

OPTOIO-PCI16 EXTENDED

EDV-No.: A-429400

16 Optocoupler Isolated Digital Inputs
(8 Inputs interrupt capable)
16 Optocoupler Isolated Digital Outputs
24 TTL Inputs/Outputs
3 * 16-Bit Counter - interrupt capable

wasco[®]

user's guide

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1. Introduction

The **wasco**[®] interface card OPTOIO-PCI16_{Extended} provides 16 digital inputs and 16 digital outputs, each channel is galvanically isolated by optocouplers of high quality and additionally protected against harmful overvoltage peaks by protection diodes. All input optocouplers have integrated Schmitt Trigger Function. Special high power output optocouplers manage a maximum switching current of 150 mA. There are two different voltage ranges easily adjustable by changing resistors in sockets. Triggering the interrupt is possible by 8 of the 16 optocoupler inputs or time-dependent across the timer or counter IC, combined with a quartz crystal oscillator. 24 TTL compatible digital inputs / outputs are at proposal for any other control tasks. The signals of the output optocouplers are led to a 37-pin D-Sub connector mounted to the board's slot bracket. Optocoupler inputs and TTL inputs and outputs likewise are fed to two box headers.

Pin assignment and input voltage ranges are compatible with ISA bus card OPTOIO-16_{EXTENDED}.

2. Installation of the OPTOIO-PCI16_{EXTENDED}

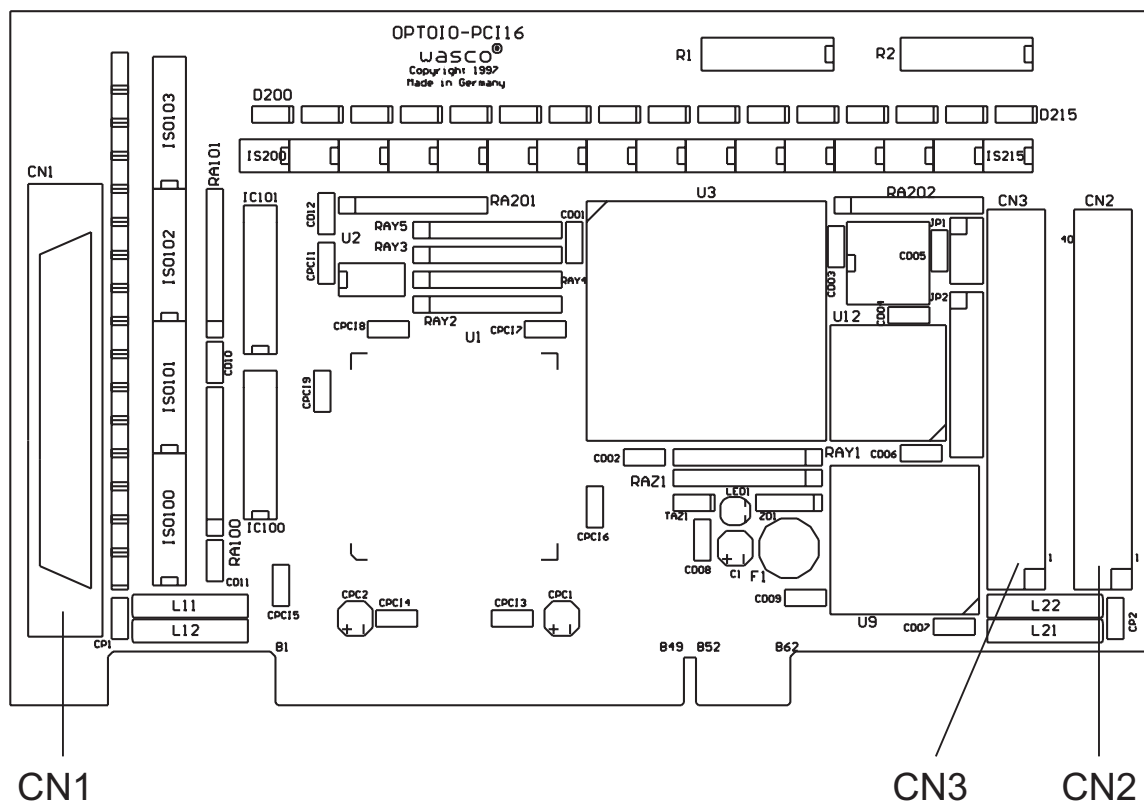
2.1 How to Install the Card into your System

Before you insert the card unplug the power plug or make sure, there is no current to/in the computer. Inserting the interface card in a running system may cause damaging or destroying the OPTOIO-PCI16 and even other previously installed cards.

Select an empty PCI slot of your computer to insert the card. Please refer to the computer's manual for support. Secure the OPTOIO-PCI16 from loss of connection by screwing the mounting bracket to the casing of the computer.

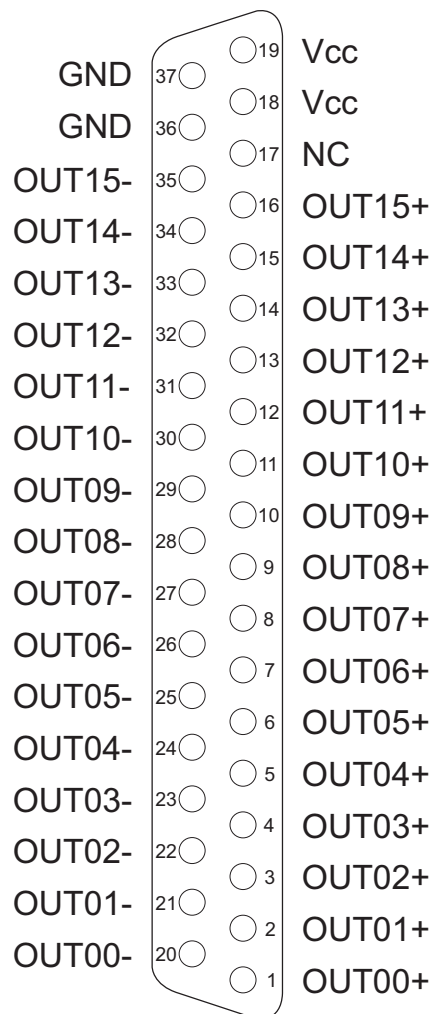
3. Connectors

3.1 Position of the Connector Plugs



- CN1: Optocoupler outputs OUT00...OUT15
- CN2: Optocoupler inputs IN00...IN15
- CN3: Signals of the timer and of the TTL I/O IC

3.2 Pin assignment of CN1



Vcc:

Connector for internal voltage power supply (+ 5V) (an inductor must be soldered on L11),
Never apply an external voltage across this pin.

GND:

Ground connection (only when an inductor is soldered to L12)

NC:

not connected

3.3 Pin assignment of CN2

NC	40	39	NC
NC	38	37	Vcc
GND	36	35	Vcc
GND	34	33	NC
IN15-	32	31	IN15+
IN14-	30	29	IN14+
IN13-	28	27	IN13+
IN12-	26	25	IN12+
IN11-	24	23	IN11+
IN10-	22	21	IN10+
IN09-	20	19	IN09+
IN08-	18	17	IN08+
IN07-	16	15	IN07+
IN06-	14	13	IN06+
IN05-	12	11	IN05+
IN04-	10	9	IN04+
IN03-	8	7	IN03+
IN02-	6	5	IN02+
IN01-	4	3	IN01+
IN00-	2	1	IN00+

Vcc:

Connector for internal voltage power supply (+ 5V) (an inductor must be soldered on L21),
Never apply an external voltage across this pin.

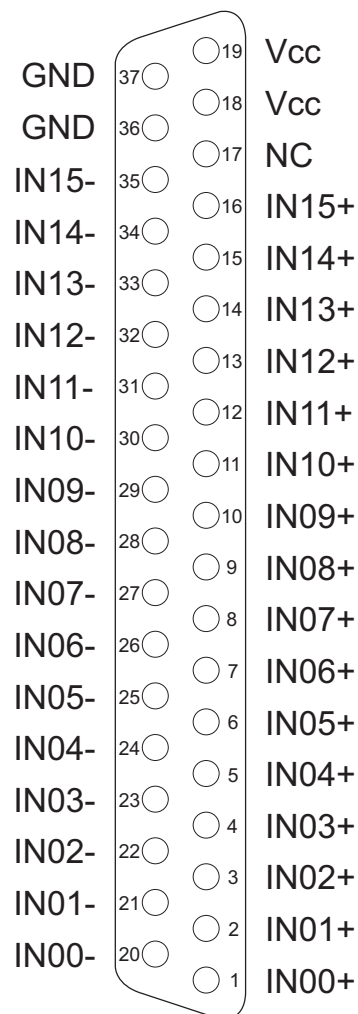
GND:

Ground (only when an inductor is soldered to L22).

NC:

not connected

3.4 Pin assignment of CN2 on D-Sub37 (flat ribbon cable)



Vcc:

Connector for internal voltage power supply (+ 5V) (an inductor must be soldered on L21),
Never apply an external voltage across this pin.

GND:

Ground (only when an inductor is soldered to L22).

NC:

not connected

3.5 Pin assignment of CN3

NC	40	39	NC
NC	38	37	Vcc
GND	36	35	Vcc
GND	34	33	OUT2
G2	32	31	CLK2
OUT1	30	29	G1
CLK1	28	27	OUT0
G0	26	25	CLK0
PC7	24	23	PC6
PC5	22	21	PC4
PC3	20	19	PC2
PC1	18	17	PC0
PB7	16	15	PB6
PB5	14	13	PB4
PB3	12	11	PB2
PB1	10	9	PB0
PA7	8	7	PA6
PA5	6	5	PA4
PA3	4	3	PA2
PA1	2	1	PA0

Vcc:

Connector for internal voltage power supply (+ 5V). **Never apply an external voltage across this pin!**

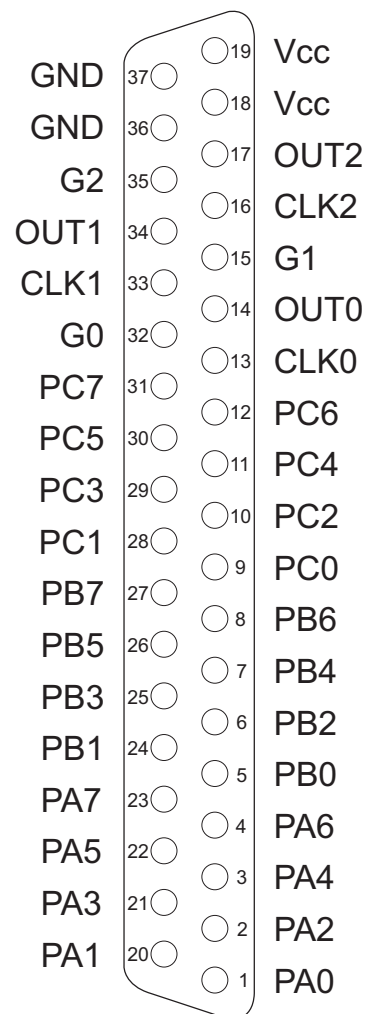
GND:

Ground

NC:

Not connected

3.6 Pin assignment of CN3 on D-Sub37 (flat ribbon cable)



Vcc:

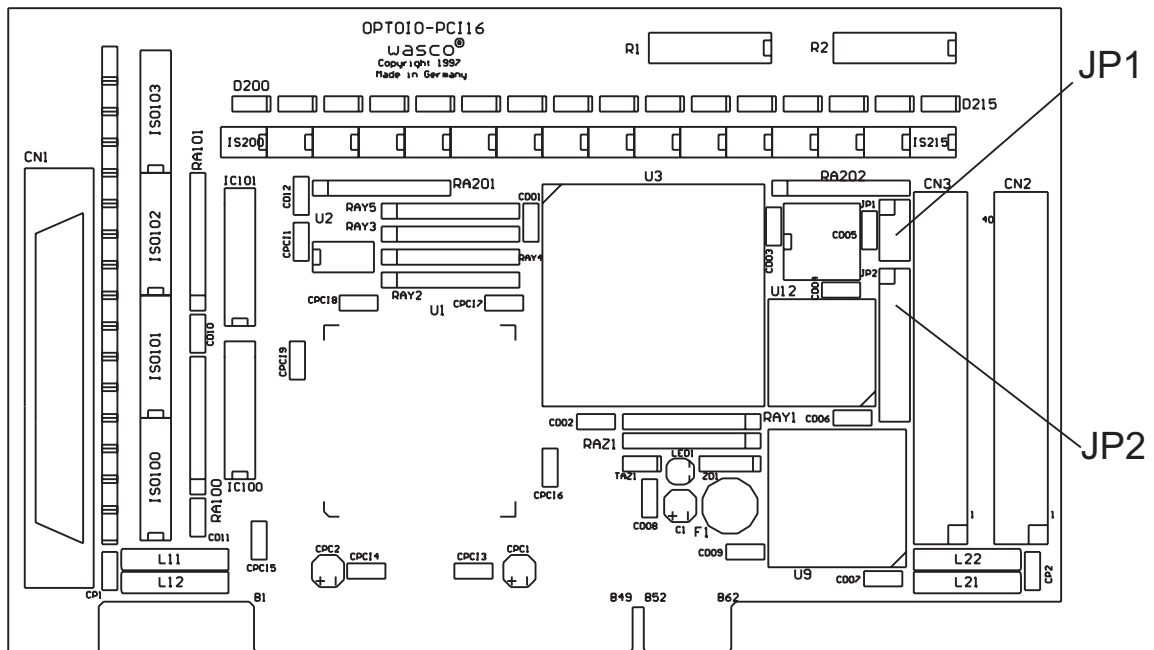
Connector for internal voltage power supply (+ 5V). **Never apply an external voltage across this pin!**

GND:

Ground

4. Jumper Blocks

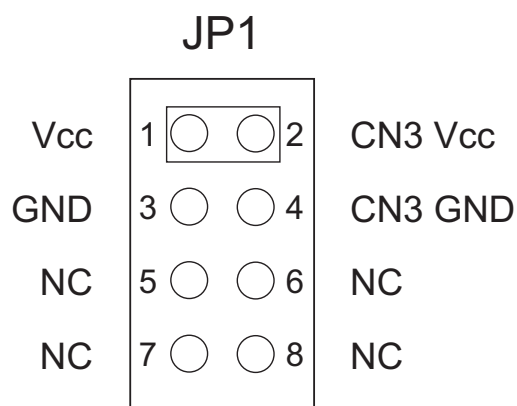
4.1 Position of the Jumpers on the Board



JP1: Connection of the internal voltage power supply to the connector CN3

JP2: Jumper block for using the timer

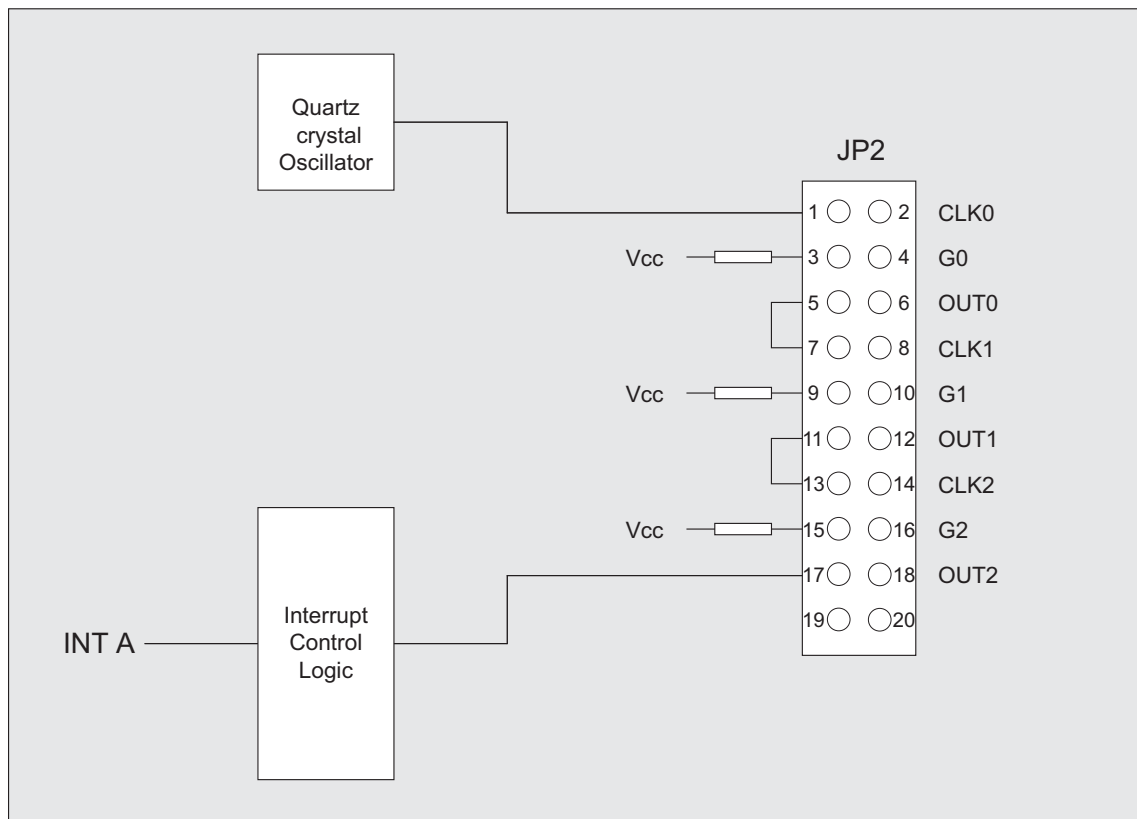
4.2 Jumper Block Assignment JP1



If you set the jumpers JP1/1-2 and 3-4 it is possible to allocate the internal voltage power supply (+ 5V) as well as the ground of the PC to pin header CN3.

Jumper setting at delivery: JP1/5-6, 7-8

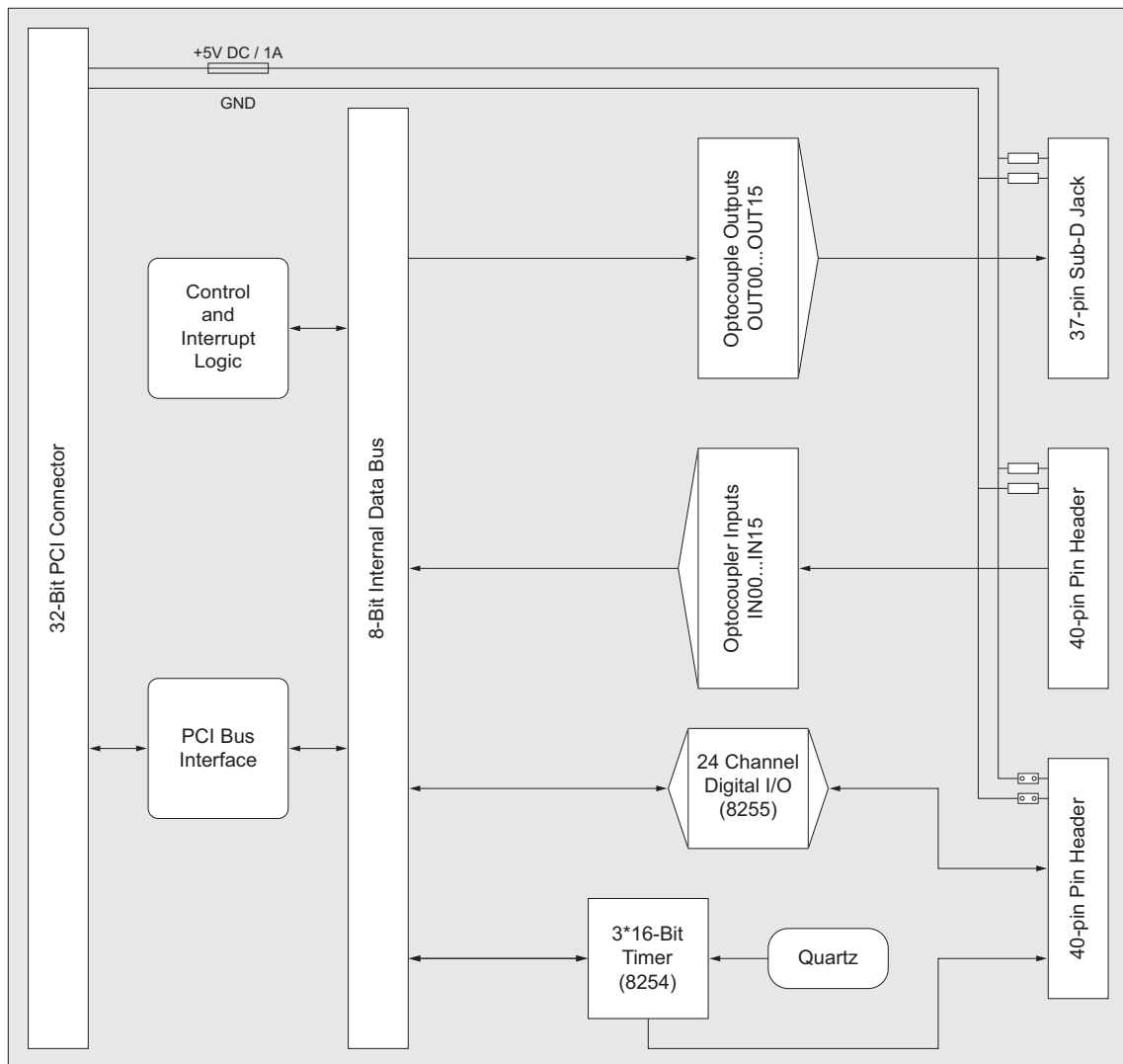
4.3 Jumper Block Assignment JP2



Caution: The jumper connection 19/20 serves for internal test purposes only and must not be set by the user!

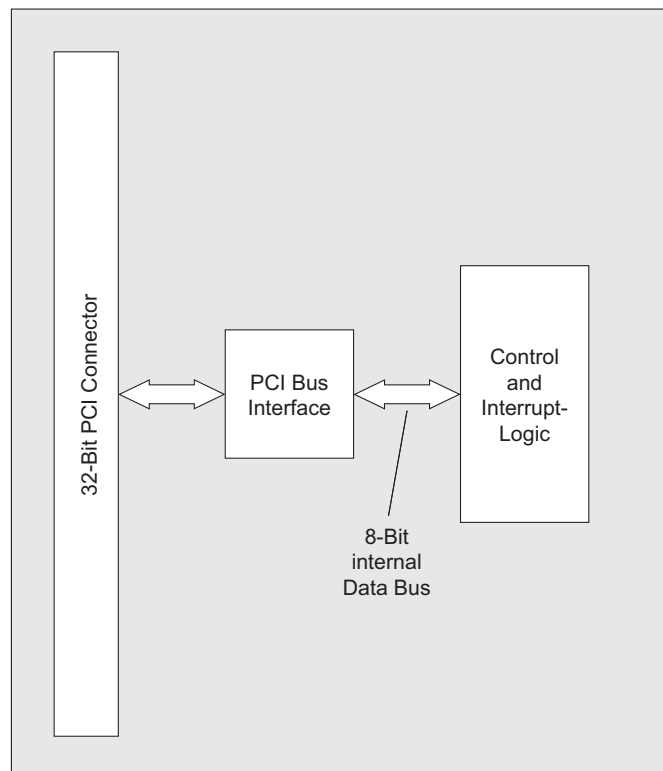
5. System Components

5.1 Block Diagram



5.2 Access to the System Components

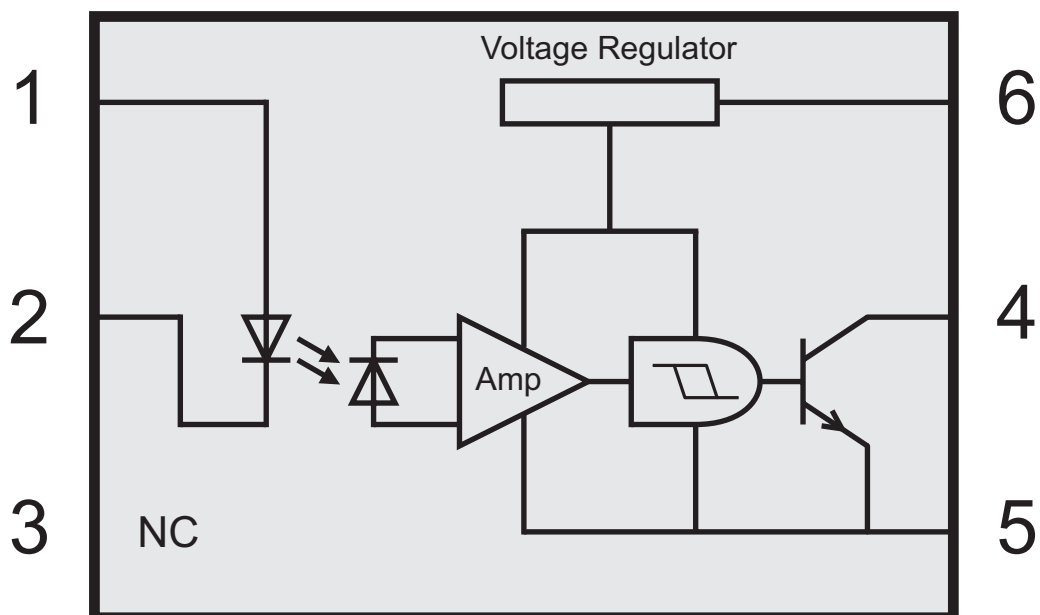
Access to the hardware components is made by reading and writing port addresses by library functions. The relevant port addresses for OPTOIO-PCI16 depend on the base address given by the PCI BIOS. Port access to the OPTOIO-PCI16 is made by byte access (8-Bit) only, word or double word accesses are not suitable. (Please find further information in chapter Programming or in the provided samples on the enclosed CD)



6. 16 Optocoupler Inputs

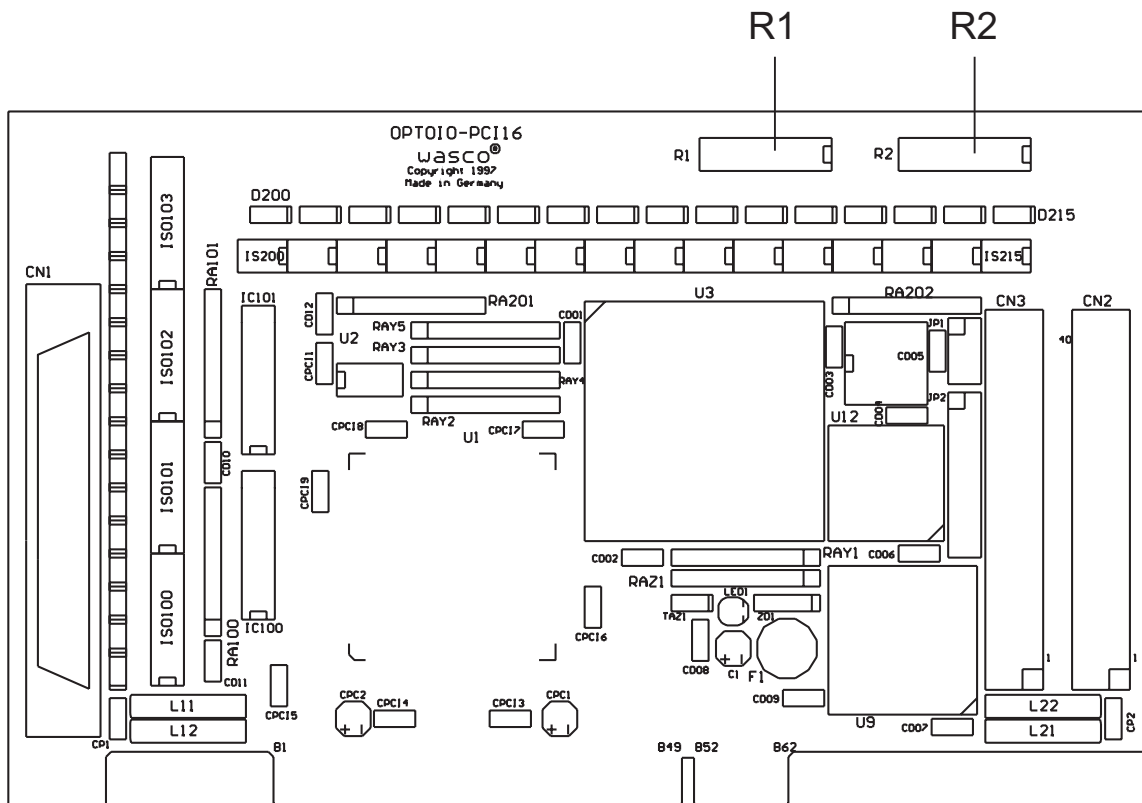
The OPTOIO-PCI16_{Extended} provides 16 input channels which are optically isolated. The isolation voltage between GND and input is 500 V_{DC}. The voltage within the input channels is limited to 100 V_{DC}.

6.1 Pin Assignment of the Input Optocouplers



6.2 Input Voltage Ranges

Two different input voltage ranges can be selected by exchange of the resistors R1 and R2.



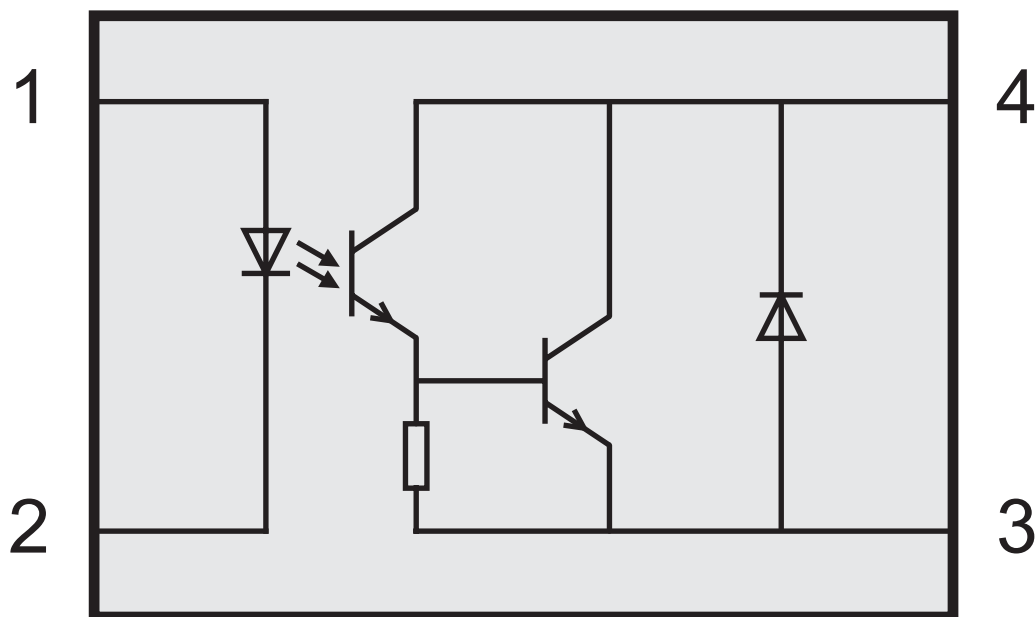
Following table shows the data of the two input voltage ranges:

Resistor R1, R2	Identifier	low	high
1,0 KOhm	102	0...1,5 V	2,2...15 V
4,7 KOhm	472	0...4,0 V	7,0...30 V

7. 16 Optocoupler Outputs

The OPTOIO-PCI16_{Extended} provides 16 output channels, which are optically isolated by optocouplers likewise. The isolation voltage between GND and the output is 500 V_{DC}.

7.1 Pin Assignment of the Output Optocoupler



7.2 Optocoupler Specifications

Voltage CE:	max. 50V
Voltage EC:	0,1V
Current CE:	150 mA

8. 24 TTL Inputs / Outputs (8255)

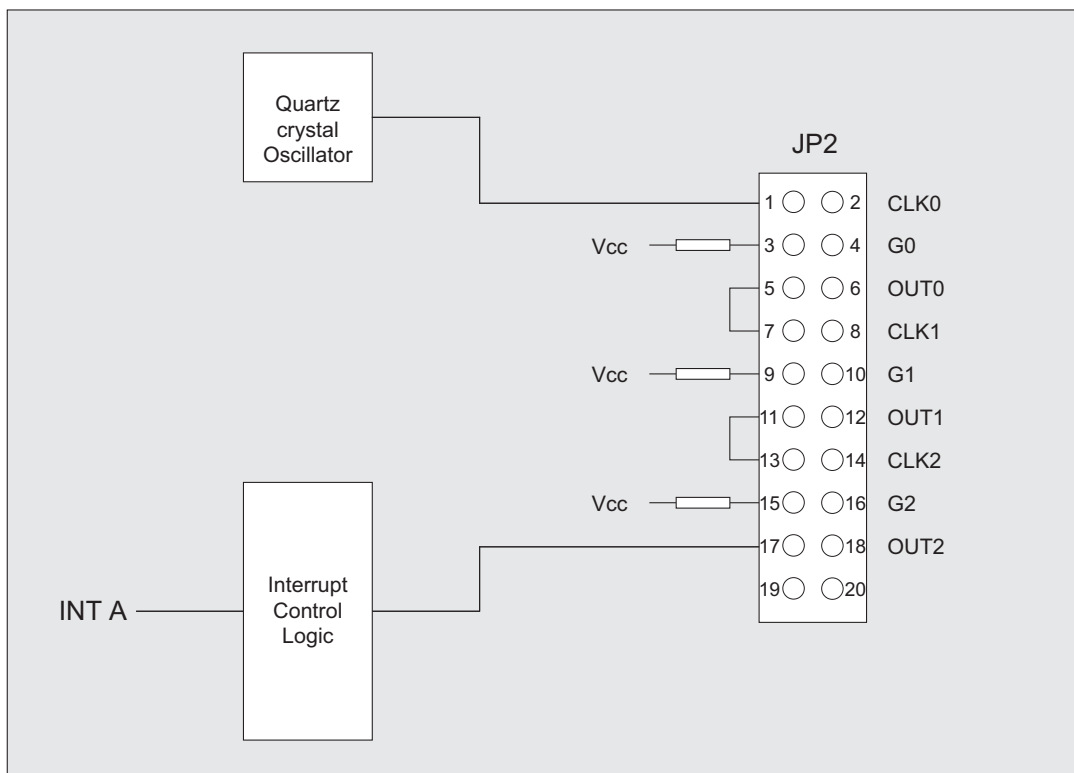
For digital input and output purposes an interface IC Type 8255 is implemented on OPTOIO-PCI16_{EXTENDED}. It has 24 I/O pins which may be individually programmed in two groups of 12 and used in 3 major modes of operation. In the first mode (MODE 0) each group of 12 I/O pins may be programmed in sets of 4 to be input or output. In MODE 1, the second one, each group may be programmed to have 8 lines of input or output. Of the remaining 4 pins, 3 are used for handshaking and interrupt signals. The third mode of operation (MODE 2) is a bidirectional bus mode which uses 8 lines for a bidirectional bus, and 5 lines, borrowing one from the other group, for handshaking.

Apart from that it is possible to set and reset single bits directly.

9. 3 * 16-Bit Counter (Timer 8254)

OPTOIO-PCI16 enables to generate time-controlled triggering of interrupts by combining the timer IC 8254 and a quartz crystal oscillator. All interrupt requests are forwarded to one of the PC's IRQs via PCI bus wire INT A. The PCI-PNP-BIOS of the computer issues the relevant IRQ number autonomously.

If you want to use the timer for generating time-controlled triggering of interrupts, you have to adjust the relevant connections on jumper block JP2. For this purpose set jumper connections 1-2 and 17-18 on jumper block JP2. The signal for triggering the interrupt (output OUT2 of counter 2) will be generated by appropriate programming of the counter and then forwarded to the interrupt logic. Interrupt requests are generated on OUT2 of the timer IC when logic level HIGH switches over to logic level LOW.

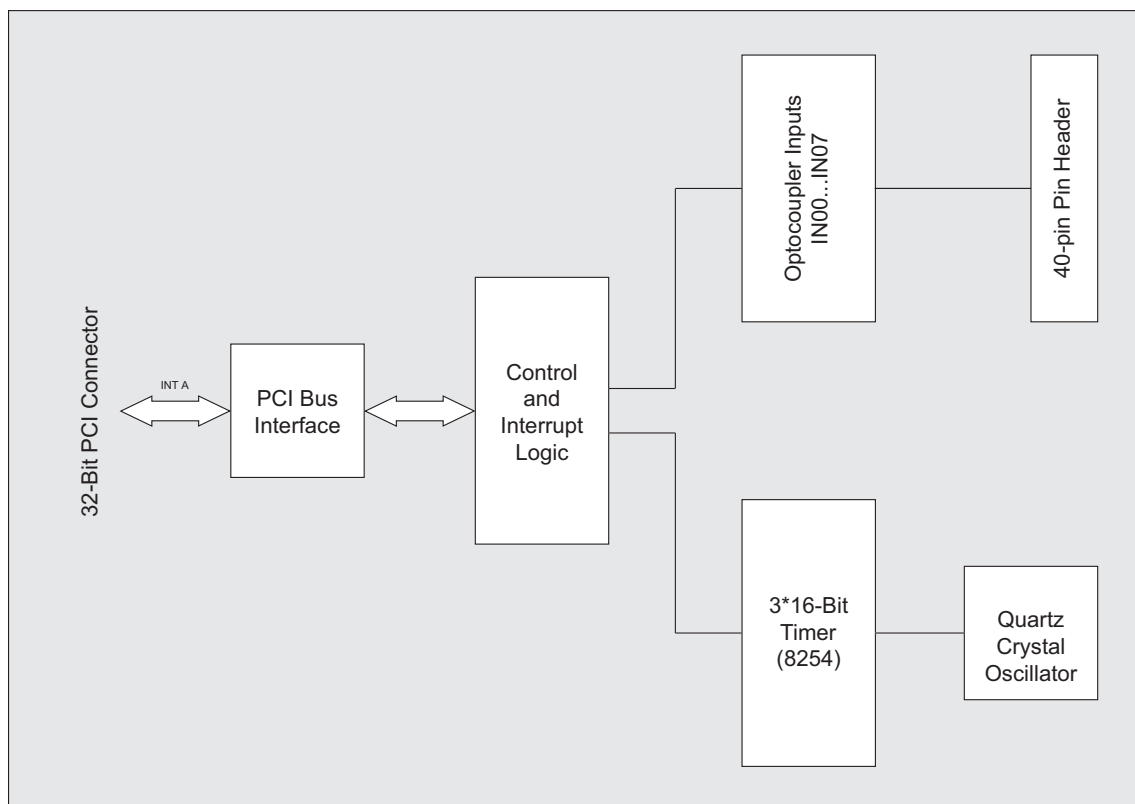


10. Interrupt

10.1 Interrupt Requests

OPTOIO-PCI16 can generate interrupt requests by the eight optocoupler inputs IN00...IN07 as well as time-dependent via the combination of 8254 timer IC and quartz crystal oscillator. All interrupt requests will be forwarded to one of the computer's IRQs via PCI bus wire INT A. The PCI-PNP-BIOS of the computer or the operating system respectively will issue the relevant IRQ number.

The communication between interrupt inputs of the OPTOIO-PCI16 and the PC is illustrated by following block diagram:



10.2 Triggering Interrupts across Optocoupler Inputs

Interrupt block:

[Optocoupler inputs IN00...IN07]

-> interrupt request by an edge rising edge (from logic level LOW to logic level HIGH) on at least one of the optocoupler inputs IN00...IN07.

This assumes that the software access to the OPTOIN interrupt control register is enabled!

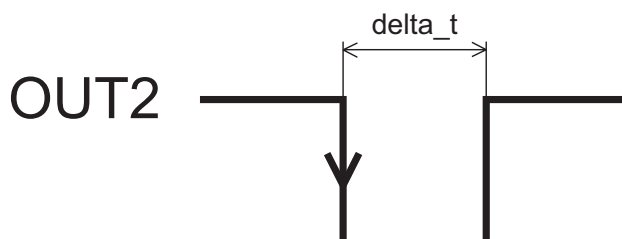
10.3 Time-Controlled Triggering of Interrupts

Interrupt block:

[Timer/Quartz oscillator]

-> interrupt request by a falling edge (from logic level HIGH to logic level LOW) on OUT2 of Timer 2 of IC 8254.

This assumes that the software access to the timer interrupt control register is enabled!



Interrupt at falling the edge (from High ---> Low) of OUT2
recommended: $\Delta t = 5 \mu\text{s}$

Interrupt requests of both of the interrupt blocks will be handled by a common interrupt service routine. Reading the interrupt status register and the OPTOIN interrupt input register enables to detect the request source. The interrupt requests of the interrupt inputs will be cached in the OPTOIN interrupt input register.

Interrupt requests remain preserved until reset by reading source specific reset addresses.

10.4 Interrupt Register

For programming interrupts of OPTOIO-PCI16 you can use following control, reading or reset registers:

Find more details in DOS examples on the enclosed CD for programming interrupts.

optoin_int_contr (port address BA + \$21, writing access):

Function: Release or lock OPTOIN interrupts IN00...IN07 by writing 0 or 1 to the register.

0 = lock

1 = release

optoin_int_reg (port address BA + \$E, reading access):

Function: detection of interrupt source of IN00...IN07 by reading this register

--> 00000001:	Optocoupler Interrupt IN00
--> 00000010:	Optocoupler Interrupt IN01
--> 00000100:	Optocoupler Interrupt IN02
--> 00001000:	Optocoupler Interrupt IN03
--> 00010000:	Optocoupler Interrupt IN04
--> 00100000:	Optocoupler Interrupt IN05
--> 01000000:	Optocoupler Interrupt IN06
--> 10000000:	Optocoupler Interrupt IN07

optoin_int_reset+q (port address BA + \$20 + source, reading access):

Function: Reset of interrupt source IN00...IN07 by reading this register

Reading of address BA + \$20 :	Reset OPTOIN interrupt IN00
Reading of address BA + \$21 :	Reset OPTOIN interrupt IN01
Reading of address BA + \$22 :	Reset OPTOIN interrupt IN02
Reading of address BA + \$23 :	Reset OPTOIN interrupt IN03
Reading of address BA + \$24 :	Reset OPTOIN interrupt IN04
Reading of address BA + \$25 :	Reset OPTOIN interrupt IN05
Reading of address BA + \$26 :	Reset OPTOIN interrupt IN06
Reading of address BA + \$27 :	Reset OPTOIN interrupt IN07

timer_int_contr (port address BA + \$22, writing access):

Function: Release or lock of timer interrupt by writing 0 oder 1 to the register.

0 = Lock

1 = Release

timer_int_reset (port address BA + \$28, reading access):

Function: Reset of timer interrupt by reading this register.

oio_int_status (port address LC + \$4C, reading access):

Function: Detection of the interrupt source (optoin_int or tim_int respectively) by reading this register.

For the detection please link the read byte with "AND" to \$20 or \$04

--> read byte "AND" \$20 = \$20 --> timer interrupt

--> read byte "AND" \$04 = \$04 --> OPTOIN interrupt

11. DOS[®] Programming

11.1 Programming of the OPTOIO-PCI16

The enclosed software provides library functions and programming examples to access OPTOIO-PCI16 under DOS[®]. You can program hardware components of the OPTOIO-PCI16 by access to port addresses. These addresses depend on the OPTOIO-PCI16's I/O base address (and LC base address) issued by the PCI-BIOS. You can determine I/O base address, LC base address and specified port addresses of each hardware components with help of initializing routines. Additionally you can access to further information such as IRQ number, localization of the card in your bus system or the card's version.

If you work with a programming language not (yet) provided by library functions, you can detect the PCI parameters of the OPTOIO-PCI16 with help of the programme "OIOSCAN" (-> in directory UTIL) .

PCI Parameter:

- I/O-Base Address
- IRQ Number
- LC-Base Address
- Bus Number
- Device Number
- Function Number
- OPTOIO Version

PCI Identification:

Device ID	=	\$9050
Vendor ID	=	\$10B5
Subsystem Vendor ID	=	\$10B5
Subsystem ID	=	\$114A

11.2 Allocation of Port Addresses

The port addresses of each hardware component depend on the I/O base address (BA) and LC base address (LC) as follows:

Port/Register	BA + Offset	RD/WR
Optocoupler Input Port A (IN00...IN07)	BA + \$0	RD
Optocoupler Input Port B (IN08...IN15)	BA + \$1	RD
Optocoupler Output Port A (OUT00...OUT07)	BA + \$2	WR
Optocoupler Output Port B (OUT08...OUT15)	BA + \$3	WR
8255-I/O-Port A	BA + \$4	RD/WR
8255-I/O-Port B	BA + \$5	RD/WR
8255-I/O-Port C	BA + \$6	RD/WR
8255-I/O-Control Register	BA + \$7	WR
8254-Timer 0	BA + \$8	RD/WR
8254-Timer 1	BA + \$9	RD/WR
8254-Timer 2	BA + \$A	RD/WR
8254-Timer Control Register	BA + \$B	RD/WR
OPTOIN-Interrupt Control Register	BA + \$21	WR
OPTOIN-Interrupt Input Register	BA + \$E	RD
OPTOIN-Interrupt-Reset IN00	BA + \$20	RD
OPTOIN-Interrupt-Reset IN01	BA + \$21	RD
OPTOIN-Interrupt-Reset IN02	BA + \$22	RD
OPTOIN-Interrupt-Reset IN03	BA + \$23	RD
OPTOIN-Interrupt-Reset IN04	BA + \$24	RD
OPTOIN-Interrupt-Reset IN05	BA + \$25	RD
OPTOIN-Interrupt-Reset IN06	BA + \$26	RD
OPTOIN-Interrupt-Reset IN07	BA + \$27	RD
Timer-Interrupt Control Register	BA + \$22	WR
Timer-Interrupt Reset Register	BA + \$28	RD
Interrupt Status Register (for OPTOIN and Timer Interrupts)	LC + \$4C	RD

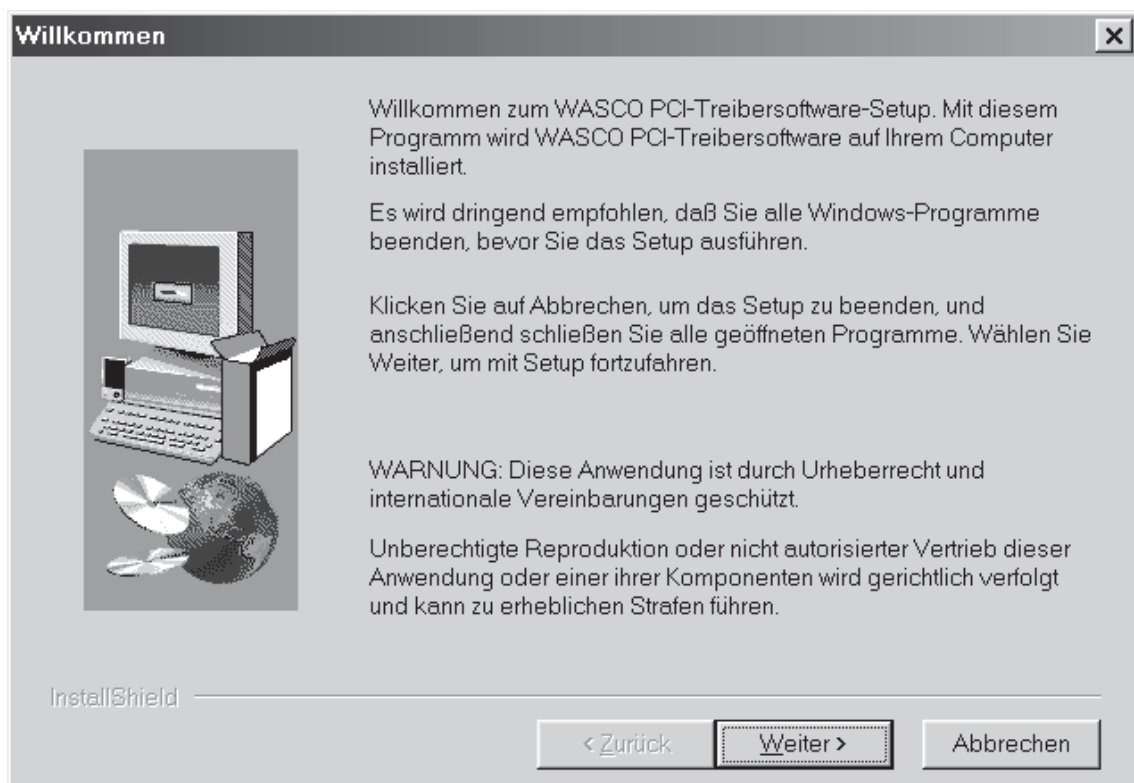
12. Windows[®] Programming

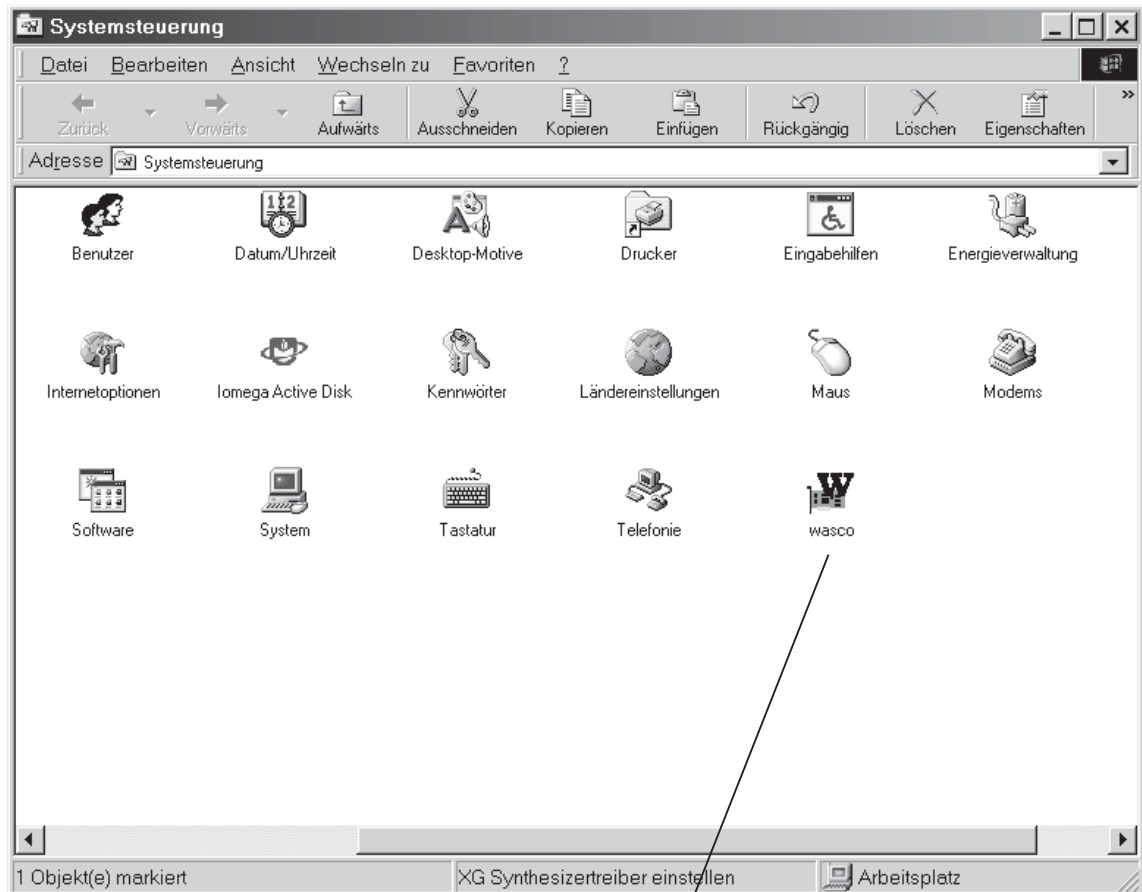
12.1 Programming OPTOIO-PCI16

To apply the card under Windows[®] a special driver has to be installed which enables the access to the port addresses of the card.

12.2 Installation of Windows[®] drivers

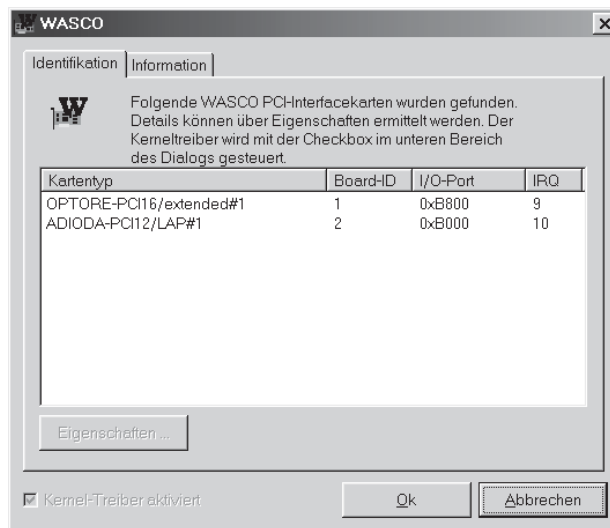
To install the Windows[®] driver please run setup.exe in the directory „Treiber“ on the enclosed CD and then follow installation instructions.





Having installed driver software completely, your system control panel shows an icon for the localization of all **wasco**® PCI cards existing in the system.

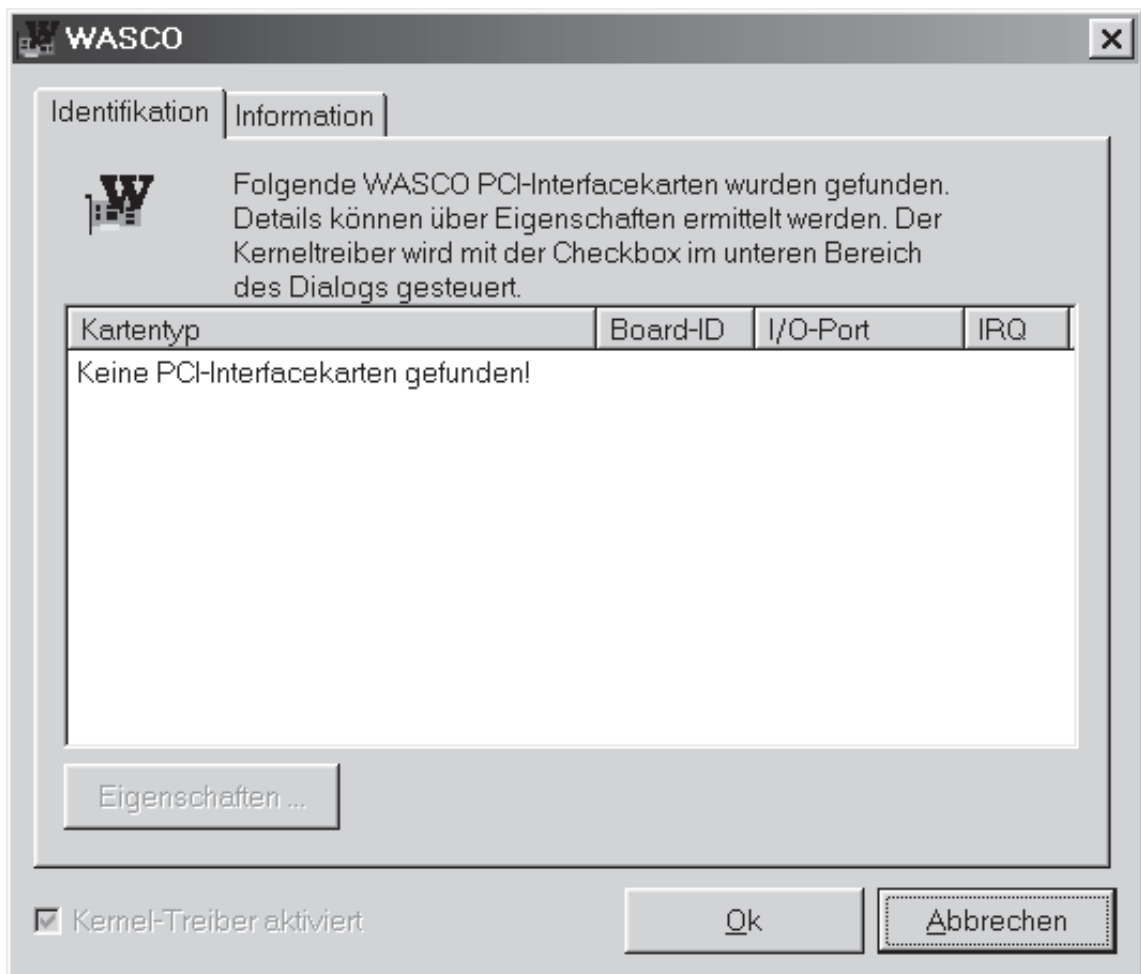
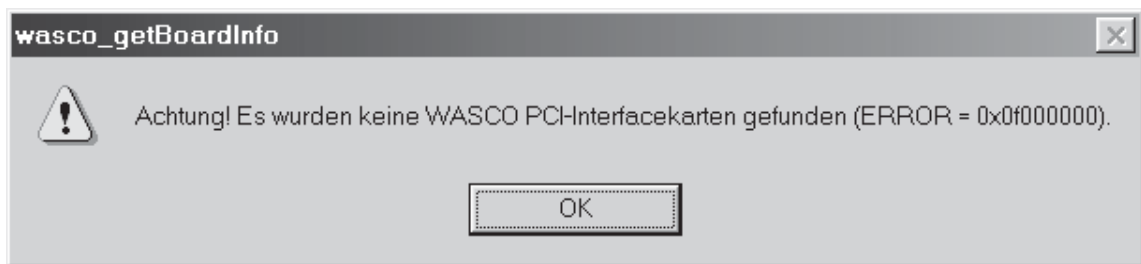
Start the card monitoring by double-clicking the "**wasco**®" icon. Following screen appears (in this example an OPTORE-PCI16 and an ADIODA-PCI12 may be used)



Once the system detected the card, this window shows card name, board ID, I/O address and possible interrupt number for each card. Furthermore the tab „Information“ leads to information about driver version and localization of the driver file.



If the system did not detect your card, following error messages pop up:



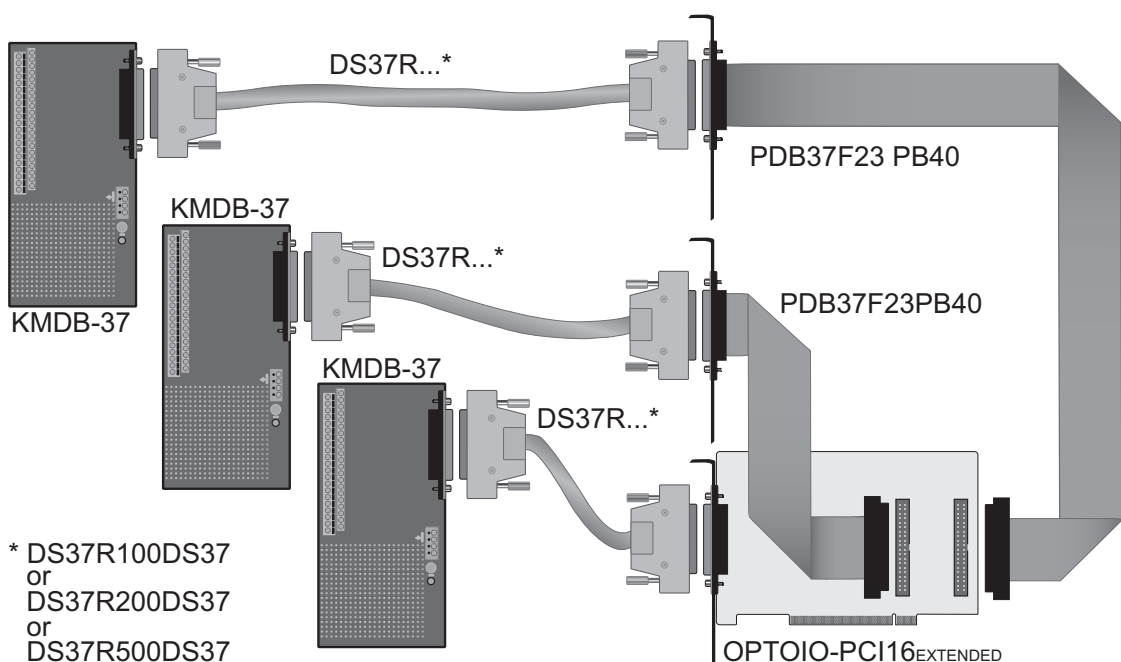
Please search for possible causes in chapter troubleshooting.

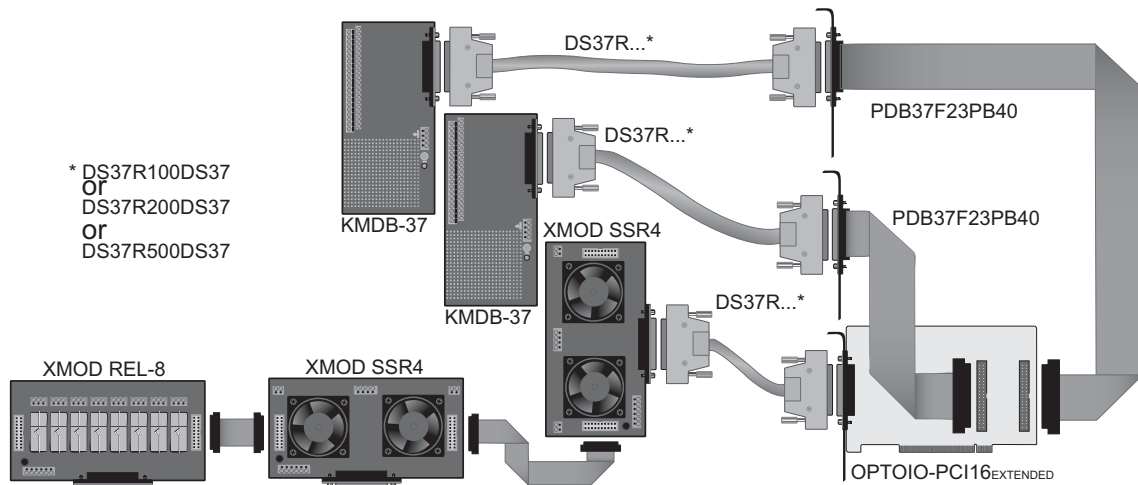
13. Accessories

13.1 Compatible **wasco®** accessories

Connecting parts	EDV No.
PDB37F23PB40 Flat Ribbon Cable	A-497500
DS37R100DS37 Connecting Wire (1 meter)	A-202200
DS37R200DS37 Connecting Wire (2 meters)	A-202400
DS37R500DS37 Connecting Wire (5 meters)	A-202800
KMDB-37 Connecting Board (screw clamp with hole grid for soldering)	A-2046
KMDB-37S Connecting Board Small (screw clamp)	A-204910
XMOD SSR-2 Solid State Relay Module	A-3282
XMOD SSR-4 Solid State Relay Module	A-3284
XMOD REL-4 Relais Module	A-3264
XMOD REL-8 Relais Module	A-3268

13.2 Connecting technique (application examples)





13.3 Single components for own Assembly

Connection parts	EDV-No.
D-Sub-plug 37 pin for solder connection	A-5506
Junction shell 37 pin plug (solder connection)	A-5586
D-Sub connector male 37 pin for flat ribbon cable	A-5526
D-Sub connector female 37 pin for flat ribbon cable	A-5566
Slot bracket with cutout for connector male/female 37 pin	A-5754
Box header 40 pin for flat ribbon cable	A-5642
flat ribbon cable 37 pin	A-5718
flat ribbon cable 40 pin	A-5720

14. Troubleshooting

Following you can find a short compilation of most known error causes, which can occur while starting-up or running OPTOIO-PCI16.

Please check this list before you contact your dealer or distributor to solve your problem:

1. Is OPTOIO-PCI16 inserted to the PCI slot properly?
2. Are all cable connections alright?
3. Is the fuse F1 blown?
4. Did your system detect the card correctly?
Please check all settings of your computer or contact your system administrator. (As this are BIOS settings we cannot expand on this issue. We point to your computer's system user guide)
5. Did you install the latest driver-version for the **wasco®** drivers?
Updates you can find here: <http://www.messcomp.com>
<http://www.wasco.de>

15. Specifications

Optocoupler Inputs

16 * PC900

16 channels, optically isolated

8 channels usable as interrupt inputs

Overvoltage protection by protection diodes

Two different input voltage ranges adjustable by enclosed resistors:

R = 4,7 kOhm: high = 8...30 Volt
 low = 0...4 Volt

R = 1,0 kOhm: high = 2,2...15 Volt
 low = 0...1,5 Volt

Input frequency: max. 10 KHz

Optocoupler Outputs

16 * PC853

16 channels, optically isolated

Overvoltage protection by protection diodes

Output current max. 150mA

Voltage collector-emitter: max. 50V

Voltage emitter-collector: max. 0,1V

TTL Inputs/Outputs

1 * 71055 or 8255

24 channels, TTL compatible

Organized in Port A, B and C

Port A and Port B are programmable in 8-Bit groups as input or output, Port C is programmable in one 8-Bit group or in two 4-Bit groups as input or output

Quartz crystal oscillator

4 MHz

Timer

1 * 71054 or 8254

3 * 16-Bit downwards counter for triggering time-dependent interrupts

Timed by quartz crystal oscillator

Connection plug

1 * 37-pin D-Sub connector female

2 * 40-pin pin header

Bussystem

32-Bit PCI Bus (internal data bus 8-Bit)

Fuse

+ 5V 1 A miniature fuse F1

Power consumption

+ 5V typ. 450mA

16. Product Liability Act

Information for Product Liability

The Product Liability Act (Act on Liability for Defective Products - Prod-HaftG) in Germany regulates the manufacturer's liability for damages caused by defective products.

The obligation to pay compensation can be given, if the product's presentation could cause a misconception of safety to a non-commercial end-user and also if the end-user is expected not to observe the necessary safety instructions handling this product.

It must therefore always be shown, that the non-commercial end-user was made familiar with the safety rules.

In the interest of safety, please always advise your non-commercial customer of the following safety instructions:

Safety instructions

The valid VDE-instructions must be observed, when handling products that come in contact with electrical voltage.

Especially the following instructions must be observed:
VDE100; VDE0550/0551; VDE0700; VDE0711; VDE0860.

The instructions are available from:

Vde-Verlag GmbH
Bismarckstr. 33
10625 Berlin

- * unplug the power plug before you open the unit or make sure, there is no current to/in the unit.
- * You only may start up any components, boards or equipment, if they are installed inside a secure touch-protected casing before. During installation there must be no current to the equipment.
- * Make sure that the device is disconnected from the power supply before using any tools on any components, boards or equipment. Any electric charges stored in components in the device are to be discharged prior.
- * Voltaged cables or wires, which are connected with the unit, the components or the boards, must be tested for insulation defects or breaks. In case of any defect the device must be immediately taken out of operation until the defective cables are replaced.
- * When using components or boards you must strictly comply with the characteristic data for electrical sizes shown in the corresponding description
- * As a non-commercial end-user, if it is not clear whether or not the electrical characteristic data given in the provided description are valid for a component, you must consult a specialist.

The compliance with building and safety instructions of all kinds (VDE, TÜV, industrial injuries corporation, etc.) are entirely the responsibility of the user/customer.

17. CE Confirmation

This is to certify, that the product

OPTOIO-PCI16_{EXTENDED}
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comply with the requirements of the EC directives. This declaration will lose its validity, if the instructions given in this manual for the intended use of the products are not fully complied with.

EN 5502 Class B
IEC 801-2
IEC 801-3
IEC 801-4
EN 50082-1
EN 60555-2
EN 60555-3

The following manufacturer is responsible for this declaration:

Messcomp Datentechnik GmbH
Neudecker Str. 11
83512 Wasserburg

given by

Dipl.Ing.(FH) Hans Schnellhammer

Wasserburg, 30.05.2006



Reference system for intended use

This PC extension card is not a stand-alone device. The CE-conformity only can be assessed when using additional computer components simultaneously. Thus the CE conformity only can be confirmed when using the following reference system for the intended use of the extension card:

Control Cabinet:	Vero IMRAK 3400	804-530061C 802-563424J 802-561589J
19" Casing:	Vero PC Casing	145-010108L
19" Casing:	Additional Electronic	519-112111C
Motherboard:	GA-586HX	PIV 1.55
Floppy-Controller:	on Motherboard	
Floppy:	TEAC	FD-235HF
Graphic Card:	Advantech	PCA-6443
Interface:	OPTOIO-PCI16 _{EXTENDED}	A-429400