EMX-75XX SERIES

64-CHANNEL
DIGITAL INPUT/OUTPUT

USER'S MANUAL

P/N: 82-0127-022
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VTI Instruments

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CERTIFICATION

VTI Instruments (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.

WARRANTY

The product referred to herein is warranted against defects in material and workmanship for a period of three years 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.

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.

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VTI Instruments
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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.

Service should only be performed by qualified personnel.

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:

ATTENTION - Important safety instructions

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 takeback 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.

Power Consumption Prior to using these cards, it is imperative that the power consumption of all cards that will be installed in the mainframe be calculated on all power supply rails. ***Failure to do so may result in damaging the switch card and the mainframe***.

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.
- 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.

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

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ADVANCED MEASUREMENT TECHNOLOGY

SECTION 1

INTRODUCTION

OVERVIEW

The EMX-75xx Series is a family of high-performance PXIe modules consisting of multiple I/O configurations and logic levels. Dedicated input or output cards are available for high channel count applications while other cards provide ultimate flexibility with eight, 8-bit ports (64 channels) that can be configured as an input or output under programmatic control.

FEATURES

Models capable of sinking 300 mA include built-in clamping diodes, making these modules ideal for driving and sensing external devices such as relays, while all clamping diodes and open collector channels can be pulled up internally, rather than on a per channel basis, simplifying overall system cabling. Isolated models are also available for more demanding applications.

PREPARATION FOR USE

UNPACKING

When an EMX-75xx Series module is unpacked from its shipping carton, the contents should include the following items:

- An EMX-7510/EMX-7511/EMX-7512/EMX-7513/EMX-7514/EMX-7515
- VTI Instruments Distribution CD

All components should be immediately inspected for damage upon receipt of the unit. ESD precautions should be observed while unpacking and installing the instrument into a PXI Express chassis. The part number, model number, and serial number can be found on the side cover of the card as shown below.

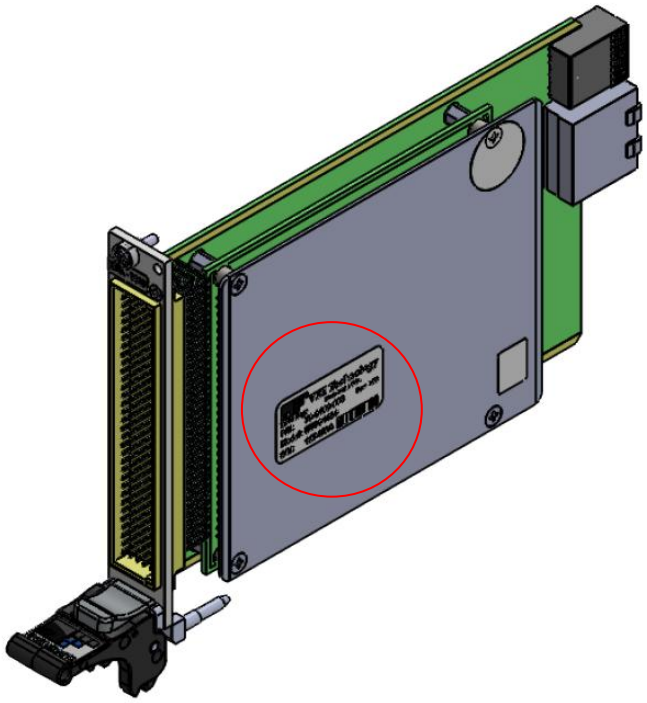


FIGURE 1-1: SERIAL NUMBER LOCATION

INSPECTING THE EMX-75XX SERIES

The EMX-7510/EMX-7511/EMX-7512/EMX-7513/EMX-7514/EMX-7515 modules were carefully inspected both mechanically and electrically before shipment. They should be free of marks or scratches and they should meet their published specifications upon receipt. If the module was damaged in transit, do the following:

- Save all packing materials
- File a claim with the carrier
- Call a VTI Instruments sales and service office

INSTALLATION

INSTALL EMX-75XX

1. Set up the PXI Express chassis. See the *Chassis' Installation Guide* for assistance.
2. Make sure the PXI Express chassis is powered off.
3. Select a PXIe slot or a hybrid slot in the PXI Express chassis for the EMX-75xx and insert it carefully.
4. After the EMX-75xx is inserted all the way, secure it with the screws at the top and bottom of the EMX-75xx front panel.

STORAGE AND SHIPMENT

STORING INSTRUMENTS

Store the module in a clean, dry, and static-free environment. For other requirements, see storage and transport restrictions in *Specification*.

TRANSPORTING INSTRUMENTS

Package the module using the original factory packaging or packaging identical to the factory packaging. Containers and materials identical to those used in factory packaging are available through VTI Instruments offices. If returning the module to VTI Instruments for service, contact a VTI Service Center to set up an RMA. The following information will be required:

- Serial number
- Model number
- Type of service required
- Return address
- If applicable, a description of the problem that is being encountered which provides specific detail relating the instrument being returned.

In any correspondence, refer to the serial number and RMA number. Mark the container "FRAGILE" to ensure careful handling. If it is necessary to package the module in a container other than the original packaging, observe the following (although use of other packaging material is not recommended):

1. Wrap the module in heavy paper or anti-static plastic
2. Protect the front panel with cardboard
3. Use a double-wall carton made of at least 350 lbs test material
4. Cushion the module to prevent damage

CAUTION	**Do not use styrene pellets in any shape as packing material for the module. The pellets do not adequately cushion the module and do not prevent the module from shifting in the carton. In addition, the pellets create static electricity that can damage electronic components.**

ORDERING INFORMATION

Model	Configuration
EMX-7510	64-CH DIO, Source/Sink, 60 V max Static I/O
EMX-7511	64-CH, DIO TTL, Static I/O
EMX-7512	64-CH, DIO LV TTL, Static I/O
EMX-7513	32DI/32DO, Source/Sink, 60 V max, Isolated Static I/O
EMX-7514	64 DO, Source/Sink, 60 V max, Isolated Static I/O
EMX-7515	64 DI, 60 V max, Isolated Static I/O

ACCESSORIES REQUIRED

EMX-75XX ACCESSORIES

CONNECTOR INFORMATION	
STRAIN RELIEF BRACKET KIT (INCLUDES CONNECTOR)	
VTI Part Number	70-0363-504 (recommended accessory)
STRAIN RELIEF BRACKET KIT (WITHOUT CONNECTOR)	
VTI Part Number	70-0363-503
CRIMP PIN	
VTI Part Number	52-0109-000 (includes 100 crimp pins)
Manufacturer/Part Number	ERNI 234064
MATING CONNECTOR	
VTI Part Number	27-0088-160 (one per board)
Manufacturer/Part Number	ERNI 024070
CRIMP PIN	
VTI Part Number	27-0088-000
Manufacturer/Part Number	ERNI 014729
CRIMP TOOL (DIN)	
VTI Part Number	46-0010-000
Manufacturer/Part Number	ERNI 014374
EXTRACTION TOOL (DIN)	
VTI Part Number	46-0011-000
Manufacturer/Part Number	ERNI 471555
TERMINAL BLOCK INFORMATION	
Description	EMX-7510-TB160SE, single-ended module
VTI Part Number	70-0367-005
UNTERMINATED CABLE ASSEMBLY	
Description	160-pin, unterminated cable assembly, 3 ft
VTI Part Number	70-0363-505

SPECIFICATIONS

TECHNICAL SPECIFICATIONS

Data Card Specifications			
EMX-7510	Digital Input	Channels	64 (Eight 8-Bit Ports
		V_{IN} (high)	>40% of VCLAMP
		V_{IN} (low)	<16% of V_{CLAMP}
		V_{IN} (max)	60 V
	Data Output Characteristics	V_{OUT} (high)	>2 V to 60 V
		V_{OUT} (low)	<1.5 V @ 300m/A
	Voltage Range	Internal Voltage Source ($V_{CLAMP)}$	3.3 V, 5.0 V, 12.0, V, and 24.0 V
		User Voltage (V_{CLAMP})	>2 V up to 60 V
		Connector Type	ERNI 160-Pin
	Modes	Immediate	Inputs and outputs read and written via software control
EMX-7511	Digital Input/Output	Channels	64 (Eight 8-Bit Ports)
		Logic Levels	Standard TTL
EMX-7512	Digital Input/Output	Channels	64 (Eight 8-Bit Ports)
		Logic Levels	Standard LV TTL
EMX-7513	Digital Input	Channels	32
		Logical High	2.5 V to 60 V
		Logical Low	<2.5 V
		Isolation	1000 V

Data Card Specifications			
	Digital Output	Channels	32
		Sink/Source	50 mA to 60 V (AC/DC)
		Potential Free	Yes
		Isolation	1000 V
		Connector Type	ERNI 160-Pin
EMX-7514	Digital Output	Channels	64
		Sink/Source	50 mA to 60 V (AC/DC)
		Potential Free	Yes
		Isolation	1000 V
		Connector Type	ERNI 160-Pin
EMX-7515	Digital Input	Channels	32
		Logical High	2.5 V to 60 V
		Logical Low	<2.5 V
		Isolation	1000 V
		Connector Type	ERNI 160-Pin

ENVIRONMENTAL SPECIFICATIONS

Data Card Specifications	
Operating Environment	
Operating Temperature	0°C to +55 °C
Relative Humidity, Non Condensing	10% to 90%
Storage Environment	
Storage Temperature	-40°C to +80°C
Relative Humidity, Non Condensing	5% to 95 %
Altitude	3,000 m
Pollution Degree	2

SECTION 2

EMX-7510, 64-CHANNEL, DIGITAL I/O CARD

The EMX-7510 is a high-performance I/O module with eight ports of 8 bits (64 channels) each. Each 8-bit port may be configured as an Input or Output under program control.

In order to ease overall system cabling, all clamping diodes and open collector channels are pulled up internally, rather than on a per-channel basis.

Each channel can sink 300 mA, and includes built-in clamping diodes, making this module ideal for driving and sensing external devices such as relays.

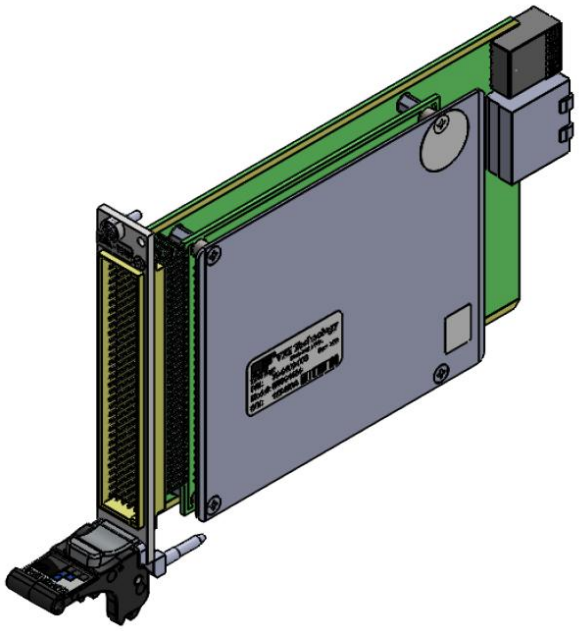


FIGURE 2-1: EMX-7510

EMX-7510 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA INPUT CHARACTERISTICS	
V_{IN} (high)	> 40% of Vclamp (Typical)
V_{IN} (low)	< 16% of Vclamp (Typical)
V_{IN} (max)	60 V
DATA OUTPUT CHARACTERISTICS	
V_{OUT} (high)	> 2 V to 60 V
V_{OUT} (low)	< 1.5 V @ 300 mA
VOLTAGE RANGE	
Internal voltage source	3.3 V, 5.0 V, 12.0 V, and 24.0 V
User	> 2 V up to 60 V
MODES	
Immediate (Normal)	Inputs and outputs read and written via software control
DATA INPUT CLOCK SOURCES	
	Internal clock, front panel input
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

USING THE INSTRUMENT

Measurement Performance

This section discusses tips and procedures that can help maximize the actual performance realized with the EMX-7510 and aid the user in avoiding some common pitfalls associated with making measurements.

Warm-up Time

As the EMX-7510 doesn't require calibration and there are no adjustments for the instrument to meet its published specifications, there is no warm up required.

Voltage Outputs

A channel output is pulled to the configured voltage through a pull-up resistor. The actual output that will be seen by the unit under test is defined by the standard voltage divider equation:

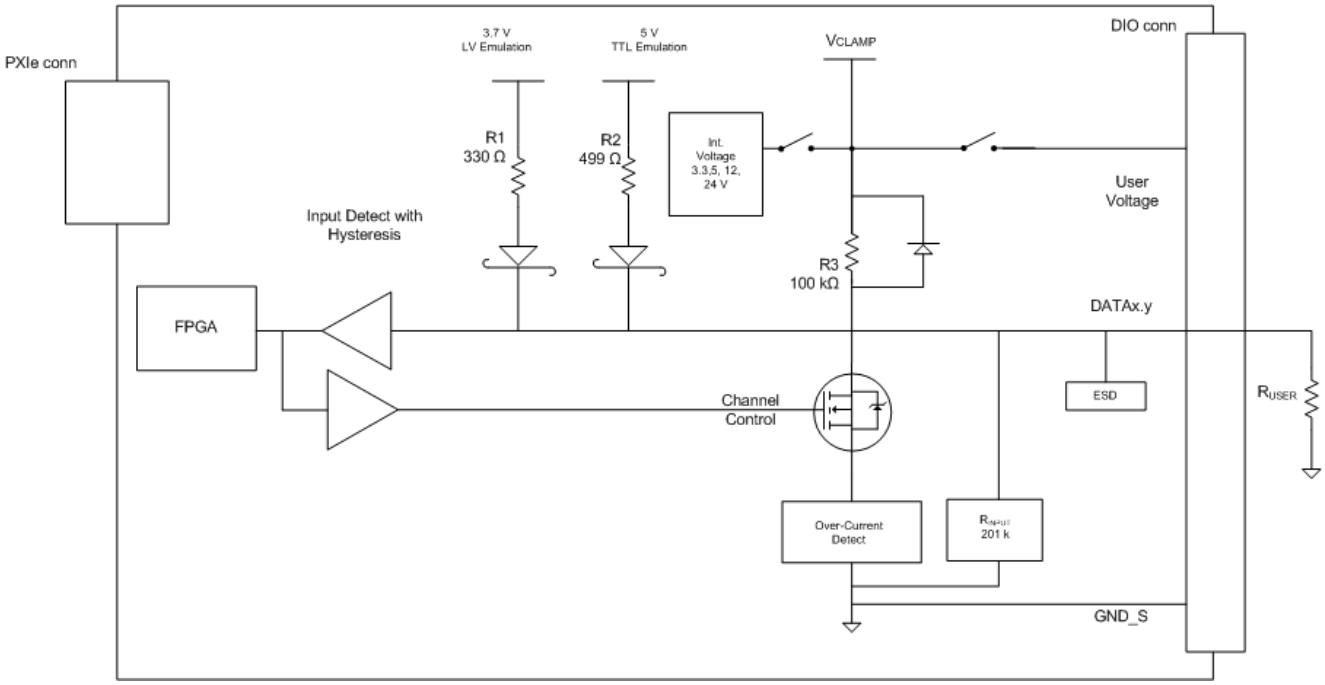
$$V_0 = V_{CLAMP}\left(\frac{R_2}{R_1+R_2}\right)$$

Where,

V_0 is the output voltage
V_{CLAMP} is the user configured voltage
R_1 is the internal pull-up resistor
R_2 is the external load presented by the unit under test

In normal mode, R_1 is 100 kΩ. In TTL emulation mode, R_1 is 499 Ω and in LV emulation mode, R1 is 330 Ω. So the pull-up to V_{CLAMP} is much stronger. TTL emulation mode is available for the 3.3 V and 5 V voltage levels.

If voltages higher than those provided by the equation above are desired, the user can supply a voltage with an external power supply in conjunction with a low-value pull-up resistor to get closer to the user's V_{CLAMP} voltage. The 300 mA sink capability of the channel still must be observed.



Voltage Output			
Mode	**Internal Supply**	**Pull-Up (R_X)**	***Open Circuit V_0***
Normal	24 V	100 kΩ (R_3)	~15.84 V
Normal	12 V	100 kΩ (R_3)	~7.92 V
Normal	5 V	100 kΩ (R_3)	~3.3 V
Normal	3.3 V	100 kΩ (R_3)	~2.47 V
TTL Emulation	5 V*	499 Ω (R_2)	~4.64 V
LV Emulation	3.7 V*	330 Ω (R_1)	~3.34 V
**For TTL and LV modes, there is approximately a 0.35 V drop due to the Schottky diode, resulting in an actual internal supply voltage of 4.65 V and 3.35V, respectively.*			
Mode	**External Supply**	**Load**	***$V_{O\text{-}USER}$***
Normal	V_{CLAMP}	R_{USER}	$V_{CLAMP}\left[\frac{R_{USER} \parallel R_{INPUT}}{100k\Omega + (R_{USER} \parallel R_{INPUT})}\right]$

FIGURE 2-2: VOLTAGE OUTPUT BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	GND_S	**B1**	GND_C	**C1**	GND_S	**D1**	EXT_GATE_ACQ	**E1**	EXT_GATE_GEN
A2	GND_S	**B2**	GND_S	**C2**	GND_S	**D2**	EXT_CLK	**E2**	GND_S
A3	DATA1.4	**B3**	GND_S	**C3**	DATA1.8	**D3**	GND_S	**E3**	DATA1.5
A4	DATA1.1	**B4**	GND_S	**C4**	DATA1.2	**D4**	GND_S	**E4**	DATA1.6
A5	DATA1.3	**B5**	GND_S	**C5**	DATA1.7	**D5**	GND_S	**E5**	DATA2.5
A6	DATA2.4	**B6**	DATA2.1	**C6**	DATA2.8	**D6**	GND_S	**E6**	DATA2.2
A7	GND_S	**B7**	GND_S	**C7**	GND_S	**D7**	DATA2.3	**E7**	GND_S
A8	GND_S	**B8**	GND_S	**C8**	GND_S	**D8**	GND_S	**E8**	DATA2.6
A9	DATA2.7	**B9**	USER_V2	**C9**	DATA3.8	**D9**	GND_S	**E9**	DATA3.5
A10	DATA3.4	**B10**	GND_S	**C10**	DATA3.1	**D10**	USER_V1	**E10**	GND_S
A11	DATA3.2	**B11**	GND_S	**C11**	DATA3.7	**D11**	GND_S	**E11**	DATA3.6
A12	DATA3.3	**B12**	GND_S	**C12**	DATA4.2	**D12**	GND_S	**E12**	DATA4.4
A13	GND_S	**B13**	USER_V4	**C13**	GND_S	**D13**	GND_S	**E13**	DATA4.5
A14	GND_S	**B14**	GND_S	**C14**	GND_S	**D14**	GND_S	**E14**	DATA4.8
A15	DATA4.1	**B15**	GND_S	**C15**	DATA4.7	**D15**	GND_S	**E15**	GND_S
A16	DATA4.3	**B16**	USER_V3	**C16**	DATA5.1	**D16**	GND_S	**E16**	GND_S
A17	DATA5.3	**B17**	GND_S	**C17**	DATA5.2	**D17**	USER_V6	**E17**	DATA4.6
A18	DATA5.8	**B18**	GND_S	**C18**	DATA5.4	**D18**	GND_S	**E18**	DATA5.5
A19	GND_S	**B19**	GND_S	**C19**	GND_S	**D19**	GND_S	**E19**	DATA5.7
A20	GND_S	**B20**	USER_V5	**C20**	GND_S	**D20**	GND_S	**E20**	DATA5.6
A21	DATA6.4	**B21**	GND_S	**C21**	DATA6.5	**D21**	GND_S	**E21**	GND_S
A22	DATA6.1	**B22**	GND_S	**C22**	DATA6.8	**D22**	GND_S	**E22**	GND_S
A23	DATA6.3	**B23**	GND_S	**C23**	DATA6.2	**D23**	GND_S	**E23**	DATA6.6
A24	DATA7.4	**B24**	USER_V7	**C24**	DATA7.1	**D24**	USER_V8	**E24**	DATA6.7
A25	GND_S	**B25**	GND_S	**C25**	GND_S	**D25**	GND_S	**E25**	DATA7.8
A26	GND_S	**B26**	GND_S	**C26**	GND_S	**D26**	GND_S	**E26**	DATA7.5
A27	DATA7.3	**B27**	GND_S	**C27**	DATA7.6	**D27**	GND_S	**E27**	GND_S
A28	DATA7.2	**B28**	GND_S	**C28**	DATA7.7	**D28**	GND_S	**E28**	GND_S
A29	DATA8.4	**B29**	GND_S	**C29**	DATA8.1	**D29**	GND_S	**E29**	DATA8.5
A30	DATA8.2	**B30**	GND_S	**C30**	DATA8.6	**D30**	GND_S	**E30**	DATA8.8
A31	GND_S	**B31**	GND_C	**C31**	GND_S	**D31**	GND_S	**E31**	GND_S
A32	DATA8.3	**B32**	GND_S	**C32**	DATA8.7	**D32**	GND_S	**E32**	GND_S

TABLE 2-1: EMX-7510 CONNECTOR PIN SIGNAL ASSIGNMENT

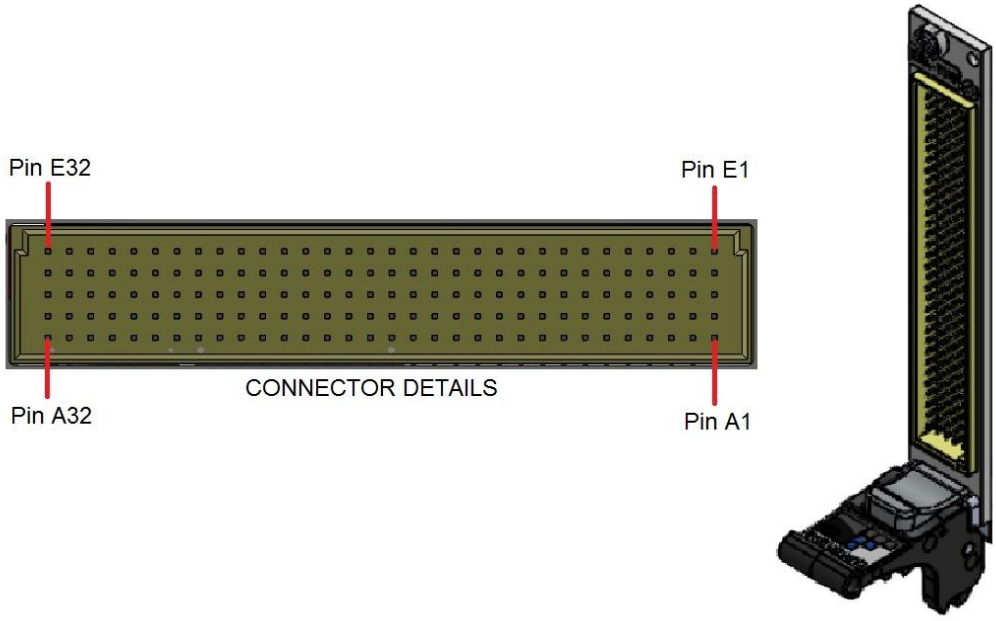


FIGURE 2-3: EMX-7510 FRONT PANEL DETAIL

EMX-7510-TB160SE Terminal Block

VTI offers a single-ended terminal block for the EMX-7510 (P/N: 70-0367-005). The terminal block simplifies cabling by providing screw-terminal blocks for user wiring. Signal pin mapping for the EMX-7510 can be seen in Table 2-2.

TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin
T1	GND_S	E2	T41	DATA4.1	A15	T81	GND_S	C14	T121	DATA6.1	A22
T2	EXT_CLK	D2	T42	GND_S	A14	T82	GND_S	B14	T122	DATA6.3	A23
T3	DATA1.5	E3	T43	GND_S	A13	T83	DATA4.7	C15	T123	GND_S	A20
T4	GND_S	D3	T44	DATA3.3	A12	T84	GND_S	B15	T124	DATA5.8	A18
T5	DATA1.6	E4	T45	DATA3.4	A10	T85	DATA5.1	C16	T125	GND_S	A19
T6	GND_S	D4	T46	USER_V1	D10	T86	USER_V3	B16	T126	DATA4.3	A16
T7	DATA2.5	E5	T47	GND_S	E10	T87	DATA5.2	C17	T127	DATA5.3	A17
T8	GND_S	D5	T48	DATA3.7	C11	T88	GND_S	B17	T128	GND_S	D32
T9	DATA2.2	E6	T49	GND_S	B11	T89	DATA5.4	C18	T129	DATA8.8	E30
T10	GND_S	D6	T50	DATA3.2	A11	T90	GND_S	B18	T130	GND_D	D30
T11	GND_S	E7	T51	GND_S	B12	T91	GND_S	C19	T131	DATA8.5	E29
T12	DATA2.3	D7	T52	DATA4.2	C12	T92	GND_S	B19	T132	GND_S	D29
T13	DATA2.6	E8	T53	USER_V4	B13	T93	GND_S	C20	T133	GND_S	E31
T14	GND_S	D8	T54	GND_S	C13	T94	USER_V5	B20	T134	GND_S	D31
T15	DATA3.5	E9	T55	DATA2.7	A9	T95	DATA8.7	C32	T135	DATA8.6	C30
T16	GND_S	D9	T56	GND_S	A8	T96	EXT_GATE_GEN	E1	T136	GND_S	B30
T17	DATA1.8	C3	T57	GND_S	A7	T97	DATA7.5	E26	T137	GND_S	C31
T18	GND_S	B3	T58	DATA2.4	A6	T98	GND_S	D26	T138	GND_C	B31
T19	GND_S	C2	T59	DATA1.3	A5	T99	DATA6.7	E24	T139	GND_D	B29
T20	GND_S	B2	T60	DATA1.1	A4	T100	USER_V8	D24	T140	GND_S	C29
T21	DATA1.2	C4	T61	DATA1.4	A3	T101	GND_S	E27	T141	GND_S	B28
T22	GND_S	B4	T62	GND_S	A2	T102	GND_S	D27	T142	DATA7.7	C28
T23	DATA1.7	C5	T63	GND_S	B10	T103	GND_S	E28	T143	GND_S	C25
T24	GND_S	B5	T64	DATA3.1	C10	T104	GND_S	D28	T144	GND_S	B25
T25	DATA2.8	C6	T65	GND_S	E15	T105	DATA6.6	E23	T145	GND_S	B27
T26	DATA2.1	B6	T66	GND_S	D15	T106	GND_S	D23	T146	DATA7.6	C27

TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin	TB Ref	Signal	Conn Pin
T27	GND_S	C7	T67	GND_S	E16	T107	GND_S	E22	T147	GND_S	B26
T28	GND_S	B7	T68	GND_S	D16	T108	GND_S	D22	T148	GND_S	C26
T29	GND_S	C8	T69	DATA4.6	E17	T109	GND_S	D25	T149	GND_S	A26
T30	GND_S	B8	T70	USER_V6	D17	T110	DATA7.8	E25	T150	DATA7.3	A27
T31	DATA3.8	C9	T71	DATA8.6	E18	T111	DATA5.6	E20	T151	DATA7.2	A28
T32	USER_V2	B9	T72	GND_S	D18	T112	GND_S	D20	T152	DATA8.4	A29
T33	DATA3.6	E11	T73	DATA5.7	E19	T113	DATA6.8	C22	T153	DATA8.2	A30
T34	GND_S	D11	T74	GND_S	D19	T114	GND_S	B22	T154	GND_S	A31
T35	GND_S	D12	T75	DATA6.5	C21	T115	DATA6.2	C23	T155	GND_S	E32
T36	DATA4.4	E12	T76	GND_S	B21	T116	GND_S	B23	T156	GND_C	B1
T37	GND_S	D13	T77	GND_D	D1	T117	DATA7.1	C24	T157	DATA8.3	A32
T38	DATA4.5	E13	T78	DATA3.5	A21	T118	USER_V7	B24	T158	GND_	A1
T39	GND_S	D14	T79	EXT_GATE_ACQ	D21	T119	DATA7.4	A24	T159	GND_S	B32
T40	DATA4.8	E14	T80	GND_S	E21	T120	GND_S	A25	T160	GND_S	C1

TABLE 2-2: EMX-7510 TO TB160SE TERMINAL BLOCK PIN AND SIGNAL MAPPING

THEORY OF OPERATION

This section provides an overview of how the EMX-7510 works. The figure below shows illustrates this process.

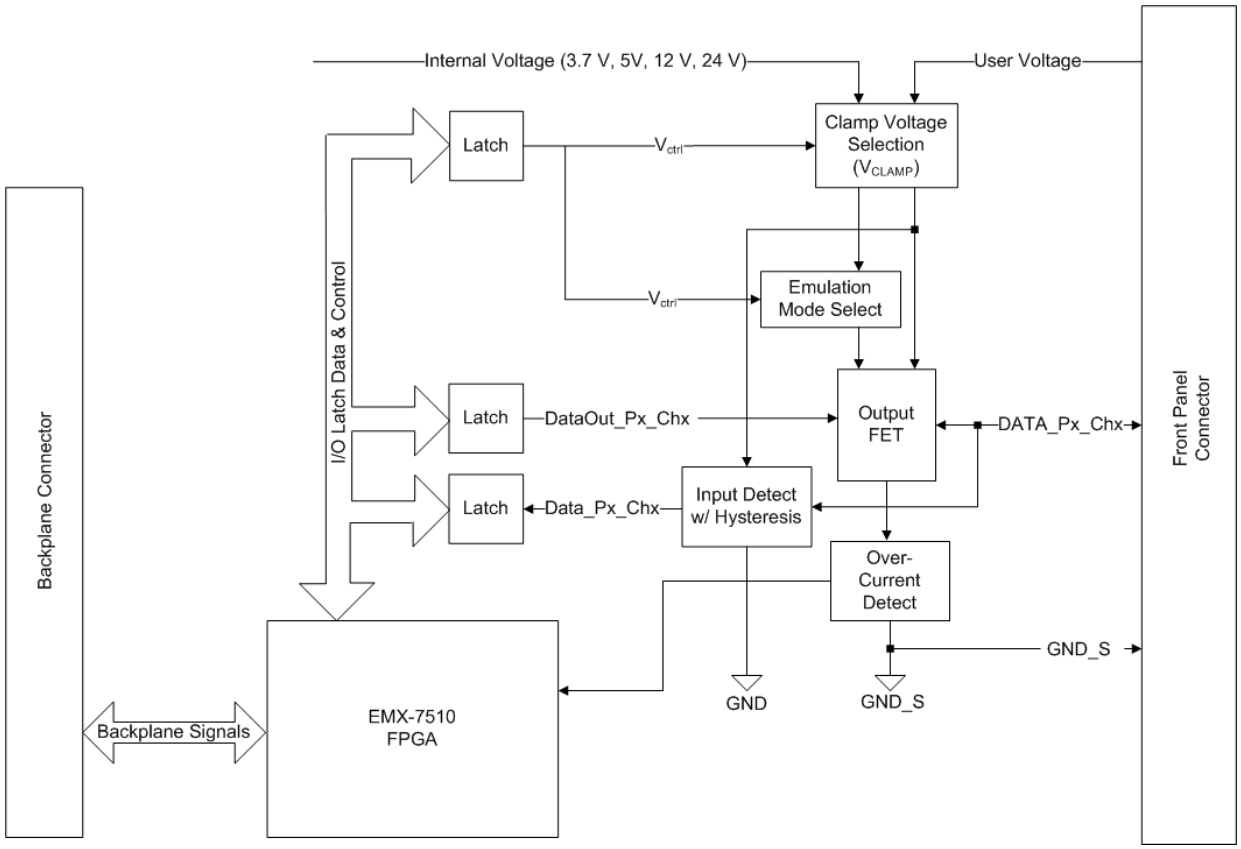


FIGURE 2-4: EMX-7510 BLOCK DIAGRAM

Overview

The EMX-7510 supports a static mode where user-driven software commands execute reading/writing data channels on a per port basis. Each port can be programmed for direction and polarity. The default direction is input and default polarity is normal. Ports also need a voltage reference before data can be read or written; this voltage is used for pulling up open drain data lines and setting reference voltage for threshold detection in input path. No voltage should be applied on data lines before voltage selection and during voltage configuration process. User can select a voltage from 3.3 V, 5 V, 12 V or 24 V provided on the module or supply a voltage through front panel connector, to be used as V_{CLAMP}. By default, no voltage is selected and data lines are floating. There is also an option of configuring a port's voltage setting as either TTL or Low Voltage emulation. In TTL emulation setting, open drain lines are pulled up to 5 V and have a sourcing capability of 4 mA, whereas in Low Voltage (LV) option the pull-up voltage is 3.3 V with 4 mA drive strength.

When doing read and writes, data written to a port set for output updates data on that port, data written to a port set for input does not have any effect. Data read from a port always reads current status of data pins (whether driven by card or by user).

When a port's direction is output, data is driven by the DIO on the corresponding channels and no user voltage should be applied on those channels. When direction is input, data lines are pulled up

to V_{CLAMP} using 100 kΩ resistor and user can drive their data on the channels with a V_{IN} range of zero to V_{CLAMP}.

TTL and LV emulation voltage selection is only applicable when port's direction is output. Input mode will not be allowed for emulation voltage.

Data in output register(s) of concerned port is reset (set to all F's) after reset and any operation that involves voltage configuration, as listed below:

1) When card is reset. All ports are affected.
2) A port's direction is changed when its voltage is set for TTL/LV emulation. Only concerned port is affected.
3) Port voltage configuration is done. Only concerned port is affected.

Data in output registers is not retained if direction is changed. So for example, when an output port that is driving AA on data lines is made input, all its channels are pulled up so that user data can be driven but when the direction is changed back to output, FF gets driven, given that polarity and voltage setting didn't change.

Polarity settings are applicable irrespective of direction. On output channels, changing the polarity flips the state of data lines and further writes are done according to polarity selection (for example, if polarity is configured as reversed then writing 1 to a channel writes a 0 to it and vice versa). Read back of data, whether driven by card when direction is output or driven by user when direction is input, also checks for polarity and if polarity is reversed, 1 is read as 0, otherwise as 1 and 0 is read as 1, otherwise as 0.

Configuration Section

This section of circuit is used to select reference voltage (V_{CLAMP}) for ports. Each port has a set of programmatically controlled switches that let the user select a voltage from 3.3 V, 5 V, 12 V, 24 V and User supplied voltage, which can be anywhere from 3.3 V to 60 V. In addition, LV and TTL emulation modes can be selected which use 3.3 V and 5 V as V_{CLAMP} respectively, and insert a low impedance pull-up resistor in the path to source 4 mA.

Output Section

The output section of each channel consists of an N-channel MOSFET, pull-up resistors and over current sense circuitry. When a 1 is driven on channel, the MOSFET is turned off and data line is pulled-up to V_{CLAMP} using appropriate pull-up resistor (330 Ω for LV emulation, 500 Ω for TTL emulation and 100 kΩ otherwise). The rising voltage level at data channel exhibits RC charging with a rise time of approximately 70 µs with 100 kΩ pull-up resistor and about 600 ns with low impedance pull-up in TTL and LV voltage configurations. When a 0 is driven on channel, the MOSFET is turned on and data line is connected to ground via a current sense resistor of 0.3 Ω. The falling edge is much sharper with a maximum fall time of 300 ns approximately. When the port is set as input, the data lines are pulled up using 100 kΩ resistor. Please refer to electrical characteristics for output voltage levels with different load resistance.

The load resistor and pull-up resistor form a voltage divider of V_{CLAMP} and determine output voltage, thus output voltage decreases with decreasing load resistance. The minimum load resistance that can be connected on channels is 500 Ω for LV emulation, 750 Ω for TTL emulation and 150 kΩ otherwise.

The data lines have a current sinking capacity of 300 mA. If the current through MOSFET increases above limited value, the over current protection circuit turns off all FETs in the concerned port. The over current condition must last for greater than 12.8 µs before over current protection circuit is activated. This is done to prevent false over current events due to transients. It takes approximately 20 µs from first occurrence of the over current event before the FETs are truned off. The over current circuit will activate with 340 mA hold current and 475 mA trip

current, where hold current is the maximum current circuit will allow without tripping and trip current is the minimum current required to trip the circuit. The absolute maximum limit on sinking current is 500 mA. Staying within these limits is user's responsibility. Over current readings from ports will be latched and can be read by user. When they reset over current condition then port will be enabled and data last written to port will be applied on channels.

Input Section

The input section converts the high or low voltage reading on the data channels to 1 or 0 that can be read by the user. The port's V_{CLAMP} voltage is used as a reference for threshold detection. If voltage on data line is greater than 40% (range spreads to 37% to 42% across different voltage levels) of port's V_{CLAMP} voltage, 1 is read and if voltage on data line is less than 13% (10% to15% range) of port's V_{CLAMP} voltage, 0 is read. Hysteresis loop is implemented on input comparison meaning that on rising voltage, level has to cross higher threshold (VIH) to record a 1 and on falling voltage, level has to cross lower threshold (VIL) to record a 0. In between VIH and VIL the digital state of data channel reading stays the same. Please refer to the recommended operating conditions for input threshold values.

The input section also has a fly-back protection diode. The port's reference voltage VCLAMP is routed to the cathode of a fly-back protection diode, whose anode is then connected to the associated port's data line. Every data line has a diode installed to suppress transients in case of voltage overshooting. The current through diode must be limited as indicated in absolute maximum ratings.

TTL/LV Emulation Sourcing Current Typical connection

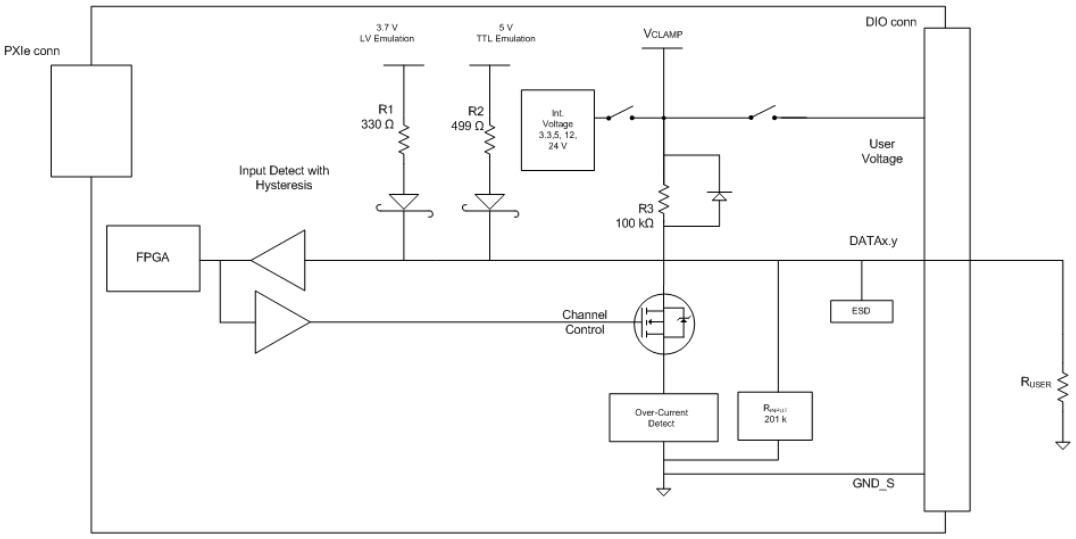


FIGURE 2-5: TTL/LV EMULATION SOURCING CURRENT TYPICAL CONNECTION

Sinking Current Typical connection

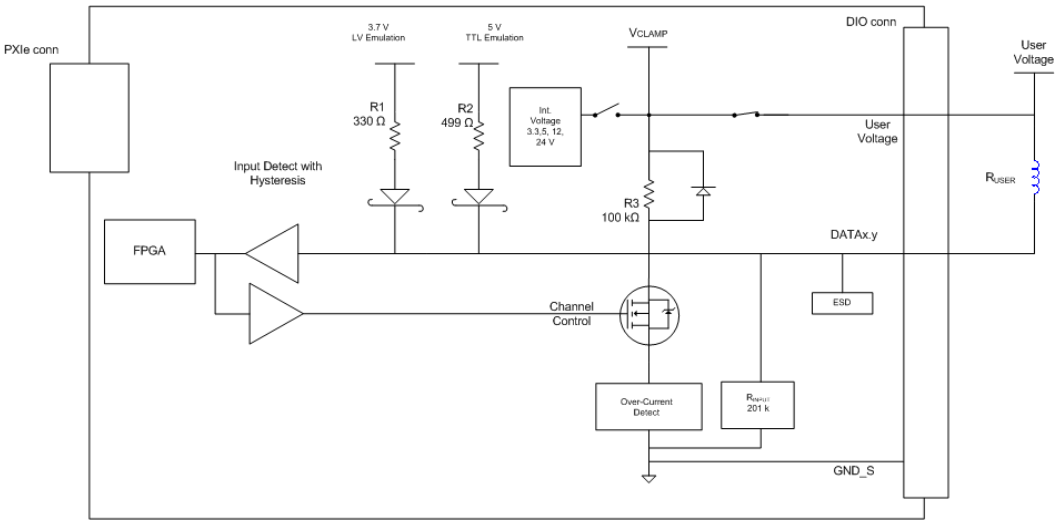


FIGURE 2-6: SINKING CURRENT TYPICAL CONNECTION

EMX-7511, 64-CHANNEL, DIGITAL I/O TTL CARD

The EMX-7511 is a high-performance I/O module with eight ports of 8 bits (64 channels) each with standard TTL voltage levels. Each 8-bit port may be configured as an Input or Output under program control.

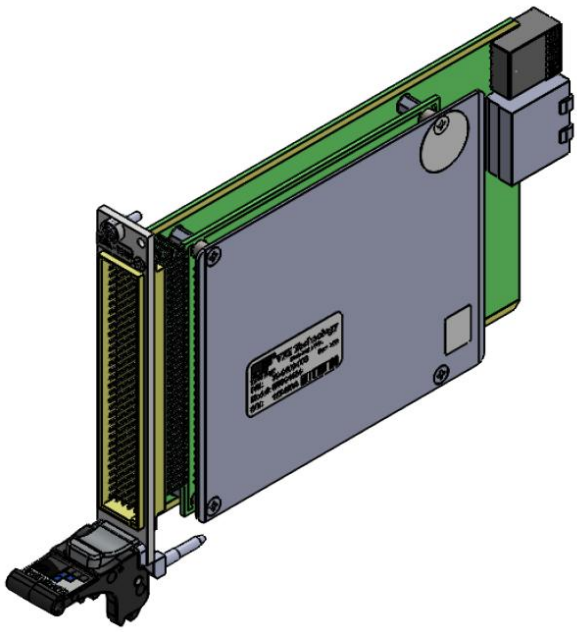


FIGURE 2-7: EMX-7511

BLOCK DIAGRAM

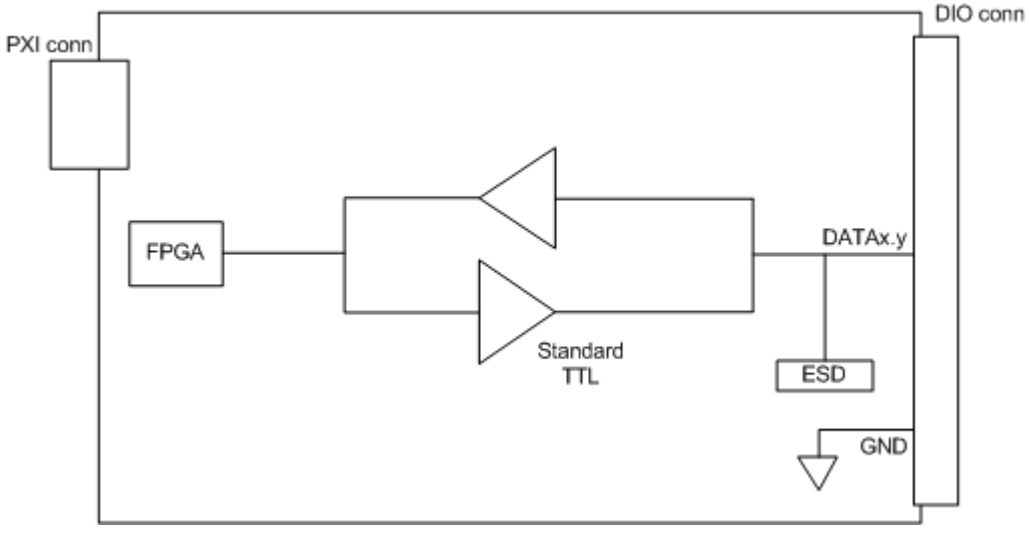


FIGURE 2-8: EMX-7511 BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	GND	**B1**	GND_C	**C1**	GND	**D1**	EXT_GATE_ACQ	**E1**	EXT_GATE_GEN
A2	GND	**B2**	GND	**C2**	GND	**D2**	EXT_CLK	**E2**	GND
A3	DATA1.4	**B3**	GND	**C3**	DATA1.8	**D3**	GND	**E3**	DATA1.5
A4	DATA1.1	**B4**	GND	**C4**	DATA1.2	**D4**	GND	**E4**	DATA1.6
A5	DATA1.3	**B5**	GND	**C5**	DATA1.7	**D5**	GND	**E5**	DATA2.5
A6	DATA2.4	**B6**	DATA2.1	**C6**	DATA2.8	**D6**	GND	**E6**	DATA2.2
A7	GND	**B7**	GND	**C7**	GND	**D7**	DATA2.3	**E7**	GND
A8	GND	**B8**	GND	**C8**	GND	**D8**	GND	**E8**	DATA2.6
A9	DATA2.7	**B9**		**C9**	DATA3.8	**D9**	GND	**E9**	DATA3.5
A10	DATA3.4	**B10**	GND	**C10**	DATA3.1	**D10**		**E10**	GND
A11	DATA3.2	**B11**	GND	**C11**	DATA3.7	**D11**	GND	**E11**	DATA3.6
A12	DATA3.3	**B12**	GND	**C12**	DATA4.2	**D12**	GND	**E12**	DATA4.4
A13	GND	**B13**		**C13**	GND	**D13**	GND	**E13**	DATA4.5
A14	GND	**B14**	GND	**C14**	GND	**D14**	GND	**E14**	DATA4.8
A15	DATA4.1	**B15**	GND	**C15**	DATA4.7	**D15**	GND	**E15**	GND
A16	DATA4.3	**B16**		**C16**	DATA5.1	**D16**	GND	**E16**	GND
A17	DATA5.3	**B17**	GND	**C17**	DATA5.2	**D17**		**E17**	DATA4.6
A18	DATA5.8	**B18**	GND	**C18**	DATA5.4	**D18**	GND	**E18**	DATA5.5
A19	GND	**B19**	GND	**C19**	GND	**D19**	GND	**E19**	DATA5.7
A20	GND	**B20**		**C20**	GND	**D20**	GND	**E20**	DATA5.6
A21	DATA6.4	**B21**	GND	**C21**	DATA6.5	**D21**	GND	**E21**	GND
A22	DATA6.1	**B22**	GND	**C22**	DATA6.8	**D22**	GND	**E22**	GND
A23	DATA6.3	**B23**	GND	**C23**	DATA6.2	**D23**	GND	**E23**	DATA6.6
A24	DATA7.4	**B24**		**C24**	DATA7.1	**D24**		**E24**	DATA6.7
A25	GND	**B25**	GND	**C25**	GND	**D25**	GND	**E25**	DATA7.8
A26	GND	**B26**	GND	**C26**	GND	**D26**	GND	**E26**	DATA7.5
A27	DATA7.3	**B27**	GND	**C27**	DATA7.6	**D27**	GND	**E27**	GND
A28	DATA7.2	**B28**	GND	**C28**	DATA7.7	**D28**	GND	**E28**	GND
A29	DATA8.4	**B29**	GND	**C29**	DATA8.1	**D29**	GND	**E29**	DATA8.5
A30	DATA8.2	**B30**	GND	**C30**	DATA8.6	**D30**	GND	**E30**	DATA8.8
A31	GND	**B31**	GND_C	**C31**	GND	**D31**	GND	**E31**	GND
A32	DATA8.3	**B32**	GND	**C32**	DATA8.7	**D32**	GND	**E32**	GND

TABLE 2-3: EMX-7511 CONNECTOR PIN SIGNAL ASSIGNMENT

EMX-7511 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA INPUT OUTPUT CHARACTERISTICS	
Channels	64 (Eight 8-Bit Ports)
Logical Level	Standard TTL
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

EMX-7512, 64-CHANNEL, DIGITAL I/O LV TTL CARD

The EMX-7512 is a high-performance I/O module with eight ports of 8 bits (64 channels) each with standard LV TTL voltage levels. Each 8-bit port may be configured as an Input or Output under program control.

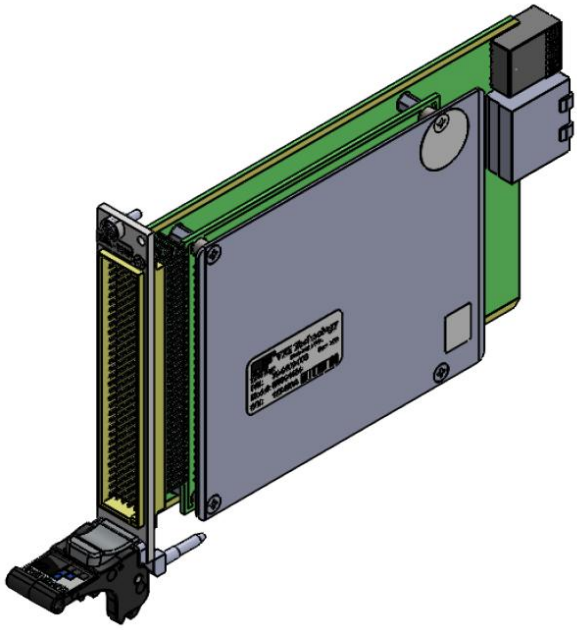


FIGURE 2-9: EMX-7512

BLOCK DIAGRAM

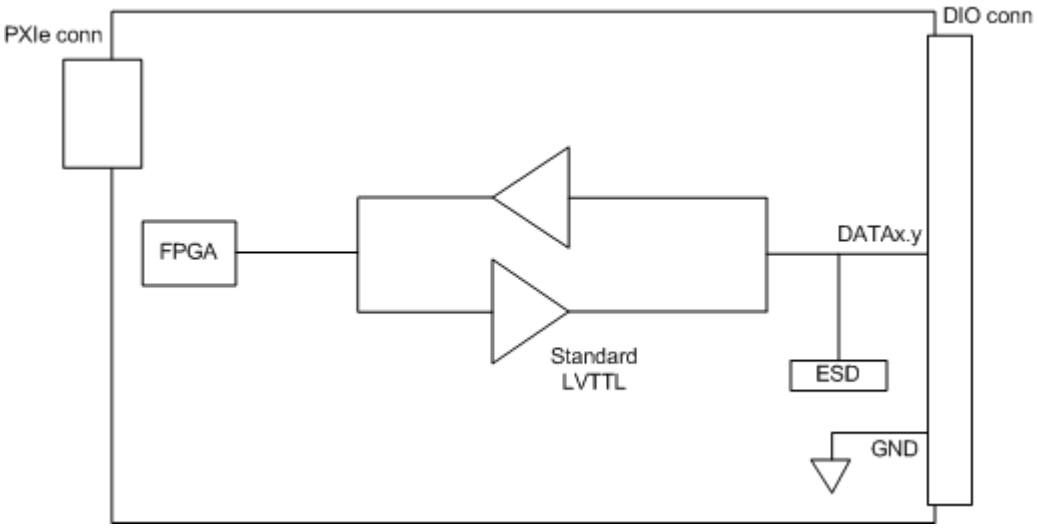


FIGURE 2-10: EMX-7512 BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	GND	**B1**	GND_C	**C1**	GND	**D1**	EXT_GATE_ACQ	**E1**	EXT_GATE_GEN
A2	GND	**B2**	GND	**C2**	GND	**D2**	EXT_CLK	**E2**	GND
A3	DATA1.4	**B3**	GND	**C3**	DATA1.8	**D3**	GND	**E3**	DATA1.5
A4	DATA1.1	**B4**	GND	**C4**	DATA1.2	**D4**	GND	**E4**	DATA1.6
A5	DATA1.3	**B5**	GND	**C5**	DATA1.7	**D5**	GND	**E5**	DATA2.5
A6	DATA2.4	**B6**	DATA2.1	**C6**	DATA2.8	**D6**	GND	**E6**	DATA2.2
A7	GND	**B7**	GND	**C7**	GND	**D7**	DATA2.3	**E7**	GND
A8	GND	**B8**	GND	**C8**	GND	**D8**	GND	**E8**	DATA2.6
A9	DATA2.7	**B9**		**C9**	DATA3.8	**D9**	GND	**E9**	DATA3.5
A10	DATA3.4	**B10**	GND	**C10**	DATA3.1	**D10**		**E10**	GND
A11	DATA3.2	**B11**	GND	**C11**	DATA3.7	**D11**	GND	**E11**	DATA3.6
A12	DATA3.3	**B12**	GND	**C12**	DATA4.2	**D12**	GND	**E12**	DATA4.4
A13	GND	**B13**		**C13**	GND	**D13**	GND	**E13**	DATA4.5
A14	GND	**B14**	GND	**C14**	GND	**D14**	GND	**E14**	DATA4.8
A15	DATA4.1	**B15**	GND	**C15**	DATA4.7	**D15**	GND	**E15**	GND
A16	DATA4.3	**B16**		**C16**	DATA5.1	**D16**	GND	**E16**	GND
A17	DATA5.3	**B17**	GND	**C17**	DATA5.2	**D17**		**E17**	DATA4.6
A18	DATA5.8	**B18**	GND	**C18**	DATA5.4	**D18**	GND	**E18**	DATA5.5
A19	GND	**B19**	GND	**C19**	GND	**D19**	GND	**E19**	DATA5.7
A20	GND	**B20**		**C20**	GND	**D20**	GND	**E20**	DATA5.6
A21	DATA6.4	**B21**	GND	**C21**	DATA6.5	**D21**	GND	**E21**	GND
A22	DATA6.1	**B22**	GND	**C22**	DATA6.8	**D22**	GND	**E22**	GND
A23	DATA6.3	**B23**	GND	**C23**	DATA6.2	**D23**	GND	**E23**	DATA6.6
A24	DATA7.4	**B24**		**C24**	DATA7.1	**D24**		**E24**	DATA6.7
A25	GND	**B25**	GND	**C25**	GND	**D25**	GND	**E25**	DATA7.8
A26	GND	**B26**	GND	**C26**	GND	**D26**	GND	**E26**	DATA7.5
A27	DATA7.3	**B27**	GND	**C27**	DATA7.6	**D27**	GND	**E27**	GND
A28	DATA7.2	**B28**	GND	**C28**	DATA7.7	**D28**	GND	**E28**	GND
A29	DATA8.4	**B29**	GND	**C29**	DATA8.1	**D29**	GND	**E29**	DATA8.5
A30	DATA8.2	**B30**	GND	**C30**	DATA8.6	**D30**	GND	**E30**	DATA8.8
A31	GND	**B31**	GND_C	**C31**	GND	**D31**	GND	**E31**	GND
A32	DATA8.3	**B32**	GND	**C32**	DATA8.7	**D32**	GND	**E32**	GND

TABLE 2-4: EMX-7512 CONNECTOR PIN SIGNAL ASSIGNMENT

EMX-7512 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA INPUT OUTPUT CHARACTERISTICS	
Channels	64 (Eight 8-Bit Ports)
Logical Level	Standard LV TTL
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

EMX-7513, 32 DI, 32DO-CHANNEL, DIGITAL I/O CARD

The EMX-7513 is a high-performance module with four ports of 8 bits input channels (32 channels) and four ports of 8 bits of Output channels (32 channels).

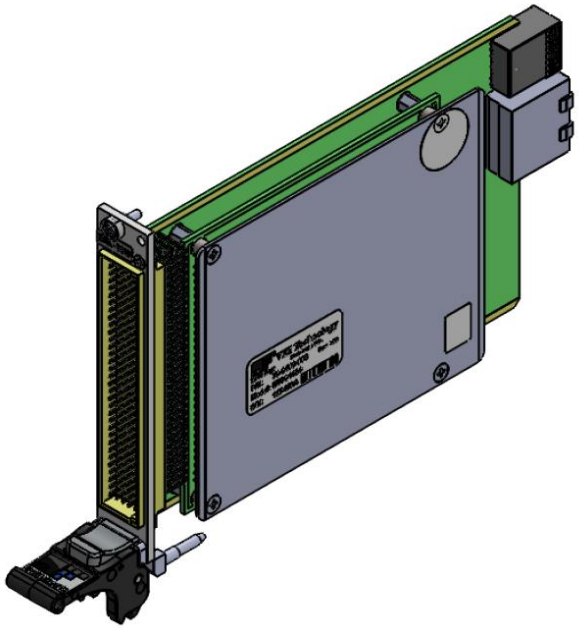


FIGURE 2-11: EMX-7513

BLOCK DIAGRAM

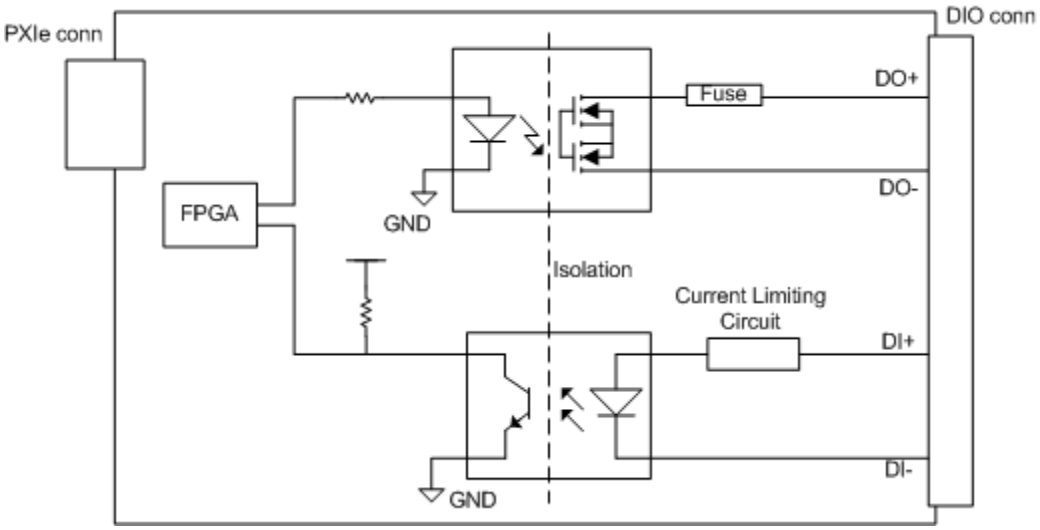


FIGURE 2-12: EMX-7513 BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	GND_ISO	**B1**	VCC5V_ISO	**C1**	EXT_CLK-	**D1**	EXT_GATE_ACQ-	**E1**	EXT_GATE_GEN-
A2	GND_ISO	**B2**	VCC5V_ISO	**C2**	EXT_CLK+	**D2**	EXT_GATE_ACQ+	**E2**	EXT_GATE_GEN-
A3		**B3**		**C3**	DI_1.5-	**D3**		**E3**	DI_2.1-
A4		**B4**		**C4**	DI_1.5+	**D4**		**E4**	DI_2.1+
A5	DI_1.1-	**B5**	DI_1.2-	**C5**	DI_1.6-	**D5**	DI_1.7-	**E5**	DI_2.2-
A6	DI_1.1+	**B6**	DI_1.2+	**C6**	DI_1.6+	**D6**	DI_1.7+	**E6**	DI_2.2+
A7	DI_2.3-	**B7**	DI_1.3-	**C7**	DI_2.7-	**D7**	DI_1.8-	**E7**	DI_3.3-
A8	DI_2.3+	**B8**	DI_1.3+	**C8**	DI_2.7+	**D8**	DI_1.8+	**E8**	DI_3.3+
A9	DI_2.4-	**B9**	DI_1.4-	**C9**	DI_2.8-	**D9**	DI_3.1-	**E9**	DI_3.4-
A10	DI_2.4+	**B10**	DI_1.4+	**C10**	DI_2.8+	**D10**	DI_3.1+	**E10**	DI_3.4+
A11	DI_3.5-	**B11**	DI_2.5-	**C11**	DI_4.1-	**D11**	DI_3.2-	**E11**	DI_4.5-
A12	DI_3.5+	**B12**	DI_2.5+	**C12**	DI_4.1+	**D12**	DI_3.2+	**E12**	DI_4.5+
A13	DI_3.6-	**B13**	DI_2.6-	**C13**	DI_4.2-	**D13**	DI_4.3-	**E13**	DI_4.6-
A14	DI_3.6+	**B14**	DI_2.6+	**C14**	DI_4.2+	**D14**	DI_4.3+	**E14**	DI_4.6+
A15	DI_4.7-	**B15**	DI_3.7-	**C15**	DO_1.3-	**D15**	DI_4.4-	**E15**	DO_1.7-
A16	DI_4.7+	**B16**	DI_3.7+	**C16**	DO_1.3+	**D16**	DI_4.4+	**E16**	DO_1.7+
A17	DI_4.8-	**B17**	DI_3.8-	**C17**	DO_1.4-	**D17**	DO_1.5-	**E17**	DO_1.8-
A18	DI_4.8+	**B18**	DI_3.8+	**C18**	DO_1.4+	**D18**	DO_1.5+	**E18**	DO_1.8+
A19	DO_2.1-	**B19**	DO_1.1-	**C19**	DO_2.5-	**D19**	DO_1.6-	**E19**	DO_3.1-
A20	DO_2.1+	**B20**	DO_1.1+	**C20**	DO_2.5+	**D20**	DO_1.6+	**E20**	DO_3.1+
A21	DO_2.2-	**B21**	DO_1.2-	**C21**	DO_2.6-	**D21**	DO_2.7-	**E21**	DO_3.2-
A22	DO_2.2+	**B22**	DO_1.2+	**C22**	DO_2.6+	**D22**	DO_2.7+	**E22**	DO_3.2+
A23	DO_3.3-	**B23**	DO_2.3-	**C23**	DO_3.7-	**D23**	DO_2.8-	**E23**	
A24	DO_3.3+	**B24**	DO_2.3+	**C24**	DO_3.7+	**D24**	DO_2.8+	**E24**	
A25	DO_3.4-	**B25**	DO_2.4-	**C25**	DO_3.8-	**D25**	DO_4.1-	**E25**	
A26	DO_3.4+	**B26**	DO_2.4+	**C26**	DO_3.8+	**D26**	DO_4.1+	**E26**	
A27	DO_3.6-	**B27**	DO_3.5-	**C27**	DO_4.3-	**D27**		**E27**	
A28	DO_3.6+	**B28**	DO_3.5+	**C28**	DO_4.3+	**D28**		**E28**	
A29	DO_4.4-	**B29**	DO_4.2-	**C29**	DO_4.5-	**D29**		**E29**	DO_4.6-
A30	DO_4.4+	**B30**	DO_4.2+	**C30**	DO_4.5+	**D30**		**E30**	DO_4.6+
A31	DO_4.7-	**B31**		**C31**	DO_4.8-	**D31**		**E31**	
A32	DO_4.7+	**B32**		**C32**	DO_4.8+	**D32**		**E32**	

TABLE 2-5: EMX-7513 CONNECTOR PIN SIGNAL ASSIGNMENT

EMX-7513 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA INPUT CHARACTERISTICS	
Logical High	2.5 V to 60 V
Logical Low	< 2.5
Isolation	1000 V
DATA OUTPUT CHARACTERISTICS	
Sink/Source	60 V @ 50 mA (AC/DC)
Potential free	Yes
Isolation	1000 V
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

EMX-7514, 64-CHANNEL, DIGITAL OUTPUT CARD

The EMX-7514 is a high-performance output module with eight ports of 8 bits (64 channels) each.

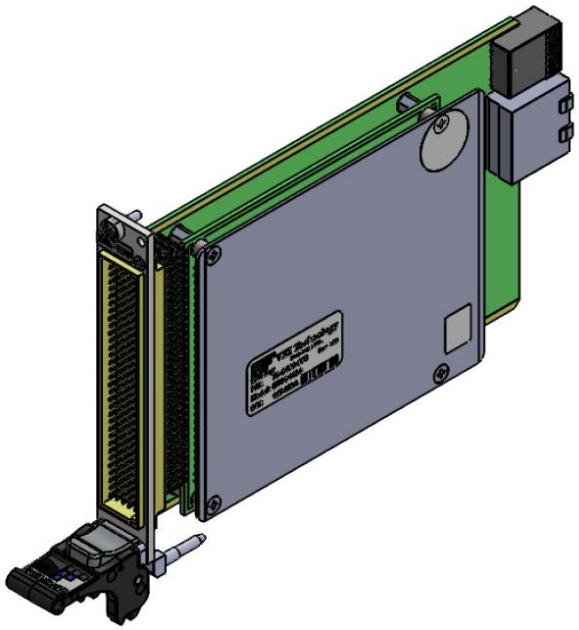


FIGURE 2-13: EMX-7514

BLOCK DIAGRAM

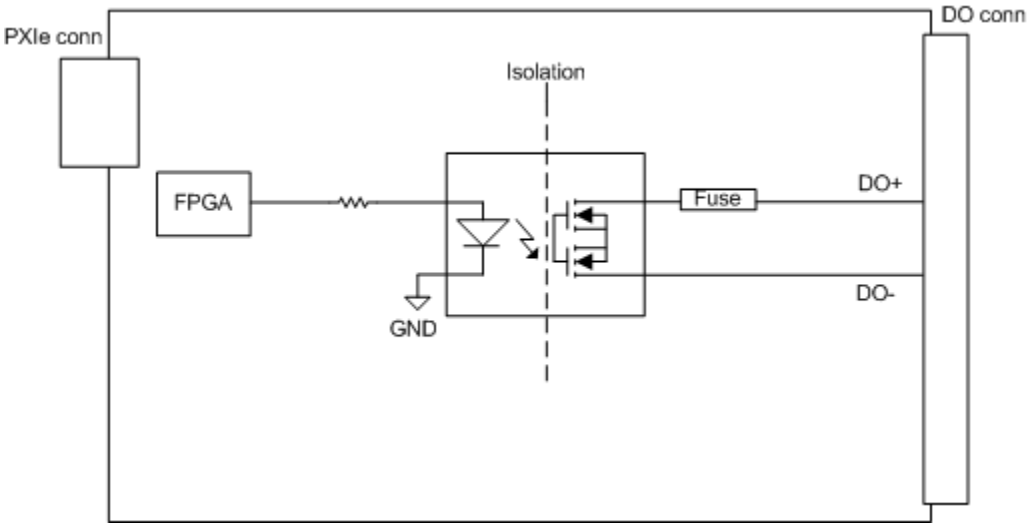


FIGURE 2-14: EMX-7514 BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	URS_SHLD _PLANE	**B1**		**C1**	EXT_CLK	**D1**	EXT_GATE_ ACQ-	**E1**	EXT_GATE_ GEN-
A2		**B2**		**C2**	EXT_CLK	**D2**	EXT_GATE_ ACQ+	**E2**	EXT_GATE_ GEN+
A3		**B3**		**C3**	DO_1.5	**D3**		**E3**	DO_2.1-
A4		**B4**		**C4**	DO_1.5	**D4**		**E4**	DO_2.1+
A5	DO_1.1-	**B5**	DO_1.2-	**C5**	DO_1.6	**D5**	DO_1.7-	**E5**	DO_2.2-
A6	DO_1.1+	**B6**	DO_1.2+	**C6**	DO_1.6	**D6**	DO_1.7+	**E6**	DO_2.2+
A7	DO_2.3-	**B7**	DO_1.3-	**C7**	DO_2.7	**D7**	DO_1.8-	**E7**	DO_3.3-
A8	DO_2.3+	**B8**	DO_1.3+	**C8**	DO_2.7	**D8**	DO_1.8+	**E8**	DO_3.3+
A9	DO_2.4-	**B9**	DO_1.4-	**C9**	DO_2.8	**D9**	DO_3.1-	**E9**	DO_3.4-
A10	DO_2.4+	**B10**	DO_1.4+	**C10**	DO_2.8	**D10**	DO_3.1+	**E10**	DO_3.4+
A11	DO_3.5-	**B11**	DO_2.5-	**C11**	DO_4.1	**D11**	DO_3.2-	**E11**	DO_4.5-
A12	DO_3.5+	**B12**	DO_2.5+	**C12**	DO_4.1	**D12**	DO_3.2+	**E12**	DO_4.5+
A13	DO_3.6-	**B13**	DO_2.6-	**C13**	DO_4.2	**D13**	DO_4.3-	**E13**	DO_4.6-
A14	DO_3.6+	**B14**	DO_2.6+	**C14**	DO_4.2	**D14**	DO_4.3+	**E14**	DO_4.6+
A15	DO_4.7-	**B15**	DO_3.7-	**C15**	DO_5.3	**D15**	DO_4.4-	**E15**	DO_5.7-
A16	DO_4.7+	**B16**	DO_3.7+	**C16**	DO_5.3	**D16**	DO_4.4+	**E16**	DO_5.7+
A17	DO_4.8-	**B17**	DO_3.8-	**C17**	DO_5.4	**D17**	DO_5.5-	**E17**	DO_5.8-
A18	DO_4.8+	**B18**	DO_3.8+	**C18**	DO_5.4	**D18**	DO_5.5+	**E18**	DO_5.8+
A19	DO_6.1-	**B19**	DO_5.1-	**C19**	DO_6.5	**D19**	DO_5.6-	**E19**	DO_7.1-
A20	DO_6.1+	**B20**	DO_5.1+	**C20**	DO_6.5	**D20**	DO_5.6+	**E20**	DO_7.1+
A21	DO_6.2-	**B21**	DO_5.2-	**C21**	DO_6.6	**D21**	DO_6.7-	**E21**	DO_7.2-
A22	DO_6.2+	**B22**	DO_5.2+	**C22**	DO_6.6	**D22**	DO_6.7+	**E22**	DO_7.2+
A23	DO_7.3-	**B23**	DO_6.3-	**C23**	DO_7.7	**D23**	DO_6.8-	**E23**	
A24	DO_7.3+	**B24**	DO_6.3+	**C24**	DO_7.7	**D24**	DO_6.8+	**E24**	
A25	DO_7.4-	**B25**	DO_6.4-	**C25**	DO_7.8	**D25**	DO_8.1-	**E25**	
A26	DO_7.4+	**B26**	DO_6.4+	**C26**	DO_7.8	**D26**	DO_8.1+	**E26**	
A27	DO_7.6-	**B27**	DO_7.5-	**C27**	DO_8.3	**D27**		**E27**	
A28	DO_7.6+	**B28**	DO_7.5+	**C28**	DO_8.3	**D28**		**E28**	
A29	DO_8.4-	**B29**	DO_8.2-	**C29**	DO_8.5	**D29**		**E29**	
A30	DO_8.4+	**B30**	DO_8.2+	**C30**	DO_8.5	**D30**		**E30**	
A31	DO_8.8-	**B31**		**C31**	DO_8.7	**D31**		**E31**	
A32	DO_8.8+	**B32**		**C32**	DO_8.7	**D32**		**E32**	

TABLE 2-6: EMX-7514 CONNECTOR PIN SIGNAL ASSIGNMENT

EMX-7514 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA OUTPUT CHARACTERISTICS	
Sink/Source	60 V @ 50 mA (AC/DC)
Potential free	Yes
Isolation	1000 V
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

EMX-7515, 64-CHANNEL, DIGITAL INPUT CARD

The EMX-7515 is a high-performance input module with eight ports of 8 bits (64 channels) each.

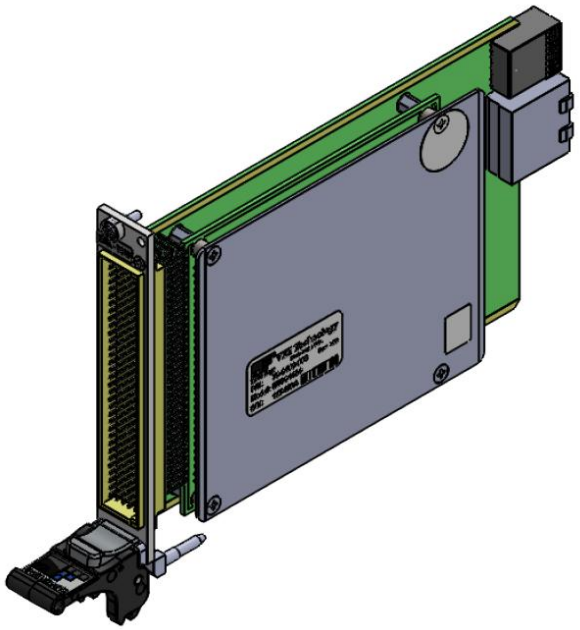


FIGURE 2-15: EMX-7515

BLOCK DIAGRAM

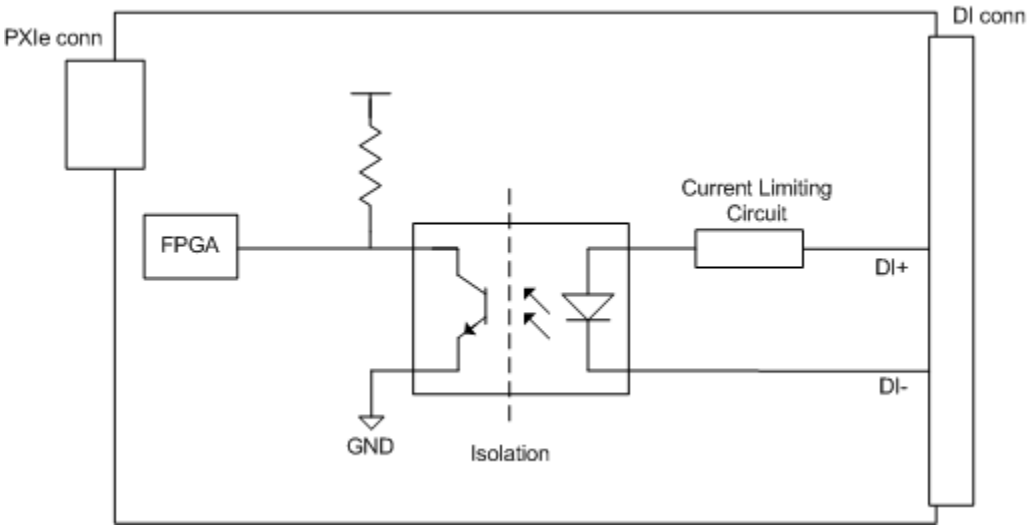


FIGURE 2-16: EMX-7515 BLOCK DIAGRAM

Connector Pin/Signal Assignment

The connector pins and their signal assignments are shown below**Error! Reference source not found.**. For mating connector and accessory information, please see the *EMX-75xx Accessories*.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	USR_SHLD _PLANE	**B1**		**C1**	EXT_CL K-	**D1**	EXT_GATE)_AC Q-	**E1**	EXT_GATE)_GEN -
A2		**B2**		**C2**	EXT_CL K+	**D2**	EXT_GATE)_AC Q+	**E2**	EXT_GATE)_GEN +
A3		**B3**		**C3**	DI_1.5-	**D3**		**E3**	DI_2.1-
A4		**B4**		**C4**	DI_1.5+	**D4**		**E4**	DI_2.1+
A5	DI_1.1-	**B5**	DI_1.2-	**C5**	DI_1.6-	**D5**	DI_1.7-	**E5**	DI_2.2-
A6	DI_1.1+	**B6**	DI_1.2+	**C6**	DI_1.6+	**D6**	DI_1.7+	**E6**	DI_2.2+
A7	DI_2.3-	**B7**	DI_1.3-	**C7**	DI_2.7-	**D7**	DI_1.8-	**E7**	DI_3.3-
A8	DI_2.3+	**B8**	DI_1.3+	**C8**	DI_2.7+	**D8**	DI_1.8+	**E8**	DI_3.3+
A9	DI_2.4-	**B9**	DI_1.4-	**C9**	DI_2.8-	**D9**	DI_3.1-	**E9**	DI_3.4-
A10	DI_2.4+	**B10**	DI_1.4+	**C10**	DI_2.8+	**D10**	DI_3.1+	**E10**	DI_3.4+
A11	DI_3.5-	**B11**	DI_2.5-	**C11**	DI_4.1-	**D11**	DI_3.2-	**E11**	DI_4.5-
A12	DI_3.5+	**B12**	DI_2.5+	**C12**	DI_4.1+	**D12**	DI_3.2+	**E12**	DI_4.5+
A13	DI_3.6-	**B13**	DI_2.6-	**C13**	DI_4.2-	**D13**	DI_4.3-	**E13**	DI_4.6-
A14	DI_3.6+	**B14**	DI_2.6+	**C14**	DI_4.2+	**D14**	DI_4.3+	**E14**	DI_4.6+
A15	DI_4.7-	**B15**	DI_3.7-	**C15**	DI_5.3-	**D15**	DI_4.4-	**E15**	DI_5.7-
A16	DI_4.7+	**B16**	DI_3.7+	**C16**	DI_5.3+	**D16**	DI_4.4+	**E16**	DI_5.7+
A17	DI_4.8-	**B17**	DI_3.8-	**C17**	DI_5.4-	**D17**	DI_5.5-	**E17**	DI_5.8-
A18	DI_4.8+	**B18**	DI_3.8+	**C18**	DI_5.4+	**D18**	DI_5.5+	**E18**	DI_5.8+
A19	DI_6.1-	**B19**	DI_5.1-	**C19**	DI_6.5-	**D19**	DI_5.6-	**E19**	DI_7.1-
A20	DI_6.1+	**B20**	DI_5.1+	**C20**	DI_6.5+	**D20**	DI_5.6+	**E20**	DI_7.1+
A21	DI_6.2-	**B21**	DI_5.2-	**C21**	DI_6.6-	**D21**	DI_6.7-	**E21**	DI_7.2-
A22	DI_6.2+	**B22**	DI_5.2+	**C22**	DI_6.6+	**D22**	DI_6.7+	**E22**	DI_7.2+
A23	DI_7.3-	**B23**	DI_6.3-	**C23**	DI_7.7-	**D23**	DI_6.8-	**E23**	
A24	DI_7.3+	**B24**	DI_6.3+	**C24**	DI_7.7+	**D24**	DI_6.8+	**E24**	
A25	DI_7.4-	**B25**	DI_6.4-	**C25**	DI_7.8-	**D25**	DI_8.1-	**E25**	
A26	DI_7.4+	**B26**	DI_6.4+	**C26**	DI_7.8+	**D26**	DI_8.1+	**E26**	
A27	DI_7.6-	**B27**	DI_7.5-	**C27**	DI_8.3-	**D27**		**E27**	
A28	DI_7.6+	**B28**	DI_7.5+	**C28**	DI_8.3+	**D28**		**E28**	
A29	DI_8.4-	**B29**	DI_8.2-	**C29**	DI_8.5-	**D29**		**E29**	DI_8.6-
A30	DI_8.4+	**B30**	DI_8.2+	**C30**	DI_8.5+	**D30**		**E30**	DI_8.6+
A31	DI_8.8-	**B31**		**C31**	DI_8.7-	**D31**		**E31**	
A32	DI_8.8+	**B32**		**C32**	DI_8.7+	**D32**		**E32**	

TABLE 2-7: EMX-7515 CONNECTOR PIN SIGNAL ASSIGNMENT

EMX-7515 SPECIFICATIONS

GENERAL SPECIFICATIONS	
DATA INPUT CHARACTERISTICS	
Logical High	2.5 V to 60 V
Logical Low	< 2.5 V
Isolation	1000 V
POWER CONSUMPTION	
3.3 V	
5 V	
12 V	

SECTION 3

SOFTWARE INSTALLATION

The fastest way to begin controlling an EMX-75xx card is to discover the EMX-2500 chassis in which the card can be plugged. This can be found using the LXI Discovery Tool utility (a free tool available from LXI Consortium). For more information, refer to: http://lxistandard.org/Resources/LXIDiscoveryTool.aspx

The **LXI Discovery Tool** searches for all LXI Devices on the LAN Subnet. It uses mDNS and VXI-11 protocols to detect the LXI Instruments. The mDNS service additionally has some dependency on "Apple Bonjour Print Services" and hence the user has to install this service in the system to perform discovery mechanism. However, it is not mandatory to install this service, since LXI devices use various other protocols and services for discovery.

DRIVER INSTALLATION

VTI Instruments provides two types of drivers for this instrument. For Windows there is an IVI driver, based on the industry standard IVI driver architecture specifications. The IVI driver exposes both IVI-COM and IVI-C interface APIs. The IVI-COM interface can be used from any programming language that supports Microsoft COM (Component Object Model). For Linux, there is a driver that provides a C++ API. Both Windows and Linux drivers have a consistent API design so that the application software developed for one can be easily migrated to the other. The drivers are compatible with both 32-bit and 64-bit operating systems. In general, the API descriptions in this document apply to both the Windows and Linux drivers unless otherwise specified.

To control the EMX-75XX series card programmatically (via a user generated program or through tools such as Agilent VEE®, NI LabVIEW®, Mathworks Matlab®, etc.), two additional components must be installed: the IVI Shared Components library (for Windows OS only) or the VTI Common Library (for Linux OS only) and the provided VTI Instruments driver. For 32-bit Windows OS, install the 32-bit driver. For Windows 7 (64-bit), Windows 8 (64-bit), and Windows 10 (64-bit), the 64-bit driver installer includes both 64-bit and 32-bit compatible drivers. These drivers are available for free download on the VTI Instruments web portal (www.vtiinstruments.com), in the respective product page, under download tab. The following sections describe installing the required software.

IVI Shared Components Installation (Windows Only)

If this component was installed during a previous LXI instrument installation, please proceed to Instrument Driver Installation. First, close all other open programs, leaving only Windows Explorer open. Navigate to the `<CD-ROM Drive>:\EMX Platform Requisites` directory on the CD and run the `IVISharedComponentsX.X.X.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 Web page, www.ivifoundation.org.

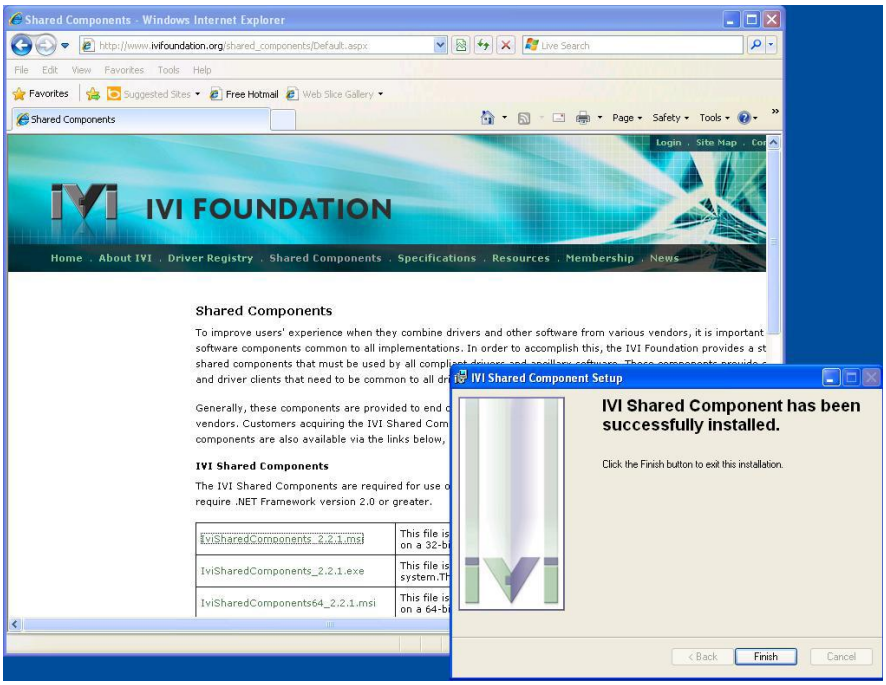


FIGURE 3-1: IVI SHARED COMPONENT INSTALLATION

Instrument Driver Installation

If the VTEXDio instrument driver was installed previously on the host PC, you may skip this step of the installation process, and proceed to Platform/LXISync Instrument Driver Installation. The previously installed driver may need to be updated to the most recently released version to support the EMX-7510. To install the VTEXDio instrument driver, navigate *to* `<CD-ROM Drive>:\Drivers\LXI Drivers\EMX Series`, on the CD, open the appropriate zip file in this directory, and then run the `.msi` installer. Alternately the drivers are available for free download from VTI Instruments online portal (www.vtiinstruments.com) under the specific product's download page.

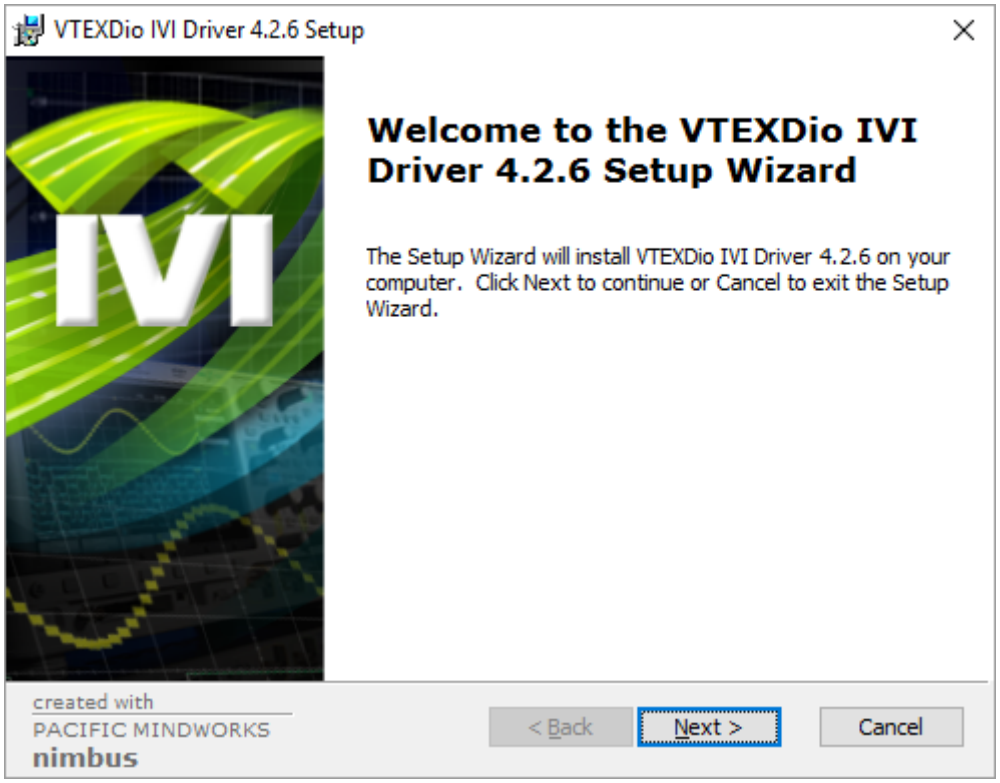


FIGURE 3-2: INSTRUMENT DRIVER INSTALLATION

The Linux driver (32-bit and 64-bit) is located under `<CD-ROM Drive>:\Drivers\Linux Drivers\Linux EMX Series`. Open the appropriate zip file in this directory and then run the RPM Installer. Alternately the instrument drivers for Linux OS are also available for free download from VTI Instrument website, www.vtiinstruments.com

PROGRAMMING THE INSTRUMENT

This section provides programming examples for the EMX-75xx series. Additional information can be found in the driver help file. If the instrument will be used on a Linux system, a .chm viewer must be installed on the host PC (examples of these programs can be found at the following URL: http://www.linux.com/news/software/applications/8209-chm-viewers-for-linux.)

NOTE	Programming examples are installed with the IVI Driver – DIO, typically located in the "<HDD Designation>\Program Files\IVI Foundation\IVI\Drivers\VTEXDIO\Examples" folder.

RELATED SOFTWARE COMPONENTS

IVI-COM Driver
IVI-C Driver
LabView Driver (Currently this is not available)
Linux C++ Driver (Currently this is not available)

USING THE DRIVER

The EMX-75xx series may be used in a variety of environments including: Visual Basic, C#, C++, LabView. VTI instruments provides a IVI-C and IVI-COM compliant driver as well as a shared object that can be used on Linux systems that comply with the Linux Standard Base (Version 3.1).

Here is how to use the driver in each environment:

4) **Visual Studio C++**
```
#import "IviDriverTypeLib.dll" no_namespace
#import "VTEXDIO.dll" no_namespace
```

5) **C#**
Add a reference to VTEXDIO.dll in the project. Include the following at the top of any code file that will access the driver:
```
using VTI.VTEXDIO.Interop;
```

6) **C/C++ on Windows**
Link against VTEXDIO.lib and include VTEXDIO.h in the file.

7) **C++ on Linux**
Link against /opt/vti/lib/libdio.so and include all the headers in /opt/vti/include in the source file.

8) **LabView**
Copy the driver package to the <Labview>/instr.lib directory and access all relevant VIs

USING THE EMX-75XX SERIES

INITIALIZING\CLOSING THE INSTRUMENT

The base interface of the EMX-75xx IVI driver, VTEXDIO (LibDIO on Linux), is used to open and close connections to the instrument as well as containing pointers to all other interfaces to access the functionality of the instrument.

Initialization

Prior to using the EMX-75xx, an instrument driver connection must be made to the EMX-75xx. Once a connection is made using the Initialize call, the user can execute their test code. Before the program exits, the user should release the resources using the Close call. Users familiar with other VTI Instrument Drivers for the EMX series should find this driver is very similar to ones they have used before.

C++

```
#import "IviDriverTypeLib.dll" no_namespace
#import "VTEXDio.dll" no_namespace

int main()
{
	//Windows driver creation
	::CoInitialize(NULL); // start COM layer
	try
	{
		IVTEXDIOPtr Dio (__uuidof(VTEXDIO));
		/*We chose to give this driver an empty options string. If you have more
		than one DIO card in your chassis, you will have to give it options such
		as a slot number. This is because the DIO driver does not support more
		than one card per driver instance. Note also that we set the reset flag
		so that we can get a clean start witht he unit */

		Dio->Initialize("TCPIP::10.20.1.5::INSTR", VARIANT_TRUE, VARIANT_TRUE,
		"");
		dio->Close();
		::CoUninitialize();
	}
```

```
	catch (_com_error &e)
	{
		::MessageBox(NULL, e.Description(), e.ErrorMessage(),
		MB_ICONERROR);
	}
	catch (...)
	{
	// handle errors here, depending on needs
	}
	Return 0;
}
```

Option Strings

The VTEX drivers provide option strings that can be used when Initializing an instrument. The option string values exist to change the behavior of the driver. The following options strings are available on VTI IVI drivers:

- **Simulate**: Allows the user to run a program without commanding switch card or instruments. This option is useful as a debugging tool.
- **Cache**: Per the IVI specification, this option "specifies whether or not to cache the value of attributes." Caching allows IVI drivers to maintain certain instrument settings to avoid sending redundant commands. The standard allows for certain values to be cached always or never. In VTI IVI-drivers, all values used are of one of these types. As such, any values entered have no effect.
- **QueryInstrumentStatus**: Queries the instrument for errors after each call is made. As implemented in the VTI IVI drivers, instruments status is always queried regardless of the value of this property.
- **DriverSetup**: Must be last, and contains the following properties:
  - **Logfile**: Allows the user to specify a file to which the driver can log calls and other data.
  - **Logmode**: Specifies the mode in which the log file is opened. The allowed modes are:
    - **w**: truncate s the file to zero length or creates a text file for writing.
    - **a**: opens the file for adding information to the end of the file. The file is created if it does not exist. The stream is positioned at the end of the file.
  - **LogLevel**: Allows the user to determine the severity of a log message by providing a level-indicator to the log entry.
  - **Slots**: This is the most commonly used option and it allows for a slot number or a slot number and a card model to be specified.
    "Slots=(2)" - Just slot 2.
    "Slots=(2=EMX_75xx)" - slot and card model
    "Slots=(2,3)" - Multiple slots
- **InterchangeCheck**: Boolean option that enables/disables IVI Interchangeability checking. As implemented in the VTI IVI drivers, values entered for this property have no effect.
- **RangeCheck**: Boolean option that enables or disables driver validation of user-submitted values. As implemented in the VTI IVI drivers, validation of user inputs is always performed at the firmware level regardless of this property's value.
- **RecordCoercions**: Boolean option that enables driver recording of coercions. As implemented in the VTI IVI drivers, coercions are handled in the firmware and cannot be recorded.

BASIC OPERATION

The EMX-75xx Series is a family of high-performance PXIe modules consisting of multiple I/O configurations and logic levels. Dedicated input or output cards are available for high channel count applications while other cards provide ultimate flexibility with eight, 8-bit ports (64 channels) that can be configured as an input or output under programmatic control

Voltage

This example covers the main functionality of the device: setting a voltage as an output in a port. Note that the voltage should be set first, then enabled. This prevents enabling the port with the default value enabled, which is the maximum value.

C++

```
//For Microsoft products
#import "IviDriverTypeLib.dll" no_namespace
#import "VTEXDio.dll" no_namespace

int main()
{
  //Windows driver creation
  ::CoInitialize(NULL); //Start the COM layer
  try
  {
    IVTEXDioPtr Dio(__uuidof(VTEXDio));

    /*We chose to give this driver an empty options string. If you have more than one
DIO card in your chassis, you will have to give it options such as a slot number. This
is because the DIO driver does not support more than one card per driver instance.
Note also that we set the reset flag so that we can get a clean start with the unit */

    Dio->Initialize("TCPIP::10.20.1.5::INSTR", VARIANT_TRUE, VARIANT_TRUE, "");

    /* Now we get to the meat of the example code. First, we want to drill down into
the ports interface. The first thing we always want to do is set a voltage. Many other
operations in the ports interface depend on having a voltage set. */

    Dio->Normal->Ports->Item["PORT1"]->VoltageRange = 5.0;

    /* By default, ports are set to input direction and normal polarity. This means we
should be able to read the current state of the pins on the 5V range, as long as we
don't have an OverCurrent condition. Let's check for OverCurrent before we read the
data back. */

    if(Dio->Normal->Ports->Item["PORT1"]->LatchedOverCurrent == 1)
    {
    //The port is in an OverCurrent state, so we would want to take some action here.
    }

    /* We want to check the Latched OverCurrent because while the OverCurrent tells us
if we are in an OverCurrent state now, the LatchedOverCurrent bit will tell us if we
have ever had one. If we have ever had an OverCurrent condition, the port will be
stuck in the reset state until we fix the inputs and call ResetOverCurrent. Now that
we've verified there's no OverCurrent condition, Let's read some data. */

       int data = Dio->Normal->Ports->Item["PORT1"]->Data;

       /* We can also change our Polarity if we want to read the data inverted. */

       Dio->Normal->Ports->Item["PORT1"]->Polarity = VTEXDioPolarityInverse;
       data = Dio->Normal->Ports->Item["PORT1"]->Data;

       /*Now let's pick another port and set it to an output, and output some data on
it. Changing the direction to Output allows us to write data as well as read it back.
Note that we also have to set a voltage on the port before we can write data.*/
```

```
      Dio->Normal->Ports->Item["PORT2"]->Direction = VTEXDioDirectionOutput;
      Dio->Normal->Ports->Item["PORT2"]->VoltageRange = 3.3;
      Dio->Normal->Ports->Item["PORT2"]->Data = 128;

      /* Changing the Polarity of an output changes both the output and readback
polarity. This means the user will always read back what they wrote, but the opposite
signal will be placed on the line. */

      Dio->Normal->Ports->Item["PORT2"]->Polarity = VTEXDioPolarityInverse;
      Dio->Normal->Ports->Item["PORT2"]->Data = 128; //Looks the same as above, really
outputting 127
      data = Dio->Normal->Ports->Item["PORT2"]->Data; //Will return 128.

      /* The Configure call lets us set all the values for a particular port quickly.
Here we will configure the port with a direction of Output, a Polarity of Normal, a
VoltageSource of User, and a voltage of 5V TTL Emulation (which has no effect, since
the voltage source is set to User. */
      Dio->Normal->Ports->Item["PORT3"]->Configure(VTEXDioDirectionOutput,
VTEXDioPolarityNormal, VTEXDioVoltageSourceUser, -1.0);

      /* We can also work with multiple ports at once. The ReadPorts and WritePorts
functions allow us to set or get data from several ports at a time. Setting data on
ports with an Input direction is ignored. */

      Dio->Normal->WritePorts(VTEXDioDataWidth16, 2, 255); //Writes a data of 255 on
port 2, and 0 on port 3.

      Dio->Close();

      ::CoUninitialize(); //Turn off the COM layer.
  }
  catch(...)
  {
       //Exception handling here
  }
  return 0;
}
```

C#

```
using System;
using System.Runtime.InteropServices;
using VTI.VTEXDio.Interop;

namespace PortConfiguration
{
    class PortConfiguration
    {
        static void Main(string[] args)
        {
            try
            {
                VTEXDio Dio = new VTEXDio();

                try
                {
                    Dio.Initialize("TCPIP::10.20.1.6::INSTR", true, true, "");
                    Dio.Normal.Ports.get_Item("PORT1").VoltageRange = 5.0;

                    /* By default, ports are set to input direction and normal
polarity. This means we should be able to read the current state of the pins on the 5V
range, as long as we don't have an OverCurrent condition. Let's check for OverCurrent
before we read the data back. */

                    if (Dio.Normal.Ports.get_Item("PORT1").LatchedOverCurrent == true)
                    {
```

```
                        //The port is in an OverCurrent state, so we would want to
take some action here.
                    }

                    /* We want to check the Latched OverCurrent because while the
OverCurrent tells us if we are in an OverCurrent state now, the LatchedOverCurrent bit
will tell us if we have ever had one. If we have ever had an OverCurrent condition,
the port will be stuck in the reset state until we fix the inputs and call
ResetOverCurrent. Now that we've verified there's no OverCurrent condition,
                       Let's read some data. */

              int data = Dio.Normal.Ports.get_Item("PORT1").Data;

           /* We can also change our Polarity if we want to read the data inverted. */

                    Dio.Normal.Ports.get_Item("PORT1").Polarity =
VTEXDioPolarityEnum.VTEXDioPolarityInverse;
                    data = Dio.Normal.Ports.get_Item("PORT1").Data;

                    /*Now let's pick another port and set it to an output, and output
some data on it. Changing the direction to Output allows us to write data as well as
read it back. Note that we also have to set a voltage on the port before we can write
data.*/
                    Dio.Normal.Ports.get_Item("PORT2").Direction =
VTEXDioDirectionEnum.VTEXDioDirectionOutput;
                    Dio.Normal.Ports.get_Item("PORT2").VoltageRange = 3.3;
                    Dio.Normal.Ports.get_Item("PORT2").Data = 128;

                    /* Changing the Polarity of an output changes both the output and
readback polarity. This means the user will always read back what they wrote, but the
opposite signal will be placed on the line. */
                    Dio.Normal.Ports.get_Item("PORT2").Polarity =
VTEXDioPolarityEnum.VTEXDioPolarityInverse;
                    Dio.Normal.Ports.get_Item("PORT2").Data = 128; //Looks the same as
above, really outputting 127
                    data = Dio.Normal.Ports.get_Item("PORT2").Data; //Will return 128.

                    /* The Configure call lets us set all the values for a particular
port quickly. Here we will configure the port with a direction of Output, a Polarity
of Normal, a VoltageSource of User, and a voltage of 5V TTL Emulation (which has no
effect, since the voltage source is set to User. */

Dio.Normal.Ports.get_Item("PORT3").Configure(VTEXDioDirectionEnum.VTEXDioDirectionOutp
ut, VTEXDioPolarityEnum.VTEXDioPolarityNormal,
VTEXDioVoltageSourceEnum.VTEXDioVoltageSourceUser, -1.0);

                    /* We can also work with multiple ports at once. The ReadPorts and
WritePorts functions allow us to set or get data from several ports at a time. Setting
data on ports with an Input direction is ignored. */

                    Dio.Normal.WritePorts(VTEXDioDataWidthEnum.VTEXDioDataWidth16, 2,
255); //Writes a data of 255 on port 2, and 0 on port 3.

                    Dio.Close();
                }
                catch (COMException e)
                {
                    //Error handling for driver-related errors goes here
                }
            }
            catch (Exception e)
            {
                //Error handling for instantiation errors goes here
            }
        }
    }
}
```

SECTION 4

SFP OPERATION

INTRODUCTION

The EMX-2500 chassis accommodates the EMX-75XX card and provides an internal web page, which allows easy configuration, management and troubleshooting of the device. This internal Soft Front Panel (SFP) is a JavaScript based application which is designed to work, within web browser environment. If you know the IP address of the instrument, you can type it in the address bar of any modern web browsers, such as Microsoft Internet Explorer, Mozilla Firefox etc.

To open the embedded web page, simply type the IP address of the instrument into browsers address bar, and navigate accordingly. In order for your browser to communicate with the instrument, the instrument and your computer should be within the same network, and may require permissions from your network/computer administrator.

There are various ways to search the IP address, and other network configuration parameters of the instrument. The easiest method is to refer to the embedded display on the instrument, and use the menu key to navigate to necessary details. However, if the device display is not physically accessible, you can use LXI Discovery tool, or any standard IO Libraries tool, such as National Instruments (c) Measurement and Automation Explorer (MAX) and the Keysight (formerly Agilent) (c) Connection Expert (ACE) to discover the instrument. The instrument also supports mDNS protocols, so that any tools meant for Zero Configuration Networking, such as Apple ® Bonjour ® or Avahi, can also be used to discover the instrument. For more information on installation of these software utilities, please refer to their respective vendors.

The LXI Discovery tool is a free utility, available for download from LXI Consortium itself. It uses both VXI-11, as well as mDNS protocols to detect the LXI instruments present in your network. Once installed, this software will discover EMX-2500 instruments, if available, as shown below.

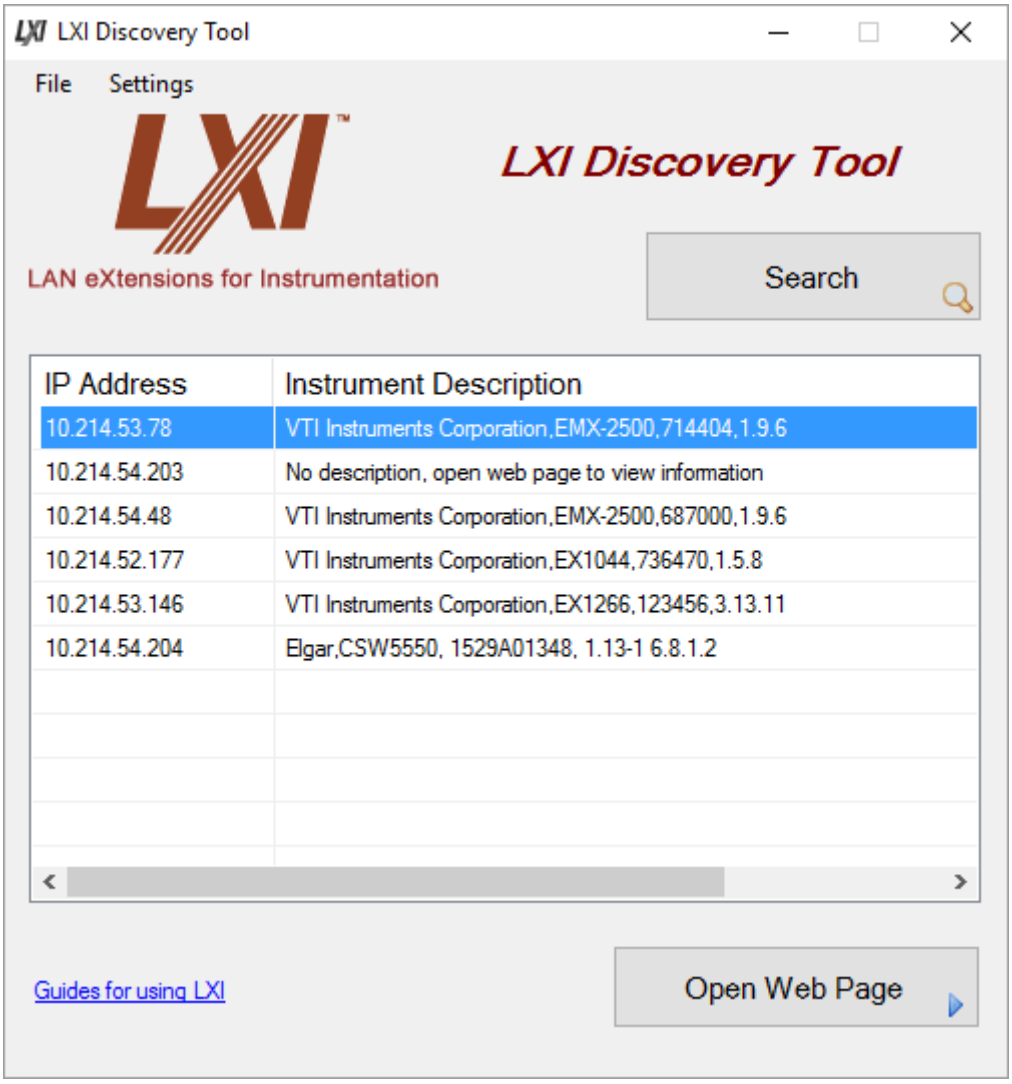


FIGURE 4-1: LXI DISCOVERY TOOL WITH EMX-2500 SELECTED

Alternatively, the EMX-2500 may also be discovered using Internet Explorer's Bonjour for Windows plug-in. The IP address of the EMX-2500 can also be entered into the address bar of any web browser to view the embedded web page. 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 is connected to, it will instead use Auto IP. Determining the Auto IP address is discussed in the **Error! Reference source not found.** portion of **Error! Reference source not found.**. Other discovery methods, such as VXI-11, can be used as well.

COMMON ISSUES

Although Ethernet is an easy connectivity option, some users may experience difficulty discovering LXI devices. Most often, these issues have been caused by networking issues, such as the instrument and host computer being connected to different sub-nets of the network. The user can either search internet or contact their system/network administrator for assistance on these issues. Here are few other causes that may be present in the user system which may obstruct instrument discovery:

Multiple Network Ports

It is possible that the user computer, can have multiple network adaptors (physical/virtual). Common example of this case, is use of Wireless Internet/Wi-Fi in Laptop computers, whose Wired Ethernet connections are connected to LXI device connected network. In some cases, virtual network adaptors could have been created for use by some of the installed applications on user system. The easy solution to these problems is to disable all other Ethernet connections and so force the computer to select the network port which is used by LXI Instrument.

Firewall

It is possible that the firewall of the computer may be stopping the data traffic to the connected LXI device. It may not be always feasible to stop the Firewall completely, and hence the user may contact their computer administrator for making exceptions in Firewall configuration to allow LXI data traffic. Here are the list of ports and protocols, typically used by LXI devices.

Protocol / Service	Port	Base Protocol	Remarks
mDNS	5353	UDP/TCP	Zero-config protocol for <hostname>.local address resolution; service discovery; Multicast 224.0.0251, FF02::FB
HTTP	80	TCP	Instrument web pages (SFP) and driver communication
ICMPv4		ICMP	Typically enables echo request/respond for ping
ICMPv6		ICMP	Optional - Typically enables echo request/respond for ping, also SLAAC for IPv6 addresses, RDDNS
Arp		Arp	Used to confirm address assignments
DHCPv4	67/68	UDP/TCP	IPv4 address assignment, DNS Server, Dynamic DNS, Gateway
DNS	53	UDP	Naming service
SSH	22	TCP	Bidirectional interactive text oriented communication
RPC port-mapper	111	UDP/TCP	Builds upon Sun-RPC and port-mapper
VXI-11	Varies	TCP	VXI-11 instrument discovery The exact port number varies; query the RPC port-mapper to determine which port is current in use
LXI-eventsvc	5044	UDP/TCP	LXI Event support for instrument triggering; multicast 224.0.23.159, FF02::138. LXI Events can use other ports also, but default port number is 5044
Ptp-event	319	UDP/TCP	LXI Profile IEEE 1588 Precision Time Protocol (PTP); multicast 224.0.1.129, FF02::181
Ptp-general	320	UDP/TCP	LXI Profile IEEE 1588 Precision Time Protocol (PTP); multicast 224.0.1.129, FF02::181
Data stream	9900	TCP	Driver data stream

TABLE 4-1: STANDARD PORTS, PROTOCOLS, AND SERVICES

GENERAL WEB PAGE OPERATION

When initial connection is made to the EMX-2500, the instrument home page, or **Index**, appears. This page displays instrument-specific information. 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 allows changing configuration parameters of the EMX-2500, a password may be required. If so, the Login page will appear.

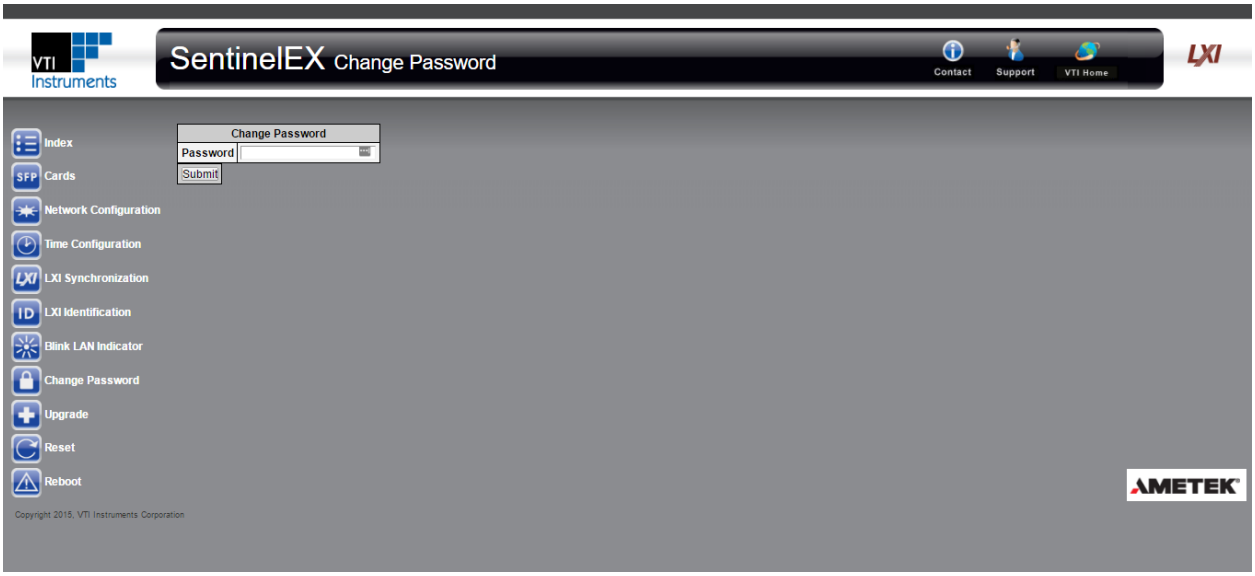


FIGURE 4-2: LOGIN PAGE

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, performing a network reset operation will reset the EMX-2500 to no password.

INDEX

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

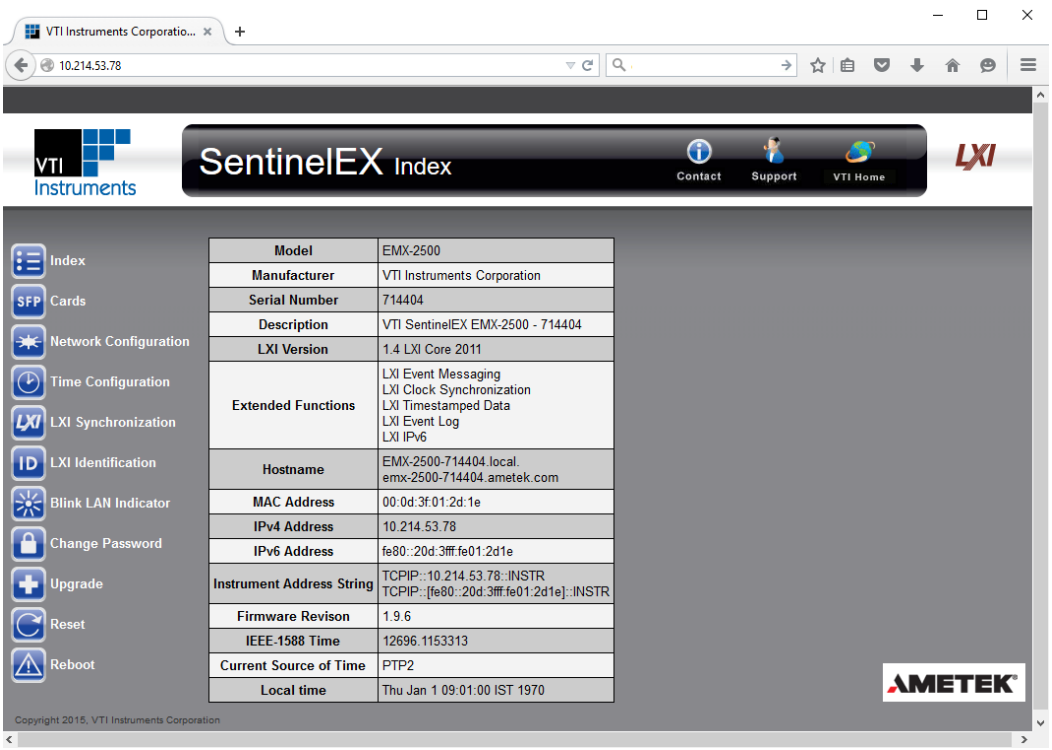


FIGURE 4-3: EMX-2500 CHASSIS MAIN WEB PAGE

The **Index** is accessible from any other instrument page by clicking on the EMX-2500 web page header. The EMX-2500 **Command Menu** is displayed on the left-hand side of every internal web page. The entries on the command menu represent three types of pages:

Status This type of page performs no action and accepts no entries. It provides operational status and information only. The **Index** page is an example of a status page.

Action This type of page initiates a command on the instrument, but does not involve parameter entry. The **Reboot** page is an example of an action page.

Entry This type of page displays and accepts changes to the configuration of the instrument. The **Time 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.

Notes on Web Page Use

If a window needs to be resized, this should be done when the window opens. Resizing requires a refresh which causes the current state to be lost.

VTI Instruments Logo

The VTI Instruments logo that appears on the upper left of all EMX-2500 web pages is a link to the VTI Instruments corporate website: http://www.vtiinstruments.com.

The remainder of this discussion will focus on the EMX-75xx soft front panel. For more information on other EMX-7510 soft front panel elements, please refer to the *EMX-75xx Series User's Manual*.EMX-75xx Soft Front Panel

To navigate to the EMX-75xx soft front panel, click on **Soft Front Panel** in the **Command Menu** (see Figure 4-4). Next, select **DIO EMX-75xx** from the list of cards installed in the EMX-75xx.

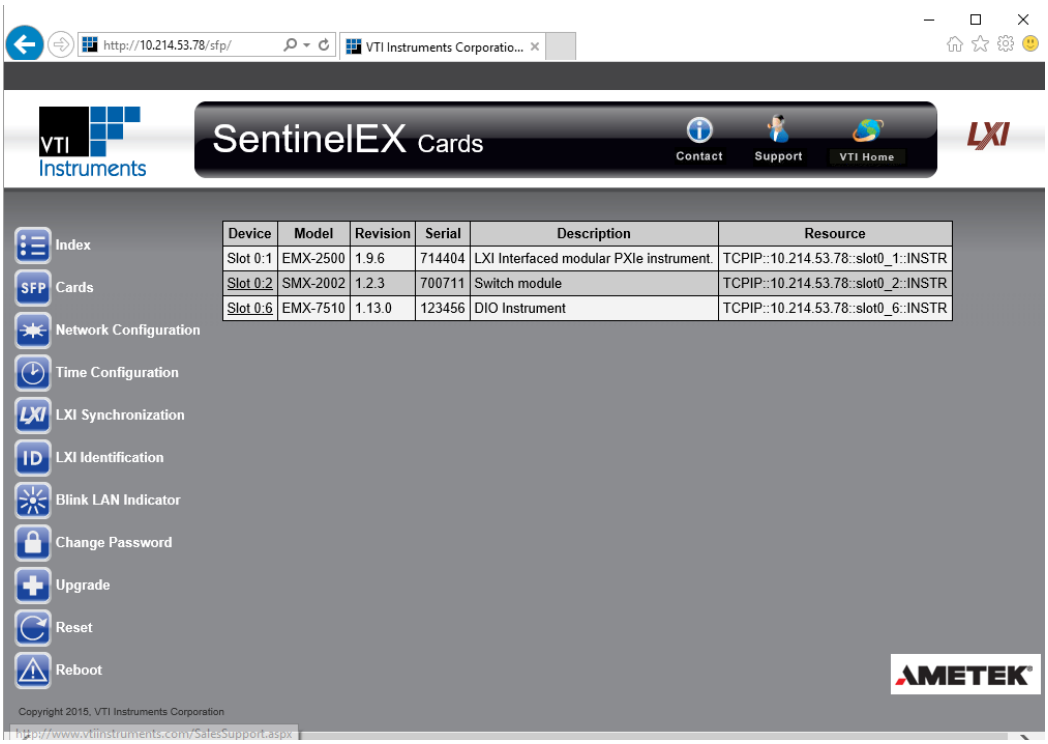


FIGURE 4-4: EMX-75XX SOFT FRONT PANEL MAIN PAGE

MONITOR AND CONTROL PAGE

By default, the EMX-75xx SFP opens to the **Monitor and Control** view. From this view, the user can define the DIO's mode, its ports configurations. Although the SFP does not expose the entire functionality of the DIO, the SFP can be used to set up the EMX-75xx in most applications.

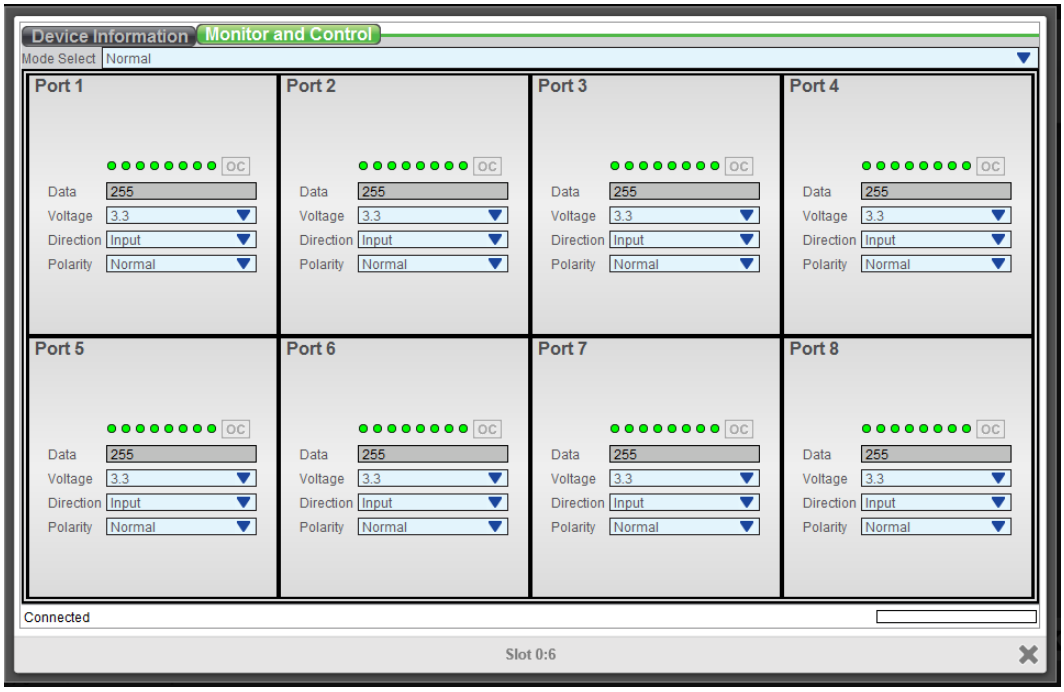


FIGURE 4-5: EMX-75XX SOFT FRONT PANEL (NORMAL MODE)

At the top of the Monitor and Control menu, the **Mode Select** drop menu is used to set the EMX-75xx for either **Normal** or **Pattern** mode. The settings for each mode will now be discussed.

NORMAL MODE CONFIGURATION

When normal mode is selected, the user can define each port independently.

Port Configuration Fields

For each Port, the following settings can be configured.

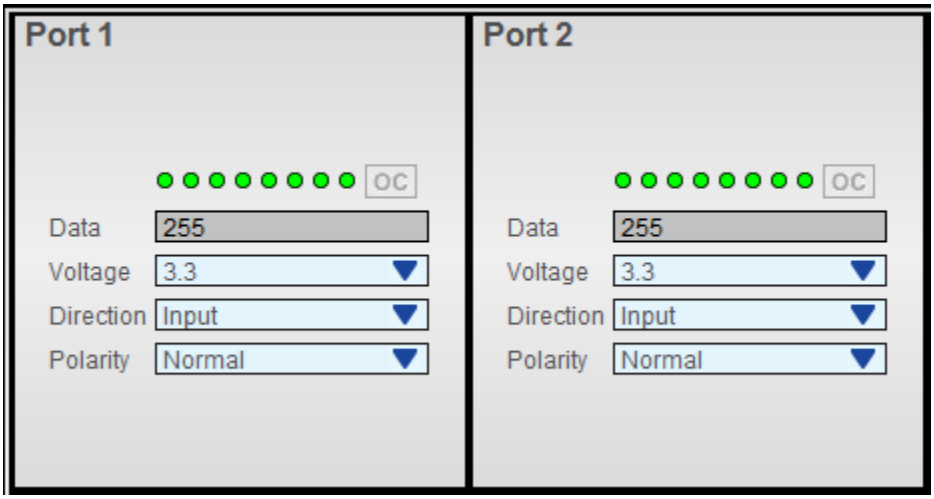


FIGURE 4-6: PORT CONFIGURATION FIELDS

- **Data Indicators**: The LED indicators in each port configuration section indicate the data value this is being sent by or received by the indicated port. The data is an 8-bit integer with the green LEDs indicating an output high (1) and a red LED indicating an output low (0).
- **OC**: If an over-current event occurs, the **OC** indicator will turn **red**, indicating that actions should be taken by the user.
- **Data**: When the direction is set to **Output**, the user can enter the data value that will be sent on the selected port.
- **Voltage**: Select the voltage range for the port. Allowable values are **-2.0**, **-1.0**, (output only), **3.3**, **5.0**, **12.0**, **24.0**, and **User Voltage Source**. Note that the **-2.0** and **-1.0** are not voltage values, but correlate to LV emulation and TTL emulation, respectively hence if the user sets that value the direction will be changed to Output automatically.
- **Direction**: Sets the port as either an **Input** or an **Output**.
- **Polarity**: Sets the ports polarity as either **Normal** or **Inverse**.

PATTERN MODE CONFIGURATION

Currently, Pattern mode feature is not available for EMX-75XX card.

DEVICE INFO TAB

If the **Device Info** tab is clicked, information regarding the selected instrument will be displayed including the versions of the SFP, firmware, and hardware.

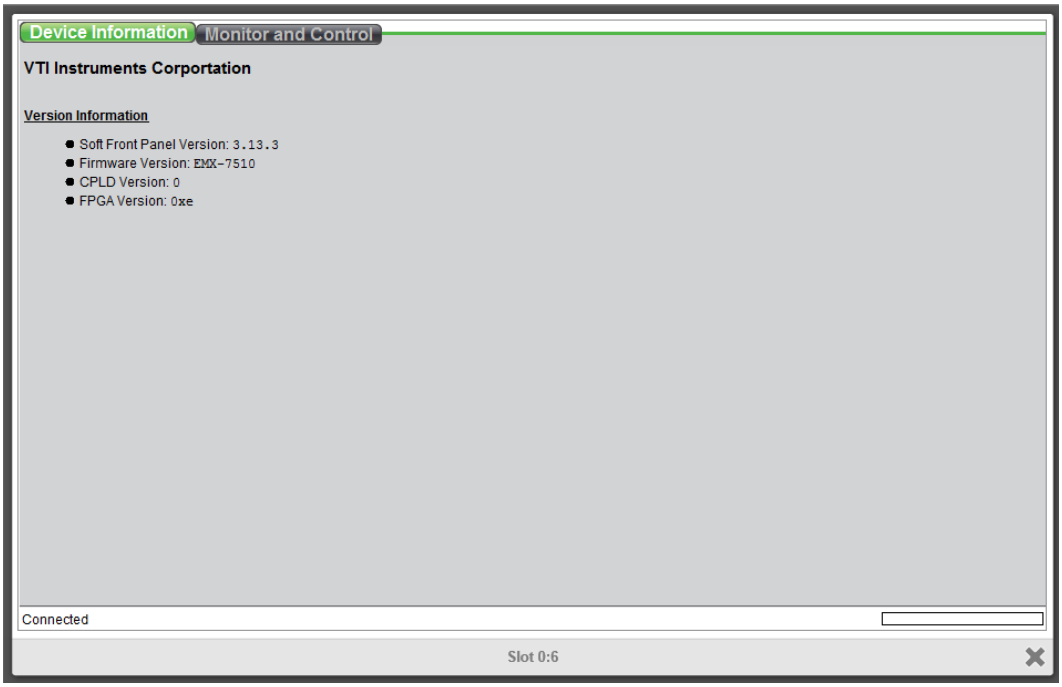


FIGURE 4-7: DEVICE INFORMATION WEB PAGE