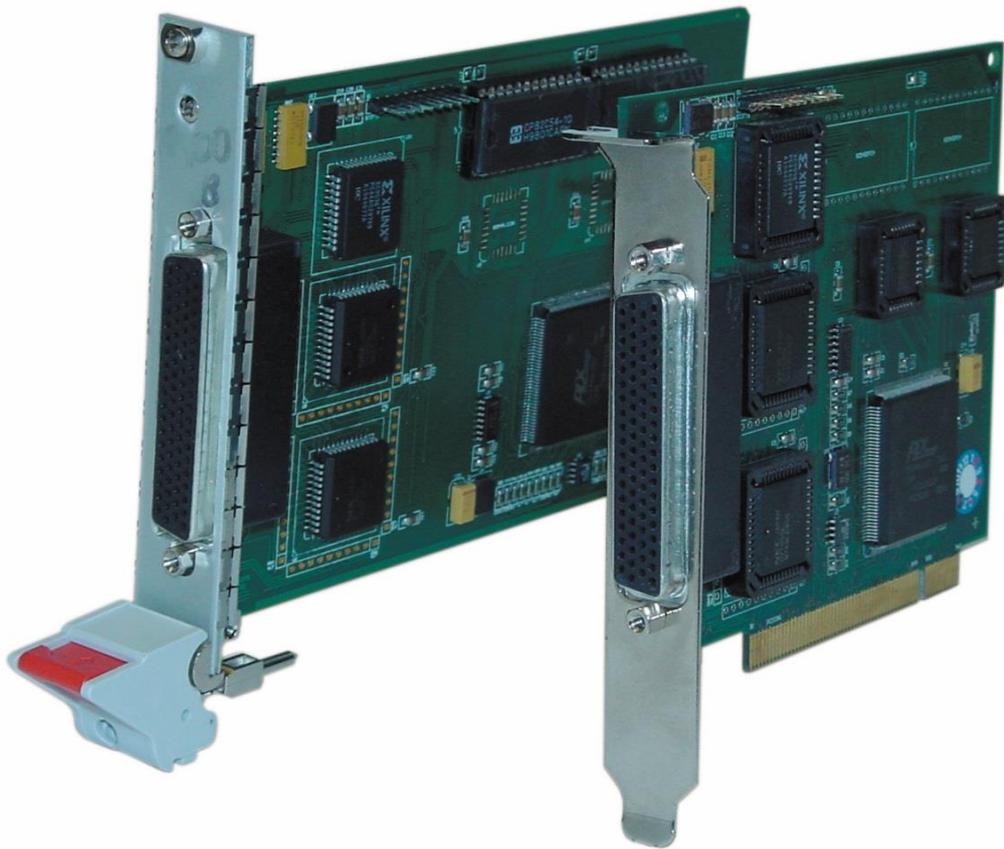


Meilhaus Electronic Manual

ME-1400 Series

(PCI- and CompactPCI-Versions)



TTL Digital I/O and Counter Boards

Imprint

Manual ME-1400 Series

Revision 3.0

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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-1400 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 PCI-slot (PCI versions) or
- a free CompactPCI slot (3 HE cPCI versions)

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.
- All unused inputs should be connected to the ground reference of the appropriate functional section. This avoids cross talk between the input lines.
- 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- 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.

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-1400 series for PCI- or CompactPCI-bus.
- Manual in PDF format on CD/DVD.
- Driver software on CD/DVD.
- ME-1400E/EA/EB: D-sub 37-pin male-connector.
- ME-1400/A/B: D-sub 78-pin male-connector.
- ME-1400EB: ribbon cable from IDC-connector to 37-pin D-Sub-female-connector mounted on additional mounting bracket.

1.3 Features

The **ME-1400 series** is provided as a digital I/O and counter board for PCI- resp. CompactPCI-bus compatible).

Model Overview

Model	Connector	TTL IOs	Counter	IRQ
ME-1400 PCI/cPCI	78-pin D-Sub	24	–	–
ME-1400A PCI/cPCI	78-pin D-Sub	24	3 x 16 bit	✓
ME-1400B PCI/cPCI	78-pin D-Sub	48	6 x 16 bit	✓
ME-1400E PCI (connector compatible with ME-14)	37-pin D-Sub	24	–	–
ME-1400EA PCI (connector compatible with ME-14A)	37-pin D-Sub	24	3 x 16 bit	✓
ME-1400EB PCI (connector compatible with ME-14B)	2 x 37-pin D-Sub	48	6 x 16 bit	✓

Table 1: Model overview ME-1400 family

The boards resp. boxes of the ME-1400 series provide 24 or 48 TTL compatible digital-I/O lines (8-bit ports) and up to 30 independent programmable 16-bit counters (8254 compatible), depending on model.

All models with counters 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 with exception of the models ME-1400/E.

The external connections to the board are realized with a 37-pin D-Sub (ME-1400E versions) resp. a 78-pin D-Sub connector (ME-1400/A/B). The ME-1400EB has an extra IDC connector on the board to enable access to the expanded signals for the second digital-I/O and counter units of the board. A flat ribbon cable and an extra mounting bracket with a 37-pin D-Sub female connector are included with the package.

1.4 System Requirements

The ME-series may be installed into any PC (Intel® Pentium® processor) with a free standard PCI- 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.

- Installation under Linux

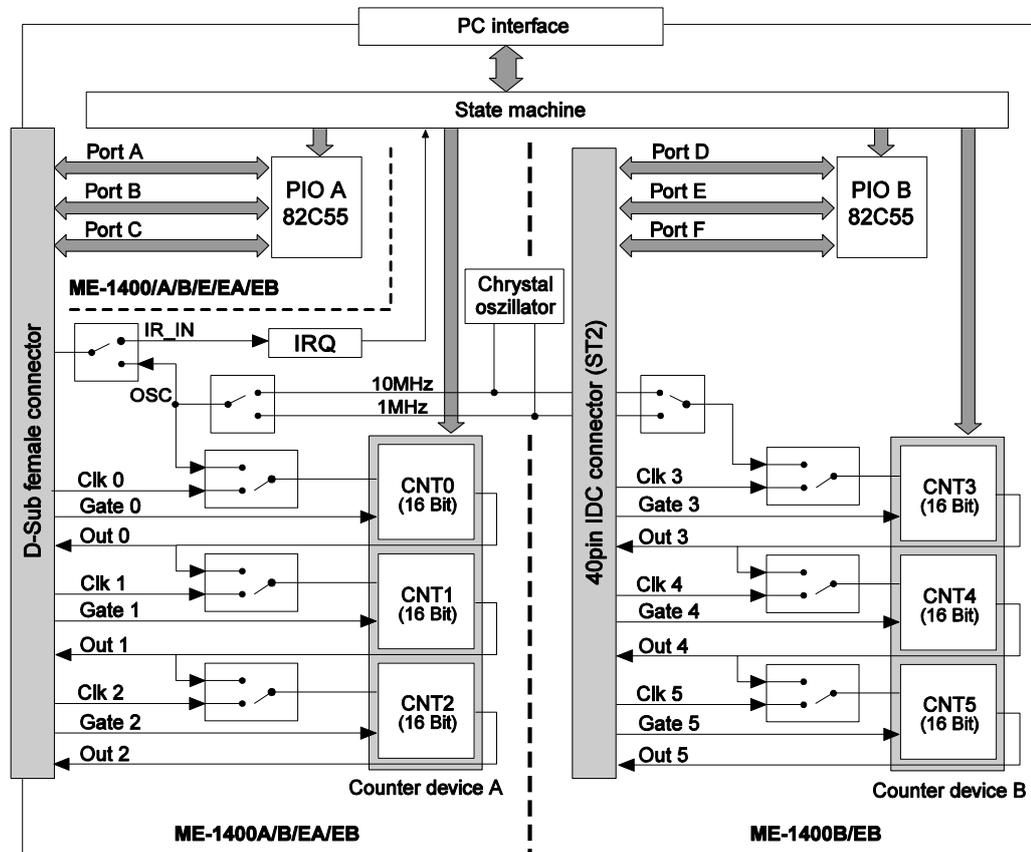
Note the installation instructions included with archive file of the appropriate driver.

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 ME-1400/A/B/E/EA/EB



Picture 1: Block diagram of ME-1400/A/B/E/EA/EB

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

ME-1400/E: 24 digital I/Os (PIO A) without oscillator and interrupt input.

ME-1400A/EA: 24 digital I/Os (PIO A), 3 x 16-bit counters (CNT0...2), interrupt input.

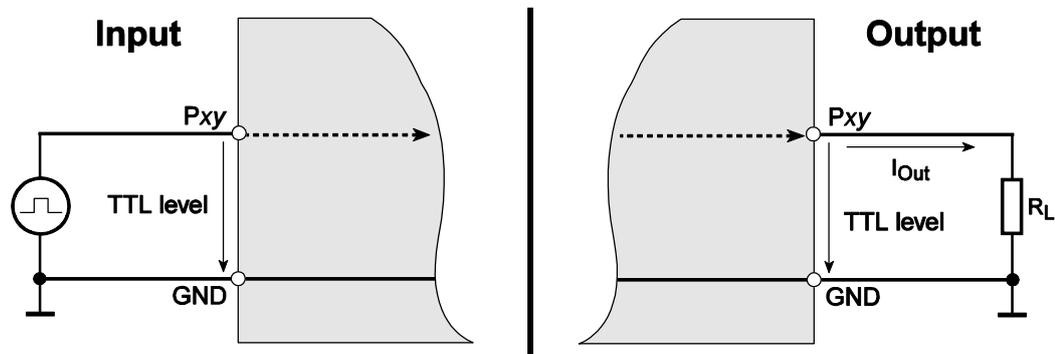
ME-1400B/EB: 48 digital I/Os (PIO A, B), 6 x 16-bit counters (CNT0...5), interrupt input.

3.2 Digital-I/O Section

For the programmable input/output component (PIO) the standard component 82C55 (fully compatible CMOS-version of the 8255A) is used. This component has 3 x 8-bit-wide programmable I/O ports and is TTL/CMOS compatible.

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 21) 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 17.



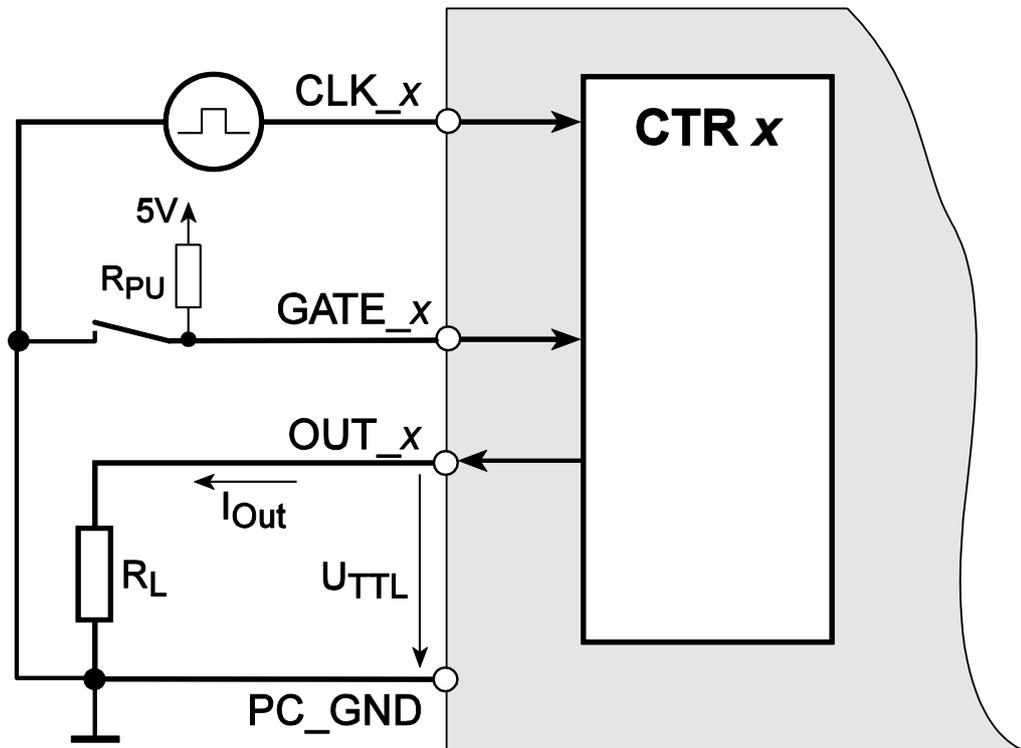
Picture 2: Switching off the digital I/Os

3.3 Counter (8254)

The counter component is 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 component 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 10 up.

The counter signals work with TTL level (see specifications on page 21) and require a reference to PC ground (PC_GND). The maximum output current is $I_{Out} = 2.5 \text{ mA}$.



Picture 3: 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 18.

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 18. The interrupt logic is disabled after power-up and must be enabled before using by software.

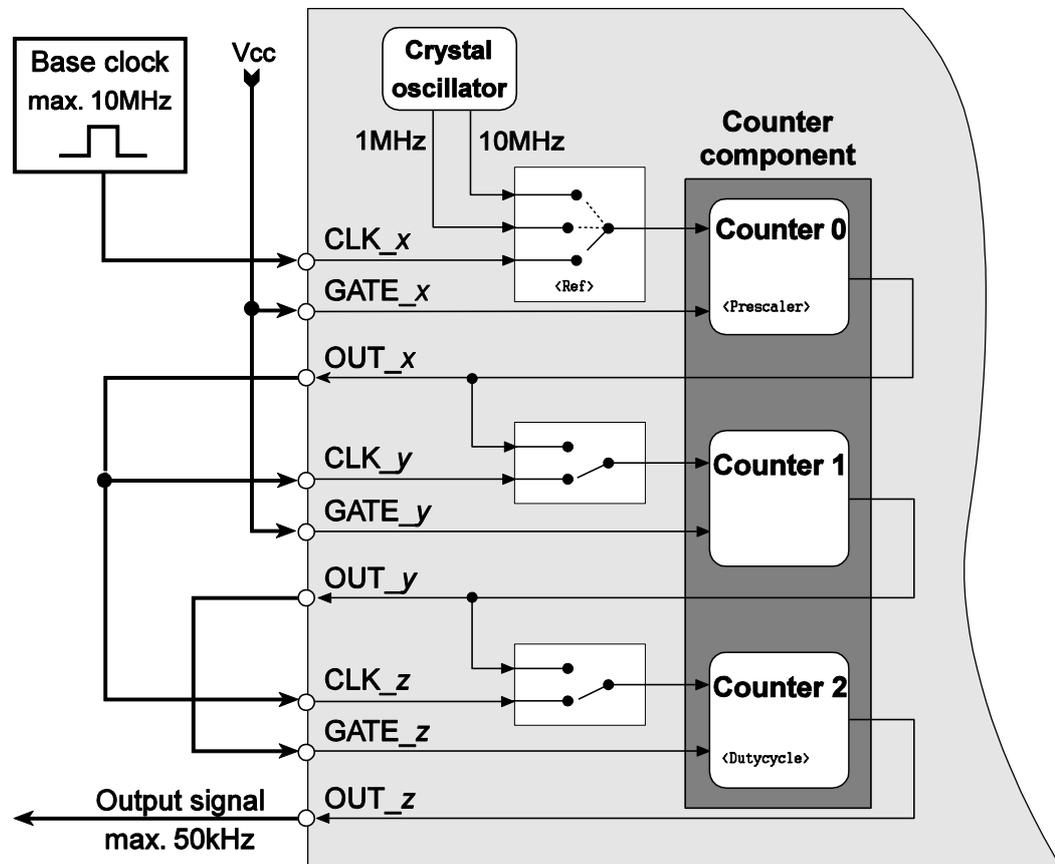
Model	Function	Default	Setting
ME-1400	n.c.	–	
ME-1400E	n.c.	–	–
ME-1400A	(OSC)/IR_IN	IR_IN	by software
ME-1400EA	(OSC)/IR_IN	IR_IN	
ME-1400B	(OSC)/IR_IN	IR_IN	by software
ME-1400EB	(OSC)/IR_IN	IR_IN	

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 4: 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...).

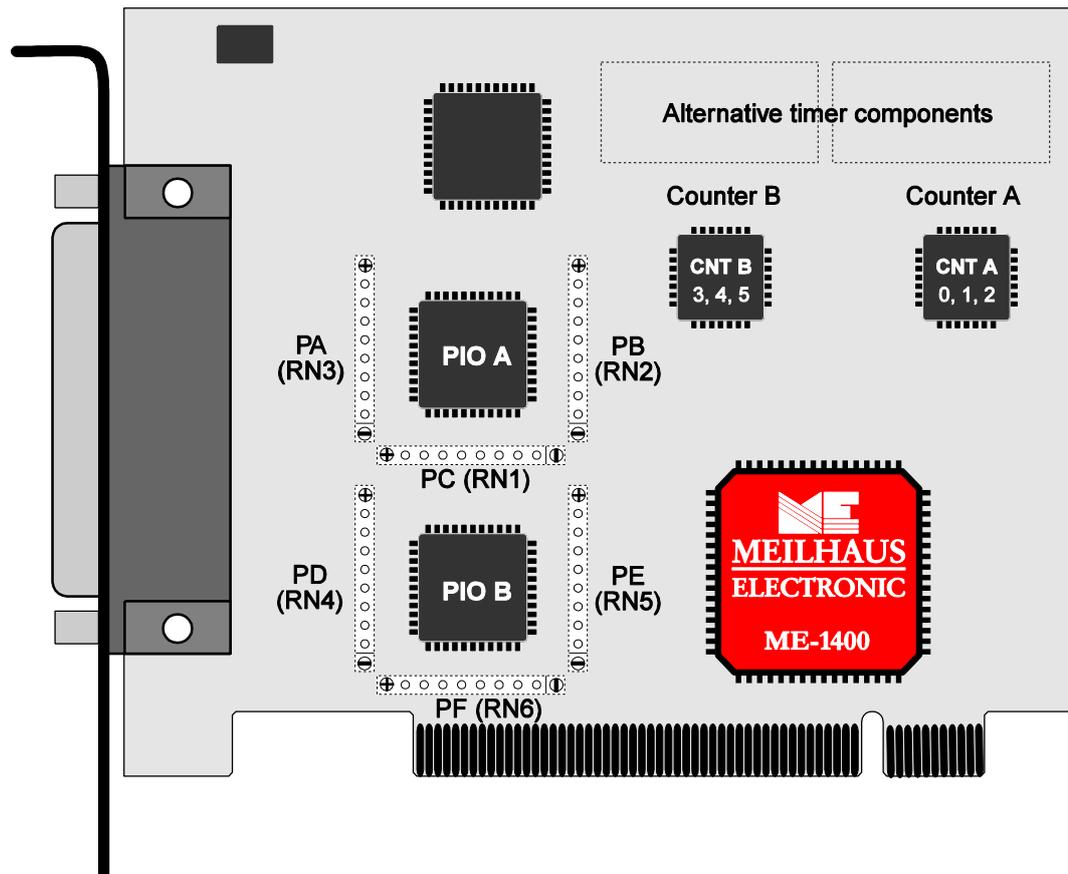
3.3.4 Pull-Up/Pull-Down Resistors

On a power-up, all digital ports are set to input. Because of this the corresponding input lines are all set to high impedance (without external wiring). Depending on the application, it may be desirable to have the digital lines in a defined state on power-up. The ME-1400 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 $R_{up}=4.7\text{ k}\Omega$, $I_{max}=1.6\text{ mA}$).

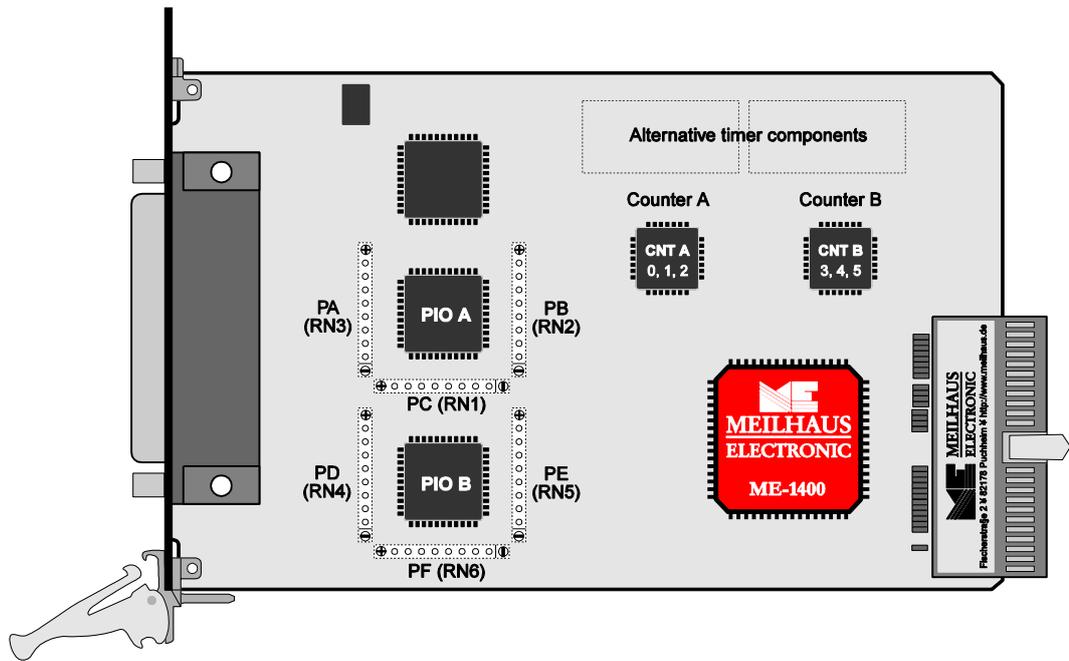
Depending on how the resistor arrays are placed on the board, the pull-up or pull-down state is selected. For pull-up, the end pin of the array must go to the “+”-pin and for pull-down, the end pin of the array must go to the “-”-pin (see diagram 8 to 13).

Note:

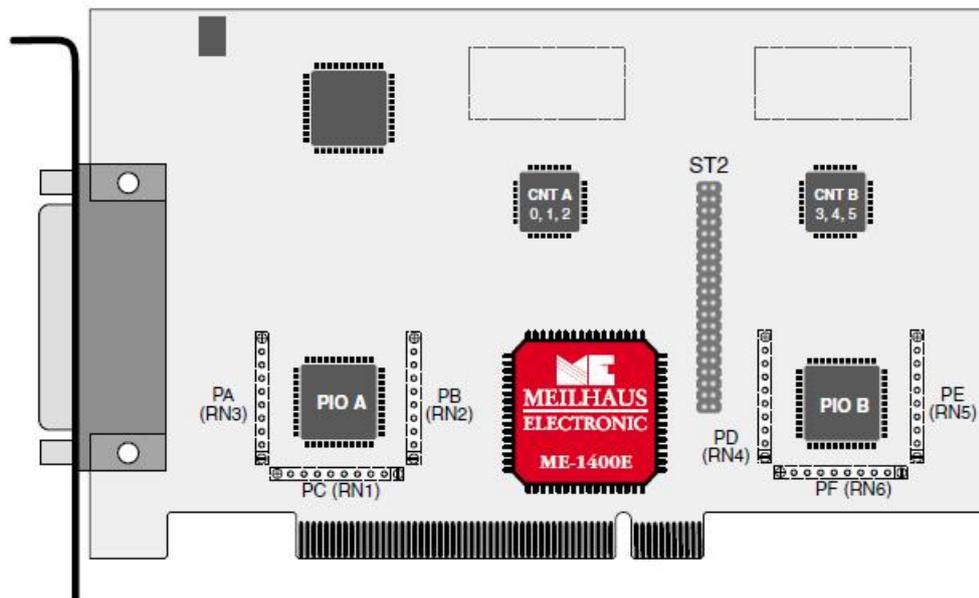
Make sure to ground yourself before inserting the arrays to avoid a static discharge



Picture 5: Location of resistor arrays ME-1400/A/B PCI



Picture 6: Location of resistor arrays ME-1400/A/B cPCI



Picture 7: Location of resistor arrays ME-1400E/EA7EB

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 as well as Linux systems with kernel 2.6 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 you find the last revision of the old function reference in the ME-1400 manual Rev. 2.1 (see: <http://meilhaus.org/downloadserver/me-1400>). Please note, that we cannot support this driver anymore.

4.1 Digital I/O

Each digital port of the ME-1400 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-1400 ME-1400 E	ME-1400 A ME-1400 EA	ME-1400 B ME-1400 EB
3 ports	3 ports	6 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 *meIOSingleConfig()* 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-1400 ME-1400 E	ME-1400 A ME-1400 EA	ME-1400 B ME-1400 EB
-	3 counters	6 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 10 up).

- `ME_REF_CTR_INTERNAL_PREVIOUS`
Clock source is the output of previous counter within a counter component. On the ME-1400C/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 (only within the same component).

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-1400 ME-1400 E	ME-1400 A ME-1400 EA	ME-1400 B ME-1400 EB
-	✓	✓

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-1400/A/B/E/EA/EB)

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

Digital I/O

Number	ME-1400/A/E/EA: 24, TTL-compatible ME-1400B/EB: 48, TTL-compatible
Input voltage	low: -0,5 V... +0,8 V ($I_{ILmax} = \pm 10 \mu A$) high: +2,0 V... +5,5 V ($I_{IHmax} = \pm 10 \mu A$)
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-1400A/EA: 3 independent ME-1400B/EB: 6 independent
Type	82(C) 54
Resolution	16 bit
Input voltage	low: -0.5 V... +0,8 V ($I_{ILmax} = \pm 10 \mu A$) high: +2.2 V... +6 V ($I_{IHmax} = \pm 10 \mu A$)
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

PCI/cPCI-models: Power consumption at +5 V	ME-1400: typ. 200 mA ME-1400A typ. 220 mA
--	--

(without load)	ME-1400B: typ. 400 mA ME-1400E: typ. 200 mA ME-1400EA: typ. 220 mA ME-1400EB: typ. 400 mA
Physical size (without mounting bracket and connector)	ME-1400/A/B: 132 x 99 mm ME-1400E/EA/EB: 175 x 99 mm cPCI-Modelle: 100 x 160 mm
Connectors	ME-1400E/EA/EB: 37-pin D-Sub female connectors at the mounting bracket of the board additional for ME-1400EB: 40-pin connector for adapter on 37-pin D-Sub connector mounted on additional mounting bracket (pinout as connector on mounting bracket of card). ME-1400/A/B/C/D: 78-pin D-Sub female connector at the mounting bracket of the board

Common Data

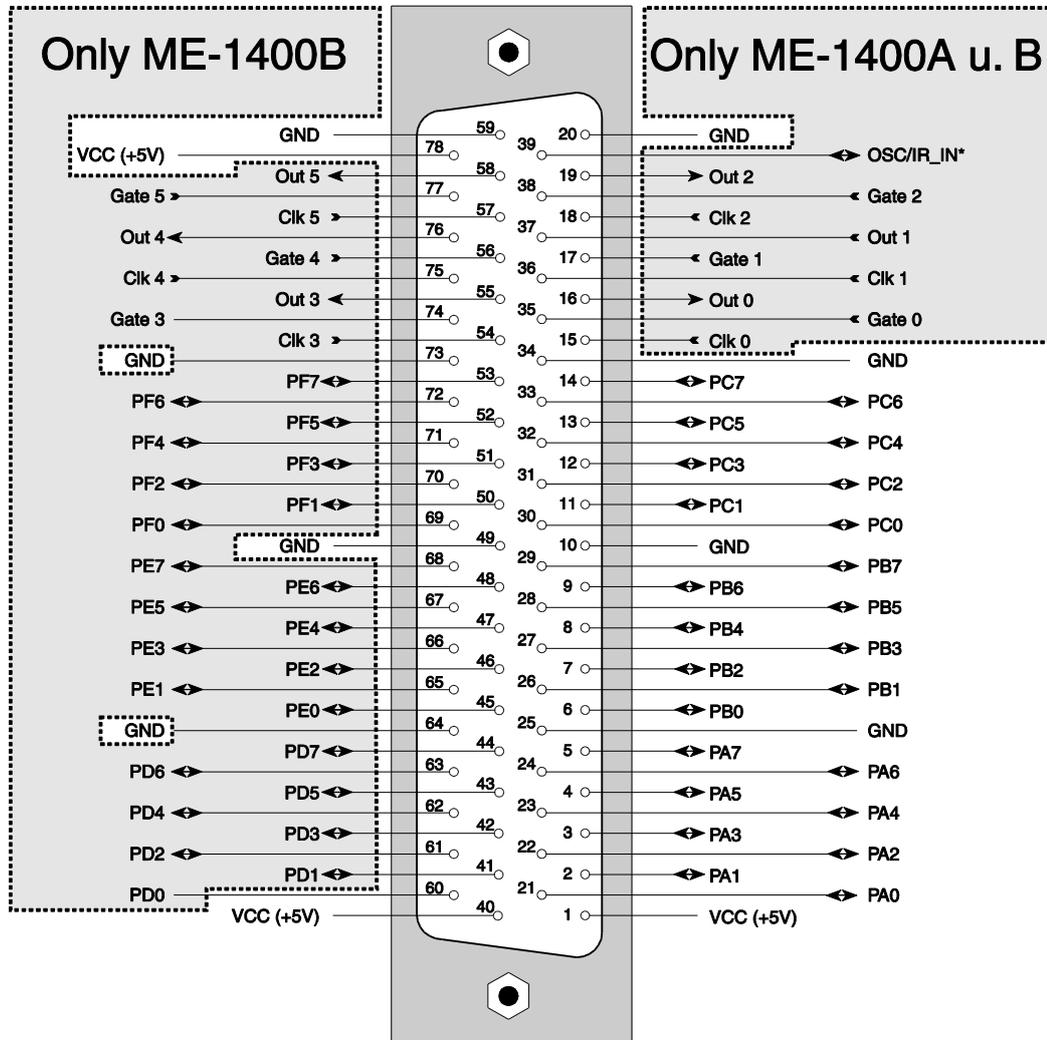
VCC loading at the D-Sub connector: 200 mA	
Operating temperature	0...70 °C
Storage temperature	-40...100 °C
Relative humidity	20...55 % (non-condensing)

CE Certification

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

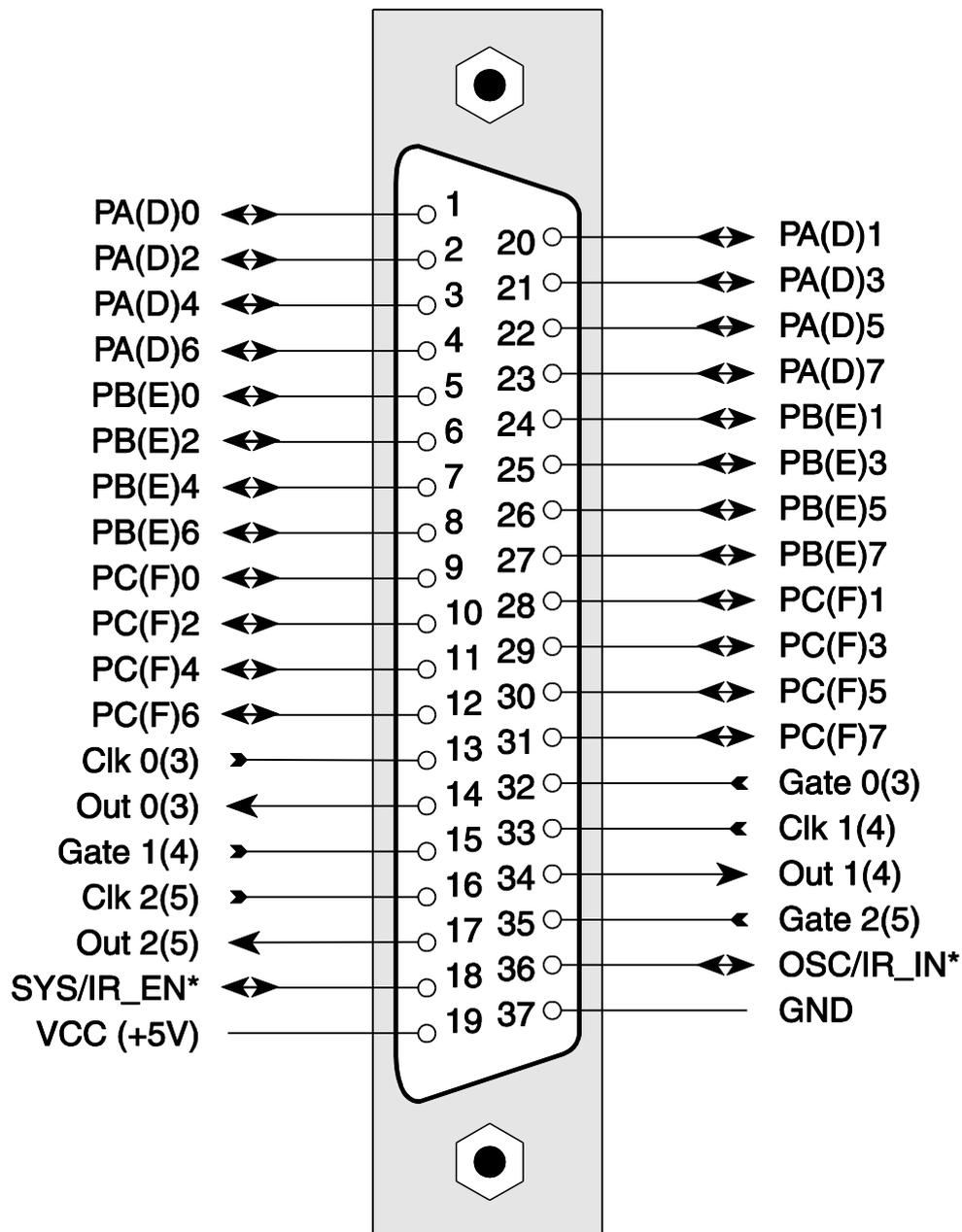
B Pinout

B1 ME-1400/A/B



Picture 8: 78-pin female D-Sub connector ME-1400/A/B

*Only in operation on ME-1400/A/B. When programming with the ME-iDS this pin is always an interrupt input.

B2 ME-1400E/EA/EB

Picture 9: Pinout of the 37-pin female D-Sub

Note:

Ports D, E and F (in brackets are only available on B-versions in combination with an additional mounting bracket (included with the package), see also B5 and B6.

*Functional overview see table on the next page.

B3 IDC-Connector for B-Versions (ST2)

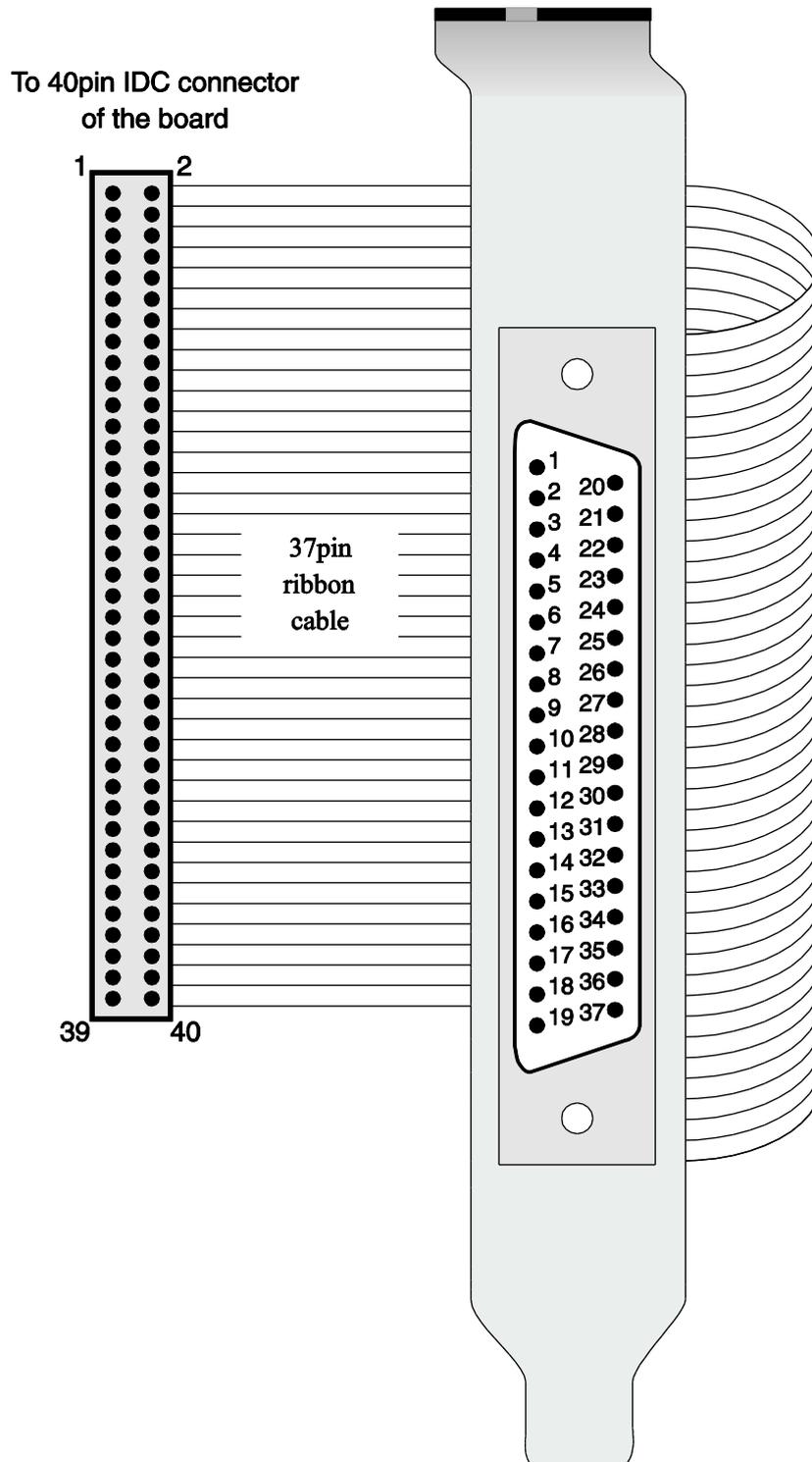
Port D	PD0	1	•	•	2	PD1
	PD2	3	•	•	4	PD3
	PD4	5	•	•	6	PD5
	PD6	7	•	•	8	PD7
Port E	PE0	9	•	•	10	PE1
	PE2	11	•	•	12	PE3
	PE4	13	•	•	14	PE5
	PE6	15	•	•	16	PE7
Port F	PF0	17	•	•	18	PF1
	PF2	19	•	•	20	PF3
	PF4	21	•	•	22	PF5
	PF6	23	•	•	24	PF7
Timer	Clk 3	25	•	•	26	Gate 3
	Out 3	27	•	•	28	Clk 4
	Gate4	29	•	•	30	Out 4
	Clk 5	31	•	•	32	Gate 5
	Out 5	33	•	•	34	OSC/IR_IN*
	SYS/IR_EN*	35	•	•	36	GND
	+5 V	37	•	•	38	NC
	NC	39	•	•	40	NC

Picture 10: Pinout of the 40-pin IDC-connector

	37-pin D-Sub		40-pin IDC connector (ST2)	
	SYS/IR_EN (Pin 18)	OSC/IR_IN (Pin 36)	SYS/IR_EN (Pin 35)	OSC/IR_IN (Pin 34)
ME-1400E	n.c.	–	–	–
ME-1400EA	n.c.	–/√	–	–
ME-1400EB	n.c.	–/√	n.c.	n.c.

*When programming with the ME-iDS the “OSC”-function is only supported by Linux at the moment.

B4 Additional Mounting Bracket



Picture 11: Mounting bracket with female D-Sub for ME-14B and ME-1400EB

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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D-82239 Alling

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Support:

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Download-Server and Driver Update:

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

www.meilhaus.org/driver

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:

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

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