

# **OPTOIO-PCIe16 STANDARD**

**EDP No.: A-829200**

16 optocoupler isolated digital inputs  
16 optocoupler isolated digital outputs

**wasco<sup>®</sup>**

user's guide

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## 1. Description

The **wasco**<sup>®</sup> interface card OPTOIO-PCIe16<sup>STANDARD</sup> provides 16 digital inputs and 16 digital outputs with galvanic isolation, individually for each channel. Optocouplers of high quality ensure the potential separation for the inputs and outputs. All input optocouplers are bipolar. Special high power output optocouplers can handle a maximum switching current of up to 150 mA.

Each input or output is fitted with additional protection diodes against harmful voltage peaks. You can adjust two different voltage ranges for each single input channel by jumpers easily to plug in.

Output optocouplers are led to a 37 pin D-Sub jack mounted to the board's slot bracket. Optocoupler inputs are fed to a 40-pin box header. A special available cable (set of female connector, ribbon cable and 37pin female sub-D-connector with slot bracket) can postpone the connection to a slot of your PC casing.

Pin assignment and input voltage ranges are identical with the ISA bus card OPTOIO-16<sup>STANDARD</sup> and PCI bus card OPTOIO-PCI16<sup>STANDARD</sup>. Therefore a switch to PCIe is easily to realise.

Furthermore the card provides a jumper block for card identification.

This enables you to differentiate between several identical cards in your system.

## **2. Installation of OPTOIO-PCle16<sub>STANDARD</sub>**

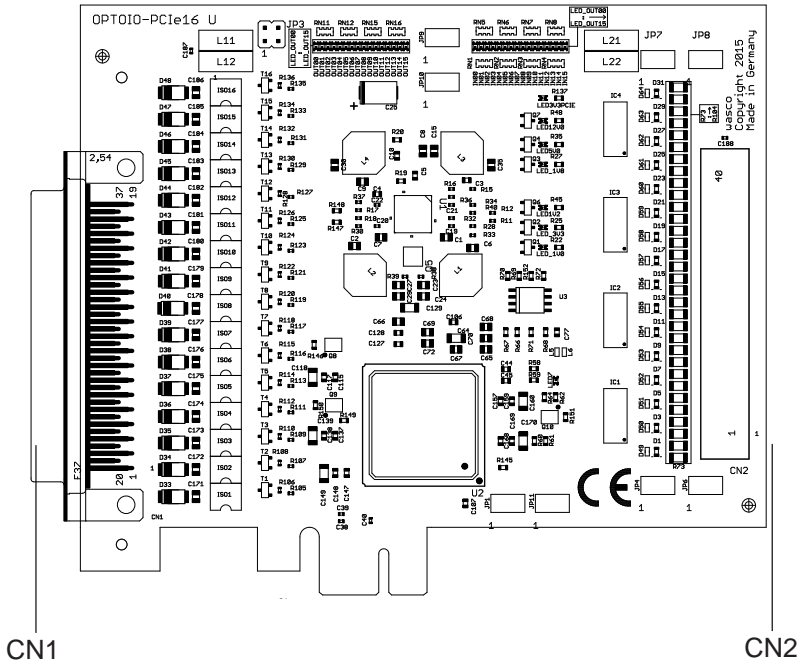
### **2.1 How to install the card into your system**

Before you insert the card unplug the power cord or make sure, there is no current to/in the computer. Inserting in a running system may cause damaging or destroying not only OPTOIO-PCle16<sub>STANDARD</sub>, but even other already inserted cards of your computer.

Select an empty PCIe slot of your computer for inserting the card. Please refer to the computer's manual for support. Secure the OPTOIO-PCle16 by screwing the mounting bracket to the casing of the computer to avoid a card's loosening by effects of the cables.

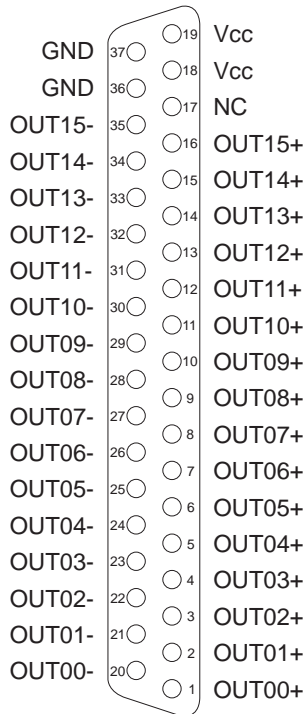
### 3. Connectors

#### 3.1 Position of the connector plugs



- CN1: Optocoupler Output OUT0...OUT15
- CN2: Optocoupler Input IN0...IN15

### 3.2 Pin assignment of CN1



**Vcc:**

Connector for internal voltage source (+ 5V) (a wiring bridge must be soldered on L11),  
**Never apply an external voltage across this pin.**

**GND:**

Ground connection (only when a wiring bridge is soldered on 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 source (+ 5V) ( a wiring bridge must be soldered on L21),  
**Never apply an external voltage across this pin.**

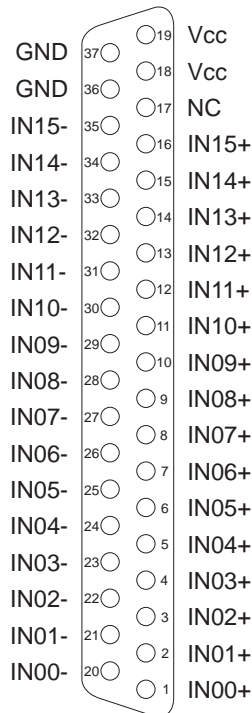
**GND:**

Ground connection (only when a wiring bridge is soldered on L22).

**NC:**

not connected

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



**Vcc:**

Connector for internal voltage source (+ 5V) (a wiring bridge must be soldered on L21),  
**Never apply an external voltage across this pin.**

**GND:**

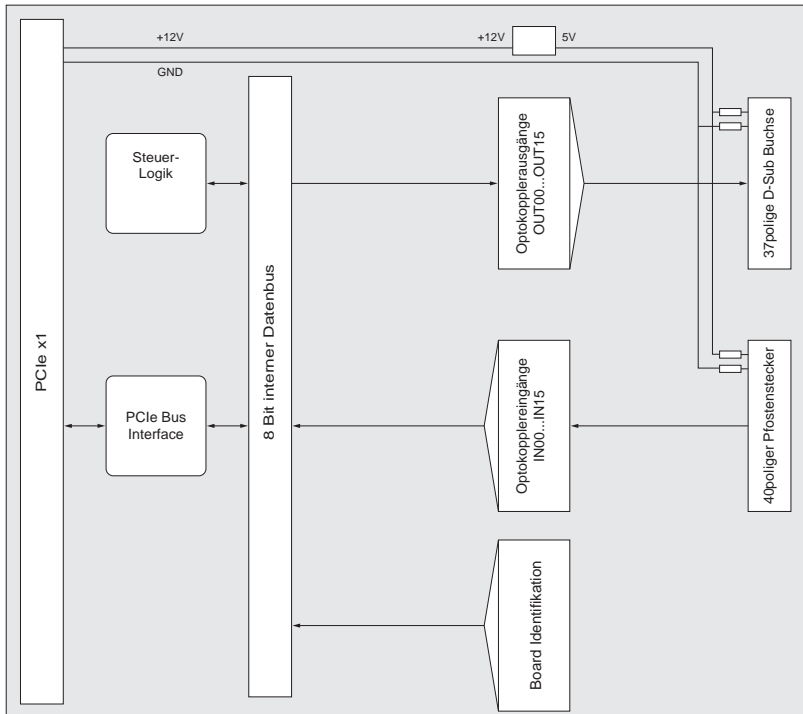
Ground connection (only when a wiring bridge is soldered on L22).

**NC:**

not connected

## 4. System Components

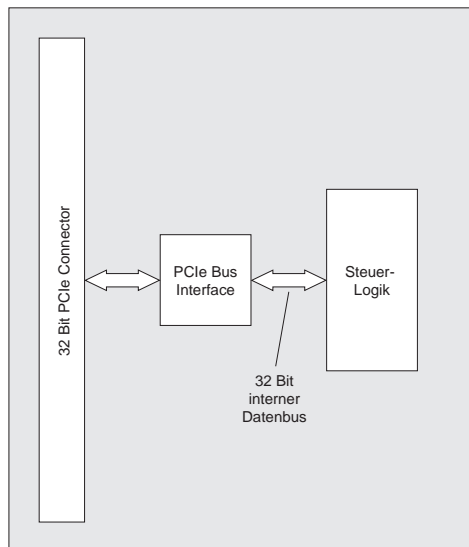
### 4.1 Block diagram



## 4.2 Access to the system components

Access to the hardware components of the OPTOIO-PCle16 is made by reading and writing in Memory Mapped I/O addresses by library functions. The relevant addresses for OPTOIO-PCle16 depend on the base address given by the BIOS. Access to the OPTOIO-PCle16 is made by double word access only. For reasons of compatibility the wasco drivers handle or regard the lowest value bytes only.

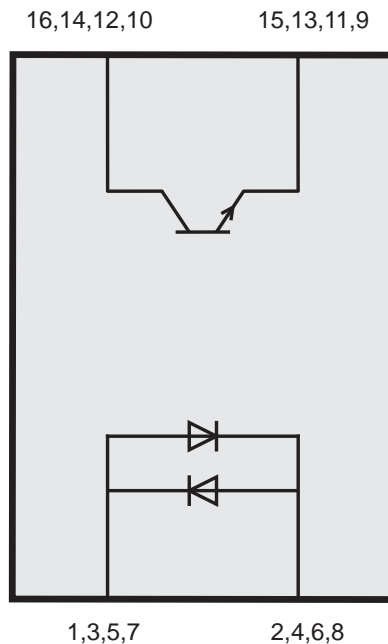
(Please find more information in chapter Programming or in samples on the enclosed CD)



## 5. 16 Optocoupler Isolated Digital Inputs

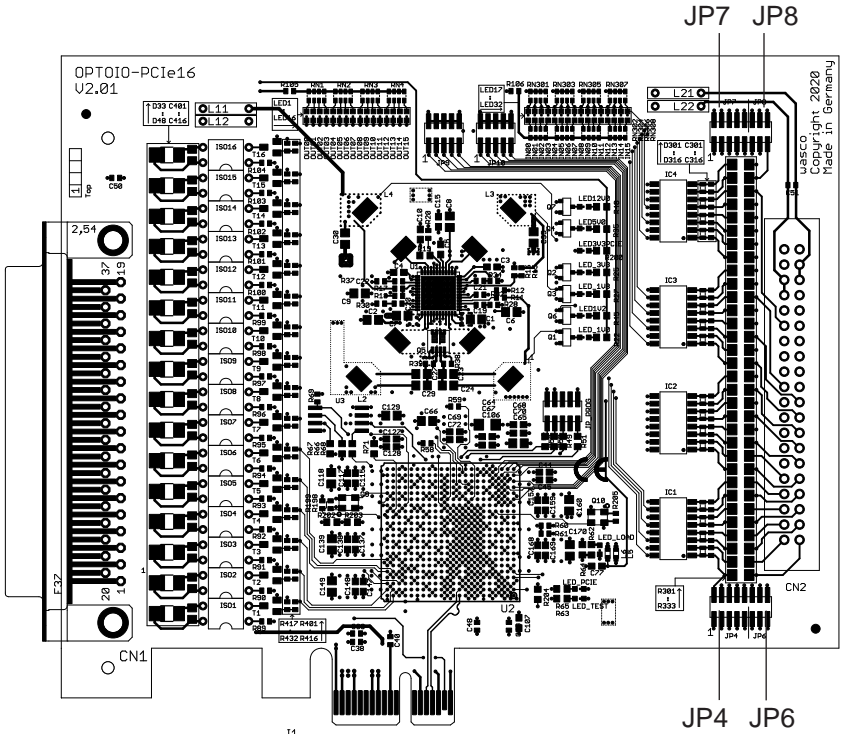
The OPTOIO-PCle16<sup>STANDARD</sup> provides 16 input channels which are optically isolated by optocouplers. The isolation voltage between GND and input is 500 V<sub>DC</sub>. The voltage within the input channels is limited to 50 V<sub>DC</sub>.

### 5.1 Pin assignment of the input optocouplers



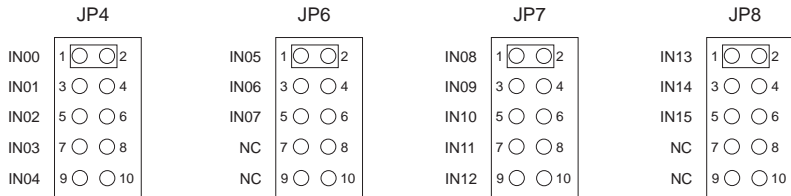
### 5.2 Input voltage ranges

You can select two different input voltage ranges for each optocoupler input by setting jumpers on the blocks JP4, JP6, JP7 and JP8.



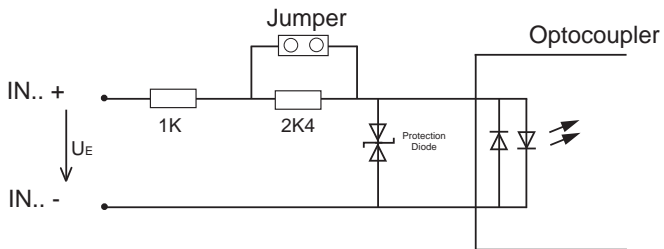
Following table shows the data of the two input voltage ranges:

Jumper	low	high
closed	0...1 V	5...15 V
off	0...2 V	14...30 V



Setting the jumper over Pin1 and Pin2 of the jumper block JP4 the input voltage range of IN00 changes from 0..2V (Low) and 14..30V (High) to 0..1V (Low) and 5..15V (High). The other input voltage ranges remain unaffected.

### 5.3 Input circuitry



### 5.4 Input current

$$I_E \approx \frac{U_E - 1,1V}{3400\Omega} \quad (\text{Jumper off})$$

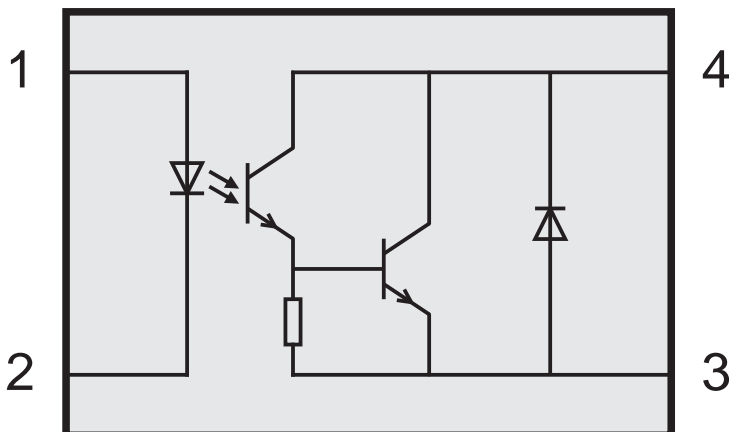
$$I_E \approx \frac{U_E - 1,1V}{1000\Omega} \quad (\text{Jumper closed})$$



## 6. 16 Optically Isolated Outputs

The OPTOIO-PCle16<sub>STANDARD</sub> provides 16 output channels, which are galvanically isolated by optocouplers. The isolation voltage between GND and output ist 500 V<sub>DC</sub>.

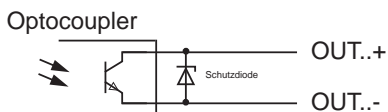
### 6.1 Pin assignment of the output optocouplers



### 6.2 Optocoupler specifications

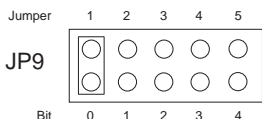
Voltage collector-emitter:	max. 50V
Voltage emitter-collector:	0,1V
Current collector-emitter:	150 mA

### 6.3 Output circuitry



## 7. Board Configuration

### 7.1 Board Identification



The board Identification enables you to differentiate between several PC boards of the same type in your system. This is realised by a software readable jumper block.

The board identification to be read consists of one Byte (8 Bit) and is structured as follows:

Bit	31	..	..	8	7	6	5	4	3	2	1	0
Jumper								5	4	3	2	1
Board ID Register	0	0	0	0	0	0	0	x	x	x	x	x

„x“ corresponds to „1“, if the Jumper is closed, otherwise „0“

Calling the reading command, you can read out the setting of the jumper block JP1. Not used bits are basically „0“, a set or closed jumper will be read as „1“.

For example:



Result of the reading command: \$05

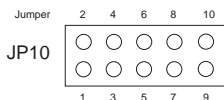
## 7.2 Access with 8 or 32 Bit

The jumper block JP10/1-2 enables you to set the data width of the access.

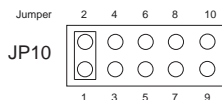
If the jumper block JP10/1-2 is not set (Default) the card works in compatibility mode. In this mode the card is accessed in 8-bit mode. Additionally, the offset addresses of the PCI card OPTOIO-PCI16<sup>STANDARD</sup> are valid with the factor 4.

If the jumper is set, the card works in 32-Bit mode and it is compatible with other PCIe boards for offset addressing.

The offset addresses of the two modes are covered in chapter 8.5 „Assignment of the Memory-Mapped I/O Addresses“.



8-Bit mode



32-Bit mode

## 8. Windows<sup>®</sup> Programming

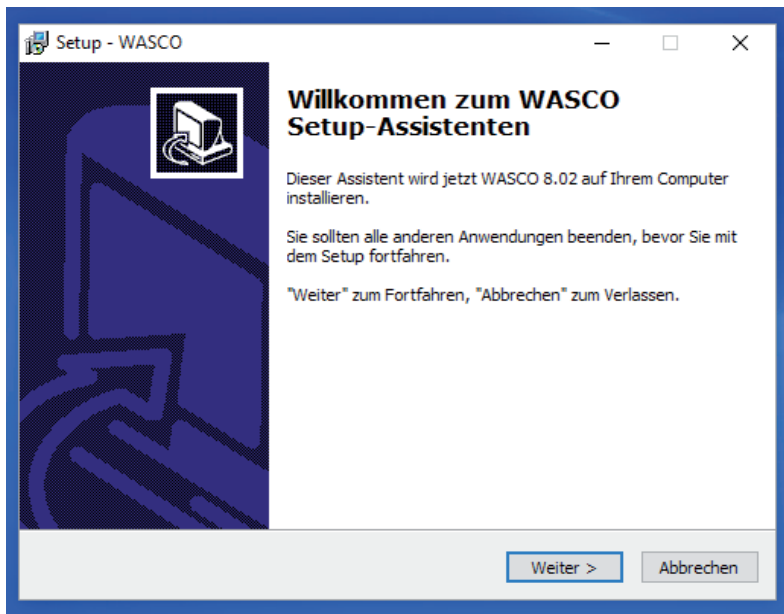
### 8.1 Installation of the Windows<sup>®</sup> driver

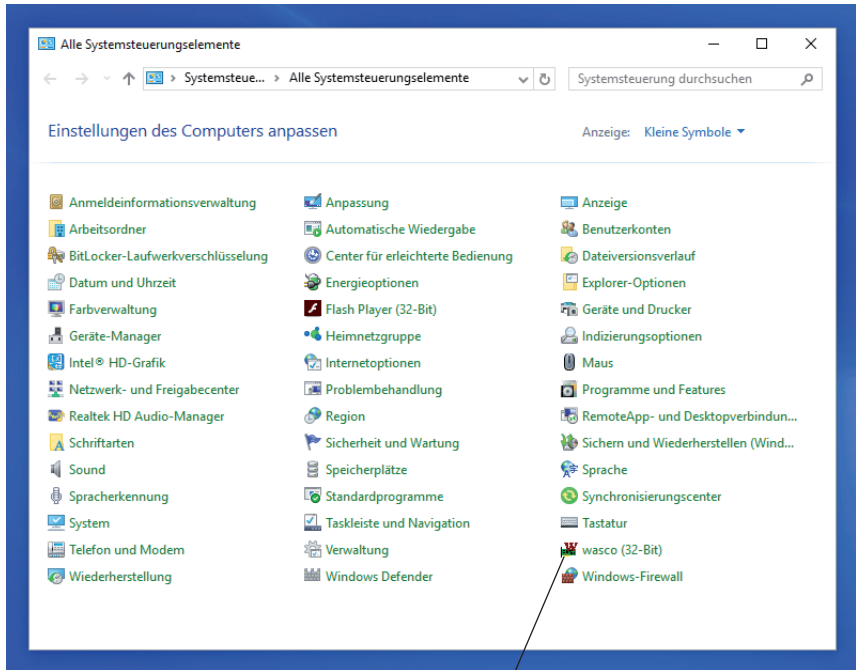
To apply the card under Windows<sup>®</sup> a special driver has to be installed, which enables access to the card.

After starting-up Windows<sup>®</sup> 10, 8 und 7 your operating system automatically registers a new hardware device to be found. In this case insert the data medium and advise your system to install the driver files therefrom. If the operating system does not react it is possible to install the drivers in the device manager.

### 8.2 Installation of the Windows<sup>®</sup> development files

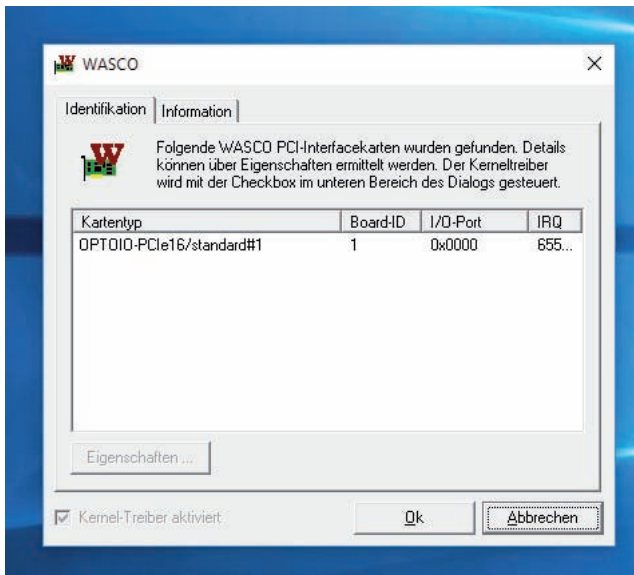
To install Windows<sup>®</sup> development files please run setup.exe in the directory „Treiber“ on the enclosed CD and then follow installation instructions.





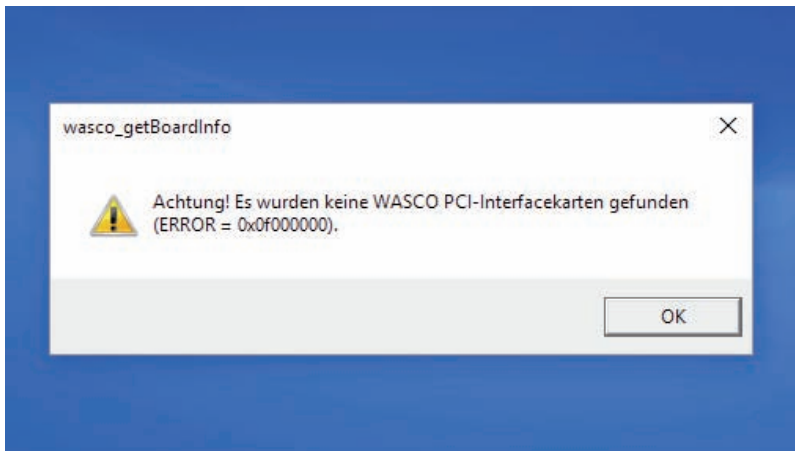
Having installed driver software and development files completely, your system control panel shows an icon for the localisation of all **wasco®** PCI and PCIe cards existing in the system.

Start the card's monitoring by double-clicking the "wasco®" icon. Following screen appears (in this example an OPTOIO-PCIe16STANDARD 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 localisation of the driver file.

If the system did not detect your card, following error message pops up:



Please search for possible causes in chapter troubleshooting.

### 8.3 Programming of the OPTOIO-PCle16 by **wasco**® driver

After having installed Kithara's development files by means of the setup program the folder **wasco** contains of the relevant development files and program samples. More program samples specified for access to the OPTOIO-PCle16 you can find on the enclosed CD or please visit our Website.

Programming the hardware components of the OPTOIO-PCle16 is realised by access to Memory Mapped I/O addresses which depend on the basic address created by the system's BIOS for the OPTOIO-PCle16. Find more detailed descriptions for programming in the driver's documentation.

## 8.4 Access to the board OPTOIO-PCle16<sup>Standard</sup>

The access to the OPTOIO-PCle16<sup>Standard</sup> is done exclusively via the board name (type of card) OPTOIO-PCle16/standard.

## 8.5 Assignment of the Memory Mapped I/O addresses

The Memory Mapped I/O addresses of the single hardware components depend on the basic address according to following table:

### 8-Bit mode

Port/Register	BA + Offset	RD WR
Optocoupler input port A (IN00...IN07)	BA + \$0	RD
Optocoupler input port B (IN08...IN15)	BA + \$4	RD
Optocoupler output port A (OUT00...OUT07)	BA + \$8	WR
Optocoupler output port B (OUT08...OUT15)	BA + \$C	WR
Board Identification	BA+ \$3E0	RD

### 32-Bit mode

Port/Register	BA + Offset	RD WR
Optocoupler inputs (IN00...IN015)	BA + \$0	RD
Optocoupler outputs (OUT00...OUT015)	BA + \$8	WR
Board Identification	BA+ \$FF8	RD

Attention! The driver's offset constants directly work with PCI boards only. If you want to use the constants with PCIe boards in the same way, please multiply the offset by four.

In programming we recommend using offsets rather than constants.



## 8.5 Compatibility to the OPTOIO-PCI16<sup>STANDARD</sup>

Developing OPTOIO-PCI16<sup>STANDARD</sup> and its drivers special regard was attended to use identical accesses as to OPTOIO-PCI16<sup>STANDARD</sup>. This enables you to switch from PCI to PCIe in existing programs in a very easy way. The driver (as from version 8.02) is usable for PCI as well as for PCIe.

What changed or what is got to be changed for PCIe board respectively:

1. The board's name switched from „OPTOIO-PCI16<sup>STANDARD</sup>“ to „OPTOIO-PCI16<sup>STANDARD</sup>“
2. The functions to access to port addresses for the PCIe board are given as „wasco\_outputPCIEB“ and „wasco\_inputPCIEB“
3. The offsets to access to the Memory Mapped I/O addresses changed. For PCIe boards you are to multiply the former offsets by four. (Unchanged constants are usable for PCI only).
4. Via an additional address the setting of jumper block JP9 can be monitored. The jumper can be used for example for the identification of the OPTOIO-PCI16<sup>STANDARD</sup> in case your computer registers more than one board.

## 9. Linux<sup>®</sup> Programming

To use the board with Linux<sup>®</sup>, you can find a Linux wasco<sup>®</sup> driver on the CD provided or on our website. This is in code form and therefore can be changed and customized by the customer at any time.

### 9.1 Installing the Linux<sup>®</sup> driver

To apply the card under Linux<sup>®</sup> a special driver has to be installed, that enables access to the card. Insert the data medium and copy the folder of the Linux driver to your system. For installation, follow the instructions of the readme file.

### 9.2 Supported Linux-Distributions/Kernelversions

The wasco<sup>®</sup> driver has been tested in the following environments:

Ubuntu<sup>®</sup> 18.04.4 LTS (Kernel: 5.3.0)

### 9.3 Programming the OPTOIO-PCle16 with **wasco**<sup>®</sup> driver

Programming the hardware components of the OPTOIO-PCle16 is realised by accessing Memory Mapped I/O addresses which depend on the base address assigned by the system's BIOS for the OPTOIO-PCle16.

The access is done via the functions pread und pwrite. For this, under programming language C and C/C++ no further external libraries are required. Examples for the exact access to the OPTOIO-PCle16 can be found on the enclosed CD as well as on our homepage.

#### 9.4 Access to the OPTOIO-PCIe16<sup>Standard</sup>

The access to the OPTOIO-PCIe16<sup>Standard</sup> is done exclusively via the board name (type of card) OPTOIO-PCIe16/standard.

#### 9.5 Assignment of the Memory Mapped I/O addresses

The Memory Mapped I/O addresses of the single hardware components depend on the base address according to following table:

32-Bit mode

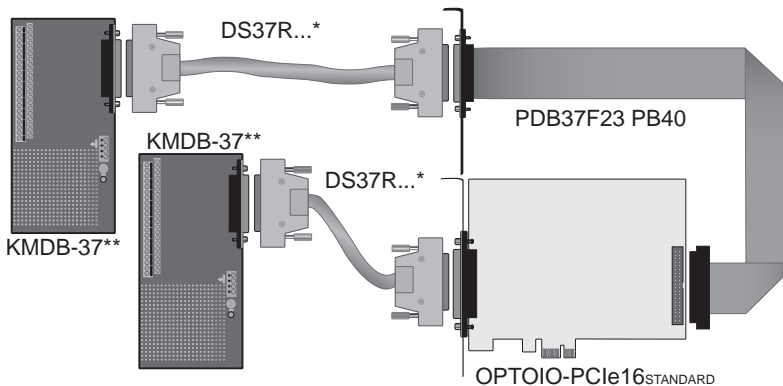
Port/Register	BA + Offset	RD/WR
Optocoupler inputs (IN00...IN015)	BA + \$0	RD
Optocoupler outputs (OUT00...OUT015)	BA + \$8	WR
Board Identification	BA+ \$FF8	RD

## 10. Accessories

### 10.1 Fitting **wasco**<sup>®</sup> accessories

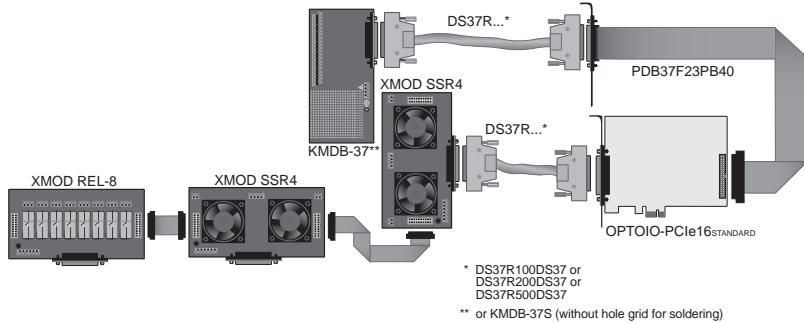
Connecting parts	EDP no.
PDB37F23PB40 connector laying set	A-497500
DS37R100DS37 Connecting cable	A-202200
DS37R200DS37 Connecting cable	A-202400
DS37R500DS37 Connecting cable	A-202800
KMDB-37S Screw Terminal block (without perfboard)	A-204910
KMDB-37 Screw Terminal block (with perfboard for soldering)	A-2046
XMOD SSR-2 Solid State Relay Module	A-3282
XMOD SSR-4 Solid State Relay Module	A-3284
XMOD REL-4 Relay Module	A-3264
XMOD REL-8 Relay Module	A-3268

### 10.2 Connecting technique (application examples)



\* DS37R100DS37 or DS37R200DS37  
or DS37R500DS37

\*\* or KMDB-37S (without hole grid for soldering)



### 10.3 Single components for customer assembly

Connection parts	EDP 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

## 11. Troubleshooting

In the following you will find a short compilation of most frequently known error causes, that may occur while starting-up or running OPTOIO-PCIe16. Please check the following points before you contact your dealer or distributor:

1. Is OPTOIO-PCIe16 properly inserted to the connector?
2. Are all cable connections alright?
3. Did your system detect the card correctly?  
Please check all settings of your computer or contact your system administrator. (Since these are BIOS settings we cannot expand on this issue. We point to your computer's system user's guide)
4. Did you install the latest driver version for the **wasco**<sup>®</sup> drivers?  
Updates you can find here: <http://www.messcomp.com>

## 12. Specifications

### Optocoupler Inputs

Optocoupler: LTV-244 or compatible

16 channels, optically isolated

Galvanic isolation also between every single channel with each two separate connections

Overvoltage protection by protection diodes

Two different input voltage ranges selectable by jumpers:

Range 1            high = 14..30 Volt  
                         low = 0..2 Volt

Range 2:           high = 5..15 Volt  
                         low = 0..1 Volt

Input frequency: max. 10 kHz

### Optocoupler Outputs

Optocoupler: 16 \* PC853 or compatible socket mounted

16 channels, optically isolated

Galvanic isolation also between every single channel with each two separate connections

Overvoltage protection by protection diodes

Output current max. 150mA

Output frequency approx. 1 KHz

Voltage collector-emitter: max. 50V

Voltage emitter-collector: max. 0,1V

### Board Identification

Jumper block with five pairs of contact pins

### Connection plug

1 \* 37-pin D-Sub female connector

1 \* 40-pin box header

### Bus system

32-Bit PCIe Bus (8 Bit data access)

### Board Dimensions

129 mm x 111 mm (l x w)

standard height, half length card

multilayer board

### Other

Control LEDs for power supply

## 13. 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 already 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 when handling this product.

It must therefore always be provable, that the non-commercial end user has been familiarized with the safety rules.

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

### Safety instructions

The valid VDE regulations must be observed, when handling products that come into contact with electrical voltage.

Particularly 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 ta device or make sure, that there is no current to/in the device.

\* You only may start up any components, boards or devices, if they have been installed in a secure touch-protected casing before. During installation they must be de-energized.

\* Make sure that the device is disconnected from the power supply before using any tools on any components, boards or devices. Any electrical 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 always be inspected for insulation faults or breaks. In case of any defect the device must be taken out of operation immediately until the defective cables has been replaced.

\* When using components or boards you must strictly comply with the characteristic data of the electrical parameters specified 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 apply to a component, you must consult a specialist.

In all other respects, compliance with building and safety regulations of all kinds (VDE, TÜV, industrial injuries corporation, etc.) is the responsibility of the user/purchaser.

## 14. EC Declaration of Conformity

This is to certify, that the following product with CE marking

**OPTOIO-PCIe16<sup>STANDARD</sup>**  
**EDP number A-829200**

comply with the requirements of the relevant EMC directives 2014/30/EU. 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.

Following standards were regarded:

EN 55011: 2009 + A1. 2010 (Group 1, Class A)

EN 55022: 2010 / AC: 2011

EN 55024: 2010

EN 61000-6-4: 2007 + A1: 2011

EN 61000-6-2: 2005 / AC: 2005

(EN 6100-4-2: 2008; EN 6100-4-3: 2006 + A1: 2007 + A2; EN 6100-4-4: 2012;  
EN 6100-4-5: 2014; EN 6100-4-6: 2013; EN 6100-4-8: 2009; EN 6100-4-11: 2004)

The following manufacturer is responsible for this declaration:

Messcomp Datentechnik GmbH  
Neudecker Str. 11  
83512 Wasserburg

given by

Dipl.Ing.(FH) Hans Schnellhammer

Wasserburg, 30.09.2015



**Reference system for intended use**

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

Electrical enclosure:	Vero IMRAK 3400	804-530061C 802-563424J 802-561589J
19" Casing:	Vero PC-Casing	145-010108L
19" Casing:	Additional Electronic	519-112111C
Motherboard:	ASUS P5G41-M LE	
Interface:	OPTOIO-PCIe16 <sup>STANDARD</sup>	A-829200