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

VXI
96-CHANNEL
1X1 SWITCHING
MODULE

MODEL
VX416C

Manual Part No: 11027579A

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INTRODUCTION

This manual describes the operation and use of the C&H Model VX416C VXI 96-Channel 1x1 Switching Module (Part Number 11027575). 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
11027575-0001	VX416C 96-Channel 1x1 Switching Module

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1.0 GENERAL DESCRIPTION

The VX416C 96-Channel 1x1 Switching Module is a C size, Register based switching card that provides 96 channels of SPST (Form A) switching.

1.1 PURPOSE OF EQUIPMENT

This module is designed to provide a low cost solution to Form-A 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

- 96 independently controlled single pole, single throw (SPST) non-latching relays
- Mercury-wetted relays providing fast operation, no contact bounce, low contact resistance, and very long life expectancy
- Read-back of control register state
- Relay contacts are open on power-up or reset

1.2.2 Electrical

The module requires +5V and +12V power from the VXI backplane. For the +5 volt supply, the peak current (I_{PM}) is 1.0 amps and the dynamic current (I_{DM}) is 0.15 amps. The relays require 16 milliamps per closed relay from the +12 volt supply. If all relays are closed at the same time, slightly over 1.5 amps is required from the +12 volt supply. Detail specifications for the relays is 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:	**This module uses mercury-wetted relays, and for proper operation, must be positioned vertical (±30°) as indicated on the module's shield.**

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Table I. Relay Specifications

Ratings For Resistive Loads	Mercury-Wetted Relays
Maximum Power Switched, per relay	50 W (AC or DC)
Maximum Volts Switched	500 VDC
Maximum Current:	
Switched	2.0A (AC_{peak} or DC)
Carry	3.0A (AC_{peak} or DC)
Contact Resistance	0.07Ω (max. initial)
Insulation Resistance	10^{10} Ω
Relay Life (operations)	
Low Level	10^9 operations
Rated Load	5×10^7 operations
Operate Time	1.5 ms (typical)
Release Time	1.0 ms (typical)

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 C-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:	$FFEE_{16}$
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 VX416C 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 VX416C 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).

NOTE: This module uses mercury-wetted relays, and for proper operation, must be positioned vertical (±30°) as indicated on the module's shield.

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

VX416C is a general purpose switching module that provides individual switches for controlling external devices and routing general purpose signals. The module provides 96 channels of Form-A relays with external access via a front panel connector. Each channel includes an SPST non-latching relay with the two contact terminals of each relay brought out through the three front panel connectors.

A functional block diagram is shown in Figure 1.

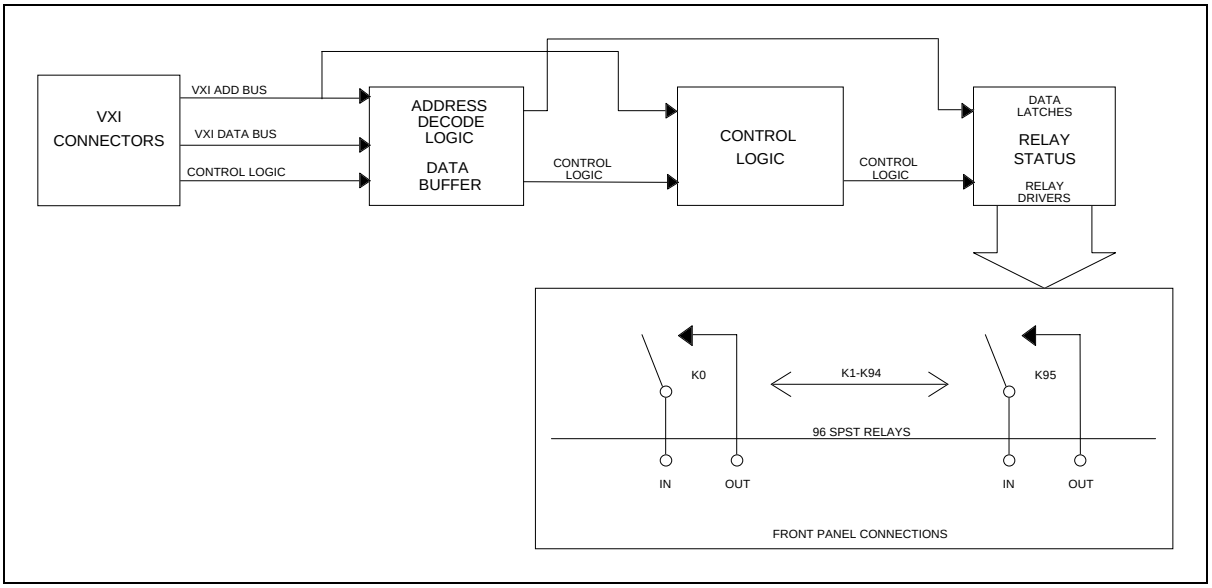


Figure 1. Functional Block Diagram

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 96 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 closes the contact. Module reset results in the output of the relay driver at logic high, thus de-energizing the relay and opening the contact.

3.1.4 Relay Status

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

3.1.5 Relay

The contacts of the relay are routed to corresponding pins on a connector on the front panel, and are available by supplying a mating connector and wiring to an external requirement.

The relay contact closes when the relay has a sufficient current applied across its coil. The relay is in its open state if no current is present on its coil, such as when the module is reset.

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 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. The most significant bit (MSB) has a weighted value of 128 when the switch is in the off (1) position. The least significant bit has a weighted value of 1 when the switch is in the off (1) position. The sum of the weighted values of all the switches in the off position is the module logical 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.

3.4 CONNECTORS

3.4.1 Front Panel Connectors

J1 and J3 are AMP HD-22 78-position receptacle type connectors. J2 is an AMP HD-22 44-postion receptacle type connector. The connectors mate with any size 22 subminature D connectors dimensionally complying with MIL-C-24308. Pin locations are shown in Appendix C.

> NOTE: Due to the close proximity of J1 and J2, care must be taken in selecting strain relief shells for the mating connectors. Do not use shells that extend beyond the base of the connector.

3.4.2 Rear Connectors

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

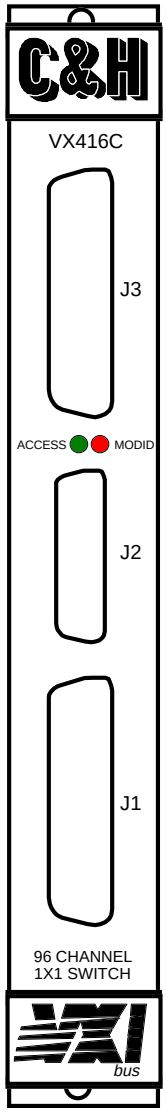


Figure 3. Front Panel

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3.5 CONFIGURATION REGISTERS

There are several registers used to configure and control the VX416C. 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 to 0E	Unused
Base + 10	Relay Control/Status K15-K0
Base + 12	Relay Control/Status K31-K16
Base + 14	Relay Control/Status K47-K32
Base + 16	Relay Control/Status K63-K48
Base + 18	Relay Control/Status K79-K64
Base + 1A	Relay Control/Status K95-K80

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.

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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 ⇨ Device Class (11 = Register Based)
Address Space ⇨ Address Space (11 = A16 only)
Manuf. ID ⇨ 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 ⇨ Model code (VX416C = $FFEE_{16}$)

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 ⇨ A24/A32 Access (0 = disabled)
RST ⇨ Reset (A 1 written to this bit resets the module)
MID ⇨ Module ID Status (0 = P2 MODID* line is selected)
RDY ⇨ Ready (1 = ready)
PASS ⇨ 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, as described below.

Relay Control/Status Register K15-K0 (10_{16}) A write to this register controls the state of relays K0 through K15 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

Relay Control/Status Register K31-K16 (12_{16}) A write to this register controls the state of relays K16 through K31 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

Relay Control/Status Register K47-K32 (14_{16}) A write to this register controls the state of relays K32 through K47 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

Relay Control/Status Register K63-K48 (16_{16}) A write to this register controls the state of relays K48 through K63 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

Relay Control/Status Register K79-K64 (18_{16}) A write to this register controls the state of relays K64 through K79 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

Relay Control/Status Register K95-K80 ($1A_{16}$) A write to this register controls the state of relays K80 through K95 (0 = open, 1 = close). A read of this register reports the status of the control state of the relays.

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10	Relay Control/Status K15 - K0															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K15	K14	K13	K12	K11	K10	K9	K8	K7	K6	K5	K4	K3	K2	K1	K0
Read	K15	K14	K13	K12	K11	K10	K9	K8	K7	K6	K5	K4	K3	K2	K1	K0

0 ⇒ Open
1 ⇒ Closed

12	Relay Control/Status K31 - K16															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K31	K30	K29	K28	K27	K26	K25	K24	K23	K22	K21	K20	K19	K18	K17	K16
Read	K31	K30	K29	K28	K27	K26	K25	K24	K23	K22	K21	K20	K19	K18	K17	K16

0 ⇒ Open
1 ⇒ Closed

14	Relay Control/Status K47 - K32															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K47	K46	K45	K44	K43	K42	K41	K40	K39	K38	K37	K36	K35	K34	K33	K32
Read	K47	K46	K45	K44	K43	K42	K41	K40	K39	K38	K37	K36	K35	K34	K33	K32

0 ⇒ Open
1 ⇒ Closed

16	Relay Control/Status K63 - K48															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K63	K62	K61	K60	K59	K58	K57	K56	K55	K54	K53	K52	K51	K50	K49	K48
Read	K63	K62	K61	K60	K59	K58	K57	K56	K55	K54	K53	K52	K51	K50	K49	K48

0 ⇒ Open
1 ⇒ Closed

18	Relay Control/Status K79 - K64															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K79	K78	K77	K76	K75	K74	K73	K72	K71	K70	K69	K68	K67	K66	K65	K64
Read	K79	K78	K77	K76	K75	K74	K73	K72	K71	K70	K69	K68	K67	K66	K65	K64

0 ⇒ Open
1 ⇒ Closed

1A	Relay Control/Status K95 - K80															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Write	K95	K94	K93	K92	K91	K90	K89	K88	K87	K86	K85	K84	K83	K82	K81	K80
Read	K95	K94	K93	K92	K91	K90	K89	K88	K87	K86	K85	K84	K83	K82	K81	K80

0 ⇒ Open
1 ⇒ Closed

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:

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

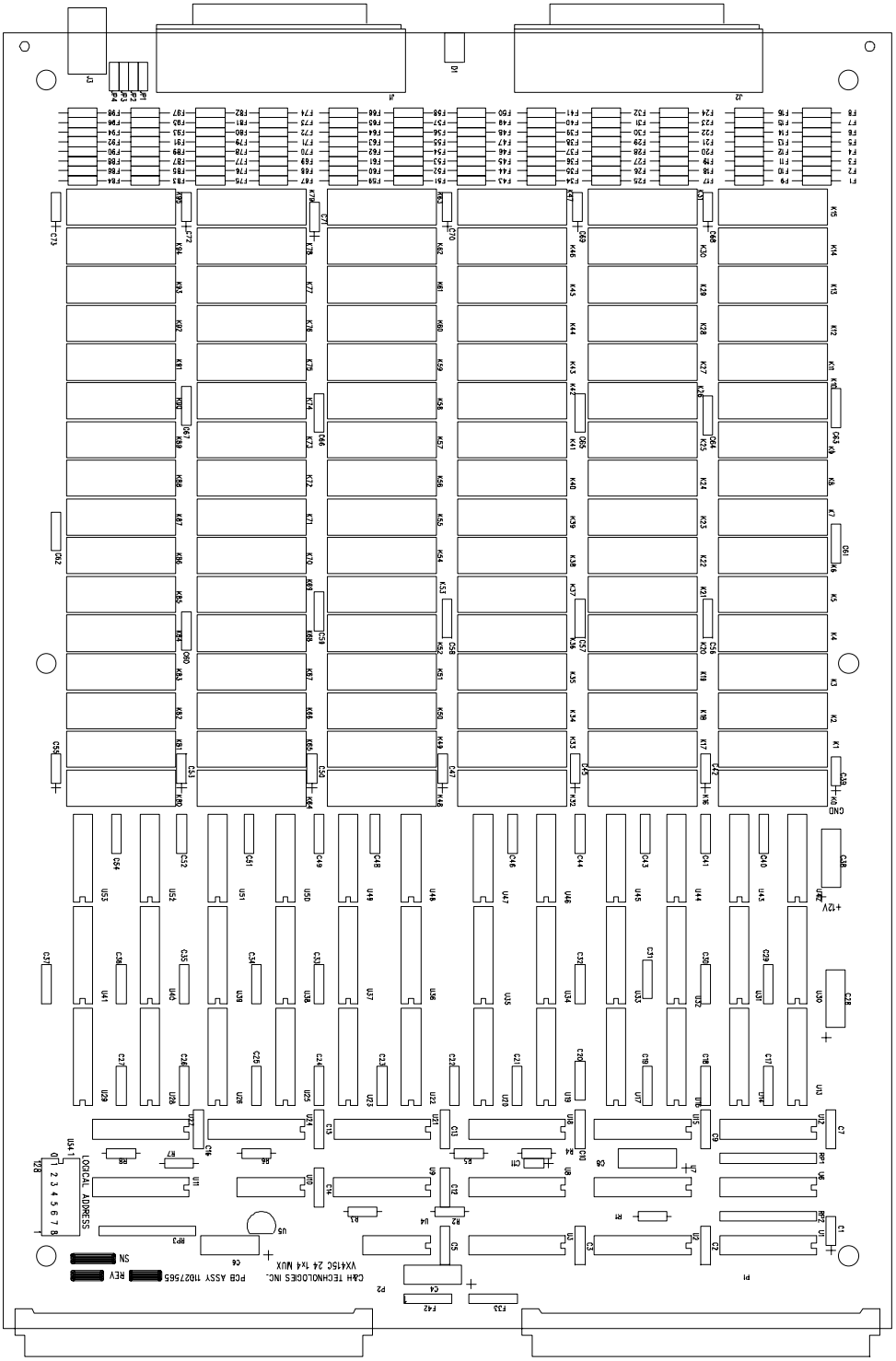
The logical address has a range of 0 to 255. Any value, except 0 and 255 which are reserved for slot 0 controllers and dynamic addressing, is valid. However, care should be taken not to set the logical address the same as another module in the system. The most significant bit (MSB) has a weighted value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

Relay operation is controlled by writing a '0' or '1' to the corresponding bit in the Relay Control/Status registers detailed in Section 3.5.

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APPENDIX A - BOARD LAYOUT



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APPENDIX B - VXI 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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APPENDIX C - RELAY CONNECTORS

RELAY	IN	OUT
K0	J3-51	J3-13
K1	J3-53	J3-32
K2	J3-55	J3-33
K3	J3-76	J3-14
K4	J3-59	J3-34
K5	J3-78	J3-15
K6	J3-58	J3-35
K7	J3-77	J3-16
K8	J3-57	J3-36
K9	J3-56	J3-17
K10	J3-75	J3-37
K11	J3-74	J3-18
K12	J3-54	J3-38
K13	J3-73	J3-19
K14	J3-72	J3-39
K15	J3-52	J3-20
K16	J3-71	J3-4
K17	J3-70	J3-24
K18	J3-69	J3-5
K19	J3-49	J3-25
K20	J3-50	J3-6
K21	J3-48	J3-26
K22	J3-68	J3-7
K23	J3-47	J3-27
K24	J3-67	J3-8
K25	J3-66	J3-28
K26	J3-46	J3-9
K27	J3-45	J3-29
K28	J3-44	J3-10
K29	J3-43	J3-30
K30	J3-42	J3-11
K31	J3-41	J3-31
K32	J3-63	J2-23
K33	J3-62	J2-24
K34	J3-64	J2-9
K35	J3-65	J2-25
K36	J3-60	J2-10
K37	J3-61	J2-11
K38	J3-40	J2-12
K39	J2-42	J2-13
K40	J2-43	J2-14
K41	J2-44	J2-15
K42	J2-30	J3-1
K43	J2-29	J3-21
K44	J2-28	J3-2
K45	J2-27	J3-22
K46	J2-41	J3-3
K47	J2-26	J3-23

RELAY	IN	OUT
K48	J2-37	J1-77
K49	J2-38	J1-58
K50	J2-39	J1-78
K51	J2-22	J1-59
K52	J2-21	J1-57
K53	J2-4	J1-76
K54	J2-3	J1-56
K55	J2-2	J2-34
K56	J2-1	J2-33
K57	J1-39	J2-32
K58	J1-20	J2-31
K59	J1-19	J2-16
K60	J1-38	J2-17
K61	J1-18	J2-18
K62	J1-37	J2-19
K63	J1-17	J2-20
K64	J1-36	J1-67
K65	J1-16	J1-47
K66	J1-35	J1-68
K67	J1-15	J1-49
K68	J1-34	J1-69
K69	J1-14	J1-70
K70	J1-33	J1-51
K71	J1-13	J1-71
K72	J1-32	J1-52
K73	J1-12	J1-72
K74	J1-31	J1-53
K75	J1-11	J1-73
K76	J1-30	J1-54
K77	J1-10	J1-74
K78	J1-29	J1-55
K79	J1-9	J1-75
K80	J1-28	J1-50
K81	J1-8	J1-48
K82	J1-27	J1-46
K83	J1-7	J1-44
K84	J1-26	J1-62
K85	J1-6	J1-40
K86	J1-25	J1-60
K87	J1-5	J1-41
K88	J1-24	J1-61
K89	J1-4	J1-42
K90	J1-23	J1-63
K91	J1-3	J1-43
K92	J1-22	J1-64
K93	J1-2	J1-45
K94	J1-1	J1-65
K95	J1-21	J1-66

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