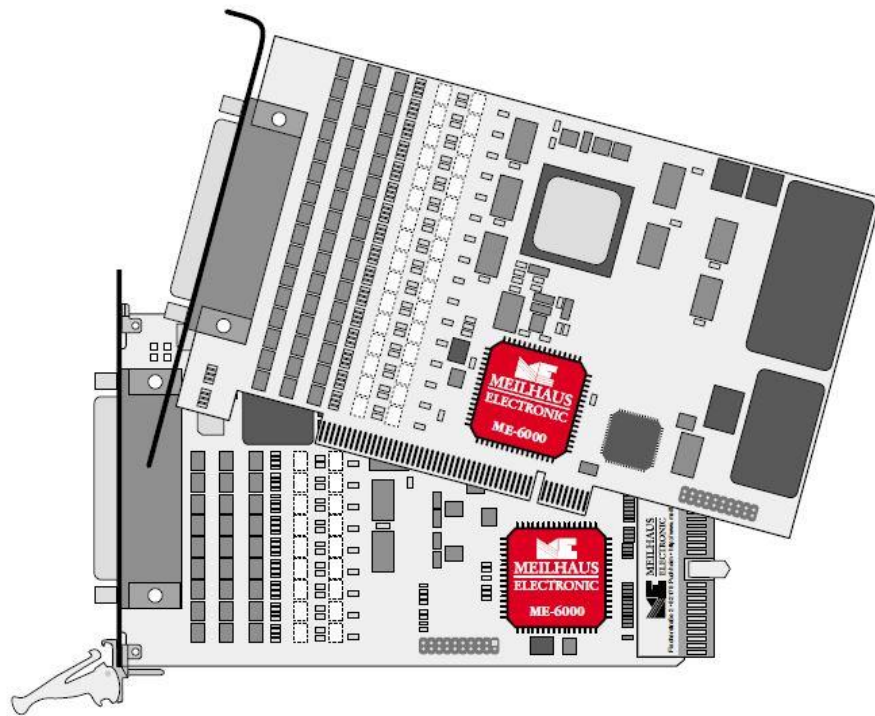Meilhaus Electronic Manual

ME-6000 Series 3.0E

(ME-6000/6100/6200/6300)

16-bit D/A Conversion Board
with up to 16 Channels and Electrical Isolation
(optional: "Island Channels")

Imprint

Manual ME-6000/6100/6200/6300

Revision 3.0E

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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-, PCI-Express- and CompactPCI-versions of the ME-630 series if not otherwise noted.

1.1   Important Notes

1.1.1 Use in Accordance with the Requirements

The PC boards of the ME-6000 series are designed for acquisition and output of analog and digital signals with a PC. Depending on type, install the models of the ME-6000 series into:

> a free PCI slot (ME-6x00 PCI) or

> a free CompactPCI slot (ME-6x00 cPCI)

For installing a plug-in board please read the manual of your PC. Please follow the notes and the specifications from page 22 on.

- 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:

D/A conversion board of the ME-6000 series for PCI- resp. CompactPCI-bus.

- Manual in PDF format on CD/DVD (optional as printed version).
- Driver software on CD/DVD.
- Additional mounting bracket ME-AK-D25F/S (cPCI) for PCI- resp. CompactPCI-slot.
- 25-pin D-Sub male connector.

1.3   Features

ME-6000/6100 PCI/CompactPCI

16-bit D/A Converter			
Model	**Total**	**With FIFO**	**Digital I/Os**
ME-6000x/4	4	-	16
ME-6000x/8	8	-	16
ME-6000x/16	16	-	16
ME-6100x/4	4	4	16
ME-6100x/8	8	4	16
ME-6100x/16	16	4	16
x = "i"	„i"-option: all D/A channels electrically isolated from PC GND however with common ground reference ISO_GND		
x = "p"	„p"-option: all D/A channels isolated from one another („Island Channels")		

Table 1: Model overview ME-6000/6100

ME-6200/6300 CompactPCI

16-bit D/A Converter			
Model	**Total**	**With FIFO**	**Digital I/Os**
ME-6200x/5	4+1 „U-Plus"	-	16
ME-6200x/9	8+1 „U-Plus"	-	16
ME-6300x/5	4+1 „U-Plus"	4	16
ME-6300x/9	8+1"U-Plus"	4	16
x = "i"	„i"-option: all D/A channels electrically isolated from PC GND however with common ground reference ISO_GND		
x = "p"	„p"-option: all D/A channels isolated from one another („Island Channels")		

Table 2: Model overview ME-6200/6300

Depending on the model the boards of the ME-6000 series provides 4, 8 or 16 D/A channels for bipolar voltage output in the output range ± 10 V as well as 16 digital I/Os. Each channel has its own high-accuracy, high-speed 16-bit D/A converter.

The D/A section is electrically isolated as a whole from the rest of the board. As an option you can isolate the single channels from one another ("p"-option with so called "**Island Channels**"). With that accuracies better than ± 1 % are possible.

Independent of the total number of channels you can use the first 4 channels for signal curve output on the ME-6100/6300. Each of the 4 channels has its own 8 kByte FIFO for output values. Sample rates up to **500 kHz** per channel are possible without load for the host computer. You can choose between the operation mode "Continuous" for putting out values continuously and the operation mode "Wraparound" for periodically signal curves.

All ME-6000/6100 with hardware version 2.6 and higher as well as all CompactPCI boards provide **16 digital-I/O lines.** These are organized in two 8-bit-wide TTL ports. The connection is done by the 25-pin D-Sub connector of the included additional mounting bracket.

All models of **type ME-6200/6300** provide a special D/A channel (U_{OUT}_8) for voltage output in the range of 0…+50 V at 20 mA maximum. This channel is also named as "U-Plus"-channel. The supply for the electrical isolated output buffer of this channel provides

a DC/DC converter on board (as a standard). The settling time of the channel is 25 μs (full-scale).

On demand OEM-versions with other output voltage ranges up to ±28 V are possible. An external supply for the output buffer in the range of ±12...±28 V is also possible. If you are interested in OEM-versions please contact our sales department under the phone number: +49 8141 52 71-0.

1.4 System Requirements

The ME-6000 series may be installed into any PC 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 6000/6100 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, 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.
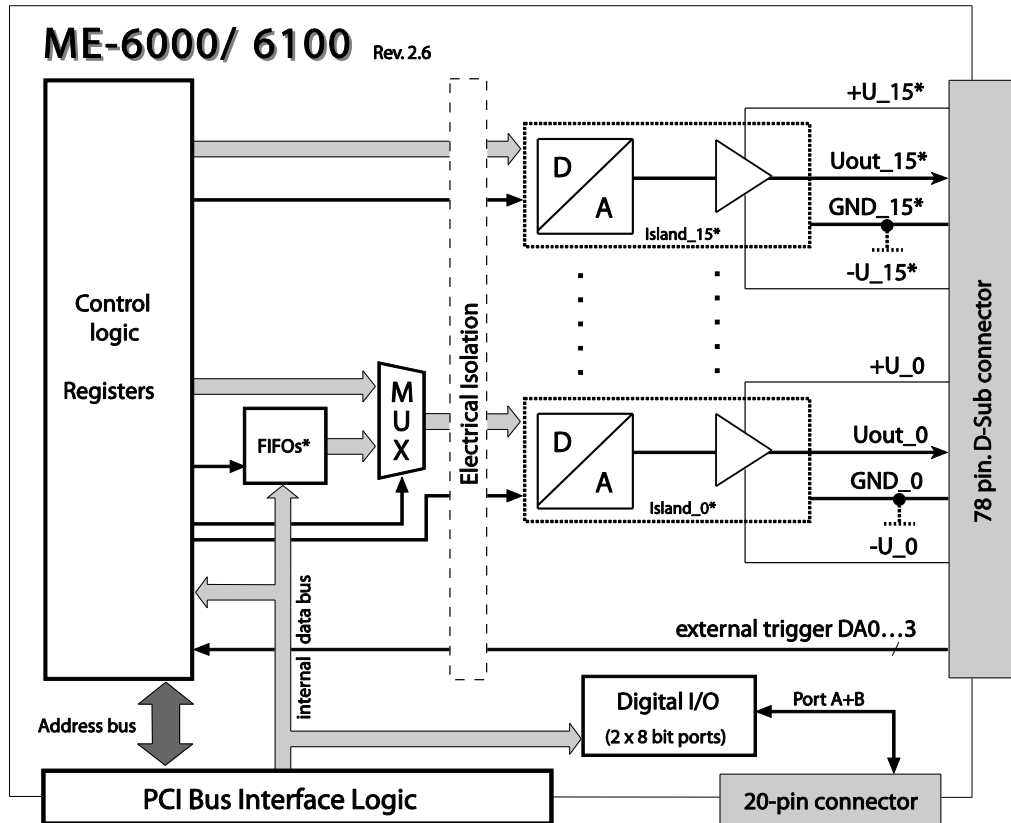
3   Hardware

3.1   Block Diagrams

Diagram 1: Block diagram of ME-6000/6100

ME-6000/4:   4 D/A channels $\pm$10 V ($U_{OUT}_0\ldots3$), 16 DIOs

ME-6000/8:   8 D/A channels $\pm$10 V ($U_{OUT}_0\ldots7$), 16 DIOs

ME-6000/16:   16 D/A channels $\pm$10 V ($U_{OUT}_0\ldots15$), 16 DIOs

ME-6100/4:   4 D/A channels $\pm$10 V ($U_{OUT}_0\ldots3$), with FIFO, 16 DIOs

ME-6100/8:   8 D/A channels $\pm$10 V ($U_{OUT}_0\ldots7$), 4 of them FIFO ($U_{OUT}_0\ldots3$), 16 DIOs

ME-6100/16:   16 D/A channels $\pm$10 V ($U_{OUT}_0\ldots15$), 4 of them FIFO ($U_{OUT}_0\ldots3$), 16 DIOs

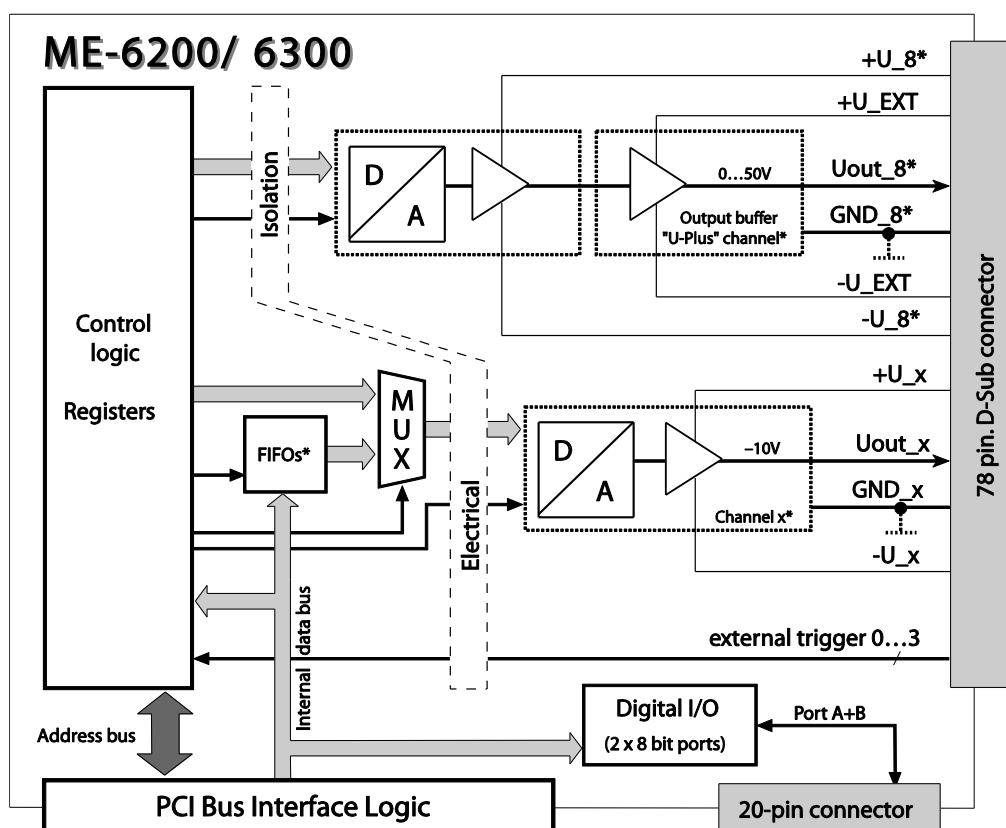*Depending on the version not all functional groups available.

Diagram 2: Block diagram of ME-6200/ME-6300

ME-6200/5: 4 D/A channels ±10 V (x=0...3), 1"U-Plus"-channel (U_{OUT}_8), 16 DIOs

ME-6200/9: 8 D/A channels ±10 V (x=0...7), 1 "U-Plus"-channel (U_{OUT}_8), 16 DIOs

ME-6300/5: 4 D/A channels ±10 V (x=0...3), with FIFO, 1 "U-Plus"-channel (U_{OUT}_8), 16 DIOs

ME-6300/9: 8 D/A channels ±10 V (x=0...7) 4 of them with FIFO, 1 "U-Plus"-channel (U_{OUT}_8), 16 DIOs

*Depending on the version not all functional groups available.

3.2   D/A Section

Depending on model, the boards of the ME-6000 series provides up to 16 analog output channels. Each channel has its own serial 16-bit D/A converter and converts up to 500 kS/s.

The standard D/A channels can output in the range from -10 V to +10 V-1LSB.
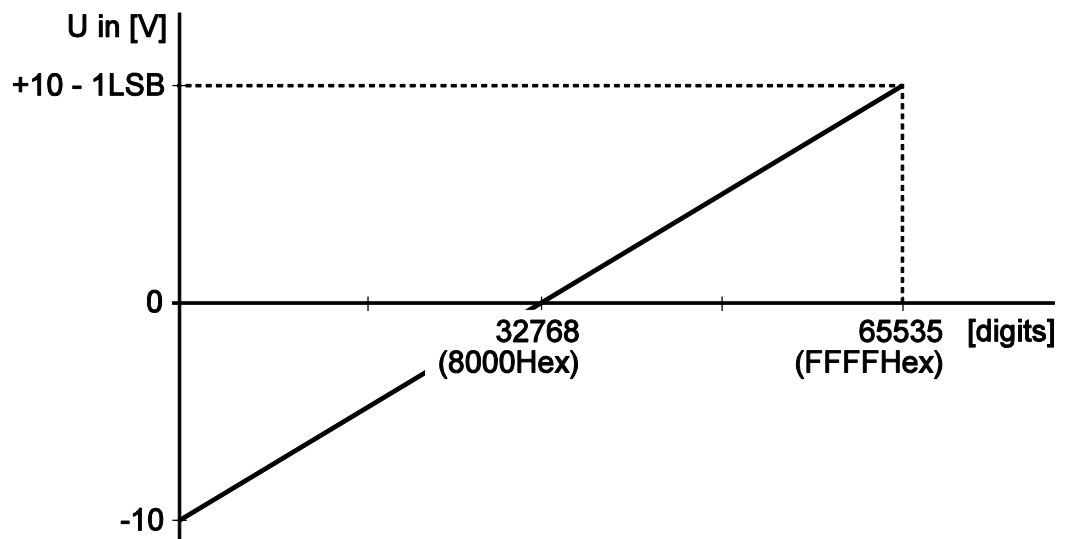
Diagram 3: Characteristic for standard D/A channels

The output voltage range of the "U-Plus"-channels (ME-6200/ME-6300) is from 0 V to+50 V-1LSB if the standard output buffer is used.
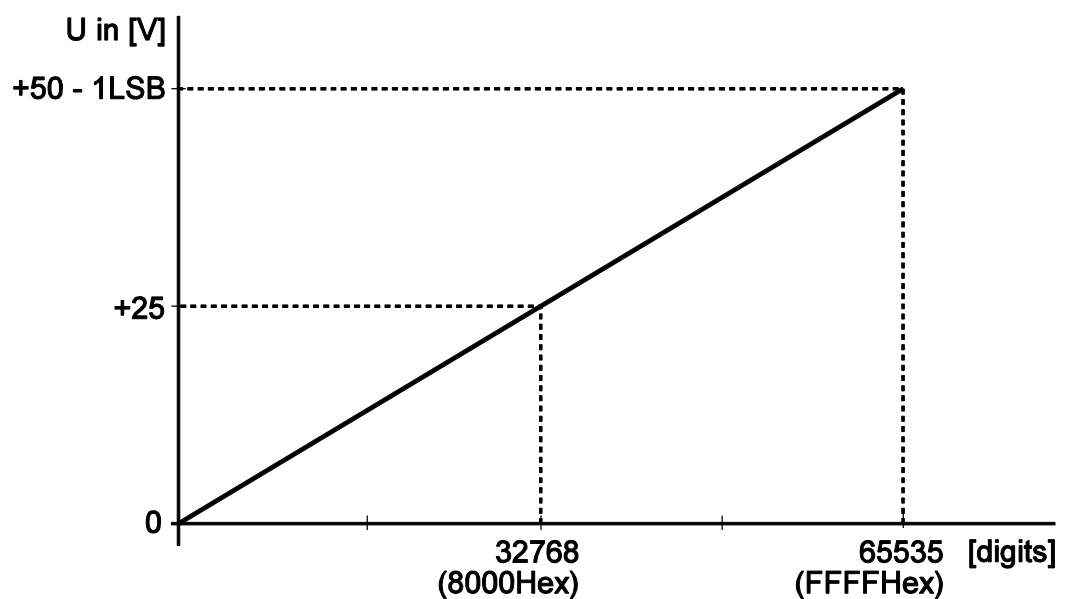

Diagram 4: Characteristic for "U-Plus" channels

3.2.1 Notes for Wiring

Attention:

After power up, the standard D/A channels output - 10 V. After starting the driver the output value changes to 0 V. To guarantee

a defined power-up condition please start your host computer first and do not power up your external wiring until the driver started.

The "U-Plus"-channel of the ME-6200/6300 outputs 0 V immediately after power up.

Important Note!

Make sure that a reference from the external wiring to PC ground is made. The pins +U_0...15 and –U_0...15 are only required, if the one of the options „Island Channels" or „High Current" (HC) will be used; else they must be **not connected!**

3.2.2 Electrical Isolation

All D/A channels of the board are electrically isolated by opto-couplers from PC-GND. I.e. GND_0...15 are connected with one another and have a common ground reference (ISO_GND). On the ME-6100/6300 also the external trigger inputs are opto-isolated.

The output current I_{max} per channel depends of the number of assembled resp. used channels (see table below)

Channels	I_{max}	Channels	I_{max}
4	±15 mA	12	±10 mA
8	±15 mA)	16	±3 mA

Table 3: Max. Output Current

Note that the output current per channel may not exceed **±15 mA**! The pins for the external ±15 V power supply (+U_x und –U-x) are driven internally and **may not be connected externally!**
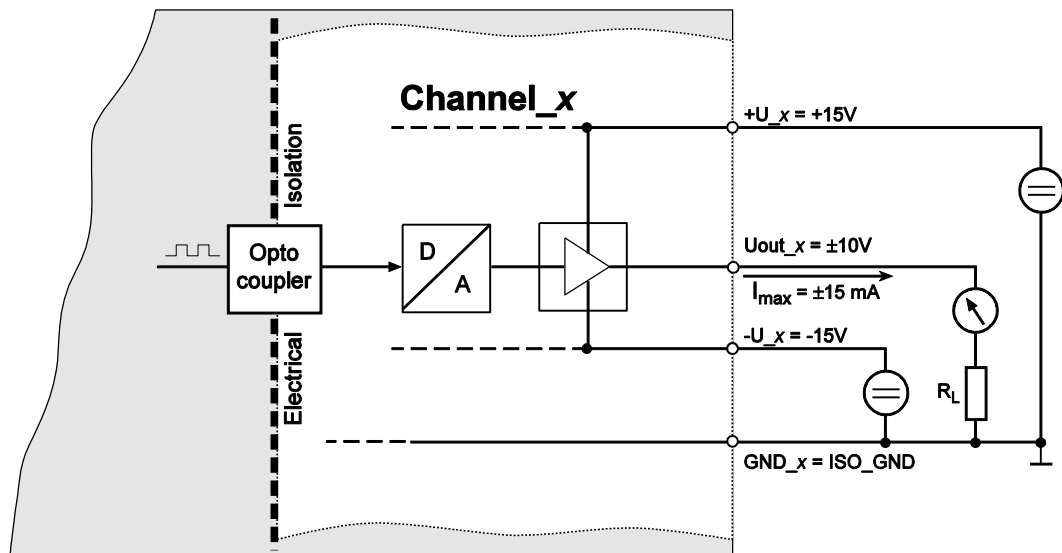
Diagram 5: Electrical isolation of all channels

3.2.3 Island Channels

With the "p"-Option ("Island Channels") all the D/A channels use independent ground levels and supply pins. I.E. you have to connect the ground reference of each channel (GND_0...15) with the appropriate GND of your external application. Further on, every island channel requires an independent, symmetrical power supply of ± 15 V (± 22 mA per channel for $I_{max} = \pm\textbf{15 mA}$). If you use a high-end, low-noise power supply, you can realize excellent accuracies better than $\pm\textbf{1 \%.}$

The external trigger inputs (AO_TRIG_0...3) are also included with the "islands".
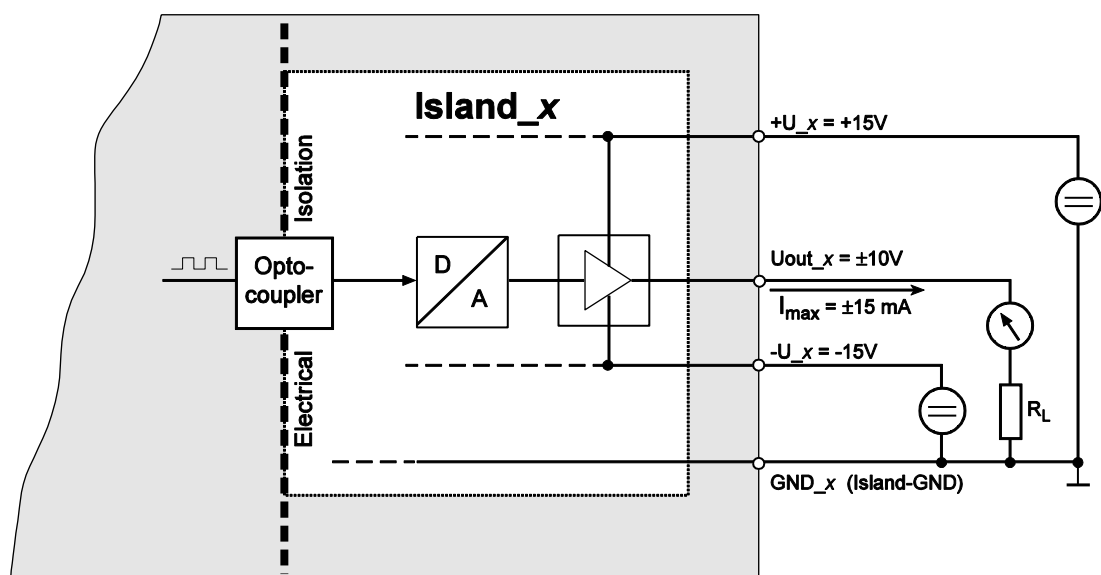

Diagram 6: Island Channels

3.2.4 Option "High Current"

The option "High Current" (HC) can be combined with the board versions without "island channels". It gives you the possibility to increase the output current per channel to $I_{max} = $ **±15 mA**. This requires an external, low-noise power supply of ±15 V (±22 mA per channel for $I_{max} = $ **±15 mA**) and a change to your hardware – please contact our service department (see page 31).
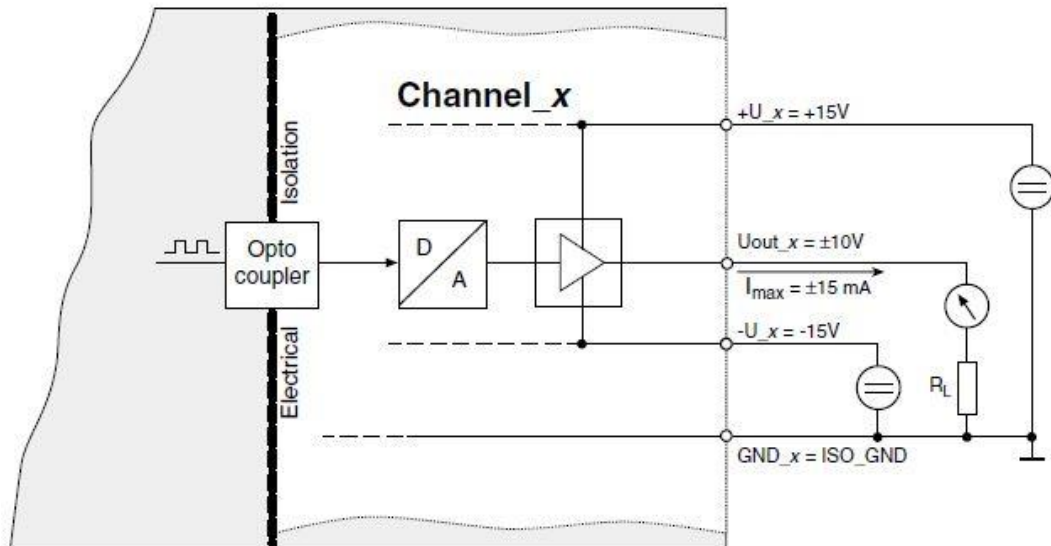

Diagram 7: Wiring of the outputs with the option "High Current" (with electrical isolation)

3.2.5 External Trigger D/A Section

The D/A channels 0…3 can be started by an external trigger signal (AO_TRIG_x). Depending on the selected option (RISING, FALLING or BOTH) the conversion will be started on the matching edge. The option "BOTH" means either rising **or** falling edge.
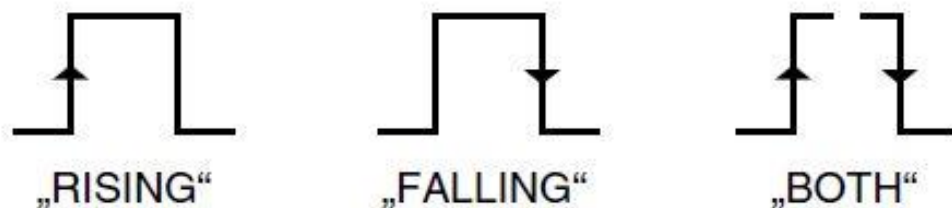

Diagram 8: Trigger edges

It is important that the voltage levels of the external trigger input wiring be within the specified limits (see specifications on page 22) and that a reference to ground (GND_x) be made.

The opto-isolated trigger inputs work with a high level of +5 V. For low level a current I_F of 7.5 mA ≤ I_F ≤ 10 mA must be driven against ground (GND_x).
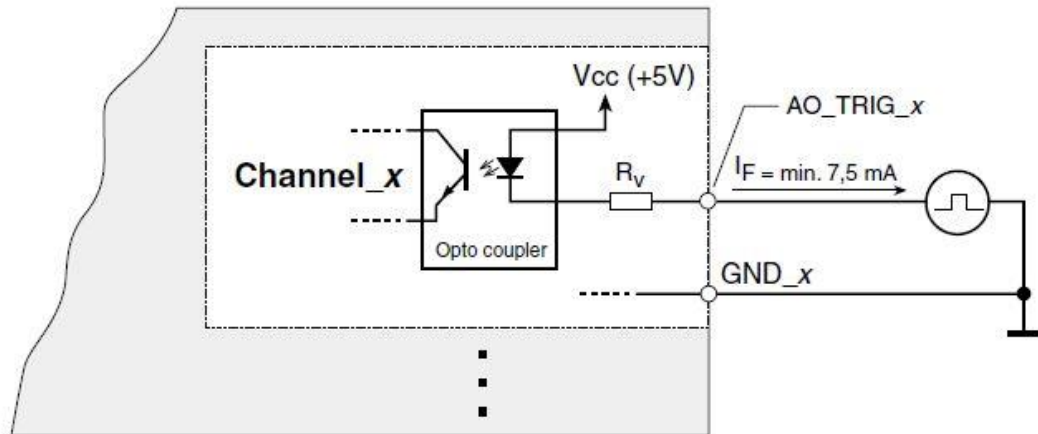

Diagram 9: Wiring of the D/A trigger inputs

Note: By appropriate programming one or multiple channels (up to 16 channels depending on model) can be started from any trigger input.

3.3   Digital-I/O Section

All boards of type ME-6000/6100 with hardware version 2.6 or higher as well as all boards of type ME-6200/6300 provide two TTL ports with 8 bits each. Each port can be independently configured as input or output. After power up, all ports are set to input. For more information about programming refer to chapter 4.2 "Digital-I/O Section" on page 20.

The both ports A and B, are available on the 20-pin flat connector ST2 or can be routed to an additional mounting bracket (ME-AK-D25F/S) with a D-sub 25 female connector.
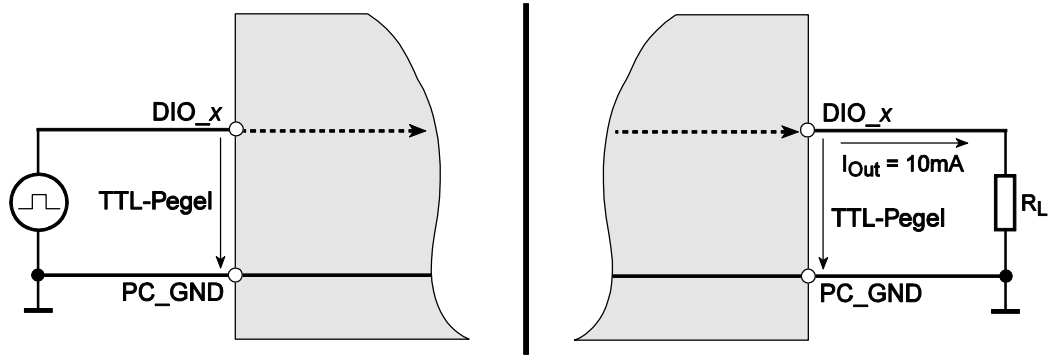
Diagram 10: Wiring of the digital inputs (left) and outputs (right)

It is important that the voltage levels of the digital input/output wiring be within the TTL level limits (see specifications on page 22) and that a reference to PC ground (PC_GND) be made. The maximum output current is $I_{OUT} = I_{OL} = I_{OH} = 10$ mA.

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-6x00 manual Rev. 3.0 (see: www. meil-haus. com/download/ME-6x00). Please note that we cannot support this driver anymore.

4.1   D/A Section

4.1.1 Single Value Output

ME-6000/6200	ME-6100/6300
✓	✓

The output of a single value is done in operation mode "Single". Each D/A channel is accessed as a subdevice of type ME_TYPE_AO, 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.
• Channel number: always "0".
• Output voltage range: ±10 V.

- Trigger channel: optional synchronous start of several channels.
- Trigger type: per software or external digital trigger.
- Trigger edge: trigger event on falling, rising or any edge.
- Time-Out: in case the external trigger signal does not occur.

4.1.2 Timer Controlled Output

ME-6000/6200	ME-6100/6300
-	✓

Programming of timer controlled output is done in operation mode "Streaming". Each D/A channel is accessed as a subdevice of type ME-TYPE_AO, subtype ME-SUBTYPE_STREAMING. **Note** the order of operation as described in the ME-iDS manual. The following parameters can be configured by the functions *meIOStreamConfig():*

- Determine subdevice with *meQuery...*functions (capable for streaming operation).
- Channel number: always "0"
- Output voltage range: ±10 V.
- Trigger channel: optional synchronous start of several channels.
- Trigger type: per software or external digital trigger.
- Trigger edge: trigger event on falling, rising or any edge.
- A programmable counter serves as timer which is configured by the trigger structure `meIOStreamTrigger`. The 32-bit counter uses a 33 MHz base frequency. This results in a period of 30.30 ns, which is the smallest time unit available. This will be referred to as "1 Tick" in the following sections. The functions `meIOStreamFrequencyToTicks()` and `meIOStreamTime-ToTicks()` offer a convenient way to convert the frequency resp. the period in ticks to program the timer. Sample rates between 500 kS/s and 0.5 samples per minute can be set.

4.2 Digital-I/O Section

All ME-6000/6100 PCI with hardware version 2.6 and higher as well as all CompactPCI boards provide two 8-bit-wide digital-I/O ports (A, B). Each port is considered as a unique subdevice I the Meilhaus Electronic Intelligent Driver System (ME-iDS) and can be independently configured as input or output. On power up, all ports

are set to input. 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 3.3 on page 17.

The following operation modes are possible:

4.2.1 Simple Input/Output

ME-6000/6200	ME-6100/6300
✓	✓

The input/output of single digital values is done in operation mode "Single". Each digital port is accessed as a 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 *meIOSingle-Config()* and *meIOSingle()*:

- Determine subdevice with *meQuery…*functions.
- Port direction: input or output.
- Port width: bit or byte operation (8 bit).

Note: Ports defined as output can also be read back!

5 Appendix

A Specification

(Ambient temperature 25 º)

PC-Interface

Standard-PCI- resp. CompactPCI-bus (32 bit, 33 MHz, 5 V
PCI Local bus specification version 2.1 compliant;
CompactPCI Specification PICMG 2.0 R3.0,
Resources assigned automatically (Plug&Play)

Voltage Outputs

(Partly different specifications are valid for the „U-Plus"-channel – see separate section)		
Number of channels	4, 8 or 16 (depends on model)	
D/A converter	1 serial converter (500 kHz) per channel	
Resolution	16 bit	
Output range	± 10 V	
Output current	Without external power supply: depends on the number of assembled resp. used channels:	
	channels	**I_{max} per channel**
	4	15 mA
	8	15 mA
	12	10 mA
	16	3 mA
	With external power supply (± 15 V) only in connection with options „Island channels" and „High Current": max. ± 15 mA per channel)	
Ext. power supply	± 15 V (optional); current per channel: 7 mA + load (max. ± 15 mA)	
Settling time (DAC)	max. 2 µs at full-scale (-10 V $\longrightarrow$ +10 V)	

Total accuracy

„With electrical isolation"	max. ±20 mV
„With island channels"	max. ±10 mV
Operation modes	„Single", „Streaming"
Trigger modes	software start, ext. digital trigger, synchronous start (software/external)
External trigger edges	rising, falling, any

Timer-Controlled Output (ME-6100/6300, channel 0...3)

Channels	0...3 (independent of one other)
D/A-FIFOs	8 k values per channel
Sample-Rate	max. 500 kS/s
D/A-Timer	programmable from 2 µs up to 130 s in steps of 30.30 ns

External Trigger (channel 0...3)

Voltage level	typ. 5 V
Input current I_F	7.5 mA ≤I_F≤10 mA
Reference to ground	ground (GND_x)
Delay time	max. 80 ns

Electrical Isolation, Island Channels (optional)

Over-voltage protection	max. 500 V

Output Buffer „U-Plus" (channel number 8)

Output line l	U_{OUT}_8
Voltage range	0...50 V
Output current	max. 20 mA
Offset error	typ. ±5 mV; max. ± 20 mV
Gain error	±0,16 %
Settling time	max. 25 µs at full-scale (0 ⟶ 50 V) with 20 mA load

Digital I/Os

Ports		2 x 8 bit
Reference to ground		PC ground (PC_GND)
Port type		bidirectional TTL ports
Output level	U_{OL}	max. 0.5 V bei 24 mA
	U_{OH}	min. 2.4 V bei -24 mA
Input level	U_{IL}	max. 0.8 V bei Vcc = 5 V
	U_{IH}	min. 2 V bei Vcc = 5 V
	Input current	± 1 µA

General Information

Power consumption at +5 V (16 D/A channels; without ext. load)	
„With electrical isolation"	max. 3.6 A
„With island channels"	max. 1.2 A
Load for VCC_OUT	max. 200 mA
Physical size PCI	174 mm x 99 mm
	(without mounting bracket and connector)
Physical size CompactPCI	3 U CompactPCI board
Connectors	78-pin D-Sub female connector (ST1) 20-pin IDC connector (ST2)
Operation temperature	0…70 C
Storage temperature	-40…100 C
Relative humidity	20…55 % (non-condensing)
Certification	CE

B   Pinout

Legend for pinouts:

Attention: With the options "High Current" and "Island Channels" the pins –U_x and +U_x are inputs for the external ±15 V power supply. In all other cases these pins output ±15 V and it is not permitted to connect them. **The hardware will be irreversible damaged!**

Pin-name	Function
Uout_x	analog output channels
+U_x	+15 V power supply; **only** with the options „High Current" (HC) and "Island Channels"
-U_x	-15 V power supply; **only** with the options „High Current" (HC) and „Island Channels"
AO_TRIG_x	digital trigger input for each D/A channels 0..3.
DIO_Ax	digital-I/O port A
DIO_Bx	digital-I/O port B
GND_*x*	Common ground for all D/A channels. Electrical isolated from PC ground. On models with the option "Island Channels" the grounds of the single D/A channels are additionally isolated from one another.
PC_GND	PC ground for the digital-I/O section
VCC_OUT	V_{CC} output (+5 V from PC) max. 200 mA load
+U_EXT	ME-6200/6300 optional: pins for the positive supply for the output buffer of the „U-Plus"-channel (U_{OUT}_8)
-U_EXT	ME-6200/6300 optional: pins for the negative supply for the output buffer of the „U-Plus"-channel (U_{OUT}_8)
n.c.	pin not connected

B1   D-Sub Connector (ST1)
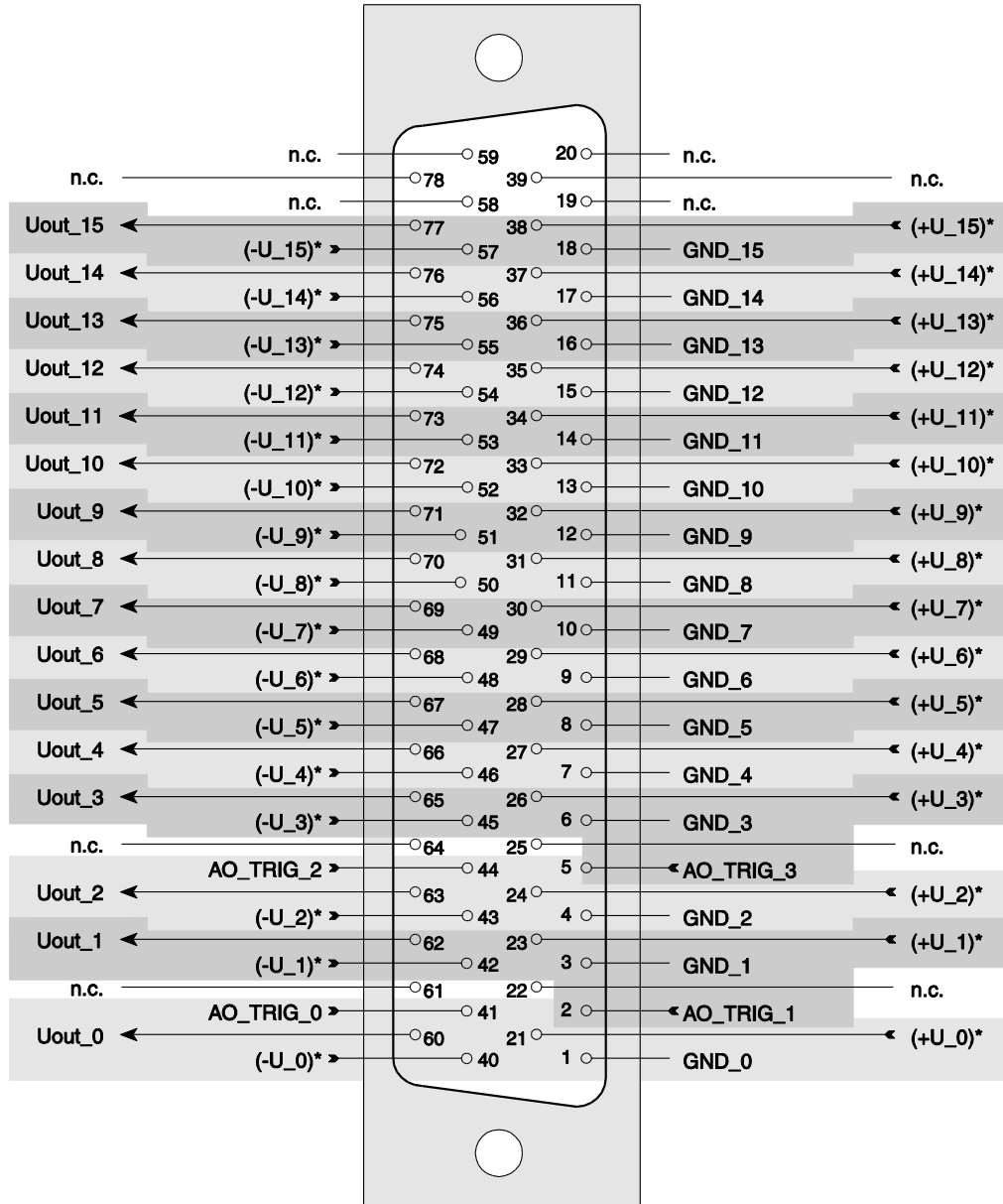
B1.1   ME-6000/6100

Diagram 11: Pinout of the 78-pin D-Sub female connector

*Note the warning on page 25.
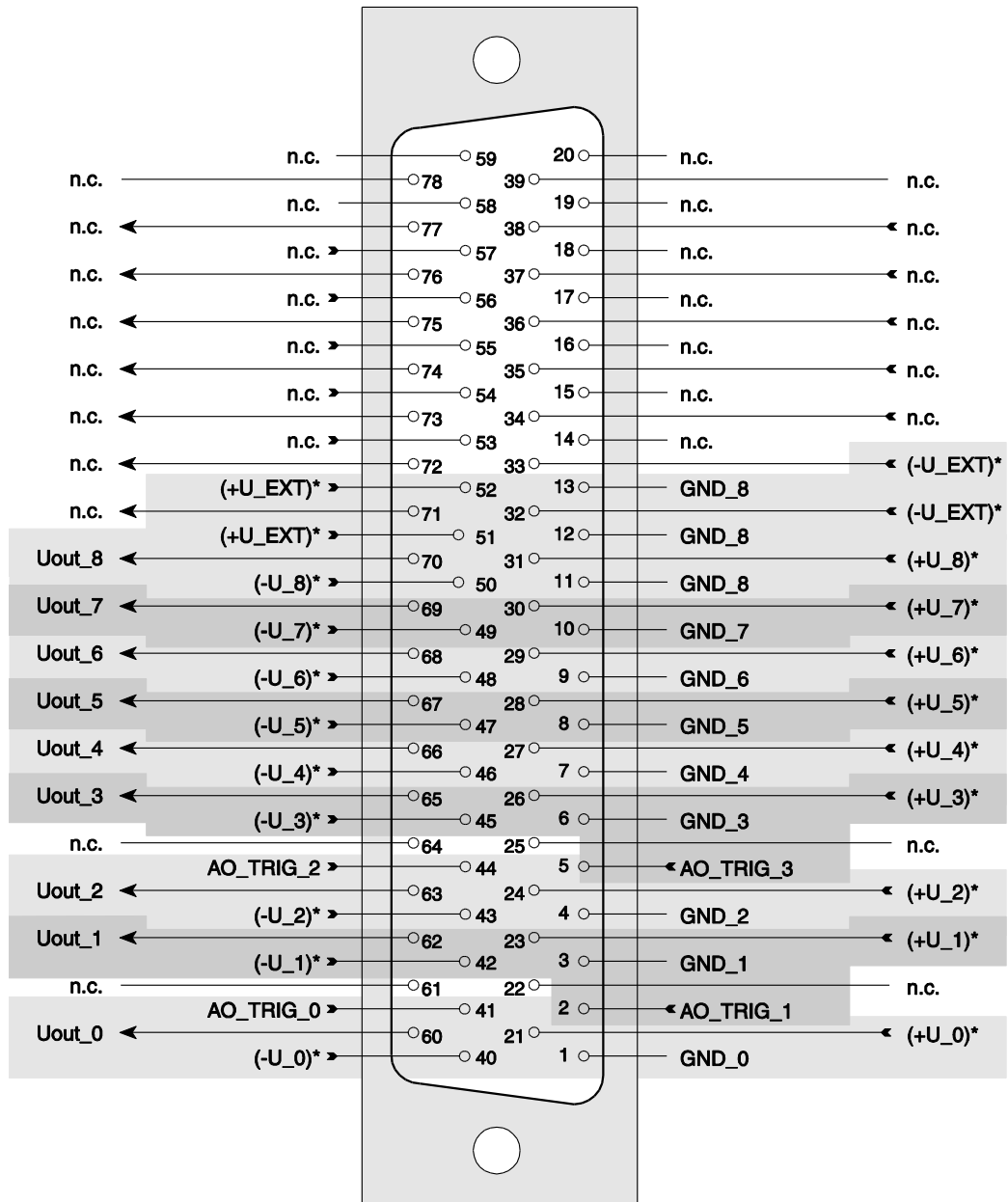
B1.2   ME-6200/6300

Diagram 12: Pinout of the 78-pin D-Sub female connector

*Note the warning on page 25.

B2   Auxiliary Connector (ST2)

Adapter cable (ME-AK-D25F/S (cPCI)) from 20-pin IDC connector to mounting bracket with 25-pin D-Sub female connector (comes with the board).
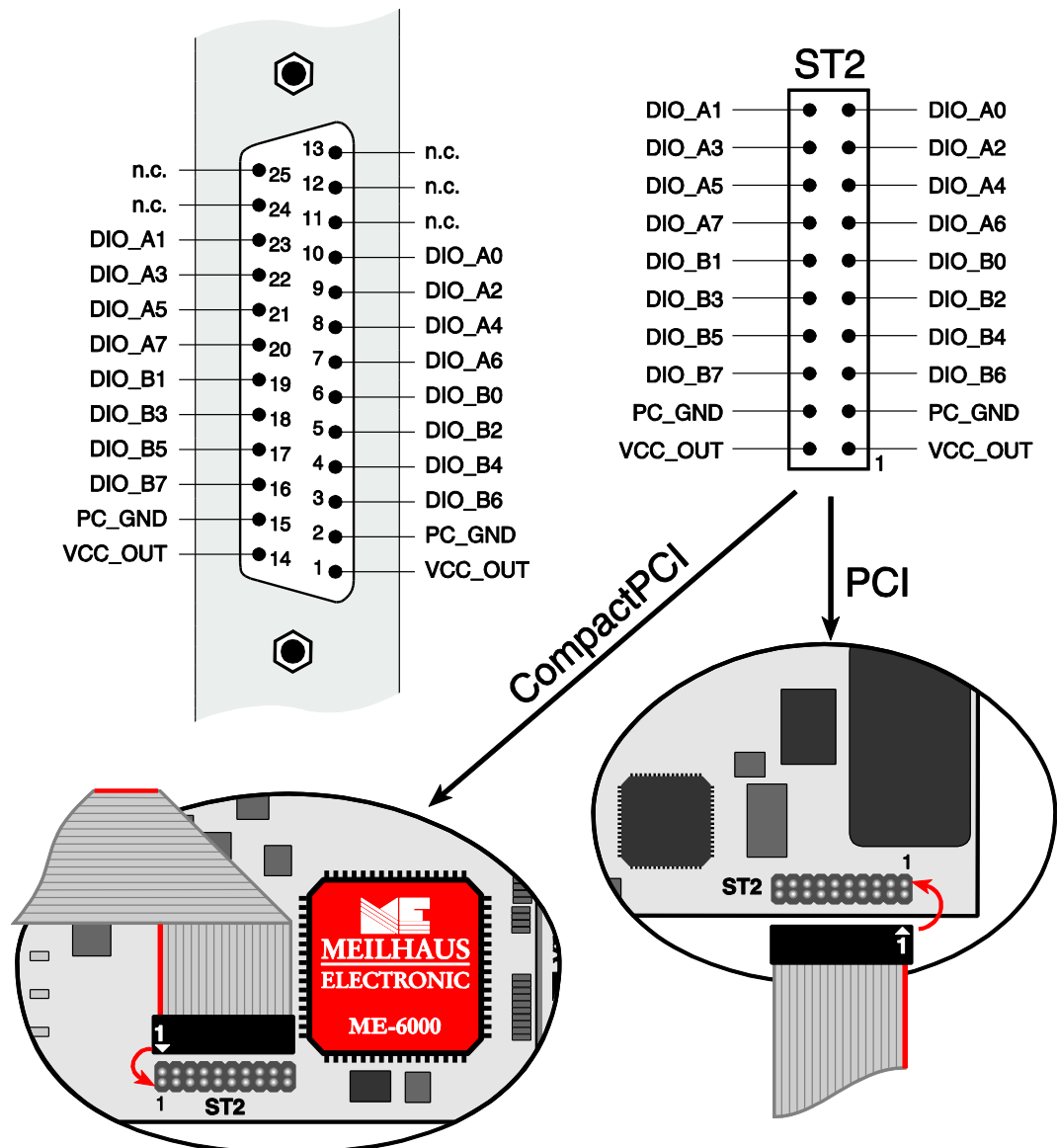

Diagram 13: Auxiliary connector ST2 for ME-6000 series (top view)

Attention: When connecting the mounting bracket make sure to plug in pin 1 of the flat ribbon cable (red marked line) as shown above to the IDC connector ST2.

C   Accessories

We recommend to use high-quality connector cables with single-shielded lines per channel. As accessory we provide the special connector cable ME-AK-D78/6000M-OE (length: 1 m).

ME-AK-D78/6000M-OE

Special connector cable from 78-pin D-Sub male connector to 16 single-shielded lines with open end. Note the warning on page 25.
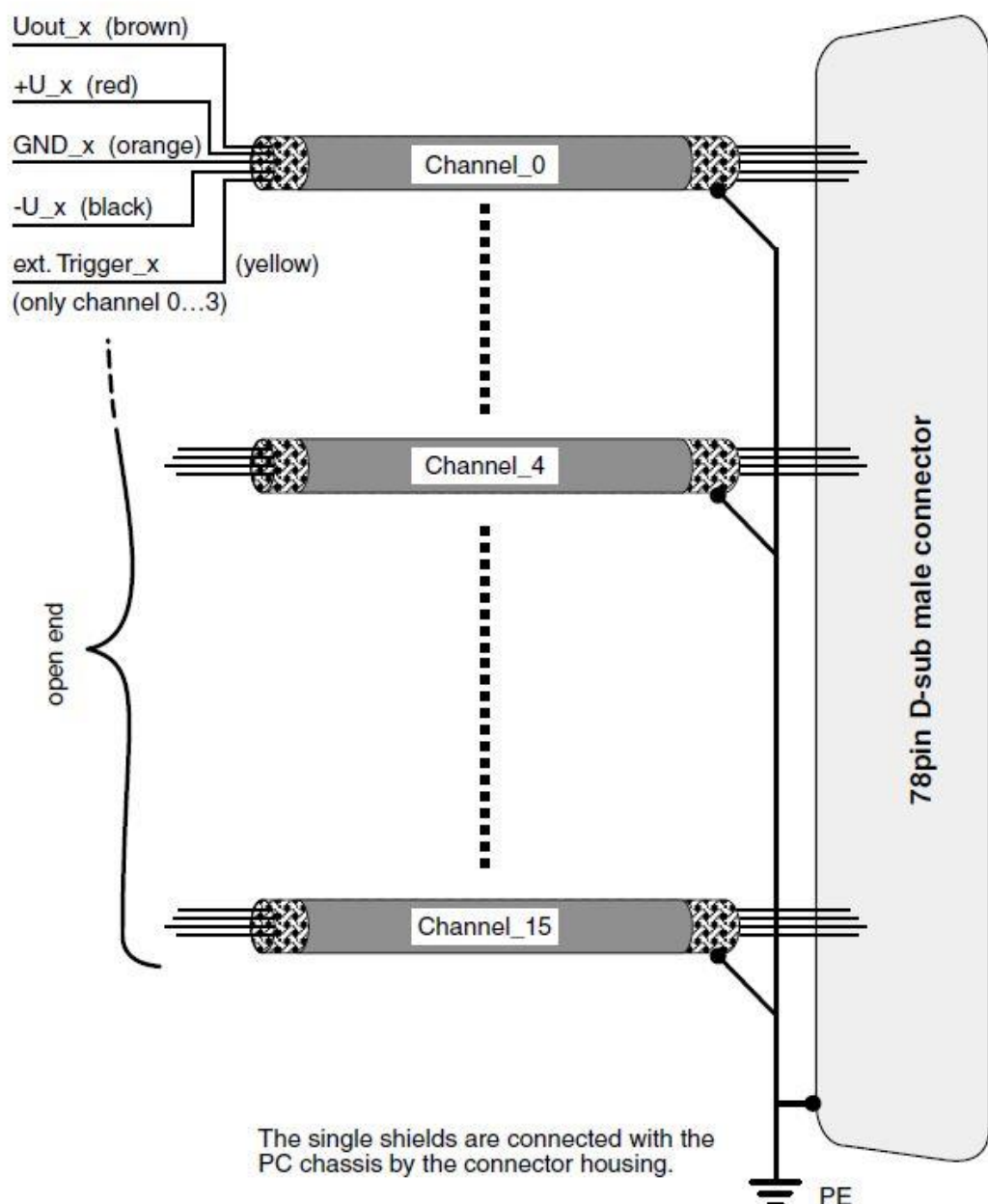

Diagram 14: Special cable for ME-6000 series

ME-63Xtend Series

External relay and digital-I/O boards (DIN rain mounting possible). Connection by ST2 with additional mounting bracket ME AK-D25F/S and special connection cable ME AK-D2578/4000.

ME-UB Series

Desktop relay and digital-I/O boxes. Connection by ST2 with additional mounting bracket ME AK-D25F/S and special connection cable ME AK-D2515/4000.

ME AK-D25/HQ/1

High-quality cable with different lengths. 25-pin D-sub male to female, 1:1 contacted. With metal housing, line diameter 40 x 0.25 mm^2. Max. current load 1.4 A per line; load on 20 lines: 2 A.

For further accessories please refer to the current Meilhaus Electronic catalog and the internet under http://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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Repair & Service
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D-82239 Alling

Sales:		**Support:**	
Tel.:	(08141) 52 71 – 0	Tel.:	(08141) 52 71 – 188
Fax:	(08141) 52 71 – 129	Fax:	(08141) 52 71 – 169
eMail:	sales@meilhaus.de	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:
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.

E   Index