Serial communication protocol
ModBUS® for KX6 controllers

KX6 CONTROLLERS COMMUNICATION PROTOCOL

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1 PREFACE

Ascon Tecnologic uses ModBUS® RTU communication protocol a royalty free protocol, easy to be implemented. For ModBus RTU a vast literature is available also in internet.

The ModBus protocol represent all data in hexadecimal format.

All communication strings finish with a check sum type CRC (cyclic redundancy check). Every devices on a line must have different address. The protocol allows only one master and up to 255 slaves

Only the Master unit can start the transmission, it sends the address of the calling unit and the command must be executed. Only the unit having the correct address answers 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 KX6 controller allows to configure:

– Address (1... 254);
– Baud rate (1200/2400/9600/19200 or 38400).

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

This document is intended to describe the KX6 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

KX6 controllers are provided with an 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 KX6s must to be carried on in parallel, i.e. all “**A**” terminals have to be connected between them so as “**B**” terminals.

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

Adopted baud rates range between 1200... 38400 baud, that is very satisfactory for application speed, yet very slow for RS485 interface. This fact allows the line wiring 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 KX6 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 KX6 Kube serie 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 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)

All messages contain four fields:

◊ Slave address (from 1 to 255): MODBUS RTU (JBUS) reserves address 0 for broadcasting messages and it is implemented in the KX6 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.

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” field the values of the requested registers are presented in word format [2 byte]: the first byte represents the MSB (Most Significant Byte) while the second byte represents 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 replays 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

KX6 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

KX6 controllers 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)

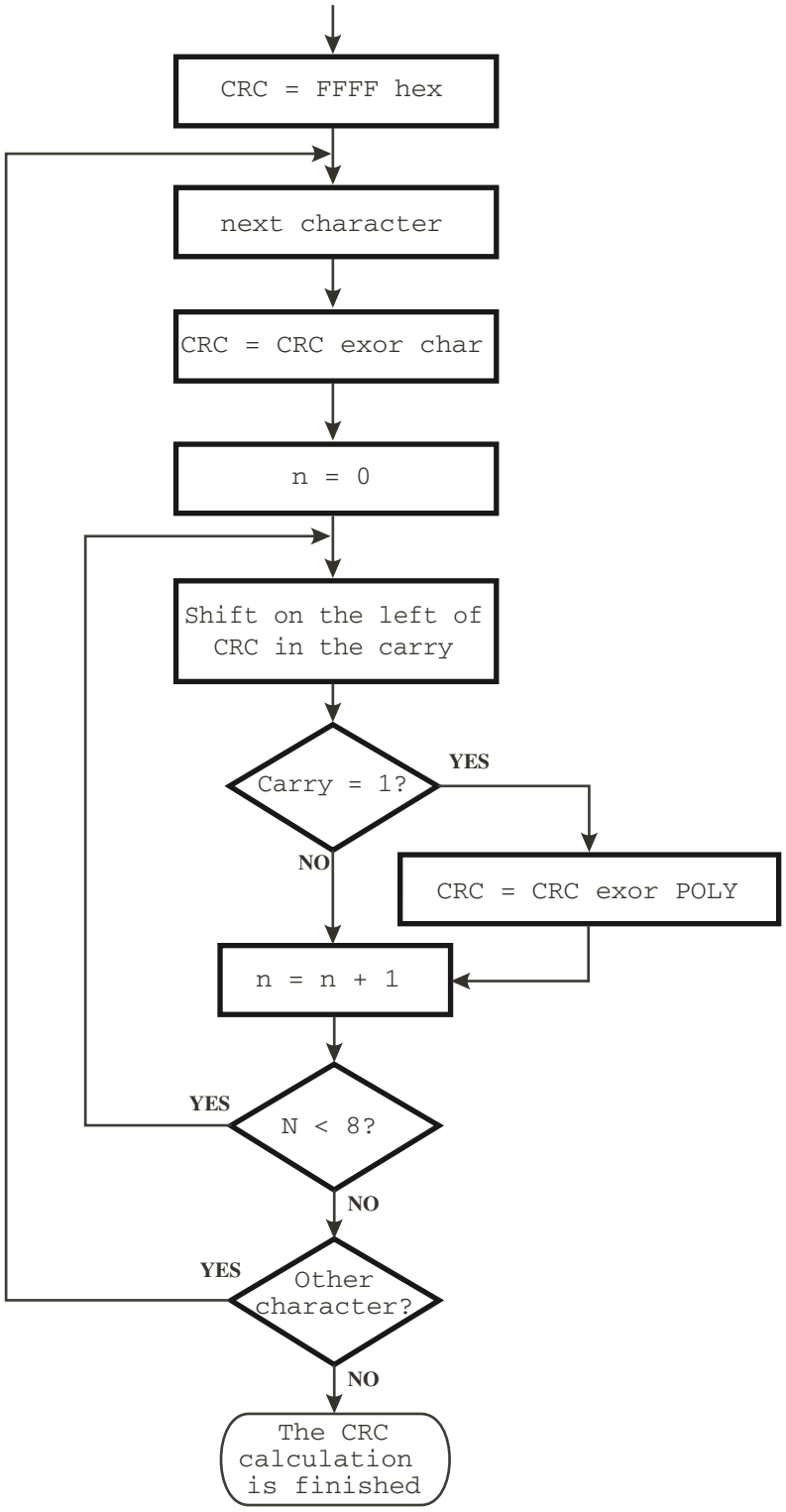
CRC is a check word that permits to verify the integrity of a message. Every message, sent or received, has in the two last characters the CRC check word.

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, KX6 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 KX6 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 KX6 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 continues 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 operates as follows:

- **B.1)** If you write a value within parameter range, the instrument accepts it; the new value is stored and the instrument sends back the standard answer.
- **B.2)** If you try to write a value OUT of parameter range, the instrument refuses the new value; the new value is NOT stored and the instrument sends an exception message to the master.

The available data follow.

5 ADDRESS MAP

All KX6 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
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 ÷ 8 = Reserved bit 9 = LBA status bit 10 = Power feilure indicator bit 11 = Generic error bit 12 = Reserved bit 13 = Potentiometer broken alarm bit 14 ÷ 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 ÷ 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 = Reserved bit 6 = Reserved bit 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 = Program running bit 12 = Measure status (0 = OK while 1 = error). bit 13 = potentiometer auto calibration running bit 14 ÷ 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 = Factory Default parameter loading -581 = User Default parameter loading -681 = User Default parameter Store	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 protocol.	0	r
21A	15	21	**Instrument identification code** 30 = KX6	0	r
22A	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/w
23A	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/w
24A	20	32	**Valve position** **Range:** 0... 100% **Notes: 1.** When the potentiometer is not used or it is broken, this value shows the calculated position. **2.** When servomotor control is not programmed, this location will send 10003	0	r
25A	21	33	Reserved	0	r
26A	22	34	**Potentiometer measure status** **Range:** 0 = Measure OK or potentiometer not used; 1 = Error detected.	0	r

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

no.	Address		Description	Dec. Point	r/w
	Hex	Dec			
1B	0200	512	**PV : Measured value** As address 1	dP	r
2B	0201	513	**Number of decimal figure of the measured value** As address 2	0	r
3B	0202	514	**Power output** As 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	0208	520	**Operative set point** As address 3	DP	r
9B	020A	522	**LBA status** 0 = OFF 1 = ON	0	r
10B	020F	527	**Controller status** 0 = Stand-by 1 = Auto 2 = Tuning 3 = Manual	0	r
11B	0224	548	**Status of the Output 1** 0 = OFF 1 = ON	0	r/w
12B	0225	549	**Status of the Output 2** 0 = OFF 1 = ON	0	r/w
13B	0226	550	**Status of the Output 3** 0 = OFF 1 = ON	0	r/w
14B	0227	551	**Status/remote control of the Output 4** 0 = OFF 1 = ON	0	r/w
15B	0240	576	**Digital input 1 status** 0 = OFF 1 = ON **Note:** Digital input 1status can be read from the serial port even if the input is not used by the controller	0	r/w
16B	0241	577	**Digital input 2 status** 0 = OFF 1 = ON **Note:** Digital input 2 status can be read from the serial port even if the input is not used by the controller	0	r/w
17B	250	592	**Power output when the instrument is in manual mode** Range:-10000 ÷ 10000 (%)	2	r/w

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

5.3.1 inP GROUP - Main and auxiliary input configuration

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
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 = 0.20 = 0... 20 mA, 6 = 4.20 = 4... 20 mA, 7 = 0.60 = 0... 60 mV, 8 = 12.60 = 12... 60 mV.	0	r/W
2	dp	281 2801	641 10241	Decimal Point Position (linear inputs) Decimal Point Position (different than linear inputs)	0... 3 0/1	0	r/w
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	diF1	288 2808	648 10248	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 = SP1 - SP2 selection,	0	r/w
10	diF2	289 2809	649 10249	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 = SP1 - SP2 selection,	0	r/w
11	di.A	28A 290A	650 10249	Digital inputs action	0 = Dig. input 1 direct, dig. input 2 direct 1 = Dig. input 1 REVERS, dig. input 2 direct 2 = Dig. input 1 direct, dig. input 2 REVERS 3 = Dig. input 1 REVERS, dig. input 2 REVERS	0	r/w

5.3.2 Out group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
12	o1t	28B 280B	651 10251	Output 1 type (when Out 1 is an analogue output)	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
13	o1F	28C 280C	652 10252	Out 1 function	0 = NonE = Output not used 1 = H.rEG = Heating output 2 = c.rEG = Cooling output	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
14	o2F	28D 280D	653 10253	Out 2 function	0 = NonE = Output not used 1 = H.rEG = Heating output 2 = c.rEG = Cooling output	0	r/w
15	o3AL	28E 280E	654 10254	Alarms linked up with the out 3	From 1 to 31 +1 > Alarm 1 +2 > Alarm 2 +4 > Loop break alarm +8 > Sensor break +16 > potentiometer break	dp	r/w
16	o3Ac	28F 280F	655 10255	Out 3 action	0 = Direct 1 = Reverse 2 = Direct action with reverse LED 3 = Revers action with reverse LED	0	r/w
17	o4AL	290 2810	656 10256	Alarms linked up with the out 4	From 1 to 31 +1 > Alarm 1 +2 > Alarm 2 +4 > Loop break alarm +8 > Sensor break +16 > Potentiometer break	0	r/w
18	o3Ac	291 2811	657 10257	Out 4 action	0 = Direct 1 = Reverse 2 = Direct action with reverse LED 3 = Revers action with reverse LED	0	r/w

5.3.3 AL1 group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
19	AL1t	292 2812	658 10258	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	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
21	AL1L	294 2814	660 10260	- 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	- 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	AL1 threshold	From AL1L to AL1H (E.U.)	dP	r/w
24	HAL1	297 2817	663 10263	AL1 hysteresis	1... 9999 (E.U.)	dP	r/w
25	AL1d	298 2818	664 10264	AL1 delay	From 0 (oFF) to 9999 (s)	0	r/w
26	AL1o	299 2819	665 10265	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 out of range condition	0	r/w

5.3.4 AL2 group

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
27	AL2t	29A 281A	666 10266	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
28	Ab2	29B 281B	667 10267	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
29	AL2L	29C 281C	668 10268	- 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
30	AL2H	29D 281D	669 10269	- 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
31	AL2	29E 281E	670 10270	AL2 threshold	From AL2L to AL2H (E.U.)	dP	r/w
32	HAL2	29F 281F	671 10271	AL2 hysteresis	1... 9999 (E.U.)	dP	r/w
33	AL2d	2A0 2820	672 10272	AL2 delay	From 0 (oFF) to 9999 (s)	0	r/w
34	AL2o	2A1 2821	673 10273	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

5.3.5 LBA group - Loop Break Alarm Parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
35	LbAt	2A2 2822	674 10274	LBA time	From 0 (oFF) to 9999 (s)	0	
36	LbSt	2A3 2823	675 10275	Delta measure used by LBA during Soft start	From 0 (oFF) to 9999 (E.U.)	dP	
37	LbAS	2A4 2824	676 10276	Delta measure used by LBA	1...9999 (E.U.)	dP	
38	LbcA	2A5 2825	677 10277	Condition for LBA enabling	0 = uP = Active when Pout = 100% 1 = dn = Active when Pout = -100% 2 = both = Active in both cases	0	

5.3.6 rEG group - Control Parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
39	cont	2A6 2826	678 10278	Control type when one Heat **and** one Cool output are programmed	0 = Pid = PID (heat and/or) 1 = nr = Heat/Cool ON/OFF control with neutral zone	0	r/w
				Control type when one Heat **or** one Cool output are programmed	0 = Pid = PID (heat and/or) 1 = On.FA = ON/OFF asymmetric hysteresis 2 = On.FS = ON/OFF symmetric hysteresis		
				Control type when one Heat **or** one Cool output are programmed and the valve control is present.	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 "**MM**")		
40	Auto	2A7 2827	679 10279	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
41	tunE	2A8 2828	680 10280	Manual start of the Autotuning	0 = oFF = Autotuning Not active 1 = on = Autotuning Active	0	r/w
42	HSEt	2A9 2829	681 10281	Hysteresis of the ON/OFF control	0... 9999 (E.U.)	dP	
43	Pb	2AA 282A	682 10282	Proportional band	1... 9999 (E.U.)	dP	
44	ti	2AB 282B	683 10283	Integral time	From 0 (oFF) to 9999 (s)	0	r/w
45	td	2AC 282C	684 10284	Derivative time	From 0 (oFF) to 9999 (s)	0	r/w
46	Fuoc	2AD 282D	685 10285	Fuzzy overshoot control	0... 200	2	r/w
47	tcH	2AE 282E	686 10286	Heating output cycle time	10... 1300 (s)	1	r/w
48	rcG	2AF 282F	687 10287	Power ratio between heating and cooling action	1... 9999	2	r/w
49	tcc	2B0 2830	688 10288	Cooling output cycle time	1... 1300 (s)	1	r/w
50	rS	2B1 2831	689 10289	Manual reset (Integral pre-load)	-1000... +1000 (%)	1	r/w
51	Str.t	2B2 2832	690 10290	Servomotor stroke time	5...1000 seconds	0	r/w
52	db.S	2B3 2833	691 10291	Servomotor dead band	0...100%	1	r/w
53	oP.L	2B4 2834	692 10292	Minimum power output	From -100 to OP.H (%)	2	r/w
54	oP.H	2B5 2835	693 10293	Maximum power output	From OP.L to 100 (%)	2	r/w
55	St.P	2B6 2836	694 10294	Maximum power output used during soft start	-100... 100 (%)	0	r/w

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
56	SSt	2B7 2837	695 10295	Soft start time	- 0 (oFF)... 800 = inF (h.mm)	2	r/w
57	SS.tH	2B8 2838	696 10296	Threshold for soft start disabling	-2000 = (oFF)... 9999 (E.U.)	dP	r/w
58	Pot	2B9 2839	697 10297	Potentiometer function	0 = nonE > Not used 1 = Pot.o > control valve with potentiometer used for indication only (open loop) 2 = Pot.c > control valve with potentiometer used as feedback (closed loop)	dP	r/w
59	P.cAL	2BA 283A	698 10298	Automatic potentiometer calibration	0 = no > No action 1 = YES > start the automatic potentiometer calibration procedure.	dP	r
60	PoSi	2EB 286B	747 10347	Valve positioning at power up	0 = no > No action 1 = oPEn > at all power up the instruemnt force the “open” relay for a time equal to the programmed stroke time (position = 100%). 2 = cLoS > at all power up the instruemnt force the “close” relay for a time equal to the programmed stroke time (position equal to 0%).	dP	r/w

5.3.7 SP group - Set point parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
61	nSP	2BB 283B	699 10299	Number of used set points	1... 4	0	r/w
62	SPLL	2BC 283C	700 10300	Minimum set point value	From -1999 to SPHL	dP	r/w
63	SPHL	2BD 283D	701 10301	Maximum set point value	From SPLL to 9999	dP	r/w
64	SP	2BE 283E	702 10302	Set point 1	From SPLL to SPLH	dP	r/w
65	SP 2	2BF 283F	703 10303	Set point 2	From SPLL to SPLH	dP	r/w
66	SP 3	2C0 2840	704 10304	Set point 3	From SPLL to SPLH	dP	r/w
67	SP 4	2C1 2841	705 10305	Set point 4	From SPLL to SPLH	dP	r/w
68	A.SP	2C2 2842	706 10306	Selection of the active set point	0 = SP 1 = SP 2 2 = SP 3 3 = SP 4	0	r/w
69	SP.rt	2C3 2843	707 10307	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
70	SPLr	2C4 2844	708 10308	Local/remote set point selection	0 = Loc = local 1 = rEn = remote	0	r/w
71	SP.u	2C5 2845	709 10309	Rate of rise for **POSITIVE** set point change (ramp UP)	0.01... 99.99 (inF) Eng. units per minute	2	r/w
72	SP.d	2C6 2846	710 10310	Rate of rise for **NEGATIVE** set point change (ramp DOWN)	0.01... 99.99 (inF) Eng. units per minute	2	r/w

5.3.8 PAn group - Operator HMI parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
73	PAS2	2C7 2847	711 10311	Level 2 password (limited access level)	- oFF (Level 2 not protected by password) - 1... 200	0	r/w
74	PAS3	2C8 2848	712 10312	Level 3 password (complete configuration level)	3... 200	0	r/w
75	uSrb	2C9 2849	713 10313	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 = 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. 6 = SP1.2 > SP1 - SP2 selection	0	r/w
76	diSP	2CA 284A	714 10314	Display management	0 = nonE = Standard display 1 = SPF = Final set point 2 = Spo = Operative set point 3 = AL1 = Alarm 1 threshold 4 = AL2 = Alarm 2 threshold 5 = Po = Power output.		r/w
77	di.cL	2CB 284B	715 10315	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)		
78	AdE	2CC 284C	716 10316	Deviation for display colour management	1... 9999	Dp	r/w
79	di.St	2CD 284D	717 10317	Display Timeout	0 = oFF (display always ON)... 9959 (mm.ss)	2	r/w
80	FiLd	2CE 284E	718 10318	Filter on the displayed value	0 = oFF (filter disabled)... 100	Dp	r/w
81	dSPu	2CF 284F	719 10319	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
82	oPr.E	2D0 2850	720 10320	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
83	oPEr	2D1 2851	721 10321	Operative mode selection	0 = Auto = Auto mode 1 = oPLo = Manual mode 2 = St.bY = Stand by mode	0	r/w

5.3.9 Ser group - Serial link parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
84	Add	2D2 2852	722 10322	Instrument address	oFF... 254	0	r/w
85	bAud	2D3 2853	723 10323	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
86	trSP	2D4 2854	724 10324	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

5.3.10 CAI group - User calibration parameters

no.	Param.	Address		Description	Values	Dec. Point	r/w
		Hex	Dec				
87	AL.P	2D5 2855	725 10325	Adjust Low Point	From -1999 to (AH.P - 10) (E.U.)	dP	r/w
88	AL.o	2D6 2856	726 10326	Adjust Low Offset	-300... +300 (E.U.)	dP	r/w
89	AH.P	2D7 2857	727 10327	Adjust High Point	From (AL.P + 10)... 9999 (E.U.	dP	r/w
90	AH.o	2D8 2858	728 10328	Adjust High Offset	-300... +300 (E.U.)	dP	r/w

5.4 Identification code zone

This zone provides only informations for identifying model, order code and software release of the KX6 series instrument. Starting from the address 0800H it's possibile to read the instrument name (KX6, etc.) and from the address 0x80A (up to 0x818) it's possibile tro read the instrument sales code.

6 PERFORMANCE

After receiving a valid request the instrument prepares the reply, then sends it back to the master station according to the following specifications:

– A minimum time is granted greater or equal 3 characters time (depending on adopted baud rate, allowing line direction reversal)

– The reply is ready to be transmitted in less then 20 ms except in case 3;

A 20 ms silence on the line is necessary to recover from abnormal contitions or erroneous messages; this means that a time less than 20 ms is allowed between any two characters in the same message.

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