

Q.series

Manual

Q.bloxx-EC



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1

Safety Information

Before starting installation, setting up, operation and before maintenance work is carried out, it is essential to read and follow the appropriate warning and safety information given in this manual.

Installation, setting up, operation and maintenance of the modules or devices must take place as intended, i.e. under the conditions of use laid down in this manual and in the technical data for the relevant module or device.

1.1

Intended use

The products in the Q.series range are intended for use in industrial and experimental test engineering and for monitoring assembly and production processes. Transducers (sensors) for the acquisition of physical quantities such as voltage, current, resistance, temperature, force, displacement, torque, mass, strain and pressure can be connected. The modules are used exclusively for these kinds of measurement and control applications. Any application which goes beyond this scope does not fall within the intended use of the modules.

To ensure safe operation the modules and devices must only be operated according to the details given in the manuals and technical data sheets. In addition, the required legal and safety regulations covering the respective application must be followed. This applies in particular to the modules A123, A124, A127 and A128 with which input voltages of up to $1200V_{DC}$ are possible.

1.2

Checking for damage in transit

On receipt of the goods visually check that the packaging and the module or device together with the data medium are intact. Also check the shipment for completeness (accessory parts, documentation, auxiliary aids, etc.). If the packaging has been damaged in transit or if you suspect that the product is damaged or may malfunction, the product must not be put into operation. In this case contact your customer consultant or Gantner Instruments GmbH.

1.3

Personnel

The installation, operation and maintenance of the modules or devices must only be carried out by competent persons. Competent persons are those who through their professional education have sufficient knowledge in the required field and are familiar with the relevant national occupational protection regulations,

accident prevention regulations, guidelines and accepted engineering rules. They must be able to reliably assess the results of their work and must be familiar with the contents of this manual. Electrical connections must only be carried out by specialist personnel trained for the task.

In particular, pay attention to the following:

- the national installation and erection regulations (e.g. ÖVE, VDE, etc.)
- generally accepted engineering rules
- the details on transport, installation, operation, servicing, maintenance and disposal in this manual.
- the parameters, limits and the details about the operating and ambient conditions on the name-plates and in the data sheets.

1.4 Special risks

The modules A123, A124, A127 and A128 are specifically intended for measurements at high voltages. Consequently, on the modules a voltage of up to 1200 V may be present, which can lead to fatal or severe injury on touching the terminal contacts or bare parts of the connecting cables. Therefore, make sure that only qualified personnel have access to the modules or devices and that the voltages on modules can be switched off by a switch-disconnector or similar device for service purposes.

1.5 Siting locations

The devices in the Q.series range are protected to IP20 against water, dirt and small parts. If the ambient conditions require it, the modules can be fitted in water-protected or watertight housings.

Please note the admissible ambient temperatures specified in the technical data.

1.6 Modifications

Making modifications to the modules or devices is not permitted. Dirt and shrouding covers may only be removed for service and maintenance purposes.

1.7 Servicing and cleaning

The modules or devices do not need any servicing. Cleaning may only take place in the voltage-free state. Therefore follow the points below:

- Before cleaning, disconnect all connectors.
- Clean the housing with a soft, slightly moistened cloth. Never use any solvents, because these may attack the labels.
- When cleaning, make sure that no liquid enters into the device or goes onto the terminals.

Never attempt to repair nor to again operate devices which are defective, have developed a fault or are damaged. In this case it is essential to contact your customer consultant or Gantner Instruments GmbH.

1.8



Disposal

Old devices which are no longer usable must be disposed of according to national and local regulations regarding environmental protection and raw-material recycling. Electronic components must not be disposed of with the household refuse. The packaging can be recycled and should therefore be passed into the recycling system. However, we recommend that the packaging is kept until the end of the warranty period so that you can pack faulty devices or modules properly.

1.9

General hazards due to non-observance of the safety information

The modules or devices conform to the state of the art and are operationally safe. However residual risks may arise when they are used and operated improperly by untrained personnel.

Any person commissioned with the task of siting, operating, servicing or repairing a module or device in the Q.series must have read and understood the operating manual and in particular the information relating to safety.

2

Labels and warning information

2.1

Warning information

To prevent personal injury and damage to property it is essential that you follow the warning and safety information given in this operating manual.



Indicates a directly threatening hazard. If it is not prevented, the consequence will be fatal or serious injuries.



Indicates a possibly hazardous situation. If it is not prevented, the consequence may be fatal or serious injuries.



Indicates a possibly hazardous situation. If it is not prevented, the consequence may be injuries of slight or medium severity.

NOTICE

Indicates a situation in which the consequence may be property damage if the information is not followed.

2.2

Labels on the modules

Symbol: 

Meaning: This symbol is the CE marking. This shows that we guarantee that our product meets the requirements of the relevant EC directives.

Symbol: **CAT I, CAT II, CAT III**

Meaning: Modules with this symbol are intended for the connection of high voltage. The maximum admissible voltage is also given.

Symbol: 

Meaning: High voltage may be present on the module connections. Connection may only be made with the insulated connecting plugs provided.

2.3

Labels in this manual

To simplify reading this manual we use – along with the warning information given above – the following labels and notation:

IMPORTANT

Paragraphs with this symbol give important information about the product or about using the product.

Tip

Contains application hints and other particularly useful information.

Symbol: 

Meaning: Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

| | |
|------------------|--|
| <i>italics</i> | signifies highlighted text |
| interface | signifies entries and entry fields in program user interfaces |
| Options | indicates menu items in the program user interfaces |
| > | signifies a sequence of menu items, e.g. in Options > Settings |
| ➡ | indicates special features or restrictions |

3

Introduction

Dear Customer,

Thank you for purchasing a product in the Q.series from Gantner Instruments GmbH. We are sure that you have obtained an excellent product which will enable you to make fast and reliable measurements with low measurement uncertainties.

If you find faults on the product or errors in the accompanying documentation or if you have suggestions for improvement, please contact your customer consultant or Gantner Instruments GmbH directly. We would be glad to receive your comments and ideas.

You will find further information in the section Technical Information in our Wiki at <https://dev.gantner-instruments.com/doku-wiki>. The user name is **support** and the password is **gins** (not all sections are open to the public).

Austria

Gantner Instruments GmbH
Montafonerstr. 4
6780 Schruns/Austria
Tel.: +43 (0) 5556 77463-0
Fax: +43 (0) 5556 77463-300
E-mail: office@gantner-instruments.com
Web: www.gantner-instruments.com

Germany

Gantner Instruments Test & Measurement GmbH
Heidelberger Landstr. 74
64297 Darmstadt
Tel.: +49 (0) 6151 95136-0
Fax: +49 (0) 6151 95136-26
E-mail: testing@gantner-instruments.com
Web: www.gantner-instruments.com

3.1

The documentation in the Q.bloxx-EC range

The documentation for the Q.bloxx-EC consists of this manual about the Q.bloxx-EC modules A101, A102, A103, A104, A105, A106, A107, A108, A109, A111, A116, A123, A124, A127, A128, D101, D104, D105 and D107 as well as the bus coupler Q.bloxx-EC BC.

You will find this manual also as a PDF file on our home page www.gantner-instruments.com and on the Gantner CD enclosed with your module or which you can order free of charge from Gantner Instruments GmbH.

3.2

About this manual

This manual describes the installation, operation and the configuration of the modules Q.bloxx-EC A101, A102, A103, A104, A105, A106, A107, A108, A109, A111, A116, A123, A124, A127, A128, D101, D104, D105 and D107 through the bus coupler Q.bloxx-EC BC and using the program ICP 100. Also included is an introduction to the setup and method of operation with a EtherCAT master, using TwinCAT from Beckhoff as an example. The modules are differentiated through the number of their analog and/or digital inputs and outputs, by the maximum possible sample rate and the admissible input voltages.

The manual is divided into several chapters:

- Safety information in Chapter 1, page 7ff.
- A description of the labels and symbols used on the modules and in this documentation can be found in Chapter 2 from page 11 onwards.
- You will find a description of the system and the main combination and expansion options in the next section.
- Chapter 4 from page 17 contains an introduction to the method of operation of EtherCAT.
- The description of the connection variants and the pin assignments on the inputs and outputs can be found in Chapter 5, *Connection*, ff. page 21.
- An explanation of the module configuration using the ICP 100 program and an introduction to TwinCAT can be found in Chapter 6, *Configuration* from page 85.
- In the appendix from page 116 you will find explanations on the use of sensors (sense leads, scaling, current measurements).

3.3

System description

The modules in the Q.bloxx-EC series have been developed for industrial and experimental measurement and test engineering, in particular for multi-channel measurements of electrical, mechanical and thermal signals on engine and component test-rigs as well as for monitoring processes and long-term supervision in EtherCAT networks. For example, individual modules can change the operating mode and measure either voltages, thermocouples, resistances or sensors. Depending on the operating mode, there are other options such as the 4- or 6-wire circuit, selectable measurement ranges and much more. The modules A123, A124, A127 and A128 are specially designed for measurements at high voltages.



Voltages of up to 1200V may be present on the connections of the modules A123, A124, A127 and A128.



Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

The individual modules can be combined to form one system as required. You can connect up to ten modules as independent EtherCAT slaves using a bus coupler and an EtherCAT master. On all modules the power supply, bus interface and the inputs and outputs are electrically isolated from one another.

Alternatives

Another way of using Gantner measurement modules through EtherCAT is offered to you, for example, by the Test Controller Q.pac or Q.station 101. The Test Controllers have EtherCAT interfaces and bundle the data of the Q.bloxx modules connected to them (standard modules). In EtherCAT the relevant Test Controller is displayed as a bus device with various inputs and outputs. In addition the Test Controller can output data over Ethernet, carry out event-controlled acquisition, send using FTP, etc. Two or more applications are possible simultaneously without the EtherCAT functionality being restricted. You can connect up to 64 modules per controller depending on the Test Controller and you can, of course, integrate several controllers in an EtherCAT network.

4

Measuring with EtherCAT

EtherCAT (Ethernet for Control Automation Technology) is a field bus based on Ethernet and has been standardized since 2007 in IEC 61158. The EtherCAT field bus is suitable for real-time requirements. The advantages include:

- fast data transfer with short cycle times ($\leq 100\mu\text{s}$),
- low jitter ($\leq 1\mu\text{s}$) which facilitates very good synchronization,
- low hardware costs,
- various methods of wiring using line, tree, ring or stern topology, facilitating line redundancy.

4.1

Method of operation

The EtherCAT network consists of a master and generally several slaves. Here, the master can be, for example, a commercially available PC with an Ethernet network card; the slaves usually have an EtherCAT slave controller implemented in hardware as ASIC or FPGA.

The master sends a so-called EtherCAT frame (data block, also known as a telegram). The EtherCAT telegrams are here embedded in a normal Ethernet data block (packet). All bus devices pass on this data block within a defined time. During this time period they extract the data intended for them from the EtherCAT frame and insert the data they have produced into the frame. The last bus device then passes the data block back to the master.

The propagation time is basically only determined by the (defined) delay time per bus device. This is the time needed to transfer three bits. Consequently, EtherCAT facilitates fixed reaction times.

4.2

The EtherCAT master

The EtherCAT master is the only bus device which may actively send an EtherCAT frame. In this way it controls all EtherCAT bus devices and also facilitates the configuration of a system.

In order to make the master functionality available, various programs are on the market which facilitate the installation of a master on almost any hardware providing it uses a standard Ethernet Medium Access Controller (MAC). However, in practice there are restrictions depending on the program used, so therefore follow the manufacturer's instructions for your program.

To recognize the properties of the bus devices, i.e. the inputs and outputs, the master requires the information of which data are needed. Usually, a configuration tool is used for this so that the

master takes over the real-time transfer of the data and the configuration tool handles the settings. Then, either the standardized slave description files (ESI, EtherCAT Slave Information) or a complete network configuration (ENI, EtherCAT Network Information) are made available to the master.

4.3 Synchronization of the EtherCAT bus devices

For the exact synchronization of all bus devices EtherCAT offers the Distributed Clock (DC) mechanism. In this case each bus device has a clock which is normally synchronized by the master. Here, the simultaneity is better than 1 μ s. This means that the outputs, for example, which are set by various I/O modules, or the data from inputs have a maximum “offset” of 1 μ s. You only have to make sure that the setting **DC (Distributed Clock)** is active in the master for the synchronization.

4.4 Connecting the Q.bloxx-EC modules

You connect the Q.bloxx-EC modules to a master through an EtherCAT bus coupler. For I/O components EtherCAT specifies an LVDS (Low Voltage Differential Signal) transfer, which is similar to RS-485 and which takes place in the Q.bloxx-EC modules via the ET1100 chip set from Beckhoff. Therefore, when connecting the I/O assemblies, the bus coupler Q.bloxx-EC BC is needed to convert the signals to the Ethernet standard. You can connect up to ten modules to one bus coupler. Each module has its own EtherCAT slave controller with Distributed Clock (DC).

4.5 Configuring the Q.bloxx-EC modules

As is normal with the Q.series, the Q.bloxx-EC modules can be configured in many ways. For example, individual modules can change the operating mode and measure either voltages, thermocouples, resistances or sensors. Depending on the operating mode, there are other options such as the 3-, 4- or 6-wire circuit, selectable measurement ranges and much more. As with normal EtherCAT slaves, these settings can be principally modified using so-called SDOs. However, here many settings are conceivable which are not fully supported by the normal EtherCAT configuration tools. Alternatively, the configuration could also take place using a slave description file (ESI). But here too there would be the problem that another file would be needed for each possible configuration. Consequently, the Q.bloxx-EC modules only contain a general ESI file; the detail configuration can be carried out using SDOs and CoE (not supported by all masters).

The Q.bloxx-EC modules support several protocols for configuration:

1. CoE: CAN application protocol over EtherCAT
With this the communication mechanisms of CAN are available. The configuration is carried out with SDOs (Service Data Objects) and the process data are arranged with PDO mapping (Process Data Objects).
2. FoE: File access over EtherCAT
Files can be transferred with this protocol. For example, configuration files or firmware updates can be sent to the modules.

You therefore have various ways of configuring your system:

1. You configure all settings using the graphically guided configuration software ICP 100 from Gantner and transfer the parametrization file over the USB interface of the bus coupler. This configuration is read by the master and it then recognizes all settings.
2. You configure all settings using the graphically guided configuration software ICP 100 from Gantner and transfer the parametrization file via the EtherCAT master by FoE in the modules. Here too, the configuration is read by the master and it then recognizes all settings.
3. The Q.bloxx-EC modules offer a simplified ESI file. With this the master can read the configuration of the modules and put them into operation with the default configuration. You can then carry out a further configuration with the EtherCAT master via CoE with SDOs, provided this is supported by your master.

4.6

Support for fast data transmission (XFC)

In an EtherCAT network measurements can be transferred up to 10,000 times per second. In order to be able to achieve higher data rates for individual bus devices, the Q.bloxx-EC modules support the XFC Technology (eXtreme Fast Control Technology) from Beckhoff. In this method a slave does not just transfer only one measurement per EtherCAT telegram, but rather several (oversampling). Here, the measurements themselves are acquired synchronously; several are just “collected”, before they are (can) be output. With a cycle time for the telegrams of 200µs and when ten measurements per telegram are transferred, you then obtain a time-base resolution of 20µs for the measurements of this channel.

You can transfer up to 100 values of a channel in one telegram with this technique. The oversampling factor can here be set dif-

ferently for each Q.bloxx-EC module in order to obtain different sample rates. In total per telegram you have approx. 1450 bytes available to which measurements or values computed in the modules can be assigned. If required, the master can however transfer a further telegram, to fetch values, assuming the selected cycle time permits this within the bandwidth of the EtherCAT interface (the Q.bloxx-EC modules support 100Mbit/s).

i Tip

A configuration example can be found in Section 6.1.11, page 100.

5

Connection

This chapter contains the description for the mounting of the bus coupler and modules and the description of the connector variants for the various sensor types with the pin assignments.

5.1

Mounting modules and connecting them to the bus coupler

The modules and the bus coupler are intended for mounting on a mounting rail (35 mm DIN rail conforming to DIN EN 60715). Up to ten modules can be connected to one bus coupler.

NOTICE

Modules must only be connected together and to the bus coupler in the de-energized state.

Remove any power supply connected to the bus coupler, because otherwise the modules may be damaged.

Procedure

1. Clip the bus coupler onto the left side of the mounting rail. To do this hang the bus coupler over the upper part of the rail and then press it downwards until the latching cam locks in (Fig. 5-1).
2. Clip the first module on at a slight distance to the right of the bus coupler.
3. Push the module so close to the bus coupler that the side latching cams (Fig. 5-1) also lock in. When mounted correctly, no intervening space remains between the bus coupler and the module on the front panel.
4. Screw in the fixing screw (Fig. 5-3, with spacers).
5. Connect further modules in the same way: clip them onto the mounting rail and then push them to the left until the side latching cam locks in. When mounted correctly, no intervening space remains between the modules and the front panels contact at the corners.
6. Screw in the fixing screw(s) (Fig. 5-3).
7. Plug the supplied protective cap onto the connector to the right (Fig. 5-3) on the last module.

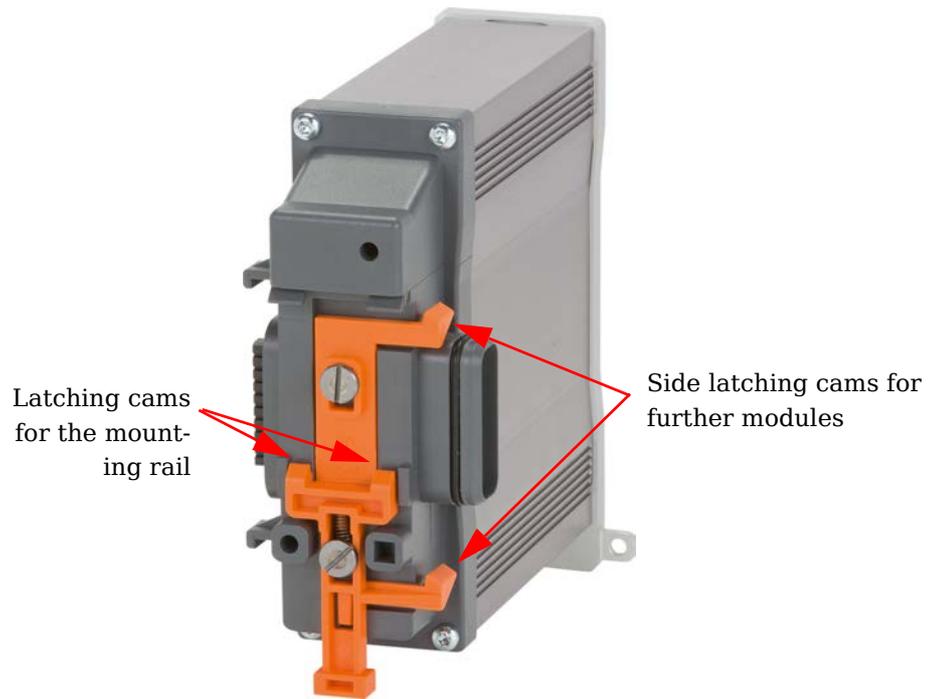


Fig. 5-1 Latching cams.

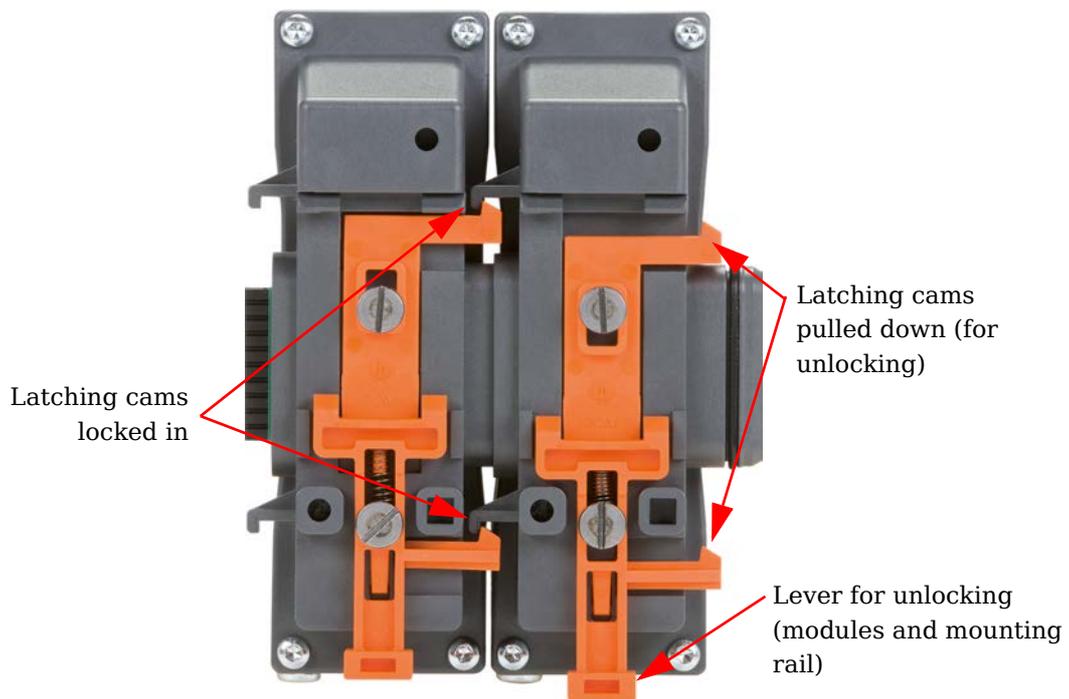


Fig. 5-2 Coupled modules (illustrated without mounting rail).

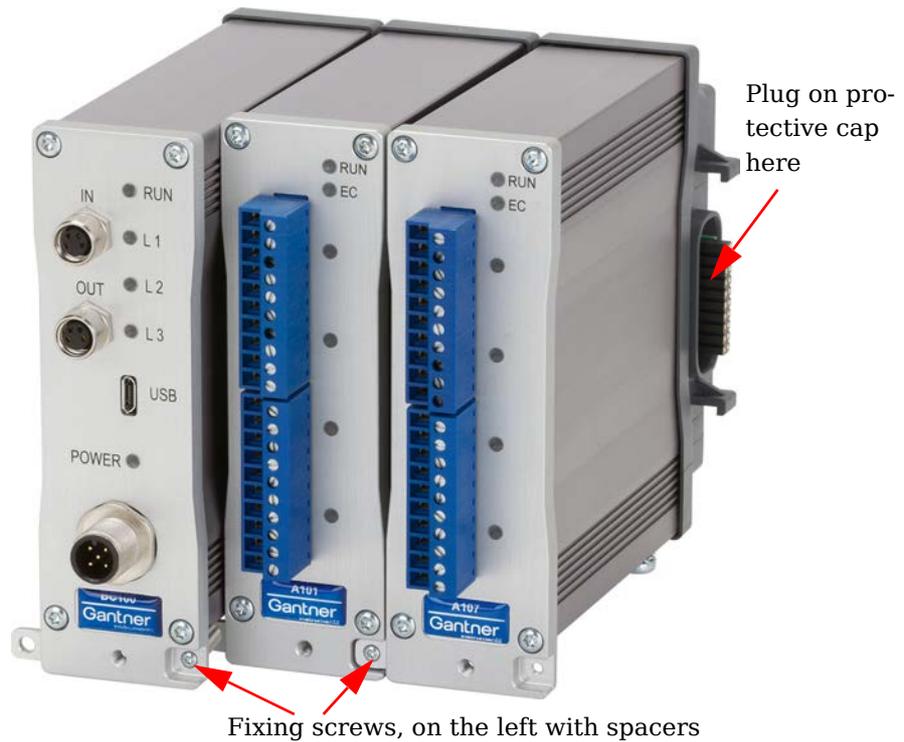


Fig. 5-3 Fixing screws and protective cap.

5.2

Removing modules or bus coupler

NOTICE

The modules must only be separated when de-energized.

Remove any power supply connected to the bus coupler, because otherwise the modules may be damaged.

1. Remove the fixing screw (Fig. 5-3) on the front panel which holds adjacent modules or a module and the bus coupler together.

! IMPORTANT

If you do not remove the fixing screw, the clip becomes bent on attempting to remove the module and may easily break off.

2. Pull the orange lever downwards on the lower end of the modules (on the mounting rail, Fig. 5-2) and push the module to the right.

If you want to remove a module in the middle, you must either push all the modules to the right of it simultaneously or remove one module after the other.

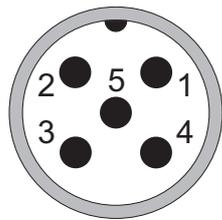
- Continue to pull on the grip and tilt the module upwards to be able to remove it from the mounting rail.

5.3

Connecting the power supply

For the power supply to the bus coupler and modules a regulated direct voltage between 10 and 30volts is required, which is connected to the contacts 1 and 2 of the socket. Fig. 5-4 shows the pin assignment. Each module requires a power of approx. 4W in addition to the power supplied for the connected transducers. The power required is almost constant over the complete voltage range.

View onto the socket



Pin Pin assignment

| Pin | Pin assignment |
|-----|--|
| 1 | Supply +10 ... 30V _{DC} |
| 2 | Supply 0V (GND) |
| 3 | GND for external sensor supply, only assigned for the modules Q.bloxx EC OMN |
| 4 | 5 ... 24V for external sensor supply, only assigned for the modules Q.bloxx EC OMN |
| 5 | Protective earth (PE) |

Fig. 5-4 Assignment for the base socket contacts (plan view).

! IMPORTANT

When the modules are switched on, there is an increase current demand until the modules are operating in a stable manner: In the start-up phase up to 700mA (10ms) per module is needed depending on the supply voltage. Thereafter, you should expect approx. 500mA per module for a 10V supply voltage, with a 30V supply voltage approx. 170mA. You should therefore either use power supplies which can deliver the required peak power when the voltage is switched on or - with many bus couplers - switch the bus couplers on one after the other.

The modules have internal protection against brief excessive voltages and currents and against short-term connection with incorrect polarity.

- ➔ Do not use cable which is too thin for the connection so that the required power can be transferred to the modules without significant losses.

5.4

Connecting the housing to the protective earth conductor

Since mounting on the mounting rail does not establish any conductive connection between the housings and mounting rail, you should connect the housings to the protective earth of the control cabinet using the screw provided on the underside of the modules and bus coupler (Fig. 5-5).

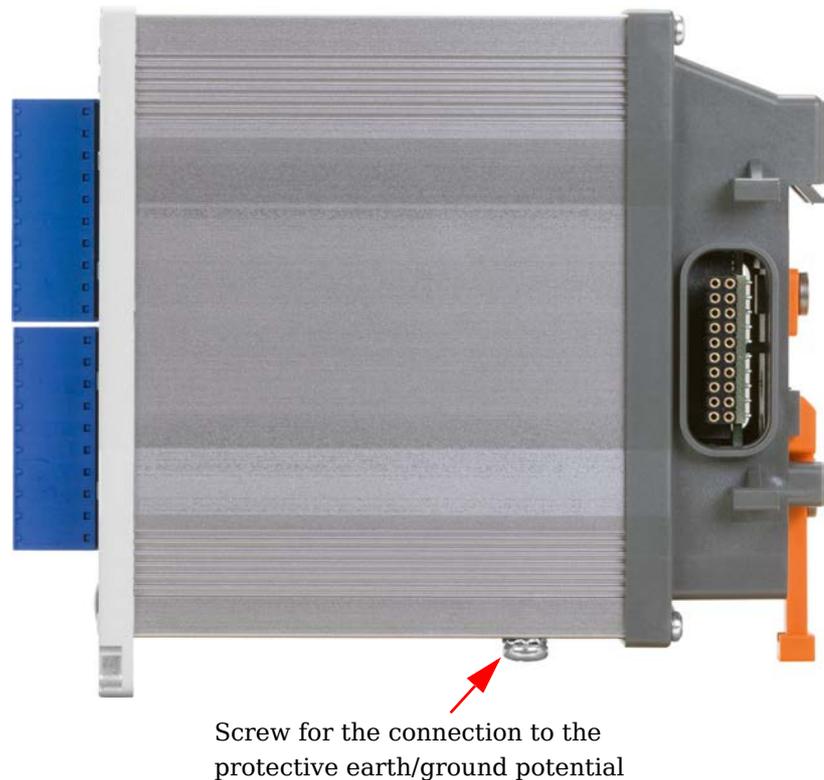


Fig. 5-5 Protective earth connection.

! DANGER

The modules A123, A124, A127 and A128 must also be grounded using the grounding point on the front panel, because the side housing and front panel consist of two parts.

Before connecting measuring cables, connect *both* grounding points to the protective earth or ground potential.

5.5 Connecting interfaces

For communication (configuration and data interchange) you have basically two possibilities. You can:

- Connect the bus coupler to the EtherCAT.
In this case you must have an EtherCAT system available and can then also perform configuration here; refer to Section 5.6, *Flashing sequences of bus coupler and modules*, page 28 and Chapter 6, *Configuration*, page 85.

- Connect the bus coupler via USB to a PC.
For this you need a driver for the interface. Normally the driver is installed when you connect the module. However if Windows already provides a driver for USB-to-serial, a new (more suitable driver) might not be installed. In this case you must install the driver manually.

5.5.1 EtherCAT Connecting interfaces

Screw the supplied cable with the screw connection onto the IN connector and connect the other end to the EtherCAT master. Use the OUT connection to connect further bus devices. The bus coupler interface uses a speed of 100Mbit/s.

5.5.2 Manually installing the USB driver for the PC

For this you need the FTDI driver “CDM vX.XX.XX WHQL Certified”; the X characters stand for the program version (at least 2.10.00). If required, you can download the driver via <http://www.ftdichip.com/Drivers/D2xx.htm>.

! **IMPORTANT**

You need administrator rights for the driver installation.

1. Mark the file and in the context menu select **Run as administrator** to start the installation.
2. Click on **Extract** (Fig. 5-6).

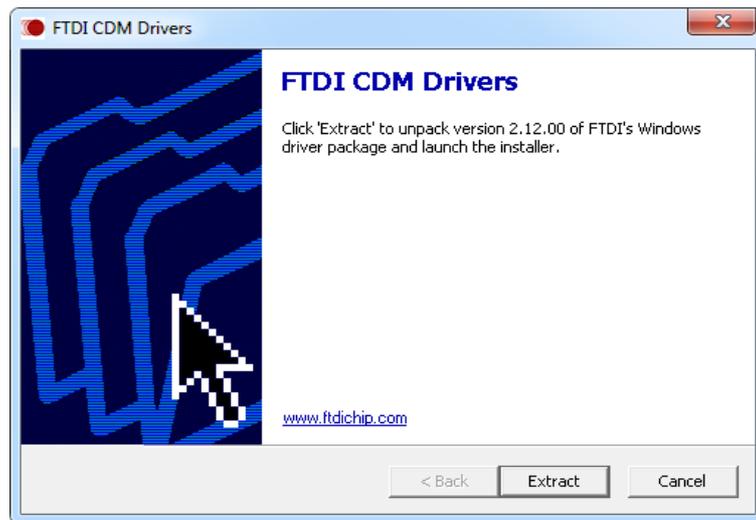


Fig. 5-6 Extracting drivers.

3. After extraction click on **Continue** (Fig. 5-7) and follow the installation instructions.

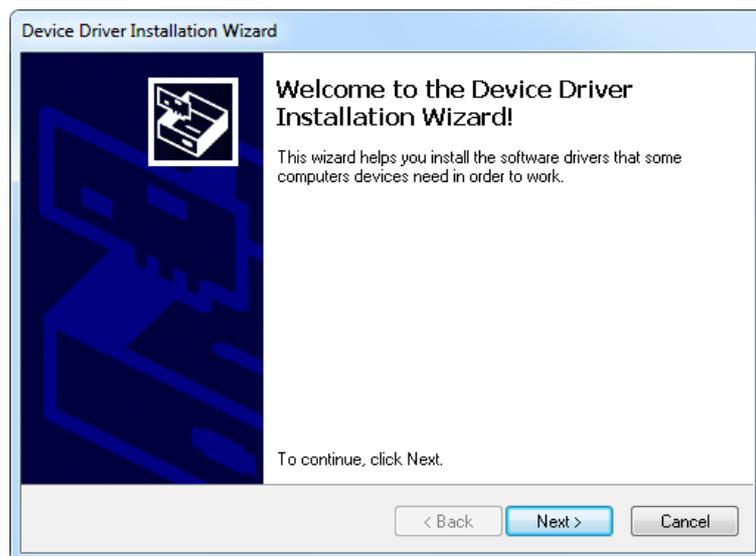


Fig. 5-7 Start the installation.

4. After installation you are informed of whether the driver files were properly installed (Fig. 5-8).

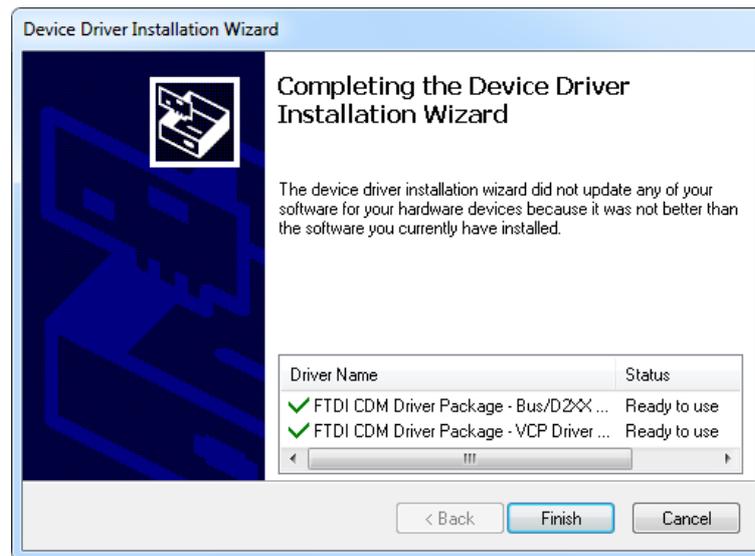


Fig. 5-8 Finishing the installation.

You might have to restart your PC after finishing the installation. Then once you connect the bus coupler, the driver is fully installed (in the taskbar the message appears that a driver is installed). After installation, “USB Serial Port (COMx)” and “The device driver software has been successfully installed” are displayed in the taskbar. The x in COMx represents the interface used for the connection; you have to specify this in the ICP 100 program.

Then you can configure the modules with the ICP 100 program (from Version 3.2.21); refer to Chapter 6, *Configuration*, page 85.

5.6

Flashing sequences of bus coupler and modules

The bus coupler has five (green) LEDs. The modules have six LEDs: one blue LED and a green LED on the upper edge and in each case two green/red LEDs per connector strip.

5.6.1

Bus coupler LEDs

The Run LED indicates the bus coupler status.

| RUN LED | Explanation |
|--------------------------|-----------------------------------|
| Off | “Init” operating mode |
| Flashing (approx. 0.4Hz) | “Pre-Operational” operating mode |
| Flashing (approx. 1.2Hz) | “Safe Operational” operating mode |

| RUN LED | Explanation |
|----------------------------|------------------------------|
| Flickering (fast flashing) | “Bootstrap” operating mode |
| On | “Operational” operating mode |

The LEDs L1 to L3 provide status information about the bus communication; the POWER LED indicates whether the correct supply voltage is applied.

| LED | Explanation |
|-----|-------------------------------------|
| L1 | Bus communication IN (EC_IN) |
| L2 | Bus communication LVDS (to modules) |
| L3 | Bus communication OUT (EC_OUT) |

5.6.2

Module LEDs

The blue RUN LED lights continuously after the switch-on process (approx. 15 seconds) if the module has been connected properly. When the ICP 100 program is connected to the module, the LED flashes. The LED also lights continuously for communication via EtherCAT.

The green EC LED indicates the module status; the flashing sequences correspond to those of the RUN LED on the bus coupler.

The other four LEDs show the status of the analog inputs and outputs. A green LED indicates that a valid configuration is present and everything is in order; a red LED signals that a setting or signal is faulty, e.g. overdriven. With modules with more than four inputs one LED represents two adjacent channels combined. When one of the channels has a range error, the LED lights red. Digital inputs and outputs have no influence on the LEDs. Please also note the hints given for the relevant modules from page 32.

5.7

The modules and their connection options

| Modules: | A 101 | A 102 | A 103 | A 104 | A 105 | A 106 | A 107 | A 108 | A 109 | A 111 | A 116 |
|--|-----------------|-----------------|-------|-------|-------|-----------------|-----------------|-------|-------|-------|-------|
| Signal inputs | | | | | | | | | | | |
| Voltage | X | X | X | X | | | X | X | | X | |
| Current | X | X | X | | | | X | X | | | |
| Potentiometer | X | | | | | | X | | | | |
| Resistance | X | | | | X | | X | | | | |
| Pt100, Pt1000 | X | | | | X | | X | | | | |
| Thermocouple | X | | | X | | | X | | | | |
| (Strain gauges) full + half bridge | X | X | | | | X | X ¹⁾ | | | | X |
| Strain-gauge quarter bridge | X ²⁾ | X ²⁾ | | | | X ²⁾ | X ²⁾ | | | | X |
| Inductive full and half bridge | | | | | | X | | | | | |
| LVDT, RVDT | | | | | | X | | | | | |
| IEPE/ICP [®] Sensor | X | X | | | | | | | | X | |
| Digital input: frequency, pulse width, counter | | | | | | | | | X | | |
| Digital input: Status | | | X | | | | | | X | | |
| Signal outputs | | | | | | | | | | | |
| Voltage | | X | | | | X | | | X | | |
| Current | | X | | | | | | | X | | |
| Digital output: frequency, pulse width | | | | | | | | | X | | |
| Digital output: Status | | | X | | | | | | X | | |
| Number of channels | 2 | 1 | 8 | 8 | 4 | 2 | 4 | 8 | 4 | 4 | 8 |
| Data rate (in Hz) | 100k | 100k | 100 | 100 | 10 | 10k | 10k | 10k | 100k | 100k | 10k |
| For description refer to page | 32 | 37 | 41 | 43 | 45 | 47 | 50 | 54 | 56 | 58 | 60 |

1) Half bridge only with Q.bloxx-EC Terminal

2) Quarter bridge with Q.bloxx-EC Terminal

| Modules: | A123 | A124 | A127 | A128 | D101 | D104 | D105 | D107 |
|--|------|------|------|------|------------|------|------|------|
| Signal inputs | | | | | | | | |
| Voltage | X | X | X | X | | | | |
| Current | | | | | | | | |
| Potentiometer | | | | | | | | |
| Resistance | | | | | | | | |
| Pt100, Pt1000 | | | | | | | | |
| Thermocouple | | X | | | | | | |
| (Strain gauges) full + half bridge | | | | | | | | |
| Strain-gauge quarter bridge | | | | | | | | |
| Inductive full and half bridge | | | | | | | | |
| LVDT, RVDT | | | | | | | | |
| IEPE/ICP [®] Sensor | | | | | | | | |
| Digital input: frequency, pulse width, counter | | | | | X | | | X |
| Digital input: Status | | | | | X | X | | X |
| Signal outputs | | | | | | | | |
| Voltage | | | | | | | | |
| Current | | | | | | | | |
| Digital output: frequency, pulse width | | | | | X | | | |
| Digital output: Status | | | | | X | | X | |
| Number of channels | 4 | 4 | 4 | 4 | 8 | 16 | 16 | 6 |
| Data rate (in Hz) | 100k | 10k | 100k | 100k | up to 100k | 10k | 10k | 1M |
| For description refer to page | 68 | 70 | 72 | 74 | 76 | 79 | 81 | 82 |

5.8

Q.bloxx-EC A101: Connecting sensors

The Q.bloxx-EC Module A 101 has two electrically isolated analog inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections.

GND identifies the measurement ground of an input. Measurement ground and (module) supply voltage are electrically isolated in the module.

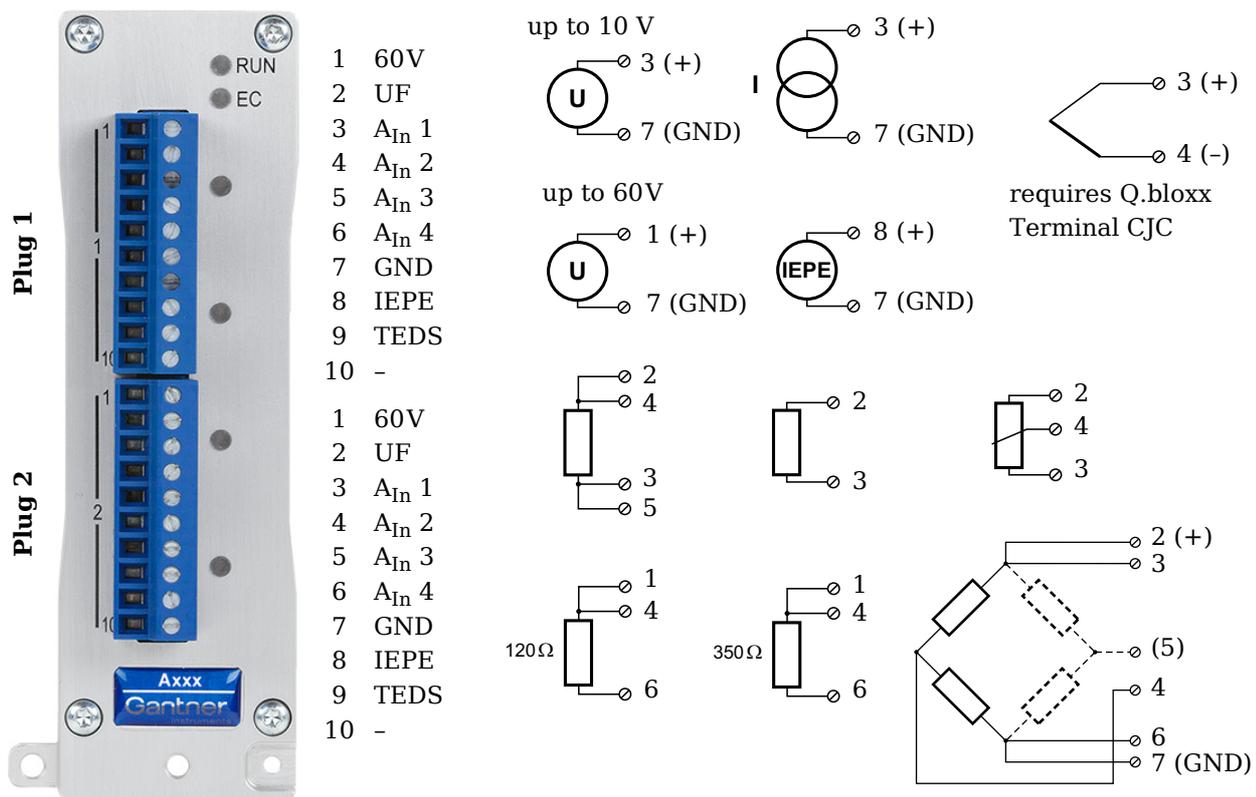


Fig. 5-9 Pin assignment for Q.bloxx-EC Module A101.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.8.1

Voltage

With voltage measurements two connection variants are possible, depending on the level of the voltages to be measured: up to 10V and up to 60V.

! IMPORTANT

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

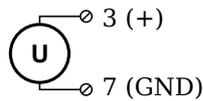
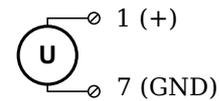
Voltages up to 10V**Voltages up to 60V**

Fig. 5-10 A101, measurement of voltage.

5.8.2**Current**

A shunt resistance of 50Ω is integrated into the Q.bloxx-EC Module A101 for current measurement. This facilitates the measurement of currents of up to 25mA. For higher currents use a voltage measurement and an external shunt; refer to Section 6.4, page 127.

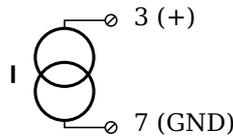


Fig. 5-11 A101, measurement of current.

5.8.3**Potentiometer**

Potentiometers with resistances between 1 k Ω and 10 k Ω are connected in a three-wire configuration.

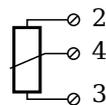


Fig. 5-12 A101, measurement with potentiometers.

5.8.4**Resistance, Pt100, Pt1000**

You can connect resistances and Pt100/1000 probes in two-wire or four-wire circuits. You specify the selected type of circuit during the module configuration (**Type** column).

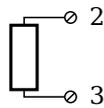
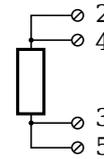
2-wire circuit**4-wire circuit**

Fig. 5-13 A101, measurement of resistance and Pt100/1000 probes.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.8.5**Thermocouple**

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold point compensation) required for thermocouples. The plug can be obtained under the designation Q.bloxx Terminal CJC-A101 from Gantner Instruments GmbH. You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

Alternatively, you can also use two thermocouples or a reference temperature source.

i Tip

You will find information on the comparative measuring point and on the measurement with a reference temperature source in Section 6.5, *Measuring with thermocouples*, page 128.

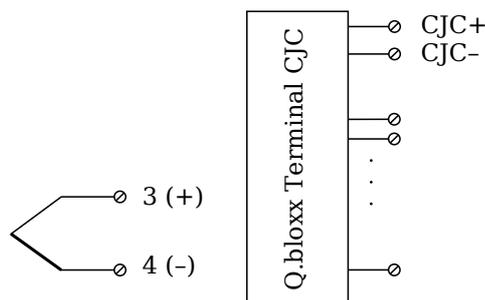


Fig. 5-14 A101, measurement with thermocouple using Q.bloxx Terminal CJC-A101.

5.8.6**Full and half-bridge transducers**

With (resistive) full bridges (strain-gauge full bridges) all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration (**Type** column). With half

bridges the side drawn in dashes and the connection 5 are omitted.

The bridge excitation voltage is 2.5V.

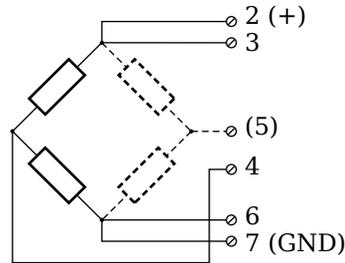


Fig. 5-15 A101, measurement with full and half bridges.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.8.7

Strain-gauge quarter bridges

For the connection of strain-gauge quarter bridges you need a special connecting plug which contains the completion resistances. The plug can be obtained under the designation Q.bloxx Terminal B4/120-A101 with 120Ω or B4/350-A101 with 350Ω from Gantner Instruments GmbH.

The bridge excitation voltage is 2.5V.

! IMPORTANT

The plug must have the same resistance values as the strain gauges used, because otherwise no measurement is possible. Since, for reasons of stability, all necessary completion resistances are located in the Q.bloxx Terminal, you have to select a full bridge circuit as the bridge type for the channel.

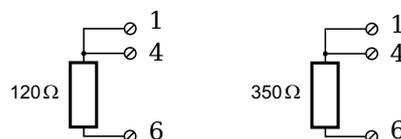


Fig. 5-16 A101, measurement with strain-gauge quarter bridge using Q.bloxx Terminal B4.

5.8.8

IEPE/ICP[®] sensor

The sensor is supplied with 4mA of current from the module (current supply).

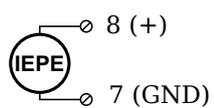


Fig. 5-17 A101, measurement with IEPE or ICP[®] sensors.

5.9

Q.bloxx-EC A102: Connecting sensors and I/O

The Q.bloxx-EC Module A102 has one electrically isolated analog input and one analog output. The assignment of both connector strips is *not* identical. The plug number is specified in the following. The connection terminals have numbers for identifying the connections.

GND identifies the measurement ground of an input. Measurement ground and (module) supply voltage are electrically isolated in the module.

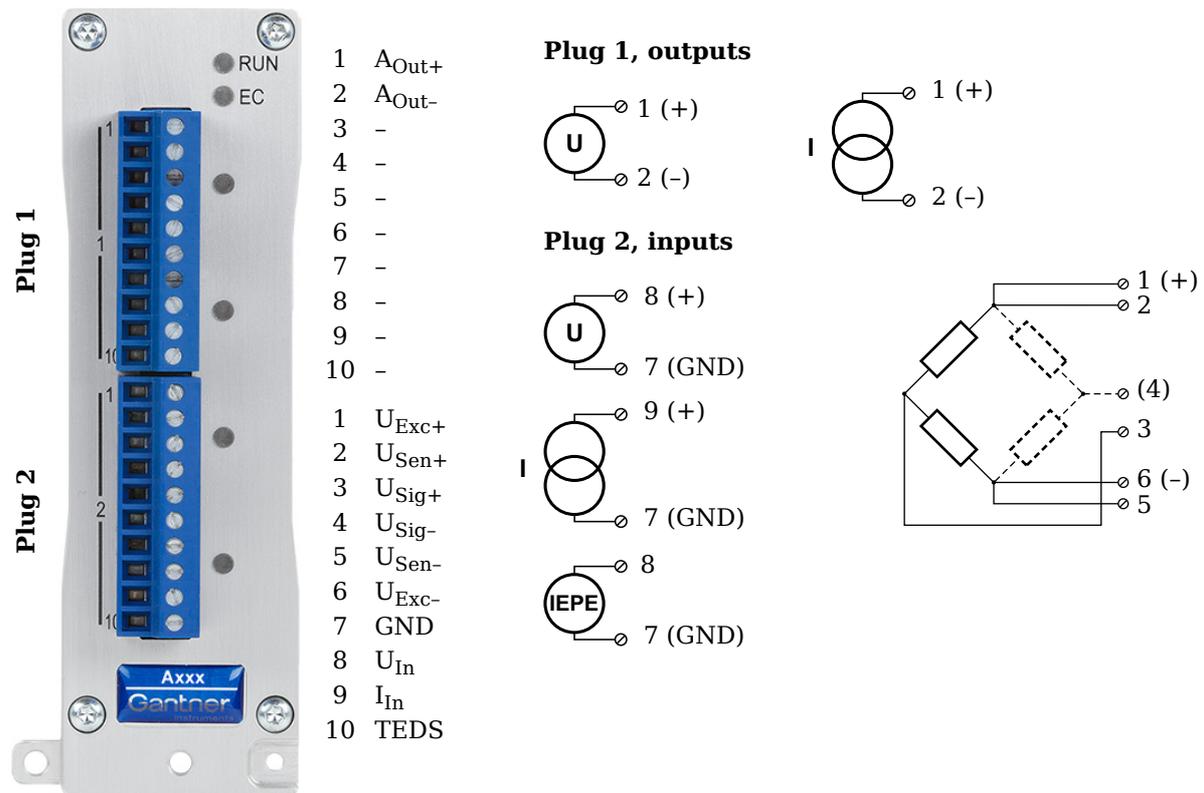


Fig. 5-18 Pin assignment for Q.bloxx-EC Module A102.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.9.1

Voltage

You can measure voltages of up to 10V via Plug 2.

! **IMPORTANT**

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

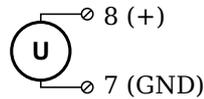


Fig. 5-19 A102, measurement of voltage, Plug 2.

5.9.2

Current

A shunt resistance of 50Ω is integrated into the Q.bloxx-EC Module A102 for current measurement. This facilitates the measurement of currents of up to 25 mA via Plug 2. For higher currents use a voltage measurement and an external shunt; refer to Section 6.4, page 127.

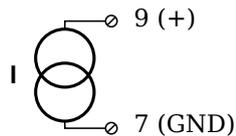


Fig. 5-20 A102, measurement of current, Plug 2.

5.9.3

Full and half-bridge transducers

With (resistive) full bridges (strain-gauge full bridges) all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration (**Type** column). With half bridges the side drawn in dashes and the connection 4 are omitted.

The bridge excitation voltage is switched via software between 1V, 2.5V, 5V and 10V.

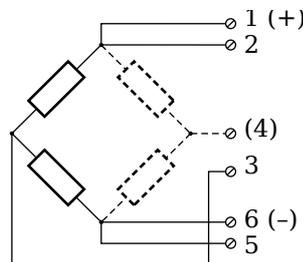


Fig. 5-21 A102, measurement with full and half bridges, Plug 2.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.9.4**Strain-gauge quarter bridges**

For the connection of strain-gauge quarter bridges you need a special connecting plug which contains the completion resistances. The plug can be obtained under the designation Q.bloxx Terminal B4/120-A102 with 120Ω or B4/350-A102 with 350Ω from Gantner Instruments GmbH.

The bridge excitation voltage is switched via software between 1V, 2.5V, 5V and 10V.

! IMPORTANT

The plug must have the same resistance values as the strain gauges used, because otherwise no measurement is possible. Since, for reasons of stability, all necessary completion resistances are located in the , you have to select a full bridge circuit as the bridge type for the channel.

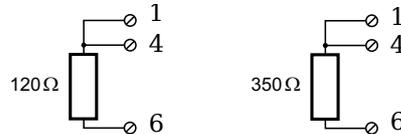


Fig. 5-22 A102, measurement with strain-gauge quarter bridge using Q.bloxx Terminal B4 on Plug 2.

5.9.5**IEPE/ICP[®] sensor**

The sensor is supplied with 4mA of current from the module (current supply).

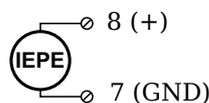


Fig. 5-23 A102, measurement with IEPE and ICP[®] sensors, Plug 2.

5.9.6**Analog output**

An analog output for voltage or current is available on Plug 1. The selection between voltage and current is made via software.

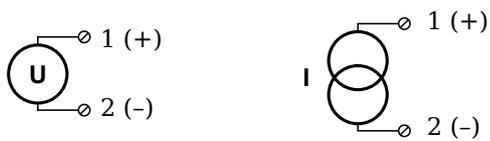


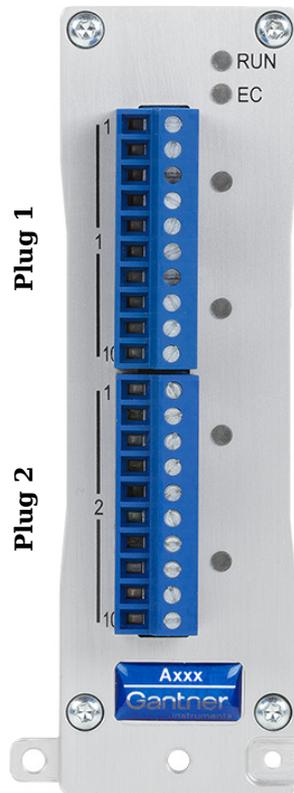
Fig. 5-24 A102, output of voltage or current, Plug 1.

5.10

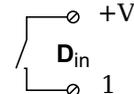
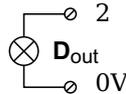
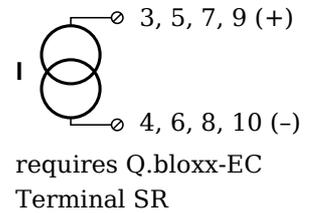
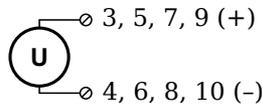
Q.bloxx-EC A103: Connecting sensors and I/O

The Q.bloxx-EC Module A103 has eight electrically isolated analog inputs and two digital inputs and outputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

The designations 0 V and +V refer to the (external) supply voltage connections. Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.



- 1 D_{In}
- 2 D_{Out}
- 3 A_{In} 1+
- 4 A_{In} 1-
- 5 A_{In} 2+
- 6 A_{In} 2-
- 7 A_{In} 3+
- 8 A_{In} 3-
- 9 A_{In} 4+
- 10 A_{In} 4-



- 1 D_{In}
- 2 D_{Out}
- 3 A_{In} 1+
- 4 A_{In} 1-
- 5 A_{In} 2+
- 6 A_{In} 2-
- 7 A_{In} 3+
- 8 A_{In} 3-
- 9 A_{In} 4+
- 10 A_{In} 4-

Fig. 5-25 Pin assignment for Q.bloxx-EC Module A103.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.10.1

Voltage

You can measure voltages of up to ±10V.

! IMPORTANT

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

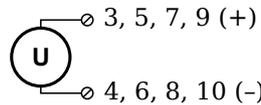


Fig. 5-26 A103, measurement of voltage.

5.10.2

Current

For current measurement you need the connecting plug Q.bloxx-EC Terminal SR containing the shunt resistances. This facilitates the measurement of currents of up to 25 mA.

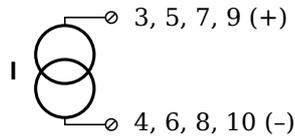


Fig. 5-27 A103, measurement of current via Q.bloxx-EC Terminal SR.

5.10.3

Digital input and output

On each connecting plug two contacts are available for an input and an output.



Fig. 5-28 A103, Digital Input and Output.

The digital input is active (high level) when the applied signal voltage lies above the threshold of 10V.

5.11

Q.bloxx-EC A104: Connecting sensors

The Q.bloxx-EC Module A104 has eight electrically isolated analog inputs for thermocouples or voltages. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

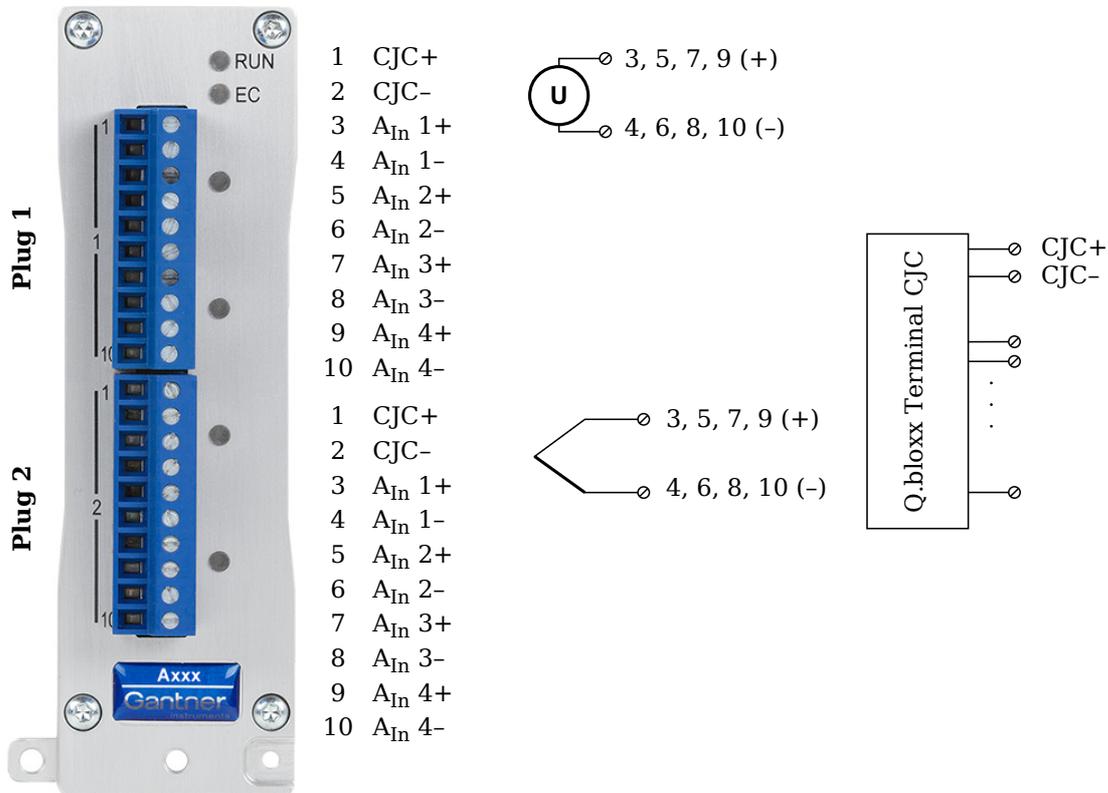


Fig. 5-29 Pin assignment for Q.bloxx-EC Module A104.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.11.1

Voltage

You can measure voltages of up to 80mV.

! **IMPORTANT**

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

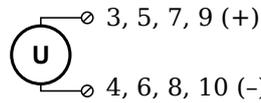


Fig. 5-30 A104, voltage measurement.

5.11.2

Thermocouple

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold junction compensation) required for thermocouples. The plug can be obtained under the designation Q.bloxx Terminal CJC-A104 from Gantner Instruments GmbH. You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

Alternatively, you can also use two thermocouples or a reference temperature source.

i **Tip**

You will find information on the comparative measuring point and on the measurement with a reference temperature source in Section 6.5, *Measuring with thermocouples*, page 128.

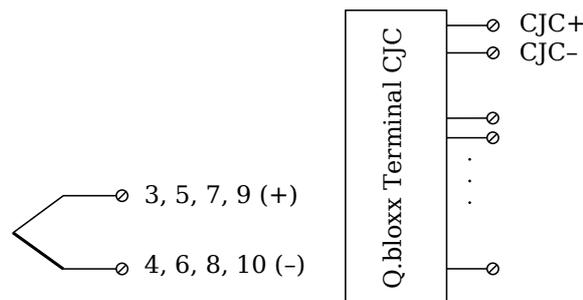


Fig. 5-31 A104, measurement with thermocouple using Q.bloxx Terminal CJC-A104.

5.12

Q.bloxx-EC A105: Connecting sensors

The Q.bloxx-EC Module A 105 has four electrically isolated analog inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

GND identifies the measurement ground of an input; measurement ground and the (module) supply voltage are electrically isolated in the module.

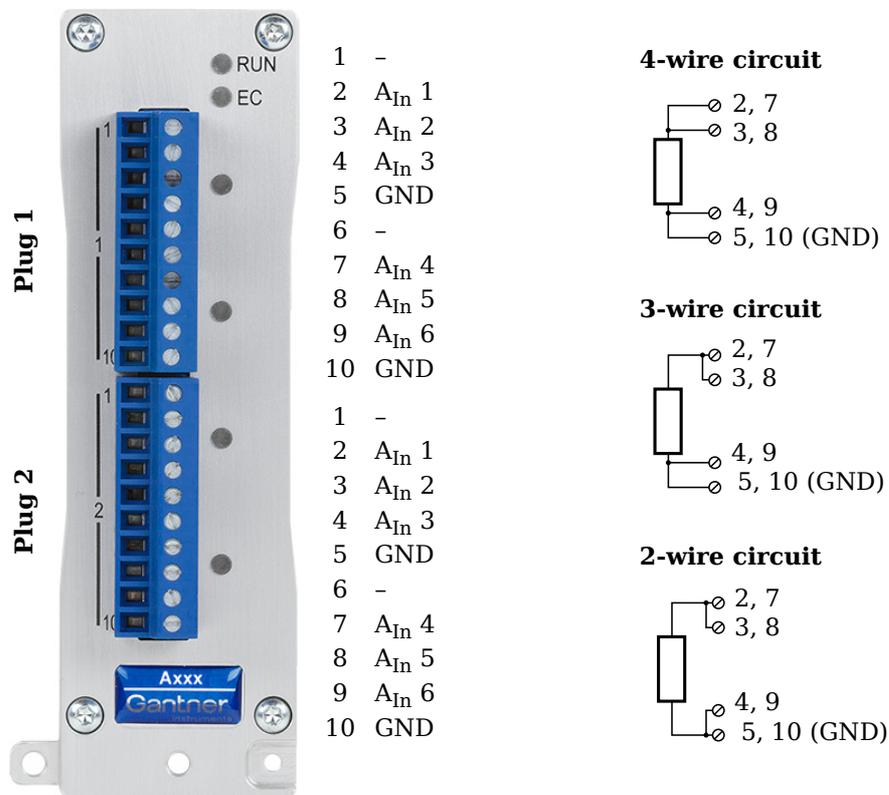


Fig. 5-32 Pin assignment for Q.bloxx-EC Module A105.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.12.1

Resistance, Pt100, Pt1000

You can connect resistances and Pt100/1000 probes in two-wire, three-wire or four-wire circuits. However, you must in each case connect *all* the terminals, i.e. you specify the circuit used for the type of circuit when configuring the module (**Type** column), but

with two and three-wire circuits the unused terminals must be bridged.

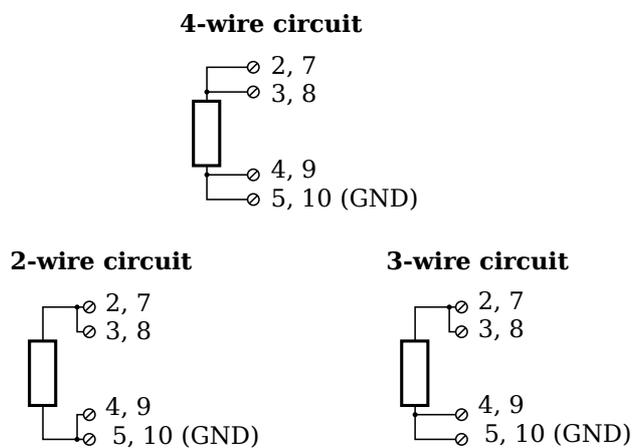


Fig. 5-33 A105, measurement of resistance and Pt100/1000 probes.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.13

Q.bloxx-EC A106: Connecting sensors and I/O

The Q.bloxx-EC Module A106 has two electrically isolated analog inputs and two analog outputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections.

GND identifies the analog and measurement grounds. Measurement ground/GND and (module) supply voltage are electrically isolated in the module. The measurement ground for input and the analog ground (output) are identical.

In each case the upper LED signals the status of the analog input, the lower one of the analog output on the relevant connector.

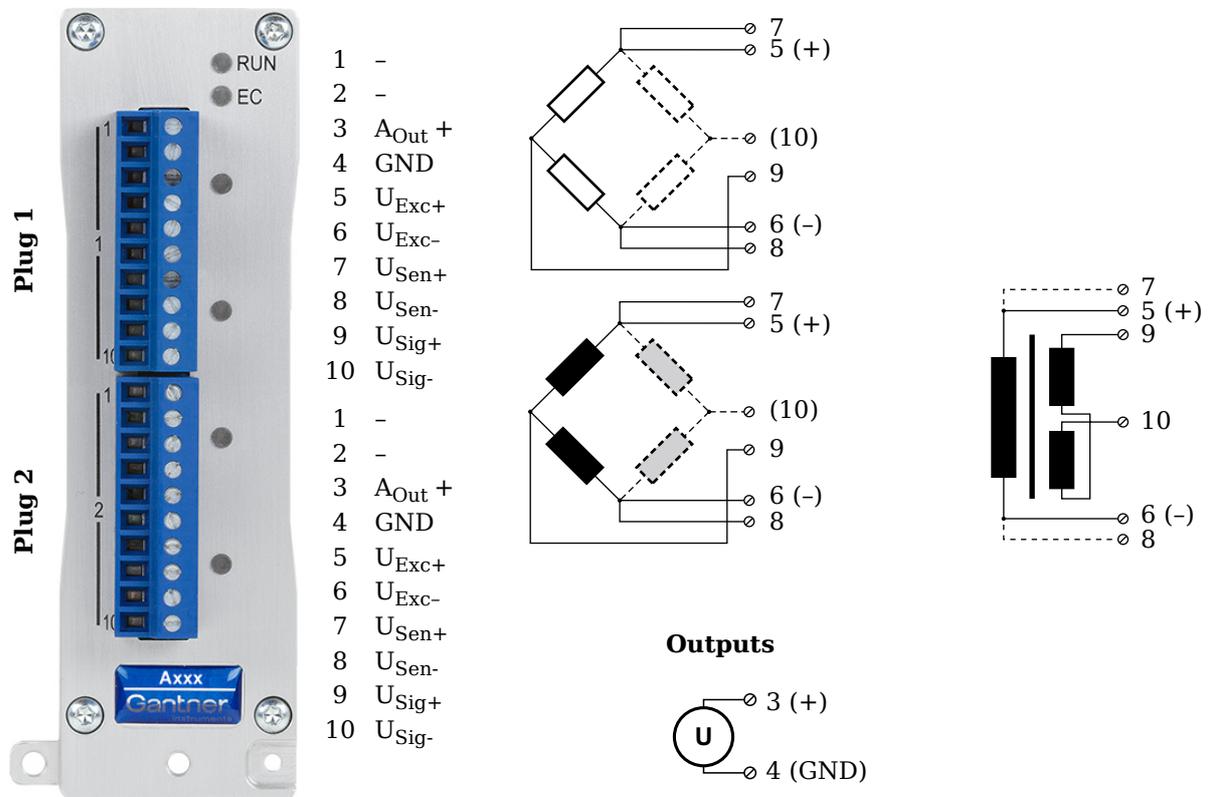


Fig. 5-34 Pin assignment for Q.bloxx-EC Module A106.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.13.1

Full and half-bridge transducers

With (resistive) full bridges (strain-gauge full bridges) all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration (**Type** column). With half

bridges the side drawn in broken lines and the connection 10 are omitted.

The bridge excitation voltage can be 2.5V or 5V (DC or CF).

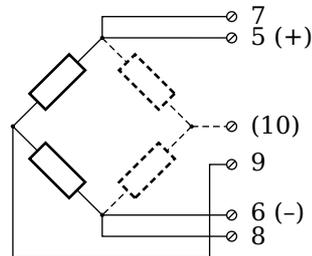


Fig. 5-35 A106, measurement with full and half bridges.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.13.2

Strain-gauge quarter bridge

For the connection of strain-gauge quarter bridges you need a special connecting plug which contains the completion resistances. The plug can be obtained under the designation Q.bloxx Terminal B4/120-A106 with 120Ω or B4/350-A106 with 350Ω from Gantner Instruments GmbH.

The bridge excitation voltage can be 2.5V or 5V (DC or CF).

! IMPORTANT

The plug must have the same resistance values as the strain gauges used, because otherwise no measurement is possible. Select a half-bridge circuit as the type of bridge for the channel.

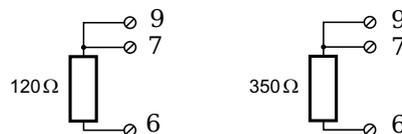


Fig. 5-36 A106, measurement with strain-gauge quarter bridge using Q.bloxx Terminal B4.

5.13.3

Inductive full and half bridges

With inductive full bridges all connections are occupied. If the sensor has no sensing leads, you specify this during the module configuration (**Type** column). With half bridges the side drawn in broken lines and the connection 10 are omitted.

The bridge excitation voltage can be 2.5V or 5V.

! IMPORTANT

During the configuration set **CF 4800Hz** (carrier frequency) in the **Type** column; inductive sensors cannot be operated with direct voltage (DC) or 600Hz carrier frequency.

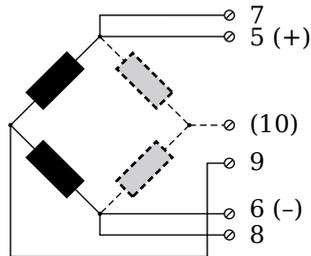


Fig. 5-37 A106, measurement with inductive full and half bridges.

5.13.4

LVDT, RVDT

With (inductive) LVDTs or RVDTs all connections can be occupied, but you can also connect without sense leads and state this in the **Type** column when configuring the module.

The bridge excitation voltage can be 2.5V or 5V.

! IMPORTANT

During the configuration set **CF 4800Hz** (carrier frequency) in the **Type** column; inductive sensors cannot be operated with direct voltage (DC) or 600Hz carrier frequency.

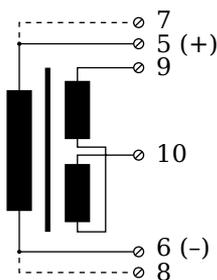


Fig. 5-38 A106, measurement with LVDTs and RVDTs.

5.13.5

Analog output

An analog voltage output is available on each connecting plug.

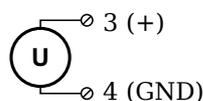


Fig. 5-39 A106, analog output.

5.14

Q.bloxx-EC A107: Connecting sensors

The Q.bloxx-EC Module A 107 has four electrically isolated analog inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

GND identifies the measurement ground. The four inputs (UF to GND) are electrically isolated in the module one to the other and to the (module) supply voltage.

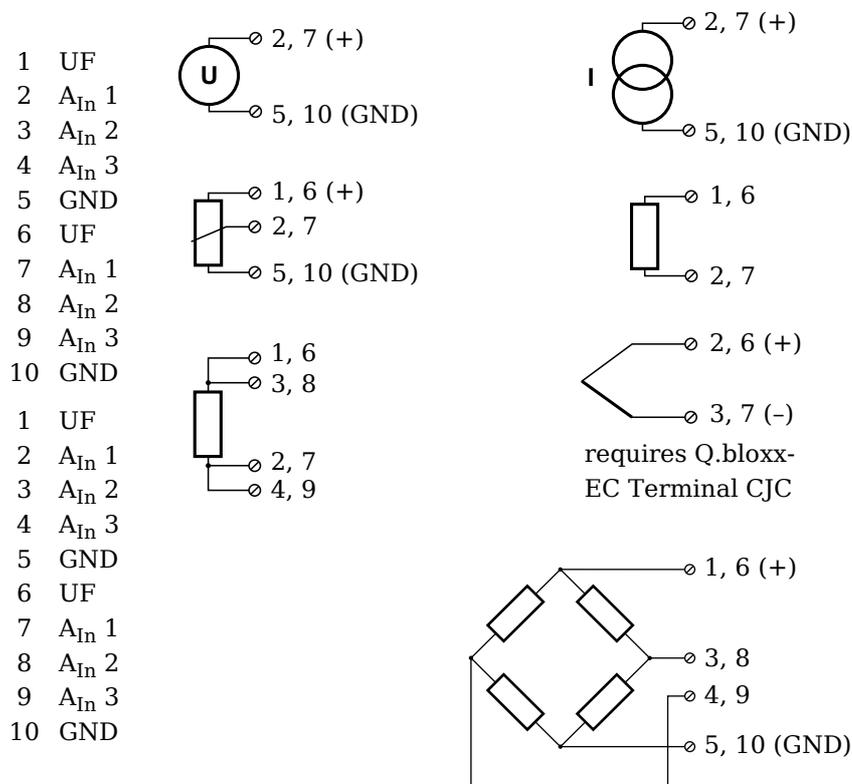
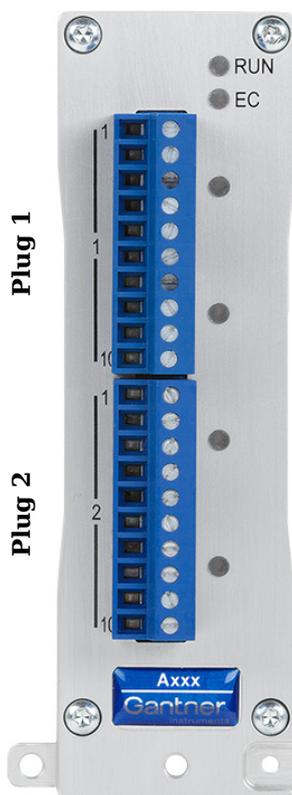


Fig. 5-40 Pin assignment for Q.bloxx-EC Module A107.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.14.1

Voltage

You can measure voltages of up to 10V.

! IMPORTANT

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

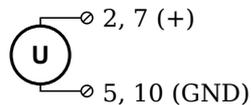


Fig. 5-41 A107, measurement of voltage.

5.14.2

Current

A shunt resistance of 50Ω is integrated into the Q.bloxx-EC Module A107 for current measurement. This facilitates the measurement of currents of up to 25 mA. For higher currents use a voltage measurement and an external shunt; refer to Section 6.4, page 127.

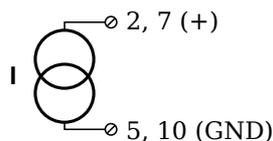


Fig. 5-42 A107, measurement of current.

5.14.3

Potentiometer

Potentiometers with resistances between 1 k Ω and 10 k Ω are connected in a three-wire configuration.

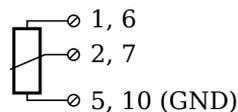


Fig. 5-43 A107, measurement with potentiometers.

5.14.4

Resistance, Pt100, Pt1000

You can connect resistances and Pt100/1000 probes in two-wire or four-wire circuits. You specify the selected type of circuit during the module configuration (**Type** column).

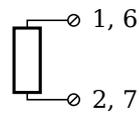
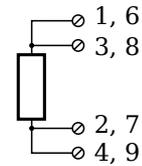
2-wire circuit**4-wire circuit**

Fig. 5-44 A107, measurement of resistance and Pt100/1000 probes.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.14.5**Thermocouple**

For connecting thermocouples you need a special connecting plug which contains the comparative measuring point (cold point compensation) required for thermocouples. The plug can be obtained under the designation Q.bloxx Terminal CJC-A107 from Gantner Instruments GmbH. You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

Alternatively, you can also use two thermocouples or a reference temperature source.

i Tip

You will find information on the comparative measuring point and on the measurement with a reference temperature source in Section 6.5, *Measuring with thermocouples*, page 128.

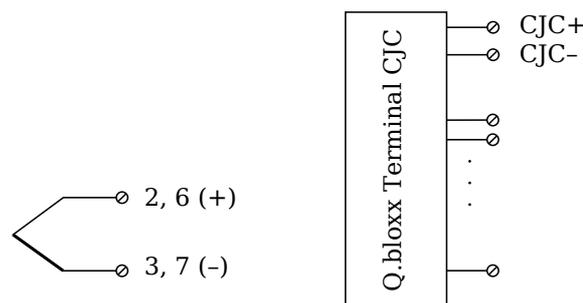


Fig. 5-45 A107, measurement with thermocouple using Q.bloxx Terminal CJC-A107.

5.14.6**Full-bridge transducer**

With (resistive) full bridges (strain-gauge full bridges) four connections are occupied. If the sensor has sense leads, you should connect them to the relevant supply lines (1 and 5 or 6 and 10).

The bridge excitation voltage is 2.5V.

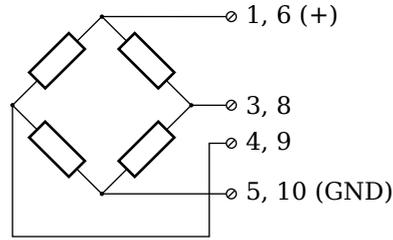


Fig. 5-46 A107, measurement with full bridges.

5.14.7

Strain-gauge half and quarter bridges

For the connection of strain-gauge half or quarter bridges you need a special connecting plug which contains the completion resistances. The plug can be obtained under the designation Q.bloxx Terminal B4/120-A107 with 120Ω or B4/350-A107 with 350Ω from Gantner Instruments GmbH.

The bridge excitation voltage is 2.5V.

! IMPORTANT

For strain-gauge quarter bridges the plug must have the same resistance values as the strain gauges used, because otherwise no measurement is possible.

Since, for reasons of stability, all necessary completion resistances are located in the , you have to select a full bridge circuit as the bridge type for the channel.

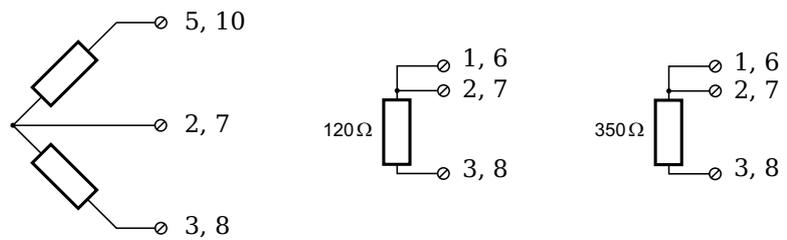


Fig. 5-47 A107, measurement with strain-gauge half bridge and quarter bridge using Q.bloxx Terminal B4.

5.15

Q.bloxx-EC A108: Connecting sensors

The Q.bloxx-EC Module A 108 has 8 electrically isolated analog inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

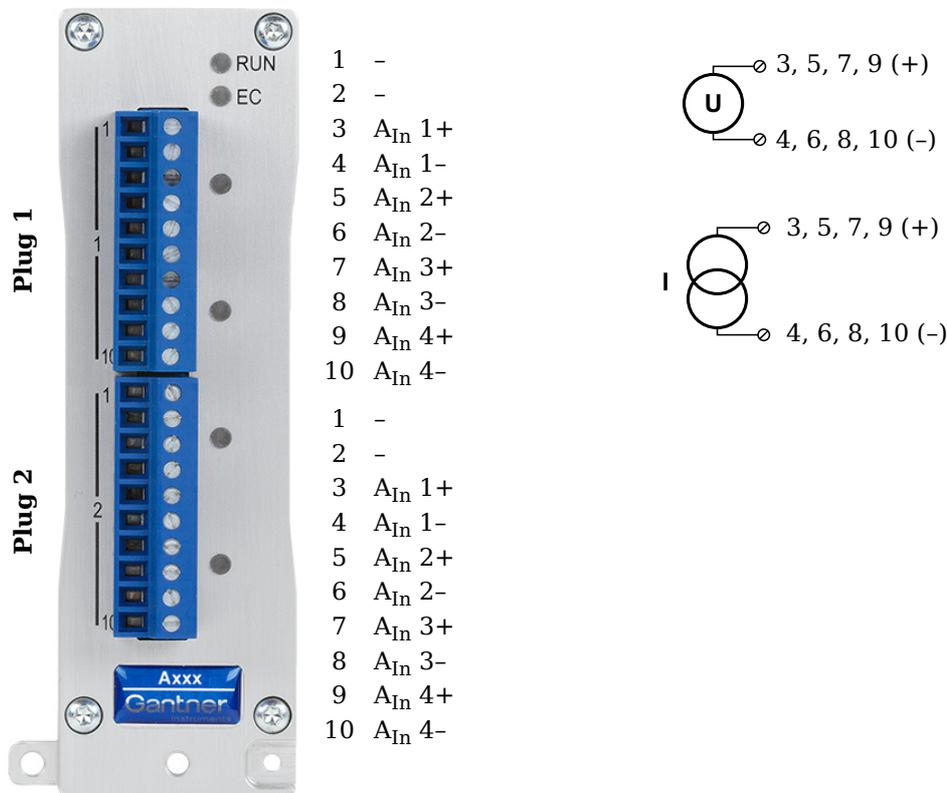


Fig. 5-48 Pin assignment for Q.bloxx-EC Module A108.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.15.1

Voltage

You can measure voltages of up to 10V.

! IMPORTANT

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

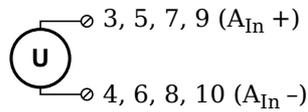


Fig. 5-49 A108, voltage measurement.

5.15.2

Current

For current measurement you need the Q.bloxx Terminal SR connecting plug containing the shunt resistances. This facilitates the measurement of currents of up to 25 mA.

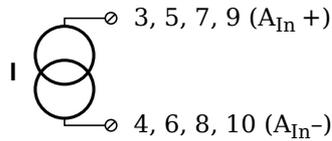


Fig. 5-50 A108, current measurement using the Q.bloxx Terminal SR.

5.16

Q.bloxx-EC A109: Connecting I/O and outputs

The Q.bloxx-EC Module A109 has four electrically isolated analog outputs, four digital inputs and four digital outputs. The assignment of both connector strips is *not* identical. The plug number is specified in the following. The connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

The designations 0 V and +V refer to the (external) supply voltage connections, NC indicates “not assigned”. Analog ground (-) and the (external) supply voltage (0V) are electrically isolated in the module.

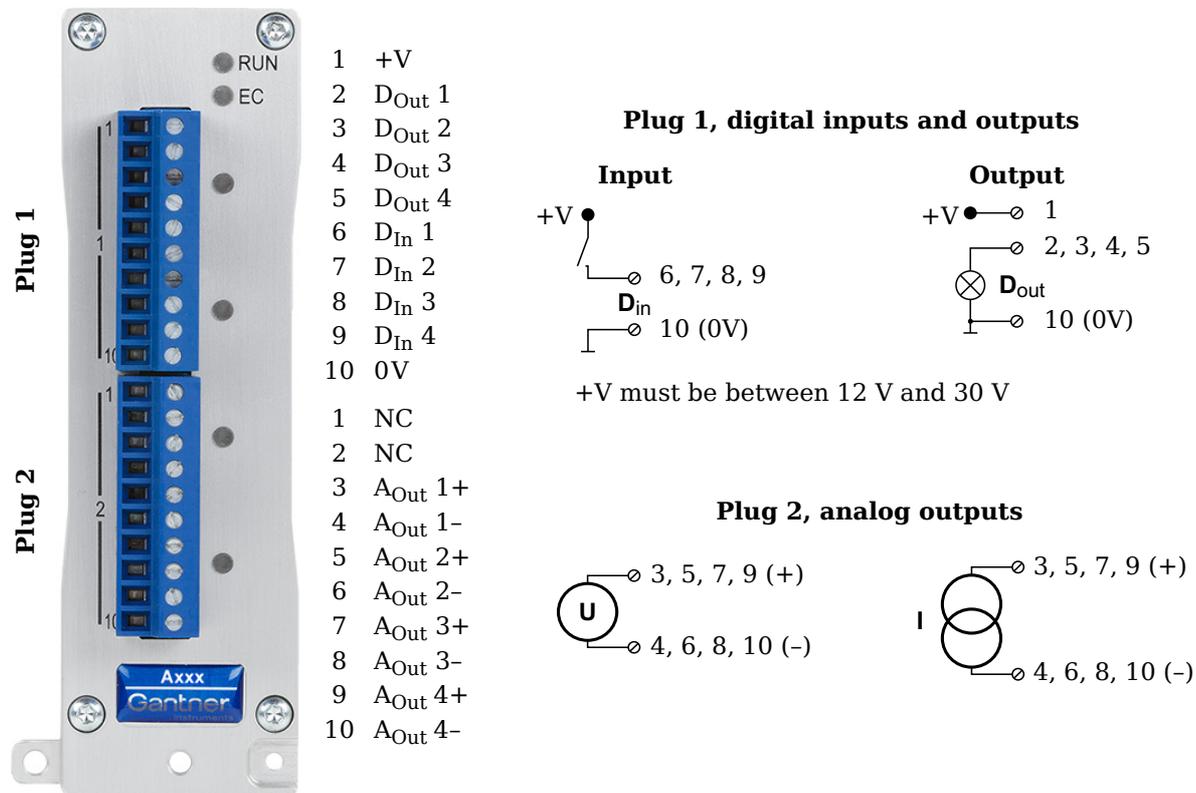


Fig. 5-51 Pin assignment for Q.bloxx-EC Module A109.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.16.1

Digital input and output, Plug 1

On Plug 1 contacts for four inputs and four outputs are available. Since the inputs and outputs of this module are electrically iso-

lated from the supply voltage, you must also connect 0V for the inputs and 0V and a supply voltage (+V) for the outputs.



Fig. 5-52 A109, digital input and output, Plug 1.

The digital input is active (high level) when the applied signal voltage lies above the (programmable) threshold.

5.16.2

Analog output, Plug 2

The analog outputs on Plug 2 supply voltage or current. Selection is made via software.

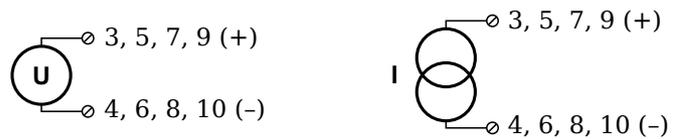


Fig. 5-53 A109, output of voltage or current, Plug 2.

5.17

Q.bloxx-EC A111: Connecting sensors and I/O

The Q.bloxx-EC Module A 111 has four electrically isolated analog inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method. NC signifies “No Connection”.

Measurement ground and (module) supply voltage are electrically isolated in the module.

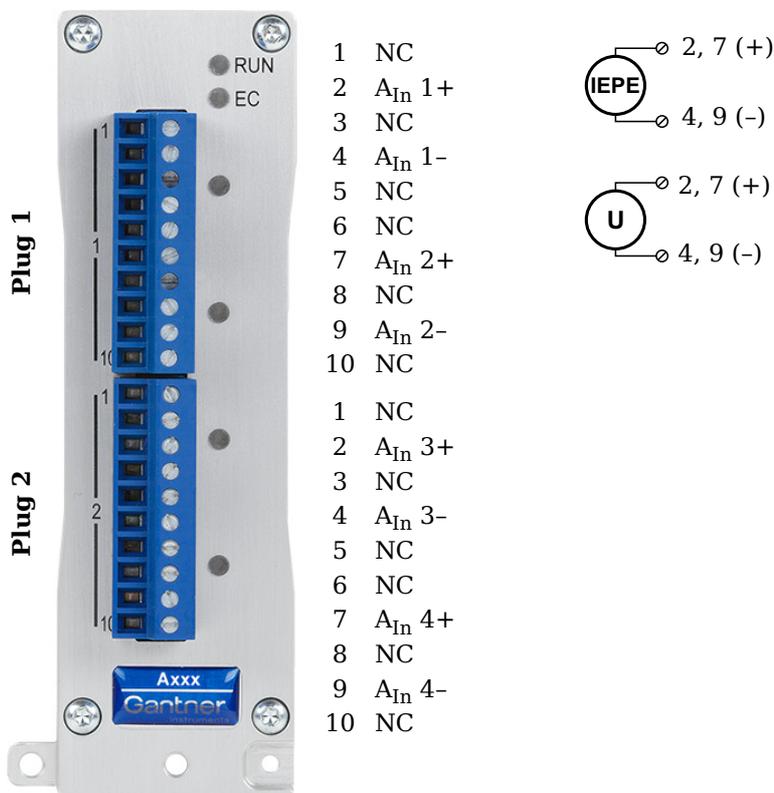


Fig. 5-54 Pin assignment for Q.bloxx-EC Module A111.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.17.1

Voltage

You can measure voltages of up to 10V.

! **IMPORTANT**

Voltages which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

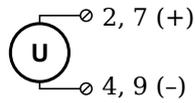


Fig. 5-55 A111, measurement of voltage.

5.17.2**IEPE/ICP[®] Sensor**

The sensor is supplied with 4 mA of current from the module (current supply).

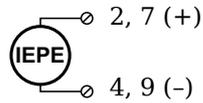


Fig. 5-56 A111, measurement with IEPE or ICP[®] sensors.

5.18

Q.bloxx-EC A116: Connecting sensors

The Q.bloxx-EC Module A116 has eight analog inputs. We recommend that either the Q.bloxx-EC Connection Terminal A116 (Fig. 5-58) or the Cable A116 (Fig. 5-59) is used with free ends for connection. You will find the associated connectors in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belongs to one possible connection method.

The channels (measurement ground) are electrically isolated against the (module) supply voltage and the interface.

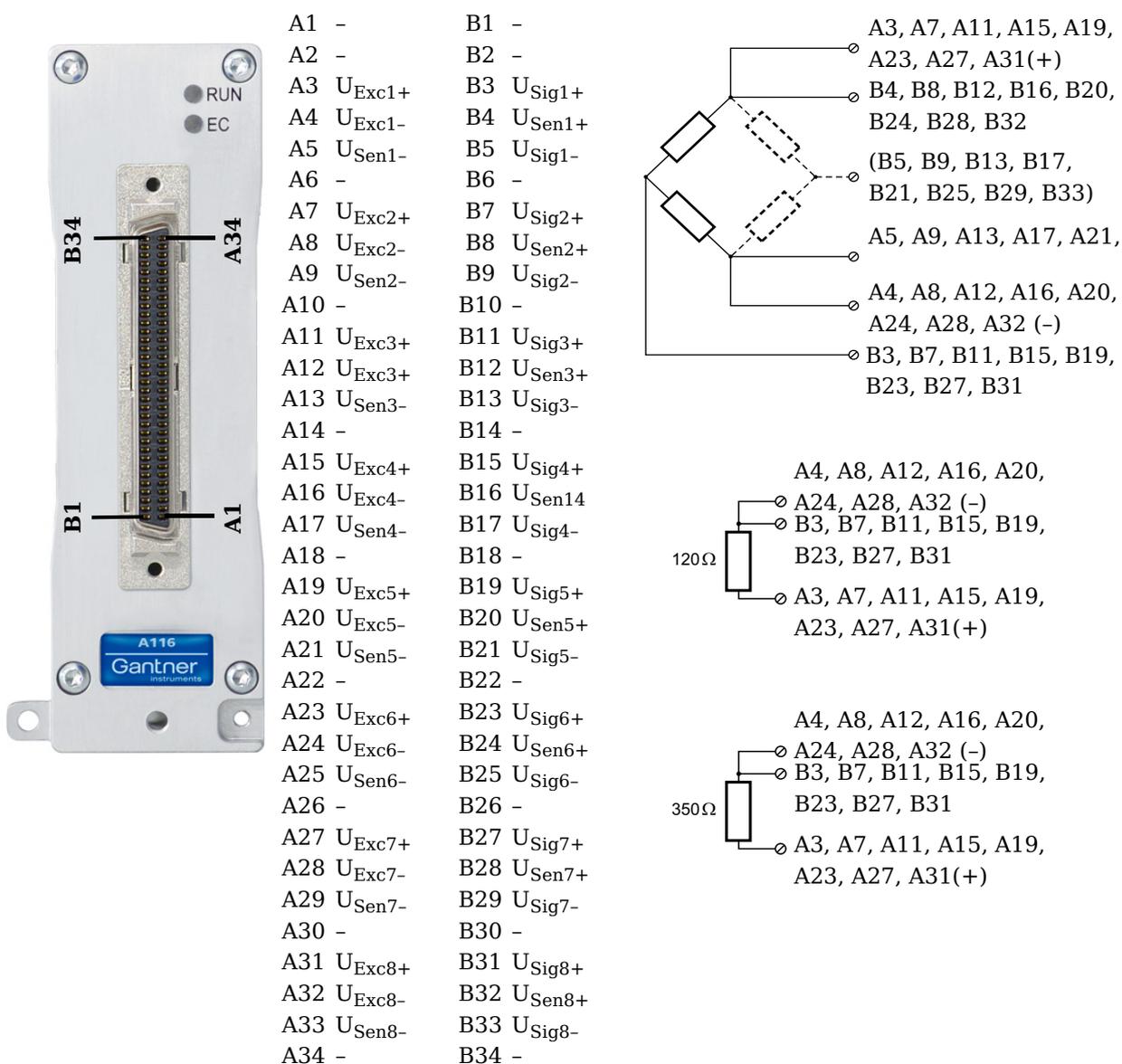


Fig. 5-57 Pin assignment for Q.bloxx-EC Module A116.

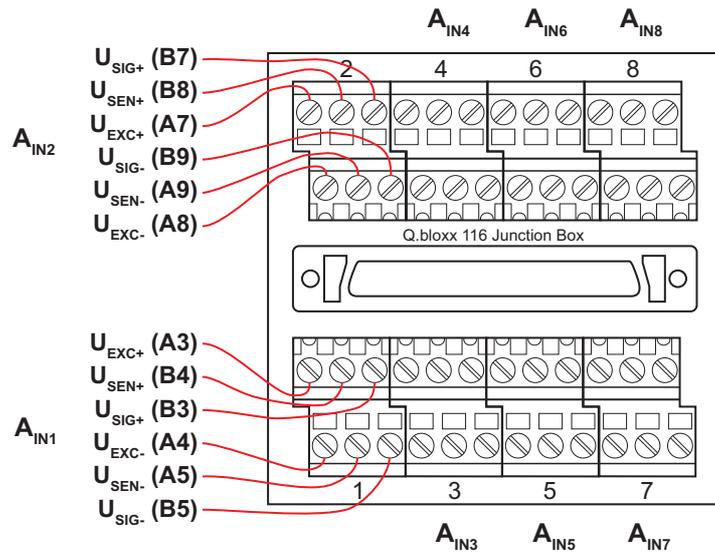


Fig. 5-58 Terminal assignment for the Q.bloxx-EC Connection Terminal CT A116.

Assignment of the cable cores for a cable termination with free ends Cable A116:

| Input/ cable bundle | Pairing | Cable color | Sensor connec- tion | Socket connection |
|---------------------------|---------|-------------------|------------------------|-------------------|
| 1 | Pair 1 | Light brown | U_{Exc+} | A3 |
| | | Light brown/red | U_{Exc-} | A4 |
| | Pair 2 | Light green | U_{Sen+} | B4 |
| | | Light green/black | U_{Sen-} | A5 |
| | Pair 3 | White | U_{Sig+} | B3 |
| | | White/black | U_{Sig-} | B5 |
| 2 | Pair 1 | Red/white | U_{Exc+} | A7 |
| | | Red/blue | U_{Exc-} | A8 |
| | Pair 2 | Yellow/red | U_{Sen+} | B8 |
| | | Yellow/blue | U_{Sen-} | A9 |
| | Pair 3 | Grey/red | U_{Sig+} | B7 |
| | | Grey/blue | U_{Sig-} | B9 |

| Input/ cable bundle | Pairing | Cable color | Sensor connec- tion | Socket connection |
|---------------------------|---------|--------------------|------------------------|-------------------|
| 3 | Pair 1 | Blue | U_{Exc+} | A11 |
| | | Blue/white | U_{Exc-} | A12 |
| | Pair 2 | Pink/red | U_{Sen+} | B12 |
| | | Pink/blue | U_{Sen-} | A13 |
| | Pair 3 | Light green/yellow | U_{Sig+} | B11 |
| | | Light green/green | U_{Sig-} | B13 |
| 4 | Pair 1 | Green/white | U_{Exc+} | A15 |
| | | Light green/white | U_{Exc-} | A16 |
| | Pair 2 | Light blue/blue | U_{Sen+} | B16 |
| | | Light blue/red | U_{Sen-} | A17 |
| | Pair 3 | Black | U_{Sig+} | B15 |
| | | Black/white | U_{Sig-} | B17 |
| 5 | Pair 1 | Pink | U_{Exc+} | A19 |
| | | Pink/black | U_{Exc-} | A20 |
| | Pair 2 | Orange/white | U_{Sen+} | B20 |
| | | Grey/white | U_{Sen-} | A21 |
| | Pair 3 | White/red | U_{Sig+} | B19 |
| | | White/blue | U_{Sig-} | B21 |
| 6 | Pair 1 | Light green/red | U_{Exc+} | A23 |
| | | Green/blue | U_{Exc-} | A24 |
| | Pair 2 | Red | U_{Sen+} | B24 |
| | | Red/black | U_{Sen-} | A25 |
| | Pair 3 | Purple | U_{Sig+} | B23 |
| | | Purple/white | U_{Sig-} | B25 |

| Input/ cable bundle | Pairing | Cable color | Sensor connec- tion | Socket connection |
|---------------------------|---------|-------------------|------------------------|-------------------|
| 7 | Pair 1 | Green | U_{Exc+} | A27 |
| | | Green/black | U_{Exc-} | A28 |
| | Pair 2 | Light blue/green | U_{Sen+} | B28 |
| | | Light blue/yellow | U_{Sen-} | A29 |
| | Pair 3 | Light yellow | U_{Sig+} | B27 |
| | | Light yellow/red | U_{Sig-} | B29 |
| 8 | Pair 1 | Grey | U_{Exc+} | A31 |
| | | Grey/black | U_{Exc-} | A32 |
| | Pair 2 | White/yellow | U_{Sen+} | B32 |
| | | White/green | U_{Sen-} | A33 |
| | Pair 3 | Brown | U_{Sig+} | B31 |
| | | Brown/white | U_{Sig-} | B33 |

Fig. 5-59 Assignment of the cores for a cable termination with free ends Cable A116.

i Tip

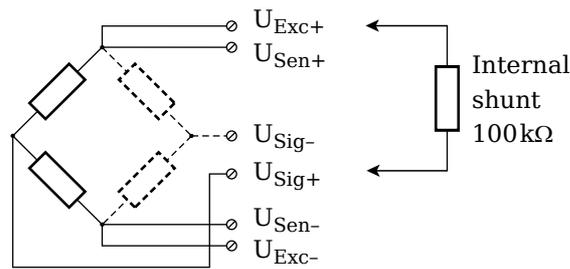
Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.18.1

Full and half-bridge transducers

With (resistive) full bridges (strain-gauge full bridges) six connections are used per measuring point. If the sensor has no sensing leads, you specify this during the module configuration (**Type** column); the U_{Sen} inputs then remain open. With half bridges the side drawn in dashes and the U_{Sig-} connection are omitted.

The bridge excitation voltage is $2V_{DC}$; with 350Ω sensor resistance you can also use $4V_{DC}$. The internal shunt resistance can be activated also with full and half bridges.



| Input 1 | | Input 2 | | Input 3 | | Input 4 | |
|------------|----|------------|----|------------|-----|------------|-----|
| U_{Exc+} | A3 | U_{Exc+} | A7 | U_{Exc+} | A11 | U_{Exc+} | A15 |
| U_{Exc-} | A4 | U_{Exc-} | A8 | U_{Exc-} | A12 | U_{Exc-} | A16 |
| U_{Sen+} | B4 | U_{Sen+} | B8 | U_{Sen+} | B12 | U_{Sen+} | B16 |
| U_{Sen-} | A5 | U_{Sen-} | A9 | U_{Sen-} | A13 | U_{Sen-} | A17 |
| U_{Sig+} | B3 | U_{Sig+} | B8 | U_{Sig+} | B11 | U_{Sig+} | B15 |
| U_{Sig-} | B5 | U_{Sig-} | B9 | U_{Sig-} | B13 | U_{Sig-} | B17 |

| Input 5 | | Input 6 | | Input 7 | | Input 8 | |
|------------|-----|------------|-----|------------|-----|------------|-----|
| U_{Exc+} | A19 | U_{Exc+} | A23 | U_{Exc+} | A27 | U_{Exc+} | A31 |
| U_{Exc-} | A20 | U_{Exc-} | A24 | U_{Exc-} | A28 | U_{Exc-} | A32 |
| U_{Sen+} | B20 | U_{Sen+} | B24 | U_{Sen+} | B28 | U_{Sen+} | B32 |
| U_{Sen-} | A21 | U_{Sen-} | A25 | U_{Sen-} | A29 | U_{Sen-} | A33 |
| U_{Sig+} | B19 | U_{Sig+} | B23 | U_{Sig+} | B27 | U_{Sig+} | B31 |
| U_{Sig-} | B21 | U_{Sig-} | B25 | U_{Sig-} | B29 | U_{Sig-} | B33 |

Fig. 5-60 A116, measurement with full and half bridges, direct connection; U_{SIG} = signal voltage (output signal), U_{SEN} = sense lead, U_{EXC} = excitation voltage

You will find the terminal assignment for the terminal CT A116 or the Cable A116 in the first section of this chapter. For the activation of the shunt resistance refer to Section 5.18.3.

i Tip

Information about the types of circuit and the respective advantages and disadvantages can be found in Section 6.2, *Connecting sensors with sensing leads*, page 124.

5.18.2

Strain-gauge quarter bridge

With this module, for the connection of strain-gauge quarter bridges you do not need any special connection plugs as the 120Ω and 350Ω completion resistances are present in the module and only need to be activated. In addition you can activate the internal shunt resistance for test purposes.

The bridge excitation voltage is $2V_{DC}$; with 350Ω sensor resistance you can also use $4V_{DC}$.

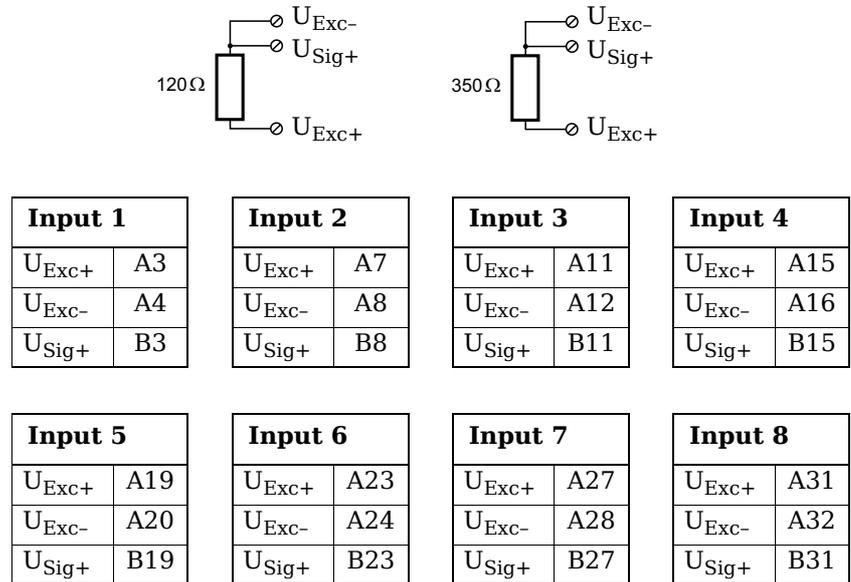


Fig. 5-61 A116, measurement with a strain-gauge quarter bridge, direct connection.

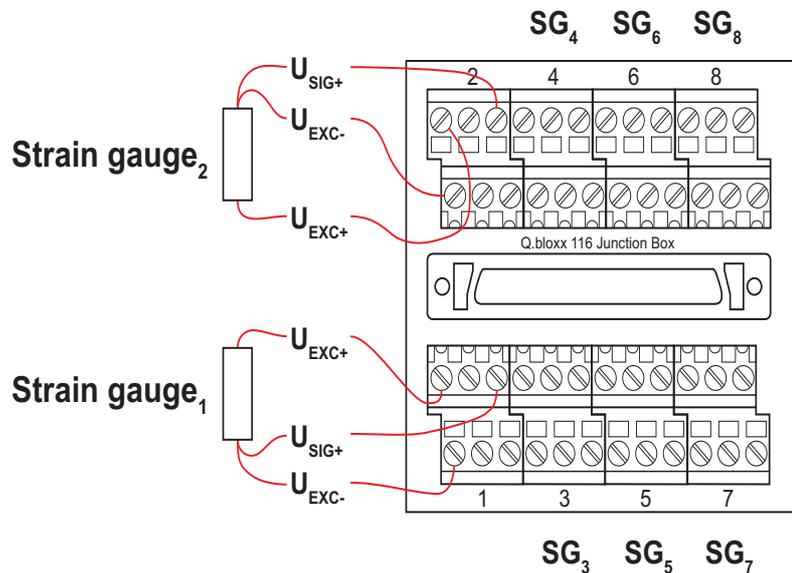


Fig. 5-62 A116, measurement with a strain-gauge quarter bridge. Connection assignment for the Q.bloxx-EC Connection Terminal CT A116.

You will find the terminal assignment for the Cable A116 in the first section of this chapter. With quarter bridges only U_{Exc+} , U_{Exc-} and U_{Sig+} are assigned. For the activation of the shunt resistance refer to Section 5.18.3.

With the three-wire circuit the internal completion resistance is used in this module to determine the voltage drop over the cable and to correct the result accordingly. In this way not only can the influence of the temperature on the cable (normal three-wire circuit) be compensated, but also the loss of sensitivity due to the cable resistance over a wide range.

5.18.3

Activating the shunt resistance

You can activate the shunt both via a variable and manually via a button.

Open the module settings dialog (Fig. 5-63), activate the tab **Variable definition** and click in the column **Format/balance**. The dialog of Fig. 5-64 opens.

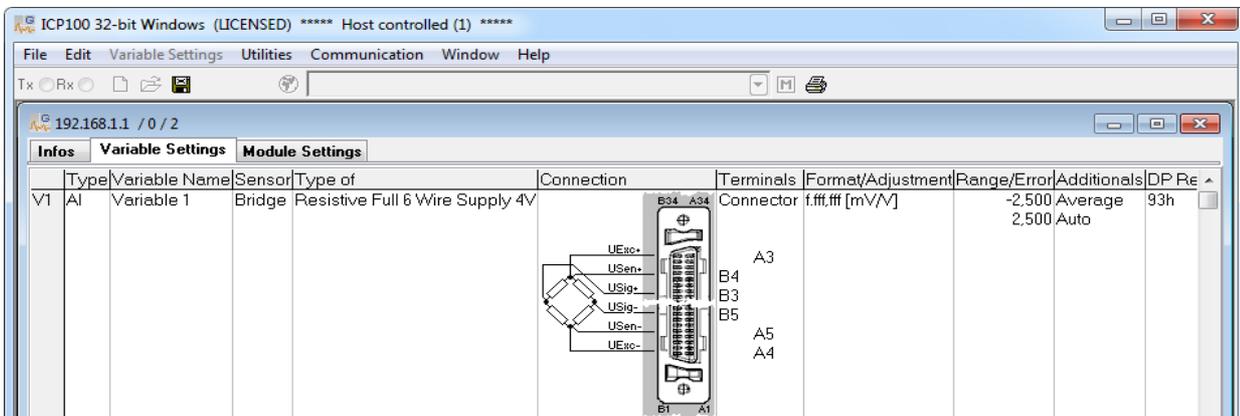


Fig. 5-63 Module configuration dialog.

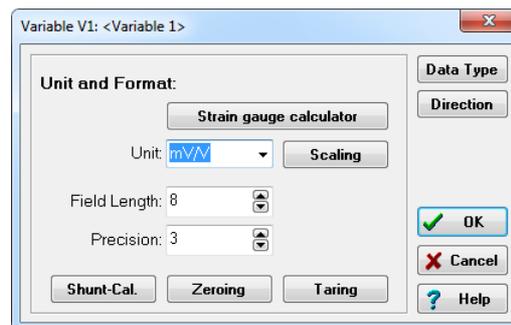


Fig. 5-64 Dialog for format settings.

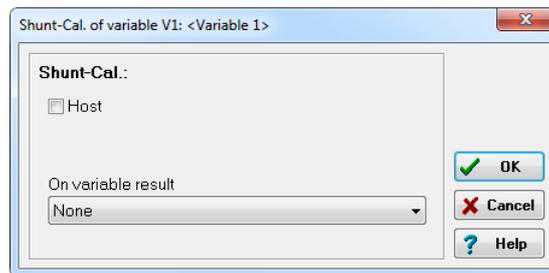


Fig. 5-65 Dialog for shunt activation.

Manual activation

Define the **Direction** for the variable on **Input/output** (Fig. 5-64) and click on **Shunt cal.** Activate **Control computer** in the dialog (Fig. 5-65).

Setting a value of **16** for the variable (the channel) activates the shunt and **0** deactivates it again.

Activation via variable

Click on **Shunt cal.** Activate **At variable value** in the dialog (Fig. 5-65) and specify the variable to be used.

Any variable value > 0.5 activates the shunt.

5.19

Q.bloxx-EC A123: Connecting sensors

DANGER



The cables to be connected or disconnected may carry voltages of up to 1200V!

Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

The Q.bloxx-EC module A123 can be used in the categories CAT II up to 1000V and CAT III up to 600V and has four electrically isolated analog inputs. The connection sockets have numbers for identifying the channels; the rated input voltage is also stated.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

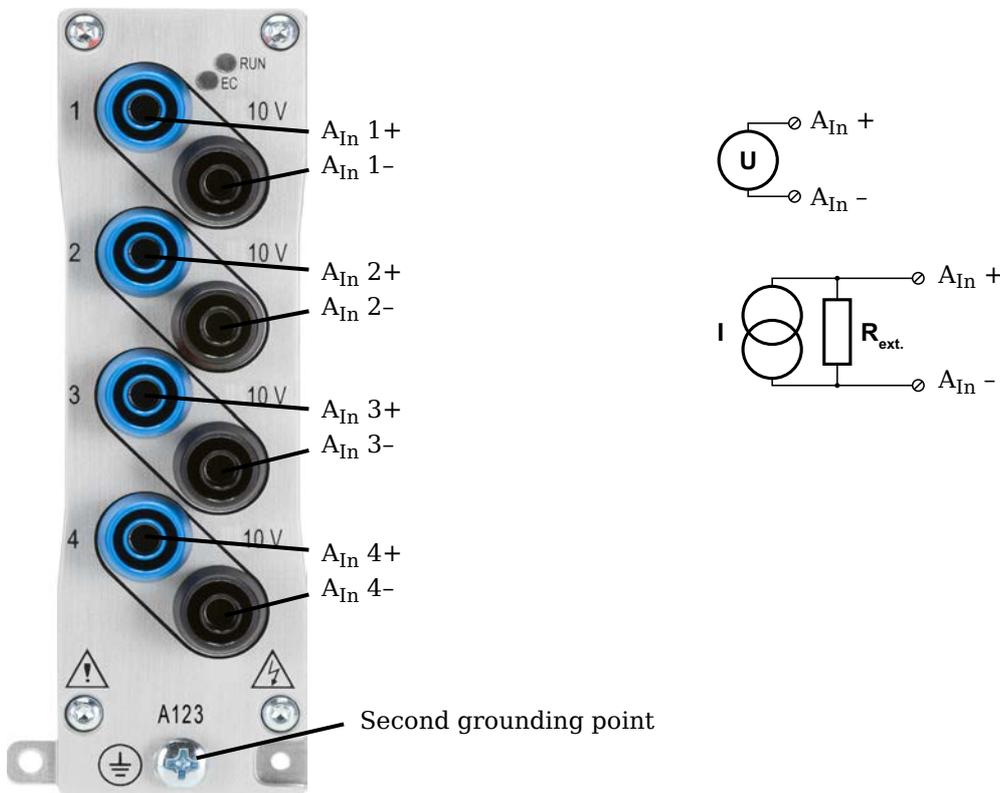


Fig. 5-66 Terminal assignment for Q.bloxx-EC Module A123.

DANGER

The module must also be grounded using the grounding point on the front panel, because the side housing and front panel consist of two parts.

Before connecting measuring cables, connect **both** grounding points to the protective earth or ground potential.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.19.1**Voltage**

You can measure voltage differences of up to $\pm 10\text{V}$. The voltage level (the potential) may be up to 1200V_{DC} .

! IMPORTANT

Voltage differences which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

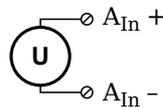


Fig. 5-67 A123, voltage measurement.

5.19.2**Current**

You need an (external) shunt resistance for the current measurement.

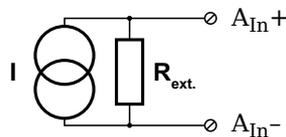


Fig. 5-68 A123, current measurement using an external shunt resistance.

5.20

Q.bloxx-EC A124: Connecting sensors

DANGER



The cables to be connected or disconnected may carry voltages of up to 1200V!

Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

The Q.bloxx-EC module A124 can be used in the categories CAT II up to 1000V and CAT III up to 600V and has four electrically isolated analog inputs for thermocouples.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

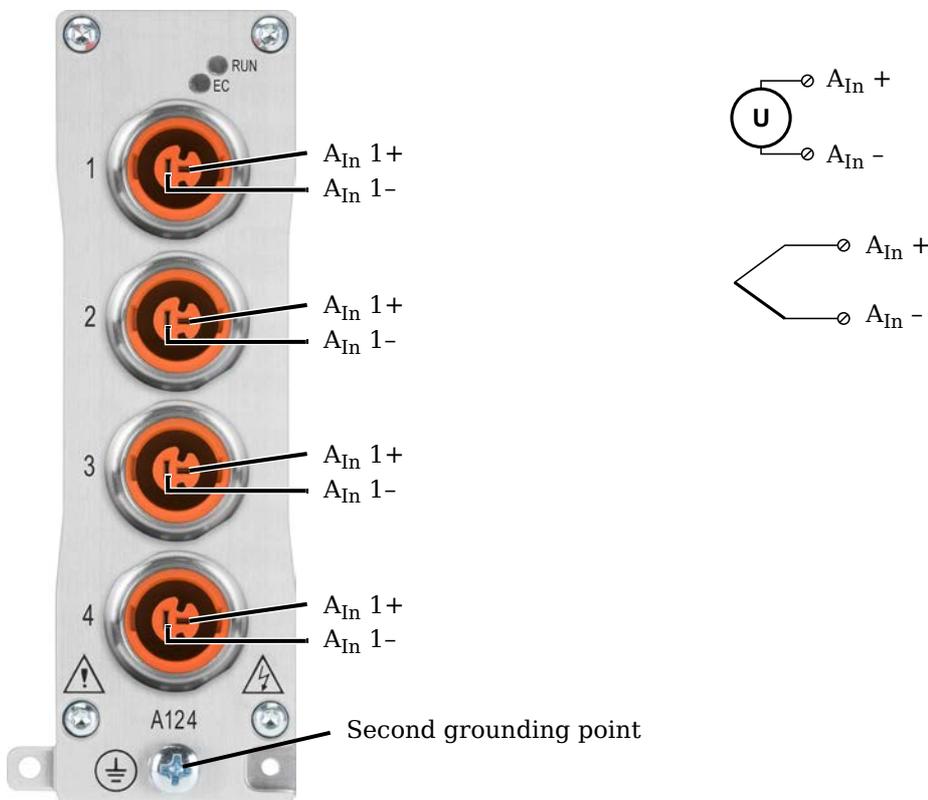


Fig. 5-69 Terminal assignment for Q.bloxx-EC Module A124.

DANGER

The module must also be grounded using the grounding point on the front panel, because the side housing and front panel consist of two parts.

Before connecting measuring cables, connect *both* grounding points to the protective earth or ground potential.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.20.1**Voltage**

You can measure voltage differences of up to $\pm 80\text{mV}$. The voltage level (the potential) may be up to 1200V_{DC} .

! IMPORTANT

Voltage differences which exceed the admissible limits produce incorrect measurement data, because the inputs are protected against overvoltages and limit the input voltage.

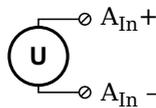


Fig. 5-70 A124, voltage measurement.

5.20.2**Thermocouple**

Thermocouples can be connected directly; the comparative measuring point (cold junction compensation) is integrated in the module plug. You can connect the following types of thermocouple: B, E, J, K, L, N, R, S, T and U.

Alternatively, you can also use two thermocouples or a reference temperature source.

i Tip

You will find information on the comparative measuring point and on the measurement with a reference temperature source in Section 6.5, *Measuring with thermocouples*, page 128.

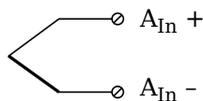


Fig. 5-71 A124, measurement with a thermocouple.

5.21

Q.bloxx-EC A127: Connecting sensors

DANGER



The cables to be connected or disconnected may carry voltages of up to 1200V!

Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

The Q.bloxx-EC module A127 can be used in the categories CAT II up to 1000V and CAT III up to 600V and has four electrically isolated analog inputs. The connection sockets have numbers for identifying the channels; the rated input voltage is also stated.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

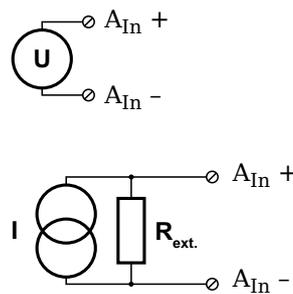
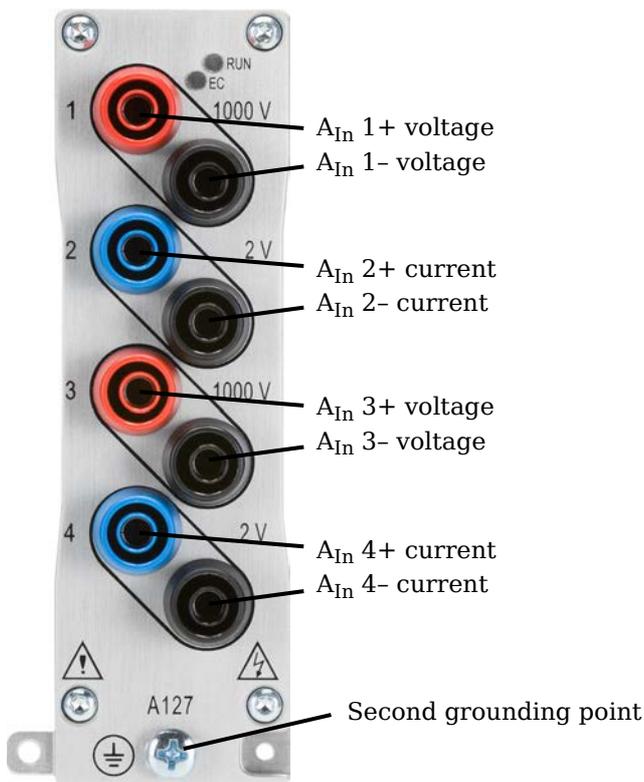


Fig. 5-72 Terminal assignment for Q.bloxx-EC Module A127.

DANGER

The module must also be grounded using the grounding point on the front panel, because the side housing and front panel consist of two parts.

Before connecting measuring cables, connect *both* grounding points to the protective earth or ground potential.

i Tip

Further information on transducers and sensors can also be found in Chapter 7 ff. page 116.

5.21.1**Voltage**

You can measure voltage differences of up to $\pm 1200\text{V}$. Here, various input voltage ranges from $\pm 40\text{V}_{\text{DC}}$ to $\pm 1200\text{V}_{\text{DC}}$ are possible. The voltage level (the potential) may be up to 1200V_{DC} .

NOTICE

Voltages above 1200V can damage the module.

Each module is tested with a test voltage of 5kV_{DC} for one minute. A longer duration or a higher voltage can damage the module. In addition, each period of overvoltage reduces the service life of the module.

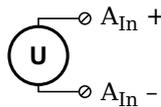


Fig. 5-73 A127, measurement of voltage.

! IMPORTANT

Voltages which exceed the admissible limits give incorrect measurement data, because the input voltage is internally limited.

5.21.2**Current****NOTICE**

Confusing the current and voltage inputs can damage the module and/or the external load resistance.

Make sure that no high voltages are applied to the current inputs. The voltage drop must not be beyond $\pm 2.4\text{V}$.

You need an (external) shunt resistance for the current measurement.

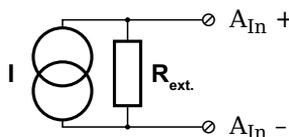


Fig. 5-74 A127, current measurement using an external shunt resistance.

5.22

Q.bloxx-EC A128: Connecting sensors

⚠ DANGER



The cables to be connected or disconnected may carry voltages of up to 1200V!

Before connecting or disconnecting cables make sure that all sources of power are Locked Out.

The Q.bloxx-EC module A128 can be used in the categories CAT II up to 1000V and CAT III up to 600V and has four electrically isolated analog inputs. The connection sockets have numbers for identifying the channels; the rated input voltage is also stated.

Measurement ground (-) and the (module) supply voltage are electrically isolated in the module.

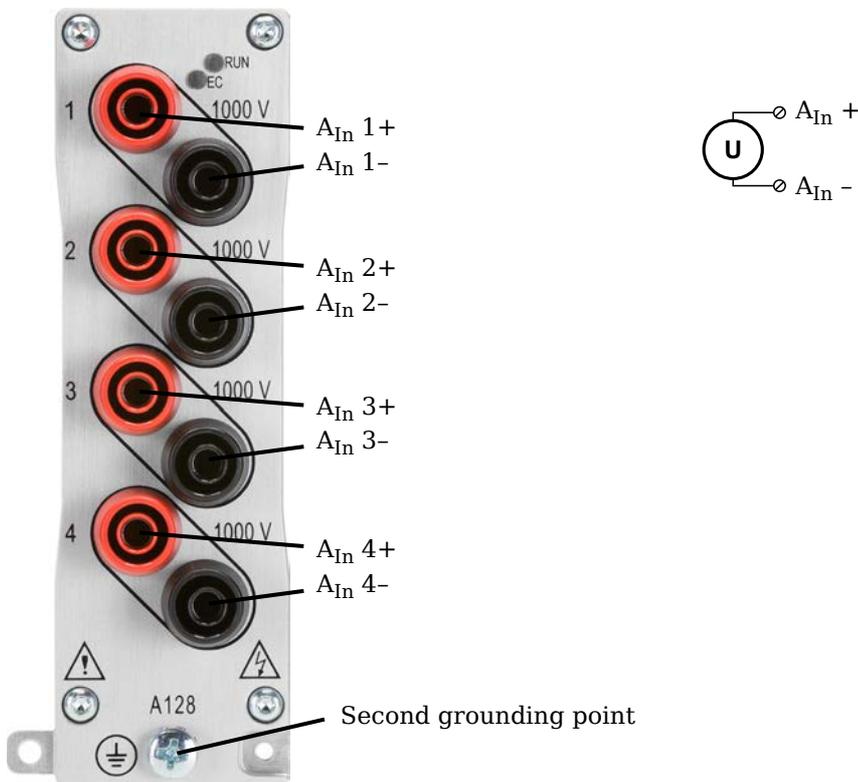


Fig. 5-75 Terminal assignment for Q.bloxx-EC Module A128.

⚠ DANGER

The module must also be grounded using the grounding point on the front panel, because the side housing and front panel consist of two parts.

Before connecting measuring cables, connect *both* grounding points to the protective earth or ground potential.

5.22.1

Voltage

You can measure voltages of up to $\pm 1200V_{DC}$. Here, various input voltage ranges from $\pm 40V_{DC}$ to $\pm 1200V_{DC}$ are possible.

NOTICE

Voltages above 1200V can damage the module.

Each module is tested with a test voltage of $5kV_{DC}$ for one minute. A longer duration or a higher voltage can damage the module. In addition, each period of overvoltage reduces the service life of the module.

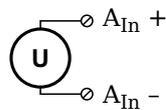


Fig. 5-76 A128, voltage measurement.

! IMPORTANT

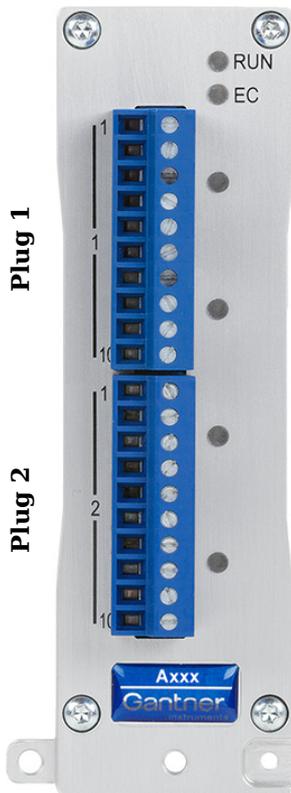
Voltages which exceed the admissible limits give incorrect measurement data, because the input voltage is internally limited.

5.23

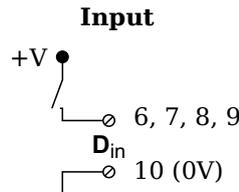
Q.bloxx-EC D101: Connecting I/O

The Q.bloxx-EC Module D101 has eight digital inputs and eight digital outputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections.

The designations 0 V and +V refer to the (external) supply voltage connections.



- | | |
|----|--------------------|
| 1 | +V |
| 2 | D _{Out} 1 |
| 3 | D _{Out} 2 |
| 4 | D _{Out} 3 |
| 5 | D _{Out} 4 |
| 6 | D _{In} 1 |
| 7 | D _{In} 2 |
| 8 | D _{In} 3 |
| 9 | D _{In} 4 |
| 10 | 0V |
-
- | | |
|----|--------------------|
| 1 | +V |
| 2 | D _{Out} 1 |
| 3 | D _{Out} 2 |
| 4 | D _{Out} 3 |
| 5 | D _{Out} 4 |
| 6 | D _{In} 1 |
| 7 | D _{In} 2 |
| 8 | D _{In} 3 |
| 9 | D _{In} 4 |
| 10 | 0V |



+V must be between 12 V and 30 V

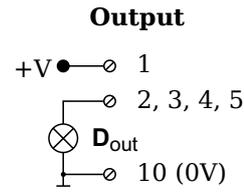


Fig. 5-77 Pin assignment for Q.bloxx-EC Module D101.

5.23.1

Digital input and output

On each connecting plug contacts for four inputs and four outputs are available. Since the inputs and outputs of this module are electrically isolated from the supply voltage, you must also connect 0V for the inputs and 0V and a supply voltage (+V) for the outputs.

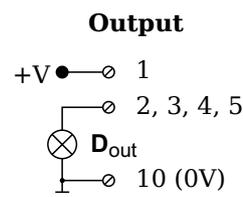
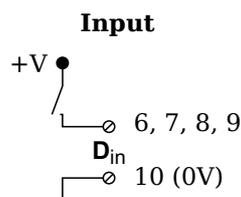


Fig. 5-78 D101, digital input and output.

The digital input is active (high level) when the applied signal voltage lies above the (programmable) threshold.

The following table shows possible combinations of contact assignments for the inputs:

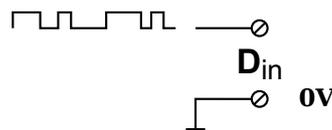
| Plug.Contact | | | | | | | |
|--------------------------------|--------|--------------------------------|--------|--------------------------------|--------|--------------------------------|--------|
| 1.6 | 1.7 | 1.8 | 1.9 | 2.6 | 2.7 | 2.8 | 2.9 |
| Status | Status | Status | Status | Status | Status | Status | Status |
| Status | Status | Status | Status | Status | Status | 2-channel signal ¹⁾ | |
| Status | Status | Status | Status | 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | |
| Status | Status | 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | |
| 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | | 2-channel signal ¹⁾ | |
| 8-channel signal ²⁾ | | | | | | | |

1) e.g. counter with additional input for counting direction or 2-phase counter signals or frequency measurement with direction detection (torque transducers)

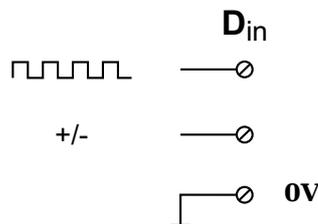
2) e.g. sensors with binary coding

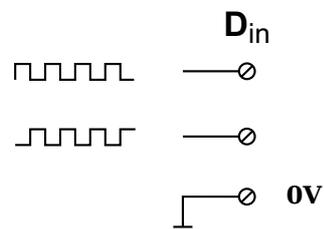
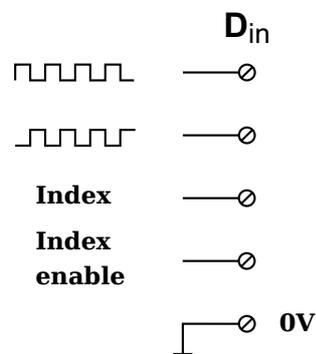
The following block diagrams give you an overview of the possible circuits.

Measurement of status, time, frequency or PWM (Pulse-Width Modulation), 1 signal



Up/down counter or measurement of frequency and direction with static direction signal, 2 signals



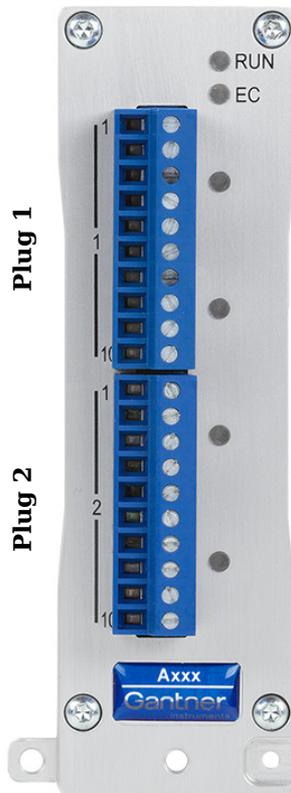
Measurement of frequency and direction or up/down counter with 2-channel frequency signal (90° phase delay)**Measurement of frequency and direction or up/down counter with 4-channel frequency signal**

5.24

Q.bloxx-EC D104: connecting digital inputs

The Q.bloxx-EC Module D104 has sixteen digital inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

The designations 0 V and +V refer to the (external) supply voltage connections, NC indicates “not assigned”.



- | | |
|----|-------------------|
| 1 | NC |
| 2 | D _{In} 1 |
| 3 | D _{In} 2 |
| 4 | D _{In} 3 |
| 5 | D _{In} 4 |
| 6 | D _{In} 5 |
| 7 | D _{In} 6 |
| 8 | D _{In} 7 |
| 9 | D _{In} 8 |
| 10 | 0V |
| 1 | NC |
| 2 | D _{In} 1 |
| 3 | D _{In} 2 |
| 4 | D _{In} 3 |
| 5 | D _{In} 4 |
| 6 | D _{In} 5 |
| 7 | D _{In} 6 |
| 8 | D _{In} 7 |
| 9 | D _{In} 8 |
| 10 | 0V |

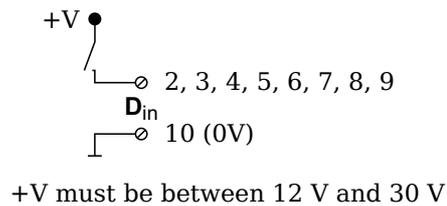


Fig. 5-79 Pin assignment for Q.bloxx-EC Module D104.

5.24.1

Digital input

On each connecting plug contacts for eight inputs are available. Since the inputs of this module are electrically isolated from the power supply, you must also connect 0V and a supply voltage (+V).

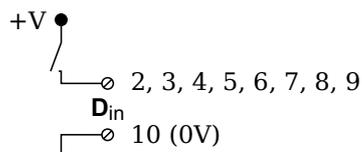


Fig. 5-80 D104, digital input.

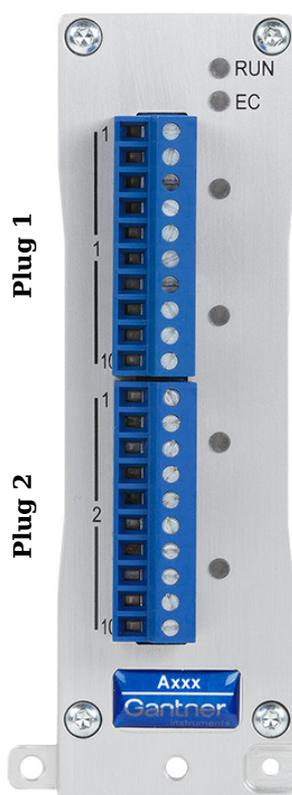
The digital input is active (high level) when the applied signal voltage lies above the (programmable) threshold.

5.25

Q.bloxx-EC D105: connecting digital outputs

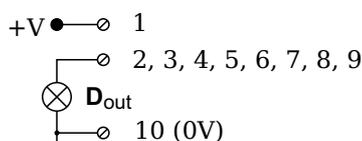
The Q.bloxx-EC Module D105 has sixteen digital outputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

The designations 0 V and +V refer to the (external) supply voltage connections.



- 1 +V
- 2 D_{Out} 1
- 3 D_{Out} 2
- 4 D_{Out} 3
- 5 D_{Out} 4
- 6 D_{Out} 5
- 7 D_{Out} 6
- 8 D_{Out} 7
- 9 D_{Out} 8
- 10 0V

- 1 +V
- 2 D_{Out} 1
- 3 D_{Out} 2
- 4 D_{Out} 3
- 5 D_{Out} 4
- 6 D_{Out} 5
- 7 D_{Out} 6
- 8 D_{Out} 7
- 9 D_{Out} 8
- 10 0V



+V must be between 12 V and 30 V

Fig. 5-81 Pin assignment for Q.bloxx-EC Module D105.

5.25.1

Digital output

On each connecting plug contacts for eight outputs are available. Since the outputs of this module are electrically isolated from the power supply, you must also connect 0V and a supply voltage (+V) for the outputs.

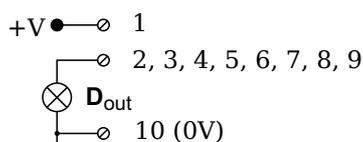


Fig. 5-82 D105, digital output.

5.26

Q.bloxx-EC D107: Connecting digital inputs

The Q.bloxx-EC Module D107 has sixteen digital inputs. The pin assignment of the two connector strips is identical and the connection terminals have numbers for identifying the connections. You will find the associated figures in each case at the same place in the circuit diagrams, for example each of the figures quoted in the second place belong to one possible connection method.

The designations 0 V (GND) and +V refer to the supply voltage connections for supplying the sensors. NC signifies “No Connection”. Both terminals are electrically isolated from one another and from the module supply voltage.

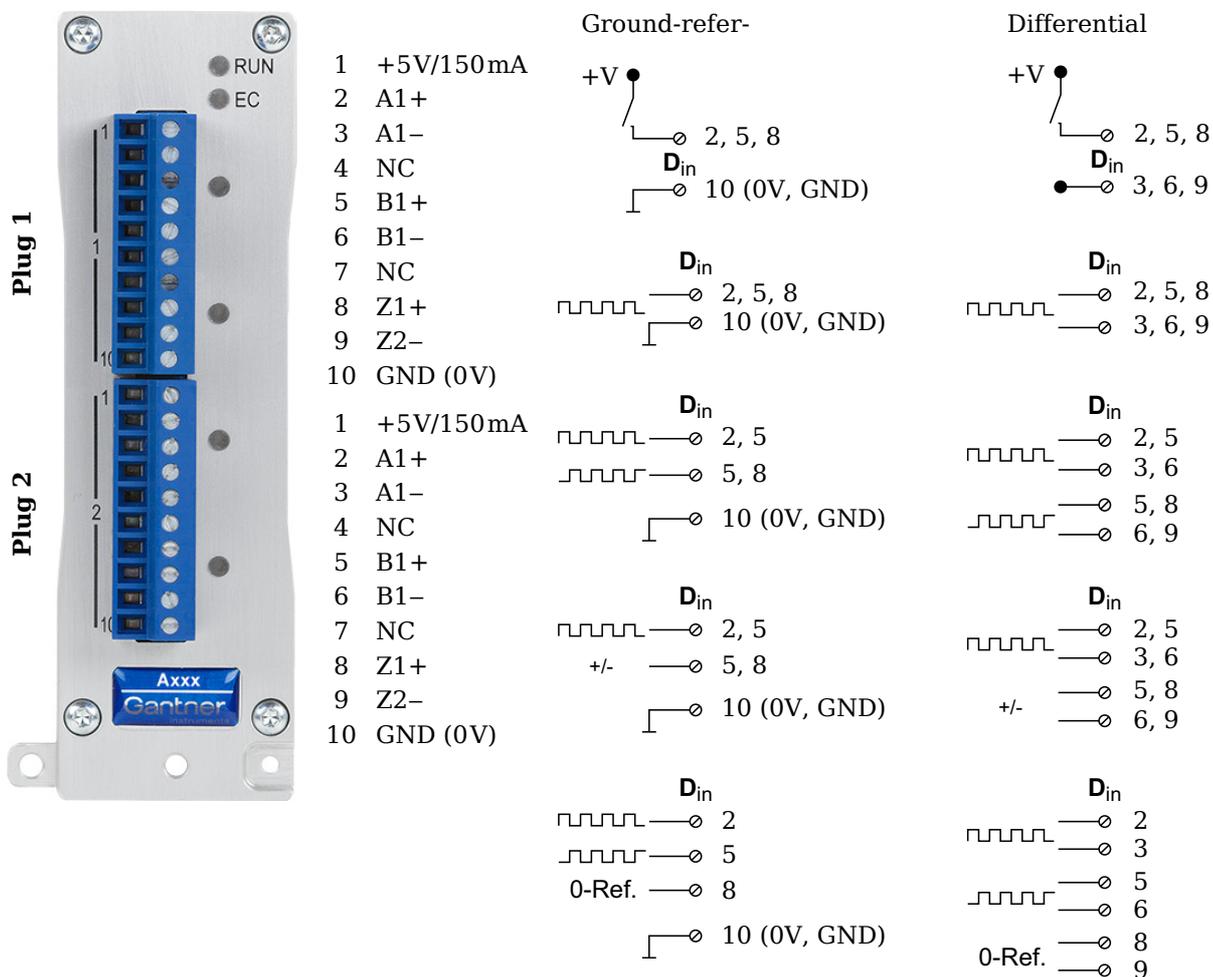


Fig. 5-83 Pin assignment and circuit variants for the Q.bloxx-EC Module D107.

5.26.1

Digital input

On each connecting plug contacts for three inputs are available. You can use the inputs as a differential input or as a ground-referenced (single-ended) input. Since in each case the inputs termi-

nals are electrically isolated from one another and from the supply voltage, you also have to connect GND (0V) even with differential inputs.

A supply voltage (+V) of 5V and max. 150mA per terminal is available for supplying the connected sensors.

The digital input is active (high level) when the applied signal voltage lies above the threshold. In the differential measurement mode the threshold can be set in 256 steps between -20V and +20V, otherwise between 0V and +26V.

The following table shows possible combinations of contact assignments for the inputs on Plug 1 (Dx = Sensor x):

| Operating mode | Plug.Contact (assignment) | | | | | | |
|--|---------------------------|------------------|------------------|------------------|------------------|------------------|--------------|
| | 1.2 (A1+) | 1.3 (A1-) | 1.5 (B1+) | 1.6 (B1-) | 1.8 (Z1+) | 1.9 (Z1-) | 1.10 (0V) |
| 3 x standard ¹⁾ , differential | D1 ₁₊ | D1 ₁₋ | D2 ₁₊ | D2 ₁₋ | D3 ₁₊ | D2 ₁₋ | GND |
| 3 x standard, single-ended | D1 ₁₊ | — | D2 ₁₊ | — | D3 ₁₊ | — | GND |
| 1 x 2 sensor signals ²⁾ + 1 x standard, differential | D1 ₁₊ | D1 ₁₋ | D1 ₂₊ | D1 ₂₋ | D2 ₁₊ | D2 ₁₋ | GND |
| 1 x 2 sensor signals + 1 x standard, single-ended | D1 ₁₊ | — | D1 ₂₊ | — | D2 ₁₊ | — | GND |
| 1 x 3 sensor signals ²⁾ , dif- ferential | D1 ₁₊ | D1 ₁₋ | D1 ₂₊ | D1 ₂₋ | D1 ₃₊ | D1 ₃₋ | GND |
| 1 x 3 sensor signals, sin- gle-ended | D1 ₁₊ | — | D1 ₂₊ | — | D1 ₃₊ | — | GND |

1) e.g. status input, frequency measurement or counter

2) e.g. counter with additional input for counting direction (forwards/reverse counter) or 2-phase counter signals (quadrature counter) or frequency measurement with direction detection (torque transducers)

3) e.g. 2-phase counter signal or angle sensor with additional input for zero reference

The following illustrations show examples for the connection of various sensors. Here, in each case only one sensor and one variant is shown. For example, for the sensor in Fig. 5-85 or Fig. 5-86 you can also use connections 5/6 and 8/9 and the connections 2/3 for a standard sensor or digital input. The connection of a single digital input is not considered in illustrations. If you are connecting more than one sensor per terminal, you can mix ground-referenced and differential configurations.

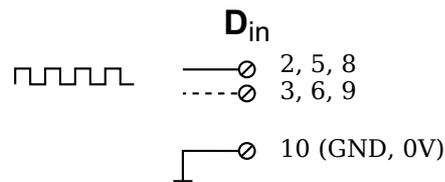


Fig. 5-84 D107, sensor with one signal, single-ended or differential (input broken line).

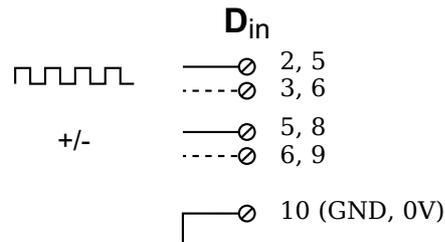


Fig. 5-85 D107, sensor with two signals (counting direction), single-ended or differential (input broken line).

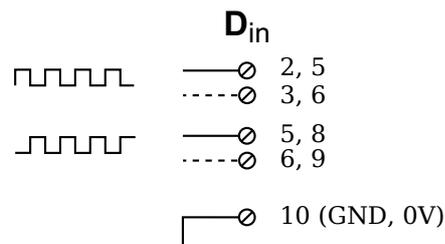


Fig. 5-86 D107, sensor with two signals (90° offset), single-ended or differential (input broken line).

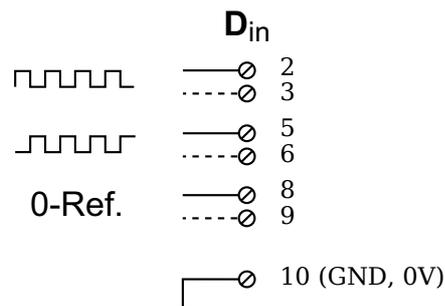


Fig. 5-87 D107, sensor with three signals (2 x 90° offset and zero reference), single-ended or differential (input broken line).

6

Configuration

Configuration is most easily carried out with the program ICP 100 (from Version 3.2.21). You can also carry out a configuration via the EtherCAT master. However, since the terms are kept very short, e.g. **Cfg: Ch1 > MeasTyp** for the selection of the sensor type, we recommend configuration with the graphically guided configuration software ICP 100.

6.1

Configuration via ICP 100

For the program a license number is needed which you have to enter to be able to save configurations. If you have installed the Gantner test.commander software, the ICP 100 software is also installed and is released when test.commander is licensed. You will find the license numbers in the PDF file enclosed with the supplied items and on the separate printout with your license data.

! **IMPORTANT**

If you would like to combine modules from older applications and recently purchased ones, all components should use the latest relevant internal software, the so-called firmware. To ensure this, carry out a firmware update; refer to Section 6.1.12, page 101.

Basic procedure

- Establish the connection (communication) between the PC and module; refer to Section 5.5, page 26.
- Start the program.
- Define the communication parameters.
- Enter the sensors used and their sensitivities to obtain an indication in the measured physical quantity.
- Define computations, digital inputs/outputs, alarm monitoring, etc.
- Activate all settings in the modules.

i **Tip**

At many points in the programs you can call the setting dialogs or settings via the context menu of an entry. You call the context menu with the right mouse key.

If you already have a configuration file with the required settings available, you can load this file into the relevant module with the program ICP 100.

6.1.1

Installing the ICP 100

- ➔ We recommend that you close all open programs before the installation.

Insert the Gantner CD into your CD drive. In the standard configuration Windows opens the CD automatically and a start window appears. If you have deactivated the Windows autostart function, find the file StartUp.exe in the main directory on the CD and give the corresponding symbol a double click to obtain the start window. Alternatively, you can also start the program Setup.exe in the folder ICP100 to carry out the installation directly.

You will also find the relevant latest versions of the programs on our home page www.gantner-instruments.com via **Software > Download**.

Procedure

- Click on the symbol over **Load software**.
- Click on the symbol  next to the program which you want to install.
The program Setup.exe is started.
- Allow the file to open so that the installation can start.
The starting dialog of the setup program appears.
- Follow the instructions of the setup program to define the installation directory and the program group for the software.
Setup.exe creates the directory you have specified, if necessary and then copies all files to it.

When the program is started for the first time, you specify the language for the program user interface (you can change your selection at any time via **Utilities > Settings > Language**).

Then enter your license data via **Help > Info** and **Licensing**. If you have licensed the program test.commander, then the program ICP 100 is also enabled and a further license is not required.

6.1.2

Set communication parameters

Once you have connected the PC to the bus coupler through USB and have started the ICP 100 program, you have to specify in the program the interface to be used.

1. Select **Communication > Parameters**.
2. Specify the interface for the connection, e.g. **COM5** (Fig. 6-1). Refer also to Section 5.5, page 26. During the installation of the interface driver for USB, the connection is displayed. Also activate **“Use scan for SNR”**, because, as delivered, all modules have the address 1. If you change the addresses during configuration so that each module receives its own address, you can later deactivate the option.

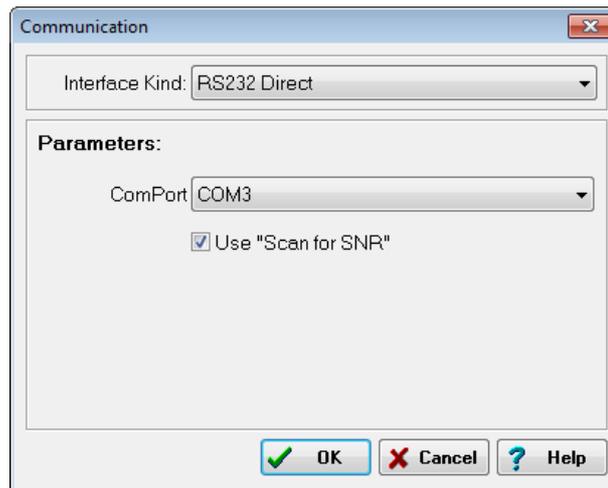


Fig. 6-1 Specifying the interface.

3. Start with **File > Bus scan** or click on  the interrogation of the modules connected to the bus coupler. The modules found are displayed (Fig. 6-2). If not all modules are displayed, check whether the module RUN-LED is lit. If not, either the module is not correctly connected to the previous module or it is defective.

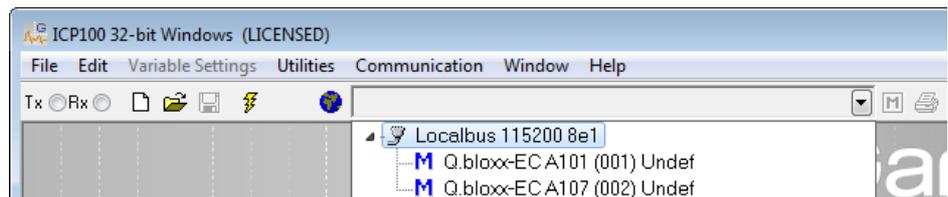


Fig. 6-2 Listing the modules found.

For configuration select from the list of modules the one you want. Then carry out all the module settings in the window that is then displayed.

You can also call several windows for several modules. The **Windows** menu includes submenus to assign the individual windows.

6.1.3

Setting sensor parameters

In order to set parameters you should be connected to the module and have called the configuration program ICP 100. For configuration select the module you want from the list of modules. Then carry out all the module settings in the window that is then displayed.

All module signals are defined as variables. Therefore, for the entry activate the tab **Variable definition**.

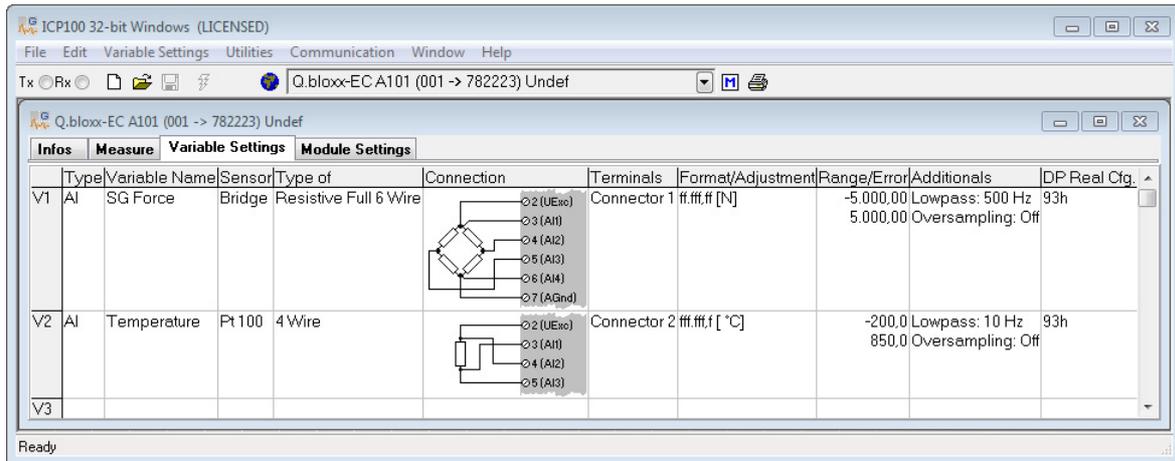


Fig. 6-3 Dialog with the configuration for force transducers (6-wire) and voltage input.

Procedure

1. Click in the column **Type** of the first row (V1 = Variable 1) or mark the row (click on V1) and use **Variable definition > Type**.
2. Select **Analog. Input**.
3. Click in the column **Variable name** and allocate a name identifying the signal from the connected sensor. Note that in the PDO mapping only the first four characters of the name are used; the channels are then e.g. Vari_0, Vari_1, etc.
4. Click in the column **Sensor** and specify the type of sensor. Depending on the type of module, you have various options available, e.g. **Bridge** for strain-gauge full and half-bridges, **Pt100**, **Resistance** for resistors or **Voltage** for voltage measurements and IEPE sensors.
5. Click in the column **Type of** and specify the type of circuit or further information about the sensor type. Depending on the selected sensor type, you have various options available, e.g. **2-wire** or **4-wire** (circuit) for resistive transducers or **Full 4-wire** or **Full 6-wire** (circuit) for strain-gauge full bridges. The column **Wiring diagram** shows you the pin assignment to be used. With more than one input the first inputs are also

always occupied first (and first Plug 1, then Plug 2, etc.).
Check that your sensor is connected correctly.

6. Click in the column **Format/balance** to enter the scaling for the sensor.

Depending on the type of sensor selected, you have various options available (refer also to Section 6.3, *Sensor scaling*, page 125):

- For voltage signals specify the conversion of the measured voltage to the physical quantity measured by the sensor or output the measured voltage quantity without conversion (scaling).
- For thermocouples or Pt100 sensors no further scaling is required as the conversion into °C is made automatically. The scaling is only needed when you want to convert to °F or K. In this case enter the **Unit** (type into the field) and then click on **Scaling**. Using the method **Factor and offset**. For a display in °F enter the factor **1.8** and **32** as the offset. For a display in °K enter the factor **1** and **-273.15** as the offset.
- For full and half-bridge transducers you can obtain the data from the data sheet or (better) from the transducer calibration certificate. For a force transducer with, for example, 2.03mV/V at 5kN enter the **Unit** (type **kN** in the field) and then click on **Scaling**. Using the method **2-point calibration**. Enter in each case **0** for **Point 1** for **Measurement** and **Displayed value** and **2.03** as **Measurement** and **5** as **Displayed measurement** for **Point 2**.
Alternatively, you can also enter **N** as **Unit** and then **5000** as **Displayed value** for **Point 2**.
- For strain gauges you have the **Strain gauge calculator** available. Here, the unit is automatically changed to µm/m. In the dialog enter the gauge factor of your strain gauge (left field) and the bridge factor (right field) for your circuit.

Floating point numbers are always transferred as 4-byte values and further setting is not necessary here.

For the formats **Integer** (2 bytes) and **Long integer** (4 bytes) specify the number of **Decimal** places and the total number of places to be output (**Field length**). The field length is calculated including the points, but without any commas displayed for the thousands positions and it is only used for representation in one of the Gantner programs. Specifying three decimal places displays, for example, the value 1234 as 1,234. After closure of the dialog the number of transferred places and the unit are displayed in the column **Format/balance**,

e.g. **ff,fff.f [kN]** for an output of a total of eight characters with two decimal places in the unit of kN and the decimal point.

If negative numbers occur, the display in this example is limited to -9,999.99 (eight characters without the comma).

7. Click in the column **Range/error** to limit the admissible value range and to define the reaction in the case of an error (optional).
8. Also optionally, you can specify in the **Other** column filtering of the sensor signal or the oversampling (refer to Section 6.1.11, page 100).
9. Save the settings with **File > Send to module** or click on . You can also save the settings in a file on the PC using **File > Save to file** so that you can load this configuration in the module again later.

6.1.4

Carrier frequency synchronization (Q.bloxx-EC D106)

The D 106 module supports the supply of sensors with direct voltage (DC) or carrier frequency (CF).

- ➔ If you are using several modules of this type and set carrier frequency supply, you should synchronize the carrier frequencies of the modules, because otherwise crosstalk can occur between the supply lines and the signal inputs of different modules. This then leads to beats in the measurement signal.

After selecting a carrier frequency, you have three methods of supply:

1. No sync.(hronization)
This setting is practicable when you are only using one module with carrier frequency supply. Within a module all carrier frequency generators are automatically synchronized.
2. Internal sync.(hronization)
Set this type of synchronization for *one* module. The module then becomes the master to which all other modules synchronize.
3. External sync.(hronization)
Specify this type of synchronization for all other modules so that they synchronize to the master.

Save the settings with **File > Send to module** or click on .

Tip

We recommend that only one variant of the carrier frequency is used, i.e. do not mix 600Hz and 4800Hz.

6.1.5

Zero balancing/taring the sensor

You have two ways of setting a measurement offset to zero, e.g. due to preloads:

1. Zero balance

With this method measurement takes place over a certain time period and the mean is computed. This mean value is then subtracted from all the following measurements.

2. Taring

With this method the (single) measurement present at a certain point in time is subtracted from all the following measurements.

Procedure

1. Click in the column **Type** of the first free row (V3 = Variable 3 in Fig. 6-4) or mark the row (click on V3) and use **Variable definition > Type**.
2. Select **Default**.
3. Click in the column **Variable name** and allocate a name specifying the purpose of the signal, e.g. Zero_tare (Fig. 6-4).

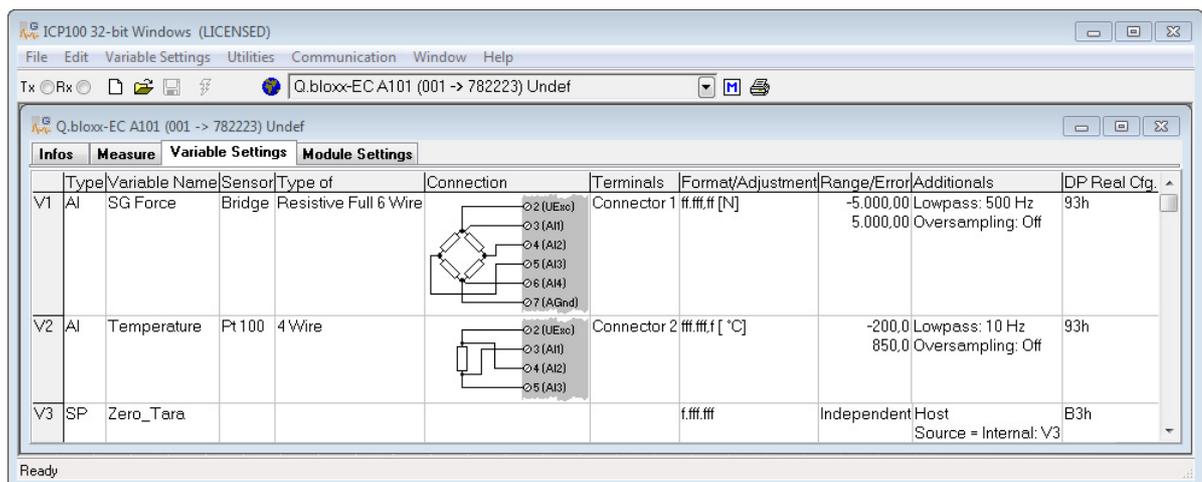


Fig. 6-4 Defining the variable for zero balancing and/or taring.

4. Click in the column **Format/balance** of the channel for which zero balancing and/or taring is to be executed, e.g. for the strain-gauge force sensor in Fig. 6-4.

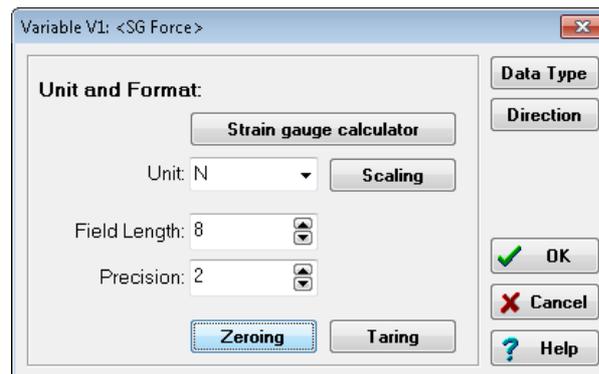


Fig. 6-5 Dialog for sensor scaling.

5. Click on **Zero balance** or **Tare** to configure the relevant process.
6. Select the variable created above as the control variable (Fig. 6-6).

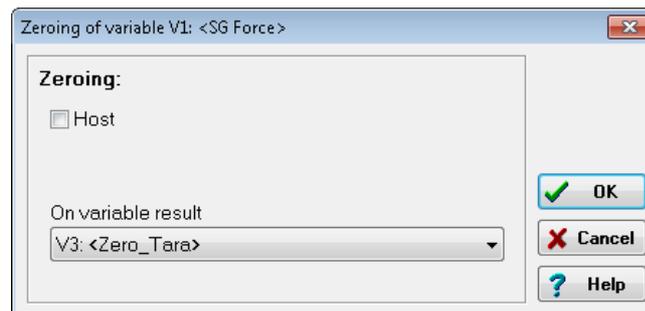


Fig. 6-6 Setting up zero balance or tare.

When the variable (Zero_tare in this example) has certain values, taring or zero balancing is carried out or an existing zero or tare value is deleted (undo zero balancing/taring):

| Value | Function |
|-------|---|
| 1 | Perform taring when setting the value |
| 2 | Reset tare (delete tare value) |
| 4 | Start zero balance The mean is formed until the value 0 is written to the variable again. |
| 8 | Reset zero balance (delete zero value) |

7. Save the settings with **File > Send to module** or click on .

6.1.6

Sensor scaling over several points (table)

In the standard setting (linear) sensors are scaled via a characteristic curve with two points. You can however also perform scaling over several points (table). During the measurement the values are then linearly interpolated between the specified points.

Procedure

1. Create the sensor as usual (two-point scaling).
2. In the **Sensor** column click on the sensor.
3. Copy the sensor (click on **Copy**) and specify a name, e.g. **ForceTable** (Fig. 6-7). If the scaling to be entered later only applies to this sensor, you should use the sensor type and the serial number as the name, e.g. **C2 #1234 (5V)**.

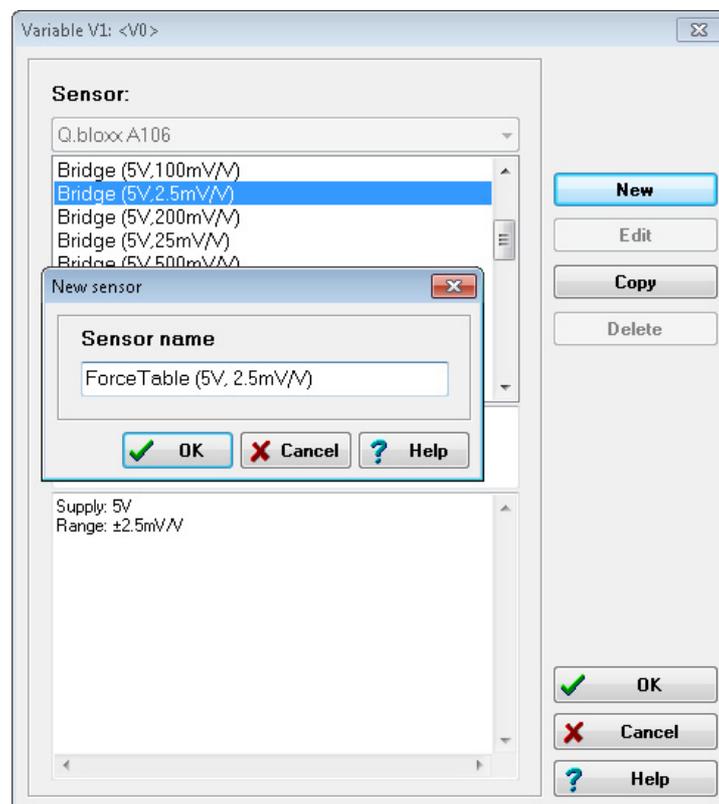


Fig. 6-7 Creating a new sensor for scaling.

4. Click on **Edit** and the **Unit** tab to be able to define the unit measured by your sensor (Fig. 6-8).

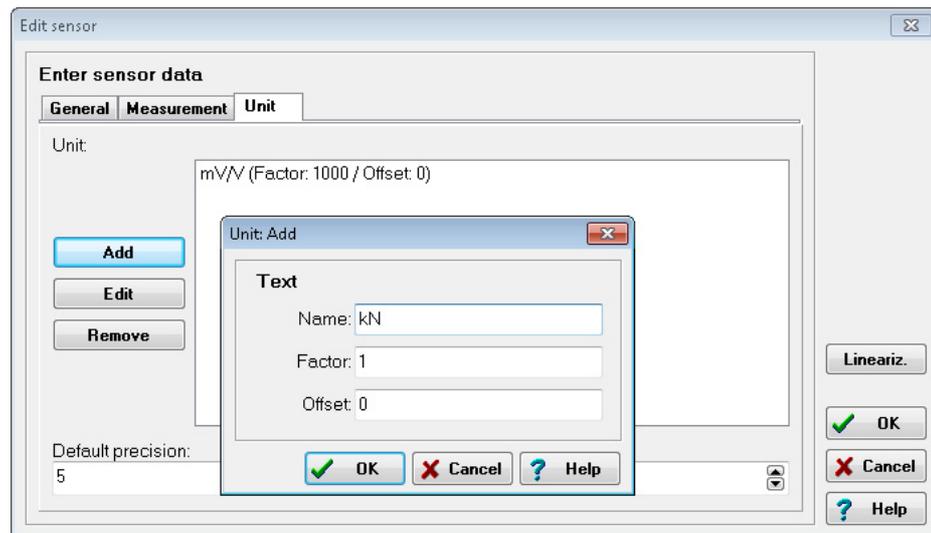


Fig. 6-8 Defining the unit for sensor scaling.

5. Specify the required unit, e.g. **kN** (Fig. 6-8).
6. Click on **Linearize** and select your unit.
7. Edit the existing values or generate further rows with **New** and specify the values for your sensor (Fig. 6-9). The rows sorted based on the entered values.

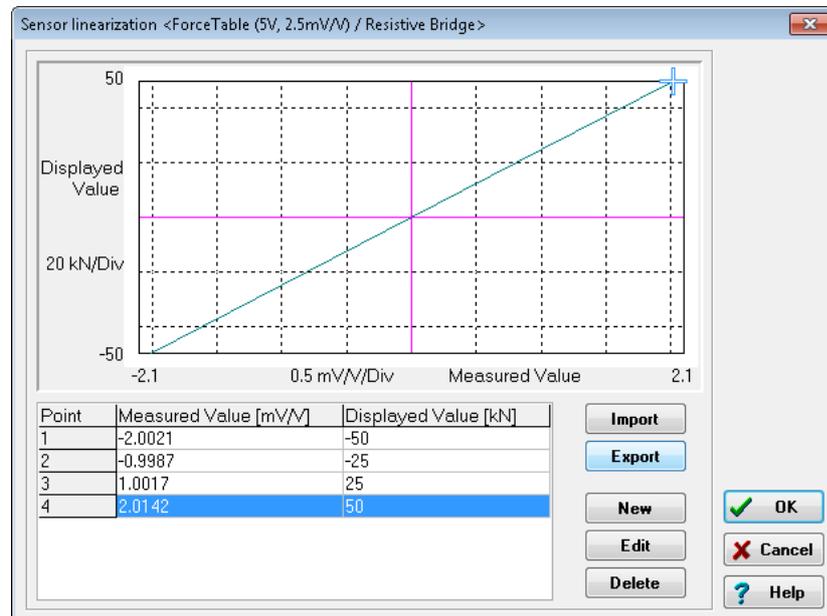


Fig. 6-9 Entering the scaling table.

If the data are present in an Excel file, you can also import a file in the format *Excel 97-2003-Workbook (*.xls)*.

Alternatively to entering a unit in step 5, you can leave the electrical unit of the sensor as it is and enter the table in this

unit, e.g. *mV/V measured value* and *mV/V displayed value*. You can then define the unit displayed for the measurement in the column **Format/balance** column.

8. Save the settings with **File > Send to module** or click on .

6.1.7

Specifying digital inputs/outputs

In order to set parameters you should be connected to the module and have called the configuration program ICP 100. For configuration select the module you want from the list of modules. Then carry out all the module settings in the window that is then displayed.

All module signals are defined as variables. Therefore, for the entry activate the tab **Variable definition**.

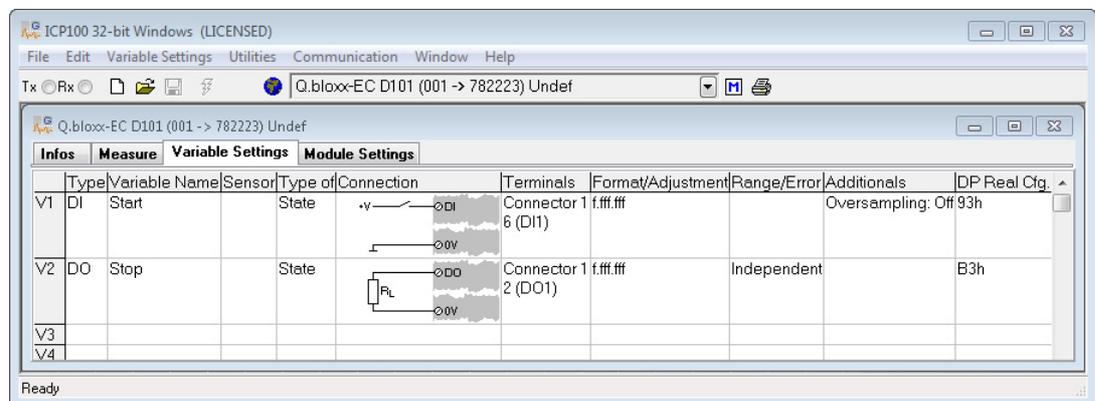


Fig. 6-10 Dialog with configuration for digital input and output.

Procedure

1. Click in the column **Type** of the first row (V1 = Variable 1) or mark the row (click on V1) and use **Variable definition > Type**.
2. Select **Digit. input** or **Digit. output**.
The column **Wiring diagram** shows you the pin assignment. With more than one input the first inputs are also always occupied first (first Plug 1, then Plug 2, etc.). Check for correct connection.
3. Click in the column **Variable name** and allocate a name identifying the signal. Note that in the PDO mapping only the first four characters of the name are used; the channels are then e.g. Vari_0, Vari_1, etc.
4. At a digital *output* click in the column **Type of** and specify whether you want to use the output as **Status** indicator, **Status field** or **Process output**.

Process output: The output monitors a module signal and changes the output level under certain conditions. Click in the column **Other** and specify the type of alarm monitoring.

You can specify up to four alarm conditions. When one of the conditions is satisfied (logical OR), the alarm signal is triggered.

To the left above the graphical displays select the levels at which switching is to occur and how they are to switch. Enter the values for the switching thresholds in the (scaled) unit of the selected signal. Use either fixed values (constants) or arrange for the values to be determined by other variables.

Status indicator: The output can be set via a command from the EtherCAT master. Click in the column **Other** and specify the type of alarm monitoring.

5. Click in the column **Format/balance** to specify the transfer format.

Since digital signals do not require any **Decimal** places, you can enter **0** here. **1** is sufficient for the **Field length**. With a digital input you can also specify a unit (optional).

For several inputs/outputs and the type **Status field (Type of column)**, as well as the transfer as a number (e.g. as integer), there is also the type **Status field 32** with which all existing inputs or outputs are transferred as binary numbers. Define a suitable field length here depending on the number of inputs and outputs.

When the dialog is closed, the number of transferred places and the unit in the column **Format/balance** are displayed.

6. Click in the column **Range/error** to define the reaction in the case of an error for the digital outputs (optional).
7. Save the settings with **File > Send to module** or click on . You can also save the settings in a file on the PC using **File > Save to file** so that you can load this configuration in the module again later.

6.1.8

Defining analog outputs

In order to set parameters you should be connected to the module and have called the configuration program ICP 100. For configuration select the module you want from the list of modules. Then carry out all the module settings in the window that is then displayed.

All module signals are defined as variables. Therefore, for the entry activate the tab **Variable definition**.

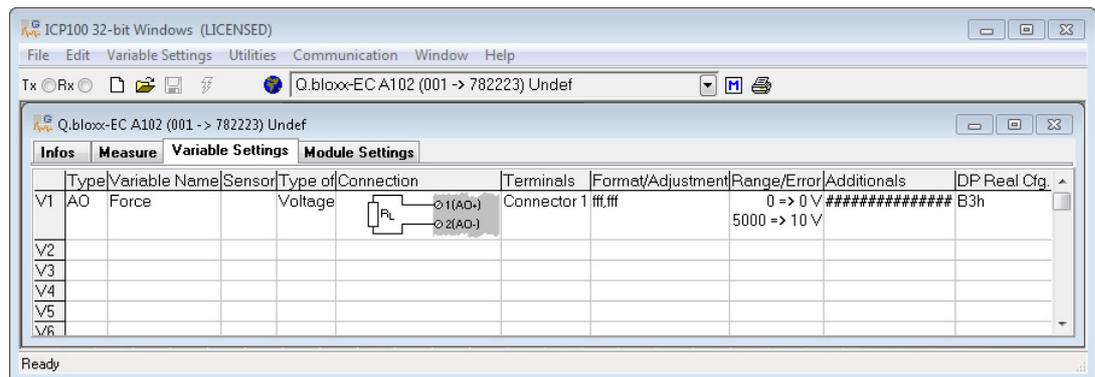


Fig. 6-11 Dialog with configuration for analog outputs.

Procedure

1. Click in the column **Type** of the first row (V1 = Variable 1) or mark the row (click on V1) and use **Variable definition > Type**.
2. Select **Analog. Output**.
The column **Wiring diagram** shows you the pin assignment. With more than one output the first outputs are also always occupied first (first Plug 1, then Plug 2, etc.). Check for correct connection.
3. Click in the column **Variable name** and allocate a name identifying the signal. Note that in the PDO mapping only the first four characters of the name are used; the channels are then e.g. Vari_0, Vari_1, etc.
4. Click in the column **Type of** and specify whether you want to use the output as a **Voltage** or a **Current** output.
5. In the **Format/balance** column the output format is shown which has no further significance here.
6. Click in the column **Range/error** to define the output scaling and the reaction in the case of an error (optional).
7. Click in the column **Other** to specify the signal source (variable) used for the output.
8. Save the settings with **File > Send to module** or click on . You can also save the settings in a file on the PC using **File > Save to file** so that you can load this configuration in the module again later.

6.1.9

Defining computations

In order to set parameters you should be connected to the module and have called the configuration program ICP 100. For configuration select the module you want from the list of modules. Then carry out all the module settings in the window that is then displayed.

All module signals are defined as variables. Therefore, for the entry activate the tab **Variable definition**.

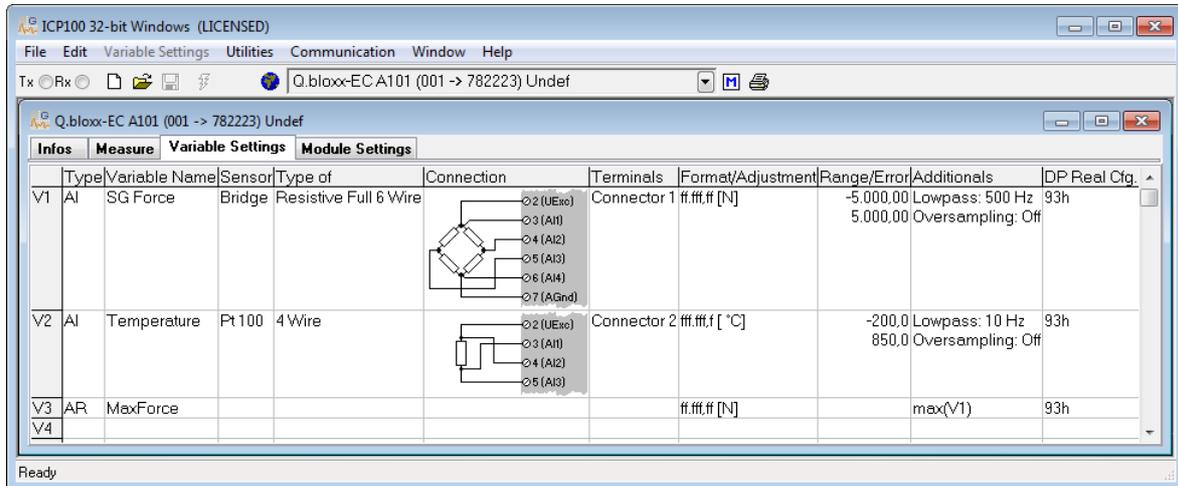


Fig. 6-12 Dialog with configuration for a computation (V4).

i Tip

Use the arithmetical function **selsyswer(0)** to count the number of telegrams with new data if your master fetches data more than once before a new Sync0 event is sent. The counter then contains the same number if no new data have been sent.

Procedure

1. Click in the column **Type** of the first free row (in the illustration V4 = Variable 4) or mark the row (click on V4) and use **Variable definition > Type**.
2. Select **Arithmetic**.
3. Click in the column **Variable name** and allocate a name identifying the signal. Note that in the PDO mapping only the first four characters of the name are used; the channels are then e.g. Vari_0, Vari_1, etc.

4. Click in the column **Other** and specify the required computation.

In the upper dialog field you can enter, as on a pocket calculator, a formula which uses the existing module variables. Create functions via the buttons in the lower section of the dialog. Click on **OK** once you have defined the required computation.

5. Click in the **Format/balance** column to specify the transfer format using the formats **Integer** (2 bytes) and **Long integer** (4 bytes).

Floating point numbers are always transferred as 4-byte values and further setting is not necessary here.

For the formats **Integer** and **Long integer** specify the number of **Decimal** places and the total number of places to be

output (**Field length**). The field length is calculated including the points, but without any commas displayed for the thousands positions and it is only used for representation in one of the Gantner programs. Specifying three decimal places displays, for example, the value 1234 as 1,234.

After closure of the dialog the number of transferred places and the unit are displayed in the column **Format/balance**, e.g. **ff,fff.f [N]** for an output in the unit N with a total of seven characters with one decimal place and the decimal separator. If negative numbers occur, the display in this example is limited to -9,999.9 (seven characters without the comma).

6. Save the settings with **File > Send to module** or click on . You can also save the settings in a file on the PC using **File > Save to file** so that you can load this configuration in the module again later.

6.1.10

Specifying the alarm monitoring

In order to set parameters you should be connected to the module and have called the configuration program ICP 100. For configuration select the module you want from the list of modules. Then carry out all the module settings in the window that is then displayed.

All module signals are defined as variables. Therefore, for the entry activate the tab **Variable definition**.

- ➔ In order to monitor a limit and to output a level on a digital output when an alarm occurs, you can directly use the function of the digital output. You do not need to set up any alarm monitoring. The alarm monitoring is used to monitor signals in the module and to make the result available to the PC or PLC as a preconditioned signal. Checking the original signal in the PC or PLC can therefore be omitted.

Procedure

1. Click in the column **Type** of the first row (V1 = Variable 1) or mark the row (click on V1) and use **Variable definition > Type**.
2. Select **Alarm**.
3. Click in the column **Variable name** and allocate a name identifying the alarm signal. Note that in the PDO mapping only the first four characters of the name are used; the channels are then e.g. Vari_0, Vari_1, etc.
4. Click in the column **Other** and specify the type of alarm monitoring.

You can specify up to four alarm conditions. When one of the conditions is satisfied (logical OR), the alarm signal is triggered.

To the left above the graphical displays select the levels at which switching is to occur and how they are to switch. Enter the values for the switching thresholds in the (scaled) unit of the selected signal. Use either fixed values (constants) or arrange for the values to be determined by other variables.

- Click in the column **Format/balance** to specify the transfer format.

Since the alarm signal, like digital signals, does not require any **Decimal** places, you can enter **0** here. **1** is sufficient for the **Field length**.

When the dialog is closed, the number of transferred places and the unit in the column **Format/balance**, e.g. **f**, are displayed.

- Save the settings with **File > Send to module** or click on . You can also save the settings in a file on the PC using **File > Save to file** so that you can load this configuration in the module again later.

6.1.11

Setting oversampling (XFC)

As explained in Section 4.6, page 19, the Q.bloxx-EC modules support the XFC Technology (eXtreme Fast Control Technology) from Beckhoff. It can be used to transfer several measurements per telegram for certain channels. You adjust the setting in the module configuration dialog in the **Other** column. In this column double-click on the relevant channel to call the setup dialog (Fig. 6-13).

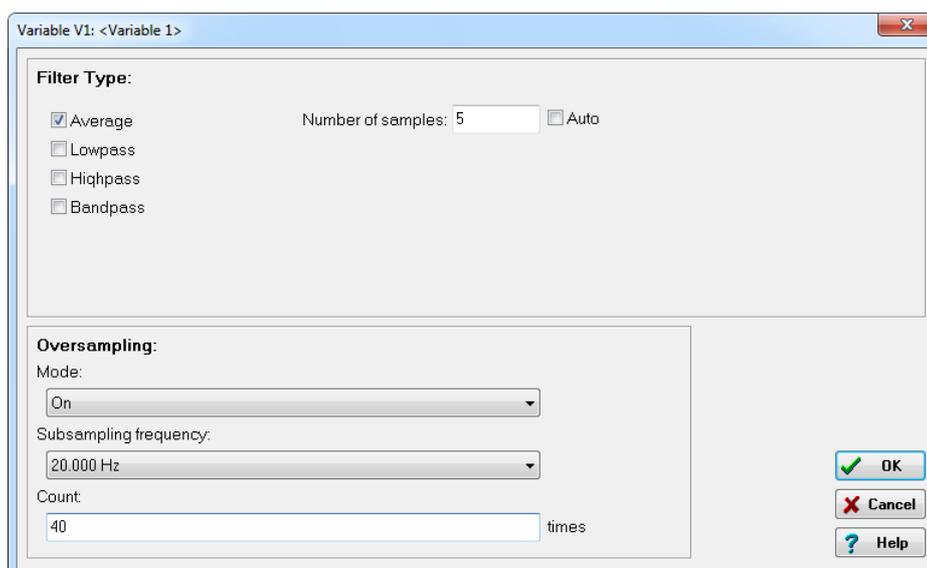


Fig. 6-13 Setting oversampling.

In the example in Fig. 6-13 the oversampling is set for the first channel (V1) of an A101 module. The module A/D converter operates at 100kHz. Also, in this example averaging over five values takes place (not necessary for oversampling). The measurements are then to be transferred at 20,000 values per second, i.e. every 5th value (**subsample frequency**). In order to be able to transfer these values with a master cycle time of 2 ms (500Hz sample rate), the **Number** of values to be transferred per telegram is set to 40. Consequently, 40 values are transferred every 2ms, i.e. in total 20,000 values per second. With a cycle time of 1 ms the **Number** could be reduced to 20.

- ➔ The **Async. buffered** mode is intended for angular synchronous measurements. If required, please contact Gantner Support (www.gantner-instruments.com) to be able to make the correct settings.

6.1.12

Firmware update

Recently purchased modules always contain the latest firmware, i.e. the software in the modules is the current version. However, if you want to combine these modules with older modules, you should update all older modules and your software to the latest version, to avoid disturbances in operation.

The current firmware is in each case included in the latest installations of the programs ICP 100 or test.commander. Install as required the latest version of ICP 100 or test.commander so that you can also install the latest version of the firmware on your PC. Here, the program licenses apply to all versions of a program. If required, download the latest versions from our web site: www.gantner-instruments.com. You will find the programs under **Software > Download**.

Procedure

1. In the program ICP 100 select **Utilities > Download > Firmware update**.
2. Select the required menu (Fig. 6-14) and click on **OK**.

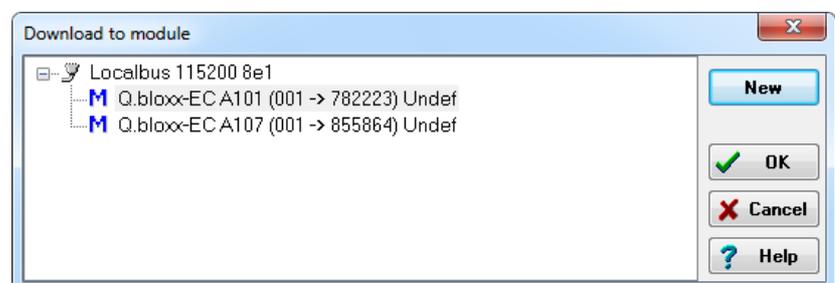


Fig. 6-14 Selecting the module for firmware update.

3. Select the file with the firmware (there is only one suitable for the module and where several are available the relevant latest version is displayed) and click on **Open** (Fig. 6-15).

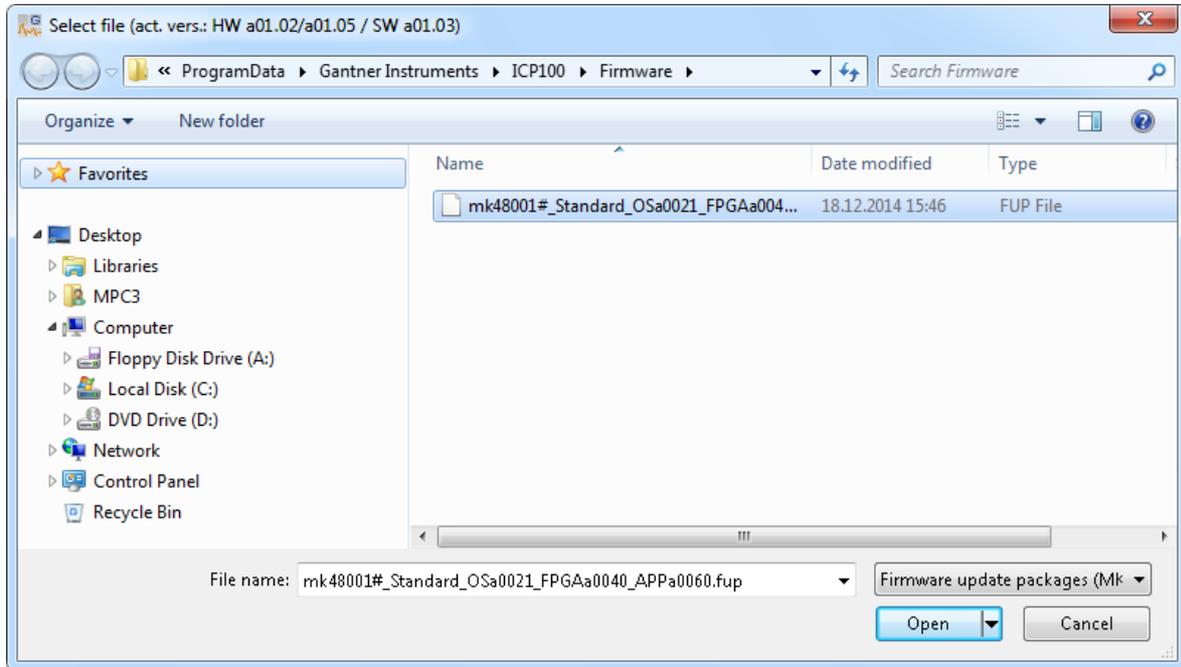


Fig. 6-15 Selecting the firmware.

6.2

Communication/configuration using TwinCAT

The following description applies to the EtherCAT program package TwinCAT 2.11 from Beckhoff. In program version 3 the settings are also similar, therefore in the following the (still) more popular version 2 is used. With other programs different terms are sometimes used, but the basic method is similar. For the configuration of the modules the master must support CoE; if this is not the case, carry out the configuration using ICP100.

Basic procedure

- In the first step you must give your EtherCAT master the possibility of detecting the modules (copy XML file). Then the module configuration can be read out via CoE or a configuration file loaded into the modules using FoE.
- In the second step you must configure your EtherCAT master for the interface used.
- Then you can find the devices connected to this interface - here the Q.bloxx-EC bus coupler and the modules connected to it.
- Now you can carry out the configuration of your system.

The configuration of a EtherCAT system is not discussed here, but you will find examples for the configuration of the modules in Section 6.2.4, page 110.

6.2.1

Configuration file for EtherCAT master

1. In the Windows Explorer enter “%ProgramData%” in the address line (Fig. 6-16).

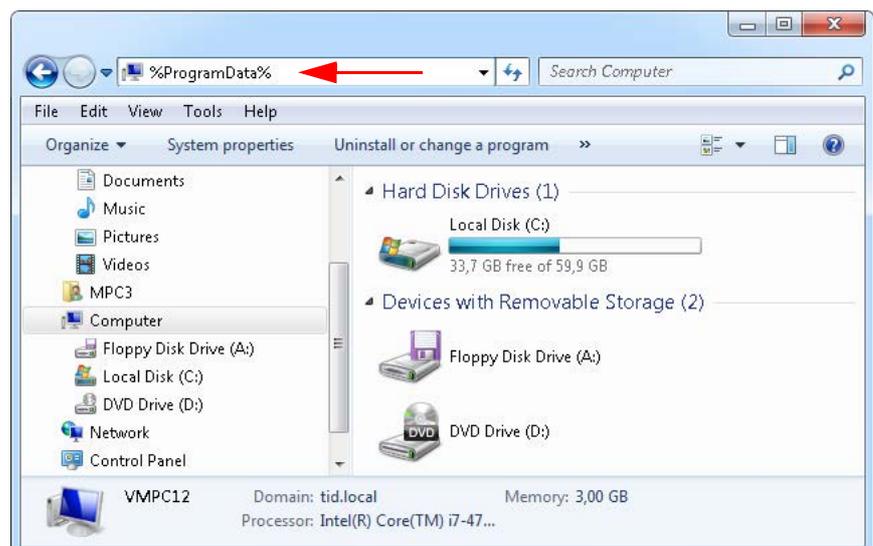


Fig. 6-16 Opening the (hidden) directory ProgramData.

2. Open the directory **Gantner Instruments > ICP100 > EtherCAT** and copy the file “Gantner Instruments.xml”

The file contains the information about the possible settings for the Gantner modules and Test Controller for EtherCAT.

3. Insert the file in your TwinCAT installation directory into the subdirectory **Io > EtherCAT**.

The configuration file is read in and processed during the next start of the program.

6.2.2

Defining an interface

1. Select **Options > List of real-time Ethernet-compatible devices** (Fig. 6-17).

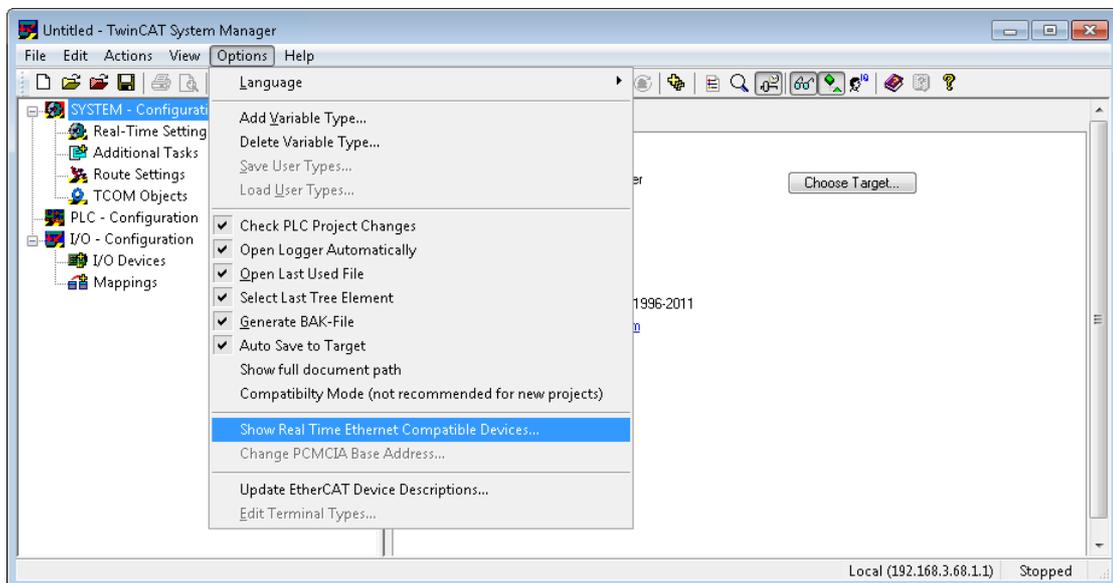


Fig. 6-17 Setting up the interface adapter.

2. Mark one of the interface adapters specified under **Compatible devices** and click on **Install** so that the real-time driver for this adapter is installed (Fig. 6-18).

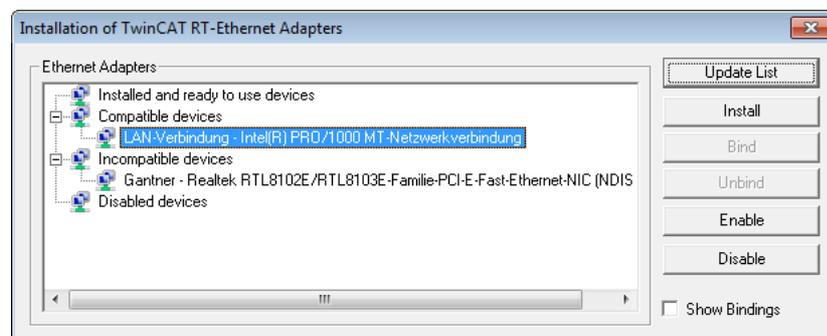


Fig. 6-18 Selecting the interface adapter.

The adapter is then shown in the group **Installed and ready to use devices** (Fig. 6-19).

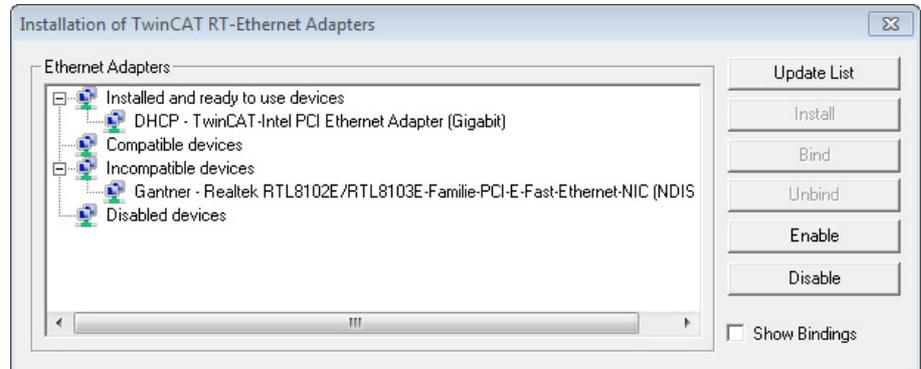


Fig. 6-19 Interface adapter with installed driver.

3. Close the dialog with OK.

6.2.3

Linking the Q.bloxx-EC modules

1. In the TwinCAT System Manager mark the **Group I/O device** and select **Find devices** from the context menu (Fig. 6-20).

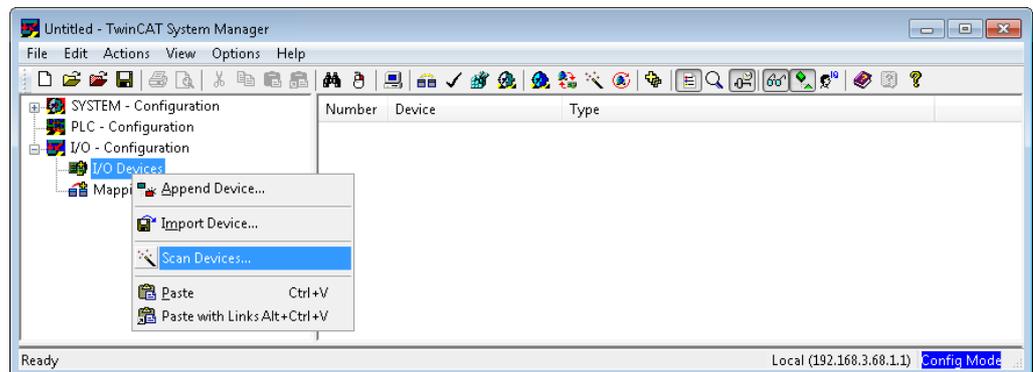


Fig. 6-20 Finding devices (bus coupler).

TwinCAT displays the notice that not all device types have been automatically detected (Fig. 6-21).

2. Click on **OK**.

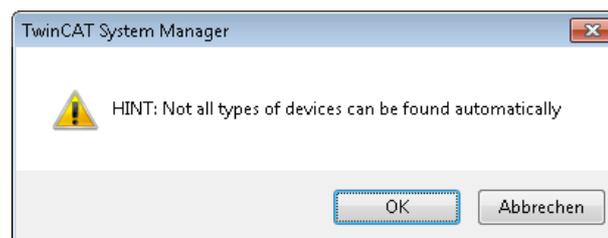


Fig. 6-21 Notice in TwinCAT.

The search for devices now finds the (newly) added Ethernet adapter with the EtherCAT driver (Fig. 6-22).

3. Confirm with **OK**.

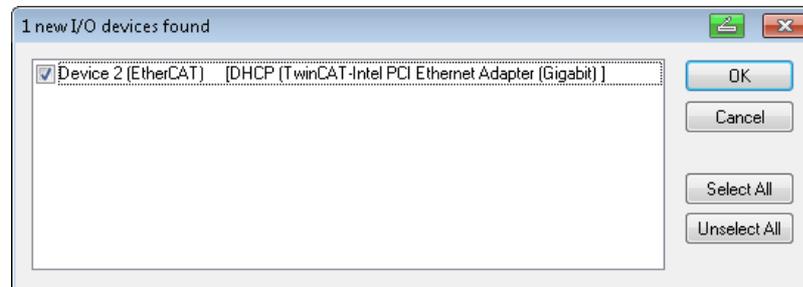


Fig. 6-22 Ethernet adapter with EtherCAT driver.

In the next dialog TwinCAT asks whether the devices (boxes) connected to this interface are to be searched (Fig. 6-23).

4. Click on **Yes**.



Fig. 6-23 Searching the connected devices (boxes).

In the next dialog TwinCAT asks whether the “Free Run” operating mode should be activated (Fig. 6-24).

5. Click on **Yes**.



Fig. 6-24 Activating the “Free Run” operating mode.

TwinCAT reads the configuration of the bus coupler and of the devices connected to it. Wait until the process has terminated: It takes several seconds depending on the number of modules. Then the modules found are displayed (Fig. 6-25 initially displays the bus coupler as an “higher level” device = terminal).

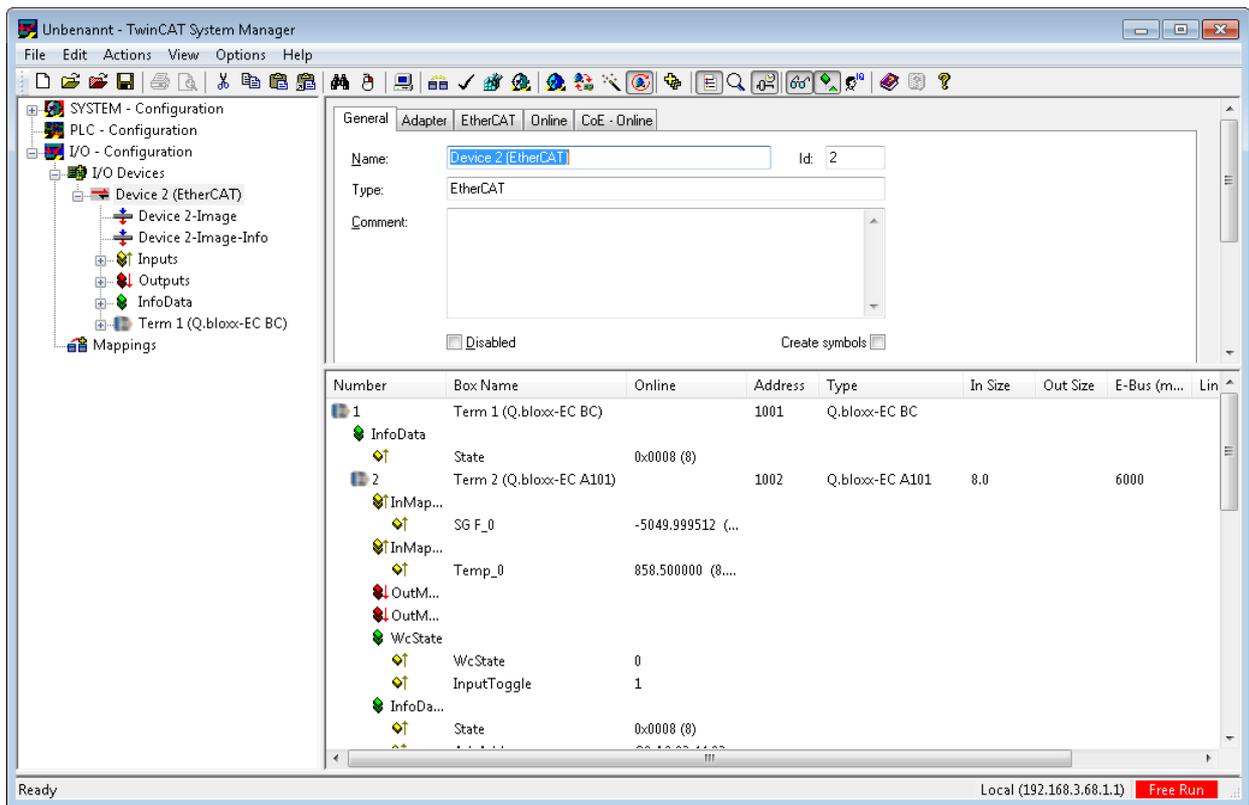


Fig. 6-25 Bus coupler on the EtherCAT adapter.

Open up the “terminal” bus coupler to view the modules connected to it. In Fig. 6-26 two modules are connected, a Q.bloxx-EC A107 (Terminal 2) and a Q.bloxx-EC A101 (Terminal 3).

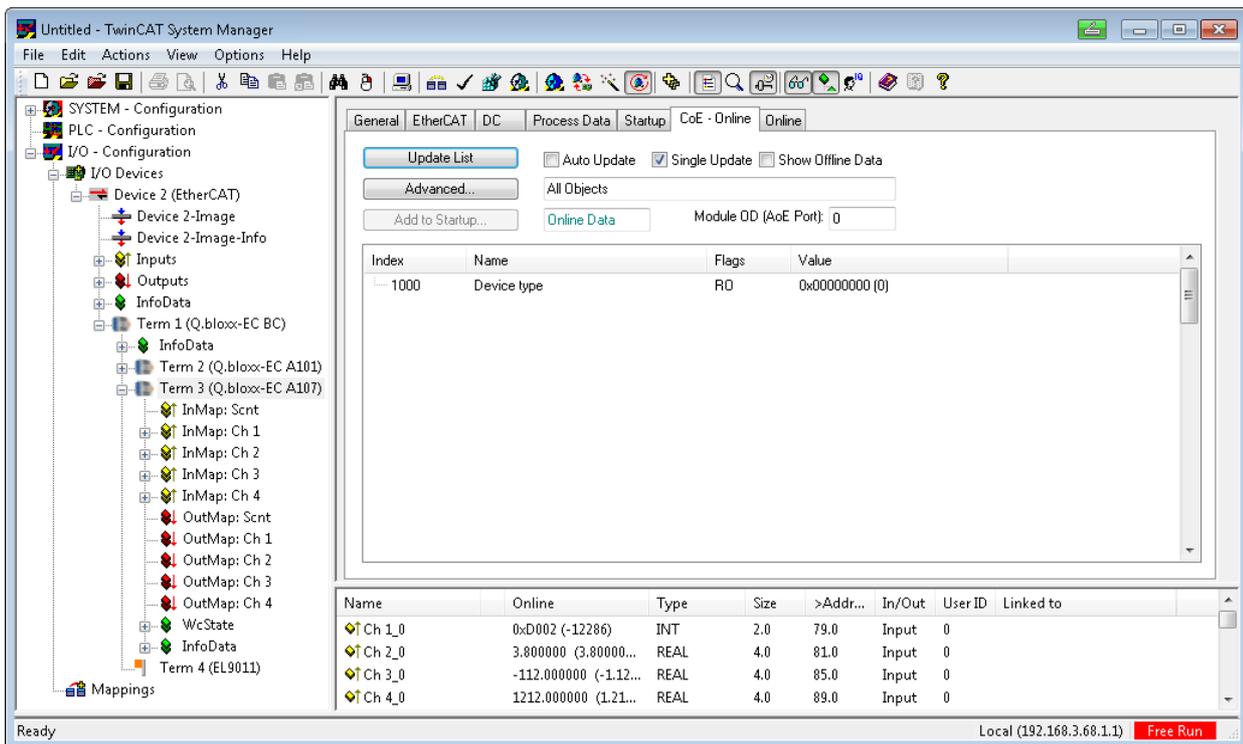


Fig. 6-26 Modules connected to the bus coupler.

To be able to work with the devices you now have to read in the information about the possible and the actual settings of the modules.

1. Mark a module (terminal) and click on **Advanced** on the **CoE - Online** tab (Fig. 6-26).

If the tab is not available because TwinCAT is in the “stopped” mode, select **Actions > Start/reset TwinCAT in config. mode** (Fig. 6-27)

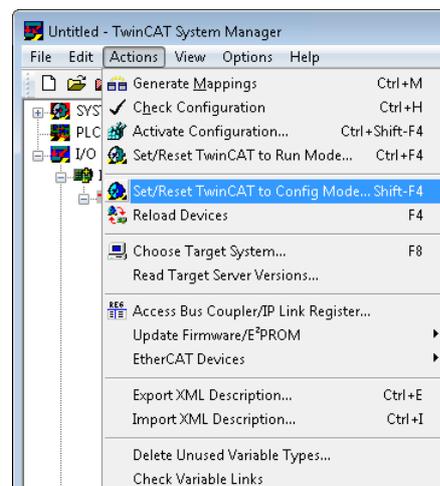


Fig. 6-27 Switching TwinCAT to the config. mode.

2. In the dialog mark **All Objects** and click on **OK** (Fig. 6-28).

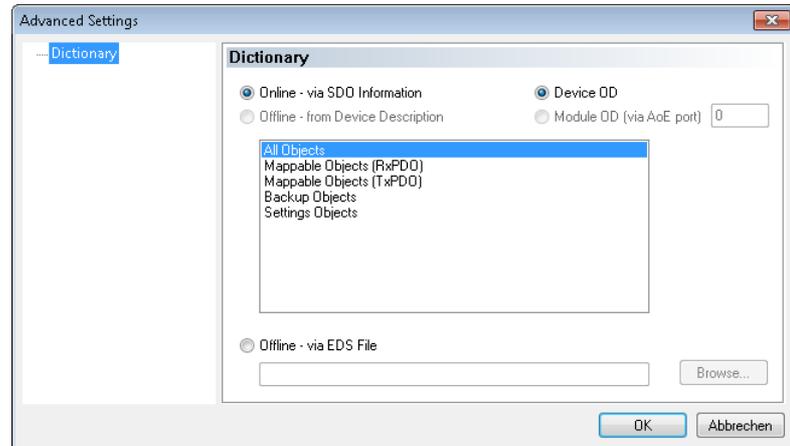


Fig. 6-28 Reading device information.

TwinCAT reads the information and displays the list of available settings (Fig. 6-29).

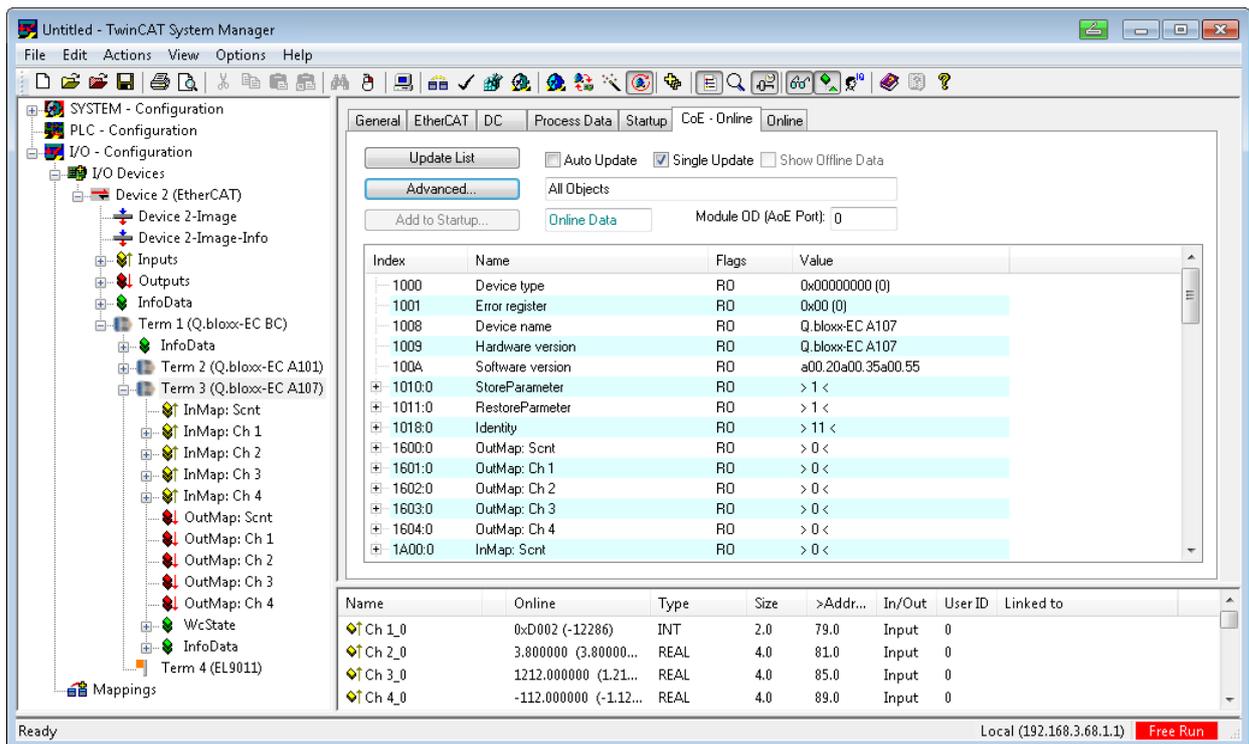


Fig. 6-29 Settings for Terminal 2.

3. Repeat the step for all modules.

6.2.4

Configuring the modules

For the module configuration mark the relevant module and go to the **CoE - Online** tab. Depending on the setting you want to change, you have to select the appropriate index or open it up in order to be able to view it and change it.

The indexes are grouped into the following sections:

- 0 to 2000: System quantities
- 6000 onwards: Input quantities
- 7000 onwards: Output quantities
- 8000 onwards: Configuration SDOs
- A000 onwards: Status SDOs

In the following you will find two examples of the displays of the configuration of a strain-gauge sensor (force transducer) and a thermocouple. You will find the configuration under the index 8000 for the first channel, plus 10 for the second one, plus 20 for the third one, etc. Open up the entry to view the settings.

- ➔ After modifying a setting you must save it, otherwise the modification will be reset when you quit the dialog. To do this call the **StoreParameter** (index 1010); refer to Section 6.2.5, page 112.

6.2.4.1

Strain-gauge force transducer

The sensor is located on Channel 2 (name: SG force sensor), therefore index 8010. The setting for the sensor type is the bridge circuit (Bridge) in a 6-wire configuration with a measurement range of 2.41 mV/V.

The filter configuration can be found under index 8011; in Fig. 6-30 a low pass with 499Hz (500Hz) is set.

Double click on an entry to view it. To view the current filter frequency, for example, double click on **LowF** (Fig. 6-31).

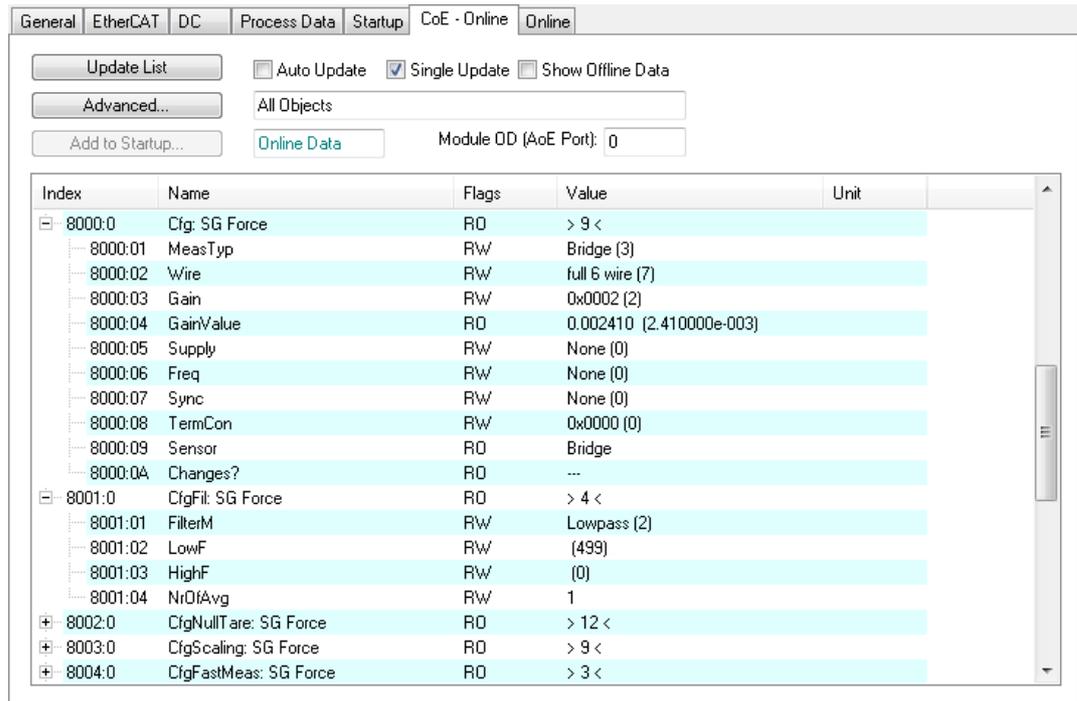


Fig. 6-30 Settings for Channel 2.

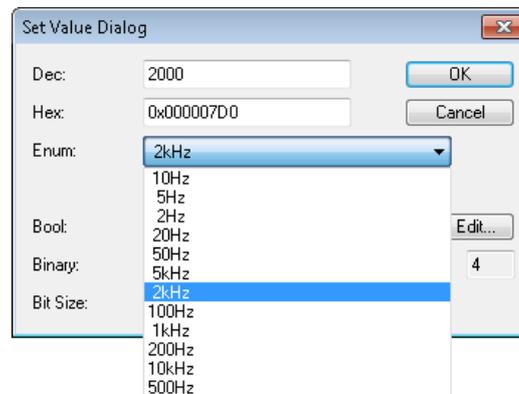


Fig. 6-31 Available filter frequencies.

6.2.4.2

Pt100

The sensor is located on Channel 3 (name: Temperature); therefore index 8020. The setting for the sensor type is PT100 in a 4-wire configuration (R4wire) with a measurement range of 400Ω.

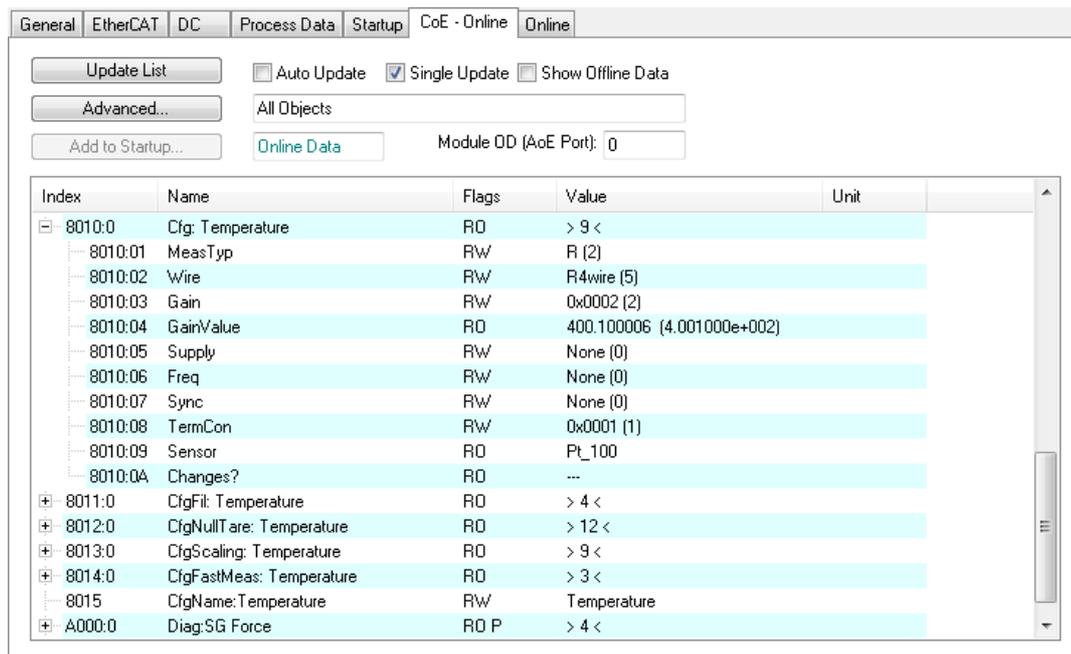


Fig. 6-32 Settings for Channel 3.

6.2.5

Saving the settings

To save modified settings you have to execute a special command (index 1010).

1. Make sure that the relevant module is in the “Pre-Operational” operating mode (**Online** tab, Fig. 6-33).

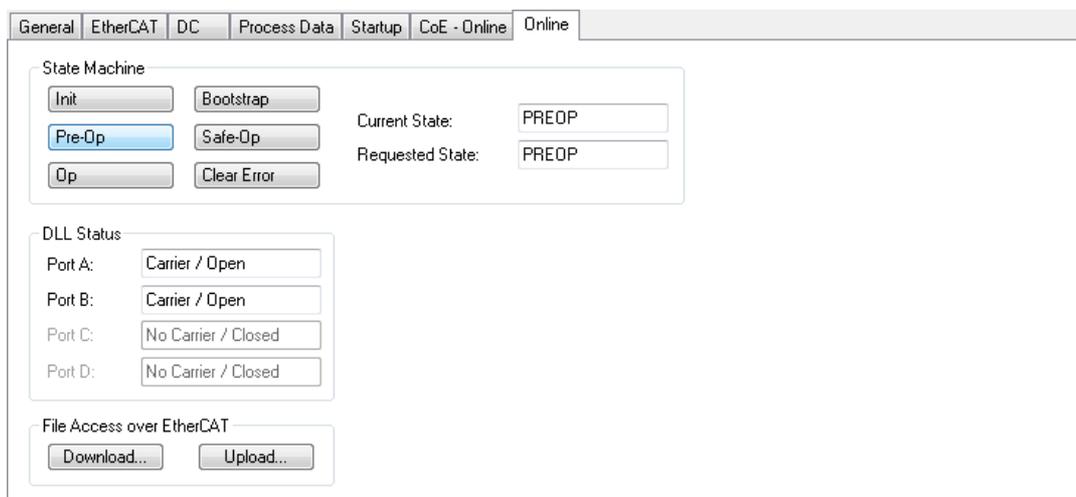


Fig. 6-33 Module in the “Pre-Operational” operating mode.

2. Go to the **CoE - Online** tab.
3. Open up index 1010 (Fig. 6-34).

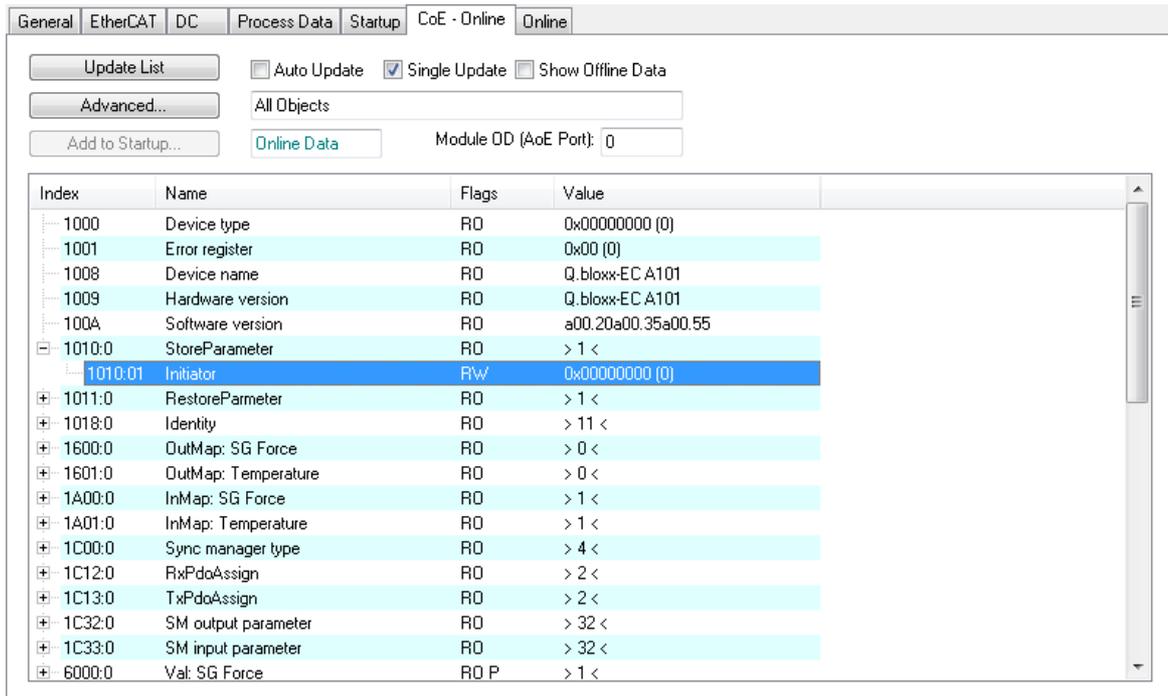


Fig. 6-34 Index 1010:01 (StoreParameter:Initiator) selected.

4. Double click on the entry **1010:01 Initiator** to call the dialog for input (Fig. 6-35).

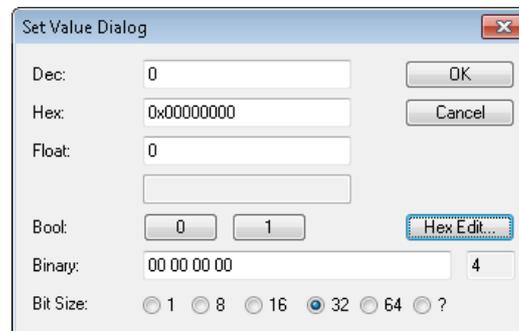


Fig. 6-35 Entering a value for saving.

5. Click on **Hex Edit** to enter the required command (if you know the values for the ASCII characters, you can enter them in the **Binary** field, but entry using the editor is easier).
6. Enter the uppercase letters **STOR** on the right side (Fig. 6-36).

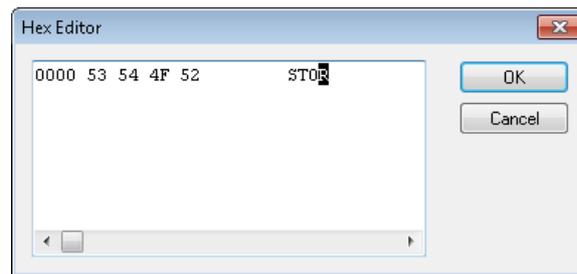


Fig. 6-36 Entering the **STOR** command.

On the left side the values for the letters, which you could have entered directly, are displayed.

7. Close the open dialogs with **OK**.

The settings are saved and are also available on restarting the modules.

6.2.6

Distributed clock (DC)

The Q.bloxx-EC modules must always use DC (default setting). You can check the setting in that you mark a module and on the **DC** tab click on **Advanced Settings** (Fig. 6-37).

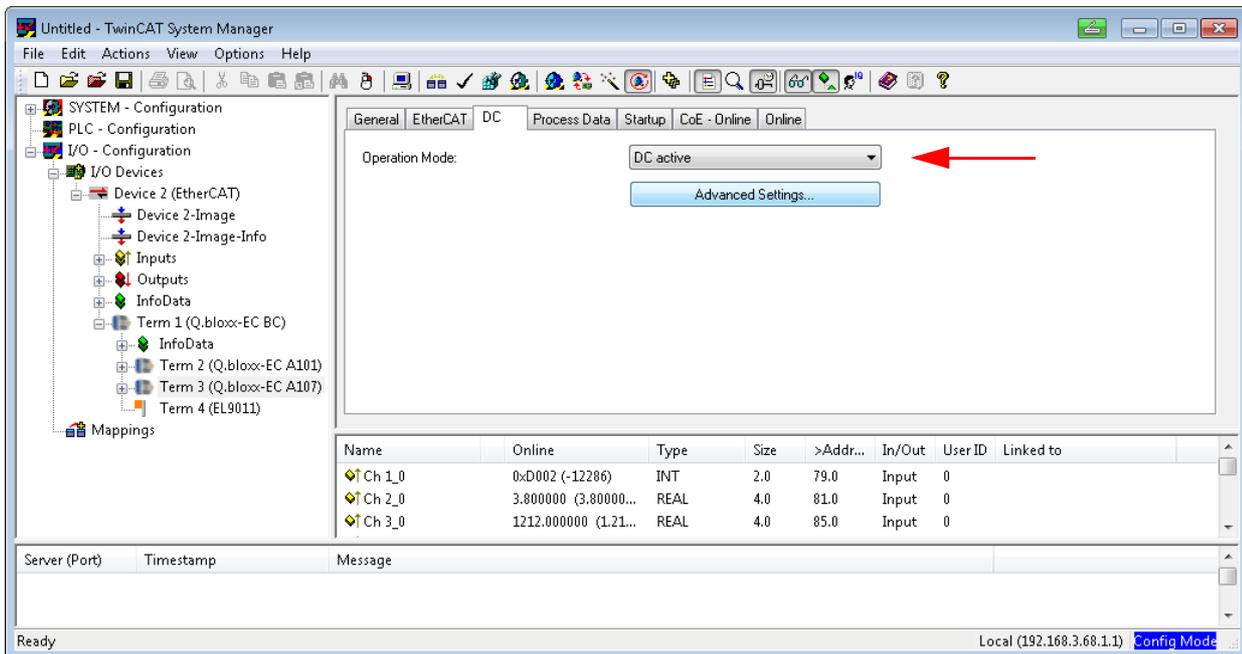


Fig. 6-37 Distributed clock.

The dialog (Fig. 6-38) shows all the settings regarding the DC, a change is not necessary.

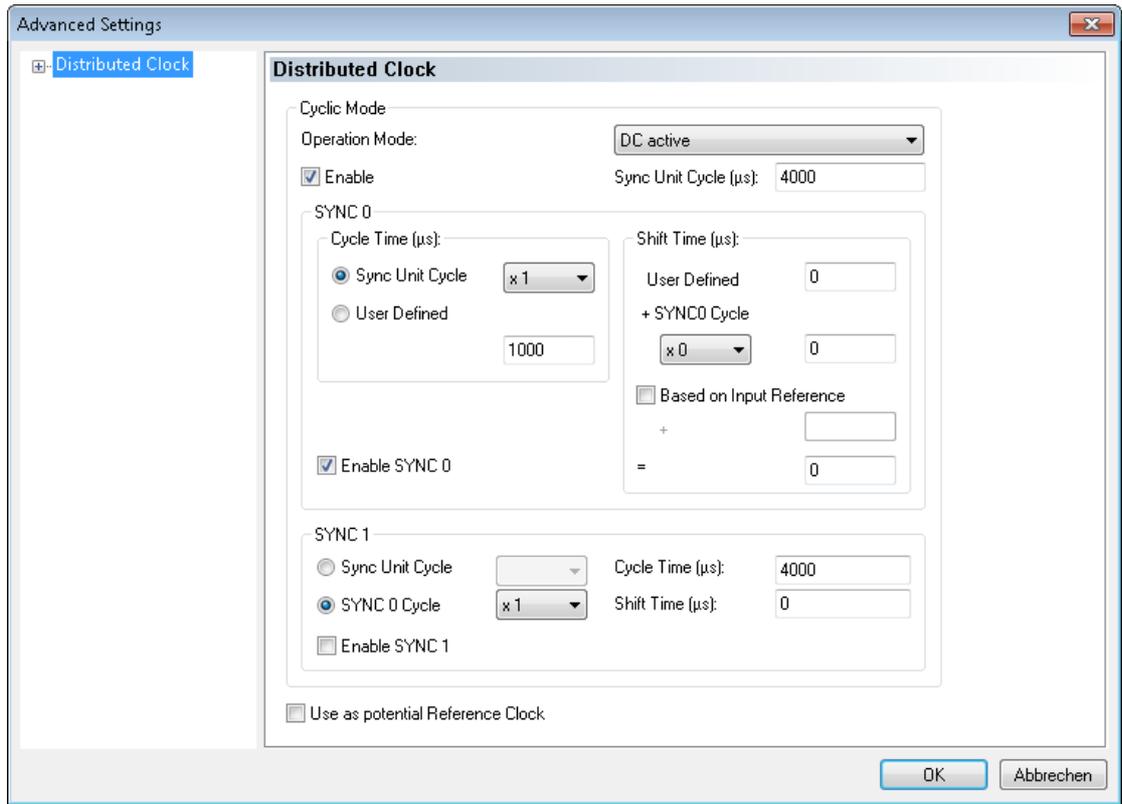


Fig. 6-38 Settings for Distributed Clock.

7

Appendix

In this chapter you will find explanations on the application of sensors. The setting dialogs in the illustrations are the dialogs displayed in the ICP 100 program.

7.1

Connecting sensors with sensing leads

Resistive sensors require an excitation voltage to be able to provide their output signal. For sensor excitation a current is passed through the connecting lead, which however causes a loss of voltage due to the resistance of the connecting lead. Consequently, the sensor is then not supplied with the voltage set on the amplifier module, but rather with a slightly lower voltage. This leads in turn to a lower output signal and, depending on the cable resistance, losses in the single-figure percentage range can occur even with just a few meters. Therefore, high quality amplifier modules for the excitation of resistive sensors use so-called sensing leads which can measure the loss of voltage, since only a very small current flows in them. This is because the inputs for the sensing leads have very high input resistances (usually over $10^6 \Omega$ compared to a sensor resistance of a few 100Ω). The amplifier module can therefore acquire the voltage arriving at the sensor error-free and increase its excitation voltage to compensate for the losses in the connecting cable. This is particularly the case when the temperature of the connecting cable changes. In this case the cable resistance changes and the sensor output signal would therefore also change if no sensing leads were used.

We therefore recommend the use of sensing leads. This is mainly necessary when several meters of cable are used, low measurement deviations are to be obtained or when the the temperature of the cable may vary.

7.2

Sensor scaling

Depending on the type of transducer (Sensor type), you have various possible scalings available. With voltage signals and strain gauge bridges (Bridge), you can define a conversion of the measured voltage (volts or mV/V) into a physical unit, e.g. in newtons. With strain gauges a special conversion tool is available to you. Click in the column **Format/balance** of the variables to be set to call up the setup dialog (Fig. 7-1).

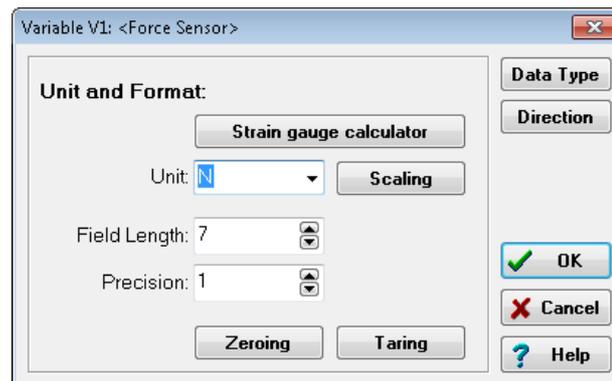


Fig. 7-1 Setup dialog for scaling.

7.2.1

Scaling of voltage signals and strain-gauge bridges

1. In the **Unit** field enter the required physical unit, e.g. **N**.
If the unit has already been entered, you can select it from the list box.
2. Click on **Scaling**.
The scaling dialog is displayed.
3. Enter the transducer (sensor) data from the calibration certificate or from the data sheet (example: refer to Fig. 7-2 on page 118).

Instead of the full scale readings in the positive and negative directions, you can also enter just one direction. Then in each case use **0** for **Measurement** and **Displayed value** at **Point 1**.

An alternative is the entry of **Factor** and **Offset** if these data have been specified for your sensor.

The numbers in the **Display** field depend on the settings in the **Range/error** column.

4. Close the scaling and setup dialog with **OK**.

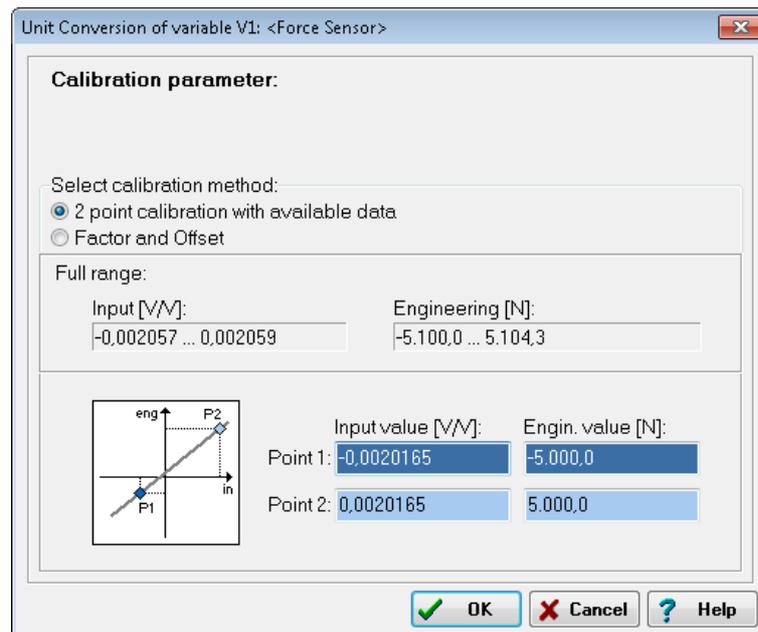


Fig. 7-2 Scaling dialog

7.2.2

Scaling strain gauges

1. Click on **Strain-gauge calculator**, the unit is then automatically changed to $\mu\text{m}/\text{m}$.
2. Enter the gauge factor of your strain gauge in the left field. The gauge factor is a measure of the sensitivity of the strain gauge and is stated on each strain-gauge pack. It is usually between 1.8 and 2.2. Fig. 7-3 shows scaling with $k = 2.03$.
3. If you are using more than one active strain gauge in your bridge circuit, you must also state the resulting bridge factor (right field). The factor depends on the orientation of the strain gauge on the measurement object and, where applicable, also on the Poisson's ratio for the material. On a tension/compression bar the bridge factor is, for example, approx. between 2.5 and 2.8 depending on the material.
4. Close the scaling and setup dialog with **OK**.

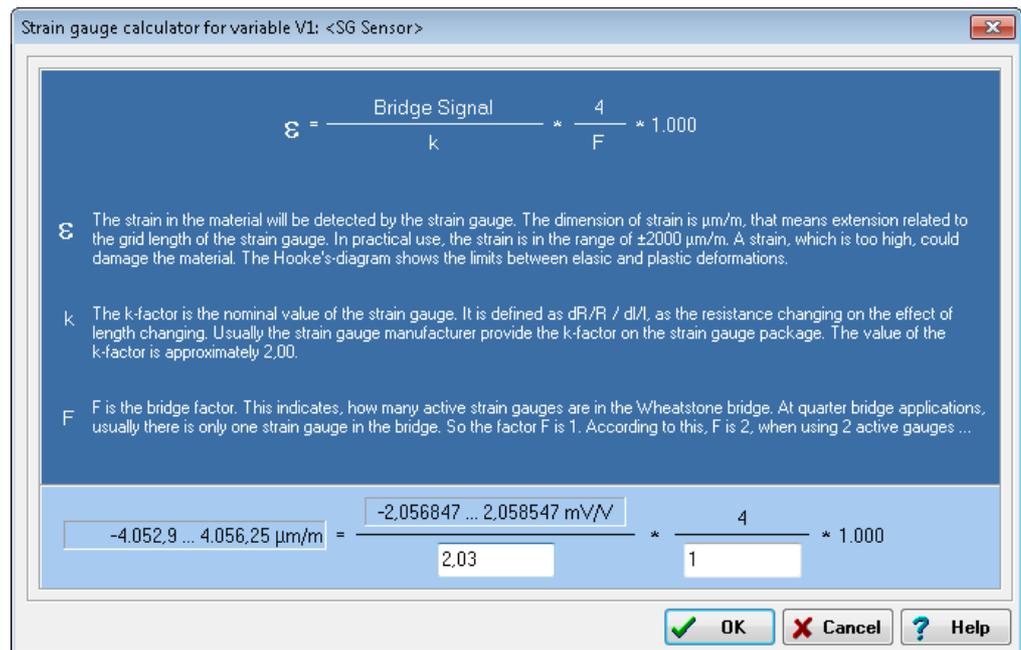


Fig. 7-3 Scaling dialog for strain gauges.

7.3

Current measurement with an external shunt

Current measurements are carried out by measuring the voltage drop across a resistance of known size (shunt resistance). In the Q.bloxx-EC modules, which are suitable for direct current measurement, this is a resistor of 50Ω , with which you can measure currents up to 25mA (the maximum shunt power dissipation is limited to 0.25W). Higher currents need an external shunt which is looped into the line to be measured. The power dissipation occurring at the current to be measured must be lower than the permissible power dissipation of the external shunt. In addition the voltages produced on the resistance must not exceed the permissible input voltage on the analog input of the Q.bloxx-EC module. Configure the analog input as a voltage input and divide the measured voltage by R_{ext} .

! **IMPORTANT**

The error in the current measurement using an external shunt depends on the accuracy of the resistor used.

8

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The current addresses of our sales partners can be found in the Internet on our web site. You can take up direct contact with Gantner Instruments GmbH at any time.

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Austria

Gantner Instruments GmbH
Montafonerstr. 4
6780 Schruns/Austria
Tel.: +43 (0) 5556 77463-0
Fax: +43 (0) 5556 77463-300
E-mail: office@gantner-instruments.com
Web: www.gantner-instruments.com

Germany

Gantner Instruments Test & Measurement GmbH
Heidelberger Landstr. 74
64297 Darmstadt
Tel.: +49 (0) 6151 95136-0
Fax: +49 (0) 6151 95136-26
E-mail: testing@gantner-instruments.com
Web: www.gantner-instruments.com

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Austria

Gantner Instruments GmbH
Montafonerstr. 4
6780 Schruns
Tel.: +43 (0) 5556 77463-0
Fax: +43 (0) 5556 77463-300
E-Mail: office@gantner-instruments.com
Web: www.gantner-instruments.com

Germany

Gantner Instruments Test & Measurement GmbH
Heidelberger Landstr. 74
64297 Darmstadt
Tel.: +49 (0) 6151 95136-0
Fax: +49 (0) 6151 95136-26
E-Mail: testing@gantner-instruments.com
Web: www.gantner-instruments.com