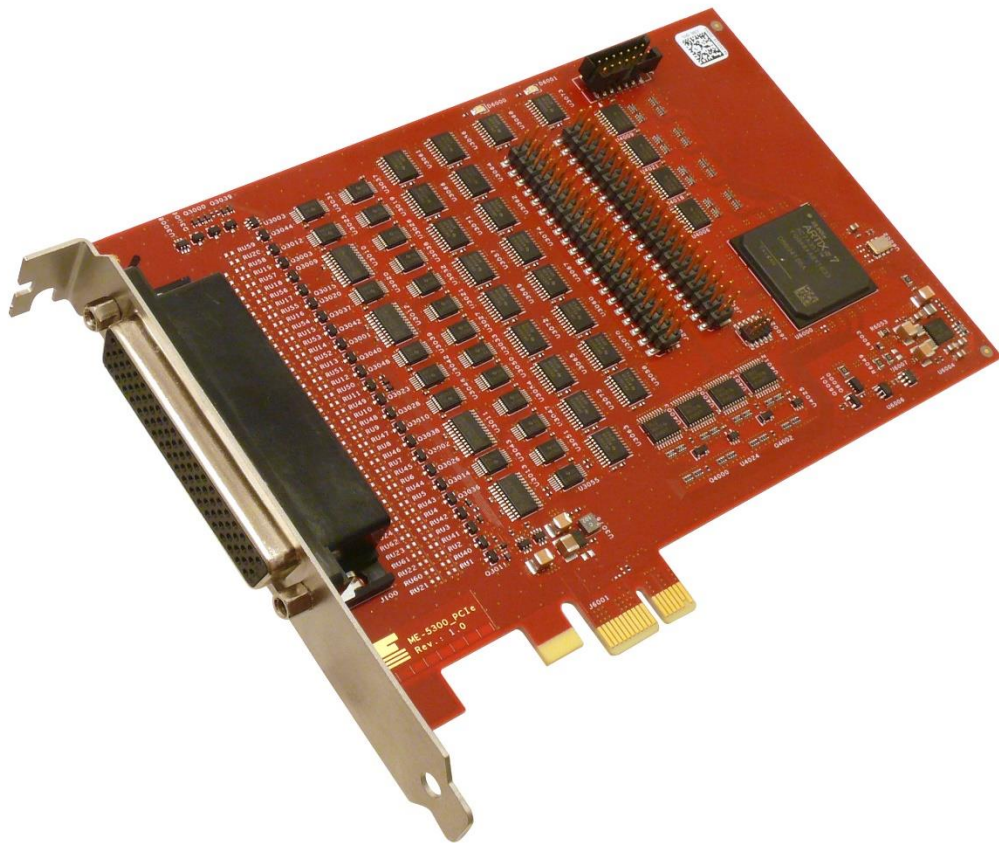


Meilhaus Electronic Manual

ME-5314 Series

(PCIe- and PXIe-Versions)



TTL Digital I/O and Counter Boards

Imprint

Manual ME-5314 Series

Revision 1.0

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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-5314 series if not otherwise noted.

1.1 Important Notes

1.1.1 Use in Accordance with the Requirements

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

- a free PCIe-slot (PCIe versions) or
- a free PXIe slot (3 HE PXIe versions)

The procedure for installing a plug-in card please read the operating instructions of your PC first.

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

- Please ensure sufficient heat dissipation for the board within the PC housing.
- 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 PCIe- or PXle-bus may not be taken into operation outside of the PC. Never connect the devices with voltage-carrying parts, especially not with mains voltage.

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.

1.1.4 Warning

The device was developed and produced in accordance to the EMC low-voltage-directive 73/23/EWG. When putting the device into operation, especially with voltages greater than 42 V, please follow the appropriate standards, installation instructions and national safety standards. Meilhaus Electronic GmbH assumes no responsibility for damage in case of faulty installation, operation or handling.

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:

- Digital I/O and counter board of the ME-5314 series for PCIe- or PXle-bus.
- Manual in PDF format on CD/DVD.
- Driver software on CD/DVD.
- ME-5314A/B/C: D-sub 78-pin male-connector.

1.3 Features

The **ME-5314 series** is provided as a digital I/O and counter board for PCIe- resp. PXIe-bus compatible).

Model Overview

Model	Connector	TTL IOs	Counter	IRQ
ME-5314A PCIe/PXIe	78-pin D-Sub	24	3 x 16 bit	✓
ME-5314B PCIe/PXIe	78-pin D-Sub	48	6 x 16 bit	✓
ME-5314C PCIe/PXIe	78-pin D-Sub	24	15 x 16 bit	✓

Table 1: Model overview ME-5314 family

The boards of the ME-5314 series provide 24 or 48 TTL compatible digital-I/O lines (8-bit ports) and up to 15 independent programmable 16-bit counters (8254 compatible), depending on model.

All models provide a 10 MHz oscillator which is independent from the system clock of the PC. The frequency can be set to 1 MHz by software. The boards have an external interrupt line available.

The external connections to the board are realized with a 78-pin D-Sub connector

1.4 System Requirements

The ME-5314 series may be installed into any PC (Intel® Pentium® processor) with a free PCIe- resp. PXIe-slot. 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 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

The following basic procedure should be used:

If you have received the driver software as an archive file please un-pack 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.

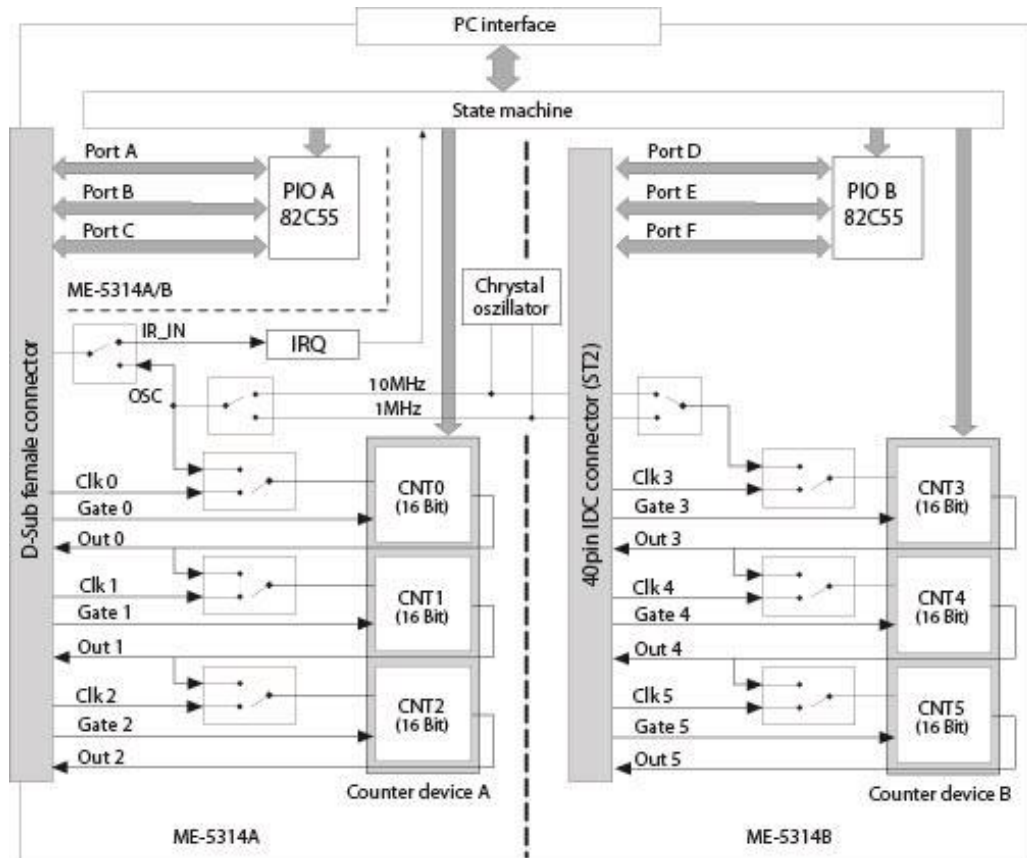
2.2 Test Program

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

3 Hardware

3.1 Block Diagram

3.1.1 Block Diagram ME-5314A/B



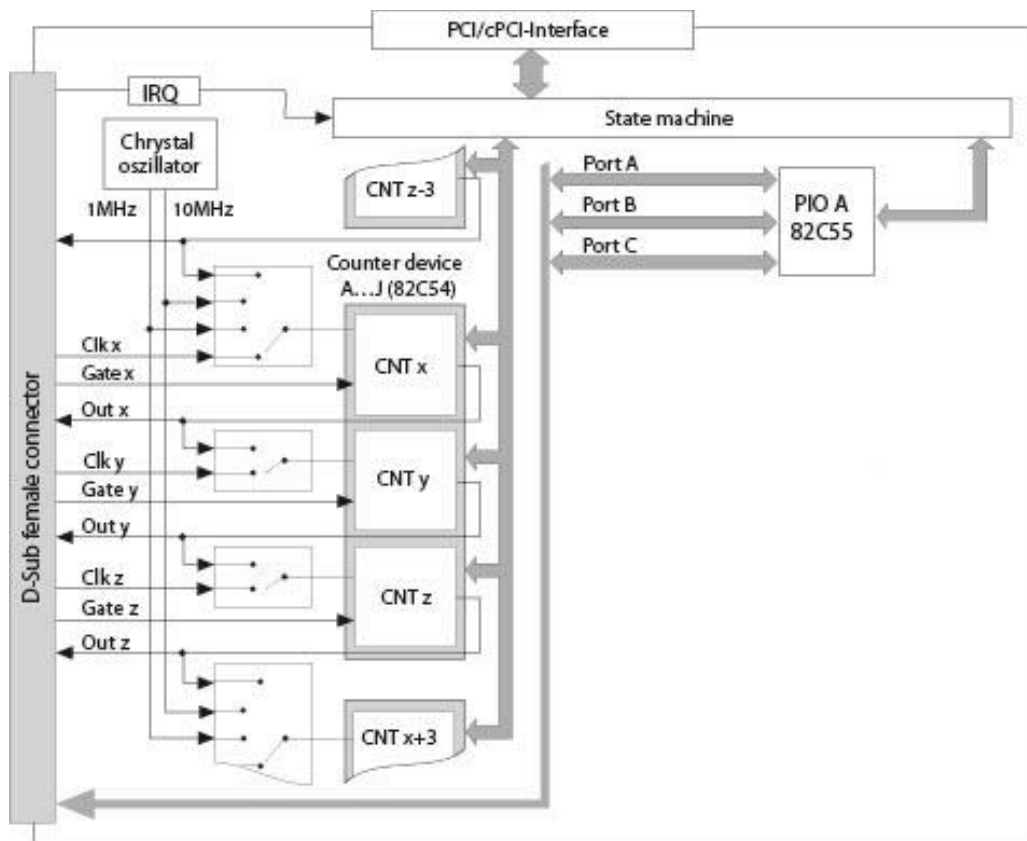
Picture 1: Block diagram of ME-5314A/B

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

ME-5314A: 24 digital I/Os (PIO A), 3 x 16-bit counters (CNT0...2), interrupt input.

ME-5314B: 48 digital I/Os (PIO A, B), 6 x 16-bit counters (CNT0...5), interrupt input.

3.1.2 Block Diagram ME-5314C



Picture 2: Block diagram of ME-5314C

ME-5314C: 24 Digital-I/Os (PIO A) and 15 x 16-bit-counter (CNT0...2), interrupt input.

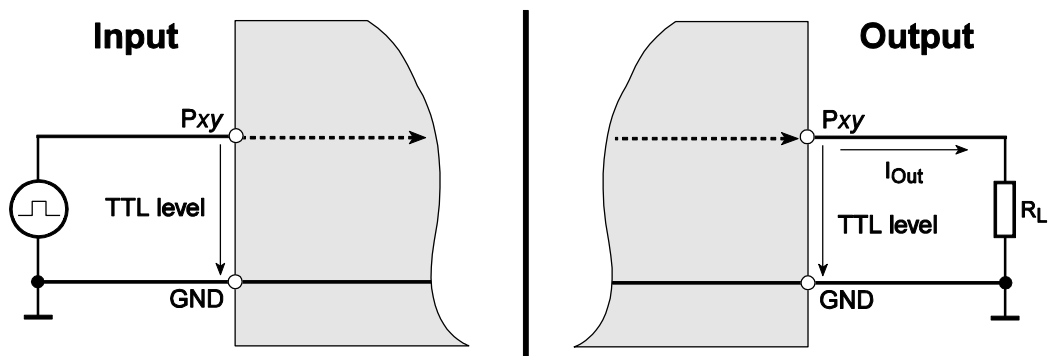
The counters can be cascaded via software. Each counter of a module can be fed by the quartz oscillator. The following indices apply to the 3 counters (CNTx, y, z) per counter module (A...E). See table 8:

	ME-5314C	TTL-I/Os	counter	IRQ
ME-5314A PCIe/PXle	78-pol. Sub-D	24	3 x 16 bit	✓
ME-5314B PCIe/PXle	78-pol. Sub-D	48	6 x 16 bit	✓
ME-5314C PCIe/PXle	78-pol. Sub-D	24	15 x 16 bit	✓

3.2 Digital-I/O Section

The 8-bit-wide digital-I/O ports can be configured independently as input or output. After power-up all ports are configured as input. Make sure the voltage levels of the I/Os keep within the TTL level-limits (see specifications on page 20) and that a reference to PC ground (GND) must be done. The maximum output current is $I_{out} = I_{OL} = I_{OH} = 2.5 \text{ mA}$.

For programming the digital-I/O section please read chapter 4.1 "Digital I/O" on page 16.



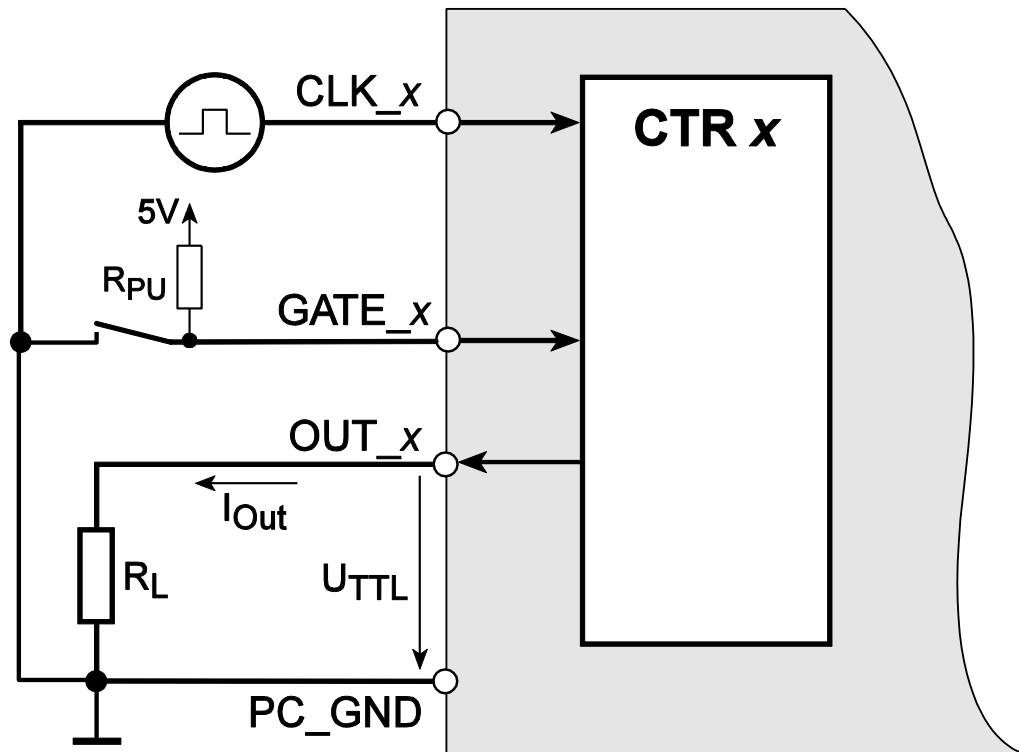
Picture 3: Switching off the digital I/Os

3.3 Counter (8254)

The counter component emulates the standard type 82C54. This flexible device has 3 independent 16-bit-(down) counters. All counter signals are available on the D-sub connector. After the GATE-signal has been properly set (5V) the counter counts down on every falling edge.

The counter clock can be sourced alternatively by the internal oscillator (1 MHz/10 MHz), externally (10 MHz max.) or by cascading. The internal oscillator can be set separately for each counter input from 1 MHz (default) to 10 MHz. The settings are done by software. After power-up or after reset all counters are configured for an external clock source. See also chapter programming and the block diagrams from page 9 up.

The counter signals work with TTL level (see specifications on page 20) and require a reference to PC ground (PC_GND). The maximum output current is $I_{out} = 2.5 \text{ mA}$.



Picture 4: Wiring the counters

The GATE and OUT lines of the 82C54 are directly connected with the corresponding pins of the D-Sub connector. In the CLK-lines „multiplexer“ are switched between.

3.3.1 Cascading the Counter

The counters of the same component can be cascaded without external connections.

In spite of cascading the outputs of all counters are also available at the D-Sub connector.

Cascading the counters is done by software. For programming please read chapter 4.2 on page 17.

3.3.2 Clock Output and Interrupt Control

Note: The clock output is not supported by the ME-iDS at the moment!

The pin labelled „OSC/IR_IN“ resp. „IR_IN“ is the interrupt input by default. Alternatively a system independent symmetrical clock generated by the on-board crystal oscillator can be output (1 MHz or 10 MHz).

OSC: Oscillator Clock Output - this signal connects the internal oscillator clock signal (1 MHz or 10 MHz) with the D-Sub connector. This functionality is only supported by the ME-iDS under Linux at the moment!

IR_IN: IRQ Input - a rising edge at this pin will cause an interrupt. If IR_IN is held high or not connected, the IR IN is ignored.

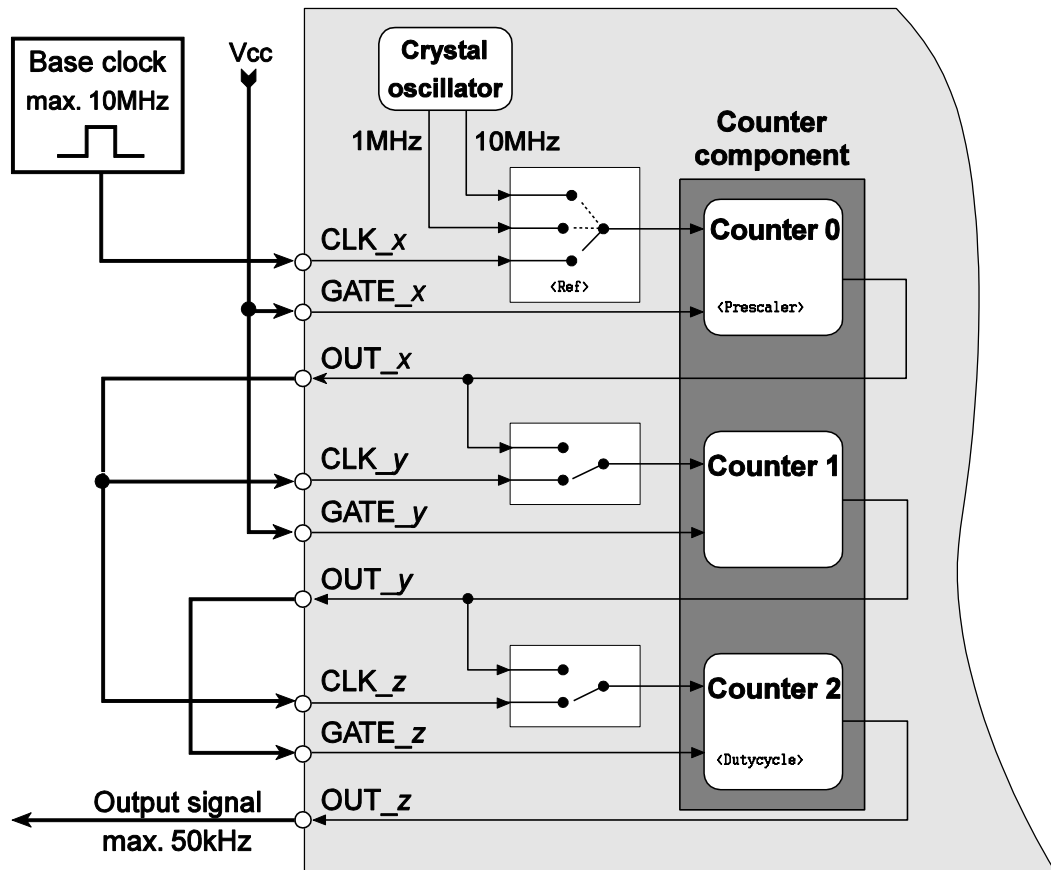
Configuration is done by software. For programming please read chapter 4.2 on page 17. The interrupt logic is disabled after power-up and must be enabled before using by software.

Model	Function	Default	Setting
ME-5314A	(OSC)/IR_IN	IR_IN	by software
ME-5314B	(OSC)/IR_IN	IR_IN	by software
ME-5314C	(OSC)/IR_IN	IR_IN	by software

Table 2: Overview clock output and interrupt control

3.3.3 Pulse Width Modulation

A special application for the counters is the so-called pulse width modulation (PWM). With proper external wiring (see diagram 4) the 3 counters of each counter component can be used together to create an output signal with a variable duty cycle. The duty cycle can be set between 1...99 % in 1 % steps. The base clock can be sourced either by an external frequency generator (max.10 MHz) or by the internal crystal oscillator (1 MHz or 10 MHz). This results in an output signal of maximum 50 kHz. By using the wiring shown in diagram 4, the functions *meUtilityPWM* can be used which greatly simplifies programming (see also ME-iDS manual).



Picture 5: Wiring pulse width modulation

The output signal is always available at the output of the third counter of each counter component (OUT_2, OUT_5...).

3.3.4 Pull-Up/Pull-Down Resistors

On a power-up, all digital ports are set to input. Because of this the corresponding input lines are all set to high impedance (with- out external wiring). Depending on the application, it may be desirable to have the digital lines in a defined state on power-up. The ME-5314 series allows the user to add pull-up or pull-down resistors to the circuit board directly. Appropriate resistor arrays can be used (4.7 kΩ recommended) port by port. Note, that by using pull-up resistors, the output current is decreased accordingly (e.g. with $R_{up}=4.7\text{ k}\Omega$, $I_{max}=1.6\text{ mA}$).

Modell	Port A/B/C	Port C/D/E	Counter Gate	Counter Clock
ME-5314A	pull down		pull up	pull down
ME-5314A-1	pull up		pull up	pull up
ME-5314A-2	pull down		pull up	pull up
ME-5314A-3	pull down		pull down	pull down
ME-5314A-4	pull up		pull down	pull down

Modell	Port A/B/C	Port C/D/E	Counter Gate	Counter Clock
ME-5314B	pull down	pull down	pull up	pull down
ME-5314B-1	pull up	pull up	pull up	pull up
ME-5314B-2	pull down	pull down	pull up	pull up
ME-5314B-3	pull down	pull down	pull down	pull down
ME-5314B-4	pull up	pull up	pull down	pull down

Modell	Port A/B/C	Port C/D/E	Counter Gate	Counter Clock
ME-5314C	pull down		pull up	pull up
ME-5314C-1	pull up		pull up	pull up
ME-5314C-2	pull down		pull down	pull down
ME-5314C-3	pull up		pull down	pull down

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.

4.1 Digital I/O

Each digital port of the ME-5314 series is considered to be an independent functional group (subdevice) in the Meilhaus Intelligent Driver System (ME-iDS). 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-I/O ports please read chapter 3.4 on page 11.

The following operation modes are available:

4.1.1 Simple Input/Output

ME-5314 A	ME-5314 B	ME-5314 C
3 ports	6 ports	3 ports

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_DIO, 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 *meIO-SingleConfig()* and *meIOSingle()*:

- Determine subdevice with *meQuery...* functions.
- Port direction: input or output.

- Port width: bit or byte operation (8 bit).

After power-up the bi-directional ports are configured for input.

4.2 Counter

ME-5314 A	ME-5314 B	ME-5314 C
3 counters	6 counters	15 counters

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.

After power-up or after reset all counters are sourced by the external clock.

4.2.1 Standard Operation Modes

The counters can be configured independently of one another 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.

4.2.2. Clock Source

With the parameter `<iRef>` of the function *meIOSingleConfig()* you can define the clock source (CLK) for the single counters resp. counter components (see also the block diagrams from page 9 up).

- ME_REF_CTR_INTERNAL_PREVIOUS
Clock source is the output of previous counter within a counter component. On the ME-5314C/D cascading is also possible from component to component (exception: counter 14 with 15).

- **ME_REF_CTR_INTERNAL_1 MHZ**
Clock source is the internal 1 MHz crystal oscillator (setting for each counter component possible).
- **ME_REF_CTR_INTERNAL_10 MHZ**
Clock source is the internal 10 MHz crystal oscillator (setting for each counter component possible).
- **ME_REF_CTR_EXTERNAL**
Clock source is an external oscillator (setting for each single counter possible).

4.2.3 Cascading

To cascade the counters, the clock input (CLK) of a counter can be connected to the counter output (OUT) of the previous counter without external wiring.

For example: The counters 0, 1 and 2 should be cascaded and counter 0 should be sourced externally. In the parameter `<iRef>` of the function `meIOSingleConfig()` the following constants have to be passed:

- **ME_REF_CTR_EXTERNAL**: Connect the clock input of counter 0 (CLK 0) with the external clock input.
- **ME_REF_CTR_INTERNAL_PREVIOUS**: Connect the clock input of counter 1 (CLK 1) with the output of counter 0 (OUT 0).
- **ME_REF_CTR_INTERNAL_PREVIOUS**: Connect the clock input of counter 2 (CLK 2) with the output of counter 1 (OUT 1).
- Additionally the gate inputs of the counters must be connected with +5 V to release the counters.
- The output of counter 2 (OUT 2) provides the cascaded counter signal.

4.2.4 Pulse Width Modulation

Using the wiring shown in diagram 7 you can greatly simplify programming of this operation mode with the functions `meUtilityPWM` (see also ME-iDS manual).

4.3 External Interrupt

ME-5314 A	ME-5314 B	ME-5314 C
✓	✓	✓

At the external interrupt input (IR_IN) you can initiate an interrupt by a proper edge, which is sent to the PCI bus directly.

Programming is done by the *meIOIrq* functions. The Interrupt is considered to be an independent subdevice of type ME_TYPE_EXT_IRQ. After enabling the external interrupt by the function *meIOIrqStart* an interrupt can be triggered by a rising edge. Note the order of operation as described in the ME-iDS manual.

5 Appendix

A Specification

PC Interface (ME-5314A/B/C)

PCI-Express-Bus	PCI-Express x1, Version 2.0
PXI-Express-Bus	PCI-Express x1, Version 2.0, PICMG 2.0 R3
Plug&Play functionality	Is fully supported

Digital I/O

Number	ME-5314A/C: 24, TTL-compatible ME-5314B: 48, TTL-compatible
Input voltage	low: -0,5 V...+0,8 V ($I_{Lmax} = \pm 10 \mu A$) high: +2,0 V...+5,5 V ($I_{Hmax} = \pm 10 \mu A$)
Output voltage	low: max. +0,45 V ($I_{OL} = +2.5 \text{ mA}$) high: min. +2,4 V ($I_{OH} = -2.5 \text{ mA}$)

Counter

Number	ME-5314A: 3 independent ME-5314B: 6 independent ME-5314C: 15 independent
Type	82(C) 54
Resolution	16 bit
Input voltage	low: -0.5 V...+0,8 V ($I_{Lmax} = \pm 10 \mu A$) high: +2.2 V...+6 V ($I_{Hmax} = \pm 10 \mu A$)
Output voltage	low: max. +0.45 V ($I_{OL} = +2.5 \text{ mA}$) high: min. +2.4 V ($I_{OH} = -2.5 \text{ mA}$)

Quartzoscillator

Frequency	1 MHz or 10 MHz selectable (by software)
Accuracy	$\pm 100 \text{ ppm}$ ($\pm 0.01 \%$)
Output level	LS-TTL

General Information

PCIe/PXIe-models: Power consumption at +3,3 V (without load)	ME-5314A typ. 260 mA ME-5314B: typ. 300 mA ME-5314C: typ. 260 mA
--	--

Physical size (without mounting bracket and connector)	ME-5314A/B/C: 160 x 108 mm PXle-Modelle: 100 x 160 mm
Connectors	ME-5314A/B/C: 78-pin D-Sub female connector at the mounting bracket of the board

Common Data

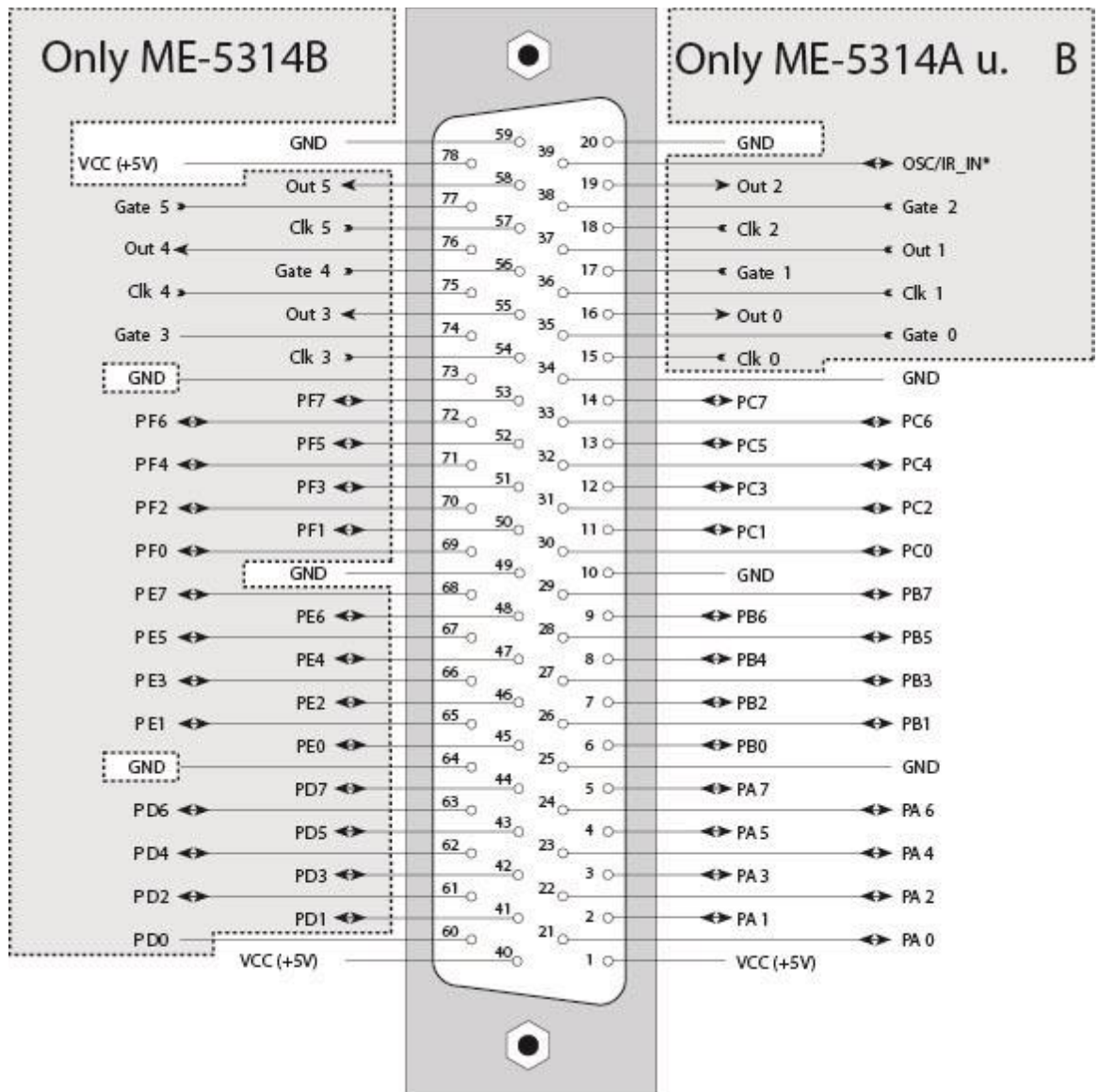
VCC loading at the D-Sub connector: 200 mA	
Operating temperature	0...70 °C
Storage temperature	-40...100 °C
Relative humidity	20...55 % (non-condensing)

CE Certification

EMC-Directive	89/336/EMC
Emission	EN55022
Immunity	EN50082-2

B Pinout

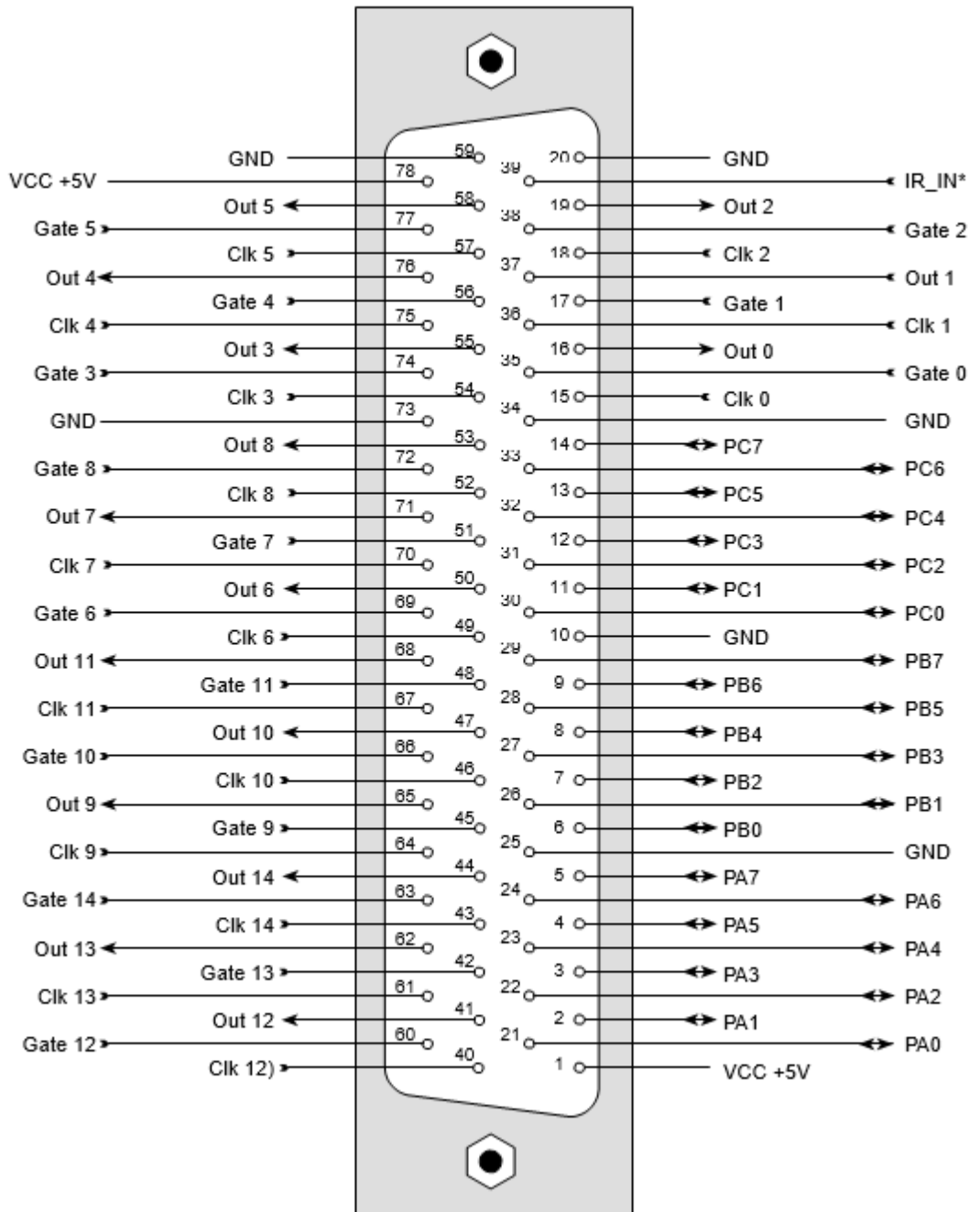
B1 ME-5314A/B



Picture 6: 78-pin female D-Sub connector ME-5314A/B

*Only in operation on ME-5314A/B. When programming with the ME-iDS this pin is always an interrupt input.

B2 ME-5314C



Picture 7: Pinout of the 78-pin female D-Sub ME-5314C

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:

<https://www.meilhaus.de/en/Infos/me>

D Technical Questions

D1 Hotline

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

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D-82239 Alling

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Tel.: (08141) 52 71 – 188
Fax: (08141) 52 71 – 169

eMail: support@meilhaus.de

Download-Server and Driver Update:

To download current driver versions for Meilhaus Electronic devices as well as manuals in PDF format, please go to:

<https://www.meilhaus.de/en/products/pc-boards/me-ids/>

Service Department with RMA Process:

In case you need to return a board for repair purposes, we strongly ask you attach a detailed description of the error as well as information regarding your computer/system and the software used. Please register online using our RMA process:

<https://www.meilhaus.de/en/about/rma-support/>

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