

PCI 62C Series

PCI PnP Digital I/O Boards User's Manual for PCI62C16, PCI62C32, PCI62C48

Optically Isolated Digital I/O

Data Acquisition and Process Control

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May 2002
Revision 1.0

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TABLE OF CONTENTS

1. INTRODUCTION	1
Features	1
Applications	1
Key Specifications	1
Software Support	1
Contact Details	1
2. INSTALLATION	2
Package	2
Operating System Support	2
Hardware Installation	3
Software Installation	4
Windows 98/2000/ME/XP	4
Post installation	6
Windows NT	8
3. INTERCONNECTIONS	9
External Connector and Accessories	9
Common Line Connections	9
Pin Assignments	10
PCI 62C/16/32/48 – DB37 (F) External Opto 0-15	10
PCI 62C – IDC40 (M) Internal Digital I/O Connector	10
PCI 62C – DB37 (M) – External Digital I/O Connector	10
PCI 62C16 – IDC40 (M) Internal Opto 16-31 and 32-47	11
PCI 62C – DB37 (M) – External Opto 16-31 and 32-47	11
Signal Definitions	12
Pin Descriptions	12
Digital Inputs DI0-15	12
Digital Inputs D00-15	12
OPTO0-47	12
COMA-F	12
+5V Power Pin (+5V)	12
+12V Power Pin (+12V)	12
Digital Ground (DGND)	12
4. PROGRAMMING GUIDE	13
EDR Enhanced API	13
Digital Inputs/Outputs	14

Reading the Digital Inputs	14
Writing to the Digital Outputs	14
Port Assignments	14
Programming Interrupts	15
Configuring the Interrupt sub-system	15
Enabling Interrupts	15
Disabling Interrupts	15
Interrupt Event	15
A. SPECIFICATIONS	17
Digital Input/Output Characteristics	17
Opto-Isolators	17
Bus Interface	17
Power Requirements	18
Dimensions	18
Connectors	18
B. CONFIGURATION CONSTANTS	19
Query Codes	19
Error Codes	20
Digital I/O Codes	20
C. LAYOUT DIAGRAM	21
D. ORDERING INFORMATION	22

Table of Figures

Figure 4-1 EDR Enhanced Design..... 13

Table of Tables

Table 1-1 PCI 62C Versions	1
Table 2-1 Operating System Support	2
Table 3-1 PCI 62C Connectors.....	9
Table 3-2 Common Line Connectors.....	9
Table 3-3 PCI 62C External Connector – DB37 (M).....	10
Table 3-4 PCI 62C/16/32/48 Digital I/O IDC40 (M) Connector.....	10
Table 3-5 PCI 62C/16/32/48 Digital I/O DB37 (M) Connector.....	11
Table 3-6 PCI 62C/16/32/48 Internal Opto-Isolated Connector.....	11
Table 3-7 PCI 62C/16/32/48 External Opto-Isolated Connector.....	12
Table 3-8 Signal definitions.....	12
Table 4-1 Port Assignments	14
Table 4-2 EDREIntX.Configure Parameters.....	15
Table 4-3 Event Source	16
Table D-1 Ordering Information	22



1. Introduction

The PCI62C series are 32-bit PCI bus architecture digital input/output optically isolated data acquisition boards. The different models have 16, 32 and 48 optically isolated input lines. Digital I/O is standard on all boards. The PCI62C is available in 4 models namely the PCI62C16, the PCI62C32 and the PCI62C48.

Features

The PCI62C series has some very unique features and are listed below:

- 32-bit PCI bus Revision 2.1 compliant at 33MHz.
- PCI Bus 5V compatible.
- Optically Isolated Inputs Up to 24V DC
- Fully programmable interrupt system.

Feature	PCI 62C16	PCI 62C32	PCI 62C48
Number of digital input channels	16	16	16
Number of digital output channels	16	16	16
Number of optically isolated channels	16	32	48

Table 1-1 PCI 62C Versions

Applications

The PCI 62C series can be used in the following applications:

- Automation test equipment.
- TTL compatible status monitoring.
- Plant/Factory process control.
- DC level monitoring.

Key Specifications

- Digital 16-bit input and output port.
- 16/32/48 Optically isolated channels.
- Fully programmable interrupt support.

Software Support

The PCI 62C series is supported by EDR Enhanced and comes with an extensive range of examples. The software will help you to get your hardware going very quickly. It also makes it easy to develop complicated control applications. All operating system drivers, utility and test software are supplied on the EDR Enhanced CD-Rom. The latest drivers can also be downloaded from the Eagle Technology website. For further support information see the Contact Details section.

Contact Details

Below are the contact details of Eagle Technology.

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2. Installation

This chapter describes how to install and configure the PCI 62C for the first time. Minimal configuration is necessary; almost all settings are done through software. The PCI BIOS or operating system will take care of all resource assignments.

Package

PCI 62C package will contain the following:

- PCI 62C PCI board and Accessory Cables.
- Eagle Technology Software CD-Rom.

Operating System Support

The PCI 62C series support the Windows NT and Windows Driver Models (WDM) driver types. The operating systems are listed in the table below.

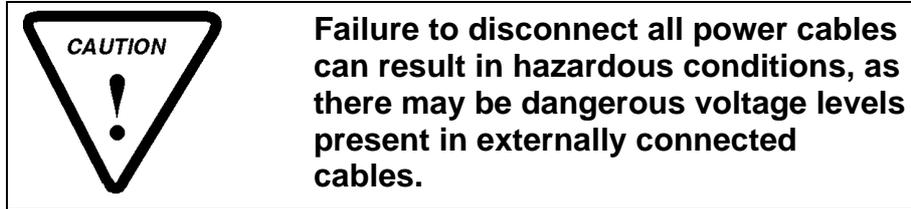
Board Type	Revision	Operating Systems	Driver Type
PCI 62C16	Revision 1	Windows NT/2000/98/ME/XP	NT Sys, WDM PnP
PCI 62C32	Revision 1	Windows NT/2000/98/ME/XP	NT Sys, WDM PnP
PCI 62C48	Revision 1	Windows NT/2000/98/ME/XP	NT Sys, WDM PnP

Table 2-1 Operating System Support

Hardware Installation

This section will describe how to install your PCI board into your computer.

- Switch off the computer and disconnect from power socket.



- Remove the cover of the PC.
- Choose any open PCI slot and insert PCI board
- Insert bracket screw and ensure that the board sits firmly in the PCI socket.
- Replace the cover of the PC.
- Reconnect all power cables and switch the power on.
- The hardware installation is now completed.

Software Installation

Windows 98/2000/ME/XP

Installing the Windows 98/2000 device driver is a very straightforward task. Because it is plug and play Windows will auto detect the PCI board as soon as it is installed. No setup is necessary. You simply have to supply Windows with a device driver.

Wait until Windows detects the new hardware



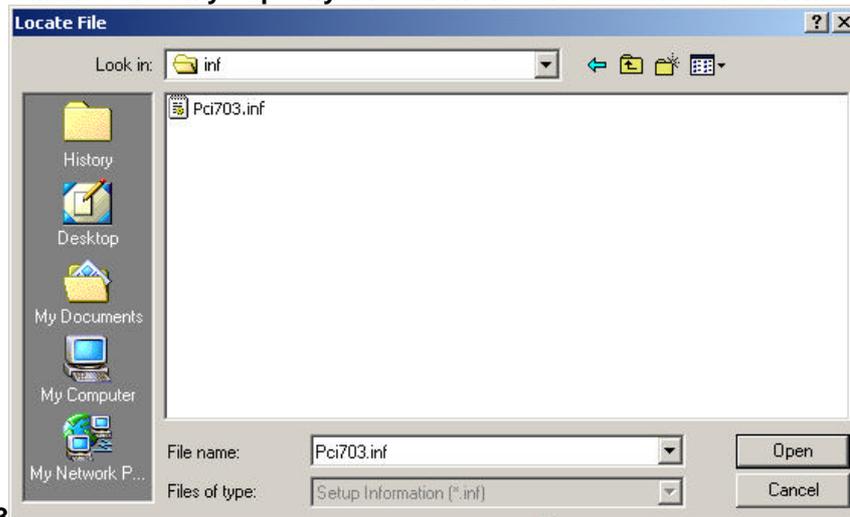
Select Next



Select "Search for a suitable driver for my device..." and select next



Make sure only "Specify a location" is selected and select next



3

Select the browse button and search for the PCI62C.inf file on the Eagle CD-Rom.



The driver is normally located in the <CDROM>:\EDRE\DRIVERS\WDM\PCI62C directory.

Select next when found.



Select next again.

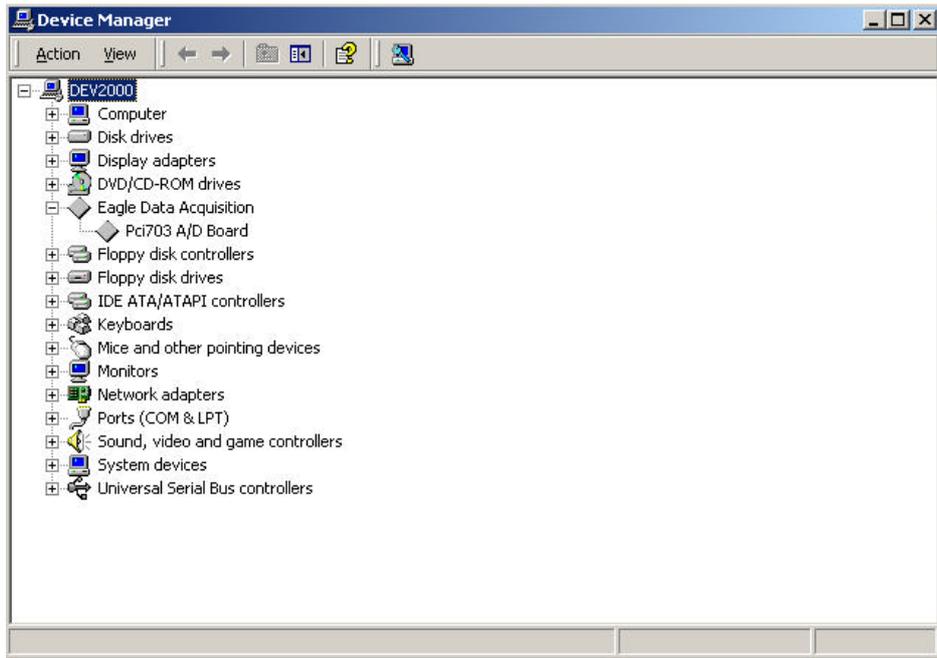


When done you might have to restart your computer.

Post installation

When done with the driver installation the device manager can be open to make sure the installation was a success.

- First make sure that the driver is working properly by opening the *Device Manager*.
- Check under the Eagle Data Acquisition list if your board is listed and working properly. See picture below.



- Clearly you can see that the PCI device is listed and working properly.
- Further open the control panel and then the *EagleDAQ* folder. This dialog should list all installed hardware. Verify your board's properties on this dialog. See picture below



Now the first part of your installation has been completed and ready to install the EDR Enhanced Software Development Kit.

- Run *edreapi.exe* found on the Eagle CD-Rom and follow the on screen instructions

Windows NT

The Windows NT driver supports both Windows NT4.0 and Windows 2000. It does not require any special setup. To install the Windows NT drivers simply run **edrewinnt.exe** on the Eagle CD-Rom. This will automatically install the device drivers. Restart your computer when done. Open the *EagleDAQ* folder in the control panel to check if your installation was successful.

If you are running on Windows 2000 and it detects a new device simply install a default driver, or so called placeholder. This will disable the device in the plug and play manager. The NT driver will take control of the device.



3. Interconnections

PCI62C has connectors for digital inputs, outputs and optically isolated inputs. The main connector, situated on the PCB, is compatible with the ISA version, the PC62C. There are 3 internal connectors that can be brought outside the computer casing via a standard ribbon cable with a bracket. All of these cables are supplied a standard accessories with the PCI62C.

External Connector and Accessories

Depending on the version of PCI62C more connectors will be populated on the board. The tables below give the pinouts for all connectors, even when using the internal connector cables.

Board Type	DB37(F) External	IDC40 Internal	DB37(M) External (IRC)
PCI62C16	1	1	1
PCI62C32	1	2	2
PCI62C48	1	3	3

Table 3-1 PCI 62C Connectors

Common Line Connections

An Opto-isolator has two connections, a positive and a negative or return connection. Some applications the negative is a common signal and therefore can be wired much simpler. The board has jumpers for connecting these signals and making the connections available on the COMX signal. The table below shows the relation between the jumpers and opto-isolators.

Signal Name	Location	Opto
COMA	H2	0-7
COMB	H1	8-15
COMC	H3	16-23
COMD	H4	24-31
COME	H6	32-39
COMF	H7	40-47

Table 3-2 Common Line Connectors

Pin Assignments

PCI 62C/16/32/48 – DB37 (F) External Opto 0-15

The table below shows the pin assignments for the DB37 (F) connector found on the entire PCI 62C series. It is the main connector found on all the boards. This connector is also compatible with the older ISA version, the PC62C.

Pin	Name	Pin	Name
1	OPTO0+	20	OPTO8+
2	OPTO0-	21	OPTO8-
3	OPTO1+	22	OPTO9+
4	OPTO1-	23	OPTO9-
5	OPTO2+	24	OPTO10+
6	OPTO2-	25	OPTO10-
7	OPTO3+	26	OPTO11+
8	OPTO3-	27	OPTO11-
9	OPTO4+	28	OPTO12+
10	OPTO4-	29	OPTO12-
11	OPTO5+	30	OPTO13+
12	OPTO5-	31	OPTO13-
13	OPTO6+	32	OPTO14+
14	OPTO6-	33	OPTO14-
15	OPTO7+	34	OPTO15+
16	OPTO7-	35	OPTO14-
17	COMA	36	COMB
18	+12V_FUSED	37	DGND
19	+5V_FUSED		

Table 3-3 PCI 62C External Connector – DB37 (M)

PCI 62C – IDC40 (M) Internal Digital I/O Connector

The table below shows the pin assignments for the IDC40 (M) connector found on the PCI 62C/16/32/48. This connector is used for digital inputs and outputs.

Pin	Name	Pin	Name
1	DO0	2	DO1
3	DO2	4	DO3
5	DO4	6	DO5
7	DO6	8	DO7
9	DO8	10	DO9
11	DO10	12	DO11
13	DO12	14	DO13
15	DO14	16	DO15
17	DGND	18	DGND
19	DI0	20	DI1
21	DI2	22	DI3
23	DI4	24	DI5
25	DI6	26	DI7
27	DI8	28	DI9
29	DI10	30	DI11
31	DI12	32	DI13
33	DI14	34	DI15
35	DGND	36	DGND
37	+5V_FUSED	38	DGND
39	DGND	40	+5V_FUSED

Table 3-4 PCI 62C/16/32/48 Digital I/O IDC40 (M) Connector

PCI 62C – DB37 (M) – External Digital I/O Connector

The table below shows the pin assignments for the DB37 (M) connector found on the supplied internal ribbon cable (IRC) supplied with the PCI 62C/16/32/48. This connector is used for digital inputs and outputs.

Pin	Name	Pin	Name
1	DI0	20	DI1
2	DI2	21	DI3
3	DI4	22	DI5
4	DI6	23	DI7

5	DI8	24	DI9
6	DI10	25	DI11
7	DI12	26	DI13
8	DI14	27	DI15
9	DGND	28	DGND
10	DO0	29	DO1
11	DO2	30	DO3
12	DO4	31	DO5
13	DO6	32	DO7
14	DO8	33	DO9
15	DO10	34	DO11
16	DO12	35	DO13
17	DO14	36	DO15
18	DGND	37	DGND
19	+5V_FUSED		

Table 3-5 PCI 62C/16/32/48 Digital I/O DB37 (M) Connector

PCI 62C16 – IDC40 (M) Internal Opto 16-31 and 32-47

The table below shows the pin assignments for the IDC40 (M) connector found on the PCI 62C/16/32/48. This connector is used for optically isolated inputs.

Pin	Name	Pin	Name
1	OPTO16+	2	OPTO16-
3	OPTO17+	4	OPTO17-
5	OPTO18+	6	OPTO18-
7	OPTO19+	8	OPTO19-
9	OPTO20+	10	OPTO20-
11	OPTO21+	12	OPTO21-
13	OPTO22+	14	OPTO22-
15	OPTO23+	16	OPTO23-
17	OPTO24+	18	OPTO24-
19	OPTO25+	20	OPTO25-
21	OPTO25+	22	OPTO25-
23	OPTO27+	24	OPTO27-
25	OPTO28+	26	OPTO28-
27	OPTO29+	28	OPTO29-
29	OPTO30+	30	OPTO30-
31	OPTO31+	32	OPTO31-
33	COMC	34	COMD
35	DGND	36	DGND
37	+5V_FUSED	38	DGND
39	+5V_FUSED	40	DGND

Table 3-6 PCI 62C/16/32/48 Internal Opto-Isolated Connector

PCI 62C – DB37 (M) – External Opto 16-31 and 32-47

The table below shows the pin assignments for the DB37 (M) connector found on the supplied internal ribbon cable (IRC) supplied with the PCI 62C/16/32/48. This connector is used for digital inputs and outputs.

Pin	Name	Pin	Name
1	OPTO0+	20	OPTO8+
2	OPTO0-	21	OPTO8-
3	OPTO1+	22	OPTO9+
4	OPTO1-	23	OPTO9-
5	OPTO2+	24	OPTO10+
6	OPTO2-	25	OPTO10-
7	OPTO3+	26	OPTO11+
8	OPTO3-	27	OPTO11-
9	OPTO4+	28	OPTO12+
10	OPTO4-	29	OPTO12-
11	OPTO5+	30	OPTO13+
12	OPTO5-	31	OPTO13-
13	OPTO6+	32	OPTO14+
14	OPTO6-	33	OPTO14-
15	OPTO7+	34	OPTO15+
16	OPTO7-	35	OPTO14-
17	COMA	36	COMB
18	DGND	37	DGND

19	+5V_FUSED	
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Table 3-7 PCI 62C/16/32/48 External Opto-Isolated Connector

Signal Definitions

This sections deal with all the signals abbreviations.

Signal	Description
OPTOX+	Positive opto-isolated input
OPTOX-	Negative or common opto-isolated input
DIX	Digital input
DOX	Digital output
DGND	Digital ground.
+5V_FUSED	Fused +5V power supply 200mA
+12V_FUSED	Fused +12V power supply line (MAX 200mA).
COMX	Common opto-isolated input.
NC	Not Connected

Table 3-8 Signal definitions

Pin Descriptions

Digital Inputs DI0-15

This is the digital input port and it is 16-bits wide.

Digital Outputs D00-15

This is the digital output port and it is 16-bits wide.

OPTO0-47

These are the optically isolated lines and each line can have it's own reference or can be connected to a sets common pin. This is jumper selectable on the card.

COMA-F

These are the common pins for each set of 8 lines.

+5V Power Pin (+5V)

This is a +5 volt fused power pin.

+12V Power Pin (+12V)

This is a +12 volt fused power pin.

Digital Ground (DGND)

All digital ground signals should be connected to this pin.

4

4. Programming Guide

The PCI62C series is supplied with a complete software development kit. EDR Enhanced (EDRE SDK) comes with drivers for many operating systems and a common application program interface (API). The API also serves as a hardware abstraction layer (HAL) between the control application and the hardware. The EDRE API makes it possible to write an application that can be used on all hardware with common sub-systems.

The PCI62C series can also be programmed at register level, but it is not recommended. A detailed knowledge of the PCI62C series is needed and some knowledge about programming Plug and Play PCI devices. We recommend that you only make use of the software provided by Eagle Technology.

EDR Enhanced API

The EDR Enhanced SDK comes with both ActiveX controls and a Windows DLL API. Examples are provided in many different languages and serve as tutorials. EDRE is also supplied with a software manual and user's guide.

The EDRE API hides the complexity of the hardware and makes it really easy to program the PCI62C board. It has got functions for each basic sub-system and is real easy to learn.

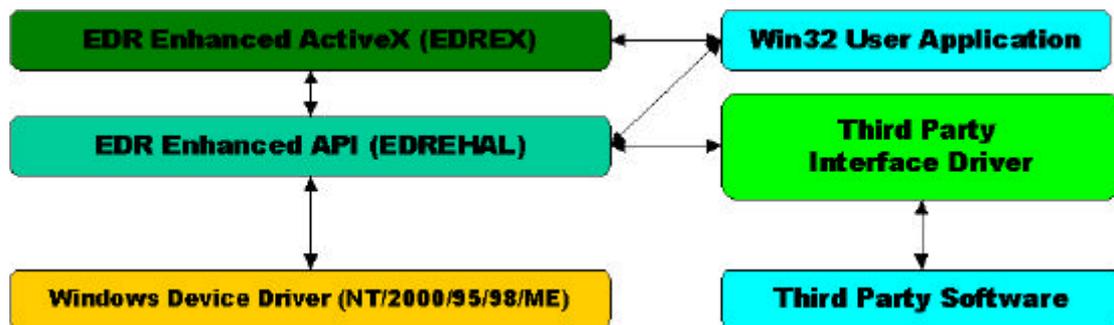


Figure 4-1 EDR Enhanced Design

Digital Inputs/Outputs

The PCI62C digital I/O ports and optically isolated port are controlled and read via the digital I/O command. The digital I/O ports can be read or write to. The optically isolated ports can be read by digital input command.

Reading the Digital Inputs

A single call is necessary to read a digital I/O port or an opto-isolated port.

API-CALL

*Long EDRE_DioRead(ulng Sn, ulng Port, ulng *Value)*

The serial number, port, and a pointer to variable to hold the result must be passed by the calling function. A return code will indicate if any errors occurred.

ACTIVEX CALL

Long EDREDioX.Read(long Port)

Only the port-number needs to be passed and the returned value will either hold an error or the value read. If the value is negative an error did occur.

Writing to the Digital Outputs

A single call is necessary to write to a digital I/O port.

API-CALL

Long EDRE_DioWrite(ulng Sn, ulng Port, ulng Value)

The serial number, port, and a value must be passed by the calling function. A return code will indicate if any errors occurred.

ACTIVEX CALL

Long EDREDioX.Write(long Port, ulng Value)

The port number and value to be written needs to be passed and the returned value holds an error or the value read. If the value is negative an error did occur.

Port Assignments

Port	Type	Assigned Number	Width	Description
PCI62C16				
Digital Input	Digital logic	0	16-bits	Digital inputs 0-15
Digital Output	Digital logic	0	16-bits	Digital outputs 0-15
Opto 0-15	Opto-isolated	1	16-bits	Optically isolated lines 0-15
PCI62C32				
Digital Input	Digital logic	0	16-bits	Digital inputs 0-15
Digital Output	Digital logic	0	16-bits	Digital outputs 0-15
Opto 0-15	Opto-isolated	1	16-bits	Optically isolated lines 0-15
Opto 16-31	Opto-isolated	2	16-bits	Optically isolated lines 16-31
PCI62C48				
Digital Input	Digital logic	0	16-bits	Digital inputs 0-15
Digital Output	Digital logic	0	16-bits	Digital outputs 0-15
Opto 0-15	Opto-isolated	1	16-bits	Optically isolated lines 0-15
Opto 16-31	Opto-isolated	2	16-bits	Optically isolated lines 16-31
Opto 32-47	Opto-isolated	3	16-bits	Optically isolated lines 32-47

Table 4-1 Port Assignments

Programming Interrupts

The PCI62C can generate interrupts from different sources, which include digital inputs and opto-isolaters. The interrupt sub-system is totally programmable and includes functions to configure, enable and disable interrupts.

WARNING!

Be careful when programming the interrupt sub-system because it is easy to generate interrupts that is faster than what Windows can service. Don't try and generate interrupts faster than 10KHz. This will not work. Remember this is 10KHz in total, and not per source. The PCI62C interrupt service routine will stop servicing interrupts if at any stage it is still busy with a previous interrupt and the next one is generated.

Configuring the Interrupt sub-system

A single call is necessary to configure the interrupt sub-system.

API-CALL

Long EDREIntX.IntConfigure(long Source, long Mode, long Type)

Parameter	Type	Description	
Source	long	Source	
		Description	
		0	Digital Input
		1	Opto All
		2	Opto 0-15
Mode	long	3	Opto 16-31
		4	Opto 32-47
Type	long	Disable or Enable a source	
RETURN	Long	0 : Disable	
		1 : Enable	
		Not Used	
		This parameter contains the error code return. If =0 then no error occurred.	

Table 4-2 EDREIntX.Configure Parameters

Enabling Interrupts

A single call is necessary to enable the interrupt sub-system. This will also enable the global interrupt on the PCI62C and connect it to the PCI Bus.

ACTIVEX-CALL

Long EDREIntX.Enable

A returned error code will contain the status of the call.

Disabling Interrupts

A single call is necessary to disable the interrupt sub-system.

ACTIVEX-CALL

Long EDREIntX.Disable

A returned error code will contain the status of the call.

Interrupt Event

If interrupts are enabled an event will occur on each interrupt. The interrupt control's interrupt event will be triggered. The source of the interrupt will also be passed to the event handler.

ACTIVEX-CALL

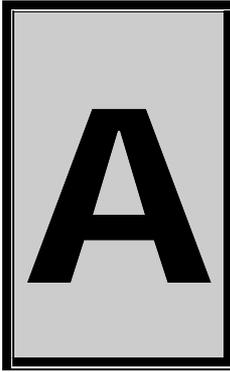
Interrupt(long Source)

The source is the value read from the interrupt status register of the PCI62C device. The sources are binary weighted. See table below.

Source Value	Interrupt	Actual source
1	Digital Input	0
2	Opto All	1

4	Opto 0-15	2
8	Opto 16-31	3
16	Opto 32-47	4

Table 4-3 Event Source



A. Specifications

Digital Input/Output Characteristics

Number of Digital Channels:

Device	Inputs	Outputs
PCI 62C16	16	16
PCI 62C32	16	16
PCI 62C48	16	16

Compatibility:

TTL

D.C Characteristics

Level	Min	Max
Input Low Voltage	0.0V	0.8V
Input High Voltage	2.0V	5.3V
Output High Voltage	2.4V	
Output Low Voltage		0.45V
Output Current		20mA

Opto-Isolators

Number of Channels:

Device	Channels
PCI 62C16	16
PCI 62C32	32
PCI 62C48	48

Input Characteristics

Characteristic	Description
Compatibility	TTL/ANALOG
Input High Voltage – LOGIC 1	3.1V to 24V
Input Low Voltage – LOGIC 0	0V to 3V
Isolation Voltage	450V rms
Maximum Reverse Voltage	50V
Peak On Current	1A, Pulse 300ms, 2% Cycle
Operating On Current	20 mA
Max forward current	50 mA

Bus Interface

Bus Type

IBM PCI Compatible Revision 2.1 Compliant

Controller

Slave

Voltage

3.3V or 5V

Power Requirements

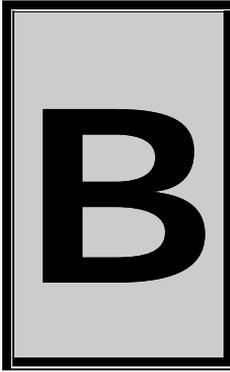
Specification	PCI62C16	PCI62C32	PCI62C48
+5V Internal Typical	350 mA	400 mA	450 mA
+5V External (DB37)	200mA Fused	200mA Fused	200mA Fused
+12V External (DB37)	200mA Fused	200mA Fused	200mA Fused
+5V External (IDC40 – Digital I/O)	200mA Fused	200mA Fused	200mA Fused
+5V External (IDC40 – Opto 0-15)	200mA Fused	None	None
+5V External (IDC40 – Opto 16-31)	200mA Fused	200mA Fused	None
+5V External (IDC40 – Opto 32-47)	200mA Fused	200mA Fused	200mA Fused

Dimensions

PCI 62C	182 mm x 99 mm
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Connectors

PCI62C16	DB37 (M) External & IDC40 (M) Internal
PCI62C32	DB37 (M) External & 2 x IDC40 (M) Internal
PCI62C48	DB37 (M) External & 3 x IDC40 (M) Internal



B. Configuration Constants

Query Codes

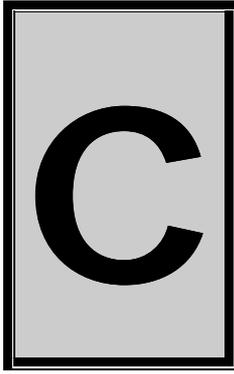
Name	Value	Description
APIMAJOR	1	Query EDRE API major version number.
APIMINOR	2	Query EDRE API minor version number.
APIBUILD	3	Query EDRE API build version number.
APIOS	4	Query EDRE API OS type.
APINUMDEV	5	Query number of devices installed.
BRDTYPE	10	Query a board's type.
BRDREV	11	Query a board's revision.
BRDYEAR	12	Query a board's manufactured year.
BRDMONTH	13	Query a board's manufactured month.
BRDDAY	14	Query a board's manufactured day.
BRDSERIALNO	15	Query a board's serial number.
DRVMAJOR	20	Query a driver's major version number.
DRVMINOR	21	Query a driver's minor version number.
DRVBUILD	22	Query a driver's build version number.
ADNUMCHAN	100	Query number of ADC channel.
ADNUMSH	101	Query number of samples-and-hold channels.
ADMAXFREQ	102	Query maximum sampling frequency.
ADBUSY	103	Check if ADC system is busy.
ADFIFOSIZE	104	Get ADC hardware FIFO size.
ADFIFOOVER	105	Check for FIFO overrun condition.
ADBUFFSIZE	106	Check software buffer size.
ADBUFFOVER	107	Check for circular buffer overrun.
ADBUFFALLOC	108	Check if software buffer is allocated.
ADUNREAD	109	Get number of samples available.
ADEXTCLK	110	Get status of external clock line – PCI30FG.
ADEXTTRIG	111	Get status of external trigger line – PCI30FG.
ADBURST	112	Check if burst mode is enabled.
ADRANGE	113	Get ADC range.
DANUMCHAN	200	Query number of DAC channels.
DAMAXFREQ	201	Query maximum DAC output frequency.
DABUSY	202	Check if DAC system is busy.
DAFIFOSZ	203	Get DAC FIFO size.
CTNUM	300	Query number of counter-timer channels.
CTBUSY	301	Check if counter-timer system is busy.
DIONUMPORT	400	Query number of digital I/O ports.
DIOQRYPORT	401	Query a specific port for capabilities.
DIOPORTWIDTH	402	Get a specific port's width.
INTNUMSRC	500	Query number of interrupts sources.
INTSTATUS	501	Queries interrupt system's status.
INTBUSCONNECT	502	Connect interrupt system to bus.
INTISAVAILABLE	503	Check if an interrupt is available.
INTNUMTRIG	504	Check number times interrupted

Error Codes

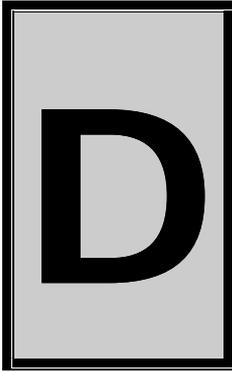
Name	Value	Description
EDRE_OK	0	Function successfully.
EDRE_FAIL	-1	Function call failed.
EDRE_BAD_FN	-2	Invalid function call.
EDRE_BAD_SN	-3	Invalid serial number.
EDRE_BAD_DEVICE	-4	Invalid device.
EDRE_BAD_OS	-5	Function not supported by operating system.
EDRE_EVENT_FAILED	-6	Wait on event failed.
EDRE_EVENT_TIMEOUT	-7	Event timed out.
EDRE_INT_SET	-8	Interrupt in use.
EDRE_DA_BAD_RANGE	-9	DAC value out of range.
EDRE_AD_BAD_CHANLIST	-10	Channel list size out of range.
EDRE_BAD_FREQUECY	-11	Frequency out of range.
EDRE_BAD_BUFFER_SIZE	-12	Data passed by buffer incorrectly sized
EDRE_BAD_PORT	-13	Port value out of range.
EDRE_BAD_PARAMETER	-14	Invalid parameter value specified.
EDRE_BUSY	-15	System busy.
EDRE_IO_FAIL	-16	IO call failed.
EDRE_BAD_ADGAIN	-17	ADC-gain out of range.
EDRE_BAD_QUERY	-18	Query value not supported.
EDRE_BAD_CHAN	-19	Channel number out of range.
EDRE_BAD_VALUE	-20	Configuration value specified out of range.
EDRE_BAD_CT	-21	Counter-timer channel out of range.
EDRE_BAD_CHANLIST	-22	Channel list invalid.
EDRE_BAD_CONFIG	-23	Configuration invalid.
EDRE_BAD_MODE	-24	Mode not valid.
EDRE_HW_ERROR	-25	Hardware error occurred.
EDRE_HW_BUSY	-26	Hardware busy.
EDRE_BAD_BUFFER	-27	Buffer invalid.
EDRE_REG_ERROR	-28	Registry error occurred.
EDRE_OUT_RES	-29	Out of resources.
EDRE_IO_PENDING	-30	Waiting on I/O completion

Digital I/O Codes

Name	Value	Description
DIOOUT	0	Port is an output.
DIOIN	1	Port is an input.
DIOINOROUT	2	Port can be configured as in or out.
DIOINANDOUT	3	Port is an input and an output.



C.Layout Diagram



D. Ordering Information

For ordering information please contact Eagle Technology directly or visit our website www.eagle.co.za. They can also be emailed at eagle@eagle.co.za.

Board	Description
PCI 62C16	16 Channel Optically Isolated PCI card
PCI 62C32	32 Channel Optically Isolated PCI card
PCI 62C48	48 Channel Optically Isolated PCI card

Table D-1 Ordering Information