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1. Introduction

The BB2 Modbus RTU module is used to connect the BB2 central unit to a Modbus RTU network as a slave. The user is assumed to be familiar with Modbus, and the Modbus configuration of the master.

2. A few words about this manual

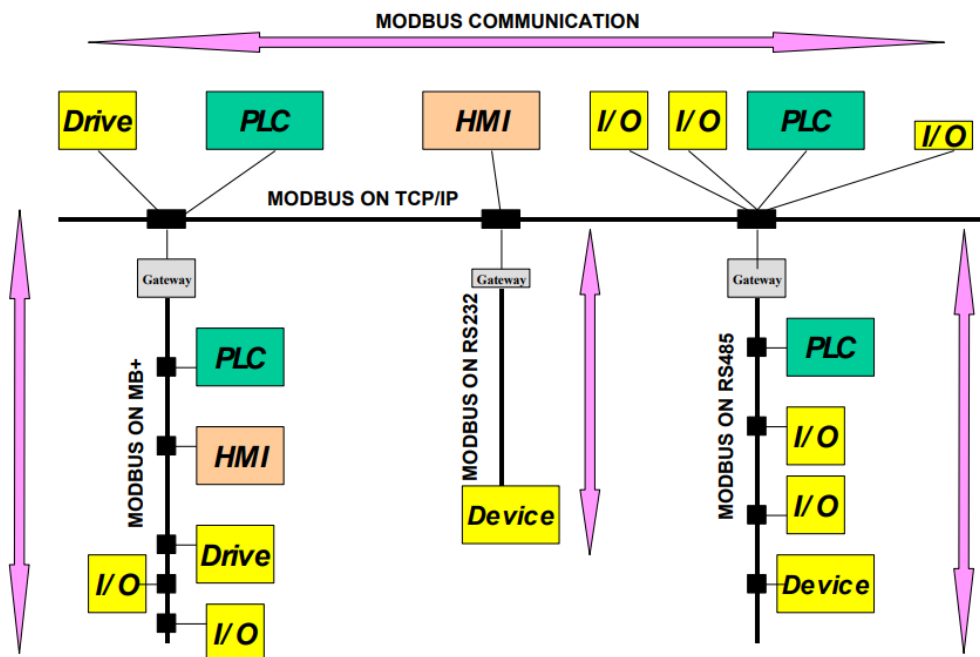
The manual primarily contains information about the BB2 Modbus module. The operation and measuring principles of the sensors and the central unit is described in their respective manuals.

3. Modbus introduction

Modbus has an international user organization called [Modbus Organization](#). Technical questions regarding Modbus should be addressed to the Modbus discussion forum.

NETWORK OVERVIEW

Modbus RTU is based on the RS485 physical layer. The baud rate for the bus is typically 19200 but is user configurable. The Modbus network can carry up to 247 devices each with its own unique address.



4. Unpacking

The unit has been tested and approved before delivery from the supplier. Please check that no visible damages are apparent in this shipment.

DAMAGES

If damages occurred during shipment, immediately contact the shipping company and the Cerlic representative. The shipment should be returned only after a return authorization number has been issued by Cerlic or representative.

PACKAGING

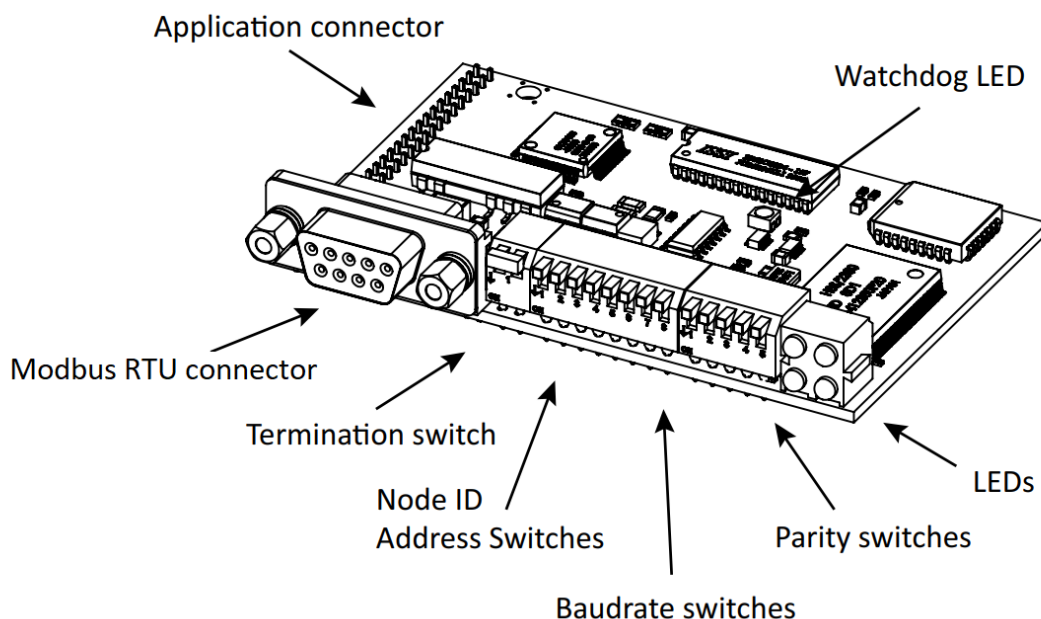
The original packaging is designed to protect the equipment and should be used for storage or if the product must be returned.

CONTENT

Please check that the content corresponds to your order and packing list.

5. Module Overview

The module for Modbus RTU is a slave node that can be read and written to, from a Modbus RTU master. The module will not initiate communication to other nodes, it will only respond to incoming commands. The module is connected to the control box via a D-Sub connector.



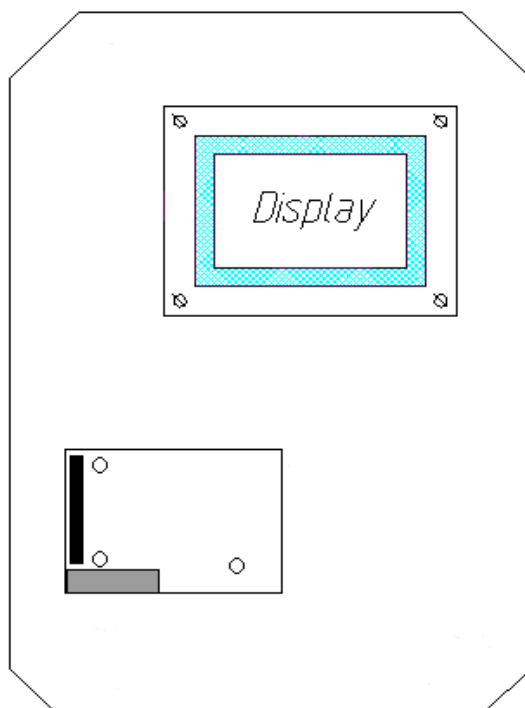
6. Mounting in the BB2 control box

The Modbus module shall be mounted in a BB2 control box. Make sure the power to the control box is switched off before mounting the Modbus module.



Connect yourself and the control box chassis to protective ground before opening the antistatic package of the module to avoid static discharges that can damage the module or the box.

Be careful to get all 32 pins into their sockets. Fasten the module using the three M 2,5x5 screws that comes with the module.



Mounting the module in the control box

WIRING CONNECTIONS

Connect the Modbus RTU to the D-Sub connector according to the table below. All other pins are unused.

No	Name	Function
5	GND	Isolated GND from RS 485 side
7	A	RS485 A
8	B	RS485 B

7. Configuration

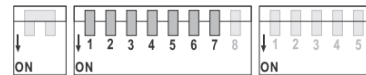
The configurations are performed by setting the Modbus modules DIP-switches to either ON or OFF. The binary value one (1) is represented by the downwards position of the DIP-switch and the value zero (0) is represented by the up position.

The right most switch (number 5) should always be in the ON position.

ADDRESS

The address can be configured to any value between 1 and 127, address zero is reserved.

Binary value	Modbus address
0000000	Setting not valid
00000001	1
00000010	2
00000011	3
...	...
...	...
11111111	127

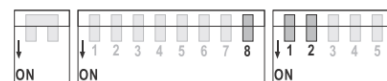


(switch 1 is MSB and switch 7 is LSB)

BAUDRATE

The baud rate on a Modbus RTU network is set during configuration of the master and only one baud rate is possible in a Modbus RTU installation. The following baud rates are supported by the Modbus module:

Binary value	Baud rate
000	Setting not valid
001	1200
010	2400
011	4800
100	9600
101	19200 (Default on RTU)
110	38400
111	57600

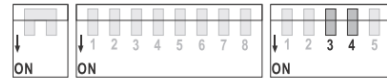


(switch 8 is MSB and switch 2 is LSB)

PARITY BIT

The parity bit is configured with DIP-switch three and four.

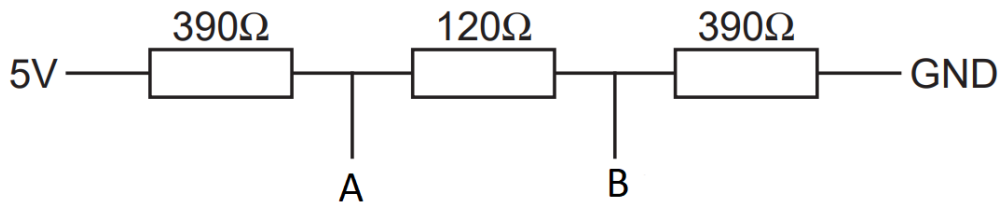
Binary value	Parity type
00	Setting not valid
01	None (Default on RTU)
10	Even
11	Odd



(switch 3 is MSB and switch 4 is LSB)

TERMINATION OF THE NETWORK

The end nodes in a Modbus RTU network should be terminated to avoid reflections on the bus line. The Modbus RTU module is equipped with a termination switch to accomplish this in an easy way. If the module is used as the first or last module in a network the termination switch must be in ON position. Otherwise, the switch should be in the OFF position. The termination switch is the left most switch and occupies two DIP-switch positions.



DATA STRUCTURE

Modbus function code 3 (FC03) is the only supported Modbus command. The data is organized as follows:

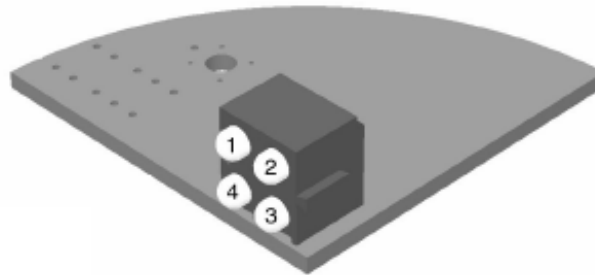
Register number	Data type	Name	Content
1	Uint16	Serial number H (Sensor 1)	The serial number is split over two registers (Reg 1 and Reg 2). Register 1 consist of an unsigned int16 that together indicate the type of meter and the year it was manufactured. Reading the number in base 10, the upper byte contains the meter-type, and the lower byte contain the manufacturing year.
2	Uint16	Serial number L (Sensor 1)	Register 2 contains a unique number that describes that particular sensor unit. The value can range between 0-9999.
3	Uint16	Serial number H (Sensor 2)	Formatted the same as sensor 1.
4	Uint16	Serial number L (Sensor 2)	Formatted the same as sensor 1.
5	Uint16	Serial number H (Sensor 3)	Formatted the same as sensor 1.
6	Uint16	Serial number L (Sensor 3)	Formatted the same as sensor 1.
7	Uint16	Serial number H (Sensor 4)	Formatted the same as sensor 1.
8	Uint16	Serial number L (Sensor 4)	Formatted the same as sensor 1.

9	Uint16	Sensor 1 & 2 status	The upper byte represents sensor 1s status and the lower byte represents sensor 2s status.
10	Uint16	Sensor 3 & 4 status	<p>The upper byte represents sensor 3s status and the lower byte represents sensor 4s status.</p> <p>The status is formatted in the following way:</p> <ul style="list-style-type: none"> • Bit 0: Online, sensor is connected and measuring. • Bit 1: Cleaning, the sensor is flushing or brushing. • Bit 2: Frozen, the sensor value is frozen after cleaning. • Bit 3: Alarm, the sensor has triggered a local alarm in the control box. • Bits 4-7 are unused. <p>It is important to note that the sensors are paired in each register. Odd numbered sensors will occupy the upper byte while the even numbered sensors will occupy the lower byte.</p>
11-12	Float	Measurement value 1 (Sensor 1)	Four IEEE float values per sensor slot. First value is the sensor output value, the rest is sensor dependent.
13-14	Float	Measurement value 2 (Sensor 1)	
15-16	Float	Measurement value 3 (Sensor 1)	
17-18	Float	Measurement value 4 (Sensor 1)	

19-20	Float	Measurement value 1 (Sensor 2)	
21-22	Float	Measurement value 2 (Sensor 2)	
23-24	Float	Measurement value 3 (Sensor 2)	
25-26	Float	Measurement value 4 (Sensor 2)	
27-28	Float	Measurement value 1 (Sensor 3)	
29-30	Float	Measurement value 2 (Sensor 3)	
31-32	Float	Measurement value 3 (Sensor 3)	
33-34	Float	Measurement value 4 (Sensor 3)	
35-36	Float	Measurement value 1 (Sensor 4)	
37-38	Float	Measurement value 2 (Sensor 4)	
39-40	Float	Measurement value 3 (Sensor 4)	
41-42	Float	Measurement value 4 (Sensor 4)	

8. Indications

The module is equipped with four LED's mounted at the front and one LED on the board, used for debugging purposes. The front LED's can be mounted in two ways, either top mounted or angle mounted. The function of the LED's are described in the table and figure below.



No	Indication	Description
1	Flashing green	Module is receiving a Query and building a response
2	Solid red	Bus Error (More than 1/10 of all queries have incorrect CRC)
3	Solid green	Bus is ready.
4	Solid red	Incorrect DIP-switch configuration.

9. Getting started

A shortcut to get the Modbus communication up and running.

- Make sure the BB2 box to be used is switched off. *
- Open the front and locate the Modbus module connector.
- Connect yourself and the control box chassis to protective ground before opening the antistatic package of the module to avoid static discharges that can damage the module or the box.
- Mount the module into the box, be careful to fit all 34 pins into the socket.
- Fasten the M2.5x5 screw
- Set the DIP-switches to the desired address and communication settings.
- Set the bus termination switch in position “On” if this is the last unit on the bus, else set it to “Off”.
- Connect the Modbus network, A-line (positive) line to pin 8, B-line (negative) to pin 7, and ground to pin 5.
- Switch on the power to the BB2 box and check that the green led on the module starts flashing.
- Configure the Master system (PC, PLC or DCS) to communicate with the BB2 at the selected address using the data structure in previous chapter.
- Now the Modbus communication should be working.

* Make sure that the program version of the BB2 box to be used has a program version of 2.23 or higher. Before open the front, make sure that the main power supply is switched off.

10. Technical specification for the Modbus module

Protocol type: Modbus RTU EN **50 170 (DIN 19245)**

- Protocol version: ver. 1.1b3.
- Protocol stack supplier: Modbus Organization.

PHYSICAL INTERFACE

- Transmission media: RS485 bus line, specified in EIA-485.
- Topology: Master-Slave communication.
- Modbus connectors: D-Sub.
- Cable: Shielded copper cable.
- Isolation: The bus is galvanically separated from the other electronics with an on-board DC/DC converter. Bus signals (A-line and B-line) are isolated via optocouplers.