TLK41

MICROPROCESSOR-BASED DIGITAL ELECTRONIC CONTROLLER

OPERATING INSTRUCTIONS

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PREFACE

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.

Ascon Tecnologic 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, things or animals, please remember that the plant has to be equipped with additional devices which will guarantee safety.

Ascon Tecnologic 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 features.

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1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION

TLK 41 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 FAST** function, **SELF-TUNING** function 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 features independently in the event of process disturbance and Set Point variations.

Furthermore, the instrument allows for RS485 serial communication using MODBUS-RTU communication protocol and a transmission speed up to 38.400 baud.

The process value is visualized on 4 red displays, while the output status is displayed by 4 LED indicators. The instrument has also a programmable 3 LED shift index.

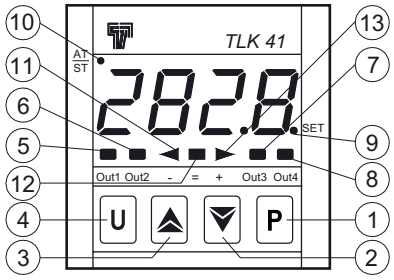
The instrument can store 4 Set Points and can have up to 4 outputs: relay type or Voltage type to drive solid state relays (SSR).

The input is programmable and accepts temperature probes (Thermocouples J, K, S; Thermo-resistances PT100, Thermistors PTC and NTC; Infrared sensors) 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 Heater Break Alarm function.

Other important available functions are: Loop-Break Alarm function, reaching of the Set Point at controlled speed, ramp and dwell function, Soft-Start function, parameters protection on different levels.

1.2 - FRONT PANEL DESCRIPTION



1) **P key:** Used to access the programming parameters and to confirm selection.
2) **▼ key:** 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 allows to show, on the display, the value of the current measured by the TAHB input.
3) **▲ key:** 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 allows to show, on the display, the value of the control output power.
4) **U key:** This is a key with a function programmable by par. "**USrb**". It can be set to: Activate Auto-tuning and Self-tuning functions, swap the instrument to manual control, silence the alarm, change the active Set Point, deactivate control (see par. 4.13) and modify the visibility of the parameters in "**ConF**" menu (see par. 2.3).
5) **OUT1 LED:** indicates the state of output OUT1
6) **OUT2 LED:** indicates the state of output OUT2
7) **OUT3 LED:** indicates the state of output OUT3
8) **OUT4 LED:** indicates the state of output OUT4
9) **SET LED:** Indicates the access to the programming mode and the parameters programming level.
10) **AT/ST LED:** indicates that the Self-tuning function is activated (light on) or that Auto-tuning (flashing) is in progress.
11) **- LED Shift index:** indicates that the process value is lower than the one programmed on par. "AdE".
12) **= LED Shift index:** indicates that the process value is within the range [SP+AdE... SP-AdE]
13) **+ LED Shift index:** indicates that the process value is higher than the one set on par. "AdE".

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 the key P, then release it and the display will show "**SP n**" (where n is the number of the Set Point active at that moment) and the programmed value.

To modify the value, press ▲ key to increase it or the ▼ key to decrease it.

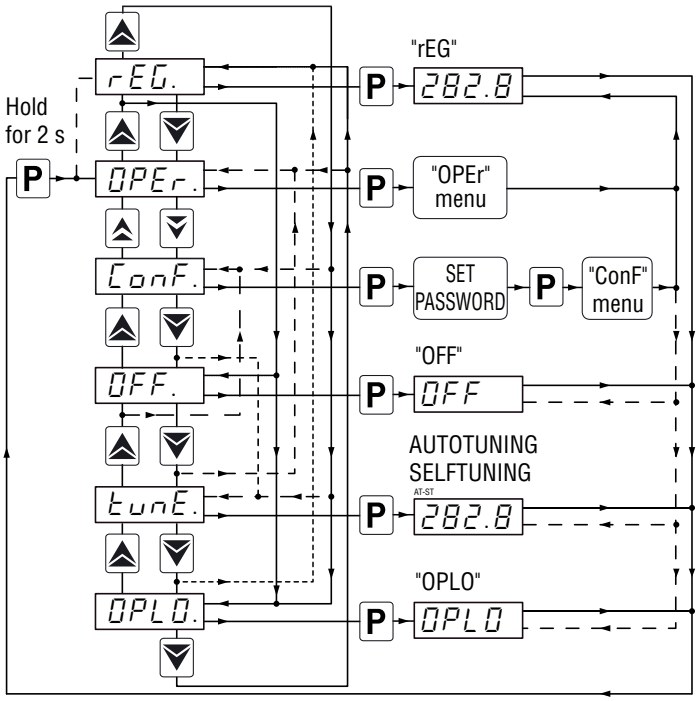
These keys change the value one digit at a time but if they are pressed for more than one second, the value increases or decreases rapidly and, after two seconds in the same condition, the changing speed increases in order to allow the desired value to be reached rapidly.

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 pressing P and holding it down for approx. 2 s it is possible to enter into the main selection menu.



Using the ▲ and ▼ keys is possible to scroll the selections available:

"OPEr"	To enter the operating parameters menu
"ConF"	To enter the configuration parameters menu
"OFF"	To place the controller in OFF state
"rEG"	To place the controller in automatic control state
"tunE"	To activate the Auto-tuning or Self-tuning function
"OPLO"	To place the controller in manual mode and to set the % control value using the ▲ and ▼ keys

Once the desired item has been selected, press P to confirm.

The selection of "**OPEr**" or "**ConF**" allows to access different submenus containing multiple parameters; in particular:

"**OPEr**" - Operating parameters Menu: it normally contains only the Set Point (SP1) parameters but can be programmed to contain all the desired parameters (see par. 2.3).

"**ConF**" - Configuration parameters Menu: it contains all the operating parameters and the functioning configuration parameters (alarm configuration, control, input, etc.)

To enter the "**ConF**" menu use the ▲ and ▼ keys to display "**ConF**" then, press P; the display will show "**0**".

At this request, enter, using keys ▲ and ▼, the password reported on the last page of this manual; once the number is the correct one, press P.

If an incorrect password is entered, the instrument exits the programming mode.

If the password is correct, the display will show the code that identifies the first group of parameters ("**SP**") and with keys ▲ and ▼ 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 recalled and displayed pressing P.

Again using the ▲ and ▼ keys, is possible to select the desired parameter and, if the key P is pressed, the display will show the parameter code then its programmed value. At this time the parameter value can be modified by using the keys ▲ and ▼.

Programmed the desired value, push key P once more: the new value will be stored and the display will return to the parameter code.

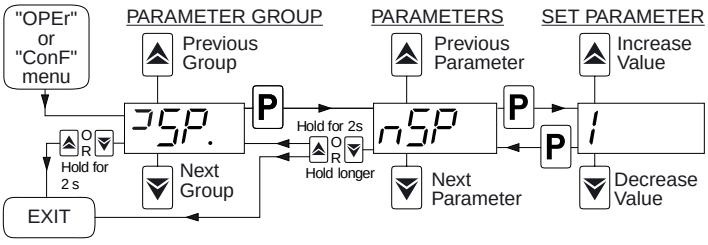
By using the ▲ and ▼ keys, it is then possible to select a different parameter (if present) and modify it as described above.

To select another group of parameters, keep the ▲ and ▼ key pressed for approx. 2 s, afterwards the display will return to show the code of the group of parameters.

Release the key and by using the ▲ and ▼ 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 ▲ and ▼ pressed until exit from the programming mode is obtained.

Entering and exiting the programming mode of menu "**OPEr**" are the same as those described for menu "**CONF**" except that to enter the menu "**OPEr**" the Password is not required.



ATTENTION: The instrument is factory programmed with all the parameters, except the Set Point ("SP1" and 2, 3, 4), programmable in the menu "**ConF**". The Set Points are not set in order 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, the SET LED switched to OFF means that the parameter is programmable only in the "**ConF**" menu, the SET LED lit means that the parameter is programmable also in the "**OPEr**" menu.

To modify the visibility of the parameter, press U: the LED SET will change its state indicating the parameter accessibility level (LED ON = menu "OPEr" and "ConF"; LED 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**").

The possibility to change the Set Points with the procedure described at paragraph 2.1 is subject to what has been programmed for the parameter "**Edit**" (contained in the group "**Pan**").

This parameter can be programmed as:

=SE: The active Set Point can be modified while the alarm thresholds cannot be modified;

=AE: The active Set Point cannot be modified while the alarm thresholds can be modified;

=SAE: Both the active Set Point and the alarm thresholds can be modified;

=SAnE: Both the active Set Point and the alarm thresholds can not be modified.

2.4 - CONTROL MODE

The controller can act in 3 different modes: automatic control (rEG), control off (OFF) and manual control (OPLO).

The instrument can switch from a control mode to another:

- Using the keyboard to select the desired control mode from the main selection menu.
- Pres U key to switch from "**rEG**" mode to the mode programmed for parameter "**USrb**" and vice versa. The "**URsb**" value must be properly programmed ("USrb" = tunE; "USrb" = OPLO; "USrb" = OFF).
- Automatically (the instrument swaps into "**rEG**" mode at the and of the auto-tuning execution).

When the instrument is power ON, it automatically resumes the control mode that was active when it has been switched OFF.

AUTOMATIC CONTROL (rEG) - Automatic control is the normal functioning mode of the controller.
During the automatic control, press U key to show on the display the output power.

The values are displayed in the range H100... C100 (H100 = 100% output power with reverse action; C100 = 100% power output with direct action).

CONTROL OFF (OFF) - The instrument can be swapped into the "**OFF**" mode, 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, shown on the display, is the same as the last one supplied and can be modified using ▲ and ▼ 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.

2.5 - ACTIVE SET POINT SELECTION

This instrument permits to pre-program up to 4 different Set Points ("**SP1**", "**SP2**", "**SP3**", "**SP4**") and then select which one must be active. The maximum number of Set Points is determined by par. "**nSP**" located in the group of parameters "**SP**".

The active Set Point can be selected:

- By parameter "**SPAt**" in the group of parameters "**SP**";
- By key U if par. "**USrb**" = CHSP;
- Automatically between SP1 and SP2 if a time "**dur.t**" (see paragraph 4.12) has been programmed.

Set Points "**SP1**", "**SP2**", "**SP3**", "**SP4**" will be visible depending on the maximum number of Set Points selected on par. "nSP" and they can be programmed with a value that is between the value programmed on par. "**SPLL**" and the one programmed on par. "**SPHL**".

Note: In all the following examples the Set Point is indicated as "**SP**", however the instrument will act according to the Set Point selected as active.

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 up to altitudes of 2000 m. The instrument use 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, things or animals, please remember that the plant MUST be equipped with additional devices which will guarantee safety.

3.2 - MECHANICAL MOUNTING

The instrument, in DIN case 48 x 48 mm, is designed for flush-in panel mounting. Make a hole 45 x 45 mm and insert the instrument, fixing it with the provided special bracket. We recommend that the gasket is mounted in order to obtain the declared front protection degree. 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 that the instrument has an adequate ventilation and avoid installation in containers which are placed devices that may cause the instrument to operate outside the temperature limits stated. 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.

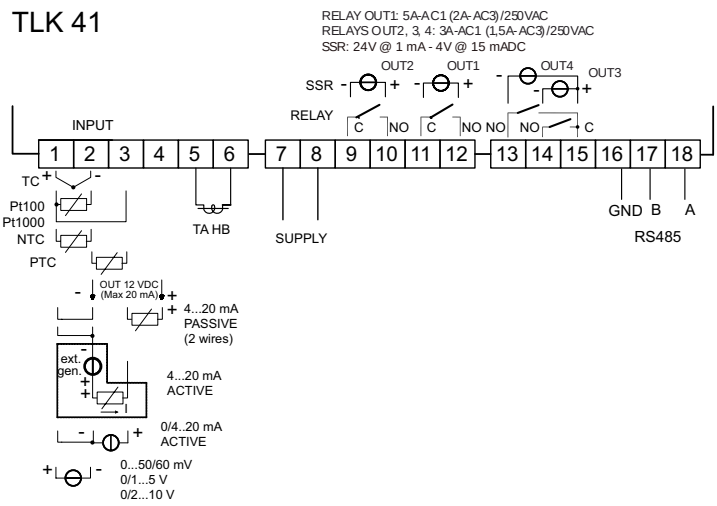
3.3 - ELECTRICAL CONNECTION

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.

Since the instrument was intended for permanent connection into a cabinet, 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 protected 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 parameter "**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 normalized 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) or for infrared sensors series Ascon Tecnologic IRTC1 with linearization J (Ir.J) or K (Ir.CA)
- For thermo-resistances Pt100 IEC (Pt1) or thermistors PTC KTY81-121 (Ptc) or NTC 103AT-2 (ntc).
- For normalized current signals: 0… 20 mA (0.20) or 4… 20 mA (4.20)
- For normalized signals in voltage 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).

In order to obtain a correct measurement, we recommend to switch the instrument OFF and ON whenever these parameters are modified.

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**".

As for the instruments with normalized analogue input signals, it is first necessary to program the desired resolution with par. "**dP**" (0=1; 1=0,1; 2=0,01; 3=0,001) then, with par. "**SSC**", the value that the instrument must display at the beginning of the scale (0/4 mA, 0/12 mV, 0/1 V o 0/2 V) and finally, with par. "**FSC**", the value that the instrument must display at the end of the scale (20 mA, 50 mV, 60 mV, 5 V or 10 V).

The instrument allows for measuring calibration, which may be used to recalibrate the instrument according to application needs, by using par. "**OFSt**" and "**rot**".

Programming par. "**rot**"=1,000, in par. "**OFSt**" it is possible to set a positive or negative offset that is simply added to the value read by the probe before visualisation, which remains constant for all the measurements.

If instead, it is desired that the offset set should not be constant for all the measurements, it is possible to operate the calibration on any two points.

In this case, in order to decide which values to program on par. "**OFSt**" and "**rot**", the following formulas must be applied:

"rot" = (D2-D1)/(M2-M1) **"OFSt" = D2 - ("rot" x M2)**

where:

M1 = measured value 1;

D1 = visualisation value when the instrument measures M1;

M2 = measured value 2;

D2 = visualisation value when the instrument measures M2;

It then follows that the instrument will display:

DV = MV x "rot" + "OFSt"

where:

DV = displayed value;

MV = measured value.

Example 1: It is desired that the instrument dislplays the value actually measured at 20°, but at 200° it must display a value of 10° lower the value measured by the probe (190°).

Therefore: M1=20; D1=20; M2=200; D2=190

"**rot**" = (190 - 20)/(200 - 20) = 0,944

"**OFSt**" = 190 - (0,944 x 200) = 1,2

Example 2: It is desired that the instrument dislplays 10° whilst the value actually measured is 0°, but, at 500° it must display a value 50° higher than the one measured by the probe (550°).

Therefore: M1=0; D1=10; M2=500; D2=550.

"**rot**" = (550 - 10)/(500 - 0) = 1,08

"**OFSt**" = 550 - (1,08 x 500) = 10

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).

In case of measurement error, the instrument supplies the power as programmed on par. "**OPE**".

This power will be calculated according to cycle time programmed for the PID controller, while for the ON/OFF controllers the cycle time is automatically considered to be equal to 20 s (e.g. In the event of probe error with ON/OFF control and "OPE"=50, the control output will be activated for 10 s, then it will be deactivated for 10 s and so on until the measurement error remains).

By using par. "**InE**" it is also possible to decide the conditions of the input error, allowing the instrument to give the power programmed on par. "**OPE**" as output.

The possibilities of par. "**InE**" are:

= Or: the condition occurs in case of over-range or probe break.
= Ur: the condition occurs in case of under-range or probe break.
= Our: the condition occurs in case of over-range or under-range or probe break.

Using par. "**diSP**", located in the group "**]PAn**", it is possible to set normal visualization of the display which can be the process variable (dEF), the control power (Pou), the active Set Point (SP.F) the Set Point operating when there are active ramps (SP.o) or alarm threshold AL1, 2 or 3 (AL1, AL2 or AL3).

Again in the group "**]PAn**" the par. "**AdE**" is present that defines the 3 LED shift index functioning.

The lighting up of the green LED **=** indicates that the process value is within the range [SP+AdE... SP-AdE], the lighting up of the LED **-** indicates that the process value is lower than [SP-AdE] and the lighting up of the LED **+** indicates that the process value is higher than [SP+AdE].

4.2 - OUTPUTS CONFIGURATION

The instrument outputs can be programmed by entering the group of parameters "**]Out**", where the relative parameters "**O1F**", "**O2F**", "**O3F**", "**O4F**" (depending on the number of outputs available on the instrument) are located.

The outputs can be set for the following functions:

- Main control output (**1.rEG**);
- Secondary control output (**2.rEG**);
- Alarm output normally open (**ALno**);
- Alarm output normally closed (**ALnc**);
- Output deactivated (**OFF**).

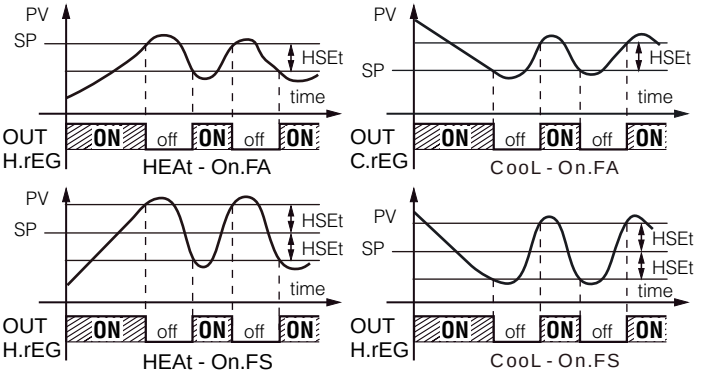
The coupling outputs number outputs - number alarms can be made in the group referring to the alarm to the alarm ("**]AL1**","**]AL2**" o "**]AL3**").

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 "**SP**", 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 [SP + HSEt] in case of symmetrical hysteresis, or [SP] in case of asymmetrical hysteresis and is then activated again when the process value goes below value [SP - HSEt]. Vice versa, in case of direct action or cooling ("Func"=CooL), it deactivates the output, when the process value reaches [SP - HSEt] in case of symmetrical hysteresis, or [SP] in case of asymmetrical hysteresis and is activated again when the process value goes above value [SP + 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**".

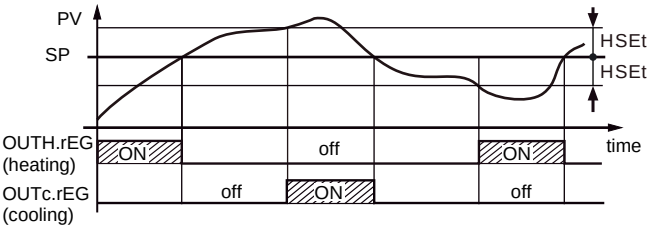
This type of control can be obtained when 2 outputs are programmed respectively as 1.rEG and 2.rEG and the par. "**Cont**" = nr.

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 "**SP**" 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 1rEG when the process value goes below value [SP - HSEt], or it activates the output 2.rEG when the process value goes above [SP + HSEt].

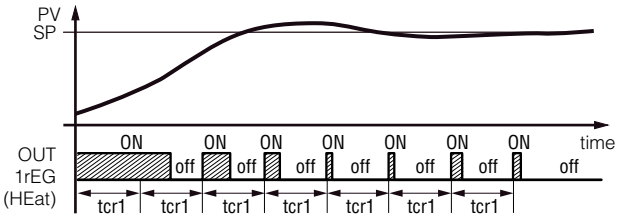
Consequently, the element causing a positive increase has to be connected to the output programmed as 1.rEG while the element causing a negative increase has to be connected to the output programmed as 2.rEG.



4.5 - SINGLE ACTION PID CONTROL (1.rEG)

All the parameters referring to PID control are contained in 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 "**SP**", on the functioning mode "**Func**" and on the instrument PID algorithm with two degree of freedom.



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

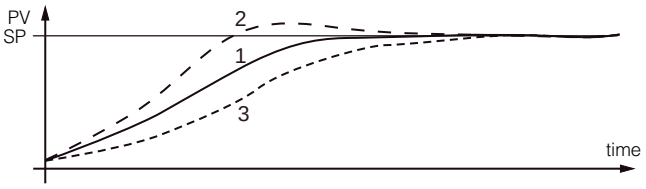
In this case use of a solid state relay (SSR) is recommended for driving the actuator.

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

"Pb" Proportional Band;
"tcr1" Cycle time of the output 1.rEG;
"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 increases it.



*1: Value "**FuOC**" OK,*
*2: Value "**FuOC**" too high,*
*3: Value "**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 "**SP**" 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 is 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 1rEG;
"tcr 2" Cycle time of the output 2rEG;
"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 and SELF-TUNING functions are contained in the group "**rEG**".

The AUTO-TUNING and SELF-TUNING functions permit the automatic tuning of the PID controller.

The AUTO-TUNING FAST function 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.

The SELF-TUNING function (rule based "TUNE-IN") instead allows control monitoring and the continuous calculation of the parameters during control.

All functions 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 1rEG.

4) Program an output as 2.rEG if the instrument controls a plant with double action.

5) Set the parameter "Auto" as:

- **= 1** - If 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 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 OFF state
- **= 3** - If manual 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 is desired to activate the 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|].

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 correctly programming 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 AT/ST.

The controller starts up a series of operations on the connected system in order to calculate the most suitable PID control parameters.

If, at the 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 tuning 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 stored automatically by the instrument at the end of the correct completion of the autotuning cycle in the parameters related to PID regulation.

Note: The instrument is factory set to perform the autotuning whenever it is switched ON ("Auto" = 1).

To activate the SELF-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 dual-action plant.

5) Program par. "SELF" = yES.

6) Exit from the parameter programming.

7) Connect the instrument to the controlled plant.

8) Activate Self-tuning selecting par. "**tunE**" in the main menu (or by correctly programming key [U]).

When the Self-tuning function is active, the LED AT/ST is permanently lit up and all the PID parameters ("**Pb**", "**Int**", "**dEr**", etc.) are no longer displayed.

To stop the Auto-tuning cycle or deactivate the Self-tuning function select one of the control types: "**rEG**", "**OPLO**" or "**OFF**" from the menu "**SEL**". If the instrument is powered OFF during Auto-tuning or with the Self-tuning function activated, these functions will remain activated the next time it is powered ON.

4.8 - REACHING OF THE SET POINT AT CONTROLLED SPEED AND AUTOMATIC SWITCHING BETWEEN TWO SET POINTS (RAMPS AND DWELL TIME)

All the parameters referring to the ramps functioning are contained in the group "**rEG**".

It is possible to reach the set point in a predetermined time (in any case longer than the time the plant would naturally need). This could be useful in those processes (heating or chemical treatments, etc.) where the set point has to be reached gradually, in a predetermined time.

Once the instrument has reached the first Set Point (SP1) it is possible to have automatic switching to the second Set Point (SP2) after a set time, thus obtaining a simple automatic process cycle.

These functions are available for all the programmable controls (PID single and double action, ON/OFF and Neutral Zone ON/OFF).

The function is determined by the following parameters:

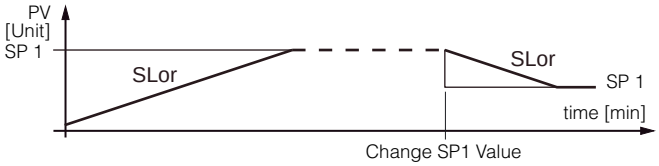
"SLor" Gradient of first ramp expressed in unit/minute;
"SLoF" Gradient of second ramp expressed in unit/minute.

"**dur.t**" - Dwell time of Set Point "**SP1**" before automatic switching to Set Point "SP2" (expressed in hrs. and min.).

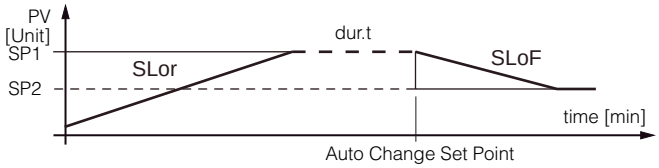
The functions are deactivated when the relative parameters are = InF.

If is desired only one ramp (ex. to reach "SP1") it is enough to program parameter "**SLor**" to the desired value.

The ramp "**SLor**" will always active at power on and when the Active Set Point value is changed.



If it is desired an automatic cycle from the power on instead it is necessary to program the par. "nSP" = 2, to program the two Set Point values "**SP1**" and "**SP2**" and naturally to program the parameters "**SLor**", "**dur**.t" and "**SLoF**" with the desired values. In this case at the end of the cycle all the ramps will not be more active.



Examples with starts from values lower than SP and with decreasing of SP.

Note: In case of PID control, if Auto-tuning is desired whilst the ramp function is active, this will not be carried out until the tuning cycle has been completed. It is therefore recommended that Auto-tuning be started avoiding activating the ramp function and, once the tuning is finished, deactivate Auto-tuning ("Auto" = OFF), program the desired ramp and, if it automatic tuning is desired, enable the Self-tuning function.

4.9 - SOFT-START FUNCTION

All the parameters referring to the Soft -Start functioning are contained in the group "**rEG**".

The Soft-Start function only works through PID control and allows the limitation of control power when the instrument is switched on, for a programmable period of time.

This is useful when the actuator, driven by the instrument, may be damaged excess power supplied when the application is not yet in the normal rating. (e.g. for certain heating elements).

The function depends on the following parameters:

"St.P" Soft-Start power
"SSt" Soft-Start time (expressed in hh.mm)
"**HSEt"** End Soft Start cycle threshold

If both parameters are programmed with values other than OFF, when switched on the instrument gives an output power as programmed on par. "**St.P**" for the time programmed on par. "**SSt**" or when is reached the absolute value programmed at par. "**HSEt**".

Practically, the instrument works in manual condition and switches to automatic control at the elapsing of time "**SSt**" or when is reached the absolute value programmed at par. "**HSEt**". To disable the Soft-Start function simply program par. "SSt" = OFF. Whenever, a measurement error occurs during the Soft-Start execution, the function is interrupted and the instrument gives an output power as programmed on par. "**OPE**". If the measurement is restored, the Soft-Start is still deactivated. If it is desired to activate the Autotuning with Soft-Start set par. "Auto"=4. The FAST Autotuning will start automatically at the end of programmed Soft-Start cycle 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|].

4.10 - ALARMS OUTPUTS FUNCTIONS (AL1, AL2, AL3)

The alarms depend on the process value (AL1, AL2, AL3) 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 "**O**", the parameters relative to the outputs required as alarm ("**O1F**", "**O2F**" ,"**O3F**" ,"**O4F**"), 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:

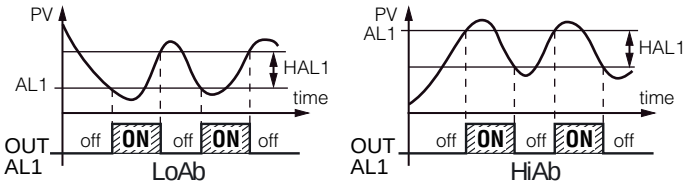
"AL1t " ALARM TYPE;
"Ab1" ALARM CONFIGURATION;
"AL1" ALARM THRESHOLD;
"AL1L" LOW ALARM THRESHOLD (for band alarm) OR MINIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm);
"AL1H" HIGH ALARM THRESHOLD (for band alarm) OR MAXIMUM SET OF AL1 ALARM THRESHOLD (for low or high alarm);
"HAL1" ALARM HYSTERESIS;
"AL1d" ALARM ACTIVATION DELAY (in seconds);
"AL1i" ALARM BEHAVIOUR IN THE EVENT OF MEASUREMENT ERROR;
"AL1t" ALARM TYPE: the alarm output can behave in 6 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.

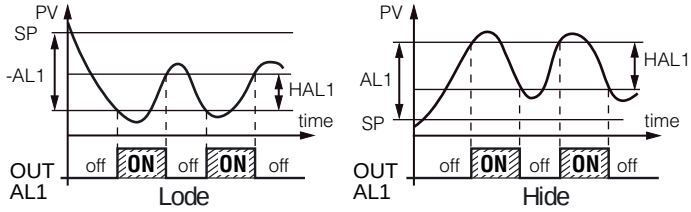


LodE = DEVIATION LOW ALARM: The alarm is activated when the process value goes below the value [SP1 + AL1] and will be deactivated when it goes above the value [SP1 + AL1 + HAL1].

With this mode is possible to program the minimum and the maximum set of **"AL1" by "AL1L" and "AL1H"** parameters.

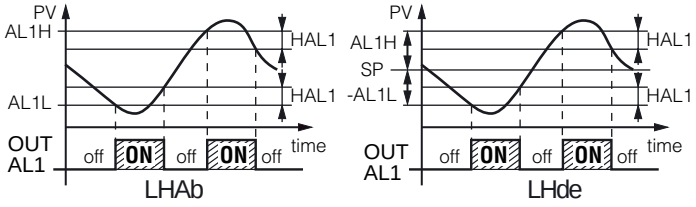
HidE = DEVIATION HIGH ALARM: The alarm is activated when the process value goes above the value [SP1 + AL1] and will be deactivated when it goes below the value [SP1 + AL1 - HAL1].

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].



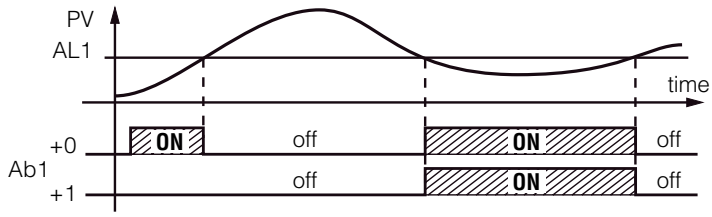
"Ab1" - ALARM CONFIGURATION: This parameter can assume a value between 0... 31.

The number to be set, which will correspond to the function desired, is obtained by adding the values reported in the following descriptions:

ALARM BEHAVIOUR AT POWER ON: the alarm output may behave in two different ways, depending on the value added to par. "**Ab1**".

+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.

+1 = ALARM NOT ACTIVATED AT POWER ON: If, when Powered ON, the instrument is in alarm condition, the alarm is not activated. It will be activated only when the process value is in non-alarm condition and then back in alarm condition.



Example with absolute low alarm

ALARM DELAY: the alarm output may behave in two different ways depending on the value added to par. "**Ab1**".

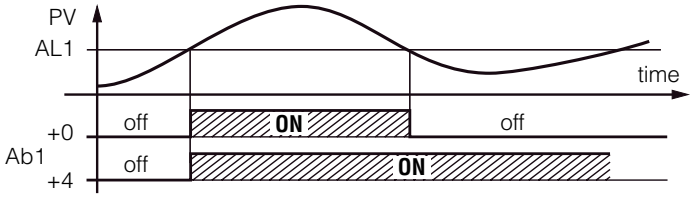
+0 = ALARM NOT DELAYED: The alarm is immediately activated when the alarm condition occurs.

+2 = ALARM DELAYED: When the alarm condition occurs, delay counting begins, as programmed on par. "**AL1d**" (expressed in seconds) and the alarm will be activated only after the elapsing of that time.

ALARM LATCH: the alarm output may behave in two different ways depending on the value added to par. "**Ab1**".

+ 0 = ALARM NOT LATCHED: The alarm remains active in alarm conditions only.

+4 = ALARM LATCHED: The alarm is active in alarm conditions and remains active even when these conditions no longer exist, until the correctly programmed key [U], ("USrb"=Aac) has been pushed.



Example with absolute high alarm

ALARM AKNOWLEDGEMENT: the alarm output may behave in two different ways depending on the value added to par. "Ab1".

+0 = ALARM NOT AKNOWLEDGED: The alarm always remains active in alarm conditions.

+8 = ALARM AKNOWLEDGED: The alarm is active in alarm conditions and can be deactivated by key [U] if properly programmed ("USrb"=ASi), and also if alarm conditions still exist.

ALARM BEHAVIOUR AT SET POINT CHANGE (DEVIATION ALARMS ONLY): the alarm output may behave in two different ways, depending on the value added to par. "**Ab1**".

+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.

+16 = ALARM NOT ACTIVATED AT SET POINT CHANGE: If, when Set Point changes, the instrument is in alarm condition, the alarm is not activated. It will be activated only when the process value is in non-alarm conditions and then back to alarm conditions.

"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).

4.11 - 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.

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**") in the group "**]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: Alarm activated when the current measured at TAHB terminals is less than the value set in parameter "**IHbL**" or when the measured current exceeds the value set in parameter "**IHbH**" regardless the 1.rEG. status.

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

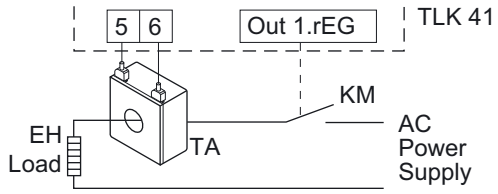
The programming of these parameters has to be carried out while also considering the fluctuations of the net voltage to avoid undesired alarms.

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 [▼] key and the current measured when output 1rEG is deactivated, by pushing the [▼] 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, at least, 264 ms. This means that, if the cycle time ("**tcr1**") is = 1 s, the HB alarm is able to intervene only when the output power is higher than 26,4%.



4.12 - LOOP BREAK ALARM FUNCTION

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

The Loop Break alarm is available on all the instruments, it triggers when, for any reason (short-circuit of a thermocouple, thermocouple inversion, load interruption), the loop control is interrupted.

First of all, 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**") in the group "**]Out**", programming the parameter as:

= 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.

Enter group "**]LbA**" and program which output the alarm signal has to be addressed to on par. "**OLbA**".

The Loop Break alarm is activated if the output power remains at the 100% of the value for the time programmed on par. "**LbAt**" (expressed in seconds).

To avoid false alarms, the value of this parameter must be set considering the time the plant takes to reach the Set Point when the measured value is far from it (for example at the plant start-up).

On alarm intervention, the instrument visualizes the message "**LbA**" and behaves as in the case of a measurement error giving a power output as programmed on par. "**OPE**" (programmable in the group "**]InP**").

To restore normal functioning after the alarm, select the control mode "**OFF**" and then re-program the automatic control ("**rEG**") after checking the correct functioning of probe and actuator.

To exclude the Loop Break alarm, set "OLbA" = OFF.

4.13 - FUNCTIONING OF KEY [U]

The function of key [U] can be set through par. "**USrb**" contained in the group "**]PAn**".

The parameter can be programmed as:

= noF: No function;

= tunE: Pushing the key for 1 s at least, it is possible to activate/ deactivate Auto-tuning or Self-tuning;

= OPLO: Pushing the key for at least 1 s, is possible to swap from automatic control (rEG) to manual one (OPLO) and vice versa;

= Aac: Pushing the key for 1 s at least, it is possible to acknowledge the alarm. (see par. 4.10);

= ASi: Pushing the key for 1 s at least, it is possible to acknowledge an active alarm (see par. 4.10);

= CHSP: Pushing the key for 1 s at least, it is possible to select one of the 4 pre-programmed Set Points on rotation;

= OFF: Pushing the key for 1 s at least, it is possible to swap from automatic control (rEG) to OFF control (OFF) and vice versa.

4.14 - RS 485 SERIAL INTERFACE

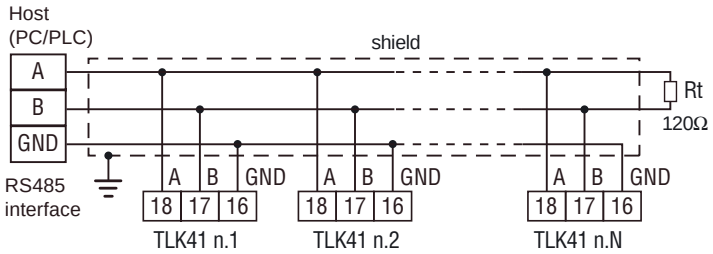
The instrument can be equipped with a RS 485 serial communication interface, by means of which it is possible to connect the regulator with a net to which other instruments (regulators of PLC) are connected, all depending typically on a personal computer used as plant supervisor. Using a personal computer it is possible to acquire all the function information and to program all the instrument configuration parameters. The software protocol adopted for TLK41 is a MODBUS RTU type, widely used in several PLC and supervision

programs available on the market (TLK41 protocol manual is available on request).

The interface circuit allows the connection of up to 32 instruments on the same line.

To maintain the line in rest conditions a 120Ω resistance (Rt) must be connected to the end of the line.

The instrument is equipped with two terminals called A and B which have to be connected with all the namesake terminals of the net. For the wiring operation it is advisable to adopt a screened cable wired as in the drawing.



If the instrument is equipped with a serial interface, the parameters to be programmed are the following, all present in the parameters group "**]SEr**":

"Add": Address of the station. Set a different number for each station, values: 1… 255.

"baud": Transmission speed (baud-rate), programmable between 1200… 38400 baud. All the stations have to have the same transmission speed.

"PACS": Programming access. If programmed as "**LoCL**" this means that the instrument is only programmable from the keyboard, if programmed as "**LorE**" it is programmable both from the keyboards and serial line.

If an attempt is made to enter the programming from the keyboard whilst a communication through the serial port is in progress the instrument will visualise "**buSy**" to indicate the busy state.

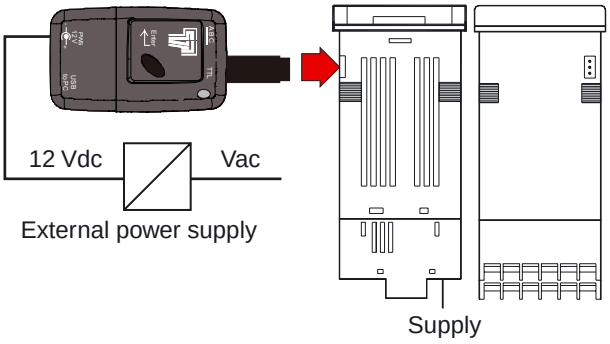
4.15 - PARAMETERS CONFIGURATION BY "KEY01"

The instrument is equipped with a connector that allows the transfer from and toward the instrument of the functioning parameters through Ascon Tecnologic KEY01 device with 3 poles connector.

This device is mainly useable for instruments serial programming which need to have the same parameters configuration or to keep a copy of the programming of an instrument and allow its rapid re-transmission.

To use KEY01 device is necessary that both device and instrument are being supplied.

Note: For instruments equipped with RS485 serial communication, it is indispensable that the parameter "PACS" is programmed = LorE.



To transfer the configuration of an instrument into the device (UP-LOAD) it is necessary to proceed in the following way:

1) Position both the dip switches of KEY 01 in OFF mode.

2) Connect the device to the instrument TLK plugging the special connector.

3) Verify that the instrument and the device are supplied.

4) Observe the indication LED on the device KEY 01: if it results green this means that a configuration is already loaded on the device while if it results green blinking or red blinking this means that it has not been loaded any valid configuration on the device.

5) Press the button placed on the device.

6) Observe the indication LED: after having pressed the button, the LED becomes red and therefore, at the end of the data transfer, it becomes green.

7) Now it is possible to disconnect the device.

To transfer the configuration loaded on the device onto an instrument of the same family (DOWNLOAD), it is necessary to proceed in the following way:

1) Position both dip switch of KEY 01 in the ON mode.

2) Connect the device to an instrument TLK having the same features of the one from which has been downloaded the desired configuration, plugging the special connector.

3) Verify that the instrument and the device are supplied

4) Observe the indication LED on the device KEY 01: it has to result green, because if the LED results green blinking or red blinking, this means that on the device it has not been downloaded any valid configuration and therefore it's useless to continue.

5) If the les results green, press the button placed on the device.

6) Observe the indication LED: after having pressed the button, the LED becomes red and therefore, at the end of the data transfer, it becomes green.

7) Now it is possible to disconnect the device.

Note: For additional info, please read the KEY01 instruction manual.

5 - PROGRAMMABLE PARAMETERS

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

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

Par.		Description	Range	Def.	Note
1	**nSP**	Number of the programmable Set Point	1... 4	1	
2	**SPAt**	Active Set Point	1... nSP	1	
3	**SP1**	Set Point 1	SPLL... SPHL	0	
4	**SP2**	Set Point 2	SPLL... SPHL	0	
5	**SP3**	Set Point 3	SPLL... SPHL	0	
6	**SP4**	Set Point 4	SPLL... SPHL	0	
7	**SPLL**	Low Set Point	-1999... SPHL	-1999	
8	**SPHL**	High Set Point	SPLL... 9999	9999	

Group "]InP" (parameters relative to the measure input)

Par.		Description	Range	Def.	Note
9	**HCFG**	Input type	tc/rtd / I/UoLt	Tc	
10	**SEnS**	Probe type: J=thermocoupled J CrAL=thermocoupled K S=thermocoupled S 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	tc: J/ CrAL/ S/ Ir.J/Ir.CA rtd: Pt1/Ptc/ ntc I: 0.20/4.20 UoLt: 0.50/ 0.60/12.60/ 0.5/1.5/0.10/ 2.10	J	
11	**SSC**	Low scale limit in case of input with V/I signals	-1999... FSC	0	
12	**FSC**	High scale limit in case of input with V/I signals	SSC... 9999	0	
13	**dP**	Number of decimal figures	tc/rtd: 0/1 UoLt/I/SEr: 0... 3	0	
14	**Unit**	Temperature unit of measurement	tc/rtd: °C/°F	°C	
15	**FiL**	Input digital filter	0FF… 20.0 s	0.2	
16	**OFSt**	Measuring Offset	-1999... 9999	0	
17	**rot**	Rotation of the measuring straight line	0.000... 2.000	1.000	
18	**InE**	“OPE” functioning in case of measuring error OUr = Over/under-range Or = Over-range only Ur = Under-range only	OUr/Or/Ur	OUr	
19	**OPE**	Output power in case of measuring error	-100... 100%	0	

Group "]Out" (parameters relative to the outputs)

Par.		Description	Range	Def.	Note
20	O1F	Func. output 1: 1.rEG= Control output 1 2.rEG= Control output 2 ALno= Alarm Out NO ALnc= Alarm Out NC	1.rEG/2.rEG ALno/ALnc OFF	1.rEG	
21	O2F	Functioning of output 2: see “O1F”	1.rEG/2.rEG ALno/ALnc OFF	ALno	
22	O3F	Functioning of output 3: see “O1F”	1.rEG/2.rEG ALno/ALnc OFF	ALno	
23	O4F	Functioning of output 4: see “O1F”	1.rEG/2.rEG ALno/ALnc OFF	ALno	

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

Par.		Description	Range	Def.	Note
24	**OAL1**	Output where alarm AL1 is addressed	Out1/Out2/ Out3/Out4/ OFF	Out2	
25	**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	
26	**Ab1**	Alarm AL1 functioning: +1 = not activated at power ON +2 = delayed +4 = latch +8 = aknowledged	0... 15	0	
27	**AL1**	Alarm AL1 threshold	AL1L… AL1H	0	
28	**AL1L**	Low threshold band alarm AL1 or Minimum set alarm AL1 for high or low alarm	-1999... AL1H	-1999	
29	**AL1H**	High threshold band alarm AL1 or Maximum set alarm AL1 for high or low alarm	AL1L... 9999	9999	
30	**HAL1**	Alarm AL1 hysteresis	OFF... 9999	1	
31	**AL1d**	Activation of AL1delay	OFF... 9999 s	OFF	
32	**AL1i**	Alarm AL1 activation in case of measuring error	no/yES	no	

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

Par.		Description	Range	Def.	Note
33	**OAL2**	Output where alarm AL2 is addressed	Out1/Out2 Out3/Out4/ OFF	OFF	
34	**AL2t**	Alarm AL2 type: see “AL1t”	LoAb/HiAb LHAb/LodE HidE/LHdE	LoAb	
35	**Ab2**	Alarm AL2 functioning: see “Ab1”	0... 15	0	
36	**AL2**	Alarm AL2 threshold	AL2L… AL2H	0	
37	**AL2L**	Low threshold band alarm AL2 or Minimum set alarm AL2 for high or low alarm	-1999... AL2H	-1999	
38	**AL2H**	High threshold band alarm AL2 or Maximum set alarm AL2 for high or low alarm	AL2L... 9999	9999	
39	**HAL2**	Alarm AL2 hysteresis	OFF... 9999	1	
40	**AL2d**	Activation of AL2 delay	OFF... 9999 s	OFF	
41	**AL2i**	Alarm AL2 activation in case of measuring error	no/yES	no	

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

Par.		Description	Range	Def.	Note
42	**OAL3**	Output where alarm AL3 is addressed	Out1/Out2 Out3/Out4 OFF	OFF	
43	**AL3t**	Alarm AL3 type: see “AL1t”	LoAb/HiAb LHAb/LodE HidE/LHdE	LoAb	
44	**Ab3**	Alarm AL3 functioning: see “Ab1”	0... 15	0	
45	**AL3**	Alarm AL3 threshold	AL3L… AL3H	0	
46	**AL3L**	Low threshold band alarm AL3 or Minimum set alarm AL3 for high or low alarm	-1999... AL3H	-1999	
47	**AL3H**	High threshold band alarm AL3 or Maximum set alarm AL3 for high or low alarm	AL3L... 9999	9999	
48	**HAL3**	Alarm AL3 hysteresis	OFF... 9999	1	
49	**AL3d**	Activation of AL3 delay	OFF... 9999 s	OFF	
50	**AL3i**	Alarm AL3 activation in case of measuring error	no/yES	no	

Group "]LbA" (parameters relative to Loop Break Alarm)

Par.		Description	Range	Def.	Note
51	**OLbA**	Output where alarm LbA is addressed	Out1/Out2 Out3/Out4 OFF	OFF	
52	**LbAt**	Time necessary to activate alarm LbA	OFF... 9999 s	OFF	

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

Par.		Description	Range	Def.	Note
53	**OHb**	Output where alarm HB is addressed	Out1/Out2 Out3/Out4 OFF	OFF	
54	**IFS**	High scale limit for input TA HB	0.0... 100.0	100.0	
55	**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	
56	**IHbL**	Low alarm HB threshold (with Out 1.rEG ON)	0.0... IFS	0.0	
57	**IHbH**	High alarm HB threshold (with Out 1.rEG OFF)	IHbL... IFS	100.0	

Group "]rEG" (parameters relative to the control)

Par.		Description	Range	Def.	Note
58	**Cont**	Control type: Pid= PID On.FA= ON/OFF asym. On.FS= ON/OFF sym. nr= Neutral Zone ON/OFF	Pid/On.FA On.FS/nr	Pid	
59	**Func**	Functioning mode output 1.rEG	HEAt/CooL	HEAt	
60	**HSEt**	Hysteresis of ON/OFF control (or end Soft Start cycle threshold)	0... 9999	1	
61	**Auto**	Autotuning enable: OFF = Not active 1 = Start each power on 2 = Start at first power on 3= Start manually 4= Start after Soft Start or Set change	OFF/1/2/3/4	1	
62	**SELF**	Selftuning enable	no/yES	no	
63	**Pb**	Proportional band	0... 9999	50	
64	**Int**	Integral time	OFF... 9999s	200	
65	**dEr**	Derivative time	OFF… 9999s	50	
66	**FuOc**	Fuzzy overshoot control	0.00... 2.00	0,5	
67	**tcr1**	Cycle time of output 1.rEG	0.1... 130.0 s	20,0	
68	**Prat**	Power ratio 2rEG/1rEG	0.01... 99.99	1.00	
69	**tcr2**	Cycle time of 2.rEG	0.1... 130.0 s	10.0	
70	**rS**	Manual reset	-100.0… +100.0%	0.0	
71	**SLor**	Gradient of first ramp: InF= Ramp not active	0.00... 99.99 / InF unit/min.	InF	
72	**dur.t**	Duration time between two ramps InF= Time not active	0.00... 99.59 / InF hrs.-min.	InF	
73	**SLoF**	Gradient of second ramp: InF= Ramp not active	0.00... 99.99 / InF unit/min	InF	
74	**St.P**	Soft-Start power	-100... 100%	0	
75	**SSt**	Soft-Start time	OFF/0.1… 7.59 /InF hrs.-min.	OFF	

Group "]PAn" (parameters relative to the user interface)

Par.		Description	Range	Def.	Note
76	**USrb**	Functioning of key [U]: noF = No Function tune= Start Autotuning or Selftuning OPLO= Manual Control (open loop) Aac= Reset Alarms latch ASi= Acknowledged Alarms OFF= Control OFF	noF/tunE/ OPLO/Aac/ ASi/CHSP/ OFF	noF	
77	**diSP**	Variable visualized on the display: dEF= Process Value Pou= Control Power SP.F= Active Set Value SP.o = Operative Set value AL1 = AL1 threshold AL2 = AL2 threshold AL3 = AL3 threshold	dEF/Pou/SP.F/ SP.o/AL1/AL2/ AL3	dEF	
78	**AdE**	Shift value for the shift index functioning	OFF...9999	2	

Par.		Description	Range	Def.	Note
79	**Edit**	Fast progr. Active Set and alarms: SE= Active Set can be modified while the alarm thresholds cannot be modified AE= Active Set cannot be modified while the alarm thresholds can be modified SAE= Active Set and alarm thresholds can be modified SAnE= Active Set and alarm thresholds cannot be modified	SE/AE/SAE/ SAnE	SAE	

Group "]SEr" (parameters relative to the serial communications)

Par.		Description	Range	Def.	Note
80	**Add**	Station address in case of serial communication	0… 255	1	
81	**baud**	Transmission speed (Baud rate)	1200/2400/ 9600/19.2/ 38.4	9600	
82	**PACS**	Access at the programming through serial port: LoCL = No (Local only) LorE = Yes (Local and remote progr.)	LoCL/LorE	LorE	

6 - PROBLEMS, MAINTENANCE AND WARRANTY

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 limits (under-range)	
oooo	The measured variable is over the probe limits (over-range)	
ErAt	FAST Autotuning not possible because the process value is too high or too low	Push [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.
LbA	Loop control interrupted (Loop break alarm)	Check the working of probe and actuator and swap the instrument to (rEG) control
ErEP	Possible anomaly of the EEPROM memory	Push [P]

In error conditions, the instrument provides an output power as programmed on par "OPE" and activates the desired alarms, if the relative parameters "ALni" have been programmed = yES.

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 - WARRANTY AND REPAIRS

The instrument is under warranty against manufacturing flaws or faulty material, found within 12 months from delivery date. The warranty 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 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 Ascon Tecnologic with a detailed description of the faults found, without any fees or charge for Ascon Tecnologic, except in the event of alternative agreements.

7 - TECHNICAL DATA

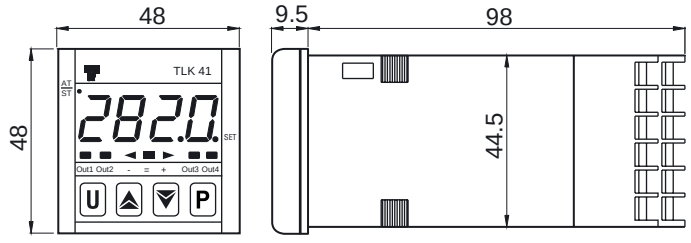
7.1 - ELECTRICAL DATA

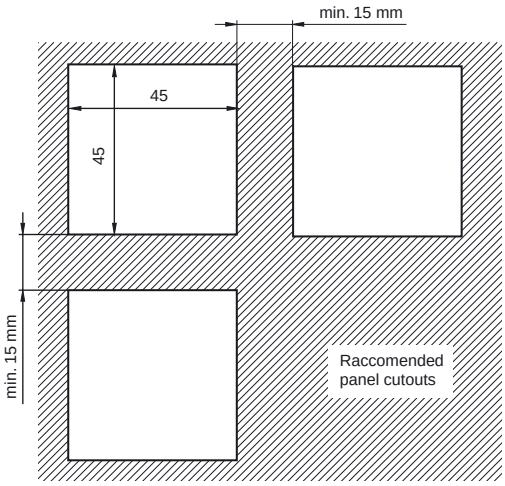
Power supply: 24 VAC/VDC, 100... 240 VAC ±10%
Frequency AC: 50/60 Hz
Power consumption: 9 VA approximately
Input/s: 1 input for temperature probes: tc J, K, S; infrared sensors Ascon Tecnologic IRS J e K; RTD Pt100 IEC; PTC KTY 81-121 (990Ω @ 25°C); NTC 103AT-2 (10 kΩ @ 25°C) or mV signals 0... 50 mV, 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.)
Normalized signals input impedance:
0/4… 20 mA: 51Ω; mV and V: 1 MΩ
Output/s: Up to 4 relay outputs. OUT1: SPST-NO (5 A-AC1, 2 A-AC3/250 VAC), OUT2, OUT3, OUT4: SPST-NO (3 A-AC1, 1 A-AC3/250 VAC); or in tension to drive SSR (7mA/ 14VDC) or voltage outputs to drive SSR (from 24VDC @ 1mA to 15mA @ 4VDC).
Auxiliary supply output: 12 VDC/20 mA max.
Electrical life for relay outputs: 100000 operations.
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 opto-isolated respect to the input. 50 V insulation between the RS485 port and the extra low voltage section.

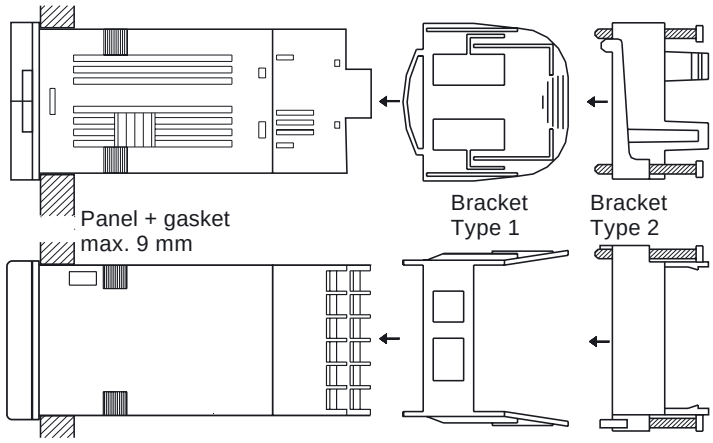
7.2 - MECHANICAL DATA

Housing: Self-extinguishing plastic, UL 94 V0
Dimensions: 48 x 48 mm DIN, depth 98 mm
Weight: 190 g approx.
Mounting: Flush in panel in 45 x 45 mm hole
Connections: 2 x 1 mm^2 screw terminals block
Degree of front panel protection: IP 54 mounted in panel with gasket
Pollution class: 2
Operating temperature: 0... 50°C
Operating humidity: 30... 95 RH% with no 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 20 min of warm-up time
Sampling rate: 130 ms
Serial Interface: RS485 insulated
Communication protocol: MODBUS RTU (JBUS)
Baud rate: Programmable between 1200... 38400 baud
Display: 4 Digit Red h 12 mm
Compliance: ECC directive EMC 2004/108/CE (EN 61326),
ECC directive LV 2006/95/CE (EN 61010-1)
Approvals: C-UL (file n. E206847)

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
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		
0... 50 mV "HCFG" = UoLt "SEnS" = 0.50		
0... 60 mV "HCFG" = UoLt "SEnS" = 0.60		
12... 60 mV "HCFG" = UoLt "SEnS" = 12.60		
0... 5 V "HCFG" = UoLt "SEnS" = 0.5		
1... 5 V "HCFG" = UoLt "SEnS" = 1.5		
0... 10 V "HCFG" = UoLt "SEnS" = 0.10		
2... 10 V "HCFG" = UoLt "SEnS" = 2.10		

7.6 - INSTRUMENT ORDERING CODE

TLK 41 a b c d e f g ii

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

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

c: OUTPUT OUT2
R = Relay
O = VDC for SSR
- = None

d: OUTPUT OUT3
R = Relay
O = VDC for SSR
- = None

e: OUTPUT OUT4 (must be equal to OUT3 type)
R = Relay
O = VDC for SSR
- = None

f: COMMUNICATION INTERFACE
S = RS 485 Serial interface
- = No interface

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

h: OPTIONAL PROBES
- = None

ii: SPECIAL CODES

TLK 41 PASSWORD = 381