Serial communication protocol
ModBUS® for KM3-L

this document is related to the firmware version 1.04

KUBE FAMILY COMMUNICATION PROTOCOL

INDEX

1 PREFACE

Tecnologic uses ModBUS® RTU communication protocol.

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

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

The ModBus protocol represent all data in hexadecimal format.

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

Every devices in a line must have different address.

The protocol allows one master only and up to 255 slaves

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

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

The transmission characteristics are usually programmable:

Device address: From 1 to 255.

Baud rate: bit per second.

byte format:

- 1 start bit;
- 8 data bitis;
- 2 final bits composed as follows:

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

The K30 allows to configure:

- address (1 – 254);
- Baud rate (1200 – 2400 – 9600 – 19200 – 38400).

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

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

2 PHYSICAL CONNECTION

2.1 Interface

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

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

2.2 Line

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

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

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

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

The line can be up to 1000 meters in length.

3 COMMUNICATION PROTOCOL

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

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

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

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

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

The communication process involves five types of messages:

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

Every a message contains four fields:

- ◊ Slave address (from 1 to 255): MODBUS RTU (JBUS) reserves address 0 for broadcasting messagesand it is implemented in the Kube series;
- ◊ Function code: contains 3, 6 or 16 for specified functions;
- ◊ Fnformation field: contains data like word addresses and word values as required by function in use;
- ◊ Control word: a cyclic redundancy check (CRC) performed with particular rules for CRC16.

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

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

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

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

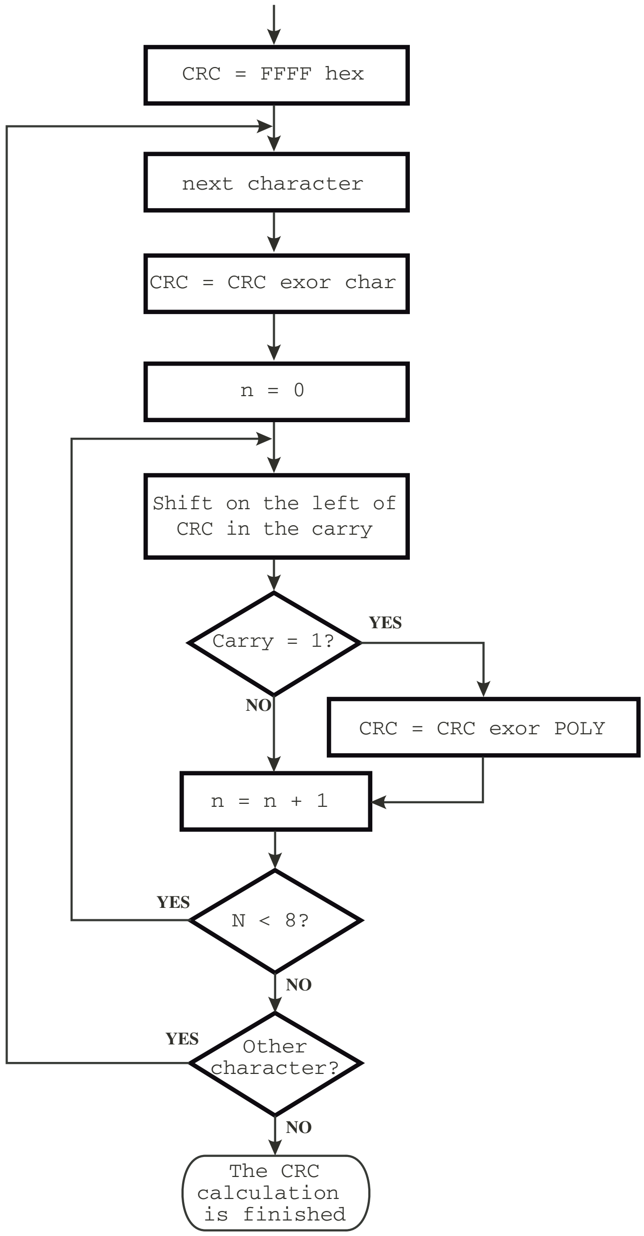
Every message, sent or received, has in the two last characters the CRC check word.

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.

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

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

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

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

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

4 DATA EXCHANGE

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

4.1 Some definitions

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

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

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

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

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

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

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

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

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

4.2 Memory zones

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

The memory map has three zones:

◊ Varaibles,

◊ Parameters,

◊ Instrument identification code.

Following parameters explore the characteristics of each zone.

4.3 Variables zones

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

4.4 Most important changes

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

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

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

These are available data:

5 ADDRESS MAP

The instrument use only words:

Initial address		Final address		Mining
Hex	Dec	Hex	Dec	
1	1	1D	29	Numeric values calculated and dinamically updated. Available in read and write operations
200	512	250	592	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
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	Ref. no.			
1A	1	1	40002	**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	40003	**Number of decimal figures of the measured value**	0	r
3A	3	3	40004	**set point**	dP	r/w
4A	4	4	40005	**Exceeded status** 0 = Exceeded is OFF 1 = Exceeded is ON	0	r
5A	5	5	40006	**All alarms status** bit 0 = Alarm 1 status bit 1 = Alarm 2 status bit 2 = Exceeded status bit 3 = Power failure indication bit 4 = Generic error bit 5 = Overload out 4 bit 6 to 15 = Reserved	0	r
6A	6	6	40007	**Physical output status** bit 0 = Out 1 status bit 1 = Out 2 status bit 2 = Out 3 status bit 3 = Out 4 status bit 4÷15 = reserved Note: this parameter shows the physical output status as follows: 0 = relay de-energized (for out 1 = output not used) 1 = relay energized (output used)	0	r
7A	7	7	40008	**Alarm 1 status** 0 = OFF 1 = ON	0	r
8A	8	8	40009	**Alarm 2 status** 0 = OFF 1 = ON	0	r
9A	9	9	40010	**Overload alarm status** 0 = OFF 1 = ON	0	r
10A	A	10	40011	**Out 1 status** 0 = not used 1 = in use	0	r
11A	B	11	400412	**Out 2 status** 0 = OFF 1 = ON	0	r

no.	Address			Description	Dec. Point	r/w
	Hex	Dec	Ref. no.			
12A	C	12	40013	**Status/remote command of the out 3** 0 = OFF 1 = ON Note: writable only when o3F = nonE	0	r/w
13A	D	13	40014	**Status/remote command of the out 4** 0 = OFF 1 = ON Note: writable only when o4F = nonE	0	r/w
14A	E	14	40015	**Digital input 1 status** 0 = OFF 1 = ON	0	r
15A	F	15	40016	**Reset of the "power failure" indication** 0 = standard 1 = reset	0	r/w
16A	10	16	40017	**Load default parameter** 481 = value to start the default parameter loading action	0	r/w
17A	11	17	40018	**Identification code of the parameter table** range: 0 to 65535	0	r
18A	12	18	40019	**Instrument identification** examples 20 = KM1/KM3 25 = KX1/KX3 26 = KR1/KR3	0	r
19A	13	19	40020	**Value to be retransmitted by analogue output when the output is not used** range: Ao1L to Ao1H	0	r/w
20A	14	20	40021	**Analog output value** from 0.00 to 100.00 % of the electric output selected e.g. output type: 4-20 mA Output = 12 mA this parameter will shows 50.00 %	0	r

5.2 Common variables (continued)

no.	Address			Description	Dec. Point	r/w
	Hex	Dec	Ref. no.			
1B	0200	512	40513	**PV : Measured value** As address 1	dP	r
2B	0201	513	40514	**Number of decimal figure of the measured value** As address 2	0	r
3B	0202	514	40515	**Set Point**	dP	r/W
4B	0203	515	40516	**EXCEEDED STATUS** 0 = OFF 1 = ON	0	r

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

5.3.1 inP GROUP - Main and auxiliary input configuration

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
1	SEnS	280 2800	640 10240	40641	**Input Type**	0 = J = TC J, 1 = crAL = TC K, 2 = S = TC S, 3 = r = TC R, 4 = t = TC T, 5 = n = TC N, 6 = Pt1 = RTD Pt100, 7 = Pt10 = RTD Pt1000, 8 = 0.60 = 0 to 60 mV, 9 = 12.60 = 12 to 60 mV, 10 = 0.20 = 0 to 20 mA, 11 = 4.20 = 4 to 20 mA, 12 = 0.5 = 0 to 5 V, 13 = 1.5 = 1 to 5 V, 14 = 0.10 = 0 to 10 V, 15 = 2.10 = 2 to 10 V	0	r/W
2	dp	281 2801	641 10241	40642	**Decimal Point Position** (linear inputs) Decimal Point Position (different than linear inputs)	0 to 3 0/1	0	r/w
3	SSC	282 2802	642 10242	40643	**Initial scale read-out for linear inputs**	-1999 to 9999	dP	r/w
4	FSc	283 2803	643 10243	40644	**Full Scale Readout for linear inputs**	-1999 to 9999	dP	r/w
5	unit	284 2804	644 10244	40645	**Engineering unit**	0 = C = °C 1 = F = °F	0	r/w
6	Fil	285 2805	645 10245	40646	**Digital filter on the measured value** **Note:** This filter affects the control action, the PV retransmission and the alarms action.	0 (OFF) to 200 (in seconds)	1	r/w
7	dS	286 2806	646 10246	40647	**Measuring input bias**	From -100 to 100 % off the input spen	0	r/w
8	di.A	287 2807	647 10247	40648	Digital input action	0 = direct 1 = reverse	0	r/w

5.3.2 Out group

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
9	O1.t	288 2808	648 10248	40649	Output 1 type (when Out 1 is present)	0 = 0-20 = 0 to 20 mA 1 = 4-20 = 4 to 20 mA 2 = 0-10 = 0 to 10 V 3 = 2-10 = 2 to 10 V	0	r/w
10	o1F	289 2809	649 10249	40650	Out 1 function (when Out 1 is present)	0 = NonE = Output not used 1 = r.inP = Measure retransmission 2 = r.Err = Error (sp - PV) retransmission 3 = r.SP = Set point retransmission 4 = r.SEr = Serial value retransmission	0	r/w
11	Ao1L	28A 280A	650 10250	40651	Initial scale value of the analog retransmission (when Out 1 is present)	-1999 ... Ao1H	dp	r/w
12	Ao1H	28B 280B	651 10251	40652	Full scale value of the analog retransmission (when Out 1 is an analog output)	Ao1L ... 9999	dp	r/w
13	o3F	28C 280C	652 10252	40653	Out 3 function	0 = Not used 1 = Alarm output 2 = Out-of-range or burn out indicator; 3 = Power failure indicator; 4 = Out-of-range, Burnout and Power failure indicator;	0	r/w
14	o3Ac	28D 280D	653 10253	40654	Alarms linked up with the out 3	+ 1 = Alarm 1 + 2 = Alarm 2 + 4 = Sensor break + 8 = Overload Out4	0	r/w
15	o3Ac	28E 280E	654 10254	40655	Out 3 action	0 = direct 1 = reverse	0	r/w
16	o4F	28F 280F	655 10255	40656	Out 4 function	0 = Not used 1 = Alarm output 2 = Out-of-range or burn out indicator; 3 = Power failure indicator; 4 = Out-of-range, Burnout and Power failure indicator; 5 = Output ever ON	0	r/w
17	o4AL	290 2810	656 10256	40657	Alarms linked up with the out 3	+ 1 = Alarm 1 + 2 = Alarm 2 + 4 = Sensor break + 8 = Overload Out4	0	r/w
18	o4AC	291 2811	657 10257	40658	Out 4 action	0 = direct 1 = reverse	0	r/w

5.3.3 AL1 group

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
19	AL1t	292 2812	658 10258	40659	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
20	Ab1	293 2813	659 10259	40660	Alarm 1 function	0 to 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

no.	Param.	Address Hex	Address Dec	Address Ref. no.	Description	Values	Dec. Point	r/w
21	AL1L	294 2814	660 10260	40661	- 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
22	AL1H	295 2815	661 10261	40662	- 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
23	AL1	296 2816	662 10262	40663	AL1 threshold	From AL1L to AL1H (E.U.)	dP	r/w
24	HAL1	297 2817	663 10263	40664	AL1 hysteresis	1 to 9999 (E.U.)	dP	r/w
25	AL1d	298 2818	664 10264	40665	AL1 delay	From 0 (oFF) to 9999 (s)	0	r/w

5.3.4 AL2 group

no.	Param.	Address Hex	Address Dec	Address Ref. no.	Description	Values	Dec. Point	r/w
26	AL2t	299 2819	665 10265	40666	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
27	Ab2	29A 281A	666 10266	40667	Alarm 2 function	0 to 15 +1 = Not active at power up +2 = Relative alarm not active at set point change	0	r/w
28	AL2L	29B 281B	667 10267	40668	- 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
29	AL2H	29C 281C	668 10268	40669	- 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
30	AL2	29D 281D	669 10269	40670	AL2 threshold	From AL2L to AL2H (E.U.)	dP	r/w
31	HAL2	29E 281E	670 10270	40671	AL2 hysteresis	1 to 9999 (E.U.)	dP	r/w
32	AL2d	29F 281F	671 10271	40672	AL2 delay	From 0 (oFF) to 9999 (s)	0	r/w

5.3.5 rEG group - Control Parameters

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
33	Hi.Lo	2A0 2820	672 10272	40673	**Control type**	0 = Hi > High limiter 1 = Lo > low limiter	0	r/w
34	r.md	2A1 2821	673 10273	40674	Restart mode	0 = limit output is ON in any case 1 = Limit output is OFF at power on when PV doesn't exceed SP.	0	r/w
35	HYS	2A2 2822	674 10274	40675	limit output hysteresis	0 to 100 % of the input span	0	r/w
36	oP.SL	2A3 2823	675 10275	40676	Operating display selection.	0 = PV (upper display) and SP (lower display) 1 = SP only (lower display)	0	r/w
37	SPLL	2A4 2824	676 10276	40677	Minimum set point value	-1999 to SPHL (E.U.)	dP	r/w
38	SPHL	2A5 2825	677 10277	40678	Time for compressor protection	From 0 (oFF) to 9999 (s)	0	r/w
39	SP	2A6 2826	678 10278	40679	Set point limit	SPLL to SPHL	dP	r/w
40	diS	2A7 2827	679 10279	40680	the way of confirming operation	but = by keyboard di = by digital input	0	r/w
41	tim	2A8 2828	680 10280	40681	time duration of the last exceeded periode.	00.00 to 99.99 (HH.mm)	2	r
42	Hi	2A9 2829	681 10281	40682	maximum measured value	E.U.	dP	r
43	Lo	2AA 282A	682 10282	40683	minimum measured value	E.U.	dP	r

5.3.6 PAn group - Operator HMI parameters

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
44	PAS2	2AB 282B	683 10283	40684	Level 2 password	oFF (Level 2 not protected by password) 1 to 200	0	r/w
45	PAS3	2AC 282C	684 10284	40685	Level 3 password (complete configuration level)	3 to 200	0	r/w
46	di.CL	2AD 282D	685 10285	40686	Display colour	0 = the display colour is used to show the Exceed condition. 1 = fixed red display 2 = fixed green display 3 = fixed amber display	0	r/w
47	diS.t	2AE 282E	686 10286	40687	Display Time-out	0 ÷ 99.59 (mm.ss)	2	r/w

5.3.7 Ser group - Serial link parameters

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
48	Add	2AF 282F	687 10287	40688	Instrument address	0 (oFF) to 254	0	r/w
49	bAud	2B0 2830	688 10288	40689	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

5.3.8 CAI group - User calibration parameters

no.	Param.	Address			Description	Values	Dec. Point	r/w
		Hex	Dec	Ref. no.				
51	A.L.P	2B1 2831	689 10289	40690	Adjust Low Point	-1999 to (A.H.P - 10)(E.U.)	dP	r/w
52	A.L.o	2B2 2832	690 10290	40691	Adjust Low Offset	-300 to +300 (E.U.)	dP	r/w
53	A.H.P	2B3 2833	691 10291	40692	Adjust High Point	From (A.L.P + 10) to 9999 (E.U.)	dP	r/w
54	A.H.o	2B4 2834	692 1092	40693	Adjust High Offset	-300 to +300 (E.U.)	dP	r/w