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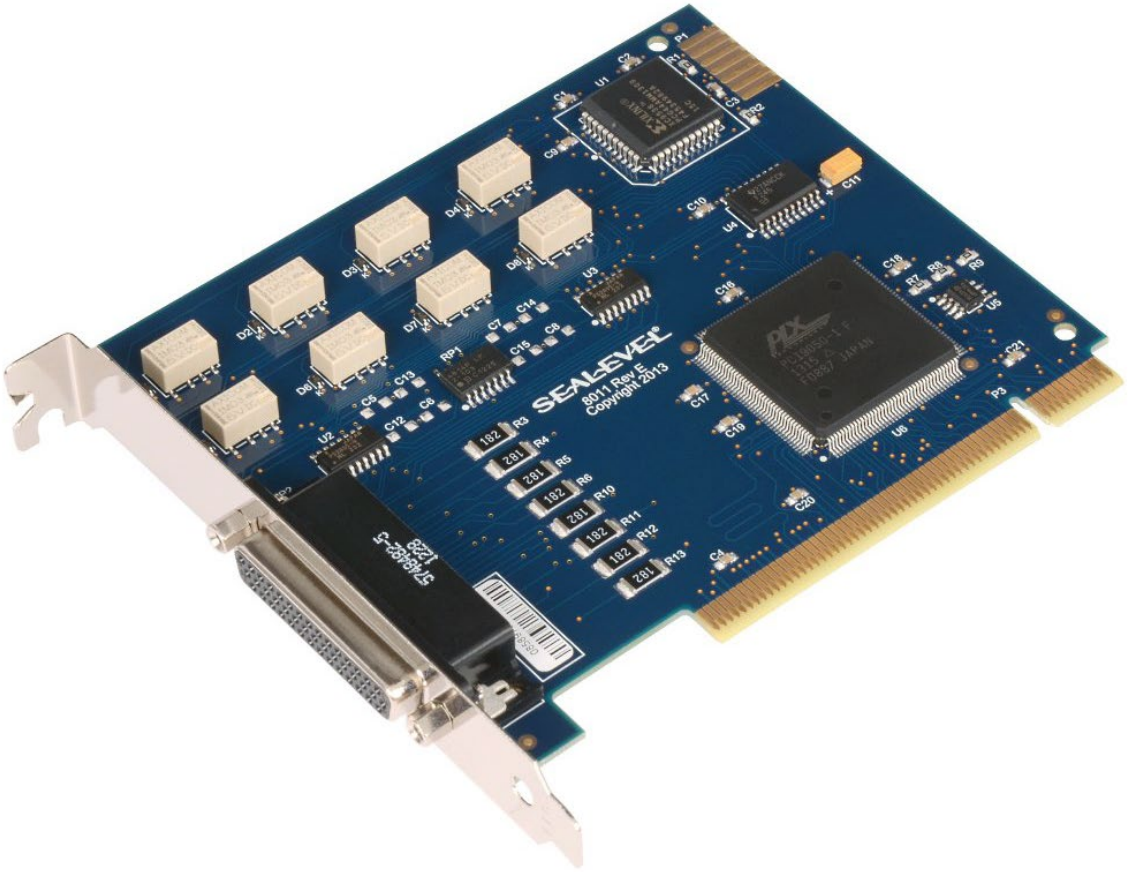
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PLC-16.PCI

User Manual | 8011



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Introduction

The PLC-16.PCI provides 8 Form C relays that can switch and carry 2A loads making it suitable for latching power, data, or other electronic signals for control applications. Eight optically isolated inputs (rated for 5-30V) are also provided to allow monitoring of off board switch closures, relays or for any other general purpose monitoring needs. The PLC-16.PCI is optimized for 24V DC/AC usage. The board is PCI bus specification 2.1 compliant.

The PLC-16.PCI is designed to be used with a variety of Operating Systems including Windows 98/NT/ME/2000/XP, Linux, and DOS. The SeaI/O API (Application Programmer Interface) included in the software provides a variety of useful high-level function calls implemented as a Windows dynamic link library (DLL) and as a Linux kernel module and library. In addition to the API, SeaI/O includes sample code and utilities to simplify software development.

Other Sealevel PCI Digital I/O Products

PIO-24.PCI	(P/N 8008)	- 24 TTL Inputs/Outputs
PIO-32.PCI	(P/N 8010)	- 32 TTL Inputs/Outputs
PIO-48.PCI	(P/N 8005)	- 48 TTL Inputs/Outputs
PIO-96.PCI	(P/N 8009)	- 96 TTL Inputs/Outputs
PLC-16.PCI	(P/N 8002)	- 8 Reed Relay Outputs/8 Opto-isolated Inputs
REL-16.PCI	(P/N 8003)	- 16 Reed Relay Outputs
DIO-32.PCI	(P/N 8004)	- 16 Reed Relay Outputs/16 Opto-isolated Inputs
ISO-16.PCI	(P/N 8006)	- 16 Opto-isolated Inputs
REL-32.PCI	(P/N 8007)	- 32 Reed Relay Outputs

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Before You Get Started

What's Included

The PLC-16.PCI is shipped with the following items. If any of these items is missing or damaged, please contact Sealevel for replacement.

- **PLC-16.PCI Adapter**

Advisory Conventions



Warning
The highest level of importance used to stress a condition where damage could result to the product, or the user could suffer serious injury.



Important
The middle level of importance used to highlight information that might not seem obvious or a situation that could cause the product to fail.



Note
The lowest level of importance used to provide background information, additional tips, or other non-critical facts that will not affect the use of the product.

Optional Items

Depending upon your application, you are likely to find one or more of the following items useful for interfacing the PLC-16.PCI to real-world signals. All items can be purchased from our website (www.sealevel.com) or by calling (864) 843-4343.

- **DB44 Male to DB44 Female 6' Cable (Part Number CA185)**
  - High Density DB44 Male to Female extension cable.
- **DB44 Male Terminal Block (Part Number TB08-KT)**
  - The TB08-KT, designed for use with the Sealevel 8011, eases field wiring of 8 optically isolated inputs and 8 Form C relay outputs. The terminal block has an HD44 male connector that breaks out to 28 screw terminals.
- **Cable and Terminal Block Kit (Part Number KT108)**
  - Includes CA185, TB08-KT, 6" Snap Track, and DIN rail clips.
- **DB44 Male to DB37 Male/Female V-Cable (Part Number CA184)**
  - Optional cable for 8011 with a DB44 connector that breaks out to one DB37 Female connector for Inputs and one DB37 Male connector for Outputs.
- **DB37 Male/Female Terminal Block (Part Number TB02-KT)**
  - Break out serial and digital connectors to 37 screw terminals for easy field connection. The TB02 terminal block is designed with both DB37 male and female connectors, therefore; it can be used with any DB37 board regardless of the board's port gender.
- **Cable and Terminal Block Kit (Part Number KT109)**
  - Includes CA184, two TB02-KT, 6" Snap Track, and DIN rail clips.

Software Installation

Windows Installation

Do not install the adapter in the machine until the software has been fully installed.

Only users running Windows 7 or newer should utilize these instructions for accessing and installing the appropriate driver via Sealevel's website. If you are utilizing an operating system prior to Windows 7, please contact Sealevel by calling 864.843.4343 or emailing support@sealevel.com to receive access to the legacy driver download and installation instructions.

1. Select the download for the SeaIO Classic for Windows (Software: SeaIO Classic V5 - Windows - Sealevel.) The setup file will automatically detect the operating environment and install the proper components. Next (depending on your browser) select the 'Run this program from its current location' or 'Open' option. Follow the information presented on the screens that follow. During setup, the user may specify installation directories and other preferred configurations. This program also adds entries to the system registry that are necessary for specifying the operating parameters for each driver. An uninstall option is also available to remove SeaIO files and registry/INI file entries from the system.
2. A screen may appear with the declaration: "The publisher cannot be determined due to the problems below: Authenticode signature not found." Please select the 'Yes' button and proceed with the installation. This declaration simply means that the Operating System is not aware of the driver being loaded. It will not cause any harm to your system.
3. During setup, the user may specify installation directories and other preferred configurations. This program also adds entries to the system registry that are necessary for specifying the operating parameters for each driver. An uninstall option is also included to remove all registry/INI file entries from the system.

Windows software installation is complete.

Windows NT Card Installation: After accomplishing the above steps, bring up the Control Panel and double-click on the SeaIO Devices icon. To install a new card, click "Add Port". Repeat this procedure for as many SeaIO cards as you wish to install.

Linux Software: You may download the SeaIO Classic for Linux Windows for the 8011. If you need additional information with this installation, please contact Sealevel's Technical Support: support@sealevel.com.

Physical Installation

The adapter can be installed in any 5V PCI expansion slot.



Do not install the adapter in the machine until the software has been fully installed.

1. **Turn off PC power. Disconnect the power cord.**
2. Remove the PC case cover.
3. Locate an available 5V PCI slot and remove the blank metal slot cover.
4. Gently insert the PCI adapter into the slot. Make sure that the adapter is seated properly.
5. After the adapter has been installed, the cables should be routed thru the opening in the bracket. This bracket also features a strain relief function that should be used to prevent un-expected cable removal.
6. Replace the screw you removed for the blank and use it to secure the adapter into the slot. (This is required to ensure FCC Part 15 compliance.)
7. Replace the cover.
8. Connect the power cord.

The PLC-16.PCI is now ready for use.

Programming the PLC-16.PCI

Sealevel's SeaI/O software is provided to assist in the development of reliable applications for the Sealevel Systems family of digital I/O adapters. Included in Sealevel's software and drivers are driver functions for use in accessing the I/O as well as helpful samples and utilities.

Programming for Windows

The SeaI/O API (Application Programmer Interface) provides a variety of useful high-level function calls implemented in a Windows dynamic link library (DLL). The API is defined in the help file (Start/Programs/SeaIO/SeaIO Help) under "Application Programmers Interface". This help file also includes detailed information dealing with installation / removal of the software and information about latency, logic states, and device configuration.

For C language programmers we recommend using the API to access the PLC-16.PCI. If you are programming in Visual Basic, using the ActiveX control included with SeaI/O is advised.

Samples and Utilities

A variety of sample programs and utilities (both executable and source code) are included in the software for the SeaI/O. Further documentation on these samples can be found by selecting "Start/Programs/SeaIO/Sample Application Description." If you have any problems locating these files, please contact Sealevel's Technical Support at 864-843-4343 or email support@sealevel.com.

Programming for Linux

SeaI/O for Linux consists of two major parts: a kernel module and a library. The kernel module is a simple IO pass-through device, allowing the library to handle the more sophisticated functions provided to SeaI/O users. It is provided in a 'tarball' format and can easily be compiled and included in the kernel build.

Digital I/O Interface

The PLC-16.PCI 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 relay output port.

Input Port

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 that 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 1K ohms (factory default). The opto-isolator requires approximately 3mA to turn on. The maximum input current is 50mA. 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 specification. The following formulas apply:

Turn on Voltage = diode drop + (turn on current) x (resistance) [Ex: 1.1 + (.003) x R]

Input Current = ((input voltage)-1.1V) / (resistor value)

Maximum voltage = 1.1 + square root of (.25(resistor value))

The following table shows the ranges associated with the resistor.

Input Resistor	Turn-On	Input Range	Max Input	Max Current
1KΩ	3.0V	5.0 – 24.0V	30V	29mA



The turn-off voltage for all resistors is less than 1V.

Because through hole resistors are utilized, they cannot be easily replaced. If modification is necessary, Sealevel can do this for an additional charge.



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. .

Input Port Pin Assignments (HD44 Female)

The inputs are not polarized and can be wired in either direction.

Port A Bit	P1
D0	9,10
D1	11,12
D2	13,14
D3	23,24
D4	25,26
D5	27,28
D6	29,30
D7	40,41

Output Ports (Form C Relays)

The PLC-16.PCI provides 8 Form C (SPDT) Electro-mechanical relays. These relays have three connections: Normally Open (NO), Normally Closed (NC) and a Common. The relays are all de-energized at power-on. Data to the relays is latched by a write to the base+2 address. On/off status of the relays can be read back by a read at the base+2 address.

Output Port Pin Assignments (HD44 Female)

Port C Bit	Normally Closed	Common	Normally Open
D0 (K1)	1	16	31
D1 (K2)	2	17	32
D2 (K3)	3	18	33
D3 (K4)	4	34	35
D4 (K5)	5	19	36
D5 (K6)	6	20	37
D6 (K7)	7	21	38
D7 (K8)	8	22	39

Direct Hardware Control

In systems where the user's program has direct access to the hardware (i.e. DOS) the table below gives the mapping and functions that the PLC-16.PCI provides.

Function Available	Port	Address Hex	Port Type
RD	A	Base+0	Input Port (Opto Input)
	B	Base+1	Not Assigned
RD/WR	C	Base+2	Output Port (Reed Relays)
	D	Base+3	Not Assigned

RD = Read, RD/WR = Read or Write

Reading the Inputs

The inputs are active Low. If no voltage is applied across one of the differential inputs, it returns a binary one (1) on that bit. If an AC or DC voltage is applied, it returns a binary zero (0) on that bit.

Writing the Outputs

The output ports are the only ports that can be written. The relays on a standard PLC-16.PCI are normally open. To close a relay a binary one (1) must be written to the appropriate bit.

Reading the Outputs

The relay ports can also be read to determine the status of the various relays. A read will return the ones complement (or opposite) of the value that is currently written to the port.

Register Description

All ports are set to input after reset or power up.

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	RD/WR	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+2	RD/WR	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+4	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+5	RD/WR	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Interrupt Control

When enabled, interrupts are generated on Port A bit D0.

IRQEN	Interrupt enable	1 = enabled	0 = disabled (0 on power up)
IRC0 **IRC1**	Interrupt mode select, see table below Interrupt mode select, see table below		

Interrupt Mode Select Table

Interrupt source is Base+0 bit D0. When selecting the Interrupt Type, always disable interrupts prior to changing or setting states. This will help prevent inadvertent or unexpected interrupts from occurring.

IRC1	IRC0	Interrupt Type
0	0	Low Level
0	1	High Level
1	0	Falling Edge
1	1	Rising Edge



When using the High and Low Level interrupts, an interrupt occurs when input D0 changes to either a High or Low state. This will cause the computer to remain in an interrupt state until the input state changes.

Interrupt Read

Reading the Interrupt Status port (Base+5) clears any interrupt pending.

IRQST	(D0) Interrupt Status	1 = interrupt pending, 0 = none

HD44 Female Pin Assignment

The table below describes the pin out for the HD44 Female connector on the 8011 board. The previous pages explain Port A (Inputs) and Port C (Form C Relay Outputs) addressing and how to read and/or write to them.

Pin#	Port	Bit	Type		Pin#	Port	Bit	Type
1	C	D0	(K1) Relay NC		**23**	A	D3	Input 4
2	C	D1	(K2) Relay NC		**24**	A	D3	Input 4
3	C	D2	(K3) Relay NC		**25**	A	D4	Input 5
4	C	D3	(K4) Relay NC		**26**	A	D4	Input 5
5	C	D4	(K5) Relay NC		**27**	A	D5	Input 6
6	C	D5	(K6) Relay NC		**28**	A	D5	Input 6
7	C	D6	(K7) Relay NC		**29**	A	D6	Input 7
8	C	D7	(K8) Relay NC		**30**	A	D6	Input 7
9	A	D0	Input 1		**31**	C	D0	(K1) Relay NO
10	A	D0	Input 1		**32**	C	D1	(K2) Relay NO
11	A	D1	Input 2		**33**	C	D2	(K3) Relay NO
12	A	D1	Input 2		**34**	C	D3	(K4) Relay Common
13	A	D2	Input 3		**35**	C	D3	(K4) Relay NO
14	A	D2	Input 3		**36**	C	D4	(K5) Relay NO
15	-	-	No Connect		**37**	C	D5	(K6) Relay NO
16	C	D0	(K1) Relay Common		**38**	C	D6	(K7) Relay NO
17	C	D1	(K2) Relay Common		**39**	C	D7	(K8) Relay NO
18	C	D2	(K3) Relay Common		**40**	A	D7	Input 8
19	C	D4	(K5) Relay Common		**41**	A	D7	Input 8
20	C	D5	(K5) Relay Common		**42**	-	-	No Connect
21	C	D6	(K6) Relay Common		**43**	-	-	No Connect
22	C	D7	(K7) Relay Common		**44**	-	-	No Connect

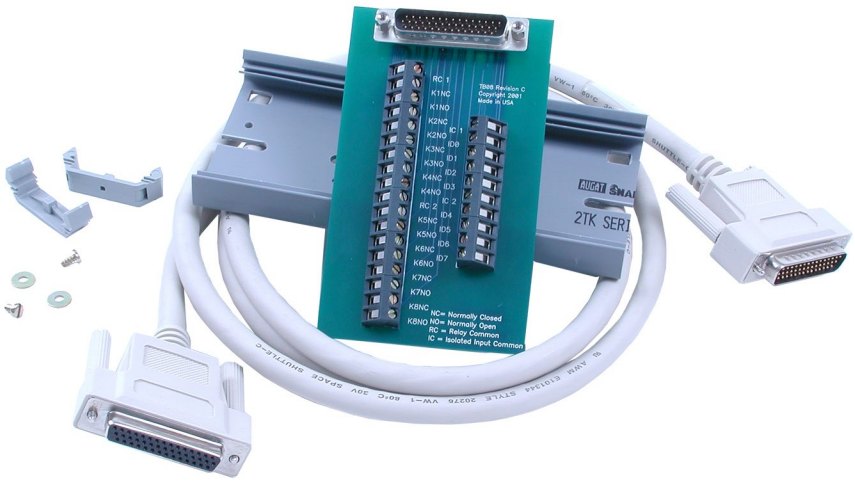
Optional Terminal Block Kit (Item# KT108)

Another option for termination of the PLC-16.PCI is the Terminal Block Kit (Item# KT108). This kit includes an HD44 Male to HD44 Female six-foot cable (Item# CA185) and a 28-Pin Terminal Block (Item# TB08-KT). The silk screen with diagram is shown on the following page.

The CA185 cable is wired straight through, one-to-one.

The terminal block groups the common connections of the PLC-16.PCI into groups of four as shown:

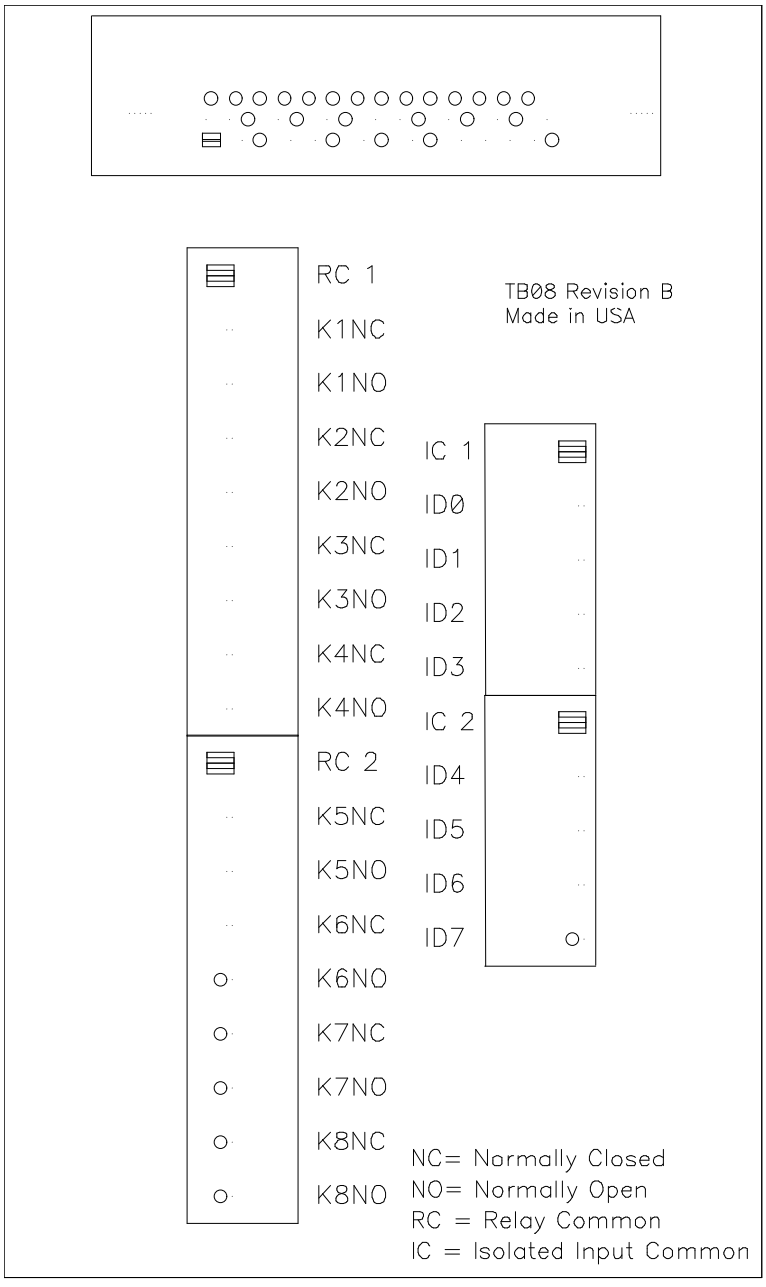
- RC1 (Relay Common 1) ties together the ground pins for physical relays K1 – K4 (logical D0 – D3) e.g.: HD44 pins 16,17,18 and 34 are connected to simplify field wiring
- RC2 (Relay Common 2) ties together the ground pins for physical relays K5 – K8 (logical D4 – D8) e.g.: HD44 pins 19,20,21 and 22 are connected to simplify field wiring
- The other eight screw terminals in each group (16 total) are used to wire to the NO (Normally Open) or NC (Normally Closed) side of the relays. These are labeled K1 – K4 and K5 – K8
- IC1 (Input Common 1) ties together one side of the input pins for D0-D3 and IC2 (Input Common 2) ties together one side of inputs D4-D7 to simplify field wiring
- The other four pins in each group (8 total) are used to wire to the inputs. These are labeled ID0 – ID3 and ID4 – ID8



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Silk Screen – TB08 Terminal Block

The silk screen for the TB08 terminal block shows how the connections are labeled for ease in wiring and troubleshooting.



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Optional Cable Pin Assignments (Item# CA184)

Part Number CA184 is an optional cable for use with the PLC-16.PCI. The CA184 has an HD44 connector that breaks out to one DB37 Female connector for Inputs and one DB37 Male connector for Outputs. This cable was designed to make our products more easily integrated into systems that may have previously used Sealevel legacy I/O interface products. The CA184 cable mimics several of the pin-out options found on Sealevel PCI and ISA legacy products and provides a direct connection to the 37 pin Terminal Block, Part Number TB02-KT. The following tables show the pin out for this cable.

Input Port Pin Assignments (DB37 Female)

Port A Bit	Input
D0	3,22
D1	4,23
D2	5,24
D3	6,25
D4	7,26
D5	8.27
D6	9,28
D7	10,29

Output Port Pin Assignments (DB37 Male)

Port C Bit	Normally Closed	Common	Normally Open
D0 (K1)	1	2	3
D1 (K2)	4	5	6
D2 (K3)	7	8	9
D3 (K4)	10	11	12
D4 (K5)	22	23	24
D5 (K6)	25	26	27
D6 (K7)	28	29	30
D7 (K8)	31	32	33

Electrical Characteristics

Features

- 8 SPDT Form C relays
- Eight optically isolated inputs
- DB44 Female connector
- PCI 2.1 Bus compatible

Specifications

Inputs Ports

Turn On Current:	3mA
Isolator Diode Drop:	1.1 VDC
Resistor Power Max:	1 W
Maximum Input Range:	5 – 30 VDC/VAC

Outputs Relays

Type:	Bifurcated, Gold clad, silver palladium
Contact Max Power Rating:	30 W DC / 60 VA AC
Contact Voltage Maximum:	60 VDC/VAC
Contact Current Maximum:	2A AC/DC RMS
Contact Resistance, Initial:	.10Ω
Rated Life:	Mechanical Minimum : 10 Minimum Closures Electrical, Minimum: 5 Million Closures (Full Load)
Contact Speed:	Operate: .2 mS Release: .1 mS Bounce: .7 mS

Temperature Range

Operating	0°C - 70°C
Storage	-50°C - 105°C

Power Requirements

Supply line	+5 VDC
Rating	380mA

Physical Dimensions

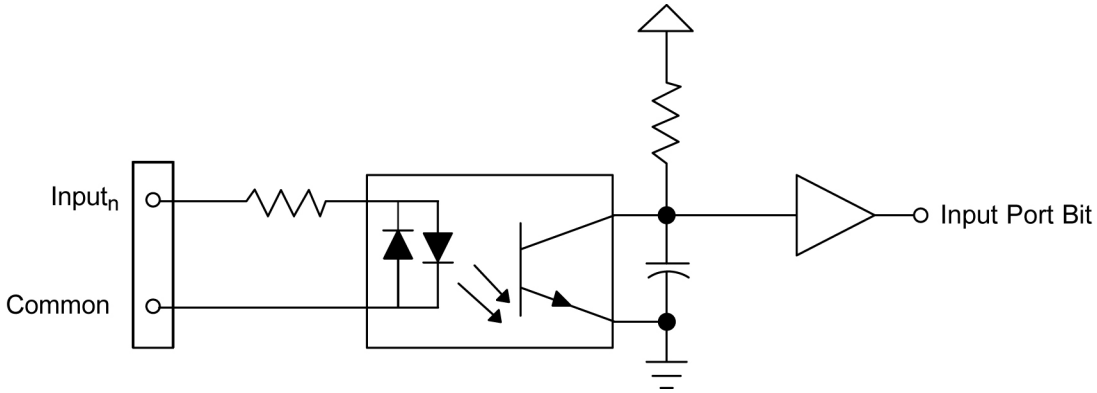
PCB Length:	4.9 inches (12.4 cm)
PCB Height:	4.2 inches (10.7 cm, including Gold fingers)

Manufacturing

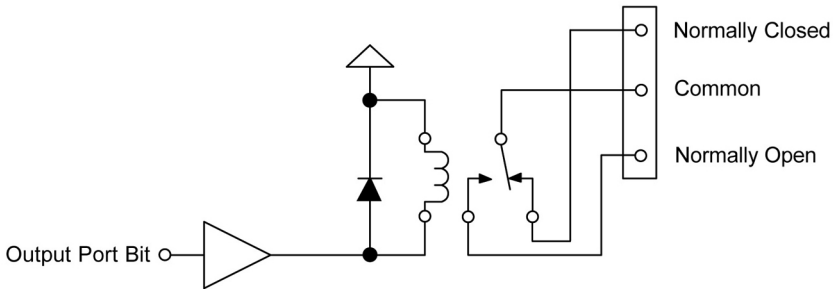
All Sealevel Systems Printed Circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Example Circuits

Input Circuit



Form C Output Circuit



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Appendix A – Troubleshooting

Following these simple steps can eliminate most common problems.

1. **Install software first**. After installing the software then proceed to adding the hardware. This places the required installation files in the correct locations.

2. Read this manual thoroughly before attempting to install the adapter in your system.

3. Use Device Manager under Windows to verify proper installation.

4. Use the SeaIO Control Panel applet or the Device Manager's property page for card identification and configuration.

If these steps do not solve your problem, please call Sealevel Systems' Technical Support, (864) 843-4343. Our technical support is free and available Monday through Friday from 8:00 AM - 5:00 PM, Eastern Time. For email support contact support@sealevel.com.

Appendix B – How To Get Assistance

Begin by reading through the Troubleshooting Guide in Appendix A. If assistance is still needed, please see below.

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.

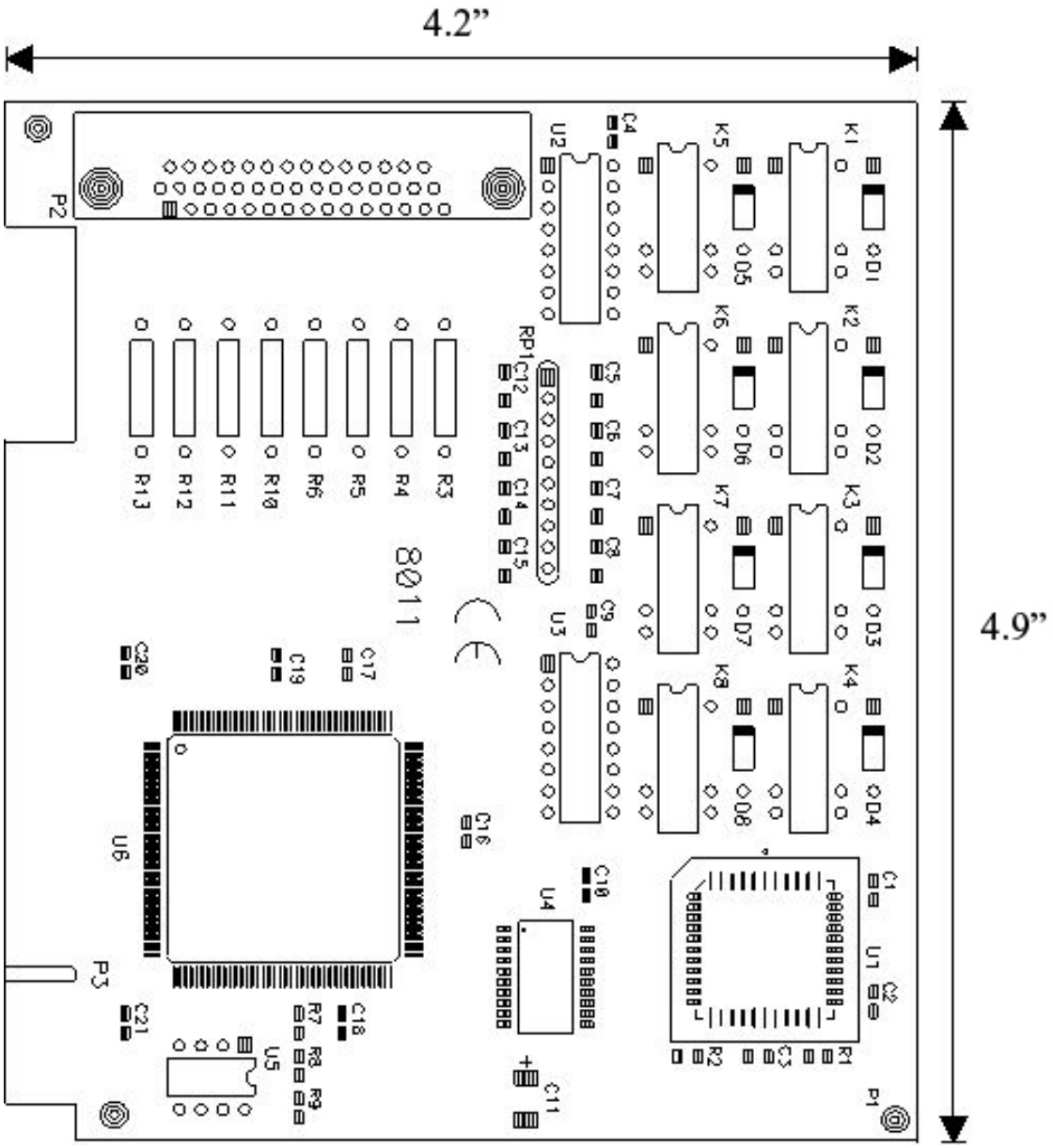
Sealevel Systems provides an FAQ section on its web site. Please refer to this to answer many common questions. This section can be found at http://www.sealevel.com/faq.asp.

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.

Technical support is available Monday to Friday from 8:00 AM to 5:00 PM, Eastern Time. Technical support can be reached at (864) 843-4343. For email support contact support@sealevel.com.

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 - 8011 PCB



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Appendix D – Compliance Notices

Federal Communications Commission (FCC) Statement



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 the users 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".



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 to prevent or correct the interference.



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's commitment to providing the best I/O solutions is reflected in the Lifetime Warranty that is standard on all Sealevel manufactured I/O products. We are able to offer this warranty due to our control of manufacturing quality and the historically high reliability of our products in the field. Sealevel products are designed and manufactured at its Liberty, South Carolina facility, allowing direct control over product development, production, burn-in and testing. Sealevel achieved ISO-9001:2015 certification in 2018.

Warranty Policy

Sealevel Systems, Inc. (hereafter "Sealevel") warrants that the Product shall conform to and perform in accordance with published technical specifications and shall be free of defects in materials and workmanship for the warranty period. In the event of failure, Sealevel will repair or replace the product at Sealevel's sole discretion. Failures resulting from misapplication or misuse of the Product, failure to adhere to any specifications or instructions, or failure resulting from neglect, abuse, accidents, or acts of nature are not covered under this warranty.

Warranty service may be obtained by delivering the Product to Sealevel and providing proof of purchase. Customer agrees to ensure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to Sealevel, and to use the original shipping container or equivalent. Warranty is valid only for original purchaser and is not transferable.

This warranty applies to Sealevel manufactured Product. Product purchased through Sealevel but manufactured by a third party will retain the original manufacturer's warranty.

Non-Warranty Repair/Retest

Products returned due to damage or misuse and Products retested with no problem found are subject to repair/retest charges. A purchase order or credit card number and authorization must be provided in order to obtain an RMA (Return Merchandise Authorization) number prior to returning Product.

How to obtain an RMA (Return Merchandise Authorization)

If you need to return a product for warranty or non-warranty repair, you must first obtain an RMA number. Please contact Sealevel Systems, Inc. Technical Support for assistance:

Available	Monday – Friday, 8:00 AM to 5:00 PM EST
Phone	864-843-4343
Email	support@sealevel.com

Trademarks

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