ModBUS® serial communication protocol
for KM7/KR7/KX7 series
Temperature controller with motor speed control at 24 VDC

This document is related to the firmware version 1.1.0

22.11 - Code: ISTR_P_K_7-SERIES_E_00_--

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1 PREFACE

Ascon Tecnologic uses the ModBUS® communication protocol in the RTU variant because it is one of the most widespread in industrial communication, so much so that it has become a de facto standard. It is a royalties-free protocol, easy to be implemented and on which there is a vast literature.

The ModBUS® RTU protocol uses serial communications and represents all data in compact form of hexadecimal type.

The commands/data are necessarily followed by a check-sum of the CRC (cyclic redundancy check) type.

To each connected device is assigned a unique address. The protocol provides for a single Master and up to 254 slaves.

Only the Master can initiate transmission by sending a command that contains the address of the device with which it wants to communicate and only the latter will act on the command, although the others also receive it.

All commands contain control information, which ensures that the command arrived is correct.

The transmission characteristics are usually user programmable:

- Device address: From 1 to 254.
- Baud rate: bit per second.
- Byte format:
  - 1 start bit;
  - 8 data bits;
  - 2 final bits composed as follows:
    - 1 parity bit (even or odd);
    - 1 stop bit;

or

- no parity bit;
- 2 stop bits.

The K_7 series allow 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 K_7 series 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

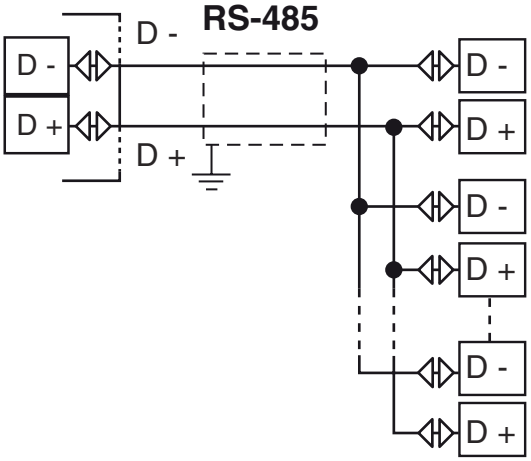
K_7 series controllers are provided with a RS485 serial communication interface, insulated so that any problem arising from ground potential is removed.

If the computer or PLC should use a communication interface other than RS485, it will be necessary to install a converter to allow the data exchange between the controllers and the supervisor.

While at rest, the instruments are in a receive condition and switch 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 **D+** and **D-**. The connection between K_7 s has to be carried on in parallel, i.e. all **D+** terminals have to be connected between them and in the same way all those indicated with label **D-**.



The communication speeds adopted (1200 ÷ 34800 baud), while allowing very satisfactory performance, remain well below the limits set by the RS485 standard. This fact allows the line to be wired with a simple medium quality twisted pair (the total capacity of the line must not exceed 200 nF). The line can be up to 1000 meters long.

The characteristics of asynchronous transmission are: 8 bits, no parity, one stop bit.

3 COMMUNICATION PROTOCOL

The MODBUS® RTU communication protocol requires that only the unit selected as the master can start the communication. Slave units can only transmit after receiving a request from the master.

The generic format for the transmission between master and slave is:

Data	Number of bytes
Slave address	1
Function code	1
Data	n
Checksum (CRC-16)(MSB = Most Significant byte)	1
Checksum (CRC-16)(LSB = Less Significant byte)	1

The MODBUS® RTU communication protocol provides that the end of a message is determined when the interval in the transmission of two successive characters is greater than 3.5 T.U. (Time Unit = Time required to transmit a character). Given the latency times associated with current supervision devices and their operating systems, it is very difficult to calculate the silence time with precision.

The communication protocol function codes implemented provide for messages with a fixed length, the end of the message is therefore determined by the character count. A fixed delay will be respected for the start of the response in order to respect the silence period required by the various baud rate configurations.

3.1 Cyclic redundancy check (CRC-16)

CRC is a check word that allows to verify a message integrity. All messages, sent or received, have in the two last characters the CRC check word.

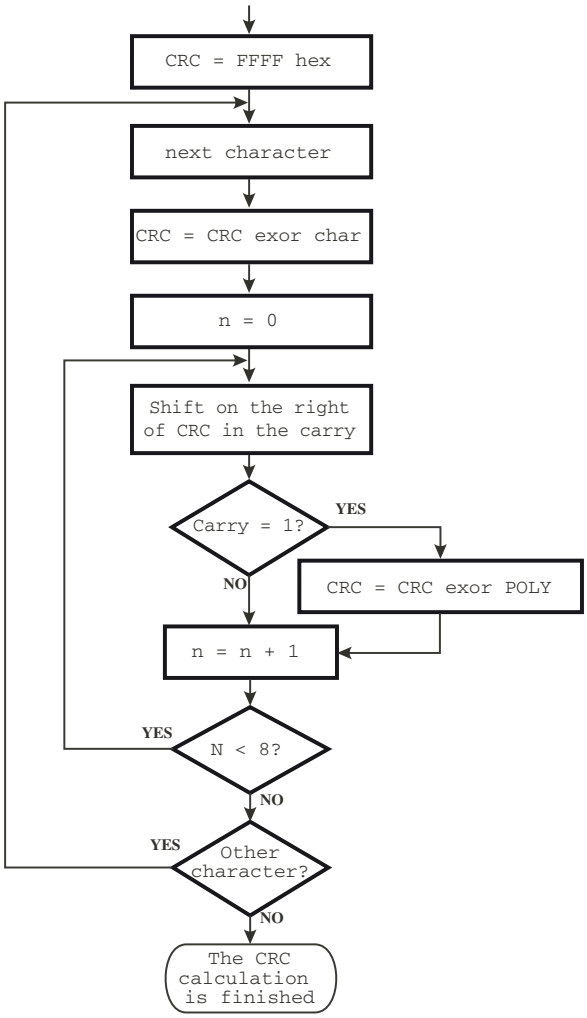
The CRC-16 value is calculated by the transmitting device. This value is appended to the message. After receiving a request, the controller checks the validity of the received message comparing the received CRC with the calculated one. The two values must be identical. When the reply is ready the controller 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.

CRC-16 calculation procedure:

0 = Initialize the word (16 bits) used to store the CRC-16 with the value 0xFFFF;
1 = Perform an exclusive OR (XOR) between the first byte of the message and the lower part of the CRC-16 by putting the result in the CRC-16;
2 = Move the CRC-16 one position to the right, towards the Least Significant Byte (LSB) by inserting the value zero in the Most Significant Byte (MSB). Examine the Least Significant Byte.
3 = If = 0: Repeat step 3 (move to another position),
If = 1: Perform an exclusive OR (XOR) between the CRC-16 and the polynomial value 0xA001;
4 = Repeat steps 3 and 4 until 8 moves have been made. At this point an entire byte will have been processed;
5 = Repeat the procedure from step 2 to step 5 for the next bytes of the message;
6 = The final content of CRC-16 word is the value of CRC-16.

The lower part of the word containing the CRC-16 (16 bytes) is always transmitted first and then the upper part.



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 FUNCTION CODES

The protocol adopted by K_7 is a subset of the widely used MODBUS RTU (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 K_7 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_7) 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 four 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 (1 ÷ 254): MODBUS RTU reserves address 0 for broadcasting messagesand it is implemented in the K_7 series;

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

◊ Information 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.

4.1 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)

4.2 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

4.3 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

4.4 The exception reply

K_7 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

K_7 series adopts a subset of MODBUS RTU (JBUS) exception codes:

Error detected	**Error code**
Unknown function code	1
Invalid memory address	2
Invalid data field	3
Controller not ready	6

Note: Error code 6: The instrument sends an exception response with error code 6:
- Upon a request to read or write an address not available in the current configuration,
- When a read/write request arrives while the instrument is in the parameter display/programming phase.

5 DATA EXCHANGE

This section contains informations about data exchanged with K_7 series controllers concerning numerical and not numerical data, with their formats and limits.

5.1 Some definitions

5.1.1 Data formats

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 represent the value of a quantity (e.g.: the measured variable, the set point, etc.).

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

Both data type are encoded as integers and represented by word. A word consists of 2 bytes. The information is transferred using a word in which the first byte transmitted represents the most significant part.

The “2’s complement” format is used for the transmission of negative values.

Examples:

– The value 2046 (7FE in hexadecimal) is transmitted as 0x7, 0xFE;

– The value -1250 (2’s complement = FB1E in hexadecimal) is transmitted as 0xFB, 0x1E.

5.1.2 Decimal data

Due to the protocol characteristics, the decimal point cannot appear in the transmitted data. The attribution of the decimal point must therefore take place outside the communication protocol. For addresses that represent values with fixed decimals and established in advance, reference must be made to the technical specifications and/or the user manual. For those addresses instead that represent values with a variable number of decimals, the address of the parameter is specified in the relative table determines the number.

5.1.3 Writing addresses

The value sent by the master during a write session must be within the limits set for the corresponding register. Otherwise, the new value will be rejected and the previous value remains valid.

5.1.4 Performance

After receiving a valid request, an instrument of the Kube series prepares the response and sends it to the master station, according to the methods specified below:

Between the end of reception and the start of transmission, a minimum time of three characters is guaranteed to allow line switching.
An online silence time of 20 ms is necessary to recover anomalous conditions or incorrect messages: this means that the time between two consecutive characters of the same message must be less than 20 ms.

6 ADDRESS MAP

The K_7 family devices can operate in 2 different modes:

– Controller (PID or ON/OFF) of a physical quantity + speed controller for a 24 Vdc motor (FULL mode).

– Speed controller for a 24 Vdc motor (SPEd mode).

The selection of the operating mode is done by loading the default parameters.

If the **password -481** is used as the **password for loading the default parameters** via the keyboard or via the serial port, **the instrument will carry out both the control of the variable and the speed control and will make all the parameters available**.

If, on the other hand, the **password -418** is used, **the instrument masks all the parameters relating to the control of the variable, supplying only the subset relating to speed control**.

When the instrument is switched on, after the LED test, the instrument will display, for a few seconds, the selected mode (FULL or SPEd).

The following paragraphs list the configuration parameters according to the selected operating mode.

The devices of the K_7 family use only word addresses, divided as follows:

Initial address		Final address		Meaning
Hex	Dec	Hex	Dec	
0	0	35	53	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 instruments (before K_7 series): numeric values calculated and dinamically updated. Available in read and write operations
280	640	323	803	Configuration parameters: Numeric and symbolic values. Available in read and write operations
800	2048	82C	2092	Instrument identification parameters
2800	10240	28A3	10403	Repetition of the configuration parameters: Numeric and symbolic values. Available in read and write operations
CF08	53000	CF5E	53086	Instrument identification parameters common to all new devices. Read only.

6.1 Common Variables

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
0A	0	0	**Broadcast mode activation** 0x44BB = Broadcast function activation 0x55AA = Broadcast function deactivation	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	dp	r
2A	2	2	**Number of decimal digits 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 operates 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

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
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 ÷ 15 Reserved	0	r
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 ÷ 7 Reserved 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 Reserved bit 12 Measure status (0 = OK; when 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 Aknowledged	0	r/w
15A	F	15	**Control status** 0 Automatic 1 Manual 2 Stand-by	0	r/w
16A	10	16	**Remote temporary set point (from serial link)** **Range:** SPLL ÷ SPLH **Note:** The remote set point is not stored (charged 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 not stored (charged in RAM)	0	r/w
19A	13	19	**Default parameters loading** **-481** Command for loading FULL type factory default configuration (FULL) **-418** Command for loading SPEED type factory default configuration (SPEd)	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** **35** KR7 **36** KM7 **37** KX7	0	r
22A	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
23A	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

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
24A	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
25A	1D	29	**% of the current speed**	0	r
26A	31	49	**SPEED output start/stop command** **Range: 0** Stop; **1** Start.	0	r/w
27A	32	50	**SPEED output calibration phase from keyboard** **Range: 0** no; **1** wait; **2** ON; **3** END.	0	r
28A	33	51	**SPEED output calibration phase from serial command** **Range: 0** no; **1** wait; **2** ON; **3** END.	0	r/w
29A	34	52	**Active SPEED** **Range: 0** Sd.t1; **1** Sd.t2; **2** Sd.t3; **3** Sd.t4.	0	r
29A	35	53	**Instrument configuration type** **Range: 0** FULL (FULL); **1** SPEED (SPEd).	0	r

6.2 Group of variables compatible with the old Ascon Tecnologic instruments (before K_7 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 digits 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 ÷ 10000 (%)	2	r
5B	0204	516	**Power output of 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	**LBA status** 0 OFF 1 ON	0	r
11B	020E	526	**Overload alarm status** 0 OFF 1 ON	0	r
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 = nonE). This parameter is not stored (charged 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 = nonE). This parameter is not stored (charged 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 = nonE). This parameter is not stored (charged in RAM).	0	r/w
16B	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
17B	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
18B	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
19B	0245	581	**Timer status** 0 Not configured 1 Reset (stop) 2 Run 3 Hold 4 End (Read only)	0	r/w
20B	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
21B	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
22B	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
23B	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			
24B	24A	586	**Wattmeter:** The meaning of this parameter is defined by the Co.ty parameter setting. Co.ty 0ff 0 Co.ty 1/2 Total worked days; Co.ty 3/4 Total worked hours; Co.ty 5/6 Totalizer of control relay worked days; Co.ty 7/8 Totalizer of control relay worked hours.	0	r
25B	24B	587	**Duration of first program ramp** **Range:** 0 ÷ 9999 s	0	r
26B	24C	588	**Days counted with the controller Powered ON** **Range:** 0 ÷ 9999	0	r
27B	250	592	**Power output when the instrument is in manual mode** Range:-10000 ÷ 10000 (%)	2	r/w

6.3 Instrument identification parameters

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
Instrument identification					
1	800	2048	**Reserved**	0	r
...	...	...	**...**	0	r
8	807	2055	**Reserved**	0	r
Instrument Firmware revision number - ASCCII format Example: r4.35					
9	808	2056	**Instrument Firmware Revision - First part** E.g.: 0x7234 - ' r4'	0	r
10	809	2057	**Instrument Firmware Revision - Second part** E.g.: 0x3335 - '35'	0	r
Product code					
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:** 0x37 = '7' - KM7, KR7, KX7	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 0x4X = 'U' - 24 ÷ 240 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 – SPEED Output** **Range:** 0x53 = 'S' - PWM output to control a 24 Vdc 4A motor	0	r
18	811	2065	**Model Code – Output 1 type** **Range:** 0x2D = '-' - Not present 0x4D = 'M' – Servomotor command relay 0x4F = 'O' - SSR 0x52 = 'R' - Relay	0	r
19	812	2066	**Model Code – Output 2 type** **Range:** 0x2D = '-' - Not present 0x4D = 'M' – Servomotor command relay 0x4F = 'O' - SSR 0x52 = 'R' - Relay	0	r
20	813	2067	**Model Code – Output 3 type** **Range:** 0x44 = 'D' - Output 3 (VDC for SSR/Sensor Power Supply/Digital Input DI2)	0	r

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
21	814	2068	**Model Code – Serial communication type (KR7 only)** **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	**Reserved**	0	r
...	...	...	...	0	r
38	825	2085	**Reserved**	0	r
Serial number **Example: Serial number 1.237.422=0x12E1AE**					
39	826	2086	**Serial Number – First part (LL)** E.g.: 0x00AE	0	r
40	827	2087	**Serial Number – Second part (L)** E.g.: 0x00E1	0	r
41	828	2088	**Serial Number – Third part (H)** E.g.: 0x0012	0	r
42	829	2089	**Serial Number – Fourth part (HH)** E.g.: 0x0000	0	r
Calibration date **Example: 28 January 2016**					
43	82A	2090	**Calibration Date – Day** E.g.: 28	0	r
44	82B	2091	**Calibration Date – Month** E.g.: 1	0	r
45	82C	2092	**Calibration Date – Year** E.g.: 2016	0	r

6.4 Parameters setting for FULL (FULL) functioning mode: Addresses form 280 hex (640 dec) and 2800 hex (10240 dec)

6.4.1 inP GROUP - Inputs configuration parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
1	SEnS	280 2800	640 10240	**Input type** Model C (Pt100, Pt1000)	**0** TC J (-50 ÷ +1000°C/-58 ÷ +1832°F); **1** TC K (-50 ÷ +1370°C/-58 ÷ +2498°F); **2** TC S (-50 ÷ +1760°C/-58 ÷ +3200°F); **3** TC R (-50 ÷ +1760°C/-58 ÷ +3200°F); **4** TC T (-70 ÷ +400°C/-94 ÷ +752°F); **5** Exergen IRS J (-46 ÷ +785°C/-50 ÷ +1445°F); **6** Exergen IRS K (-46 ÷ +785°C/-50 ÷ +1445°F); **7** RTD Pt 100 (-200 ÷ +850°C/-328 ÷ +1562°F); **8** RTD Pt 1000 (-200 ÷ +500°C/-328 ÷ +932°F); **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
				Input type Model E (Ptc, Ntc)	TC J (-50 ÷ +1000°C/-58 ÷ +1832°F); TC K (-50 ÷ +1370°C/-58 ÷ +2498°F); TC S (-50 ÷ +1760°C/-58 ÷ +3200°F); TC R (-50 ÷ +1760°C/-58 ÷ +3200°F); TC T (-70 ÷ +400°C/-94 ÷ +752°F); Exergen IRS J (-46 ÷ +785°C/-50 ÷ +1445°F); Exergen IRS K (-46 ÷ +785°C/-50 ÷ +1445°F); PTC (-55 ÷ 150°C/-67 ÷ 302°F); NTC (-50 ÷ 110°C/-58 ÷ 230°F); **17** 0.60 0 ÷ 60 mV, **18** 12.60 12 ÷ 60 mV, **19** 0.20 0 ÷ 20 mA, **20** 4.20 4 ÷ 20 mA, **21** 0.5 0 ÷ 5 V, **22** 1.5 1 ÷ 5 V, **23** 0.10 0 ÷ 10 V, **24** 2.10 2 ÷ 10 V		
2	dP	281 2801	641 10241	**Decimal Point Position** **Decimal Point Position**	0 ÷ 3 (Linear inputs) 0 ÷ 1 (Analogue inputs: Temperature Sensors)	0	r/w
3	SSC	282 2802	642 10242	**Linear input scale start**	-1999 ÷ 9999 (E.U.)	dp	r/w
4	FSc	283 2803	643 10243	**Linear input full scale**	-1999 ÷ 9999 (E.U.)	dp	r/w
5	unit	284 2804	644 10244	**Engineering 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 1 ÷ 200 (seconds)	1	r/w
7	inE	286 2806	646 10246	**Sensor error used to enable the safety output value**	**0** our Over and under range **1** or Over range **2** ou Under range	0	r/w
8	oPE	287 2807	647 10247	**Safety output value (% of the output)**	-100 ÷ 100 %	0	r/w
9	i03F	288 2808	648 10248	**I/O 3 function**	**0** dG2c Voltage free digital input 2; **1** dG2U Voltage digital input 2; **2** on Trasmitter power supply; **3** out3 Output 3 (out3 digital output).	0	r/w
10	rEcS	289 2809	649 10249	**Recipe enable (temperature + speed)**	**0** no; **1** Yes.	0	r/w

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
11	d iF 1	28A 280A	650 10250	**Digital Input 1 function**	**0** oFF Not used, **1** AAc Alarm reset [status], **2** ASi Alarm acknowledge (ACK) [status], **3** hoLd Hold of the measured value [status], **4** Stby Stand by mode [status], **5** oPLo Manual mode [status], **6** hEco HEAt with SP1, CooL with SP2 [status], **7** Strt Timer RUN/Hold/Reset [transition], **8** t.run Timer Run [transition], **9** t.rES Timer Reset [transition], **10** t.r.h Timer Run/Hold [status], **11** t.r.r Timer Run/Reset [status], **12** t.r.r.b Timer Run/Reset with lock at count end, **13** P.run Program Start [transition]; **14** P.rES Program Reset [transition]; **15** P.r.h.t Program Hold [transition]; **16** P.r.h.S Program Run/Hold [status]; **17** P.r.r Program Run/Reset [status]; **18** Sdr.S SPEED/TIME run/stop [status]; **19** Sdr.t SPEED/TIME run/stop [transition]; **20** ch.SP Set Point sequential selection [transition]; **21** ch.Sd SPEED sequential selection [transition]; **22** SP14 Set Point binary selection, **23** Sd14 SPEED binary selection	0	r/w
12	d iF2	28B 280B	651 10251	**Digital Input 2 function**		0	r/w
13	d iA	28C 280C	652 10252	**Digital Inputs Action (DI2 only 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.	0	r/w

6.4.2 oUt GROUP - Outputs configuration parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
14	o 1F	28D 280D	653 10253	**Out 1 function**	**0** NonE Output not used **1** H.rEG Heating output, if cont = 3P heating (valve control): **Open** **2** c.rEG Cooling output, if cont = 3P cooling (valve control): **Open** **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 DI1 status **17** diF.2 The output repeats the DI2 status **18** on Out 1 always ON **19** riSP Inspection request		
15	o 1AL	28E 280E	654 10254	**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
16	o 1Ac	28F 280F	655 10255	**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
17	o2F	290 2810	656 10256	**Out 2 function**	See the values of [14] o1F parameter	0	r/w
18	o2AL	291 2811	657 10257	**Alarms linked up with the out 2**	See the values of [15] = o1AL parameter	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
19	o2Ac	292 2812	658 10258	**Out 2 action**	See the values of [16] o1Ac parameter	0	r/w
20	o3F	293 2813	659 10259	**Out 3 function**	See the values of [14] o1F parameter except options 16, 17, 18 e 19	0	r/w
21	o3AL	294 2814	660 10260	**Alarms linked up with the out 3**	See the values of [15] = o1AL parameter	0	r/w
22	o3Ac	295 2815	661 10261	**Out 3 action**	See the values of [16] o1Ac parameter	0	r/w

6.4.3 AL 1 GROUP - Alarm 1 configuration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
23	AL1t	296 2816	662 10262	**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
24	Ab1	297 2817	663 10263	**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
25	AL1L	298 2818	664 10264	**For High and low alarms, AL1L is the low limit of the AL1 threshold; For band alarm, AL1L is low alarm threshold**	-1999 ÷ AL1H (E.U.)	dp	r/w
26	AL1H	299 2819	665 10265	**For High and low alarms, AL1H is the high limit of the AL1 threshold; For band alarm, AL1H is high alarm threshold**	AL1L ÷ 9999 (E.U.)	dp	r/w
27	AL1	29A 281A	666 10266	**AL1 threshold**	AL1L ÷ AL1H (E.U.)	dp	r/w
28	HAL1	29B 281B	667 10267	**AL1 hysteresis**	1 ÷ 9999 (E.U.)	dp	r/w
29	AL1d	29C 281C	668 10268	**AL1 delay**	**0** oFF 1 ÷ 9999 (s)	0	r/w
30	AL1o	29D 281D	669 10269	**Alarm 1 enabling during Stand-by mode and out of range conditions**	**0** AL1 disabled during Stand by and out of range **1** AL1 enabled in stand by **2** AL1 enabled in out of range **3** AL1 enabled in stand by and over range	0	r/w

6.4.4 AL2 GROUP - Alarm 2 configuration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
31	AL2t	29E 281E	670 10270	**Alarm 2 type**	See the values of [23] AL1t parameter	0	r/w
32	Ab2	29F 281F	671 10271	**Alarm 2 function**	See the values of [24] Ab2 parameter	0	r/w
33	AL2L	2A0 2820	672 10272	**For High and low alarms, AL2L is the low limit of the AL2 threshold; For band alarm, AL2L is low alarm threshold**	-1999 ÷ AL2H (E.U.)	dp	r/w
34	AL2H	2A1 2821	673 10273	**For High and low alarms, AL2H is the high limit of the AL2 threshold; For band alarm, AL2H is high alarm threshold**	AL2L ÷ 9999 (E.U.)	dp	r/w
35	AL2	2A2 2822	674 10274	**AL2 threshold**	AL2L ÷ AL2H (E.U.)	dp	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
36	HAL2	2A3 2823	675 10275	**AL2 hysteresis**	See the values of [28] HAL1 parameter	dp	r/w
37	AL2d	2A4 2824	676 10276	**AL2 delay**	See the values of [29] AL1d parameter	0	r/w
38	AL2o	2A5 2825	677 10277	**Alarm 2 enabling during Stand-by mode and out of range conditions**	See the values of [30] AL1o parameter	0	r/w

6.4.5 3AL3 GROUP - Alarm 3 configuration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
39	AL3t	2A6 2826	678 10278	**Alarm 3 type**	See the values of [23] AL1t parameter	0	r/w
40	Ab3	2A7 2827	679 10279	**Alarm 3 function**	See the values of [24] Ab2 parameter	0	r/w
41	AL3L	2A8 2828	680 10280	**For High and low alarms, AL3L is the low limit of the AL3 threshold; For band alarm, AL3L is low alarm threshold**	-1999 ÷ AL3H (E.U.)	dp	r/w
42	AL3H	2A9 2829	681 10281	**For High and low alarms, AL3H is the high limit of the AL3 threshold; For band alarm, AL3H is high alarm threshold**	AL3L ÷ 9999 (E.U.)	dp	r/w
43	AL3	2AA 282A	682 10282	**AL3 threshold**	AL3L ÷ AL3H (E.U.)	dp	r/w
44	HAL3	2AB 282B	683 10283	**AL3 hysteresis**	See the values of [28] HAL1 parameter	dp	r/w
45	AL3d	2AC 282C	684 10284	**AL3 delay**	See the values of [29] AL1d parameter	0	r/w
46	AL3o	2AD 282D	685 10285	**Alarm 3 enabling during Stand-by mode and out of range conditions**	See the values of [30] AL1o parameter	0	r/w

6.4.6 3SPEd GROUP - SPEED output configuration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
47	SPdP	2AE 282E	686 10286	**Output behaviour at power ON**	**0** AS.Pr Resumes the value it had when it was turned OFF **1** OFF.A It restarts with speed 0 and waits for a command **2** OFF.b It restarts with speed 0 and waits for the measurement to enter the band		r/w
48	SPdb	2AF 282F	687 10287	**Speed output activation band**	**0** oFF 1 ÷ 9999 (E.U.)		r/w
49	SPdt	2B0 2830	688 10288	**Engineering unit used for speed**	**0** Perc **1** tinE **2** E.U.		r/w
50	SddF	2B1 2831	689 10289	**Speed decimal digits**	0 ÷ 3		r/w
51	SPdr	2B2 2832	690 10290	**Detected time/speed setting with 100% output**	If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	2 Sd.dF	r/w
52	nSPd	2B3 2833	691 10291	**Number of speeds used**	1 ÷ 4	0	r/w
53	Sdt 1	2B4 2834	692 10292	**Speed /time 1**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w
54	Sdt2	2B5 2835	693 10293	**Speed /time 2**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
55	SdE3	2B6 2836	694 10294	**Speed /time 3**	If Spd.t = Perc: 0 ÷ 100 (%)	0	r/w
					If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss)	2	
					If Spd.t = E.U.: 0 ÷ 9999 E.U.	Sd.dF	
56	SdE4	2B7 2837	695 10295	**Speed /time 4**	If Spd.t = Perc: 0 ÷ 100 (%)	0	r/w
					If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss)	2	
					If Spd.t = E.U.: 0 ÷ 9999 E.U.	Sd.dF	
57	ASdE	2B8 2838	696 10296	**Speed /time active**	1 ÷ 4	0	r/w
58	SdcA	2B9 2839	697 10297	**Minimum time Auto-calibration**	Yes No	0	r

6.4.7 LbA GROUP - Loop Break Alarm Parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
59	LbAt	2BA 283A	698 10298	**LBA time**	**0** oFF 1 ÷ 9999 (s)	0	
60	Lb5t	2BB 283B	699 10299	**ΔT used by LBA during Soft start**	**0** oFF 1 ÷ 9999 (E.U.)	dp	
61	LbAS	2BC 283C	700 10300	**ΔT used by LBA**	1 ÷ 9999 (E.U.)	dp	
62	LbcA	2BD 283D	701 10301	**Condition for LBA enabling**	**0** uP Active when Pout = 100% **1** dn Active when Pout = -100% **2** both Active in both cases	0	

6.4.8 rEG GROUP - Control Parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
63	cont	2BE 283E	702 10302	**Control type:** If configured at least one heating and one cooling output	**0** Pid PID (heat and/or) **1** nr Heat/Cool ON/OFF control with neutral zone	0	r/w
				Control type: If only heating or cooling outputs are configured and there is no 3-point valve	**0** Pid PID (heat and/or) **1** On.FA ON/OFF asymmetric hysteresis **2** On.FS ON/OFF symmetric hysteresis		
				Control type: If only heating or cooling outputs are configured and there is a 3-point valve	**0** Pid PID (heat and/or) **1** On.FA ON/OFF asymmetric hysteresis **2** On.FS ON/OFF symmetric hysteresis **3** 3Pt Servomotor control (available only when **Output 2** and **Output 3** have been ordered as "**M**")		
64	Auto	2BF7 283F	703 10303	**Autotuning selection**	-4 Oscillating autotune with restart after Soft start and Set point changes -3 Oscillating autotune with manual start -2 Oscillating tune with start at 1st power up only -1 Oscillating autotune with restart at all power ups 0 Not used 1 Fast auto tuning with restart at all power ups 2 Fast auto-tune with start 1st power up only 3 Fast auto-tune with manual start 4 Fast auto-tune with restart after Soft start and Set point changes 5 Auto-select auto-tune with restart at every power up 6 Auto-select auto-tune with start the first power up only 7 Auto-select auto-tune with manual start 8 Auto-select auto-tune with restart at set point changes	0	r/w
65	tunE	2C0 2840	704 10304	**Autotuning manual start** **Note:** r/w if autotuning with manual start, only r in all the other cases	**0** oFF Autotuning not active **1** on Autotuning active	0	r/w
66	HSEt	2C1 2841	705 10305	**Hysteresis of the ON/OFF control**	0 ÷ 9999 (E.U.)	dp	
67	cPdt	2C2 2842	706 10306	**Time for compressor protection**	**0** oFF 1 ÷ 9999 (s)	0	r/w
68	Pb	2C3 2843	707 10307	**Proportional band**	1 ÷ 9999 (E.U.)	dp	

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
69	t i	2C4 2844	708 10308	**Integral time**	**0** oFF 1 ÷ 9999 (s)	0	r/w
70	td	2C5 2845	709 10309	**Derivative time**	**0** oFF 1 ÷ 9999 (s)	0	r/w
71	Fuoc	2C6 2846	710 10310	**Fuzzy overshoot control**	0 ÷ 200	2	r/w
72	tcH	2C7 2847	711 10311	**Heating output cycle time**	10 ÷ 1300 (s)	1	r/w
73	rcG	2C8 2848	712 10312	**Power ratio between heating and cooling action**	1 ÷ 9999	2	r/w
74	tcc	2C9 2849	713 10313	**Cooling output cycle time**	1 ÷ 1300 (s)	1	r/w
75	rS	2CA 284A	714 10314	**Manual reset** (integral pre-load)	-1000 ÷ +1000 (%)	1	r/w
76	Str.t	2CB 284B	715 10315	**Servomotor stroke time**	5 ÷ 1000 seconds	0	r/w
77	db.S	2CC 284C	716 10316	**Servomotor dead band**	0 ÷ 100%	1	r/w
78	oP.L	2CD 284D	717 10317	**Minimum output power**	-100 ÷ oP.H (%)	0	r/w
79	oP.H	2CE 284E	718 10318	**Maximum output power**	oP.L ÷ 100 (%)	0	r/w
80	od	2CF 284F	719 10319	**Delay at power ON**	**0** oFF 1 ÷ 99.59 (hh.min)	0	r/w
81	St.P	2D0 2850	20 10320	**Maximum power output used during soft start**	-100 ÷ 100 (%)	0	r/w
82	SSt	2D1 2851	721 10321	**Soft start time**	**0** Function not used 001 ÷ 759 hh.mm 800 Soft start Always active	2	r/w
83	SS.tH	2D2 2852	722 10322	**Threshold for soft start disabling**	-2000 oFF -1999 ÷ 9999 (E.U.)	dp	r/w

6.4.9 SP GROUP - Set points parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
84	nSP	2D3 2853	723 10323	**Number of used set points**	1 ÷ 4	0	r/w
85	SPLL	2D4 2854	724 10324	**Minimum set point value**	From -1999 to SPHL	dp	r/w
86	SPHL	2D5 2855	725 10325	**Maximum set point value**	From SPLL to 9999	dp	r/w
87	SP	2D6 2856	726 10326	**Set point 1**	From SPLL to SPLH	dp	r/w
88	SP 2	2D7 2857	727 10327	**Set point 2**	From SPLL to SPLH	dp	r/w
89	SP 3	2D8 2858	728 10328	**Set point 3**	From SPLL to SPLH	dp	r/w
90	SP 4	2D9 2859	729 10329	**Set point 4**	From SPLL to SPLH	dp	r/w
91	ASP	2DA 285A	730 10330	**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				
92	SPrt	2DB 285B	731 10331	**Remote set point type**	**0** RS: 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
93	SPLr	2DC 285C	732 10332	**Local/remote set point selection**	**0** Loc: local **1** rEn: remote	0	r/w
94	SPu	2DD 285D	733 10333	**Rate of rise for POSITIVE set point change (ramp UP)**	0.01 ÷ 9999 Engineering units per minute 10000 inF: Ramp disabled (Step transfer)	2	r/w
95	SPd	2DE 285E	734 10334	**Rate of rise for NEGATIVE set point change (ramp DOWN)**	0.01 ÷ 9999 Engineering units per minute 10000 inF: Ramp disabled (Step transfer)	2	r/w

6.4.10 tim GROUP - Timer function parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
96	trF	2DF 285F	735 10335	**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
97	tru	2E0 28607	736 10356	**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
98	trt1	2E1 2801	737 10337	**Time 1**	When tr.u = 0: 1 ÷ 9959 (hh.mm)	2	r/w
					When tr.u = 1: 1 ÷ 9959 (mm.ss)		
					When tr.u = 2: 1 ÷ 9959 (tenth of seconds)	1	
99	trt2	2E2 2802	738 10338	**Time 2**	When tr.u = 0: From 0 (oFF) to 9959 (inF) (hh.mm)	2	r/w
					When tr.u = 1: From 0 (oFF) to 9959 (inF) (mm.ss)		
					When tr.u = 2: From 0000 (oFF) to 9959 (inF) (tenth of seconds)	1	
100	trSt	2E3 2803	739 10339	**Timer status**	**0** rES: Timer reset **1** run: Timer run **2** HoLd: Timer hold	0	r/w

6.4.11 PrG GROUP - Programmer function parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
101	PrF	2E4 2864	740 10340	**Program action at power up**	**0** nonE: Programmer not used **1** S.uP.d: Start at power up with 1st 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 1st step in stand-by	0	r/w
102	Pru	2E5 2865	741 10341	**Time unit of the soaks**	**0** hh.nn: Hours and minutes **1** nn.SS: Minutes and seconds	0	r/w
103	PrE	2E6 2866	742 10342	**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
104	PrEt	2E7 2867	743 10343	**Time of the end program indication**	0 oFF; 1 ÷ 9959 minutes and seconds inF Always ON.	2	r/w
105	Pr.S1	2E8 2868	744 10344	**Set point of the first soak**	From SPLL to SPHL -8000 Program End	dp	r/w
106	Pr.G1	2E9 2869	745 10345	**Gradient of the first ramp**	1 ÷ 9999 Engineering Unit/minute 100000 inF: Step transfer	1	r/w
107	Pr.t1	2EA 286A	746 10346	**Time of the 1st soak**	0 ÷ 9959 Time unit of the soaks	2	r/w
108	Pr.b1	2EB 286B	747 10347	**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				
109	PrE1	2EC 286C	748 10348	**Events of the 1st group**	0000 ÷ 1111 (0 = Event OFF, 1 = Event ON)	2	r/w
110	Pr52	2ED 286D	749 10349	**Set point of the 2nd soak**	From SPLL to SPHL -8000 Program End	dp	r/w
111	PrG2	2EE 286E	750 10350	**Gradient of the 2nd ramp**	1 ÷ 9999 Engineering Unit/minute 100000 inF: Step transfer	1	r/w
112	PrE2	2EF 286F	751 10351	**Time of the 2nd soak**	0 ÷ 9959 Time unit of the soaks	2	r/w
113	Prb2	2F0 2870	752 10352	**Wait band of the 2nd soak**	**0** oFF 1 ÷ 9999 (E.U.)	0	r/w
114	PrE2	2F1 2871	753 10353	**Events of the 2nd group**	0000 ÷ 1111 (0 = Event OFF, 1 = Event ON)	2	r/w
115	Pr53	2F2 2872	754 10354	**Set point of the 3rd soak**	From SPLL to SPHL -8000 Program End	dp	r/w
116	PrG3	2F3 2873	755 10355	**Gradient of the 3rd ramp**	1 ÷ 9999 Engineering Unit/minute 100000 inF: Step transfer	1	r/w
117	PrE3	2F4 2874	756 10356	**Time of the 3rd soak**	0 ÷ 9959 Time unit of the soaks	2	r/w
118	Prb3	2F5 2875	757 10357	**Wait band of the 3rd soak**	**0** oFF 1 ÷ 9999 (E.U.)	0	r/w
119	PrE3	2F6 28766	758 10358	**Events of the 3rd group**	0000 ÷ 1111 (0 = Event OFF, 1 = Event ON)	2	r/w
120	Pr54	2F7 2877	759 10359	**Set point of the 4th soak**	From SPLL to SPHL -8000 Program End	dp	r/w
121	PrG4	2F8 2878	760 10360	**Gradient of the 4th ramp**	1 ÷ 9999 Engineering Unit/minute 100000 inF: Step transfer	1	r/w
122	PrE4	2F9 2879	761 10361	**Time of the 4th soak**	0 ÷ 9959 Time unit of the soaks	2	r/w
123	Prb4	2FA 287A	762 10362	**Wait band of the 4th soak**	**0** oFF 1 ÷ 9999 (E.U.)	0	r/w
124	PrE4	2FB 287B	763 10363	**Events of the 4th group**	0000 ÷ 1111 (0 = Event OFF, 1 = Event ON)	2	r/w
125	Pr5t	2FC 287C	764 10364	**Program status**	**0** rES: Program reset **1** run: Program start **2** HoLd: Program hold	0	r/w

6.4.12 PAn GROUP - Operator HMI parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
126	PAS2	2FD 287D	765 10365	**Level 2 password (limited access level)**	oFF (Level 2 not protected by password) 1 ÷ 200	0	r/w
127	PAS3	2FE 287E	766 10366	**Level 3 password (complete configu-ration)**	3 ÷ 200	0	r/w
128	uSrb	2FF 287F	767 10367	**button function during RUN TIME**	**0** nonE: No function **1** Sd.St: RUN/STOP SPEED **2** SPD.S: Sequential SPEED selection **3** tunE: Auto-tune enabling. **4** oPLo: Instrument in manual mode **5** AAc: Alarm reset **6** ASi: Alarm acknowledge **7** chSP: Sequential set point selection **8** St.by: Stand by mode **9** Str.t: Timer run/hold/reset **10** P.run: Program run **11** P.rES: Program reset **12** P.r.H.r: Program run/hold/reset	0	r/w
129	HdSP	300 2880	768 10368	**Upper display man-agement**	**0** SPEd: Current SPEED value **1** Sd.nA: Selected SPEED **2** PV: Present value (current value of the measured variable)	0	r/w

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
130	L.dSP	301 2881	769 10369	**Display management**	**0** nonE: Standard display **1** SPEd: Current SPEED value **2** Sd.nA: Selected SPEED **3** Pou: Power output **4** SPF: Final set point **5** Spo: Operative set point **6** AL1: Alarm 1 threshold **7** AL2: Alarm 2 threshold **8** AL3: Alarm 3 threshold **9** Pr.tu: The soak elapsed time **10** Pr.td: Soak remaining time (count down) **11** P.t.tu: Program total elapsed time **12** P.t.td: Program remaining time (count down) **13** ti.uP: Timer elapsed time **14** ti.du: Timer remaining time (count down) **15** PErc: Percentage of output power during soft start **16** PoS: Servomotor valve position		r/w
131	d icL	302 2882	770 10370	**Display colour**	**0** The colour changes to point out the actual deviation (PV - SP) **1** Display red (fix) **2** Display green (fix) **3** Display orange (fix)		
132	AdE	303 2883	771 10371	**Deviation for display colour management**	1 ÷ 9999	dp	r/w
133	d iSt	304 2884	772 10372	**Display timeout**	**0** oFF: Display always ON 1 ÷ 9959 (mm.ss)	2	r/w
134	F iLd	305 2885	773 10373	**Filter on the displayed value**	**0** oFF: Filter disabled 1 ÷ 100	dp	r/w
135	bGF	306 2886	774 10374	**Bar graph Function (KX7 only)**	**0** nonE: Bargraph not lit **1** Po.h: Speed set for SPEED output **2** Pou: Output power **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 **9** PoS: Servomotor valve position	0	r/w
136	dSPu	307 2887	775 10375	**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
137	oPrE	308 2888	776 10376	**Operative modes enabling**	**0** ALL: All modes are selectable by oPEr parameter **1** Au.oP: Auto and manual modes are selectable by parameter oPEr **2** Au.Sb: Auto and Stand-by modes are selectable by parameter oPEr	0	r/w
138	oPEr	309 2889	777 10377	**Operative mode selection**	**3** Auto: Auto mode **4** oPLo: Manual mode **5** St.bY: Stand by mode	0	r/w

6.4.13 SErn GROUP - Serial link parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
139	Add	30A 288A	778 10378	**Instrument address**	**0** oFF: Serial port not used 1 ÷ 254	0	r/w
140	bAud	30B 288B	779 10379	**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

6.4.14 PCOn GROUP - Consumption parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
141	CotY	30C 288C	780 10380	**Measurement type**	**0** oFF: Not used **1** Total worked days **2** Total worked hours **3** Total worked days with threshold, the controller is forced in stand-by when Co.ty = [142] h.Job value **4** Total worked hours with threshold, the controller is forced in stand-by when Co.ty = [142] h.Job value **5** Totalizer of control relay worked days **6** Totalizer of control relay worked hours **7** Totalizer of control relay worked days with threshold, the controller is forced in stand-by when Co.ty = [142] h.Job value **8** Totalizer of control relay worked hours with threshold, the controller is forced in stand-by when Co.ty = [142] h.Job value	0	r/w
142	h.Job	30D 288D	781 10381	**Threshold of the working period**	**0** OFF: Threshold not used 1 ÷ 999 days (when CotY = 3 or 7) 1 ÷ 999 hours(when CotY = 4 or 8)	0	r/w
143	t.Job	30E 288E	777 10377	**Worked time** (not resettable)	1 ÷ 9999 days	0	r

6.4.15 PCAL GROUP - User calibration parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
144	AL.P	30F 288F	783 10383	**Adjust Low Point**	From -1999 to (AH.P - 10) (E.U.)	dp	r/w
145	AL.o	310 2890	784 10384	**Adjust Low Offset**	-300 ÷ +300 (E.U.)	dp	r/w
146	AH.P	311 2891	785 10385	**Adjust High Point**	From (AL.P + 10) ÷ 9999 (E.U.)	dp	r/w
147	AH.o	312 2892	786 10386	**Adjust High Offset**	-300 ÷ +300 (E.U.)	dp	r/w

6.5 Parameters setting for SPEED (SPEd) functioning mode: Addresses form 280 hex (640 dec) and 2800 hex (10240 dec)

6.5.1 P inP GROUP - Inputs configuration parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
9	IO3F	288 2808	648 10248	**I/O 3 function**	**0** dG2c Voltage free digital input 2; **1** dG2U Voltage digital input 2; **2** on Trasmitter power supply; **3** out3 Output 3 (out3 digital output).	0	r/w
11	diF1	28A 280A	650 10250	**Digital Input 1 function**	**0** oFF Not used, **1** Sdr.S SPEED/TIME run/stop [status]; **2** Sdr.t SPEED/TIME run/stop [transition]; **3** ch.Sd SPEED sequential selection [transition]; **4** Sd14 SPEED binary selection	0	r/w
12	diF2	28B 280B	651 10251	**Digital Input 2 function**		0	r/w
13	diA	28C 280C	652 10252	**Digital Inputs Action (DI2 only 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.	0	r/w

6.5.2 SPEd GROUP - SPEED output configuration parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
47	SPdP	2AE 282E	686 10286	**Output behaviour at power ON**	**0** AS.Pr Resumes the value it had when it was turned OFF **1** OFF.A It restarts with speed 0 and waits for a command		r/w
48	SPdb	2AF 282F	687 10287	**Speed output activation band**	**0** oFF 1 ÷ 9999 (E.U.)		r/w
49	SPdt	2B0 2830	688 10288	**Engineering unit used for speed**	**0** Perc **1** tinE **2** E.U.		r/w
50	SddF	2B1 2831	689 10289	**Speed decimal digits**	0 ÷ 3		r/w
51	SPdr	2B2 2832	690 10290	**Detected time/speed setting with 100% output**	If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	2 Sd.dF	r/w
52	nSPd	2B3 2833	691 10291	**Number of speeds used**	1 ÷ 4	0	r/w
53	Sdt 1	2B4 2834	692 10292	**Speed /time 1**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w
54	Sdt2	2B5 2835	693 10293	**Speed /time 2**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w
55	Sdt3	2B6 2836	694 10294	**Speed /time 3**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w
56	Sdt4	2B7 2837	695 10295	**Speed /time 4**	If Spd.t = Perc: 0 ÷ 100 (%) If Spd.t = tinE: 00.01 ÷ 99.59 (mm.ss) If Spd.t = E.U.: 0 ÷ 9999 E.U.	0 2 Sd.dF	r/w
57	ASdt	2B8 2838	696 10296	**Speed /time active**	1 ÷ 4	0	r/w
58	SdcA	2B9 2839	697 10297	**Minimum time Auto-calibration**	Yes No	0	r

6.5.3 PAn GROUP - Operator HMI parameters

no.	Param.	Address Hex	Address Dec	Description	Values	Dec. Point	r/w
126	PAS2	2FD 287D	765 10365	**Level 2 password (limited access level)**	oFF (Level 2 not protected by password) 1 ÷ 200	0	r/w
127	PAS3	2FE 287E	766 10366	**Level 3 password (complete configuration)**	3 ÷ 200	0	r/w
128	uSrb	2FF 287F	767 10367	**button function during RUN TIME**	**0** nonE: No function **1** Sd.St: RUN/STOP SPEED **2** SPD.S: Sequential SPEED selection	0	r/w
129	HdSP	300 2880	768 10368	**Upper display management**	**0** SPEd: Current SPEED value **1** Sd.nA: Selected SPEED	0	r/w
130	LdSP	301 2881	769 10369	**Display management**	**0** nonE: Standard display **1** SPEd: Current SPEED value **2** Sd.nA: Selected SPEED		r/w
131	d icL	302 2882	770 10370	**Display colour**	**0** Display red (fix) **1** Display green (fix) **2** Display orange (fix)		
133	d iSt	304 2884	772 10372	**Display timeout**	**0** oFF: Display always ON 1 ÷ 9959 (mm.ss)	2	r/w

6.5.4 SEr GROUP - Serial link parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
139	Add	30A 288A	778 10378	**Instrument address**	**0** oFF: Serial port not used 1 ÷ 254	0	r/w
140	bAud	30B 288B	779 10379	**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

6.5.5 COn GROUP - Consumption parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
141	CotY	30C 288C	780 10380	**Measurement type**	**0** oFF: Not used **1** Total worked days **2** Total worked hours	0	r/w
142	h.Job	30D 288D	781 10381	**Threshold of the working period**	**0** OFF: Threshold not used 1 ÷ 999 days (when CotY = 1) 1 ÷ 999 hours(when CotY = 2)	0	r/w
143	t.Job	30E 288E	777 10377	**Worked time** (not resettable)	1 ÷ 9999 days	0	r

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