ModBUS® Serial communications protocol for KM2 Line Instruments

Instrument with universal power supply and HBD function

Based on FW Rel. 1.0.0

INDEX

1 PREFACE

Tecnologic uses ModBUS® RTU communication protocol.

It is a royalty free protocol and it is easy to implement.

For ModBus RTU a vast literature is available also in internet.

The ModBus protocol represent all data in hexadecimal format.

All communication string finish with a check sum type CRC (cyclic redundancy check).

Every devices in a line must have different address.

The protocol allows one master only and up to 255 slaves

Only Master unit can start the transmission by sending the address of the unit and the command to execute.

Only the unit having the same address will answer to the master.

The transmission characteristics are usually programmable:

Device address: From 1 to 255.

Baud rate: bit per second.

byte format:

– 1 start bit;

– 8 data bitis;

– 2 final bits composed as follows:

1 parity bit (even or odd);
1 stop bit;
or
no parity bit;
2 stop bits.

The K30 allows to configure:

– address (1 – 254);

– Baud rate (1200 – 2400 – 9600 – 19200 – 38400).

The byte format is fixed: 8 bits without parity and 1 stop bit.

This document is intended to describe the K30 controllers using the MODBUS protocol in their communication capability and is mainly directed to technicians, system integrators and software developers.

2 PHYSICAL CONNECTION

2.1 Interface

Kube series controllers are provided with a RS485 serial communication interface, insulated so that any problem arising from ground potential is removed.

While at rest, the instruments are in a receive condition and are revert to transmission after a correct message has been decoded that matches the configured address.

2.2 Line

The instruments are equipped with 2 terminals named A and B.

The connection between Kube s has to be carried on in parallel, i.e. all A terminals have to be connected between them so as B terminals.

A termination resistor of 120Ω is required to maintain the quiescent condition on the line.

Adopted baud rates range 1200... 38400 baud, that is very satisfactory for application performances, yet very slow for RS485 interface. This fact allows the wiring of the line with a medium quality twisted pair cable: total capacity of the line should not exceed 200 nF.

The line can be up to 1000 meters in length.

3 COMMUNICATION PROTOCOL

The protocol adopted by K30 is a subset of the widely used MODBUS RTU (JBUS, AEG Schneider Automation, Inc. registered trademark) protocol, so that connections are easy for many commercial PLCs and supervisory programs.

For users needing to develop their own communication software, all information is available as well as implementation hints.

The MODBUS RTU (JBUS) communication functions implemented in Kube series are:

Function 3 Read n register;
Function 6 Preset one register;
Function 16 Preset multiple registers.

These functions allow the supervisory program to read and modify any data of the controller. The communication is based on messages sent by the master station (host) to the slave stations (K 30) and viceversa. The slave station that recognises the message as sent to it, analyses the content and, if it is formally and semantically correct, generates a reply message directed back to the master.

The communication process involves five types of messages:

From master to slave	From slave to master
Function 3: read n registers request	Function 3: read n registers reply
Function 6: preset one register request	Function 6: preset one register reply
Function 16: preset multiple registers request	Function 16: preset multiple registers reply
	Exception reply (as reply to all functions in abnormal conditions)

Every a message contains four fields:

◊ Slave address (from 1 to 255): MODBUS RTU (JBUS) reserves address 0 for broadcasting messagesand it is implemented in the Kube series;

◊ Function code: contains 3, 6 or 16 for specified functions;

◊ Fnformation field: contains data like word addresses and word values as required by function in use;

◊ Control word: a cyclic redundancy check (CRC) performed with particular rules for CRC16.

The characteristics of the asyncronous transmission are 8 bits, no parity, one stop bit.

3.1 Function code 3: read multiple registers (maximum 16 registers)

This function code is used by the master to read a group of sequential registers present in the slave.

Master request	
Data	Byte
Slave address (1... 255)	1
Function code (3)	1
First register address (MSB = Most Significant Byte)	1
First register address (LSB = less Significant Byte)	1
Number of requested registers (MSB)	1
Number of requested registers (MSB)	1
CRC-16 (MSB)	1
CRC-16 (MSB)	1

Slave reply	
Data	Byte
Slave address (1... 255)	1
Function code (3)	1
Byte number (n)	1
Data(s)	n
CRC-16 (LSB)	1
CRC-16 (MSB)	1

In the “Data(s)” fild the values of the requested registers are presented in word format [2 byte] : the first byte represent the MSB (Most Significant Byte) while the second byte represent the LSB (Less Significant Byte). This mode will be the same for all requested locations.

Example:

The master requires to the address 1 the value of the locations 25 and 26 (0x19 and 0x1A).

Master request	
Data	Byte (Hex)
Slave address	01
Function code (3 = read)	03
First register address (MSB)	00
First register address (LSB)	19
Number of requested registers (MSB)	00
Number of requested registers (MSB)	02
CRC-16 (LSB)	15
CRC-16 (MSB)	CC

Slave reply	
Data	Byte (Hex)
Slave address	01
Function code (3 = read)	03
Byte number	04
Value of the first register (MSB)	00
Value of the first register (LSB)	0A
Value of the second register (MSB)	00
Value of the second register (LSB)	14
CRC-16 (LSB)	DA
CRC-16 (MSB)	3E

The slave replay means:
The value of the location 25 = 10 (0x000A hexadecimal)
The value of the location 26 = 20 (0x0014 hexadecimal)

3.2 Function code 6: write a single word (one location)

Master request	
Data	Byte (Hex)
Slave address	01
Function code (6)	06
Register address (MSB)	03
Register address (LSB)	02
Value to write (MSB)	00
Value to write (LSB)	0A
CRC-16 (MSB)	A8
CRC-16 (LSB)	49

Slave reply	
Data	Byte (Hex)
Slave address (1-255)	1
Function code (6)	1
Register address (MSB)	1
Register address (LSB)	1
Written value (MSB)	1
Written value (LSB)	1
CRC-16 (MSB)	1
CRC-16 (LSB)	1

Example:
The master unit asks to the slave 1 to write in the memory location 770 (0x302) the value 10 (0x0A).

Master request	
Data	Byte (Hex)
Slave address	01
Function code (6)	06
Register address (MSB)	03
Register address (MSB)	02
Value to write (MSB)	00
Value to write (MSB)	0A
CRC-16 (MSB)	A8
CRC-16 (MSB)	49

Slave reply	
Data	Byte (Hex)
Slave address	01
Function code (6)	06
Register address (MSB)	03
Register address (MSB)	02
Written value (MSB)	00
Written value (MSB)	0A
CRC-16 (MSB)	A8
CRC-16 (MSB)	49

3.3 Function code 16: preset multiple registers (maximum 16 registers)

This function code allows to preset 16 registers at a time.

Master request	
Data	Byte (Hex)
Slave address (1-254)	1
Function code (16)	1
First register address (MSB)	1
First register address (MSB)	1
Number of requested registers (MSB)	1
Number of requested registers (MSB)	1
Byte count	1
Values	n
CRC-16 (MSB)	1
CRC-16 (MSB)	1

Slave reply	
Data	Byte (Hex)
Slave address (1-254)	1
Function code (16)	1
First register address (MSB)	1
First register address (MSB)	1
Number of written registers (MSB)	1
Number of written registers (MSB)	1
CRC-16 (MSB)	1
CRC-16 (MSB)	1

Example:

The master unit requires to the slave 1 to write in the registers 10314 (0x284A) and 10315 (0x284B) the values 100 (0x64) and 200 (oxC8)

Master request	
Data	Byte (Hex)
Slave address	01
Function code (16)	10
First register address (MSB)	28
First register address (MSB)	4A
Number of requested registers (MSB)	00
Number of requested registers (MSB)	02
Byte count	4
Value 1 (MSB)	00
Value 1 (MSB)	64
Value 2 (MSB)	00
Value 2 ((LSB)	C8
CRC-16 (MSB)	C9
CRC-16 (MSB)	A8

Slave reply	
Data	Byte (Hex)
Slave address	01
Function code (16)	10
First register address (MSB)	28
First register address (MSB)	4A
Number of written registers (MSB)	00
Number of written registers (MSB)	02
CRC-16 (MSB)	69
CRC-16 (MSB)	BE

3.4 The exception reply

Kube instruments reply with an exception when the request is formally correct, but cannot be satisfied standing particular situations; the reply contains a code indicating the cause of the missing regular reply, the frame is:

Exception replay	
Data	Byte (Hex)
Slave address	1
Function code	1
Error code	1
CRC-16 (MSB)	1
CRC-16 (MSB)	1

Kube series adopts a subset of MODBUS RTU (JBUS) exception code:

- Unknown function code 1
- Invalid memory address 2
- Invalid data field 3
- Controller not ready 6

3.5 Cyclic redundancy check (CRC)

CRC is a check word that permits to verify the integrity of a message.

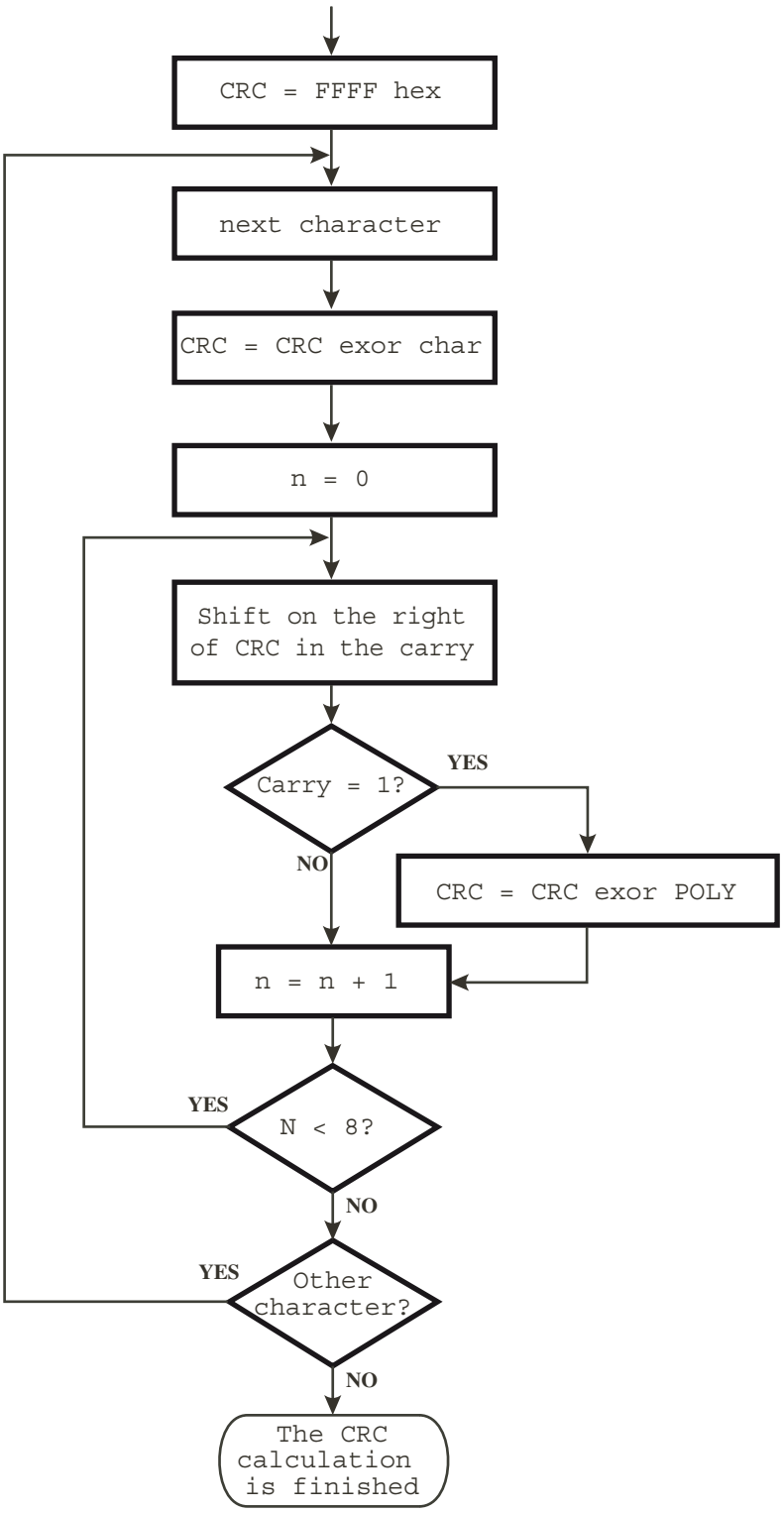
Every message, sent or received, has in the two last characters the CRC check word.

After receiving a request, the controller checks the validity of the received message comparing the received CRC with the calculated one.

When a reply is ready the controller calculates the CRC word and adds two characters to the prepared message.

CRC calculation is performed on every character of the message, excluding the last two.

Being MODBUS RTU (JBUS) compatible, Kube series controllers adopt an identical algorithm for CRC calculation, sketched in following diagram:



The polinomial adopted by MODBUS RTU (JBUS) is 1010 0000 0000 0001.

Note: The first transmitted character of the CRC word is the least significant between calculated bytes.

A subroutine written in “C language” capable of calculating the CTC-16 follows.

```
/* ----------------------------------------------------------------
crc_16   CRC-16 calculation

Input:
buffer:  character string on which CRC is calculated
length:  string length in bytes

Output:  crc_16
---------------------------------------------------------------- */
unsigned int crc_16 (unsigned char *buffer, unsigned int length)
{
      unsigned int i, j, temp_bit, temp_int, crc;
      crc = 0xFFFF;
      for (i = 0; i < length; i++ ){
            temp_int = (unsigned char) *buffer++;
            crc ^= temp_int;
            for ( j = 0; j < 8; j++ ) {
                  temp_bit = crc & 0x0001;
                  crc >>= 1;
                  if ( temp_bit != 0 )
                        crc ^= 0xA001;
            }
      }
      return (crc);
}
```

Note: All numerical values in the format 0x.... are expressed in hexadecimal format.

4 DATA EXCHANGE

This section contains informations about data exchanged with Kube series controllers concerning numerical and not numerical data, with their formats and limits.

4.1 Some definitions

All exchanged data are in the form of 16 bit words.

Two types of data are distinguished: numerical and symbolic (or not numerical).

Numerical data represents the value of a quantity (e.g. the measured variable, the set point).

Symbolic data represents a particular value in a set of values (e.g. the thermocouple type in the set of available ones: J, K, S ...).

Both types are coded as integers number : signed numbers for numerical and unsigned numbers for symbolic.

A numerical data, coded as an integer, is coupled with appropriate number of decimal digits to represent a quantity with the same engineering units adopted aboard the instrument.

Numerical data are in fixed point representation; however we make a distinction between two kinds of data:

◊ The first kind has determined and unmodifiable decimal point position;

◊ The second has programmable decimal point position (dP parameter).

4.2 Memory zones

All readable and writable data appear to be allocated as 16 bit words in the memory of the instrument.

The memory map has three zones:

◊ Varaibles,

◊ Parameters,

◊ Instrument identification code.

Following parameters explore the characteristics of each zone.

4.3 Variables zones

In this zone there is a collection of main Kube controller variables, it is a group of frequently computed or updated data residing in volatile memory.

4.4 Most important changes

A) During parameter modification by push-button, the serial interface continue to operate without any “limit” (you can see by serial link the value of all parameters and you can set it also).

B) When you write a value in a location the instrument will operate as follows:

- **B.1)** If you write a value within parameter range, the instrument will accept it; the new value will be memorized and the instrument will send back the standard answer.
- **B.2)** If you try to write a value OUT of parameter range, the instrument will refuse the new value; the new value will NOT be memorized and the instrument will send an exception message to the master.

These are available data:

5 ADDRESS MAP

KM2 instruments use only words:

Initial address		Final address		Meaning
Hex	Dec	Hex	Dec	
1	1	1D	29	Group of variables common to all new Ascon Tecnologic instruments: numeric values calculated and inamically updated. Available in read and write operations
200	512	250	592	Group of variables compatible with the old Ascon Tecnologic instruments (before Kube series): numeric values calculated and dinamically updated. Available in read and write operations
280	640	31B	795	Configuration parameters: Numeric and symolic values. Available in read and write operations
800	2048	82C	2092	Instrument identification parameters
2800	10240	289B	10395	Repetition of the configuration parameters: Numeric and symolic values. Available in read and write operations

5.1 Common Variables

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
0A	0	0	**Broadcast mode activation** 0x44BB = Broadcast function activation 0x55AA = Disable broadcast function	0	w
1A	1	1	**PV: Measured value** **Note:** When a measuring error is detected the instrument sends: • 10000 = Underrange; • 10000 = Overrange; • 10001 = Overflow of the A/D converter; • 10003 = Variable not available.		r
2A	2	2	**Number of decimal figures of the measured value**	0	r
3A	3	3	**Operative set point (value)**	dP	r
4A	4	4	**Power output in manual mode** **Range:** -10000 ÷ 10000 (%) **Note:** This parameter is ever writeable but it will be active only when the instrument operate in Manual mode.	2	r/w
5A	5	5	**Active set point selection** 0 = SP; 1 = SP 2; 2 = SP 3; 3 = SP 4.	0	r/w
6A	6	6	**SP** **Range:** SPLL ÷ SPLH	dP	r/w
7A	7	7	**SP 2** **Range:** SPLL ÷ SPLH	dP	r/w
8A	8	8	**SP 3** **Range:** SPLL ÷ SPLH	dP	r/w
9A	9	9	**SP 4** **Range:** SPLL ÷ SPLH	dP	r/w

10A	A	10	**Alarms status**
			bit managed Word:
			bit 0 = Alarm 1 status;
			bit 1 = Alarm 2 status;
			bit 2 = Alarm 3 status;
			bit 3 ÷ 8 = Reserved;
			bit 9 = LBA status;
			bit 10 = Power failure indicator;
			bit 11 = Generic error;
			bit 12 = Overload alarm;
			bit 13 ÷15 = Reserved.
				0	r

11A	B	11	**Outputs status (physical outputs)**
			bit managed Word:
			bit 0 = Output 1 status;
			bit 1 = Output 2 status;
			bit 3 = Output 3 status;
			bit 4 = Output 4 status;
			bit 5 = Output 5 status;
			bit 6÷15 = Reserved.
			When the linear output is driven by serial link, the relative bit must remain equal to 0.
				0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			

12A	C	12	**Instrument status**
			bit managed Word:
			bit 0 = Automatic;
			bit 1 = Manual;
			bit 2 = Standby;
			bit 3 = Remote Set point (temporary) used;
			bit 4 = Auto-tuning active;
			bit 5 = Reserved;
			bit 6 = Reserved;
			bit 7 = Timer running;
			bit 8 = Soft start running;
			bit 9 = Ramp for set point change (up or down) running;
			bit 10 = Delay at start up (od) running;
			bit 11 = Program running;
			bit 12 = Measure status (0 = OK while 1 = error);
			bit 13÷15 = Reserved.
				0	r

13A	D	13	**Alarms reset** 0 = Not reset; 1 = Reset.	0	r/w
14A	E	14	**Alarms acknowledge** 0 = Not acknowledged; 1 = Acknowledged.	0	r/w
15A	F	15	**Controller status** 0 = Automatic; 1 = Manual; 2 = Stand-by.	0	r/w
16A	10	16	**Remote set point (temporary)** (from serial link) **Range:** SPLL ÷ SPLH **Note:** The remote set point is stored in RAM	dP	r/w
17A	11	17	**Auto-tune activation** 0 = Not active; 1 = Active.	0	r/w
18A	12	18	**Power output used when a measuring error is detected** **Range:** -100 ÷ 100 **Note:** This value is stored in RAM	0	r/w
19A	13	19	**Default parameters loading** 481 = Default parameter loading	0	r/w
20A	14	20	**Parameters table identification code** **Range:** 0 ÷ 65535 **Note:** The transmitted word is composed by two parts: - Low byte – Version of the parameter table; - High byte – Version of the family protocol.	0	r
21A	15	21	**Instrument identification code** 39 = KM2	0	r
26A	1A	26	**Time to end of running program segment** **Range:** 0 ÷ 9959 (hh.mm or mm.ss) **Note:** When the program is not active, the return value is 0.	0	r
27A	1B	27	**Manual Auto-tuning start request pending for Od or Soft start** **Range:** 0 = No pending request waiting for the execution; 1 = Pending request waiting for the execution.	0	r
28A	1C	28	**Auto-tuning start request pending for setpoint change for Od or Soft start** **Range:** 0 = No pending request waiting for the execution; 1 = Pending request waiting for the execution.	0	r
29A	1D	29	**Value to be retransmitted on the analogue Output** **Range:** Ao1L ÷ Ao1H	0	r/w
30A	40	64	**Instantaneous Current** **Range:** 0 ÷ 999 A	Ct.dF	r
31A	41	65	**Current with OFF relay** **Range:** 0 ÷ 999 A	Ct.dF	r
32A	42	66	**Current with ON relay** **Range:** 0 ÷ 999 A	Ct.dF	r
33A	43	67	**“Present measurement in OFF” indicator** **Range:** 0 = Measure stored and not current because the present status is different than OFF; 1 = Measure just taken; 2 = Measurement stored and not current because the measurement time is not sufficient.		r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
34A	44	68	**"Present measurement in ON" indicator** **Range:** 0 = Measure stored and not current because the present status is different than ON; 1 = Measure just taken; 2 = Measurement stored and not current because the measurement time is insufficient.		r
35A	45	69	**HBD alarm status - bit management** **Range:** bit 0 = Alarm on the load (relay ON); bit 1 = Leak alarm (relay OFF); bit 2 = Overload alarm.		r
36A	46	70	**HBD status bit with Latch and Acknowledge - bit management** **Range:** bit 0 = Alarm on the load (relay ON); bit 1 = Leak alarm (relay OFF); bit 2 = Overload alarm.		r

5.2 Group of variables compatible with the old Ascon Tecnologic instruments

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
1B	0200	512	**PV: Measured value** As Modbus address 1	dP	r
2B	0201	513	**Number of decimal figure of the measured value** As Modbus address 2	0	r
3B	0202	514	**Output power** As Modbus address 4	2	r
4B	0203	515	**Output power for the heating output** **Range:** 0 ÷ 10000 (%)	2	r
5B	0204	516	**Output power for the cooling output** **Range:** 0 ÷ 10000 (%)	2	r
6B	0205	517	**Alarm 1 status** 0 = OFF 1 = ON	0	r
7B	0206	518	**Alarm 2 status** 0 = OFF 1 = ON	0	r
8B	0207	519	**Alarm 3 status** 0 = OFF 1 = ON	0	r
9B	0208	520	**Operative set point** As Modbus address 3	dp	r
10B	020A	522	**OUT 3 overload Alarm Status** 0 = OFF 1 = ON	0	r
11B	020F	527	**Controller status** 0 = Stand-by 1 = Auto 2 = Tuning 3 = Manual	0	r
12B	0224	548	**Output 1 Status/remote control** 0 = OFF 1 = ON **Note:** Enabled when Output 1 in not configured (o1F = nonE). This value is not stored in RAM	0	r/w
13B	0225	549	**Output 2 Status/remote control** 0 = OFF 1 = ON **Note:** Enabled when Output 2 in not configured (o2F = nonE). This value is not stored in RAM	0	r/w
14B	0226	550	**Output 3 Status/remote control** 0 = OFF 1 = ON **Note:** Enabled when Output 3 in not configured (o3F = nonE). This value is not stored in RAM	0	r/w
15B	0240	576	**Digital input 1 status** 0 = OFF 1 = ON **Note:** Digital input 1status can be read from the serial port even if the input is not used by the controller	0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
16B	0241	577	**Digital input 2 status** 0 = OFF 1 = ON **Note:** Digital input 2 status can be read from the serial port even if the input is not used by the controller	0	r
17B	0244	580	**Program status** 0 = Not configured 1 = Reset (not running) 2 = Run 3 = Hold 4 = Wait (system) 5 = End (system) 6 = Hold + Wait (system) 7 = Continue	0	r/w
18B	0245	581	**Timer status** 0 = Not configured 1 = Reset (stop) 2 = Run 3 = Hold 4 = End (Read only)	0	r/w
19B	0246	582	**Program step in execution** 0 = Program not active 1 = ramp step 1 2 = soak step 1 2 = ramp step 2 4 = soak step 2 5 = ramp step 3 6 = soak step 3 7 = ramp step 4 8 = soak step 4 9 = END	0	r
20B	0247	583	**Remaining time to program end** **Range:** 0 ÷ 65535 (minutes when Pru=hh.mm, seconds when Pru=mm.ss) **Note:** When the program is not running the return code is 0	2	r
21B	248	584	**Program events status** 0 > E1 = 0 E2 = 0 1 > E1 = 1 E2 = 0 2 > E1 = 0 E2 = 1 3 > E1 = 1 E2 = 1	0	r
22B	249	585	**Remaining time to the timer end** **Range:** 0 ÷ 65535 (Hours when Tru=hh.mm, Minutes when Tru=mm.ss)	2	r
			Range: 0 ÷ 9959 (tenth of seconds when Tru=SSS.d) **Note:** When the timer is not active the return code is 0.	1	
23B	24A	586	**Wattmeter:** The return code of this parameter is defined by the CO.ty parameter setting. 0 OFF; 1 Instantaneous power (kW); 2 Power consumption (kW/h); 3 Energy used during program execution (kW/h); 4 Total worked days (instrument ON); 5 Total worked hours: number of hours (instrument ON); 6 Total worked days (instrument ON) with threshold and Stand-by; 7 Total worked hours (instrument ON) with threshold and Stand-by; 8 Total of days the control relay has been in ON condition; 9 Total of hours the control relay has been in ON condition; 10 Total of days the control relay has been in ON condition with threshold and Stand-by; 11 Total of hours the control relay has been in ON condition with threshold and Stand-by.	0	r
24B	24B	587	**Duration of first program ramp** **Range:** 0 ÷ 9999 s	0	r
25B	24C	588	**Days with the controller Powered ON** **Range:** 0 ÷ 9999	0	r
26B	250	592	**Output power in manual mode** Range:-10000 ÷ 10000 (%)	2	r/w

5.3 Parameters Setting: Addresses form 280 hex (640 dec) and 2800 hex (10240 dec)

5.3.1 inP group - Main and auxiliary input configuration

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
1	SEnS	280	640	Input type when configured asC (Pt100, Pt1000)	0 = J = TC J, 1 = crAL = TC K, 2 = S = TC S, 3 = r = TC R, 4 = t = TC T, 5 = ir.J = IRS J, 6 = ir.cA = IRS K, 7 = Pt1 = RTD Pt100, 8 = Pt10 = RTD Pt1000, 9 = 0.60 = 0 ÷ 60 mV, 10 = 12.60 = 12 ÷ 60 mV, 11 = 0.20 = 0 ÷ 20 mA, 12 = 4.20 = 4 ÷ 20 mA, 13 = 0.5 = 0 ÷ 5 V, 14 = 1.5 = 1 ÷ 5 V, 15 = 0.10 = 0 ÷ 10 V, 16 = 2.10 = 2 ÷ 10 V.	0	r/W
		2800	10240	Input type when configured as E (Ptc, Ntc)	0 = J = TC J, 1 = crAL = TC K, 2 = TC K, 3 = S = TC S, 4 = r = TC R, 5 = t = TC T, 6 = ir.J = IRS J, 7 = ir.cA = IRS K, 8 = Ptc = TC KTY81-121, 9 = ntc = NTC 103-AT2, 10 = 0.60 = 0 ÷ 60 mV, 11 = 12.60 = 12 ÷ 60 mV, 12 = 0.20 = 0 ÷ 20 mA, 13 = 4.20 = 4 ÷ 20 mA, 14 = 0.5 = 0 ÷ 5 V, 15 = 1.5 = 1 ÷ 5 V, 16 = 0.10 = 0 ÷ 10 V, 17 = 2.10 = 2 ÷ 10 V		
2	dp	281	641	Decimal Point Position (linear inputs)	0 ÷ 3	0	r/w
		2801	10241	Decimal Point Position (sensor inputs)	0/1		
3	SSc	282	642	Low limit readout for linear inputs	-1999 ÷ 9999	dP	r/w
		2802	10242				
4	FSc	283	643	High limit readout for linear inputs	-1999 ÷ 9999	dP	r/w
		2803	10243				
5	unit	284	644	Temperature Engineer unit	0 = C = °C 1 = F = °F	0	r/w
		2804	10244				
6	Fil	285	645	Digital filter on the measured value **Note:** This filter affects the control action, the PV retransmission and the alarms action	0 (= OFF) 1 ÷ 200 (seconds)	1	r/w
		2805	10245				
7	inE	286	646	Sensor error that enables the safety output value	or = Over range ou = Under range our = Over and under range	0	r/w
		2806	10246				
8	oPE	287	647	Safety output value (% of the output)	-100 ÷ 100	0	r/w
		2807	10247				
9	IO3.F	288	648	I/O 3 function	0 = on = Output used as PWS for TX, 1 = out4 = Output 4 (digital output 4), 2 = dG2c = Digital input 2 driven by contact, 3 = dG2U = Digital input 2 driven by voltage	0	r/w
		2808	10248				

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
10	diF1	289 2809	649 10249	Digital Input 1 function	0 = oFF = Not used, 1 = Alarm reset, 2 = Alarm acknowledge (ACK), 3 = Hold of the measured value, 4 = Stand by mode, 5 = Manual mode, 6 = HEAt with SP1 and CooL with SP2, 7 = Timer RUN/Hold/Reset, 8 = Timer Run, 9 = Timer Reset, 10 = Timer Run/Hold, 11 = Timer Run/Reset, 12 = Timer Run/Reset with lock, 13 = Program Start, 14 = Program Reset, 15 = Program Hold, 16 = Program Run/Hold, 17 = Program Run/Reset, 18 = Sequential SP selection, 19 = SP1 - SP2 selection, 20 = SP1 ÷ SP4 binary selection, 21 = Digital inputs in parallel to ▲ and ▼ keys	0	r/w
11	diF2	28A 280A	650 10250	Digital Input 2 function		0	r/w
12	di.A	28B 280B	651 10251	Digital Inputs Action (DI2 if configured)	0 = DI1 direct action, DI2 direct action; 1 = DI1 reverse action, DI2 direct action; 2 = DI1 direct action, DI2 reverse action; 3 = DI1 reverse action, DI2 reverse action.		

5.3.2 Out group - Outputs configuation

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
13	o1t	28C 280C	652 10252	Output 1 type	0 = 0-20 = 0-20 mA 1 = 4-20 = 4-20 mA 2 = 0-10 = 0-10 V 3 = 2-10 = 2-10 V	0	r/w
14	o1F	28D 280D	653 10253	Out 1 function (when Out1 is a digital output)	0 = NonE = Output not used; 1 = H.rEG = Heating output; 2 = c.rEG = Cooling output; 3 = AL = Alarm output; 4 = t.out = Timer output; 5 = t.HoF = Timer out -OFF in hold; 6 = P.End = Program end indicator; 7 = P.HLd = Program hold indicator; 8 = P.uit = Program wait indicator; 9 = P.run = Program run indicator; 10 = P.Et1 = Program Event 1; 11 = P.Et2 = Program Event 2; 12 = or.bo = Out-of-range or burn out indicator; 13 = P.FAL = Power failure indicator; 14 = bo.PF = Out-of-range, burn out and Power failure indicator; 15 = St.bY = Stand by status indicator; 16 = diF.1 = Repeats the digital input 1 status; 17 = diF.2 = Repeats the digital input 2 status; 18 = on = Out 1 always ON; 19 = r.isp = Inspection request.	0	r/w
				Out 1 function (when Out 1 is a linear output)	0 = NonE = Output not used; 1 = H.rEG = Heating output; 2 = c.rEG = Cooling output; 3 = r.inP = Measure retransmission; 4 = r.Err = Error retransmission; 5 = r.SP = Set Point retransmission; 6 = r.SEr = Serial value retransmission 7 = r.PO = Output power value retransmission.		
15	Ao1L	28E 280E	654 10254	Low limit of the analog retransmission	-1999 ÷ Ao1H	dp	r/w
16	Ao1H	28F 280F	655 10255	High limit of the analog retransmission	Ao1L ÷ 9999	dp	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
17	o1AL	290 2810	656 10256	Alarms linked up with the out 1	0 ÷ 63 +1 = Alarm 1 +2 = Alarm 2 +4 = Alarm 3 +8 = Loop break alarm +16 = Sensor Break +32 = Overload on output 4	0	r/w
18	o1Ac	291 2811	657 10257	Out 1 action	0 = dir = Direct action 1 = rEU = Reverse action 2 = dir.r = Direct with reversed LED 3 = ReU.r = Reverse with reversed LED	0	r/w
19	o2F	292 2812	658 10258	Out 2 function	See the values of 14 = o1F parameter	0	r/w
20	o2AL	293 2813	659 10259	Alarms linked up with the out 2	See the values of 17 = o1AL parameter	0	r/w
21	o2Ac	294 2814	660 10260	Out 2 action	See the values of 18 = o1Ac parameter	0	r/w
22	o3F	295 2815	661 10261	Out 3 function	See the values of 14 = o1F parameter	0	r/w
23	o3AL	296 2816	662 10262	Alarms linked up with the out 3	See the values of 17 = o1AL parameter	0	r/w
24	o3Ac	297 2817	664 10264	Out 3 action	See the values of 18 = o1Ac parameter	0	r/w

5.3.3 AL 1 group - Alarm 1 configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
25	AL1t	298 2818	664 10264	Alarm 1 type	0 = nonE = Alarm not used 1 = LoAb = Absolute low alarm 2 = HiAb = Absolute high alarm 3 = LHAo = Windows alarm in alarm outside the windows 4 = LHAI = Windows alarm in alarm inside the windows 5 = SE.br = Sensor Break 6 = LodE = Deviation low alarm (relative) 7 = HidE = Deviation high alarm (relative) 8 = LHdo = Relative band alarm in alarm out of the band 9 = LHdi = Relative band alarm in alarm inside the band	0	r/w
26	Ab1	299 2819	665 10265	Alarm 1 function	0 ÷ 15 +1 = Not active at power up +2 = Latched alarm (manual reset) +4 = Acknowledgeable alarm +8 = Relative alarm not active at set point change	0	r/w
27	AL1L	29A 281A	666 10266	- For High and low alarms, it is the low limit of the AL1 threshold; - For band alarm, it is low alarm threshold	From -1999 to AL1H (E.U.)	dP	r/w
28	AL1H	29B 281B	667 10267	- For High and low alarms, it is the high limit of the AL1 threshold; - For band alarm, it is high alarm threshold	From AL1L to 9999 (E.U.)	dP	r/w
29	AL1	29C 281C	668 10268	AL1 threshold	From AL1L to AL1H (E.U.)	dP	r/w
30	HAL1	29D 281D	669 10269	AL1 hysteresis	1 ÷ 9999 (E.U.)	dP	r/w
31	AL1d	29E 281E	670 10270	AL1 delay	0 (oFF) 1 ÷ 9999 (s)	0	r/w
32	AL1o	29F 281F	671 10271	Alarm 1 enabling during Stand-by mode and out of range conditions	0 = Alarm 1 disabled during Stand by and out of range 1 = Alarm 1 enabled in stand by mode 2 = Alarm 1 enabled in out of range condition 3 = Alarm 1 enabled in stand by and over range	0	r/w

5.3.4 AL2 group - Alarm 2 configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
33	AL2t	2A0 2820	672 10272	Alarm 2 type	0 = nonE = Alarm not used 1 = LoAb = Absolute low alarm 2 = HiAb = Absolute high alarm 3 = LHAo = Windows alarm in alarm outside the windows 4 = LHAI = Windows alarm in alarm inside the windows 5 = SE.br = Sensor Break 6 = LodE = Deviation low alarm (relative) 7 = HidE = Deviation high alarm (relative) 8 = LHdo = Relative band alarm in alarm out of the band 9 = LHdi = Relative band alarm in alarm inside the band	0	r/w
34	Ab2	2A1 2821	673 10273	Alarm 2 function	0 ÷ 15 +1 = Not active at power up +2 = Latched alarm (manual reset) +4 = Acknowledgeable alarm +8 = Relative alarm not active at set point change	0	r/w
35	AL2L	2A2 2822	674 10274	- For High and low alarms, it is the low limit of the AL2 threshold; - For band alarm, it is low alarm threshold	From -1999 to AL2H (E.U.)	dP	r/w
36	AL2H	2A3 2823	675 10275	- For High and low alarms, it is the high limit of the AL2 threshold; - For band alarm, it is high alarm threshold	From AL2L to 9999 (E.U.)	dP	r/w
37	AL2	2A4 2824	676 10276	AL2 threshold	From AL2L to AL2H (E.U.)	dP	r/w
38	HAL2	2A5 2825	677 10277	AL2 hysteresis	1 ÷ 9999 (E.U.)	dP	r/w
39	AL2d	2A6 2826	678 10278	AL2 delay	0 (oFF) 1 ÷ 9999 (s)	0	r/w
40	AL2o	2A7 2827	679 10279	Alarm 2 enabling during Stand-by mode and out of range conditions	0 = Alarm 2 disabled during Stand by and out of range 1 = Alarm 2 enabled in stand by mode 2 = Alarm 2 enabled in out of range condition 3 = Alarm 2 enabled in stand by and over range	0	r/w

5.3.5 AL3 group - Alarm 3 configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
41	AL3t	2A8 2828	680 10280	Alarm 3 type	0 = nonE = Alarm not used 1 = LoAb = Absolute low alarm 2 = HiAb = Absolute high alarm 3 = LHAo = Windows alarm in alarm outside the windows 4 = LHAI = Windows alarm in alarm inside the windows 5 = SE.br = Sensor Break 6 = LodE = Deviation low alarm (relative) 7 = HidE = Deviation high alarm (relative) 8 = LHdo = Relative band alarm in alarm out of the band 9 = LHdi = Relative band alarm in alarm inside the band	0	r/w
42	Ab3	2A9 2829	681 10281	Alarm 3 function	0 ÷ 15 +1 = Not active at power up +2 = Latched alarm (manual reset) +4 = Acknowledgeable alarm +8 = Relative alarm not active at set point change	0	r/w
43	AL3L	2AA 282A	682 10282	- For High and low alarms, it is the low limit of the AL3 threshold; - For band alarm, it is low alarm threshold	From -1999 to AL3H (E.U.)	dP	r/w
44	AL3H	2AB 282B	683 10283	- For High and low alarms, it is the high limit of the AL3 threshold; - For band alarm, it is high alarm threshold	From AL3L to 9999 (E.U.)	dP	r/w
45	AL3	2AC 282C	684 10284	AL3 threshold	From AL3L to AL3H (E.U.)	dP	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
46	HAL3	2AD 282D	685 10285	AL3 hysteresis	1 ÷ 9999 (E.U.)	dP	r/w
47	AL3d	2AE 282E	686 10286	AL3 delay	0 (oFF) 1 ÷ 9999 (s)	0	r/w
48	AL3o	2EF 282F	687 10287	Alarm 3 enabling during Stand-by mode and out of range conditions	0 = Alarm 3 disabled during Stand by and out of range 1 = Alarm 3 enabled in stand by mode 2 = Alarm 3 enabled in out of range condition 3 = Alarm 3 enabled in stand by and over range	0	r/w

5.3.6 HbA group - Heater Break Alarm Configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
49	Ct.So	2B0 2830	688 10288	Current Transformer source	0 = (oFF)> HBD not used 1 = NonE> Measurement as Ammeter 2 = out 3> synchronous with out 3 4 = out 2> synchronous with out 2 5 = out 1> synchronous with out 1		r/w
50	Ct.dF	2B1 2831	689 10289	Decimal point position in the CT measurement	0 ÷ 2		r/w
51	Ct.rA	2B2 2832	690 10290	Current in the primary winding of the CT	1 ÷ 999 (Ampère)	Ct.dF	r/w
52	Ct.FL	2B3 2833	691 10291	Filter on current measurement	0 = No 1 = Yes	0	r/w
53	Ct.LA	2B4 2834	692 10292	Latching the HBD alarm	0 = Automatic reset 1 = Manual reset 2 = Acknowledgeable		r/w
54	Ct.Ld	2B5 2835	693 10293	Load current	1 ÷ 999 (Ampère)	Ct.dF	r/w
55	Ct.LE	2B6 2836	694 10294	Loss threshold	1 ÷ 999 (Ampère)	Ct.dF	r/w
56	Ct.oc	2B7 2837	695 10295	Overcurrent	1 ÷ 999 (Ampère)	Ct.dF	r/w

5.3.7 rEG group - Control Configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
57	cont	2B8 2838	696 10296	**Control type** If at least one heating and one cooling output are configured	0 = Pid = PID (heat and/or) 1 = nr = Heat/Cool ON/OFF control with neutral zone	0	r/w
				If are configured only heating or cooling outputs and no 3-point valve is expected	0 = Pid = PID (heat and/or) 1 = On.FA = ON/OFF asymmetric hysteresis 2 = On.FS = ON/OFF symmetric hysteresis		
				If are configured only heating or cooling outputs and a 3-point valve is expected	0 = Pid = PID (heat and/or) 1 = On.FA = ON/OFF asymmetric hysteresis 2 = On.FS = ON/OFF symmetric hysteresis 3 = 3Pt = 3-point open loop valve control (no feedback)		
58	Auto	2B9 2839	697 10297	Autotuning selection	-4 Oscillating auto-tune with start after soft-start or Set Point changes; -3 Oscillating auto-tune with manual start; -2 Oscillating auto-tune with start at 1st power ON only; -1 Oscillating auto-tune with start at all power ON; 0 Not used; 1 Fast auto tune with start at all power ON; 2 Fast auto-tune with start 1st power ON only; 3 Fast auto-tune with manual start; 4 Fast auto-tune with start at power ON and Set Point changes; 5 Evo-tune with start at all power ON; 6 Evo-tune with start the first power ON only; 7 Evo-tune with manual start; 8 Evo-tune with start at power ON and Set Point changes.	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
59	tune	2BA 283A	698 10298	Manual start of the Autotuning **Note:** Parameter r/w with auto-tuning manual start, read only in the other cases	0 = oFF = Autotuning Not active 1 = on = Autotuning Active	0	r/w
60	HSEt	2BB 283B	699 10299	Hysteresis of the ON/OFF control	0 ÷ 9999 (E.U.)	dP	
61	cPdt	2BC 283C	700 10300	Compressor protection time	0 = oFF 1 ÷ 9999 (s)	0	r/w
62	Pb	2BD 283D	701 10301	Proportional band	1 ÷ 9999 (E.U.)	dP	
63	ti	2BE 283E	702 10302	Integral time	0 = oFF 1 ÷ 9999 (s) 10000 = inf	0	r/w
64	td	2BF 283F	703 10303	Derivative time	0 = oFF 1 ÷ 9999 (s)	0	r/w
65	Fuoc	2C0 2840	704 10304	Fuzzy overshoot control	0 ÷ 200	2	r/w
66	tcH	2C1 2841	705 10305	Heating output cycle time	10 ÷ 1300 (s)	1	r/w
67	rcG	2C2 2842	706 10306	Power ratio between heating and cooling action	1 ÷ 9999	2	r/w
68	tcc	2C3 2843	707 10307	Cooling output cycle time	1 ÷ 1300 (s)	1	r/w
69	rS	2C4 2844	708 10308	Manual reset (Integral pre-load)	-1000 ÷ +1000 (%)	1	r/w
70	od	2C5 2845	709 10309	Delay at power up	0.00 = oFF 1 ÷ 9959 (hh.mm)	2	r/w
71	St.P	2C6 2846	710 10310	Maximum power output used during soft start	-100 ÷ 100 (%)	0	r/w
72	SSt	2C7 2847	711 10311	Soft start time	0 = oFF 1 ÷ 800 = inF (h.mm)	2	r/w
73	SS.tH	2C8 2848	712 10312	Threshold for soft start disabling	-2000 = (oFF) ÷ 9999 (E.U.)	dP	r/w

5.3.8 SP group - Set point Configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
74	nSP	2C9 2849	713 10313	Number of available set points	1 ÷ 4	0	r/w
75	SPLL	2CA 284A	714 10314	Minimum set point value	From -1999 to SPHL (E.U.)	dP	r/w
76	SPHL	2CB 284B	715 10315	Maximum set point value	From SPLL to 9999 (E.U.)	dP	r/w
77	SP	2CC 284C	716 10316	Set point 1	From SPLL to SPLH (E.U.)	dP	r/w
78	SP 2	2CD 284D	717 10317	Set point 2	From SPLL to SPLH (E.U.)	dP	r/w
79	SP 3	2CE 284E	718 10318	Set point 3	From SPLL to SPLH (E.U.)	dP	r/w
80	SP 4	2CF 284F	719 10319	Set point 4	From SPLL to SPLH (E.U.)	dP	r/w
81	A.SP	2D0 2850	720 10320	Selection of the active set point	0 = SP 1 = SP 2 2 = SP 3 3 = SP 4	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
82	SP.rt	2D1 2851	721 10321	Remote set point type	0 = RSP = The value coming from serial link is used as remote set point 1 = trin = The value coming from serial link is added to the operative set point 2 = PErc = The value coming from serial link is scaled as a percentage of the input Span	0	r/w
83	SPLr	2D2 2852	722 10322	Local/remote set point selection	0 = Loc = local 1 = rEn = remote	0	r/w
84	SP.u	2D3 2853	723 10323	Rate of rise for **POSITIVE** set point change (ramp UP)	0.01 ÷ 99.99 E.U./minute (1000 = inF)	2	r/w
85	SP.d	2D4 2854	724 10324	Rate of rise for **NEGATIVE** set point change (ramp DOWN)	0.01 ÷ 99.99 E.U./minute (1000 = inF)	2	r/w

5.3.9 t In group - Timer function configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
86	tr.F	2D5 2855	725 10325	Independent timer function	0 = NonE = Timer not used 1 = i.d.A = Delayed start timer 2 = i.uP.d = Delayed start at power up 3 = i.d.d = Feed-through timer 4 = i.P.L = Asymmetrical oscillator with start OFF 5 = i.L.P = Asymmetrical oscillator with start ON	0	r/w
87	tr.u	2D6 2856	726 10326	Timer unit	0 = hh.nn = Hours and minutes 1 = nn.SS = Minutes and seconds 2 = SSS.d = Second and tenth of seconds	0	r/w
88	tr.t1	2D7 2857	727 10327	Time 1	When tr.u = 0: 1 ÷ 9959 (hh.mm) When tr.u = 1: 1 ÷ 9959 (mm.ss)	2	r/w
					When tr.u = 2: 1 ÷ 9959 (tenth of seconds)	1	
89	tr.t2	2D8 2858	728 10328	Time 2	When tr.u = 0: 0 (oFF)/1 ÷ 9959 (inF) (hh.mm) When tr.u = 1: 0 (oFF)/1 ÷ 9959 (inF) (mm.ss)	2	r/w
					When tr.u = 2: 0000 (oFF)/1 ÷ 9959 (inF) (tenth of seconds)	1	
90	tr.St	2D9 2859	729 10329	Timer status	0 = rES = Timer reset 1 = run = Timer run 2 = HoLd = Timer hold	0	r/w

5.3.10 PrG group - Programmer function configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
91	Pr.F	2DA 285A	730 10330	Program action at power ON	0 = nonE = Programmer not used 1 = S.uP.d = Delayed Start 2 = S.uP.S = Starts at power ON 3 = u.diG = Starts at Run command 4 = u.dG.d = Delayed Start at Run command	0	r/w
92	Pr.u	2DB 285B	731 10331	Time units of the soaks	0 = hh.nn = Hours and minutes 1 = nn.SS = Minutes and seconds	0	r/w
93	Pr.E	2DC 285C	732 10332	Instrument behaviour at the end of the program execution	0 = cnt = Continue 1 = A.SP = Go to the set point selected by A.SP 2 = St.by = Go to stand-by mode	0	r/w
94	Pr.Et	2DD 285D	733 10333	Time of the end program indication	0 = oFF 1 ÷ 9959 minutes and seconds 10000 = inF	2	r/w
95	Pr.S1	2DE 285E	734 10334	Set point of the first soak	From SPLL to SPHL -8000 Program End	dP	r/w
96	Pr.G1	2DF 285F	735 10335	Gradient of the first ramp	0.1 ÷ 999.9 Engineering Unit/minute 1000 = inF = Step transfer	1	r/w
97	Pr.t1	2E0 2860	736 10336	Time of the 1st soak	0 ÷ 9959 time units of the soaks	2	r/w
98	Pr.b1	2E1 2861	737 10337	Wait band of the 1st soak	0 (oFF) 1 ÷ 9999 (E.U.)	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
99	Pr.E1	2E2 2862	738 10338	Events of the 1st group	0000 ÷ 1111 (0: Event OFF, 1: Event ON)	2	r/w
100	Pr.S2	2E3 2863	739 10339	Set point of the 2nd soak	From SPLL to SPHL -8000 Program End	dP	r/w
101	Pr.G2	2E4 2864	740 10340	Gradient of the 2nd ramp	1 ÷ 9999 Engineering Unit/minute 10000 = inF = Step transfer	1	r/w
102	Pr.t2	2E5 2865	741 10342	Time of the 2nd soak	0 ÷ 9959 time units of the soaks	2	r/w
103	Pr.b2	2E6 2866	742 10342	Wait band of the 2nd soak	0 (oFF)/1 ÷ 9999 (E.U.)	0	r/w
104	Pr.E2	2E7 2867	743 10343	Events of the 2nd group	0000 ÷ 1111 (0: Event OFF, 1: Event ON)	2	r/w
105	Pr.S3	2E8 2868	744 10344	Set point of the 3rd soak	From SPLL to SPHL -8000 Program End	dP	r/w
106	Pr.G3	2E9 2869	745 10345	Gradient of the 3rd ramp	1 ÷ 9999 Engineering Unit/minute 10000 = inF = Step transfer	1	r/w
107	Pr.t3	2EA 286A	746 10346	Time of the 3rd soak	0 ÷ 9959 time units of the soaks	2	r/w
108	Pr.b3	2EB 286B	747 10347	Wait band of the 3rd soak	0 (oFF)/1 ÷ 9999 (E.U.)	0	r/w
109	Pr.E3	2EC 286C	748 10348	Events of the 3rd group	0000 ÷ 1111 (0: Event OFF, 1: Event ON)	2	r/w
110	Pr.S4	2ED 286D	749 10349	Set point of the 4th soak	From SPLL to SPHL -8000 Program End	dP	r/w
111	Pr.G4	2EE 286E	750 10350	Gradient of the 4th ramp	1 ÷ 9999 Engineering Unit/minute 10000 = inF = Step transfer	1	r/w
112	Pr.t4	2EF 286F	751 10351	Time of the 4th soak	0 ÷ 9959 time units of the soaks	2	r/w
113	Pr.b4	2F0 2870	752 10352	Wait band of the 4th soak	0 (oFF)/1 ÷ 9999 (E.U.)	0	r/w
114	Pr.E4	2F1 2871	753 10353	Events of the 4th group	0000 ÷ 1111 (0: Event OFF, 1: Event ON)	2	r/w
115	Pr.St	2F2 2872	754 10354	Program status	0 = rES = Program reset 1 = run = Program start 2 = HoLd = Program hold	0	r/w

5.3.11 PAn group - Operator interface (HMI) configuration

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
116	PAS2	2F3 2873	755 10355	Level 2 password (limited access level)	oFF (Level 2 not protected by password) 1 ÷ 200	0	r/w
117	PAS3	2F4 2874	756 10356	Level 3 password (complete configuration level)	3 ÷ 200	0	r/w
118	uSrb	2F5 2875	757 10357	↵ button function	0 = nonE = No function 1 = tunE = Auto-tune enable 2 = oPLo = Manual mode 3 = AAc = Alarm acknowledge 4 = ASi = Alarm reset 5 = chSP = Sequential set point selection 6 = St.by = Stand by mode 7 = Str.t = Timer run/hold/reset 8 = P.run = Program run 9 = P.rES = Program reset 10 = P.r.H.r = Program run/hold/reset	0	r/w
119	HdSP	2F6 2876	758 10358	Variable shown on the higher (main) display	0 = nonE = Display OFF 1 = PV = Present Value 2 = Pou = Power output 3 = SPF = Final Set Point 4 = Spo = Operative Set Point 5 = AL1 = Alarm 1 threshold 6 = AL2 = Alarm 2 threshold 7 = AL3 = Alarm 3 threshold 8 = Pr.tu = Shows the soak elapsed time 9 = Pr.td = Shows the soak remaining time (count down) 10 = P.t.tu = Shows the program total elapsed time 11 = P.t.td = Shows the program total remaining time (count down) 12 = ti.uP = Shows the timer counting up 13 = ti.du = Shows the timer counting down (count down) 14 = PErc = Output power percentage used during soft start 15 = ct.on = Current measured by CT with output ON 16 = ct.oF = Current measured by CT with output oFF (leakage) 17 = ct.iS = Istantaneous current measured by CT	0	r/w
120	L.dSP	2F7 2877	759 10359	Variable shown on the lower (secondary) display			r/w
121	di.cL	2F8 2878	760 10360	Display colour	0 = The display colour changes to point out the actual deviation (PV - SP) 1 = Display red (fix) 2 = Display green (fix) 3 = Display orange (fix)		
122	AdE	2F9 2879	761 10361	Deviation for display colour management	1 ÷ 9999	Dp	r/w
123	di.St	2FA 287A	762 10362	Display Timeout	0 = oFF (display always ON) 1 ÷ 9959 (mm.ss)	2	r/w
124	fiLd	2FB 287B	763 10363	Filter on the displayed value	0 = oFF (filter disabled) 1 ÷ 100	Dp	r/w
126	dSPu	2FD 287D	765 10365	Instrument status at power ON	0 = AS.Pr = Starts in the same way it was prior to the power down 1 = Auto = Starts in Auto mode 2 = oP.0 = Starts in manual mode with a power output equal to zero 3 = St.bY = Starts in stand-by mode	0	r/w
127	oPr.E	2FE 287E	766 10366	Operative modes enabling	0 = ALL = All modes will be selectable by the next parameter 1 = Au.oP = Auto and manual (OPLO) mode only will be selectable by the next parameter 2 = Au.Sb = Auto and Stand-by modes only will be selectable by the next parameter	0	r/w
128	oPEr	2FF 287F	767 10367	Operative mode selection	0 = Auto = Auto mode 1 = oPLo = Manual mode 2 = St.bY = Stand by mode	0	r/w

5.3.12 SEr group - Serial Communications configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
130	Add	300 2880	768 10368	Instrument address	oFF 1 ÷ 254	0	r/w
131	bAud	301 2881	769 10369	baud rate	0 = 1200 = 1200 baud 1 = 2400 = 2400 baud 2 = 9600 = 9600 baud 3 = 19.2 = 19200 baud 4 = 38.4 = 38400 baud	0	r/w
132	trSP	302 2882	770 10370	Selection of the value to be retransmitted (Master)	0 = nonE = Retransmission not used 1 = rSP = The instrument retransmits the operative Set Point 2 = PErc = The instrument retransmits the power output (%)	0	r/w

5.3.13 CO n group - Consumption configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
132	Co.tY	303 2883	771 10371	Measurement type	0 = oFF = Not used 1 = Instantaneous power (kW) 2 = Power consumption (kW/h) 3 = Energy used during program execution. This measure starts from zero when a program runs end stops at the end of the program. A new program execution will reset the value 4 = Total days the instrument has been powered ON 5 = Total hours the instrument has been powered ON 6 = Total days the instrument has been powered ON with threshold and stand by 7 = Total hours the instrument has been powered ON with threshold and stand by 8 = Total days the control output has been activated 9 = Total hours the control output has been activated 10 = Total days the control output has been activated with threshold and stand by 11 = Total hours the control output has been activated with threshold and stand by	0	r/w
133	UoLt	304 2884	772 10372	Nominal Voltage of the load	1 ÷ 9999 (V)	0	r/w
134	cur	305 2885	773 10373	Nominal current of the load	1 ÷ 999 (A)	0	r/w
135	h.Job	306 2886	774 10374	Threshold of the working period	OFF = Threshold not used; 1 ÷ 9999 days when [132] Co.tY = 6 or 10; 1 ÷ 9999 hours when [132] Co.tY = 7 or 11.	0	r/w
136	t.Job	307 2887	775 10375	Number of worked days (not resettable)	0 ÷ 9999	0	r

5.3.14 CAL group - User calibration configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
137	AL.P	308 2888	776 10376	Adjust Low Point	From -1999 to (AH.P - 10) (E.U.)	dP	r/w
138	AL.o	309 2889	777 10377	Adjust Low Offset	-300 ÷ +300 (E.U.)	dP	r/w
139	AH.P	30A 288A	778 10378	Adjust High Point	From (AL.P + 10) ÷ 9999 (E.U.)	dP	r/w
140	AH.o	30B 288B	779 10379	Adjust High Offset	-300 ÷ +300 (E.U.)	dP	r/w

5.3.15 SYS group - System configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
148	tic	314 2894	788 10388	Integral time used in double action control	-1(disabled) ÷ 10000 (inf)	0	r/w
149	tdc	315 2895	789 10389	Derivative time used in double-action control	-1(disabled) ÷ 9999	0	r/w
150	A	316 2896	790 10390	Calculated oscillation amplitude	0 ÷ 9999	0	r/w
151	t	317 2897	791 10391	Oscillation period	0 ÷ 9999	0	r/w
152	tAu	318 2898	792 10392	Time constant for the calculation of auto-tuning	0 ÷ 9999	0	r/w
153	n.dEr	319 2899	793 10393	Value of the filter on the PID derivative	0.1 ÷ 20.0	1	r/w
154	t.ini	31A 289A	794 10394	Room temperature	-1999 ÷ +9999	dp	r/w
155	tSd2	31B 289B	795 10395	Minimum Delta (SP-PV) above which FAST autotuning can be started for normalized signals	0.0 ÷ 100.0% of the measuring range [default: 5.0%]	1	r/w
156	oSc.F	31F 289F	799 10399	Minimum threshold for rapid oscillation tuning	0 = oFF> Normal oscilatory tuning (lasts the time necessary to find a symmetry condition) 1 ÷ 179 = Maximum oscillation period beyond which the tuning stops and the parameters are calculated considering the last period 180 = inF> Fast oscillatory tuning (as TLK and K family controllers)	0	r/w
157	At.Ft	320 28A0	800 10400	Auto tune for slow or normal processes	0 = Standard Auto tune 1 = Slow processes Auto tune	0	r/w

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