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U S E R ' S M A N U A L

VXI SPDT SWITCHING MODULE

MODEL VX412C

Manual Part No: 11026209A

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INTRODUCTION

This manual describes the operation and use of the C&H Model VX412C VXI SPDT Switching Module (Part Number 11026205). This VXI module is one of a number of test and data acquisition/control modules in the VME and VXI format provided by C&H.

Contained within this manual are the physical and electrical specifications, installation and startup procedures, functional description, and configuration and programming guidelines to adequately use the product.

The part numbers covered by this manual are:

Part Number	Description
11026205-0001	VX412C (standard relays)
11026205-0002	VX412C (mercury wetted relays)

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1.0 GENERAL DESCRIPTION

The VX412C SPDT Switching Module is a C size, Register based switching card that provides 32 channels of SPDT (Form C) switching. Normally closed, normally open and common pins are provided on front panel connectors for each of the non-latching relays. The module is provided with standard dry-contact power relays (Option -0001) or high switching voltage mercury-wetted relays (Option -0002).

1.1 PURPOSE OF EQUIPMENT

This module is designed to provide a low cost solution to Form-C switching requirements in VXI test or measurement applications. Typical applications include power switching and low-frequency switching and control.

1.2 SPECIFICATIONS

1.2.1 Key Features

- 32 independently controlled single pole, double throw (SPDT) non-latching relays
- Read-back of Relays state
- Power up/down states: normally open contact is open

1.2.2 Electrical

The module requires +5V and +12V power from the VXI backplane. The typical module current for the +5 volt supply is 1.0 amp and for the +12 volt supply is 1.5 amps. Detail specifications for the relays are provided in Table I.

1.2.3 Mechanical

The mechanical dimensions of the module are in conformance with the VXI bus specification for single slot Size-C modules. The nominal dimensions are 233.35 mm (9.187 in) high x 340 mm (13.386 in) deep. The module is designed for a mainframe with 30.48 mm (1.2 in) spacing between slots.

NOTE:	**When using mercury-wetted relays (Option -0002) the module must be positioned vertical (±30°) for proper operation.**

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Table I. Relay Specifications

Ratings For Resistive Loads	Standard Power Relay (Option -0001)	Mercury-Wetted Relays (Option -0002)
Maximum Power Switched, per relay	1250VA, 150Wdc	50 W (AC or DC)
Maximum Volts Switched	200V_{ac} (rms), 100Vdc	500 V_{ac} (peak) or DC
Maximum Current:		
Switched	5A (AC), 5A (DC)	1.0A (AC_{peak} or DC)
Carry[1]	5A (AC), 5A (DC)	2.0A (AC_{peak} or DC)
Initial Contact Resistance	0.1 Ω (6VDC @ 1A)	0.1 Ω (50mV @ 10ma)
Insulation Resistance	100MΩ @ 500Vdc	10^{12} Ω @ 100Vdc
Relay Life (operations)	No Current - 10 million 5A @ 250Vrms - 100,000	500Vdc @ 100mA - 3 million 50Vdc @ 1A - 1.7 million
Operate Time	4-7 ms	2 ms (typical)
Release Time	1-2 ms	1.5 ms (typical)
Maximum Operating Speed	20 CPM	30 CPS

Notes:
1. 50A maximum for module.
2. Maximum operating speed to guarantee rated relay life. Faster operation for short periods is permitted.

1.2.4 Environmental

The environmental specifications of the module are:

Operating Temperature:	0°C to +55°C
Storage Temperature:	-40°C to +75°C
Humidity:	<95% without condensation

1.2.5 Bus Compliance

The module complies with the VXIbus Specification Revision 1.4 for B-size register based modules and with VMEbus Specification ANSI/IEEE STD 1014-1987, IEC 821 and IEC 822.

Module:	C-size, single slot
Device Type:	Register Based
Manufacturer ID:	$FC1_{16}$
Model Code:	FFF_{16}
Addressing:	A16
Data Transfer:	D16 Slave
Memory Space:	None
Interrupts:	None
Bus Arbitration:	BRx tied to BGx

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2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION

In most cases the VX412C is individually sealed and packaged for shipment. Verify that there has been no damage to the shipping container. If damage exists then the container should be retained as it will provide evidence of carrier caused problems. Such problems should be reported to the carrier immediately as well as to C&H. If there is no damage to the shipping container, carefully remove the module from its box and anti static bag and inspect for any signs of physical damage. If damage exists, report immediately to C&H.

2.2 HANDLING PRECAUTIONS

The VX412C contains components that are sensitive to electrostatic discharge. When handling the module for any reason, do so at a static-controlled workstation, whenever possible. At a minimum, avoid work areas that are potential static sources, such as carpeted areas. Avoid unnecessary contact with the components on the module.

2.3 INSTALLATION

CAUTION: Read the entire User's Manual before proceeding with the installation and application of power.

Set the module's logical address and configure all jumpers as described in 3.2. Insert the module into the appropriate slot according to the desired priority. Apply power. If no obvious problems exist, proceed to communicate with the module as outlined in Section 4.0 (Operating Instructions).

2.4 PREPARATION FOR RESHIPMENT

If the module is to be shipped separately it should be enclosed in a suitable water and vapor proof anti static bag. Heat seal or tape the bag to insure a moisture-proof closure. When sealing the bag, keep trapped air volume to a minimum.

The shipping container should be a rigid box of sufficient size and strength to protect the equipment from damage. If the module was received separately from a C&H system, then the original module shipping container and packing material may be re-used if it is still in good condition.

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3.0 FUNCTIONAL DESCRIPTION

3.1 GENERAL

VX412C is a general purpose switching module that provides individual switches for controlling external devices and routing general purpose signals. The module provides 32 channels of Form-C relays with external access via a front panel connector. Each channel includes an SPDT non-latching relay with common (C), normally open (NO) and normally closed (NC) terminals of each relay brought out through a front panel connector.

A functional block diagram is shown in Figure 1.

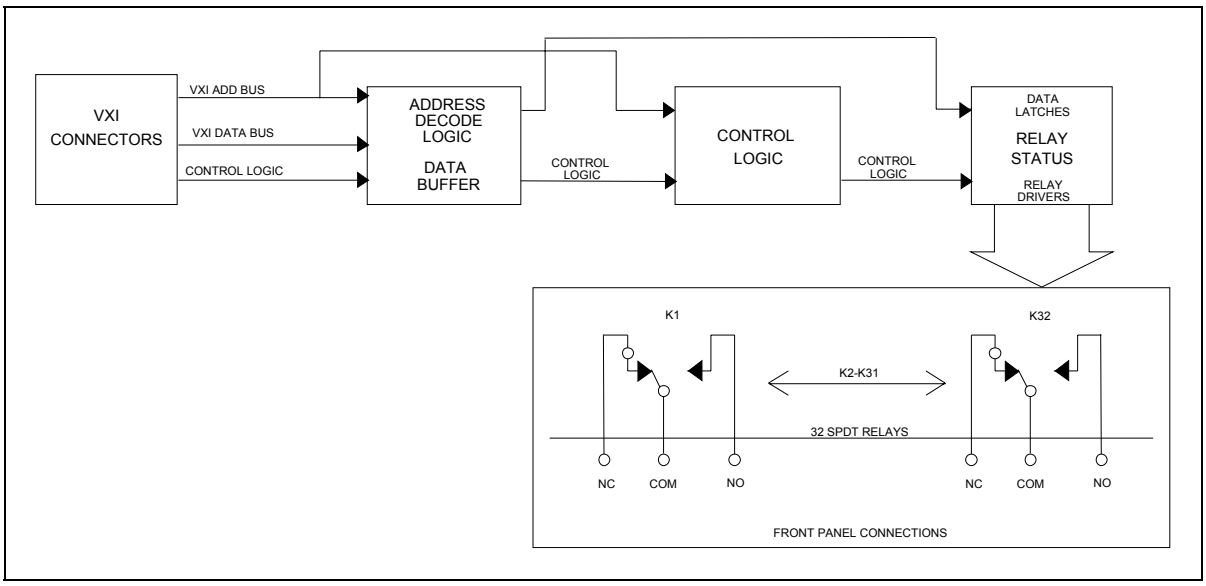


Figure 1. Functional Block Diagram

3.1.1 VXI Interface

The VXI interface, consisting of the VXI connectors, address decode logic, control logic and data buffer, provides the electrical and mechanical connections to the VXI backplane. It performs address decoding and bus buffering functions.

3.1.2 Data Latches

Programming of the module is through direct register access. There are 32 independent relays on the module which are controlled using the relay control registers. The relay control register receives relay control data from the VXI interface and latches it into registers. Module reset results in these registers being cleared to a low output.

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3.1.3 Relay Driver

The relay driver function receives relay control data from the data latch and provides relay coil current control for energizing or de-energizing the relay. A logic high on the input of the relay driver results in a low on its output, thus providing a current through the relay coil, which opens the path between the normally closed contact and the common contact, and closes the path between the normally open contact and the common contact. Module reset results in the output of the relay driver at logic high, thus de-energizing the relay and connecting the normally closed contact to the common contact.

3.1.4 Relay Status

This function reports the status of the control state of the Form C relays. A read of the relay status registers allows a verification of the programmed state of the relays.

3.1.5 Relay

The normally closed, normally open and common contacts of the relay are each routed to a corresponding pin on a connector on the front panel, and are available by supplying a mating connector and wiring to an external requirement.

The normally closed contact of the relay is connected internally to the common contact when the relay has a sufficiently low current applied across its coil. This state obviously occurs when the module is not powered up, but can also be selected through the control of the relay driver. Module reset sets all relay to the above state.

3.1.6 Connector

The front panel connectors allow the relay contacts to be connected to an external application. A mating connector must be acquired and wired to the external application.

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3.2 HARDWARE CONFIGURATION

Logical Address An 8-bit logical address switch is provided to uniquely identify the module in the system. The logical address has a range of 0 to 255. Any value, except 0 and 255 which are reserved for slot 0 controllers and dynamic addressing, is valid. However, care should be taken not to set the logical address the same as another module in the system. Position 1 on the switch (marked 128 on the shield) is the most significant bit and has a weighted value of 128 when the switch is in the off position. Position 8 on the switch (marked 1 on the shield) is the least significant bit and has a weighted value of 1 when the switch is in the off position. The sum of the weighted values of all the switches in the off position is the module address. The switch location is shown in Figure 2.

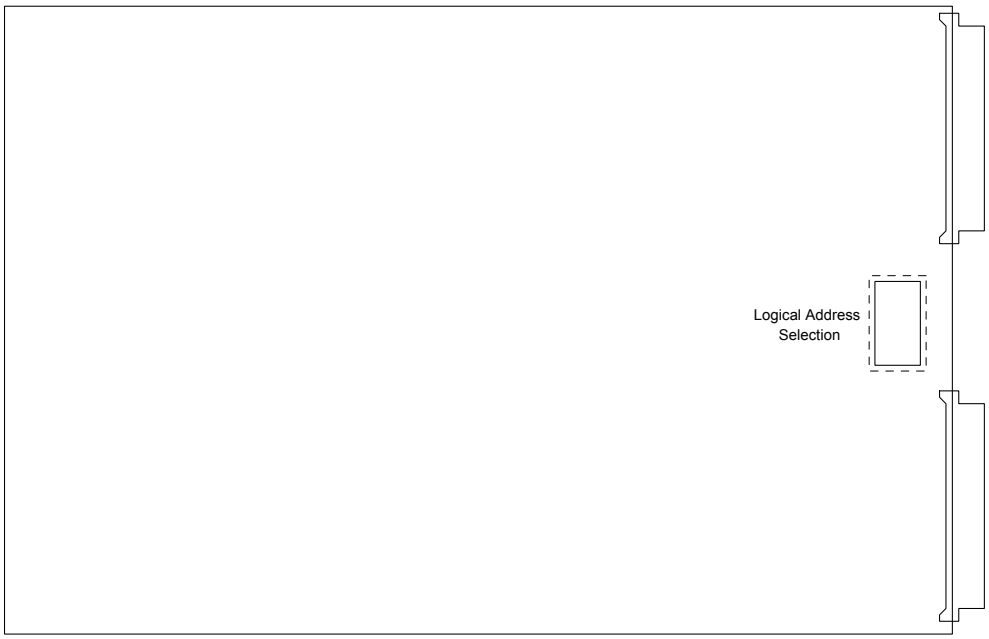


Figure 2. Hardware Configurable Controls

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3.3 INDICATORS

Two LED indicators are provided on the front panel. Their functions are described below:

ACCESS This LED illuminates when the module is properly accessed by the host processor.

MODID This LED illuminates when the host processor applies the MODID signal to the slot the module is occupying.

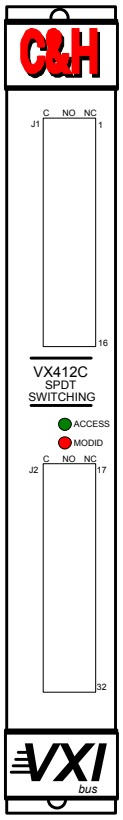


Figure 3. Front Panel

3.4 CONNECTORS

3.4.1 Front Panel Connectors

J1 and J2 are DIN 41612 Type F48M connectors. Mating connectors are DIN 41612 Type F48F. Pin locations are shown in Appendix B.

3.4.2 Rear Connectors

The P1 and P2 connectors are configured in accordance with the VXI specification (See Appendix B).

3.5 CONFIGURATION REGISTERS

There are several registers used to configure and control the VX412C. These registers are divided into two groups: VXI Configuration and Relay Control/Status. All of the registers are located within the A16 address space as shown in Table I. The base address of the registers is a function of the Logical Address of the module.

Table II. Configuration Register Summary

A16 Address	Register Description
Base + 00	VXI ID
Base + 02	VXI Device Type
Base + 04	VXI Status/Control
Base + 06	VXI Unused Register
Base + 08	Relay Control/Status K1-K16
Base + 0A	Relay Control/Status K17-K32

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3.5.1 VXI Configuration Registers

The VXI configuration registers contain basic information needed to configure a VXIbus system. The configuration information includes: manufacturer identification, product model code, device type, memory requirements, device status, and device control. The registers are briefly described below and are detailed in Figure 4.

VXI Identification (ID) Register (00_{16}) A read of this register provides manufacturer identification, device classification (i.e., register based), and the addressing mode (A16). A write to this register has no effect.

VXI Device Type Register (02_{16}) A read of this register provides the model code identifier. A write to this register has no effect.

VXI Status/Control Register (04_{16}) A read of this register provides the state of P2 MODID* line, the interrupt level, and the Ready and self-test Passed status. A write to this register controls resetting of the module.

VXI ID

00

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Read Only	Device Class		Address Space		Manufacturer ID											

Device Class ð Device Class (11 = Register Based)
Address Space ð Address Space (11 = A16 only)
Manuf. ID ð Manufacturer Identification (C&H Technologies = $FC1_{16}$)

VXI Device Type

02

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Read Only	Model Code															

Model Code ð Model code (VX412C = $FFFF_{16}$)

VXI Status/Control

04

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	Not Used															RST
Read	AAA	MID	1	1	1	1	1	1	0	0	0	0	RDY	PASS	0	1

AAA ð A24/A32 Access (0 = disabled)
RST ð Reset (A 1 written to this bit resets the module)
MID ð Module ID Status (0 = P2 MODID* line is selected)
RDY ð Ready (1 = ready)
PASS ð Pass/fail indicator (0 = executing or failed, 1 = passed)

Figure 4. VXI Registers

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3.5.2 Relay Control/Status Registers

The Relay Control and Status Registers are used for the control and status of relay switch states. Two 16-bit registers are used, as described below.

Relay Control/Status Register K1-K16 (08_{16}) A write to this register controls the state of Form-C relays K1 through K16 (1 = set relay to normally open (NO) terminal connected to common (C) terminal). A read of this register reports the status of the control state of the Form-C relays K1 through K16 (1 = relay control set for normally open (NO) terminal connected to common (C) terminal).

Relay Control/Status Register K17-K32 ($0A_{16}$) A write to this register controls the state of Form-C relays K17 through K32 (1 = set relay to normally open (NO) terminal connected to common (C) terminal). A read of this register reports the status of the control state of the Form-C relays K17 through K32 (1 = relay control set for normally open (NO) terminal connected to common (C) terminal).

08	**Relay Control/Status K1 - K16**															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K16	K15	K14	K13	K12	K11	K10	K9	K8	K7	K6	K5	K4	K3	K2	K1
Read	K16	K15	K14	K13	K12	K11	K10	K9	K8	K7	K6	K5	K4	K3	K2	K1

0 ⇒ Common connected to Normally Closed contact
1 ⇒ Common connected to Normally Open contact

0A	**Relay Control/Status K17 - K32**															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K32	K31	K30	K29	K28	K27	K26	K25	K24	K23	K22	K21	K20	K19	K18	K17
Read	K32	K31	K30	K29	K28	K27	K26	K25	K24	K23	K22	K21	K20	K19	K18	K17

0 ⇒ Common connected to Normally Closed contact
1 ⇒ Common connected to Normally Open contact

Figure 5. Relay Control/Status Registers

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4.0 OPERATING INSTRUCTIONS

All registers and memory, including the flag bytes are accessed as 16-bit data words on even boundaries. The configuration registers are accessed in the A16 address space. The A16 base address is a function of the logical address of the module. It can be computed as follows:

$$\text{A16 Base Address} = (LA \times 64) + C000_{16}$$

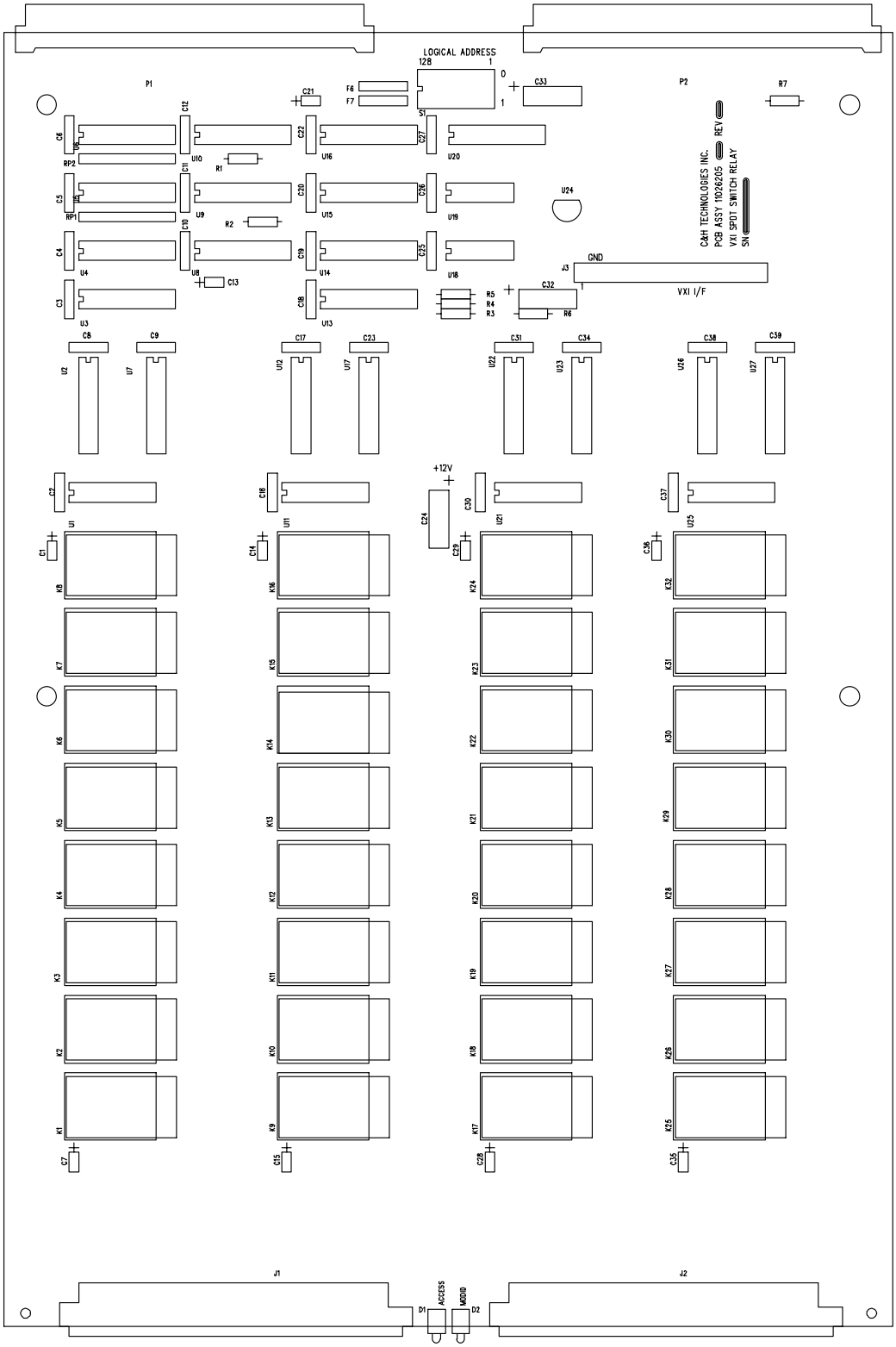
The logical address has a range of 0 to 255. Any value, except 0 and 255 which are reserved for slot 0 controllers and dynamic addressing, is valid. However, care should be taken not to set the logical address the same as another module in the system. Position 1 on the switch (marked 128 on the shield) is the most significant bit and has a weighted value of 128 when the switch is in the off position. Position 8 on the switch (marked 1 on the shield) is the least significant bit and has a weighted value of 1 when the switch is in the off position. The sum of the weighted values of all the switches in the off position is the module address.

For immediate use of the VX412C, set the logical address, insert the module in the VXI chassis and perform a read or write command (remove from the front panel connectors any connections to external circuitry). The resultant read data is the VXI register's contents or the relay switch state. User write data to this module controls the relay switch state; however the operation may be considered successful if a Bus Error does not occur. For further verification the user can set the MODID to the slot containing the VX412C and read the VXI Status register.

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APPENDIX A - BOARD LAYOUT



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APPENDIX B - CONNECTORS

PIN	C	B	A
1	D08	-	D00
2	D09	-	D01
3	D10	-	D02
4	D11	BG0IN*	D03
5	D12	BG0OUT*	D04
6	D13	BG1IN*	D05
7	D14	BG10UT*	D06
8	D15	BG2IN*	D07
9	GND	BG20UT*	GND
10	-	BG3IN*	-
11	-	BG3OUT*	GND
12	SYSRESET*	-	DS1*
13	LWORD*	-	DS0*
14	AM5	-	WRITE*
15	A23	-	GND
16	A22	AM0	DTACK*
17	A21	AM1	GND
18	A20	AM2	-
19	A19	AM3	GND
20	A18	GND	-
21	A17	-	IACKIN*
22	A16	-	IACKOUT*
23	A15	GND	AM4
24	A14	-	A07
25	A13	-	A06
26	A12	-	A05
27	A11	-	A04
28	A10	-	A03
29	A09	-	A02
30	A08	-	A01
31	+12 V	-	-12 V
32	+5 V	+5 V	+5 V

Figure B-1. P1 Pin Configuration

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PIN	C	B	A
1	-	-	-
2	-	-	-
3	-	-	-
4	-	VA24	-
5	-	VA25	-
6	-	VA26	-
7	-	VA27	-
8	-	VA28	-
9	-	VA29	-
10	-	VA30	-
11	-	VA31	-
12	-	GND	-
13	-	-	-
14	-	-	-
15	-	-	-
16	-	-	-
17	-	-	-
18	-	-	-
19	-	-	-
20	-	-	-
21	-	-	-
22	GND	-	GND
23	-	-	-
24	-	-	-
25	-	-	-
26	-	-	-
27	-	-	-
28	-	-	-
29	-	-	-
30	-	-	MODID
31	-	-	-
32	-	-	-

Figure B-2. P2 Pin Configuration

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J1 (Top Connector)

COL ROW	Z	B	D	RELAY
32	COM	NO	NC	K1
30	COM	NO	NC	K2
28	COM	NO	NC	K3
26	COM	NO	NC	K4
24	COM	NO	NC	K5
22	COM	NO	NC	K6
20	COM	NO	NC	K7
18	COM	NO	NC	K8
16	COM	NO	NC	K9
14	COM	NO	NC	K10
12	COM	NO	NC	K11
10	COM	NO	NC	K12
8	COM	NO	NC	K13
6	COM	NO	NC	K14
4	COM	NO	NC	K15
2	COM	NO	NC	K16

J2 (Bottom Connector)

COL ROW	Z	B	D	RELAY
32	COM	NO	NC	K17
30	COM	NO	NC	K18
28	COM	NO	NC	K19
26	COM	NO	NC	K20
24	COM	NO	NC	K21
22	COM	NO	NC	K22
20	COM	NO	NC	K23
18	COM	NO	NC	K24
16	COM	NO	NC	K25
14	COM	NO	NC	K26
12	COM	NO	NC	K27
10	COM	NO	NC	K28
8	COM	NO	NC	K29
6	COM	NO	NC	K30
4	COM	NO	NC	K31
2	COM	NO	NC	K32

Figure B-3. Front Panel Connectors

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