TLK 31 C

MICROPROCESSOR-BASED DIGITAL ELECTRONIC MULTISTEP CONTROLLER

OPERATING INSTRUCTIONS
Vr. 01 (ENG)- cod.: ISTR 06659

TECNOLOGIC S.p.A.

VIA INDIPENDENZA 56
27029 VIGEVANO (PV) ITALY
TEL.: +39 0381 69871
FAX: +39 0381 698730
internet : http:\\www.tecnologic.it
e-mail: info@tecnologic.it

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.

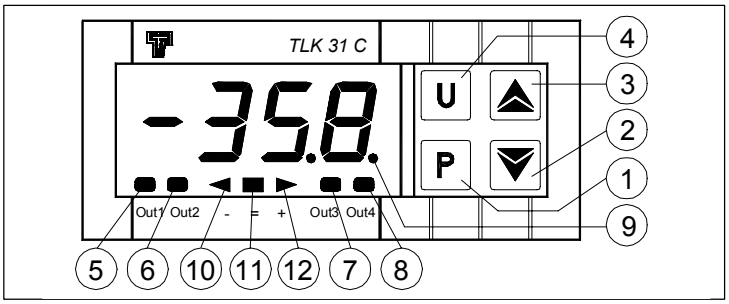
INDEX

1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION
TLK 31 C is a microprocessor based digital multistep controller usable typically for the control of multi-compressors refrigeration unit but it's also available for other systems having more separate actuators that can to condition the process variable.
The instrument can perform the control with ON/OFF regulation , Neutral Zone or Proportional and has the possibility to have two programmable digital inputs and serial communication RS485 with MODBUS-RTU communication protocol with 38400 bauds as as transmision rate.
The process value is visualized on 4 red displays, while the output status is indicated by 4 LED displays.
The instrument has besides a digital shift-index made by 3 leds.
The instrument foresees the memorization of 4 Set-Point and it has 4 relay or for static relay (SSR) driving outputs.
According to the probe to connect are available 4 different configurations :

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
Other important available functions are:
Multistage compressors control, load rotation by time functioning, compressors protection times, parameters protection on different levels.

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 : This is a key with a function programmable by par. "USrb". It can be set to :swap the instrument to manual control, silence the alarm, change the active Set Point, deactivate control(see par. 4.11). When in programming mode, it can be used to change the parameters programming level (see par. 2.3).
5 - Led OUT1 : indicates the state of output OUT1
6 - Led OUT2 : indicates the state of output OUT2
7 - Led OUT3 : indicates the state of output OUT3
8 - Led OUT4 : indicates the state of output OUT4
9 - Led SET :indicates access to the programming mode and the parameters programming level.
10 - Led – Shift index: indicates that the process value is lower than the one programmed on par. "AdE".
11 - Led = Shift index: indicates that the process value is within the range [SP+AdE ... SP-AdE]
12 - 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

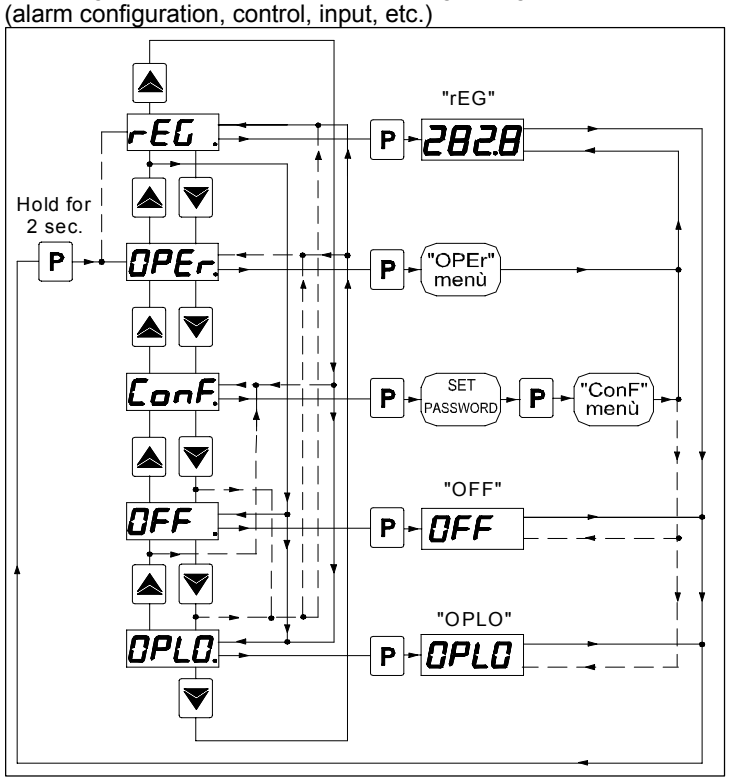
This procedure permits rapid programming of the active Set Point and possibly the alarm thresholds (see par 2.3)
Push key "P", then release it and the display will visualise **"SP n"** (where n is the number of the Set Point active at that moment) alternatively to the programmed value.
To modify the 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 it is possible to visualise the alarm thresholds (see par. 2.3).
To exit from the fast Set programming it is necessary to push the 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 PARAMETER PROGRAMMING

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

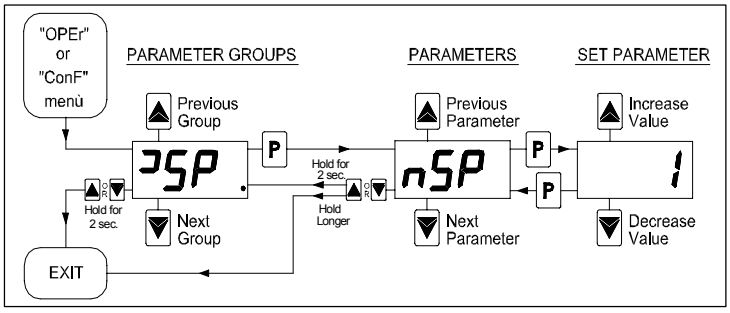
"OPEr"	to enter into the operating parameters menu
"ConF"	to enter into the configuration parameters menu
"OFF"	to swap the regulator into the OFF state
"rEG"	to swap the regulator into the automatic control state
"OPLO"	to swap the regulator to the manual control state and therefore to program the % control value using the "UP" and "DOWN" keys

Once the desired item has been selected, push key "P" to confirm.
Selecting "OPEr" and "ConF" gives the possibility of accessing other menus containing additional parameters and more precisely :
"OPEr" - Operating parameters Menu: this normally contains the Set Point parameters but it can contain all the desired parameters (see par. 2.3).
"ConF" - Configuration parameters Menu: this contains all the operating parameters and the functioning configuration parameters (alarm configuration, control, input, etc.)



To access the menù "ConF" to select therefore the option "ConF", to press the key P and the display will show "0."
To this point to program, through the keys UP and DOWN, the password mentioned to the last page of this manual and to press the key "P."
If a wrong password is programmed the instrument returns in the state of regulation in which was previously found.
If the password is correct, the display will visualize the code that identifies the first group of parameters ("] SP") and with the keys UP and DOWN it will be possible to select the group of parameters that have to be programmed.
Once selected the desired group of parameters to press the key P and will be visualized the code that identifies the first parameter of the selected group.
Always with the keys UP and DOWN the desired parameter can be selected and, pressing the key P, the display it will alternatively visualize the code of the parameter and its setting. Any change can be made with the keys UP or DOWN.

Programmed the desired value to again press the key P: the new value will be memorized and the display will show only again the label of the first selected parameter.
Acting on the keys UP or DOWN is therefore possible to select another parameter of the group (if it foresees) and to modify it as above described.
To select another group of parameters to hold down the key UP or the key DOWN for around 2 sec. ,after taht the display will return to visualize the code of the group of parameters.
When this happens to release the key and with the keys UP and DOWN it will be possible to select another group and to access its parameters as previously described.
To exit from programming mode not to act on any key for around 20 seconds, or to hold down the key UP or DOWN over 2 seconds.
Programming mode for "OPEr" menu is the same as described for "ConF" menù with the difference that to access the "OPEr" menù the Password is not in demand.



WARNING: The instrument is pre-programmed in factory with all the parameters, except of the Set Point "SP1" (and 2,3,4) programmable in the "ConF" menù, to the purpose to prevent wrong accidental setting from non experienced consumers.

2.3 - PARAMETERS PROGRAMMING LEVELS

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

2.4 - CONTROL STATES

The controller can act in 3 different ways : automatic control **(rEG),** control off **(OFF)** and manual control **(OPLO).**
The instrument is able to pass from one state to the other :
- by selecting the desired state from the main selection menu suing the keyboard.
- By using the key "U" on the keyboard; suitably programming par. "USrb" ("USrb" = OPLO; "USrb" = OFF) it is possible to pass "rEG" state to the state programmed on the parameter and vice versa.
- By using the digital input 1 suitably programming par. "diF" ("diF" = = OFF) it is possible to pass from "rEG" state to the state OFF and vice versa.

When switched on, the instrument automatically reassumes the state it was in when it was last switched off.
AUTOMATIC CONTROL (rEG) – Automatic control is the normal functioning state of the controller.
During automatic control it is possible to visualize the control power on the display by pushing key "UP".
The range of the power values goes from H100 (100% of the output power with reverse action) to C100 (100% of the output power with direct action).
CONTROL OFF (OFF) – The instrument can be swapped into the "OFF" state, i.e. the control and the relative outputs are deactivated.
The alarm outputs are instead working normally.
BUMPLESS MANUAL CONTROL (OPLO) – By means of this option it is possible to manually program the power percentage given as output by the controller by deactivating automatic control.
When the instrument is swapped to manual control, the power percentage is the same as the last one supplied and can be modified using the "UP" and "DOWN" keys.
As in the case of automatic control, the programmable values range from H100 (+100%) to C100 (-100%).
To return to automatic control, select "rEG" in the selection menu.

2.5 - ACTIVE SET POINT SELECTION

This instrument permits pre-programming of up to 4 different Set points (**"SP1"**, **"SP2"**, **"SP3"**, **"SP4"**) and then selection of which one must be active.
The maximum number of Set points is determined by the 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
- by the digital inputs if "diF" = CHSP , = SP1.2 , =SP1.4

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 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

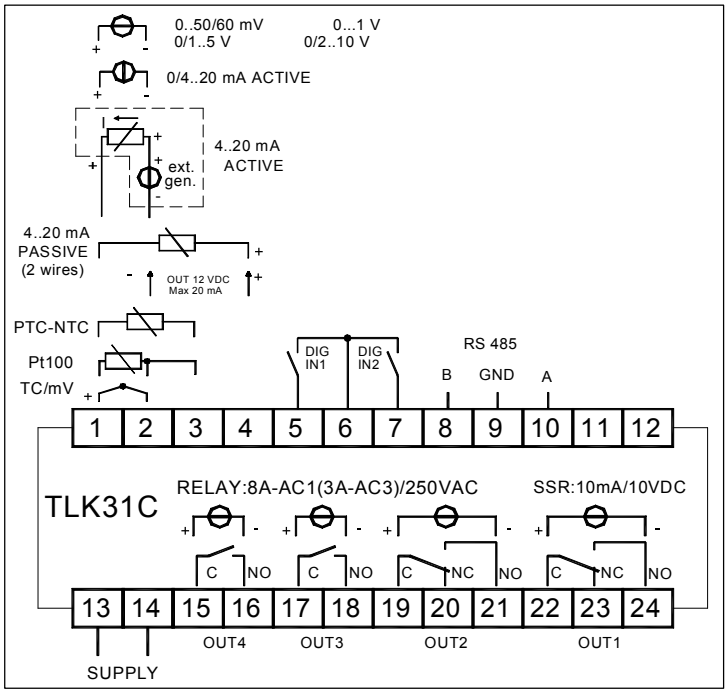
The instrument, in case 33 x 75 mm, is designed for flush-in panel mounting.
Make a hole 29 x 71 mm and insert the instrument, fixing it with the provided special bracket.
We recommend that the gasket is mounted in order to obtain the front protection degree as declared.

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 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 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.
For the electrical supply of the instrument 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.).
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 breakage
= Ur : the condition occurs in case of under-range or probe breakage
= Ur : the condition occurs in case of under-range or probe breakage
= Our : the condition occurs in case of over-range or under-range or probe breakage
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) or alarm threshold AL1 or 2(AL1, AL2).
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

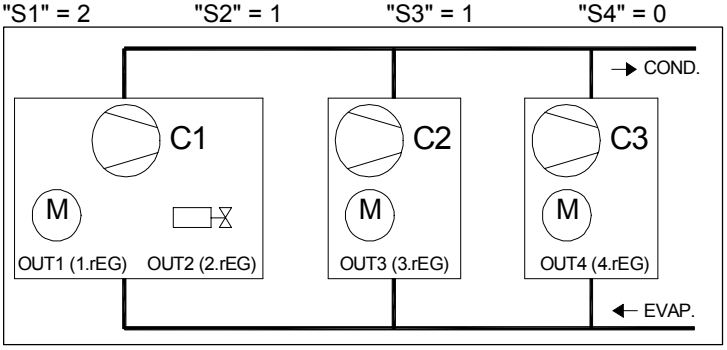
The instrument's outputs can be programmed by entering the group of parameters **"]Out**, where the relative parameters ,depending on the number of outputs available on the instrument, are located.
"O1F" , "O2F" , "O3F" , "O4F" - Outputs function
"nC" - Number of compressors (or fans or independent elements not multistage)
"S1" - steps number for compressor n.1
"S2" - steps number for compressor n.2
"S3" - steps number for compressor n.3
"S4" - steps number for compressor n.4
The outputs can be configurated through the parameters "O1F", "O2F", "O3F", "O4F" for the following operations:
- First control output (1.rEG)
- Second control output (2.rEG)
- Third control output (3.rEG)
- Fourth control output (4.rEG)
- Alarm output normally open (ALno)
- Alarm output normally closed (ALnc)
- Alarm output normally closed but without led indication (ALni)
- Deactivated output (OFF)

The coupling outputs number – alarms number can be made in the group referring to the alarm ("]AL1","]AL2")
In case of applications on cooling plants, the control outputs (1.rEG, 2.rEG, 3.rEG and 4.rEG) can typically be used for compressors or for compressors and multistage electro valves if is checked the suction pressure / temperature or for fans that cool the condenser if is checked the pressure / temperature of emission.
In case of applications where the operation of some outputs doesn't have to be conditioned from the operation of other outputs (for example, groups of simple compressors, fans or heating elements) it is enough to program to the parameter "nC" the number of the programmed regulation outputs and to program the parameters "S1", "S2", S3" and "S4" all =1.
Different it is the case where compressors toghether with multistage elctro valves are controlled.
In fact in this type of application the output that controll the compressor motor must be always activates before the relative electro valves and must be turned off for last in respect to the electro valves.
In these cases must be programmed :
- to the parameter "nC" the number of the compressors
- to the parameters "S1", "S2", "S3" and "S4" the number of the steps of the relative compressors

Remark : the compressor with more stages have to be connected to the first output.
To the purpose to facilitate the understanding of the outputs configuration followings three examples are shown.

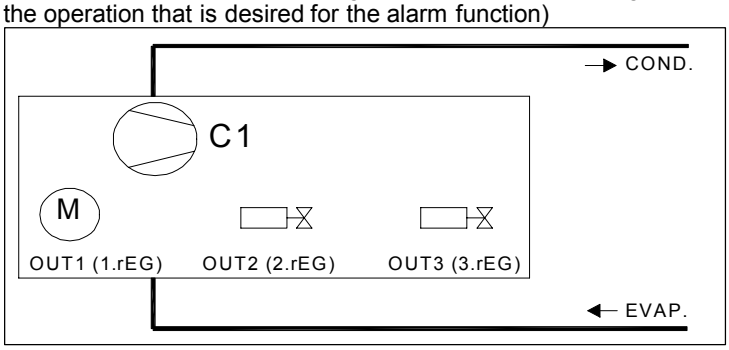
CONFIGURATION EXAMPLE No. 1

Supposing to regulate the suction pressure (or temperature) of a refrigeration plant controlling the following compressors :
C1) compressor with 2 stages
C2) compressor without stages
C3) compressor without stages
Following the principle for which the compressors with more stages have to be connected to the first outputs it comes that the outputs will control then respectively :
OUT1 : Motor of compressor C1 (1st step)
OUT2 : Electrovalve C1 2nd step
OUT3 : Motor of compressor C2
OUT4 : Motor of compressor C3
The parameters programming will be the following :
"O1F"= 1.rEG "O2F"= 2.rEG "O3F"= 3.rEG "O4F"= 4.rEG
"nC" = 3
"S1" = 2 "S2" = 1 "S3" = 1 "S4" = 0



CONFIGURATION EXAMPLE No. 2

For example, it's desired to control the suction pressure of a plant through the control of the following compressor :
C1) compressor with 3 stages
Also, it's desired to have an alarm with normally open output.
The outputs will control then respectively :
OUT1 : Compressore motor C1 (1st step)
OUT2 : Electro valve C1 (2nd step)
OUT3 : Electro valve C1 (3rd step)
OUT4 : Alarm AL1
The parameters programming will be the following :
"O1F"= 1.rEG "O2F"= 2.rEG "O3F"= 3.rEG "O4F"= ALno
"nC" = 1
"S1" = 3 "S2" = 0 "S3" = 0 "S4" = 0
and for the alarm
"OAL1"= Out4
(for the other parameters of the group "] AL1" it will be programmed the operation that is desired for the alarm function)



CONFIGURATION EXAMPLE No. 3

It's desired to control the condensing pressure (or temperature) of a plant using following fans :

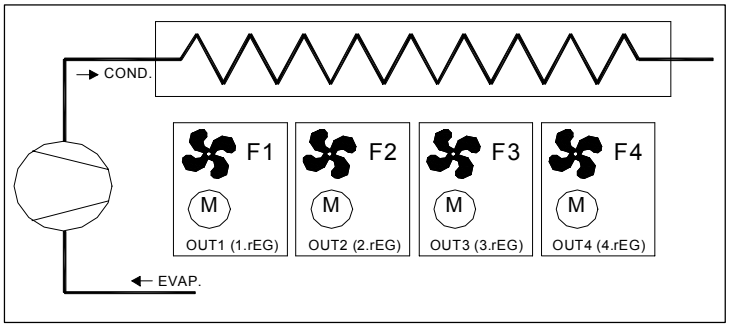
F1) Fan 1 F2) Fan 2
F3) FAn 3 F4) Fan 4

The outputs will control then respectively :

OUT1 : Motor of Fan 1
OUT2 : Motor of Fan 2
OUT3 : Motor of Fan 3
OUT4 : Motor of Fan 4

The parameters programming will be the following :

"O1F"= 1.rEG "O2F"= 2.rEG "O3F"= 3.rEG "O4F"= 4.rEG
"nC" = 4
"S1" = 1 "S2" = 1 "S3" = 1 "S4" = 1



Remark: Same example could be available to control 4 compressors or 4 heating elements.

4.3 - POWER CONTROLLED BY THE OUTPUTS

For different reasons (outputs state in case of probe error, proportional control or gradual insertion of the power) it's indispensable to program on parameters **"P1", "P2", "P3" and "P4"** (present in the group **"[]Out"**) a number which defines a proportion between the powers or the flows controlled by each outputs.

Obviously the fitter should know a common parameter (Power expressed in KW or CV or the flow or something else).

For example, whether are used 3 compressors with the following features :

First of 11 KW multistage with 2 steps of equal flow(driven by the outputs programmed as 1.rEG and 2.rEG)

Second of 2,5 KW not multistage (driven by the output programmed as 3.rEG)

Third of 2,5 KW not multistage (driven by the output programmed as 4.rEG)

the parameters have to be programmed in this way :

"P1" = 55 "P2" = 55 "P3" = 25 "P4" = 25

Since P1 + P2 + P3 + P4 = 100 % of the power = 160 for this example

the instrument will be then able to calculate the power controlled by the different outputs :

1.rEG = 100 * 55 / 160 = 34,375%
2.rEG = 100 * 55 / 160 = 34,375%
3.rEG = 100 * 25/ 160 = 15,625%
4.rEG = 100 * 25 / 160 = 15,625%

In case where all the outputs have to control loads having equal powe, the parameters have to be setted with the same number.

4.4 - ON/OFF CONTROL MODE

All the parameters referring to the ON/OFF control are contained in the group **"[]rEG".**

This type of control is extremely simple, but requires the continuous activation / deactivation of the outputs and it's not then advisable if it's necessary to avoid frequent switch on/off ; it could be used for other particular cases.

Insofar it is not particularly recommended for the control of motors.

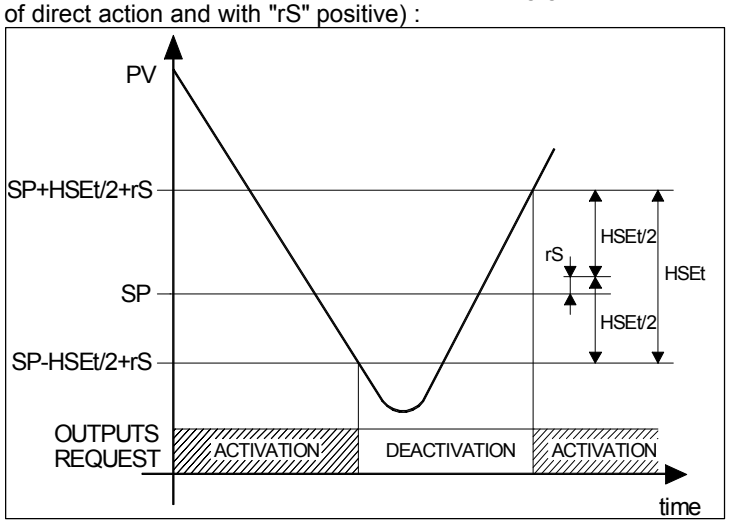
This type of control can be obtained by programming par.**"Cont"** = On.FS and works on the control outputs depending on the measure, on the programmation of the active Set Point **"SP",** of the hysteresis **"HSEt"**, of the manual reset for the hysteresis **"rS"** and the function that has to execute as programmed to the parameter **"Func"**.

In case of direct action or cooling ("Func"=CooL), the instrument will provide to activate the control outputs when the process value goes above to [SP - HSEt/2 + rS] while it will provide to deactivate same outputs when the process value is below to [SP + HSEt/2 + rS].

In case of reverse action, or heating action ("FunC"=HEAt) the instrument will provide to activate the control outputs when the process value goes below to [SP - HSEt/2 + rS] while it will provide to deactivate same outputs when the process value is above to [SP + HSEt/2 + rS].

The deviation of the hysteresis band or manual reset are understood as offset of the hysteresis band in comparison to the Set Point and it has therefore a range [- HSEt/2... +HSEt/2].

The operation can be exemplified in the following graphic (example of direct action and with "rS" positive) :



4.5 - NEUTRAL ZONE CONTROL MODE

All the parameters referring to Neutral Zone ON/OFF control are contained in the group **"[]rEG".**

The Neutral Zone control is used when it is wanted to avoid, as far as possible, frequent turning on and turning off of the loads to loss however of an accurate maintenance of the process value and it is therefore suitable when in the plant there are few compressors of elevated power.

This way of regulation is feasible programming the parameter **"Cont"** = nr and, as the ON/OFF control, it acts on the control outputs depending on the process value and according to what is programmed on the active Set point **"SP",** on the hysteresis **"HSEt",** on the manual reset for the hysteresis **"rS"** and naturally according to the action that has to execute as programmed to the parameter **"Func".**

In case of direct action , or cooling ("FunC"=CooL) the instrument will provide to :

-to activate the control outputs when the process value goes above to [SP - HSEt/2 + rS]

-to deactivate the control outputs when the process value goes below to [SP + HSEt/2 + rS]

-to maintain the outputs in the same state in which they were found at moment when the process value enter in the band
[SP + HSEt/2 + rS] ... [SP - HSEt/2 + rS]

In case of reverse action, or heating ("FunC"=HEAt) the instrument will provide to :

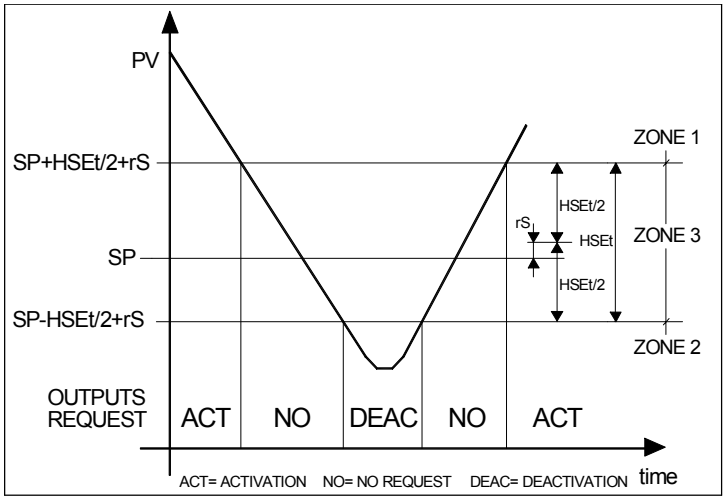
-to activate the control outputs when the process value goes below to [SP - HSEt/2 + rS],

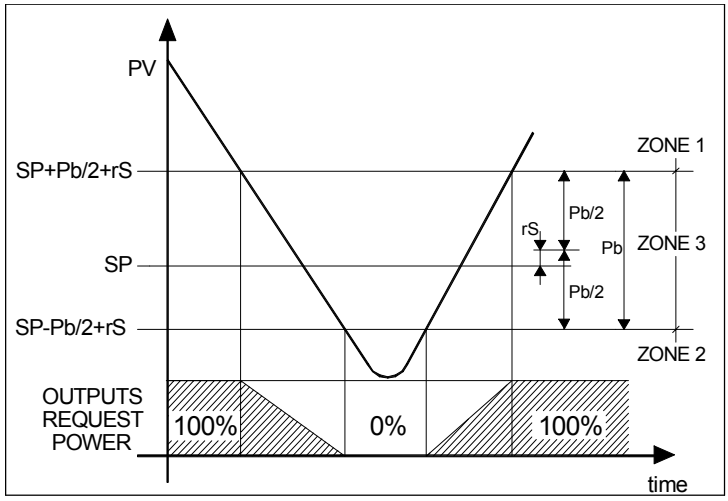
-to deactivate the control outputs when the process value goes above to [SP + HSEt/2 + rS]

-to maintain the outputs in the same state in which they were found at moment when the process value enter in the band
[SP + HSEt/2 + rS] ... [SP - HSEt/2 + rS]

The deviation of the hysteresis band or manual reset are understood as offset of the hysteresis band in comparison to the Set Point and it has therefore a range [-HSEt/2 ... +HSEt/2].

The operation can be exemplified in the following graphic (example of direct action and with "rS" positive) :





Zone 1 : PV > [SP + HSEt/2 + rS]
It will activate (Func=CooL) or deactivate (Func=HEAt) the outputs
Zone 2 : PV < [SP - HSEt/2 + rS]
It will deactivate (Func=CooL) or activate (Func=HEAt) the outputs
Zone : [SP + HSEt/2 + rS] < PV < [SP - HSEt/2 + rS]
It will maintain the outputs in the same state in which they were found at moment when the process value enter in the hysteresis band.
(Note: PV = Process Value)
With this system (differently from the ON/OFF) it's very probable that the outputs activation / deactivation are less frequent because, after one or some oscillations, after that the process value is at the inside of the hysteresis band and the load of the plant is constant, there shouldn't be the necessity of outputs activation or deactivation.

4.6 - PROPORTIONAL CONTROL MODE

All the parameters referring to proportional control are contained in the group **"rEG".**
Proportional control is used when it is wanted to maintain the more possible constant the process value with the disadvantage however of possible frequent requets of turning on & off of the actuators and it is therefore suitable when in the plant there are many compressors (or however steps).
This type of control can be obtained by programming parameter **"Cont"** = ProP and works on the control outputs depending on the measure, on the active Set Point **"SP"** programming, on the proportional band **"Pb**", on the manual reset **"rS"** and on the function that has to execute as programmed to the parameter **"Func"**.
With this type of control it's absolutely necessary that the controller knows the power percentage controlled by the different outputs, in order to supply to the plant only the effective power required by the proportional controller.
The proportional controller behaves exactly as the Neutral Zone controller when the process variable is located in Zones 1 or 2 (requiring then the outputs activation or deactivation, i.e. supplying to the plant the 100% or 0% of the power) while in Zone 3 (i.e. at the internal of the proportional band) it will not maintain the outputs deactivated as in the Neutral Zone control, but it will supply the power depending on the shift [Process Value - Set Point].
The regulator, after the exact calculation of the power to be given, will provide to activate the outputs, allowing the supply of power , as near as possible to what required.
The operation can be exemplified in the following graphic (example of direct action and with "rS" positive) :

4.7 - SWITCH ON / OFF PRIORITY OF THE LOADS

All the parameters concerning the priorities of turning on & off of the loads, that are mainly conceived to optimize applications on refrigeration plants, are contained in the group **"rEG."**
Before that the regulator has decided whether it's necessary to switch on or off the actuators, it's obligatory that the controller verifies the configuration, in order to defines the possible combinations and successively it has to consider the following conditions.

4.7.1 - SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF MULTISTAGE COMPRESSORS

As already told, in case of multistage compressors it's necessary that all the outputs driving the motors are being activated before than the outputs driving the relative multistage valves and, when these are all switched off, to switch off the relative motor.
Furthermore, once one motor is switched on, before than switch on all the others, it's necessary to activate all the relative multistage valves of that motor, in order to avoid the functioning of all the motors not working full load.
As regard the motors switching on, it could be advisable (with equal power for the proportional regulator), instead of switching off the whole plant, to keep the motor working and switch off the valve of another plant, in order to have, in case of an activation request, always available a valve instead of a motor, so to avoid motor switching on.
Otherwise, could be also advisable (still with equal power) to switch off the whole plant, because it's foreseen not to have immediate activation requests (for instance in case of night functioning) so to obtain an energetic saving.
Summing up:
- To switch on a motor instead of a valve means to save the energy used by the motor, but it has to be reminded that, at the successive power request, the regulator will be obliged to switch on the motor (not saving then the number of activation)
- To switch off a valve instead of a motor means to save a motor activation, because at the successive power request, the regulator actives the valve instead of the motor (not saving then the energy used by the motor).

This function works with following parameter :
"ES" : Functioning saving for multistage motorss
OFF = Valves switching off priority (activation saving)
On = Motors switching off priority (energetic saving)
This parameter is obviously uninfluential whether there are no multistage compressors (all parameters S1, S2, S3, S4 are = 1 or 0)

4.7.2 - SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF PROGRESSIVE POWER ACTUATION

It's active only when there are no multistages loads.

This function allows, with ON/OFF or NEUTRAL ZONE control modes, to avoid too high increases or decreases when the process variable is next to the intervention values (permitting a better process stabilization particularly with Neutral Zone control) and, in

case of proportional control, it allows to active the power effectively required (having obviously different powers driven by the outputs) not considering frequent switching on and off.
The function is actionable through the parameter :
"PS " - Switch on / off priority in case of progressive power actuation
On =Switch on / off priority for progressive power
In case of switch on / off request, the regulator provides to active / deactive the outputs, in order to obtain the combination which allows to add/subtract the lowest power to the plant.
Then, if the switching on / off request still remains, the regulator provides to add/subtract the lowest possible power, although to do this it's necessary to switch off and successively switch on the outputs.
OFF = No priority
The switching on / off considers only the outputs available to be activated / deactivated which has the lowest power and doesn't consider all the possible combinations, avoiding in this way to switch off and on different outputs.
In the practice, anyway, if the powers controlled by the outputs are all equal the parameter has no influence on the switching on / off priority.
In case of multistage compressors with any kind of control type and obviously with different powers, the switching on / off priority is always established starting from the lower power available, but it's excluded the functioning described on par. "PS"=on, because the activation of this combination could requires too many operations and then too much time to be executed, as it has necessarely to be respected the conditions which permit not to have all the motors working not full load.

4.7.3 - SWITCH ON / OFF PRIORITY OF THE LOADS IN CASE OF FUNCTIONING HOURS (LOADS ROTATION)

It's active in all the conditions and permits to make equal, as much as possible, the functioning hours of the different motors through the parameters :
"rtLd": Loads rotations with functioning hours
On = Active rotation
Whenever it's required an activation, with equal power request, it's switched on the output driving a motor with less functioning hour and, whenever it's required a switching off, it's switched off the one presenting a higher number of functioning hours.
In case of equal power and equal functioning hours, anyway, it's not activated the last output switched on or deactivated the last one switched on.
OFF = Fix sequence of switching on
It's allows the switch on priority of the first output with a numerical order(1.rEG, 2.rEG, ecc.) and the switch off priority of the last output activated. At the conditions under which, obviously, being the powers different, there is no priority of power; in this case will be activated / deactivated the output which has lower power.
When par. "rtLd" is = On, to avoid an eccessive want of balance of the functioning between the different compressors, through par.
"Hh" : Maximum continuous functioning of a motor
it's possible to program the maximum number of continuous functioning hours of a motor, at the elapsing of which the controller provides, after have verified that it's available another motor to be switched on (or plant if the compressor is multistages) of the same power, to switch off the motor which is working and to switch on the other one available.

4.8 - DELAY TIME OF THE OUTPUT ACTIVATION / DEACTIVATION (PROTECTION TIMES)

All the parameters related to the priorities of the loads activation /deactivation, that are mainly conceived to optimize applications on refrigeration plants, are contained in the **"] rEG"** group.
These delay times, also called protection times, are mainly used to avoid loads "short cycles" (principally compressors) and, generally, to avoid "short cycles" of the uses controlled.

The outputs activation/deactivation anyway is never contemporary, but it's always sequential with a minimum interval of 1 sec. between a switch on (or switch off) and the successive one. (times "t4" and "t5").
So, once decided if to active or to deactive the outputs and with which priority, the regulator will verify the conditions programmed through the protection times, which are:
"t1" - Minimum time between switch on of the same compressor or delay between the different switch on (in min.)
"t2" - Minimum time between switch off and switch on of the same compressor or delay after switch off (in min.)
Times "t1" and "t2" work only on the output driving the same compressors motors (individualizable by the configuration)
"t3" - Minimum functioning time of an output (in sec.). Since is activated, an output works for the programmed time, although the activation request is finished.
"t4" - Delay time between successive switch on, of two different outputs (in sec.) Delay, starting from an output activation up to the activation of the successive one.
"t5" - Delay time between successive switch off, of two different outputs (in sec.) Delay, starting from an output deactivation up to the deactivation of the successive one.
Times "t3", "t4", "t5" work, instead, always on all outputs indipendently by the driving of motors or multistage valves.
Whenever the regulator requires the output activation or deactivation, but this one is inhibited by one of the protection times, the led relative to the output will flash.

4.9 - OUTPUTS DELAY AT TURNING ON

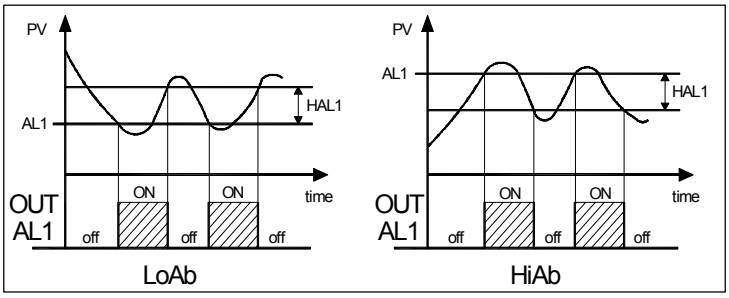
The function of outputs activation delay when turn on is activable through the par. **"od"** (contained in the group **"] rEG"**).
Programming the parameter with the desired time value (in min.) it is possible to delay the possible activation of all the control outputs after the turning on of the instrument and when it passes from the conditionb of OFF to the condition of rEG.
The state of delay is signalled by the display that show, during the delay alternatively "od" and the process value.

4.10 - ALARM OUTPUTS OPERATION (AL1, AL2)

The alarms (AL1, AL2) depend on the process value 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 the parameters relative to the outputs required as alarm ("O1F" , "O2F" ,"O3F" ,"O4F"), in the group of parameters **"]Out",** 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 (in this case the led on the front indicates the alarm condition)
= ALni if the same operation of ALnc is desired but with denied operation of the frontal led (in this case the led on the front indicates the output condition)
Remark: *In all the examples that follow it is made reference to the alarm AL1. Naturally the operation of the other alarms results analogous.*
Access the group **"]AL1"** and program which output the alarm signal must be sent to on par **"OAL1"**.
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 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

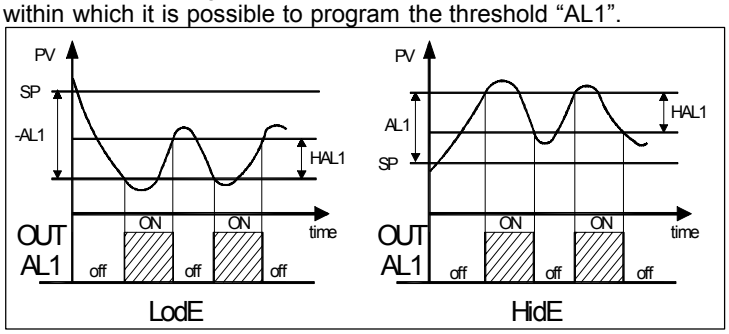
"AL1" and is deactivated when goes over the threshold [AL1 + HAL1].
With this mode is possible to program to the par. “AL1L” and AL1H” the limits within which it is possible to program the threshold “AL1”.

HiAb =ABSOLUTE HIGH ALARM:The alarm is activated when the process value goes over the alarm threshold set on parameter “AL1" and is deactivated when goes below the threshold [AL1 - HAL1]. With this mode is possible to program to the par. “AL1L” and AL1H” the limits within which it is possible to program the threshold “AL1”.



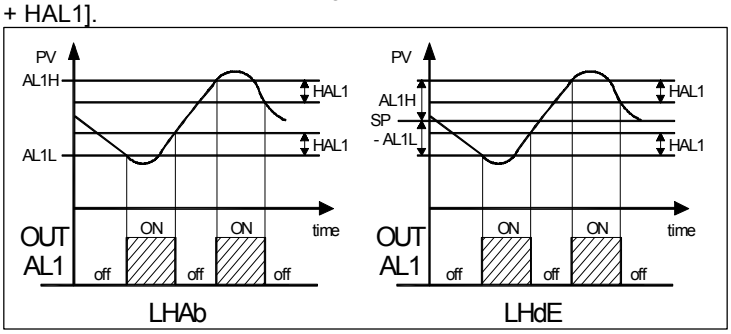
LodE =DEVIATION LOW ALARM:The alarm is activated when the process value goes below the value [SP + AL1] and is deactivated when goes over the threshold [SP + AL1 + HAL1]. With this mode is possible to program to the par. “AL1L” and AL1H” the limits within which it is possible to program the threshold “AL1”.

HidE =DEVIATION HIGH ALARM:The alarm is activated when the process value goes over the value [SP + AL1] and is deactivated when goes below the threshold [SP + AL1 - HAL1]. With this mode is possible to program to the par. “AL1L” and AL1H” the limits within which it is possible to program the threshold “AL1”.

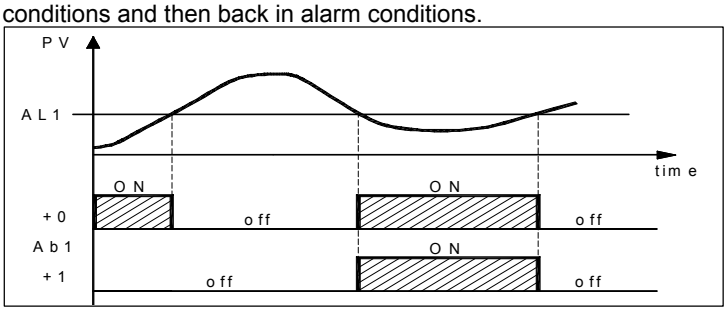


LHAb = ABSOLUTE WINDOW ALARM:The alarm is activated when the process value goes below the alarm threshold value setted to the par. "AL1L" or when the process value goes over the alarm threshold value setted to the par "AL1H" and is deactivated when it reenters in the range [AL1H - HAL1 ... AL1L + HAL1].

LHdE = DEVIATION WINDOW ALARM:The alarm is activated when the process value goes below the value [SP + AL1L] or [when the process value goes over the valu [SP + AL1H] and is deactivated when it reenters in the range [SP + AL1H - HAL1 ... SP + AL1L + HAL1].

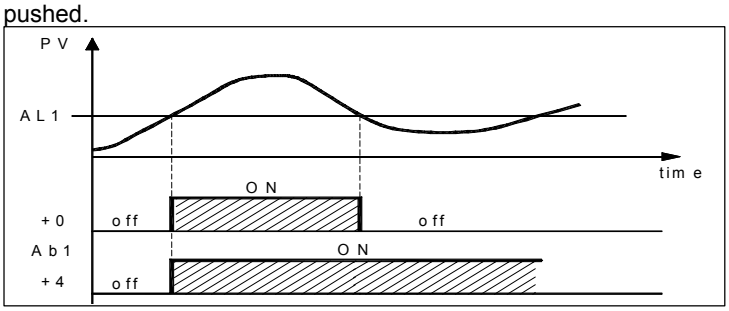


"**Ab1" -ALARM CONFIGURATION:** This parameter can assume a value between 0 and 31.
The number to be set, which will correspond to the desired operation, is obtained by adding the values reported in the following descriptions :
ALARM BEHAVIOUR AT SWITCH ON: the alarm output may behave in two different 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 SWITCH ON: If, when switched 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 conditions and then back in alarm conditions.



In the example the behavior is represented with an 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 sec.) 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.



In the example the behavior is represented with an absolute high alarm.

ALARM AKNOWLEDGEMENT: the alarm output may behave in two different ways depending on the value added to par. “Abn”.
+ 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 BEHAVIOR WHEN THE SET POINT CHANGE (ONLY FOR DEVIATION ALARMS): the alarm output may behave in two different ways depending on the value added to par. “Ab1”.
+0 = NORMAL BEHAVIOR: The alarm is always activated when the alarm condition occurs.
+16 = ALARM NOT ACTIVATED WHEN SET POINT CHANGE: If after the Set Point change the instrument is found under the alarm conditions, this it is not activated. The alarm will be activated only when the process value , after the change of the Set, it is not brought under the not-alarm conditions and subsequently under the alarm conditions.

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

4.11 - 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

= OPLO : Pushing the key for 1 sec. at least, it is possible to swap from automatic control (rEG) to manual one (OPLO) and vice versa.
= Aac : Pushing the key for 1 sec. at least, it is possible to acknowledge the alarm. (see par. 4.10)
= ASi : Pushing the key for 1 sec. at least, it is possible to acknowledge an active alarm (see par. 4.10)
= CHSP : Pushing the key for 1 sec. at least, it is possible to select one of the 4 pre-programmed Set Points on rotation.
= OFF : Pushing the key for 1 sec. at least, it is possible to swap from automatic control (rEG) to OFF control (OFF) and vice versa.

4.12 - DIGITAL INPUTS

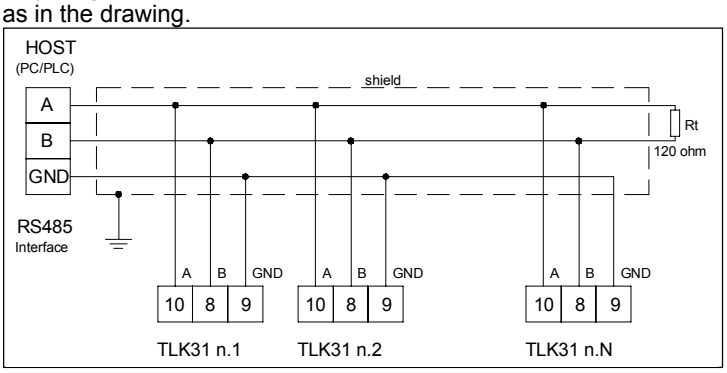
The instrument can be equipped with 2 digital inputs.
The function of the digital inputs can be set through par. **"diF1"** and **"diF2"** contained in the group **"]InP"**.
The parameter can be programmed as :
= noF : no function
= AaC :Closing the contact connected to the digital input it is possible to reset an acknowledged alarm. (see par. 4.10)
= ASi :Closing the contact connected to the digital input it is possible to acknowledge an active alarm (see par. 4.10)
= HoLd :Closing the contact connected to the digital input there is the hold of the measure in that instant (P.A.: not the reading on the display, therefore the indication could settle with a proportional delay to the filter of measure). With the function hold the instrument operate the control in base to the memorized measure.
Reopening the contact the instrument returns to the normal acquisition of the measure.
= OFF : When the instruments is in the "rEG" state, closing the contact connected to the digital input the instruments is set in OFF condition. Re-opening the same contact the instrument returns in the automatic control "rEG".
= CHSP : Closing and opening the contact connected to the digital input it is possible to select one of the 4 pre-programmed Set Points on rotation.
= SP1.2 : Closing the contact connected to the digital input it is possible to select as active the set point SP2. Reopening the contact is select as active the set point SP1. This function is possible only when "nSP" = 2, and when is selected it disables the selection of the active set through the parameter "SPAt" and through the key U.
= ALG: Closing the contact connected to the digital input the label **"ALG"** is signalized on the display. Such function could be used for signalling the intervention of the actuators protections.
= SP1.4 : Programming both the par. "diF1" and "diF2" it allows the selection of the active Set Point as the following combination of closing of the connected contacts to the two digital inputs.

DIG IN1	DIG IN2	SET POINT
off	off	SP1
on	off	SP2
off	on	SP3
on	on	SP4

When this function is selected it disables the selection of the active set through the parameter "SPAt" and through the key U.

4.13 - 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's configuration parameters. The software protocol adopted for TLK31 C is a MODBUS RTU type, widely used in several PLC and supervision programs available on the market (TLK series 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 120 Ohm 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 they must be interlaced with a double cable (telephonic type). Nevertheless, particularly when the net results very long or noised, it is advisable to adopt a screened cable wired as in the drawing.

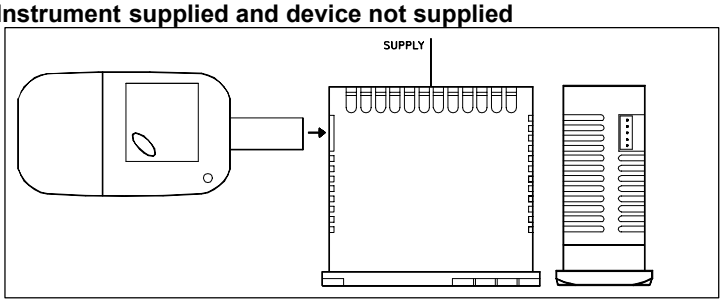


If the instrument is equipped with a serial interface, the parameters to be programmed are the following, all present in the parameters group **"]SEr"** :
"Add" : Address of the station. Set a different number for each station, from 1 to 255.
"baud" : Transmission speed (baud-rate), programmable from 1200 to 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.

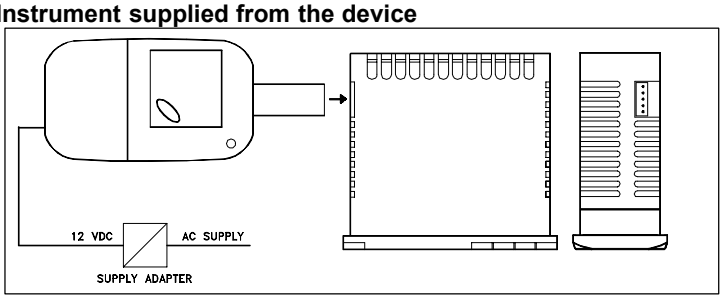
4.14 - PARAMETERS CONFIGURATION BY "KEY01"

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.

Instrument supplied and device not supplied



Instrument supplied from the device



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

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	**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	**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= thermores. 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	
10	**SSC**	Low scale limit input with V / I signals	-1999 ÷ FSC	0	
11	**FSC**	High scale limit input with V / I signals	SSC ÷ 9999	100	
12	**dP**	Number of decimal figures	<u>Pt1 / Ptc / ntc:</u> 0 / 1 <u>norm sig.:</u> 0 ÷ 3	0	
13	**Unit**	Temperature unit of measurement	°C / °F	°C	
14	**FiL**	Input digital filter	0FF÷ 20.0 sec.	1.0	
15	**OFSt**	Measuring Offset	-1999 ÷ 9999	0	
16	**rot**	Rotation of the measuring straight line	0.000 ÷ 2.000	1.000	
17	**InE**	"OPE" functioning in case of measuring error OUr = Over and under-range Or = Over-range only Ur = Under-range only	OUr / Or / Ur	OUr	
18	**OPE**	Output power in case of measuring error	-100 ÷ 100 %	0	
19	**diF1**	Digital input 1 function: noF = No Function Aac= Reset Alarms latch ASi= Aknowledged Alarms HoLd = Hold Measure OFF= Control OFF CHSP= Sel. Set Point SP1.2 = Sel. SP1/SP2 ALG = Alarm ALG SP1.4= Sel. SP1,2,3,4 by DIG IN 1 and 2	noF / Aac / ASi / HoLd / OFF / CHSP / SP1.2 / ALG / SP1.4	noF	
20	**diF2**	Digital input 2 function: see "diF1"	noF / Aac / ASi / HoLd / OFF / CHSP / SP1.2 / ALG / SP1.4	noF	

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

Par.		Description	Range	Def.	Note
21	**O1F**	Functioning of output 1 : 1.rEG= Control output 1 2.rEG= Control output 2 3.rEG= Control output 3 4.rEG= Control output 4 ALno= Alarm Out normally opened ALnc= Alarm Out normally closed ALni= Alarm Out normally closed with reverse led func.	1.rEG / 2.rEG 3.rEG/4.rEG ALno / ALnc ALni / OFF	1.rEG	
22	**O2F**	Functioning of output 2 : see "O1F"	1.rEG / 2.rEG 3.rEG/4.rEG ALno / ALnc ALni / OFF	2.rEG	
23	**O3F**	Functioning of output 3 : see "O1F"	1.rEG / 2.rEG 3.rEG/4.rEG ALno / ALnc ALni / OFF	3.rEG	
24	**O4F**	Functioning of output 4 : see "O1F"	1.rEG / 2.rEG 3.rEG/4.rEG ALno / ALnc ALni / OFF	4.rEG	
25	**nC**	Motors Load number (compressors)	1 ... 4	4	
26	**S1**	Steps number for compressor 1	1 ... 4	1	
27	**S2**	Steps number for compressor 2	0 ... 2	1	

28	**S3**	Steps number for compressor 3	0 ... 1	1	
29	**S4**	Steps number for compressor 4	0 ... 1	1	
30	**P1**	Power controlled by output 1.rEG	0 ... 999	1	
31	**P2**	Power controlled by output 2.rEG	0 ... 999	1	
32	**P3**	Power controlled by output 3.rEG	0 ... 999	1	
33	**P4**	Power controlled by output 4.rEG	0 ... 999	1	

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

Par.		Description	Range	Def.	Note
34	**OAL1**	Output where alarm AL1 is addressed	Out1 / Out2 Out3 / Out4 OFF	OFF	
35	**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	
36	**Ab1**	Alarm AL1 functioning: +1 = not activated at power on +2 = delayed +4 = latch +8 = aknowledged +16 = not activated at Set Point change (Deviation alarm only)	0 ÷ 31	0	
37	**AL1**	Alarm AL1 threshold	AL1L÷ AL1H	0	
38	**AL1L**	Low threshold band alarm AL1 or Minimum set alarm AL1 for high or low alarm	-1999 ÷ AL1H	-1999	
39	**AL1H**	High threshold band alarm AL1 or Maximum set alarm AL1 for high or low alarm	AL1L ÷ 9999	9999	
40	**HAL1**	Alarm AL1 hysteresis	OFF ÷ 9999	1	
41	**AL1d**	Activation delay of alarm AL1	OFF ÷ 9999 sec.	OFF	
42	**AL1i**	Alarm AL1 activation in case of measuring error	no / yES	no	

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

Par.		Description	Range	Def.	Note
43	**OAL2**	Output where alarm AL2 is addressed	Out1 / Out2 Out3 / Out4 OFF	OFF	
44	**AL2t**	Alarm AL2 type: see "AL1t"	LoAb / HiAb LHAb / LodE HidE / LHdE	LoAb	
45	**Ab2**	Alarm AL2 functioning: see "Ab1"	0 ÷ 31	0	
46	**AL2**	Alarm AL2 threshold	AL2L÷ AL2H	0	
47	**AL2L**	Low threshold band alarm AL2 or Minimum set alarm AL2 for high or low alarm	-1999 ÷ AL2H	-1999	
48	**AL2H**	High threshold band alarm AL2 or Maximum set alarm AL2 for high or low alarm	AL2L ÷ 9999	9999	
49	**HAL2**	Alarm AL2 hysteresis	OFF ÷ 9999	1	
50	**AL2d**	Activation delay of alarm AL2	OFF ÷ 9999 sec.	OFF	
51	**AL2i**	Alarm AL2 activation in case of measuring error	no / yES	no	

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

Par.		Description	Range	Def.	Note
52	**Cont**	Control type: ProP= Proportional On.FS= ON/OFF nr= Neutral Zone	ProP / On.FS/ nr	ProP	
53	**Func**	Functioning mode	HEAt / CooL	CooL	
54	**HSEt**	Hysteresis	0 ÷ 9999	1	
55	**Pb**	Proportional band	0 ÷ 9999	10	
56	**rS**	Manual reset	-Pb/2 ÷ Pb/2	0	
57	**ES**	Saving of motors functioning	OFF - On	OFF	
58	**PS**	Switch on/off priority in case of progressive power actuation	OFF - On	OFF	
59	**rtLd**	Loads rotation with functioning hours	OFF - On	On	
60	**Hh**	Maximum continuous functioning of a motor	0 ... 9999 hrs	0	
61	**t1**	Minimum time between two successive switch on, of the same motor	0 ... 999 min.	1	
62	**t2**	Minimum time between switch off and switch on, of the same motor	0 ... 999 min.	1	
63	**t3**	Minimum functioning time of the output	0 ... 999 sec.	10	
64	**t4**	Delay time between successive switch on	1 ... 999 sec.	10	
65	**t5**	Delay time between successive switch off	1 ... 999 sec.	10	
66	**od**	Outputs delay at switch on	0 ... 999 min.	0	

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

Par.		Description	Range	Def.	Note
67	**USrb**	Functioning of key "U" : noF = No Function OPLO= Manual Control (open loop) Aac= Reset Alarms latch ASi= Aknowledged Alarms OFF= Control OFF	noF / OPLO / Aac / ASi / CHSP / OFF	noF	
68	**diSP**	Variable visualized on the display: dEF= Process Value Pou= Control Power SP.F= Active Set Value AL1 = AL1 threshold AL2 = AL2 threshold	dEF / Pou / SP.F / AL1 / AL2	dEF	
69	**AdE**	Shift value for the shift index functioning	OFF...9999	2	
70	**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 communication)

Par.		Description	Range	Def.	Note
71	**Add**	Station address in case of serial communication	0 … 255	1	

72	**baud**	Transmission speed (Baud rate)	1200 / 2400 / 9600 / 19.2 / 38.4	9600	
73	**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 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)	
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 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 - 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

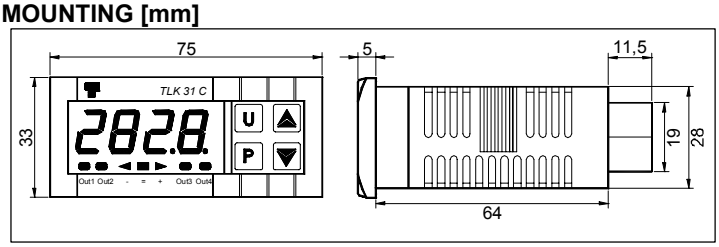
7.1 - ELECTRICAL DATA

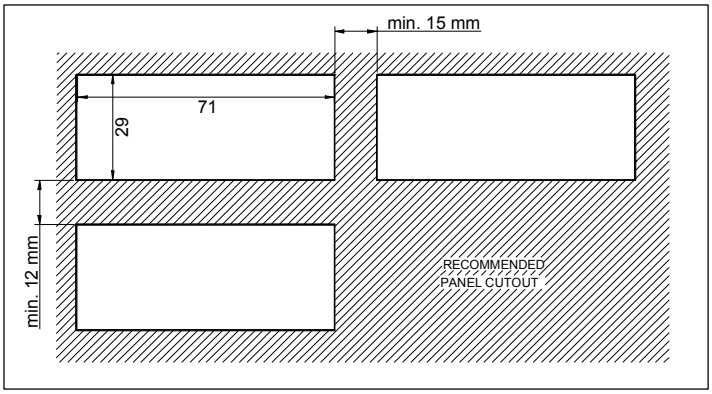
Power supply: 12 VAC/VDC +/- 10%
Frequency AC: 50/60 Hz
Power consumption: 4 VA approx.
Input/s: 1 input for temperature probes: tc J,K,S ; infrared sensors TECNOLOGIC IRS J e K; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C) or mV signals 0...50 mV, 0...60 mV, 12 ...60 mV or normalized signals 0/4...20 mA, 0..1 V, 0/1...5 V , 0/2...10 V. 2 digital inputs for free voltage contacts.
Normalized signals input impedance: 0/4..20 mA: 51 Ω; mV and V: 1 MΩ
Output/s: Up to 4 outputs. Relay 2 SPDT and 2 SPST-NO (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 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); No insulation between input and SSR outputs; 50 V insulation between RS485 and extra low voltage section.

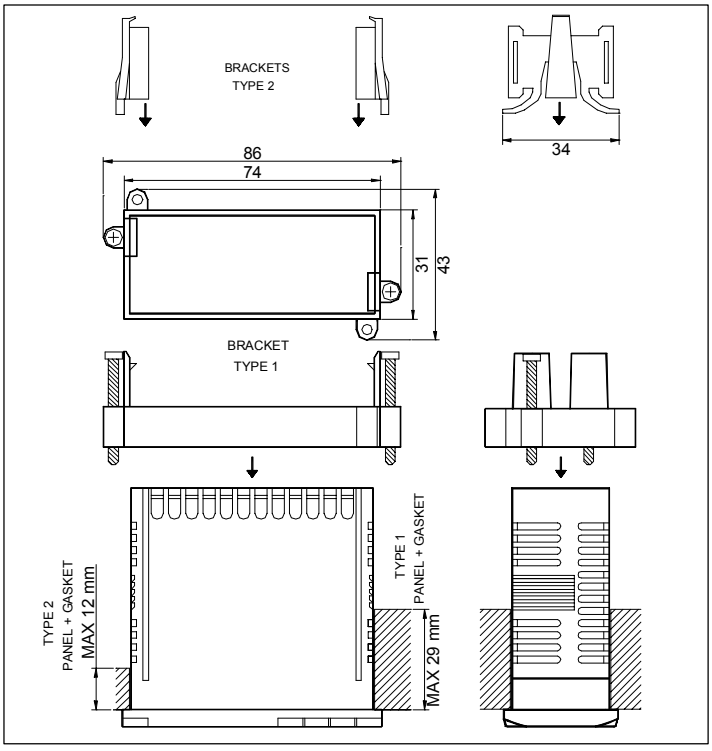
7.2 – MECHANICAL DATA

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, Neutral Zone, Proportional
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 (tc S: +/- 1 % fs)
Sampling rate: 130 ms.
Serial Interface : RS485 insulated
Communication protocol: MODBUS RTU (JBUS)
Baud rate: Programmable from 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)

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	-99.9 ... 850.0 °C -99.9 ... 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**		
0 ... 60 mV **"SEnS" = 0.60**		
12 ... 60 mV **"SEnS" = 12.60**		
0 ... 1 V **"SEnS" = 0.1**		
0 ... 5 V **"SEnS" = 0.5**		
1 ... 5 V **"SEnS" = 1.5**		
0 ... 10 V **"SEnS" = 0.10**		
2 ... 10 V **"SEnS" = 2.10**		

7.6 – INSTRUMENT ORDERING CODE

TLK31 a b c d e f g hh C

a : 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.

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

c : OUTPUT OUT2
R = Relay
O = VDC for SSR

d : OUTPUT OUT3
R = Relay
O = VDC for SSR

e : OUTPUT OUT4
R = Relay
O = VDC for SSR

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

g : DIGITAL INPUTS
I = 2 digital inputs
- = None

hh : SPECIAL CODES

TLK 31 C PASSWORD = 381