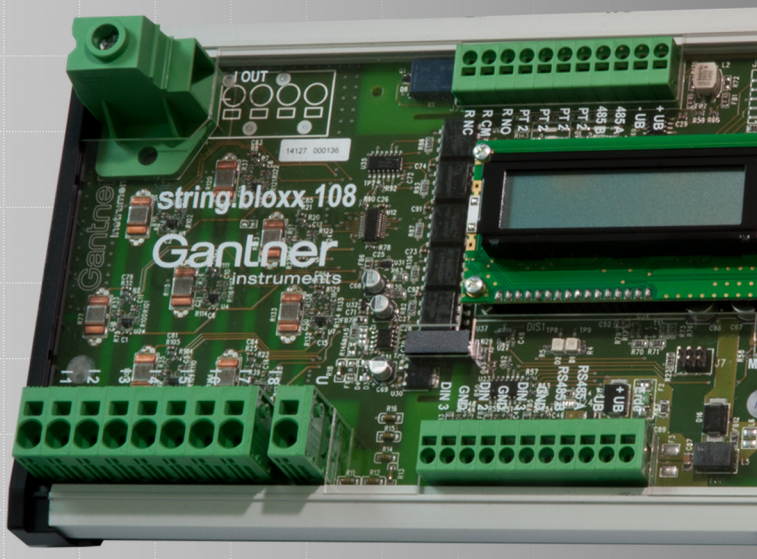
Gantner instruments

# string.bloxx

# Manual




Vers. No. 1.0

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# 1 Safety Instructions

Please read and follow all warnings and safety instructions in this manual before beginning the installation, commissioning and maintenance.

Installation, commissioning, operation and maintenance of the modules must be carried out in accordance with specifications, i.e. within the operating conditions outlined in this manual and the technical data of the relevant module.

## 1.1 Intended use

The modules of the string.bloxx series are designed for monitoring and testing of solar modules. Solar module strings (interconnection of multiple solar modules), hereafter referred to as strings, can be connected to the modules. The modules may be used only for these measurement and control tasks. Any other use above and beyond this is considered as improper use.

To ensure safe operation, the modules may be operated only in accordance with the information in the manuals and technical data sheets. In addition, the legal and safety regulations required for the individual application have to be observed.

## 1.2 Check for transport damage

Directly on receipt of the goods, inspect both the packaging and the module itself for any signs of damage. Also check that the delivery is complete (accessories, documentation, auxiliary devices, etc.). If the packaging has been damaged in transport or should you suspect that the product has been damaged or that it may have a fault, the product must not be put into service. In this case, contact your customer advisor or Gantner Instruments Environment Solutions GmbH.

## 1.3 Personnel

Installation, commissioning and maintenance of the modules must only be carried out by suitably trained personnel. Persons are suitably trained when they have acquired sufficient knowledge in the field of electrical installation through their training as specialists in the electrical trade or similar training, and when they are familiar with the relevant national occupational health and safety regulations, accident prevention regulations, standards and approved rules of technique. They must be able to assess the results of their work safely, and they must be familiar with the contents of this manual.

Please observe in particular:

- the national installation and mounting regulations (e.g. VDE in Germany)
- the generally recognized rules of technology
- details on transportation, installation, operation, maintenance and disposal in this manual
- the parameters, limit values and specifications for the operating and environmental conditions on the type plates and in the data sheets.

## 1.4 Special risks

The modules are used as a component in installations of solar systems and must therefore be integrated into the safety concept of the system. The modules are not safety components and cannot perform any safety-related shutdowns. This requires additional components that must be provided by the company setting up and/or operating the system.

A very high voltage is permanently present at the modules after connection of solar modules, which upon contact can result in death or serious bodily harm. Therefore, please make sure that only qualified personnel have access to the modules and the modules can be switched off for servicing by means of a load break switch.

## 1.5 Installation sites

The modules of the string.bloxx series are protected against direct contact by a cover. The modules have to be mounted in an enclosed housing so that they are accessible only to authorized personnel. If required by the environmental conditions, the modules can be installed in water-protected or water-proof enclosures.

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

## 1.6 Alterations

It is prohibited to make alterations to the modules.

## 1.7 Maintenance and cleaning

Installation and maintenance work on the modules is exclusively to be carried out when the modules are disconnected from the power supply. Check before carrying out any work on the module that the voltage has been disconnected.

Do not attempt yourself to repair devices after a defect, failure or damage, or to put the devices back into operation again. In such cases, please contact your customer adviser or Gantner Instruments Environment Solutions GmbH.

## 1.8 Disposal

Equipment that is no longer suitable for use must be disposed of in accordance with national and local regulations for environmental protection and resource recycling. Electronic components must not be disposed of together with household garbage.

## 1.9 General hazards in the event of failure to comply with safety regulations

The modules employ state-of-the-art technology and are safe to operate. However, an element of risk remains if the modules are used or operated by untrained personnel.

Any person commissioned with the installation, start-up, maintenance or repair of a module of the string.bloxx series must have read and understood the manual, especially the safety-related function recommendations.

## 1.10 Markings on the string.bloxx module

This symbol is the CE marking. It guarantees that our product complies with the requirements of relevant EU directives (the Declaration of Conformity can be found in Chapter 7 on Page 36).

This symbol is the marking for disposal required by law. Equipment that is no longer suitable for use must be disposed of in accordance with national and local regulations for environmental protection and resource recycling, separate from regular household waste.

## 1.11 Markings and warnings in this manual

To avoid personal injury and damage to property, please follow the warnings and safety instructions in this operating manual.

| | |
|---|---|
| ⚠ DANGER | **Indicates an immediate danger which will result in death or serious bodily harm if not avoided.** |

## 1.12 Conventions in this manual

To make it easier for you to read this manual, we will use the following conventions:

| | |
|---|---|
| *italic font* | indicates emphasis |
| **ADDRESS** | indicates a message on the LCD display |
| ➡ | refers to special features or restrictions |

# 2 Introduction

Dear customer!

Thank you for purchasing a module of the string.bloxx series by Gantner Instruments Environment Solutions GmbH. We are sure that with this module you have acquired an excellent product that enables you to perform reliable measurements.

The scope of supply also includes this manual. Always keep this manual within easy reach. To avoid personal injury and property damage, please follow the warnings and safety instructions in this manual (Chapter 1, Page 5). If you still can't resolve an issue, despite studying this manual, please do not hesitate to contact us.

Should you discover any fault with the product or in its accompanying documentation, or have any suggestions for improvement, you may confidently approach either your customer adviser or Gantner Instruments Environment Solutions GmbH directly. We are looking forward to your suggestions.

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## 2.1 Documentation for string.bloxx

The documentation for the string.bloxx modules 108-1P, 108-8P, 108-1M and 108-8M consists of this manual. You can download this manual as a PDF document from our website www.gantner-environment.de.

## 2.2 About this manual

This manual describes the installation, configuration and operation of the string.bloxx modules 108-1P, 108-8P, 108-1M and 108-8M. The modules differ in the following two points:

1. The modules 108-1P (standard module) and 108-1M are equipped with a *bus terminal* as a common output of the measured currents. The modules 108-8P and 108-8M include a separate output terminal for each measured current. For the current inputs, eight terminals are available for all modules.
2. The modules 108-1P and 108-8P measure the currents in the positive branch, the models 108-1M and 108-8M measure the currents in the negative branch.

The manual is divided into several chapters:

- Safety instructions in Chapter 1, Page 5 ff.
- The following section contains a description of the system and the general combination and expansion options.
- The installation and connection configuration is described in Chapter 3, *Installation and Dismantling*, Page 13 ff.
- The description of the possible displays (LCD) and the configuration of the bus address can be found in Chapter 4, *Operation and Displays*, Page 19 ff.
- Chapter 5, *Modbus Communication*, Page 23 ff contains an overview of the Modbus RTU commands and functions valid for the module.
- See Chapter 6, *Technical Data*, Page 31 ff for a block diagram of the string.bloxx module and all technical data.
- Chapter 7 on Page 36 contains the Declaration of Conformity.

## 2.3 System Description

The string.bloxx series is designed for measuring and testing technology for solar energy systems, especially for multi-channel measurements of electrical and thermal data. Independent of the inverter, the DC side of photovoltaic systems (PV systems) can thus be monitored precisely and you can identify and fix errors in time:

- Contamination by pollen, dust and soot
- Weather influence, e.g. hail, snow loads
- Installation errors
- Production errors
- Theft and vandalism

You can combine individual modules as desired in one system, when more than eight solar module strings (interconnection of multiple solar modules), hereafter referred to as strings, are to be connected.

The modules can be plugged directly onto mounting rails (DIN rail 35 mm according to DIN EN 60715).

For the operation and tests on site, parameters such as voltage and current, or temperature can be viewed directly on the integrated LCD display. For control and readout of data, the modules are equipped with a Modbus interface.

# 3 Installation and Dismantling

**DANGER**

**The cables to be connected may carry voltages up to 1000 volts!**

**Before connecting any cables test that all cables to be connected are switched off.**

Please observe the safety instructions in Chapter 1, Page 5.

## 3.1 Integration of the module into a solar system

Fig. 3-1 shows a typical example of the wiring of the string.bloxx 108-1P module within a solar system.

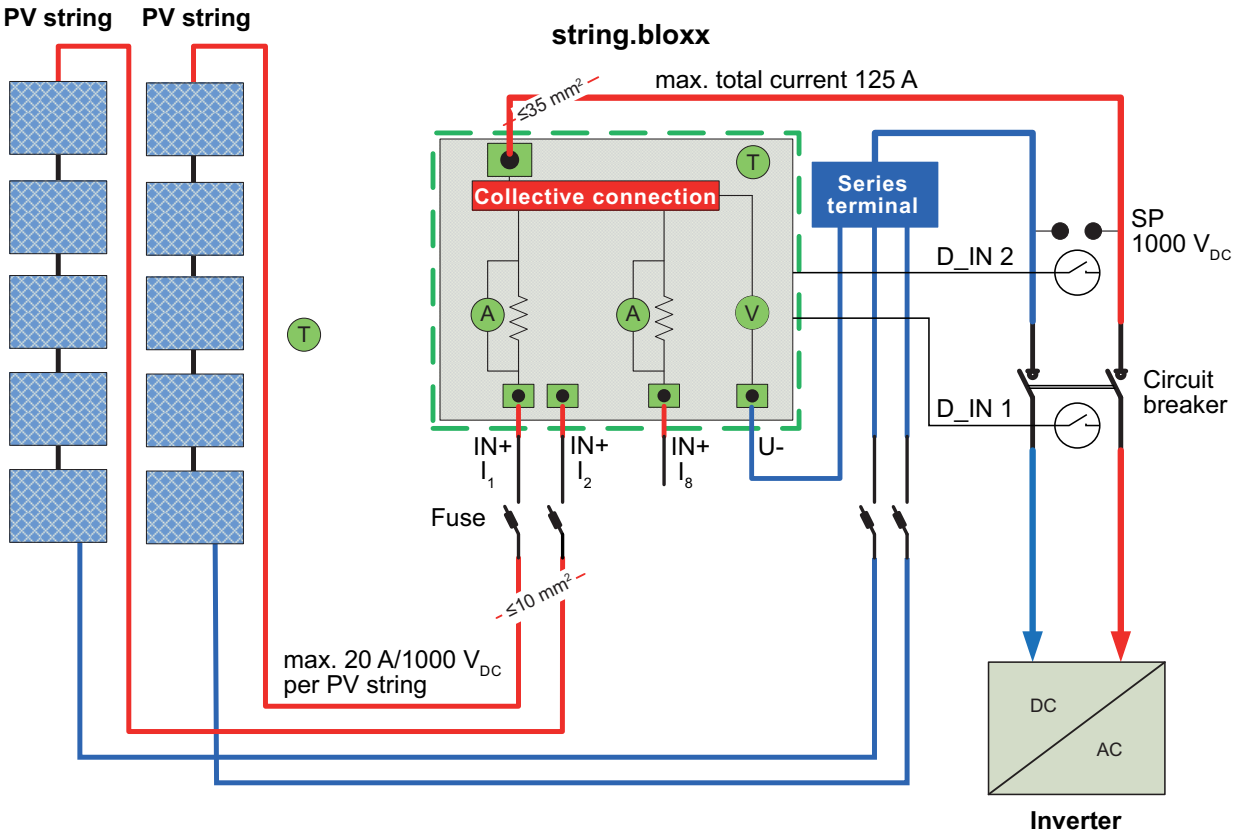



*Fig. 3-1: Typical wiring of the string.bloxx; SP = surge protection. The example shows the 108-1P module.*

The individual photovoltaic modules (PV strings) are connected to the IN+ inputs (positive voltage). This allows the currents of

the individual strings to be measured. The total voltage of the connected string is measured via the U– input (negative voltage). Up to eight strings can be connected to a string.bloxx module. The total current is discharged through a single terminal, the bus terminal. Please note that other elements are required for the connection that are not supplied with the string.bloxx module, for example, fuses, surge protection, or DC circuit breakers.

## 3.2 Terminal assignment

Fig. 3-2 on Page 15 shows the terminal assignment of the string.bloxx module. The connections for the supply voltage and the RS-485 interface are duplicated to facilitate interconnection when working with several modules.

#### Meaning of the relay names

NC: *N*ormally *C*losed contact

CO: *C*hange *O*ver contact

NO: *N*ormally *O*pen contact

#### Reserved names for the digital input functions

D_IN 1: Main Switch

D_IN 2: Surge Protection

The state of these two digital inputs can also be viewed on the LCD display.

The inputs are connected through a resistor to the internal +5 V operating voltage of the module. Therefore, switch the inputs to ground, for example, via a relay contact or an optocoupler.

#### Names used for the PT1000 in the LCD display

PT1000 1: Temperature 1

PT1000 2: Temperature 2

#### Differences between the modules

➡ The modules 108-8P and 108-8M do not come with a bus terminal; on these modules, 8 output terminals each are available for the PV strings which must then be interconnected with separate lines.

➡ With the modules 108-1M und 108-8M, the negative terminals of the PV strings, rather than the positive terminals, are connected to $I_1$ to $I_8$ (IN– instead of IN+ in Fig. 3-2). Accordingly, terminal U– in Fig. 3-2 is connected with the positive overall voltage (U+) of the connected strings.

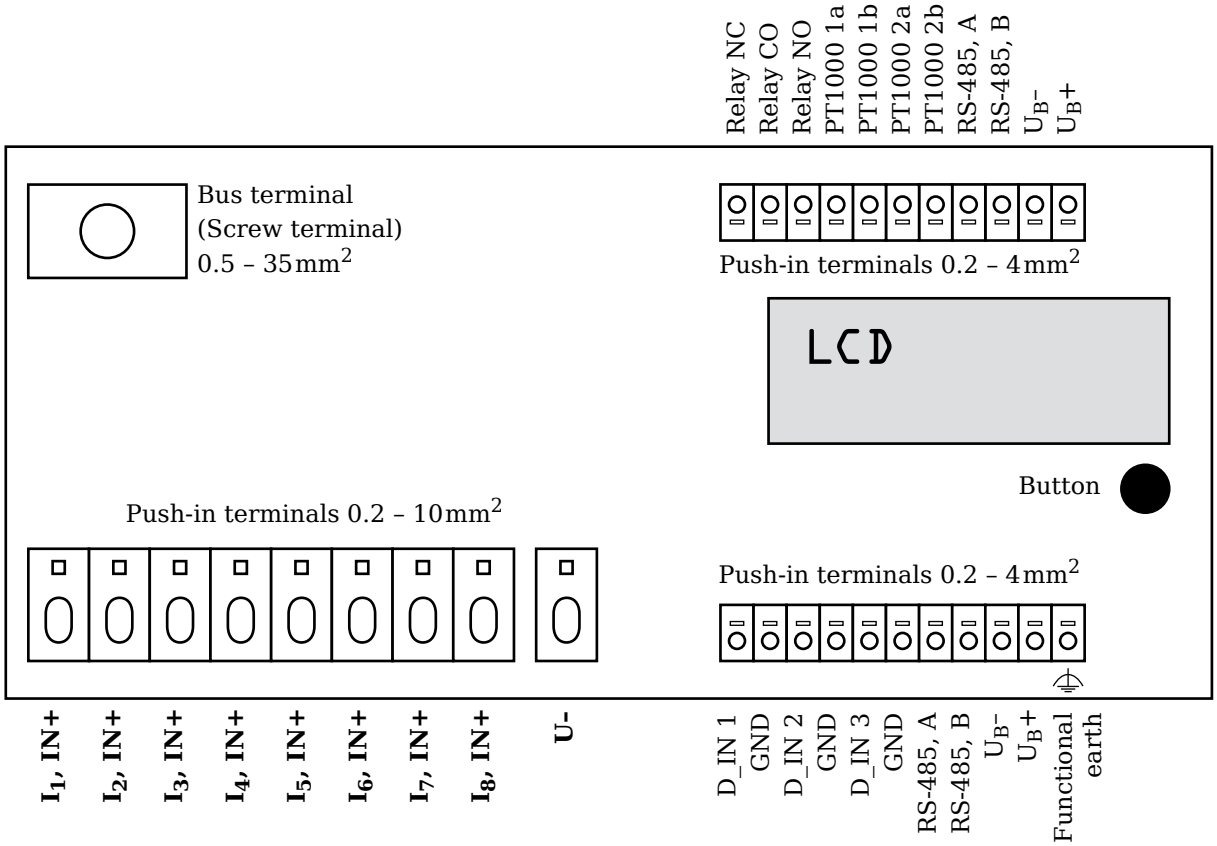



*Fig. 3-2: Terminal assignment of the string.bloxx 108-1P module (the drawing is not to scale)*

## 3.3 Installation

To install the module on a mounting rail, first hook the module onto the mounting rail at the bottom and then push it against the mounting rail at the top until it clicks into place (see also the figure in Section 3.4, *Decommissioning, dismantling*, Page 16).

#### Installing wires in the push-in terminals

In order to connect wires to the push-in terminals, insert a small screwdriver into the slot of the terminal next to the cable entry (cable duct). This opens the clamping fastener and you can push the wire into the spring cage. After removing the screwdriver, the spring then pulls the conductor against the busbar.

#### Procedure for connecting

1. Connect the functional ground.
2. Connect the supply voltage.

3. If necessary, connect the interface connections (RS-485 / Modbus).

   The bus lines should be terminated at the ends with 120 Ω resistors. The string.bloxx modules do not contain any terminating resistor; this must be connected externally. Use twisted cables, preferably with a shield. Connect the bus participants, preferably in the form of chains (in a row), avoid connections in a star topology or stub lines. The modules include double, internally connected connections for the chain circuit: Use a bus connection as an input, the other as an output to the next bus participant.

4. If necessary, connect your signals to the digital inputs D_IN.

   Since the state of the inputs D_IN 1 and D_IN 2 can also be displayed on the LCD screen, where they are labeled Main Switch and Surge Protection, we recommend to connect these inputs as follows: D_IN 1 to the corresponding auxiliary contacts of the main switch and D_IN 2 to the remote signaling contacts of the surge protection. Please note that state 1 is displayed with open input and state 0 with short-circuited input.

5. If necessary, connect the temperature sensor (PT1000).
6. If necessary, connect the relay.
7. Connect the cable for the positive output voltage (108-1P module) to the bus terminal. With the 108-8P module you need to connect the corresponding lines to all terminals to discharge the string currents. In the 108-1M module the connection, in the 108-8M module the connections, are made to the negative output voltage.
8. Connect the cable for the measurement of the overall voltages to U– (“series terminal” in Fig. 3-1).
9. Connect the individual strings ($I_1$ to $I_8$).

Thus, the string.bloxx module is fully connected and can be put into operation.

## 3.4 Decommissioning, dismantling

**DANGER**

**The connected cables may carry voltages up to 1000 volts!**

**Before dismantling any cables test that all connected cables are switched off.**

Please observe the safety instructions in Chapter 1, Page 5.

### Dismantling wires

To remove wires from the push-in terminals, insert a small screwdriver into the slot of the terminal next to the cable entry. This opens the clamping fastener and the conductor can be pulled out easily.

### Dismantling from the mounting rail

Insert a small screwdriver through one of the flaps at the top of the module (1 in Fig. 3-3). Then push the screwdriver in the direction of the module (2) to release the holding mechanism and you can pull off the module on this side a little from the mounting rail (3). Hold the module with one hand so it does not fall down and do the same with the flap on the other side in order to completely disassemble the module from the mounting rail.

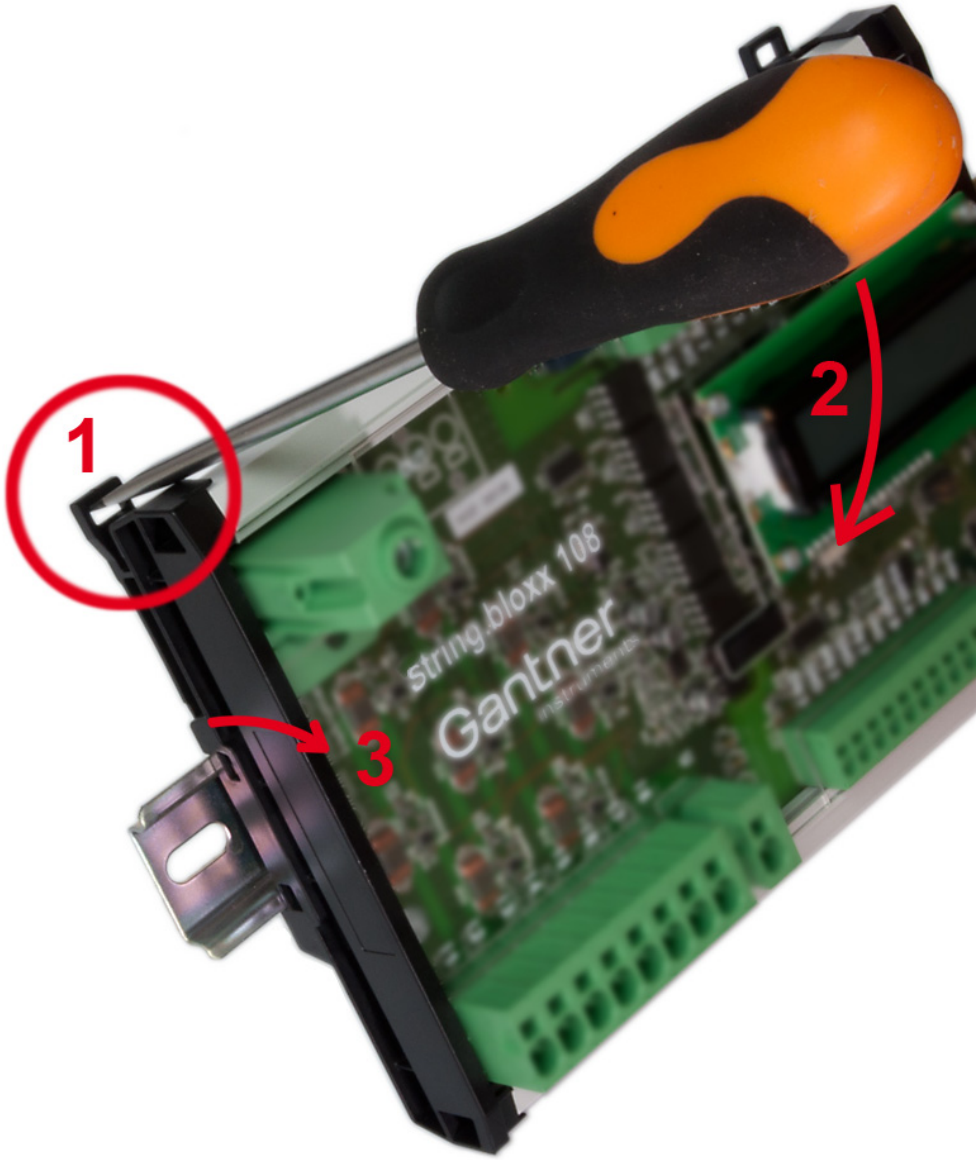



*Fig. 3-3: Dismantling the module*

# 4 Operation and Displays

The string.bloxx module can display various measured values and operating conditions via the integrated LCD display and the buttons below the display: the currents of the individual strings, the total voltage or the states of inputs and outputs (relays).

The only setting you can make with the display is setting the interface bus address.

## 4.1 Setting the interface bus address

The RS 485 interface is a bus-compatible interface, i.e., in principle, up to 256 participants can be connected to *one* interface. In order to establish a connection with a participant, each participant must therefore receive a unique address. The current address of the string.bloxx module is displayed on the main screen in the second row, e.g. **ADDRESS 116**. At the string.bloxx module, you can enter the addresses 1 to 247, the other addresses are reserved, e.g. the address 0 for broadcasts (see Section 5.3.3, Page 28).

#### Proceed as follows to change the address

1. If the main screen is not displayed (see also Section 4.2.1), repeatedly press the button below the LCD screen to display the main screen.
2. When the main screen is displayed, press the button for about 4 seconds to enter the input mode.

   The current address, e.g. **ADDRESS 116**, and the text **PROGRAMMING MODE** will be displayed.
3. Press the button again to get a higher number.

   If you press briefly, the number will increase only by 1, if you press the button for a longer time, the numbers are incremented continuously. After reaching 247, the count starts again at 1.
4. As soon as you do not press the button for more than 6 seconds, the displayed address is stored in non-volatile memory and is enabled and the programming mode is exited.

## 4.2 Displayable information

After applying the supply voltage for about 5 seconds, the manufacturer information, e.g. **GANTNER INSTRUMENTS**, and then the module name and the software version, e.g. **STRING.BLOXX 108 V1.02**, are displayed. Then the main screen appears.

### 4.2.1 Information displayed on the main screen

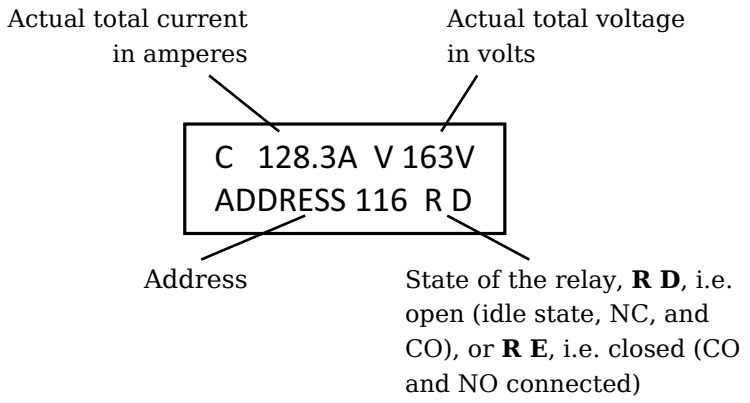



*Fig. 4-1: Main screen*

### 4.2.2 Displayable information

Press the button below the LCD display to view the available information on the display. Each press of the button switches to the next display.

➡ The display does not jump back to the main screen, the last viewed screen remains displayed. In the EcoMode (see Section 5.2, Page 24, Modbus functions), the backlight is turned off, however.
See also Section 5.3.2, Page 28 for more information on the Eco-Mode.

Display after pressing the button once:

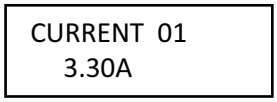



*Fig. 4-2: Display of the current in the first string ($I_1$ IN+)*

Pressing the button again shows:

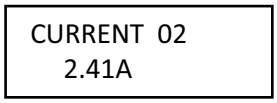



*Fig. 4-3: Display of the current in the second string ($I_2$ IN+)*

Each press of the button switches to the display of the next current up to the current in the eighth string; then further system parameters will be displayed whenever you press the button:

Press each button 1x to advance to the next display

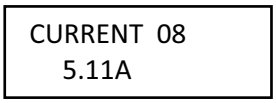



*Fig. 4-4: Display of the current in the eighth string ($I_8$ IN+)*

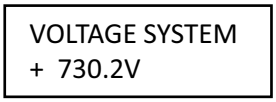



*Fig. 4-5: Display of the system voltage applied to U-*

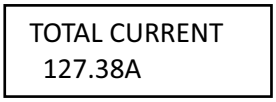



*Fig. 4-6: Display of the sum of the eight string currents (total current)*

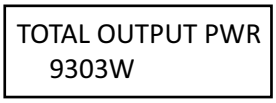



*Fig. 4-7: Display of the total DC power of the eight strings*

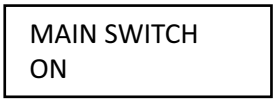



*Fig. 4-8: Display showing whether the DC circuit breaker is open (OFF) or closed (ON), if the digital input D_IN 1 is connected accordingly*


*Fig. 4-9: Display showing whether the surge protection has been triggered, if the digital input D_IN 2 is connected accordingly*

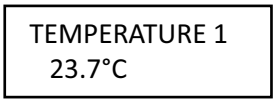



*Fig. 4-10: Display of the temperature at sensor 1 (PT1000 1), if a PT1000 is connected*

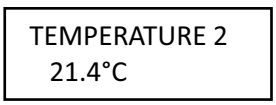



*Fig. 4-11: Display of the temperature at sensor 2 (PT1000 2), if a PT1000 is connected*

After another push on the button, the main screen appears again.

# 5 Modbus Communication

This section contains the list of interface parameters (Section 5.1), the list of available registers with the respective functions (Section 5.2) and the explanation of the advantages and disadvantages of special functions (sections 5.3.1 to 5.3.3).

## 5.1 Interface parameters

The string.bloxx module supports the Modbus RTU protocol with the following interface parameters:

| | |
|---|---|
| Baud rate | 19200 bps |
| Format | 8n1 |
| Maximum cable length | 1.2km |
| Unit Load | 1/8 |
| Byte order | MSBit–LSBit |
| Word order | LSByte–MSByte |
| Address range | 1 – 247 |
| Max. frame length | 256 bytes |

The following function codes are supported:

| | |
|---|---|
| 03 | Read contents of a holding register |
| 04 | Read contents of an input register |
| 06 | Write contents of a R/W register (preset single register) |

For reading the registers it holds:

| | **Address basis** | **Function code for reading** | **Function code for writing** |
|---|---|---|---|
| **Input register** | 30001 | 0x04 | – |
| **Holding register** | 40001 | 0x03 | 0x06 |

The table in Section 5.2 contains a list of features, the associated registers and data types and permissible or possible values.

## 5.2 List of registers and functions

| Abbreviations used | Explanation |
|---|---|
| UINT16 | Data type Unsigned Integer, 16 bit |
| UINT32 | Data type Unsigned Integer, 32 bit |
| Float32 | Data type Float, 32 bit |
| R | Only read access possible (read only) |
| R/W | Read and write access possible (read/write) |

| Register (integer) | Data type | Channel (description) | Possible values | Unit | R/W |
|---|---|---|---|---|---|
| 0000 | UINT16 | Digital input 01<br>(Main switch) | 0: OFF<br>1: ON | | R |
| 0001 | UINT16 | Digital input 02<br>(1000$V_{DC}$ surge protection) | 0: NOK<br>1: OK | | R |
| 0003 | UINT16 | Digital input 03 | 0, 1 | | R |
| 0004, 0005 | Float32 | Current $I_1$ | -20,00 ... +20,00 | A | R |
| 0006, 0007 | Float32 | Current $I_2$ | -20,00 ... +20,00 | A | R |
| 0008, 0009 | Float32 | Current $I_3$ | -20,00 ... +20,00 | A | R |
| 0010, 0011 | Float32 | Current $I_4$ | -20,00 ... +20,00 | A | R |
| 0012, 0013 | Float32 | Current $I_5$ | -20,00 ... +20,00 | A | R |
| 0014, 0015 | Float32 | Current $I_6$ | -20,00 ... +20,00 | A | R |
| 0016, 0017 | Float32 | Current $I_7$ | -20,00 ... +20,00 | A | R |
| 0018, 0019 | Float32 | Current $I_8$ | -20,00 ... +20,00 | A | R |
| 0020, 0021 | Float32 | Voltage | 0 ... 1000.0 | V | R |
| | | | | | |
| 0028, 0029 | Float32 | Power | 0 ... 160000 | W | R |
| | | | | | |
| 0036, 0037 | Float32 | Temperature 1 | -40.0 ... +160.0 | °C | R |
| 0038, 0039 | Float32 | Temperature 2 | -40,0 ... +160,0 | °C | R |
| | | | | | |

| Register (integer) | Data type | Channel (description) | Possible values | Unit | R/W |
|---|---|---|---|---|---|
| 0042, 0043 | Float32 | Total current | -160.00 ... +160.00 | A | R |
| 0044, 0045 | UINT32 | Date of the firmware | 0xDDMMYYYY<br>Example:<br>0x040507DB<br>04.05.2011 | | R |
| 0046, 0047 | UINT32 | Software version | 0xBBBBMMNN<br>Example:<br>0x12510102<br>V1.02.1251 | | R |
| 0048 | UINT16 | Error code | 1: OK<br>≠1: NOK | | R |
| 0059 | UINT16 | Sync ID[1)] | User code of Reg 0302 | | R |
| 0060, 0061 | Float32 | Sync_Current $I_1$[1)] | -20.00 ... +20.00 | A | R |
| 0062, 0063 | Float32 | Sync_Current $I_2$ | -20,00 ... +20,00 | A | R |
| 0064, 0065 | Float32 | Sync_Current $I_3$ | -20,00 ... +20,00 | A | R |
| 0066, 0067 | Float32 | Sync_Current $I_4$ | -20,00 ... +20,00 | A | R |
| 0068, 0069 | Float32 | Sync_Current $I_5$ | -20,00 ... +20,00 | A | R |
| 0070, 0071 | Float32 | Sync_Current $I_6$ | -20,00 ... +20,00 | A | R |
| 0072, 0073 | Float32 | Sync_Current $I_7$ | -20,00 ... +20,00 | A | R |
| 0074, 0075 | Float32 | Sync_Current $I_8$ | -20,00 ... +20,00 | A | R |
| 0076, 0077 | Float32 | Sync_Voltage | 0 ... 1000.0 | V | R |
| 0078, 0079 | Float32 | Sync_Power | 0 ... 160000 | W | R |
| 0080, 0081 | Float32 | Sync_Temperature 1 | -40.0 ... +160.0 | °C | R |
| 0082, 0083 | Float32 | Sync_Temperature 2 | -40,0 ... +160,0 | °C | R |
| 0084, 0085 | Float32 | Sync_Total_current | -160.00 ... +160.00 | A | R |
| | | | | | |
| 0099 | UINT16 | Relay status | 0: OFF<br>1: ON | | R/W |

| Register (integer) | Data type | Channel (description) | Possible values | Unit | R/W |
|---|---|---|---|---|---|
| | | | | | |
| 0200 | UINT16 | Device ID | e.g. 2005 | | R |
| 0202 | UINT16 | Serial number low | e.g. 14148 | | R |
| 0203 | UINT16 | Serial number high | e.g. 4 | | R |
| 0205 | UINT16 | Modbus address | 1 ... 254 | | R/W |
| 0206 | UINT16 | Type of current measurement[1)] | 0: Default (Factory setting)<br>1: Fast, 20 ms | | R/W |
| 0208 | UINT16 | Response delay in ms[3)] | 0 ... 250 | | R/W |
| 0300 | UINT16 | EcoMode[4)] | 0: OFF (Factory setting)<br>1: ON | | R/W |
| 0302 | UINT16 | Sync register[1)] | User code<br>Write: Trigger Sync | | R/W |

1) Please refer to Section 5.3.3, Page 28 for an explanation of the Sync register and the benefits of synchronization.

2) Please see Section 5.3.1, Page 28 for an explanation of the two types of current measurement.

3) For an explanation of the use of the response delay see Section 5.3.4, Page 30.

4) For more information on the EcoMode see Section 5.3.2, Page 28.

## 5.3 Advanced configuration options

To adapt the string.bloxx module optimally to your needs, you can use several parameters to control the behavior. The following table provides an overview of the available options. For a more detailed explanation please see the sections specified in the table (“See” column).

| | Mode | Property | Explanation | Register | See |
|---|---|---|---|---|---|
| Measurement modes | Default | Low noise, good noise suppression | The values are written into the registers every second.<br>Due to the longer measurement time, however, the response time of the Modbus communication is about 20 ms. | 206 = 0 | 5.3.1 |
| | Fast | High measuring rate | The values are written into the registers every 100 ms. | 206 = 1 | |
| Operating modes | Default | Fast measuring value update | The string.bloxx module is permanently and fully operational.<br>Power consumption 1.4 W. | 300 = 0 | 5.3.2 |
| | Eco | Minimal power consumption, power supply possible from the PV system | The metrological part is turned on only once per minute to perform the measurement and write the values into the registers. The display backlight is switched off.<br>The communication part is permanently active.<br>Power consumption 0.1 W. | 300 = 1 | |
| Data collection modes | Default | Simple communication | With several string.bloxx modules on one bus, the data are collected sequentially, i.e. with a time lag. | – | 5.3.3 |
| | Sync | Synchronous measured values from all modules in a system | In the synchronized mode, the controller sends a broadcast value to all modules (register 302). These store the current measured values simultaneously in special registers. Then the values are transmitted sequentially. Thus, all values will be collected simultaneously even in large systems. | 302 | |
| Delay | Default | Short response times | Requests from the bus master will be answered as quickly as possible. | – | 5.3.4 |
| | Delayed | Adaptation to PLC reaction time | Requests from the bus master will be answered only after the specified time. | 208 | |

### 5.3.1 Toggling the measurement mode

The measurement of the input currents and the total voltage can be carried out in two ways:

1. In the *Default* setting, all inputs are measured over about one second (1000 ms) and this value is transferred to the registers.

   Due to this relatively long measurement time, over which the individual measured values of the A/D converter are averaged, the noise component in the signal is low and you get a good interference signal suppression.

2. In the *Fast* mode (register 206 = 1) the measurement is carried out only over about 100 ms (milliseconds).

   This provides a high measurement or refresh rate and the response time to the Modbus interfaces (response delay, see also Section 5.3.4) drops from about 20 ms to about 5 to 8 ms.

### 5.3.2 Using the EcoMode

By enabling the EcoMode (register 300 = 1) you can dramatically reduce the power consumption of the string.bloxx module: from about 1.4 W to only 0.1 W.

To this end, the metrological part of the module is turned off completely after each measurement in the string.bloxx module, depending on the measurement mode (100 ms or 1000 ms, see Section 5.3.1), and also the display backlight. Every minute, the metrological part is now enabled for a new measurement and then disabled again. The communication part of the module (Modbus interface) is always active, however; i.e., the measured values can be read at any time. However, new measured values will be generated only once per minute.

### 5.3.3 Synchronizing modules (Data collection modes)

One major problem in larger solar systems is caused by the serial transmission of data and the limited transmission speed of the Modbus connection: The values of each PV string (or string.bloxx of each module) are usually scanned individually and sequentially. This creates a time lag between the data of the first ($t_{1)}$ and those of the last PV strings ($t_{n),}$ which may be in the range of several seconds (Fig. 5-1). The measured values are thus not determined synchronously and cannot be compared directly. (With the string.bloxx modules, all PV strings within a module are detected at the same time.)

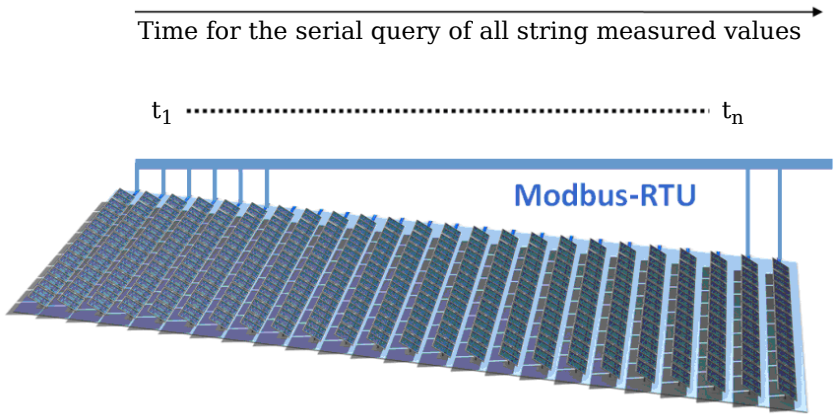



*Fig. 5-1: Time lag due to serial communication in standard PV systems*

string.bloxx modules offer the opportunity to prevent this delay by sending a special command to all modules at the same time (broadcast) to “freeze” the current measured values of all PV strings of all modules at the same time. Then, these values are queried sequentially by all string.bloxx modules and transmitted. Although the data arrive with a delay at the controller, the values themselves have been collected simultaneously and synchronously.

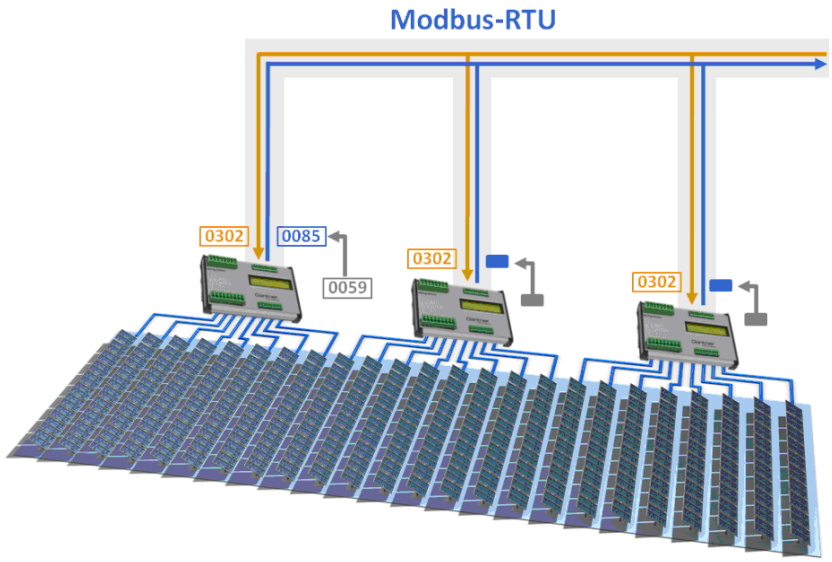



*Fig. 5-2: Synchronous detection of the measured values of all PV strings with string.bloxx*

**Procedure to follow**

1. Send a broadcast message by writing a value in register 302 (Sync register) via the Modbus address 0 (broadcast address).

   Thus, in each module, the actual measured values are written into the (internal) registers 60 to 85, the broadcast value is transferred to register 59.

2. Now read out sequentially from all modules the measured values of the individual strings from registers 60 to 85 and the value of register 302 from register 59.

Because the modules transmit the measured values of the individual strings to the sync registers 60 to 85 at the same time, this method delivers synchronously detected measured values from all PV strings.

**Tip**

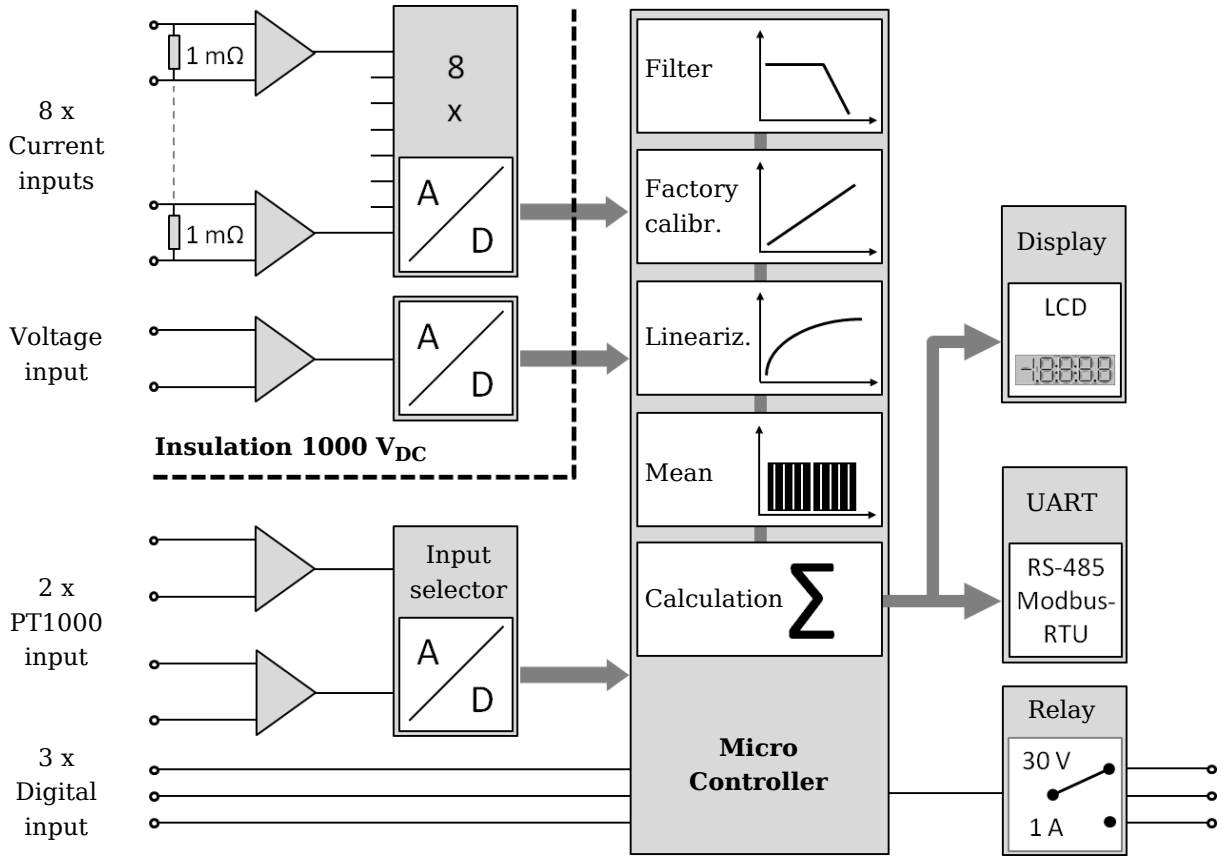
If you write a different value in the register 302 for every broadcast, you can use the value from register 59 to check whether the broadcast was received and if these are the actual measured values (same value).

### 5.3.4 Using the response delay

Depending on the measurement mode for the current and voltage measurement, the response time to a query (request) via the Modbus interface is between 5 and 20 milliseconds. You can use the register 208 to extend the time to answer, if this is too fast for the Modbus master used and, therefore, there is a risk that responses are not recognized because they are available on the bus already shortly after the request. Enter the *additional* required delay in milliseconds in register 208 as a numerical value.

# 6 Technical Data

## 6.1 Block diagram string.bloxx



## 6.2 Technical data string.bloxx

| **Input current** | |
|---|---|
| Number | 8 |
| Measuring range | ± 20 A |
| Accuracy | 0.25% of full scale |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 10 $mm^2$ with solid conductor<br>0.2 $mm^2$ to 6 $mm^2$ with flexible conductor<br>0.25 $mm^2$ to 6 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve<br>0.2 $mm^2$ to 4 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 15 mm |
| **Output current string.bloxx 108-1P and 108-1M** | |
| Number | 1 |
| Maximum total current | 125A |
| Connection<br>(Screw terminal) | 0.5 $mm^2$ to 35 $mm^2$ with solid conductor<br>0.5 $mm^2$ to 25 $mm^2$ with flexible conductor<br>1 $mm^2$ to 25 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve<br>1.5 $mm^2$ to 25 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 18 mm |
| **Output current string.bloxx 108-8P and 108-8M** | |
| Number | 8 |
| Maximum current | 20A |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 10 $mm^2$ with solid conductor<br>0.2 $mm^2$ to 6 $mm^2$ with flexible conductor<br>0.25 $mm^2$ to 6 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve<br>0.2 $mm^2$ to 4 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 15 mm |

| **Input voltage** | |
|---|---|
| Number | 1 |
| Measuring range | 0 V to 1000 $V_{DC}$ |
| Accuracy | 0.2% of full scale |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4$mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5$mm^2$ with flexible conductor<br>0.25$mm^2$ to 2.5$mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8mm<br>0.2$mm^2$ to 1.5$mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8mm |
| **Input temperature** | |
| Number | 2 |
| Type | PT1000 2-wire circuit |
| Measuring range | -40°C to +160°C |
| Accuracy | 0.5% of full scale |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4$mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5$mm^2$ with flexible conductor<br>0.25$mm^2$ to 2.5$mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8mm<br>0.2$mm^2$ to 1.5$mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8mm |
| **Digital input** | |
| Number | 3 |
| Type<br>Upper switching threshold<br>Lower switching threshold | Status<br>> 3.5 V (logic 0, the input is internally pulled to +5 V)<br><1.0 V (logic 1) |
| Maximum input voltage | 30 $V_{DC}$ |
| Default value | D_IN 1: Main Switch (state can also be displayed on the LCD)<br>D_IN 2: Surge Protection (state can also be displayed on the LCD) |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4$mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5$mm^2$ with flexible conductor<br>0.25$mm^2$ to 2.5$mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8mm<br>0.2$mm^2$ to 1.5$mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8mm |

| Digital output | |
|---|---|
| Number | 1 |
| Type | Status, alarm |
| Contact | Relay changer |
| Maximum switching voltage | 30 $V_{DC}$ |
| Maximum switching current | 1000 mA (resistive load) |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4 $mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5 $mm^2$ with flexible conductor<br>0.25 $mm^2$ to 2.5 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8 mm<br>0.2 $mm^2$ to 1.5 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8 mm |
| **Supply** | |
| Supply voltage | 10 $V_{DC}$ to 60 $V_{DC}$, surge and reverse voltage protection |
| Power consumption | approximately 1.4 W; 0.1 W in EcoMode (see Section 5.3.2, Page 28) |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4 $mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5 $mm^2$ with flexible conductor<br>0.25 $mm^2$ to 2.5 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8 mm<br>0.2 $mm^2$ to 1.5 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8 mm |
| **Communication interface** | |
| Standard | RS-485 (TIA/EIA-485), 2-wire |
| Data format | 8n1 |
| Protocols | Modbus RTU |
| Baud rate | 19,200 bps |
| Number of devices on the bus | max. 250 |
| Unit load on the bus | 1/8 (thus enabling up to 256 participants) |
| Connection<br>(Push-in spring-cage connection) | 0.2 $mm^2$ to 4 $mm^2$ with solid conductor<br>0.2 $mm^2$ to 2.5 $mm^2$ with flexible conductor<br>0.25 $mm^2$ to 2.5 $mm^2$ with flexible conductor with wire end ferrule without plastic sleeve, wire stripping length 8 mm<br>0.2 $mm^2$ to 1.5 $mm^2$ with flexible conductor with wire end ferrule with plastic sleeve, wire stripping length 8 mm |

| **Environmental conditions** | |
|---|---|
| Operating temperature | -20°C to +60°C |
| Storage temperature | -40°C to +85°C |
| Relative humidity | 5 % to 95 % at 50 °C, non-condensing |
| **Housing** | |
| Material | Polycarbonate |
| Dimensions (W x H x D) | 205 x 128 x 55 (in mm) |
| Weight | approx. 400 g |
| Type of mounting | Top-hat rail according to DIN EN 60715 or wall mounting |

# 7 Declaration of Conformity

**Konformitätserklärung – Declaration of Conformity – Déclaration de Conformité**

The undersigned, representing:

Gantner Instruments Environment Solutions GmbH
Am Mühlgraben 8 – 08297 Zwönitz /Germany
tel: +49 /37754-3351-0 – www.gantner-environment.com

herewith declares, that the product:

**String.bloxx**
Certificate Ref No: **110412JS-01**

is in conformity with the following EC directive(s), including all applicable amendments:

| Directives | | Short Title |
|---|---|---|
| X | 2004 / 108 / EC | EMC Directive |
| | 99 / 5 / EEC | R&TTE Directive |
| | 2006 / 95 / EC | Low Voltage Directive |
| | 2006 / 42 / EC | Machinery Directive |
| | 99 / 519 / EEC | Limitation of human exposure to electromagnetic Fields |

Only "x"-marked directives are relevant for the product and for this declaration of conformity!

and that the standards and/or technical specifications referenced below have been applied:

| Standards | | | Short Title |
|---|---|---|---|
| EMC | | EN 61000-6-1 : 2007 | Generic immunity standard for residential, commercial and light-industrial environments |
| | X | EN 61000-6-2 : 2005 | Generic immunity standard for industrial environments |
| | | EN 61000-6-3 : 2007 | Generic emission standard for residential, commercial and light-industrial environments |
| | X | EN 61000-6-4 : 2007 | Generic emission standard for industrial environments |
| | X | EN 61326: 1997+A1+A2 | Electrical equipment for measurement, control and laboratory use – EMC requirements |
| R&TTE | | EN 300220-1/3 : 2010 | Electromagnetic compatibility for Short Range Devices (SRDs) from 25 to 1000 MHz |
| | | EN 300330-1/2 : 2010 | Electromagnetic compatibility for Short Range Devices (SRDs) from 9 kHz to 25 MHz |
| | | EN 301489-1/3 : 2008 | Electromagnetic compatibility for Short Range Devices (SRDs) from 9 kHz to 40 GHz |
| Safety | | EN 61010 : 2001 | Safety requirements for electrical equipment for measurement, control and laboratory use |
| | | EN 60950 : 2000 | Safety requirements for information technology equipment |
| | | EN 60335 : 2002 | Safety of household and similar electrical appliances |
| | X | IEC 62109 - 1 | Safety of power converters for use in photovoltaic power systems |
| Machinery | | EN 12100-1: 2003+A1:09 | Safety of machinery – Basic concepts, general principles for design |
| | | EN 954-1: 1996 | Safety of machinery – Safety-related parts of control system |
| | | EN 60204-1: 2006/A1:09 | Safety of machinery – Electrical equipment |
| Human Expos. | | EN 50364 : 2001 | Limitation of human exposure to electromagnetic fields |
| | | EN 50371 : 2002 | Limitation of human exposure to electromagnetic fields (10MHz-300GHz) – Generic Standard |

Remarks: Only "x"-marked standards are relevant for the product and for this declaration of conformity! Concerning safety aspects, the general and the product specific warning and safety instruction in the product accompanying documents must also be regarded!

This declaration is based upon the respective technical documentation held by the manufacturer.

CE

**Zwönitz, 12th April 2011**

Jörg Scholz, General Manager

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Subject to change in the course of further technical development



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