Digital I/O PCIe card
PCD-8104/8105/8106
User Guide

My DAQ Card Details:

type of card:	. . . .	(e.g. PCD-8104)
serial number:	. . . .	(e.g. 80410108)
purchase date:	. . . .	
card owner:	. . . .	

Manufacturing, sales office, service center, technical support and headquarters:

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CE Declaration of Conformity

All TEDIA® products described in this user guide comply with the essential requirements of the following applicable European Directives:

- Electromagnetic Compatibility (EMC) Directive 2014/30/EU

- RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU

The CE Declaration of Conformity original document is stored at the manufacturer and its copy may be provided on request.

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products should be disposed of separately from municipal household waste according to WEEE Directive 2012/19/EU of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources.
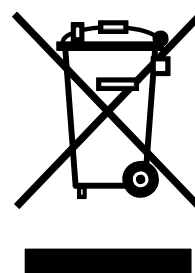
1.   Introduction

1.1   Description

The PCD-8104/8105/8106 are add-on PCI Express cards intended especially for laboratory and industrial automation and measuring systems.

The PCD-8104/8105/8106 cards provide especially these features:

- 24 isolated digital inputs; signal levels depending on the type of card (5 V or 24 V)
- three 8-bit bidirectional digital ports, software configurable as input or output
- IRQ logic with interrupt sources derived from rising or falling edge of each digital port signal (i.e. 96 individually programmable interrupt sources) and internal timer

Available types and versions of cards:

PCD-8104   standard format card intended for 5 V signal levels (common GND)

PCD-8104/LP   low-profile format card of PCD-8104

PCD-8105   standard format card intended for 24 V signal levels (common GND)

PCD-8105/LP   low-profile format card of PCD-8105

PCD-8106   standard format card intended for 24 V signal levels (common 24 V)

PCD-8106/LP   low-profile format card of PCD-8106

In the following text, unless otherwise stated, the designation **PCD-810x applies to all types and versions of card.**

1.2   General instructions for use

The PCD-810x card is suitable for installation in either office or industrial computers that are fitted with the PCI Express bus (Gen 1 compatible).

Cable types and their maximum length are described in paragraph 2.4 General data.

Caution:

The cards are designed for DAQ&C applications and may be used only according to the manufacturer's recommendations and precautions given in this manual and other general standards and terms and may be used only such a way, that its failure caused by any reason will not be dangerous to any person or property.

1.3   Note on the contents of the manual

This manual contains all information related to card features, I/O connectors etc., but does not include a description of installing and using drivers.

For information about drivers and programming check the dedicated documentation.

1.4   New firmware versions and customer´s firmware

The PCD-810x card is based on a FPGA unified core providing implementation of PCI Express bus and all peripheral circuitry, e.g. solution that gives maximum control and supervision over full functionality. High concentration of control algorithms within FPGA allows to add or modify functions without redesign the board (e.g. firmware with added special custom features or a build completely new custom firmware).

A simple software utility for user-friendly firmware upgrade is available.

2.   Specifications

2.1   Digital inputs

Input type:

PCD-8104, PCD-8104/LP	HC/HCT/TTL	
PCD-8105, PCD-8105/LP	24 V, common GND	(designed for PNP outputs)
PCD-8106, PCD-8106/LP	24 V, common 24 V	(designed for NPN outputs)

Number of inputs: 24

Parameters of HC/HCT/TTL type inputs:

signal level L:	< 0.8 V	
signal level H:	> 2.0 V	
input impedance:	10 kOhm approx.	(pull-up resistor against 5 V)
overvoltage protection:	-10 V / +15 V	

Parameters of 24 V type inputs:

signal level L:	< 5 V	(see Fig. 4 and 5 in Appendix)
signal level H:	15÷30 V	(see Fig. 4 and 5 in Appendix)
input impedance:	10 kOhm approx.	
overvoltage protection:	±40 V max. 1 s	

Isolation voltage:	1000 V_{DC}	(standard version of the card)
	600 V_{DC}	(card with ESD-X1 option)

Note: *ESD-X1 option includes Surge Arrester (protection of the isolation barrier).*

2.2   Digital ports

Number of ports:	three 8-bit bidirectional ports
Operating levels:	HC/HCT/TTL
Load impedance of outputs:	500 Ohm min.

Note: *Digital bidirectional ports are not protected against overvoltage, stresses outside the range 0÷5 V will may cause permanent damage.*
The digital ports in the output mode are durable to permanent short-circuit against GND while maintaining the maximum current of the 5V power source (see paragraph 2.4 General data).

2.3   Interrupt logic

Interrupt sources:	timestamp IRQ generator (1÷255 ms), all digital ports
Interrupt trigger event:	timestamp generator overflow, any combination of rising or falling edges on all digital ports and digital inputs

2.4   General data

Bus type: PCI Express (x1, Gen 1)

PCI ID: VID=1760_H, DID=0804_H (PCD-8104, PCD-8104/LP)
                                       VID=1760_H, DID=0805_H (PCD-8105, PCD-8105/LP)
                                       VID=1760_H, DID=0806_H (PCD-8106, PCD-8106/LP)

Bus power consumption: 300 mA typ. @ 3.3 V   (500 mA max.)
                                       150 mA typ. @ 12 V   (500 mA max.)

Internal power supply: 700 mA max. @ 5 V   (see note below)

Board dimensions::   56 x 128 mm approx.   (PCE-8019 not included)

Connectors: D-Sub 25 - male   (digital inputs)
                                       10 pin header type   (DIO ports 0, 1 a 2)

Operating temperature: 0÷60 °C

Storage temperature: -20÷70 °C

Operating humidity: 10÷90 %, noncondensing

Recommended cable length: shielded cables, 2 m max.

Note: *The internal 5V power supply voltage is generated by the on-board circuits from the 12V PCI Express bus power source and is used to supply the DIO ports and also to supply PCE-16xx series external boards (see description of KX1÷KX3 connectors). The total current of all 24 DIO signals when output mode is selected, including the current consumption of PCE-16xx boards, must not exceed the permitted value.*

3. Installation

3.1 Introduction

Attention has been focused on achieving a high quality and reliability during the manufacturing process and attention was also paid to an inspection of the card before being shipped to you. Detailed reading of this guide and following the instructions precisely are highly recommended for achieving full quality and to prevent any damage during installation. For further information see manufacturer's website http://www.tedia.eu.

3.2 Hardware configuration

The PCD-810x card contains a single configuration element - a two-segment DIP switch (the status of this switch can be read by the program to identify multiple cards as CardID value). Check Figure 1 in Appendix of this manual for more information.

3.3 Installation

Important Warning:
While installing the card, please follow the principles for handling the circuits, which are sensitive to the electrostatic discharge damage. Touch the card carefully only by the edges, and do not touch the components or metal contacts on the bottom of the card.
The computer must be switched off before the card is installed. Always disconnect the power supply cord and other cables connected to the PC!
The cards may be stored only in an antistatic wrapper outside of the computer. Failure to comply with the rules listed above may lead to damage of the sensitive circuits of the card, or even of the whole computer.

After removing the slot cover plate, plug the configured card into a free slot for expansion PC cards and fix it in place.

If you plan to use the digital ports DIO1 and DIO2 of standard format card, install the PCE-16xx series board (not included in the delivery package of the card) into the next position and connect the flat cables. Similarly, if you plan to use the digital ports DIO0, DIO1 and DIO2 of low-profile card, install the PCE-8025/LP adaptor board (not included in the delivery package) into the next position and connect the flat cables.

Note: *In the event of any queries, please contact the manufacturer's technical support. See http://www.tedia.eu for more contact information.*

3.4 Location of switches and connectors

See the Appendix, Figure 1 for location of configuration switches and connectors.

3.5 Connector pin assignment

The connector pin layouts are shown in Table 1 through Table 3, the connector pin assignment is shown in Figure 2 (all in Appendix of this manual).

4.   Digital Inputs and Ports

4.1   Introduction

The PCD-810x card provides 24 isolated digital inputs (signal levels depending on the type of card) and three 8-bit bidirectional digital ports.

All digital inputs (identified as DIN00÷DIN23) use the D-Sub 25 connector located on the card bracket, three digital ports (identified as DIO0, DIO1 and DIO2) use header type connectors located at the back edge of the card.

In case of the standard format card (ie. PCT-842x), the DIO0 port is accessed on the card bracket via adapter cable PCE-8019 terminated with D-Sub 9 connector. Remaining two ports (ie. DIO1 and DIO2) can be accessed via adapter cable PCE-1620 (card bracket with D-Sub 9 connector), or other types from the PCE-16xx series adapter boards.

Note: *Unlike the adapter cable PCE-8019, the PCE-16xx boards are not included in the delivery package of the card.*

In case of the low-profile format card (ie. PCD-810x/LP) all three ports DIO0, DIO1 and DIO2 can be accessed via adapter cable PCE-8025/LP (low-profile card bracket with D-Sub 25 connector); there are currently no other option available.

Note: *The PCE-8025/LP adaptor board is not included in the delivery package of the card.*

The signal direction of DIO port (ie. input or output option) can be selected independ for each 8-bit port (it is not possible to select direction individually for each of the eight signals of one DIO port) from the user software.

The port direction and output data after computer is turned on or restarted are stored in the on-board EEPROM memory and can modify by the software utility (by default, all ports are set as input).

4.2   Description of digital inputs

All cards of the PCD-810x series contain 24 isolated digital inputs they differ from each other only by signal levels and input connections.

The PCD-8104 card digital inputs work with HC/HCT/TTL levels and use HCTMOS circuits providing high input impedance, very low leakage current and protection diodes. The unconnected state of inputs represents the H logic level generated by pull-up resistors 10 kOhm against a voltage of 5 V, and the inputs can be therefore also used to direct connecting of floating contacts.

Check the Appendix, Figure 3 for detail information.

The PCD-8105 card digital inputs support 24 V signals level and work with positive polarity against the common rail (inputs are designed for PNP outputs).

Check the Appendix, Figure 4 for detail information.

Similar to PCD-8105 card, digital inputs of the PCD-8106 card support 24 V signals level, but work with negative polarity against the common rail (inputs are designed for NPN outputs).

Check the Appendix, Figure 5 for detail information.

4.3   Description of digital ports

Drivers and receivers based on HCTMOS technology were used for digital ports.

In the output mode (ie. driver mode), the HCTMOS circuits provide true 5 V signal levels with a high output current with low voltage drop and can therefore be used for direct control of LEDs, optocouplers, or miniature relays (coil parameters 5 V, 500 Ohm).

In the input mode (ie. receiver mode), the HCTMOS circuits provide not only TTL signal compatibility, but moreover high input impedance, very low leakage current and protection diodes. The unconnected state of inputs represents the H logic level generated by pull-up resistors 10 kOhm against a voltage of 5 V, and the inputs can be therefore also used to direct connecting of floating contacts.

Check the Appendix, Figure 6 for detail information.

Note: *Unfortunately, the concept of bidirectional ports does not provide the overvoltage protection available to other ports of PCI/PCIe TEDIA cards.*

4.4   Interrupt logic

The PCD-810x card allows to trigger an interrupt (simultaneously with the timestamp IRQ generator) by any combination of rising or falling edges of the signals of all digital inputs and digital ports.
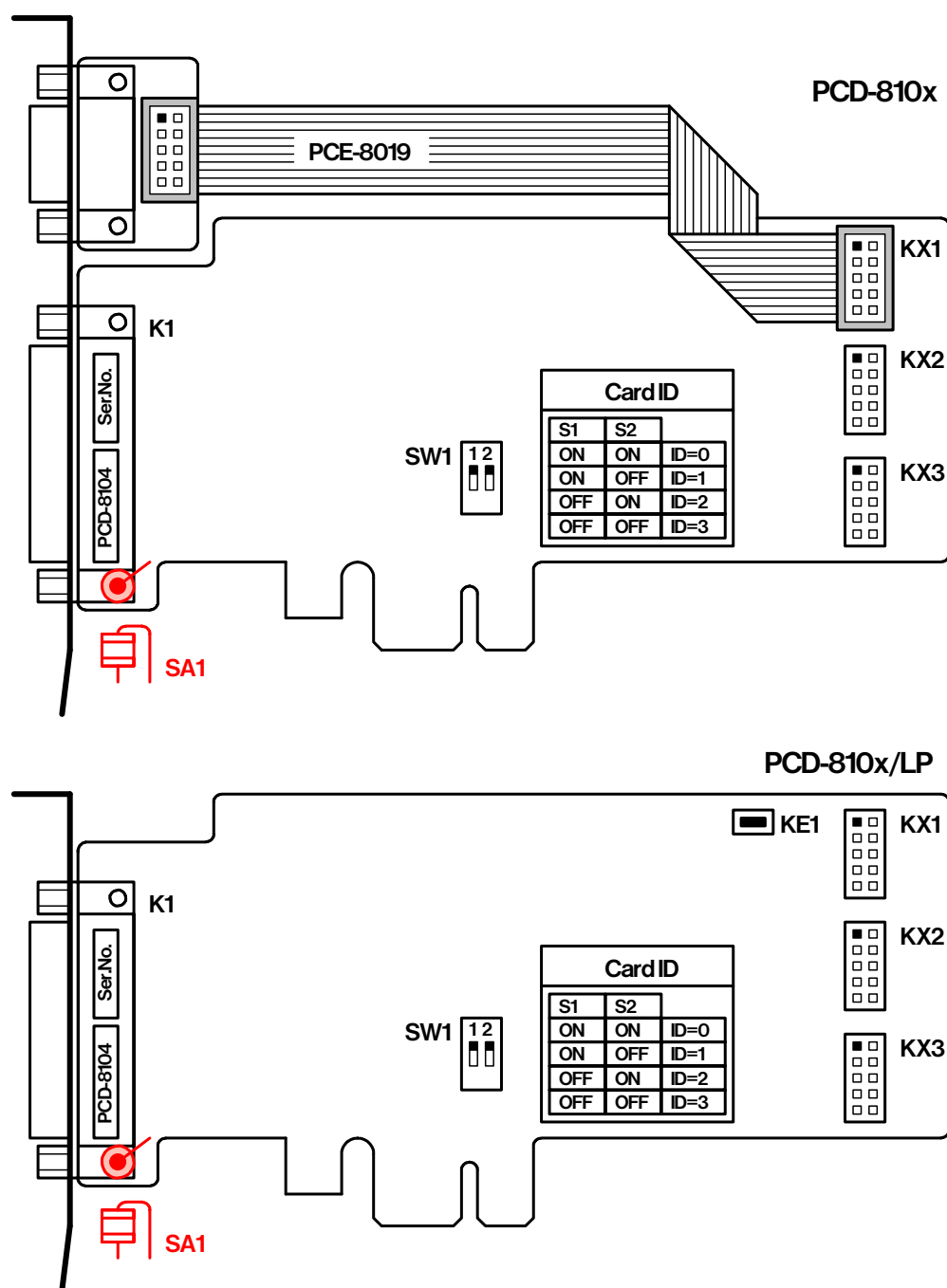
Figure 1.   Location of switches and connectors on both version of cards.

K1	connector of digital inputs DIN00÷DIN23 (D-Sub 25 - male)
KX1	connector of digital port DIO0, ie. DIO00÷07 signals (2x5 pin header type)
KX2	connector of digital port DIO1, ie. DIO08÷15 signals (2x5 pin header type)
KX3	connector of digital port DIO2, ie. DIO16÷23 signals (2x5 pin header type)
SW1	DIP switch for identifying multiple cards (CardID value)
PCE-8019	adapter cable PCE-8019 terminated with D-Sub 9 male connector (included in the delivery package of the standard format card)
KE1	button for activating backup firmware (intended for service purposes)
SA1	Surge Arrester (cards with ESD-X1 option)

K1 signal (PCE-8025/LP)	pin	pin	K1 signal (PCE-8025/LP)
DIN00 (DIO00)	C1	C14	DIN01 (DIO01)
DIN02 (DIO02)	C2	C15	DIN03 (DIO03)
DIN04 (DIO04)	C3	C16	DIN05 (DIO05)
DIN06 (DIO06)	C4	C17	DIN07 (DIO07)
DIN08 (DIO08)	C5	C18	DIN09 (DIO09)
DIN10 (DIO10)	C6	C19	DIN11 (DIO11)
DIN12 (DIO12)	C7	C20	DIN13 (DIO13)
DIN14 (DIO14)	C8	C21	DIN15 (DIO15)
DIN16 (DIO16)	C9	C22	DIN17 (DIO17)
DIN18 (DIO18)	C10	C23	DIN19 (DIO19)
DIN20 (DIO20)	C11	C24	DIN21 (DIO21)
DIN22 (DIO22)	C12	C25	DIN23 (DIO23)
COM (GND)	C13		

Table 1.   D-Sub 25 (male) connector pin assignment.

Note: *The signal names before the bracket apply to the connector K1 located on card, the signal names in brackets apply to the connector located on PCE-8025/LP adapter.*

KX1/KX2/KX3 signal	pin	pin	KX1/KX2/KX3 signal
DIO00/08/16	D1	D2	DIO01/09/17
DIO02/10/18	D3	D4	DIO03/11/19
DIO04/12/20	D5	D6	DIO05/13/21
DIO06/14/22	D7	D8	DIO07/15/23
GND	D9	D10	5V (see specification chapter)

Table 2.   Header type connector pin assignment.

Note: *In case of the standard format card, the DIO0 port is accessible on the card bracket via adapter cable PCE-8019 terminated with D-Sub 9 connector. Remaining two ports (ie. DIO1 and DIO2) can be accessed via adapter cable PCE-1620 (card bracket with D-Sub 9 connector), or other types from the PCE-16xx series adapter boards.*
In case of the low-profile format card all three ports DIO0, DIO1 and DIO2 can be accessed via adapter cable PCE-8025/LP (see Table 1).

signal	pin	pin	signal
DIO00/08/16	C1	C6	DIO01/09/17
DIO02/10/18	C2	C7	DIO03/11/19
DIO04/12/20	C3	C8	DIO05/13/21
DIO06/14/22	C4	C9	DIO07/15/23
GND	C5		

Table 3.   D-Sub 9 (male) connector pin assignment located on PCE-8019 (single DIO port adapter cable) and PCE-1620 (dual DIO port adapter cable).
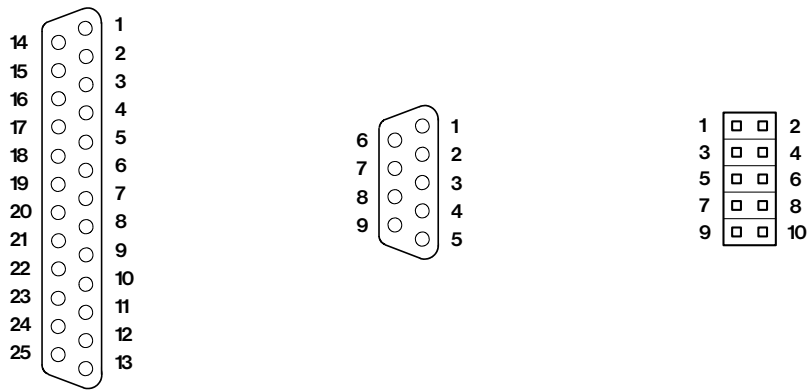
Figure 2.   Pin layout on D-Sub 25 (male), D-Sub 9 (male) and header type connectors (2x 5 pins, 2.54 mm pitch).
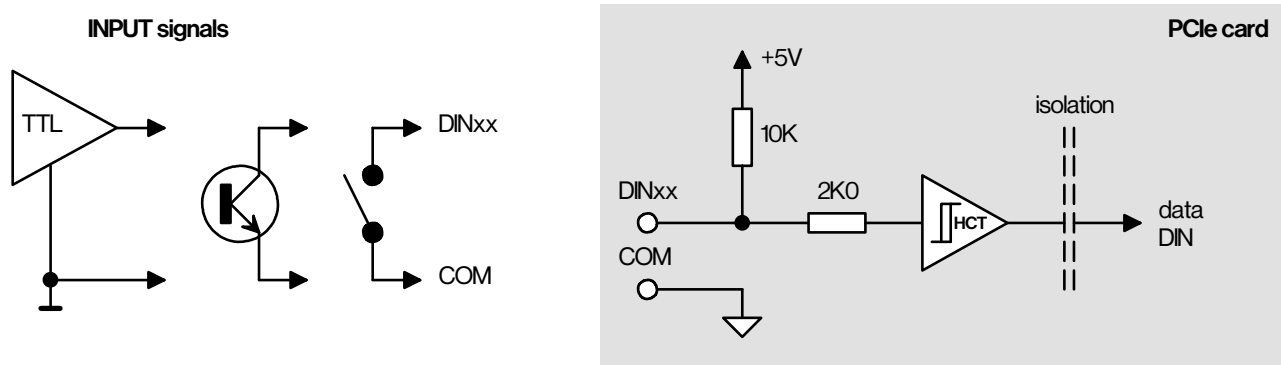
Figure 3.   Simplified schematic of isolated inputs PCD-8104.
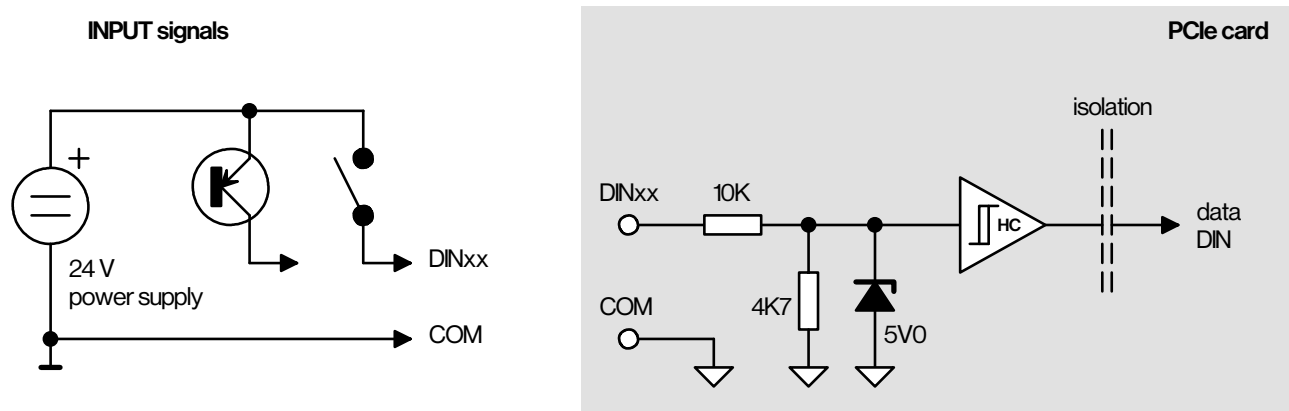
Figure 4.   Simplified schematic of isolated inputs PCD-8105.

As can be seen from the schematic, DINxx inputs handle signals with positive polarity against the common rail (COM).

Unconnected input or signal voltage lower than 5 V is represented by the value 0 in the data register of the card, the signal voltage greater than 15 V is represented by the value 1.
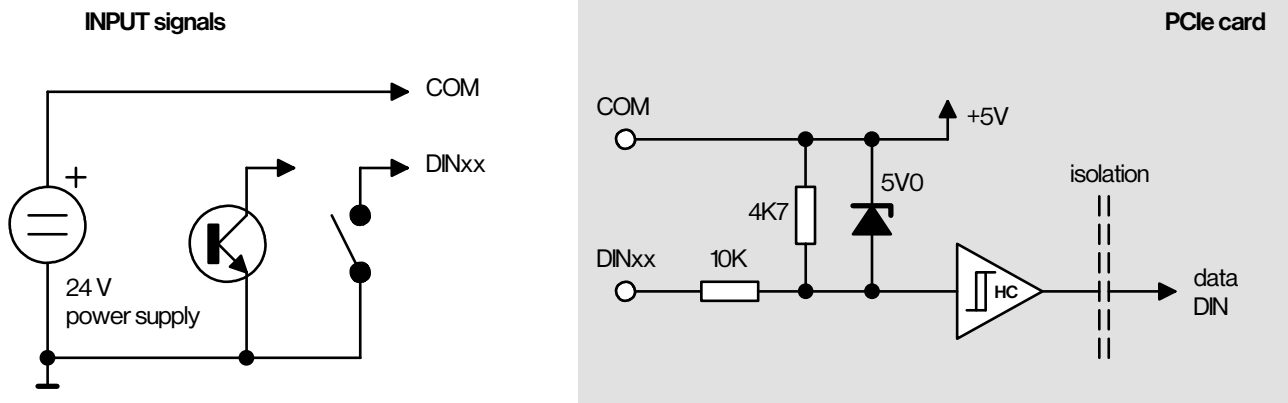
Figure 5.   Simplified schematic of isolated inputs PCD-8106.

As can be seen from the schematic, DINxx inputs handle signals with negative polarity against the common rail (COM).
Unconnected input or signal voltage lower than 5 V is represented by the value 0 in the data register of the card, the signal voltage greater than 15 V is represented by the value 1.

Figure 6.   Simplified schematic of DIO ports.

The diagram shows one bidirectional I/O channel.
The signal direction of DIO port (ie. input or output option) can be selected independ for each 8-bit port, but it is not possible to select direction individually for each of the eight signals of one DIO port.

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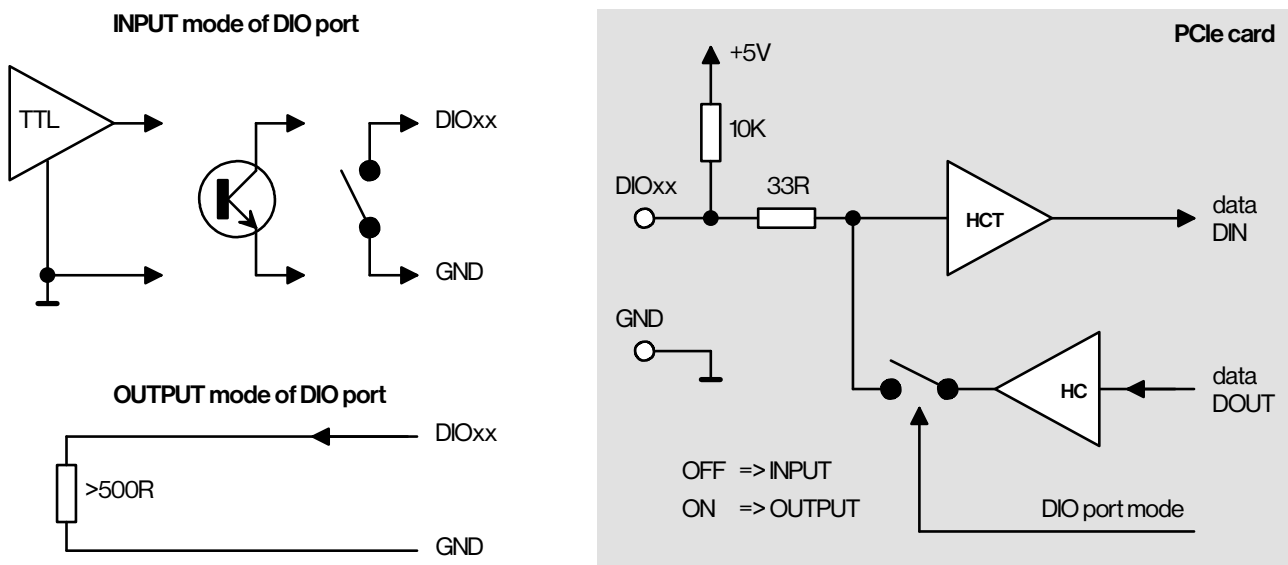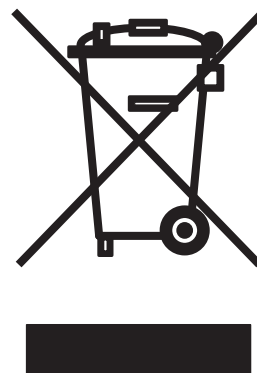
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