USER'S REFERENCE MANUAL

XIO-DI8

External I/O - 8 Channel Digital Input Interface

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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 which controls the XIO-DI8 operation.

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-DI8 is an eight channel digital input board which allows low level digital inputs, as found on Single-Board-Computers and similar devices, to monitor external AC and DC signals. It features eight opticaly coupled input channels offering 500 volt isolation.

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

Each channel may be indiviudally configured to measure a wide range of voltages. In addition, all channels have input low-pass filters which can be independently enabled to allow AC frequencies as low as 40hz to be sensed reliably. Also included are status LEDs which show overall board operation. Connections to the host is made through a 50 position or 26 position IDC ribbon cable connectors. The connectors follow the two most common arrangements for digital port pinouts. External field connections are made through a single 16-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-DI8 is supplied by the host or provided externally through a two position removable screw-terminal strip.

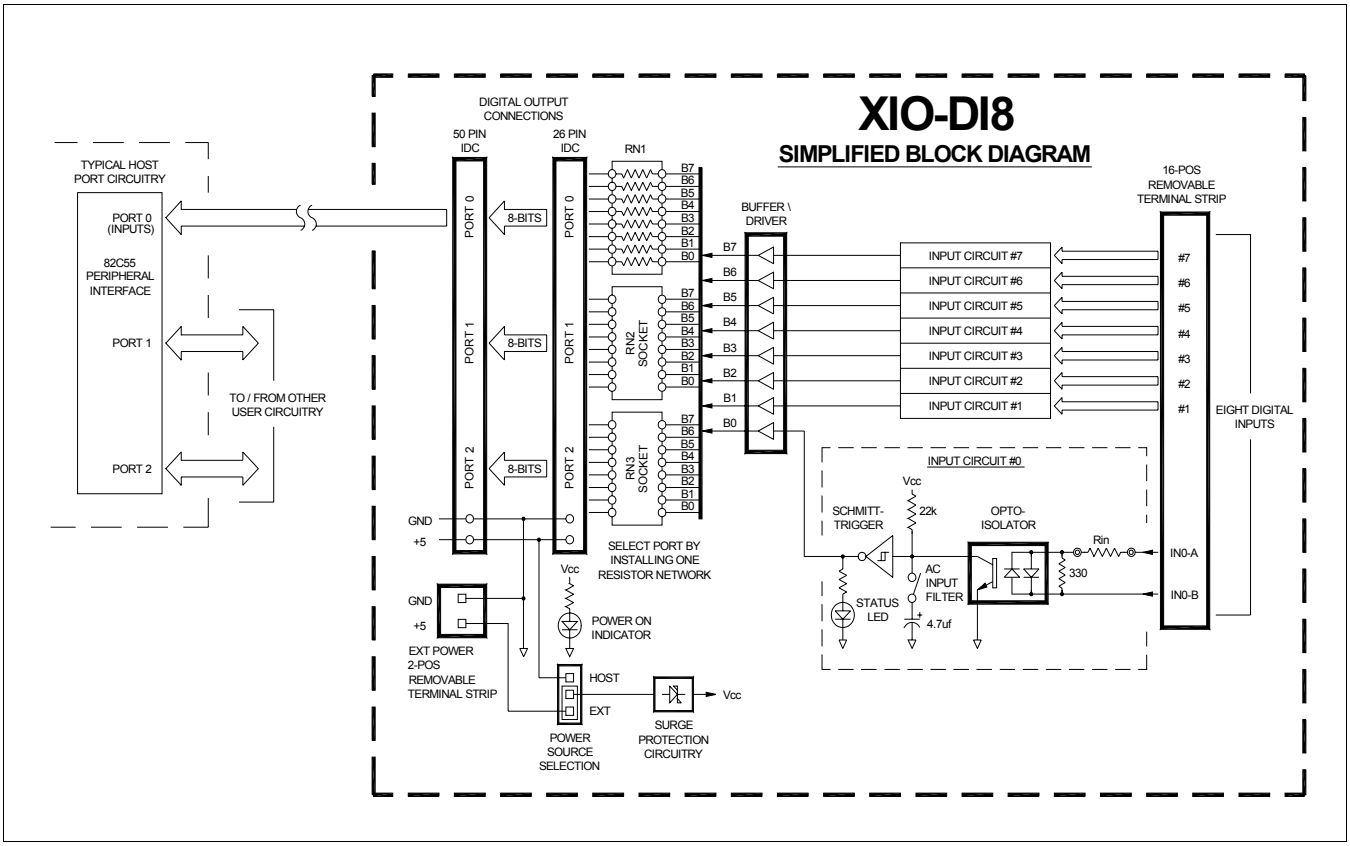

Figure 1 - XIO-DI8 Block Diagram

Component Identification

Before the XIO-DI8 can be put into service it must be properly configured for the intended application. This is accomplished by placing shorting jumpers, setting switches, and installing input resistors located at various locations on the board. The component identification is shown in Figure 2. Each XIO-DI8 comes from the factory set with a default configuration. The user is free to change the default configuration to satisfy any particular application requirements and the settings are fully described in subsequent sections of this manual.

XIO-DI8 Component Identification	
Item	Description
1	**Digital Input IDC Headers (CON1, CON2)** These two headers output the digital signals to the host device. Only one header is generally used. CON1: 50-Pin IDC CON2: 26-Pin IDC
2	**Power ON Indicator** This LED is illuminated whenever logic power is present on the XIO-DI8 board.
3	**AC Input Filter Switches (SW1)** These eight switches correspond to the eight digital inputs. A switch in the "ON" or "CLOSED" position activates a low-pass filter for the respective digital input and enables reliable AC signal monitoring. Note: Position #1 corresponds to digital input IN0 and so on.
4	**Input Status Indicators** These eight LEDs are illuminated whenever their corresponding input is activated and the XIO-DI8 is powered on.
5	**Input Resistors (R1 - R8)** These eight socketed resistors correspond to the eight inputs. Their ohmic value determines the voltage range the input can measure. **NOTE: These resistor must be correctly selected and installed for safe and reliable operation.**
6	**Input Connector (CON4)** This 16-position removable screw terminal strip is used to connect field wiring to the XIO-DI8.
7	**Host Port Selection Resistor Networks (RN1, RN2, RN3)** Installing a resistor network in one of these three sockets determines which host port of CON1 or CON2 the XIO-DI8 will drive. RN1 = PORT-0, RN2 = PORT-1, RN3 = PORT-2
8	**External Logic Power Input Connector (CON3)** Logic Power from an external +5Vdc source is applied to the XIO-DI8 through this 2-position removable screw terminal strip.
9	**Power Source Selection Jumper (J1)** This jumper block determines whether logic power for the XIO-DI8 will come from the HOST (via CON1 or CON2) or an EXTernal power source through connector CON3.

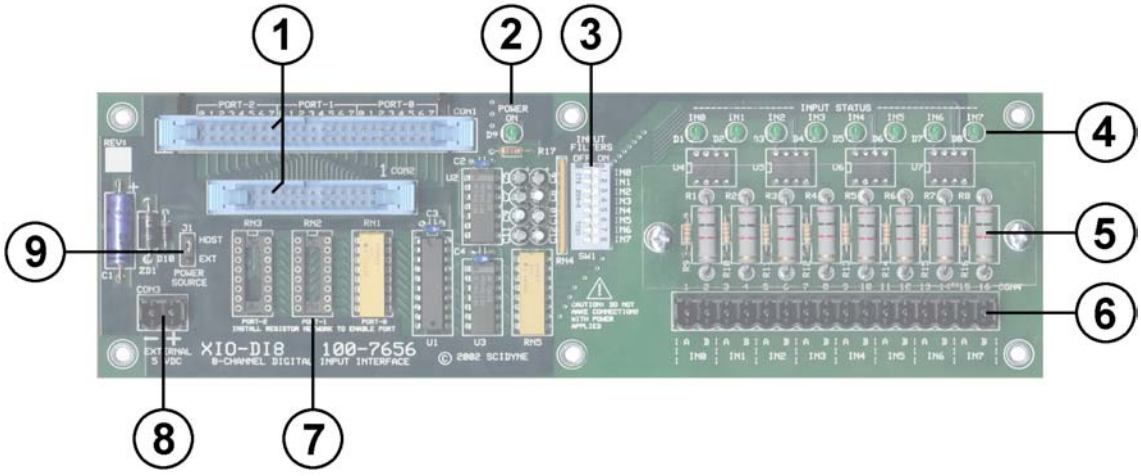

Figure 2 - Component Identification

Board Setup

Power Source Selection Jumper (J1)

Power for the XIO-DI8 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 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-DI8 requires a clean +5Vdc ±5% at approximately 125ma max. to operate properly.*

CAUTION: *Be careful when using external supplies.. Although the XIO-DI8 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.*

Host Port Selection

The XIO-DI8 accomodates three 8-bits ports but uses only one of them when driving the host device. The selection of which port will be used is determined by installing a resistor network in one of three DIP sockets as shown in the following table.

Host Port Selection	
Driven Port	RNET Installation Position
PORT-0	RN1
PORT-1	RN2
PORT-2	RN3

Resistor Network

The host port selection resistor network contains eight separate resistors in a standard 16-Pin Dual-Inline-Package (0.3" DIP) as shown in figure 3. The ohmic value must be high enough to provide suffient protection for the XIO-DI8 drivers in case of accidental cabling short circuits or if the host port is inadvertantly made to function as outputs. However, it must also be low enough to reliably drive the host input circuitry. For practically all applications the 47Ω resistor network supplied with the XIO-DI8 is suitable.

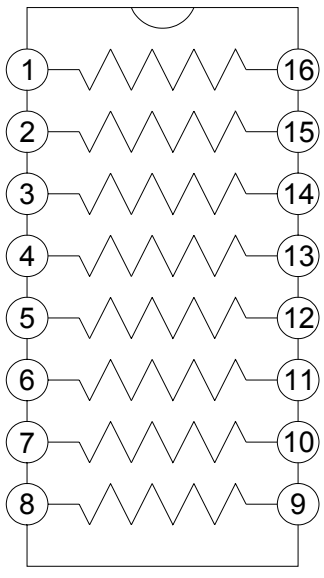

Figure 3 - Resistor Network

AC Input Filters

The optical isolators used in the digital input circuitry are designed to accept AC signals. However, by its very nature, an optical isolator driven by an AC signal will momentarily switch between logic states as it crosses through zero volts while changing polarity. Depending on when the host application reads the port, the signal can be misinterpreted even though a steady AC signal is applied. To overcome this condition the XIO-DI8 is equipped with a low-pass filter on each of the inputs. DIP switch SW1 is used to selectively enable a filter for each input. A switch in the "ON" or "CLOSED" position enables the filter for that particular digital input.

NOTE: *The input filters are after the optical isolation and do not affect the input impedanceas seen by the field circuirty.*

NOTE: *Inputs which are controlled by DC signals may also benefit by using the AC filters. If the input is being driven over a long distance or if the DC signal is excessively noisy enabling the filter can help minimize erroneous readings.*

AC Input Filter Selection	
SW1 Position	Digital Input
-1	IN0
-2	IN1
-3	IN2
-4	IN3
-5	IN4
-6	IN5
-7	IN6
-8	IN7

Configuring Input Voltage Ranges

All digital input channels of the XIO-DI8 have indentical circuitry as shown in figure 4. For each channel a single socketed resistor (Rin) is used to limit the input current. Its ohmic value is selected to allow a approximately 4.0ma of current flow when the input is driven at the desired input voltage. Higher input voltages can be tolerated but the input current must never exceed 25ma or XIO-DI8 input circuitry can be damaged. In addition, the power disapated by the resistor must be considered and limited to below 1.4watts RMS.

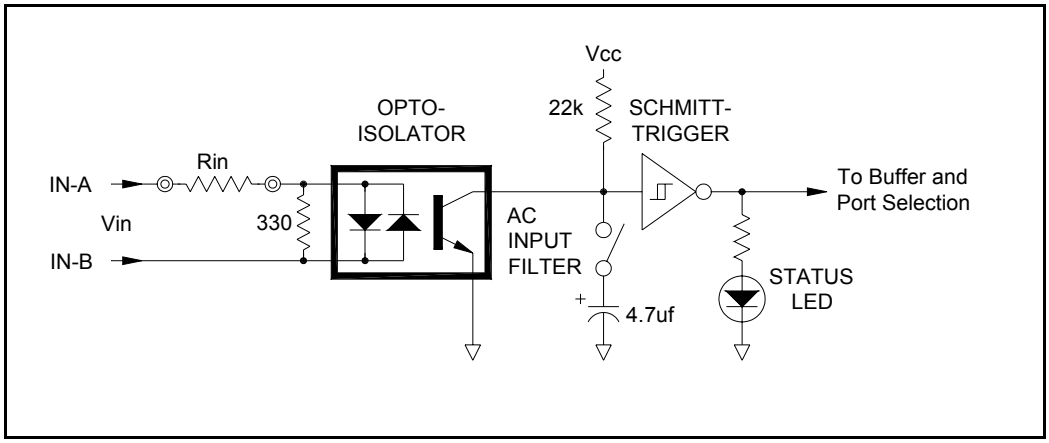

Figure 4 - Digital Input Circuitry (one channel shown)

The table below provides resistor values for common input voltages. However, other input voltages can be easily accomodated by calculating resistor values from the formulas provided.

Common Input Voltage / Resistor Values		
Input Voltage	Input Resistor (Ohms)	SCIDYNE Stock Number
5	1K	101 - 0157
24	5.6K	101 - 0158
48	12K	101 - 0159
120	27K	101 - 0160

$$Rin \approx \frac{(Vin_{RMS} - 1.2V_{LED})}{0.004}$$

(1) Input Resistor Value

$$PD_{RinWatts} \approx \frac{(Vin_{RMS} - 1.2V_{LED})^2}{Rin}$$

(2) Input Resistor Power Dissipation

Input Resistor Designation	
Channel	Resistor
IN0	R1
IN1	R2
IN2	R3
IN3	R4
IN4	R5
IN5	R6
IN6	R7
IN7	R8

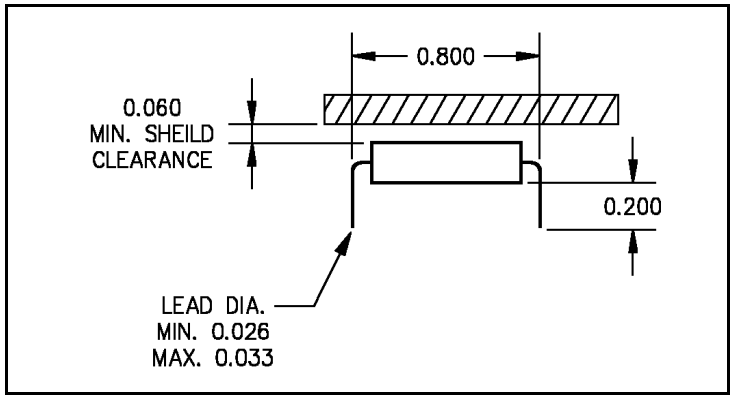

Figure 5 - Input Resistor Mechanical Specifications

Application Information

Host Connections

The host attaches to the XIO-DI8 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 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-DI8 works equally well in all these configurations provided the application developer observes the relationship between the ports, bits and the actual XIO-DI8 digital input channels. For convenience, a few different arrangements are depicted in the table to the right.

Shared Ribbon Cables

It is not uncommon for manufacturers to combine all I/O signals (analog, digital, counters, etc.) on the same IDC ribbon connector. When connecting the XIO-DI8 to these devices, **only** the digital signals should be routed to the XIO-DI8. This is generally accomplished by "stripping-out" that section of the ribbon cable which contain only the digital signals being used.

Using Multiple XIO-DI8 Boards

Multiple boards can be used by a single host device by associating each 8-bit host port to a separate XIO-DI8 or other SCIDYNE XIO family members.

Digital Output Connections to Host Device					
Output Header		PORT.BIT			Digital Input
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

Specifications

General:

Description:	Eight channel optically-isolated digital input interface board
Power:	5Vdc ±5% @ 125mA typical. Host or Externally supplied, "Power-On" LED
Environmental:	Operating temperature: -20ºC to 70ºC Non-condensing relative humidity: 5% to 95%
Dimensions:	3.00" W x 9.500" L x 1.35" H
Mounting:	Mounts using Standoffs, SNAPTRACK® or DIN Rail
Isolation:	500V DC or AC Input-to-output; 250V maximum between adjacent inputs

Digital Inputs from Field:

General:	Eight independent non-polarized optically isolated inputs, Status LEDs
Connections:	16-position removable screw-terminal strip, accepts wires 12-24 AWG
Input voltage:	Each channel is programmable by means of a socketed resistor
DC:	3V minimum, 250V maximum, non-polarized
AC:	$3V_{PP}$ minimum, $250V_{PP}$ maximum, 40hz to 1khz
Input current:	3.5ma minimum, 25ma maximum per input
Input power:	1.4watts maximum per input

Propagation delay: (Input-Channel-to-Output-Bit. Measured with 5V input signal, Rin = 1k)

AC Filter Disabled:	On: 40µs Off: 100µs
AC Filter Enabled:	On: 20ms Off: 85ms
AC input filter:	RC type Low-Pass. Switch selectable on a per input basis

Digital Output to Host:

General:	Drives one of three 8-bit ports. Port selected by installation of DIP resistor network
Connections:	50-Pin and 26Pin IDC headers. Supports the two most common pinouts
Output levels:	TTL/CMOS compatible
Logic "0":	1.35Vdc maximum @ 5mA
Logic "1":	3.15Vdc minimum @ 5mA

Output Impedance:

Driven port:	47 ohms, primarily from output resistor network.
Undriven Ports:	> 10M ohms

Appendix A - Mechanical Dimensions