SBL8 230

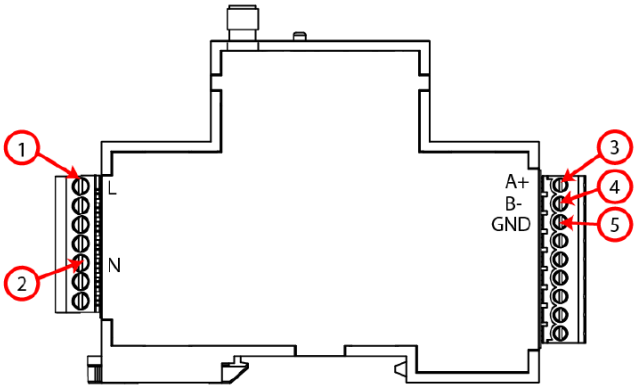
RS-485 to LoRa converter

Description	
	Gateway that performs the conversion between the RS-485 physical medium and the LoRa long-range wireless network. Easy installation thanks to completely transparent communication between master and slaves. Capable of reading sensors up to 1 km away indoors and 15 km outdoors.
Featured Features	
	- Turns any Modbus RTU device wireless - 100% transparent long-range wireless communications - Up to 1 km coverage indoors and 15 km outdoors - Point-to-point or multipoint networks
Electrical data	
Power supply	110 .. 264 VAC
Frequency	47 .. 63 Hz
Maximum consumption	2,5 .. 4,5 VA
Environmental conditions	
Temperature	-10 .. +60 ºC
Humidity	5% .. 95%
Mechanical data	
Surround material	UL94-V0 self-extinguishing plastic
Protection degree	IP20
Dimensions	18 x 70 x 109 mm
Weight	70 g
Mounting	DIN rail
Maximum working altitude	2000 m
Serial interface	
Type	RS-485 three threads (A+/S GND/ B-) (RX/GND/TX)
Transmission speed	9600 / 19200 / 38400 / 57600 / 115200 bps configurable
Data bits	8
Parity	No Parity / Configurable Par
Stop bit	1 / 2 configurable
Characteristics and electrical safety	
Electrical safety	CAT III 300 V according to EN 61010
Electric shock protection	Double insulation class II
Regulations	
	IEC 60664, VDE 0110, UL 94, EN-61010-1, EN 55011, EN 61000-4-3, EN 61000-4-11, EN 61000-6-4, EN 61000-4-2, EN 61000-6-2, EN 61000-6-1, EN 61000-6-3, EN 61000-4-5 -CE
Installation	
	The equipment is installed on a DIN rail, leaving all the connections inside an electrical panel.
	The equipment must be connected to a power circuit protected with type gl (IEC 269) or type M fuses, between 0.5 and 2 A. A magneto-thermal switch or equivalent device must be provided to disconnect the equipment from the power supply network. The power supply circuit of the equipment will be connected with a cable with a minimum section of 2.5 mm².

ATTENTION: The SBL8 230 antenna should not be located inside a metal box as this would make communication impossible. If the equipment is located inside one, place an external antenna.

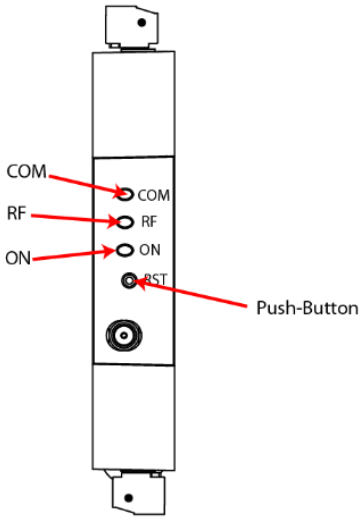
The RS-485 communication wiring must be done with a shielded cable and connecting the mesh to the ground only at the end from which the communication comes.

Electrical wiring



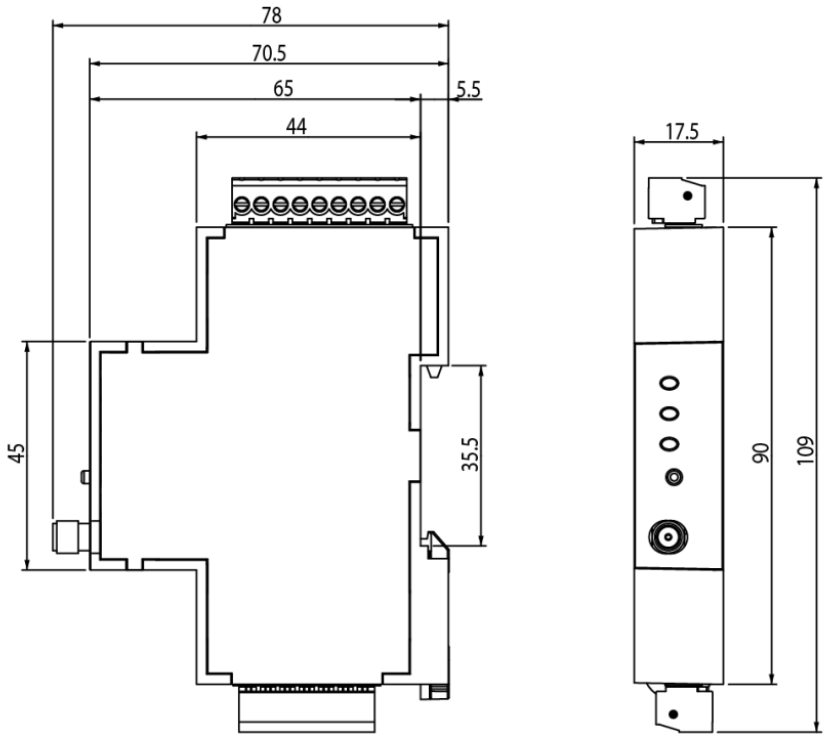
Number	Description
1	L, Auxiliary power
2	N, Auxiliary power
3	A+, RS-485 port
4	B-, RS-485 port
5	GND, RS-485 port

Leds



Led	Description
ON	Power - Activity: Steady Green
RF	LoRa Radio Frequency - Data Transmission: Slow Flashing Red - Data Reception: Fast Flashing Green - Silence/Timeout: Steady Blue (only in Master mode)
COM	RS-485 - Data transmission: Fast flashing red - Data reception: Green fast flashing

Dimensions



MANUAL

RS-485 communication

The equipment has an RS-485 type communication port for reading and writing the device parameters. To do this, the equipment uses the Modbus/RTU communication protocol.

By default, it is configured with the peripheral number 1 (in decimal) and communication mode 0, that is, 9600 bps, 8, N, 1. By means of the address change command we can assign any other address (maximum FF in hexadecimal equivalent to peripheral 255). If you do not remember the slave number, you can retrieve the address that comes by default (1 decimal), for this you must:

- Press the button located on the front of the equipment for 10 seconds.
- When you stop pressing the button, all the leds will blink, in this way the equipment will automatically recover its default configuration.

LoRa communication parameters

The equipment is equipped with LoRa radio technology for private networks. These devices are for private networks only and cannot connect to LoRaWAN networks. By default, SBL8 is configured in slave mode.

The frequency for Europe is the free ISM band of 868 MHz, being able to configure up to 9 different channels between 865.1 MHz (channel 0) and 869.85 MHz (channel 9). The default frequency is 869.525 MHz (channel 7). These channels present very different working and silence time behaviors, depending on the restrictions of each frequency. Below is a table with the duty cycle of each frequency channel, that is, the percentage of time that transmission is allowed on said channel. The smaller the more restrictive, therefore, it is recommended to use channels with higher duty cycle for applications that require a faster refresh rate.

Radio channel	Frequency	Duty cycle
0	865,1 MHz	1%
1	865,2 MHz	1%
2	865,6 MHz	1%
3	868,5 MHz	1%
4	868,3 MHz	1%
5	868,85 MHz	0,10%
6	868,95 MHz	0,10%
7	869,525 MHz	10%
8	869,85 MHz	1%

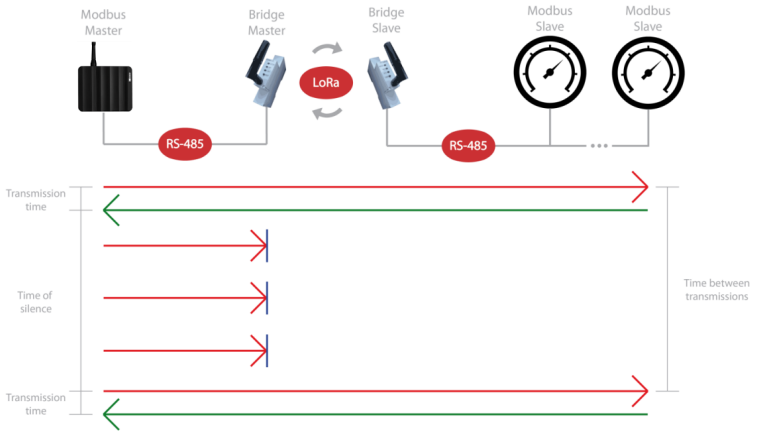
In reference to the transmission and reception modes, we will have up to 10 modes that will allow us to select speeds between 300 bps and 21875 bps, being able to sacrifice transmission signal range while increasing communication speed. In order to respect the spectral limitation, depending on the transmission mode selected in the master, a silence time will be established in which the equipment will not be able to transmit and will be indicated with the RF LED in fixed blue and returning ´Busy´ through the serial channel. . The following table shows the properties of each mode:

LoRa mode	Bits per second	Comments and maximum distance
0	292,97 bps	Max. 15km
1	585,94 bps	Max. 7,50 km
2	976,56 bps	Max. 4,50 km
3	1171,88 bps	Max. 3,75 km
4	1953,13 bps	Max. 2,25 km
5	2148,44 bps	Max. 2,05 km
6	3515,63 bps	Max. 1,25 km
7	7031,25 bps	Max. 0,63 km
8	12500 bps	Max. 0,35 km
9	21875 bps	Max. 0,20km

LoRa communication rules

The different times to be taken into account in a wireless installation are described below:

- Transmission time: This is the time it takes for the frame to leave the Modbus master, arrive at the Modbus slave and return to the Modbus master. In the LoRa case, it can be between 0.5 and 10 seconds, depending on settings.
- Silence time: Depending on the LoRa Transmission Time, the LoRa Mode and the configured Frequency, SBL8 Master sets a silence time in which all RS-485 communication to elements of the LoRa network is blocked. During the silence time, if the Mobdbus Master of the installation continues to launch requests, it will receive timeouts.
- Time between transmissions: In the Modbus Master, it is the time between requests to the RS485 or Ethernet network, that is, the sending rate.



Based on these times, 2 communication rules are established that must be applied in the Master Modbus of the installation. The first one, described below, is absolutely essential to establish wireless communication with the Modbus slaves through an SBL8 wireless network:

Timeout RX Master Modbus > Transmission time

The second rule allows you to avoid having timeouts in the communication bus of the Modbus Master since the Time between transmissions becomes greater than the Transmission Time required plus the Time that the Bridge LR Master is silent (blue LED ON):

Time between transmissions = Transmission time + Silence time

LoRa transmision cicles

As stated in the previous sections of the manual, in order to achieve correct communication between the Modbus master and the Modbus slaves (through the Modbus-LoRa SBL8 gateways), certain time rules must be configured in the Modbus master that will ask the devices.

In order to facilitate the configuration of Modbus masters, below is a guide to the transmission times and silence times generated in two common scenarios, such as are the request for 1 and 2 Modbus registers.

The transmission time must be configured as timeout, while the total time must be configured as time between transmissions in the Modbus master. The first one is totally necessary for the application to work, while the second one will allow us to control the cadence of questions to be able to make sequential and orderly requests, and thus avoid having Modbus communication errors during the silence time of SBL8.

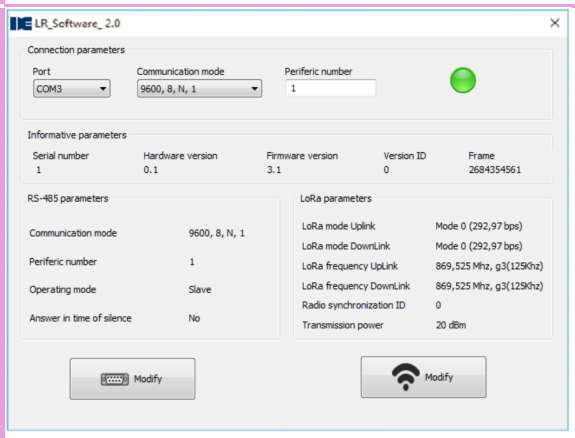
Transmission of 1 Modbus register (16 bits)

LoRa mode	Transmision time	Silence time	Total time
0	4s	8s	12s
1	3s	3s	6s
2	2s	3s	5s
3	2s	2s	4s
4	1s	2s	3s
5	1s	1s	2s
6	1s	1s	2s
7	1s	1s	2s
8	0,402s	1s	1,402s
9	± 0	± 0	0,126s

Transmission of 2 Modbus registers (32 bits)

LoRa mode	Transmision time	Silence time
0	4s	14s
1	3s	6s
2	3s	3s
3	2s	3s
4	2s	2s
5	1s	2s
6	1s	1s
7	1s	1s
8	0,804s	1s
9	± 0	± 0

Software PC

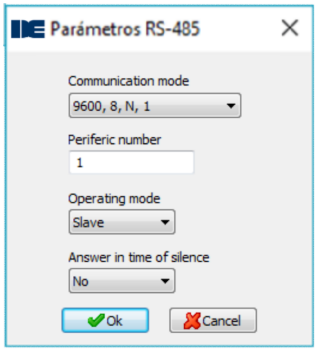


For the parameterization of SBL8 is required a PC software that can be downloaded free of charge from the website www.disibeint.com.

To proceed with the configuration, connect the device to your computer via a USB RS-485 gateway and fill in the fields in the Connection Parameters section, selecting the communications port provided by the PC (visible by accessing Device Manager/Ports (COM and LPT)), the communication mode and the peripheral number.

Once the equipment is in communication with the PC, you will be able to see how the connection icon turns green, read the informative parameters and the default RS-485 and LoRa parameters.

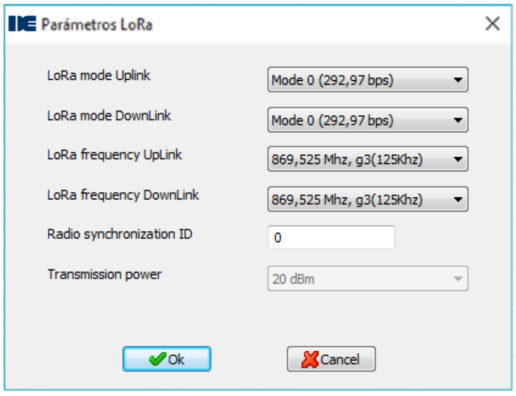
To configure the RS-485 parameters we must click on the Modify button with the serial port icon.



By accessing we can configure the parameters Communication mode, Peripheral number, Operating mode and Response in silence time. The mode will allow us to select if the SBL8 that we are configuring will be the Master of the installation or Slave. If ´Response in silence time´ is enabled, the Master SBL8 will respond ´Busy´ through the Modbus line if it is found during the silence time, while if it remains disabled it will not send new transmissions

Once we´ve made the appropriate changes, we´ll click the OK button to send them to your device. Changes to RS-485 settings will be applied automatically without the need to update the connection settings to restore communication.

To configure the LoRa settings, click the Modify button with the wireless network icon.



By accessing we can configure the parameters LoRa Uplink Mode, LoRa DownLink Mode, LoRa UpLink Frequency, LoRa DownLink Frequency, LoRa gateway ID, transmission power and radio synchronization ID.

For a basic configuration we only have to make sure
that the Mode and Frequency parameters are identical in the
Master and in all the Slaves to communicate. The ID sync parameter
allows you to create subnets between Master and Slave devices that
share the same ID

Modbus RTU memory map

Magnitude	Holding registers	Unit	Function
Serial no.	0x00-0x03	-	3
Software version	0x04-0x05	-	3
Internal device ID	0x06	-	3
Hardware version	0x07	-	3
Modbus peripheral address	0x0E-0x0F	1 (Default)	3,16(0x10)
RS-485 communication	0x10-0x11	0: 9600, 8, N, 1 (Default) 1: 19200, 8, N, 1 2: 38400, 8, N, 1 3: 57600, 8, N, 1 4: 115200, 8, N, 1 5: 9600, 8, E, 1 6: 19200, 8, E, 1 7: 9600, 8, N, 2 8: 19200, 8, N, 2 13: 38400, 8, N, 2	3,16(0x10)
Operating mode	0x12-0x13	0: Slave (Default) 1: Máster	3,16(0x10)
Silence time (Master only)	0x1E-0x1F	ms	3
LoRa receiving mode	0x50-0x51	0: 292,97 bps (Default) 1: 585,94 bps 2: 976,56 bps 3: 1171,88 bps 4: 1953,13 bps 5: 2148,44 bps 6: 3515,63 bps 7: 7031,25 bps 8: 12500 bps 9: 21875 bps	3,16(0x10)
LoRa transmiting mode	0x52-0x53	Same IDs as at reception	3,16(0x10)
LoRa receiving frequency	0x54-0x55	0: 865,1 MHz 1: 865,2 MHz 2: 865,6 MHz 3: 868,5 MHz 4: 868,3 MHz 5: 868,85 MHz 6: 868,95 MHz 7: 869,525 MHz (Default) 8: 869,85 MHz	3,16(0x10)
LoRa transmission frequency	0x56-0x57	Same IDs as at reception	3,16(0x10)
Radio synchronization ID	0x58-0x59	0: No subnet Other: Subnet ID	3,16(0x10)
Radio signal level	0x1004	MSB: RSSI (negative dBm) LSB: SNR If 0 < SNR < 15, Positive If SNR > 15, Subtract 0xFF and treat as negative	3