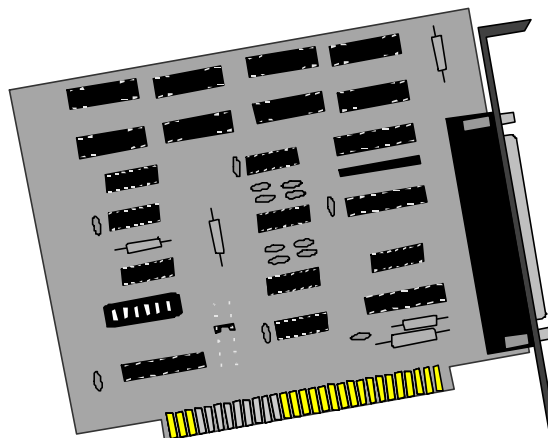


DIO-16TM
USER MANUAL



Part# 3096

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Introduction

Overview

The **DIO-16** provides 8 reed relays that can latch power, data or other electronic signals for control applications and 8 optically isolated inputs to allow monitoring of off board switch closures, relays or for any other general purpose monitoring needs. The **DIO-16** is PC compatible and fits in any ISA or EISA slot. Addressing, data and control signals are TTL compatible.

The **DIO-16** is simple to operate. By writing instruction bytes to the I/O port addresses, the reed relays are energized or de-energized. Inputs are just as simply read from their data ports.

What's Included

The **DIO-16** is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- **DIO-16** Interface Adapter
- DIO Software
- User manual

Factory Default Settings

The **DIO-16** factory default settings are as follows:

Base Address	IRQ
300	5

To install the **DIO-16** using factory default settings, refer to Installation on page 4.

For your reference, record installed **DIO-16** settings below:

Base Address	IRQ

Card Setup

The **DIO-16** contains several jumper straps for each port which must be set for proper operation.

Address Selection

The **DIO-16** occupies 4 consecutive I/O locations. The DIP-switch (SW1) is used to set the base address for these locations. Be careful when selecting the base address as some selections conflict with existing PC ports. The following table shows several examples that usually do not cause a conflict.

Address	Binary	Switch Settings							
		1	2	3	4	5	6	7	8
100-104	01 0000 00xx	Off	On	On	On	On	On	On	On
104-108	01 0000 01xx	Off	On	On	On	On	On	On	Off
200-204	10 0000 00xx	On	Off	On	On	On	On	On	On
280-283	10 1000 00xx	Off	On	Off	On	On	On	On	On
284-287	10 1000 01xx	Off	On	Off	On	Off	On	On	Off
2EC-2EF	10 1110 11xx	Off	On	Off	Off	Off	On	Off	Off
300-303	11 0000 00xx	Off	Off	On	On	On	On	On	On
320-323	11 0010 00xx	Off	Off	On	On	Off	On	On	On
388-38B	11 1000 10xx	Off	Off	Off	On	On	On	Off	On
3A0-3A3	11 1010 00xx	Off	Off	Off	On	Off	On	On	On
3A4-3A7	11 1010 01xx	Off	Off	Off	On	Off	On	On	Off

Figure 1 - Address Selection Table

The following illustration shows the correlation between the DIP-switch setting and the address bits used to determine the base address. In the example below, address 300 is selected as the base address. Address 300 in binary is XX 11 0000 00XX where X = a non-selectable address bit and address bit A9 is always a 1.

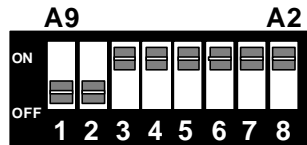


Figure 2 - DIP-Switch Illustration

Note: Setting the switch 'On' or 'Closed' corresponds to a '0' in the address, while leaving it 'Off' or 'Open' corresponds to a '1'.

IRQ Header E2

Interrupts can be generated by Port A, bit 0 going low if enabled at jumper location E2. Interrupt request signals 2/9 through 7 (IRQ 2/9 - 7) can be selected by placing the jumper in the appropriate position.

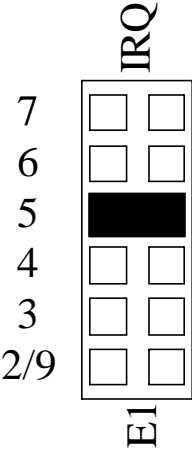


Figure 3 - IRQ Header E2

Installation

The **DIO-16** can be installed in any of the PC ISA expansion slots. The **DIO-16** contains a DIP-switch (SW1) and IRQ selection which must be set prior to installation.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover.
3. Locate any two available slots and remove the blank metal slot covers.
4. Gently insert the **DIO-16** into the slot. Make sure the adapter is seated properly. Insert the cable bracket into the adjacent slot and screw in place.
5. Replace the cover.
6. Connect the power cord.

Installation is complete.

Software Installation

For Windows Users

Choose **Install Software** at the beginning of the CD and select the **Digital I/O** software drivers and install **SeaIO**.

Technical Description

The **DIO-16** provides two parallel input/output (I/O) ports. The ports are organized as ports A, B, C, and D. Port A is an input port interfaced to optically-isolated inputs, while port C is the reed relay output port. Assuming an I/O address of 300 Hex the following table shows the Port Addresses.

Note: Ports B and Port D are decoded but not used.

Base Address	Hex	Decimal	Mode
Port A Address	300	768	Input Port (Opto-Isolator Input)
Port B Address	301	769	Not Used
Port C Address	302	770	Output Port (Reed Relays)
Port D Address	303	771	Not Used

Features

- Selectable I/O port addressing from 100H - 3FFH
- 1 set SPST relays with each set having 8 relays
- 1 eight bit input port
- DB-37 female connector
- Highly reliable 10 VA DIP reed relays utilized
- 8 bit slot connector
- Multiple adapters can reside in same computer
- All address, data and control signals are TTL compatible

Input Ports

Port A is 8 bit input port connected to optically isolated input sensors. Each sensor can be used to interface a voltage input and then sense whether the voltage is on or off. Each sensor is isolated (with respect to a common ground) from every other sensor, and also isolated with respect to the host PC ground. This means that signals such as low-level AC line voltage, motor servo voltage, and control relay signals can be 'sensed', or read by the PC, without the risk of damage due to ground loops or ground faults.

Each sensor input pair has a current limiting resistor which is used to limit the input current to the opto-isolator. The opto-isolator has two 'back-to-back' diodes internally. This allows AC or DC signals to be sensed, regardless of polarity. When the applied voltage is high enough to cause the LED in the opto-isolator to turn-on, the output of the opto-isolator goes low (0 volts) and the signal is read as a low logic level (binary 0) by the PC. When the input signal is too low to turn on the opto-isolator, the output goes high and the port bit is read by the PC as a high logic level (binary 1).

The input impedance of each isolated input is approximately 560 ohms (factory default). The opto-isolator requires approximately 3 mA to turn on. The maximum input current is 60 mA. Two things to consider when selecting the input resistor. The first is turn on voltage for the circuit to sense, and second is the maximum input voltage. Maximum input voltage must not provide too much power to the input resistor, and must also not overdrive the opto-isolator input current specification. The following formulas apply:

Turn on current: 3 mA
Isolator diode drop: 1.1 V
Resistor power Max: .25 W

Turn on Voltage = diode drop + (turn on current) x (resistance)

Or :

$$1.1 + (.003) \times R$$

Maximum voltage = square root of (.25 (resistor value))

The following table shows four common input resistors and the ranges associated with each .

Input Resistor (Ohms)	Min Turn-On (Volts)	Max Input (Volts)	Max Current (mA)
220	1.76	7	32
560	2.8	12	22
1K	4.1.	16	16
2.2K	7.7	24	11

The maximum input voltage can be increased by increasing the input resistor accordingly. Because socketed DIP resistor networks are utilized, they can easily be replaced with a different value. This can be done at the factory, if necessary. The input circuits are not intended for monitoring 120 volt AC circuits. In addition to being too high a voltage for the circuits, it is dangerous to have that high a voltage on the card.

Sensor Input Port Pin Assignments (P1)

Port A Bit	P1
0	2,20
1	3,21
2	4,22
3	5,23
4	6,24
5	7,25
6	8,26
7	9,27

Output Ports (Reed Relay)

Reed relays provide very high quality, long life, low current (10 Watt maximum), dry contact switch closures. Reed relays are not suited for high current applications, and can be destroyed by inductive load switching, where a spark occurs across the contacts internally. The relays are normally open, and close when energized. Each relay can be individually energized by writing a '1' to the proper port bit.

Relay Specifications

- Contact Power Ratings: 10 Watts Maximum
- Contact Voltage Maximum: 100 Volts DC or AC Maximum
- Contact Current Maximum: .5 Amps DC or AC RMS
- Contact Resistance, Initial: .15 Ohms
- Rated Life:
 - Low Load: 200 Million Closures
 - Maximum Load: 100 Million Closures
- Contact Speed:
 - Operate: .5 m Sec
 - Release: .5 m Sec
 - Bounce: .5 m Sec
- Maximum Operating Speed: 600 Hertz

Output Ports (Reed Relay) Pin Assignments (P1)

Port C Bit	Relay	P2 Pin
0	K1	10,28
1	K2	11,29
2	K3	12,30
3	K4	13,31
4	K5	14,32
5	K6	15,33
6	K7	16,34
7	K8	17,35

Power and Ground Pin Assignments

Ground	18,36,37
+ 5 Volts	19
+ 12 Volts	1

Programming

Application Programmers Interface (API)

Most modern operating systems do not allow direct hardware access. The SeaIO driver and API have been included to provide control over the hardware in Windows and Linux environments.

The purpose of this section of the manual is to help the customer with the mapping of the API to the actual inputs and relays for the 3096 specifically. Complete documentation of the API can be found in its accompanying help file.

Interrupts

Interrupt sampling can be set up in the API. Port A bit zero is the interrupt source. Refer to the API help file for more detailed information.

Relative Addressing Vs. Absolute Addressing

The SeaIO API makes a distinction between “absolute” and “relative” addressing modes. In absolute addressing mode, the Port argument to the API function acts as a simple byte offset from the base I/O address of the device. For instance, Port #0 refers to the I/O address base + 0; Port #1 refers to the I/O address base + 1.

Relative addressing mode, on the other hand, refers to input and output ports in a logical fashion. With a Port argument of 0 and an API function meant to output data, the first (0th) output port on the device will be utilized. Likewise, with a Port argument of 0 and an API function designed to input data, the first (0th) input port of the device will be utilized.

In all addressing modes, port numbers are zero-indexed; that is, the first port is port #0, the second port is #1, the third #2, and so on.

Technical Description

Tables : API Port/bit reference numbers for Absolute and Relative Addressing

R = Read

W = Write

R/W = Read or Write

Port	API Port # Absolute Address (function)	API Port # Relative Address (function)	Port Type
A	0 (R)	0 (R)	Input Port (Opto Input)
B	1		Not Used
C	2 (R/W)	0 (W)	Output Port (Reed Relays)
D			Not Used

API Bit # Absolute Address (function)	API Bit # Relative Address (function)	Port Bit
0 (R)	0 (R)	A0 - Input
1 (R)	1 (R)	A1 - Input
2 (R)	2 (R)	A2 - Input
3 (R)	3 (R)	A3 - Input
4 (R)	4 (R)	A4 - Input
5 (R)	5 (R)	A5 - Input
6 (R)	6 (R)	A6 - Input
7 (R)	7 (R)	A7 - Input
16 (R/W)	0 (W)	C0 - Output
17 (R/W)	1 (W)	C1 - Output
18 (R/W)	2 (W)	C2 - Output
19 (R/W)	3 (W)	C3 - Output
20 (R/W)	4 (W)	C4 - Output
21 (R/W)	5 (W)	C5 - Output
22 (R/W)	6 (W)	C6 - Output
23 (R/W)	7 (W)	C7 - Output

Direct Hardware Control

In systems where the users program has direct access to the hardware (DOS) the table below gives the mapping and functions which the 3096 provides, a base address of 300 was used. If a different base address is used then the port addresses are calculated as shown in the table.

Reading the Inputs (direct) :

The inputs are active Low. If no voltage is applied across one of the differential inputs it returns a one on that bit. If an AC or DC voltage (of sufficient magnitude, covered above) is applied it returns a zero on that bit.

Reading the Outputs (relays) (direct) :

The relay ports return the ones complement of the value that is currently being used to drive the relays. When using the API the value is returned not the complement of the value.

Writing the Outputs (relays) (direct) :

The output ports are the only ports that can be written. The relays on a standard 3096 are normally open. To close a relay a one must be written to the appropriate bit.

R = Read
 W = Write
 R/W = Read or Write

Function Available	Port	Address Hex	Address Decimal	Port Type
R	A	300 (Base + 0)	768	Input Port (Opto Input)
	B	301 (Base + 1)	769	Not Used
R/W	C	302 (Base + 2)	770	Output Port (Reed Relays)
	D	303 (Base + 3)	771	Not Used

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0° to 50° C (32° to 122° F)	-20° to 70° C (-4° to 158° F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Power Consumption

Supply line	+5 VDC
Rating	270 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board length	4.9 inches	(12.446 cm)
Board Height including Goldfingers	4.2 inches	(10.66 cm)
Board Height excluding Goldfingers	3.9 inches	(9.906 cm)

Note: Please see Appendix D for board layout and dimensions.

Appendix A - Troubleshooting

1. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc.
2. Configure your Sealevel Systems adapter so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address.
3. Make sure the Sealevel Systems adapter is securely installed in a motherboard slot.
4. The following are known I/O conflicts:
 - The 278 and 378 settings may conflict with your printer I/O adapter.
 - 3B0 cannot be used if a Monochrome adapter is installed.
 - 3F8-3FF is typically reserved for COM1:
 - 2F8-2FF is typically reserved for COM2:
 - 3E8-3EF is typically reserved for COM3:
 - 2E8-2EF is typically reserved for COM4:

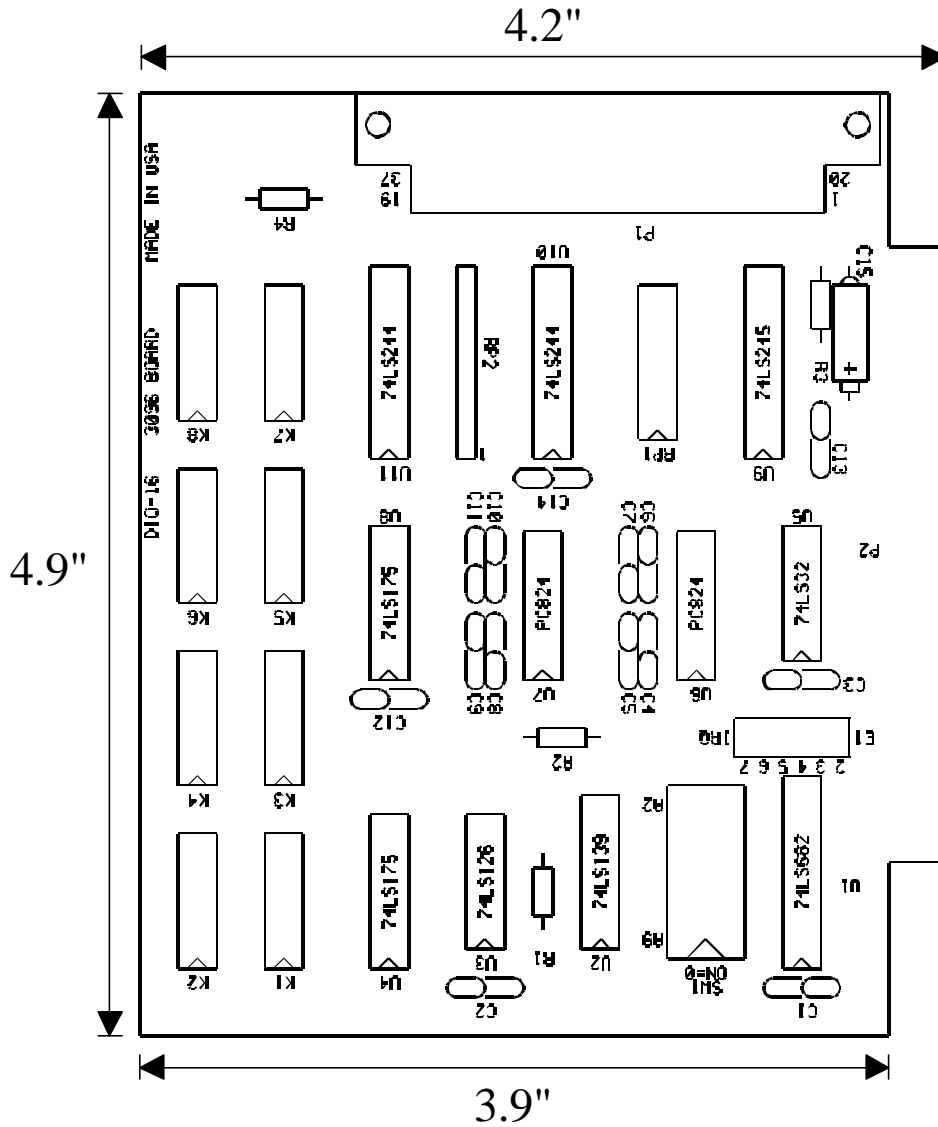
Appendix B - How To Get Assistance

Please refer to Appendix A - Troubleshooting prior to calling Technical Support.

1. Read this manual thoroughly before attempting to install the adapter in your system.
2. When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the adapter installed in a computer ready to run diagnostics.
3. Sealevel Systems maintains a Home page on the Internet. Our home page address is www.sealevel.com. The latest software updates, and newest manuals are available via our FTP site that can be accessed from our home page.
4. Technical support is available Monday to Friday from 8:00 a.m. to 5:00 p.m. Eastern time. Technical support can be reached at (864) 843-4343.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

Appendix C - Silk-Screen



Appendix D - Schematic

Appendix E - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in such case the user will be required to correct the interference at his own expense.

EMC Directive Statement



Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

- **EN55022 Class A** - "Limits and methods of measurement of radio interference characteristics of information technology equipment"
- **EN55024** - "Information technology equipment Immunity characteristics Limits and methods of measurement."
- **EN60950 (IEC950)** - "Safety of information technology equipment, including electrical business equipment"

Warning

This is a Class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.

Warranty

Sealevel Systems, Inc. provides a lifetime warranty for this product. Should this product fail to be in good working order at any time during this period, Sealevel Systems will, at its option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster.

Sealevel Systems assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Sealevel Systems will not be liable for any claim made by any other related party.

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