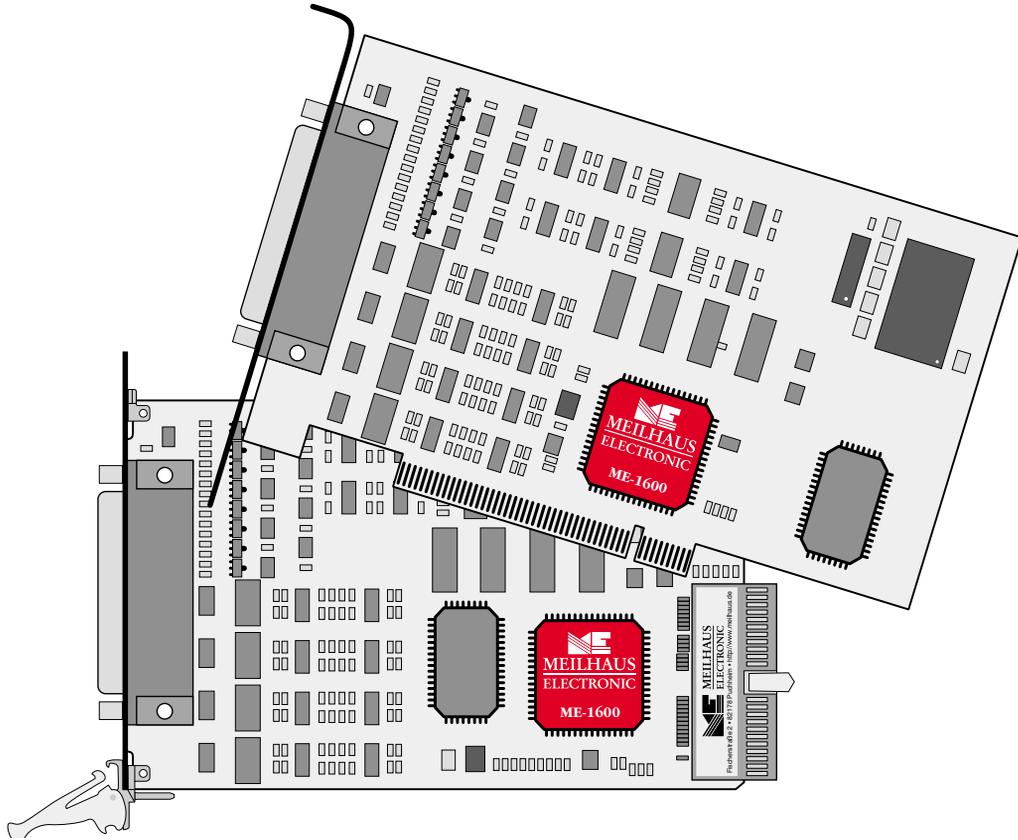# Meilhaus Electronic Manual

ME-1600 2.0E

PCI- and CompactPCI versions

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

Imprint

Manual ME-1600 PCI/cPCI

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Table of Contents

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.

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, contact us immediately.

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

1.1   Important Notes

1.1.1   Usage in accordance with the requirements

The PC boards of the ME-1600 series are designed for output of analog voltage and current signals with a PC. Depending on type the models of the ME-1600 series:

… have to be installed into a free PCI slot (ME-1600 PCI) or

… have to be installed into a free CompactPCI slot
    (ME-1600 cPCI)

For installing a plug-in board please read the manual of your PC.

Please follow the notes and the specifications from page 21 on:

• Ensure a sufficient heat conductance from the board in the PC housing.

• All unused inputs should be connected to the ground reference of the appropriate functional group. This avoids cross talk between the input lines. We recommend using shielded cables.

• 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 connecting signals to the board by the external switching.

- The external connections to the board should only be made or removed in a powered down state of all components.

- Ensure that no static discharge occurs when handling the board or when 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 the both screws, otherwise proper operation of the board can not be guaranteed!

1.1.2   Specialadverse Usage

PC plug-in boards for PCI resp. CompactPCI bus may not taken into operation outside of a PC system. Never connect the devices with live parts, especially not with supply.

Make sure, that no contact with live parts can happen by the external switching. All connections to the board should only be made or removed in a powered down state.

1.1.3   Unforeseeable Misapplication

The device may not be used as children´s toy, in the household or with adverse environment conditions (e.g. outside). Appropriate precautions to avoid unforseeable misapplication have to 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 safty 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 make sure that the package is complete in every way. We do ask that you take the time to examine the contents of the box. Your box should consist of:

- 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

- 78pin 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, 8 channels of them can be used for current output at the same time

Table 1: Model overview ME-1600 familiy

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 each other 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-1600 can be installed into any PC with Intel® Pentium® processor or compatible computers with a free standard PCI resp. CompactPCI slot (32 bit, 33MHz, 5V). The board is supported by the Meilhaus Intelligent Driver System (ME-iDS) under Windows 2000 or higher and Linux kernel 2.6 or higher.

1.5   Software Support

The ME-1600 is supported by the Meilhaus Intelligent Driver System (ME-iDS). The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 2000/XP an Vista as well as Linux systems with kernel 2.6 and contains an 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-ROM enclosed.

Please read also the notes in the appropriate read-me files.

2   Installation

Please read your computer manual instructions on how to install new hardware components **before installing the board**. Note the chapter „Hardware Installation" in this manual.

- **Installation under Windows**

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:\Meilhaus).

We recommend to operate your new data acquisition hardware using the Meilhaus Intelligent Driver System (ME-iDS). For installation and operation of the driver system please follow the documentation in electronic form included with the software package.

If you want to operate the hardware with the older single driver for the appropriate device family, first plug-in the board into your computer and install the driver software second. This order of operation is important to guarantee the Plug&Play operation under Windows 95*/98/Me/2000/XP. Windows 95 and NT 4.0 need an analogous order of operation however the installation procedure differs slightly.

If the Windows version is supported by the appropriate board type (see readme files).

- **Installation under Linux**

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

2.1   Test Program

For simple testing of the board use the appropriate test program provided with the ME-iDS.
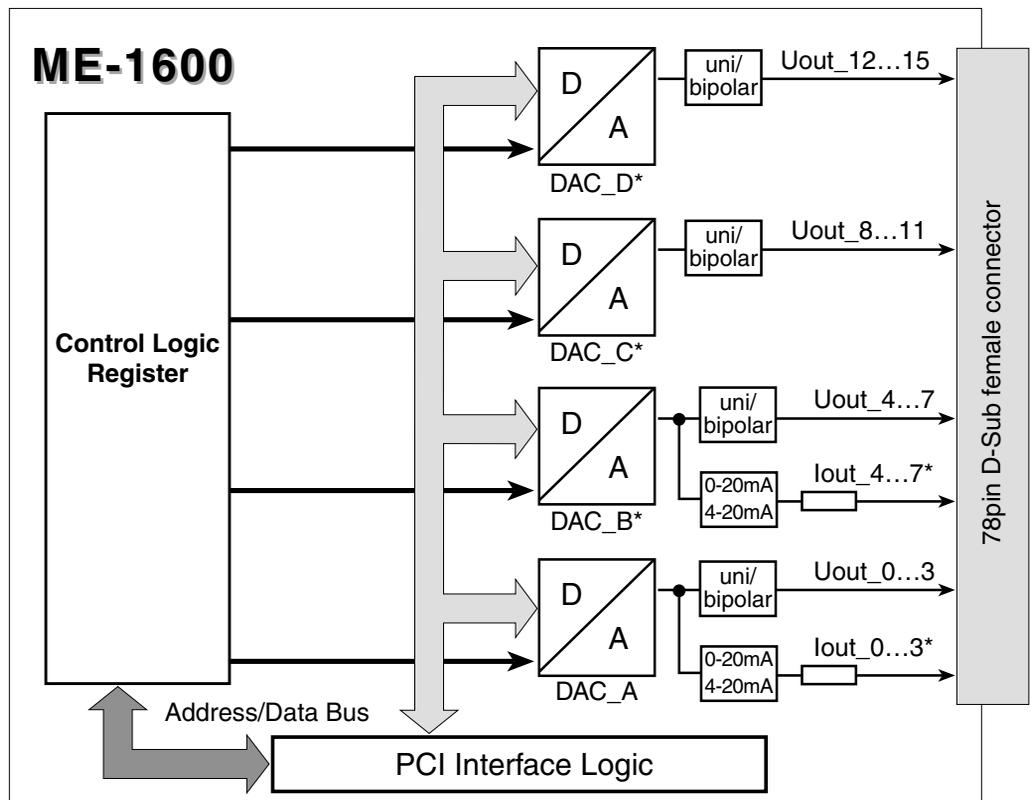
3   Hardware

3.1   Block Diagram

Diagram 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 (Uout_0…3).

ME-1600/8U: 8 voltage outputs (Uout_0…7).

ME-1600/12U: 12 voltage outputs (Uout_0…11).

ME-1600/16U: 16 voltage outputs (Uout_0…15).

ME-1600/16U8I: 16 voltage outputs (Uout_0…15) and
8 current outputs (Iout_0…7)

3.2   D/A Section

The DAC boards of the ME-1600 family can output voltages (0…10V, ±10V) and optionally currents (0…20mA, 4…20mA). Each 4 channels are integrated into one 12 bit DAC component (see also chapter programming from page 17 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 choosen separately for each channel. Voltage and current ranges can be used independently from each other:
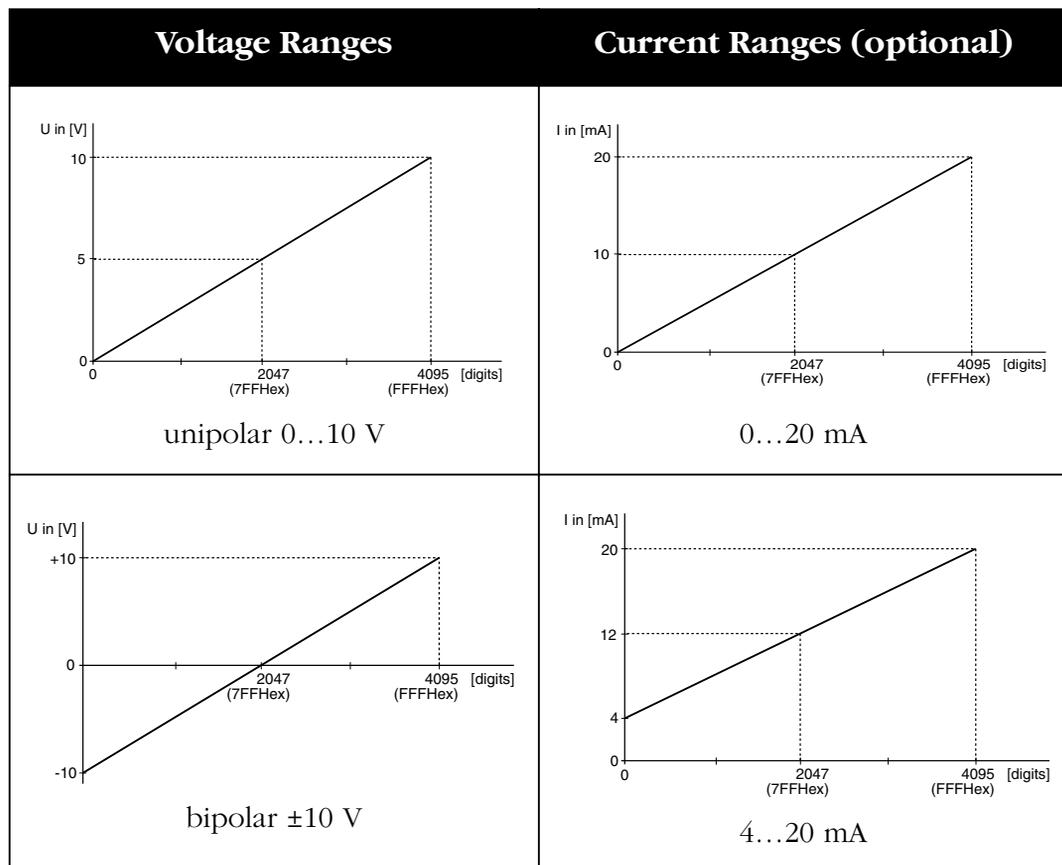
Voltage Ranges	Current Ranges (optional)
unipolar 0…10 V	0…20 mA
bipolar ±10 V	4…20 mA

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 78pin female D-Sub see „Pinout of the 78pin D-Sub female connector" on page 23). 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 ±U_{BUF} = ±15 V.
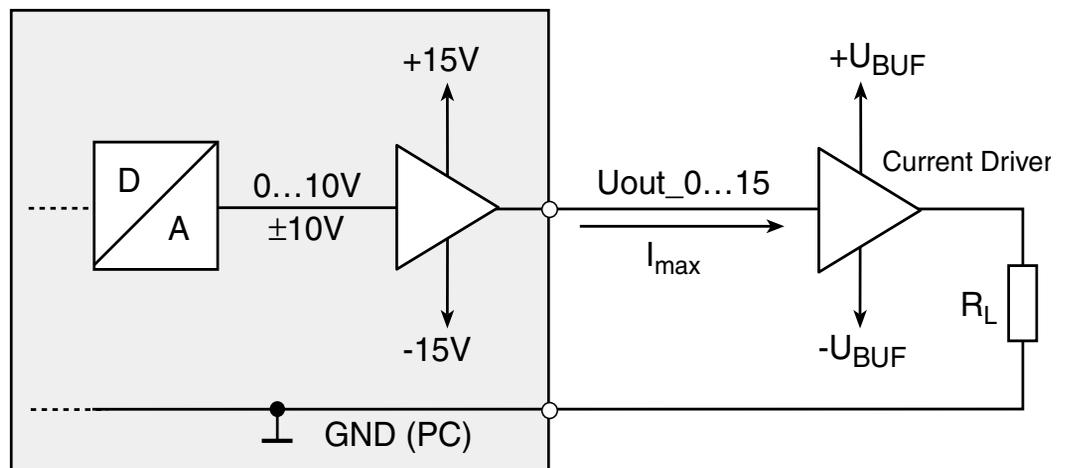

Diagram 2: Wiring of the voltage outputs

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, 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:

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

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

Attention: U_{ext} must not exceed 36 V!
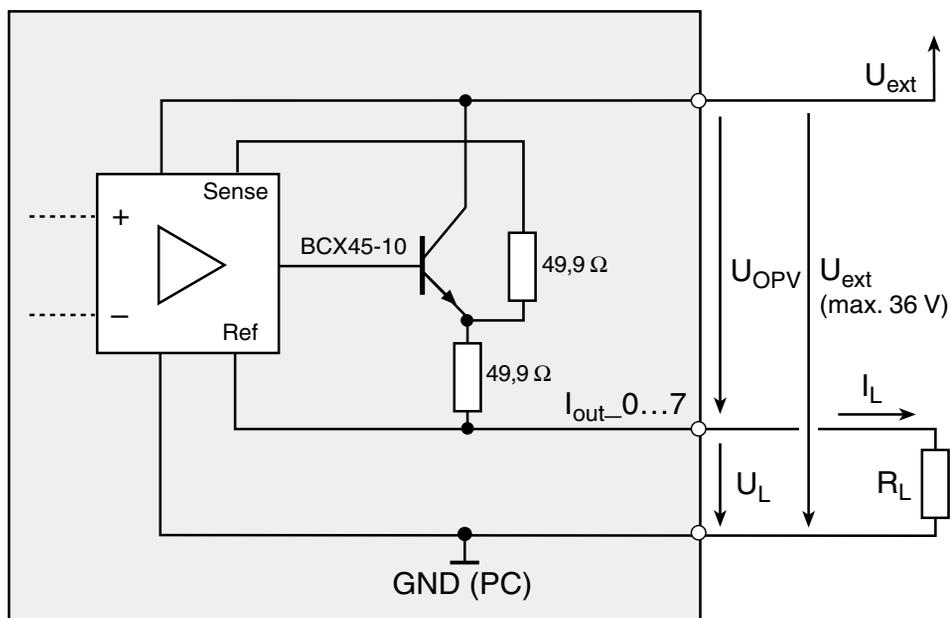

Diagram 3: Wiring of the current outputs

4   **Programming**

For programming the device you find the Meilhaus Intelligent Driver System (ME-iDS) included with 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 an 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-ROM enclosed or online under: www.meilhaus.com/download). Further details regarding to the assignment of the subdevices and device specific arguments can be found in the CHM file (help file format under Windows, *.chm) which is included with the ME-iDS.

If you don´t 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. 1.3 (see: www.meilhaus.com). 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)	U_{OUT} 0...3	all models
		I_{OUT} 0...3	only ME-1600/16U8I
DAC_B	Subdevice 4...7 (ME_TYPE_AO)	U_{OUT} 4...7	ME-1600/8U, ME-1600/12U, ME-1600/16U, ME-1600/16U8I
		I_{OUT} 4...7	only ME-1600/16U8I
DAC_C	Subdevice 8...11 (ME_TYPE_AO)	U_{OUT} 8...11	ME-1600/12U, ME-1600/16U, ME-1600/16U8I
DAC_D	Subdevice 12...15 (ME_TYPE_AO)	U_{OUT} 12...15	ME-1600/16U, ME-1600/16U8I

Table 3: Assignment of subdevices

For wiring of the analog outputs please read chapter 3.2 on page 14.

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...10V, ±10V,
  ME-1600/16U8I additionally: 0...20mA, 4...20mA.

- 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 *meIOSinlge* is output immediately after calling the function. Also applicable for current output see 4.1.1.3.

4.1.1.2   Operation Mode „Synchronous"

Die Betriebsart „Synchron" gilt jeweils für alle 4 Kanäle einer Funktionsgruppe. Es können aber auch mehrere Funktionsgruppen in die synchrone Ausgabe einbezogen werden. Konfigurieren Sie die einzelnen Kanäle durch wiederholten Aufruf der Funktionen *meIOSingleConfig* und *meIOSingle*. Übergeben Sie im Parameter `<TrigChan>` der Funktion *meIOSingleConfig* die Konstante ME_TRIG_CHAN_SYNCHRONOUS um einen Kanal für die synchrone Ausgabe vorzubereiten. Für den letzten Kanal, der in die synchrone Ausgabe einbezogen werden soll, müssen Sie im Parameter `<Flags>` der Liste `<SingleList>` in der Funktion *meIOSingle* die Konstante ME_IO_SINGLE_TYPE_TRIG_SYNCHRONOUS übergeben. Dadurch wird die synchrone Ausgabe per Software gestartet. Gilt auch für Stromausgabe see 4.1.1.3.

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 *meIOSingleConfig* 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 ouput you must pass the constant ME_IO_SINGLE_TYPE_TRIG_SYNCHRONOUS 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.

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 78pin 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 `<SingleConfig>` 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

Appendix

A   Specifications

PC Interface

Bus system	Standard PCI (32 Bit, 33 MHz);
(depends on model)	CompactPCI (32 Bit, 33 MHz)
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
Differential amplifier type	Burr-Brown INA132
Output ranges	0…20 mA, 4…20 mA
Output power per channel	max. 0.65 W
	(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	0.5 µs (full scale)

General Information

Power consumption at +5V	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: 3U CompactPCI board
Connectors	78pin 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	EN 55022
Noise immunity	EN 50082-2

B   Pinout

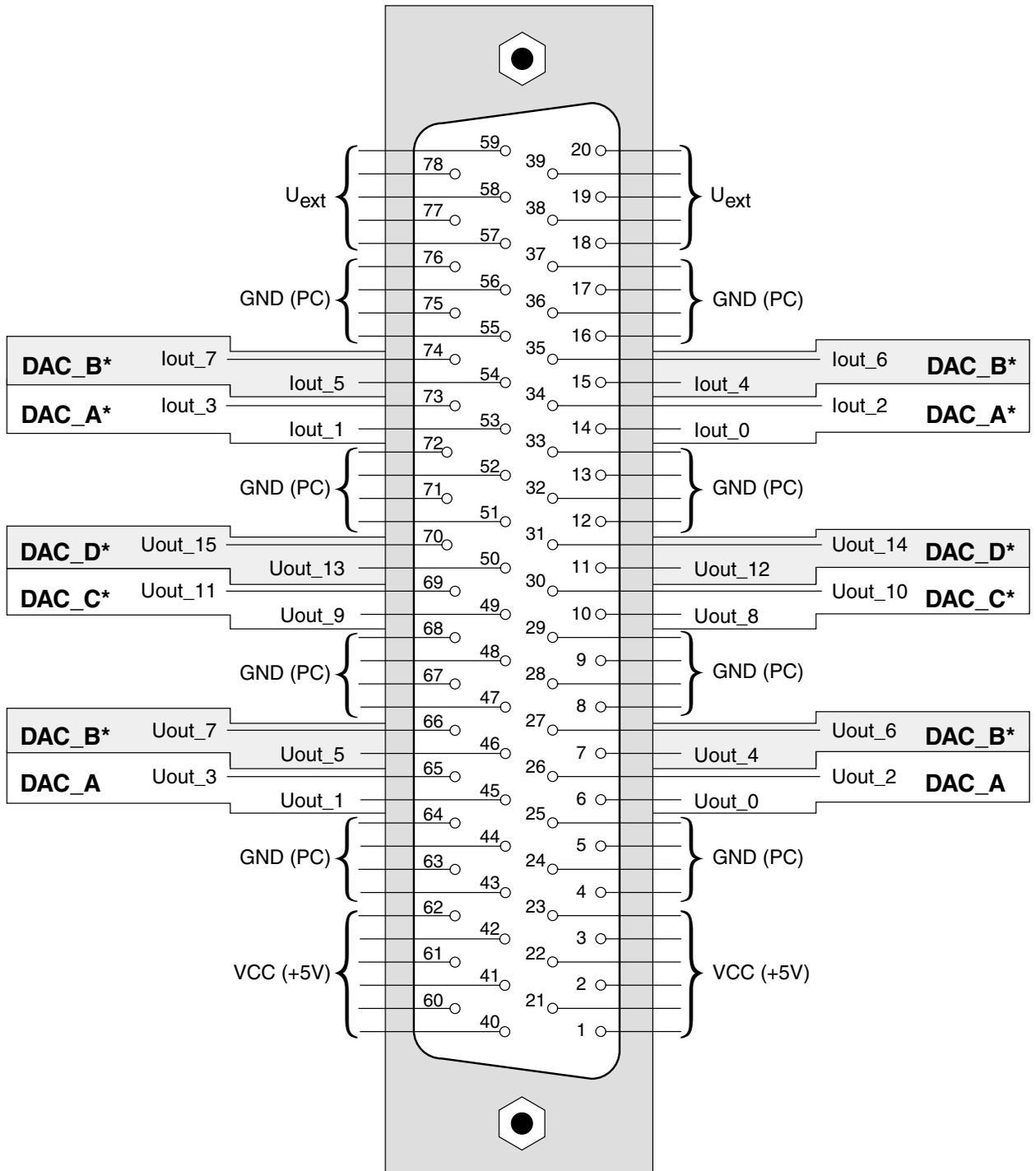## B1   Pinout D-Sub Connector

Diagram 4: Pinout of the 78pin D-Sub female connector

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

C   Accessories

Optionally the following products are available:

ME-AB-D78M

78pin D-Sub connector block (male) for ME-1600 PCI and cPCI

ME-AK-D78

78pin D-Sub cable (male - female), 2 m, for ME-1600 PCI and cPCI

D   Technical Questions

D1   Hotline

If you should have any technical questions or problems that can be put down to your Meilhaus device, please send a fax to our hotline:

Fax hotline: + 49 (0) 89/89 01 66 28
eMail: support@meilhaus.de

Please give a full description of the problems and as much information as possible, including operating system information.

D2   Service address

If a technical error should occur with your device please contact us at the following address:

Meilhaus Electronic GmbH

Service Department
Fischerstraße 2
D-82178 Puchheim/Germany

If you want to send back a device to be repaired it is strictly necessary to request for a RMA number and to follow the notes to deal with the RMA process. Please attach a detailed error description of the problem, including information about operating system and application software!

D3   Driver Update

The current driver versions for Meilhaus devices and our manuals in PDF format are available under www.meilhaus.com.

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