Gantner instruments

string.bloxx 116

Manual

Vers. No. 1.2

Table of Contents

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.

For the declaration of conformity please refer to Chapter 7 on page 37.

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.**

Symbol: 

Meaning: High voltage may be present on the module connections. Connections may only be made by particularly educated persons.

Symbol: 

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

1.12 Conventions in this manual

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

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.

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.

Germany

Gantner Instruments Environment Solutions GmbH
Am Mühlgraben 8
08297 Zwönitz
Tel.: +49 (0) 37754 3351–0
Fax: +49 (0) 37754 3351–20
E-mail: office@gantner-environment.com
Web: www.gantner-environment.com

or

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

Austria

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

2.1 The documentation for string.bloxx

The documentation for the string.bloxx module 116 consists of this manual. You can also download this manual as a PDF file from our home page www.gantner-environment.com.

2.2 About this manual

This manual describes the installation, configuration and operation of the string.bloxx module 116.

The manual is divided into several chapters:

- Safety information in Chapter 1, page 5ff.
- You will find a description of the system and the main combination and expansion options in the next section.
- The description of the installation and the terminal assignments can be found in Chapter 3, *Installation and Removal*, page 13ff.
- The description of the possible displays (LCD display) and the configuration of the bus address can be found in Chapter 4, *Initial Operation*, page 19ff.
- The Modbus RTU commands and functions applicable to the module can be found in Chapter 5, *Modbus Communication*, page 23ff.
- A block diagram of the string.bloxx module and all technical data can be found in Chapter 6, *Technical Data*, page 33ff.
- The declaration of conformity can be found in Chapter 7 on page 37.

2.3 System description

The string.bloxx series has been developed for measurement and test engineering on solar power systems, in particular for multi-channel measurements of electrical and thermal quantities. The modules enable the direct voltage side of photovoltaic systems (PV systems) to be monitored independently of the inverter and you can also detect errors promptly and rectify them:

- soiling due to pollen, dust and soot
- influence of the weather, 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 16 solar module strings (interconnection of multiple solar modules), hereafter referred to as PV strings, are to be connected.

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

Parameters, such as voltage and current or temperature, can be directly displayed with the integral display for operation and checking on site. The modules have a Modbus interface for control and for reading out data.

3 Installation and Removal

DANGER

The cables to be connected may be carrying voltages of up to 1000 volts!

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

Follow the safety information in Chapter 1, page 5.

3.1 Integration of the module into a solar power system

A typical example for the wiring of the string.bloxx module 116 within a solar power system is shown in Fig. 3-1.

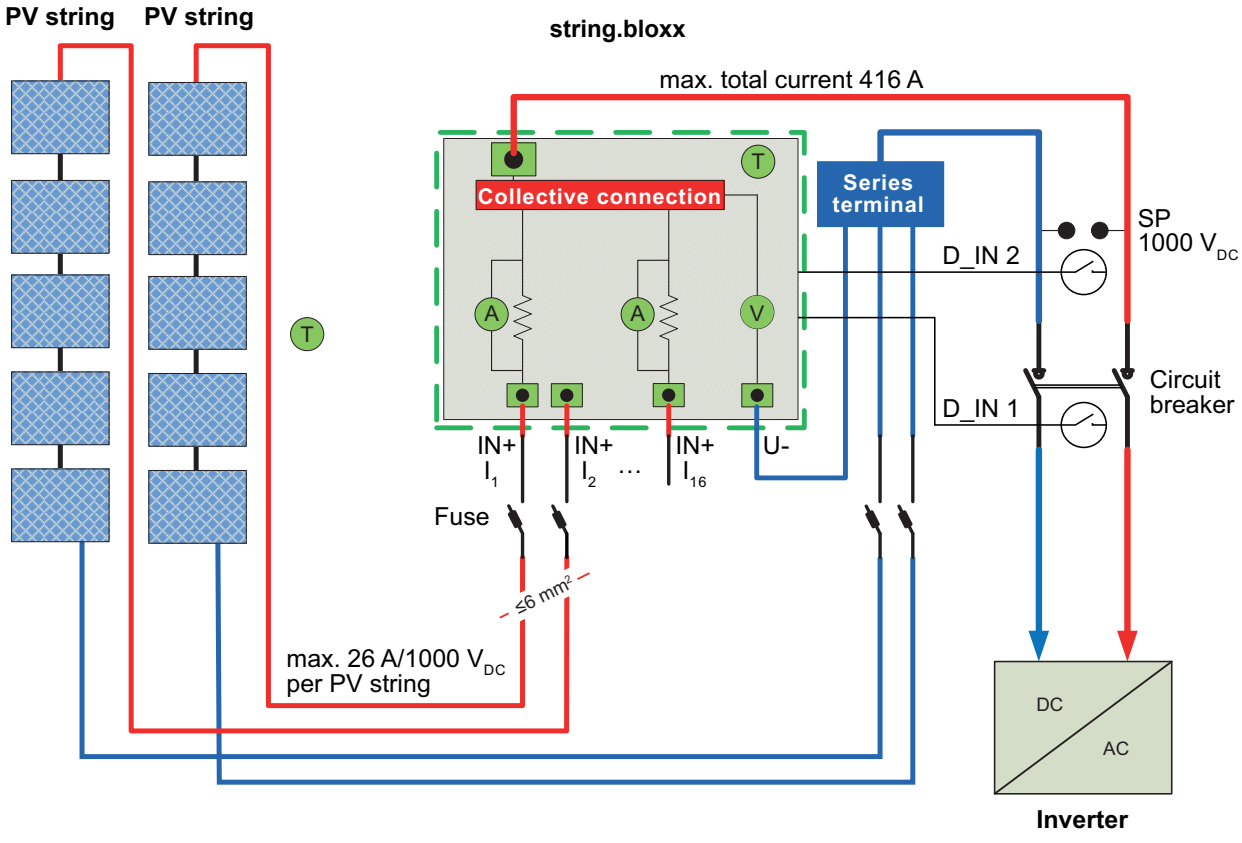


Fig. 3-1 Typical wiring; OVP = overvoltage protection.

The combinations of the individual photovoltaic modules (PV strings) are connected to the IN+ inputs (positive voltage). In this way the currents of the individual strings can be measured. The overall voltage of the connected strings is measured through the

U– input (negative voltage). Up to 16 strings can be connected to a string.bloxx module. The total current is led out through a single terminal, the bus terminal.

NOTICE

For a proper connection further components are required which are not included with the string.bloxx module, e.g. fuses, overvoltage protection (SPD, Surge Protection Devices) or DC disconnectors.

Install these types of elements depending on the system (size, spatial distribution, etc.), because otherwise the module can be damaged.

3.2 Terminal assignment

Fig. 3-2 on page 15 illustrates the terminal assignment of the string.bloxx module. The connections for the supply voltage and the RS-485 interface are provided double to simplify the connection of further modules.

Reserved names for the digital input functions

D_IN 1: Main Switch

D_IN 2: Surge Protection

The status of these two digital inputs can also be shown in the LCD display.

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

Names used in the LCD display for the PT1000

PT1000 1: Temperature 1

PT1000 2: Temperature 2

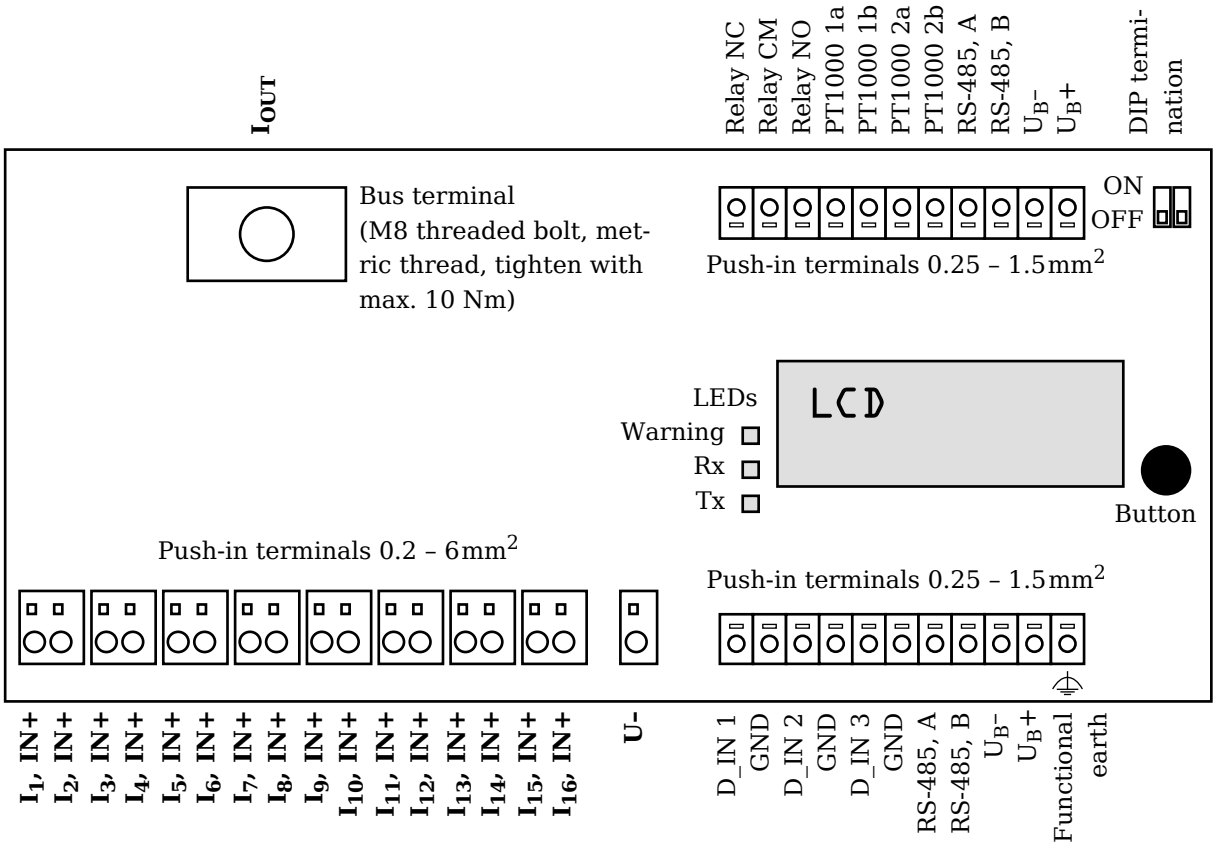


Fig. 3-2 Terminal assignment of the string.bloxx module 116 (the drawing is not drawn to scale).

3.3 Installation

To install the module on a mounting rail first hook the module onto the mounting rail at the bottom and then at the top press it onto the mounting rail until it latches (refer also to the illustration in Section 3.4, *Withdrawal from operation, removal*, page 17).

Fitting the cables into the push-in terminals

To connect cables to the push-in terminals insert a narrow screwdriver into the slot in the terminal next to the cable entry (conductor shaft). This opens the clamping fastener and the wire can be pushed into the spring cage. Once the screwdriver is removed, the spring pulls the conductor against the bus bar.

Fitting the cable to the bus terminal

The M8 threaded bolt has a metric thread. Tighten the fastening nut with a maximum of 10 Nm.

Procedure for connection

1. Connect the functional earth.
2. Connect the supply voltage.
3. If required, connect the interface links (RS-485 / Modbus) and set the bus termination.

   Refer to Section 5.2, *Connecting interfaces* on page 24 with regard to wiring the bus cables and the bus termination.
4. Connect your signals, as required, to the D_IN digital inputs.

   Since the status of the D_IN 1 and D_IN 2 inputs can also be displayed on the LCD display and is pre-assigned with the terms Main Switch and Surge Protection, we recommend that these inputs are only connected as follows: D_IN 1 on appropriate auxiliary contacts of the main switch and D_IN 2 on remote alarm contacts of the overvoltage protection. Note that the status 1 with open input and the status 0 with short-circuited input are displayed.
5. Connect the temperature probe (PT1000) as required.
6. Connect the relay as required.
7. Connect the cable for the positive output voltage to the bus terminal.
8. Connect the cable for the measurement of the total voltage to U– (“terminal block” in Fig. 3-1).
9. Connect the individual strings (I_1 to I_{16}).

With that the string.bloxx module is fully connected and can be put into operation.

3.4 Withdrawal from operation, removal

DANGER

The connected cables may be carrying voltages of up to 1000 volts!

Before removal check that all sources of power are Locked Out.

Follow the safety information in Chapter 1, page 5.

IMPORTANT

The “Warning” LED on the circuit board (Fig. 3-2, page 15) lights when a voltage exceeding 40V is present on one of the terminals for the PV strings.

Removal of the cables

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

Removal from the mounting rail

Insert a narrow screwdriver through one of the lugs at the top on the module (1 in Fig. 3-3). Then press the screwdriver in the direction of the module (2). The retaining mechanism then unlatches and you can slightly pull off the module from the mounting rail on this side (3). Hold the module with one hand so that it dos not fall down and proceed similarly with the lug on the other side to completely remove the module from the mounting rail.

Fig. 3-3 Removing a module (example).

4 Operation and Display

The string.bloxx module can display various measurements and operating states using the integrated display and the button situated below it: the currents of the individual strings, the total voltage or the states of inputs and the output (relay).

The only setting which you can carry out with the display is the setting of the bus address for the interface.

4.1 Setting the interface bus address

The RS-485 interface is an interface capable of bus operation, i.e. basically up to 256 devices can be connected to *one* interface. In order to be able to establish a connection to a device, each device must therefore have a unique address.

The current address of the string.bloxx module is displayed in the main screen in the second line, e.g. **ADDRESS 116**: On the string.bloxx module you can enter the addresses 1 to 247; the other addresses are reserved.

Procedure for changing the address

1. If the main screen is not displayed (refer also to Section 4.2.1), press the button below the LCD display a number times until the main screen is shown.
2. Once the main screen is displayed, press the button for about four seconds to enter the input mode.

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

   If you press it only briefly, the number is only increased by one, but pressing for longer continually increments the number. When 247 is reached, counting starts again.
4. If the button is left unpressed for longer than six seconds, the displayed address is saved secure from power supply failure and activated. The programming mode is then exited.

4.2 Displayable information

When the supply voltage is applied, the manufacturer's information is displayed for about five seconds, e.g. **GANTNER INSTRUMENTS** and then the module name and the software version, e.g. **STRING.BLOXX 116 V1.02**. Then the main screen is displayed.

4.2.1 Information displayed in the main screen

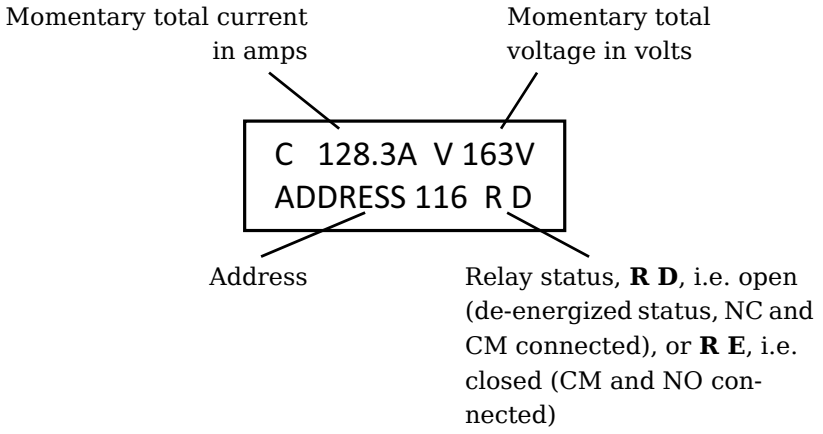


Fig. 4-1 Main screen.

4.2.2 Displayable information

By pressing the button below the LCD display you can show the available information in the display. Each depression switches further to the next display.

➡ The display does not jump back again to the main screen; the display holds the last displayed screen.

Display after pressing the button once:

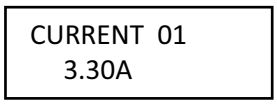


Fig. 4-2 Display of the current in the first string (I_1 IN+).

The following appears on pressing the button again:

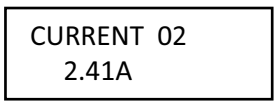


Fig. 4-3 Display of the current in the second string (I_2 IN+).

Each depression of the button switches to the display of the next current until the current in the sixteenth string is reached, then further system parameters are shown after each depression:

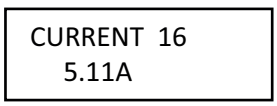
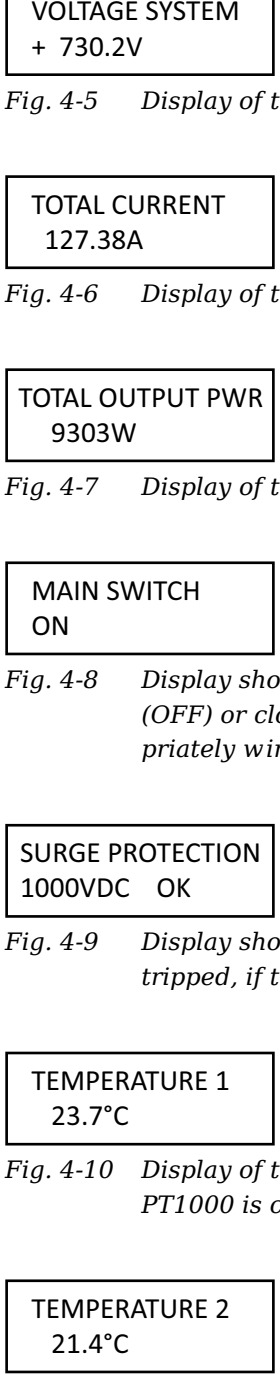


Fig. 4-4 Display of the current in the sixteenth string (I_{16} IN+).

Press the button once to move to the next display



VOLTAGE SYSTEM
+ 730.2V

Fig. 4-5 Display of the system voltage present on U–.

TOTAL CURRENT
127.38A

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

TOTAL OUTPUT PWR
9303W

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

MAIN SWITCH
ON

Fig. 4-8 Display showing whether the DC disconnector is open (OFF) or closed (ON), if the digital input D_IN 1 is appropriately wired.

SURGE PROTECTION
1000VDC OK

Fig. 4-9 Display showing whether the overvoltage protection has tripped, if the digital input D_IN 2 is appropriately wired.

TEMPERATURE 1
23.7°C

Fig. 4-10 Display of the temperature on Probe 1 (PT1000 1), if a PT1000 is connected.

TEMPERATURE 2
21.4°C

Fig. 4-11 Display of the temperature on Probe 2 (PT1000 2), if a PT1000 is connected.

The main screen is shown again on pressing the button once more.

5 Modbus Communication

This chapter contains the list of interface parameters (Section 5.1), the list of available registers with the relevant functions (Section 5.3) and the explanation of the advantages and disadvantages of particular functions (sections 5.4.1 to 5.4.3).

5.1 Interface parameters

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

Baud rate	1200 ... 38400bit/s
Format	8n1, 8e1 or 8o1
Max. cable length	1.2km
Unit load	1/8
Byte order	MSBit–LSBit
Word order	LSByte–MSByte
Address range	1 – 254
Max. frame length	256 bytes

The following are supported as function codes:

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

For reading the registers the following therefore arises:

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

The table in Section 5.3 contains a list of the functions, the associated registers and data types and the admissible or possible values.

5.2 Connecting interfaces

5.2.1 Cables

Use twisted-wire cables, with a screen if possible. Connect all bus devices as a chain (one behind the other; refer to Fig. 5-1). For the chain configuration the modules have doubled, internally linked through-connections (top and bottom): you use one bus connection as input, the other as output to the next bus device. The order of top or bottom is here unimportant.

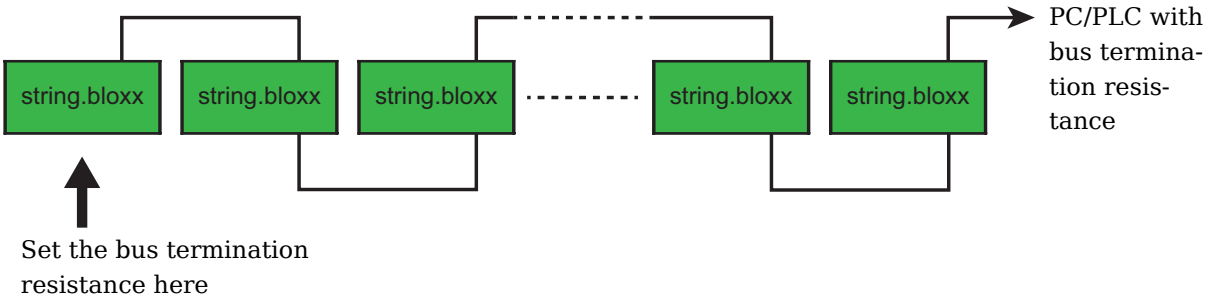


Fig. 5-1 Bus wiring for RS-485 or Modbus.

Connect the screen of the bus cable flat on the screen terminals (no point contact), e.g. with the type SKS 8-SNS35 – 3062786 from Phoenix Contact (refer to the adjacent illustration). We recommend that the screens are only earthed at one point and between the modules are only connected one to the other.

5.2.2 Tx and Rx LED indicators

The Rx LED lights when communication is taking place on the bus. Tx lights when the module itself is transmitting. Refer to Fig. 3-2, page 15 for the location of the LEDs.

5.2.3 Bus termination

To prevent signal reflections on the interface lines each section (bus segment) must be terminated at its physical start and end with a certain resistance. To do this, a terminating resistance is connected between the bus lines A and B. The line A is then connected via a pull-up resistor to +5V and line B is connected via a pull-down resistor to 0V. This cascade of three resistors ensures interference-free data transmission and defined potentials (voltage levels) when no data are being transmitted over the bus (the interface). The string.bloxx modules 116 already have these resistors built in. You activate the resistors via *both* DIP switches; in this way both bus lines are connected to the resistance circuit: Push the switch in Fig. 5-2 upwards (refer also to Fig. 3-2 on

page 15). The DIP switches must always be both actuated, i.e. both set to On or both set to Off.

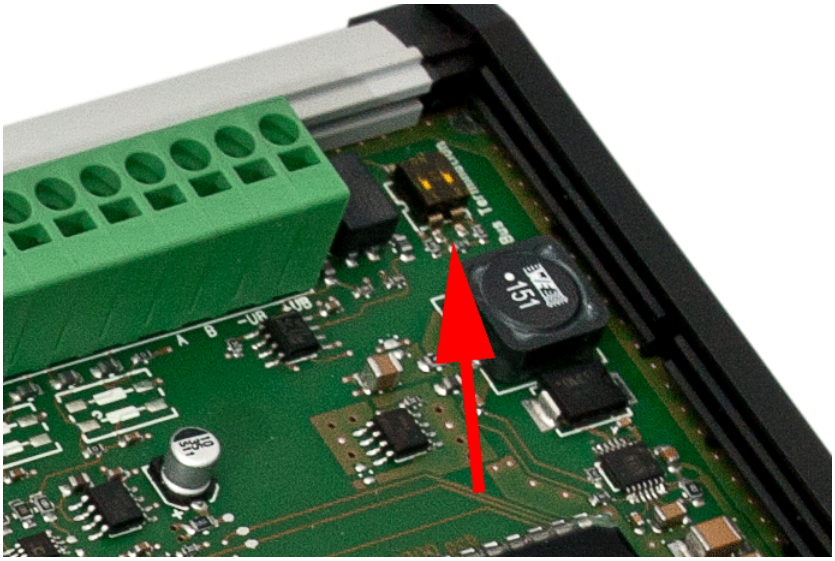


Fig. 5-2 DIP switches for activating the bus termination resistances; current setting: OFF (down, default setting)

IMPORTANT

The terminating resistances may only be activated at the end points of the interface line (of the bus segment). If resistances are also activated in between, the signal is weakened and interference or even interruption of the data transmission occurs for the modules located after the additional resistances.

5.3 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 floating, 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 (Main switch)	0: OFF 1: ON		R
0001	UINT16	Digital input 02 (1000V_{DC} overvoltage protection)	0: NOK 1: OK		R
0003	UINT16	Digital input 03	0, 1		R
0004, 0005	Float32	Current I_1	-30.00 ... +30.00	A	R
0006, 0007	Float32	Current I_2	-30.00 ... +30.00	A	R
0008, 0009	Float32	Current I_3	-30.00 ... +30.00	A	R
0010, 0011	Float32	Current I_4	-30.00 ... +30.00	A	R
0012, 0013	Float32	Current I_5	-30.00 ... +30.00	A	R
0014, 0015	Float32	Current I_6	-30.00 ... +30.00	A	R
0016, 0017	Float32	Current I_7	-30.00 ... +30.00	A	R
0018, 0019	Float32	Current I_8	-30.00 ... +30.00	A	R
0020, 0021	Float32	Current I_9	-30.00 ... +30.00	A	R
0022, 0023	Float32	Current I_{10}	-30.00 ... +30.00	A	R
0024, 0025	Float32	Current I_{11}	-30.00 ... +30.00	A	R
0026, 0027	Float32	Current I_{12}	-30.00 ... +30.00	A	R
0028, 0029	Float32	Current I_{13}	-30.00 ... +30.00	A	R
0030, 0031	Float32	Current I_{14}	-30.00 ... +30.00	A	R
0032, 0033	Float32	Current I_{15}	-30.00 ... +30.00	A	R
0034, 0035	Float32	Current I_{16}	-30.00 ... +30.00	A	R
0036, 0037	Float32	Summed current	-480.00 ... +480.00	A	R
0038, 0039	Float32	Voltage	0 ... 1000.0	V	R
0040, 0041	Float32	Power	0 ... 480,000	W	R
0042, 0043	Float32	Temperature 1	-40,0 ... +160.0	°C	R
0044, 0045	Float32	Temperature 2	-40,0 ... +160,0	°C	R

Register (integer)	Data type	Channel (description)	Possible values	Unit	R/W
0050, 0051	UINT32	Firmware date	0xDDMMYYYY Example: 0x040507DB 04.05.2011		R
0052, 0053	UINT32	Software version	0xBBBBMMNN Example: 0x12510102 V1.02.1251		R
0059	UINT16	Sync ID[1)]	User code of Reg. 0302		R
0060, 0061	Float32	Sync_current I_1[1)]	-30.00 ... +30.00	A	R
0062, 0063	Float32	Sync_current I_2	-30.00 ... +30.00	A	R
0064, 0065	Float32	Sync_current I_3	-30.00 ... +30.00	A	R
0066, 0067	Float32	Sync_current I_4	-30.00 ... +30.00	A	R
0068, 0069	Float32	Sync_current I_5	-30.00 ... +30.00	A	R
0070, 0071	Float32	Sync_current I_6	-30.00 ... +30.00	A	R
0072, 0073	Float32	Sync_current I_7	-30.00 ... +30.00	A	R
0074, 0075	Float32	Sync_current I_8	-30.00 ... +30.00	A	R
0076, 0077	Float32	Sync_current I_9	-30.00 ... +30.00	A	R
0078, 0079	Float32	Sync_current I_{10}	-30.00 ... +30.00	A	R
0080, 0081	Float32	Sync_current I_{11}	-30.00 ... +30.00	A	R
0082, 0083	Float32	Sync_current I_{12}	-30.00 ... +30.00	A	R
0084, 0085	Float32	Sync_current I_{13}	-30.00 ... +30.00	A	R
0086, 0087	Float32	Sync_current I_{14}	-30.00 ... +30.00	A	R
0088, 0089	Float32	Sync_current I_{15}	-30.00 ... +30.00	A	R
0090, 0091	Float32	Sync_current I_{16}	-30.00 ... +30.00	A	R
0092, 0093	Float32	Sync_summed_current	-480.00 ... +480.00	A	R
0094, 0095	Float32	Sync_voltage	0 ... 1000.0	V	R
0096, 0097	Float32	Sync_power	0 ... 480.000	W	R

Register (integer)	Data type	Channel (description)	Possible values	Unit	R/W
0098, 0099	Float32	Sync_temperature 1	-40,0 ... +160.0	°C	R
0100, 0101	Float32	Sync_temperature 2	-40,0 ... +160,0	°C	R
0200	UINT16	Device identification, string.bloxx type, see right	2005: 108 2006: 116 2007: 208 2008: 124 2009: AIO 2010: 116 E 2011: 116 E 1500V 2012: 124 E 2013: 124 E 1500V		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
0208	UINT16	Response delay in ms[2)]	0 ... 250		R/W
0209	UINT16	Baud rate and parity	For values refer to table on on page 28		R/W
0300	UINT16	EcoMode[3)]	0: OFF (Factory setting) 1: ON		R/W
0302	UINT16	Sync register[1)]	User code Write: Trigger sync		R/W

1) For the explanation of the sync register and the advantages of synchronization refer to Section 5.4.2, page 30.

2) For the explanation of the response delay refer to Section 5.4.3, page 32.

3) For the explanation of the EcoMode refer to Section 5.4.1, page 30.

Table of values for setting the baud rate and parity

Setting	Specified value (decimal)
No parity (8n1)	0 ... 5
Even parity (8e1)	100 ... 105
Odd parity (8o1)	200 ... 205

Setting	Specified value (decimal)
1200bit/s	0 | 100 | 200
2400bit/s	1 | 101 | 201
4800bit/s	2 | 102 | 202
9600bit/s	3 | 103 | 203
19.2kbit/s	4 | 104 | 204
38.4kbit/s	5 | 105 | 205

For even parity and a baud rate of 38.4kbit/s enter 105 as the value. The number of stop bits cannot be changed (always 1).

The factory setting is: no parity (8n1) and 19.2kbit/s (4).

5.4 Extended configuration options

In order to adapt the string.bloxx module optimally to your requirements, you can control the behavior using several parameters. The following table gives you an overview of the available options; a comprehensive explanation can be found in the sections stated in the table (“Refer to” column).

	Modus	Properties	Explanation	Registers	Refer to
Operating modes	Default	Fast reading refresh	The string.bloxx module is permanently and fully in operation. Power consumption 0.9W.	300 = 0	5.4.1
	Eco	Minimal power requirement, supply from the PV system possible	The measurement section is only switched on briefly once each minute to perform the measurement and to write the values into the registers. The display illumination is switched off. The communication section is permanently active. Power consumption 0.2W.	300 = 1	

	Modus	Properties	Explanation	Registers	Refer to
Data acquisition modes	Default	Simple communication	With several string.bloxx modules on a bus the data are acquired sequentially, i.e. with a time offset.	–	5.4.2
	Sync	Synchronous measurements of all modules in a system	In the synchronized mode the controller sends a broadcast value to all modules (register 302). The modules save the current measurements simultaneously in special registers. Then the measurements are transmitted sequentially. Consequently, all values are acquired simultaneously even in large systems.	302	
Delay	Default	Short response times	Bus master requests are answered as quickly as possible.	–	5.4.3
	Delayed	Adaptation to PLC reaction time	Bus master requests are only answered after the specified time.	208	

5.4.1 Use EcoMode

Activating the EcoMode (register 300 = 1) enables you to drastically reduce the string.bloxx module power demand: from approx. 0.9 W to only 0.2 W.

To do this the measurement section in the string.bloxx module is switched off completely after each measurement and also the display illumination. Every minute the measurement section is activated for a new measurement and then switched off again. The module communication section (Modbus interface) is however always active, i.e. the measurements can be read out any time. New measurements are however only produced once per minute.

5.4.2 Synchronization of modules (data acquisition modes)

A problem with larger solar power systems arises due to the serial transmission of data and the limited transmission speed of the Modbus link: The values of each PV string (or each module with string.bloxx) are normally interrogated individually and sequentially. Consequently a time offset arises between the data of the first (t_1) and the last PV string (t_n), which can be in the range of several seconds (Fig. 5-3). The measurements are therefore not acquired synchronously and cannot be directly compared. (With the string.bloxx modules all PV strings are acquired simultaneously within a module.)

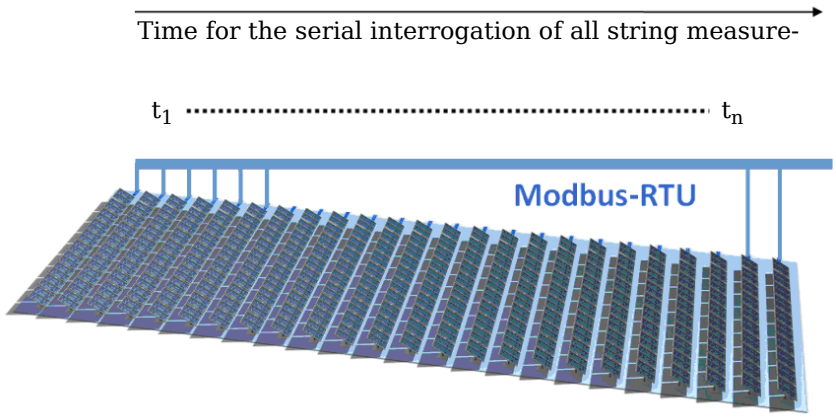


Fig. 5-3 Time offset due to serial communication in standard PV systems.

The string.bloxx modules offer you the possibility of preventing this time delay in that you send a special command simultaneously to all modules (broadcast) to “freeze” the current measurements of all PV strings of all modules simultaneously. Then you can interrogate and transmit these values consecutively from all string.bloxx modules. Although the data here arrive at the controller with a time offset, the values themselves have been acquired simultaneously and simultaneously.

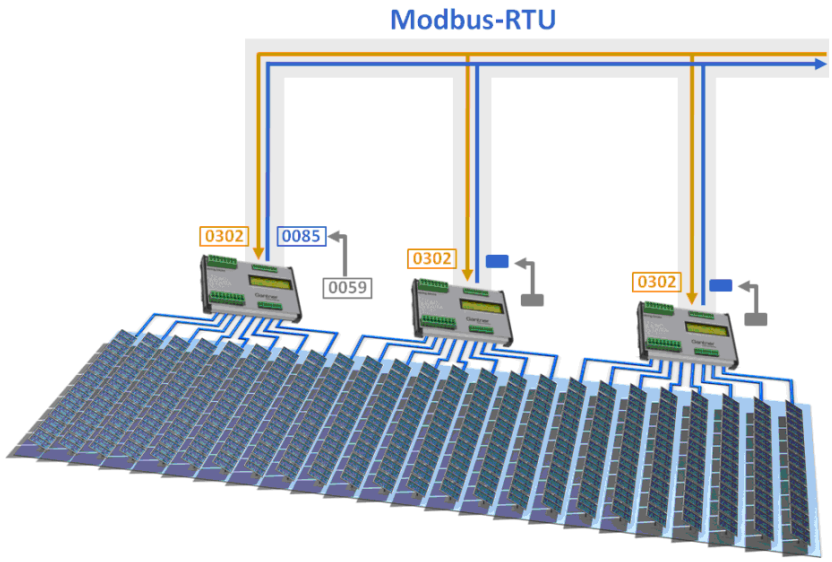


Fig. 5-4 Synchronous acquisition of all measurements of all PV strings with string.bloxx

Procedure

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

   With that the current measurements in each module are written to the (internal) registers 60 to 101 and the broadcast value is transferred into register 59.

2. Now read out the measurements of all strings from the registers 60 to 101 and the value of register 302 from register 59 from all modules consecutively.

Since the modules transfer the measurements of the individual strings simultaneously into the sync registers 60 to 101, with this method you obtain synchronously acquired measurements of all PV strings.

Tip

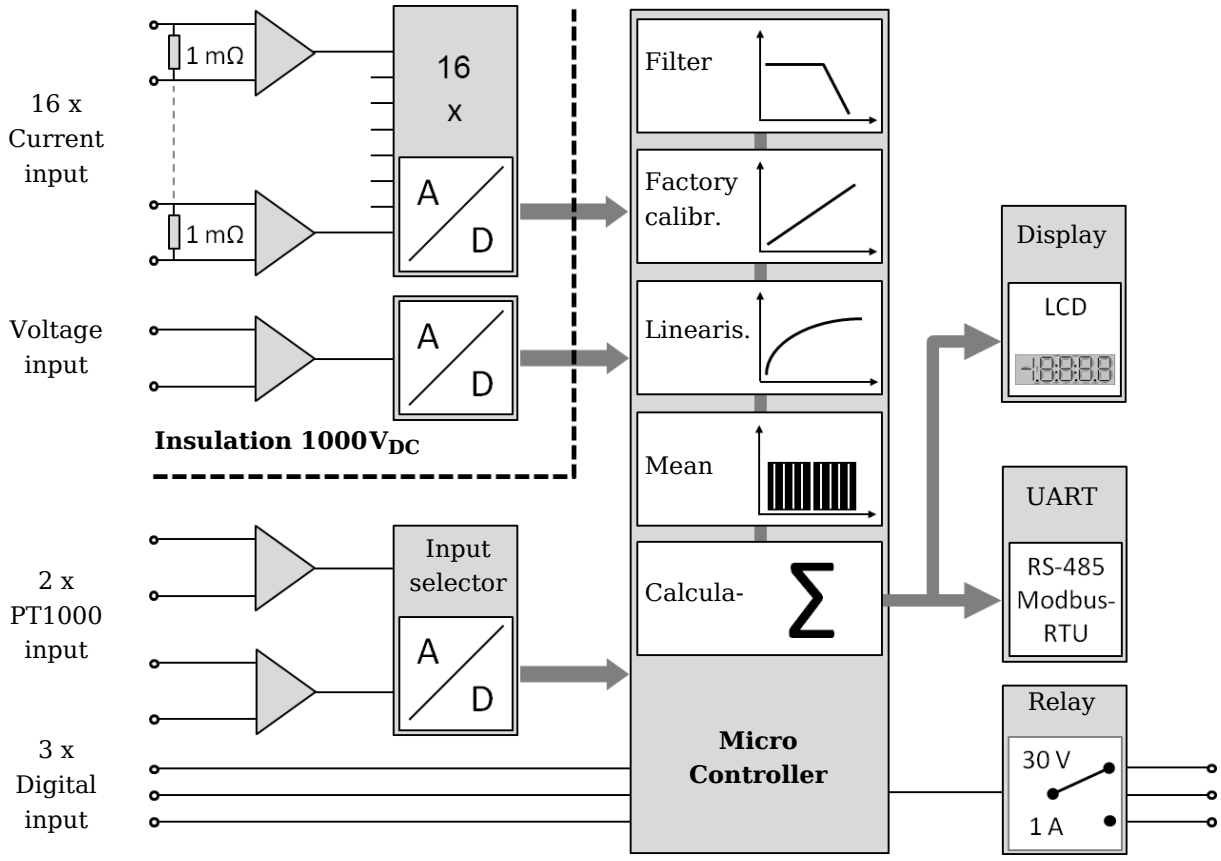
If you write a different value into register 302 for each broadcast, you can check with the value from register 59 whether the broadcast has been received and that the current measurement (same value) is involved.

5.4.3 Use response delay (Delay)

Depending on the measurement mode for the current and voltage measurements the response time for a request (Request) through the Modbus interface is between 5 and 20 milliseconds. With register 208 you can extend the time up to the response if this is too fast for the Modbus master used and there is therefore the risk that responses are not detected, because they were already available on the bus shortly after the request. Specify the *additionally* desired delay in milliseconds in register 208 as a numerical value.

6 Technical Data

6.1 Block Diagram string.bloxx 116



6.2 Technical Data string.bloxx 116

Current input	
Number	16
Measuring range	±26A
Accuracy	0.25% of full scale reading
Connection (push-in spring connector)	0.2mm^2 to 10mm^2 for rigid conductor 0.2mm^2 to 6mm^2 for flexible conductor 0.25mm^2 to 6mm^2 for flexible conductor with wire-end sleeve without plastic sleeve 0.2mm^2 to 4mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 15 mm
Current output	
Number	1
Maximum summed current	416A
Connection	M8 threaded terminal, metric thread, for ring cable lugs; max. tightening torque 10 Nm
Voltage input	
Number	1
Measuring range	0V to 1000V$_{DC}$
Accuracy	0.2% of full scale reading
Connection (push-in spring connector)	0.2mm^2 to 4mm^2 for rigid conductor 0.2mm^2 to 2.5mm^2 for flexible conductor 0.25mm^2 to 2.5mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8mm 0.2mm^2 to 1.5mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8mm
Temperature input	
Number	2
Type	PT1000 in 2-wire circuit
Measuring range	-40°C to +160°C
Accuracy	0.5% of full scale reading

Connection (push-in spring connector)	0.2 mm^2 to 4 mm^2 for rigid conductor 0.2 mm^2 to 2.5 mm^2 for flexible conductor 0.25 mm^2 to 2.5 mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8 mm 0.2 mm^2 to 1.5 mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8 mm
Digital input	
Number	3
Type Upper switching threshold Lower switching threshold	Status >3.5 V (logical 0, the input is internally pulled up to +5 V) <1.0 V (logical 1)
Maximum input voltage	30 V_{DC}
Pre-assigned	D_IN 1: Main Switch (status can also be shown in the LCD display) D_IN 2: Surge Protection (status can also be shown in the LCD display)
Connection (push-in spring connector)	0.2 mm^2 to 4 mm^2 for rigid conductor 0.2 mm^2 to 2.5 mm^2 for flexible conductor 0.25 mm^2 to 2.5 mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8 mm 0.2 mm^2 to 1.5 mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8 mm
Digital output	
Number	1
Type	Status, alarm
Contact	Changeover relay
Maximum switched voltage	30 V_{DC}
Maximum switched current	1000 mA (resistive load)
Connection (push-in spring connector)	0.2 mm^2 to 4 mm^2 for rigid conductor 0.2 mm^2 to 2.5 mm^2 for flexible conductor 0.25 mm^2 to 2.5 mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8 mm 0.2 mm^2 to 1.5 mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8 mm

Supply	
Supply voltage	10 V_{DC} to 60 V_{DC}, overvoltage and reverse polarity protection
Power consumption	approx. 0.9 W; 0.2 W in EcoMode (refer to Section 5.4.1, page 30)
Connection (push-in spring connector)	0.2 mm^2 to 4 mm^2 for rigid conductor 0.2 mm^2 to 2.5 mm^2 for flexible conductor 0.25 mm^2 to 2.5 mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8 mm 0.2 mm^2 to 1.5 mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8 mm
Communication interface	
Standard	RS-485 (TIA/EIA-485), 2-wire
Data format	8n1, 8e1 or 8o1, default setting: 8n1
Protocols	Modbus-RTU
Baud rate	1200 to 38400 bit/s, default setting: 19.2 bit/s
Number of devices on the bus	max. 250
Unit load on the bus	1/8 (thus facilitating up to 256 devices)
Connection (push-in spring connector)	0.2 mm^2 to 4 mm^2 for rigid conductor 0.2 mm^2 to 2.5 mm^2 for flexible conductor 0.25 mm^2 to 2.5 mm^2 for flexible conductor with wire-end sleeve without plastic sleeve, bared length 8 mm 0.2 mm^2 to 1.5 mm^2 for flexible conductor with wire-end sleeve with plastic sleeve, bared length 8 mm

Ambient conditions	
Operating temperature	-20 °C to +60 °C: max. 384 A -20 °C to +75 °C: max. 192 A
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)	305 x 128 x 55 (figures in mm)
Weight	approx. 600 g
Type of installation	Mounting rail to DIN EN 60 715 or wall installation

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 116
Certificate Ref No: **120710JS-02**

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	X	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
		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, 15th July 2013

Gantner Instruments
Environment Solutions GmbH
Am Mühlgraben 8
D-08297 Zwönitz
TEL: +49 37754 3351 0
FAX: +49 37754 3351 20
www.gantner-environment.com

Jörg Scholz, General Manager

Gantner Instruments Environment Solutions GmbH
Am Mühlgraben 8 D-08297 Zwönitz
Tel. +49 (0)37754 3351-0 Fax +49 (0)37754 3351-20
HRB 26151 AG Chemnitz · UID DE274123583
Geschäftsführung: Jörg Scholz, Reinhard Kehrer
office@gantner-environment.com www.gantner-environment.com

International Sales and Service

You find the current addresses of our distributors on our web site. You may also contact Gantner Instruments Environment Solutions GmbH directly.

Germany

Gantner Instruments Environment Solutions GmbH
Am Mühlgraben 8
08297 Zwönitz
Tel.: +49 (0) 37754 3351–0
Fax: +49 (0) 37754 3351–20
E-mail: office@gantner-environment.com
Web: www.gantner-environment.com

or

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

Austria

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

Subject to change in the course of further technical development

Vers. No. 1.2
Released: 19/08/2016
Printed: 08/2016

Austria
Gantner Instruments GmbH
Montafonerstr. 4
6780 Schruns/Österreich
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 Environment Solutions GmbH
Am Mühlgraben 8
08297 Zwönitz
Tel.: +49 (0) 37754 3351–0
Fax: +49 (0) 37754 3351–20
E-mail: office@gantner-environment.com
Web: www.gantner-environment.com