USER'S REFERENCE MANUAL

XIO-RO8

External I/O 8 Channel Relay Output Board

Model No.	100-7632		
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Conventions and Terminology Used Throughout This Publication

Safety and Usage Conventions

NOTE: *Contains important information and useful tips that will assist in the understanding and operation of the product.*

CAUTION: *Calls attention to a procedure, practice or condition that could possibly cause personal injury or damage to equipment.*

WARNING: *Calls attention to a procedure, practice or condition that could possibly cause severe bodily injury, death or extensive equipment damage.*

Terminology

Host This is the computer or similar device into which the XIO-RO8 is plugged.

Logic conditions Unless otherwise noted, logic signals are designated as TRUE (Set) and FALSE (Clear). Names with an asterisk (*) postscript are inverted or active low. Unless otherwise noted TRUE is considered logic “1" (+5vdc) and FALSE is logic “0" (0vdc).

Numbering Systems Computerized equipment often requires its numeric data to be represented in different forms depending on the audience and information being conveyed. Decimal numbers are typically used for end-user data entry and display while internally these values are converted and manipulated in native binary. Hexadecimal numbers are often used by programmers as an intermediate level between binary and decimal notations.

Base	Name	Format (MS <---> LS)
2	Binary	$1011\ 1001_2$
10	Decimal	185
16	Hexadecimal	0xB9 or $B9_{16}$ or &HB9.

INTRODUCTION

The XIO-RO8 is a relay output board which allows low level digital outputs, typically found on Single-Board-Computers and similar devices, to control high current AC and DC loads. It features eight independent "dry-contact" SPDT (form-C) relay outputs, each having 10A/250V load capability and 500V isolation. On board logic accepts standard TTL/CMOS levels and provides buffering, port selection, and choice of input control signal polarity. In addition, status LEDS are included for quick observation of overall board operation. External connections are made through a single 24-position removable screw-terminal strip which can accommodate wires as large as 12AWG. Versatile mounting options include using standoffs, SNAPTRACK®, or mounting on a DIN rail. Power for the XIO-RO8 can be supplied by the host or provided externally through a two position removable screw-terminal strip.

CAUTION: *The 500v isolation specification applies only to board-to-output potential and not the potential between individual I/O channels even though all I/O channels are isolated from each other. The maximum "output side" inter-channel potential is limited to 250V.*

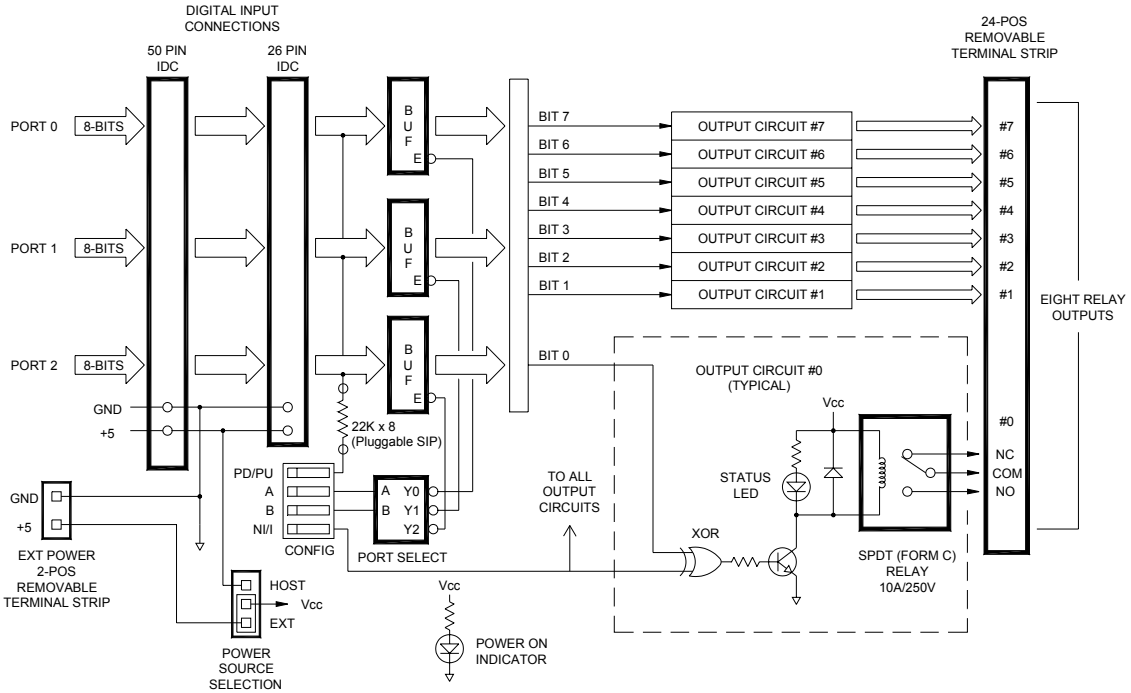

Figure 1 – XIO-RO8 Simplified Block Diagram

Component Identification

Before the XIO-RO8 can be put into service it must be properly configured for the intended application. This is accomplished by placing shorting jumpers and by setting switches located at various positions on the board. The component identification is shown in Figure 2. Each XIO-RO8 comes from the factory set to a basic functional default configuration. The user is free to change the default settings to satisfy any particular application requirements. A full explanation for each setting appears in the subsequent sections of this manual.

XIO-RO8 Component Identification	
Item	Description
1	**Digital Input IDC Headers (CON1, CON2)** These two headers accept the digital signals from the host device. CON1: 50-Pin IDC CON2: 26-Pin IDC
2	**Power ON Indicator** This green LED is illuminated whenever logic power is present on the XIO-RO8 board.
3	**Output Status Indicator** These eight LEDs are illuminated whenever their corresponding relay is activated (Relay's NO and COM contacts are connected).
4	**Output Connector (CON4)** This 24-position removable screw terminal strip is used to connect field wiring to the XIO-RO8.
5	**Power Source Selection Jumper (J1)** This jumper block determines whether logic power for the XIO-RO8 will come from the HOST (via CON1 or CON2) or an EXTernal power source through connector CON3.
6	**External Logic Power Input Connector (CON3)** Logic Power from an external +5Vdc source is applied to the XIO-RO8 through this 2-position removable screw terminal strip.
7	**Configuration DIP Switch (SW1)** This four position DIP switch configures the operation of the XIO-RO8.
8	**Pull-Up/Pull-Down Resistor Network Sockets (RN1, RN2, RN3)** These sockets allow a SIP resistor network to placed in parallel with the digital input signals controlling the XIO-RO8.

BOARD SETUP

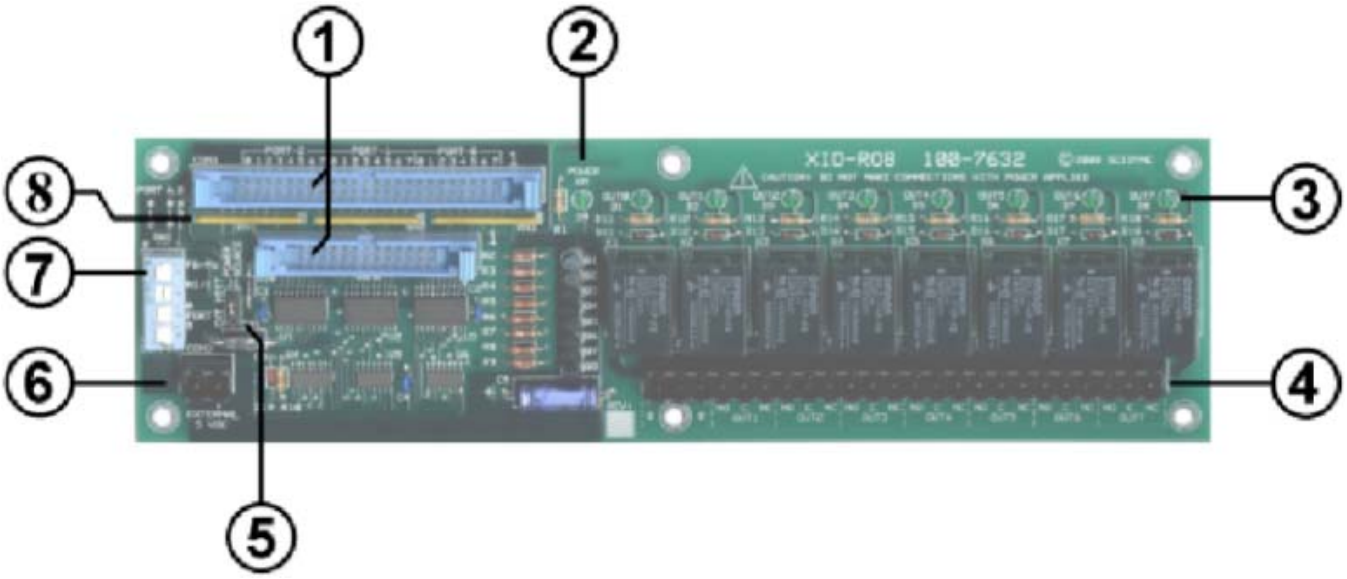

Figure 2 – Component Identification

Power Source Selection Jumper (J1)

Power for the XIO-RO8 logic circuits can be derived from either the Host (controlling device) or an external supply. The selection is made by placing a shorting jumper at the appropriate location of jumper block J1.

HOST - With the shorting jumper is in the **HOST** position, power is supplied by the controlling device through either of the two digital input IDC headers CON1 or CON2.

EXT - This is the factory default position. When the shorting jumper is in the **EXT** position, power is provided by an external +5Vdc supply through screw terminal connector CON3

NOTE: *A XIO-RO8 requires a clean +5Vdc ±5% at approximately 700ma max. to operate properly.*

CAUTION: *Be careful when using external supplies. Although the XIO-RO8 has special circuitry to withstand momentary over-voltages and reversed polarity, the board can be permanently damaged if subjected to these conditions for extended periods of time.*

Configuration DIP Switch (SW1)

The four position DIP switch SW1 is used to configure the various operating modes of the XIO-RO8. Three separate parameters are defined by the switch. The numbers 1, 2, 3, and 4 corresponding to the four switch positions are clearly visible on the switches plastic case.

SW1-1 Digital Inputs Pull-Down / Pull-Up Selection

A "Bussed" resistor network is placed in parallel with the selected port so that each of the eight bits has an associated Pull-Up or Pull-Down resistor. The purpose of the resistors is to place the XIO-RO8 input signals in a known and safe state in the event the host device loses power, becomes disconnected or resorts to a high impedance (input) mode. The resistors ohmic value should be sufficiently high so as not to affect normal digital signal operation. The choice of whether to have the resistors act as Pull-up or Pull-Down depends primarily on how the controlling device's output circuitry has been designed. In general, the XIO-RO8 should be configured to match the reset state of the controlling device. For instance, if the controlling device uses an 82C55 chip with Pull-Up resistors (a very common arrangement) then SW1-1 should be set to the PU (Pull-Up) position.

PD - A "Bussed" resistor network installed in the RN3, RN2 or RN1 position will act as Pull-Down resistors for the eight bits of PORT-0, PORT-1 or PORT-2 respectively.

PU - A "Bussed" resistor network installed in the RN3, RN2 or RN1 position will act as Pull-Up resistors for the eight bits of PORT-0, PORT-1 or PORT-2 respectively.

SW1-2 Non-Inverted / Inverted Control Polarity

The polarity of the port signals controlling the relays can be set to be inverted or non-inverted. This parameter is closely related to the Pull-Up / Pull-Down selection and must be set correctly for proper board operation. If SW1-2 is set to the "NI" (Non-Inverted) position, a relay is activated whenever its control bit is at logic "1". Conversely, if SW1-2 is set to the "I" (Inverted) position, a relay is activated whenever its control bit is at logic "0". The following table shows the correct SW1-2 setting in relation to the setting of SW1-1.

SW1-2 Setting		
SW1-1 Setting	Set SW1-2 to:	Digital input level required to activate relay
PU (Pull-Up)	I (Inverted)	"0"
PD (Pull-Down)	NI (Non-Inverted)	"1"

⚠ WARNING: *Failure to properly configure SW1-1, SW1-2, and install a resistor network can cause the relays and the loads they control to become activated whenever the controlling device loses power, becomes disconnected, is reset, or inadvertently changes to high-impedance inputs.*

SW1-3, 4 Port Selection

The XIO-RO8 accepts up to three 8-bits ports using only one of them to control the eight relay outputs. The selection of which port is used is made by positions 3 and 4 of SW1 as shown in the following table.

Port Selection			
Switch Position		Selected Port	RNET Installation Position
A (SW1-3)	B (SW1-4)		
0	0	PORT-0	RN3
1	0	PORT-1	RN2
0	1	PORT-2	RN1
1	1	PORT-2	RN1

The "0" and "1" designations for SW1 are silk screened on the XIO-RO8 printed circuit board

APPLICATION INFORMATION

Digital Input Signal Requirements

The digital signals sent from the host to the XIO-RO8 must meet standard TTL/CMOS voltage levels for the board to operate properly. CMOS buffers are used making the input current requirement very low. A host supplying only a few hundred microamps of source/sink output current can easily drive a XIO-RO8 input. It is important to note that the majority of the input current is actually consumed by the Pull-Up / Pull-Down resistor network placed in parallel with the selected port. It is therefore important to keep the ohmic value high enough so that the host will not be driving too hard, but also low enough to adequately commit the digital inputs and prevent spurious operation. Our recommend value for most applications is 22kΩ. The following equation can be used to determine the input current for any value of Pull-Up / Pull-Down input resistor.

$$InputCurrent \approx \frac{Vcc}{Rin} + 5\mu A$$

Digital Input Connections

The host attaches to the XIO-RO8 through one of two IDC ribbon headers, CON1 or CON2. The pinout for these headers conform to two common industry standards. Other connection arrangements, such as a 37-pin D-SUB, are easily accommodated by using simple custom cable assemblies.

Some board manufactures offer an alternative pinout which reverses the bit order within each port (shown as ALT-1) or may transpose the locations of PORT-0 and PORT-2 altogether (shown as ALT-2). The XIO-RO8 works equally well in all these situations provided the application developer observes the relationship between the ports, bits and the relay outputs they control. For convenience, a few different arrangements are depicted in table 1.0.

Digital Input Connections					
Input Header		PORT.BIT			Relay Output Controlled
CON1 Pin (IDC-50)	CON2 Pin (IDC-26)	STD	ALT-1	ALT-2	
1	1	P0.7	P0.0	P2.7	7
3	2	P0.6	P0.1	P2.6	6
5	3	P0.5	P0.2	P2.5	5
7	4	P0.4	P0.3	P2.4	4
9	5	P0.3	P0.4	P2.3	3
11	6	P0.2	P0.5	P2.2	2
13	7	P0.1	P0.6	P2.1	1
15	8	P0.0	P0.7	P2.0	0
17	9	P1.7	P1.0	P1.7	7
19	10	P1.6	P1.1	P1.6	6
21	11	P1.5	P1.2	P1.5	5
23	12	P1.4	P1.3	P1.4	4
25	13	P1.3	P1.4	P1.3	3
27	14	P1.2	P1.5	P1.2	2
29	15	P1.1	P1.6	P1.1	1
31	16	P1.0	P1.7	P1.0	0
33	17	P2.7	P2.0	P0.7	7
35	18	P2.6	P2.1	P0.6	6
37	19	P2.5	P2.2	P0.5	5
39	20	P2.4	P2.3	P0.4	4
41	21	P2.3	P2.4	P0.3	3
43	22	P2.2	P2.5	P0.2	2
45	23	P2.1	P2.6	P0.1	1
47	24	P2.0	P2.7	P0.0	0
49	25	+5V			
2 - 50	26	COM			

STD = Standard Pinout
ALT = Alternate Pinout

Table 1 – Header Connections

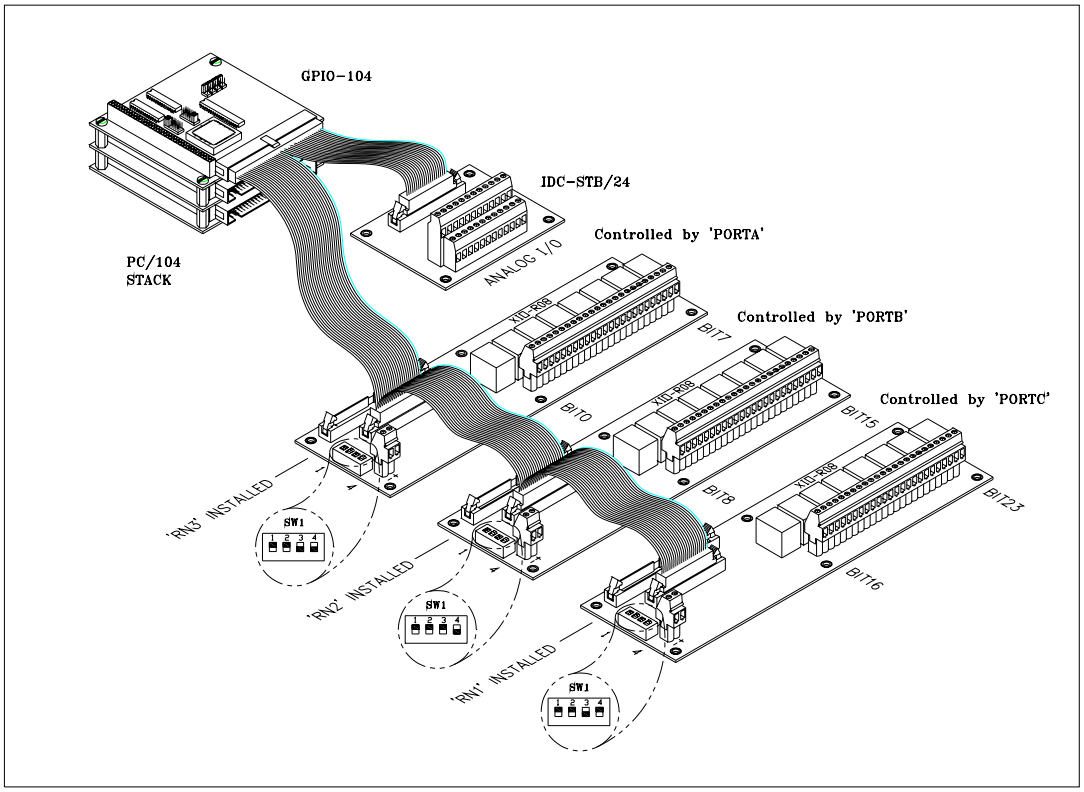

Figure 3 – Host connections to XIO-RO8

Shared Ribbon Cables

It is not uncommon for board manufacturers to combine all I/O signals (analog, digital, counters, etc.) on the same IDC ribbon connector. When using these boards, **only** the digital signals must be routed to the XIO-RO8. This is generally accomplished by "stripping-out" that section of the ribbon cable which contain only digital signals.

Using Multiple XIO-RO8 Boards

Multiple boards can be used by a single host device by associating each 8-bit host port to a separate XIO-RO8. It is also possible to have a single host port drive several identically configured XIO-RO8 boards simultaneously. This effectively creates another output relay 'pole' for every XIO-RO8 used. For example, having five XIO-RO8 boards all associated with the same host port would form an equivalent 5PDT relay for each of the eight output channels. In this case, the input resistor network (RN1, RN2 or RN3) on each XIO-RO8 may need to be proportionally increased in value because they are in parallel with each other via the ribbon cable.

Relay Outputs

The XIO-RO8 has eight independent sealed SPDT (form C) relay outputs. To ease wiring constraints and permit flexible mixing of AC and DC signals, the Normally-Closed (NC), Normally-Open (NO) and Common (COM) contacts from each relay are available separately on screw-terminal strip CON4. The relays are capable of handling loads up to 10A @ $125V_{RMS}$. Break-Before-Make operation assures the Normally-Closed and Normally-Open contacts will never be mechanically connected to each other or to the relays COM contact at the same time.

CAUTION: *Inductive loads often generate voltages with enough potential to cause arcing between a relay's contacts. This effect can cause problems in some situations and inevitably reduces the life-time of the contacts. When driving inductive loads it is suggested that an appropriate "Snubber" network be used across the offending contacts to dissipate any inductive spikes that may occur.*

SPECIFICATIONS

General:

Description:	Eight channel high current relay output board
Power requirement:	+5Vdc ±5% @ 700mA typical, all relays activated. Host or Externally supplied, "Power-On" LED
Environmental:	Operating temperature: -20°C to 70°C Non-condensing relative humidity: 5% to 95%
Dimensions:	3.00"W x 10.00"L x 1.35"H
Mounting:	Mounts using Standoffs, SNAPTRACK® or DIN Rail
Isolation:	500V DC or AC, board-to-output. Isolation between adjacent relay outputs channels: 250V maximum

Digital Inputs:

General:	24 digital inputs arranged as three 8-bit ports (PORT-0, PORT-1 and PORT-2)
Input levels:	TTL/CMOS compatible
Logic "0":	1.35V maximum
Logic "1":	3.15V minimum
Control polarity:	Switch selectable for Non-Inverted or Inverted operation
Input impedance:	22kΩ typ. on control port, Switch selectable as Pull-Up or Pull-Down, 1MΩ typ. on unused ports

Relay Outputs:

General:	Eight SPDT (Form C) sealed electro-mechanical relays, Break-Before-Make operation, "Active" LED
Power handling:	
DC:	8 Ampere @ 30Vdc maximum (resistive load)
AC:	10 Ampere @ $125V_{RMS}$ maximum (resistive load)
Switching capacity:	100ma, 5Vdc minimum, 1200 VA, 240W maximum, 250Vac, 125Vdc
Contact resistance:	100mΩ maximum, $AgSnO_2$ contacts
Operate time:	10ms maximum (activate or release)
Bounce time:	Operate: 0.6ms Release: 7.2ms
Switching frequency:	1,800 operations per hour under rated load
Service life:	10,000,000 operations minimum

APPENDIX A - Mechanical Dimensions