

EL.CO. SRL Via Lago di Molveno, 20 – 36015 SCHIO (VI)			
Document title :	User manual communication protocol		
Codice documento :	ELK22xS.ManualeProtocollo.ENG	Mag. code:	
	.00.ELK22xS.DOC		
replace code :		Mag. code:	
replaced by:		Mag. code:	
Commision code :	Section :	Modul:	Total page : 10
Document type :	Sig.doc :	Vers : 00	
written :	Verified :	Approved :	
Date : 15/01/2018	Date :	Date :	

Variazioni rispetto al documento precedente:

ELK22S / ELK22MS

Communication protocol

user's guide

INDEX

1	Preface.....	3
2	Physical connection	3
2.1	Interface	3
2.2	Line	3
3	Communication protocol	4
3.1	Function 1 – read output status	5
3.2	Function 2 – read input value	5
3.3	Function 3 – read n word	5
3.4	Function 6 – one word write.....	6
3.5	Function 7 – read allarm status.....	6
3.6	Cyclic redundancy check (CRC)	7
4	Dati exchange	Errore. Il segnalibro non è definito.
4.1	Some definitions	8
4.2	Memory	Errore. Il segnalibro non è definito.
4.3	Parameters programming	Errore. Il segnalibro non è definito.

1 Preface

This document is intended to describe the ELK22 and ELK22MS controllers using the MODBUS protocol in their communication capability and is mainly directed to technicians, system integrators and software developers.

The subject is subdivided in four levels of interest:

- The first level describes the physical connection to the line;
- The second level presents the data link protocol, that is a subset of the MODBUS RTU protocol;
- The third level describes in detail each data that can be exchanged;
- The fourth level states performance characteristics of the system.

2 Physical connection

2.1 Interface

ELK22S and ELK22MS 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 ELKs 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 120 ohm is required to maintain the quiescent condition on the line; Adopted baud rates range from 1200 to 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.

3 Communication protocol

The protocol adopted by ELK22S and ELK22MS controllers is a subset of the widely used MODBUS RTU 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 communication functions implemented in ELK22S and ELK22MS are:

- function 1 - output status read
- function 2 - input value read
- function 3 - n word read
- function 6 - one word write
- function 7 - allarm status read

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 (ELK22S and ELK22MS) 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 1: output status read request	function 1: output status read replay
function 2: input value read request	function 2: input value read replay
function 3: n word read request	function 3: n word read replay
function 6: one word write request	function 6: one word write replay
function 7: allarm status read request	function 7: allarm status read replay

Every message contains four fields:

- Slave address: valid value from 1 to 255; address 0 is reserved from MODBUS RTU for all broadcasting messages, but due to inherent unreliability of its not implemented for ELK22S and ELK22MS;
- function code: contains 1 or 2 or 3 or 6 or 7 for specified functions;
- information field: contains data like word addresses and word values as required by function use;
- control word: a cyclic redundancy check (CRC) performed with particular rules for CRC16.

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

3.1 Function 1 – read output status

The address first word must be less of the number of the output and the number of the word to read, must be less or equal of the number of output minus address first word.

The request has the following frame:

slave number	1	First word address		Number of words		CRC	
		MSB	LSB	MSB	LSB	LSB	MSB
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The reply has the following frame:

slave number	1	NB	Status	CRC	
		Number of read byte	output byte	LSB	MSB
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5

3.2 Function 2 – read input value

The first word address must bve 0 and the number of words to read must be 1.

The request has the following frame:

slave number	2	First word address		Number of words		CRC	
		MSB	LSB	MSB	LSB	LSB	MSB
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The reply has the following frame:

slave number	2	NB	Word input value		CRC	
		Number of read byte			LSB	MSB
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6

3.3 Function 3 – read n word

The number of words to be read must be less or equal twenty-eight.

The request has the following frame:

slave number	3	First word address		Number of words		CRC	
		MSB	LSB	MSB	LSB	LSB	MSB
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The reply has the following frame:

slave number	3	NB Number of read byte	Value of first word MSB LSB		Following words	CRC LSB MSB	
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte NB+2	byte NB+3

3.4 Function 6 - one word write

The request has the following frame:

slave number	6	First word address MSB LSB		Value to write MSB LSB		CRC LSB MSB	
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7

The normal reply is merely an echo of the request message:

slave number	6	First word address MSB LSB		Value to write MSB LSB		CRC LSB MSB	
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	Byte 6	byte 7

3.5 Function 7 – read allarm status

The request has the following frame:

slave number	7	CRC LSB MSB	
byte 0	byte 1	byte 6	byte 7

The reply has the following frame:

slave number	7	Stato allarme	CRC LSB MSB	
byte 0	byte 1	byte 2	Byte 3	byte 4

3.6 Cyclic redundancy check (CRC)

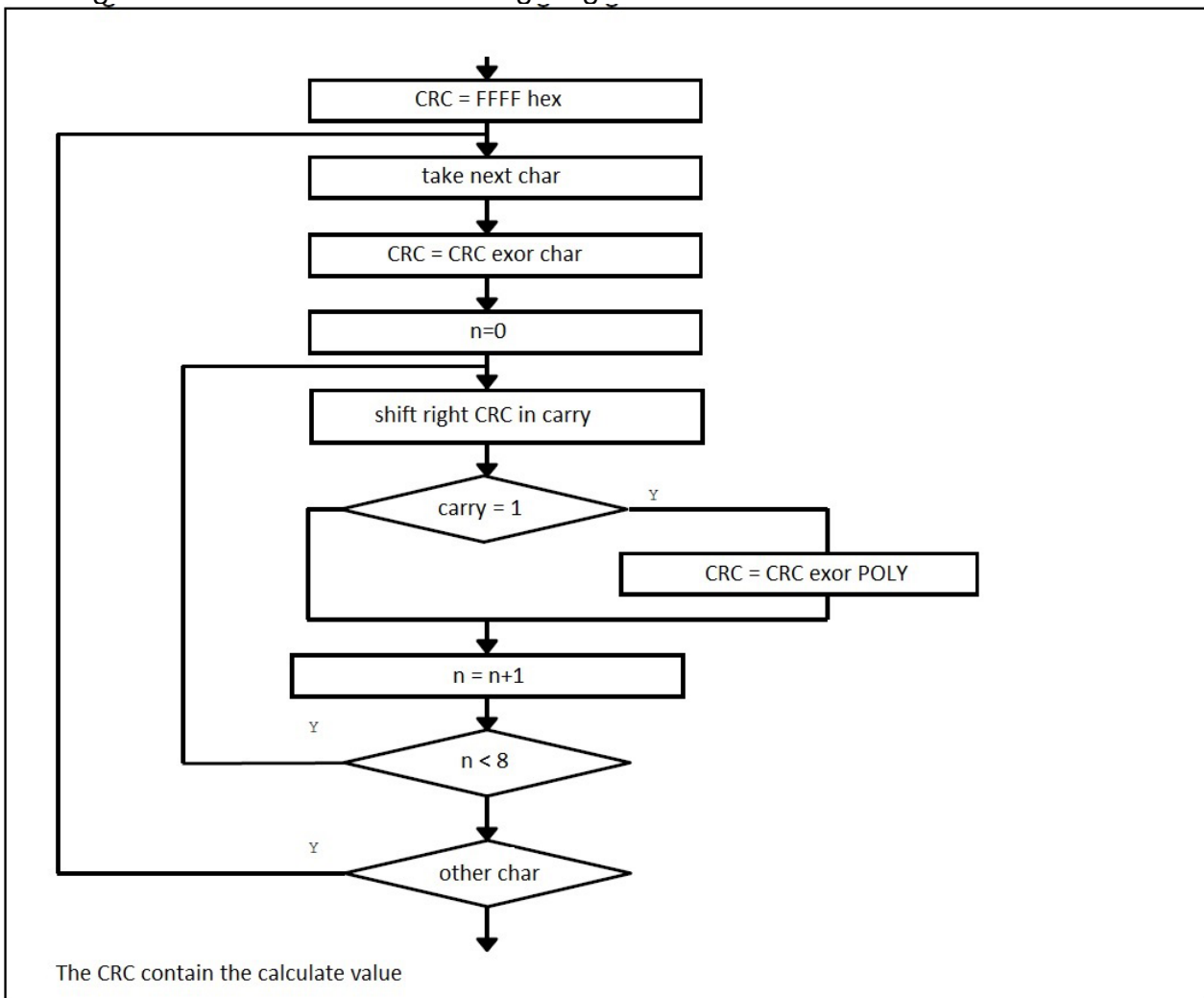
CRC is a check word that permits to verify the integrity of a message. Every message, sent or received, has in the two last characters the CRC check word.

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) protocol compatible, ELK22S and ELK22MS controllers adopt an identical algorithm for CRC calculation.

This algorithm is sketched in following diagram:



The polinimial 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..

4 Data exchange

This section contains informations about data exchanged with ELK 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.

4.2 Memory

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

4.3 Program parameters

The operating and configuration parameters of the instrument can be read and written by serial communication.

Parameter	address dec	Description	setting value
SP1 ₁	0000	Setpoint 1	SSP ÷ FSP
SENS	0001	Input type	0) TCJ 1) TCK 2) NTC 3) PTC 4) PT100 5) 0-10V 6) 4-20Ma
DP	0002	Number of decimal	0, 1
SSC ₁	0003	Minimus visualization	-999 ÷ 1000
FSC ₁	0004	Maximum visualization	-999 ÷ 1000
UNIT	0005	Measure unit	C, F
CA	0006	Measure offset	-100 ÷ 100
FIL.D	0007	Display refresh time	50 ÷ 200
CONT	0008	Type of regulation	0) PID 1) ON/OFF 2) Neutral zone
AUTO	0009	Enabling autotuning	0) Off 1) Start every powerup 2) Start next powerup 3) Manual start
BP	0010	Proportional band	1 ÷ 1000
TI	0011	Integral time	0 ÷ 1000
TD	0012	Derivative time	0 ÷ 1000
TR1	0013	Time period out	50 ÷ 200
HPOS	0014	Positiv hysteresis	0 ÷ 100

Parameter	address dec	Description	setting value
HNEG	0015	Negativ hysteresis	0 ÷ 100
SSP ₁	0016	Minumum limit setpoint setting	SSC ÷ FSC
FSP ₁	0017	Maximun setpoint setting	SSC ÷ FSC
O1F	0018	Function mode out 1	0) Not used 1) heating 2) cooling 3) always ON
O2F	0019	Function mode out 2	0) Not used 1) heating 2) cooling 3) allarm 4) always ON
AL1T	0020	Function mode allarm 1	0) not used 1) minimun 2) maximun
AL1 ₁	0021	Allarm setpoint	SSP ÷ FSP
HAL1	0022	Hysteresis allarm 1 remedy	0 ÷ 100
AL1D	0023	Delay allarm 1 remedy	0 ÷ 1000
ADR ₂	0024	Module address	1 ÷ 16
ADRM ₃	0025	Modbus address	1 ÷ 250
VELM ₃	0026	Modbus baud	0) 1200 baud 1) 2400 baud 2) 9600 baud 3) 19200 baud 4) 38400 baud
PASS ₃	0027	Password menù	xxxx

- 1) In these parameters must be consider an offset of 0x3E8, at the exampleif we want to set the setpoint at 5 we must set $0x3E8 + 0x05 = 0x3ED$, at the opposite if we want set -5 we musta set $0x3E8 - 0x05 = 0x3E3$.
- 2) Not present in ELK22S
- 3) Address dec respectly 0024 0025 0026

Is possible hidden or show every parameter in the user menu: setting 1 the MSB of the WORD we hidden the parameter from the user menù and we can modify it only under password menu.

EL.CO. SRL
Via Lago di Molveno, 20
36015 SCHIO (VI) Italia

Tel. ++39/0445/661722
Fax ++39/0445/661792
Sito: www.elco-italy.com
e-mail : support@elco-italy.com

This manual is the exclusive property of EL.CO. SRL that prohibits the reproduction even if it is not expressly authorized. Every care has been taken to verify the information contained in this manual, but EL.CO. SRL, the people and companies involved in its creation and production, are not responsible for any damage caused by its use. EL.CO. SRL reserves the right to make both aesthetic and functional changes in order to improve the quality of the product at any time and without notice.