
Brain Boxes Manual

PCI OPTO DIO 48(Source) Card

By Paul D. Sinclair.



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Contents

Information	1
Guarantee	1
Copyright	1
Brain Boxes Limited.....	1
About this Card	2
General Information.....	2
Chapter 1 Inputs, Outputs, Watchdogs & Power	3
Introduction.....	3
Power Supply.....	3
Regulated Power Supply.....	3
Unregulated Power Supply.....	3
Useless Power Supply.....	4
Source Explained.....	4
Source Driver Output Connection - UDN2984 Drivers.....	4
Source Driver Output Port Schematic.....	5
Source Driver Output Connections.....	5
Source Driver Output Logical Levels.....	5
Input Port Schematic.....	6
Programmable Watchdog.....	6
Watchdog Timeout Register.....	7
Watch Dog Enable Register.....	7
Watch Dog Enable Register Table.....	8
Chapter 2 Hardware Configuration	9
Introduction.....	9
Memory Map.....	9
Opto DIO48 Memory Map.....	10
Output Specification.....	10
Input Specification.....	10
Pinouts.....	11
Chapter 3 Card Installation	12
Installing The Opto DIO Board In The Computer.....	12
.....	14
Problems!.....	15
Screw Terminal Board.....	15
Chapter 4 Windows 95 Software Installation	16
Installation.....	16
Insert Data Aquisition CD ROM.....	16
Select Other Locations.....	17
Type Driver Path.....	17
Driver Location.....	17

Copying Driver Files	18
Chapter 5 Setup Information	18
Setting up the Quanta OCX.....	18
Index	20

Information

Guarantee

BRAIN BOXES LIMITED guarantee your DIO Card for a full 36 months from purchase, parts and labour, provided it has been used in the specified manner. In the unlikely event of failure return your interface to BRAIN BOXES or to your Dealer, with proof of purchase, who will determine whether to repair or replace this product with an equivalent unit.

Copyright

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Due to Brain Boxes commitment to quality, software is subject to continuous improvements: upgrades can be obtained from :

www.brainboxes.com/software

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About this Card

General Information

OPTO DIO48 provides 24 high voltage, high current outputs lines and 24 input lines all with +/-2500 Volts optical isolation.

The optically isolated outputs are high voltage, high current outputs lines, with +/-2500 Volts optical isolation. Fast TTL buffers, Opto isolators and drivers allow a maximum throughput of 150kHz. The cards may be fitted with source drivers or with sink drivers. The on chip current limiting resistors and output transient suppression diodes have been augmented by on board higher duty suppression diodes and pull down resistors so ensuring long term use in an industrial environment.

Cards with these outputs require an external, user supplied, power input to supply the Opto isolators and the I/O drivers. On board regulation allows the use of unregulated supplies in the range 17.5-35 Volts. A minimum of 8VA current capability per 8-line source output package is needed. DIO48 requires 25VA power supply.

The optically isolated inputs are current limited and reverse polarity protected and provide +/-2500 Volts optical isolation. Fast TTL buffers Opto isolators and drivers allow a maximum throughput of 150kHz.

Most of the Opto card range has an on board Watchdog Timer that can be used as a fail safe way to ensure the users program is running correctly and the PC has not crashed. The Opto DIO cards are the ideal for high output current control applications such as driving relays, solenoids, stepper motors, LED's or lamps requiring separate logic and load grounds.

A separate manual "The Interfacing Guide" with a disk full of worked examples in BASIC, PASCAL, C, Assembler and FORTRAN ensure that you are up and running with the card straight away!

Your card is designed and manufactured in England, and our policy is one of complete support to our dealers and direct to our users. It is designed 'in house' and is completely understood by our staff. Its great strength is the support we give it. Our intention is to supply the hardware, software and any technical information you may need to allow you to exercise complete control the card and I/O devices. After searching the manuals, do not hesitate to contact us by email at help@brainboxes.com

We trust that if you adhere to the following procedures you will enjoy many years of useful service from your interface.

Chapter 1 Inputs, Outputs, Watchdogs & Power

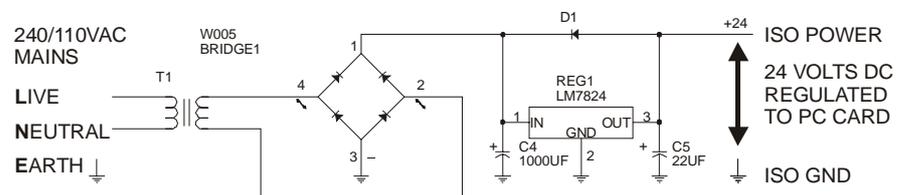
Introduction

This chapter describes the features of the PCI Opto DIO 48 (source) card. The topics covered are the external user supplied power supply, the output drivers types, the input circuit and the watch dog timer.

Power Supply.

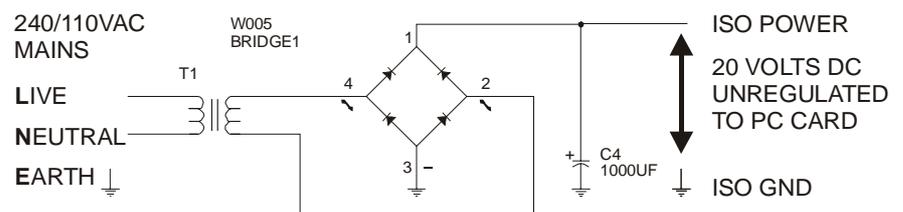
The PCI Opto DIO 48 (source) card requires an external power input to drive the isolators and the output driver chips. The external power input is a nominal 24 volts input.

Regulated Power Supply.



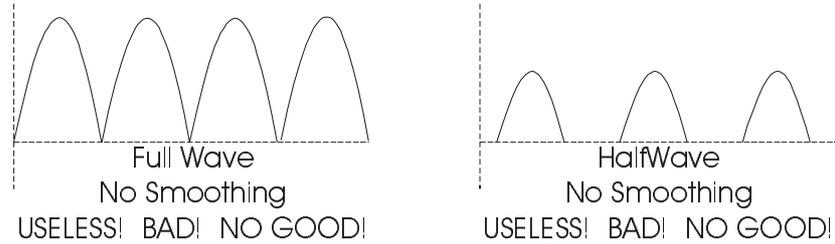
Either a commercially available DC power supply or a home made one may be used. The supply can be regulated or unregulated. The PCI Opto DIO 48 (source) card has on board regulation and reverse connection protection. Suitable regulated and unregulated supply circuits are given below. The power supplies range of 17.5 to 30 Volts maximum must be capable of supplying a minimum of 2 Amps at 25 Volts. i.e. 50 VA rating. (OUT48 4 Amp @ 25 Volts = 100VA). If an unregulated power supply is used ensure that it is rectified and has sufficient smoothing to keep it above the absolute minimum of 17 volts.

Unregulated Power Supply.



Unsuitable power supplies are those that provide only half wave rectification and those that are unsmoothed. Both these types fall below the minimum +17 Volts necessary to allow the on board regulation to work.

Useless Power Supply.



Source Explained.

The output ports of the card are optically isolated from the rest of the PC so that wiring defects or accidental connections to high voltage or high current devices do not damage the PC. In addition the outputs are via high voltage, high current driver chips. The lines of these driver chips are connected by the user to a load. As the users programs sets the output port lines high and low the output driver chips attempt to pull the loads to a high and low voltage.

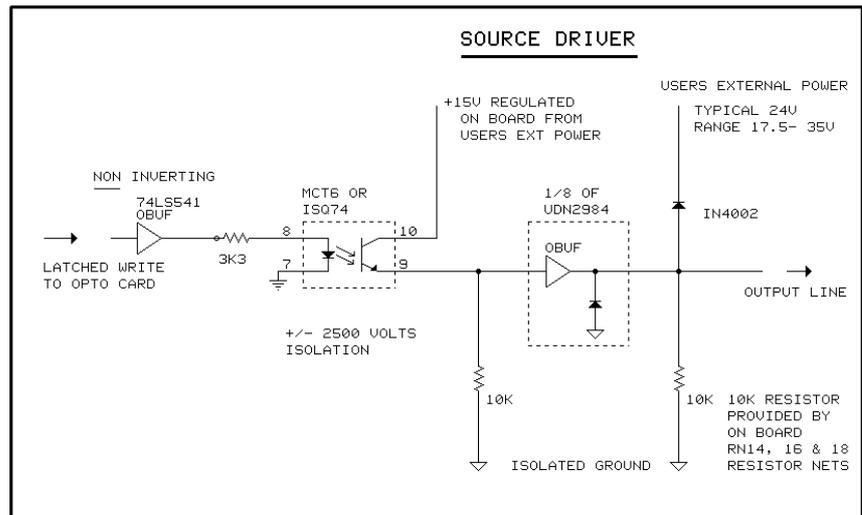
When current flows out of the driver output terminal and into the load, the device is said to "source" current. This is a source driver. Conversely current flows from a load into a "sink" driver.

Source drivers can pull outputs both up and down. When the PC is powered off whilst the external power is ON the port lines are ON.

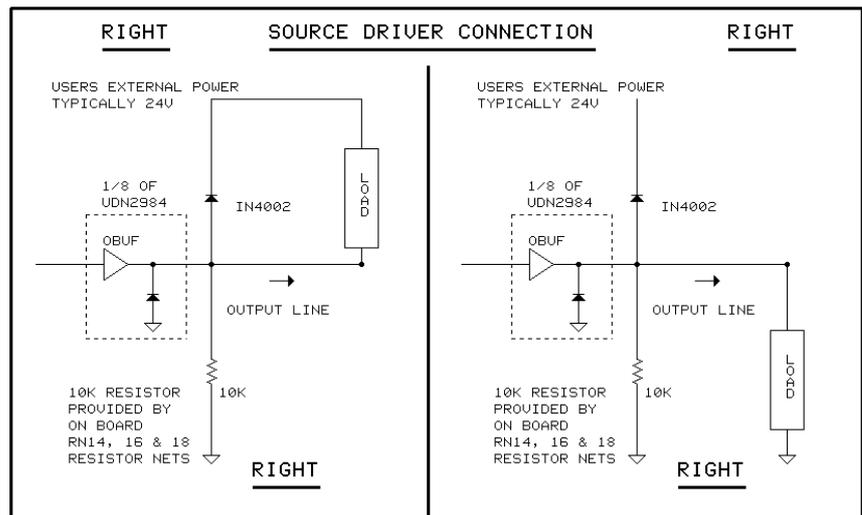
Source Driver Output Connection - UDN2984 Drivers.

The UDN2984 chips are high voltage, high current SOURCE drivers, output voltage range 35 to 80 Volts, these could be directly replaced by UDN2981 drivers for output voltages in the range 5 to 50 Volts. Whilst the 2984/81 drivers have built in output transient suppression diodes, extra diodes are provided on board the PCI Opto DIO 48 (source) card for extra protection.

Source Driver Output Port Schematic.



Source Driver Output Connections.

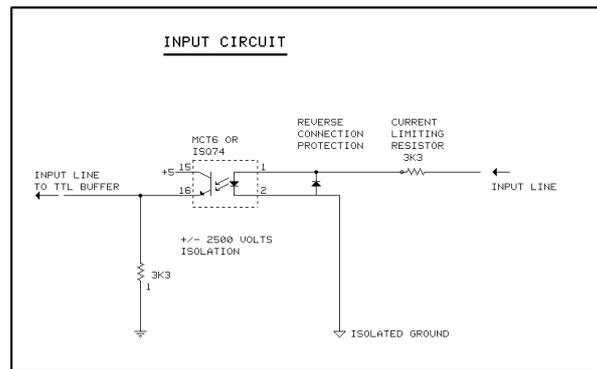


Source Driver Output Logical Levels.

On the PCI Opto DIO 48 (source) card, a logical one written to the output register drives the output high and a logical zero written to the output port drives the output low. Thus in this normal mode of operation, the voltage level of the output line follows the logical level in the output register.

There is an option of changing the polarity of the output, so that a logical one is written to the output register drives the output low and a logical zero written to the output drives the output high. Thus in this inverse mode of operation the voltage level of the output line does the opposite of the logic level in the output register.

Input Port Schematic.



The input port lines are reverse connection protected and current limited. Input voltages of 0.0 - 2.38 Volts read as input logic low, 0. Input voltages of 2.4 - 24.00 Volts read as input logic high, 1.

The inputs are current limited by a 3k3 Ohm resistor and are reverse connection protected by diodes.

Programmable Watchdog

The watchdog is a failsafe method of ensuring that the users program is still running correctly. If the users program enables the watchdog, an Interrupt is generated after a default 50ms timeout period. Reading or writing to the watchdog control register, the watchdog timeout register or global interrupt register shall reset the count. The watchdog output shall be selectable active high/low and available inside the PC or externally via port A, bit 0.

The Timeout of the Watchdog shall be programmable between 25ms to 1second in the following increments:

25,50,75,100ms to 1ms accuracy

250,500,750,1000ms to 10ms accuracy

Default value shall be 50ms

A connection point shall be available and marked on the PCB where a non-isolated CMOS signal is available which is asserted when the watchdog has expired.

Watchdog Timeout Register

Register bit 4 3 2 1 0	Watchdog timeout (in ms)	Watchdog accuracy (worst case, in ms)
0 0 0 0 0	50	5
0 1 0 0 0	25	5
0 1 0 1 0	50	5
0 1 1 0 0	75	5
0 1 1 1 0	100	5
1 0 0 0 0	250	50
1 0 0 1 0	500	50
1 0 1 0 0	750	50
0 1 1 1 0	1000	50
Other values	Reserved for future use	

Register bit 5	Port A1 bit 0 output value
0	As set by normal output register
1	Watchdog timeout signal

Register bit 7 6	External watchdog trigger type
0 0	Active high
0 1	Active low
1 0	Open source (wire-OR, positive logic)
1 1	Open drain (wire-OR, negative logic)

Watch Dog Enable Register.

The watchdog enable register is an 8 bit read write register. Writing the bits enables, gates, various signals onto the PC expansion bus IRQ or RESET line, thus allowing an interrupt or reset to be generated in the PC. On power up all the bits are cleared to zero, i.e. No signals are gated through to the PC bus. The bitmap of the watchdog register is given below.

Bits 7-4 are always read back as zero, writing them high or low has no effect. For compatibility with future versions of this card bits 7-4 should always be written as 0.

Bit 0 when =1 the watchdog BUS jumper signal is gated to PC bus RESET line. This line causes a power on reset of the PC when driven high.

NOTE this line is an output only on many PC's and so cannot be used to reset the PC.

Bit 1

When =1 the watch dog BUS jumper signal is gated to the PC bus IRQ line as selected by the IRQ jumper block.

Bit 2

When =1 the Port C2 bit 0 input signal is gated from the Opto isolator to the IRQ selected by the IRQ jumper block. Low to high transitions generates a PC interrupt.

Bit 3

When =1 the Port C2 bit 3 input signal is gated from the Opto isolator to the IRQ line selected by the IRQ jumper block. Low to high transition generates the PC interrupt.

The IRQ handler should check, by reading the watchdog register, which interrupt is enabled and service the appropriate function, e.g. watchdog timeout or transition of the Port C lines.

Watch Dog Enable Register Table.

Watch dog Enable Register Default Address' are 030b & 030f hex. This is a read/write register							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Write - Don't Care. Read - Always Zero.				Gate Port C2 Bit3 to IRQ	Gate Port C2 Bit0 to IRQ	Gate Jumper Bus to IRQ	Gate Jumper Bus to Reset
Read of this register refreshes the watchdog timer. Read this at least once every 50 milli-seconds to prevent timeout							

Chapter 2 Hardware Configuration

Introduction

In the state it leaves our factory, Opto DIO48 card is ready to plug straight into a PC computer. **So, unless you have GOOD REASON, you do not need to alter its default setting.**

However, due to the large variety of add-on cards that may be present in the PC, your Opto DIO48 card may need adjusting to suit your setup.

The Opto DIO48 requires an external power input to power the output drivers and the isolated side of the Opto couplers. On card power regulation allows the use of external un-regulated power source, input range 17.5 - 35 Volts. The power supply input is reverse polarity protected.

Using More Than One Opto DIO48 Board.

Several Opto DIO cards can be installed at the same time, allowing each card to control its own set of I/O lines.

Memory Map

Output Specification

Input Specification

Pinouts

Memory Map.

The Opto DIO48 has 24 dedicated output lines arranged as 3 eight bit read/write registers, 24 dedicated input lines arranged as 3 eight bit read only registers and one read/write watchdog enable/strobe register. Thus the DIO card occupies 7 consecutive i/o addresses. The output ports are output only, however the output registers are read/write, writing to them sets the level of the output lines, reading them provides a read back of the previously written value. On power up the outputs are zero.

Inputting and outputting data to the Port A, B and C registers senses and sets the values of the pins at the external connector. Writes to the watchdog register gate the Port C2 bit 0 and Bit 3 input signals are gated onto IRQ line or RESET line of the PC.

Reading the watchdog register refreshes the timer and postpones timeout for another 50milliseconds.

Opto DIO48 Memory Map

BASE ADDRESS	OFFSET	DIO PORT	REGISTER SELECTED				
0000	R/W	P0	PORT A1 OUTPUT PORT A				
0001	R/W	P1	PORT B1 OUTPUT PORT B				
0002	R/W	P2	PORT C1 OUTPUT PORT C				
0003	R/W	P3	WATCH DOG ENABLE REG TO REFRESH WATCHDOG				
0004	READ	P4	PORT A2 OUTPUT PORT A				
0005	READ	P5	PORT B2 OUTPUT PORT B				
0006	READ	P6	PORT C2 OUTPUT PORT C				
READ / WRITE WATCH DOG ENABLE REGISTER DEFAULT ADDRESS = 030B h							
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
WRITE	DON'T CARE			GATE	GATE	GATE	GATE
READ	ALWAYS 0			PORT	PORT	JUMPER	JUMPER
				C2	C2	BUS TO	BUS TO
				BIT3	BIT0	IRQ	RESET
				TO	TO		
				IRQ	IRQ		

Output Specification.

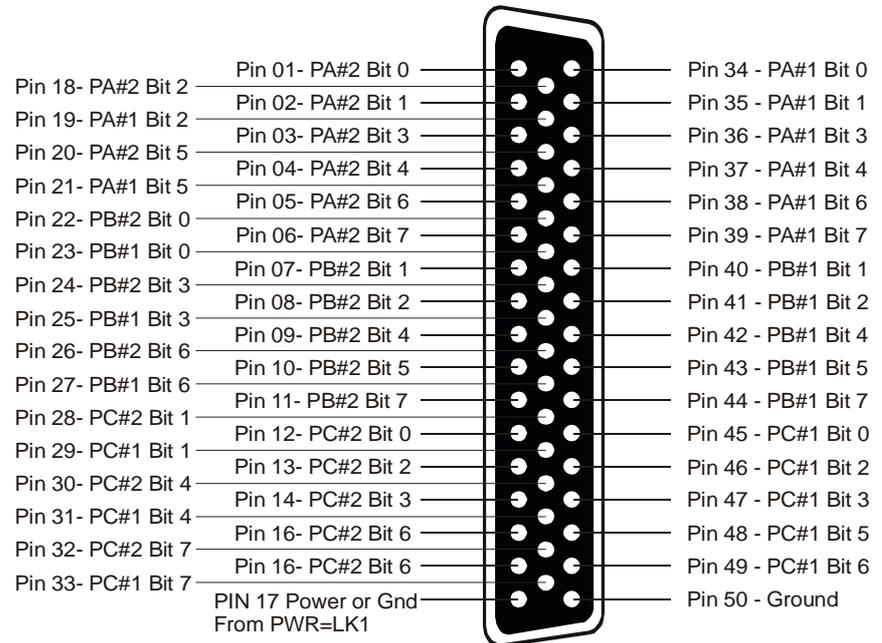
Number Of Port Output Lines	24
External Power Voltage Range	17.5 -35 Volts
Ext Power Supply Reverse Polarity Connection Protected.	
Maximum External Power Current	
All Outputs High Shorted To All Inputs.	1000 mA @ 24V
Output Voltage.	0 - 35 Volts
Can with stand Maximum OFF Voltage.	80 Volts
Sustained Simultaneous O/p Current all lines.	50mA @35V
Max Output Current per 8-line package.	500mA
Peak Output Current any one line.	350mA

Input Specification.

Number Of Port Input Lines.	24
Input Logic level HIGH.	2.4 - 24.0 Volts
Input Logic level LOW.	0.0 - 2.38 Volts
Maximum I/p Current One In Line High.	7.25 mA @24V
Maximum I/p Current All In Lines High.	175 mA @ 24V
Absolute Maximum Input Voltage.	35 Volts
PC Power Requirements.	125mA @ 5 Volts
Optical Isolation.	+/- 2500 Volts
Length x Height Of Card.	9.75 x 4.2 inch.
All Inputs Reverse Polarity Connection Protected.	

Pinouts.

The DIO48 card has a 50 pin D connector which has three rows of 17, 16, 17 pins, on a 2.75 mm pitch.



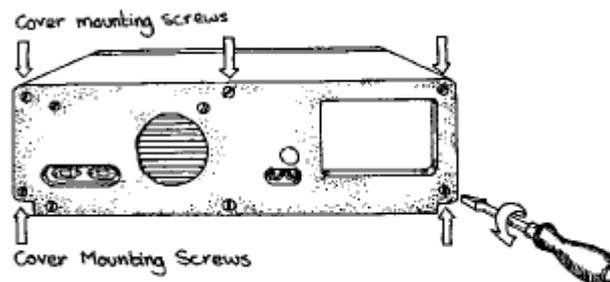
Chapter 3 Card Installation

Installing The Opto DIO Board In The Computer.

STEP 1: Turn off the Power

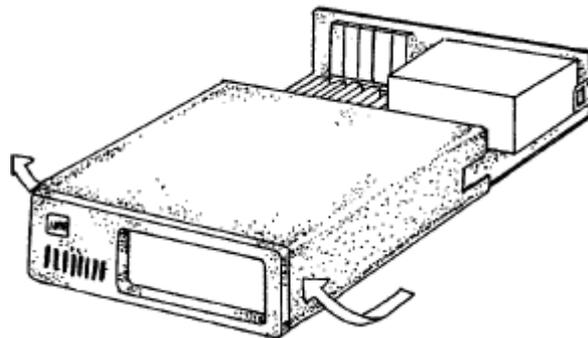
Before the Opto board can be installed the power to the PC MUST be switched OFF!

STEP 2: Remove Cover Mounting Screws



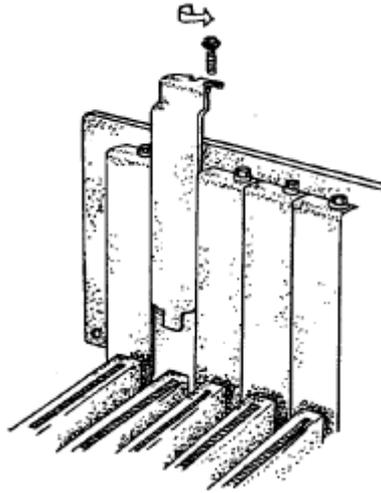
Then using a screwdriver, remove the cover mounting screws on the back panel the PC system unit.

STEP 3: Removing The PC Cover



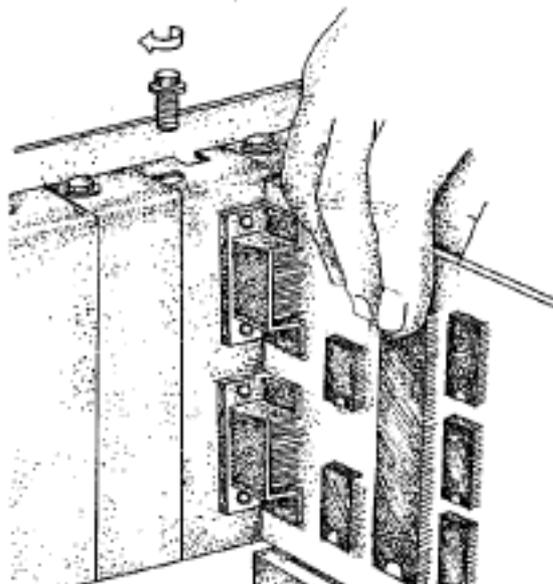
Next, remove the PC's cover by sliding it forward and up. It usually helps to disconnect the keyboard from the PC since it tends to get in the way when the case is removed.

STEP 4: Removing Blanking Cover



Choose an empty expansion slot. The Opto card will fit either a full length or a short slot, a 8 bit PC type slot or a 16 bit AT type slot. In general it is wise to leave the larger slots free for those boards that insist on greater room. Remove the blanking cover protecting the slot on the PC back panel. KEEP the blanking cover screw safely for later.

STEP 5: Inserting The Opto Card



Now insert the Opto card in the slot. Be careful to ensure that the gold plated pcb fingers fits neatly into the I/O expansion connector. Press down firmly but evenly on the top of the Opto card.

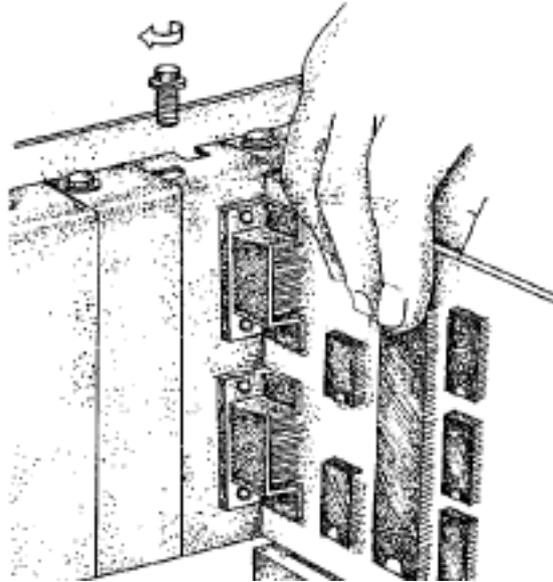
STEP 6: Replace Covers

Now replace the system unit's cover by carefully sliding it down and over the system unit. Replace the cover screws.

STEP 7: Reconnect and Restart

After attaching all the monitor and keyboard cables, power up the PC. Do not forget the mains power cable!

The PC should power on in the normal way.



Problems!

If the system fails to power up check the following.

- i.) Ensure that the Opto card is installed correctly.
- ii.) Ensure that other cards in the PC have not been upset.
- iii.) Ensure the power is connected and the PC is switched ON!
- iv.) Ensure the Opto card I/O address is set correctly. Default for the Opto DIO48 is at 0308h.

If all these have been checked and the PC still does not power up then there is probably a conflict of I/O address between the Opto board and another board in the PC. Ask your dealer to check this or contact the HELP line as given on Intro page 2.

Screw Terminal Board.

The easiest and tidiest way to connect your I/O card to your rig is via the Screw Terminal Board.

The Screw Terminal Board converts from either 50 IDC ribbon or 50D cable to screw terminals. The screw terminals can take wire up to 2.5mm, 0.1 inch diameter. The 50IDC entry is a latching connector, the 50D has screw locks to ensure hold fast connections. Power taken from the PC via the cards PWR=LNK jumper is fed through a removable fuse and LED. De-coupling capacitors are provided.

Each screw terminal, is clearly identified by IDC pin number, and Opto DIO signal name, it can also take an optional LED to show signal logic state. A handy cable grip clamps the wires to ensure a robust, tidy layout. Order one now!

Chapter 4 Windows 95 Software Installation

Installation

To obtain a trouble free mix-and-match of the COM ports, insert the PCI DIO24 Card into your PC, as described in Chapter 3 and restart.

Insert Data Aquisition CD ROM

During the booting process, Windows 95 will detect the PCI 1 DIO24 Card, but will display it simply as a "PCI CARD", and you will briefly see a message box to this effect



Windows will then display the "Update Device Driver Wizard", which asks you to "insert any disk which came with the PCI card".

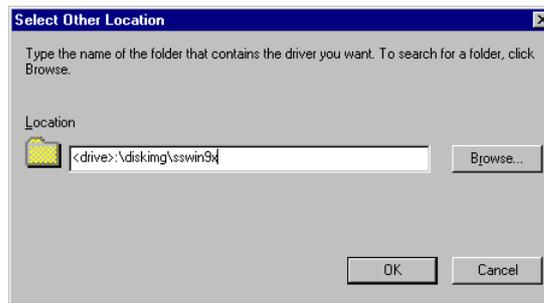
Insert the Data Aquisition CD ROM into an appropriate drive and click **Next**.

Select Other Locations



Click Other Locations

Type Driver Path



In the location space type **<drive>:\disking\sswin9x** where drive is the appropriate letter for your CDROM drive

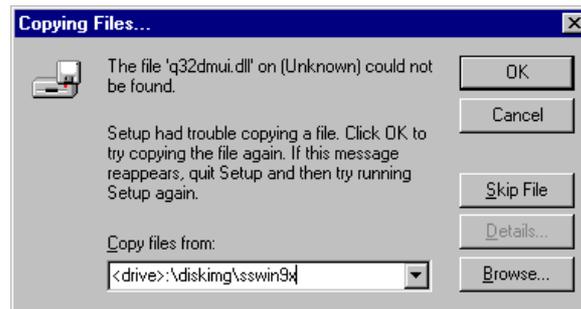
Click **OK**

Driver Location



The screen shot above shows that the **Update Device Driver Wizard** has found a suitable driver and the location of that driver.

Copying Driver Files



In the location space type `<drive>:\diskimg\sswin9x` where drive is the appropriate letter for your CDROM drive

Click **OK**

This concludes the Windows 95 Driver installation

Chapter 5 Setup Information

Setting up the Quanta OCX

To install the Quanta OCX.

Click on **Start**

Click on **RUN**

Type the Path

`<Drive>:\software\quantocx\setup`

Program information is installed to Program files\ Brain boxes\ Quanta 2000. This contains Documentation, Examples and Tools.

Documentation contains a description of the Quanta API set, including associated properties, methods and events.

Release.txt details current release version plus known problems with workarounds.

Examples contains a DOS example (for backward compatibility) for use with PCI cards. A VB6 example indicating the use of read/ write methods to access ports is also included.

Tools contains debug software bbcards.exe which can be run from from a dos window within Win9x. This provides port information about the card. **Methods of debugging can be found in Release.txt.**

Drivers are not installed to the windows system during setup but may be located on your CD at folders diskimg\sswin9x

Index

2

2500 11

5

50 IDC 17

50D 17

C

Current 11

E

External Power 11

I

I/O address 12, 13, 16

IDC 17

Input 6, 11

Isolation 11

P

Power 3, 4, 11, 17

Power Supply 3, 4, 11

S

Schematic 5, 6

Screw Terminal 17

Specification 11

V

Volts 2, 3, 4, 6, 9, 10, 11

W

watchdog 7, 8, 10