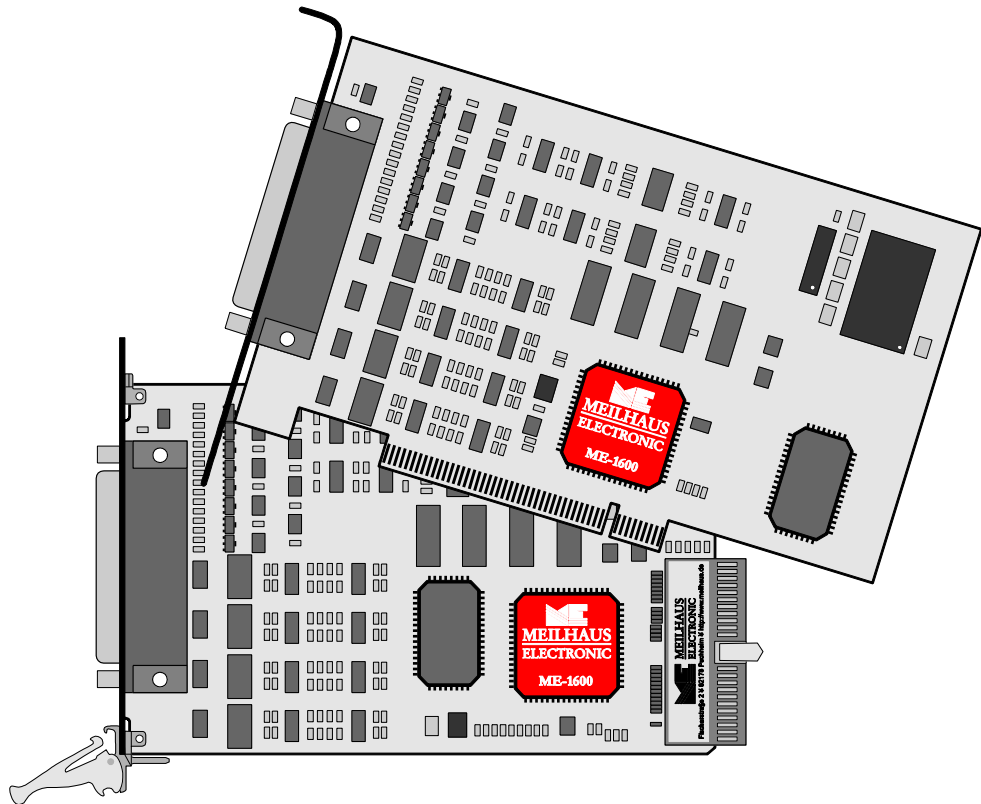# Meilhaus Electronic Manual

ME-1600 Series

(PCI- and CompactPCI-Versions)

12-bit D/A-Conversion Board with up to
16 Channels and optional Current Outputs

Imprint

Manual ME-1600 PCI/cCI Series

Revision 3.0E

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Important note:

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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-1600 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 PCI-Express slot (PCIe versions) or
>
> a free CompactPCI slot (3 HE cPCI versions)

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 Unforseeable 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:

- D/A conversion board of the ME-1600 family for PCI- or CompactPCI-bus.
- Manual in PDF format on CD-ROM (optional as printed version).
- Driver software on CD-ROM.
- 78-pin D-Sub male connector.

1.3   Features

Model Overview

Model	D/A Channels
ME-1600/4U PCI **ME-1600/4U cPCI**	4 voltage outputs
ME-1600/8U PCI **ME-1600/8U cPCI**	8 voltage outputs
ME-1600/12U PCI **ME-1600/12U cPCI**	12 voltage outputs
ME-1600/16U PCI **ME-1600/16U cPCI**	16 voltage outputs
ME-1600/16U8I PCI **ME-1600/16U8I cPCI**	16 voltage outputs, of which 8 channels can be used for current output at the same time

Table 1: Model overview ME-1600 family

The boards of the **ME-1600 family** have 4, 8, 12 or 16 D/A channels depending on the model. Thereby each 4 channels are located in one 12-bit D/A converter component (DAC). Every voltage output can be driven independently of one another in the output ranges 0...10 V or ±10 V.

Optional: From the 16 channels of the board up to 8 channels can also be used for current output. At the same time the corresponding voltage outputs can be used with a voltage proportional to the

adjusted current. The current outputs can be driven in the output ranges 0…20 mA or 4…20 mA and are short-circuit proof.

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.

2.3   Test Program

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

3   Hardware

3.1   Block Diagram
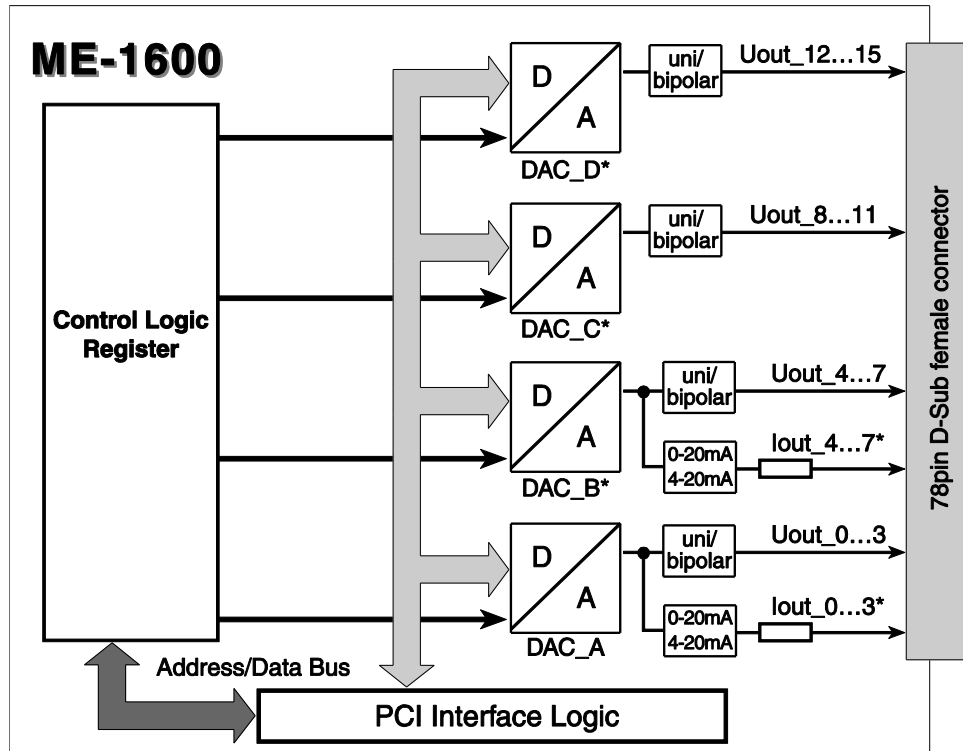
Picture 1: Block diagram of ME-1600

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

ME-1600/4U: 4 voltage outputs (U_{OUT}_0...3).

ME-1600/8U: 8 voltage outputs (U_{OUT}_0...7).

ME-1600/12U: 12 voltage outputs (U_{OUT}_0...11).

ME-1600/16U: 16 voltage outputs (U_{OUT}_0...15).

ME-1600/16U8I: 16 voltage outputs (U_{OUT}_0...15) and
                      8 current outputs (I_{OUT}_0...7)

3.2   D/A Section

The DAC-boards of the ME-1600 family can output voltages (0…10 V, ±10 V) and optionally currents (0…20 mA, 4…20 mA). Each 4 channels are integrated into one 12-bit DAC-component (see also chapter programming from page 14 up).

Attention:

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.

3.2.1   Output Ranges

The output ranges can be chosen separately for each channel. Voltage and current ranges can be used independently from one another:
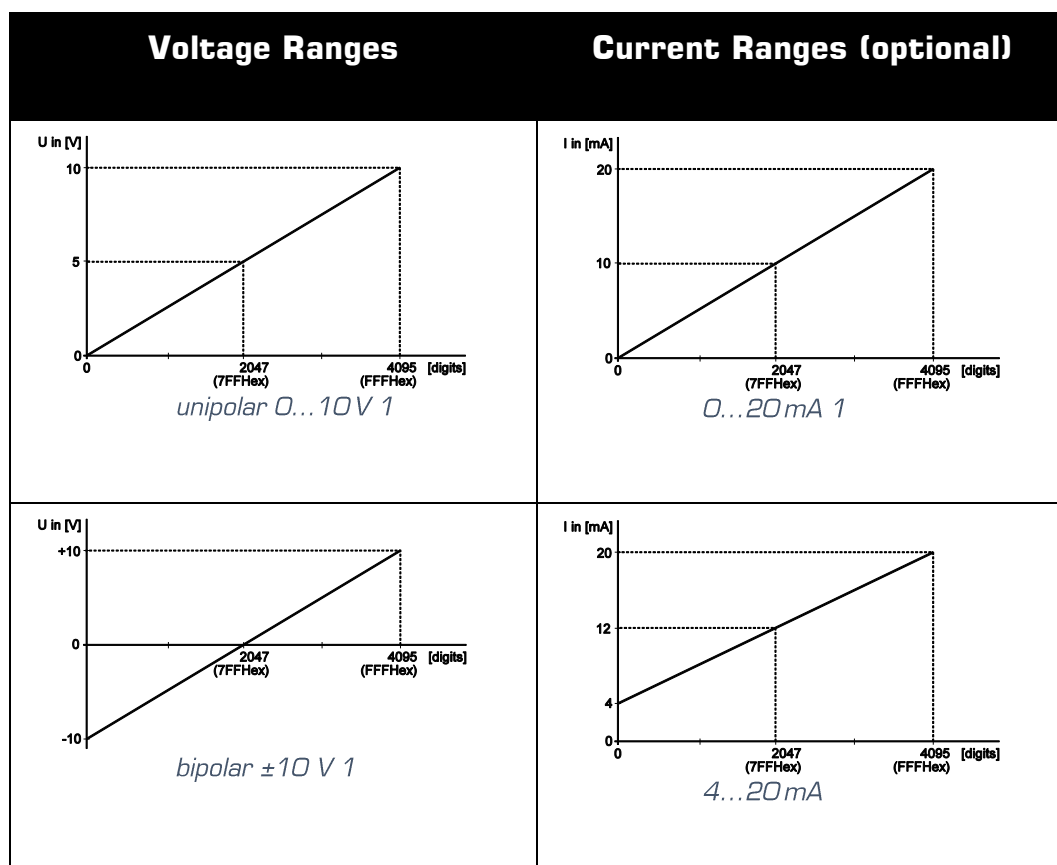

Table 2: Output ranges

Note: After changing the output range (e.g. from 0…10 V to ±10 V) the value written to the output register of the DAC will be newly interpreted and output immediately.

For the pin configuration of the 78-pin female D-Sub see „Pinout of the 78-pin D-Sub female connector" on page 19). Pins which are assigned to function groups not provided are not connected.

3.2.2 Voltage Outputs

Attention: The total current of all voltage outputs must not exceed ±32 mA per channel! One single channel must not exceed I_{max} = ±20 mA.

If one of the maximum values above should be exceeded we recommend the usage of external drivers. The +5 V supply of the PC available at the D-Sub connector can be used to supply a DC/ DC converter sourcing the necessary symmetrical voltage of $\pm U_{BUF}$ = ±15 V.
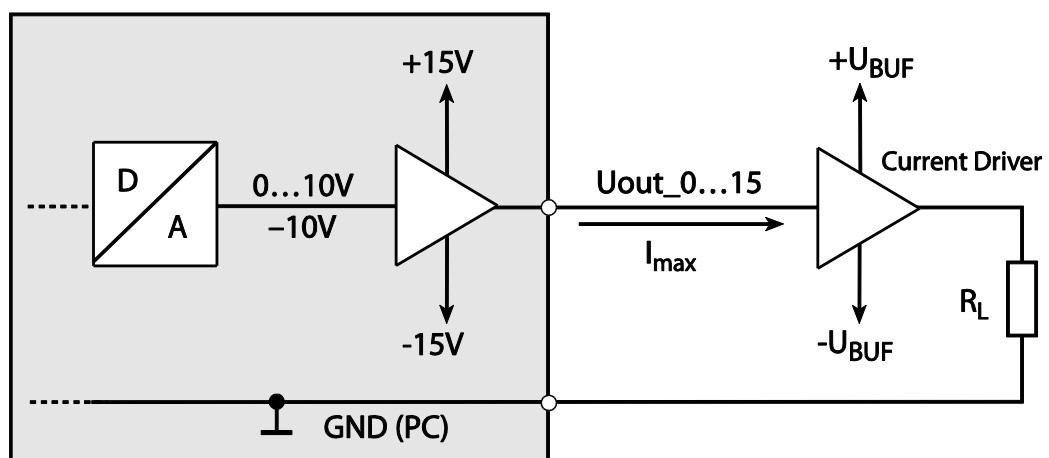
Picture 2: Wiring of the voltage outputs

3.2.3 Current Outputs

The current outputs of the ME-1600 are realized as voltage controlled constant-current-sources. The outputs are short-circuit proof.

Note that the driver components are warming up significantly if a short-circuit happens. Ensure a sufficient heat flow and take into account an appropriate protection against contact.

For operation of the constant-current-source an external voltage supply U_{ext} is necessary, depending on the load resistor R_L and the current I_L to be kept constant. An extra charge of voltage of $U_{OPV} = 5\,V$ for the output circuitry must be taken into account.

Example:

The load resistor R_L should be 1 kΩ and the current to be kept constant should be 20 mA. The minimum required voltage supply U_{ext} results as follows:

$$U_{ext} \geq U_{OP} + U_L = U_{OP} + (R_L \times I_L)$$

$$= 5\,V + (1\,k\Omega \times 20\,mA) = \underline{25\,V}$$

Attention: U_{ext} must not exceed. 36 V!
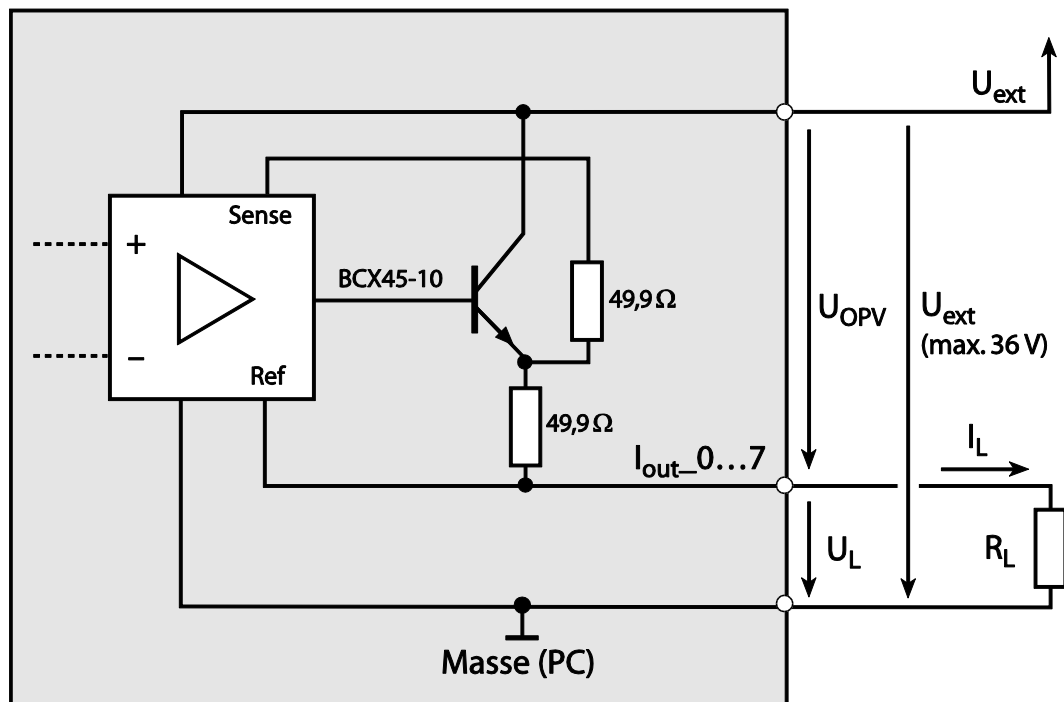
Picture 3: Wiring of the current outputs

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 you find the last revision of the old function reference in the ME-1600 manual Rev. 2.0 (see: www.meilhaus.com/download/ME-1600). Please note, that we cannot support this driver anymore.

4.1   D/A Section

In the Meilhaus Intelligent Driver System (ME-iDS) each D/A channel is regarded as a subdevice of type ME_TYPE_AO, subtype ME_SUBTYPE_SINGLE. The following table shows the assignment of subdevices:

DAC	Subdevice	Output	Models
DAC_A	subdevice 0…3 (ME_TYPE_AO)	UOUT 0…3	all models
		IOUT 0…3	only ME-1600/16U8I
DAC_B	subdevice 4…7 (ME_TYPE_AO)	UOUT 4…7	ME-1600/8U, ME-1600/12U, ME-1600/16U, ME-1600/16U8I

		IOUT 4...7	only ME-1600/16U8I
DAC_C	subdevice 8...11 (ME_TYPE_AO)	UOUT 8...11	ME-1600/12U, ME-1600/16U, ME-1600/16U8I
DAC_D	subdevice 12...15 (ME_TYPE_AO)	UOUT 12...15	ME-1600/16U, ME-1600/16U8I

For wiring of the analog outputs please read chapter 3.2 on page 11.

4.1.1 Single Value Output

The analog output of a value (voltage/current) 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:*

- Subdevice: see table 3.
- Channel number: always „0" (channel = subdevice).
- Output voltage range: 0...10 V, ±10 V, ME-1600/16U8I additionally: 0...20 mA, 4...20 mA.
- Trigger channel: By the parameter `<TrigChan>` you can choose between the operation modes „Transparent" and "Synchronous" for each subdevice (see chap. 4.1.1.1 and 4.1.1.2).
- Trigger type: Software trigger (ME_TRIG_TYPE_SW).
- Trigger edge: not relevant (see trigger type).

4.1.1.1 Operation Mode "Transparent"

The operation mode „Transparent" can be configured individually for each channel (subdevice). Doing this pass the constant ME_TRIG_CHAN_DEFAULT in parameter <TrigChan> of the function *meIOSingleConfig*. The value passed in parameter `<Value>` of the function *meIOSingle* is output immediately after calling the function. Also applicable for current output see 4.1.1.3   Current Output.

4.1.1.2 Operation Mode "Synchronous"

The operation mode „Synchronous" can be configured individually for each channel (subdevice). Appropriately at least two channels should be included in the synchronous output. Configuration of the

single channels is done by repeatedly calling the functions *meI-OSingleConfig* and *meIOSingle*. Pass the constant ME_TRIG_CHAN_SYNCHRONOUS in parameter `<TrigChan>` of the function *meIOSingleConfig* to prepare a channel for synchronous output. For the last channel to be included in the synchronous output you must pass the constant ME_IO_SINGLE_TYPE_ TRIG_SYN-CHRONOUS in parameter `<Flags>` of the list `<SingleList>` in the function *meIOSingle*. By this function call the synchronous output starts. Also applicable for current output see 4.1.1.3   Current Output.

4.1.1.3 **Current Output**

On model ME-1600/16U8I from the 16 channels of the board up to 8 channels can also be used for current output. The current outputs are lead to separate pins (Iout_0...7) of the 78-pin D-Sub connector. This enables you to use the voltage outputs with a voltage proportional to the adjusted current. The current channels are enabled automatically when a current range in parameter `<Single-Config>` of the function *meIOSingleConfig* is passed. Determine the current range wanted by the function *meQueryRangeByMinMax* or pass one of the following values:

„2" → 0...20 mA

„3" → 4...20 mA

5   Appendix

A   Specifications

PCI-Interface

Bus system	Standard PCI (32 bit, 33 MHz, 5 V);
(depends on model)	CompactPCI (32 bit, 33 MHz, 5 V)
Plug&Play-operation	resources are assigned automatically

Voltage Outputs

Number	4, 8, 12 or 16 (depends on version)	
D/A converter	Quad type, Burr-Brown DAC7624U	
Resolution	12 bit	
Output ranges	0...10 V, ±10 V	
Total output current	max. ±32 mA (all channels)	
Output current per channel	max. ±20 mA	
Operation modes	synchronous or transparent	
Gain error	typ. ±3 LSB	
Zero error (bipolar)	max. ±3 LSB	
Linearity error (DAC	max. ±2 LSB	
Settling time (DAC)	max. 10 μs (-10 V $\rightarrow$ +10 V)	

Current Outputs (only ME-1600/16U8I)

|	
Number	8
D/A converter	Burr-Brown INA132
Output ranges	0...20 mA, 4...20 mA
Output power per channel	max. 0.65 V (for U_{ext}= 36 V and R_L=1.5 kΩ) short circuit: 0.7 W
Accuracy (0...20 mA)	max. 0.45 %
Accuracy (4...20 mA	max. 0.375 %
Settling time (DAC)	max. 0.5 μs (full scale)

General Information

Power consumption at +5 V	ME-1600/16U: typ. 1.5 A
VCC-loading at the D-Sub connector	approx. 2 A (depends on PC power supply)
Physical size	ME-1600 PCI: 174 mm x 98 mm (without mounting bracket and connector) ME-1600 cPCI: 3-U-CompactPCI board
Connectors	78-pin D-Sub female connector
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
Noise immunity	EN50082-2

B   Pinout

B1   Pinout D-Sub Connector
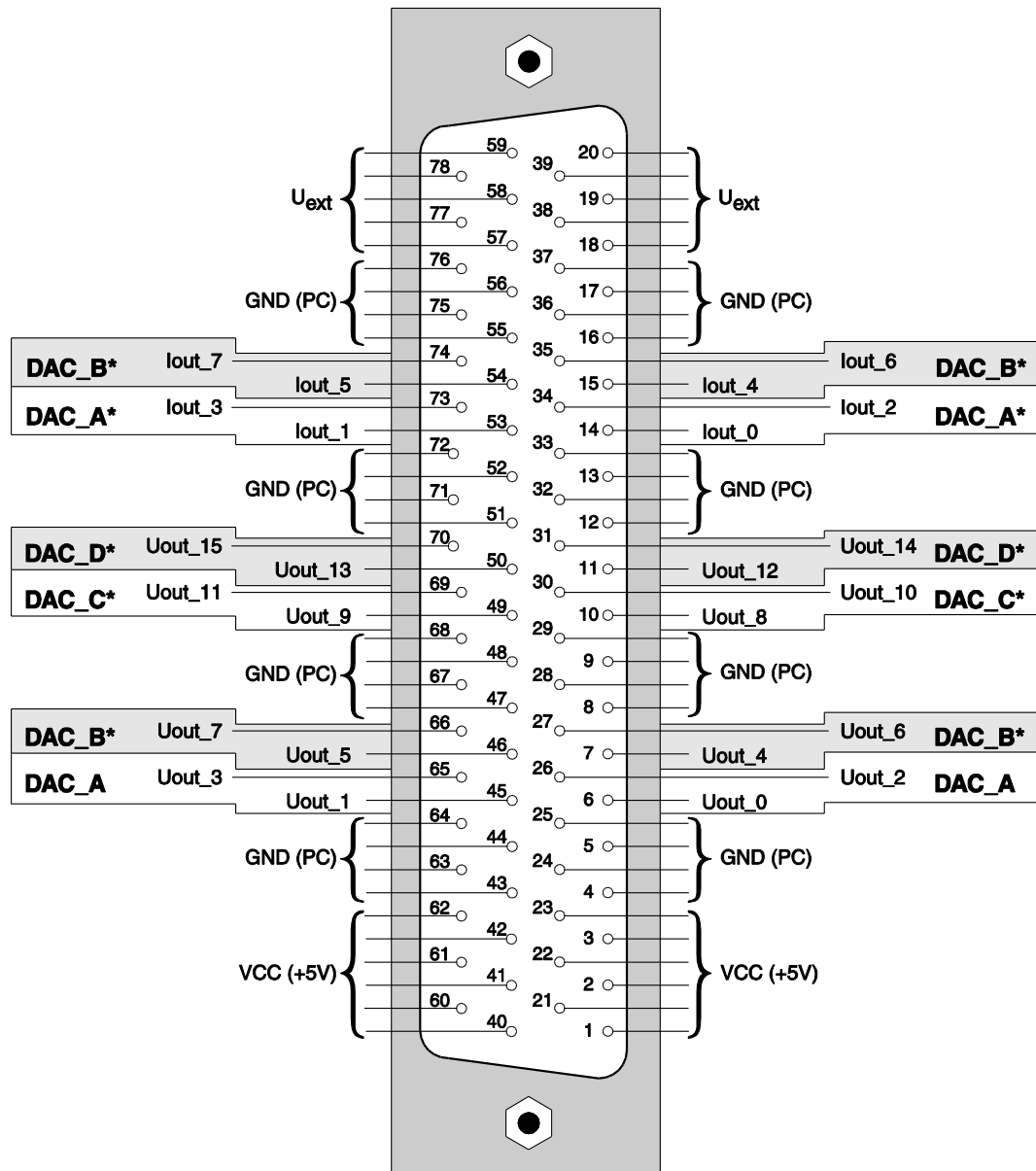
Picture 4: Pinout of the 78-pin D-Sub female connector

*Depending on the version not all pins of the 78-pin D-Sub connector are available.

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:

Meilhaus Electronic GmbH
Repair & Service
Am Sonnenlicht 2
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

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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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