

PRODUCT CODE: MB-OTG

Gateway MODBUS-to-Opentherm Technical Manual

Release 3.0

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1 Introduction

MB-OTG Gateway is used to interface systems that use Modbus protocol (PLCs, Industrial PCs, SCADA systems, etc.) with Boilers (sometimes in this manual, it is used the annotation *BLR*) that use OpenTherm® protocol.

It is mandatory to assign to every gateway a Modbus address (using a rotative switch) from 16 to 23; therefore, it is possible to use more than a Gateway on the same bus (up to 8) if you need to control more than one Boiler.

The common features of the model are:

- Plastic case size: 30 mm X 55 mm (20 mm height, except electrical terminal)
- 12 Vdc power supply (direct current)
- RS485 Interface to the Modbus Master
- Optoisolated connection to the Boiler
- Communication protocol MODBUS RTU (RS-485), with communication parameters 9600, N, 8,1 (no parity), or 19200, E, 8, 1 (even parity)



Figure 1: MB-OTG device close

2 Installation

The gateway must be connected as indicated in the following scheme, to realize the connections it is necessary to remove the black plastic cover: to do this, just apply a slight pressure with a small flat screwdriver in one of the cavities on the sides of the device.

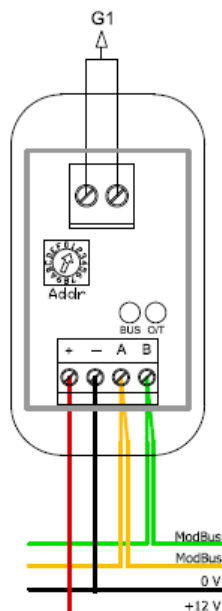


Figure 2: MB-OTG Module connections

Notes:

- OpenTherm connections **are not** polarized, so the two boiler cables can be inverted.
- Gateway's OpenTherm channel is optoisolated from the Modbus side.
- Modbus interface **is not** optoisolated respect to the Gateway's Power Supply, so typically the Master and Gateway are powered by the same Power Supply, or from Power Supply with shorted references.
- The polarity definition on the "A" and "B" wires is arbitrary because it does not exist a unique standard for the Modbus; other companies may use different conventions (for example, "+" and "-"). Therefore, in case of no communication, try to exchange the connection on the two poles "A" and "B" and check the communication state by checking the "BUS" LED (for more information read chapter 4).

ATTENTION!

OpenTherm protocol is a point-to-point protocol: only 1 Boiler must be connected to a MB-OTG; the connection of two or more Boilers on the same MB-OTG may cause damage to the Boiler and/or the Gateway interface.

3 Integration with Modbus

The protocol is MODBUS RTU over Serial Line, (EIA-485):



Figure 3: MB-OTG module open

3.1 Communication Modbus side, parameters setting

The communication parameters change according to the position of the rotative switch (below the black plastic cover) that has 16 options.

It allows to set the communication parameters (Baud Rate and Parity) and the address assigned to the device, according to the following table:

Switch position	Communication Parameters	MODBUS Address
0	9600 baud rate, Parity NONE, 9600,N,8,1	16
1		17
2		18
3		19
4		20
5		21
6		22
7		23
8	19200 baud rate, Parity EVEN, 19200,E,8,1	16
9		17
A		18
B		19
C		20
D		21
E		22
F		23

Note that selector's changing is immediately recognized, there is no need to power cycle the device.

3.2 LED meaning and function

On the Gateway front panel there are two LEDs that show the functioning state of the device.

LED	STATUS	MEANING
BUS (green color)	ON	Gateway correctly Powered
BUS (green color)	Blinking	Writing/Reading data correctly transmitted to the Master MODBUS
O/T (yellow color)	Blinking	Boiler communicates correctly with the Gateway

NOTE

We remember that the blinking of the "BUS" LED happens only if data is correctly received/transmitted by the Gateway, therefore if the data transmission between Gateway and Master rarely happens, the blinking of the LED will rarely happen too; therefore, if the Master frequently exchanges data with the Gateway, the "BUS" led will be always on.

3.3 Modbus registers and OpenTherm Protocol mapping

The Gateway maps the exchanged information (some information read, other written) with the Boiler in as many Holding Register or Coils of the Modbus protocol.

In particular, the Gateway recognizes the following Modbus protocol commands:

- 0x01: Read Coil (reading one or more coil, ON/OFF status, true/false)
- 0x03: Read Holding Register (reading one or more holding register)
- 0x05: Write Single Coil (writing one coil)
- 0x06: Write Single Register (writing one holding register)

The gateway reads from the Boiler the information using the OpenTherm protocol and memorize those data in Holding Registers or Coils (depending on the read value is scalar or Boolean type), that are readable by Modbus; the writable holding registers and the coils by using Modbus are in turn transmitted to the Boiler.

From version 1.40 onwards it is possible to make a maximum of 12 consecutive readings for the holding registers and 32 for the coil registers.

The mapping between Register/Coil and OpenTherm function is the following:

Holding Register READABLE (using Modbus function 0x03)	Corresponding ID OpenTherm	Format	Register Number (address)	NOTES
Slave Configuration	3		2	
Fault Flag (OEM Fault Code)	5		3	
RBP Flags	6		4	
Maximum boiler capacity (kW) / Minimum Modulation Level (%)	15		5	
Relative Modulation Level (%)	17	Tenth of %	6	
Water Pressure in CH Circuit (bar)	18	Tenth of bar	7	
Boiler Water Outlet Temperature	25	Tenth of °C	8	
DHW Temperature (°C)	26	Tenth of °C	9	
Outdoor Temperature (°C)	27	Tenth of °C	10	
Inlet Water Temperature (°C)	28	Tenth of °C	11	
Boiler Exhaust Temperature (°C)	33	Tenth of °C	12	
Boiler Fan Speed Setpoint and Actual Value	35		13	
Electrical current through burner flame (uA)	36		14	
DHW Setpoint limit	48	Tenth of °C	15	
CH Setpoint limit	49	Tenth of °C	16	
Burner working time	120	Integer Number (h)	17	
CH Pump working time	121	Integer Number (h)	18	
Number of Communication Error on OpenTherm side	n/a	Integer Number	22	
OpenTherm communication status	n/a	If=1, communication KO	23	
Firmware release	n/a	0x140	32	Firmware release 1.40 *
Holding Register WRITABLE (using Modbus function 0x06)				
CH Water temperature setpoint	1	Tenth of °C	25	
DHW Setpoint	56	Tenth of °C	26	
Maximum relative modulation level setting	14	Tenth of %	27	Default 100 %
Maximum heating set point	57	Tenth of °C	28	Default 95°C *
Coils WRITABLE (using Modbus function 0x01)	Bit of OpenTherm ID 0		Coil MODBUS Address	
Fault Indication	0 (reading)		0	
Heating mode	1 (reading)		1	
DHW mode	2 (reading)		2	
Flame status	3 (reading)		3	
Coils WRITABLE (using Modbus function 0x05)				
Heating Enable	0 (writing)		48	
DHW Enable	1 (writing)		49	
Reset request	-		56	*

Note: the parameters with an * are available from version 1.40 onwards.

Examples:

- To active the “Central Heating” (CH) function on the Boiler, set to value “1” the coil number 48.
- To set the flow temperature setpoint of the Boiler on 55 °C, set to 550 the holding register number 25
- To set the power limit to 70% for the Boiler, set to 700 the holding register number 27

To control the temperature boiler, the parameter “Maximum relative modulation level setting” (holding register 27), corresponding to OpenTherm ID nr. 14, must be set out at value 1000 (corresponding at the percentage value 100,0%). Lower values can prevent the Boiler to reach the expected temperature.

ATTENTION!

The OpenTherm standard does not require that the Boiler uses all the protocol IDs, so it's possible that one Boiler will not return all the previously shown information; in that case will be returned a fixed value that means that the data is not used.

4 Troubleshooting

4.1 The gateway does not power on

- Check the Power supply value and the polarity applied on the contacts “+” and “-” of the Gateway; if the poles have been inverted, the Gateway doesn’t Power ON.
- The Gateway is equipped with self-resetting fuses: if has been applied a high value of Voltage or in over-voltage case, these fuses may should have intervened. In that case it is necessary to disconnect the Gateway from the power supply, waiting for the Fuse cooling down and then reconnect the Gateway to the Power Supply.

4.2 The gateway does not communicate with the Master device

The LED “BUS” placed on the Front panel of the Gateway, turns ON and remain in this state for some seconds when the Gateway receive a valid command from the Modbus.

In presence of Communication errors, first check if the LED “BUS” turns on (if the Modbus communication is frequent, the led will be always on, on the other side if the communication happens periodically the led will turn on and then turn off again at every valid data received from Modbus).

If the “BUS” LED does not turn on:

- Check if the communication parameters on the MASTER device are correctly set, for more information read paragraph 3.1 (page 5).
- Check if the address number set on the Gateway corresponds with the address request from the Master device.
- Check that the Master is using the correct MODBUS functions during the communication with the Gateway (especially the 0x03 for reading registers).
- Check if the polarity of MODBUS connection is correct: because a unique standard of the Poles labelling does not exist, it is possible that the poles on the Master device are not defined as “A” and “B”, but as “+” and “-” or with another label. In each case, try to invert the connection on the Gateway and verify, by checking the “BUS” LED, if the communication starts; you should note that even if on the Master the poles are marked as “A” and “B”, it may be an inverted convention unlike the Gateway. So, in case of communication error, we always recommend trying to exchange the connection on the Modbus poles.