

MODBUS interface – Instruction guide

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1. Description

Aim of this document is showing how to use MODBUS RS-485 serial interface on "REG_ROB" code 16020427 and its effects on thermoregulation functions.

2. Wiring diagram

MODBUS RS-485 protocol uses "BUS" topology connection, where all the devices are connected on the same line and messages are sent to a single device (slave) by the controller (master) using addressing mode; the protocol admits "broadcast" method so (in some cases) it's possible to have the same effect on all the devices through a single transmission.

Figure no. 1 shows a network where two REG_ROB devices (Slave_1 – Slave_2) are connected on a MODBUS line managed by a master controller (eg. PLC, ...).

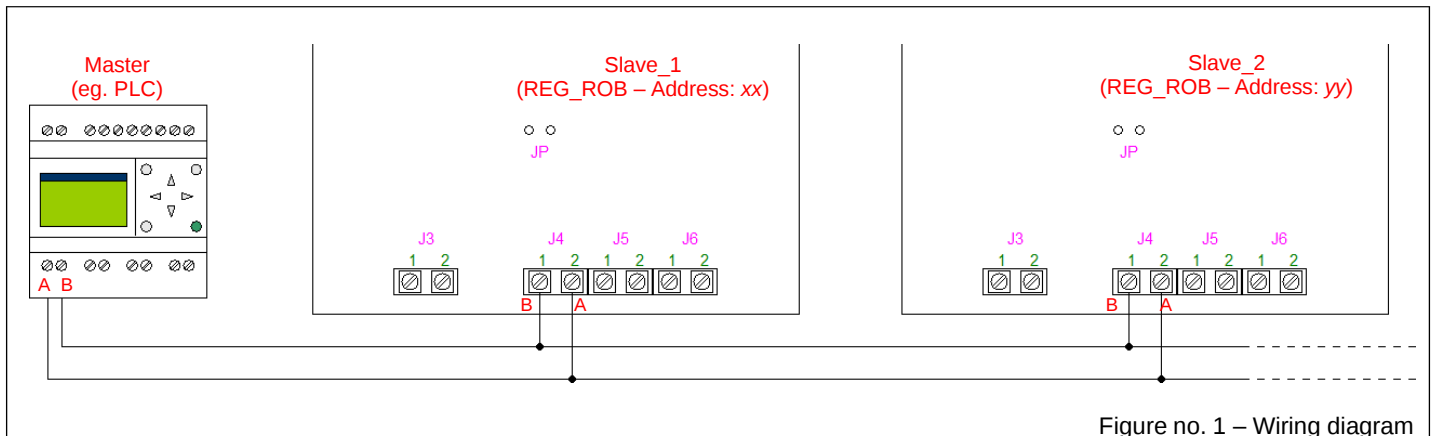


Figure no. 1 – Wiring diagram

3. Operating and instructions

REG_ROB admits MODBUS protocol with the following features:

Data rate (kbps): 19.2

Data bits: 8

Parity: EVEN

Stop bit: 1

Master device can perform the following actions:

- setting the operating state (stand-by, assisted heating, independent heating, cooling);
- setting the setpoint temperature to use in case of independent heating;
- requiring the reset of burner control unit managed by REG_ROB;
- reading the operating state of the machine;
- reading anomalies/faults of the system;
- reading the REG_ROB's temperature probe.

Instructions that master can perform (with related response messages) are described below.

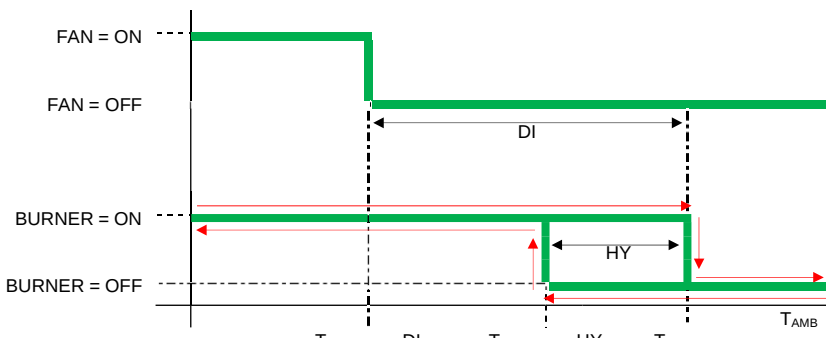
3.1 Setting of the operating state

This function uses command code "06" (Preset Single Register); "broadcast" mode is admitted.

Message to send (in bytes)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
ADDRESS	FUNCTION	DATA Start Addr HI	DATA Start Addr LO	DATA Word #HI	DATA Word #LO	CRC HI	CRC LO
NN	6	0	11	*	*	*	*
↓	↓	↓	↓	↓	↓	↓	↓
Slave address ¹	Function number	Parameter's address		Operating state		16 bits CRC	
				↓	↓		
				Value	Value	Operating state	
				0	0	Stand-by (REQ=OFF – FAN=OFF)	
				3 ... 29 30	0 ... 9 0	Independent heating mode ²	
				50	0	Assisted heating – MIN power (REQ=ON – FAN=OFF)	
				100	0	Assisted heating – MAX power (REQ=ON – FAN=ON/OFF ³)	
				128	0	Cooling mode (forced) (REQ=OFF – FAN=ON)	

Remarks:

1	With address "0", function will be used in "broadcast" mode and it will have effect on all the slaves of the bus.
2	In this mode REG_ROB compares room temperature (measured by probe) with the setpoint required, as shown on the following image.  Where: - $T_{SETPOINT}$: is the temperature required by Modbus <i>Example: if</i> <i>DATA Word #HI = 17</i> <i>DATA Word #LO = 9</i> <i>Then</i> $T_{SETPOINT} = 17.9\text{ }^{\circ}\text{C}$ - T_{AMB}: is the room temperature that REG_ROB measure by probe - HY: is the local hysteresis of REG_ROB (parameter 2) - DI: is the local differential of REG_ROB (parameter 6) If parameter no. 5 is set to "00", FAN is always OFF. If parameter no. 5 is set to "02", FAN is ON until BURNER is ON. If di parameter is less than HY parameter and ambient temperature has decreases direction, FAN output is ON if REQ output is ON otherwise is OFF in order to eliminate the condition of FAN ON with burner (REQ) OFF.
3	Depending on parameter no. 5 (Mo): - If: Mo=01 → FAN=ON - If: Mo=00 → FAN=OFF - If: Mo=02 → FAN=ON until BURNER is ON.

Message to receive

If correctly received, Slave will answer with the same message received from the Master. In case of "broadcast" mode, no Slave will answer to the Master.

3.2 Reset request

This function uses command code "06" (Preset Single Register); "broadcast" mode is admitted.

Message to send

To increase the protection against unwanted reset actions, a special procedure must be performed: it consists of a sequence of 3 independent messages to send within 10 seconds of each other, as shown on the following image.

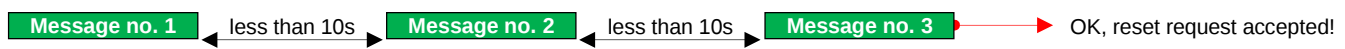


Figure no. 2 – Reset request procedure

The messages to send (in bytes) are as follow:

Message no.	Byte 1 ADDRESS	Byte 2 FUNCTION	Byte 3 DATA Start Addr HI	Byte 4 DATA Start Addr LO	Byte 5 DATA Word #HI	Byte 6 DATA Word #LO	Byte 7 CRC HI	Byte 8 CRC LO
1	NN	6	0	12	170	85	*	*
2	NN	6	0	12	85	170	*	*
3	NN	6	0	12	170	85	*	*

Slave address ¹	Function number	Parameter's address	Access key values	16 bits CRC
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If sequence is interrupted before the end, the entire procedure must be performed again from the beginning after more than 10s.

Remarks:

1	With address "0", function will be used in "broadcast" mode and it will have effect on all the slaves of the bus.
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Message to receive

If correctly received, Slave will answer with the same message (after each of the messages) received from the Master. In case of "broadcast" mode, no Slave will answer to the Master.

3.3 Heater state reading

This function uses command code "03" (Read Holding Registers); "broadcast" mode is NOT admitted.

Message to send (in bytes)

Byte 1 ADDRESS	Byte 2 FUNCTION	Byte 3 DATA Start Addr HI	Byte 4 DATA Start Addr LO	Byte 5 DATA Word #HI	Byte 6 DATA Word #LO	Byte 7 CRC HI	Byte 8 CRC LO
NN	3	0	1	0	1	*	*

Slave address	Function number	Parameter's address	Number of words (1 word = 2 bytes)	16 bits CRC
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Message to receive (in bytes)

Byte 1 ADDRESS	Byte 2 FUNCTION	Byte 3 DATA byte count	Byte 4 DATA Word #HI	Byte 5 DATA Word #LO	Byte 6 CRC HI	Byte 7 CRC LO
NN	3	2	0	1	*	*

Slave address	Function number	Number of bytes	Heater state value	16 bits CRC
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Value	Heater state
1	Stand-by
3	Running (MIN power) ¹
4	Running (MAX power)
5	Cooling
6	Lockout

Remarks:

1	Not available with parameter no. 5 (Mo) set to "00" (off)
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3.4 Anomalies / Faults reading

This function uses command code “03” (Read Holding Registers); “broadcast” mode is NOT admitted.

Message to send (in bytes)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
ADDRESS	FUNCTION	DATA Start Addr HI	DATA Start Addr LO	DATA Word #HI	DATA Word #LO	CRC HI	CRC LO
NN	3	0	2	0	1	*	*
↓	↓	↓	↓	↓	↓	↓	↓
Slave address	Function number	Parameter's address		Number of words (1 word = 2 bytes)		16 bits CRC	

Message to receive (in bytes)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
ADDRESS	FUNCTION	DATA byte count	DATA Word #HI	DATA Word #LO	CRC HI	CRC LO
NN	3	2	0	1	*	*
↓	↓	↓	↓	↓	↓	↓
Slave address	Function number	Number of bytes	Anomaly / Fault code		16 bits CRC	

Value	Anomaly / Fault state
0	None
1	Lockout of Burner Control Unit
2	Anomaly on used probe
4	5 remote resets in 15 minutes reached – Reset not accepted
5	Lockout of BCU for safety thermostat switch-on
6	Lockout of BCU for low temperature of flue gas.
7	Lockout of BCU for flame fault.

3.5 Probe temperature reading

This function uses command code “03” (Read Holding Registers); “broadcast” mode is NOT admitted.

Message to send (in bytes)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
ADDRESS	FUNCTION	DATA Start Addr HI	DATA Start Addr LO	DATA Word #HI	DATA Word #LO	CRC HI	CRC LO
NN	3	0	3	0	1	*	*
↓	↓	↓	↓	↓	↓	↓	↓
Slave address	Function number	Parameter's address		Number of words (1 word = 2 bytes)		16 bits CRC	

Message to receive (in bytes)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
ADDRESS	FUNCTION	DATA byte count	DATA Word #HI	DATA Word #LO	CRC HI	CRC LO
NN	3	2	0	1	*	*
↓	↓	↓	↓	↓	↓	↓
Slave address	Function number	Number of bytes	Probe temperature ¹ [°C]	[tenths of a °C]	16 bits CRC	

Remarks:

1	Example: if Then $T_{PROBE} = 19.6\text{ °C}$ T_{PROBE} equal to 99.5°C indicate fault on probe, like short circuit or not connected
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