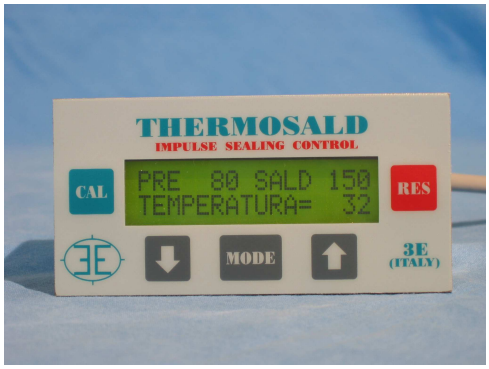
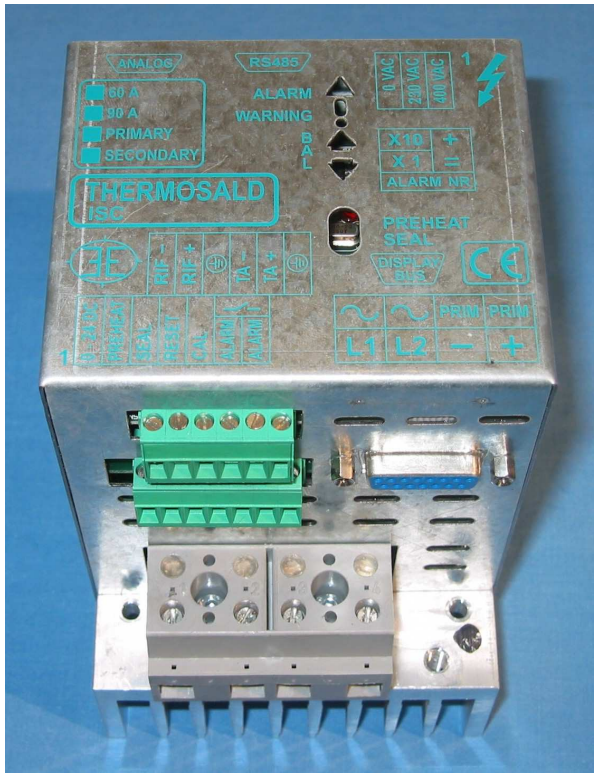
THERMOREGULATOR for PULSE WELDING

THERMOSALD ISX





- **ADDRESS OF UNITS WITH DIP SWITCHES**
- **ADDRESS OF UNITS FROM 1 TO 255**
- **BROADCASTING ADDRESS = 0**
- **CONNECTION OF 3E PANEL UP TO 255 UNITS**
- **CHANGE ALL VARIABLE FROM RS485**
- **CHANGE COMMUNIC. PARAMETERS FROM RS485**

RS485 MODBUS
(V5)

(ENGLISH)

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1 GENERAL INFORMATION

1.1 Revisions of this manual

Rev.: 1	*Date: 29/07/2009*	*Software V1*
Rev.: 2	*Date: 25/06/2010*	*Software V2*
Rev.: 3	*Date: 01/03/2011*	*Software V3*
Rev.: 4	*Date: 19/12/2011*	*Software V4*
Rev.: 5	*Date: 15/04/2012*	*Software V4*
Rev.: 6	*Date: 20/06/2012*	*Software V4.2*
Rev.: 7	*Date: 26/11/2012*	*Software V4.3*
Rev.: 8	*Date: 25/03/2013*	*Software V4.4*
Rev.: 9	*Date: 13/09/2013*	*Software V5.0*

1.2 Information on this document

This document describes the functions of 3E's RS485 Modbus developed on the THERMOSALD ISX thermoregulator.
To continue reading this document, you need to know the basic functions of Modbus' RTU (Remote Terminal Unit) master/slave communication - HALF DUPLEX.

1.3 Reference documents

“Modicon Modbus Protocol Reference Guide”, PI-MBUS-300, Rev.J

1.4 Definitions

THERMOSALD ISX	Pulse thermoregulator, model THERMOSALD ISX, manufactured by 3E Srl.
PROTOCOL TIMEOUT	Maximum time allowed between a Master query and a Slave response: this parameter can be set only on the Master.
IDLE CHAR BEFORE TX	Number of idle characters before and after a useful string: can also be expressed in milliseconds.
DEVICE ADDRESS	Slave unit address number

2 RS485 MODBUS COMMUNICATION

2.1 Hardware Interface – RS485 - HALF DUPLEX

The THERMOSALD ISX thermoregulator can communicate with a PC or PLC supervisor or a 3E - RS485 multilingual Panel through serial port CN5.
CN5 is a 9-pin female connector (CN5/3 = channel A+; CN5/8 = channel B-)
NOTE FOR CONNECTION WITH SIEMENS: A+ must be connected to Siemens channel B+; B- must be connected to Siemens channel A- (+ with +; - with -)

2.2 Transmission protocol

The driver supports **Modbus RTU** (Remote Terminal Unit) **SLAVE** format
The format of each byte in RTU mode is as follows:

- Coding System: 8 binary protocol bits
- Bits per Byte: 1 start bit
  8 data bits, least significant bit sent first
  2 stop bits, no parity
- Error checksum Field: Cyclical Redundancy Check (CRC)

2.3 Communication Parameters that can be changed

Parameter	**Range**	**Default**
TRANSMISSION RATE	9600-19200-28800 -38400-48000-57600	9600
DEVICE ADDRESS	1-128	1
PARITY	none	none
STOP BIT	1,2	2
IDLE CHAR BEFORE TX	0-100 [ms.] Transmission start and end time, during which characters are not sent. The time between the last character sent by the master and the first character answered by the slave must be 2 x 10ms (idle char) = 20ms	10 (ms)

2.4 RS485 MODBUS warning LEDs

BF LED	**Meaning**
ON	Rs485 cable disconnected
Flashing	Rs485 cable connected, but address not received within 3 sec.

2.5 RS485 MODBUS Termination

Activate the RS485 termination on-board the THERMOSALD ISX slave (SW1 ON) only if the slave is the last one of segment RS-485 and if the connector's own internal termination is not already enabled.
EXAMPLE:
SW1.1=ON, SW1.2=ON -> last slave of the chain

SW1.1=OFF, SW1.2=OFF -> not last slave of the chain

2.6 RS485 MODBUS Address

The RS485 address should be set using the SW2 dip-switches on the device; the address is set in binary format in the 1-127 range.
EXAMPLES:
SW2.1=ON, all others are OFF -> address = 1 (2E0)
SW2.2=ON, all others are OFF -> address = 2 (2E1)
SW2.1=ON, SW2.2=ON, all others are OFF -> address = 3 (2E0+2E1)

2.7 RS485 MODBUS Stop Bits

SW2.8=ON 2 STOP BITS
SW2.8=OFF 1 STOP BIT

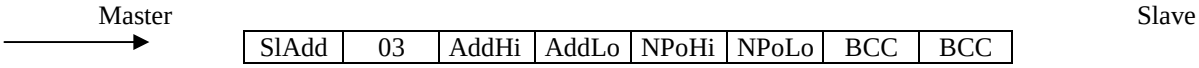
3 MODBUS PROTOCOL AND TELEGRAMS USED

3.1 Supported codes

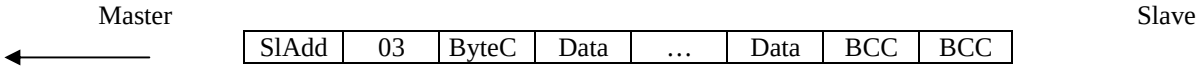
03 read 1 or n registers

This command allows the supervisor to read 1 or n registers

Query:



Response:

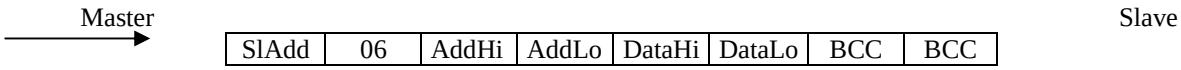


SlAdd: slave address
AddHi: starting address high
AddLo: starting address low
NPoHi: no. of points high
NPoLo: no. of points low
ByteC: byte count, number of data bytes
Data: data bytes
BCC: checksum

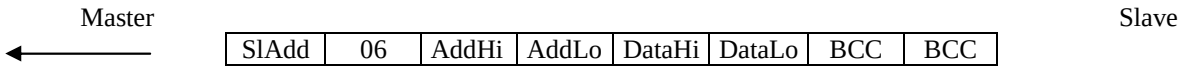
06 write 1 register

This command allows the supervisor to write 1 register

Query:



Response:

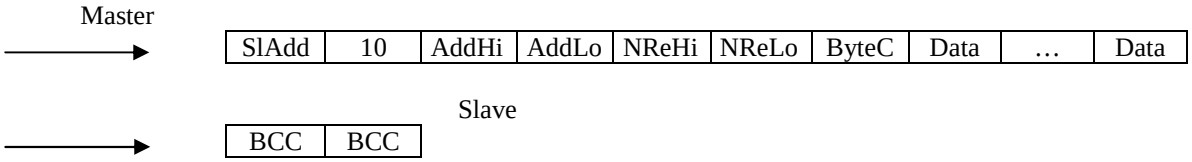


SlAdd: slave address
AddHi: starting address high
AddLo: starting address low
NPoHi: no. of points high
NPoLo: no. of points low
ByteC: byte count, number of data bytes
Data: data bytes
BCC: checksum

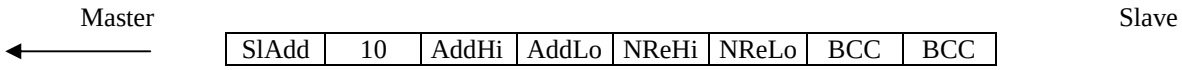
16 (10 Hex) write n registers (not managed)

This command allows the supervisor to write n registers

Query:



Response:



SlAdd: slave address
AddHi: starting address high
AddLo: starting address low
NReHi: no. of registers high
NReLo: no. of registers low
ByteC: byte count, number of data bytes
Data: data bytes
BCC: checksum

4 Start-up

4.0 General information

The exchange of data is immediate, according to standard RS485 MODBUS RTU; simply connect the communication cable to a SUPERVISOR equipped with a standard RS485 MODBUS RTU interface, set the communication parameters and data exchange is operational at once.
Each THERMOSALD ISX parameter or command can be read and/or written by the SUPERVISOR by indicating the corresponding address (see lists in chapter 5).
You must parameterize the supervisor to read significant addresses.
As a supervisor, you can also use our standard 3E Panel that has a fully operational RS485 interface.

4.1 Connect the Cable

Connect cable RS485 (see chapter 2.2)
N.B.: when the RS485 bus does not transmit, its A+ voltage must always be greater than B- (A+ - B- > 200mV)

4.2 Set thermoregulator address (SW2/1,2,3,4,5,7 address 0-127) and STOP BITS (SW2/8=OFF -> 1 STOP BIT, SW2/8=ON -> 2 STOP BITS)

SW2/1 is low bit=1, SW2/7 is high bit=64.
The supervisor can address 1 unit at a time with the specific address or write on all, together with address 0=broadcasting.

4.3 Set the thermoregulator's default parameters on the supervisor

Baud rate	9600 bauds
Parity	no parity
Bits	8
Stop Bits	2
Idle char	10ms x 2 = 20ms

4.4 Changing transmission parameters on thermoregulator via supervisor

Even the transmission parameters on the thermoregulator can be changed by the supervisor: in order to complete the operation in progress, changes will be active only after issuing a SAVE DATA command.

4.5 Commands and States

MASTER RESET: you can reset the master via hardware with a simultaneous 24Vdc signal at reset+calibration inputs for 6 seconds.

CALIBRATION COMMAND: send command no. 15 to hexadecimal address 05 05

COMMAND SAVE DATA TO EEPROM: send command no.. 16 to hexadecimal address 05 05

STATUS READ: you can read a value at hexadecimal address 0306
Example: 17 = thermoregulator not calibrated, 153 = calibration in progress.

5 LISTS

- Default values are outlined in the “USE AND MAINTENANCE MANUAL”
- All exchanged data are words (2 bytes)
- Data are read with Modbus code 03 and written with Modbus codes 06, 16
- N.U. means: do not use

MACHINE DATA	HEX ADDRESS		
0- Heating ramp degrees/100ms	**00 00H**	[xxx]	(R/W)
1- KV Gain	**00 01H**	[xxx]	(R/W)
2- KINT Gain (x10)	**00 02H**	[xx.x]	(R/W)
3- Final KINT threshold	**00 03H**	[xxx]	(R/W)
4- Partial short circuit factor (x10)	**00 04H**	[xx.x]	(R/W)
5- Mode Configuration	**00 05H**	[000 pulse weld]	(R/W)
6- Display Configuration	**00 06H**	[000 analog	(R/W)
		001 analog+panel	(R/W)
		002 panel or FIELDBUS]	(R/W)
7- Rated current	**00 07H**	[xx.x]	(R)
8- KD derivative gain	**00 08H**	[xxx]	(R/W)
9- Disabling 1 alarm	**00 09H**	[xxx]	(R/W)
10- BUS-P1 RS485 enable	**00 0AH**	[000=Disabled	(R/W)
		001=RS485 - 9600 Bauds,	
		002=RS485 - 19200 Bauds,	
		003=RS485 - 28800 Bauds,	
		004=RS485 - 38400 Bauds,	
		005= RS485 - 48000 Bauds,	
		006= RS485 - 57600 Bauds]	
11- BUS-P2 RS485 address	**00 0BH**	[selection from dip switch DIP1/1-7]	(R)
12- 1=Master reset done	**00 0CH**	[xxx]	(R)
13- Disabling 2 alarm	**00 0DH**	[xxx]	(R/W)
14- Temperature coefficient (PPM)	**00 0EH**	[xxx]	(R/W)
15- Units per degree	**00 0FH**	[xxx]	(R)
16- Primary	**00 10H**	[xxx]	(R)
17- Low voltage	**00 11H**	[xxx]	(R)
18- PLC enable	**00 12H**	[xxx]	(R/W)
19- Password	**00 13H**	[xxx]	(R/W)
20- Key password (1-9999)	**00 14H**	[000=Disabled	(R/W)
		001=Partial	
		002=Total]	
21- THERMOSALD Model	**00 15H**	[010=Thermosald ISX]	(R)
22-	**00 16H**	[xxx] Free	
23- I2T - I effective for max 1 sec.	**00 17H**	[xxx]	(R/W)
24- Temperature probe enable	**00 18H**	[xxx]	(R/W)
25- Tmargin_read (v4.4)	**00 19H**	[xxx]	(R/W)
26- Initial KINT threshold (v4.4)	**00 1AH**	[xxx]	(R/W)
27- Fs KINT threshold (v4.4)	**00 1BH**	[xxx]	(R/W)
28-	**00 1CH**	[xxx] Free	

SETTING DATA

256- Burn-in number of cycles	**01 00H**	[xxx]	(R/W)	
257- Language	**01 01H**	[xxx]	(R/W)	
258- Calibration temperature (°C)	**01 02H**	[xxx]	(R/W)	(***B)**
259- 0 = °C / 1 = ° F	**01 03H**	[xxx]	(R/W)	
260- Temperature Burn-in (°C)	**01 04H**	[xxx]	(R/W)	
261- Heating Time Burn-in (sec.)	**01 05H**	[xxx]	(R/W)	
262- Max weld temperature (°C)	**01 06H**	[xxx]	(R/W)	(***B)**
263- Max weld time (x 10)	**01 07H**	[xx.x]	(R/W)	
264- Cooling gradient during bal. (degrees/10sec.)	**01 08H**	[xxx]	(R/W)	
265- Warn66 display time (sec.)	**01 09H**	[xxx]	(R/W)	
266- Increase weld temperature	**01 0AH**	[xxx]	(R/W)	
267- Increase no. of welds	**01 0BH**	[xxx]	(R/W)	
268- Set end-of-weld temperature	**01 0CH**	[0 / 1]	(R/W)	
269- Set pre-heat temperature (°C)	**01 0DH**	[xxx]	(R/W)	(***A)**
270- Set weld temperature (°C)	**01 0EH**	[xxx]	(R/W)	(***A)**
271- Bus-P3	**01 0FH**	[N.U.]		
272- Bus-P4 RS485 stop bit	**01 10H**	[selection via dip switches DW1/8 0=1 stop bit 1=2 stop bits] (R)		
273- Bus-P5	**01 11H**	[N.U.]		
274- Bus-P6 RS485 Idle char	**01 12H**	[1–100,1=10ms,100=1 sec.] (R/W)		
275- Bus-P7	**01 13H**	[N.U.]		
276- Weld delay timer (x 100)	**01 14H**	[x.xx]	(R/W)	
277- Bars closing timer (x 100)	**01 15H**	[x.xx]	(R/W)	
278- Weld timer (x 100)	**01 16H**	[x.xx]	(R/W)	
279- Cooling timer (x 100)	**01 17H**	[x.xx]	(R/W)	
280- Welds interval timer (x 100)	**01 18H**	[x.xx]	(R/W)	
281- Set temperature in page 1	**01 19H**	[x.xx]	(R/W)	
282- Set% band to ground for alr.69	**01 1AH**	[x.xx]	(R/W)	
283- Set current loop value	**01 1BH**	[x.xx]	(R/W)	
284- Increase time to restore (in seconds)	**01 1CH**	[x.xx]	(R/W)	

COMMISSIONING DATA

512- Software release units (ASCI)	**02 00H**	[xxx]	(R)
513- Software release tenths (ASCI)	**02 01H**	[xxx]	(R)
514- Ohms x mm² / mt (x 1000)	**02 02H**	[xxx]	(R/W)
515- Sealing band length (mm)	**02 03 H**	[xxx]	(R/W)
516- Sealing band thickn.(mm x 100)	**02 04H**	[x.xx]	(R/W)
517- Wire diameter (mm x 100)	**02 05H**	[x.xx]	(R/W)
518- Sealing band width (mm x 10)	**02 06H**	[xx.x]	(R/W)
519- Amperes/mm² (A / mm²)	**02 07H**	[xxx]	(R/W)
520- No. of sealing bands in parallel	**02 08H**	[xxx]	(R/W)
521- No. of sealing bands in series	**02 09H**	[xxx]	(R/W)
522- Duty cycle (x 10)	**02 0AH**	[xx.x]	(R/W)
523- Theoretical-I eff. full wave (A)	**02 0BH**	[xxx]	(R)
524- Theoretic-Resist. (Ohms x100)	**02 0CH**	[x.xx]	(R)
525- Theoretical-V eff. full wave (V)	**02 0DH**	[xxx]	(R)

526- Theoretical-P.eff. full wave (VA)	**02**	**0EH**	[xxx]	(R)	
527- Calibration-I eff. full wave (A)	**02**	**0FH**	[xxx]	(R)	(***B)**
528- Calibr.-Resistance (Ohms x100)	**02**	**10H**	[x.xx]	(R)	(***B)**
529- Calibration-V eff. full wave (V)	**02**	**11H**	[xxx]	(R)	(***B)**
530- Calibration - P.eff.full wave (VA)	**02**	**12H**	[xxx]	(R)	(***B)**
531- Max I effective for alm. 90 (A)	**02**	**13H**	[xxx]	(R)	

RUN TIME DATA

768- Current temperature (°C)	**03**	**00H**	[xxx]	(R)	(***A)**
769- Alarm/warning number (U/M)	**03**	**01H**	[xxx]	(R)	**(*A)**
770- I effective full wave (Ax10)	**03**	**02H**	[xx.x]	(R)	(***B)**
771- Resistance (Ohms x100)	**03**	**03H**	[x.xx]	(R)	(***B)**
772- V effective full wave (V)	**03**	**04H**	[xxx]	(R)	(***B)**
773- P. effective full wave (VA/10)	**03**	**05H**	[xxx0]	(R)	(***B)**
774- Thermoregulator status	**03**	**06H**	[xxx]	(R)	
Status 000 [0x00]	Power off				
Status 017 [0x11]	Not Calibrated				
Status 096 [0x60]	Balancing				
Status 112 [0x70]	Pre-heat				
Status 128 [0x80]	Weld				
Status 136 [0x88]	Master reset in progress				
Status 153 [0x99]	Calibration in progress				
Status 154 [0x9A]	Wait for scaling				
Status 170 [0xAA]	Burn-in in progress				
Status 187 [0xBB]	Wait for coprocessor calibration				
Status 238 [0xEE]	Alarm				
775- I effective	**03**	**07H**	[xxx]	(R)	
776- Active temperature probe	**03**	**08H**	[xxx]	(R)	
777- Bar temperature probe	**03**	**09H**	[xxx]	(R)	
778- Steady working conditions % (updated every 10 seconds)	**03**	**0AH**	[xxx]	(R)	(***B)**

(*A) Data needed to be handled in the fieldbus interface
(*B) Data recommended to be handled in the fieldbus interface

1285-COMMANDS (WRITE CODE 06 ONLY)	**05 05H**	**COMMAND CODES (DECIMALS)**		
		Reset alarms = **14**	(W)	**(*B)**
		Calibration = **15**	(W)	**(*B)**
		Save data to eeprom = **16**	(W)	**(*B)**
		Read data from eeprom = **17**	(W)	**(*B)**
		Burn-in on = **18**	(W)	
		Burn-in off = **19**	(W)	
		Emergency test = **20**	(W)	
		Save calibration data = **26**	(W)	
		Save coprocessor data = **27**	(W)	
		Disable coprocess. alarms = **28**	(W)	
		Pre-heat on = **31**	(W)	
		Pre-heat off = **32**	(W)	
		Weld on = **33**	(W)	
		Weld off = **34**	(W)	
		Current loop on = **35**	(W)	
		Current loop off = **36**	(W)	
		Disable checksum= **80 (*)**	(N.U.)	
		Enab.checks RTU/CRC= **81 (*)**	(N.U.)	
		Enable checksum XOR= **82 (*)**	(N.U.)	
		Master reset = **99**	(W)	

NOTE: command 26 “save calibration data” allows you to store the data of the last calibration; it is advisable to use this command after the machine's first commissioning in order to store calibration data after factory testing. This figure, compared with RUN TIME data, will be used later to make a remote diagnosis of the machine.

(*) As soon as the checksum change command is received, the unit applies the command, i.e. the new checksum is calculated on the command's frame.

(**) In the case of a Proface panel, program 1-1286 in order to direct 0-1285.