ELK 94 S

MICROPROCESSOR-BASED DIGITAL ELECTRONIC CONTROLLER

OPERATING INSTRUCTIONS

Vr. 01 (ENG) - 01/10
cod.: ISTR-MELK94SENG1

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FOREWORD

This manual contains the information necessary for the product to be installed correctly and also instructions for its maintenance and use; we therefore recommend that the utmost attention is paid to the following instructions and to save it.

ELCO S.r.l. reserves the right to make any formal or functional changes at any moment and without any notice.
Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional devices which will guarantee safety.
ELCO S.r.l. and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument's features.

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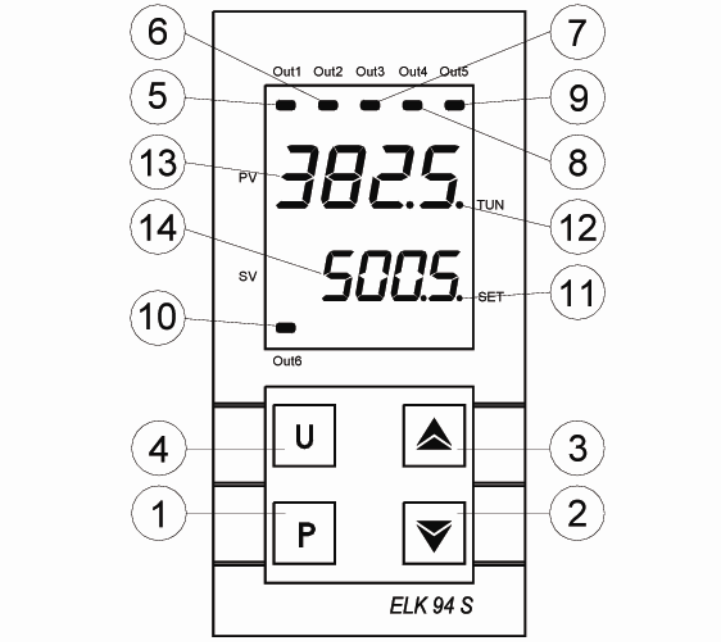
1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION

ELK 94S is a "single loop" digital microprocessor-based controller, with ON/OFF, Neutral Zone ON/OFF, PID single action, PID dual action (direct and reverse) control and with **AUTO-TUNING** function (FAST or OSCILLATING type), and automatic calculation of the **FUZZY OVERSHOOT CONTROL** parameter for PID control.
The PID control has a particular algorithm with **TWO DEGREES OF FREEDOM** that optimises the instrument's features independently in the event of process disturbance and Set Point variations.
The process value is visualized on 4 red display, the Set value is visualized on 4 green display while the outputs state is indicated by 6 led.
The instrument can have up to 5 outputs: relay type or to drive solid state relays type (SSR).
The input is programmable and accepts temperature probes (Thermocouples J,K,S,B,C,E,L,N,R,T; Thermo-resistances PT100, Thermistors PTC and NTC; Infrared sensors mod. ELCO IRS) and normalized analogue signals (0/4..20 mA, 0/1..5 V, 0/2..10 V, 0..50/60 mV, 12..60 mV).
The instrument can be equipped with an input for the current transformer, working as a Heater Break Alarm function

1.2 - FRONT PANEL DESCRIPTION



1 - Key P : This is used to access the programming parameters and to confirm selection.
2 - Key DOWN : This is used to decrease the values to be set and to select the parameters. If the key is held down, the user returns to the previous programming level until he exits the programming mode. Outside the programming mode it permits visualisation of the current measured by the TAHB input, on the SV display.
3 - Key UP : This is used to increase the values to be set and to select the parameters. If the key is held down, the user returns to the previous programming level until he exits the programming mode. Outside the programming mode it permits visualisation of the output control power, on the SV display.
4 - Key U : It can be used to activate Auto-tuning and modify the visibility of the parameters in "ConF" menu (see par. 2.3).
5 - Led OUT1 : indicates the state of output OUT1
6 - Led OUT2 : indicates the state of output OUT2
7 - Led OUT3 : indicates the state of output OUT3
8 - Led OUT4 : indicates the state of output OUT4
9 - Led OUT5 : indicates the state of output OUT5
10 - Led OUT6 : indicates the state of output OUT6
11 - Led SET : it indicates access to the programming mode and the parameters level (see par. 2.3).
12 - Led TUN: indicates that the Auto-tuning is in progress (flashing).
13 - Display PV : indicates the process value
14 - Display SV : indicates the active Set value

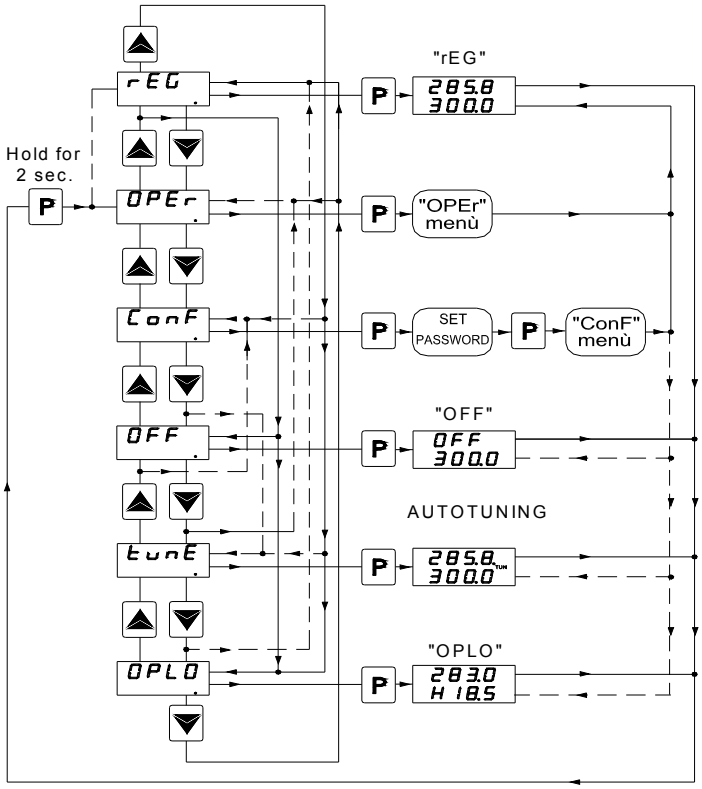
2 - PROGRAMMING

2.1 - FAST PROGRAMMING OF THE SET POINT

This procedure permits rapid programming of the active Set Point and possibly the alarm thresholds (see par 2.3)
Push key "P", then release it and the display will visualise **"SP 1"** and the programmed value.
To modify the value, press "UP" key to increase it or the "DOWN" key to decrease it.
These keys change the value one digit at a time but if they are pressed for more than one second, the value increases or decreases rapidly and, after two seconds in the same condition, the changing speed increases in order to allow the desired value to be reached rapidly.
Once the desired value has been reached, by pushing key P it is possible to exit by the fast programming mode or it is possible to visualise the alarm thresholds **AL1, AL2, AL3** (see par. 2.3).
To exit the fast Set programming it is necessary to push key P, after the visualisation of the last Set Point, or alternatively, if no key is pressed for approx. 15 seconds, the display will return to normal functioning automatically.

2.2 - SELECTION OF THE CONTROL STATE AND PARAMETERS PROGRAMMING

By pushing key "P" and holding it down for approx. 2 sec. it is possible to enter into the main selection menu.

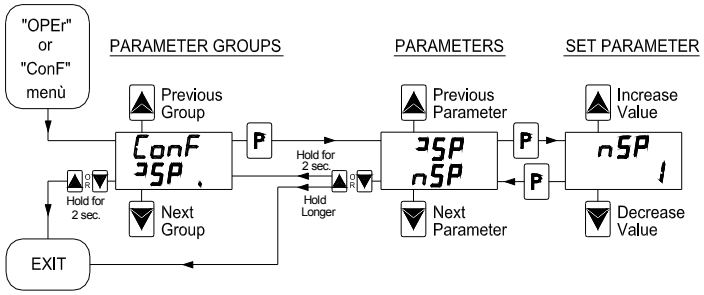


Using the "UP" or DOWN" keys, it is then possible to roll over the selections:

"OPEr"	to enter into the operating parameters menu
"ConF"	to enter into the configuration parameters menu
"OFF"	to swap the regulator into the OFF state
"rEG"	to swap the regulator into the automatic control state
"tunE"	to activate the Auto-tuning or Self-tuning function
"OPLO"	to swap the regulator to the manual control state and therefore to program the % control value using the "UP" and "DOWN" keys

Once the desired item has been selected, push key "P" to confirm.
Selecting "OPEr" and "ConF" gives the possibility of accessing other menus containing additional parameters and more precisely :
"OPEr" – Operating parameters Menu: this normally contains the Set Point parameters but it can contain all the desired parameters (see par. 2.3).
"ConF" – Configurtion parameters Menu: this contains all the operating parameters and the functioning configuration parameters (alarm configuration, control, input, etc.)
To enter the menu **"ConF"** select the option "ConF", press the key "P" and the display will show "0".
At this request, enter, using keys "UP" and "DOWN", the number reported on the last page of this manual and push key "P".
If an incorrect password is entered, the instrument exit from programming mode.
If the password is correct, the display will visualise the code identifying the first group of parameters (" [1]**SP** ") and with keys "UP" and "DOWN" it will be possible to select the desired group of parameters.
Once the desired group of parameters has been selected, the code identifying the first parameter of the selected group will be visualised by pushing the "P" key.
Again using the "UP" and "DOWN" keys, it is possible to select the desired parameter and, if the key "P" is pressed, the display will

show the parameter's code and its programming value, which can be modified by using the "UP" or "DOWN" keys.
Once the desired value has been programmed, push key "P" once more: the new value will be memorised and the display will show only the code of the selected parameter.
By using the "UP" or "DOWN" keys, it is then possible to select a new parameter (if present) and modify it as described above.
To select another group of parameters, keep the "UP" or "DOWN" key pressed for approx. 2 sec., afterwards the display will return to visualise the code of the group of parameters.
Release the key and by using the "UP" and "DOWN" keys, it will be possible to select a new group.
To exit the programming mode, no key should be pressed for approx. 20 seconds, or keep the "UP" or "DOWN" pressed until exit from the programming mode is obtained.
The programming and exit modes for the "OPEr" menu are the same as those described for menu "ConF" with the difference that to access the menù "OPEr" the Password is not required.



ATTENTION: *The instrument is programmed in factory with all the parameters, to exception of the Set Point "SP1" and Alarm* thresholds *AL, programmable in the menù "ConF" to the purpose to prevent wrong accidental programming from non experienced consumers.*

2.3 - PARAMETERS PROGRAMMING LEVELS

The menu "OPEr" normally contains the parameters used to program the Set Point; however it is possible to make all desired parameters appear or disappear on this level, by following this procedure:
Enter the menu "ConF" and select the parameter to be made programmable or not programmable in the menu "OPEr".
Once the parameter has been selected, if the led SET is switched off, this means that the parameter is programmable only in the menu "ConF", if instead the led SET is on, this means that the parameter is also programmable in the menu "OPEr".
To modify the visibility of the parameter, push key "U" : the led SET will change its state indicating the parameter accessibility level (on = menu "OPEr" and "ConF"; off = menu "ConF" only).
The active Set Point and the alarm thresholds will only be visible on the Set Point fast programming level (described in par. 2.1) if the relative parameters are programmed to be visible (i.e. if they are present in the menu "OPEr").

2.4 - CONTROL STATE

The controller can act in 3 different ways : automatic control **(rEG),** control off **(OFF)** and manual control **(OPLO).**
The instrument is able to pass from one state to the other :
- by selecting the desired state from the main selection menu suing the keyboard.
- Automatically (the instrument swaps into "rEG" state at the and of the auto-tuning execution)
When switched on, the instrument automatically reassumes the state it was in when it was last switched off.
AUTOMATIC CONTROL (rEG) – Automatic control is the normal functioning state of the controller.
During automatic control, on the SV display, it is possible to visualize the control power on the display by pushing key "UP".
The range of the power values goes from H100 (100% of the output power with reverse action) to C100 (100% of the output power with direct action).
CONTROL OFF (OFF) – The instrument can be swapped into the "OFF" state, i.e. the control and the relative outputs are deactivated. The alarm outputs are instead working normally.
BUMPLESS MANUAL CONTROL (OPLO) – By means of this option it is possible to manually program the power percentage given as output by the controller by deactivating automatic control.
When the instrument is swapped to manual control, the power percentage, visualised on the SV display, is the same as the last one supplied and can be modified using the "UP" and "DOWN" keys.
In case of ON/OFF control, 0% corresponds to the deactivated output while any value different from 0 corresponds to the activated output.
As in the case of visualization, the programmable values range from H100 (100% output power with reverse action) to C100 (100% output power with direct action).
To return to automatic control, select "rEG" in the selection menu.

3 - INFORMATION ON INSTALLATION AND USE

3.1 - PERMITTED USE

The instrument has been projected and manufactured as a measuring and control device to be used according to EN61010-1 for the altitudes operation until 2000 ms.
The use of the instrument for applications not expressly permitted by the above mentioned rule must adopt all the necessary protective measures.
The instrument CANNOT be used in dangerous environments (flammable or explosive) without adequate protection.
The installer must ensure that EMC rules are respected, also after the instrument installation, if necessary using proper filters.
Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional devices which will guarantee safety.

3.2 - MECHANICAL MOUNTING

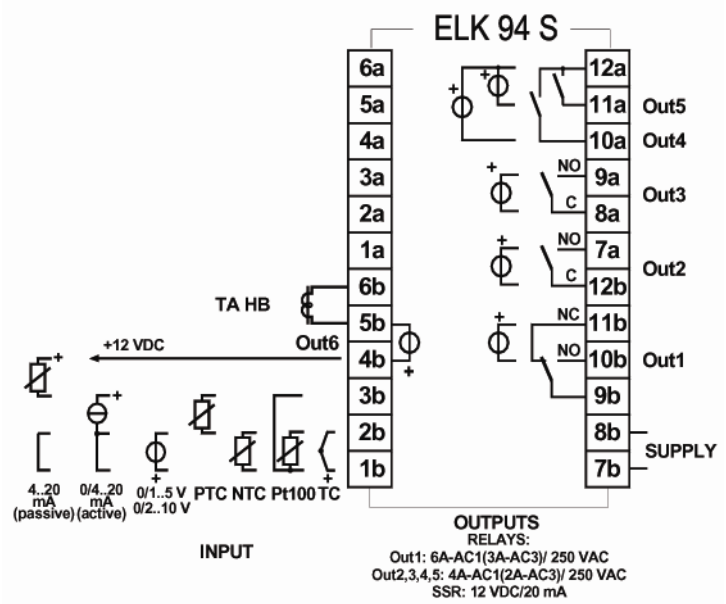
The instrument, in DIN case 48 x 96 mm, is designed for flush-in panel mounting.
Make a hole 45 x 92 mm and insert the instrument, fixing it with the provided special brackets.
We recommend that the gasket is mounted in order to obtain the front protection degree as declared. Avoid placing the instrument in environments with very high humidity levels or dirt that may create condensation or introduction of conductive substances into the instrument.
Ensure adequate ventilation to the instrument and avoid installation in containers that house devices which may overheat or which may cause the instrument to function at a higher temperature than the one permitted and declared.
Connect the instrument as far away as possible from sources of electromagnetic disturbances such as motors, power relays, relays, solenoid valves, etc.
The instrument can be removed from its housing from the front side : it is recommended that the instrument be disconnected from the power supply when it is necessary to carry out this operation.

3.3 - ELECTRICAL CONNECTION

Carry out the electrical wiring by connecting only one wire to each terminal, according to the following diagram, checking that the power supply is the same as that indicated on the instrument and that the load current absorption is no higher than the maximum electricity current permitted.
As the instrument is built-in equipment with permanent connection inside housing, it is not equipped with either switches or internal devices to protect against overload of current: the installation will include an overload protection and a two-phase circuit-breaker, placed as near as possible to the instrument, and located in a position that can easily be reached by the user and marked as instrument disconnecting device which interrupts the power supply to the equipment.
It is also recommended that the supply of all the electrical circuits connected to the instrument must be protect properly, using devices (ex. fuses) proportionate to the circulating currents.

It is strongly recommended that cables with proper insulation, according to the working voltages and temperatures, be used.
Furthermore, the input cable of the probe has to be kept separate from line voltage wiring. If the input cable of the probe is screened, it has to be connected to the ground with only one side.
We recommend that a check should be made that the parameters are those desired and that the application functions correctly before connecting the outputs to the actuators so as to avoid malfunctioning that may cause irregularities in the plant that could cause damage to people, things or animals.

3.4 - ELECTRICAL WIRING DIAGRAM



4 - FUNCTIONS

4.1 - MEASURING AND VISUALIZATION

All the parameters referring measurements are contained in the group **"[]InP".**
By using par. **"HCFG",** it is possible to select the input signal type which may come: from a thermocouple (tc), a thermo-resistance or a thermistor (rtd), from a transducer with normalised analogue signal in current (I) or tension (UoLt) or also from a signal coming from the communication serial line of the instrument (SEr).
Once the signal type has been selected, it is necessary to set the type of input probe on par. **"SEnS",** which can be :
- for thermocouples J (J), K (CrAL), S (S), B (b), C (C), E (E), L (L), N (n), R (r), T (t) or for infrared sensors serie ELCO IRS – A range - with linearization J (Ir.J) or K (Ir.CA)
- for thermoresistances Pt100 IEC (Pt1) or thermistors PTC KTY81-121 (Ptc) or NTC 103AT-2 (ntc)
- for normalised signals in current 0..20 mA (0.20) or 4..20 mA (4.20)
- for normalised signals in tension 0..50 mV (0.50), 0..60 mV (0.60), 12..60 mV (12.60), 0..5 V (0.5), 1..5 V (1.5), 0..10 V (0.10) or 2..10 V (2.10).

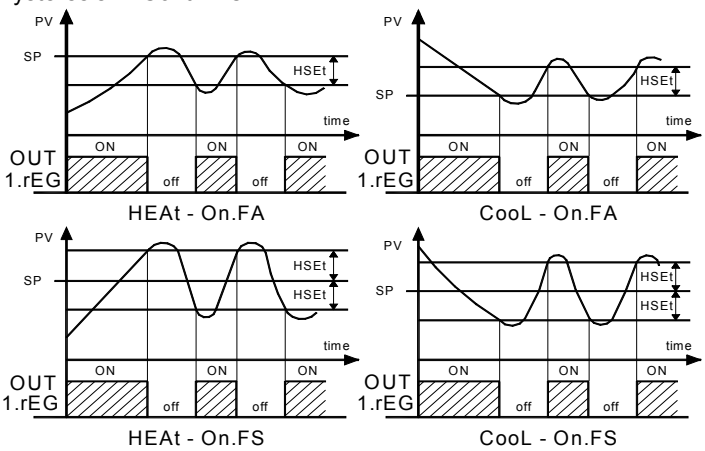
We recommend that the instrument be switched on and off whenever these parameters are modified, in order to obtain a correct measurement.
For the instruments with input for temperature probes (tc, rtd) it is possible to select the unit of measurement (°C, °F) through par. **"Unit",** and the desired resolution (0=1°; 1=0,1°) through par. **"dP"**.
Instead, with regards to the instruments with normalised analogue input signals, it is first necessary to program the desired resolution on par. **"dP"** (0=1; 1=0,1; 2=0,01; 3=0,001) and then, on par. **"SSC"**, the value that the instrument must visualise at the beginning of the scale (0/4 mA, 0/12 mV, 0/1 V o 0/2 V) and, on par. **"FSC",** the value that the instrument must visualise at the end of the scale (20 mA, 50 mV, 60 mV, 5 V or 10 V).
In the case of infrared sensors (ELCO IRS-"A" range), by programming the sensor as "Ir.J" or "Ir.CA", the par. "**rEFL**" is also present and it allows the correction of possible measuring errors caused by the environment lighting and by the reflectivity of the material. This parameter should be programmed with a high value if the material to be measured is particularly bright / reflective and must be reduced if the surface is particularly dark / not reflective, keeping in mind however that for most materials, the recommended value is within 1.00 and 0.80.
The instrument allows for measuring calibration, which may be used to recalibrate the instrument according to application needs, by using par. **"OFSt"**.
By using par. **"FiL"** it is possible to program time constant of the software filter for the input value measured, in order to reduce noise sensitivity (increasing the time of reading).

4.2 - OUTPUTS CONFIGURATION

The instrument's outputs can be programmed by entering the group of parameters **"[]Out**, where the relative parameters **"O1F" , "O2F" ,"O3F" ,"O4F" "O5F", "O6F"** (depending on the number of outputs available on the instrument) are located.
Note: *In the following examples, the number of outputs is generically indicated with* ***n***
The outputs can be set for the following functions :
= 1.rEG :Main control output
= 2.rEG : Secondary control output
= ALno : Alarm output normally open
= ALnc : Alarm output normally closed
= On : Output always activated
= OFF : Output deactivated
The coupling outputs number outputs – number alarms can be made in the group referring to the alarm to the alarm ("[]AL1, 2, 3, 4").
The option "On" it results usable for the output OUT6 (standard on all the models) to have an auxiliary supply output for input sensors

4.3 - ON/OFF CONTROL (1.rEG)

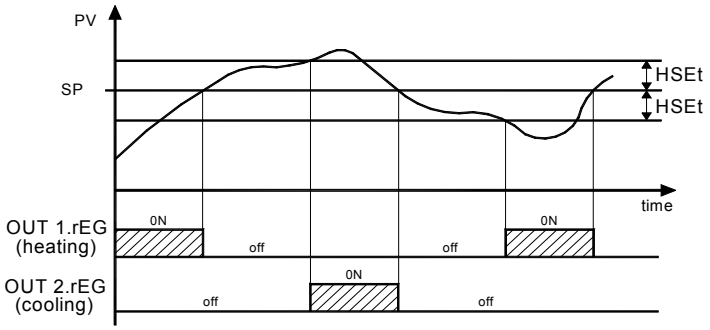
All the parameters referring to the ON/OFF control are contained in the group **"[]rEG".** This type of control can be obtained by programming par.**"Cont"** = On.FS or = On.FA and works on the output programmed as **1.rEG,** depending on the measure, on the active Set Point **"SP1"**, on the functioning mode **"Func"** and on the hysteresis **"HSEt"**. The instrument carries out an ON/OFF control with symmetric hysteresis if "Cont" = On.FS or with asymmetrical hysteresis if "Cont" = On.FA.



The control works in the following way : in the case of reverse action, or heating ("FunC"=HEAt), it deactivates the output, when the process value reaches [SP1 + HSEt] in case of symmetrical hysteresis, or [SP1] in case of asymmetrical hysteresis and is then activated again when the process value goes below value [SP1 - HSEt]. Vice versa, in case of direct action or cooling ("Func"=CooL), it deactivates the output, when the process value reaches [SP1 - HSEt] in case of symmetrical hysteresis, or [SP1] in case of asymmetrical hysteresis and is activated again when the process value goes above value [SP1 + HSEt].

4.4 - NEUTRAL ZONE ON/OFF CONTROL (1.rEG - 2.rEG)

All the parameters referring to Neutral Zone ON/OFF control are contained in the group **"]rEG".** This type of control can be obtained when 2 outputs are programmed respectively as 1.rEG and 2.rEG and the par. **"Cont"** = nr . The Neutral Zone control is used to control plants in which there is an element which causes a positive increase (ex. Heater, humidifier, etc.) and an element which causes a negative increase (ex. Cooler, de-humidifier, etc). The control functions works on the programmed outputs depending on the measurement, on the active Set Point **"SP1"** and on the hysteresis **"HSEt**". The control works in the following way : it deactivates the outputs when the process value reaches the Set Point and it activates the output 1.rEG when the process value goes below value [SP1 - HSEt], or it activates the output 2.rEG when the process value goes above [SP1 + HSEt]. Consequently, the element causing a positive increase has to be connected to the output programmed as 1.rEG while the element causing a negative increase has to be connected to the output programmed as 2.rEG.



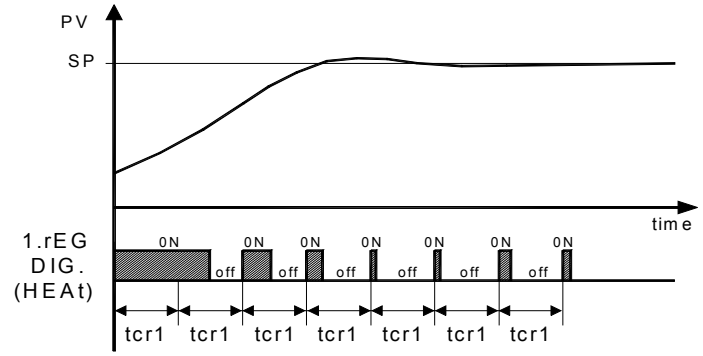
4.5 - SINGLE ACTION PID CONTROL (1.rEG)

All the parameters referring to PID control are contained in the group **"]rEG".**

The Single Action PID control can be obtained by programming par.**"Cont"** = Pid and works on the output 1.rEG depending on the active Set Point **"SP1"**, on the functioning mode **"Func"** and on the instrument's PID algorithm with two degree of freedom.

In order to obtain good stability of the process variable, in the event of fast processes and with control by digital output, the cycle time "tcr1" has to have a low value with a very frequent intervention of the control output.

In this case use of a solid state relay (SSR) is recommended for driving the actuator.

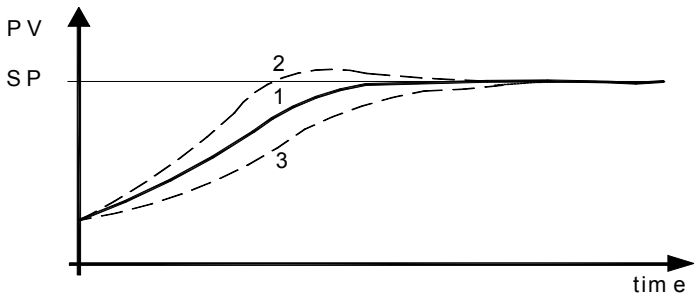


The Single Action PID control algorithm foresees the setting of the following parameters :

"Pb" - Proportional Band
"tcr1" - Cycle time of the output 1rEG (digital output only)
"Int" - Integral Time
"rS" - Manual Reset (if "Int =0 only)
"dEr" - Derivative Time
"FuOC" - Fuzzy Overshoot Control

This last parameter allows the variable overshoots at the start up of the process or at the changing of the Set Point to be avoided.

Please remember that a low value on this parameter reduces the overshoot while a high value increase it.



1: "FuOC" OK 2: "FuOC" too high 3: "FuOC" too low

4.6 - DOUBLE ACTION PID CONTROLLER (1.rEG - 2.rEG)

All the parameters referred to PID control are contained into the group **"]rEG".**

The Double Action PID control is used to control plants where there is an element which causes a positive increment (ex. Heating) and an element which causes a negative increment (ex. Cooling).

This type of control is obtainable when 2 outputs are programmed respectively as 1.rEG and 2.rEG and the par. **"Cont"** = Pid.

The element causing a positive increase has to be connected to the output programmed as 1.rEG while the element causing a negative increase has to be connected to the output programmed as 2.rEG.

The Double Action PID control works on the outputs 1.rEG and 2.rEG depending on the active Set Point **"SP1"** and on the instrument's PID algorithm with two degree of freedom.

In order to obtain a good stability of the process variable, in case of fast processes and with control by digital outputs, the cycle times "tcr1" and "tcr2" have to have a low value with a very frequent intervention of the control outputs.

In this case it's recommended to use solid state relays (SSR) to drive the actuators.

The Double Action PID control algorithm needs the programming of the following parameters :

"Pb" - Proportional Band
"tcr1" - Cycle time of the output 1.rEG
"tcr 2" - Cycle time of the output 2.rEG
"Int" - Integral Time
"rS" - Manual Reset (if "Int =0 only)
"dEr" - Derivative Time
"FuOC" - Fuzzy Overshoot Control
"Prat" - Power Ratio or relation between power of the element controlled by output 2.rEG and power of the element controlled by output 1.rEG.

4.7 - AUTOTUNING AND SELFTUNING FUNCTIONS

All the parameters referring to the AUTO-TUNING function are contained in the group **"]rEG".**

The AUTO-TUNING function permit the automatic tuning of the PID controller.

The **AUTO-TUNING** function (**FAST** or **OSCILLATING** type) permits the calculation of the PID parameters by means of a tuning cycle and, at the end of this operation, the parameters are stored into the instrument's memory and remain constant during control.

Autotuning automatically calculate the following parameters :

"Pb" - Proportional Band
"tcr1" - Cycle time of the output 1.rEG
"Int" - Integral Time
"dEr" - Derivative Time
"FuOC" - Fuzzy Overshoot Control

and, for the Double Action PID control, also :

"tcr 2" - Cycle time of the output 2.rEG
"Prat" - Ratio P 2.rEG/ P 1.rEG

To activate the AUTO-TUNING function proceed as follows :

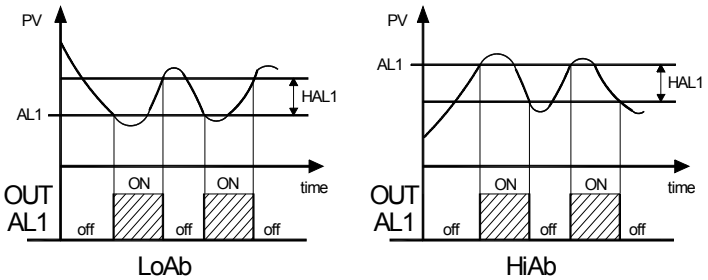
1) Program and activate the desired Set Point.
2) Program par. "Cont" =Pid
3) Program par. "Func" according to the process to be controlled through output 1.rEG.
4) Program an output as 2.rEG if the instrument controls a plant with double action
5) Set the parameter **"Auto"** as:

= 1 - if FAST autotuning is desired automatically, each time the instrument is switched on, on the condition that the process value is lower (with "Func" =HEAt) than [SP- |SP/2|] or higher (with "Func" =CooL) than [SP+ |SP/2|].
= 2 - if FAST autotuning is desired automatically, the next time the instrument is switched on, on the condition that the process value is lower (with "Func" =HEAt) than [SP- |SP/2|] or higher (with "Func" =CooL) than [SP+ |SP/2|], and once the tuning is finished, the par. "Auto" is automatically swapped to the OFF state
= 3 - if manual FAST autotuning is desired, by selecting par. "tunE" in the main menu or by key "U" correctly programming as "USrb" = tunE. The Autotuning will start at the condition that the process value is lower (with "Func" =HEAt) than [SP- |SP/5|] or higher (with "Func" =CooL) than [SP+ |SP/5|].
= 4 - if it's desired to activate the FAST autotuning automatically at the end of programmed Soft-Start cycle or each time the Set Point is changed. The Autotuning will start at the condition that the process value is lower (with "Func" =HEAt) than [SP- |SP/5|] or higher (with "Func" =CooL) than [SP+ |SP/5|].
= - 1 - if the OSCILLATING autotuning is to be started automatically each time the instrument is turned on.
= - 2 - if the OSCILLATING autotuning is to be started automatically when the instrument is turned on the next time and, once tuning has been completed, the parameter "Auto"=OFF is set automatically.
= - 3 - if OSCILLATING autotuning is started up manually, by selecting par. "tunE" in the main menu or by key "U" correctly programming as "USrb" = tunE.
= - 4 - if OSCILLATING autotuning is to be started automatically each time the Set Point is changed.
Notes : the Autotuning Fast type is particularly rapid and has no effect on the control as it calculates the parameters during the Set Point reaching phase.
In order to correctly perform the Autotuning Fast type it's necessary that at the start of the cycle there is a certain difference between the process and the Set Point and for this reason the instrument activates the Autotuning Fast type only when :
- For "Auto" = 1 or 2: the process value is lower (with "Func" =HEAt) than [SP- |SP/2|] or higher (with "Func" =CooL) than [SP+ |SP/2|].
- For "Auto" = 3 or 4 : the process value is lower (with "Func" =HEAt) than [SP- |SP/5|] or higher (with "Func" =CooL) than [SP+ |SP/5|].
The Autotuning Fast type is not advisable when the Set Point is next to the initial reading or when the measured variable changes irregularly during the tuning cycle (for reasons due to the process the variable goes up or down).
In this cases we advice the Autotuning oscillatory type that activates some ON-OFF control cycles permitting the oscillation of the process value around the Se Point value and afterward the control swap to the PID type with those values calculated by the Autotuning.
6) Exit from the parameter programming.
7) Connect the instrument to the controlled plant.
8) Start up autotuning turning off and on the instrument if "Auto" = 1 or 2, by selecting "tunE" in the main menu (or by key "U") if "Auto" = 3, or by varying the Set value if "Auto" = 4.
At this point, the Autotuning function is started up and is marked by the turning on of the led TUN.
The regulator starts up a series of operations on the connected system in order to calculate the most suitable PID regulation parameters.
If, at the FAST Auto-tuning start, the condition for the lower or higher process value is not found the display will show **"ErAt"** and the instrument will be swapped to normal control conditions according to the previously programmed parameters.
To make the error "ErAt" disappear, press key P.
The autotuning cycle is limited to a maximum of 12 hours.
If the process has not ended in 12 hours the instrument will show **"noAt"** .
Instead, if a probe error should occur, the instrument will interrupt the cycle being carried out.
The values calculated by Autotuning will be memorized automatically by the instrument at the end of the correct completion of the autotuning cycle in the parameters related to PID regulation.
To stop the Auto-tuning cycle select one of the control types : "rEG", "OPLO" or "OFF" from the menu "SEL".
If the instrument is switched off during Auto-tuning, the function will remain activate the next time it is switched on.

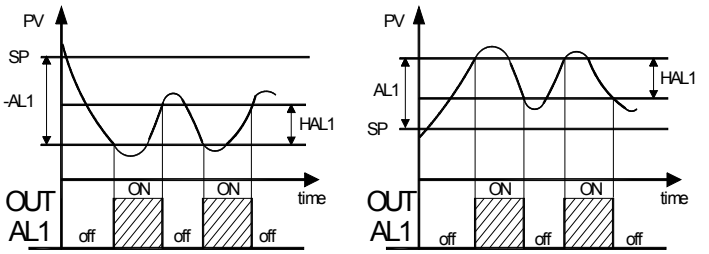
4.8 - ALARMS OUTPUTS FUNCTIONS (AL1, AL2, AL3, AL4)

The alarms depend on the process value (AL1, AL2, AL3, AL4) and before setting them to work, it is necessary to know which output the alarm has to correspond to.
First of all it is necessary to configure in the groups of parameters **"[]Out ",** the parameters relative to the outputs required as alarm ("O1F", "O2F", "O3F", "O4F", "O5F", "O6F") programming the parameter relating to the desired output as follows :
= ALno if the alarm output has to be ON when the alarm is active, while it is OFF when the alarm is not active
= ALnc if the alarm output has to be ON when the alarm is not active, while it is OFF when the alarm is active
Note: *In all the examples that follow is made reference to the alarm AL1. Naturally the operation of the other alarms results analogous.*
Have now access at the group **"[]AL1",** and program on par. **"OAL1"** , to which output the alarm signal has to be sent.
The alarm functioning is instead defined by parameters :
"AL1t " - ALARM TYPE
"AL1" - ALARM THRESHOLD
"AL1L" - LOW ALARM THRESHOLD (for band alarm) OR MINIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm)
"AL1H" - HIGH ALARM THRESHOLD (for band alarm) OR MAXIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm)
"HAL1" - ALARM HYSTERESIS
"AL1d" - ALARM ACTIVATION DELAY (in sec.)
"AL1i" - ALARM BEHAVIOUR IN THE EVENT OF MEASUREMENT ERROR

"AL1t" - ALARM TYPE : the alarm output can behave in six different ways.
LoAb = ABSOLUTE LOW ALARM: The alarm is activated when the process value goes below the alarm threshold set on parameter "AL1" and will be deactivated when it goes above the value [AL1+HAL1].
With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.
HiAb = ABSOLUTE HIGH ALARM: The alarm is activated when the process value goes higher than the alarm threshold set on parameter "AL1" and will be deactivated when it goes below the value [AL1 - HAL1].
With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.

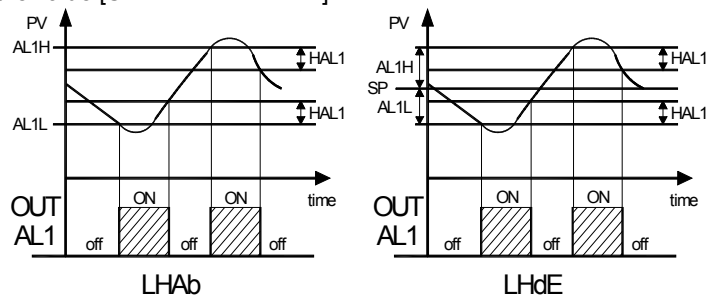


LodE = DEVIATION LOW ALARM: The alarm is activated when the process value goes below the value [SP1 + AL1] and will be deactivated when it goes above the value [SP1 + AL1 + HAL1].
With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.
HidE = DEVIATION HIGH ALARM: The alarm is activated when the process value goes above the value [SP1 + AL1] and will be deactivated when it goes below the value [SP1 + AL1 - HAL1].
With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.



LHAb = ABSOLUTE BAND ALARM: The alarm is activated when the process value goes under the alarm threshold set on parameter "AL1L" or goes higher than the alarm threshold set on parameter "AL1H" and will be deactivated when it goes below the value [AL1H - HAL1] or when it goes above the value [AL1L + HAL1].

LHdE = DEVIATION BAND ALARM: The alarm is activated when the process value goes below the value [SP1 + AL1L] or goes above than the value [SP1 + AL1H] and will be deactivated when it goes below the value [SP1 + AL1H - HAL1] or when it goes above the value [SP1 + AL1L + HAL1].



"AL1i" - ALARM ACTIVATION IN CASE OF MEASUREMENT ERROR: This allows one to establish how the alarm have behave in the event of a measurement error (yES=alarm active; no=alarm deactivated).

4.9 - HEATER BREAK ALARM FUNCTION (HB)

All the parameters referring to the Heater Break alarm function are contained in the group **"]Hb".**

The Heater Break alarm function (Breakage of the heating element) is only available when the instrument is equipped with the input (TAHB) to measure the current and if use a digital output to control the load.

This input accepts signals coming from current transformers (TA) with max. output 50 mA.

The first operation to be carried out in order to obtain a correct current measurement, is to set the current that the instrument has to measure at the end of scale of the input TA (50 mA) on par. **"IFS"**.

It is necessary to establish to which output the alarm has to correspond.

To do this it is necessary to set the parameter relative to the output to be used ("O1F", "O2F", "O3F", "O4F", "O5F", "O6F") in the groups **"]Out ",** programming the parameter as :

= ALno if the alarm output has to be active when the alarm is active while it is deactivated when the alarm is not active.

= ALnc if the alarm output has to be active when the alarm is not active while it is deactivated when the alarm is active.

Enter group **"]Hb"** and program which output the alarm signal has to address on parameter **"OHb**.

The functioning mode of the alarm is instead defined on par. **"HbF"** which can be set in the following way :

= 1 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** .

= 2 : The alarm is active when, with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. **"IHbH"** .

= 3 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** or with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. **"IHbH"**.

= 4 : The alarm is active when the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** or the measured current is higher than the value programmed on par. **"IHbH"**, independently by the state of the output 1.rEG.

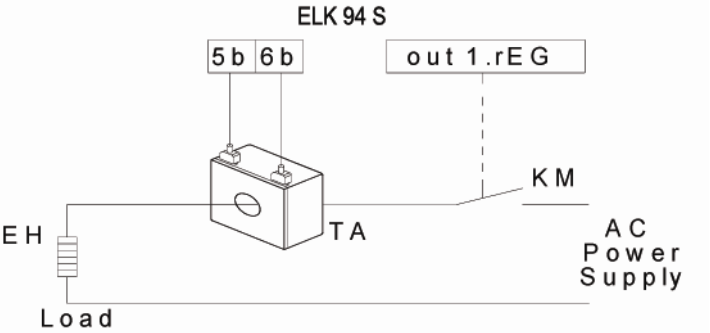
On par. "IHbL" the value of the current normally absorbed by the load when output 1.rEG is active has to be set, while on par. "IHbH" the current normally absorbed by the load when output 1.rEG is not active.

The programming of these parameters has to be carried out while also considering the fluctuations of the net voltage to avoid undesired alarms.

With regards to the hysteresis of the HB alarm, this is automatically calculated by the instrument as 1% of the programmed thresholds.

During functioning it is possible to visualize the current measured by the input TAHB when output 1rEG is activated, by pushing the "DOWN" key and the current measured when output 1.rEG is deactivated, by pushing the "DOWN" and "U" keys at the same time.

To exclude the Heater Break alarm it is enough to set "OHb" = OFF.



Note : *The HB current measurement is valid if the output 1rEG is activated (or deactivated) for 264 ms. at least.*

This means that, if the cycle time ("tcr1") is = 1 sec, the HB alarm is able to intervene only when the output power is higher than 26,4%.

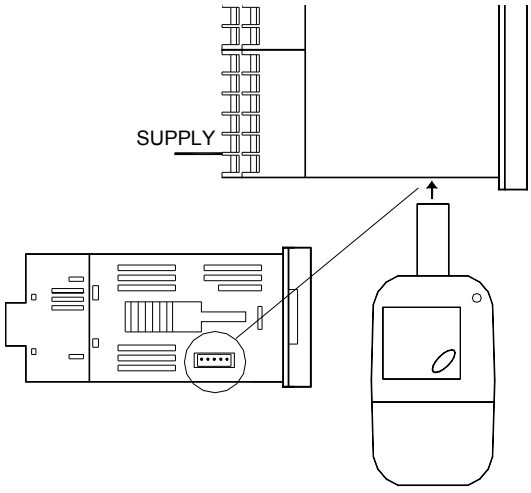
4.10 - PARAMETERS CONFIGURATION BY "A01"

The instrument is equipped with a connector that allows the transfer from and toward the instrument of the functioning parameters through the device **ELCO A01** with **5 poles** connector.

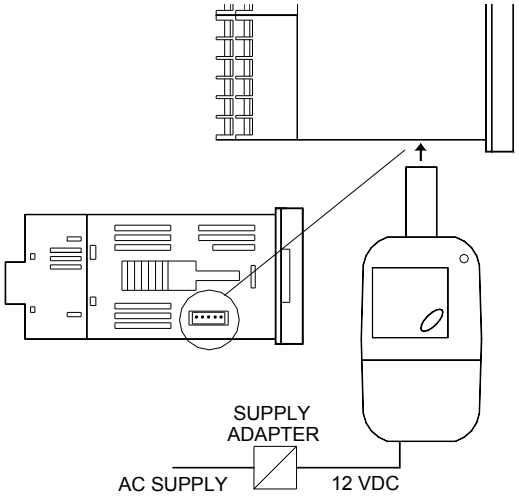
This device it's mainly useable for the serial programming of the instruments which need to have the same parameters configuration or to keep a copy of the programming of an instrument and allow its rapid retransmission.

To use the device A01 it's necessary that the device or instrument are being supplied.

Instrument supplied and device not supplied



Instrument supplied from the device



For additional info, please have a look at the A01 instruction manual.

5 - PROGRAMMABLE PARAMETERS TABLE

Here following are described all the parameters available on the instrument. Some of them could be not present or because they are depending on the type of instrument or because they are automatically disabled as unnecessary.

Group "] SP" (parameters relative to the Set Point)

Par.		Description	Range	Def.	Note
1	**SP1**	Set Point	SPLL ÷ SPHL	0	
2	**SPLL**	Set Point minimum	-1999 ÷ SPHL	-1999	
3	**SPHL**	Set Point maximum	SPLL ÷ 9999	9999	

Gruppo "] InP" (parameters relative to the inputs)

Par.		Description	Range	Def.	Note
4	**HCFG**	Input type	tc / rtd / I / UoLt / SEr	tc	
5	**SEnS**	Probe type: J=thermocoupled J CrAL=thermocoupled K S=thermocoupled S b=thermocoupled B E=thermocoupled E n=thermocoupled N r=thermocoupled R t=thermocoupled T C=thermocoupled C Ir.J=IR Sen. IRS J Ir.CA=IR Sen. IRS K Pt1=thermores. Pt100 0.50= 0..50 mV 0.60= 0..60 mV 12.60= 12..60 mV Ptc= PTC KTY81-121 ntc= NTC 103-AT2 0.20= 0..20 mA 4.20= 4..20 mA 0.1= 0..1 V 0.5=0..5 V 1.5= 1..5 V 0.10= 0..10 V 2.10= 2..10 V	<u>tc :</u> J/ CrAL/ S/ b/ E/ L/ n/ r/ t/ C/ Ir.J / Ir.CA <u>rtd :</u> Pt1 / Ptc / ntc <u>I :</u> 0.20 / 4.20 <u>UoLt :</u> 0.50 / 0.60 / 12.60 / 0.5 / 1.5 / 0.10 / 2.10	J	
6	**rEFL**	Reflection coefficient for IRS sensors	0.10 ÷ 1.00	1.00	
7	**SSC**	Low scale limit in case of input with V / I signals	-1999 ÷ FSC	0	
8	**FSC**	High scale limit in case of input with V / I signals	SSC ÷ 9999	0	
9	**dP**	Number of decimal figures	<u>tc/rtd :</u> 0 / 1 <u>UoLt / I / SEr:</u> 0 ÷ 3	0	
10	**Unit**	Temperature unit of measurement	<u>tc/rtd :</u> °C / °F	°C	
11	**FiL**	Input digital filter	0FF÷ 20.0 sec.	0.2	
12	**OFSt**	Measuring Offset	-1999 ÷ 9999	0	

Group "] Out" (parameters relative to outputs)

Par.		Description	Range	Def.	Note
13	**O1F**	Out1 Function: 1.rEG= Control output 1 2.rEG= Control output 2 ALno= Alarm Out normally opened ALnc= Alarm Out normally closed On = always on OFF= disable	1.rEG / 2.rEG ALno / Alnc On / OFF	1.rEG	
14	**O2F**	Out2 Function:: see "O1F"	1.rEG / 2.rEG ALno / ALnc On / OFF	OFF	
15	**O3F**	Out3 Function:: see "O1F"	1.rEG / 2.rEG ALno / ALnc On / OFF	OFF	
16	**O4F**	Out4 Function: see "O1F"	1.rEG / 2.rEG ALno / ALnc On / OFF	OFF	
17	**O5F**	Out5 Function: see "O1F"	1.rEG / 2.rEG ALno / ALnc On / OFF	OFF	
18	**O6F**	Out6 Function: see "O1F"	1.rEG / 2.rEG ALno / ALnc On / OFF	On	

Group "] AL1" (parameters relative to alarm AL1)

Par.		Description	Range	Def.	Note
19	**OAL1**	Output where alarm AL1 is addressed	Out1 / Out2 Out3 / Out4 / Out5 / Out6 / OFF	Out2	
20	**AL1t**	Alarm AL1 type: LoAb= Absolute Low HiAb= Absolute High LHAb= Absolute Band LodE= Deviation Low HidE= Deviation High LHdE= Deviation Band	LoAb / HiAb LHAb / LodE HidE / LHdE	LoAb	
21	**AL1**	Alarm AL1 threshold	AL1L÷ AL1H	0	
22	**AL1L**	Low threshold band alarm AL1 or Minimum set alarm AL1 for high or low alarm	-1999 ÷ AL1H	-1999	
23	**AL1H**	High threshold band alarm AL1 or Maximum set alarm AL1 for high or low alarm	AL1L ÷ 9999	9999	
24	**HAL1**	Alarm AL1 hysteresis	OFF ÷ 9999	1	
25	**AL1d**	Activation delay of alarm AL1	OFF ÷ 9999 sec.	OFF	
26	**AL1i**	Alarm AL1 activation in case of measuring error	no / yES	no	

Group "] AL2" (parameters relative to alarm AL2)

Par.		Description	Range	Def.	Note
27	**OAL2**	Output where alarm AL2 is addressed	Out1 / Out2 Out3 / Out4 / Out5 / Out6 OFF	OFF	
28	**AL2t**	Alarm AL2 type: see "AL1t"	LoAb / HiAb LHAb / LodE HidE / LHdE	LoAb	
29	**AL2**	Alarm AL2 threshold	AL2L÷ AL2H	0	

30	**AL2L**	Low threshold band alarm AL2 or Minimum set alarm AL2 for high or low alarm	-1999 ÷ AL2H	-1999	
31	**AL2H**	High threshold band alarm AL2 or Maximum set alarm AL2 for high or low alarm	AL2L ÷ 9999	9999	
32	**HAL2**	Alarm AL2 hysteresis	OFF ÷ 9999	1	
33	**AL2d**	Activation delay of alarm AL2	OFF ÷ 9999 sec.	OFF	
34	**AL2i**	Alarm AL2 activation in case of measuring error	no / yES	no	

Group "] AL3" (parameters relative to alarm AL3)

Par.		Description	Range	Def.	Note
35	**OAL3**	Output where alarm AL3 is addressed	Out1 / Out2 Out3 / Out4 / Out5 / Out6 OFF	OFF	
36	**AL3t**	Alarm AL3 type: see "AL1t"	LoAb / HiAb LHAb / LodE HidE / LHdE	LoAb	
37	**AL3**	Alarm AL3 threshold	AL3L÷ AL3H	0	
38	**AL3L**	Low threshold band alarm AL3 or Minimum set alarm AL3 for high or low alarm	-1999 ÷ AL3H	-1999	
39	**AL3H**	High threshold band alarm AL3 or Maximum set alarm AL3 for high or low alarm	AL3L ÷ 9999	9999	
40	**HAL3**	Alarm AL3 hysteresis	OFF ÷ 9999	1	
41	**AL3d**	Activation delay of alarm AL3	OFF ÷ 9999 sec.	OFF	
42	**AL3i**	Alarm AL3 activation in case of measuring error	no / yES	no	

Group "] AL4" (parameters relative to alarm AL4)

Par.		Description	Range	Def.	Note
43	**OAL4**	Output where alarm AL4 is addressed	Out1 / Out2 Out3 / Out4 / Out5 / Out6 OFF	OFF	
44	**AL4t**	Alarm AL4 type: see "AL1t"	LoAb / HiAb LHAb / LodE HidE / LHdE	LoAb	
45	**AL4**	Alarm AL4 threshold	AL4L÷ AL4H	0	
46	**AL4L**	Low threshold band alarm AL4 or Minimum set alarm AL4 for high or low alarm	-1999 ÷ AL4H	-1999	
47	**AL4H**	High threshold band alarm AL4 or Maximum set alarm AL4 for high or low alarm	AL4L ÷ 9999	9999	
48	**HAL4**	Alarm AL4 hysteresis	OFF ÷ 9999	1	
49	**AL4d**	Activation delay of alarm AL4	OFF ÷ 9999 sec.	OFF	
50	**AL4i**	Alarm AL4 activation in case of measuring error	no / yES	no	

Group "] Hb" (parameters relative to Heater Break Alarm)

Par.		Description	Range	Def.	Note
51	**OHb**	Output where alarm HB is addressed	Out1 / Out2 Out3 / Out4 / Out5 / Out6 OFF	OFF	
52	**IFS**	High scale limit for input TA HB	0.0 ÷ 100.0	100.0	
53	**HbF**	HB Alarm function: 1= Min. 1.rEG on 2=Max. 1.rEG off 3= Min. 1.rEG on and Max. 1.rEG off 4= Max and Min.	1 / 2 / 3 / 4	1	
54	**IHbL**	Low alarm HB threshold (with Out 1.rEG ON)	0.0 ÷ IFS	0.0	
55	**IHbH**	High alarm HB threshold (with Out 1.rEG OFF)	IHbL ÷ IFS	100.0	

Group "] rEG" (parameters relative to control)

Par.		Description	Range	Def.	Note
56	**Cont**	Control type: Pid= PID On.FA= ON/OFF asym. On.FS= ON/OFF sym. nr= Neutral Zone 3Pt= don't use.	Pid / On.FA On.FS / nr 3 Pt	Pid	
57	**Func**	Functioning mode output 1.rEG	HEAt / CooL	HEAt	
58	**HSEt**	Hysteresis of ON/OFF control (or end Soft Start cycle threshold)	0 ÷ 9999	1	
59	**Auto**	Autotuning enable FAST (positive values), OSCILLATING (negative values) OFF = Not active 1 = Start each power on 2= Start at first power on 3= Start manually 4= Start after Set change	-4 / -3 / -2 / -1 0 / 1 / 2 / 3 / 4	1	
60	**Pb**	Proportional band	0 ÷ 9999	50	
61	**Int**	Integral time	OFF ÷ 9999 sec.	200	
62	**dEr**	Derivative time	OFF÷ 9999 sec.	50	
63	**FuOc**	Fuzzy overshoot control	0.00 ÷ 2.00	0.5	
64	**tcr1**	Cycle time of output 1.rEG	0.1 ÷ 130.0 sec.	20.0	
65	**Prat**	Power ratio 2.rEG/1.rEG	0.01 ÷ 99.99	1.00	
66	**tcr2**	Cycle time of 2.rEG	0.1 ÷ 130.0 sec.	10.0	
67	**rS**	Manual reset	-100.0÷100.0 %	0.0	

6 - PROBLEMS, MAINTENANCE AND GUARANTEE

6.1 - ERROR SIGNALLING

Error	Reason	Action
- - - -	Probe interrupted	Verify the correct connection between probe and instrument and then verify the correct functioning of the probe
uuuu	The measured variable is under the probe's limits (under-range)	
oooo	The measured variable is over the probe's limits (over-range)	
ErAt	FAST Autotuning not possible because the process value is too higher or too lower	Push key "P" in order to make the error message disappear. Once the error has been found, try to repeat the auto-tuning.
noAt	Auto-tuning not finished within 12 hours	Check the functioning of probe and actuator and try to repeat the auto-tuning.
ErEP	Possible anomaly of the EEPROM memory	Push key "P"

6.2 - CLEANING
We recommend cleaning of the instrument with a slightly wet cloth using water and not abrasive cleaners or solvents which may damage the instrument.

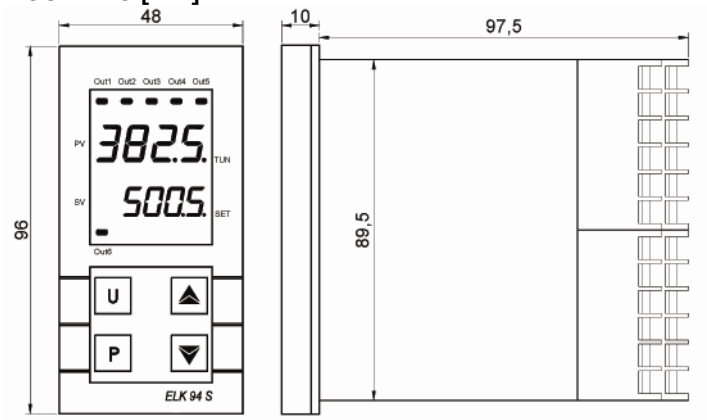
6.3 - GUARANTEE AND REPAIRS
The instrument is under warranty against manufacturing flaws or faulty material, that are found within 12 months from delivery date.
The guarantee is limited to repairs or to the replacement of the instrument.
The eventual opening of the housing, the violation of the instrument or the improper use and installation of the product will bring about the immediate withdrawal of the warranty's effects.
In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.
The faulty product must be shipped to ELCO with a detailed description of the faults found, without any fees or charge for ELCO, except in the event of alternative agreements.

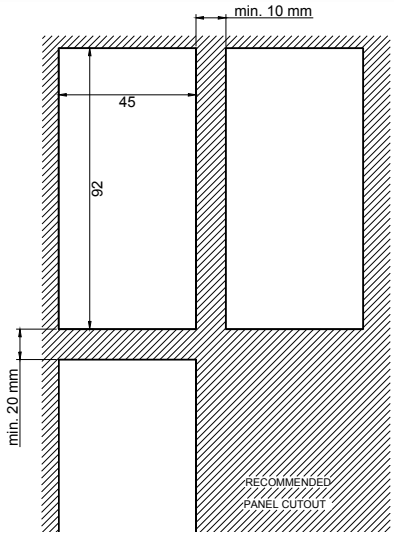
7 - TECHNICAL DATA

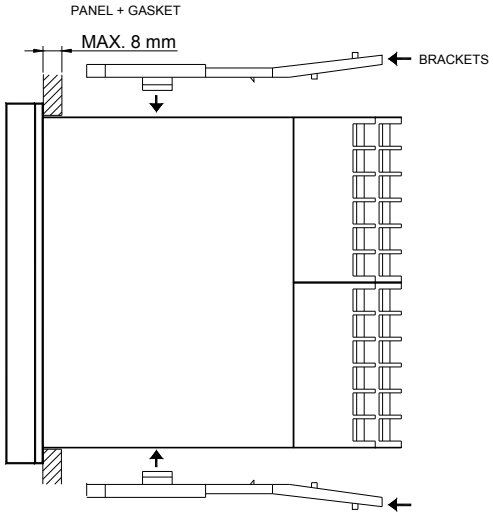
7.1 - ELECTRICAL DATA
Power supply: 24 VAC/VDC, 100... 240 VAC +/- 10%
Frequency AC: 50/60 Hz
Power consumption: 10 VA approx.
Input/s: 1 input for temperature probes: tc J,K,S,B,C,E,L,N, R,T; infrared sensors ELCO IRS J and K range A ; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C) or mV signals 0...50 mV, 0...60 mV, 12 ...60 mV or normalized signals 0/4...20 mA, 0/1...5 V , 0/2...10 V.
1 input for current transformer (50 mA max.)
Impedance normalized signals input: 0/4..20 mA: 51 Ω;
mV and V: 1 MΩ
Output/s: Up to 6 digital outputs. Relay OUT1: SPST-NO (6 A-AC1, 3 A-AC3 / 250 VAC), OUT2,3,4,5:SPST-NO (4 A-AC1, 2 A-AC3 / 250 VAC) or voltage output to drive SSR (12 VDC / 20 mA).
Auxiliary supply output / OUT6: 12 VDC / 20 mA Max.
Electrical life for relay outputs: 100000 operat.
Installation category: II
Measurement category: I
Protection class against electric shock: Class II for Front panel
Insulation: Reinforced insulation between the low voltage section (supply and relay outputs) and the front panel; Reinforced insulation between the low voltage section (supply and relay outputs) and the extra low voltage section (inputs, SSR outputs); SSR outputs optoisolated respect to the input.

7.2 - MECHANICAL DATA
Housing: Self-extinguishing plastic, UL 94 V0
Dimensions: 48 x 96 mm DIN, depth 98 mm
Weight: 260 g approx.
Mounting: Flush in panel in 45 x 92 mm hole
Connections: 2 x 1 mm^2 screw terminals block
Degree of front panel protection : IP 54 mounted in panel with gasket
Pollution situation: 2
Operating temperature: 0 ... 50 °C
Operating humidity: 30 ... 95 RH% without condensation
Storage temperature: -10 ... +60 °C

7.3 - MECHANICAL DIMENSIONS, PANEL CUT-OUT AND MOUNTING [mm]







7.4 - FUNCTIONAL FEATURES
Control: ON/OFF, single and double action PID
Measurement range: according to the used probe (see range table)
Display resolution: according to the probe used 1/0,1/0,01/0,001
Overall accuracy: +/- (0,2 % fs + 1 digit); PTC/NTC: +/- (0,5 % fs + 1 digit)
Max. cold junction compensation drift (in tc) : 0,04 °C/°C with operating temperature 0 ... 50 °C after warm-up of 20 min.
Sampling rate: 130 ms.
Display: Display: 4 digit, 1 Red (PV) h 10mm and 1 green (SV), h 7,5 mm
Compliance: ECC directive EMC 2004/108/CE (EN 61326), ECC directive LV 2006/95/CE (EN 61010-1)

7.5 - MEASURING RANGE TABLE

INPUT	"dP" = 0	"dP"= 1, 2, 3
tc J **"HCFG" = tc** **"SEnS" = J**	-160 ... 1000 °C - 256 ... 1832 °F	-160.0 ... 999.9 °C -199.9 ... 999.9 °F
tc K **"HCFG" = tc** **"SEnS" = CrAl**	-100 ... 1370 °C - 148 ... 2498 °F	-100.0 ... 999.9 °C -148.0 ... 999.9 °F
tc S **"HCFG" = tc** **"SEnS" = S**	0 ... 1760 °C 32 ... 3200 °F	0.0 ... 999.9 °C 32.0 ... 999.9 °F
tc B **"HCFG" = tc** **"SEnS" = b**	72 ... 1820 °C 162 ... 3308 °F	72.0 ... 999.9 °C 162.0 ... 999.9 °F
tc E **"HCFG" = tc** **"SEnS" = E**	-150 ... 750 °C -252 ... 1382 °F	-150.0 ... 750.0 °C -199.9 ... 999.9 °F
tc L **"HCFG" = tc** **"SEnS" = L**	-150 ... 900 °C -252 ... 1652 °F	-150.0 ... 900.0 °C -199.9 ... 999.9 °F
tc N **"HCFG" = tc** **"SEnS" = n**	-250 ... 1300 °C -418 ... 2372 °F	-199.9 ... 999.9 °C -199.9 ... 999.9 °F
tc R **"HCFG" = tc** **"SEnS" = r**	-50 ... 1760 °C -58 ... 3200 °F	-50.0 ... 999.9 °C -58.0 ... 999.9 °F
tc T **"HCFG" = tc** **"SEnS" = t**	-250 ... 400 °C -418 ... 752 °F	-199.9 ... 400.0 °C -199.9 ... 752.0 °F
tc C **"HCFG" = tc** **"SEnS" = C**	0 ... 2320 °C 32 ... 4208 °F	0.0 ... 999.9 °C 32.0 ... 999.9 °F
IRS range "A" **"HCFG" = tc** **"SEnS"= Ir.J - Ir.CA**	-46 ... 785 °C -50 ... 1445 °F	-46.0 ... 785.0 °C -50.8 ... 999.9 °F
Pt100 (IEC) **"HCFG" = rtd** **"SEnS" = Pt1**	-200 ... 850 °C -328 ... 1562 °F	-199.9 ... 850.0 °C -199.9 ... 999.9 °F
PTC (KTY81-121) **"HCFG" = rtd** **"SEnS" = Ptc**	-55 ... 150 °C -67 ... 302 °F	-55.0 ... 150.0 °C -67.0 ...302.0 °F
NTC (103-AT2) **"HCFG" = rtd** **"SEnS" = ntc**	-50 ... 110 °C -58 ... 230 °F	-50.0 ... 110.0 °C -58.0 ... 230.0 °F
0..20 mA **"HCFG" = I** **"SEnS" = 0.20**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
4..20 mA **"HCFG" = I** **"SEnS" = 4.20**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 50 mV **"HCFG" = UoLt** **"SEnS" = 0.50**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 60 mV **"HCFG" = UoLt** **"SEnS" = 0.60**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
12 ... 60 mV **"HCFG" = UoLt** **"SEnS" = 12.60**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 5 V **"HCFG" = UoLt** **"SEnS" = 0.5**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
1 ... 5 V **"HCFG" = UoLt** **"SEnS" = 1.5**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 10 V **"HCFG" = UoLt** **"SEnS" = 0.10**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
2 ... 10 V **"HCFG" = UoLt** **"SEnS" = 2.10**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999

7.6 - INSTRUMENT ORDERING CODE

ELK94S a b c d e f g h i j kk ll A

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

b : OUTPUT OUT1
R = OUT1 Relay
S = OUT1 VDC for SSR

c : OUTPUT OUT2
2R = OUT2 Relay
2S = OUT2 VDC for SSR
- = (No OUT2)

d : OUTPUT OUT3
3R = OUT3 Relay
3S = OUT3 VDC for SSR
- = (No OUT3)

e : OUTPUT OUT4
4R = OUT4 Relay
4S = OUT4 VDC for SSR
- = (No OUT4)

f : OUTPUT OUT5
5R = OUT5 Relay
5S = OUT5 VDC for SSR
- = (No OUT5)

g : CURRENT TRANSFORMER INPUT
- = Not present
HB = Present

h, i, j : INTERNAL CODES

kk, ll : SPECIAL CODES

P.A. : The outputs OUT 4, 5 must be the same type (Relay or VDC for SSR)

ELK 94S PASSWORD = 381