MODBUS-RTU per Vision Touch THR

MODBUS-RTU protocol specifications for LAN control of Vision Touch THR series devices

Document name: **MODBUS-RTU_VT_THR_02-18_ENG**
Installed Software: VT_THR_1_0_6_12**.pego**

REED AND KEEP

INDEX

1: GENERAL DESCRIPTION

1.1 MODBUS PROTOCOL

The data communication system based on Modbus protocol allows to connect up to 247 devices in a common RS485 line with standard format and communication mode.
Communication takes place in half duplex by frame (transmitted continuously); only master (PC , PLC ...) can start polling with slaves as question/answer (only one slave addressed) and the polled slave answers. The slave answers after a minimum pause of 3,5 characters between received frame and the one to be transmitted.
Also broadcast communication mode exists where the master send a request to all the slaves simultaneously, and they give no answer back; this mode it's not available with this controller.
The data serial transmission mode implemented on the controller is RTU type (Remote Terminal Unit), where data are exchanged in binary format (8 bit characters).

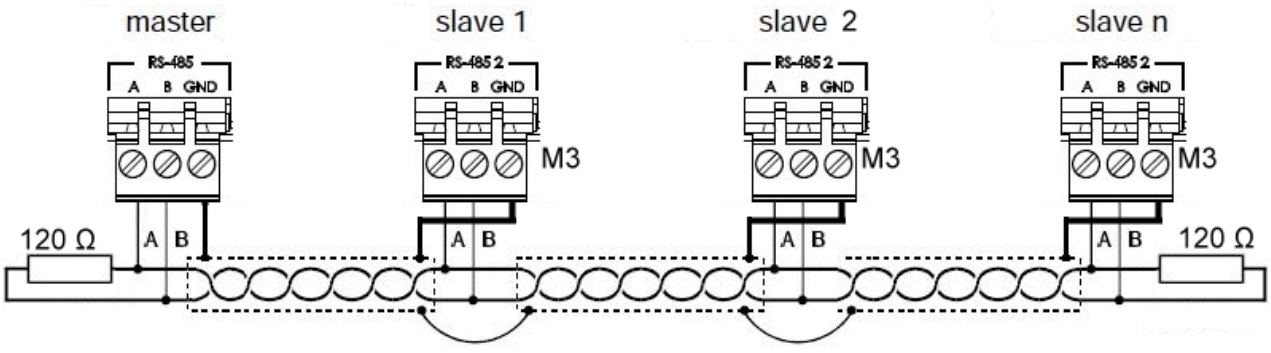
1.2 SERIAL CONFIGURATION

Serial line:	***RS485***
Baud rate:	***300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200***
Data length:	***8 bit***
Parity:	***none, left or right***

Serial transmission of characters in RTU format

Start	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	Parity (optional)	Stop 1

Is recommended to connect a resistance of 120Ω tra A e B between A and B at the beginning and at the end of the line in case of communication problems.
For proper operation, the Master must have a polarized RS485.



1.3 MESSAGE FORMAT (FRAME)

Each message (Frame) is made, based on MODBUS-RTU standard, by the following parts:

Start	Device address	Function code	Data	CRC16		Stop
silence of (3,5 x byte time) msec	Byte	Byte	n x Byte	LSByte	MSByte	silence of (3,5 x byte time) msec

- **Start / Stop :**
  Message starts with a silence equal to 3.5 times of one byte transmission time. See chap. 4.1 for further clarifications.

- **Device address**:
  Device address with whom the master established the communication. It's a value between 1 and 247. Address 0 is reserved to the broadcast, message sent to all slave devices (not active on this controller). RS485 line allows to connect together up to 32 devices (1 Master + 31 slaves), but with appropriate "bridges" or relay devices it is possible to use the whole logical addressing field.

- **Function code:**
  The code of the function to be executed or was executed; On device are active codes 0x03 (register reading), 0x06 (single register writing) and 0x2B/0x0E (identification data reading).

- **Data:**
  Data that must be exchanged.

- **CRC16:**
  Error checking field based on CRC16 algorithm. CRC16 is calculated on the whole message by the master device which is trasmitting and attached to the message itself. The slave, at the end of reception, calculates CRC16 on the message and compares it with the value learnt by the master; if the values do not match, the message will be considered not valid and will be discarded without sending any answer to the master.
  The following fragment of C code shows the CRC16 calculation mode:

```
unsigned int CRC16
void Modbus_CRC(unsigned char *Frame, unsigned char FrameLength)
{
unsigned char ByteCount;
unsigned char i;
unsigned char bit_lsb;
CRC16 = 0xFFFF;
for (ByteCount=0;ByteCount<FrameLength;ByteCount++)
  {
  CRC16^=Frame[ByteCount];
  for (i=0;i<8,i++)
    {
    bit_lsb = CRC16 & 0x0001;
    CRC16 = CRC16>>1;
    if (bit_lsb == 1)
      CRC16 ^= 0xA001;
    }
  }
}
```

1.4 MESSAGES SYNCHRONIZATION

Message synchronization between transmitter and receiver is made placing a pause on the messages at least 3.5 times the character transmission period. If the receiver does not receive any Byte for 3.5 times of one byte transmission period, the last message is considered completed and the next Byte received is set as the first one of a new message.
The slave, once received the complete message, decodes it and, if there are no errors, sends the answer message to the master. To send the answer, slave keeps RS485 line busy, wait a pause of 3.5 times the byte transmission period, send the complete message, wait 3.5 times the byte transmission period and then release the RS485 line.
The master unit will have to consider these periods to avoid risks of transmission overlap; in particular must be set a proper answer reception time-out before starting a new transmission (typical time-out value: 500msec or higher, for a baud rate = 9600).

1.5 ERROR MESSAGES (EXCEPTIONS)

If is not possible to complete the required operation, the device answers with an error message in the following format:

Device address	Function Code	Exception Code	CRC16	
Byte	Byte	Byte	LSByte	MSByte

- **Device address**: Address of slave device answering
- **Function Code**: Function code MSb =1 (to show exception); i.e. 0x83 (for 0x03 reading) or 0x86 (for 0x06 writing)
- **Exception Code**: Exception codes handled by the device are the following:

Exception code	Description	Exception cause
0x01	Function not implemented	A function code not available was requested, different from 0x03, 0x06 and 0x2B/0x0E.
0x02	Address not valid	It's generated in several situations: - a not implemented register has been requested (or a not-existing area) - a reading of a number of registers that goes further on the implemented area has been requested (starting from requested address) - tried to write on a read-only area
0x03	Value not valid for datum	It's generated in several situations: - message 0x2B/0x0E DeviceIdCode is not correct - has been tried to write a parameter with an out of range value

- **CRC16:** Error control field based on the CRC16 algorithm.

Note:
In case the device identifies in the received message an error on format or in CRC16, the message is discarded (considered not valid) and no answer is sent.

2: DESCRIPTION OF CONTROLS

All the registers, to equalize the interpretation, are handled in a Word format (16 bit), even if an 8-bit parameter is contained.

2.1 *REGISTER READING (0x03)*

Format of the command sent by the Master:

Device address	*Function Code*	*Register address*		*Number of registers*		*CRC16*	
Byte	Byte	MSByte	LSByte	MSByte	LSByte	LSByte	MSByte

- **Device address**:
  The address of the slave device to be queried
- **Function Code**:
  Function code to be executed, in this case register reading (0x03)
- **Register address**:
  Starting register address for reading expressed with two Bytes; (MSByte) and (LSByte).
- **Number of registers**:
  indicates the number of Word required from the starting address. If a number of registers more than 1 is requested, the answer message will provide all the registers required with consecutive addresses starting from the address shown on the "register address" field.
  The number of registers to read is expressed on two Bytes, particularly for this controller (MSByte) must always be 0x00 and (LSByte) with range 1-10.
- **CRC16:**
  Error control field based on the CRC16 algorithm.

Format of answer message from the slave:

Device address	*Function Code*	*Bytes of datum No.*	*Datum 1*		*Datum 2*		*Datum n*		*CRC16*	
Byte	Byte	Byte	MSByte	LSByte	MSByte	LSByte	MSByte	LSByte	LSByte	MSByte

- **Device address**:
  The address of the slave device that responds
- **Function Code**:
  Function code to be answered to, in this case register reading (0x03)
- **Number of bytes of datum**:
  It contains the total number of bytes of datum.
  Consider that the number of bytes of datum is the double of the number of registers (because we talk about word). I.e. if in the message of request 2 registers are requested, the number of bytes of datum must be set as 4 in the answer message.
- **Datum n** :
  It contains the sequence of the data each expressed on two bytes; (MSByte) e (LSByte).
- **CRC16:**
  Error control field based on the CRC16 algorithm.

2.2 *SINGLE REGISTER WRITING (0x06)*

Format of the command sent by the Master:

Device address	***Function Code***	***Register address***		***Datum***		***CRC16***	
Byte	Byte	MSByte	LSByte	MSByte	LSByte	LSByte	MSByte

- **Device address**:
  The address of the slave device to be queried
- **Function Code**:
  Function code to be executed, in this case single register writing (0x06)
- **Register address**:
  Address of register to write expressed with two Bytes; (MSByte) and (LSByte).
- **Data**:
  Value to be assigned to the register expressed with two Bytes; (MSByte) and (LSByte).
- **CRC16:**
  Error control field based on the CRC16 algorithm.

Format of the answer message from the slave:

Device address	***Function Code***	***Register address***		***Datum***		***CRC16***	
Byte	Byte	MSByte	LSByte	MSByte	LSByte	LSByte	MSByte

The answer message is a simple echo of the message of request to confirm that the variable has been modified.

2.3 READING DEVICE IDENTIFICATION DATA (0x2B / 0x0E)

Format of the command sent by the Master:

Device address	Function Code	MEI type	Read Device Id Code	Object Id	CRC16	
Byte	Byte	Byte	Byte	Byte	LSByte	MSByte

- **Device address**:
  The address of the slave device to be queried
- **Function Code**:
  Function code to be executed, in this case identification data reading (0x2B)
- **MEI type**:
  Modbus Encapsulated Interface type: it must be 0x0E.
- **Read Device Id Code**:
  It indicates the access type to data: it must be 0x01.
- **Object Id**:
  It indicates the starting object for data reading (range: 0x00 – 0x02).
- **CRC16:**
  Error control field based on the CRC16 algorithm.

Format of the answer message from the slave:

Device address	Function code	MEI Type	Read Device Id Code	Conformity level	More Follows	Next Object Id	Number Of Object	Object Id (n)	Object Length (n)	Object Value (n)	CRC16	
Byte	Byte	Byte	Byte	Byte	Byte	Byte	Byte	Byte	Byte	ASCII String	LSByte	MSByte

- **Device address**:
  The address of the slave device that responds
- **Function Code**:
  Function code to be executed, in this case identification data reading (0x2B)
- **MEI type**:
  Modbus Encapsulated Interface type: it must be 0x0E.
- **Read Device Id Code**:
  It indicates the access type to data: it must be 0x01.
- **Conformity level**:
  It indicates the slave conformity level: it is always 0x01.
- **More Follows**:
  It indicates the number of additional transactions requested: it is always 0x00.
- **Next Object Id**:
  It indicates the object that has to be requested in the eventual following transaction: it is always 0x00
- **Number Of Object**:
  The number of objects that follow (1, 2 o 3).

- **List of**:
  - **Object Id**:
    current object number.
  - **Object Length**:
    length of following string.
  - **Object Value**:
    ASCII string that contains the identification information.
- **CRC16:**
  Error control field based on the CRC16 algorithm.

Reading example of all controllers identification information with software VT_THR rev. 2 ed (address 1)

Request message: (01 2B 0E 01 00 70 77)

- **Device address**: 0x01
- **Function code**: 0x2B
- **MEI type**: 0x0E
- **Read DeviceIdCode**: 0x01
- **ObjectId**: 0x00
- **CRC16:** to be calculated on the previous values

Answer message: (01 2B 0E 01 01 00 00 03 00 04 50 45 47 4F 01 08 56 54 5F 5F 5F 54 48 52 02 03 30 30 32 34 64)

- **Device address**: 0x01
- **Function code**: 0x2B
- **MEI type**: 0x0E
- **Read DeviceIdCode**: 0x01
- **Conformity level**: 0x01
- **More Follows**: 0x00
- **Next ObjectId**: 0x00
- **Number Of Object**: 0x03
- **ObjectId**: 0x00
- **Object Length**: 0x04
- **Object Value**: 'PEGO' (Vendor Name field in ASCII)
- **ObjectId**: 0x01
- **Object Length**: 0x08
- **Object** Value: 'VT___THR' (Product Code field in ASCII)
- **ObjectId**: 0x02
- **Object Length**: 0x03
- **Object Value**: '002' (Revision field in ASCII)
- **CRC16:** to be calculated on the previous values

3: REGISTERS AND ADDRESSES DESCRIPTION

Each register has a 16 bit dimension. It has been formed some blocks of variables (each with a different MSByte address) basing on the type of these variables. In the followings paragraphs are described in the detail all the available blocks and, for each block, the implemented variables.
At the beginning of each table it has been indicated in the first row if its data could be only read (READ-ONLY) or written and read (READ/WRITE).

TABLE COLUMNS DESCRIPTION:

- **Register** :
  It indicates the register address to be used in the Modbus command structure for reading or writing data to the instrument. It is expressed on two Bytes; (MSByte) and (LSByte).
- **Description** :
  Description of the register and possible corresponding programming variable of the device.
- **Meaning and Bytes range:**
  Dimension (MSByte and LSByte), allowed range and notes about the register.
- **U.M. :**
  Unit of measure of datum contained in the register.
- **Conv. :**
  Values contained in the registers that represent signed variables require a conversion and they are marked from **X** sign in the following column.
  Conversion procedure:
  - If the value contained in the register is included between 0 and 32767, it represents a positive or null number (the results is the value itself)
  - If the value contained in the register is included between 32768 and 65535, it represents a negative number (the results is the register value - 65536)
- **Molt :**
  It indicates the multiplication factor to be applied to the data of the register and that in combination with U.m and Conv allow accurate interpretation of the value contained in it.
  Example:
  A datum **(0x0012)** = 18 con Molt =**0,1** / U.m= **°C** / Conv=**C** corresponds to a temperature of (18x0,1)= **1,8 °C**
  A datum **(0xFFF0)** = 65520 con Molt =**0,1** / U.m= **°C** / Conv=**C** corresponds to a temperature [(65520 – 65536) x0,1] = **-1,6 °C**
  A datum **(0x0078)** = 120 con Molt =**1** / U.m= **min** / Conv=**C** corresponds to a time of (120x1)= **120 minutes**
  A datum **(0x0014)** = 20 con Molt =**0,1** / U.m= **°C** / Conv=**C** corresponds to a temperature of (20x0,1)= **2,0 °C**

3.1 ANALOG INPUTS

READ-ONLY						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
256	Ambient temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1
257	Ambient humidity	MSByte LSByte	Resolution 1% range: 0 .. 99% Value = 999% indicates faulty probe	%		1
258	Evaporator temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1
259	Hot water temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1
260	Cold water temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1
261	External ambient temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1
262	External ambient humidity	MSByte LSByte	Resolution 1% range: 0 .. 99% Value = 999% indicates faulty probe	%		1
263	pH probe	MSByte LSByte	Resolution 0,01pH range: -5pH .. +20pH Value = 999,9pH indicates faulty probe	pH	X	0,01
264	Piercing probe temperature	MSByte LSByte	Resolution 0,1°C range: -45°C .. +99°C Value = 999,9°C indicates faulty probe	°C	X	0,1

3.2 PARAMETER

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
768	Temperature Setpoint	MSByte LSByte	Step of 0.1 °C, with sign range: LSt..HSt	°C	X	0,1
769	Humidity setpoint	MSByte LSByte	Step of 1 % range: 0..100	%		1
770	**dtC** Hot temperature differential	MSByte LSByte	Step of 0.1 °C range: dtn+0.2..10.0 °C	°C		0,1
771	**dtF** Cold temperature differential	MSByte LSByte	Step of 0.1 °C range: dtn+0.2..10.0 °C	°C		0,1
772	**dtn** Neutral temperature zone	MSByte LSByte	Step of 0.1 °C, with sign range: 0°C.. minimum between (dtF-0.2) and (dtC-0.2)	°C		0.1
773	**dUU** Differential of humidification	MSByte LSByte	Step of 1 %, range: 1%..10%	%		1
774	**dUd** Differential of dehumidification	MSByte LSByte	Step of 1 %, range: 1%..10%	%		1
775	**dUn** Humidity neutral zone	MSByte LSByte	Step of 1 %, range: 0%.. minimum between (dUU-1) e (dUd-1)	%		1
776	**EnU** Enabling humidification	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
777	**End** Enabling dehumidification	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
778	**EnH** Enabling hot	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
779	**dE** Enabling evaporator probe	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
780	**d4** Defrost period	MSByte LSByte	Step of 1 hour range: 0..24 hours (0 = disabled)	hours		1
781	**Enable d4** Enabling defrost period	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
782	**d5** Maximum period of defrost	MSByte LSByte	Step of 1 minute range: 1..60 minutes	min		1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
783	**d6** Defrost end temperature	MSByte LSByte	Step of 1 °C, with sign range: -35..+45 °C	°C	X	1
784	**d7** Dripping period	MSByte LSByte	Step of 1 minute range: 0..10 minutes (0 = disabled)	min		1
785	**dF1** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
786	**Enable dF1** Enabling dF1	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
787	**dF2** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
788	**Enable dF2** Enabling dF2	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
789	**dF3** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
790	**Enable dF3** Enabling dF3	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
791	**dF4** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
792	**Enable dF4** Enabling dF4	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
793	**dF5** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
794	**Enable dF5** Enabling dF5	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
795	**dF6** Defrost time programming	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
796	**Enable dF6** Enabling dF6	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
797	**di** Smart defrosts	MSByte LSByte	range: 0..1 (0 = disabled)	num		1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
798	**At1** Minimum temperature alarm threshold	MSByte LSByte	Step of 1 °C, with sign range: -45°C..(At2-1°C)	°C	X	1
799	**At2** Maximum temperature alarm threshold	MSByte LSByte	Step of 1 °C, with sign range: (At1+1°C)..+99°C	°C	X	1
800	**AU1** Minimum humidity alarm threshold	MSByte LSByte	Step of 1 % range: 0%..(AU2-1°C)	%		1
801	**AU2** Maximum humidity alarm threshold	MSByte LSByte	Step of 1 % range: (AU1+1)%..100%	%		1
802	**ALd** Temperature alarm signal delay	MSByte LSByte	Step of 1 minute range: 0..240 minutes	min		1
803	**drA** Air change duration	MSByte LSByte	Step of 1 minute range: 1..10 minutes	min		1
804	**rA1** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
805	**Enable rA1** Enabling rA1	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
806	**rA2** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
807	**Enable rA2** Enabling rA2	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
808	**rA3** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
809	**Enable rA3** Enabling rA3	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
810	**rA4** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
811	**Enable rA4** Enabling rA4	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
812	**rA5** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
813	**Enable rA5** Enabling rA5	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
814	**rA6** Scheduling air change duration	MSByte LSByte	Step of 1 minute range: 0...1439 minutes	min		1
815	**Enable rA6** Enabling rA6	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
816	**F5** Pause fans after defrost	MSByte LSByte	Step of 1 minute range: 0...10 minutes	min		1
817	**F3** Fans statum	MSByte LSByte	range: 0..2, (0 = fans running constantly)	num		1
818	**F4** Pause fans during defrost	MSByte LSByte	range: 0..1, (1 = fans stopped)	num		1
819	**F6** Air recirculation fans activation	MSByte LSByte	Step of 1 minute range: 1..240 minutes	min		1
820	**Enable F6** Enabling air recirculation fans activation	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
821	**F7** Duration of air recirculation fans activation	MSByte LSByte	Step of 1 second range: 0..240 seconds	sec		1
822	**F8** Fans speed	MSByte LSByte	range: 0..1 (0 = high speed, 1 = low speed)	num		1
823	**Fs** 0-10V fans speed	MSByte LSByte	Step of 1% range: 20%..100%	%		1
824	**Fst** Evaporator temperature that blocks the fans	MSByte LSByte	Resolution 0,1°C, with sign range: -45,0°C .. +99,0°C	°C	X	0,1
825	**Fd** Differential for fans block	MSByte LSByte	Resolution 0,1°C range: 0,1°C .. +10,0°C	°C		0,1
826	**Pr** Recovery period	MSByte LSByte	Step of 1 minute range: 1..1440 minutes	min		1
827	**Enable Pr** Enabling recovery period	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
828	**dr** Duration of recovery period	MSByte LSByte	Step of 1 minute range: 1..480 minutes	min		1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
829	**C1** Delay of re-ignition of the compressor	MSByte LSByte	Step of 1 minute range: 0..15 minutes (0 = disabled)	min		1
830	**LSt** Minimum setpoint	MSByte LSByte	Step of 0.1 °C range: -45°C..+HSt °C	°C	x	0.1
831	**HSt** Maximum setpoint	MSByte LSByte	Step of 0.1 °C range: LSt°C..+99°C	°C	x	0.1
832	**btF** Differential for cold block	MSByte LSByte	Step of 1 °C range: 1°C..+20°C	°C		1
833	**Enable btF** Enabling differential for cold block	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
834	**btC** Differential for hot block	MSByte LSByte	Step of 1 °C range: 1°C..+20°C	°C		1
835	**Enable btC** Enabling differential for hot block	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
836	**dEt** Dehumidification time limit	MSByte LSByte	Step of 1 minute range: 1..240 minutes	min		1
837	**Enable dEt** Enabling dehumidification time limit	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
838	**dEo** Timeout dehumidification management	MSByte LSByte	range: 0..1 (0 = alarm only; 1 = recovery)	num		1
839	**StH** Hot water temperature setpoint	MSByte LSByte	Step of 0.1 °C range: -45°C..+99°C	°C	x	0,1
840	**roH** Differential for hot water temperature	MSByte LSByte	Step of 1 °C range: 1°C..+20°C	°C		1
841	**tdH** Delay at response for hot water	MSByte LSByte	Step of 1 minute range: 1..+10 minutes	min		1
842	**StC** Cold water temperature setpoint	MSByte LSByte	Step of 0.1 °C range: -45°C..+99°C	°C	x	0,1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
843	**roC** Differential for cold water temperature	MSByte LSByte	Step of 1 °C range: 1°C..+20°C	°C		1
844	**tdC** Delay at response for cold water	MSByte LSByte	Step of 1 minute range: 1..10 minutes	min		1
845	**EEs** Enabling energy saving	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
846	**dEs** Differential for energy saving	MSByte LSByte	Step of 1 % range: 0%..200%	%		1
847	**tEs** Energy saving duration	MSByte LSByte	Step of 1 minute range: 1..600 minutes	min		1
848	**StS** Piercing probe setpoint	MSByte LSByte	Step of 0.1 °C, with sign range: LSt..HSt	°C	X	0,1
849	**dSm** Differential for piercing probe (manually)	MSByte LSByte	Step of 0.1 °C range: 0.2..10.0 °C	°C		0,1
850	**Buz** Enabling sounds	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
851	**dEz** Manual essence duration	MSByte LSByte	Step of 1 minute range: 1...1439 minutes	min		1
852	**Enable dEz** Enabling Manual essence duration	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
853	**FdS** Delay of evaporator fans stop	MSByte LSByte	Step of 1 second range: 0...600 seconds	sec		1
854	**Enb** Suspends the management of temperature/humidity	MSByte LSByte	range: 0..1 (0= disabled)	num		1
855	**Wce** Web command enable	MSByte LSByte	range: 0..1 (0=disabled)	num		1
856	**doC** Compressor safety time for door switch	MSByte LSByte	Step of 1 min range: 0 min..5 min	min		1

READ / WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
857	**Tdo** Compressor restart time after door opening	MSByte LSByte	Step of 1 min range: 0 min..240 min	min		1
858	**HmV** Minimum value of the humidifier regulation analogue output	MSByte LSByte	Step of 1 % RH range: 0%..99RH%	RH%		1

3.2a REAL-TIME CLOCK PARAMETERS

READ/WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
1024	Minutes of the Clock	MSByte LSByte	Range: 0..59	Min.		1
1025	Hour of the Clock	MSByte LSByte	Range: 0..23	Hour		1
1026	Year	MSByte LSByte	Range: 2000..4000	num		1
1027	Month	MSByte LSByte	Range: 1..12	num		1
1028	Day	MSByte LSByte	Range: 1..28, 1..29, 1..30, 1..31 (depending on month and year)	num		1

N.B.
- When you change a parameter of the real-time clock, the seconds of the clock are forced to zero.
- The parameters of the real-time clock cannot be changed with data logging or recipe in progress.

3.2b ***PARAMETERS***

READ-ONLY						
Register	***Description***	***Bytes meaning and range***		***U.M.***	***Conv***	***Molt***
512	**Cat** Ambient probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
513	**CaU** Humidity probe calibration	MSByte LSByte	Step of 1 % range: -20%..+20%	%		1
514	**CaE** Evaporator probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
515	**CaC** Cold water probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
516	**CaH** Hot water probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
517	**Cet** External ambient probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
518	**CeU** External humidity probe calibration	MSByte LSByte	Step of 1 % range: -20%..+20%	%		1
519	**CaS** Piercing probe calibration	MSByte LSByte	Step of 0.1 °C range: -10°C..+10°C	°C	x	0.1
520	**dEU** Dehumidification mode selection	MSByte LSByte	range: 0..3	num		1
521	**Hr** Humidity management	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
522	**EHv** Enabling hot water management	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
523	**ECv** Enabling cold water management	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
524	**EFa** Enabling 0-10V fans	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
525	**EpH** Enabling pH probe	MSByte LSByte	range: 0..1 (0 = disabled)	num		1

READ-ONLY						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
526	**LpH** Minimum pH (4mA)	MSByte LSByte	Step of 0.01 range: -5.00pH..HpH pH	pH	x	0,01
527	**HpH** Maximum pH (20mA)	MSByte LSByte	Step of 0.01 range: LpH pH..20.00pH	pH	x	0,01
528	**EnS** Enabling piercing probe	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
529	**d1** Type of defrost	MSByte LSByte	range: 0..2 0 = resistance 1 = hot gas (defrosting outlet off during dripping) 2 = hot gas (defrosting outlet on during dripping, to manage bowl resistances)	num		1
530	**CaP** pH probe calibration	MSByte LSByte	Step of 0.01 range: -1.00pH..1.00 pH	pH	x	0,01
531	**int** Datalogger time interval	MSByte LSByte	Step of 1 minute range: 0...60 minutes (0= disabled)	min		1
532	**ASr** Enable asynchronous registration	MSByte LSByte	range: 0..1 (0= disabled)	num		1

3.3 INPUTS / OUTPUTS / ALARMS STATUS

READ-ONLY							
Register	**Description**	**Bytes meaning and range**			**U.M.**	**Conv**	**Molt**
1280	outputs 1 status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6	Not used			
			bit 5	Not used			
			bit 4	Essence			
			bit 3	Notice of ended recipe			
			bit 2	Alarm			
			bit 1	Defrost			
			bit 0 (LSb)	Recovery			
		LSByte	bit 7 (MSb)	Air change			
			bit 6	Light			
			bit 5	Dehumidification call			
			bit 4	Humidification call			
			bit 3	Low speed fans			
			bit 2	High speed fans			
			bit 1	Hot call			
			bit 0 (LSb)	Cold call			
1281	outputs 2 status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				
		LSByte	bit 7 (MSb)	Not used			
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				

Please Note:
- The status of the outputs is of the function of THR and not that of the Test Center.

READ-ONLY							
Register	**Description**	**Bytes meaning and range**			**U.M.**	**Conv**	**Molt**
1282	outputs 1 status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2	Generic warning 3			
			bit 1	Generic warning 2			
			bit 0 (LSb)	Generic warning 1			
		LSByte	bit 7 (MSb)	Fans protections			
			bit 6	Humidifier alarm			
			bit 5	Compressor protections			
			bit 4	Generic alarm			
			bit 3	Door switch			
			bit 2	Disable humidity			
			bit 1	Disable hot			
			bit 0 (LSb)	Stand-by			
1283	outputs 2 status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				
		LSByte	bit 7 (MSb)	Not used			
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				

READ-ONLY							
Register	**Description**	**Bytes meaning and range**			**U.M.**	**Conv**	**Molt**
1284	Alarms status 1	MSByte	bit 7 (MSb)	Initialization error of Master (EnI)	num		1
			bit 6	Minimum humidity alarm (EuL)			
			bit 5	Maximum humidity alarm (EuH)			
			bit 4	Minimum temperature alarm (EtL)			
			bit 3	Maximum temperature alarm (EtH)			
			bit 2	Fans protections (EF)			
			bit 1	Humidifier alarm (EU)			
			bit 0 (LSb)	Compressor protections (Ec)			
		LSByte	bit 7 (MSb)	General alarm (Eg)			
			bit 6	Probe 5 anomaly (E5)			
			bit 5	Probe 4 anomaly (E4)			
			bit 4	Probe 3 anomaly (E3)			
			bit 3	Probe 2 anomaly (E2)			
			bit 2	Probe 1 anomaly (E1)			
			bit 1	EEPROM Vision Touch alarm (E0)			
			bit 0 (LSb)	Lack of communication (En)			
1285	Alarms status 2	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6	Not used			
			bit 5	Not used			
			bit 4	Not used			
			bit 3	Configuration error 9 (Ec9)			
			bit 2	Configuration error 8 (Ec8)			
			bit 1	Configuration error 7 (Ec7)			
			bit 0 (LSb)	Configuration error 6 (Ec6)			
		LSByte	bit 7 (MSb)	Configuration error 5 (Ec5)			
			bit 6	Configuration error 4 (Ec4)			
			bit 5	Configuration error 3 (Ec3)			
			bit 4	Configuration error 2 (Ec2)			
			bit 3	Configuration error 1 (Ec1)			
			bit 2	EEPROM 100Master alarm (E0m)			
			bit 1	Not used			
			bit 0 (LSb)	Dehumidification Timeout (Ed)			
1286	Alarms status 3	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				
		LSByte	bit 7 (MSb)	Not used			
			bit 6				
			bit 5				
			bit 4				
			bit 3				
			bit 2				
			bit 1				
			bit 0 (LSb)				

READ-ONLY						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
1287	Fans output (0-10V)	MSByte LSByte	Step of 0.1 Volt range: 0,0..+10,0 Volt	Volt		0,1
1288	Hot water output (0-10V)	MSByte LSByte	Step of 0.1 Volt range: 0,0..+10,0 Volt	Volt		0,1
1289	Cold water output (0-10V)	MSByte LSByte	Step of 0.1 Volt range: 0,0..+10,0 Volt	Volt		0,1
1290	Humidifier regulation (0-10V)	MSByte LSByte	Step of 0.1 Volt range: 0,0..+10,0 Volt	Volt		0,1

3.4 DEVICE STATUS

READ / WRITE							
Register	**Description**	**Bytes meaning and range**			**U.M.**	**Conv**	**Molt**
1536	Device status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6	Not used			
			bit 5	Not used			
			bit 4	Enable modification air change status			
			bit 3	Enable modification recovey status			
			bit 2	Enable modification defrost status			
			bit 1	Enable modification light status			
			bit 0 (LSb)	Enable modification stand-by status			
		LSByte	bit 7 (MSb)	Not used			
			bit 6	Not used			
			bit 5	Not used			
			bit 4	Air change status 1 = active 0 = not active			
			bit 3	Recovey status 1 = active 0 = not active			
			bit 2	Defrost status 1 = active 0 = not active			
			bit 1	Light status 1 = active 0 = not active			
			bit 0 (LSb)	Stand-by status 1 = stand-by 0 = ON			

READ / WRITE							
Register	**Description**	**Bytes meaning and range**			**U.M.**	**Conv**	**Molt**
1537	Recipe status	MSByte	bit 7 (MSb)	Not used	num		1
			bit 6	Not used			
			bit 5	Enabling phase cancellation (reg.2820)			
			bit 4	Enable creations of a new phase			
			bit 3	Enable command to ignore a phase			
			bit 2	Enable loading data from current recipe			
			bit 1	Enable loading data on current recipe			
			bit 0 (LSb)	Enable modification recipe status			
		LSByte	bit 7 (MSb)	Not used			
			bit 6	Not used			
			bit 5	Status of cancellation of phase (*) 1 = cancel the phase (reg.2820) 0 = OFF			
			bit 4	Status of creation of a new phase (*) 1 = create a new phase 0 = OFF			
			bit 3	Status of ignore a phase (**) 1 = ignore a phase 0 = OFF			
			bit 2	Status of loading (*) (***) 1 = in progress 0 = OFF			
			bit 1	Status of saving (*) (***) 1 = in progress 0 = OFF			
			bit 0 (LSb)	Status of recipe 1 = play 0 = OFF			

(*) = This functionality can be used with program in Stop.

(**) = This functionality can be used with program in Play.

(***) = The editable program by Modbus is to Work, that is executed in RAM. The change of program variables is performed in RAM and to be made permanent (not to be lost in case of failure of the control power supply) it must be saved in Flash with the appropriate Save function. The upload feature allows you to reload the values stored in the Flash of the work program in RAM, canceling any unsaved temporary changes.

To request a change in one of the bits of device status, the master must send in LSByte the required value for the bit and in MSByte the corresponding bit set to 1. Example: to force the state of standby, the master must send MSByte = 00000001 and LSByte = 00000001.

3.5 RECIPE PARAMETERS

The records described below refer to the current recipe loaded in Vision Touch.
You can modify these values only if the recipe is not in progress. To modify the parameters of a phase, select it using the 2820 registry, and then change the values of the following registers (from 2821 onwards).
To add / delete a step, see 1537 registry.

READ-WRITE						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
2816	Actions at the end of recipe	MSByte LSByte	range: 0..2 0 = manual 1 = repeat phase (loop) 2 = standby	num		1
2817	Activate the relay at the end of recipe	MSByte LSByte	range: 0..1 (0 = disabled) (1 only if the registry 2818=1)	num		1
2818	Show popup at the end of recipe	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
2819	Dripping function	MSByte LSByte	range: 0..2 0 = disabled 1 = enables with the hot Management 2 = enables with the hot/cold Management	num		1
2820	Selected phase	MSByte LSByte	range: 0..20	num		1
2821	Phase: Temperature setpoint	MSByte LSByte	Step of 0.1 °C, with sign range: -45,0..+99,0 °C	°C	X	0,1
2822	Phase: Humidity setpoint	MSByte LSByte	Step of 1 % range: 0..100	%		1
2823	Phase: Enable recovery	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
2824	Phase : Fans speed	MSByte LSByte	range: 0..1 (0 = high speed, 1 = low speed)	num		1
2825	Phase: Fans (0-10V) speed	MSByte LSByte	Step of 1% range: 20%..100%	%		1
2826	Phase: Duration	MSByte LSByte	Step of 1 minute range: 1..5999	min		1
2827	Phase: Enable essence	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
2828	Phase: Essence duration	MSByte LSByte	Step of 1 minute range: 1..Duration phase	min		1
2829	Phase: Enable air change	MSByte LSByte	range: 0..1 (0 = disabled)	num		1
2830	Phase: Piercing probe setpoint	MSByte LSByte	Step of 0.1 °C, with sign range: -45,.0°C..+99,0°C	°C	X	0,1
2831	Phase: Enable piercing probe setpoint	MSByte LSByte	range: 0..1 (0 = disabled)	num		1

READ-ONLY						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
2832	Phase: Fans status	MSByte LSByte	Step of 1 range: 0..2	num		1
2833	Phase: Recovery period	MSByte LSByte	Step of 1 minute range: 1..1440 minutes	min		1
2834	Phase: Recovery duration	MSByte LSByte	Step of 1 minute range: 1..480 minutes	min		1

3.5a RECIPE PARAMETERS

READ-ONLY						
Register	**Description**	**Bytes meaning and range**		**U.M.**	**Conv**	**Molt**
3072	Number of active phases of the recipe	MSByte LSByte	Step of 1 range: 0..20	num		1
3073	Parameters of the recipe are not saved	MSByte LSByte	range: 0..1 1 = the recipe has been modified but not saved	num		1

4: GLOSSARY

- **Binary Number:**
  It's used in computing for the internal representation of the numbers, thanks to the simplicity of physically realize an element with two states (0, 1) rather than a higher number, but also for the correspondence with the true and false logic values.

- **Decimal Number:**
  In the decimal system, all integers can be represented using the ten digits that indicate the first ten natural numbers, including zero. The value of each of these figures depends on the position it occupies within the number, and increases by power of 10 in power of 10, proceeding from right to left.

- **Hexadecimal Number:**
  It's part of a positional number system in base 16, that is, which uses 16 symbols instead of the traditional 10 decimal number system. For the hexadecimal are generally used symbols 0 to 9 and then the letters A to F, for a total of 16 symbols. By convention a number is expressed in hexadecimal preceded by 0x (example: 0x03) or H (example: H03).

- **bit:**
  A bit is a binary digit, that is, one of the two symbols of the binary number system, classically called zero (0) and one (1). It is the definition of a logic unit. It is also defined the elementary units of information processed by a computer.

- **Byte:**
  It's the necessary amount of bits to define an alphanumeric character; in particular, a Byte consists of a sequence of 8-bit (example: 10010110).

- **Word:**
  It's the measuring unit that fix the length of information to 16 bits which is also equivalent to 2 Bytes (example: 10010110 01101011).

- **LSb:**
  Least significant bit of a binary number (the first bit on the right of the number indicated)

- **MSb:**
  Most significant bit of a binary number (the first bit on the left of the number indicated)

- **LSByte:**
  Least significant bit of a Word (Byte on the right of the Word indicated)

- **MSByte:**
  Most significant bit of a Word (Byte on the left of the Word indicated)

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