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MODELS IDO-48, IDO-32 and IDO-16

**16, 32, and 48 CHANNEL ISOLATED
SOLID-STATE DIGITAL OUTPUT CARDS**

USER MANUAL

Notice

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Chapter 1: Introduction

Features

- Individually-Isolated Digital Outputs for up to Three 16-Bit Groups.
- All solid-state design permits higher throughput than possible with electromechanical relays.
- Load voltages up to 60 Volts.
- On-Card shields prevent accidental contact with user voltages.
- Outputs at zero volts at power turn-on and computer reset.
- Output connectors via on-card ribbon-cable headers.
- Lower cost per point than externally-racked solid-state relay modules.

Description

IDO-xx Series cards provide 16, 32, or 48 opto-isolated differential outputs and plug into expansion slots of IBM PC/XT/AT or compatible computers. Solid-state, P-Channel FET switches are used as the output elements and provide both greater reliability and much faster turn-on and turn-off time than is possible with electromechanical relays. User-supplied load voltages can be from 5V to 60V.

Output connections are via 50-wire ribbon cables that mate with one, two, or three headers on the card silk-screen labeled **“Port A, Port B, and Port C”**. Please note that Port A is also referred to in this manual and in the software as Port 0, Port B as Port 1, and Port C as Port 2 (see table below for correlation). A strain relief bar where the cables exit the card assures that the cables will not interfere with adjacent cards. Standard cables are six feet long but alternate lengths are available. Model STA-50 Screw Terminal Accessory cards, one per each 16 bits, can be used to provide easy connection to your system.

The card uses eight bytes of I/O Bus address; six bytes for 48 bits of output, one control byte and one unused byte. Outputs of a programmable array logic chip enable data bytes to be clocked into latches. Outputs of the latches, in turn, are connected via opto-couplers to the output P-channel FET drivers. The opto-couplers used are rated to at least 2000 V_{RMS} and on-card isolation channel-to-channel and channel-to-computer exceeds 500 V_{RMS} in optimal test environments (* see note). The P-Channel FET drivers are capable of 1 Ampere steady-state current (Note: Current output may be limited by the cable to as little as 0.5A). Diodes are included across the load for inductive-spike protection.

*Note on Isolation: The Opto-isolators used are rated to at least 2000 V_{RMS} . On-card isolation channel-to-channel and channel-to-ground is governed by factors such as cabling, spacing of pins, spacing between traces on the PCB, humidity, dust, and other environmental factors. This is a safety issue so a careful approach is required. For CE certification, isolation was specified at 60 VDC. The design intention was to eliminate the influence of common mode. Tolerance of higher isolation voltage can be obtained on request by applying a conformal coating to the board.

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There are 48-bit, 32-bit, and 16-bit versions. The latter two models are de-populated versions of the 48-bit card.

Model	No. of Bits	Port(s)
IDO-16	16	A/0
IDO-32	32	A/0, B/1
IDO-48	48	A/0, B/1, C/2

Specifications

Features

- Individually-Isolated Digital Outputs for Up to Three 16-Bit Groups.
- All Solid-State Design Permits Higher Throughput Than Possible With Electromechanical Relays.
- Load Voltages Up to 60V.
- Outputs Off at Power Turn-On and at Computer Reset.
- Output Connections via On-Card Ribbon-Cable Headers.
- On-Card Shields Prevent Accidental User Contact with Load Voltages.
- Lower Cost per Point Than Externally-Racked Solid-State Relay Modules.

Outputs

- Number of Channels: 16, 32, or 48.
- Load Voltage Range: 5V to 60V (Voltage supplied by User).
- Load Current per Channel: 1 Ampere max. steady state, 2A pulse. (Note: Current may be limited by the cable. Certain ribbon cables limit current to 0.5 A.)
- Isolation: Optically isolated channel to channel and channel to ground (* see note)
Opto-isolator: P/N ILQ2 exceeds 2000 V_{RMS}
- Switching Time:
Turn-On: 50 μsec.
Turn-Off: 2 μsec, inductive-spike protection via a diode.
- Switch Resistance: 0.4 Ω when saturated.
- Switch Leakage Current: 1 μA.
- Power Required: +5 VDC at 540 mA (48 bits)
- Size: 13.3" long (338 mm).

*Note on Isolation: The Opto-isolators used are rated to at least 2000 V_{RMS}. On-card isolation channel-to-channel and channel-to-ground is governed by factors such as cabling, spacing of pins, spacing between traces on the PCB, humidity, dust, and other environmental factors. This is a safety issue so a careful approach is required. For CE certification, isolation was specified at 60 VDC. The design intention was to eliminate the influence of common mode. Tolerance of higher isolation voltage can be obtained on request by applying a conformal coating to the board.

Environmental

- Operating Temperature Range: 0°C to 60°C
- Storage Temperature Range: -20°C to +100°C
- Humidity: 0% to 90% RH without condensation.

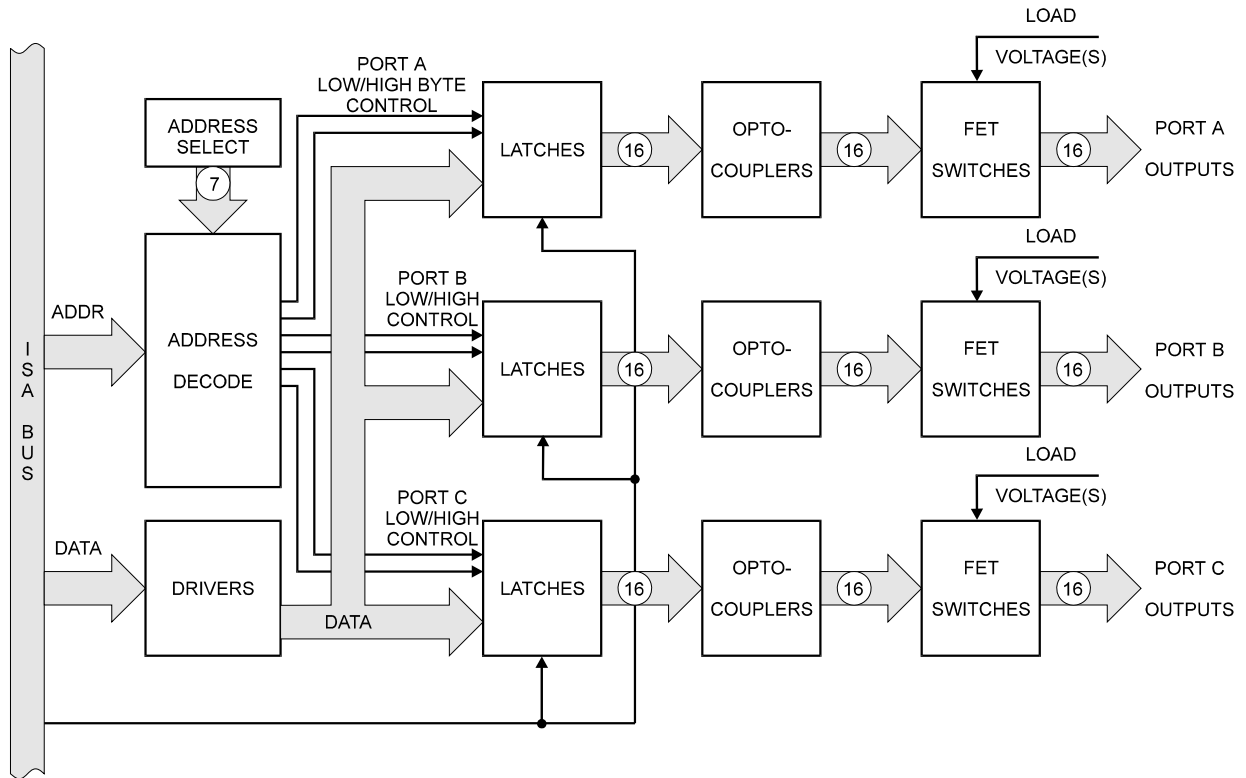
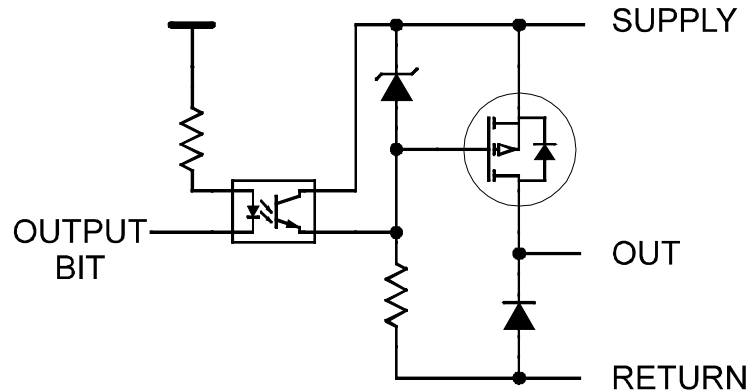


Figure 1-1: IDO-48 Block Diagram

Each bit controls a single power FET to switch an externally supplied voltage between the supply pin and the return as illustrated by the example circuit below:



Each bit of the IDO- card is optically-isolated from the output driver which switches the supply voltage to the output pin. The negative connection is made on the return pin and each output is isolated from every other output.

When the opto-isolator is OFF the FET is activated by the Zener-diode-limited supply voltage. When the FET is ON, the full Supply voltage is available at the output pin. When the opto-isolator is deactivated, the FET opens and the output drops to the return line voltage level.

The opto-couplers used are rated to at least 2000 V_{RMS} and on-card isolation channel-to-channel and channel-to-computer exceeds 500 V_{RMS} in optimal test environments (* see isolation note). (Note: Ribbon cables typically provide 300 V_{RMS} isolation.) The P-Channel FET drivers are capable of 1 Ampere steady-state current (Note: Current output may be limited by the cable to as little as 0.5A). Diodes are included across the load for inductive-spike protection.

Safety Note

- **These cards are used as switches for externally supplied power up to 60VDC and up to one Amp.**
- **Each switch output can have a separate power supply or only one power supply can be used.**
- **If the computer is turned OFF and an external power supply is ON, the switch outputs from that power supply will be ON.**
- **To avoid damage or injury, you MUST turn OFF all the external power PRIOR to shutting the computer down.**

Software

Utility software provided with IDO- Series cards includes a graphic setup program to aid in selecting an I/O-bus address that will not conflict with other computer resources. Also, a pictorial presentation shows you what switch settings to make for the base address that you select.

Software drivers are not provided for DOS applications because direct register I/O is the fastest way to communicate and can be used with ease. Most high level languages provide means for output statements and our User Manual provides complete details about register assignments. Further, sample programs are provided in C, Pascal, and QuickBASIC.

For Windows users, we provide drivers for Windows 3.1, Win 95 and Win NT.

Chapter 2: Installation

The software provided with this card is contained on either one CD or multiple diskettes and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your software format and operating system. Substitute the appropriate drive letter for your CD-ROM or disk drive where you see d: or a: respectively in the examples below.

CD Installation

DOS/WIN3.x

1. Place the CD into your CD-ROM drive.
2. Type `D:Enter` to change the active drive to the CD-ROM drive.
3. Type `INSTALLEnter` to run the install program.
4. Follow the on-screen prompts to install the software for this card.

WIN95/98/NT

- a. Place the CD into your CD-ROM drive.
- b. The CD should automatically run the install program after 30 seconds. If the install program does not run, click START | RUN and type d:install, click OK or press `Enter`.
- c. Follow the on-screen prompts to install the software for this card.

Directories Created on the Hard Disk

The installation process will create several directories on your hard disk. If you accept the installation defaults, the following structure will exist.

[CARDNAME]

Root or base directory containing the SETUP.EXE setup program used to help you configure jumpers and calibrate the card.

DOS\PSAMPLES:A subdirectory of [CARDNAME] that contains Pascal samples.

DOS\CSAMPLES:A subdirectory of [CARDNAME] that contains "C" samples.

Win32\language:Subdirectories containing samples for Win95/98 and NT.

WinRisc.exe

A Windows dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem.

ACCESS32

This directory contains the Windows 95/98/NT driver used to provide access to the hardware registers when writing 32-bit Windows software. Several samples are provided in a variety of languages to demonstrate how to use this driver. The DLL provides four functions (InPortB, OutPortB, InPort, and OutPort) to access the hardware.

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This directory also contains the device driver for Windows NT, ACCESNT.SYS. This device driver provides register-level hardware access in Windows NT. Two methods of using the driver are available, through ACCES32.DLL (recommended) and through the DeviceIOControl handles provided by ACCESNT.SYS (slightly faster).

SAMPLES

Samples for using ACCES32.DLL are provided in this directory. Using this DLL not only makes the hardware programming easier (MUCH easier), but also one source file can be used for both Windows 95/98 and WindowsNT. One executable can run under both operating systems and still have full access to the hardware registers. The DLL is used exactly like any other DLL, so it is compatible with any language capable of using 32-bit DLLs. Consult the manuals provided with your language's compiler for information on using DLLs in your specific environment.

VBACCES

This directory contains sixteen-bit DLL drivers for use with VisualBASIC 3.0 and Windows 3.1 only. These drivers provide four functions, similar to the ACCES32.DLL. However, this DLL is only compatible with 16-bit executables. Migration from 16-bit to 32-bit is simplified because of the similarity between VBACCES and ACCES32.

PCI

This directory contains PCI-bus specific programs and information. If you are not using a PCI card, this directory will not be installed.

SOURCE

A utility program is provided with source code you can use to determine allocated resources at run-time from your own programs in DOS.

PCIFind.exe

A utility for DOS and Windows to determine what base addresses and IRQs are allocated to installed PCI cards. This program runs two versions, depending on the operating system. Windows 95/98/NT displays a GUI interface, and modifies the registry. When run from DOS or Windows3.x, a text interface is used. For information about the format of the registry key, consult the card-specific samples provided with the hardware. In Windows NT, NTioPCI.SYS runs each time the computer is booted, thereby refreshing the registry as PCI hardware is added or removed. In Windows 95/98/NT PCIFind.EXE places itself in the boot-sequence of the OS to refresh the registry on each power-up.

This program also provides some COM configuration when used with PCI COM ports. Specifically, it will configure compatible COM cards for IRQ sharing and multiple port issues.

WIN32IRQ

This directory provides a generic interface for IRQ handling in Windows 95/98/NT. Source code is provided for the driver, greatly simplifying the creation of custom drivers for specific needs. Samples are provided to demonstrate the use of the generic driver. Note that the use of IRQs in near-real-time data acquisition programs requires multi-threaded application programming techniques and must be considered an intermediate to advanced programming topic. Delphi, C++ Builder, and Visual C++ samples are provided.

Findbase.exe

DOS utility to determine an available base address for ISA bus , non-Plug-n-Play cards. Run this program once, before the hardware is installed in the computer, to determine an available address to give the card. Once the address has been determined, run the setup program provided with the hardware to see instructions on setting the address switch and various option selections.

Poly.exe

A generic utility to convert a table of data into an nth order polynomial. Useful for calculating linearization polynomial coefficients for thermocouples and other non-linear sensors.

Risc.bat

A batch file demonstrating the command line parameters of RISCTerm.exe.

RISCTerm.exe

A dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem. RISCTerm stands for Really Incredibly Simple Communications TERMinal.

Installing the Card

Before installing the card, carefully read the Address Selection and Option Selection chapters 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 card.

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 on our Cd 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. Select the base address on the card. See Address Selection
5. Loosen the nuts on the strain relief bar and swing top end free
6. Install the card in an I/O expansion slot. If convenient, select a slot adjacent to a vacant slot because this will make cable installation easier, and allow clearance for the high-voltage insulating shields that ship installed onto the card.
7. Thread the I/O cables, one by one, through the cutout in the mounting bracket and plug them into the headers.
8. Smooth the cables as close as possible to the card and, while holding them close to the surface of the card, swing the strain relief bar into position and tighten nuts.
9. Inspect for proper fit of the card and cables and tighten screws.
10. Replace the computer cover.

Warning

This card can be used with signals that contain very high common mode voltages. For safety, the cables should not be connected to the sources of these signals when installing or removing connections to the card. Further, to assure that the cables aren't pinched by the strain relief bar, it is good safety practice to enclose the cables in a protective jacket. PVC protective jacketing is available that meets UL, CSA, and MIL specifications.

Safety Notes

These cards are used mostly as switches for externally supplied power up to 60 VDC and up to one Ampere. If the computer is turned OFF and that external power is still applied to the card, all the output lines will be turned ON. To avoid damage or injury, you **MUST** turn OFF the external power when the computer is turned OFF.

The board ships with high-voltage insulating shields installed to protect adjacent cards and/or conductors inside the computer chassis from inadvertent contact with the external power supply voltage.

EMC / EMI / CE Note

Input/Output connections are via 50-pin header(s) on the card. A blank mounting bracket is provided with units marked for CE (European) Certification and, for these units, CE-certifiable cable and break-out methodology (cables connected to ground at the aperture, twisted pair wiring, etc.) must be used. Also, it is important that the card mounting bracket be properly screwed into place and that there be a positive chassis ground.

Chapter 3: Address Selection

The IDO-48 card occupies eight bytes of I/O space. The card base address can be selected anywhere within the I/O address range 100-3F0 hex except 1F0 to 1F8. However two installed options cannot share the same address. If in doubt where to assign the base address, refer to the following tables and the FINDBASE program to find an available address for your system.

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 Coprocessor 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)

Table 3-1: Standard Address Assignments for 286/386/486 Computers

Setting the Address

To set desired board address, refer to the illustrated Board Address setup program on the CD provided with the card. Type the desired address in hexadecimal code and the graphic display shows you how to set the Address Setup switches. These switches are marked A3-A9 and form a binary representation of the address in negative-true logic. (assign '0' to all Address Setup switches turned ON, and assign '1' to all Address Setup switches turned OFF.)

Switch Identification	A9	A8	A7	A6	A5	A4	A3
Address Line Controlled	A9	A8	A7	A6	A5	A4	A3

The following example illustrates switch selection corresponding to hex 2D8 (or binary1011011xxx). The "xxx" represents address lines A2, A1, and A0 used on the card to select individual inputs. See Chapter 5, Programming.

Hex Representation	2		D				8
Conversion Multipliers	2	1	8	4	2	1	8
Binary Representation	1	0	1	1	0	1	1
Set Up	OFF	ON	OFF	OFF	ON	OFF	OFF
Switch ID	A9	A8	A7	A6	A5	A4	A3

Caution

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

Chapter 4: Software

There are sample programs provided with the IDO-xx card in C, Pascal, QuickBASIC, and several Windows languages. DOS samples are located in the DOS directory and Windows samples are located in the WIN32 directory.

Chapter 5: Programming

IDO- Series cards are I/O-mapped devices that are easily configured from any language and any language can easily control digital outputs through the card's ports. This is especially true if the form of the data is byte or word wide. All references to the I/O ports would be in absolute port addressing. However, a table could be used to convert the byte or word data ports to a logical reference.

A total of eight address locations are occupied by the IDO-48. Register locations are listed in the following table.

Address	Write	Read*
Base Address	Port A/0 Bits 0-7	Port A/0 Bits 0-7
Base Address +1	Port A/0 Bits 8-15	Port A/0 Bits 8-15
Base Address +2	Port B/1 Bits 0-7	Port B/1 Bits 0-7
Base Address +3	Port B/1 Bits 8-15	Port B/1 Bits 8-15
Base Address +4	Port C/2 Bits 0-7	Port C/2 Bits 0-7
Base Address +5	Port C/2 Bits 8-15	Port C/2 Bits 8-15
Base Address +6	reserved	reserved
Base Address +7	Control Byte	Control Byte

Table 5-1: Address Selection Table

Bit 7/15	Bit 6/14	Bit 5/13	Bit 4/12	Bit 3/11	Bit 2/10	Bit 1/9	Bit 0/8
D7	D6	D5	D4	D3	D2	D1	D0

Writing a byte to Port n address activates each output with a “1” at the bit location, deactivates each output with a “0” at the bit.

Reading a byte from Port n address displays a “1” for each output that is active, and displays a “0” for each output that is inactive.

**(See Control Byte description below for instructions to enable this function)*

The **Control Byte** enables / disables the read-back function of all Ports.

To enable read-back capability, write 9Bh to Base Address +7.

Reading from Base Address +7 will then return 9Bh.

To disable read-back write 80h to Base Address +7.

Reading from Base Address +7 will then return 80h.

The Power On/Default state is read-back disabled.

Chapter 6: Connector Pin Assignments

Three identical 50-pin headers are provided on the IDO-48; one for each 16-bit output group. Port A is closest to the card mounting bracket, while Port C is furthest from it. The mating connector is an AMP type 1-746285-0 or equivalent. Connector pin assignments are listed below.

Pin	Signal	Pin	Signal
1	Ground	2	Bit 0 Return
3	Bit 0 Out	4	Bit 0 Supply
5	Bit 1 Return	6	Bit 1 Out
7	Bit 1 Supply	8	Bit 2 Return
9	Bit 2 Out	10	Bit 2 Supply
11	Bit 3 Return	12	Bit 3 Out
13	Bit 3 Supply	14	Bit 4 Return
15	Bit 4 Out	16	Bit 4 Supply
17	Bit 5 Return	18	Bit 5 Out
19	Bit 5 Supply	20	Bit 6 Return
21	Bit 6 Out	22	Bit 6 Supply
23	Bit 7 Return	24	Bit 7 Out
25	Bit 7 Supply	26	Bit 8 Return
27	Bit 8 Out	28	Bit 8 Supply
29	Bit 9 Return	30	Bit 9 Out
31	Bit 9 Supply	32	Bit 10 Return
33	Bit 10 Out	34	Bit 10 Supply
35	Bit 11 Return	36	Bit 11 Out
37	Bit 11 Supply	38	Bit 12 Return
39	Bit 12 Out	40	Bit 12 Supply
41	Bit 13 Return	42	Bit 13 Out
43	Bit 13 Supply	44	Bit 14 Return
45	Bit 14 Out	46	Bit 14 Supply
47	Bit 15 Return	48	Bit 15 Out
49	Bit 15 Supply	50	Ground

Table 6-1: Connector Pin Assignments

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: manuals@acesio.com. Please detail any errors you find and include your mailing address so that we can send you any manual updates.



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