Serial communication protocol
ModBUS® for KM/KR/KX
(KM1-KM3-KR1-KR3-KX1-KX3)

this document is related to the firmware version 4.2

KUBE FAMILY COMMUNICATION PROTOCOL

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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 (LSB)	1
CRC-16 (LSB)	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 (LSB)	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 (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	01
Function code (6)	06
Register address (MSB)	03
Register address (LSB)	02
Written value (MSB)	00
Written value (LSB)	0A
CRC-16 (MSB)	A8
CRC-16 (LSB)	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 (LSB)	1
Number of requested registers (MSB)	1
Number of requested registers (LSB)	1
Byte count	1
Values	n
CRC-16 (LSB)	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 (LSB)	1
Number of written registers (MSB)	1
Number of written registers (LSB)	1
CRC-16 (LSB)	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 (LSB)	4A
Number of requested registers (MSB)	00
Number of requested registers (LSB)	02
Byte count	4
Value 1 (MSB)	00
Value 1 (LSB)	64
Value 2 (MSB)	00
Value 2 ((LSB)	C8
CRC-16 (LSB)	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 (LSB)	4A
Number of written registers (MSB)	00
Number of written registers (LSB)	02
CRC-16 (LSB)	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 (LSB)	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.

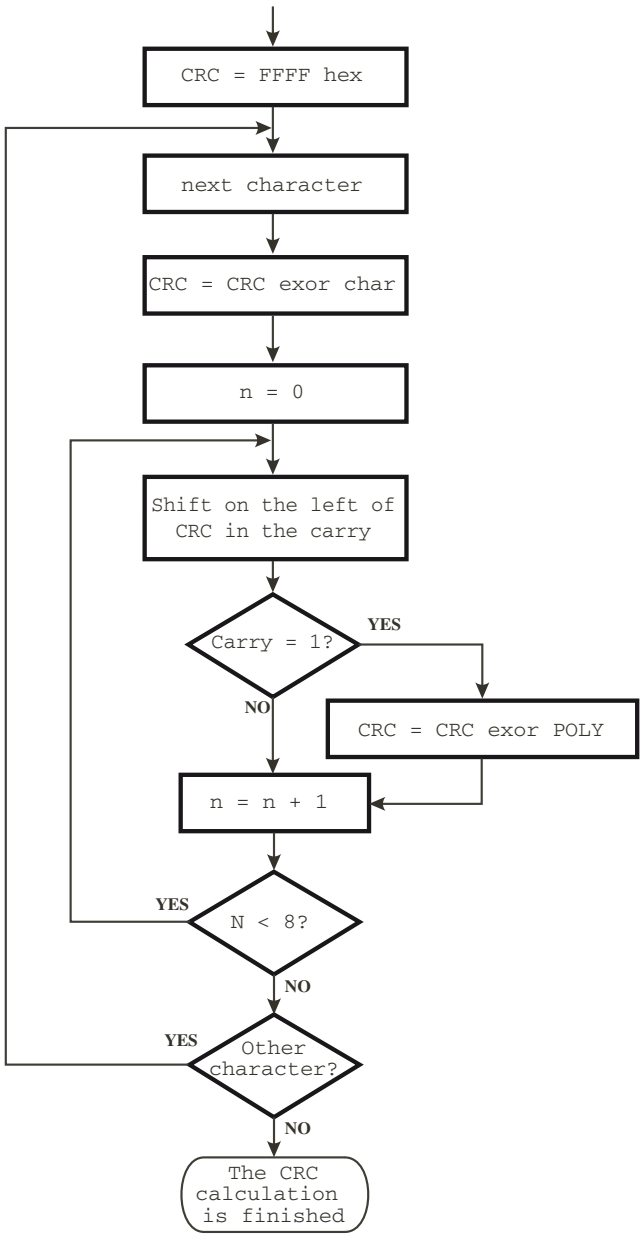
Every message, sent or received, has in the two last characters the CRC check word.

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.

Follows a subrutine made with “C” able to calculate the CTC-16.

```
/* ----------------------------------------------------------------
crc_16        calcolo del crc_16

Parametri di ingresso:
      buffer: stringa di caratteri di cui calcolare il CRC-16
      length: numero di bytes della stringa

Questa funzione ritorna il valore di 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

All Kube 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's instruments: numeric values calculated and dinamically updated. Available in read and write operations
200	512	250	592	Group of variables compatible with the old Ascon Tecnologic's 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			
1A	1	1	**PV: Measured value** **Note:** When a measuring error is detected the instrument send: • 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** **Range:** -100.00 ÷ 100.00 (%) **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 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 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 an output is driven by serial link, the relative bit will remain equal to 0.	0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
12A	C	12	**Instrument status** bit 0 = Automatic bit 1 = manual bit 2 = Standby bit 3 = Remote Set point (temporary) used bit 4 = Auto-tuning active bit 5 = Self tuning active 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 resetted 1 = Resetted	0	r/w
14A	E	14	**Alarms acknowledge** 0 = Not acknowledge 1 = acknowledge	0	r/w
15A	F	15	**Control 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 tuning 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 word is composed by two parts: - Low byte – Version of the parameter table - High byte – Version of the family protocoll	0	r
21A	15	21	**Instrument identification code** 20 = KM1/KM3 25 = KX1/KX3 26 = KR1/KR3	0	r
22A	16	22	**First temporary code for speed configuration** The code is composed by two distinct 4 digits subcodes: **AABB** where: **AA** = Input type: 0 ÷ 25 **BB** = Control type and service functions 0 ÷ 21 **Note:** 10000 = Temporary value not inserted The programmed codes will be activated only after both have been correctly be programmed.. The order has no importance.	0	r/w
23A	17	23	**Second temporary code for speed configuration** The code is composed by two distinct 4 digits subcodes: **CDEF** where: **C** = Alarm type 1 0 ÷ 9 **D** = Alarm type 2 0 ÷ 9 **E** = Alarm type 3 0 ÷ 9 **F** = Enabling service functions 0 ÷ 4 **Note:** 10000 = Temporary value not inserted The programmed codes will be activated only after that both have been correctly programmed. The order has no importance.	0	r/w

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
24A	18	24	**First final code for speed configuration** When programmed, the code is composed by two distinct 4 digits subcodes: **AABB** where: **AA** = Input type: 0 ÷ 25 **BB** = Control type and output functions 0 ÷ 21 If not programmed, the return value is -1 = Code not programmed.	0	r
25A	19	25	**Second temporary code for speed configuration** When programmed, the code is composed by two distinct 4 digits subcodes: **CDEF** where: **C** = Alarm 1 type 0 ÷ 9 **D** = Alarm 2 type 0 ÷ 9 **E** = Alarm 3 type 0 ÷ 9 **F** = Enabling service functions 0 ÷ 4 If not programmed, the return value is -1 = Code not programmed.	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 autotuning 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	**Autotuning 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

5.2 Group of variables compatible with the old Ascon Tecnologic's instruments (before Kube series)

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	**Power output** As Modbus address 4	2	r
4B	0203	515	**Power output of the heating output** **Range:** 0 ÷ 100.00 (%)	2	r
5B	0204	516	**Power output of the cooling output** **Range:** 0 ÷ 100.00 (%)	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	**LBA status** 0 = OFF 1 = ON	0	r
11B	020E	526	**Overload alarm status** 0 = OFF 1 = ON		
12B	020F	527	**Controller status** 0 = Stand-by 1 = Auto 2 = Tuning 3 = Manual	0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
13B	0224	548	**Status/remote control of the Output 1** 0 = OFF 1 = ON **Note:** This parameter is writeable when out 1 is “not used” by the controller (o1F output 1 function = nonE). This parameter is stored in RAM	0	r/w
14B	0225	549	**Status/remote control of the Output 2** 0 = OFF 1 = ON **Note:** This parameter is writeable when out 2 is “not used” by the controller (o2F output 1 function = nonE). This parameter is stored in RAM	0	r/w
15B	0226	550	**Status/remote control of the Output 3** 0 = OFF 1 = ON **Note:** This parameter is writeable when out 3 is “not used” by the controller (o3F output 1 function = nonE). This parameter is stored in RAM	0	r/w
16B	0227	551	**Status/remote control of the Output 4** 0 = OFF 1 = ON **Note:** This parameter is writeable when out 4 is “not used” by the controller (o4F output 1 function = nonE). This parameter is stored in RAM	0	r/w
17B	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/w
18B	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/w
19B	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
20B	0245	581	**Timer status** 0 = Not configured 1 = Reset (stop) 2 = Run 3 = Hold 4 = End (Read only)	0	r/w
21B	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
22B	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
23B	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
24B	249	585	**Remaining time to the timer end** **Range:** 0 ÷ 65535 (Hours when Tru=hh.mm, Minutes when Tru=mm.ss)	2	r
			0 ÷ 9959 (tenth of seconds when Tru=SSS.d) **Note:** When the timer is not active the return code is 0.	1	

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
25B	24A	586	**Wattmeter:** The meaning of this parameter is defined by the CO.ty parameter setting. CO.ty = 0ff 0 CO.ty = 1 Instantaneous power (kW); CO.ty = 2 Consumed energy (kWh); CO.ty = 3 Energy used during program execution (kWh); CO.ty = 4/6 Total worked days; CO.ty = 5/7 Total worked hours; CO.ty = 8/10 Totalizer of control relay worked days; CO.ty = 9/11 Totalizer of control relay worked hours.	0	r
26B	24B	587	**Duration of first program ramp** **Range:** 0 ÷ 9999 s	0	r
27B	24C	588	**Days counted with the controller Powered ON** **Range:** 0 ÷ 9999	0	r
28B	250	592	**Power output when the instrument is in manual mode** Range:-10000 ÷ 10000 (%)	2	r/w

5.3 Instrument identification parameters

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
1	800	2048	**Reserved**	0	r
2	801	2049	**Reserved**	0	r
3	802	2050	**Reserved**	0	r
4	803	2051	**Reserved**	0	r
5	804	2052	**Reserved**	0	r
6	805	2053	**Reserved**	0	r
7	806	2054	**Reserved**	0	r
8	807	2055	**Reserved**	0	r
9	808	2056	Instrument Firmware Revision - First part	0	r
10	809	2057	Instrument Firmware Revision - Second part	0	r
11	80A	2058	Model Code – Instrument type 1 **Range:** 0x4B = 'K'	0	r
12	80B	2059	Model Code – Instrument type 2 **Range:** 0x4D = 'M' - KM 0x52 = 'R' - KR 0x58 = 'X' - KX	0	r
13	80C	2060	Model Code – Instrument type 3 **Range:** 0x31 = '1' - KM1, KR1, KX1 0x33 = '3' - KM3, KR3, KX3	0	r
14	80D	2061	Model Code – Optional functions **Range:** 0x2D = '-' - No functions 0x54 = 'T' - Timer 0x50 = 'P' - Timer + Programmer	0	r
15	80E	2062	Model Code – Power supply type **Range:** 0x48 = 'H' - 110 ÷ 240 Vac/Vdc 0x4C = 'L' - 24 Vac/Vdc	0	r
16	80F	2063	Model Code – Measure input type **Range:** 0x43 = 'C' - Tc, Pt100, Pt1000, mA, mV, V + Digital Input 1 0x45 = 'E' - Tc, PTC, NTC, mA, mV, V + Digital Input 1	0	r
17	810	2064	Model Code – Output 1 type **Range:** 0x49 = 'I' - Analogue Output 0x4F = 'O' - SSR 0x52 = 'R' - Relay	0	r
18	811	2065	Model Code – Output 2 type **Range:** 0x2D = '-' - Not present 0x4D = 'M' – Servomotor command relay 0x4F = 'O' - SSR 0x52 = 'R' - Relay	0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
19	812	2066	Model Code – Output 3 type **Range:** 0x2D = '-' - Not present 0x4D = 'M' – Servomotor command relay 0x4F = 'O' - SSR 0x52 = 'R' - Relay	0	r
20	813	2067	Model Code – Output 4 type **Range:** 0x43 = 'D' - Output 4 (VDC for SSR)/Sensor Power Supply/Digital Input DI2	0	r
21	814	2068	Model Code – Serial communication type **Range:** 0x2D = '-' - TTL 0x53 = 'S' - Rs485 Modbus	0	r
22	815	2069	Model Code – Terminal type **Range:** 0x2D = '-' - Standard (screw terminals not removable) 0x45 = 'E' - Removable screw terminals 0x4D = 'M' - Removable spring terminals 0x4E = 'N' - Removable terminals (the fixed part only)	0	r
23	816	2070	**Model Code – Reserved**	0	r
24	817	2071	**Model Code – Reserved**	0	r
25	818	2072	**Model Code – Reserved**	0	r
26	819	2073	**Model Code – Reserved**	0	r
27	81A	2074	**Model Code – Reserved**	0	r
28	81B	2075	**Model Code – Reserved**	0	r
29	81C	2076	**Model Code – Reserved**	0	r
30	81D	2077	**Model Code – Reserved**	0	r
31	81E	2078	**Model Code – Reserved**	0	r
32	81F	2079	**Model Code – Reserved**	0	r
33	820	2080	**Model Code – Reserved**	0	r
34	821	2081	**Model Code – Reserved**	0	r
35	822	2082	**Model Code – Reserved**	0	r
36	823	2083	**Model Code – Reserved**	0	r
37	824	2084	**Model Code – Reserved**	0	r
38	825	2085	**Model Code – Reserved**	0	r
39	826	2086	Serial Number – First part (LL)	0	r
40	827	2087	Serial Number – Second part (L)	0	r
41	828	2088	Serial Number – Third part (H)	0	r
42	829	2089	Serial Number – Fourth part (HH)	0	r
43	82A	2090	Calibration Date – Day **Range:** 1 ÷ 31	0	r
44	82B	2091	Calibration Date – Month **Range:** 1 ÷ 12	0	r
45	82C	2092	Calibration Date – Year	0	r

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

5.4.1 inP GROUP - Main and auxiliary input configuration

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
1	SEnS	280 2800	640 10240	Model C (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
				Model E (Ptc, Ntc)	0 = J = TC J, 1 = c rAL = 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 = Ptc = TC KTY81-121, 8 = ntc = NTC 103-AT2, 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		
2	dp	281 2801	641 10241	Decimal Point Position (linear inputs)	0... 3	0	r/w
				Decimal Point Position (different than linear inputs)	0/1		
3	SSC	282 2802	642 10242	Initial scale read-out for linear inputs	-1999... 9999	dP	r/w
4	FSc	283 2803	643 10243	Full Scale Readout for linear inputs	-1999... 9999	dP	r/w
5	unit	284 2804	644 10244	Engineer unit	0 = C = °C 1 = F = °F	0	r/w
6	Fil	285 2805	645 10245	Digital filter on the measured value **Note:** This filter affects the control action, the PV retransmission and the alarms action.	0 (= OFF)... 200 (seconds)	1	r/w
7	inE	286 2806	646 10246	Sensor error used to enable the safety output value	or = Over range ou = Under range our = Over and under range	0	r/w
8	oPE	287 2807	647 10247	Safety output value (% of the output)	-100... 100	0	r/w
9	IO4.F	288 2808	648 10248	I/O 4 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

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
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 = 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
12	di.A	31E 289E	798 10398	Digital Inputs Action **Note:** The addresses related to this parameter are inserted after the last parameter set [157] tSd2	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.		

5.4.2 Out group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
13	o1t	28B 280B	651 10251	Output 1 type (when Out 1 is an analogue output KM3 only)	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

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
14	o1F	28C 280C	652 10252	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 (sp - PV) retransmission 5 = r.SP = Set point retransmission 6 = r.SEr = Serial value retransmission	0	r/w
				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 = The output repeats the digital input 1 status 17 = diF.2 = The output repeats the digital input 2 status 18 = on = Out 1 always ON		
15	Ao1L	28D 280D	653 10253	Initial scale value of the analog retransmission (KM3 only)	-1999 ... Ao1H	dp	r/w
16	Ao1H	28E 280E	654 10254	Full scale value of the analog retransmission (KM3 only)	Ao1L ... 9999	dp	r/w
17	o1AL	28F 280F	655 10255	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	290 2810	656 10256	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	291 2811	657 10257	Out 2 function	See the values of 13 = o1F parameter	0	r/w
20	o2AL	292 2812	658 10258	Alarms linked up with the out 2	See the values of 16 = o1AL parameter	0	r/w
21	o2Ac	293 2813	659 10259	Out 2 action	See the values of 17 = o1Ac parameter	0	r/w
22	o3F	294 2814	660 10260	Out 3 function	See the values of 13 = o1F parameter	0	r/w
23	o3AL	295 2815	661 10261	Alarms linked up with the out 3	See the values of 16 = o1AL parameter	0	r/w
24	o3Ac	296 2816	662 10262	Out 3 action	See the values of 17 = o1Ac parameter	0	r/w
25	o4F	297 2817	664 10264	Out 4 function	See the values of 13 = o1F parameter	0	r/w
26	o4AL	298 2818	664 10264	Alarms linked up with the out 4	See the values of 16 = o1AL parameter	0	r/w
27	o4Ac	299 2819	665 10265	Out 4 action	See the values of 17 = o1Ac parameter	0	r/w

5.4.3 AL1 group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
28	AL1t	29A 281A	666 10266	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
29	Ab1	29B 281B	667 10267	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
30	AL1L	29C 281C	668 10268	- 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
31	AL1H	29D 281D	669 10269	- 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
32	AL1	29E 281E	670 10270	AL1 threshold	From AL1L to AL1H (E.U.)	dP	r/w
33	HAL1	29F 281F	671 10271	AL1 hysteresis	1... 9999 (E.U.)	dP	r/w
34	AL1d	2A0 2820	672 10272	AL1 delay	From 0 (oFF) to 9999 (s)	0	r/w
35	AL1o	2A1 2821	673 10273	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 mode and in over range condition	0	r/w

5.4.4 AL2 group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
36	AL2t	2A2 2822	674 10274	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
37	Ab2	2A3 2823	675 10275	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
38	AL2L	2A4 2824	676 10276	- 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
39	AL2H	2A5 2825	677 10277	- 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
40	AL2	2A6 2826	678 10278	AL2 threshold	From AL2L to AL2H (E.U.)	dP	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
41	HAL2	2A7 2827	679 10279	AL2 hysteresis	1... 9999 (E.U.)	dP	r/w
42	AL2d	2A8 2828	680 10280	AL2 delay	From 0 (oFF) to 9999 (s)	0	r/w
43	AL2o	2A9 2829	681 10281	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 mode and in over range condition	0	r/w

5.4.5 AL3 group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
44	AL3t	2AA 282A	682 10282	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
45	Ab3	2AB 282B	683 10283	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
46	AL3L	2AC 282C	684 10284	- 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
47	AL3H	2AD 282D	685 10285	- 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
48	AL3	2AE 282E	686 10286	AL3 threshold	From AL3L to AL3H (E.U.)	dP	r/w
49	HAL3	2AF 282F	687 10287	AL3 hysteresis	1... 9999 (E.U.)	dP	r/w
50	AL3d	2B0 2830	688 10288	AL3 delay	From 0 (oFF) to 9999 (s)	0	r/w
51	AL3o	2B1 2831	689 10289	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 mode and in over range condition	0	r/w

5.4.6 LBA group - Loop Break Alarm Parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
52	LbAt	2B2 2832	690 10290	LBA time	From 0 (oFF) to 9999 (s)	0	
53	LbSt	2B3 2833	691 10291	Delta measure used by LBA during Soft start	From 0 (oFF) to 9999 (E.U.)	dP	
54	LbAS	2B4 2834	692 10292	Delta measure used by LBA	1...9999 (E.U.)	dP	
55	LbcA	2B5 2835	693 10293	Condition for LBA enabling	0 = uP = Active when Pout = 100% 1 = dn = Active when Pout = -100% 2 = both = Active in both cases	0	

5.4.7 rEG group - Control Parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
56	cont	2B6 2836	694 10294	Control type	0 = Pid = PID (heat and/or) 1 = On.FA = ON/OFF asymmetric hysteresis 2 = On.FS = ON/OFF symmetric hysteresis 3 = nr = Heat/Cool ON/OFF control with neutral zone 4 = 3Pt = Servomotor control (available only when **Output 2** and **Output 3** have been ordered as "**M**")	0	r/w
57	Auto	2B7 2837	695 10295	Autotuning selection	-4 = Oscillating auto-tune with automaticrestart at power up and after all point change -3 = Oscillating auto-tune with manual start -2 = Oscillating -tune with auto-matic start at the first power up only -1 = Oscillating auto-tune with auto-matic restart at every power up 0 = Not used 1 = Fast auto tuning with automatic restart at every power up 2 = Fast auto-tune with automatic start the first power up only 3 = FAST auto-tune with manual start 4 = FAST auto-tune with automatic restart at power up and after a set point change 5 = Evo-tune with automatic restart at every power up 6 = Evo-tune with automatic start the first power up only 7 = Evo-tune with manual start 8 = Evo-tune with automatic restart at power up and after a set point change	0	r/w
58	Aut.r	2B8 2838	696 10296	Manual start of the Autotuning	0 = oFF = Autotuning Not active 1 = on = Autotuning Active	0	r/w
59	SELF	2B9 2839	697 10297	Self tuning enabling	0 = no = The instrument does not perform the self-tuning 1 = YES = The instrument is performing the self-tuning	0	r/w
60	HSEt	2BA 283A	698 10298	Hysteresis of the ON/OFF control	0... 9999 (E.U.)	dP	
61	cPdt	2BB 283B	699 10299	Time for compressor protection	From 0 (oFF) to 9999 (s)	0	r/w
62	Pb	2BC 283C	700 10300	Proportional band	1... 9999 (E.U.)	dP	
63	ti	2BD 283D	701 10301	Integral time	From 0 (oFF) to 9999 (s)	0	r/w
64	td	2BE 283E	702 10302	Derivative time	From 0 (oFF) to 9999 (s)	0	r/w
65	Fuoc	2BF 283F	703 10303	Fuzzy overshoot control	0... 200	2	r/w
66	tcH	2C0 2840	704 10304	Heating output cycle time	10... 1300 (s)	1	r/w
67	rcG	2C1 2841	705 10305	Power ratio between heating and cooling action	1... 9999	2	r/w
68	tcc	2C2 2842	706 10306	Cooling output cycle time	1... 1300 (s)	1	r/w
69	rS	2C3 2843	707 10307	Manual reset (Integral pre-load)	-1000... +1000 (%)	1	r/w
70	Str.t	2C4 2844	708 10308	Servomotor stroke time	5...1000 seconds	0	r/w
71	db.S	2C5 2845	709 10309	Servomotor dead band	0...100%	1	r/w
72	od	2C6 2846	710 10310	Delay at power up	From 0.00 (oFF) to 9959 (hh.mm)	2	r/w
73	St.P	2C7 2847	711 10311	Maximum power output used during soft start	-100... 100 (%)	0	r/w
74	SSt	2C8 2848	712 10312	Soft start time	- 0 (oFF)... 800 = inF (h.mm)	2	r/w
75	SS.tH	2C9 2849	713 10313	Threshold for soft start disabling	-2000 = (oFF)... 9999 (E.U.)	dP	r/w

5.4.8 SP group - Set point parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
76	nSP	2CA 284A	2CA 284A	Number of used set points	1... 4	0	r/w
77	SPLL	2CB 284B	715 10315	Minimum set point value	From -1999 to SPHL	dP	r/w
78	SPHL	2CC 284C	716 10316	Maximum set point value	From SPLL to 9999	dP	r/w
79	SP	2CD 284D	717 10317	Set point 1	From SPLL to SPLH	dP	r/w
80	SP 2	2CE 284E	718 10318	Set point 2	From SPLL to SPLH	dP	r/w
81	SP 3	2CF 284F	719 10319	Set point 3	From SPLL to SPLH	dP	r/w
82	SP 4	2D0 2850	720 10320	Set point 4	From SPLL to SPLH	dP	r/w
83	A.SP	2D1 2851	721 10321	Selection of the active set point	0 = SP 1 = SP 2 2 = SP 3 3 = SP 4	0	r/w
84	SP.rt	2D2 2852	722 10322	Remote set point type	0 = RSP = The value coming from serial link is used as remote set point 1 = trin = The value will be added to the local set point selected by A.SP and the sum becomes the operative set point 2 = PErc = The value will be scaled on the input range and this value will be used as remote SP	0	r/w
85	SPLr	2D3 2853	723 10323	Local/remote set point selection	0 = Loc = local 1 = rEn = remote	0	r/w
86	SP.u	2D4 2854	724 10324	Rate of rise for **POSITIVE** set point change (ramp UP)	0.01... 99.99 (inF) Eng. units per minute	2	r/w
87	SP.d	2D5 2855	725 10325	Rate of rise for **NEGATIVE** set point change (ramp DOWN)	0.01... 99.99 (inF) Eng. units per minute	2	r/w

5.4.9 TIN group - Timer function parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
88	tr.F	2D6 2856	726 10326	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
89	tr.u	2D7 2857	727 10327	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
90	tr.t1	2D8 2858	728 10328	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	
91	tr.t2	2D9 2859	729 10329	Time 2	When tr.u = 0: From 0 (oFF) to 9959 (inF) (hh.mm) When tr.u = 1: From 0 (oFF) to 9959 (inF) (mm.ss)	2	r/w
					When tr.u = 2: From 0000 (oFF) to 9959 (inF) (tenth of seconds)	1	
92	tr.St	2DA 285A	730 10330	Timer status	0 = rES = Timer reset 1 = run = Timer run 2 = HoLd = Timer hold	0	r/w

5.4.10 PRG group - Programmer function parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
93	Pr.F	2DB 285B	731 10331	Program action at power up	0 = nonE = Programmer not used 1 = S.uP.d = Start at power up with a first step in stand-by 2 = S.uP.S = Start at power up 3 = u.diG = Start at Run command detection only 4 = u.dG.d = Start at Run command with a first step in stand-by	0	r/w
94	Pr.u	2DC 285C	732 10332	Engineering unit of the soaks	0 = hh.nn = Hours and minutes 1 = nn.SS = Minutes and seconds	0	r/w
95	Pr.E	2DD 285D	733 10333	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
96	Pr.Et	2DE 285E	734 10334	Time of the end program indication	From 0 (oFF) to 9959 (inF) minutes and seconds	2	r/w
97	Pr.S1	2DF 285F	735 10335	Set point of the first soak	From SPLL to SPHL -8000 Program End	dP	r/w
98	Pr.G1	2E0 2860	736 10336	Gradient of the first ramp	1... 10000 (inF = Step transfer) Engineering Unit/minute	1	r/w
99	Pr.t1	2E1 2861	737 10337	Time of the 1st soak	0... 9959 (hh.mm or mm.ss)	2	r/w
100	Pr.b1	2E2 2862	738 10338	Wait band of the 1st soak	0 (oFF) to 9999 (E.U.)	0	r/w
101	Pr.E1	2E3 2863	739 10339	Events of the 1st group	0000... 1111	2	r/w
102	Pr.S2	2E4 2864	740 10340	Set point of the 2nd soak	From SPLL to SPHL -8000 Program End	dP	r/w
103	Pr.G2	2E5 2865	741 10342	Gradient of the 2nd ramp	1... 10000 (inF = Step transfer) Engineering Unit/minute	1	r/w
104	Pr.t2	2E6 2866	742 10342	Time of the 2nd soak	0... 9959 (hh.mm or mm.ss)	2	r/w
105	Pr.b2	2E7 2867	743 10343	Wait band of the 2nd soak	0 (oFF) to 9999 (E.U.)	0	r/w
106	Pr.E2	2E8 2868	744 10344	Events of the 2nd group	0000... 1111	2	r/w
107	Pr.S3	2E9 2869	745 10345	Set point of the 3rd soak	From SPLL to SPHL -8000 Program End	dP	r/w
108	Pr.G3	2EA 286A	746 10346	Gradient of the 3rd ramp	1... 10000 (inF = Step transfer) Engineering Unit/minute	1	r/w
109	Pr.t3	2EB 286B	747 10347	Time of the 3rd soak	0... 9959 (hh.mm or mm.ss)	2	r/w
110	Pr.b3	2EC 286C	748 10348	Wait band of the 3rd soak	0 (oFF) to 9999 (E.U.)	0	r/w
111	Pr.E3	2ED 286D	749 10349	Events of the 3rd group	0000... 1111	2	r/w
112	Pr.S4	2EE 286E	750 10350	Set point of the 4th soak	From SPLL to SPHL -8000 Program End	dP	r/w
113	Pr.G4	2EF 286F	751 10351	Gradient of the 4th ramp	1... 10000 (inF= Step transfer) Engineering Unit/minute	1	r/w
114	Pr.t4	2F0 2870	752 10352	Time of the 4th soak	0... 9959 (hh.mm or mm.ss)	2	r/w
115	Pr.b4	2F1 2871	753 10353	Wait band of the 4th soak	0 (oFF) to 9999 (E.U.)	0	r/w
116	Pr.E4	2F2 2872	754 10354	Events of the 4th group	0000... 1111	2	r/w
117	Pr.St	2F3 2873	755 10355	Program status	0 = rES = Program reset 1 = run = Program start 2 = HoLd = Program hold	0	r/w

5.4.11 PAn group - Operator HMI parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
118	PAS2	2F4 2874	756 10356	Level 2 password (limited access level)	- oFF (Level 2 not protected by password) - 1... 200	0	r/w
119	PAS3	2F5 2875	757 10357	Level 3 password (complete configuration level)	3... 200	0	r/w
120	PAS4	2F6 2876	758 10358	Level 4 password (CODE configuration level)	201... 400	0	r/w
121	uSrb	2F7 2877	759 10359	↵ button function during RUN TIME	0 = nonE = No function 1 = tunE = Auto-tune/self-tune enabling. A single press (longer than 1 second) starts the auto-tune 2 = oPLo = Manual mode. The first pressure puts the instrument in manual mode (oPLo) while a second one puts the instrument in Auto mode 3 = AAc = Alarm reset 4 = ASi = Alarm acknowledge 5 = chSP = Sequential set point selection 6 = St.by = Stand by mode. The first press puts the instrument in stand by mode while a second one puts the instrument in Auto 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
122	diSP	2F8 2878	760 10360	Display management	0 = nonE = Standard display 1 = Pou = Power output 2 = SPF = Final set point 3 = Spo = Operative set point 4 = AL1 = Alarm 1 threshold 5 = AL2 = Alarm 2 threshold 6 = AL3 = Alarm 3 threshold 7 = Pr.tu = - During a soak, the instrument shows the soak elapsed time; - - During a ramp the display shows the operative set point. At the end of the program execution, the instrument will show "P.End" messages alternately with the measured value. - - When no program is running, the instrument shows the standard display 8 = Pr.td = - During a soak, the instrument shows the soak remaining time (count down). - - During a ramp the display shows the operative set point. At the end of the program execution, the instrument shows "P.End" messages alternately with the measured value. - - When no program is running, the instrument shows the standard display. 9 = P.t.tu = When the programmer is running, the display shows the total elapsed time. At the end of the program execution, the instrument shows "t.End" messages alternately with the measured value. 10 = P.t.td = When the programmer is running, the display shows the total remaining time (count down). At the end of the program execution, the instrument shows "P.End" messages alternately with the measured value. 11 = ti.uP = When the timer is running, the display shows the timer counting up. At the end of the counting, the instrument shows "t.End" messages alternately with the measured value. 12 = ti.du = When the timer is running, the display shows the timer counting down. At the end of the counting, the instrument shows "t.End" messages alternately with the measured value. 13 = PErc = Percent of the power output used during soft start (when the soft start time is equal to infinite, the limit is ever active and it can be used also when ON/OFF control is selected)		r/w
123	di.cL	2F9 2879	761 10361	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)		
124	AdE	2FA 287A	762 10362	Deviation for display colour management	1... 9999	Dp	r/w
125	di.St	2FB 287B	763 10363	Display Timeout	0 = oFF (display always ON)... 9959 (mm.ss)	2	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
126	fiLd	2FC 287C	764 10364	Filter on the displayed value	0 = oFF (filter disabled)... 100	Dp	r/w
127	Bg.F	2FD 287D	765 10365	Bar graph Function	0 = nonE = Bargraph not lit 1 = Pou = PID Output power (single action: 0... 100%, double action: -100... +100%) 2 = Po.h = Energy Used (kWh) 3 = Pr.tu = Elapsed time of the program in execution 4 = Pr.td = Time to end of the program in execution 5 = Pr.tS = Time to end of the program segment in execution 6 = ti.uP = Elapsed time of timer (T1 and T2) 7 = ti.du = Time to end of timer (T1 and T2) 8 = r.iSP = Time to preventive maintenance	0	r/w
128	dSPu	2FE 287E	766 10366	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
129	oPr.E	2FF 287F	767 10367	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
130	oPEr	300 2880	768 10368	Operative mode selection	0 = Auto = Auto mode 1 = oPLo = Manual mode 2 = St.bY = Stand by mode	0	r/w

5.4.12 Ser group - Serial link parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
130	Add	301 2881	769 10369	Instrument address	oFF... 254	0	r/w
131	bAud	302 2882	770 10370	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	303 2883	771 10371	Selection of the value to be retransmitted (Master)	0 = nonE = Retransmission not used (the instrument is a slave) 1 = rSP = The instrument becomes a Master and retransmits the operative set point 2 = PErc = The instrument become a Master and it retransmits the power output	0	r/w

5.4.13 COn group - Consumption parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
133	Co.tY	304 2884	772 10372	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 worked days with threshold. It is the number of hours that the instrument is turned ON divided for 24 5 = Total worked hours with threshold. It is the number of hours that the instrument is turned ON	0	r/w
134	UoLt	305 2885	773 10373	Nominal Voltage of the load	1... 9999 (V)	0	r/w
135	cur	306 2886	774 10374	Nominal current of the load	1... 999 (A)	0	r/w
136	h.Job	307 2887	775 10375	Threshold of the working period	0 = oFF... 999	0	r/w
137	t.Job	308 2888	776 10376	Worked time (not resettable)	0... 9999	0	r

5.4.14 CAI group - User calibration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
138	AL.P	309 2889	777 10377	Adjust Low Point	From -1999 to (AH.P - 10) (E.U.)	dP	r/w
139	AL.o	30A 288A	778 10378	Adjust Low Offset	-300... +300 (E.U.)	dP	r/w
140	AH.P	30B 288B	779 10379	Adjust High Point	From (AL.P + 10)... 9999 (E.U.)	dP	r/w
141	AH.o	30C 288C	780 10380	Adjust High Offset	-300... +300 (E.U.)	dP	r/w

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