



***INDUSTRIAL COMPUTER SOURCE®***

# **Model DIO16 Product Manual**

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***INDUSTRIAL COMPUTER SOURCE®***



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## FORWARD

This product manual provides information to install, operate and or program the referenced product(s) manufactured or distributed by Industrial Computer Source. The following pages contain information regarding the warranty and repair policies.

Technical assistance is available at: **1-800-480-0044**.

**Manual Errors, Omissions and Bugs:** A "Bug Sheet" is included as the last page of this manual. Please use the "Bug Sheet" if you experience any problems with the manual that requires correction.

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## Guarantee

A thirty day money-back guarantee is provided on all **standard** products sold. **Special order products** are covered by our Limited Warranty, *however they may not be returned for refund or credit. EPROMs, RAM, Flash EPROMs or other forms of solid electronic media are not returnable for credit - but for replacement only. Extended Warranty available. Consult factory.*

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In order to receive refund on a product purchase price, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, software, cables, etc.) within 30 days of receipt and in as-new and resalable condition. The **Return Procedure** must be followed to assure prompt refund.

## Restocking Charges

Product returned *after* 30 days, and *before* 90 days, of the purchase will be subject to a **minimum** 20% restocking charge and any charges for damaged or missing parts.

Products not returned within 90 days of purchase, or products which are not in as-new and resaleable condition, are not eligible for credit return and will be returned to the customer.

## Limited Warranty

One year limited warranty on all products sold with the exception of the "Performance Series" I/O products, which are warranted to the original purchaser, for as long as they own the product, subject to all other conditions below, including those regarding neglect, misuse and acts of God. Within one year of purchase, Industrial Computer Source will repair or replace, at our option, any defective product. At any time after one year, we will repair or replace, at our option, any defective "Performance Series" I/O product sold. This does not include products damaged in shipment, or damaged through customer neglect or misuse. Industrial Computer Source will service the warranty for all standard catalog products for the first year from the date of shipment. After the first year, for products not manufactured by Industrial Computer Source, the remainder of the manufacturer's warranty, if any, will be serviced by the manufacturer directly.

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The limited warranty is void if the product has been subjected to alteration, neglect, misuse, or abuse; if any repairs have been attempted by anyone other than Industrial Computer Source or its authorized agent; or if the failure is caused by accident, acts of God, or other causes beyond the control of Industrial Computer Source or the manufacturer. Neglect, misuse, and abuse shall include any installation, operation, or maintenance of the product other than in accordance with the owners' manual.

No agent, dealer, distributor, service company, or other party is authorized to change, modify, or extend the terms of this Limited Warranty in any manner whatsoever. Industrial Computer Source reserves the right to make changes or improvements in any product without incurring any obligation to similarly alter products previously purchased.



**Shipments not in compliance with this Guarantee and Limited Warranty Return Policy will not be accepted by Industrial Computer Source.**

## Return Procedure

For any Limited Warranty or Guarantee return, please contact Industrial Computer Source's Customer Service at **1-800-480-0044** and obtain a Return Material Authorization (RMA) Number. All product(s) returned to Industrial Computer Source for service or credit **must** be accompanied by a Return Material Authorization (RMA) Number. Freight on all returned items **must** be prepaid by the customer who is responsible for any loss or damage caused by common carrier in transit. Returns for Warranty **must** include a Failure Report for each unit, by serial number(s), as well as a copy of the original invoice showing date of purchase.

To reduce risk of damage, returns of product must be in an Industrial Computer Source shipping container. If the original container has been lost or damaged, new shipping containers may be obtained from Industrial Computer Source Customer Service at a nominal cost.

## Limitation of Liability

In no event shall Industrial Computer Source be liable for any defect in hardware or software or loss or inadequacy of data of any kind, or for any direct, indirect, incidental, or consequential damages in connection with or arising out of the performance or use of any product furnished hereunder. Industrial Computer Source liability shall in no event exceed the purchase price of the product purchased hereunder. The foregoing limitation of liability shall be equally applicable to any service provided by Industrial Computer Source or its authorized agent.

Some *Sales Items* and *Customized Systems* are **not** subject to the guarantee and limited warranty. However in these instances, any deviations will be disclosed prior to sales and noted in the original invoice. ***Industrial Computer Source reserves the right to refuse returns or credits on software or special order items.***

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# Chapter 1: Installation

The DIO16 board can be installed in any of the PC expansion slots. Remove the PC case, remove the blank metal slot cover, and insert the board. Replace the screw, replace the cover, and you are done.

**Note:** Be sure to set the address and jumper options before installation.

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## Chapter 2: Address Selection

The DIO16 board occupies a total of four consecutive I/O locations. A dip switch 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 POSITION SETTING							
	A9	A0	1	2	3	4	5	6	7	8
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
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
300-303	11	0000 00XX	OFF	OFF	ON	ON	ON	ON	ON	ON
304-307	11	0000 01XX	OFF	OFF	ON	ON	ON	ON	ON	OFF
2E8-2EB	10	1110 10XX	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
2EC-2EF	10	1110 11XX	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
320-323	11	0010 00XX	OFF	OFF	ON	ON	OFF	ON	ON	ON

The following table shows the correlation between the dip switch setting and the address bits used to determine the base address. Assume 300 hex to 303 hex is the desired base address. 300 hex=1100 00XX in binary.

SWITCH POSITION	ADDRESS LINE	BINARY SWITCH	SETTING
1	A9	1	OFF
2	A8	1	OFF
3	A7	0	ON
4	A6	0	ON
5	A5	0	ON
6	A4	0	ON
7	A3	0	ON
8	A2	0	ON

**Note:** Setting the switch on or closed corresponds to a "0" in the address, while leaving it open or off corresponds to a "1".

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## Chapter 3: Technical Description

The DIO16 board provides four parallel input/output (I/O) ports. The ports are organized as ports A, B, C, and D. Ports A and C are the only ports utilized. This is done to maintain compatibility with software written for the DIO32B board, which has twice as much I/O, and hence, more ports. Port A is an eight bit input port interfaced to optically-isolated inputs, while port C is an eight bit reed relay output port. See the table below.

<b>BASE ADDRESS:</b>	<b>300 HEX</b>	<b>768 DECIMAL</b>	<b>(11 0000 00XX)</b>
PORT A ADDRESS:	300 HEX	768 DECIMAL	INPUT PORT (OPTO INPUT)
PORT B ADDRESS:	301 HEX	769 DECIMAL	NOT USED
PORT C ADDRESS:	302 HEX	770 DECIMAL	OUTPUT PORT (REED RELAYS)
PORT D ADDRESS:	303 HEX	771 DECIMAL	NOT USED

Please note that port A is input only, meaning that it can be read (or input from), and not written (output) to. Port C is an output port with read-back capability, meaning that it can be written (output) to and then read back as input. Whatever was written will always be read back. This allows for bits to be set or reset without altering the state of the other port bits.

### Isolated Input Ports

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Port A is an eight 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).

Interrupts can be generated by port A, bit 0 going low if enabled at jumper location E1. Interrupt request lines 2 through 7 (IRQ2-7) can be selected by placing the jumper in the appropriate position. Other inputs can be “wire or’ed” to also generate interrupts if desired. Please consult the factory for more information.

The input impedance of each isolated input is approximately 560 ohms. The opto-isolator requires about 3 mA (milli-Amps) to turn on. The maximum input current is 60 mA. There are 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 spec. The following formulas apply:

Turn on current: 3 mA

Isolator diode drop: 1.1 Volts

Resistor power max: .25 Watt

Turn on voltage = diode drop + (turn on current) x (resistance) or :  $1.1 + (.003) R$

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

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

RESISTOR VALUE	TURN-ON	MAX INPUT	INPUT RANGE	MAX CURRENT
220 OHMS	1.76 VOLTS	7.4 VOLTS	2-6 VOLTS	29 mA
560	2.8	11.8	3-12	19
1K	4.1	15.8	4-16	15
2.2K	7.7	23.4	8-24	10

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.

## DB-37S Female Sensor Input Connector Pin-Out

PORT BIT		CONNECTOR & PIN NUMBERS	MODE
PORT A BIT	0	P1-2,20	INPUT
	1	3,21	"
	2	4,22	"
	3	5,23	"
	4	6,24	"
	5	7,25	"
	6	8,26	"
	7	9,27	"
		CONNECTOR & PIN NUMBERS	MODE
PORT BIT	RELAY		
PORT C BIT	0	K1 P1-10,28	OUTPUT
	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	"
GROUND		P1-18,36,37	
+ 5 VOLTS		P1-19	
+ 12 VOLTS		P1-1	

Programming example- To test sensor input bit position 0, port a:

```

MOV DX,300H ;SET DX TO PORT A
IN AL,DX ;GET INPUT PORT DATA
NOT AL ;DATA READ IS NEGATIVE LOGIC (ON=0)
;NOW AL,BIT D0 IS A "1" IF SIGNAL WAS ON
    
```

## Relay Output Curcuit Description

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The output port on the DIO16 is connected to 8 dip reed relays. 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.

Programming example- This method that takes into account the read-back capability of the output port C:

```

MOV DX,302H ;SET DX TO PORT C
IN AL,DX ;GET OLD PORT SETTING
NOT AL ;INVERT FOR NEGATIVE LOGIC *****
OR AL,0000 1000B ;OR IN BIT 3
OUT DX,AL ;SET BIT 3 W/O ALTERING OTHER BITS
    
```

\*\*\*\* NOTE: Reading back port C results in the binary complement of what you originally output.

## How to remain CE Compliant

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In order for machines to remain CE compliant, only CE compliant parts may be used. To keep a chassis compliant it must contain only compliant cards, and for cards to remain compliant they must be used in compliant chassis. Any modifications made to the equipment may affect the CE compliance standards and should not be done unless approved in writing by Industrial Computer Source.

The Model DIO16 is designed to be CE Compliant when used in an CE compliant chassis. Maintaining CE Compliance also requires proper cabling and termination techniques. The user is advised to follow proper cabling techniques from sensor to interface to ensure a complete CE Compliant system. Industrial Computer Source does not offer engineering services for designing cabling or termination systems. Although Industrial Computer Source offers accessory cables and termination panels, it is the user's responsibility to ensure they are installed with proper shielding to maintain CE Compliance.





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SCHEMATIC 1 OF 2

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SCHEMATIC 2 OF 2

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# *Declaration of Conformity*



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Industrial Computer Source declares under its own and full responsibility that the following products are compliant with the protection requirements of the 89/336/EEC directives.

**Only specific models listed on this declaration and labeled with the CE logo are CE compliant.**

## **DIO16**

Conformity is accomplished by meeting the requirements of the following European harmonized standards:

<b>EN 50082-1:1992</b>	EMC Generic Immunity Standard
<b>EN 55022:1987</b>	Limits & Methods of measurement of interference characteristics of IT Equipment
<b>EN 60 950</b>	Safety of Information Technology Equipment Including Electrical Business Equipment

Information supporting this declaration is contained in the applicable Technical Construction file available from:



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Mr. Steven R. Peltier  
President & Chief Executive Officer

August 29, 1997  
San Diego, CA





## BUG REPORT

While we have tried to assure this manual is error free, it is a fact of life that works of man have errors. We request you to detail any errors you find on this BUG REPORT and return it to us. We will correct the errors/problems and send you a new manual as soon as available. Please return to:



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Product: **DIO16**

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Please list the page numbers and errors found. Thank you!

