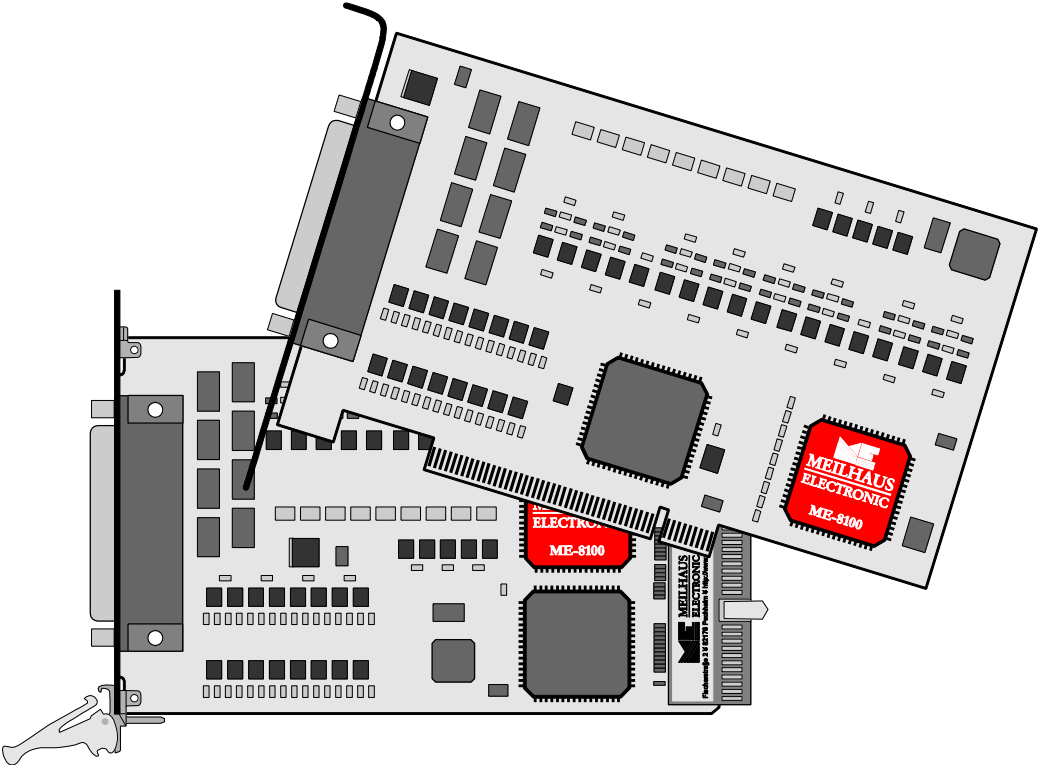# MEILHAUS ELECTRONIC

Meilhaus Electronic Manual

ME-8100 Series 3.0E

(PCI- and CompactPCI-Versions)

Opto-Isolated I/O Board
with Bit-Pattern Comparator and Optional Counter

Imprint

Manual ME-8100 Series

Revision 3.0

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Content

1   Introduction

Valued customer,

Thank you for purchasing this device from Meilhaus Electronic. You have chosen an innovative high-technology product that left our premises in a fully functional and new condition.

Please take the time to carefully examine the contents of the package for any loss or damage that may have occurred during shipping. If there are any items missing or if an item is damaged, please contact us immediately.

Before installing the board in your computer, we recommend you read this manual carefully, especially the chapter describing board installation.

The descriptions in this manual concern PCI- and CompactPCI-versions of the ME-8100 series if not otherwise noted.

1.1   Important Notes

1.1.1   Use in Accordance with the Requirements

The PC boards of the ME-8100 series are designed for acquisition and output of digital signals with a PC. Depending on type install the models of the ME-series into:

a free PCI slot (ME-8100A/B PCI) or

a free CompactPCI slot (ME-8100A/B cPCI)

For information on how to install a plug-in board or connect a USB device, please read the manual of your PC.

Please note the instructions and specifications as presented in this manual (Appendix A, Specifications):

- Please ensure sufficient heat dissipation for the board within the PC housing.
- All unused inputs should be connected to the ground reference of the appropriate functional section. This avoids cross talk between the input lines.
- The opto-isolated inputs and outputs achieve an electrical isolation of the application relative to PC ground.

- Note that the computer must be powered up prior to connecting signals by the external wiring of the board.
- As a basic principle, all connections to the board should only be made or removed in a powered-down state of all components.
- Ensure that no static discharge occurs while handling the board or while connecting/disconnecting the external cable.
- Ensure that the connection cable is properly connected. It must be seated firmly on the D-Sub connector and must be tightened with both screws, otherwise proper operation of the board cannot be guaranteed.

1.1.2 Improper Application

PC plug-in boards for the PCI-, PCI-Express- or CompactPCI-bus may not be taken into operation outside of the PC. Never connect the devices with voltage-carrying parts, especially not with mains voltage. As power supply for the USB models only an authorized power adaptor may be used.

Make sure that no contact with voltage-carrying parts can happen by the external wiring of the device. As a basic principle, all connections should only be made or removed in a powered-down state.

1.1.3 Unforeseeable Misapplications

The device is not suitable to be used as a children's toy, in the household or under unfavourable environmental conditions (e.g. in the open). Appropriate precautions to avoid any unforeseeable misapplication must be taken by the user.

1.2　Package Contents

We take great care to ensure your delivery is complete. Nonetheless, please check the list enclosed to verify the contents of your delivery. You should find included:

- Electrically isolated digital-I/O board of the board family ME-8100 for PCI- or CompactPCI-bus.
- Manual in PDF format on CD/DVD.
- Driver software on CD/DVD.
- ME-8100 PCI/cPCI: 78-pin D-Sub male connector.

1.3　Features

Model Overview

Model	Opto-Isolated Digital I/Os	Counter
ME-8100A PCI **ME-8100A cPCI**	16 inputs and 16 outputs (24 V)	3 x 16 bit (24 V)
ME-8100B PCI **ME-8100B cPCI**	32 inputs and 32 outputs (24 V)	3 x 16 bit (24 V)

Table 1: Model overview ME-8100 family

The boards of the ME-8100 series come with digital input and output ports and with three 16-bit counters. The digital ports and the counter signals are optically isolated and are designed for control applications requiring 24 V voltage level.

The ME-8100A board has 16 inputs, 16 outputs and a 16-bit-wide bit-pattern comparator. The ME-8100B has 32 inputs, 32 outputs and two bit-pattern comparators each 16 bits. All boards have three 16-bit counters available.

The ME-8100 models offer the option of switching from "source" drivers to "sink" drivers by software. This guarantees an individual adaption to your needs. First the outputs of all models are in a high-impedance state if the PC is off or after power up. That means the voltage level at the output pin depends on your external wiring. After a „1" is set on the output there is current.

As a special feature the ME-8100 offers the operation modes „bit-pattern match" and „bit-pattern change". If the bit-pattern at the

inputs matches a defined pattern or when a bit toggles from a defined bit, an interrupt occurs.

1.4   System Requirements

The ME-series may be installed into any PC (Intel® Pentium® processor) with a free standard PCI, PCI-Express resp. CompactPCI slot (32 bit, 33 MHz, 5 V). The board is supported by the Meilhaus Electronic Intelligent Driver System (ME-iDS).

1.5   Software Support

The ME-series is supported by the Meilhaus Electronic Intelligent Driver System (ME-iDS). The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 2000/XP/Vista and Windows 7, 8.1, 10 and contains a universal function library (API) for all common programming languages.

A detailed description of the functions can be found in the ME-iDS manual on the CD/DVD enclosed.

Please also note the corresponding README-files.

2   Starting up

Please read your computer's instruction manual on how to install new hardware components **before installing the board**.

2.1   Software Installation

- Installation under Windows

The following basic procedure should be used:

If you have received the driver software as an archive file, please unpack the software **before installing the board**. First choose a directory on your computer (e.g. C:\Temp\Meilhaus\ME-iDS).

Use the Meilhaus Electronic Intelligent Driver System (ME-iDS) for programming your new data acquisition hardware. For installation and operation of the driver system, please follow the documentation in electronic form included with the software package.

2.2   Test Program

For simple testing of the board use the corresponding test program provided with the ME-iDS.

3   Hardware

3.1   Block Diagram
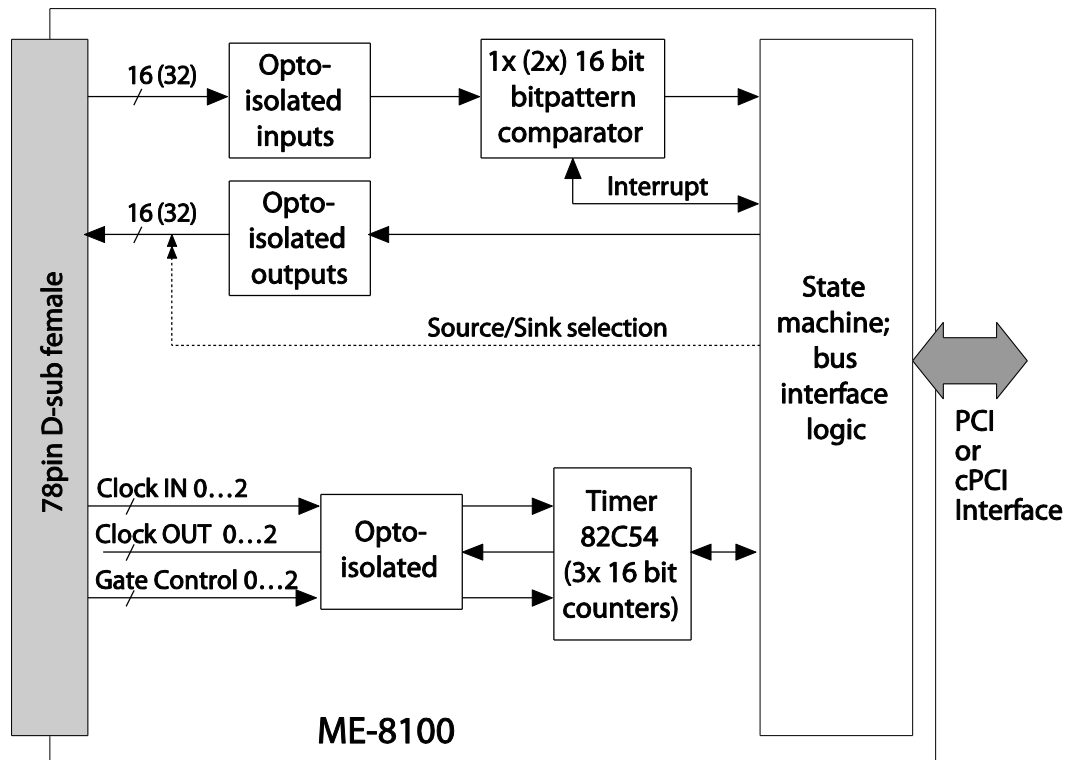
Diagram 1: Block diagram of ME-8100

Depending on the version not all functional groups included in the block diagram above are available:

ME-8100A: 16 inputs and 16 outputs, 1 x 16-bit-wide bit-pattern comparator, 3 x 16-bit counters.

ME-8100B: 32 inputs and 32 outputs, 2 x 16-bit-wide bit-pattern comparator, 3 x 16-bit counters.

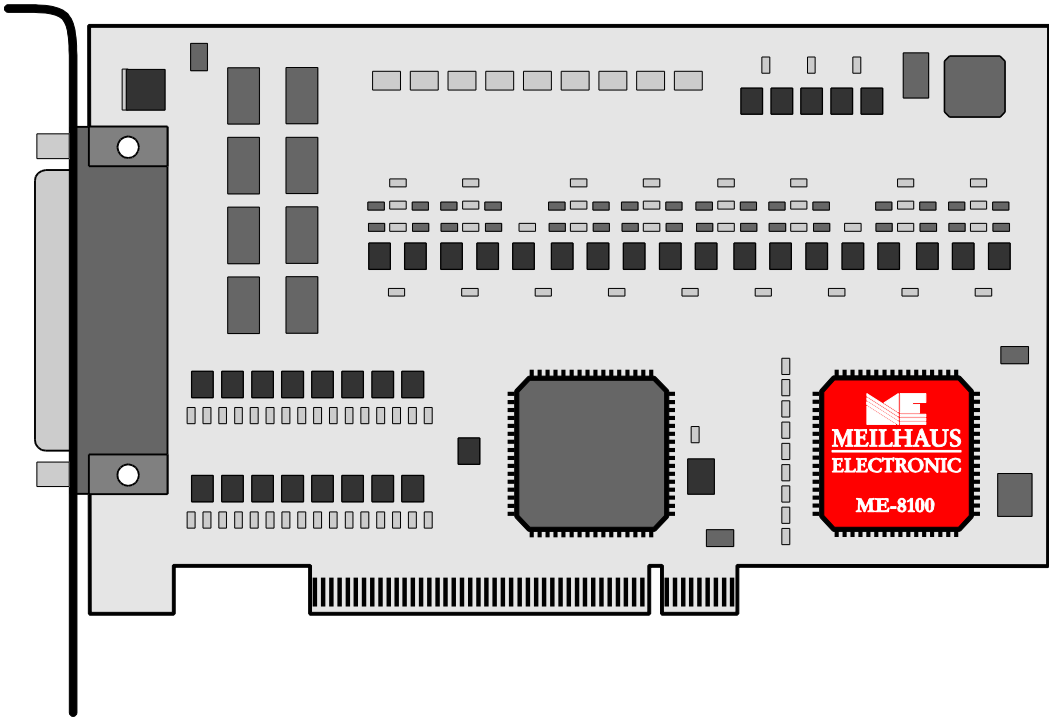**PCI-/cPCI models:** 78-pin D-Sub female connector.
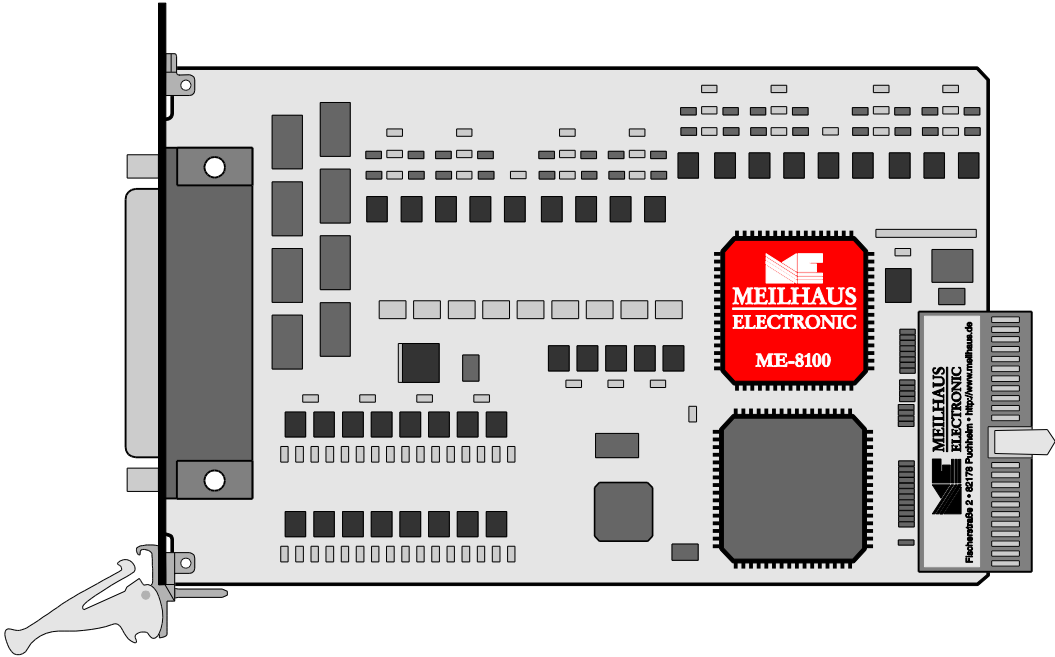
Diagram 2: ME-8100 PCI

Diagram 3: ME-8100 cPCI

3.2   Digital I/O

The opto-isolated inputs and opto-isolated outputs of the ME-8100 series are designed for control applications requiring 24 V voltage level.

For programming please read chapter 4.1 "Digital-I/O Section" on page 17:

3.2.1 Opto-Isolated Inputs

The 16 resp. 32 opto-isolated input channels (DI_A 0...15/ DI_B 0...15) of the ME-8100A/B are connected to the opto-couplers through resistors R_v. These resistors are sized for inputs of typical 24 V (R_v = 2.2 kΩ). For over voltage protection of the opto-couplers a protection diode (26 V) was assembled. If required, the resistors R_v and the protection diode can be sized for TTL signal level inputs. The digital lines must be referenced to the external ground (ext. GND).
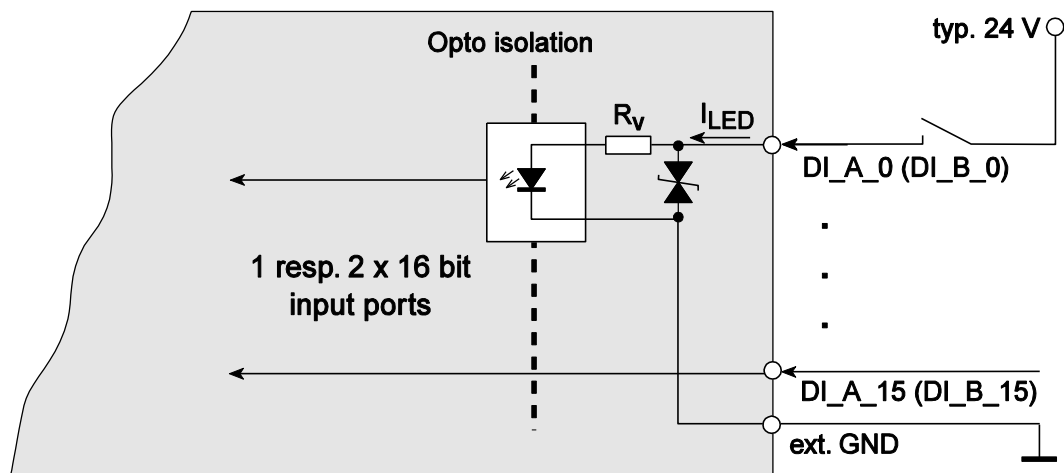
Diagram 4: Input wiring of ME-8100

3.2.2 Opto-Isolated Outputs

The 16 resp. 32 opto-isolated output channels (DO_A 0...15/ DO_B 0...15) of the ME-8100A/B are assembled with special output driver chips. Depending on the application, the user can set the outputs as active low (sink driver chip ULN2803; default) or active high (source driver chip UDN2982). Additionally the outputs can be set to a high-impedance state by port. A reference to external ground (ext. GND) must be done.

3.2.1.1 Sink Driver:
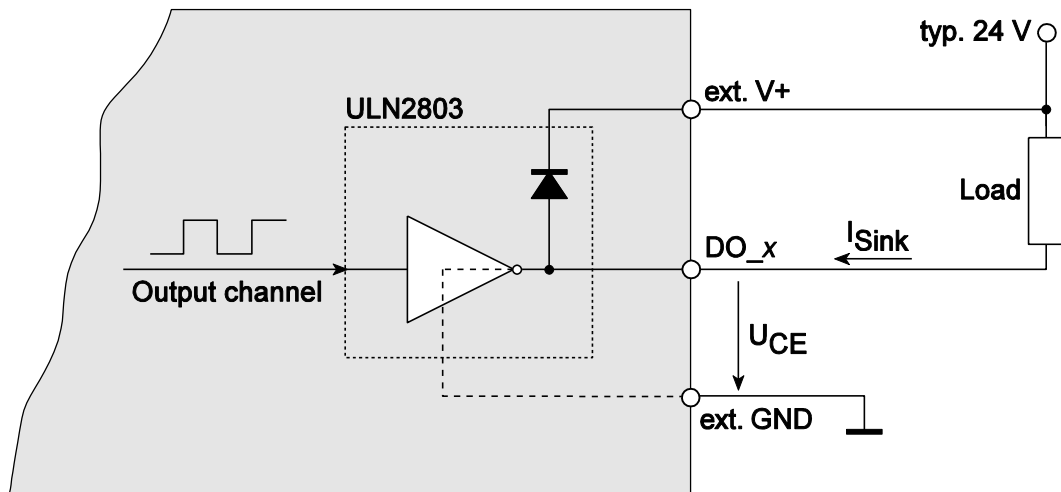
Diagram 5: Outputs of the ME-8100 with sink drivers

The maximum current ($I_C = I_{Sink}$) depends on the saturation voltage U_{CE} and is limited by the power dissipation of the sum of the channels to $P_{tot} = 1$ W per chip (DO_*x* 0...7 = chip 1, DO_*x* 8...15 = chip 2, ...), see Diagram 6: "Saturation voltage ULN2803".

$$P_{tot} = P_0 + ... + P_7 \leq 1 \text{ W (per chip at 70 °C)}$$

with $P_0 = I_{C0} \cdot U_{CE0}$
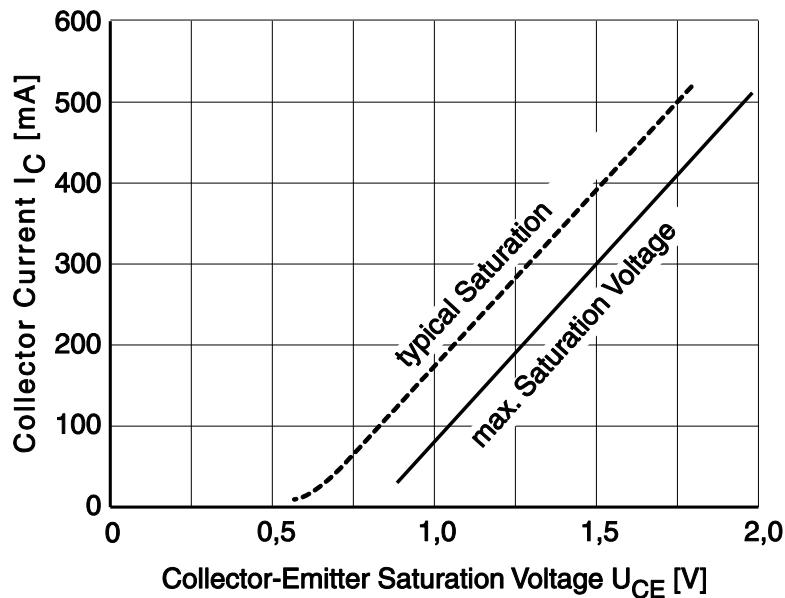
Diagram 6: Saturation voltage ULN2803

3.2.1.2 Source Driver:
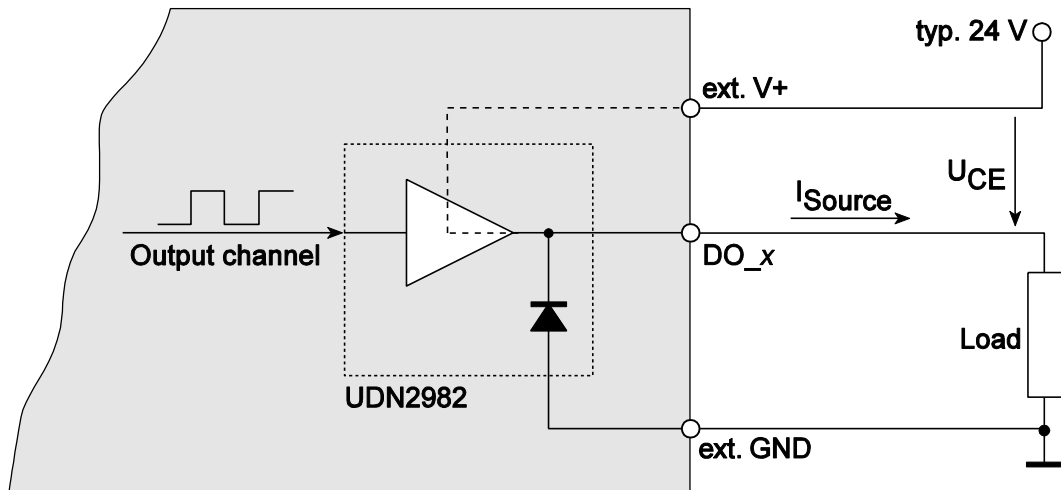
Diagram 7: Outputs of the ME-8100 with source drivers

Please see the following table for the maximum current per output ($I_C = I_{Source}$). The power dissipation of the sum of channels may not exceed $P_{tot} = 0.7$ W per chip (DO_x 0...7 = chip 1, DO_x 8...15 = chip 2, ...).

$$P_{tot} = P_0 + ... + P_7 \leq 1 \text{ W (per chip at 70 °C)}$$

with $P_0 = I_{C0} \cdot U_{CE0}$ and $U_{CE} = $ typ. 1.8 V

Number of used channels								
	1	2	3	4	5	6	7	8
I_{Cmax} [mA]	350	175	115	85	70	55	50	40

Table 2: Max. current of the source drivers

3.3 Counter

3.3.1 Counter Chip

The counter component is the standard 82C54 chip. This flexible component has 3 independent down counters, each 16-bit.

The ME-8100 series boards use the standard counter chip of type 82C54. This flexible component has 3 independent 16-bit (down) counters. All counter signals are available on the external D-Sub-connector. After the GATE signal has been properly set (OV) the counter counts down on every falling edge. The clock (CLK) sourcing the counter must be supplied externally and can have a maximum frequency of 1 MHz. The counters can be cascaded by making the proper external connections.

The "Clk", "Gate" and "Out" pins on the ME-8100 are opto-isolated. The counter outputs have pull up resistors (R_{UP} = 2.2 kΩ). All the counter signals are designed for control applications requiring 24 V (R_v = 2.2 kΩ) voltage level. All counter signals require a reference to counter ground (ext. GND).

For programming the counters please read chapter 4.2 on page 20.

3.3.1.1 Wiring Counter Inputs
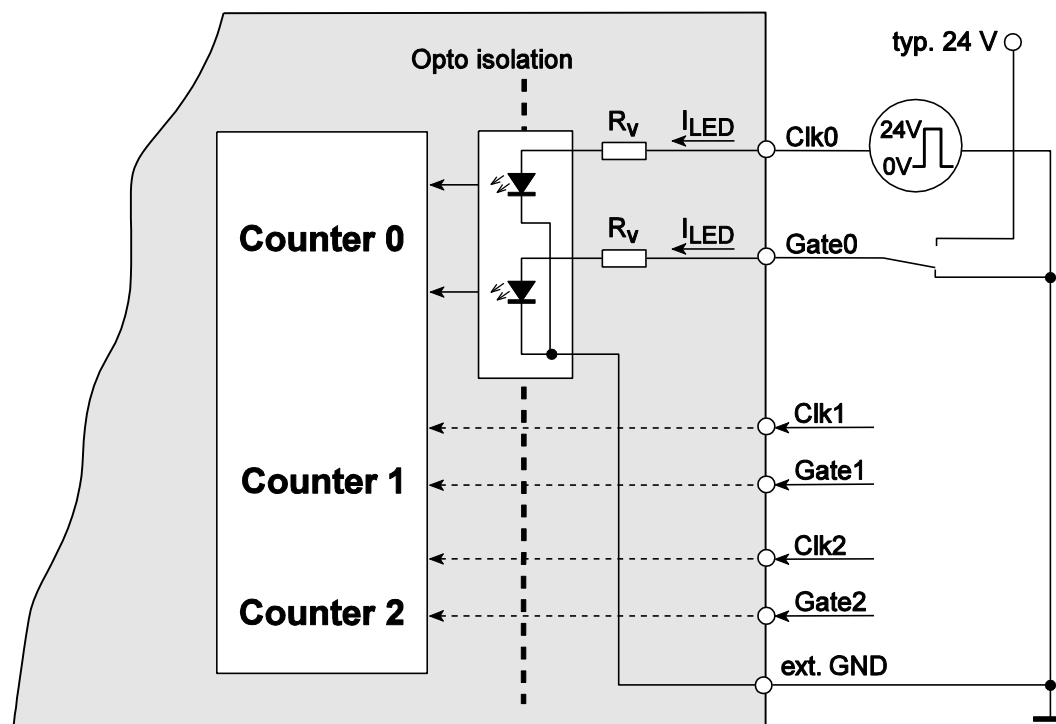
Diagram 8: Wiring of counter inputs ME-8100A/B

3.3.1.2 Wiring Counter Outputs
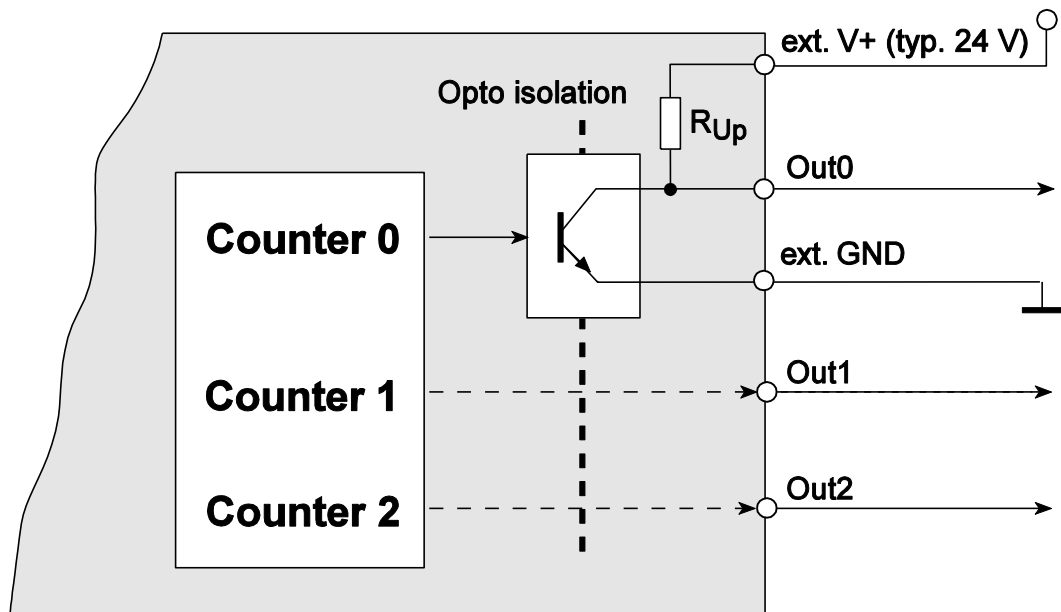
Diagram 9: Wiring of counter outputs ME-8100A/B

3.3.1.3 Cascading the Counters

The outputs of the counter(s) can be cascaded in line by making the proper external connections. The following example explains how to cascade counters 0...2:

- The clock input of counter 0 (Clk 0) is connected to the source clock.
- The output of counter 0 (Out 0) is connected to the clock input of counter 1 (Clk 1).
- The output of counter 1 (Out 1) is connected to the clock input of counter 2 (Clk 2).
- For enabling the counters the gate inputs (Gate 0...2) must be connected to 0 V.
- At the output of counter 2 (Out 2) is the cascaded counter signal.

4 Programming

For programming the device please use the Meilhaus Electronic Intelligent Driver System (ME-iDS) included in your package. The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 2000 and higher and contains a universal function library (API) for all common programming languages (the extent of the current software support can be found in the README-files of the ME-iDS).

A detailed description of the functions can be found in the ME-iDS manual (see CD/DVD enclosed or online: www.meilhaus.de/download/ME-iDS.

Further details regarding the assignment of the subdevices and device specific arguments can be found in the help file (help file format under Windows, *.chm) which can be accessed via the „ME-iDS Control Center" in the info area of the task bar (as a rule in the lower right corner of the screen) or via the Windows start menu.

If you do not want to program your board with the ME-iDS but with the legacy driver you can find the last revision of the old function reference in the ME-8100 manual Rev. 1.6 (see:www.meilhaus.com). Please note, that we cannot support this driver anymore.

4.1 Digital-I/O Section

Each digital port of the ME-8100 series is considered to be an independent functional group (subdevice) in the Meilhaus Intelligent Driver System (ME-iDS). These subdevices of a device are numbered always starting with „0". Because of the different model versions with a various number of ports the counting of subdevices differs. The assignment of the ports to the subdevices can be found in the ME-iDS help file (see ME-iDS Control Center).

For wiring the digital ports please read chapter 3.2 on page 12. The following operation modes are possible:

4.1.1 Simple Input/Output

The input/output of single digital values is done in operation mode „Single". Each digital port is accessed as a unique subdevice of type ME_TYPE_DI (port DI_A, DI_B) resp. ME_TYPE_DO (port DO_A, DO_B), subtype ME_SUBTYPE_SINGLE. **Note** the order of operation as described in the ME-iDS manual. The following parameters can be configured by the functions *meIOSingle-Config()* and *meIOSingle():*

- Determine subdevice with *meQuery...* functions.
- Port direction: input or output, if not fixed by opto-isolation.
- Port width: bit, byte or word operation.

4.1.2 Bit-Pattern Recognition

As a special feature the ME-8100 series offers the operation modes "bit-pattern match" and "bit-pattern change".

4.1.2.1 Bit-Pattern Match

In the "bit-pattern match" mode, a bit-pattern written to the comparison register is compared to the bit-pattern on the corresponding input port. An interrupt is initiated when bit-pattern is matching (see diagram 10).

Diagram 10: Bit-pattern match

4.1.2.2 Bit-Pattern Change

In the "bit-pattern change" mode, one or more input lines can be defined which should be monitored on toggling a bit. The respective bits of the corresponding mask register serve as a reference. If toggling (0 → 1 or 1 → 0) of at least one bit, masked with "1", an interrupt occurs (see diagram 11).
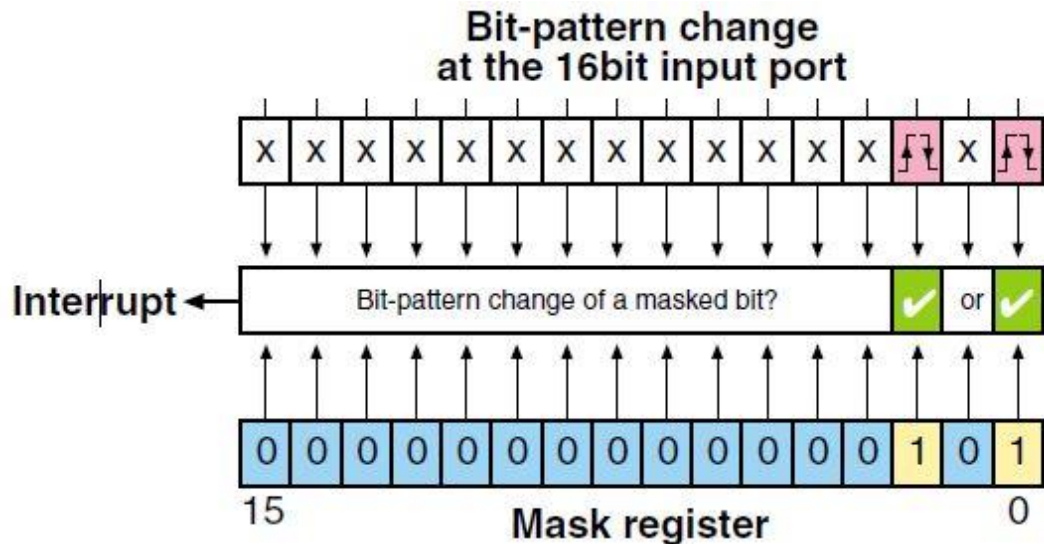

Diagram 11: Bit-pattern change

4.1.2.3 Order of Operation

Programming is done in operation mode "**Interrupt**" A digital port used for bit-pattern recognition must be of type ME_TYPE_DI. The following parameters can be configured by the functions *meIOIrqStart()* and *meIOIrqWait():*

- Determine Subdevice with *meQuery...* functions.
- Interrupt channel: always "0".
- Interrupt source (`<iIrqSource>`) on bit-pattern match:
  - Bit-pattern match: ME_IRQ_SOURCE_DIO_PATTERN
  - Bit-pattern change: ME_IRQ_SOURCE_DIO_MASK
- Parameter `<iIrqEdge>` not relevant: ME_VALUE_NOT_USED.
- In parameter `<iIrqEdge>` the appropriate reference bit-pattern is passed for the comparison register in the operation mode.
- „bit-pattern match" resp. mask register in the operation mode
  Example for bit-pattern change:
  When passing the value FFHex in parameter `<iIrqArg>` of the function *meIOIrqStart()* all bits are monitored. If only single bits should be monitored (e.g. `<iIrqArg>` = 0FHex for the 4 lower

significant bits) a transition of a higher significant bit doesn't matter. Only toggling of a bit, which is set to „1" in parameter `<iIrqArg>` an interrupt is initiated.

- The width of the reference can be determined by parameter `<iFlags>`.
  Analyzing the interrupt event is done by the function *meI-OIrqWait()*.

Further details for the order of operation can be found in the chapter „interrupt operation" with and without callback-functions described in the ME-iDS manual.

4.2   Counter

The programming of the counters is done in operation mode "Single". A counter device of type 82C54 provides three 16-bit counters. Each counter is accessed as a subdevice of type ME_TYPE_CTR, subtype ME_SUBTYPE_CTR_8254. Note the order of operation as described in the ME-iDS manual.

4.2.1 Standard Operation Modes

The counters can be configured independently of each other by the function *meIOSingleConfig()* for the following 6 operation modes (a description of the modes can be found in the ME-iDS manual):

- Mode 0: Change state at zero.
- Mode 1: Retriggerable „One Shot".
- Mode 2: Asymmetric divider.
- Mode 3: Symmetric divider.
- Mode 4: Counter start by software trigger.
- Mode 5: Counter start by hardware trigger.

5   Appendix

A   Specification

PCI Interface

Bus system	Standard PCI (32 bit, 33 MHz, 5 V)
(depends on model)	CompactPCI (32 bit, 33 MHz, 5 V)
Plug&Play	automatic assignment of resources

Digital Input

Number	ME-8100A: 1 x 16-bit port, opto-isolated ME-8100B: 2 x 16-bit ports, opto-isolated
Switching frequency	max. 1 kHz (depends on operation system and application software)
Input level	typ. 24 V ± 2 V
Input current	10 mA per channel
Operation modes	simple input; bit-pattern match, bit-pattern change
Interrupt events	bit-pattern match or bit-pattern change of a masked bit

Digital Output

Number	ME-8100A: 1 x 16-bit port, opto-isolated ME-8100B: 2 x 16-bit ports, opto-isolated
Switching frequency	max. 1 kHz (depends on operation system and application software)
Output level	typ. 24 V (depends on ext. power supply)
Output driver	ME-8100A/B: sink (ULN2803) or source (UDN2982) driver selectable by software port by port
Output current	The max. current per output (I_C) depends on the saturation voltage U_{CE} and is limited by the power dissipation of the sum of channels to $P_{tot} = 1$ W per chip: $P_{tot} = P_0 + \ldots + P_7 \leq 1$ W (at 70 °C)

ULN2803:

UDN2982:

Please see the table below for the max. current per output (I_{Source}) The power dissipation of the sum of channels is limited to $P_{tot} = 0.7$ W per chip:

$P_{tot} = P_0 + ... + P_7 \leq 0.7$ W (at 70 °C)

with

$P_0 = I_{C0} \, U_{CE0}$ and $U_{CE} = $ typ. 1.8 V

Number of Channels								
	1	2	3	4	5	6	7	8
I_{Cmax} [mA]	350	175	115	85	70	55	50	40

Counter/Timer

Number	ME-8100A/B: 3 independent
Type	82C54
Resolution	16 bit
Clock signal (Clk)	opto-isolated, input voltage typ. 24 V
Gate signal (Gate)	opto-isolated, low-active, input voltage typ. 24 V
Counter output (Out)	opto-isolated, output voltage typ. 24 V (depends on ext. power supply)
Counter clock	ext. up to max. 1 MHz

General Information

Power consumption at +5 V	typ. 1.3 A (without ext. load)
Physical size (without mounting bracket and connector)	ME-8100 PCI: 174 mm x 98 mm ME-8100 cPCI: 3 HE CompactPCI board
Connectors	78-pin D-Sub female
Operating temperature	0...50 °C
Storage temperature	0...70 °C
Relative humidity	20...55 % (non-condensing)
Certification	CE

B   Pinout

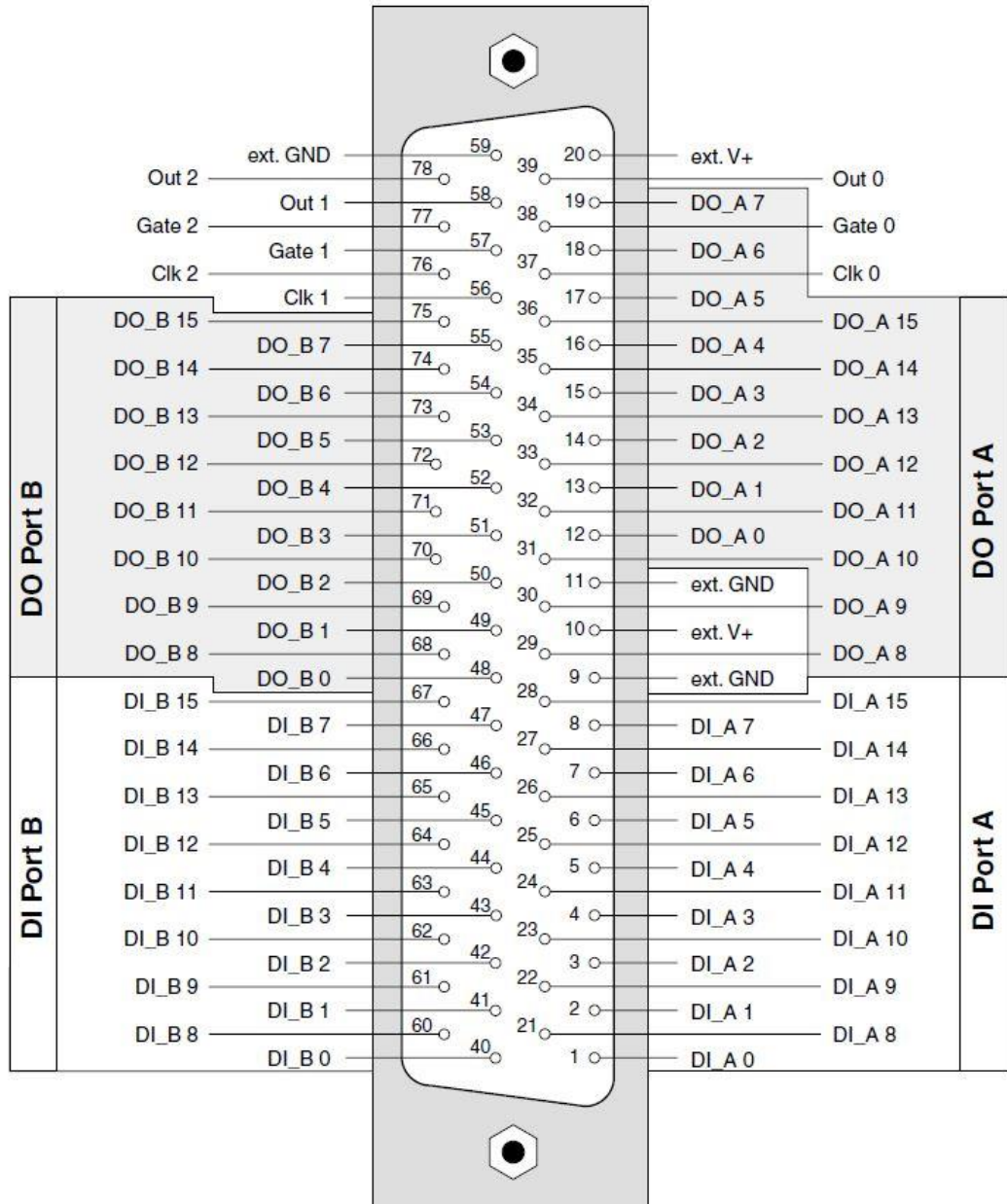## B1   ME-8100A/B PCI and cPCI

Diagram 12: Pinout of the 78-pin female D-Sub on ME-8100A/B

C Accessories

We recommend to use high-quality connector cables with single shielded lines per channel.

For further accessories please refer to the current Meilhaus Electronic catalog and the internet:
www.meilhaus.de/en/pc-boards/accessories/

D   Technical Questions

D1   Hotline

Should you have questions or inquiries concerning your Meilhaus device, please contact us:

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Am Sonnenlicht 2
D-82239 Alling

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www.meilhaus.de/en/infos/service/rma.htm.

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