OPTOIO-PCIe32
STANDARD

EDP No.: A-840600

32 optocoupler isolated digital inputs
32 optocoupler isolated digital outputs

wasco®

user's guide

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Disclaimer

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1. Description

The **wasco®** interface card OPTOIO-PCIe32STANDARD provides 32 digital inputs and 32 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 set.

Output optocouplers are led to a 68-pin SCSI jack mounted to the board's slot bracket. Optocoupler inputs are fed to a 68-pin SCSI jack on the board. On demand a special cable (set of female connector, ribbon cable and 68-pin female connector with slot bracket) is available, postponing the connection to a slot of your PC casing.

Pin assignment and input voltage ranges are identical with PCI bus card OPTOIO-PCI32STANDARD. Therefore a switch to PCIe is easily to realise.

Furthermore the card provides a jumper block for a card identification. This enables you to differentiate between several identical cards in your system.

2. Installation of the OPTOIO-PCIe32STANDARD

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 into a running system may cause damaging or destroying not only OPTOIO-PCIe32STANDARD, 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-PCIe32 by screwing the mounting bracket to the casing of your computer to avoid a card's loosening by effects of the cables.

3. Connectors

3.1 Position of the connector plugs

CN1   CN2
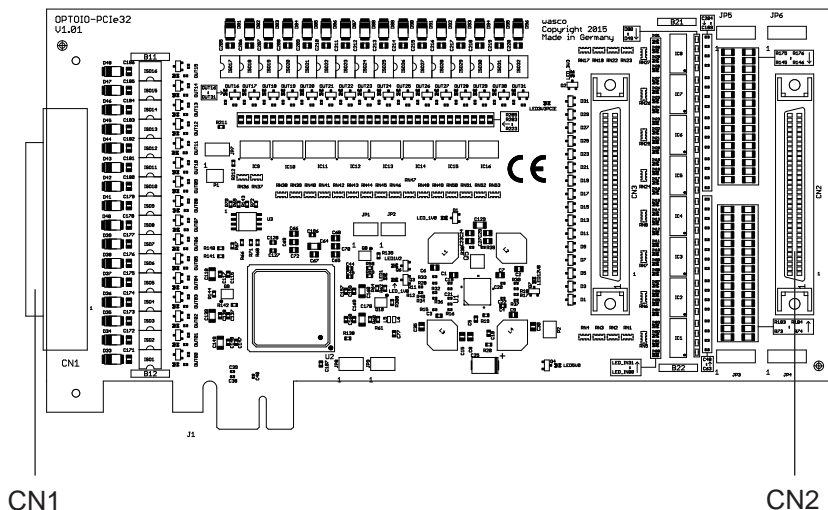
CN1:   Optocoupler Outputs OUT00...OUT31
CN2:   Optocoupler Inputs IN00...IN31

3.2 Pin assignment of CN1

GND	68	34	Vcc
GND	67	33	Vcc
OUT31-	66	32	OUT31+
OUT30-	65	31	OUT30+
OUT29-	64	30	OUT29+
OUT28-	63	29	OUT28+
OUT27-	62	28	OUT27+
OUT26-	61	27	OUT26+
OUT25-	60	26	OUT25+
OUT24-	59	25	OUT24+
OUT23-	58	24	OUT23+
OUT22-	57	23	OUT22+
OUT21-	56	22	OUT21+
OUT20-	55	21	OUT20+
OUT19-	54	20	OUT19+
OUT18-	53	19	OUT18+
OUT17-	52	18	OUT17+
OUT16-	51	17	OUT16+
OUT15-	50	16	OUT15+
OUT14-	49	15	OUT14+
OUT13-	48	14	OUT13+
OUT12-	47	13	OUT12+
OUT11-	46	12	OUT11+
OUT10-	45	11	OUT10+
OUT09-	44	10	OUT09+
OUT08-	43	9	OUT08+
OUT07-	42	8	OUT07+
OUT06-	41	7	OUT06+
OUT05-	40	6	OUT05+
OUT04-	39	5	OUT04+
OUT03-	38	4	OUT03+
OUT02-	37	3	OUT02+
OUT01-	36	2	OUT01+
OUT00-	35	1	OUT00+

Vcc:
Connector for internal voltage source (+ 5V) (a wiring bridge must be soldered on B11),
Never apply an external voltage across this pin.

GND:
Ground connection (only when a wiring bridge is soldered on B12).

3.3 Pin assignment of CN2

GND	68 □	□ 34	Vcc
GND	67 □	□ 33	Vcc
IN31-	66 □	□ 32	IN31+
IN30-	65 □	□ 31	IN30+
IN29-	64 □	□ 30	IN29+
IN28-	63 □	□ 29	IN28+
IN27-	62 □	□ 28	IN27+
IN26-	61 □	□ 27	IN26+
IN25-	60 □	□ 26	IN25+
IN24-	59 □	□ 25	IN24+
IN23-	58 □	□ 24	IN23+
IN22-	57 □	□ 23	IN22+
IN21-	56 □	□ 22	IN21+
IN20-	55 □	□ 21	IN20+
IN19-	54 □	□ 20	IN19+
IN18-	53 □	□ 19	IN18+
IN17-	52 □	□ 18	IN17+
IN16-	51 □	□ 17	IN16+
IN15-	50 □	□ 16	IN15+
IN14-	49 □	□ 15	IN14+
IN13-	48 □	□ 14	IN13+
IN12-	47 □	□ 13	IN12+
IN11-	46 □	□ 12	IN11+
IN10-	45 □	□ 11	IN10+
IN09-	44 □	□ 10	IN09+
IN08-	43 □	□ 9	IN08+
IN07-	42 □	□ 8	IN07+
IN06-	41 □	□ 7	IN06+
IN05-	40 □	□ 6	IN05+
IN04-	39 □	□ 5	IN04+
IN03-	38 □	□ 4	IN03+
IN02-	37 □	□ 3	IN02+
IN01-	36 □	□ 2	IN01+
IN00-	35 □	□ 1	IN00+

cc:
Connector for internal voltage source (+ 5V) (a wiring bridge must be soldered on B21),
Never apply an external voltage across this pin.

GND:
Ground connection (only when a wiring bridge is soldered on B22).

4. System Components

4.1 Block diagram
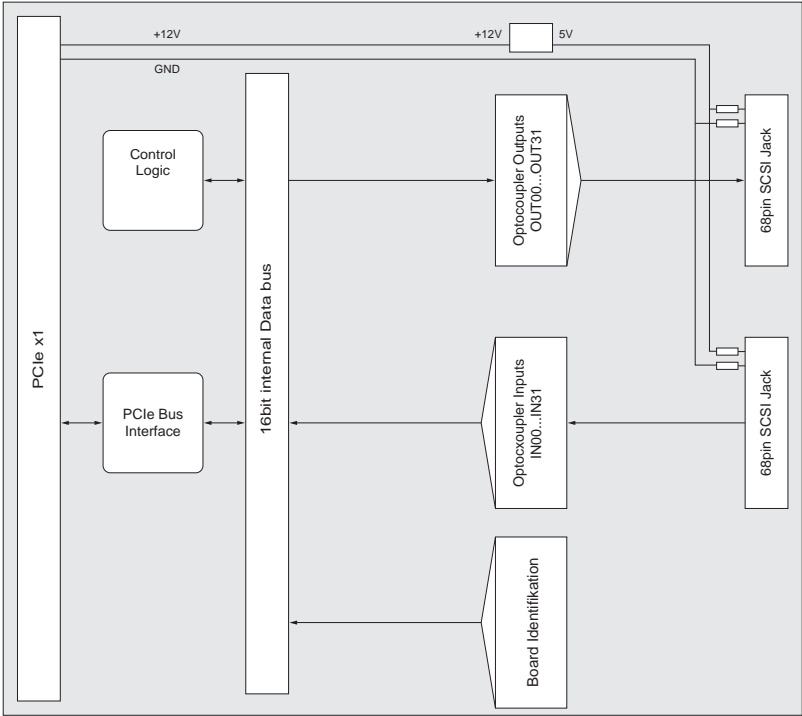
4.2 Access to the system components

Access to the hardware components of the OPTOIO-PCIe32 is made by reading and writing in Memory Mapped I/O addresses by library functions. The relevant addresses for OPTOIO-PCIe32 depend on the base address given by the BIOS. You can access to the OPTOIO-PCIe32 by double-word access only. For reasons of compatibility the wasco drivers process or take into account the two least significant bytes only.
(Please find more information in the Programming chapter or in example programs on the supplied CD)
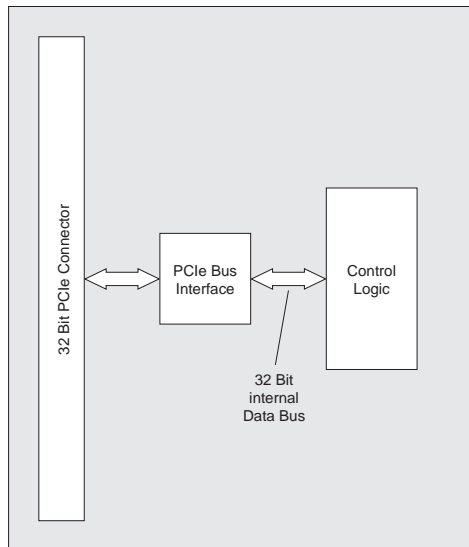
5. 32 Optocoupler Isolated Digital Inputs

Die OPTOIO-PCIe32$_{STANDARD}$ provides 32 input channels which are optically isolated by optocouplers.

5.1 Pin assignment of the input optocouplers

16,14,12,10   15,13,11,9

1,3,5,7   2,4,6,8
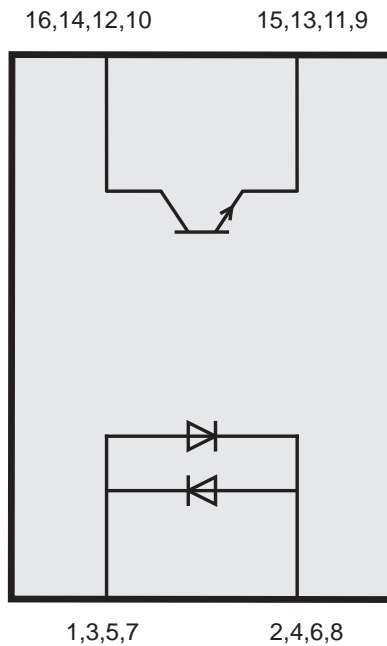
5.2 Input voltage ranges

You can select two different input voltage ranges for each optocoupler input by setting jumpers on JP3, JP4, JP5 and JP6

JP5   JP6

JP3   JP4

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

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

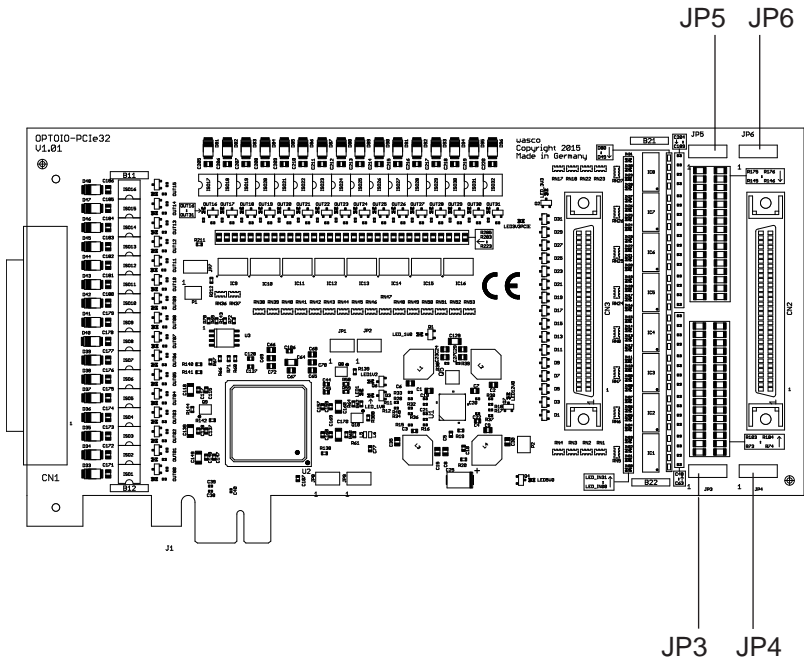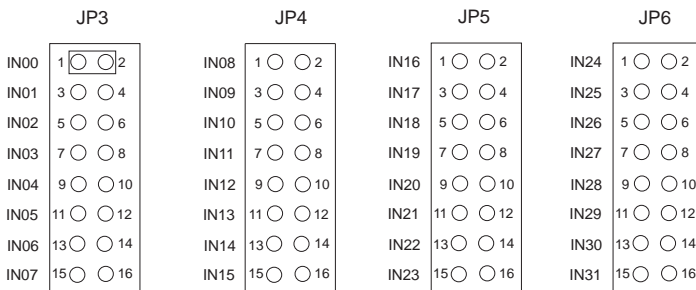| JP3	JP4	JP5	JP6
IN00 1 ○ ○ 2	IN08 1 ○ ○ 2	IN16 1 ○ ○ 2	IN24 1 ○ ○ 2
IN01 3 ○ ○ 4	IN09 3 ○ ○ 4	IN17 3 ○ ○ 4	IN25 3 ○ ○ 4
IN02 5 ○ ○ 6	IN10 5 ○ ○ 6	IN18 5 ○ ○ 6	IN26 5 ○ ○ 6
IN03 7 ○ ○ 8	IN11 7 ○ ○ 8	IN19 7 ○ ○ 8	IN27 7 ○ ○ 8
IN04 9 ○ ○ 10	IN12 9 ○ ○ 10	IN20 9 ○ ○ 10	IN28 9 ○ ○ 10
IN05 11 ○ ○ 12	IN13 11 ○ ○ 12	IN21 11 ○ ○ 12	IN29 11 ○ ○ 12
IN06 13 ○ ○ 14	IN14 13 ○ ○ 14	IN22 13 ○ ○ 14	IN30 13 ○ ○ 14
IN07 15 ○ ○ 16	IN15 15 ○ ○ 16	IN23 15 ○ ○ 16	IN31 15 ○ ○ 16

Example:
Setting the jumper over Pin1 and Pin2 of the jumper block JP3, the input voltage range of IN00 switches from 0..2V (Low) and 14..30V (High) to 0..1V (Low) and 5..15V (High). The remaining input voltage ranges keep unaffected.

5.3 Input circuitry
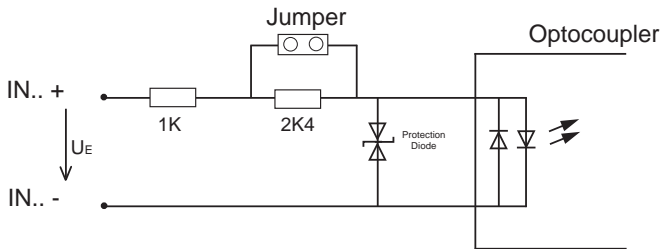
5.4 Input current

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

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

6. 32 Optically Isolated Outputs

Die OPTOIO-PCIe32 provides 32 output channels, which are optically isolated by optocouplers.

6.1 Pin assignment of the output optocouplers
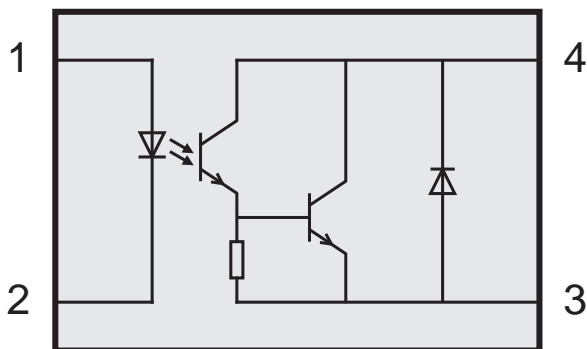
6.2 Optocoupler specifications

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

6.3 Output circuitry

Optocoupler

Schutzdiode

OUT..+

OUT..-

7. Board Configuration

7.1 Board Identification

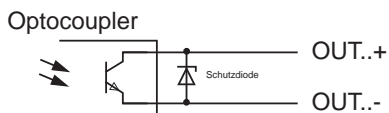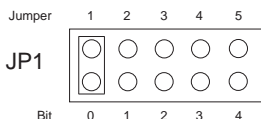The board Identification enables you to differentiate between several PC boards of the same type in your system. This is realised by a software readable jumper block.

The board identification to be read consists of one Byte (16 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:

JP1   (Jumper 1 and 3 closed)

Result of the reading command: $05

7.2 Access with 16 or 32 Bit

The jumper block JP1/1-2 enables you to set the data width of the access.

If the jumper block JP1/1-2 is not set (Default) the card works in compatibility mode. In this mode the card is accessed in 16-bit mode. Additionally, the offset addresses of the PCI card OPTOIO-PCI32$_{STANDARD}$ are valid with the factor 2.

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

The offset addresses of the two modes are covered in chapter 8.5 „Assignment of the Memory-Mapped I/O Addresses".
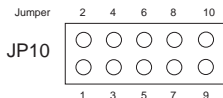
16-Bit mode
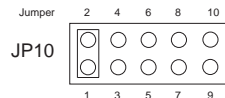
32-Bit mode

8. Windows® Programming

8.1 Installation of the Windows® driver

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

After starting-up Windows® 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® development files

To install Windows® development files please run setup.exe in the directory „Treiber" on the enclosed CD and then follow installation instructions.
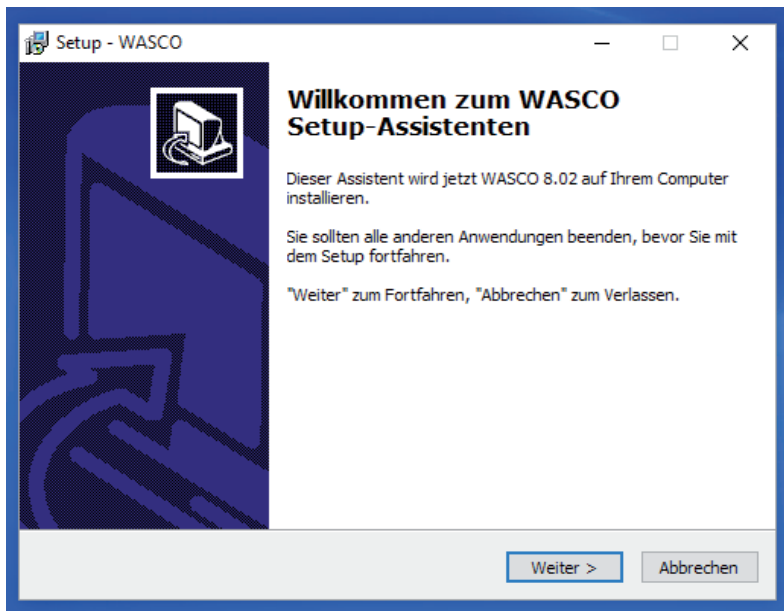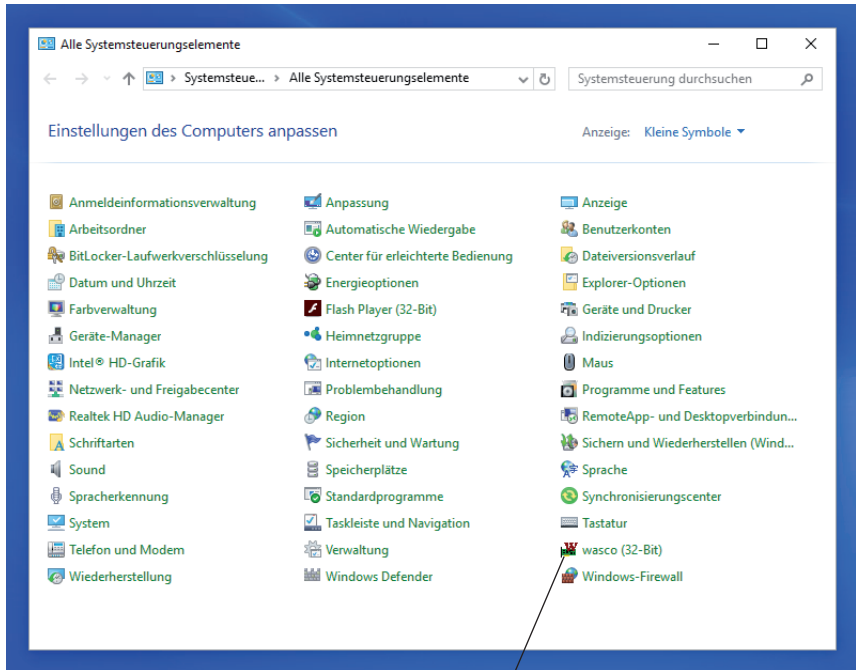
Having installed driver software and development files completely, your system control panel shows an icon for the localisation of all **wasco**® PCI and PCIe cards existing in the system.

Start the card's monitoring by double-clicking the "**wasco**®" icon. Following screen appears (in this example an OPTOIO-PCIe16STANDARD may be used)
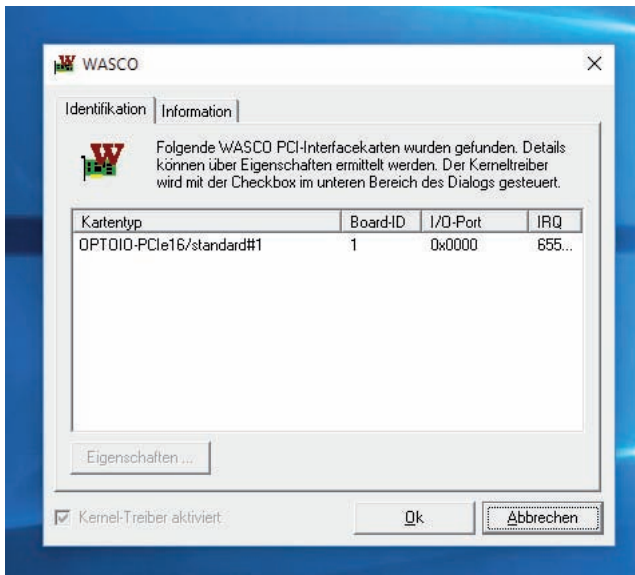
Once the system detected the card, this window shows card name, board ID, I/O address and possible interrupt number for each card. Furthermore the „Information" tab leads to information about driver version and localisation of the driver file.

If the system did not detect your card, following error message pops up:
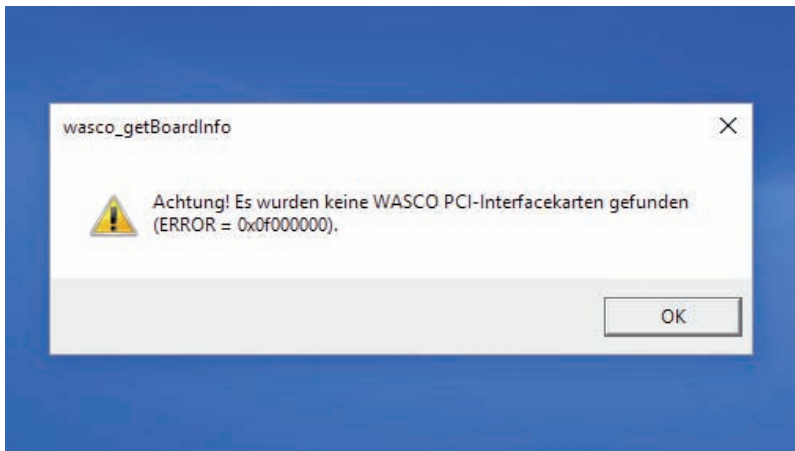
Please search for possible causes in the chapter Troubleshooting.

8.3 Programming of the OPTOIO-PCIe32 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 examples. More program examples specified for access to the OPTOIO-PCIe32 you can find on the enclosed CD or please visit our Website.
Programming the hardware components of the OPTOIO-PCIe32 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-PCIe32. Find more detailed descriptions for programming in the driver's documentation.

8.4 Access to the board OPTOIO-PCIe32Standard

The access to the OPTOIO-PCIe32Standard is done exclusively via the board name (type of card) OPTOIO-PCIe32/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:

16-Bit mode

Port/Register	BA + Offset	RD/WR
Optocoupler input port A (IN00...IN15)	BA + $0	RD
Optocoupler input port B (IN16...IN31)	BA + $4	RD
Optocoupler output port A (OUT00...OUT15)	BA + $40	WR
Optocoupler output port B (OUT16...OUT31)	BA + $44	WR
Board Identification	BA+ $3E0	RD

32-Bit mode

Port/Register	BA + Offset	RD/WR
Optocoupler inputs (IN00...IN31)	BA + $0	RD
Optocoupler outputs (OUT00...OUT31)	BA + $8	WR
Board Identifikation	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, you have to multiply the offset by two.
In programming we recommend to use offsets instead of the constants.

8.6 Compatibility to OPTOIO-PCI32$_{STANDARD}$

Developing the OPTOIO-PCIe32$_{STANDARD}$ and the corresponding driver, special care was taken to use an access as identical as possible to the OPTOIO-PCI32$_{STANDARD}$. 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 respectively for PCIe board:

1. The board's name switched from „OPTOIO-PCI32$_{STANDARD}$" to „OP-TOIO-PCIe32$_{STANDARD}$"
2. The functions to access to port addresses for the PCIe board are given as „wasco_outputPCIeW" and „wasco_inputPCIeW"
3. The offsets for the access to the Memory Mapped I/O addresses have been changed. For PCIe boards the former offsets must be multiplied by two. (Unchanged constants are usable for PCI only).
4. The setting of jumper block JP1 can be monitored via an additional address. The jumper can be used for example for the identification of the OPTOIO-PCIe32$_{STANDARD}$ in case your computer registers more than one board.

9. Linux® Programming

To use the board with Linux®, you can find a Linux wasco® driver on the supplied CD or on our website. This is available in code form and can therefore be changed and adapted by the customer at any time.

9.1 Installing the Linux® driver
To apply the card under Linux® 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® driver has been tested in the following environments:

Ubuntu® 18.04.4 LTS (Kernel: 5.3.0)

9.3 Programming the OPTOIO-PCIe32 with wasco® driver
Programming the hardware components of the OPTOIO-PCIe32 is realised by accessing Memory Mapped I/O addresses which depend on the base address assigned by the system's BIOS for the OPTOIO-PCIe32.

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-PCIe32 can be found on the supplied CD as well as on our homepage.

9.4 Access to the OPTOIO-PCIe32Standard

The access to the OPTOIO-PCIe32Standard is done exclusively via the board name (type of card) OPTOIO-PCIe32standard.

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...IN031)	BA + $0	RD
Optocoupler outputs (OUT00...OUT031)	BA + $8	WR
Board Identification	BA+ $FF8	RD

10. Accessories

10.1 Compatible **wasco**® accessories

Connecting parts	EDP No.
PDB68F33DS68 Ribbon cable	A-498600
KMDB-68 Connecting Board	A-494800
DS68R100DS68 Connecting wire (1 meter)	A-492200
DS68R200DS68 Connecting wire (2 meters)	A-492400
DS68R500DS68 Connecting wire (5 meters)	A-492800

10.2 Connecting technique (application examples)

* DS68R100DS68 or DS68R200DS68
 or DS68R500DS68

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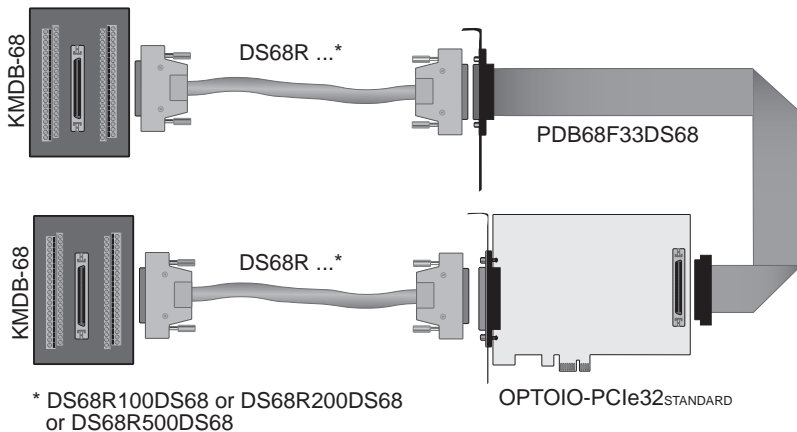
10.3 Single components for own assembly

Connection parts	EDP No.
SCSI-II plug 68pin for flat ribbon cable	A-553200
SCSI-II jack 68pin for flat ribbon cable	A-557200
Slot bracket with cutout for connector male/female 68 pin	A-577800
flat ribbon cable 68pin	A-572800

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11. Troubleshooting

You can find below a short compilation of most frequently known error causes, that may occur while starting-up or running OPTOIO-PCIe32. Please check the following points before you contact your distributor to solve your problem:

1.   Is OPTOIO-PCIe32 inserted to the PCI slot properly?

2.   Are all cable connections OK?

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 refer to your system manual)

4.   Did you install the latest driver version of the **wasco**® drivers?
         Updates you can find here: http://www.messcomp.com

12. Specifications

Optocoupler Inputs

Optocoupler: LTV-244 or compatible
32 channels, optically isolated
Galvanic isolation even between every single channel with each two separate connectors
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: 32 * PC853 or compatible socket mounted
32 channels, optically isolated
Galvanic isolation even between every single channel with each two separate connectors
Overvoltage protection by protection diodes
Output current max. 150mA
Output frequency ca 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

2 * 68pin SCSI socket

Bus system

32-Bit PCIe Bus (16 and 32 Bit data access)

Measurements of the Board

208 mm x 111 mm (l x b)
standard height, full length card
6-layer PCB

Other

Control LEDs for power supply

13. Product Liability Act

Information about 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 when handling this product.

It must therefore always be verifiable, that the non-commercial end-user has been made familiar 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-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 a 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 have 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.

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14. EC Declaration of Conformity

It is hereby confirmed, that the following CE marked product

OPTOIO-PCIe32STANDARD
EDP Number A-840600

complies 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.

The following standards were observed:

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

issued by

Dipl.Ing.(FH) Hans Schnellhammer

Wasserburg, 30.09.2015

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Reference system for intended use

This PC expansion card is a not independently operable device. 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 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:	ASUS P5G41-M LE	
Interface:	OPTOIO-PCIe32$_{STANDARD}$	A-840600