Meilhaus Electronic Manual

„ME-Axon“ 1.2E

High Precision Multi I/O Measurement System for Currents up to 50 A in a 2U 19“ Rack

Imprint

Manual ME-Axon

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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.

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 current measurement system of type ME-Axon is primarily designed to measure currents from a few µA up to 50 A (3 s max.) and communicates via an USB or ethernet interface (depending on model) with the host PC. Internally a multi I/O board of the ME-4600 series is used. Inputs and outputs not used for current measurement are routed to several connectors. To the A/D channels AD_16…31 an optional signal conditioning module of the ME-MultiSig series can be connected ahead. The device can be used either as a tabletop unit or to be integrated in a 19“ system.

For connecting an USB device please read the manual of your PC.

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.

Please follow the notes and the specifications from page 28 on as well as the additional documentation of the ME-4600 series and the ME-MultiSig system:

- The ME-Axon includes an internal 230VAC power supply. Remove your wiring from the device and disconnect the power plug unconditionally before opening the housing. If you don´t have the required electrical qualification please consult an electrically trained specialist. **Mains voltage can be life-threatening!**
- **Note**, that there is an electrical connection between the reference potential of your wiring and the ground of your PC. Make sure that the metal housing comes not in contact with voltages greater than 42V.
- Except of the current measurement inputs unused inputs basically have to be connected with reference ground of the appropriate functional group to avoid crosstalk between the input lines.
- **Note**, that the ME-Axon system must be powered up, prior connecting signals by the external wiring.
- **Note** the minimum required wire gauge in dependency of the maximum driven current.
- All external connections to the ME-Axon should only be made or removed in a powered down state of all components.
- Ensure that the connection cable is properly connected. It must be seated firmly on the connectors and must be tightened correctly (e. g. by screws), otherwise proper operation of the board can not be guaranteed!

- Ensure that no static discharge occurs via the pins when handling the I/Os or when connecting/disconnecting the external cables.
- Make sure that there is sufficient heat dissipation within the 19“ rack.

1.1.2 Improper Application

Make sure, that not any contact with voltage-carrying parts can happen by the external wiring of the device. Basically all connections 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.

1.2 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:

- ME-Axon: Multi I/O measurement system
- Mains cord (grounded)
- USB connection cable
- Depending on version 2 or 4 mating plugs for 2pin Phoenix terminals
- 1 x mating plug for 18pin Phoenix terminal
- 3 x 25pin D-Sub male connector
- 1 x bridge module ME-MUX-STD with 18pin Phoenix angled adapter (90°) pre-assembled (for using the A/D channels AD_16…31 without optional signal-conditioning module)
- Driver software on CD/DVD
- Manual in PDF format on CD/DVD

1.3 Performance Notes

The **ME-Axon series** provides the following models:

Model	Current Channels	Voltage Channels	Host Interface
ME-Axon USB/2	2	28*	USB
ME-Axon USB/4	4	28*	USB
ME-Axon LAN/2	2	28*	LAN
ME-Axon LAN/4	4	28*	LAN

Tabelle 1: Model overview ME-Axon

The „intelligent“ **multi I/O measuring system ME-Axon** primarily serves an **uninterruptable current measuring** in seven measurment ranges from 250 µA up to **50 A** (max. 3 s, continuous rating max. 40 A). The core of the system is a multi I/O board of type **ME-4670 cPCI** (TTL). To provide the complete functionality of the DAQ board all inputs and outputs which are not necessary for current measurement are routed to several connectors (see diagram 4 on page 19).

The ME-Axon system communicates alternatively via an **USB 2.0** or **10/100Base-T** ethernet interface with the host PC. It can be used either as a tabletop device or integrated into an **19“ rack** and is ideal fitting for industrial deployment.

The model **ME-Axon LAN** can be extended by a Meilhaus CompactPCI board (optional). Please ask our sales team for details.

To the A/D channels AD_16…31 an optional **signal conditioning module** of the **ME-MultiSig series** can be connected ahead. At the moment the following modules are available (by default a bridge module is installed).

**By default the analog inputs AI_8 and AI_9 are connected with two integrated temperature sensors for temperature monitoring of the current shunts. On demand they can also be used as normal analog inputs (see also chap. A2 on page 25). Please contact our support department (support@meilhaus.com) if necessary.*

ME-Diff16-xxV	16 differential voltage inputs; models available with the input ranges ±10V, ±20V, ±50V
ME-Current16	16 differential current inputs (0..20mA)
ME-RTD8-PT…	8 RTDs with 2-, 3- or 4-wire connectivity; versions for: Pt100, Pt500 or Pt1000
ME-TE8	8 inputs for thermocouples of type J, K, T, E, R, S, B, N (2 wire)
ME-BA4	4 channel bridge amplifier with constant current exitation for universal connection of Wheatstone bridges
ME-8B	6 expansion slots for signal conditioning modules of the 8B series.
ME-Proto	Prototyping/breadboard module for custom specific signal conditioning

Note: by default the bridge module ME-MUX-STD is installed.

Table 2: Signal conditoning modules

1.4 System Requirements

The system **ME-Axon USB** requires a host PC with Intel® Pentium® processor or compatible computer with a free USB 2.0 port.

The system **ME-Axon LAN** requires a host PC with Intel® Pentium® processor or compatible computer which is connected with the network by a 10/100Base-T ethernet interface.

1.5 Software Support

The models of the ME-Axon series are recognized by the **Meilhaus Intelligent Driver System** (ME-iDS) as independent devices (device ID starts with 07…Hex). The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 2000/XP/ Vista and Windows 7 as well as Linux systems with kernel 2.6. The current ME-iDS version can be found on our homepage under **www.meilhaus.com/download**.

A detailed description of the functions can be found in the ME-iDS manual on the CD/DVD enclosed.

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

2 Starting up

Please read your computer manual instructions on how to install new hardware components and the chapter „Hardware“ in this manual **before installing the system**. If necessary also consult the manuals of the ME-4600 and the ME-MultiSig system.

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 un-pack the software **before installing the system**. First choose a directory on your computer (e. g. C:\Meilhaus).

Use the Meilhaus 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.

3 Hardware

3.1 Block Diagram

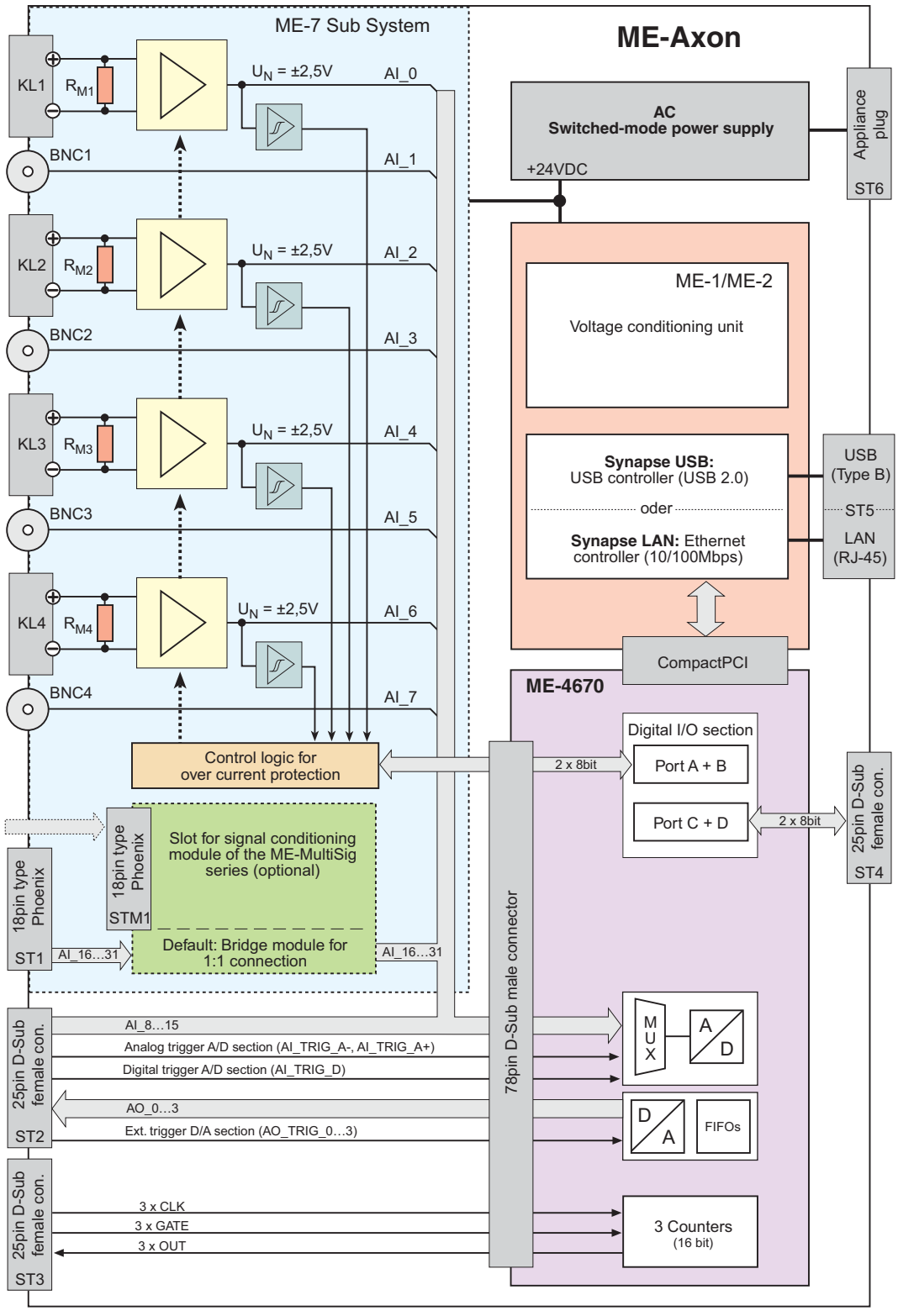


Diagram 1: Block diagram ME-Axon

3.1.1 Functional Description

The complete system ME-Axon consists of the ME-7 sub-system, a multi I/O board of type **ME-4670 cPCI** (default), a „docking" board with the host interface (USB or ethernet) and the power supply.

The system is organized into the following functional groups (see also block diagram on page 13):

3.1.1.1 Current Measurement Channels

The **ME-7 sub-system** enables high-precision current measurements up to 50 A (pulse duration max. 3 s), continuous rating max. 40 A. **Please note** the dependency of pulse duration and current rating, see diagram 8 on page 29.

Depending on current measurement range alternatively a measurement resistor of R_M = 5mΩ or R_M = 10Ω is used. The following current measurement ranges are available:

Measurement Range	Range Limits	Measuring Resistance
50A	-50A…+50A-1LSB	R_M = 5mΩ
25A	-25A…+25A-1LSB	
2,5A	-2,5A…+2,5A-1LSB	
250mA	-250mA…+250mA-1LSB	R_M = 10Ω
25mA	-25mA…+25mA-1LSB	
2,5mA	-2,5mA…+2,5mA-1LSB	
250µA	-250µA…+250µA-1LSB	

Table 3: Current measurement ranges

For the **accuracy** of the single current measurement ranges please refer to the specifications on page 28.

Change-over of the current measurement ranges is a result of appropriate programming using the ME-iDS. By checking the measurement values on minimum (8000Hex) resp. maximum (7FFFHex) values you can recognize an overflow (see diagram 2). In the next step you can adapt the measurement range by your application software accordingly. For maximum accuracy a zero balancing of the channel is recommended after each change-over of the range (see field calibration in chap. 4.3.2).

An integrated hardware comparator circuit **protects the current channels**. The comparator switches into the highest measurement range as soon as the upper limit of the measurement range was exceeded by more than 20%. This safety mechanism is also working if the software or the PC fail. When enabling this safety feature an interrupt occurs and is reported to the application. The further procedure is subject of your free discretion.

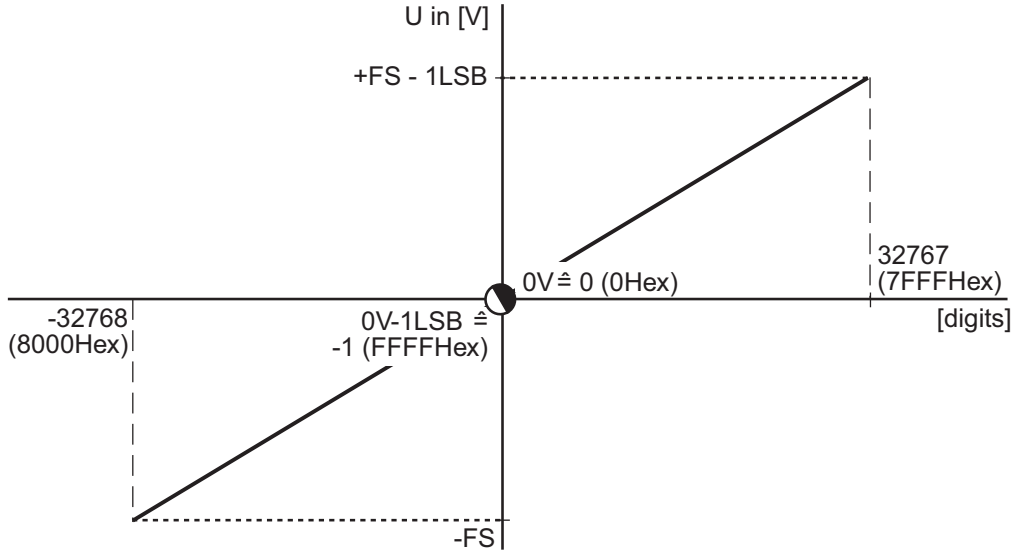


Diagram 2: Characteristic for bi-polar input ranges

The change-over on hardware level is done **uninterruptible** by relays, i. e. thereby the circuit is not broken. The current I_M causes a voltage drop U_M, which is fed to a differential amplifier and normalized to U_N = ±2,5V independent of the measurement range. Connection is done by the 2pin terminals KL1…4, whose pins are marked with „+“ and „–“. For correctly signed measuring connect the line with positive potential with the „+“ clamp and the negative potential with the „–“ clamp.

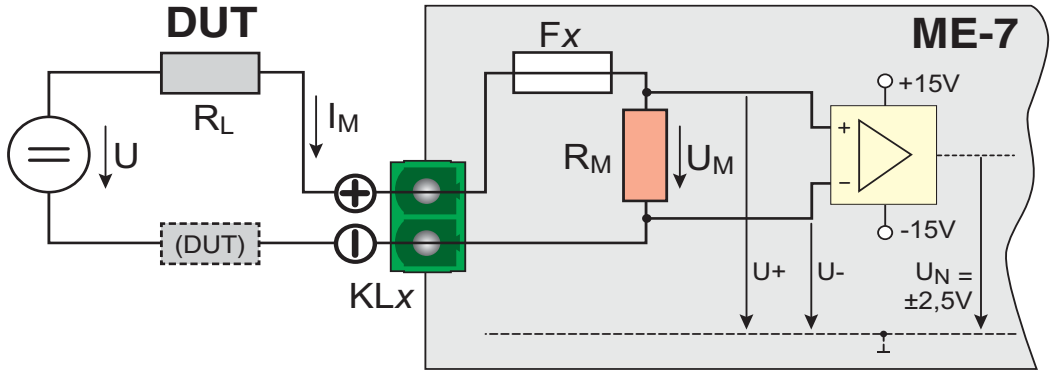


Diagram 3: Switching of the current measurement channels

Note, that the voltages **U+ and U- may not exceed 13.6V** relative to ground, else the input circuit will be damaged. This applies particularly if the DUT (device under test) is wired within the „minus“ path and not into the „plus“ path as recommended. See diagram 3 on page 15.

Ensure sufficient wire gauge of your cabling depending on the maximum current of your circuit. The mating plugs provided can accomodate wire gauges from 0,75 mm^2 up to 10 mm^2 (wire gauge stiff).

3.1.1.2 Voltage Measurement

Beside the current measurement channels four additional A/D channels are fed directly to the **BNC connectors** (BNC1…4). They can be used universally, e. g. as control channels to select the measurement range. All measurement ranges of the ME-4670 are available: 0…2.5V; 0…10V; ±2.5V; ±10V. Table 4 shows the assignment of the channels to the inputs of the ME-4670.

The **analog inputs AI_8…15** as well as the analog and digital trigger inputs are fed to the 25pin D-Sub female connector **ST2**. Pinout see page 25.

3.1.1.3 Channels with Signal Conditioning

Optionally the **analog inputs AI_16…31** of the ME-4670 can be fed to a **signal conditioning module** of the **ME-MultiSig series**. The wiring of the connectors ST1 and STM1 depends on the used plug-on module (more informations for it can be found in the ME-MultiSig manual). By default a bridge module (ME-MUX-STD) is plugged into the „MultiSig“ slot, which connects the channels AI_16…31 directly with the 18pin connector ST1 (type: Phoenix). In that case STM1 is not assembled. Pinout see page 25.

3.1.1.4 Current Output

The 4 four analog outputs of the ME-4670 including the corresponding trigger inputs (AO_TRIG_0…3) are fed to the 25pin D-Sub female connector **ST2**. Pinout see page 25.

3.1.1.5 Counter Signals

The counter signals (CLK, GATE, OUT) are directly fed to the 25pin D-Sub female connector **ST3**. Pinout see page 26.

3.1.1.6 Digital Port C + D

The digital inputs/outputs of port C and D of the ME-4600 are directly fed to the 25pin D-Sub female connector **ST4**. Pinout like ME-4600 series (see also page 27).

Max. load for VCC_OUT is 200 mA (5V).

3.1.1.7 Host Interface

As interface to the host PC the **ME-Synapse USB** (ME-1) or **ME-Synapse LAN** is used. Depending on the model the connector ST5 is an:

- USB 2.0 port (type B) or a
- 10/100Base-T ethernet port

3.1.1.8 Temperature Monitoring

For temperature monitoring of the current shunts two semiconductor temperature sensors with a linearization factor of 10 mV/°C are used. The accuracy is ±3.5°C within the range of 0…125°C.

- Read the voltage value U_{TS} from A/D channel AI_8 resp. AI_9.
- Calculate the shunt temperature T_S as follows:

$$T_S = U_{TS} \cdot 100 - 50$$

- U_{TS} is within the range of 0.5V…1.75V (corresponding to 0…125°C).

3.1.1.9 Connections

Assignment of the connectors to the channels of the ME-4600

Description	Connector	Channels ME-4600
Channel 0 (Current In 0)	KL1	AI_0
Channel 1 (Current In 1)	KL2	AI_2
Channel 2 (Current In 2)	KL3*	AI_4
Channel 3 (Current In 3)	KL4*	AI_6
Channel 4 (Voltage In 4)	BNC1	AI_1
Channel 5 (Voltage In 5)	BNC2	AI_3
Channel 6 (Voltage In 6)	BNC3*	AI_5
Channel 7 (Voltage In 7)	BNC4*	AI_7
A/D channels (8…15)**	ST2	AI_8…15
A/D channels (16…31) (optional with signal conditioning)	ST1/(STM1)	AI_16…31
D/A channels (0…3)	ST2	AO_0…3
Analog trigger input	ST2	AI_TRIG_A-, AI_TRIG_A+
Digital trigger input	ST2	AI_TRIG_D
Trigger inputs D/A section	ST2	AO_TRIG_0…3
3 x counters	ST3	CLK_0…2, GATE_0…2, OUT_0…2
Digital port C	ST4	DIO_C0…7
Digital port D	ST4	DIO_D0…7

Table 4: Assignment connectors to channels of ME-4670

*not available on ME-Axon… /2.

** By default, the A/D channels 8 and 9 are reserved for temperature sensores monitoring the current shunts. On demand they can also be used as „normal“ analog inputs. Please contact our support department (support@meilhaus.com) if necessary.

Diagram see next page.

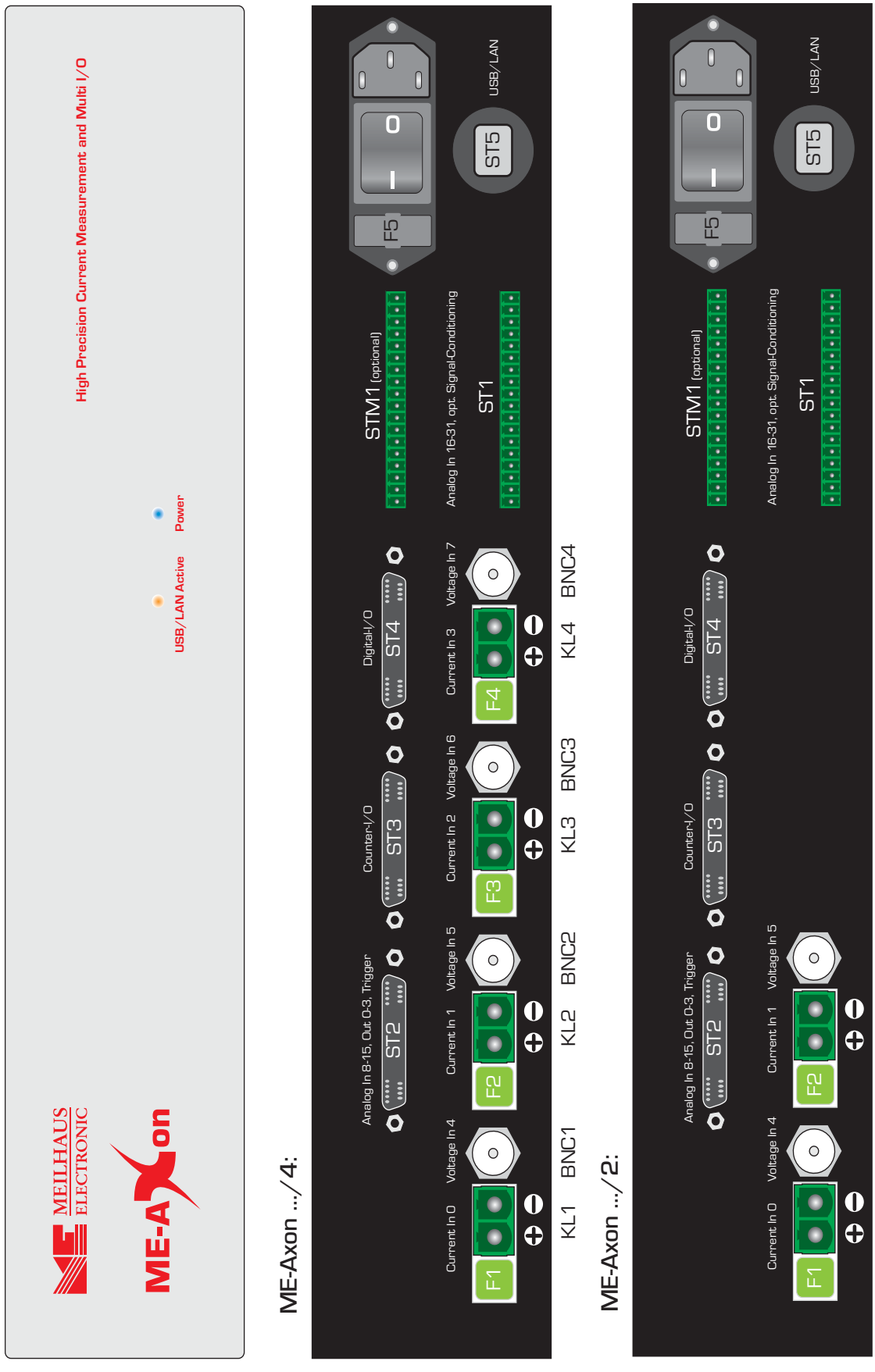


Diagram 4: Front side (left) and rear side (right)

3.1.2 Fuses and Power Supply

Hier finden Sie alle Sicherungen im Überblick:

3.1.2.1 ME-1 (only ME-Axon USB)

On the ME-1 is a fuse of type „car mini fuse“ (10A). To change it the housing must be opened. Follow the safety notes on page 5.

3.1.2.2 ME-2 (only ME-Axon LAN)

On the ME-2 are two fuses of type „car mini fuse“ (10A). To change them the housing must be opened. Follow the safety notes on page 5.

3.1.2.3 ME-7

Each current measurement channel is assembled with a 40 A fuse (F1…F4) of type „Littelfuse 495“. This is a special cartridge fuse with increased time delay, low voltage drop and has the ability to handle in-rush currents (see also specifications on page 29)

3.1.2.4 AC Power Supply

The integrated switched-mode power supply has a wide range input from 110 bis 240VAC. Secondarily it provides 24VDC. At the rear side is the power switch, the appliance plug and the fuse F5 (see specification on page 33), which protects the system primarily.

4 Programming

The models of the ME-Axon series are recognized by the **Meilhaus Intelligent Driver System** (ME-iDS) as independent devices (device ID starts with 07…Hex). The ME-iDS is a unique driver system covering different devices and operating systems. It supports current Windows versions and Linux systems with kernel 2.6. The current ME-iDS version can be found on our homepage under **www.meilhaus.com/download**.

4.1 Procedure

For the **procedure of operation** please note the ME-iDS manual and the ME-iDS help file, which can be called by the Windows system tray or the start menue.

A **detailed description of the functions** can be found in the ME-iDS manual.

4.2 Best Practice

4.2.1 Oversampling of continuous signals

On measuring an analog continuous signal please note the following items:

The **Nyquist sampling theorem** for continuous signals tells us, that the sampling rate f_S must be at least twice as fast as the frequency f_U of the signal to be sampled.

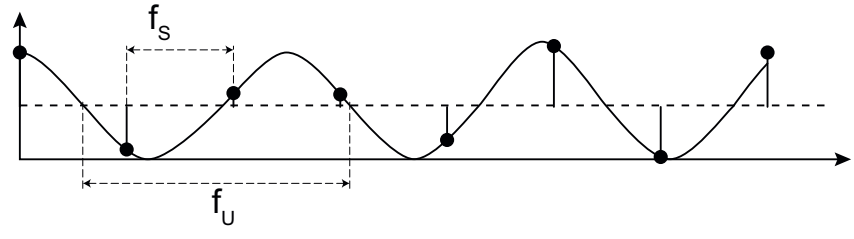


Diagram 5: Nyquist sampling theorem

In practice it is recommended to choose a sample rate which is minimum five times higher as the theorem postulates. In that case we tell it **„oversampling“**:

Example:

The signal frequency f_U should be 10 kHz. Then the sampling rate f_S should be at least 5 x 10 kHz = 50 kHz.

4.2.2 DC Measurement

In practice it is seldom that we have to deal with ideal DC current or DC voltage signals. Mostly the signals are more or less noisy as shown in diagram 6 (e. g. on a switching power supply). To get a significant and stable measured value (e. g. like a multimeter measurement), we recommend to sample during a „longer" time span and then calculating the arithmetic mean of the voltage $\overline{U}$ out of the single voltage values $U_1 \ldots U_n$:

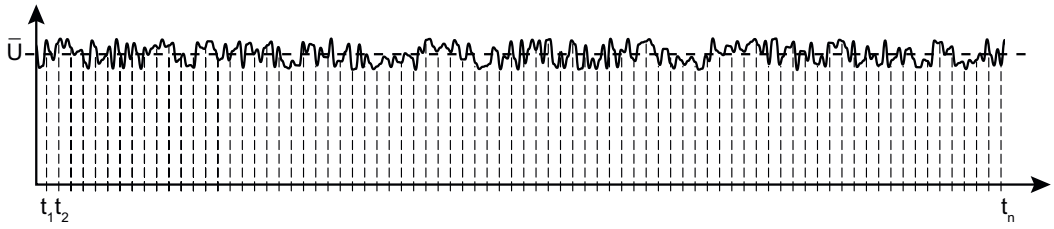


Diagram 6: Calculation of the arithmetic mean

It is valid:

$$\overline{U} = \frac{1}{n} \cdot \sum_{i=1}^{n} U_i = \frac{U_1 + U_2 + \ldots + U_n}{n}$$

Example:

Updating a DC voltage display every second. Sample the signal with a sampling rate of 1kHz during one second for example. You get 1000 voltage values to be added and then divided by 1000. Now you can pass the calculated voltage value $\overline{U}$ to a display.

4.3 Calibration

4.3.1 Factory Calibration

The ME-Axon system is completly calibrated as a whole system before delivery. The calibration data are stored into an EEPROM. If a re-calibration should be necessary please contact our service department. For contact see appendix D2 "Service address".

4.3.2 Zero Balancing

Because of the measuring of very small currents is exposed to multiple interference effects (e. g. line capacitance, thermal effects) you have the possibility to perform a zero balancing by software at program runtime. We recommend to perform a
re-balancing of the particular channel after every change-over to an other measurement range, especially in the smaller measurement ranges (250µA, 2.5mA, 25mA, 250mA).

Follow the below order of operation for it:

1. Switch-on the ME-Axon system.
2. Connect your application (field wiring) to the particular current input but without turning it on.
3. Next the offset (zero-signal) current is measured with a calibration routine within the ME-iDS and published to it. Pass the constant ME_DIR_SET_OFFSET to the parameter `<iDir>` of the function *meIOSingleConfig()* (see example code below).
4. The offset current determined is automatically included with the calculation of the values for the particular channel.

For example code see next page.

```
-----------------------------------------------------------------
// Example Code for Calibration
i_me_error = meIOSingleConfig(
              device_index,    // Device index
              subdevice_index, // Subdevice index
              channel_index,   // 0 - 3 for current channels
              range_index,    // Range index: 1 - 9
              ME_REF_AI_GROUND,  // Reference
              ME_TRIG_CHAN_DEFAULT, // Trigger channel - standard
              ME_TRIG_TYPE_SW,    // Trigger type - software
              ME_VALUE_NOT_USED,  // Trigger edge - not applicable
              ME_IO_SINGLE_CONFIG_NO_FLAGS);    // Flags

meIOSingle_t io_single[1];

io_single[0].iDevice    = device_index;

io_single[0].iSubdevice = subdevice_index;

io_single[0].iChannel   = channel_index;

// #define to determine the offset for current channels

io_single[0].iDir       = ME_DIR_SET_OFFSET;

io_single[0].iValue     = 0;

io_single[0].iTimeOut   = 0;
// No timeout - not required for software output

io_single[0].iFlags     = ME_IO_SINGLE_TYPE_NO_FLAGS;


i_me_error = meIOSingle(
                    &io_single[0],  // Output list
                    1,  // Number of elements in the above list
                    ME_IO_SINGLE_NO_FLAGS);    // Flags
-----------------------------------------------------------------
```

After calling *meIOSingle()* the channel is re-calibrated.

Appendix

A Pinouts

A1 Pinout ST1 (AI_16…31)

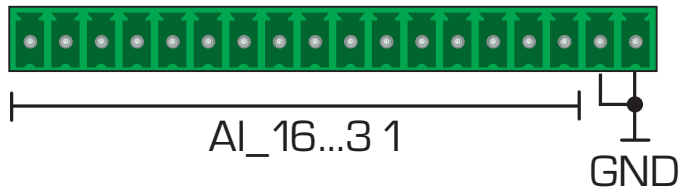
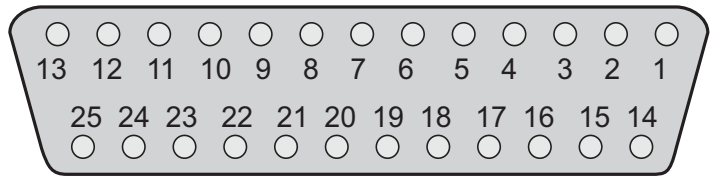


Diagram 7: Pinout ST1

As long as no signal conditioning module is used, the analog inputs AI_16…31 of the ME-4600 can be directly connected with ST1 by the bridge module ME-MUX-STD.

A2 Pinout ST2 (AI_8…15, AO_x)

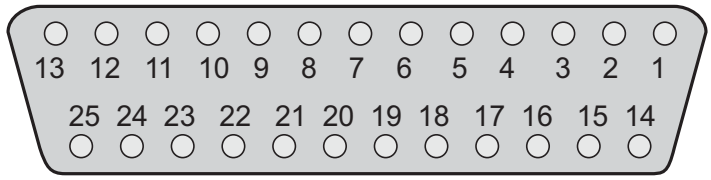


Pin ST2	Description	Pin ST2	Description
1	GND	14	GND
2	default: n.c.* (opt. AI_8)	15	default: n.c.* (opt. AI_9)
3	AI_10	16	AI_11
4	AI_12	17	AI_13
5	AI_14	18	AI_15
6	GND	19	GND
7	AO_0	20	AO_1
8	AO_2	21	AO_3
9	GND	22	GND
10	AI_TRIG_A-	23	AI_TRIG_A+
11	AI_TRIG_D	24	AO_TRIG_0
12	AO_TRIG_1	25	AO_TRIG_2
13	AO_TRIG_3	–	–

Table 5: Pinout ST2

*By default the analog inputs AI_8 and AI_9 are connected with two integrated temperature sensors for temperature monitoring of the current shunts. On demand they can also be used as normal analog inputs. Please contact our support department (support@meilhaus.com) if necessary.

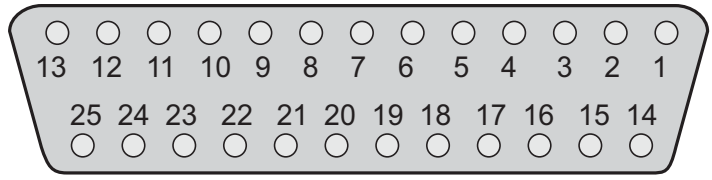
A3 Pinout ST3 (Counters)



Pin ST3	Description	Pin ST3	Description
1	GND	14	GATE_0
2	OUT_0	15	CLK_0
3	GND	16	GND
4	GND	17	GATE_1
5	OUT_1	18	CLK_1
6	GND	19	GND
7	GND	20	GATE_2
8	OUT_2	21	CLK_2
9	GND	22	GND
10	VCC_OUT	23	VCC_OUT
11	VCC_OUT	24	VCC_OUT
12	GND	25	GND
13	GND	–	–

Table 6: Pinout ST3

A4 Pinout ST4 (DIO Ports)



Pin ST4	Description	Pin ST4	Description
1	VCC_OUT	14	VCC_OUT
2	GND	15	GND
3	DIO_D6	16	DIO_D7
4	DIO_D4	17	DIO_D5
5	DIO_D2	18	DIO_D3
6	DIO_D0	19	DIO_D1
7	DIO_C6	20	DIO_C7
8	DIO_C4	21	DIO_C5
9	DIO_C2	22	DIO_C3
10	DIO_C0	23	DIO_C1
11	n.c.	24	n.c.
12	n.c.	25	n.c.
13	n.c.	–	–

Table 7: Pinout ST4

B Specifications

(Ambient temperature 25°C)

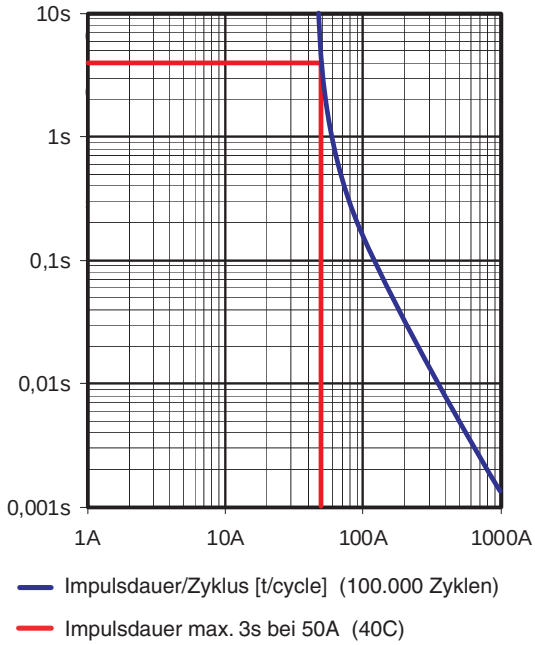
PC Interface

ME-Axon USB	USB 2.0 (USB 1.1 compatible), Plug&Play
ME-Axon LAN	10/100Base-T ethernet interface

Current Measurement Channels

Measurand/criterion	**Condition/annotation**	**Value**
Number of channels	ME-Axon /2 ME-Axon /4	2 current measurement channels 4 current measurement channels
Current measurement ranges	R_M = 5mΩ	-50A…+50A-1LSB (1LSB=1.53mA) -25A…+25A-1LSB (1LSB=763µA) -2.5A…+2.5A-1LSB (1LSB=76.3µA)
	R_M = 10Ω	-250mA…+250mA-1LSB (1LSB=7.63µA) -25mA…+25mA-1LSB (1LSB=763nA) -2.5mA…+2.5mA-1LSB (1LSB=76.3nA) -250µA…+250µA-1LSB (1LSB=7.63nA)
Resolution	16 bit	Range theoretical practical ±50A 1.53mA 10mA (4 digits) ±25A 763µA 1mA (5 digits) ±2.5A 76.3µA 100µA (5 digits) ±250mA 7.63µA 10µA (5 digits) ±25mA 763nA 1µA (5 digits) ±2.5mA 76.3nA 100nA (5 digits) ±250µA 7.63nA 10nA (5 digits)
Accuracy	R_M = 5mΩ	Range Reference current Accuracy ±50A 1A ±0,45% ±25A 1A ±0,4% ±2,5A 1A ±0,2%
	R_M = 10Ω	Range Reference current Accuracy ±250mA 200mA ±0,005% ±25mA 20mA ±0,2%) ±2,5mA 2mA ±0,1% ±250µA 200µA ±1,1%
Current rating (see diagram 8)	continuous rating	40 A max. (see diagram 8)
	max. 3 s after 10 s pause	up to 50 A (see diagram 8)
Settling time	Amplifier stage	111ms = max. 9Hz
Output voltage of the amplifier stage	bi-polar single-ended	normalized to ±2.5V
A/D channels	ME-Axon /2 (KL1…2) ME-Axon /4 (KL1…4)	AI_0, 2 AI_0, 2, 4, 6

Measurand/criterion	Condition/annotation	Value
Ground reference	existing (no electrical isolation)	U+ and U- max. 13.6V
Terminal (2pin)	Type Phoenix PC 6-16/2-G-10,16, order no 1913646	Rated current: 66 A Rated voltage: 600 V
Mating plug (2pin)	Type Phoenix PC 6/2-ST-10,16, order number 1913507	Rated current: 50 A Rated voltage: 600 V
	Connection compliant to EN-VDE	Wire gauge: 0.75mm^2…10mm^2
Fuses	see „General Information“	



Ambient temperature: 40°C, 100.000 cycles

I [A]	t [s]
1124,2	0,001
358,2	0,01
210,2	0,03
165,4	0,05
121,4	0,1
79,6	0,3
68,2	0,5
58,2	1
50,4	3
48,8	5
47,4	10

Diagram 8: Current rating depending on pulse duration

Note: Unless specified under „Current Measurement Channels“ the specifications of „Analog Inputs“ apply analogously to the current measurement channels also (see next page).

Analog Inputs

Measurand/criterion	Condition/annotation	Value
Number A/D channels	ME-Axon /2	30 total, thereof 2 current and 28 voltage (single-ended)
	ME-Axon /4	32 total, thereof 4 current and 28 voltage (single-ended)
A/D converter		500 kHz, 16 bit
Input ranges		0V…(+2,5V-1LSB) (1LSB=38µV); 0V…(+10V-1LSB) (1LSB=152µV); -2.5V…(+2.5V-1LSB) (1LSB=76µV); -10V…(+10V-1LSB) (1LSB=305µV)
Full Scale Error	uni-polar	0V+10LSB, +FS-10LSB
	bi-polar	-FS+10LSB, +FS-10LSB
Inputs protected up to		±15 V
Input impedance		R_{IN} = typ. 600 MΩ; C_{IN} = typ. 3 pF
Total accuracy	±10 V full scale	typ. ±4 LSB, max. ±10 LSB
A/D FIFO		2048 value FIFO
Channel list	Channel number, gain factor, uni-/bi-polar, s. e./diff.	max. 1024 entries
Smallest time unit for CHAN and SCAN timer		1 Tick ≙ 30.30 ns ≙ 33 MHz
CHAN-time** (time between two consecutive channel list entries)		2µs bis ~130s (in Schritten von 30.$\overline{30}$ns)
SCAN-time** (time between two consecutive channel list processings)		4µs bis ~30 Minuten (in Schritten von 30.$\overline{30}$ns)
Total sampling rate**	Single operation (dependent of system)	max. 500 kHz
	Streaming operation	max. 500 kHz
Operation modes		Single, Streaming
Trigger modes	applicable for ME-4670*	software start, external digital trigger, external analog trigger
Ext. trigger edges		rising, falling, any
Reference to ground		GND

*Optional other boards of the ME-4600 series possible.

** System-related, the ME-Axon system doesn´t achieve the full sample rate. The actual achievable sample rate heavily depends on the performance of your computer and the number of USB devices connected resp. the bandwidth of your network.

External Digital Trigger A/D Section

Measurand/criterion		Condition/annotation	Value
Reference to ground			GND
Input level	U_{IL}	Vcc=4.5V	max. 0.9V
	U_{IH}	Vcc=4.5V	min. 3.15V
Delay time			max. 30ns

Voltage Outputs

Measurand/criterion	Condition/annotation	Value
Number of D/A channels	ME-4670	4
D/A converter		1 serial converter per channel
Resolution		16 bit
Output range		±10V
Output current	per channel	max. 5mA
Settling time (DAC)	Full scale (-10V → +10V)	max. 2µs
Total accuracy		max. ±10mV
Operation modes		„Single“, „Streaming“
Trigger modes		Software start, ext. digital trigger synchronous start (software/external)
External trigger edges		rising, falling, any
Reference to ground		GND

External Digital Trigger D/A Section

Measurand/criterion		Condition/annotation	Value
Reference to ground			GND
Input level	U_{IL}	Vcc = 4.5V	max. 0.9V
	U_{IH}	Vcc = 4.5V	min. 3.15V
Delay time			max. 30ns

Digital-I/Os

Measurand/criterion		Condition/annotation	Value
Number of ports		Port C + D can be used	2 x 8 bit
Reference to ground			GND
Port type			bi-directional TTL ports
Output level	U_{OL}	at 24mA	max. 0.5V
	U_{OH}	at -24mA	min. 2.4V
Input level	U_{IL}	at Vcc = 5V	max. 0.8V
	U_{IH}	at Vcc = 5V	min. 2V
Input current			±1µA
Sample rate			max. 500kS/s (2µs)

Counter

Measurand/criterion		Condition/annotation	Value
Number		1 x 82C54	3 x 16 bit
Counter clock		external	max. 10 MHz
Reference to ground			GND
Level for counter output (OUT_x)			
	U_{OL}	I_{OL} = +7.8mA	max. +0.45V
	U_{OH}	I_{OH} = -6mA	min. +2.4V
Level for counter inputs (CLK_x, GATE_x)			
	U_{IL}	I_{ILmax} = ±10µA	-0.5V…+0.8V
	U_{IH}	I_{IHmax} = ±10µA	+2.2V…+6V

General Information

Measurand/criterion	Condition/annotation	Value
Warming up time		min. 10 minutes
Power consumption	ME-Axon USB (without external load)	22 W
Load for VCC_OUT		max. 200 mA
Physical size	B x H x T (without 19“ mounting angles)	436mm x 82mm 466mm
Connectors	ST1	18pin type Phoenix
	STM1 (optional)	18pin type Phoenix
	ST2 (analog I/O)	25pin D-Sub female
	ST3 (counters)	25pin D-Sub female
	ST4 (digital ports)	25pin D-Sub female
	ST5 (host interface)	ME-Axon USB: USB 2.0 (Typ B) ME-Axon LAN: RJ-45
	ST6 (mains connection)	3pin appliance plug
Power supply	ME-Axon USB	Primary: typ. 0.7A/115VAC typ. 0.4A/230VAC (88…264VAC / 47…63Hz) Secondary: +24VDC/1A
	ME-Axon LAN	Primary: typ. 1.3A/115VAC typ. 0.8A/230VAC (88…264VAC / 47…63Hz) Secondary: +24VDC/2.2A
Fuses	F1…F4 Cartridge fuse of type Littelfuse 495 JCASE®	40 A (green) typ. voltage drop: 87mV Cold resistance: 1.30mΩ I^2t: 3650A^2s
	F5 (ME-Axon USB) F5 (ME-Axon LAN)	T1.6A/250V T2A/250V
	ME-1 (ME-Axon USB internally) ME-2 (ME-Axon LAN internally)	1 x 10A (car mini fuse) 2 x 10A (car mini fuse)
Operating temperature		0…70°C
Storage temperature		-20…80°C
Relative humidity		20…55% (non condensing)

CE Certification

EMC Directive	89/336/EMC
Emission	EN 55022
Noise Immunity	EN 50082-2

C Accessories

Fitting accessories for ME-Axon:

Mating plug for 2pin „Phoenix“ connector

2pin high power screw terminal connector,
Type: Phoenix PC 6/2-ST-10,16 (Phoenix order code: 1913507)

ME-Diff16-…V

16 differential voltage inputs; models available with the input ranges ±10V, ±20V or ±50V

ME-Current16

16 differential current inputs (0..20mA)

ME-RTD8-PT…

8 inputs for RTDs with 2-, 3- or 4-wire connectivity; versions for: Pt100, Pt500 or Pt1000

ME-TE8

8 inputs for thermocouples of type J, K, T, E, R, S, B, N (2-wire)

ME-BA4

Bridge amplifier for 4 independent Wheatstone bridges with constant current exitation

ME-8B

6 expansion slots for signal conditioning modules of the 8B series.

ME-Proto

Prototyping/breadboard module for custom specific signal conditioning

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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