ELK22S

MICROPROCESSOR DIGITAL ELECTRONIC REGULATOR

INSTRUCTIONS FOR USE

Ver. 03 (EN) - 04/18 - code: 692074

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INTRODUCTION

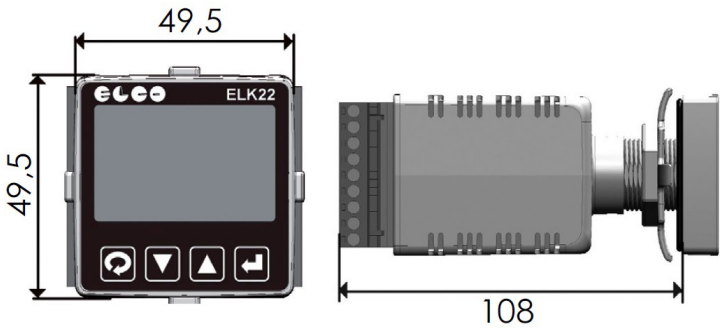
This manual contains the information required for proper installation and the instructions for use and maintenance of the product. It is therefore recommended to read it carefully and to preserve it.

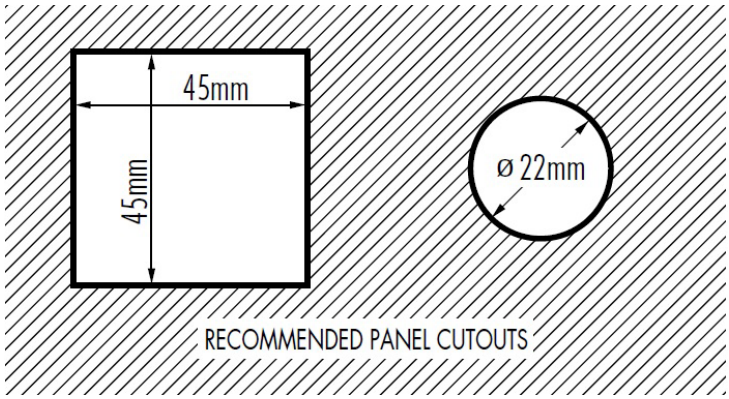
EL.CO. S.R.L. reserves the right to make aesthetic and functional changes at any time and without notice.

If a malfunction or failure of the device can create hazardous or dangerous situations for people, animals or property, the system must be equipped with additional security devices.

EL.CO. S.R.L. and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from tampering, improper use, incorrect use or otherwise not complying with the device's features.

1 - DIMENSIONS AND DRILLING (mm)





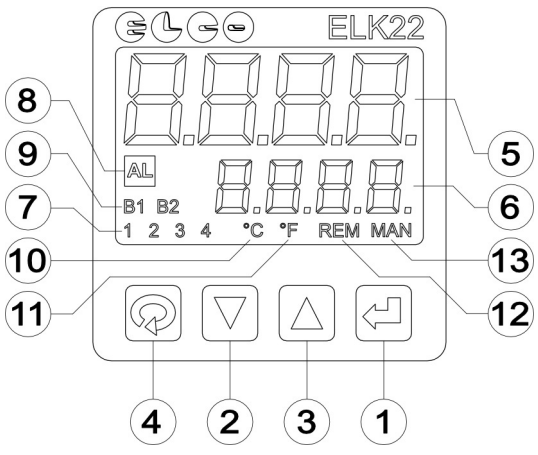
2 - DEVICE DESCRIPTION

2.1 - GENERAL DESCRIPTION

The ELK22S model is a microprocessor digital regulator with ON/OFF, Neutral Zone ON/OFF, PID and **AUTOTUNING** function for PID adjustment.

The device can have up to 2 relay outputs or static relay control (SSR). The process value is displayed on 4 red displays, the setpoint on 4 green displays while the status of the outputs is reported by 2 LEDs.

2.2 - FRONT PANEL DESCRIPTION



1 – Key ↵ : Used to access programming of the operating parameters and to confirm the selection.

2 - Key ▼ : Used for decreasing setpoint setting, values to be set, and parameter selection. Long pressed in full menu programming, it changes the access level of the selected parameter. (See para. 3.1, 3.3).

3 - Key ▲ : Used for increasing setpoint setting, values to be set, and parameter selection. Long pressed in full menu programming, it changes the access level of the selected parameter. (See para. 2.1, 2.3).

4 – Key : When in programming mode, you can use it to quit programming or to cancel the change of a parameter.
5 – 4 red digits: Process value during operation, parameter selected during programming.
6 – 4 green digits: Setpoint value during operation, value of the parameter selected during programming.
7 – LED 1 : It indicates OUT1 output status. **LED 2** : It indicates OUT2 output status.
8 – LED AL : It indicates the state of the alarm.
9 – LED B1 : In full programming mode, it indicates that the parameter is not visible in the operator menu. **LED B2** : In full programming mode, it indicates that the parameter is visible in the operator menu.
10 – LED °C : It indicates unit of measure in degrees centigrade.
11 – LED °F : It indicates measurement units in degrees Fahrenheit.
12 – LED REM : In programming mode, it indicates that you are changing the selected parameter.

3 - PROGRAMMING

3.1 - SETPOINTS FAST SETTING

The 4 green displays display always displays the setpoint set. Pressing the ▲ key increases the value and pressing the ▼ key decreases the value. These keys act at one-digit steps, but if pressed for more than half a second, the value increases or decreases rapidly to allow quick access to the desired value. The setpoint can be set with a value between the value programmed in para. **"SSP"** and the value programmed in para. **"FSP".**

3.2 - PROGRAMMING THE PARAMETERS

To have access to the operating parameters of the device in the installer mode, you must press the key ↵ and hold it for about 2 seconds, while pressing the key ↵ for user mode access. The display will show **"SET"** and then **"PASS"** if a password for the installer access is set. Use the ▲ and ▼ keys to enter the password and confirm with ↵. The red display shows the code that identifies the parameter, the green display shows the value set and with the ▲ and ▼ keys you can select the parameter you want to edit. Once the desired parameter is selected by pressing the key ↵, the **"REM"** LED lights up to indicate that you are changing the parameter setting using the ▲ and ▼ keys. After setting the desired value, press again the key ↵; the new value will be stored while, pressing the key , the new value will not be stored, then the **"REM"** LED will switch off. By using the ▲ and ▼ keys, you can select another parameter and change it as described. To exit the programming mode, do not press any key for about 10 seconds if in user mode or 20 seconds if in the installer mode, or hold down the key until you exit the programming mode.

3.3 - PROTECTION OF PARAMETERS WITH PASSWORD

The device has two levels of access to the programming, installer, and user menu. The password can be customized via the **"PASS" parameter.** If you want to have this protection, set the **"PASS"** parameter with the desired password number and exit the parameter programming. If you do not want to protect the installer menu, set the parameter **"PASS"** on "0000'. By accessing the installer mode, each parameter will have the **B1** or **B2** LED on. **B1** indicates that the parameter is visible only in the installer menu; otherwise, **B2** indicates that it is also visible in the user menu. To enable a parameter to be visible on the user menu, hold down the ▲ key until **B1** turns off and **B2** lights up. To hide a parameter from the user menu, hold down the ▼ key until **B2** turns off and **B1** lights up.
Is possible from this parameter set the default factory default. From password value 0000 hold down the key ▼ two times. Display show **rSt dEF**, premere il tasto ↵, display show **rSt SurE**, at this time hold down the key ▲ for three seconds. In any time is possible cancel the reset request by hold down the key .

4 - INSTALLATION AND USE WARNINGS

4.1 - PERMITTED USE

The device has been designed as a measurement and adjustment device in accordance with EN61010-1 for operation at altitudes up to 2000 m. The use of the device in applications not expressly provided for in the aforementioned standard must include all appropriate protective measures. The device CANNOT be used in hazardous (inflammable or explosive) environments without proper protection. It should be remembered that the installer must ensure that the electromagnetic compatibility rules are respected even after the device has been installed, possibly using special filters. If a failure or malfunction of the device can create hazardous or dangerous situations for persons, animals or property, the system must be equipped with additional electromechanical devices to ensure safety.

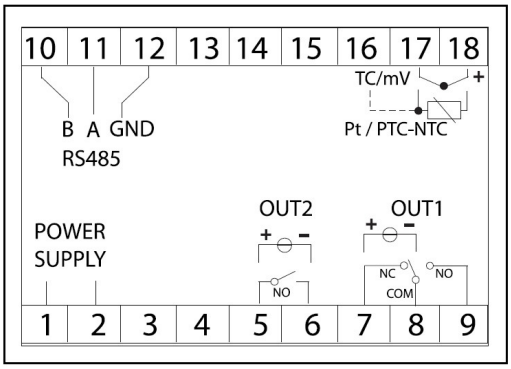
4.2 - MECHANICAL ASSEMBLY

The device, in a 50 x 50 mm container, is designed for panel-mounted mounting inside a housing. Then make a 45 x 45 mm square hole or a 22 mm diameter hole and insert the keypad by fastening it with the supplied nut. It is recommended to mount the special gasket to obtain the degree of frontal protection stated. Avoid placing the inside of the device in places subject to high humidity or dirt that may cause condensation or introduction into the device of parts or conductive substances. Ensure that the device has adequate ventilation and avoid installation in containers where devices are located that can lead the device to operate outside the declared temperature limits. Install the device as far as possible from sources that may generate electromagnetic disturbances such as motors, contactors, relays, solenoid valves etc.

4.3 ELECTRICAL CONNECTIONS

Make the connections by connecting only one conductor for each clamp and following the diagram shown, checking that the supply voltage is that indicated on the device and the absorption of the actuators connected to the device is not higher than the maximum current allowed. The device, provided for permanent connection within an equipment, does not have either switch or internal overcurrent protection devices. It is therefore recommended to provide for the installation of an overcurrent protection device and a bipolar switch/disconnecting switch, marked as a disconnecting device, which interrupts the power supply of the device. This switch must be positioned as close as possible to the device and in a place easily accessible by the user. It is also recommended to adequately protect the supply of all circuits connected to the device with suitable items (i.e. fuses) that are appropriate for circulating currents. It is recommended to use insulation cables suitable to the voltages, temperatures and operating conditions and to ensure that the cables for the input sensors are kept away from power cords and other power cables, in order to avoid induction of electromagnetic disturbances. If some wiring harness cables are shielded, it is recommended to connect them to one side on the ground. Finally, it is recommended to check that the set parameters are the desired ones and that the application works properly before connecting the outputs to the actuators in order to avoid system abnormalities that could cause damage to persons, things or animals.

4.4 - WIRING DIAGRAM



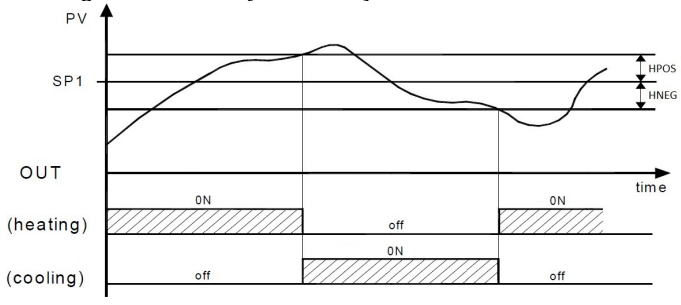
5 - OPERATION

5.1 - MEASUREMENT AND DISPLAY

The thermoregulator operates the following sensors that can be set by the **"Sens"** parameter: thermocouple type (TCJ) and K (TCK), PTC KTY81-121 (ptc), NTC 103AT-2 (ntc), PT100 (p100).
When changing this parameter, it is recommended that you turn the power off and on again to obtain a correct measurement.
You can set the measurement unit of temperature (°C, °F) by the **"Unit"** parameter and the desired measurement resolution (0=1°; 1=0,1°) **"dP"** prameter (for Pt100 only).
The device allows the calibration of the measurement, which can be used for a new calibration of the device according to the needs of the application, by par. **"CA"**. You can set a positive or negative offset that is simply added to the value read by the probe before the display and that is constant for all measurements. You can define the temperature display range by setting the **"SSC"** and **"FSC"** parameters.
Using the **"FiL.d"** parameter, you can set the display update time..

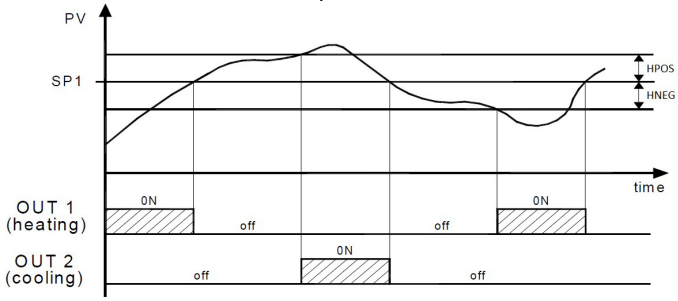
5.2 - ON/OFF REGULATOR

This adjustment mode can be achieved by setting the **"Cont" = On.F** parameter and can act on output 1 or output 2 according to the measurement, of the Setpoint **"SP1"**, the operating mode **"O1F"** and **"O2F"**, and the hysteresis **"HPOS"** and **"HNEG"** programmed.
The device performs an ON/OFF adjustment with asymmetric hysteresis.
The regulators behave as follows: in case of reverse action or heating (**"O1F"**=H.REG), they disable the output when the process value reaches the [SP + HPOS] value and reactivate it when it falls below the [SP - HNEG] value.
Vice versa, the regulators behave as follows: in case of direct action or cooling (**"O1F"**=C.REG), they disable the output when the process value reaches the [SP - HNEG] value and reactivate it when it goese over the [SP + POS] value.



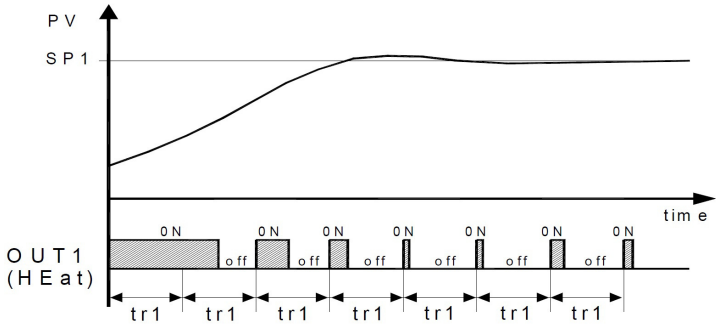
5.3 - NEUTRAL ZONE ON/OFF ADJUSTMENT

Neutral Zone operation is used to control systems that have an element that causes a positive increase (i.e. heating, humidifying, etc.) and an element that causes a negative increase (i.e. cooling, dehumidifying, etc.).
This operation can be carried out when there are 2 outputs and it's obtained by programming the parameter **"Cont" = ON.FN**, the parameter **"O1F" = H.REG**, the parameter **"O2F" = C.REG**.
The adjustment operation operates on outputs depending on the measurement of the setpoint **"SP1"** and hysteresis **"HPOS"** and **"HNEG"** programmed.
The regulator behaves as follows: it turns off the outputs when the process value reaches the **SP1** setpoint and activates the **OUT1** output when the process value is less than [**SP1-HNEG**],or turns on the OUT2 output when the process value is greater than [**SP1+HPOS**].
Consequently, the element causing the positive increase will be connected to the **OUT1** output while the negative increase element will be connected to **OUT2** output.



5.4 - PID REGULATOR

The PID single action adjustment mode can be implemented by setting the parameter **"Cont" = Pid** and acts on OUT1 or OUT2 output as a function of the **"SP1"**setpoint.



To obtain a good stability of the variable in fast processes, the **"tr1"** cycle time must have a low value with a very frequent intervention of the adjustment output.
In this case, it is recommended to use a static relay (SSR) for the actuator control.
The single-action PID adjustment algorithm provides the setting of the following parameters:
"Pb" - Proportional Band
"tI" - Integral Time
"td" - Derivative time
"tr1" - Output cycle time

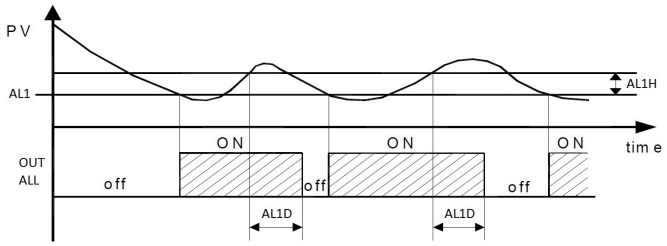
5.5 - AUTOTUNING FUNCTION

The **AUTOTUNING** function calculates the PID parameters through an OSCILLATORY tuning cycle, after which the parameters are stored by the device and, during the adjustment, they remain constant.
Autotuning function automatically calculates the following parameters:
"Pb" - Proportional Band
"Int" - Integral Time
"dEr" - Derivative time
To enable the **AUTOTUNING** function, proceed as follows:
1) Set the desired **"SP1"** setpoint.
2) Set the **"Cont"** =Pid setpoint.
3) Set the **"O1F"** parameter depending on the process to be controlled through OUT1 output.

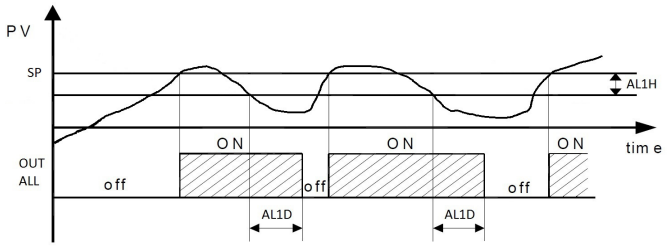
4) Set the **"Auto"** parameter as:
= 1 - if you want autotuning to start automatically every time you turn on the device.
= 2 - if you want autotuning to start automatically at the next power up of the device and, once tuning is completed, the par. **"Auto"**=OFF.
= 3 – manual start-up by hold down the key for 5 seconds
5) Quit programming parameters.
6) Connect the device to the controlled system.
7) Activate autotuning by turning the unit off and on again. At this point, the Autotuning function is activated and is reported through the "Auto" display on the green display.
The regulator then performs a series of connected system operations to calculate the most suitable PID adjustment parameters.
The duration of the Autotuning cycle is limited to a maximum of 12 hours.
If the process is not completed within 12 hours, the parameters will not be changed and display show **"Fail Auto"**. Holding down the key return to normal operation.
Is possible stop the autotuning process by hold down the key for five seconds.
The values calculated by the AutoTuning will be automatically stored by the device at the end of the proper run of the Autotuning cycle in the PID adjustment parameters.

5.6 - ALARM FUNCTION

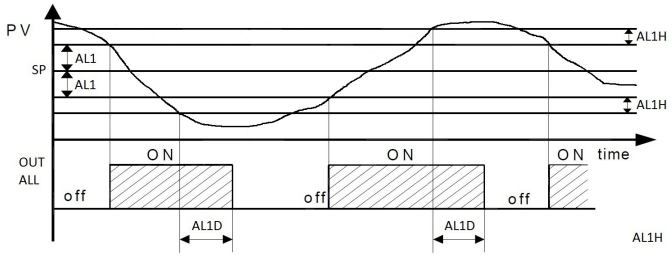
In the control mode, you can activate relative minimum or maximum, absolute minimum or maximum, relative window with activation inside or outside window alarms.
You can enter a hysteresis and a delay on the return of the alarm. Such functions may be useful in order to avoid frequent interventions of the outputs especially when they command compressors.
The delay function is deactivated by programming **"AL1D"** on 0.
The parameter **"AL1"** sets the alarm setpoint.
Set **"O2F"** = AL to associate output 2 with the alarm.



*Example of operation with **"AL1T"** = LoAb (absolute minimum)*



*Example of operation with **"AL1T"** = HidE (relative maximum)*



*Example of operation with **"AL1T"** = LHdi (relative band in)*

6 - PROGRAMMABLE PARAMETERS TABLE

Below are all the parameters that the device can be equipped with.

Par.		Description	Range	Def.	notes
1	**SP1**	SetPoint 1	SSP ÷ FSP	0	
2	**SENS**	In-probe type: TCJ = Thermocouple J TCK = Thermocouple K ntc= Thermistor NTC 103-AT2 Ptc= Thermistor PTC KTY81-121 P100= Thermal resistor Pt100	TCJ / TCK / NTC / PTC / P100	TCJ	
3	**DP**	Number of decimals	P100: 0 / 1	0	
4	**SSC**	Minimum display	-999 ÷ 1000	-50	
5	**FSC**	Maximum display	-999 ÷ 1000	1000	
6	**UNIT**	Temperature measurement unit	°C / °F	°C	
7	**CA**	Measure offset	-100 ÷ 100	0	
8	**FIL.D**	Display adjustment time		0.5	
9	**CONT**	Adjustment type: Pid= PID On.F= ON/OFF On.Fn= Neutral Zone (double action ON/OFF)	Pid / On.F / On.Fn	On.F	
10	**AUTO**	Enabling autotuning: OFF = Disabled 1 = Start-up upon each switching on 2 = Start-up upon the first switching on 3 = Manual Start-up	OFF / 1 ÷ 3	OFF	
11	**BP**	Proportional band (PID adj.)	1 ÷ 1000	40	
12	**TD**	Integral time (PID adj.)	0 ÷ 100.0 sec.	10.0	
13	**TI**	Derivative time (PID adj.)	0 ÷ 100.0 sec.	5.0	
14	**TR1**	Output time period	0.5 ÷ 20.0 sec.	20.0	
15	**HPOS**	Positive adjustment hysteresis	0 ÷ 100	2	
16	**HNEG**	Negative adjustment hysteresis	0 ÷ 100	2	
17	**SSP**	Setpoint setting lower limit	SSC ÷ FSC	-50	
18	**FSP**	Setpoint setting upper limit	SSC ÷ FSC	1000	
19	**O1F**	Operation mode of the OUT1 output: none: unused H.reg= Heating C.reg= Cooling On= Always on	None / H.reg / C.reg / On	H.reg	
20	**Operation mode of the OUT1 output:**	Operation mode of the OUT1 output: none: unused H.reg= Heating C.reg= Cooling Al= alarm On= Always on	None / H.reg / C.reg / Al / On	H.reg	
21	**AL1T**	Operation mode of the alarm: none= disabled LoAb= absolute minimum HiAb= absolut maximum LodE= relative minimum HidE= relative maximum LHdi= relative window in LHdo= relative window out	None / Loab / Hiab / LodE / HidE / LHdi / LHdo	none	

22	**AL1**	Alarm threshold	SSP ÷ FSP	0	
23	**HAL1**	Hysteresis of alarm remedy	0 ÷ 100	1	
24	**AL1D**	Delay of alarm remedy	0 ÷ 100.0 sec.	0	
25	**PASS**	Menu password		0000	
26	**REV**	Firmware revision			

7 - PROBLEMS, MAINTENANCE AND WARRANTY

7.1 - ERROR REPORTING

Error	Reason	Action
FAil Auto	Autotuning not completed within 12 hours	Check connection probe and actuator, then restart autotuning
- - - -	Interruption of the probe	Check that the probe is correctly connected to the device, and then verify that the probe is working properly

7.2 - CLEANING

It is recommended to clean the device only with a slightly soaked cloth of water or non-abrasive detergent and not containing solvents.

7.3 - WARRANTY AND REPAIR

The device is guaranteed by manufacture defects or defects in material found within 12 months from the date of delivery.
Warranty is limited to repair or replacement of the product.
Possible opening of the container, tampering with the device, or improper use and installation of the product will automatically result in the warranty being decayed.
In case of defective product during warranty period or out of warranty period, contact the EL.CO. sales office. To get permission to ship.
The defective product, therefore, accompanied by the indications of the defect found, must be delivered by freight forwarding at the EL.CO. factory, unless otherwise agreed.

8 - TECHNICAL DATA

8.1 - ELECTRICAL CHARACTERISTICS

Power supply: 24 VAC/VDC, 100.. 240 VAC +/- 10%
AC frequency: 50/60 Hz
Absorption: Approx. 4 VA
Input/s: 1 input for temperature probes: tc J,K ; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C).
Output/s: Up to 2 outputs. Relay SPDT (8A-AC1, 3A-AC3 250 VAC,1/2HP 250VAC, 1/3HP 125 VAC); or live for piloting SSR (8mA/ 8VDC).
Auxiliary power output: 15 VDC not stab. / 20 mA Max
Electrical relay output life: 100000 operat.
Installation category: II
Measurement category: I
Protection class against electric shock: Class II front
Isolation: Reinforced between low voltage parts (L and H supply and relay outputs) and front; reinforced between low voltage parts (power supply L and H and relay outputs) and low voltage parts (static inputs and outputs); reinforced between power supply and relay outputs. No insulation between the input and the static outputs.

8.2 - MECHANICAL CHARACTERISTICS

Container: Self-extinguishing plastic UL 94 V0
Dimensions: 50 x 50 mm, depth 118 mm
Weight: Approx. 150 g
Installation: Panel mounting in 49,5 x 49,5 mm hole hole or 22 mm diameter hole
Connections: 2,5 mm^2 screw terminal block
Front protection degree: IP 65 with gasket
Pollution degree: 2
Working ambient temperature: 0 ... 50°C
Working ambient humidity: 30 ... 95 RH% with no condensation
Temperature for the transportation and storage -10 ... 60°C

8.3 - OPERATING CHARACTERISTICS

Adjustment: ON/OFF, neutral zone ON/OFF, single action PID.
Measurement range: According to the probe used (see table)
Display resolution: According to the probe used. 1/0.1.
Total accuracy: +/- (0.5 % fs + 1 digit) ; tc S: +/- (1 % fs + 1 digit)
Measurement sampling time: 170 ms
Maximum cold joint compensation error (in tc): 0.1°C/°C at room temperature 0 ... 50°C after a warm-up time of 20 min.
Display: 4 red digits h 12 mm, 4 green digits h 7 mm
Conformity: Directive EEC EMC 89/336 (EN 61326), Directive EEC BT 73/23 and 93/68 (EN 61010-1).
Certifications: C-UL (file no. E206847)

8.4 - MEASUREMENT RANGE TABLE

INPUT	"dP" = 0	"dP"= 1
tc J **"SEnS" = J**	-50 ... 1000 °C -58 ... 1832 °F	- - - -
tc K **"SEnS" = CrAl**	-50 ... 1000 °C -58 ... 1832 °F	- - - -
Pt100 (IEC) **"SEnS" = Pt1**	-100 ... 400 °C -148 ... 752 °F	-100.0 ... 400.0 °C -148.0 ... 752.0 °F
PTC (KTY81-121) **"SEnS" = Ptc**	-50 ... 150 °C -58 ... 302 °F	
NTC (103-AT2) **"SEnS" = ntc**	-30 ... 110 °C -22 ... 230 °F	

8.5 - DEVICE CODING

ELK22S a b c d

a : POWER SUPPLY
24 = 24 VAC/VDC
240 = 100... 240 VAC

b : OUT1 OUTPUT
R = Relay
S = Voltage output for SSR

c : OUT2 OUTPUT
2R = Relay
2S = Voltage output for SSR

d : MODBUS COMMUNICATION
S = Present
- = Not present