

# TAC5

## TAC5 + MODBUS RTU

Installation and user's manual



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# 1 Overview

## 1.1 Scope

TAC5 DG regulations for HRglobal/HRup/HRflat fans units, DT for HRtotal, DM for HRmural and TAC5 F for control of one or two fans (forward or backward). The MODBUS RTU communication with the TAC5 regulation boards requires the addition of a satellite circuit (option SAT MODBUS) being used as interface of communication.

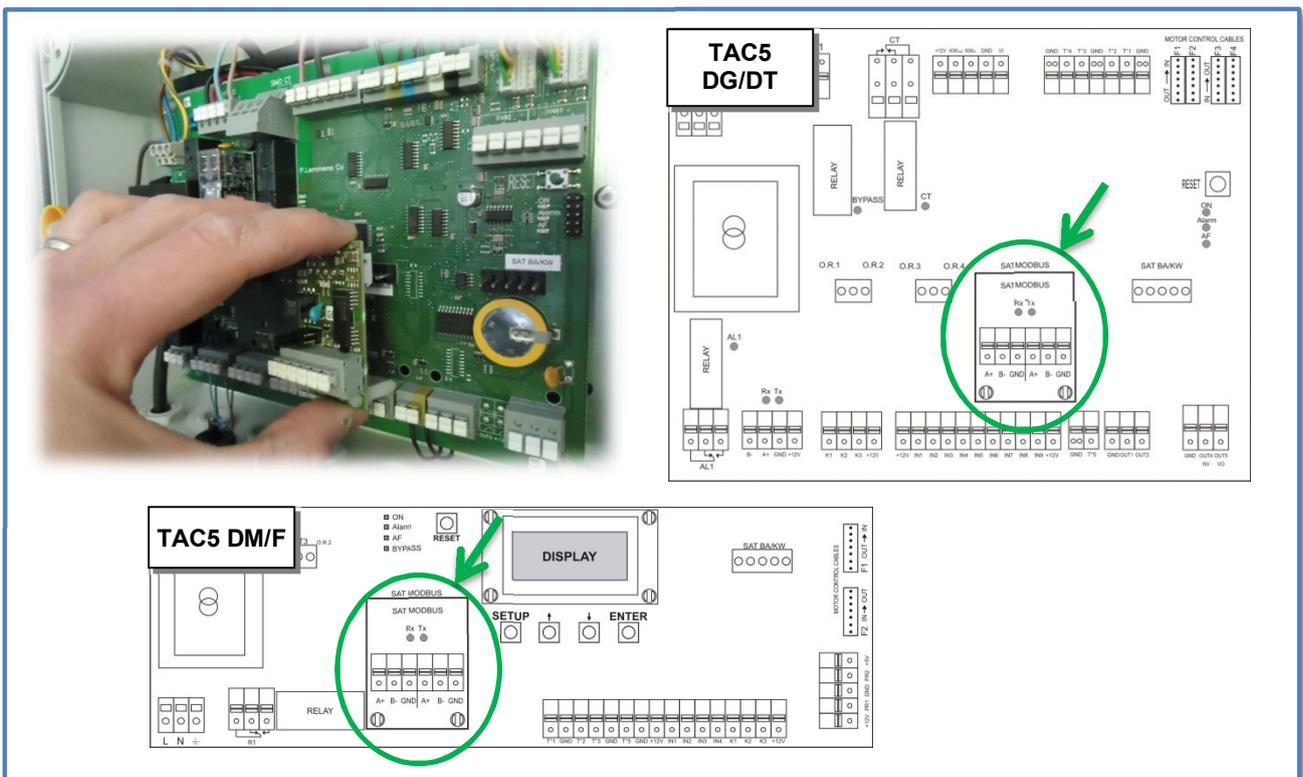
The features of each TAC5 regulation are plainly explained in their specific user manual.

## 1.2 Plugging the SAT MODBUS satellite

The assembly must be carried out with the power OFF. The SAT MODBUS must be plugged on the « SAT MODBUS » plug of the TAC5 regulation board.

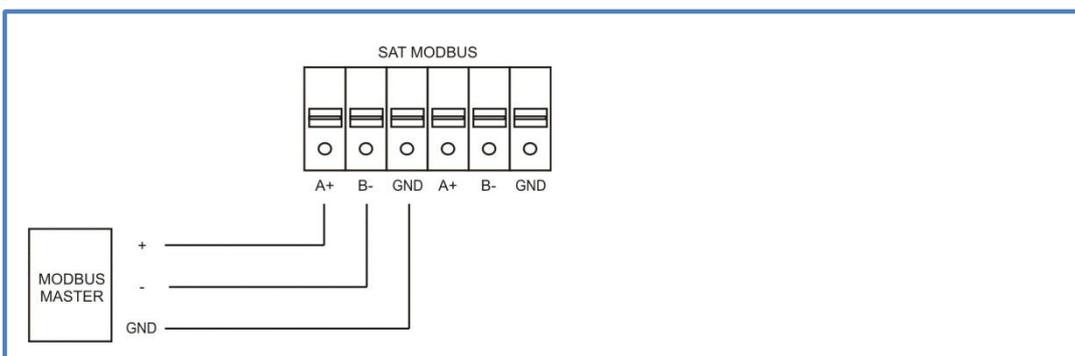
**Caution: A bad positioning of SAT MODBUS on circuit TAC5 can fatally damage both circuits!**

The following figure shows the installation of a SAT MODBUS on TAC5 control boards.

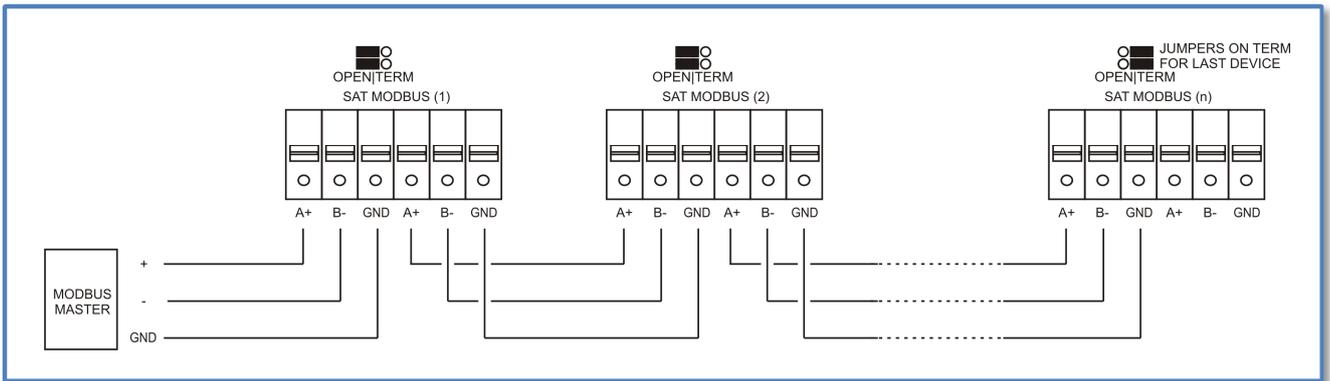


## 1.3 Wiring the SAT MODBUS

### a) Wiring one unit



**b) Network wiring**



**Cable Specifications:**

- Armoured twisted pair (FTP) category 5. Section 0,26 ... 0,50 mm<sup>2</sup>. Use wires of same pair to connect B- and A+.
- Maximal cable length = 1000m.

**2 Definition of the MODBUS RTU communication**

**2.1 MODBUS Protocol**

The TAC5 controllers use the communication protocol MODBUS RTU.

This protocol is based on a master / slave architecture. Each message has the same structure: the frame is made of the slave address, the function code (writing or reading), the data and a numeric test value to test for communication errors (CRC16)

Main specifications:

- MODBUS RTU protocol (binary)
- Physical layer: RS 485- asynchronous. a 3-wire connection with GND is required
- Factory default baud rate is 9600. 1200, 4800, 9600 or 19200 are possible.

**2.2 MODBUS frame**

The MODBUS frame is presented in the following way:

Start	address	Function code	Data	CRC	Stop
≥ 3,5 caract.	1 à 247	03 – 06 - 16	8 bits	16 bits	≥ 3,5 caract.

Controller uses the Modbus RTU time-based framing. The receiver monitors the elapsed time between receipt of characters. If three and one-half character times elapse without a new character this is considered to be the end of frame. The actual end-of-frame detection time is rounded to milliseconds because the system timing is millisecond-based.

Address:

Possible slave address is 1 to 247. Factory default is 1.

Function code:

- Supports function code 3 (decimal) for reading multiple holding registers.
- Supports function code 6 (decimal) for writing a single holding registers.
- Supports function code 16 (decimal) for writing multiple holding registers.

Data:

Number of databits is fixed to 8.

Number of stopbits is fixed to 1

All TAC5 data is in 16-bit modbus holding registers. Modbus coils, discrete inputs or input registers are not used.

The modbus communication buffers have a size of 129 bytes. This is sufficient for reading or writing 60 registers at once.

Parity:

Factory default parity is None

CRC-16:

The RTU format follows the commands/data with a "cyclic redundancy check" checksum as an error detection mechanism to ensure the reliability of data.

In the Modbus.org standard documents, holding register addresses are given a prefix of "4" to distinguish them from other register types. For example, in their documentation a holding register at address 1001 is referred to by "41001". However, the leading "4" is not really part of the address. Also, the Modbus.org standard documents refer to register addresses using "one-based" numbering. However, the addresses that are actually sent in a Modbus command message are "zero-based". For example, to read register 1001, the address that is actually sent in the command message is 1000.

## 2.3 MODBUS exception

The TAC5 Modbus protocol may respond with an exception code if the read or write command was invalid. Possible exceptions are:

- 01 ILLEGAL FUNCTION: The function code received in the query is not an allowable action for the slave.
- 02 ILLEGAL DATA ADDRESS: The data address received in the query is not an allowable address for the slave. Or the combination of data address and transfer length is not allowable.
- 03 ILLEGAL DATA VALUE: The master attempted to write a non-allowed value into a register. Which values are allowed may depend on configuration settings of other registers.

When a write of multiple registers is executed, the execution stops at the first invalid data address or invalid value.

## 2.4 MODBUS values

All values are signed values.

As usual, all modbus words are in big endian byte order.

Some registers act as bitmaps with 16 status bits.

Some values are 32-bit. They are transferred as two 16-bit registers, first low word, then high word.

When reading, the master must combine two 16-bit words into one 32-bit value. With shift:

$Val_{32} = (((long)HIGH) \ll 16) | LOW$ . With math:  $Val_{32} = HIGH * 65536 + LOW$ . For example: Reg1=33041, Reg2=13:

$Val_{32} = 885009$ .

When writing a 32-bit parameter, the controller first buffers the low word. Then, when the high word is written, the 32-bit parameter is updated. This low-word buffer is shared for all 32-bit parameters...

## 2.5 Write cycles limitation

The controller stores all setup parameters and some control parameters in non-volatile EEPROM memory to protect against power failure. This EEPROM memory has an endurance of 100 000 write cycles. Therefore, these parameters should not be changed too often! Writing a parameter with the same value is not a change. Changing a parameter once per hour would result in 8760 writes per year, or 100 000 writes in 11 years. Changing a setup parameter once per minute would result in 100 000 writes in only 69 days!

Those parameters are marked as "E1" in the MODBUS map.

Some parameters are stored in a non-volatile RAM memory. Those parameters have no writing limitation and their value is not lost in case of power break.

Those parameters are marked as "R" in the MODBUS map.

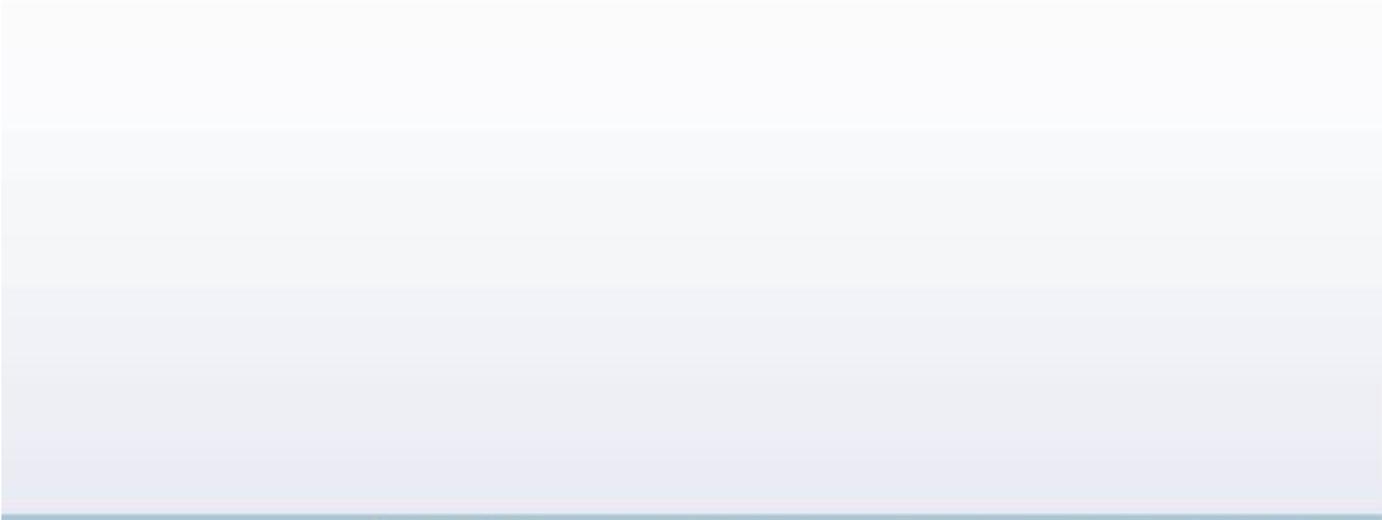
# 3 Modbus Registers

Please refer to documentation "MI Regulation TAC5 + MODBUS TABLE" since the registers in use for Modbus TCP/IP are the same than the ones for Modbus RTU.

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***Although we put a lot of care in the making of our documentation, we cannot be held responsible for any error and/or omissions that could have slipped in.***





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