TLK 38 B

MICROPROCESSOR-BASED DIGITAL ELECTRONIC CONTROLLER

OPERATING INSTRUCTIONS
Vr. 01 (ENG) - cod.: ISTR 06466

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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.

Though this manual has been issued with the greatest care, TECNOLOGIC S.p.A. will not take any responsibility deriving from its use.

The same applies to each person or Company involved in the issuing of this manual.

INDEX

1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION

TLK 38 B is a 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 for PID control.

The process value is visualized on 4 red displays, while the output status is indicated by 2 LED displays.

The instrument is equipped with a 3 LED programmable shift indexes and can have up to 2 outputs: relay type or can drive solid state relays type (SSR).

Depending on the model required the input accept:

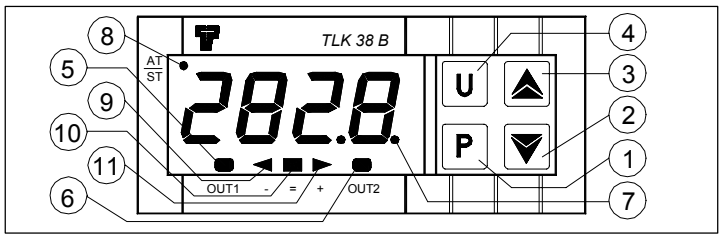
C: Thermocouples temperature probes (J,K,S and TECNOLOGIC IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermoresistances PT100.

E : Thermocouples temperature probes (J,K,S and TECNOLOGIC IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermistors PTC and NTC.

I : normalized analogue signals 0/4..20 mA

V : normalized analogue signals 0..1 V, 0/1..5 V, 0/2..10 V

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.
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.
4 - Key U : It can used to Activate Auto-tuning and Self-tuning functions 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 SET : It indicates access to the programming mode and parameter programming level.
8 - Led AT/ST : indicates that the Self-tuning function is activated (light on) or that Auto-tuning (flashing) is in progress.
9 - Led – Shift index: indicates that the process value is lower than [SP1-AdE].
10 - Led = Shift index: indicates that the process value is within the range [SP1+AdE ... SP1-AdE]
11 - Led + Shift index: indicates that the process value is higher than [SP1+AdE].

2 - PROGRAMMING

2.1 - FAST PROGRAMMING OF THE SET POINT

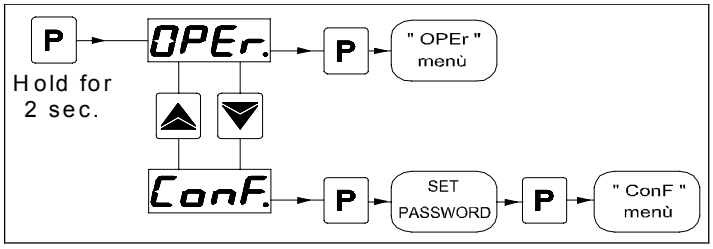
This procedure permits rapid programming of the Set Point (SP1) and the alarm threshold (AL1).
Push key "P", then release it and the display will visualise **"SP 1"** alternatively to the programmed value.
To modify the value, press "UP" key to increase it or the "DOWN" key to decrease it.
These keys 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 (if the instrument have an output configured as alarm) it is possible to visualise and modify the **"AL1"** alarm threshold like Set "SP1".
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.
Set Point "SP1" can be programmed with a value that is between the value programmed on par. **"SPLL"** and the one programmed on par. **"SPHL".**

2.2 - PARAMETERS PROGRAMMING

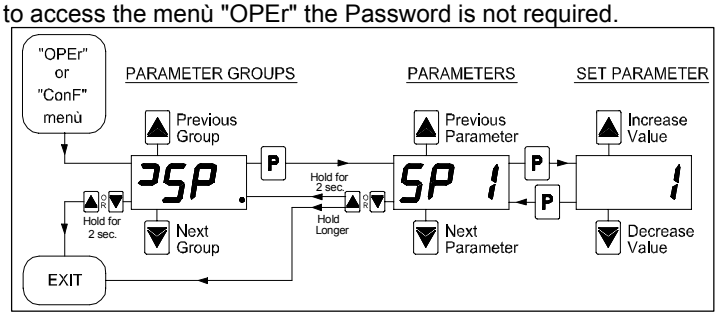
By pushing key "P" and holding it down for approx. 2 sec. it is possible to enter into the main selection menu.
Using the "UP" or DOWN" keys, it is then possible to roll over the selections:

"OPEr"	to enter into the operating parameters menu
"ConF"	to enter into the configuration parameters menu (PASSWORD is required)

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 "SP1" and the alarm threshold "AL1" parameters but it can contain all the desired parameters (see par. 2.3).
"ConF" - Configuration parameters Menu: this contains all the operating parameters and the functioning configuration parameters.



ATTENTION: *The instrument is programmed in factory with all the parameters, to exception of the Set Point "SP1" and the alarm threshold "AL1" , programmable in the menù "ConF" to the purpose to prevent wrong accidental programming from non experienced consumers.*
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 (" **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 alternatively 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.



2.3 - PARAMETERS PROGRAMMING LEVELS

The menu "OPEr" normally contains the parameter "SP1"; 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 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 Set Point "SP1" and the alarm threshold "AL1" will only be visible on the Set Point fast programming level (described in par. 2.1) if are present in the menu "OPEr").

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.

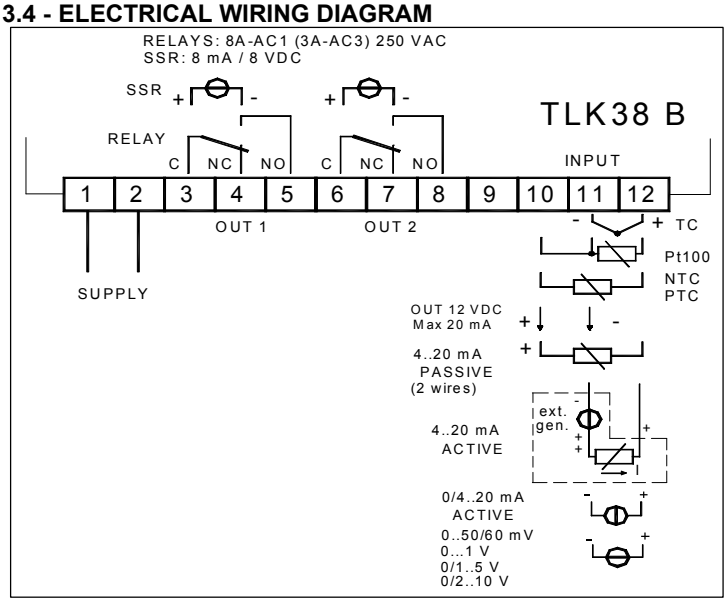
3.2 – MECHANICAL MOUNTING

The instrument, in case 33 x 75 mm, is designed for flush-in panel mounting.
Make a hole 29 x 71 mm and insert the instrument, fixing it with the provided special bracket.
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.

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.
Whether the instrument is 12 V version it's recommended to use an external transformer TCTR, or with equivalent features, and to use only one transformer for each instrument because there is no insulation between supply and input.
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.
Tecnologic S.p.A. 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.

3.4 - ELECTRICAL WIRING DIAGRAM



4 - FUNCTIONS

4.1 - MEASURING AND VISUALIZATION

All the parameters referring measurements are contained in the group **"[]InP".**
Depending on the model required the input accept:
C: Thermocouples temperature probes (J,K,S and TECNOLOGIC IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermoresistances PT100.
E : Thermocouples temperature probes (J,K,S and TECNOLOGIC IRS Infrared sensors), mV signals (0..50/60 mV, 12..60 mV), Thermistors PTC and NTC.
I : normalized analogue signals 0/4..20 mA
V : normalized analogue signals 0..1 V, 0/1..5 V, 0/2..10 V
Depending on the model, using par. **"SEnS",** it's possible to select the type of input probe, which can be :
- for thermocouples J (J), K (CrAL), S (S) or for infrared sensors serie TECNOLOGIC IRTC1 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..1 V (0.1), 0..5 V (0.5), 1..5 V (1.5), 0..10 V (0.10) or 2..10 V (2.10).
- for normalised signals in tension 0..50 mV (0.50), 0..60 mV (0.60), 12..60 mV (12.60).

We recommend to switch on and off the instrument when these parameters are modified, in order to obtain a correct measuring.
For the instruments with input for temperature probes (tc, rtd) it's possible to select, through par. **"Unit",** the unit of measurement (°C, °F) and, through par. **"dP"** (Pt100, PTC and NTC only) the desired resolution (0=1°; 1=0,1°).
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).
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 formulae 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 visualise :

DV = MV x "rot" + "OFSt"

where: DV = visualised value MV= measured value

Example 1: It is desired that the instrument visualises the value effectively measured at 20° but that, at 200°, it visualises a value lower than 10° (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 visualises 10° whilst the value actually measured is 0°, but, at 500° it visualises a 50° higher value (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 sec. (e.g. In the event of probe error with ON/OFF control and "OPE"=50, the control output will be activated for 10 sec., then it will be deactivated for 10 sec. and so on until the measurement error remains.).
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 [SP1+AdE ... SP1-AdE], the lighting up of the led – indicates that the process value is lower than [SP1-AdE] and the lighting up of the led + indicates that the process value is higher than [SP1+AdE].

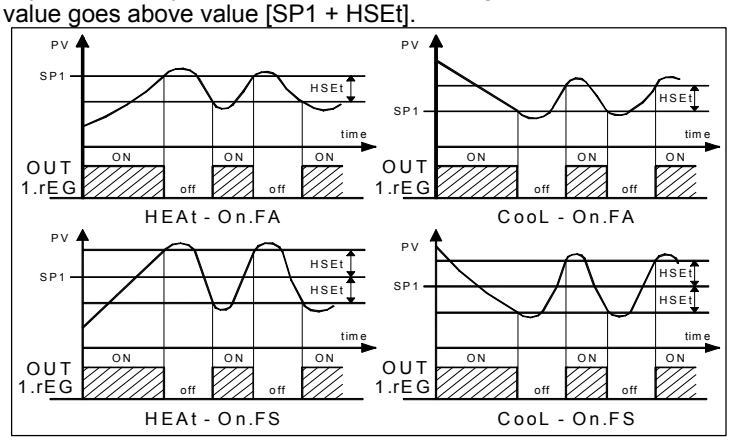
4.2 - OUTPUTS CONFIGURATION

The instrument's outputs can be programmed by entering the group of parameters **"[]Out**, where the relative parameters **"O1F"** and **"O2F"** (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)
- Alarm output normally closed with led reverse indication (ALni)
- Output deactivated (OFF)

The coupling outputs number outputs – number alarms can be made in the group referring to the alarm to the alarm ("[]AL1").

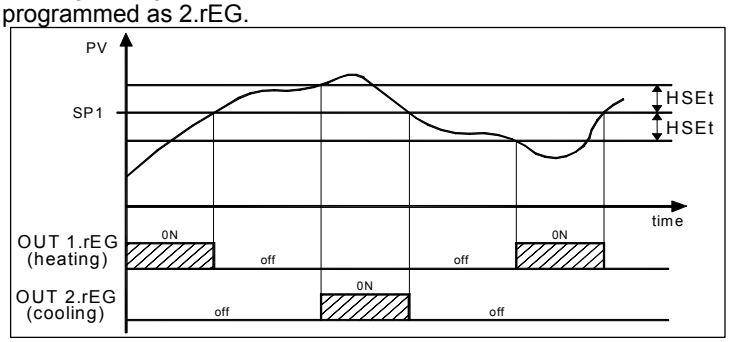
4.3 - ON/OFF CONTROL (1rEG)

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 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 (1rEG - 2rEG)

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 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.

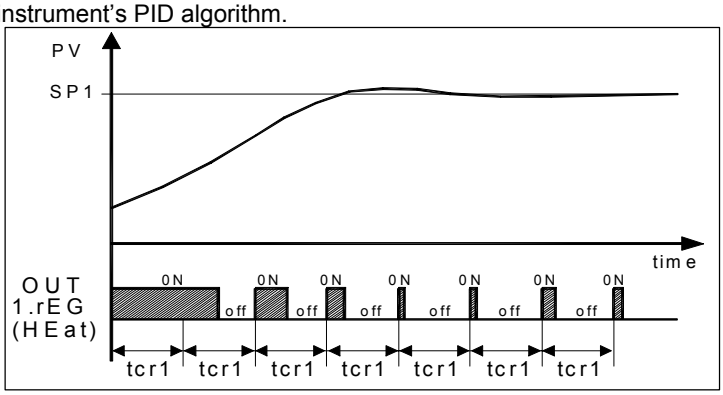


If 2.rEG output is used to control compressor is possible to use the "Compressor Protection" function that has the meaning to avoid compressor "short cycles".
This function allows a control by time on the output 2.rEG activation, independently by the temperature control request.
The protection is a "delayed after deactivation" type.
This protection permits to avoid the output activation for a time programmable on par. "**CPdt**" (expressed in sec.); the output activation will occurs only after the elapsing of time "CPdt".
The time programmed on parameter "CPdt" is counted starting from the last output deactivation.

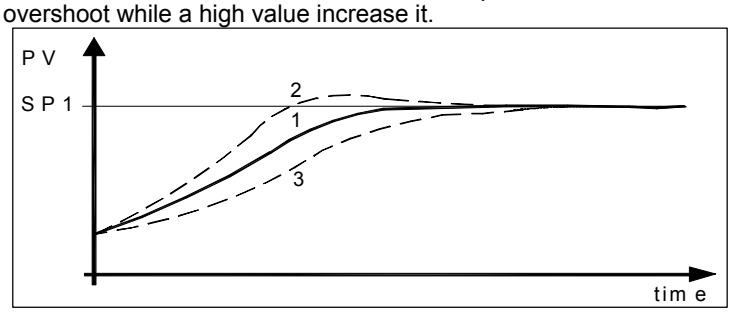
Obviously, whether during the time delay caused by the compressor protection function, the regulator request should stop, the output activation foreseen after time “CPdt” would be erased.
The function is not active programming “CPdt” =OFF.
The led relative to 2.rEG output blinks during the phases of output activation delay, caused by “Compressor Protection” function.

4.5 - SINGLE ACTION PID CONTROL (1rEG)

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 Set Point **“SP1”**, on the functioning mode **"Func”** and on the instrument’s PID algorithm.



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 increase it.



1: Value “FuOC” OK
2: Value “FuOC” too high
3: Value “FuOC” too low

4.6 - DOUBLE ACTION PID CONTROL (1rEG - 2rEG)

All the parameters referring to PID control are contained in the group **“[]rEG”.**
The Double Action PID control is used to control plants where there is an element which causes a positive increase (ex. Heating) and an element which causes a negative increase (ex. Cooling).
This type of control can be obtained 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 Set Point **“SP1”** and on the instrument’s PID algorithm.
In order to obtain good stability of the process variable, in case of fast processes, the cycle times “tcr1” and “tcr2” have to have a low value with a very frequent intervention of the control outputs.
In this case use of solid state relays (SSR) to drive the actuators is recommended.
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.
If par. “Prat” = 0, the output 2.rEG is disabled and the control behaves exactly as a single action PID controller, through output 1.rEG.

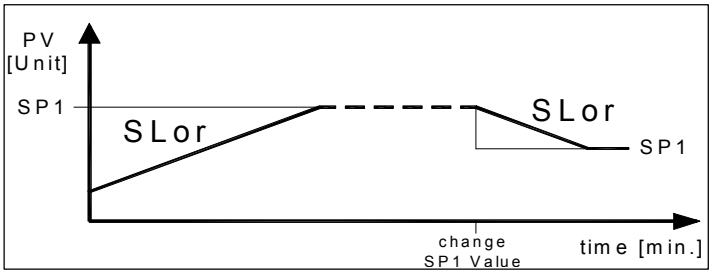
4.7 - AUTOTUNING AND SELFTUNING FUNCTIONS

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** function permits the calculation of thePID parameters by means of a FAST type 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.
Both 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 :
“tcr2” - Cycle time of the output 2.rEG
"Prat" - Ratio P 2.rEG/ P 1.rEG

<u>To activate the AUTO-TUNING function proceed as follows :</u>
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) Program par. **"Auto"** as:
- "1” – if auto-tuning is desired automatically, each time the instrument is switched on, on the condition that the process value is lower (with “Func” =HEAt) than [SP1- |SP1/2|] or higher (with “Func” =CooL) than [SP1+ |SP1/2|].
- "2" – if auto-tuning is desired automatically, the next time the instrument is switched on, on the condition that the process value is lower (with “Func” =HEAt) than [SP1- |SP1/2|] or higher (with “Func” =CooL) than [SP1+ |SP1/2|], and once the tuning is finished, the par. “Auto” is automatically swapped to the OFF state
- "3" - if manual auto-tuning is desired, by pushing key “U” for 1 sec.. In this case the auto-tuning starts without any control on the process value condition. It is recommended to use this option, starting the auto-tuning when the process value is as far as possible from the Set Point because, in order to feature the Auto-tuning FAST with its best performances , it is preferable to respect this condition.
6) Exit from the parameter programming.
7) Connect the instrument to the controlled plant.

8) Activate the Auto-tuning by key U if "Auto"= 3 or switch off and then on the instrument if "Auto" = 1 or 2.
At this point the Auto-tuning function is activated and is indicated by the flashing led AT/ST.
The regulator carries out several operations on the connected plant in order to calculate the most suitable PID parameters.
If "Auto" = 1 or "Auto" = 2, and if, at the Auto-tuning start, the condition for the lower process value is not found (with "Func" =HEAt) than [SP1- |SP1/2|] or higher (with "Func" =CooL) than [SP1+ |SP1/2|], the display will show **"ErAt"** and the instrument will be swapped to normal control conditions according to the previously programmed parameters.
The Auto-tuning cycle duration has been limited to 12 hours maximum.
If Auto-tuning is not completed within 12 hours, the instrument will show **"noAt"** on the display**.**
In case of probe error, the instrument automatically stops the cycle in progress.
The values calculated by Auto-tuning are automatically stored in the instrument's memory at the end of the correct PID parameters tuning.
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 by 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 visualized.
P.A.: *It's always preferable tuning the instrument using the Autotuning and to activate the Selftuning after because the tuning through Selftuning is more slow.*
If the instrument is switched off during Auto-tuning or with the Self-tuning function activated, these functions will remain activated the next time it is switched on.

4.8 - REACHING OF THE SET POINT AT CONTROLLED SPEED
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.
The function is determined by the following parameter :
"SLor" - Gradient of ramp expressed in unit/minute
P.A.: *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.

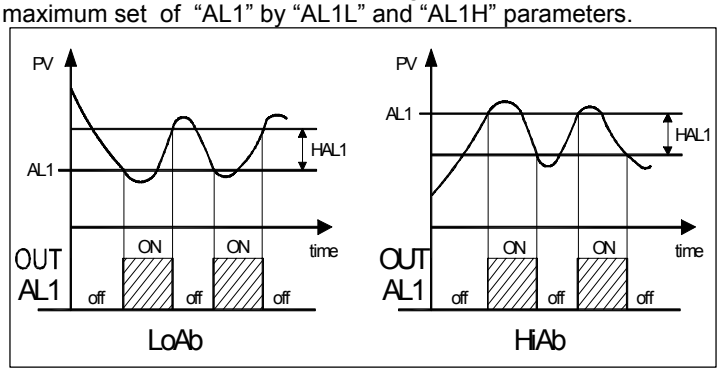


Example with start from values lower than SP 1 and with decreasing of SP 1.

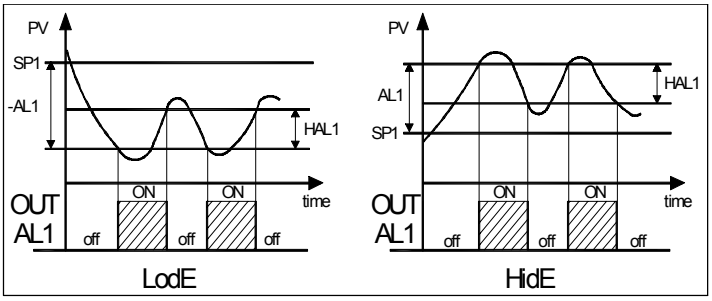
4.9 - ALARM OUTPUT FUNCTIONS (AL1)
The AL1 alarm depending on the process value and before to set his functioning it's necessary to establish to which output the alarm has to correspond to.
First of all it's necessary to configure, in the parameters group **"[]Out",** the parameters relative to the outputs required as alarm ("O1F" , "O2F") programming the parameter relative to the desired output as follows :
= ALno if the alarm output has to be ON when the alarm is active, while it's OFF when the alarm is not active
= ALnc if the alarm output has to be ON when the alarm is not active, while it's OFF when the alarm is active
= ALni if the alarm output has to be ON when the alarm is not active, while it is OFF when the alarm is active but with reverse led indication (led ON= alarm OFF).
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.

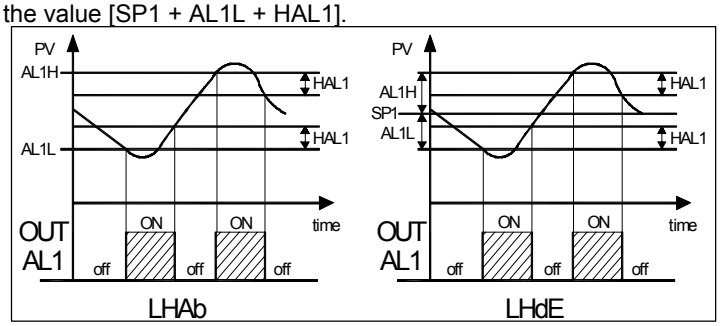


LodE = DEVIATION LOW ALARM: The alarm is activated when the process value goes below the value [SP1 + AL1] and will be deactivated when it goes above the value [SP1 + AL1 + HAL1].
With this mode is possible to program the minimum and the maximum set of "AL1" by "AL1L" and "AL1H" parameters.
HidE = DEVIATION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



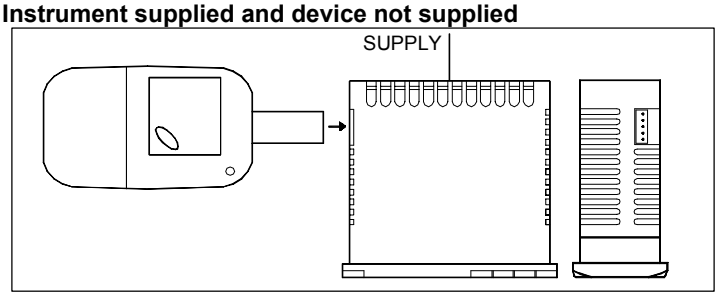
"AL1d" - ALARM DELAY: When the alarm condition occurs, delay counting begins, as programmed on par. "AL1d" (expressed in sec.) and the alarm will be activated only after the elapsing of that time.

"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).

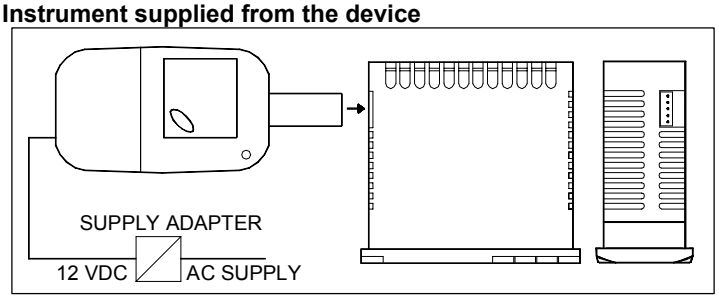
4.10 - PARAMETERS CONFIGURATION BY "KEY01"

The instrument is equipped with a connector that allows the transfer from and toward the instrument of the functioning parameters through the device **TECNOLOGIC KEY01** 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 KEY01 it's necessary that the device or instrument are being supplied.
To transfer the configuration of an instrument into the device **(UPLOAD)** it is necessary to proceed in the following way:
1) position both dip switch of KEY 01 in the **OFF** mode.
2) connect the device to the instrument TLK plugging the special connector.
3) verify that the instrument or 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 or 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.

Instrument supplied and device not supplied



Instrument supplied from the device



For additional info, please have a look at the KEY01 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**	Low Set Point	-1999 ÷ SPHL	-1999	
3	**SPHL**	High Set Point	SPLL ÷ 9999	9999	

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

Par.		Description	Range	Def.	Note
4	**SEnS**	Probe type: J= thermocoupled J CrAL= termocoupled K S= thermocoupled S Ir.J= Infrared Sen. IRS J Ir.CA= Infrared Sen. IRS K Pt1= thermoresistance Pt100 0.50= 0..50 mV 0.60= 0..60 mV 12.60= 12..60 mV Ptc= thermistor PTC KTY81-121 ntc= thermistor 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>input C :</u> J / CrAL / S / Ir.J / Ir.CA / Pt1 / 0.50 / 0.60 / 12.60 <u>input E :</u> J / CrAL / S / Ir.J / Ir.CA / Ptc / ntc / 0.50 / 0.60 / 12.60 <u>input I :</u> 0.20 / 4.20 <u>input V :</u> 0.1 / 0.5 / 1.5 / 0.10 / 2.10	J Ptc 4.20 0.10	

5	**SSC**	Low scale limit in case of input with V / I signals	-1999 ÷ FSC	0	
6	**FSC**	High scale limit in case of input with V / I signals	SSC ÷ 9999	0	
7	**dP**	Number of decimal figures	Pt1 / Ptc / ntc: 0 / 1 norm sig.: 0 ÷ 3	0	
8	**Unit**	Temperature unit of measurement	°C / °F	°C	
9	**FiL**	Input digital filter	0FF÷ 20.0 sec.	1.0	
10	**OFSt**	Measuring Offset	-1999 ÷ 9999	0	
11	**rot**	Rotation of the measuring straight line	0.000 ÷ 2.000	1.000	
12	**OPE**	Output power in case of measuring error	-100 ÷ 100 %	0	

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

Par.		Description	Range	Def.	Note
13	**O1F**	Functioning of output 1: 1.rEG= Control Out 1 2.rEG=Control Out 2 ALno= Alarm Out normally opened ALnc= Alarm Out normally closed ALni= Alarm Out normally closed with reverse led func.	1.rEG / 2.rEG ALno / ALnc ALni / OFF	1.rEG	
14	**O2F**	Functioning of output 2: see "O1F"	1.rEG / 2.rEG ALno / ALnc ALni / OFF	ALno	

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

Par.		Description	Range	Def.	Note
15	**OAL1**	Output where alarm AL1 is addressed	Out1 / Out2 / OFF	Out2	
16	**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	
17	**AL1**	Alarm AL1 threshold	AL1L÷ AL1H	0	
18	**AL1L**	Low threshold band alarm AL1 or Minimum set alarm AL1 for high or low alarm	-1999 ÷ AL1H	-1999	
19	**AL1H**	High threshold band alarm AL1 or Maximum set alarm AL1 for high or low alarm	AL1L ÷ 9999	9999	
20	**HAL1**	Alarm AL1 hysteresis	OFF ÷ 9999	1	
21	**AL1d**	Activation delay of alarm AL1	OFF ÷ 9999 sec.	OFF	
22	**AL1i**	Alarm AL1 activation in case of measuring error	no / yES	no	

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

Par.		Description	Range	Def.	Note
23	**Cont**	Control type: Pid= PID On.FA= ON/OFF asym. On.FS= ON/OFF sym. nr= ON/OFF Neutral Zone	Pid / On.FA On.FS / nr	Pid	
24	**Func**	Functioning mode output 1.rEG	HEAt / CooL	HEAt	
25	**HSEt**	Hysteresis of ON/OFF control	0 ÷ 9999	1	
26	**CPdt**	Compressor Protection time for 2.rEG	OFF÷ 9999 sec.	0	
27	**Auto**	Autotuning Fast enable	OFF / 1 / 2 / 3 / 4	OFF	
28	**SELF**	Selftuning enable	no / yES	no	
29	**Pb**	Proportional band	0 ÷ 9999	40	
30	**Int**	Integral time	OFF ÷ 9999 sec.	300	
31	**dEr**	Derivative time	OFF÷ 9999 sec.	30	
32	**FuOc**	Fuzzy overshoot control	0.00 ÷ 2.00	0,50	
33	**tcr1**	Cycle time of output 1.rEG	0.1 ÷ 130.0 sec.	20,0	
34	**Prat**	Power ratio 2rEg / 1rEg	0.01 ÷ 99.99	1.00	
35	**tcr2**	Cycle time of 2.rEG	0.1 ÷ 130.0 sec.	10.0	
36	**rS**	Manual reset	-100.0÷100.0 %	0.0	
37	**SLor**	Gradient of ramp: InF= Ramp not active	0.00 ÷ 99.99 / InF unit/min.	InF	

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

Par.		Description	Range	Def.	Note
38	**AdE**	Shift value for the shift index functioning	OFF...9999	2	

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	Auto-tuning not possible because the process value is higher (with "Func" =HEAt) than [SP1- |SP1/2|] or lower (with "Func" =CooL) than [SP1+ |SP1/2|].	Try to repeat the auto-tuning when the conditions are correct
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"

In error conditions, the instrument provides an output power as programmed on par "OPE" and activates the alarm, if the relative parameter "AL1i" 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 - 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 TECNOLOGIC with a detailed description of the faults found, without any fees or charge for Tecnologic, except in the event of alternative agreements.

7 - TECHNICAL DATA

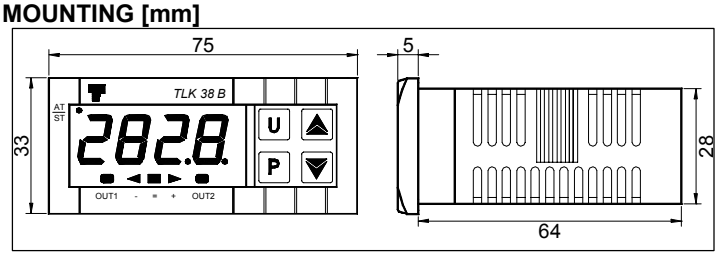
7.1 – ELECTRICAL DATA

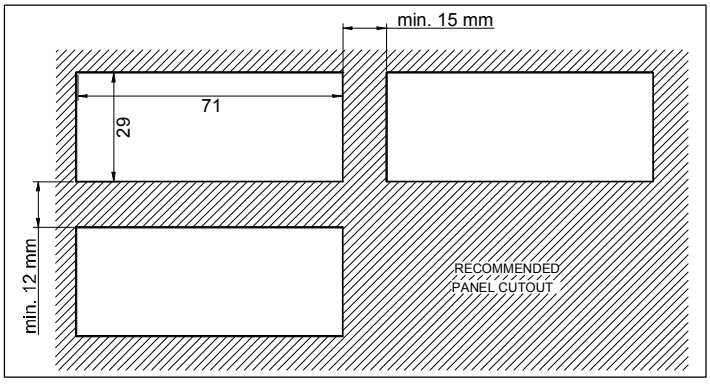
Power supply: 12 VAC/VDC, 24 VAC/VDC, 100.. 240 VAC +/- 10%
Frequency AC: 50/60 Hz
Power consumption: 4 VA approx.
Input/s: 1 input for temperature probes: tc J,K,S ; infrared sensors TECNOLOGIC IRS J e K; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C) or mV signals 0...50 mV, 0...60 mV, 12 ...60 mV or normalized signals 0/4...20 mA, 0..1 V, 0/1...5 V , 0/2...10 V.
Normalized signals input impedance: 0/4..20 mA: 51 Ω; mV and V: 1 MΩ
Output/s: Up to 2 outputs. Relay SPDT (8 A-AC1, 3 A-AC3 / 250 VAC) ; or in tension to drive SSR (8mA/ 8VDC).
Auxiliary supply output: 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 part (power supply 115 or 230 V and relay outputs) and front panel; Reinforced insulation between the low voltage section (Supply 115 or 230 V and relay outputs) and the extra low voltage section (input, SSR outputs); Reinforced between power supply and relays; No insulation between supply 12 V and input. No insulation between input and SSR outputs.

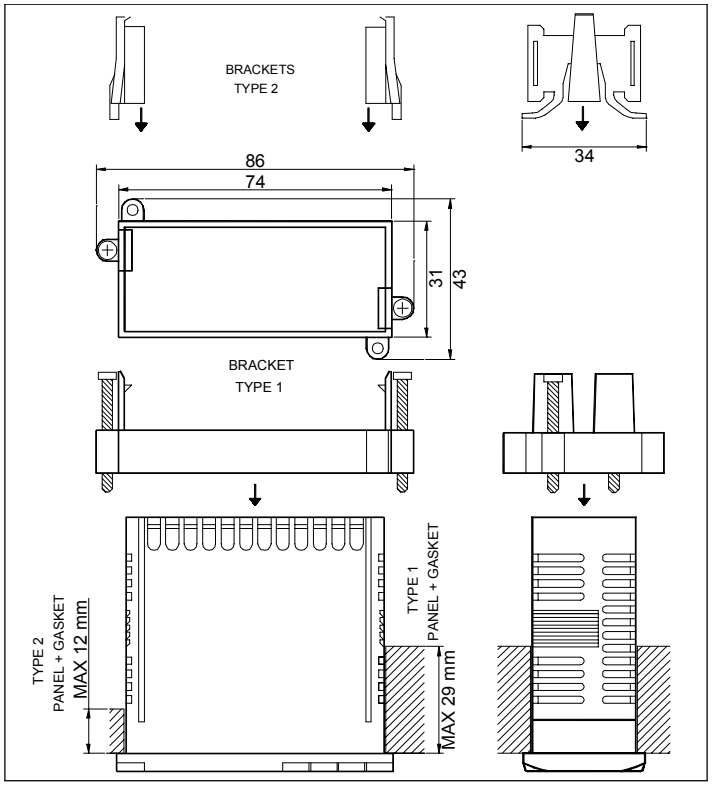
7.2 – MECHANICAL DATA

Housing: Self-extinguishing plastic, UL 94 V0
Dimensions: 33 x 75 mm, depth 64 mm
Weight: 150 g approx.
Mounting: Flush in panel in 29 x 71 mm hole
Connections: 2,5 mm^2 screw terminals block
Degree of front panel protection : IP 65 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: +/- 0,5 % fs (+/- 1% for tc S)
Max cold junction compensation drift (in tc) : 0,1 °C/°C with operating temperature 0 ... 50 °C after warm-up of 20 min.
Sampling rate: 130 ms.
Display: 4 Digit Red h 12 mm
Compliance: ECC directive EMC 89/336 (EN 61326), ECC directive LV 73/23 and 93/68 (EN 61010-1)

7.5 - MEASURING RANGE TABLE

INPUT	"dP" = 0	"dP"= 1, 2, 3
tc J **"SEnS" = J**	0 ... 1000 °C 32 ... 1832 °F	- - - -
tc K **"SEnS" = CrAl**	0 ... 1370 °C 32 ... 2498 °F	- - - -
tc S **"SEnS" = S**	0 ... 1760 °C 32 ... 3200 °F	- - - -
Pt100 (IEC) **"SEnS" = Pt1**	-200 ... 850 °C -328 ... 1562 °F	-199.9 ... 850.0 °C -199.9 ... 999.9 °F
PTC (KTY81-121) **"SEnS" = Ptc**	-55 ... 150 °C -67 ... 302 °F	-55.0 ... 150.0 °C -67.0 ...302.0 °F
NTC (103-AT2) **"SEnS" = ntc**	-50 ... 110 °C -58 ... 230 °F	-50.0 ... 110.0 °C -58.0 ... 230.0 °F
0..20 mA **"SEnS" = 0.20**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
4..20 mA **"SEnS" = 4.20**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 50 mV **"SEnS" = 0.50**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 60 mV **"SEnS" = 0.60**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999

12 ... 60 mV "SEnS" = 12.60	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 1 V "SEnS" = 0.1	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 5 V "SEnS" = 0.5	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
1 ... 5 V "SEnS" = 1.5	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0 ... 10 V "SEnS" = 0.10	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
2 ... 10 V "SEnS" = 2.10	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999

7.6 - INSTRUMENT ORDERING CODE

TLK38 a b c d ee

a : POWER SUPPLY
F = 12 VAC/VDC
L = 24 VAC/VDC
H = 100... 240 VAC

b : INPUT
C = thermocouples (J, K, S, I.R), mV, thermoresistances (Pt100)
E = thermocouples (J, K, S, I.R.), mV, thermistors (PTC, NTC)
I = normalized signals 0/4..20 mA
V = normalized signals 0..1 V, 0/1..5 V, 0/2..10 V.

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

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

ee : SPECIAL CODES
1B = Version with 1 output
2B = Version with 2 outputs

TLK 38 B PASSWORD = 381