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Application Note: 158

Operation and wiring examples for the I/O Ports and Opto-isolated Input Ports

INTRODUCTION

Some versions of the 1, 2 & 8 channel relays boards manufactured by Pencom, have an optional input/output port and/or opto-isolated inputs. These allow digital 0-5V TTL logic inputs or outputs or isolated inputs to be read from the serial port in the same manner as controlling the relays. This document will explain how to connect and operate the ports.

LOGIC 0-5VDC INPUT APPLICATIONS – (I/O PORT)

WARNING – DO NOT APPLY VOLTAGE HIGHER THAN 5VDC TO A LOGIC INPUT OR IT WILL BE DAMAGED!!!

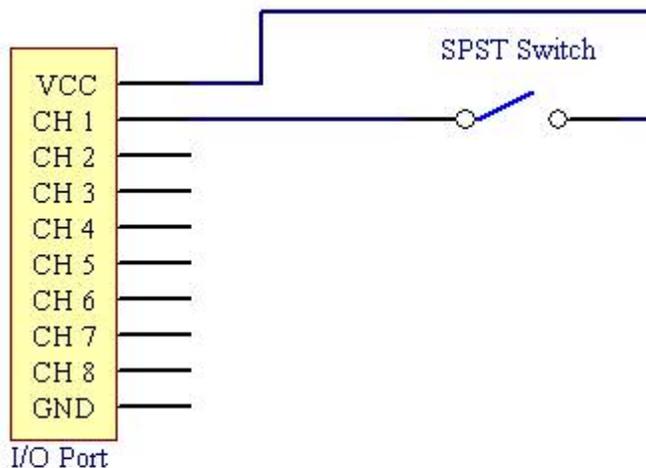
There are many applications for an input port. The most common uses are to read some kind of mechanical device used to connect and disconnect a circuit. A mechanical device is only a contact closure, meaning the device itself does not supply a voltage to the circuit. A SPST toggle switch is a mechanical device, since it does not have a power source, it only makes or breaks the circuit. An example of a simple toggle switch is shown to the right and the schematic symbol for the switch is shown below it.



SPST Switch

The drawing below shows how to connect a switch to the input port of the board. One side of the switch is connected to the VCC pin which is a 5 Volt DC output from the board. The other side of the switch is connected to one of the channels on the input port, it is connected to channel #1 on this example.

Note: the I/O ports on our boards are pulled to ground through a resistor. If your familiar with logic inputs, it's a normal procedure to connect the input side to ground, through a resistor to prevent stray voltage from floating above the low logic level, and turning ON the input. These boards already have this built in and is not needed.



In the example to the left, the voltage at VCC (5VDC) is available at one side of the switch and when the contact closes, it completes the circuit to channel #1.

To read this channel you would send a `AIO<cr>` to the board in your software -- that is assuming your board address is 'A'. The format is as follows:

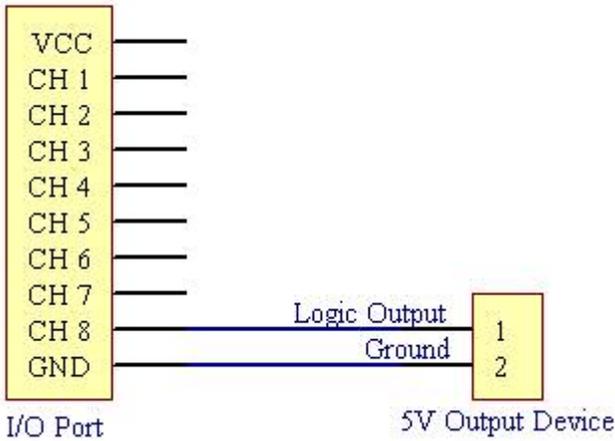
`<<address><command><value><carriage return>>`

The firmware in the unit will read the port and return a value of "1", since channel #1 is activated. This assumes that the rest of the pins 2-8 are set for inputs in setup and there are no other connections to the pin. When the switch is open (no connection) the return value will be a zero.

Some mechanical devices such as this toggle switch, may exhibit a phenomenon called contact bounce. This happens when the switch makes contact and the connection may bounce back off the contact briefly several times before it settles into position. When switching voltage to turn on a light this would never be a problem, but the input to a microprocessor is so fast that it may pick up these bounces as multiple switch open & closures. You may never see this in your application, but you need to be aware that it can happen.

If this is suspected as a problem in your application, read the port twice (or more if needed) and compare the results. By reading the port again and making sure the result is the same, it's essentially the same as a timed switch de-bounce based technique.

Logic inputs from other devices that supply an output voltage instead of a contact type of closure, may be used with this device as long as the supplied voltage is not higher than +5VDC. This type of device may be connected in the following manner to the logic port. If the voltage is higher than 5V, the voltage may be reduced to 5V with a voltage divider or an opto-isolated input port may be used instead.



If the device outputs a voltage, it will require a return path for the current to travel which is the ground connection, and needs to be connected to the ground connection on the terminal block.

To read this channel you would send a AI0<cr> to the board in your software again assuming your board address is 'A'. In this example it will return a value of 128 since this pin is connected to channel 8 instead of channel #1. This decimal return value corresponds to the binary value of the 8 bit port.

If channel 1 through 8 are used for other purposes, you may send a mask value with the command instead of a zero (which reads the entire port). The mask will allow you to read one or

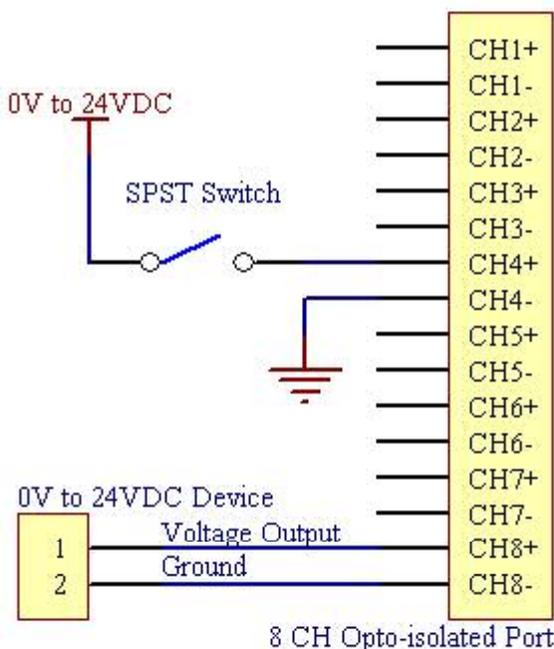
more pins instead of the entire 8 bit port.

For detailed information on the command structure including the mask function, see app note #156.

Note: Some devices that are connected to the logic input port, may generate noise that could effect the operation of our boards -- since the ground from both devices are connected together. If the connected device is known for noisy operation, it would be better to use an opto-isolated input port instead for these applications, as shown below. Be aware the opto-isolated versions are input only and cannot be used for outputs.

OPTO-ISOLATED INPUTS

Opto-isolated inputs are not electrically connected to the attached device, they are optically coupled. Essentially they are connected together using light. The connections shown on the port are labeled CH1+ & CH1- are connected to a LED (light emitting diode), that transmits the signal to a light sensitive switch. Since the connection is to an LED, a separate power source is required to activate the pins. This keeps both devices isolated from each other since the grounds are not connected together.



The opto-isolated input ports normally activates at approx. 2.5 volts which is a logic high, and voltages below 1.5 volts are normally a logic Low. Be aware, the LED in the opto-coupler draws a little current from the external power source or the connected device, typically around 10 milliamps..

The plus side of the terminal block is always connected to the positive side of the voltage. The negative is connected to ground from your attached device. Both pins must be connected for the channel to operate. Reverse voltage protection is provided in the circuit.

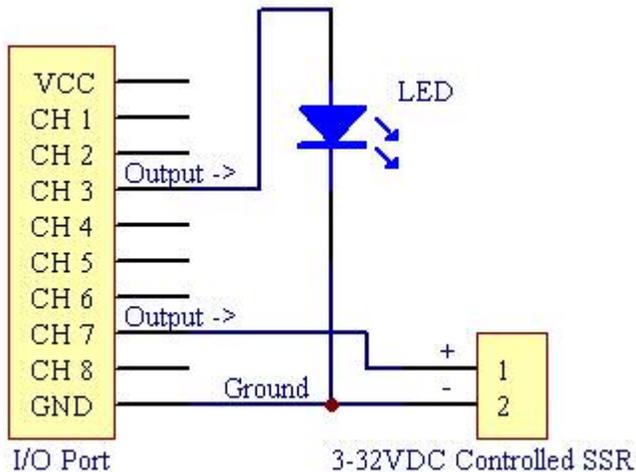
To read this channel you would send a AI0<cr> to the board in your software again, assuming your board address is 'A'. On some boards if they have both an I/O and a opto-isolated port, the command may be different than an "I". See the board's instruction manual to see which command to use.

LOGIC 0-5VDC OUTPUT APPLICATIONS – (I/O PORT)

Since the I/O ports are set to inputs at the factory, you will first need to download and install the relay test program on your windows based system to change them to outputs. Click “options/setup” to open the setup window. Enter the setup mode, and select the I/O channel(s) you wish to use for outputs in the input/output window, and save the changes to the board. If you have any questions, the help file in the program will guide you through the steps to make changes to the setup.

Note: If you are connecting it to a non-windows based system, the setup commands may be entered manually through a terminal program. Send an email to product support on our website, and request the documentation for programming the board setup manually.

In the example below we will setup two channels as outputs and leave the rest inputs. One will be used to activate a LED, and the second will be used to active a solid state relay that has a DC control.



Enter setup mode and set channel #3 & Channel #7 to outputs, leave the balance set to inputs. Save and exit the setup mode.

Normally the LED is connected through a resistor, but since the output is already current limited through a resistor on the board the LED may be connected directly to the pins. Make sure the polarity of the LED is correct.

To turn ON the LED, send a AO4<cr>, this will send “00001000” in binary activating the LED, and will leave the SSR in the OFF condition.

To activate the SSR and leave the LED OFF, AO64<cr>, this will send “00001000” in binary activating the SSR. If you wish to turn both devices ON send AO72<cr>, this will send “01001000” in binary activating both devices.

To read the status of the outputs, send a AI0<cr>, this will read the port and reply with the channels that are active.

I/O Ports and Opto-isolated inputs on the relay boards are very useful when there is a need to read a switch, or some type of sensor and activating the relay in response to this input. In addition, using an output channel to operate a solid state relay extends the capability of the relay board, allowing activation of very high current and/or voltage from the PC.

If you need any additional information, email support on the contact page of our website at www.pencomdesign.com.