

BaseBoard[®]

User's Guide



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Solving Problems for Problem Solvers

BaseBoard

User's Guide



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Agency Approvals

FCC-B FCC NOTICE-WARNING

This equipment generates and uses radio frequency energy and if not installed and used in accordance with the instructions, may cause interference to radio or television reception. It has been tested and found to comply with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a residential installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect equipment into an outlet on a circuit different from the receiver.
- Consult the dealer or an experienced radio/TV technician for help
- Shielded cables must be used in order to comply with the emission limits.

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

CE-Mark Declaration of Conformity

This product meets the essential health and safety requirements and is in conformity with the relevant EC directives herein listed using the relevant section of the following EC standards or normative documents:

Application of Council Directives:

89/336/EEC, 92/31/EEC and 93/68/EEC Article 5

Standards for which conformity is declared:

EN55022, EN50082-1 (IEC 801-2, 801-3, 801-4)

Manufacturer: Scientific Solutions Inc., - USA

Type of Equipment: BaseBoard Digital I/O for computer

The CE marking has been affixed on the device according to Article 5 and 13 of the council directive 93/68/EEC.



Checklist

The Scientific Solutions Base Board product consists of the following items:

- ☑ Base Board Interface Board
- ☑ Base Board Handbook
- ☑ Base Board Software Diskette

Be sure and return your product registration card.
Registration is required for any repairs or support!

If any of these items are missing or damaged, or if problems are encountered with this product, please notify Scientific Solutions.

Refer to the diskette for sample programs and additional programming information.

The Scientific Solutions Base Board was the first Digital I/O card available for the IBM PC. It was first introduced in 1981. The design essentially remained unchanged until recently when it was redesigned and updated to surface mount technology. The newer version of the card remains 100% hardware/software compatible with the original design. This handbook contains configuration information for both the original and new design.

Scientific Solutions also offers a PCI version of the BaseBoard.
Visit our web site at:

<http://www.Scientific-Solutions.com>

for more information about the BaseBoard / PCI

BaseBoard Product Description

The Scientific Solutions Base Board provides 96 Digital I/O on a single PC card. The Base Board Digital I/O lines are arranged in four groups of 24 lines. Each group has its own connector which provides for direct connection of the Digital I/O to the outside world.

The Base Board is a full size card so that it can accommodate signal conditioning modules that plug directly onto the Digital I/O connectors. The Base Board allows you to customize your own multifunction board by adding up to 4 modules of your choice. An unlimited array of modules can be created by the user including relay control, SCR, voltage control, etc.

Scientific Solutions offers two module options:

- Opto Isolation Input
- Opto Isolation Output

The Base Board I/O lines are arranged in 4 sections of 24 lines each. Each section may be subdivided into 3 groups of 8 lines each or 2 groups of 12 lines each. Each group of lines can be programmed for either input or output.

Features

- 96 Digital I/O lines on a single PC card
- Four sections of 24 lines of TTL Digital Input and Digital Output
- Programmable in groups of 8 as input or output
- Programmable in groups of 12 as input or output with handshaking
- Accepts up to four add-on module boards for extra features
- Implements Digital input, output, bi-directional and strobed I/O
- Simple to program, one-byte setup for each group of 24 I/O

Options

- Base Board cables
- Screw Termination boards
- Opto-Isolation Out Module Board
- Opto-Isolation In Module Board

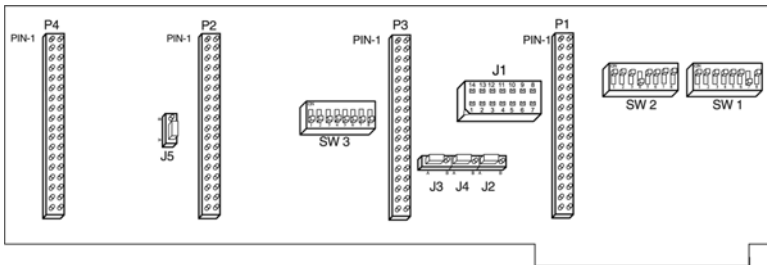


Identify Your Card

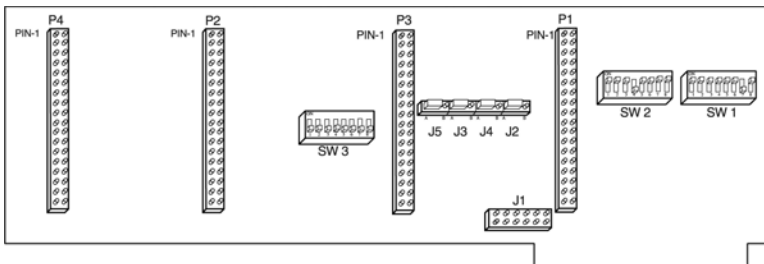
This manual addresses two versions of the Base Board. Make sure you are referring to the correct board when setting the options. Use the diagrams to identify your card and for the switch and jumper locations.

It is important to note the Pin 1 locations for connection of cables. Scientific Solution supplied ribbon cables generally have a colored stripe down one edge indicating the location of Pin 1. When connecting ribbon cables, always be sure the colored stripe on the cable corresponds with Pin 1 of the connectors the cable is attaching to.

Note the order of the connectors P1, P3, P2 and P4.



Base Board Revision 'E' and Earlier



Base Board Revision F2 and Later

Default Settings

Before installing the Base Board interface, verify that its options are set correctly. These options set up the card I/O Address, Interrupt selection, and digital I/O handshaking polarity.

Scientific Solutions ships the Base Board set to the following:

- I/O Address of 0210h - 021Fh (528d - 544d)
- No Interrupts selected
- Handshaking polarity, Non-Inverting

Check the requirements of the software you will be using. Use the information in this section to verify or change these settings.

Base Address Selection

Switch settings determine the base address used by the Base Board in the computer's I/O space. The address of each card in your computer must be unique. If you have an Address conflict, you can use the information in this section to set the Base Board card to a different address.

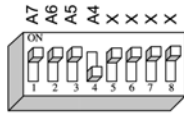
The default settings are for the I/O Address of 0210h (528 decimal).

The Base Board uses 16 consecutive 8-bit locations (16 byte block) in the PC's I/O space.

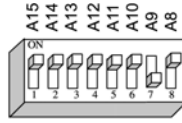
I/O Mode: Uses Address lines A15-A0 to decode an I/O address
 Provides any I/O address from 0000h-FFF0h.



Example Address Switch Settings

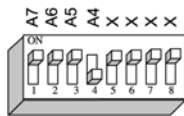


SW2

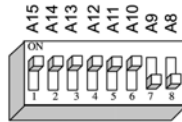


SW1

I/O Mode: 0210h (528 decimal) - DEFAULT

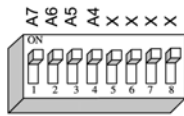


SW2

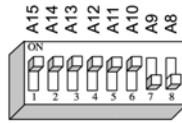


SW1

I/O Mode: 0310h (784 decimal)

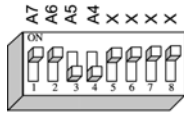


SW2

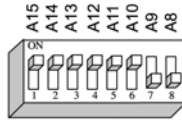


SW1

I/O Mode: 0300h (768 decimal)



SW2



SW1

I/O Mode: 0330h (816 decimal)

Interrupt Source Select

The Base Board's Digital I/O can be used in a two-wire handshaking mode - referred to as Strobed I/O mode. In Strobed I/O mode, the I/O operations may be interrupt driven. There are two possible interrupt sources from each parallel port section, and when the corresponding switch SW3 for an interrupt source is 'on', that interrupt is 'ORed' with any other selected interrupt sources from this board to provide an interrupt output to the PC. Switch SW3 selects the particular signals that will cause an interrupt. Jumper/Header J1 (described later) selects the particular PC interrupt line that the Base Board will use.

The Base Board consists of four sections, with each section consisting of three 8 bit ports labelled A, B and C. When a section is used in Strobed I/O mode, ports A and B are for data transfer and port C is used for strobe signals and interrupts.

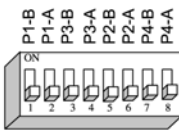
- Port C pin C0 is used for the Port B interrupt.
- Port C pin C3 is used for the Port A interrupt.

NOTE: SW-3 differ between Rev E (& earlier) and Rev F2 (& later).

Example: Interrupt sources,

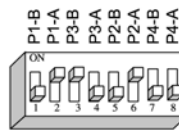
Section 1 Port A (P1-A), Section 2 Port A (P2-A), Section 3 Port B (P3-B)

No Interrupt Sources
(DEFAULT)

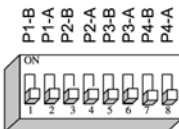


SW3

Example: Selected Interrupts
P1-A, P2-A, P3-B

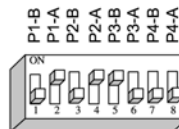


SW3



SW3

Base Board
Version F2
(& later)



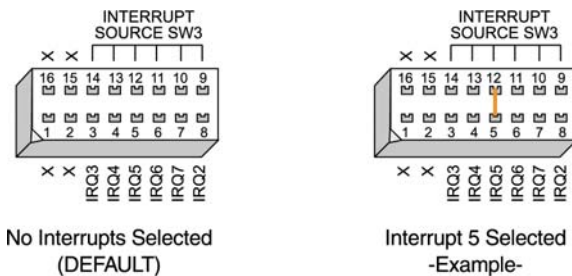
SW3

Interrupt Line Select

After using SW3 to select the Base Board interrupt source, use Jumper/ Header J1 to connect to one of the computer's interrupt lines.

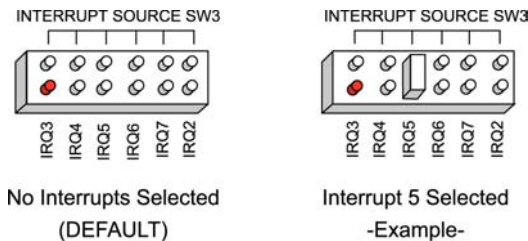
Base Board Rev E and Earlier

To connect to an interrupt, solder a small piece of wire across Header J1. One side of J1 has all the pins shorted together - this is the interrupt source from SW3. The other side of J1 are the individual interrupt connections. For example, to use interrupt 5, connect a wire from pin 12 to pin 5.



Base Board Rev F2 and Later

This revision of the Base Board uses a jumper J1 for the interrupt connection. To connect to an interrupt, connect a jumper across the pins corresponding to the desired interrupt. One side of header J1 has all the pins shorted together - this is the interrupt source from SW3. The other side of the header are the individual interrupt connections. For example, to use interrupt 5, place a jumper across the IRQ5 pin.



Digital I/O Handshake Configuration

The Base Board's Digital I/O can be used in a two-wire handshaking mode - referred to as Strobed I/O mode. In this mode, Port A and Port B are used as digital data I/O, while each uses two signals from Port C for handshaking. In strobed input mode, one handshaking signal (STB) is driven by an external device to strobe data into the Digital In buffer and the second signal is provided to the external device to acknowledge that the input buffer is full (IBF).

Normally, external devices require a high true (Non-Inverting) IBF signal to acknowledge that the input buffer is full. Some devices, however, may require a low true (Inverted) signal.

Jumpers J2, J3, J4 and J5 control the polarity of the IBF handshaking acknowledge signals for both Port A and Port B used in strobed input mode for the four Digital I/O sections.

Rev F2 & Later	Rev E & Earlier
J2 - Section 1	J2 - Section 1
J3 - Section 2	J3 - Section 3
J4 - Section 3	J4 - Section 2
J5 - Section 4	J5 - Section 4

NOTE: The difference between F2 and E on the assignment of the jumpers for the various sections.

Each jumper has two positions, A and B.

- Position A is for non-inverted handshaking (Default)
- Position B is for inverted handshaking



Non-Inverted Handshaking
(DEFAULT)



Inverted Handshaking

Digital I/O Connectors P1, P2, P3 and P4

Connectors P1, P2, P3 and P4 are 40 pin connectors for either a 40 pin ribbon cable connector permitting direct access to the outside world or for the attachment of an add-on module such as the Opto-In or Opto-Out options. The organization of the pins on these connectors is the same for all four.

Each of the digital I/O lines may be connected directly to the outside world. The BaseBoard has TTL threshold logic. When used as direct unbuffered outputs, be sure that the sink/source current of the BaseBoard is not exceeded. When used as an input, each line may be driven by any TTL logic signal.

Scientific Solutions offers 40 position screw terminals for direct connection to the Base Board's Digital I/O connectors P1, P2, P3 and P4. The screw termination units are compact and provide a convenient method for connecting discrete wires to the Base Board's Digital Input/Output signals. Each section of the Base Board can have its own individual screw terminal.

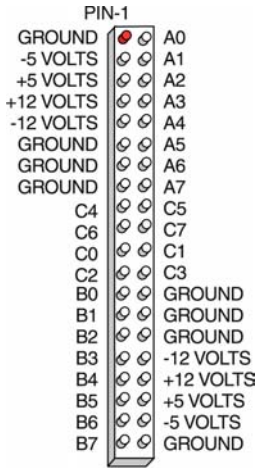
Alternatively, one to four add-on 'option' modules may be connected to the Base Board for additional drive capability, extra features, optically isolated input or output and many other possibilities.

Digital I/O Modes	Mode 0, 1, 2
Source Current	200 microamps
Sink Current	1.7 milliamps
Input/Output Level	1TTL Load/Bus Line Max

Scientific Solutions offers Opto-Isolation In and Opto-Isolation Out Modules. The features and installation of these Modules are also covered in this manual.

Note that the connector to the far right (when the retaining bracket is to your right) is the first parallel port connector, to the left of that is the third parallel port connector, then the second and then the fourth as you progress toward the left. This will make it easier to use any double sized module board and should not interfere in any way with use of the board as a simple digital in/digital out board or with single sized module boards.

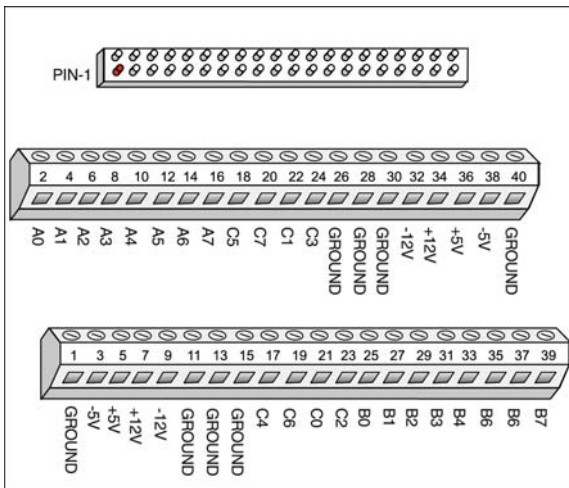
Digital I/O 40 pin Interface



Digital I/O 40 pin Interface

Base Board 40 pin Screw Terminal

The Digital I/O signals are connected to the screw terminals and are transmitted to the Base Board via a ribbon cable. The ribbon cable is connected between the screw terminal and the Digital I/O connectors P1, P2, P3 or P4. The striped edge of the ribbon cable connects to Pin 1.



40 Position Screw Terminal & Digital I/O Pinouts

Opto-Isolation Module Description

Base Board connectors P1, P2, P3 and P4 are 40 pin connectors for either a 40 pin ribbon cable connector permitting direct access to the outside world or for the attachment of an optional add-on module such as the Opto-Isolation In or Opto-Isolation Out Modules.

The Scientific Solutions' Opto Isolation Modules attach to the Base Board to give opto-isolated inputs or outputs.

The Opto Isolation boards provide 24 parallel Digital Input or Output lines that are optically isolated to provide up to 2500 Volts of isolation. This isolation protects your PC while it is monitoring other devices.

The Opto Isolation boards plug directly on the 40 pin connector on the Base Board. The Opto Isolation boards provide a 50 pin connector for interfacing to the outside world. Each Digital signal of the Base Board is represented by two pins on the 50 pin connector. The organization of the pins on these 50 pin connectors is different for the Opto-Isolation In and Opto-Isolation Out Modules.

You can mount as many as four modules on your Base Board, and you can have any combination of Opto-Isolation In or Opto-Isolation Out.

Scientific Solutions offers 50 position screw terminals for direct connection to the Base Board's Opto-Isolation Modules. The screw termination units are compact and provide a convenient method for connecting discrete wires to the Base Board's Opto-Isolated Digital Input/Output signals. Each Module attached to the Base Board can have its own individual screw terminal.

Opto-Isolation Features:

- Optically Isolates - eliminates 'ground difference' problems
- 2500 Volt Isolation
- Transient Protection
- Increased drive capability for Digital I/O
- Protects Equipment from lightning strikes thru Digital I/O
- Opto-Isolation In or Out Modules available
- Compact screw terminals available

Opto-Isolation Installation

The Scientific Solutions' Opto-Isolation Module is very easy to install and requires the use of a medium-sized, flat-blade screwdriver. Since the Opto-Isolation Module directly attaches to the Scientific Solutions' Base Board, the Base Board will have to be removed from the computer. With the Base Board outside of the computer, the Opto-Isolation Module is attached. Then you can re-install the Base Board (with the Opto-Isolation Module) into your computer.

You should refer to the instructions in this manual about installing the Base Board for the proper procedure to install/remove the Base Board.

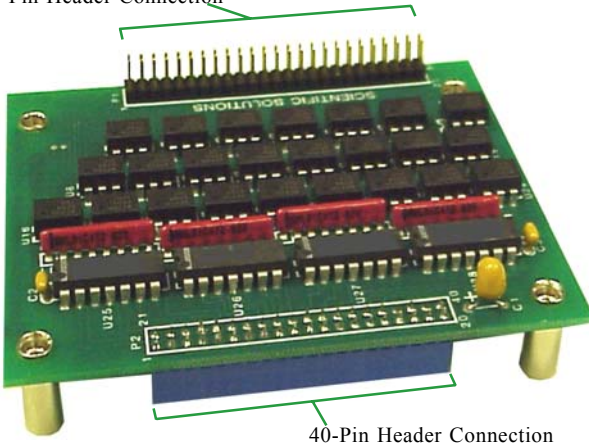
The Opto-Isolation Module contains the following connectors:

- 40 pin socket for direct connection to the Base Board.
- 50 pin Header for connection of cables to the outside world.

Before installing an Opto-Isolation Module, a 40 pin cable is used to connect the Digital I/O to the outside world.

After installing an Opto-Isolation Module, a 50 pin cable is used to connect the Digital I/O to the outside world.

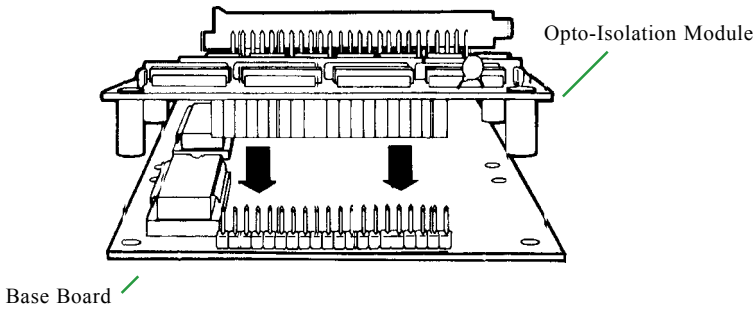
50-Pin Header Connection



Opto-Isolation Module

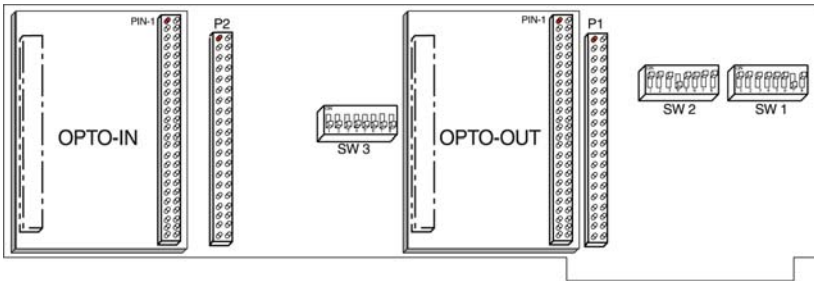
Opto-Isolation Installation

Position the Base Board with the component side up and the cable bracket to your right. When inserting the Opto-Isolation Module, the 50 Pin Header should be on your right (towards the cable bracket). To connect the Opto-Isolation Module to the Base Board, push the 40 pin socket of the Opto-Isolation Module directly onto the Base Board connector.



Make sure the two boards are firmly attached.

Opto-Isolation Cable Connections



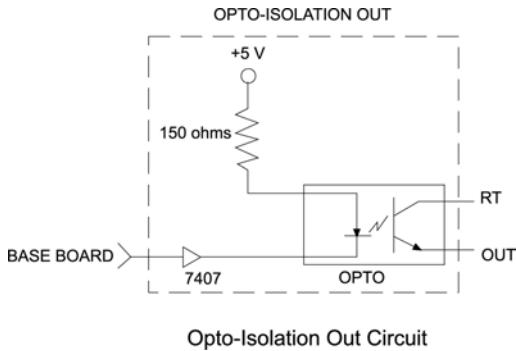
The above diagram shows an example of a Base Board with:

- Opto-Isolation In Module connected to P4
- Opto-Isolation Out Module connected to P3

NOTE: The location of Pin-1 on the Opto-Isolation Module 50 pin header when connecting cables.

Opto-Isolation Out Circuit

The Scientific Solutions' Opto-Isolation Out Module used with the Base Board provides optical isolation between your PC and the device the module is connected to.



In the above diagram, the section within the dotted lines shows the circuit on the Opto-Isolation Out Module. A single Base Board Digital output is converted to an optically isolated signal pair: RT and OUT. The signal pairs for each Digital Output are located on the module's 50 pin header.

A Base Board Digital output of logic '0' turns ON the output transistor of the OPTO circuit and lets current flow thru from RT to OUT.

A Base Board Digital output of logic '1' turns OFF the output transistor of the OPTO circuit and no current flows between RT and OUT.

Ground differences between the Base Board and the RT/OUT will have no effect, i.e. they are isolated.

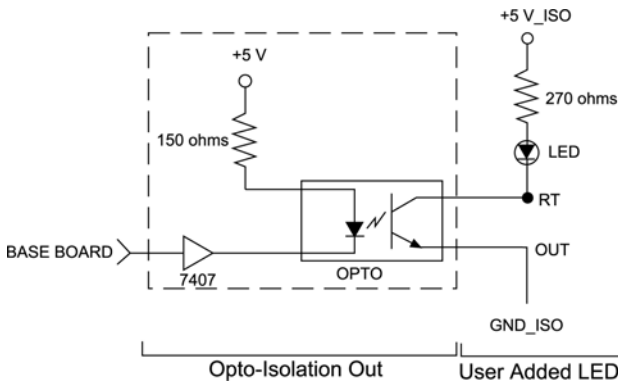
Interfacing to the Opto-Isolation Out Module

There are many ways to interface to the Opto-Isolation Out Module.

Opto-Out: Isolating current to an LED:

Logic '0' from Base Board turns ON the LED

Logic '1' from Base Board turns OFF the LED

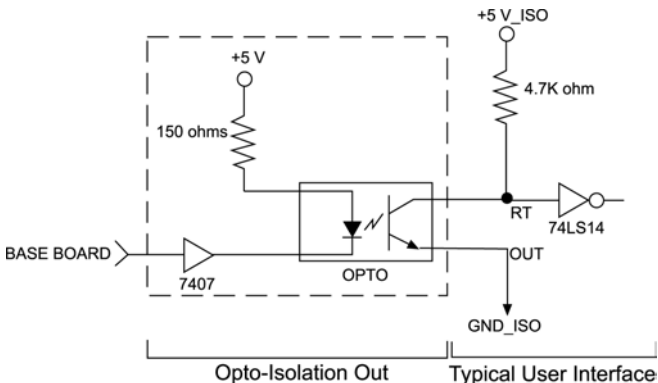


Opto-Out Typical User Added Interface:

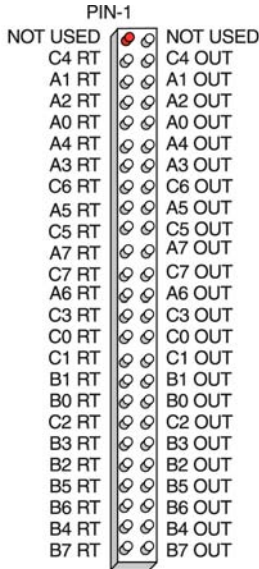
Logic '0' from Base Board produces logic '1' from 74LS14

Logic '1' from Base Board produces logic '0' from 74LS14

The 74LS14 'Schmidt' trigger output will sharpen the edges of the Opto-Isolator which has slow rise and fall times. This interface provides an inverted digital output.



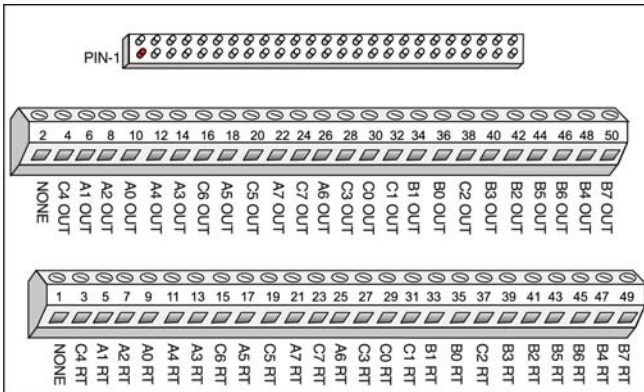
Opto-Isolation Out 50 pin Interface



Opto-Isolation Out 50 Pin Header

Opto-Isolation Out 50 pin Screw Terminal Option

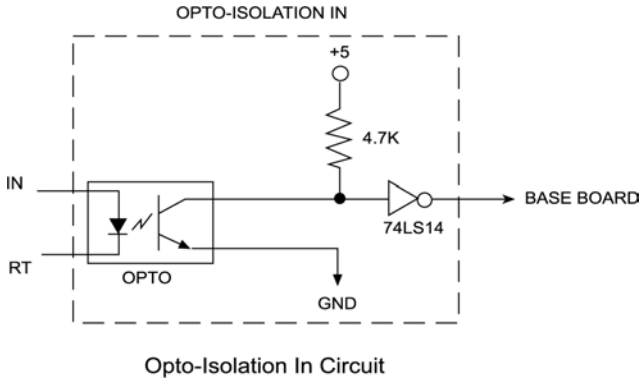
The Opto-Isolated Digital I/O signals are connected to the screw terminals and are transmitted to the Opto-Isolation Module via a ribbon cable. The ribbon cable is connected between the screw terminal and the Opto-Isolation 50 pin Header. The striped edge of the ribbon cable connects to Pin 1.



50 Position Screw Terminal & Opto-Isolation Out Pinouts

Opto-Isolation In Circuit

The Scientific Solutions' Opto-Isolation In Module used with the Base Board provides optical isolation between your PC and the device the module is connected to.



In the above diagram, the section within the dotted lines shows the circuit on the Opto-Isolation In Module. A signal pair, RT and IN, is converted to a single Base Board Digital input. The signal pairs for each Digital Input are located on the module's 50 pin header.

If current flows into the 'IN' pin and out the 'RT' pin, the OPTO transistor is ON and you will have a logic '1' at the Base Board Digital input port.

If current does not flow from the 'IN' to 'RT' pin, then the OPTO transistor is OFF and you will have a logic '0' at the Base Board Digital input port.

Ground differences between the Base Board and the RT/IN will have no effect, i.e. they are isolated.

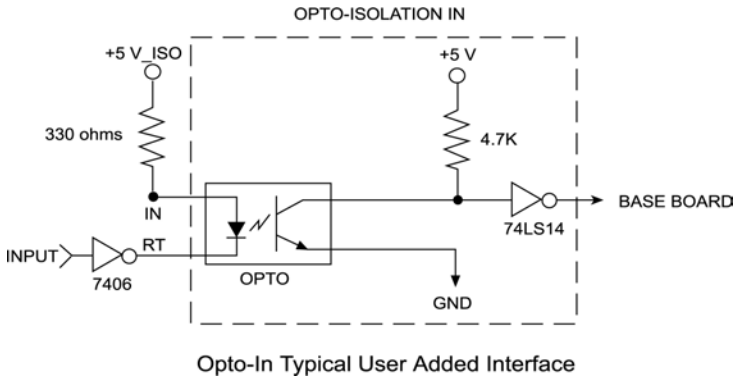
Interfacing to the Opto-Isolation In Module

There are many ways to interface to the Opto-Isolating In Module.

Opto-In Typical User Added Interface:

Logic '0' from an external device produces a logic '0' to the Base Board

Logic '1' from an external device produces a logic '1' to the Base Board.



This example uses a 330 ohm resistor to provide an input current of about 10ma which is the minimum required to provide a valid logic level at the output of the opto-isolator.

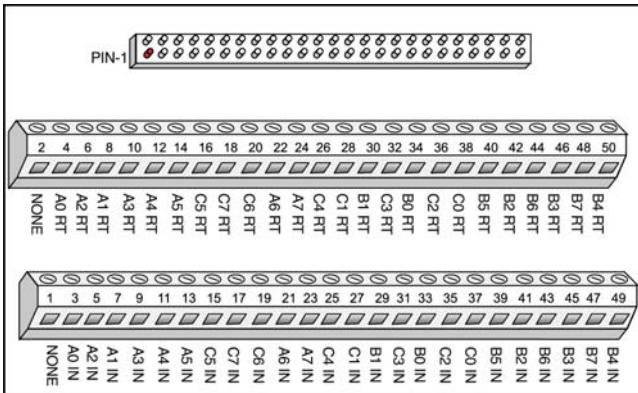
Opto-Isolation In 50 pin Interface



Opto-Isolation In 50 Pin Header

Opto-Isolation In 50 pin Screw Terminal Option

The Opto-Isolated Digital I/O signals are connected to the screw terminals and are transmitted to the Opto-Isolation Module via a ribbon cable. The ribbon cable is connected between the screw terminal and the Opto-Isolation 50 pin Header. The striped edge of the ribbon cable connects to Pin 1.



50 Position Screw Terminal & Opto-Isolation In Pinouts

Installing the BaseBoard in the Computer

The Installation of your Base Board is very simple and requires only the use of a medium sized flat blade screwdriver. The following steps detail the installation of the Base Board:

1. **TURN THE POWER OFF TO YOUR COMPUTER.** It is important that power is off while the board is being installed or serious damage to the computer and/or board could result.
2. Remove the cover of the computer.
3. Choose the slot in your computer to install your Base Board.
4. Verify the switches and jumpers are properly configured.
5. Attached to the Base Board is a board retaining bracket, a cable clamp, and a cable strain-relief bracket. The retaining bracket is attached to the Base Board and holds the Base Board in the computer. The cable clamp attaches to the retaining bracket. The cable strain-relief bracket attaches to the cable clamp. Cables attached to the Base Board are held securely in place by the cable clamp and the strain-relief bracket. Figure 1 shows how the Base Board cables are held by the cable clamp and the strain-relief bracket. To install the Base Board, you have to remove both the cable clamp and the strain relief bracket from the Base Board retaining bracket. Remove the two screws that secure the strain-relief bracket to the cable clamp as shown in Figure 2. Set the screws aside for use later in replacing the strain-relief bracket to the cable clamp.

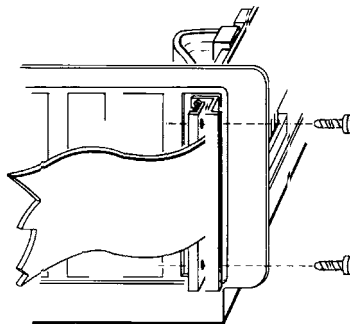


Figure 1

Installing the BaseBoard in the Computer

6. Remove the two screws, as shown in Figure 2, that attach the cable clamp to the Base Board retaining bracket. Set the screws aside for use later in replacing the cable clamp to the retaining bracket.

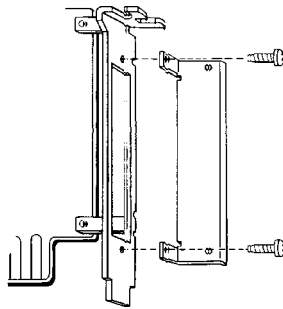


Figure 2

7. Slide the board into the chosen slot. Pass the cables which you wish to attach to the Base Board through the opening in the Base Board retaining bracket. Pin one on each cable should be towards the top of the Base Board. Scientific Solutions color codes its cables so that the colored stripe is connected to pin one. Insert the cables in the following order according to the connector they attach to: P1, P3, P2, P4. Attach the cables to the respective connectors on the Base Board.
8. Attach the Base Board to the computer with a screw on the top of the Base Board retaining bracket.
9. Reattach the cable clamp to the retaining bracket as in Figure 2.
10. Reattach the strain-relief bracket to the cable clamp as shown in Figure 1. The cables should pass between the cable clamp and the strain-relief bracket. The strain-relief bracket will help to insure that stress on the cables will not bend or damage the cable connectors on the board.
11. Replace the cover of the Computer.

BaseBoard Technical Specifications

Base Board Characteristics

Bus	IBM PC
Slots	Single 8 or 16 bit
Base Address	Switch Selectable (0000h -FFF0h)
Address Map	16 Consecutive I/O Locations
Interrupts	IRQ 2 - IRQ7 (selectable)
Power	+5 volts, 830 milliamps typical
Operating Temperature	0 to 70 deg Celsius
Load	1 TTL load/bus line max

Digital I/O Characteristics

Digital I/O Modes	Mode 0, 1, 2
Source Current	200 microamps
Sink Current	1.7 milliamps
Input/Output Level	1TTL Load/Bus Line Max

Opto-Isolation In Characteristics

Isolator Type	4N25
Input Voltage	1.15 volts at 10 milliamps
Input Current	10 milliamps minimum; 80 milliamps maximum
Input Reverse Voltage	3 volts maximum
Input Isolation	2500 volts maximum
Switching Times	
- Rise	3 microseconds maximum
- Fall	3 microseconds maximum

Opto-Isolation Out Characteristics

Isolator Type	TIL 128
Collector Emitter Voltage	30 volts maximum
Emitter Collector Voltage	7 volts maximum
Output Current	2 milliamps maximum
Isolation	2500 volts maximum
Switching Times	
- Rise	300 microseconds maximum
- Fall	5 microseconds maximum

Service Information

Your product should provide you with trouble free performance. However, if you have any questions about the installation or operation, or you encounter any problems, the following information will be helpful.

Scientific Solutions - Technical Support (Requires Product Registration)

Phone:	(440) 357-1400
Fax:	(440) 357-1416
E-mail:	support@LabMaster.com
Internet:	http://www.LabMaster.com

Should your product require factory service, the following guidelines must be followed and will help you get the fastest service.

1. Save your sales receipt. The product you purchased is covered under the limited warranty from the date of purchase, but you must submit proof of purchase for in-warranty repair.
2. Contact Scientific Solutions. You must obtain a Return Material Authorization (RMA) number prior to sending the unit to Scientific Solutions. This number must be displayed on the packing box.
3. Return all the components with your RMA. Complete troubleshooting is impossible if all components are not included. For protection against damage in transit, repack the system in its original packing.
4. Damaged and abused products will be repaired out of warranty only. Unauthorized attempts to repair, dropping, submitting to electrical surges, etc. will void the warranty.
5. Ship the unit to Scientific Solutions freight prepaid. After in-warranty service, the unit will be returned freight prepaid by a carrier designated by Scientific Solutions. Use of any other method will be freight collect or imposed shipping charge. Out-of-warranty service, will be returned freight collect or imposed shipping charge.
6. Cosmetic damage will not be repaired in warranty.

NOTE: Policies may change without notice.

Limited Warranty

Definitions:

Scientific Solutions means Scientific Solutions Inc., USA (www.LabMaster.com)

Warranty:

With respect to the product(s) delivered with this Limited Warranty, Scientific Solutions warrants to the original purchaser that:

- i) The product manufactured by Scientific Solutions will be free from defects in materials and workmanship for two (2) years from the date of delivery to such original purchaser
- ii) Any software/firmware is provided "as is" without warranty of any kind by Scientific Solutions
- iii) Any items not originally supplied by Scientific Solutions are without warranty of any kind. Use of components and accessories that do not conform to product specifications may void the warranty.

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If Scientific Solutions determines that any product which has been returned to Scientific Solutions in accordance with the provisions of the preceding paragraph is not under warranty, it will be repaired using Scientific Solutions' standard rates for parts and labor. Scientific Solutions will use its best efforts to repair the product after receipt thereof. Scientific Solutions shall not be responsible, however, for delays caused by shipping or non-availability of replacement components or other similar or dissimilar causes, events or conditions beyond its reasonable control.

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Keep your original sales receipt for the product with this warranty statement.

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General: This license constitutes the entire agreement between you and Scientific Solutions. It cannot be ratified except in writing signed by an officer of Scientific Solutions.

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