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ISOLATED DIGITAL INPUT / RELAY OUTPUT CARD

MODEL IIRO-8

USER MANUAL

File: MIIRO-8.d1

NOTICES

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INSTALLING THE CARD

Before installing the card carefully read the ADDRESS SELECTION and OPTION SELECTION Sections of this manual and configure the card according to your requirements. Use the special software program called SETUP provided on CD with the card. It supplies visual aids to configure all areas of the board.

Be especially careful with address selection. If the addresses of two installed functions overlap, you will experience unpredictable computer behavior. If unsure what locations are available, you can use the FINDBASE program provided to locate blocks of available addresses.

To install the card:

1. Remove power from the computer.
2. Remove the computer cover.
3. Remove blank I/O backplate.
4. Install jumpers for selected options. See OPTION SELECTION.
5. Select the base address on the card. See ADDRESS SELECTION.
6. Install the card in an I/O expansion slot. *Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.*
7. Inspect for proper fit of the card and cables and tighten screws.
8. Replace the computer cover.

FUNCTIONAL DESCRIPTION

The IIRO-8 is a half-size card that provides isolated input and output interface for PC/XT/AT and compatible computers. The card provides eight optically-isolated inputs for AC or DC control signals and eight electromechanical relay outputs. IIRO-8 occupies four consecutive addresses in I/O space. Read and write operations are done on an 8-bit-byte oriented basis.

INPUTS

The isolated inputs can be driven by either AC or DC signals and are not polarity sensitive. Input signals are rectified by a diode bridge and connected across an LED diode of an opto-isolator. A 470-ohm resistor in series dissipates unused power. Standard 12/24 AC control transformer outputs can be accepted as well as DC voltages. The input voltage range is 5 to 24 volts (rms). External resistors connected in series may be used to extend the input voltage range.

Each input circuit contains a switchable slow/fast filter that has a 10 millisecond time constant. (Without filtering, the response is 20 uSec.) The filter must be selected for AC inputs in order to eliminate response to zero crossings. The filter is also valuable for use with slow DC input signals in a noisy environment. The filter may be switched out for DC inputs in order to obtain faster response. Filters are individually selected by switch S2; IP0 is controlled by F0, IP1 by F1, IP2 by F2, etc. The filters are switched into the circuit when the switch is moved to the ON position. The filters may also be controlled globally under software control. All filters may be turned on by a read at base address +3. Filters that have been activated by software may be disabled by a write to base address +3.

INTERRUPTS

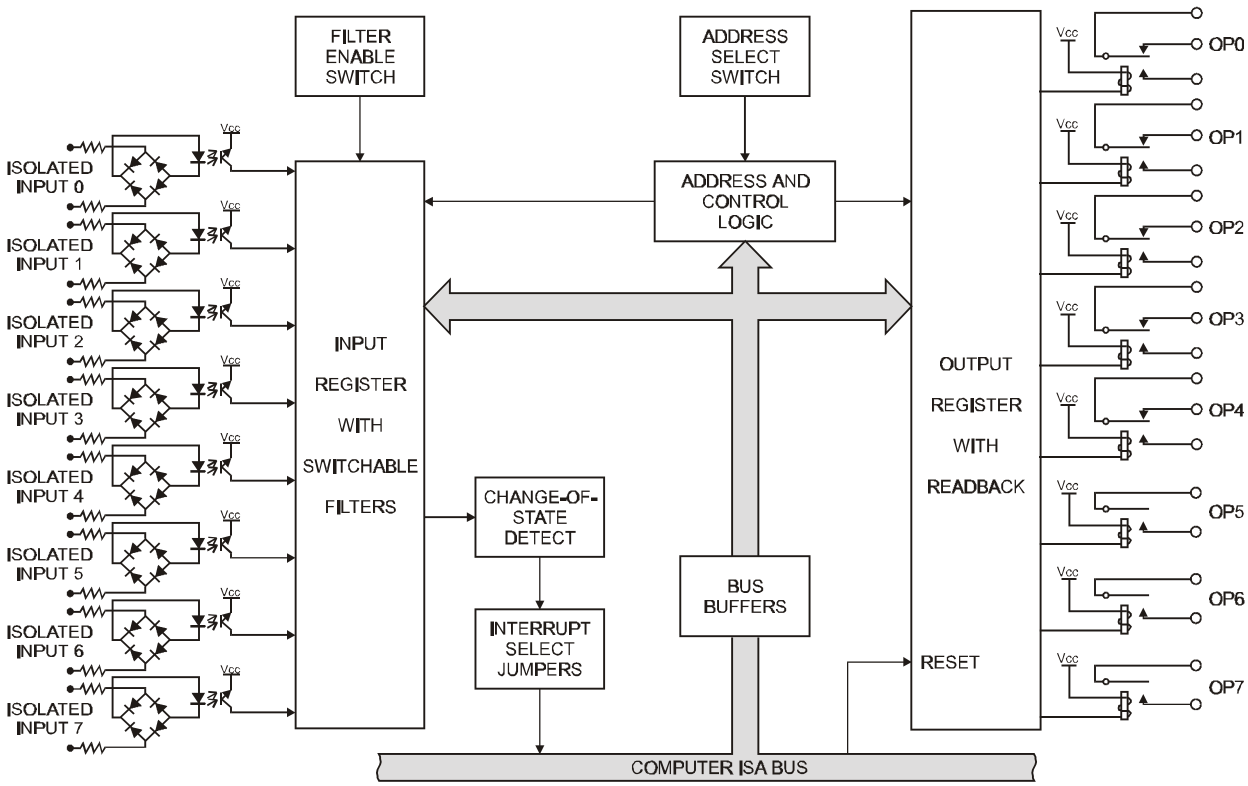
When enabled by a software read to base address +2 (and when a jumper is installed to select one of the interrupt levels IRQ2-7, IRQ10-12, and IRQ14-15), the IIRO-8 card asserts an interrupt whenever any of the inputs changes state. Once an interrupt has been generated and serviced, it must be cleared. A software write to base address +1 will clear an interrupt.

This interrupt capability may be disabled by a software write to base address +2.

OUTPUTS

The electromechanical relay outputs are comprised of five FORM C SPDT outputs and three FORM A SPST (normally open) type. The relays are all de-energized at power-on. Data to the relays is latched by a write to the base address. On/off status of the relays can be read back by a read at the base address.

BLOCK DIAGRAM



OPTION SELECTION

FILTER RESPONSE SWITCH

DIP switch S2 is used to select input filtering on a channel-by-channel basis. When S2-1 is ON, additional filtering is introduced for input bit 0, S2-2 for bit 1, etc.

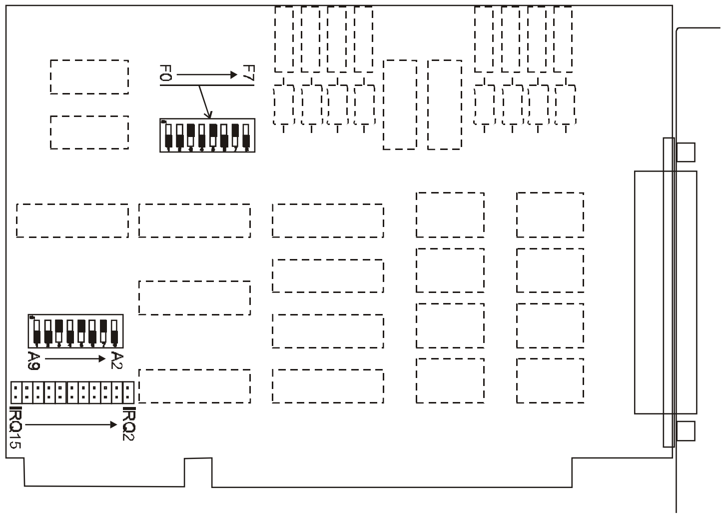
Switch Section	Bit Filtered
S2-1	IP0
-2	IP1
-3	IP2
-4	IP3
-5	IP4
-6	IP5
-7	IP6
-8	IP7

This additional filtering provides a slower response as described previously and should be used when AC inputs are applied. Note also, as previously described, that the filters can be globally activated (or de-activated) under software control at base address +3.

INTERRUPTS

Select the desired interrupt level by installing a jumper at one of the locations marked IRQxx. An interrupt is asserted by the IIRO-8 card when an input data bit changes state if software enabled as previously described.

OPTION SELECTION MAP



ADDRESS SELECTION

IIRO-8 occupies four consecutive addresses in I/O space although only two addresses are used. The base or starting address can be selected anywhere within the I/O address range 100-3FF (except 1F0 through 1F8) for AT's and 200-3FF for XT's provided that it does not cause an overlap with other functions. If the addresses of two installed functions overlap, you will experience unpredictable computer behavior. The FINDBASE program supplied by ACCES will assist you in selecting a base address that will avoid this conflict.

ADDRESS ASSIGNMENTS FOR 286/386/486 COMPUTERS

Hex Range	Usage
000-01F	DMA Controller 1
020-03F	INT Controller 1, Master
040-05F	Timer
060-06F	8042 (Keyboard)
070-07F	Real Time Clock, NMI mask
080-09F	DMA Page Register
0A0-0BF	INT Controller 2
0C0-0DF	DMA Controller 2
0F0	Clear Math Processor Busy
0F1	Reset Coprocessor
0F8-0FF	Arithmetic Processor
1F0-1F8	Fixed Disk
200-207	Game I/O
278-27F	Parallel Printer Port 2
2F8-2FF	Asynchronous Comm'n (Secondary)
300-31F	Prototype Card
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC or Binary Synchronous Comm'n 2
3A0-3AF	Binary Synchronous Comm'n 1
3B0-3BF	Monochrome Display/Printer
3C0-3CE	Local Area Network
3D0-3DF	Color/Graphic Monitor
3F0-3F7	Floppy Diskette Controller
3F8-3FF	Asynchronous Comm'n (Primary)

The IIRO-8 base address is set up by DIP switch S1. That switch controls address bits A2 through A9. (Lines A1 and A0 are used on the card to control individual registers. How these two lines are used is described in the Programming section of this manual.)

To determine how to set these switches for a desired hex-code address, refer to the SETUP program provided with the card. If you prefer to determine proper switch settings yourself, first convert the hex-code address to binary form. Then, *for each "0", set the corresponding switch to ON and for each "1", set the corresponding switch to OFF.*

The following example illustrates switch selection corresponding to hex 300 (or binary 11 0000 00xx). The "xx" represents address lines A1, and A0 used on the card to select individual registers as described in the Programming section of this manual.

Base Address in Hex Code	3		0				0	
Conversion Factors	2	1	8	4	2	1	8	4
Binary Representation	1	1	0	0	0	0	0	0
Switch Legend	A9	A8	A7	A6	A5	A4	A3	A2
Addr. Line Controlled	A9	A8	A7	A6	A5	A4	A3	A2
Switch Setting	OFF	OFF	ON	ON	ON	ON	ON	ON

Carefully review the address selection reference table on the preceding page before selecting the card address. If the addresses of two installed functions overlap, you will experience unpredictable computer behavior.

PROGRAMMING

The IIRO-8 card occupies four consecutive addresses in PC I/O space. The base or starting address is selected during installation and will fall on a four bit boundary. IIRO-8 read and write functions as follows:

I/O Address	Read	Write
Base +0	Read Relay Output	Write Relay Output
Base +1	Read Isolated Inputs	Clear Interrupt
Base +2	Enable IRQ	Disable IRQ
Base +3	Activate Filter	Deactivate Filter

DIGITAL INPUTS

Digital input states are read as a single byte from the port at Base Address +1. Each of the eight bits within the byte corresponds to a particular digital input. A "1" signifies that the input is energized and a "0" signifies that the input is de-energized.

Bit Position	D7	D6	D5	D4	D3	D2	D1	D0
Digital Input	IP7	IP6	IP5	IP4	IP3	IP2	IP1	IP0

The card response to inputs is rated at 20 uSec or faster. Sometimes it is necessary to slow down that response to accommodate AC inputs or in noisy environments. The 10 mSec filter can be enabled for all inputs in software by reading at base address +3 or disabled by writing at base address +3.

The card supports interrupts on change of state of digital inputs. Thus, it is not necessary to continuously poll inputs (by reading at base address +1) to detect any state change. To enable this interrupt capability, read at base address +2. To disable interrupts, write at base address +2 or remove the jumper that selects interrupt level IRQ2 through IRQ7. To clear an IRQ, write to base address +1

RELAY OUTPUTS

At power-up, all relays are initialized in the de-energized state. The current state of the relays can be determined at any time by a <u>read</u> operation at the Base Address. The relay outputs are controlled by <u>writing</u> to the Base Address. Data are written to all eight relays as a single byte. Each bit within the byte controls a specific relay. A "1" energizes the corresponding relay and a "0" turns it off.

Bit Position	D7	D6	D5	D4	D3	D2	D1	D0
Relay Contr'd	OP7	OP6	OP5	OP4	OP3	OP2	OP1	OP0

For example, if bit D5 is turned on by writing hex 20 to the base address, then the relay that controls OP5 is energized closing the associated normally-open contacts. All other relays would be de-energized and their normally-closed contacts would be closed.

PROGRAMMING EXAMPLES

No driver software is provided with IIRO-8 because programming is very simple and can be accomplished most efficiently using direct I/O instructions in the language that you are using. The following examples are in C but are readily translated into other languages:

Example: Turn on OP0 and OP7

```
Base=0x300          //Base I/O address
outportb(Base, 0x81);
```

Example: Read back the state of the relays

```
X=inportb(Base);          //relay register data to X%
printf("%02x");           //display results
```

Example: Read the digital inputs

```
Y=inportb(Base+1);        //digital input register to Y%
```

SOFTWARE

Utility software provided on CD with the IIRO-8 is the base address locator, an illustrated setup program,and a sample program. The sample program sequentially turns on each relay until all are on and then sequentially turns them off. After each relay is turned on, the relay states are read back, the opto-isolated inputs are read, and the data are displayed.

The sample programs are in forms suitable for use with, QuickBASIC, C, and Pascal. The programs as follows:

FINDBASE: Program locates active and available port addresses.

SETUP: IIRO-8 Board Setup Program

CSAMPLES: *SAMPLE1* This sample program will sequentially turn on all bits of the relay input and sequentially turns them off. Each time it sets a new bit, both the relay output and the relay input are read and the data displayed. This demonstrates how to read and write to a port, and to use the read back function of the board.

BSAMPLES: *SAMPLE1* Same sample in Quickbasic

CONNECTOR PIN ASSIGNMENTS

Analog and digital I/O signals are connected to the IIRO-8 via a 37-pin D type connector that extends through the back of the computer case. The mating connector is an AMP 747304-1 or equivalent. The wiring may be directly from the signal sources or may be on ribbon cable from screw terminal accessory boards such as the STA-37. Pin assignments are as follows:

PIN	NAME	FUNCTION
1	IP7	Digital Input Bit 7
2	IP6	Digital Input Bit 6
3	IP5	Digital Input Bit 5
4	IP4	Digital Input Bit 4
5	IP3	Digital Input Bit 3
6	IP2	Digital Input Bit 2
7	IP1	Digital Input Bit 1
8	IP0	Digital Input Bit 0
9	OP7(C)	Bit 7 Relay Common
10	OP6(C)	Bit 6 Relay Common
11	OP5(C)	Bit 5 Relay Common
12	OP4(NC)	Bit 4 Relay, Normally-Closed Contact
13	OP4(NO)	Bit 4 Relay, Normally-Open Contact
14	OP3(C)	Bit 3 Relay Common
15	OP2(NC)	Bit 2 Relay, Normally-Closed Contact
16	OP2(NO)	Bit 2 Relay, Normally-Open Contact
17	OP1(C)	Bit 1 Relay Common
18	OP0(NC)	Bit 0 Relay, Normally-Closed Contact
19	OP0(NO)	Bit 0 Relay, Normally-Open Contact
20	IP7	Digital Input Bit 7
21	IP6	Digital Input Bit 6
22	IP5	Digital Input Bit 5
23	IP4	Digital Input Bit 4
24	IP3	Digital Input Bit 3
25	IP2	Digital Input Bit 2
26	IP1	Digital Input Bit 1
27	IP0	Digital Input Bit 0
28	OP7(NO)	Bit 7 Relay, Normally-Open Contact
29	OP6(NO)	Bit 6 Relay, Normally-Open Contact
30	OP5(NO)	Bit 5 Relay, Normally-Open Contact
31	OP4(C)	Bit 4 Relay Common
32	OP3(NC)	Bit 3 Relay, Normally-Closed Contact
33	OP3(NO)	Bit 3 Relay, Normally-Open Contact
34	OP2(C)	Bit 2 Relay, Common
35	OP1(NC)	Bit 1 Relay, Normally-Closed Contact
36	OP1(NO)	Bit 1 Relay, Normally-Open Contact
37	OP0(C)	Bit 0 Relay, Common

SPECIFICATION

DIGITAL INPUTS

Number of inputs: Eight
Type: Non-polarized, optically isolated from each other and from the computer. (not TTL/CMOS compatible)
Voltage Range: 5 to 24V DC or AC (50 to 1000 Hz)
Isolation: 500V channel-to-ground or channel-to channel
Input Resistance: 470 ohms in series with two diodes and an LED
Response Time: 10 mSec w/filter, 20 uSec w/o filter

RELAY OUTPUTS

Number of outputs: Eight
Contact Rating: 2A carry current, bifurcated, gold clad, silver palladium
Contact Arrangement: Channels 0-4 are SPDT Form C and channels 5-7 are SPST Form A
Contact Resistance: Initial 100 milliohms maximum
Contact Life: mech'l: 10 million operations minimum
elect'l: 5 million operations minimum at full load
Operating Time: 2 milliseconds maximum
Release Time: 1 milliseconds maximum

INTERRUPTS: When enabled by software and by installation of level-select jumpers, interrupts are generated when digital inputs change state.

POWER REQUIRED: +5VDC @ 0.5A (all relays ON)

ENVIRONMENTAL

Ambient Temperature: Operating: 0^{o} to $+50^{o}$C
Storage: -20^{o} to $+70^{o}$C
Humidity: 0 to 90% (non-condensing)
Weight: Approx. 8 oz.

WARRANTY

Prior to shipment, ACCES equipment is thoroughly inspected and tested to applicable specifications. However, should equipment failure occur, ACCES assures its customers that prompt service and support will be available. All equipment originally manufactured by ACCES which is found to be defective will be repaired or replaced subject to the following considerations.

TERMS AND CONDITIONS

If a unit is suspected of failure, contact ACCES' Customer Service department. Be prepared to give the model number, serial number, and a description of the failure symptom(s). We may suggest some simple tests to confirm the failure. We will assign a Return Material Authorization (RMA) number which must appear on the outer label of the return package. All units/components should be properly packed for handling and returned with freight prepaid to the ACCES designated Service Center, and will be returned to the customer's/user's site freight prepaid and invoiced.

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First Three Years: Returned unit/part will be repaired and/or replaced at ACCES option with no charge for labor or parts not excluded by warranty. Warranty commences with equipment shipment.

Following Years: Throughout your equipment's lifetime, ACCES stands ready to provide on-site or in-plant service at reasonable rates similar to those of other manufacturers in the industry.

EQUIPMENT NOT MANUFACTURED BY ACCES

Equipment provided but not manufactured by ACCES is warranted and will be repaired according to the terms and conditions of the respective equipment manufacturer's warranty.

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