MICROPROCESSOR-BASED DIGITAL ELECTRONIC CONTROLLER

Type: TLK 41

INDEX

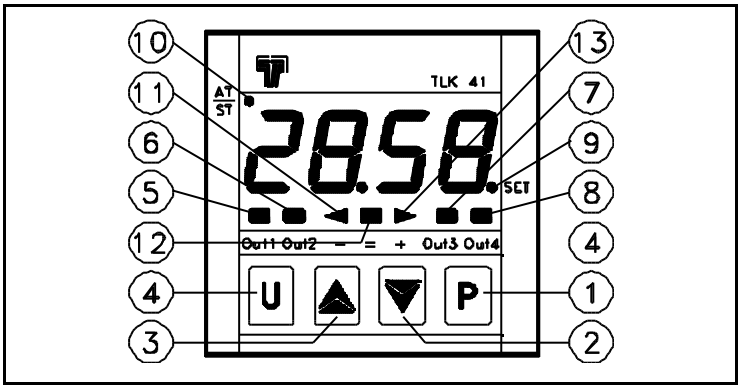
1 – INSTRUMENT DESCRIPTION

1.1 – GENERAL DESCRIPTION

TLK 41 is a "single loop" digital microprocessor based controller, with ON/OFF, Neutral Zone ON/OFF, PID single action, PID double action (direct and inverse) control and with **AUTOTUNING FAST** function, **SELFTUNING** function and automatic calculation of the **FUZZY OVERSHOOT CONTROL** parameter for PID control.
The PID control works with a particular algorithm with **TWO DEGREES OF FREEDOM** that optimises, in independent way, the features of the instrument, in case of process noises and Set Point variations.
The instrument offers furthermore the possibility to have a RS485 serial communication with MODBUS-RTU communication protocol and with transmission speed up to 38.400 baud.
The process value is visualized on 4 red display, while the outputs state is indicated by 4 led.
The instrument is equipped with a 3 led programmable shift index.

The instrument is studied to permit the memorization of 4 Set Points and to have up to 4 outputs : relay type or to drive solid state relays type (SSR).
The input is programmable and accepts temperature probes (Thermocouples J,K,S; Thermoresistances PT100, Thermistors PTC and NTC; Infrared sensors) and normalized analogue signals (0/4..20 mA, 0/1..5 V, 0/2..10 V, 0..50/60 mV, 12..60 mV).
The instrument can be equipped with an input for current transformer, working as Heater Break Alarm function.
Other important available functions are: Loop-Break Alarm function, reaching of the Set Point at controlled speed, ramp and dwell function, Soft-Start function, PC configuration, parameters protection on different levels.

1.2 – FRONT PANEL DESCRIPTION



1 - Key P : It's used to have access at the parameters programming and to confirm the selection.

2 - Key DOWN : It's used to decrease the values to be set and to select the parameters. If kept pushed it allows to pass at the previous programming level up to exit from the programming mode. Outside of the programming mode it permits to visualise the current measured by the input TA HB.

3 - Key UP : It's used to increase the values to be set and to select the parameters. If kept pushed it allows to pass at the previous programming level up to exit from the programming mode. Outside of the programming mode it permits to visualise the output control power.

4 - Key U : This is a key with function programmable on par. "USrb". It can be set to : Activate Autotuning and Selftuning functions, swap the instrument into manual control, aknowledge the alarm, change the active Set Point, deactivate the control.

5 - Led OUT1 : It indicates the state of output OUT1

6 - Led OUT2 : It indicates the state of output OUT2

7 - Led OUT3 : It indicates the state of output OUT3

8 - Led OUT4 : It indicates the state of output OUT4

9 - Led SET : Blinking, it indicates the access into the programming mode.

10 - Led AT/ST : It indicates that the Selftuning function is activated (lighted on) or that the Autotuning (blinking) is occurring.

11 - Led – Shift index: It indicates that the process value is lower than as programmed on par. “AdE”.

12 - Led = Shift index: It indicates that the process value is within the range [SP+AdE ... SP-AdE]

13 - Led + Shift index: It indicates that the process value is higher than as programmed on par. “AdE”.

2 - PROGRAMMING

2.1 – FAST PROGRAMMING OF THE SET POINT

This procedure permits to rapidly program 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 on that moment) alternatively to the programmed value.
To modify it, work on keys “UP” to increase the value or “DOWN” to decrease it.
These keys change the value one digit per time but, if they are kept pushed more than one second, the value is increased or decreased rapidly and, after two seconds in the same condition, the changing speeds increases again to allow the fast reaching of the desired value.
Once the desired value has been reached, pushing key P it’s possible to exit by the fast programming mode or it’s possible to visualise the alarm thresholds (see par. 2.3).
To get out of the fast Set programming it’s necessary to push key P, after the visualisation of the last Set Point, or do not work on any key for approx. 15 seconds, afterwards the display is coming back to the normal functioning.

2.2 – SELECTION OF THE CONTROL STATE AND PARAMETERS PROGRAMMING

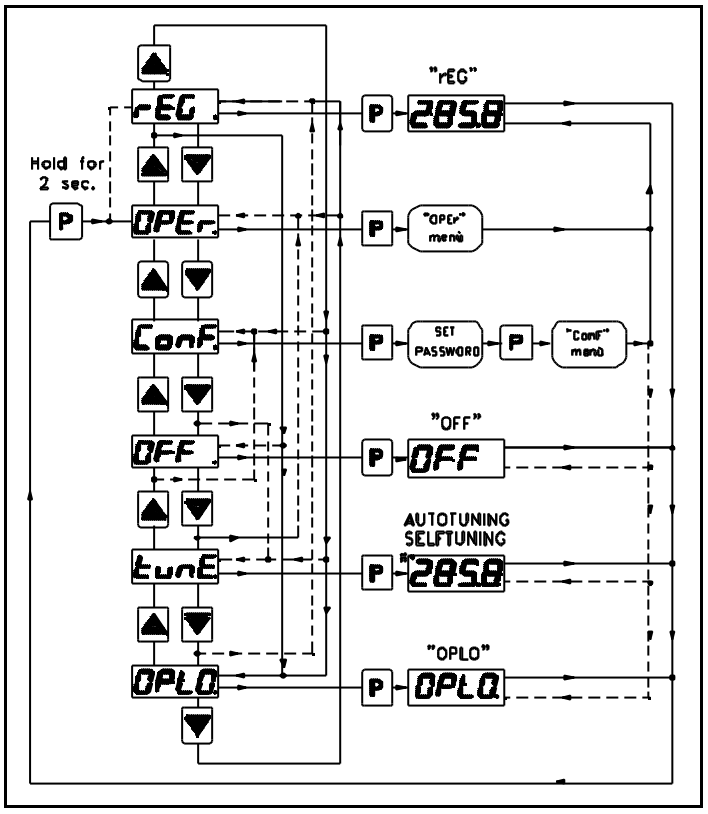
Pushing key "P" and holding it pushed for approx. 2 sec. it’s possible to enter into the main selection menu.
Through keys "UP" or DOWN” it’s then possible to roll over the selections:

"OPEr"	It permits to enter into the operating parameters menu
"ConF"	It permits to enter into the configuration parameters menu
"OFF"	It permits to swap the regulator into the OFF state
"rEG"	It permits to swap the regulator into the automatic control state
"tunE"	It permits to activate the Autotuning or Selftuning function
"OPLO"	It permits to swap the regulator into the manual control state and therefore to program the % control value using keys “UP” and “DOWN”

Once the desired item has been selected, push key “P” to confirm.
The selection "OPEr" and "ConF" give the possibility to accede to other menu containing additional parameters and more precisely :

"OPEr" – Operating parameters Menu: it normally contains the Set Point parameters but it can contain all the desired parameters (see par. 2.3).

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



To enter into the menu **"OPEr"** select then the option "OPEr" and push key "P".
Now, the display will show the code identifying the first group of parameters ("]**SP** ") and with keys "UP" and "DOWN" will be possible to select the parameters group to be modified.
Once the desired parameters group has been selected, push key "P" and it will be visualised the code Identifying the first parameter of the selected group.
Still using keys "UP" and "DOWN" its' possible to select the desired parameter and, pushing key "P", the display will alternatively show the parameter's code and its programming value, modifiable through keys "UP" or "DOWN".
Once the desired value has been programmed, push again key "P" : the new value will be memorised and the display will show only the code of the selected parameter.
Working on keys "UP" or "DOWN" it's then possible to select a new parameter (if present) and modify it as just described.
To select another group of parameters, hold key "UP" or "DOWN" pushed for approx. 2 sec., afterwards the display will come back to visualise the code of the parameters group.
Release then the key and with keys "UP" and "DOWN" it will be possible to select a new group (if present).
To get out of the programming mode, do not work on any key for approx. 20 seconds, or hold the key "UP" or "DOWN" pushed until the exit from the programming mode occurs.

To enter into the menu **"ConF"** it's instead required a PASSWORD.
At this request, do program, using keys "UP" and "DOWN", the number reported on the last page of this manual and push key "P".
Whether it's programmed a wrong password, the instrument comes back onto the previous control state.
If the password is correct the display will visualise the code identifying the first parameters group ("]**SP** ") and with keys "UP" and "DOWN" it will be possible to select the desired parameters group.
The modality of programming and exit for the "ConF" menu is the same as described for menu "OPEr".

2.3 – PARAMETERS PROGRAMMING LEVELS

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

This parameter can be programmed as :
=SE: The active Set Point is modifiable while the alarm thresholds are not modifiable
=AE :The active Set Point is not modifiable while the alarm thresholds are modifiable
=SAE: Whether the active Set Point or the alarm thresholds are modifiable
=SAnE: Whether the active Set Point or the alarm thresholds are not modifiable

2.4 – CONTROL STATE

The controller can behave 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 :
- From the keyboard selecting the desired state from the main selection menu.
- From the keyboard using key “U”; properly programming par. “USrb” (“USrb” = tunE; “USrb” = OPLO; “USrb” = OFF) it’s possible to pass from “rEG” state at the state programmed on the parameter and vice versa.
- Automatically (the instrument swaps into "rEG" state at the and of the autotuning execution)
At the switching on, the instrument automatically assumes the state it had at the switching off.

AUTOMATIC CONTROL (rEG) – The automatic control is the normal functioning state of the controller.
During the automatic control it’s possible to visualize the control power on the display 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 normally working.

BUMPLESS MANUAL CONTROL (OPLO) – By means of this option it’s possible to manually program the power percentage given as output by the controller deactivating the automatic control.
When the instrument is swapped into the manual control the power percentage is the same as the last one supplied and can be modified using keys “UP” and “DOWN”.
Likely in the case of the automatic control, the programmable values are comprised from H100 (+100%) to C100 (-100%).
To return into the automatic control, select "rEG" in the selection menu.

2.5 – ACTIVE SET POINT SELECTION

The instrument permits to pre-program up to 4 different Set point (**“SP1”**, **“SP2”**, **“SP3”**, **“SP4”**) and then to select which one has to be active. The maximum number of Set point is determined by the par. **"nSP"** located in the parameters group “]**SP** “.
The active Set point can be selected :
- Through parameter **"SPAt"** in the parameters group “]**SP** “.
- Through key “U” if par. "USrb" = CHSP
- Automatically between SP1 and SP2 in case a time “dur.t” (see par. 4.8) has been programmed.

Set Point “SP1”, “SP2”, “SP3”, “SP4” will be visible depending on the maximum number of Set Point selected on par. “nSP” and they will be programmable with a value comprised between the value programmed on par. **“SPLL”** and **“SPHL”.**

Note : in all the following examples the Set point is indicated as "SP", however the instrument will behave depending on the Set point selected as active.

3 – INSTALLATION AND USE WARNING

3.1 – USE ALLOWED

The instrument has been projected and manufactured as measuring and control device to be used according to EN61010-1 approval.
The use of the instrument for applications not expressly allowed by the above mentioned rule has to adopt all the necessary protective measures.
The instrument CAN'T be used in ambient with dangerous atmosphere (flammable or explosive) without a proper protection.
The user has to take care that EMC rules are respected, also after the instrument installation, possibly using proper filters.
Whenever a failure or a wrong functioning of the device may cause dangerous situations for persons, thighs or animals we remind that the plant has to be equipped with additional electromagnetic devices in order to grant the safety.

3.2 – MECHANICAL MOUNTING

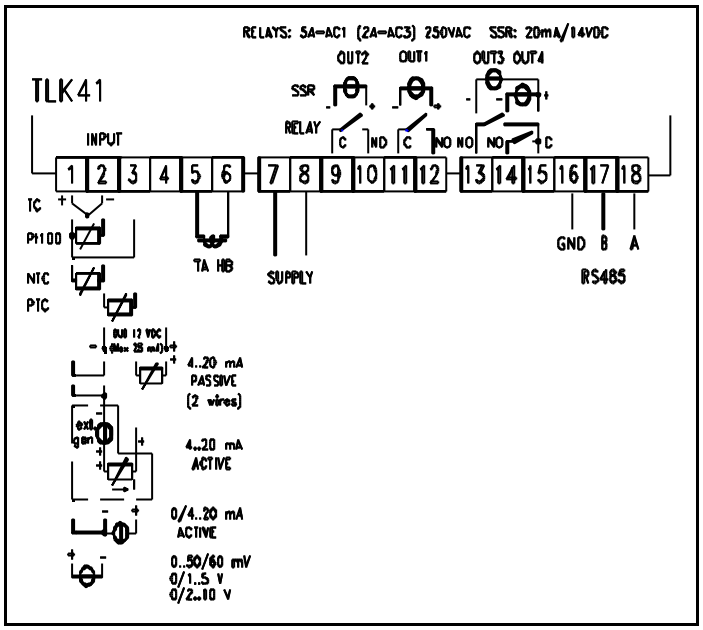
The instrument, in DIN case 48 x 48 mm, is designed for flush-in panel mounting.
Make a hole 45,5 x 45,5 mm and insert the instrument, fixing it with the provided special bracket.
We recommend to mount the gasket to obtain the front protection degree as declared. Do avoid to place the instrument in ambient with very high humidity or dirt that may create condensation or introduction into the instrument of conductive substances.
Ensure the adequate ventilation to the instrument and avoid the installation within boxes where are placed devices which may overheat or have as a consequence the instrument's functioning at higher temperature than allowed and declared.
Connect the instrument as far as possible from source of electromagnetic disturbances so as motors, power relays, relays, electrovalves,etc. The instrument is removable from its housing by the front side : is recommended to disconnect the power supply from the instrument when it's necessary to effectuate this operation.

3.3 – ELECTRICAL CONNECTION

Carry out the electrical wiring connecting only one wire for each terminal , according to the following diagram, checking that the power supply is the same as indicated on the instrument and the loads current is not higher than the maximum current admitted. The instrument, being a built in equipment with permanent connection into a cabinet, is not equipped neither with switches nor with internal devices protecting from overcurrent : the installation shall employ a two-phase circuit-breaker, placed as near as possible to the instrument, located in a position easily reachable by the user and marked as instrument disconnecting device.
It's recommended, furthermore, to properly protect all the electric circuits connected to the instrument, with devices (ex. fuses) proportionate to the circulating currents. It's strongly recommended to use cables with proper insulation, according to the working voltages and temperatures. 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 on the ground with only one side. It is advisable to check that the parameters are those desired before connecting the outputs to the actuators so as to avoid malfunctioning .
Whenever a failure of the instrument could cause dangerous or damaging situations, it should be kept in mind that the plant has to be provided with additional devices to ensure the safety.

GREISINGER and its legal representatives do not assume any responsibility for eventual damages to persons, things or animals deriving from violation wrong or not proper use or in any case not conforming with the instrument's features.

3.4 – CONNECTION DIAGRAM



4 - FUNCTIONING

4.1 – MEASURING AND VISUALIZATION

All the parameters referred to the measuring are contained into the group **"]InP".**

Using par. **"HCFG"** it's possible to select the input signal type which may come : from a thermocouple (tc), a thermoresistance or a thermistor (rtd), from a transducer with normalised analogue signal in current (I) or tension (UoLt) or furthermore from a signal coming from the communication serial line of the instrument (SEr).

Once the signal type has been selected, it's necessary to set, on par. **"SEnS",** the type of input probe, which can be :
- for thermocouples J (J), K (CrAL), S (S) or for infrared sensors serie GREISINGER 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..50 mV (0.50), 0..60 mV (0.60), 12..60 mV (12.60), 0..5 V (0.5), 1..5 V (1.5), 0..10 V (0.10) or 2..10 V (2.10).

We recommend 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"** the desired resolution (0=1°; 1=0,1°).

As regard instead the instruments with normalised **analogue** input signals it's necessary, first of all, 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 the instrument has to 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 the instrument has to visualise at the end of the scale (20 mA, 50 mV, 60 mV, 5 V o 10 V).
The instrument allows the measuring calibration, which could be used to recalibrate the instrument according to the application needs, through par. **"OFSt"** and **"rot".**

Programming par. "rot"=1,000, on par. « OFSt » it's possible to set a positive or negative offset that is simply added to the value red by the probe before the visualisation which results constant for all the measures.
Whether it's desired not to have a constant offset value for all the measures, it's possible to operate the calibration on two point as you like. In this case, to decide which values program on par. "OFSt" and "rot", it will be necessary to enforce the following formulae :

"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's then deriving that the instrument will visualise :

DV = MV x "rot" + "OFSt"

where: DV = visualised value MV= measured value

Example 1: It's required that the instrument visualises the value effectively measured at 20° but, at 200°, it has to visualise 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's required that the instrument visualises 10° whilst the value effectively measured is 0°, but, at 500° it has to visualise a value higher of 50° (550°).
Therefore : M1=0 ; D1=10 ; M2=500 ; D2=550
"rot" = (550 - 10) / (500 - 0) = 1,08
"OFSt" = 550 - (1,08 x 500) = 10

Using par. **"FiL"** it's possible to program a constant of time working as software filter referred to the input value measured, in order to reduce the sensibility at the noises (increasing the time of the reading).

In case of measuring error the instrument supplies the power as programmed on par. **"OPE".**
This power will be calculated depending on the cycle time programmed for the PID controller, while for the ON/OFF controllers the cycle time is automatically considered equal to 20 sec.
(ex. In case 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 measuring error will exist.)

Using par. **"InE"** it's also possible to decide which are the conditions of the input error allowing the instrument to give as output the power programmed on par. "OPE".
The possibilities of par. "InE" are :
= Or : the condition occurs in case of overrange or probe breakage
= Ur : the condition occurs in case of underrange or probe breakage
= Our : the condition occurs in case of overrange or underrange or probe breakage

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

Still in the group **"]PAn"** it's present par. **"AdE"** that defines the 3 led shift index functioning.
The switch on of the green led = indicates that the process value is comprised within the range [SP+AdE ... SP-AdE], the switch on of the led – indicates that the process value is lower than [SP-AdE] and the switch on of the led + indicates that the process value is higher than [SP+AdE].

4.2 – OUTPUT CONFIGURATION

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

The outputs can be set for the following functioning :
- Main control output (1.rEG)
- Secondary control output (2.rEG)
- Alarm output normally open (ALno)
- Alarm output normally closed (ALnc)
- Output deactivated (OFF)

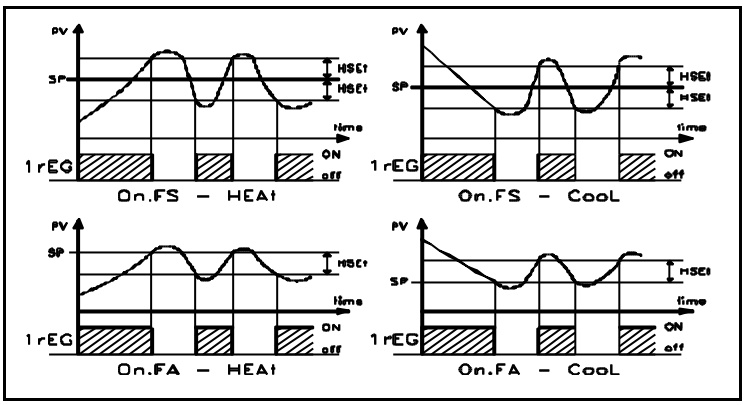
The coupling outputs number – alarms number can be effectuated in the group relative to the alarm ("]AL1","]AL2" o "]AL3")

4.3 – ON/OFF CONTROLLER (1rEG)

All the parameters referred to the ON/OFF control are contained into the group **"]rEG".**

This type of control is obtainable programming par.**"Cont"** = On.FS or = On.FA and it works on the output programmed as **1.rEG** depending on the measure, on the active Set Point **"SP"**, on the functioning mode **"Func"** and on the hysteresis **"HSEt**".
The instrument carries out an ON/OFF control with symmetric hysteresis if "Cont" = On.FS or with asymmetrical hysteresis if "Cont" = On.Fa.
The controller works in the following way : in case of reverse action, or heating ("FunC"=HEAt), it deactivates the output, when the process value reaches [SP + HSEt] in case of symmetrical hysteresis, or [SP] in case of asymmetrical hysteresis and it activates it again when the process value goes below value [SP - HSEt].

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

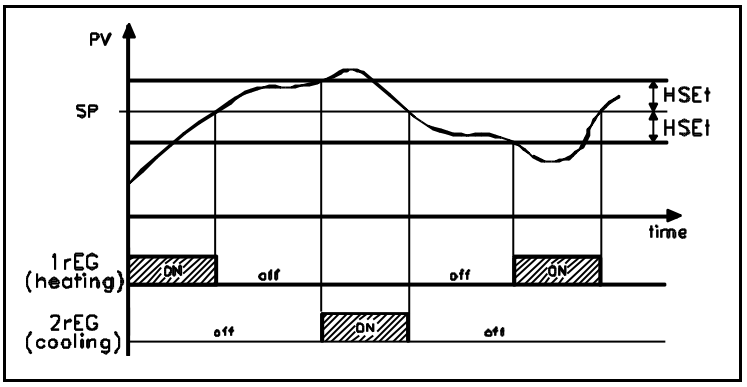


4.4 – NEUTRAL ZONE ON/OFF CONTROLLER (1rEG - 2rEG)

All the parameters referred to the Neutral Zone ON/OFF control are contained into the group **"]rEG".**

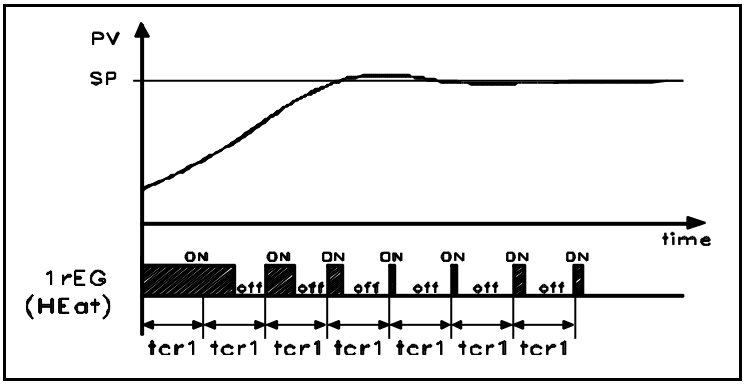
This type of control is obtainable when 2 outputs are programmed respectively as 1rEG and 2rEG and the par. **"Cont"** = nr .
The Neutral Zone control is used to control plants where there is an element which causes a positive increment (ex. Heater, humidifier, etc.) and an element which causes a negative increment (ex. Cooler, de-humidifier, etc).
The control functioning works on the programmed outputs depending on the measure, on the active Set Point **"SP"** and on the hysteresis **"HSEt**".

The controller works in the following way : it deactivates the outputs when the process value reaches the Set Point and it activates the output 1rEG when the process value goes below value [SP - HSEt], or it activates the output 2rEG when the process value goes above [SP + HSEt].
Consequently, the element causing a positive increase has to be connected to the output programmed as 1rEG while the element causing a negative increase has to be connected to the output programmed as 2rEG.



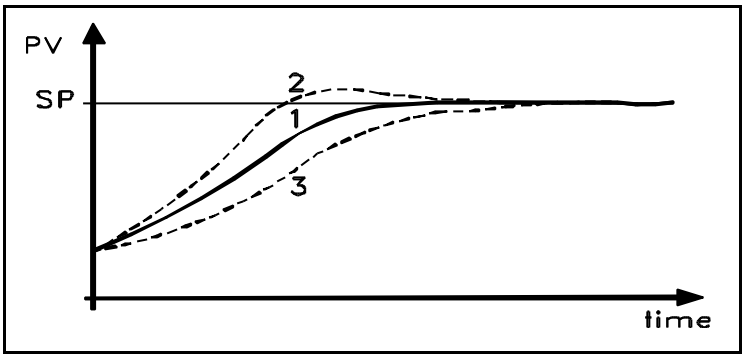
4.4 – SINGLE ACTION PID CONTROLLER (1rEG)

All the parameters referred to the PID control are contained into the group **"]rEG".**
The Single Action PID control is obtainable programming par.**"Cont"** = Pid and it works on the output 1.rEG depending on the active Set Point **"SP"**, on the functioning mode **"Func"** and on the instrument's PID algorithm with two degree of freedom.
In order to obtain a good stability of the process variable, in case of fast processes, the cycle time "tcr1" has to have a low value with a very frequent intervention of the control output.
In this case it's recommended to use a solid state relay (SSR) to drive the actuator.
The Single Action PID control algorithm needs the programming of the following parameters :



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

This last parameter permits to avoid the variable overshoots at the start up of the process or at the changing of the Set Point. It's worth to 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

4.5 – DOUBLE ACTION PID CONTROLLER (1rEG - 2rEG)

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

The Double Action PID control is used to control plants where there is an element which causes a positive increment (ex. Heating) and an element which causes a negative increment (ex. Cooling).
This type of control is obtainable when 2 outputs are programmed respectively as 1rEG and 2rEG and the par. **“Cont”** = Pid.
The element causing a positive increase has to be connected to the output programmed as 1rEG while the element causing a negative increase has to be connected to the output programmed as 2rEG.
The Double Action PID control works on the outputs 1rEG and 2rEG depending on the active Set Point **“SP”** and on the instrument’s PID algorithm with two degree of freedom.
In order to obtain a good stability of the process variable, in case of fast processes, the cycle times “tcr1” and “tcr2” have to have a low value with a very frequent intervention of the control outputs.
In this case it’s recommended to use solid state relays (SSR) to drive the actuators.

The Double Action PID control algorithm needs the programming of the following parameters :
"Pb" – Proportional Band
"tcr1" – Cycle time of the output 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 2rEG and power of the element controlled by output 1rEG.
Whenever par. “Prat” = 0, the output 2rEG is disabled and the controller behaves exactly as a single action PID controller, through output 1rEG.

4.7 - AUTOTUNING AND SELFTUNING FUNCTIONS

All the parameters referred to the AUTOTUNING and SELFTUNING functions are contained into the group **“]rEG”.**
The AUTOTUNING and SELTUNING functions permit the automatic tuning of the PID controller.
The **AUTOTUNING** function permits the PID parameters calculation through a tuning cycle FAST type and, at the end of this operation, the parameters are stored into the instrument’s memory and remain constant during the control.
The **SELFTUNING** function (rule based "TUNE-IN") permits instead the control monitoring and the continuous calculation of the parameters during the control.

Both functions automatically calculate the following parameters :
"Pb" – Proportional Band
"tcr1" – Cycle time of the output 1rEG
“tcr 2” – Cycle time of the output 2rEG
"Int" – Integral Time
"dEr" – Derivative Time
“FuOC” - Fuzzy Overshoot Control
and, for the Double Action PID control, also :
"Prat" - Ratio P 2rEG/ P 1rEG

To activate the AUTOTUNING function do proceed as follows :

1) Program and activate the desired Set Point.
2) Program par. "Cont" =Pid.
3) Program par. "Func" depending on the process to be controlled through output 1rEG.
4) Program an output as 2rEG if the instrument control a plant with double action
5) Program par. **"Auto"** as:
- "1" – if it's desired to have the autotuning automatically, each time the instrument is switched on, at the condition that the process value is lower (with "Func" =HEAt) or higher (with "Func" =CooL) than SP/2
- "2" – if it's desired to have the autotuning automatically, the next time the instrument is switched on, at the condition that the process value is lower (with "Func" =HEAt) or higher (with "Func" =CooL) than SP/2, and once the tuning is finished, the par. "Auto" IS automatically swap into the OFF state
- "3" - if it's desired to activate the autotuning manually, through the selection of par. "tunE" in the main menu or though key "U" properly programmed as "USrb" = tunE. In this case the autotuning starts without any control on the process value condition. It's recommended to use this option, starting the autotuning when the process value is as far as possible from the Set Point because, in order to feature the Autotuning FAST with its best performances , it's preferable to respect this condition :

6) Exit from the parameters programming.
7) Connect the instrument at the controlled plant.
8) Activate the Autotuning switching on and off the instrument if "Auto" = 1 or 2 or selecting par. **"tunE"** in the main menu (or through key "U" properly programmed).
At this point the Autotuning function is activated and it's indicated by the led AT/ST blinking.
The regulator carries out several operations on the connected plant in order to calculate the most suitable PID parameters.
Whether "Auto" = 1 or "Auto" = 2, and whenever, at the Autotuning start, it's not verified the condition for which the process value is lower (with "Func" =HEAt) or higher (with "Func" =CooL) than SP/2, the display will show **"ErAt"** and the instrument will be swapped into the normal control conditions according to the parameters previously programmed.
To make the error "ErAt" disappearing, swap the instrument into the OFF control (OFF) and successively turn it into the automatic control (rEG).

The Autotuning cycle duration has been limited at 12 hours maximum.
If the Autotuning is not completed within 12 hours, the instrument will show on the display **"noAt".**
In case of probe error, the instrument automatically stops the execution cycle.
The values calculated by the Autotuning are automatically stored into the instrument's memory at the end of the correct PID parameters tuning.

Note : The instrument is already programmed in our factory to execute the autotuning at every instrument switiching on ("Auto" = 1).

To activate the SELFTUNING function do proceed as follows
1) Program and activate the desired Set Point.
2) Program par. "Cont" =Pid.
3) Program par. "Func" depending on the process to be controlled through output 1rEG.
4) Program an output as 2rEG if the instrument control a plant with double action
5) Program par. **"SELF"** = yES
6) Exit from the parameters programming.
7) Connect the instrument at the controlled plant.
8) Activate the Selftuning selecting par. **"tunE"** in the main menu (or through key "U" properly programmed).
When the Selftuning function is active, led AT/ST is lighted permanently and all the PID parameters ("Pb", "Int", "dEr", etc.) are not visualized anymore.

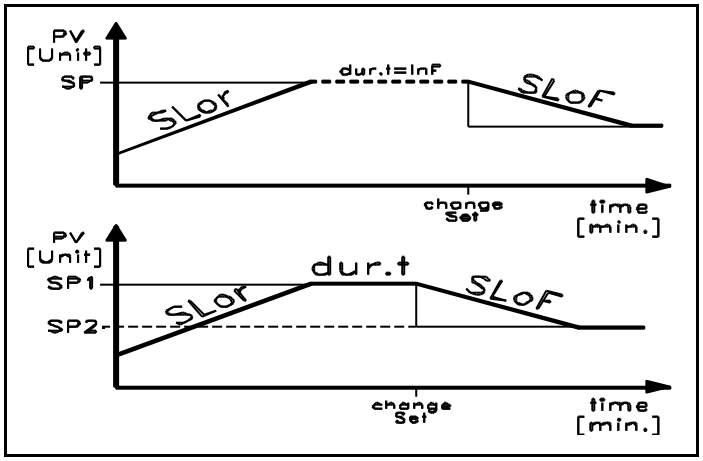
To stop the Autotuning cycle or deactivate the Selftuning function do select from menu "SEL" one of the control type : "reG", "OPLO" or "OFF". If the instrument is switched off during the autotuning or with the Selftuning function activated, at the next switching on, these functions will remain activated.

4.8 – REACHING OF THE SET POINT WITH CONTROLLED SPEED AND AUTOMATIC COMMUTATION BETWEEN TWO SET POINT (RISE RAMP, FALL RAMP AND DWELL TIME)

All the parameters referred to the ramps functioning are contained into the group **"rEG".**
It's 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.) on which the set point has to be reached gradually, in predetermined times.
Once the instrument has reached the first Set Point (SP1) it's possible to have the automatic commutation on the second Set Point (SP2) after a programmed time, obtaining in this way a simple automatic thermic cycle.
These functions are available for all the programmable control types (PID single and double action, ON/OFF and Neutral Zone ON/OFF).

The functioning is defined by the following parameters :
"SLor" - Gradient of rise ramp (Process value < Set point) expressed in unit/minute
"SLoF" - Gradient of fall ramp (Process value > Set point) expressed in unit/minute.
"dur.t" – Dwell time of Set Point SP1 before the automatic commutation on Set Point 2 SP2 (expressed in min. and sec.)
The functions are deactivated when the relative parameters are = InF.
When the Set Point value is changed or at the switching on, the instrument automatically determines which one of the two value "SLor" or "SLoF" it has to use.

Note: In case of PID controller, whether it's desired to effectuate the autotuning whilst the ramp function is active, this one will not be executed until the tuning cycle is not finished.
It's therefore recommended to start the autotuning avoiding to activate the ramp function and, once the tuning is finished, do deactivate the autotuning ("Auto" = OFF), do program the desired ramps and, if it's desired the automatic tuning, do enable the Selftuning function.



Examples : start from values lower than SP and with decreasing of SP.

4.9 - SOFT-START FUNCTION

All the parameters referred to the Soft -Start functioning are contained into the group **"]rEG".**

The Soft-Start function is only working with PID control and allows the limiting of the control power when the instrument is switched on, for a programmable time.
This is useful when the actuator, driven by the instrument, could be damaged by power too high supplied when the application is not yet in the normal rating. (ex. for certain heating elements).

The functioning is depending on the following parameters :
"St.P" – Soft-Start power
"Sst" – Soft-Start time (expressed in hh.mm)

The possible functioning modes are the following :

1) If both parameters are programmed with values different from OFF, at the switch on, the instrument gives an output power as programmed on par. "St.P" for the time programmed on par. "SSt". In the practice, the instrument works in manual condition and commutates into automatic control at the elapsing of time "SSt".
It's advisable not to program a power "St.P" too high because the function is not deactivated when the automatic control power results lower than the programmed one.

2) If par. "St.P" = OFF and on par. "SSt" is programmed a value, at the switch on, the power calculated by the PID controller is divided for the time "SSt", with the meaning to calculate a ramp. The output power starts from 0 and is progressively increased, basing on the calculated ramp, up to the reaching of time "SSt" or until when the power overcomes the power calculated by the PID controller.

To disable the Soft-Start function it's enough to program par. "Sst" = OFF
Whenever, during the Soft-Start execution, should occur a measuring error, the function is interrupted and the instrument gives an output power as programmed on par. "OPE".
If the measuring is restored, the Soft-Start is in any case deactivated.

Note : When the Soft-Start is active, it's not possible to execute the Autotuning, because it may gives an excessive power.
Consequently, if one of the Soft-Start parameter is different from OFF and the Autotuning is activated, on the display will appear the error message **"ErAt".**

If it's desired to execute the Autotuning together with the Soft-Start function activated, it's necessary to start manually the tuning ("Auto"=3) when the actuator is in the normal rating which will not cause any damage.

4.9 – ALARMS FUNCTIONING (AL1, AL2, AL3)

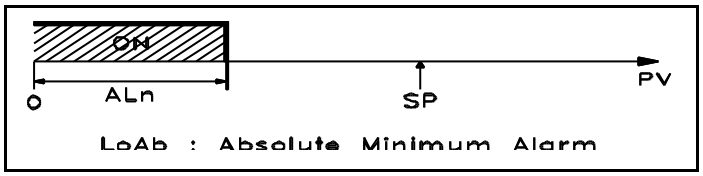
4.9.1 – ALARM OUTPUTS CONFIGURATION

The alarms are depending on the process value (AL1, AL2, AL3) and before to set their 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" ,"O3F" ,"O4F") 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

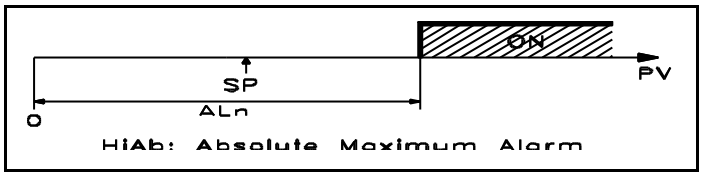
Note: In the following examples the alarm's number is generally indicated as **n**
Have now access at the group **"]ALn",** relative to the alarm which is desired to be set, and program on par. **"OALn"** , to which output the alarm signal has to be sent.

The alarm functioning is instead defined by parameters :
"ALnt " – ALARM TYPE
"Abn" – ALARM CONFIGURATION
"ALn" – ALARM THRESHOLD
"ALnL" – LOW ALARM THRESHOLD (for band alarm)
"ALnH" - HIGH ALARM THRESHOLD (for band alarm)
"ALnd" – ALARM ACTIVATION DELAY (in sec.)
"ALni" – ALARM BEHAVIOUR IN CASE OF MEASURING ERROR

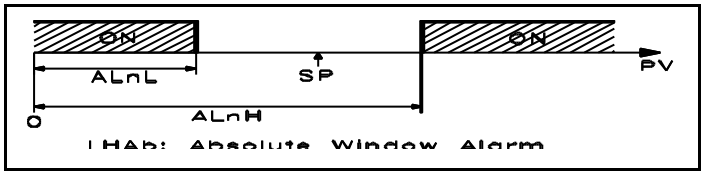
"ALnt" – ALARM TYPE : It's possible to have 6 different behaviours of the alarm output.
LOAb = ABSOLUTE LOW ALARM: The alarm is activated when the process value goes under the alarm set on parameter "ALn".



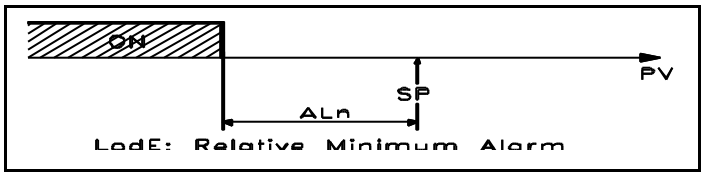
HIAb = ABSOLUTE HIGH ALARM: The alarm is activated when the process value goes higher than alarm set on parameter "ALn".



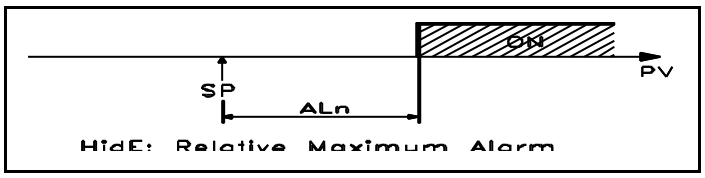
LHAb = ABSOLUTE BAND ALARM: The alarm is activated when the process value goes under the alarm set on parameter "ALn" or goes higher than alarm set on parameter "ALnH".



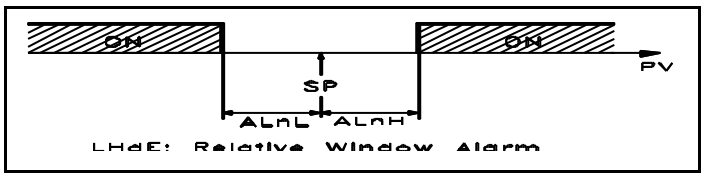
LOdE = DEVIATION LOW ALARM: The alarm is activated when the process value goes under [SP - ALn]



HIdE = DEVIATION HIGH ALARM: The alarm is activated when the process value goes higher than [SP + ALn]

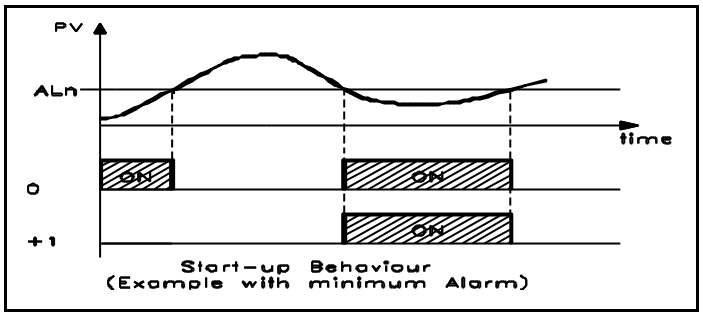


LHdE = DEVIATION BAND ALARM: The alarm is activated when the process value goes under [SP - ALnL] or goes higher than [SP + ALnH]



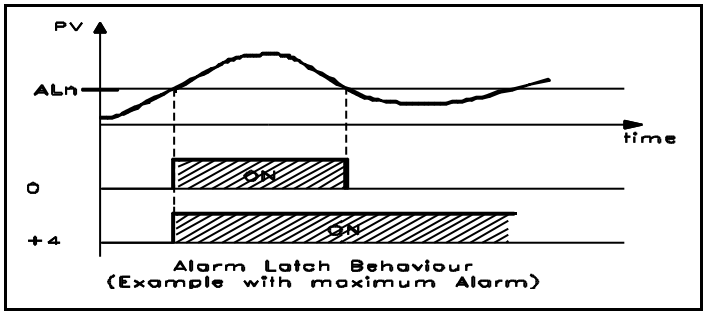
"**Abn" – ALARM CONFIGURATION:** The parameter can assume a value between 0 and 15.
The number to be set, which will correspond to the desired functioning, is obtained adding the values reported in the following descriptions :

ALARM BEHAVIOUR AT THE SWITCH ON: It's possible to have 2 different behaviours of the alarm output, depending on the value added to par. "Abn".
+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.
+1 = ALARM NOT ACTIVATED AT THE SWITCH ON: Whether, at the switch on, the instrument is in alarm conditions, the alarm is not activated. It will be activated only when the process value is out and back again in alarm conditions.



ALARM DELAY: It's possible to have 2 different behaviours of the alarm output, depending on the value added to par. "Abn".
+0 = ALARM NOT DELAYED: The alarm is immediately activated when the alarm condition has come to pass.
+2 = ALARM DELAYED: When the alarm condition has come to pass, it starts the counting of the delay, as programmed on par. "ALnd" (expressed in sec.) and only after the elapsing of that time the alarm will be activated.

ALARM LATCH: : It's possible to have 2 different behaviours of the alarm output, depending on the value added to par. "Abn".
+ 0 = ALARM NOT LATCHED: The alarm remains active in the alarm conditions only.
+ 4 = ALARM LATCHED: The alarm is active in the alarm conditions and remains active also if these conditions are not existing anymore, until when key "U", properly programmed ("USrb"=Aac) has been pushed.

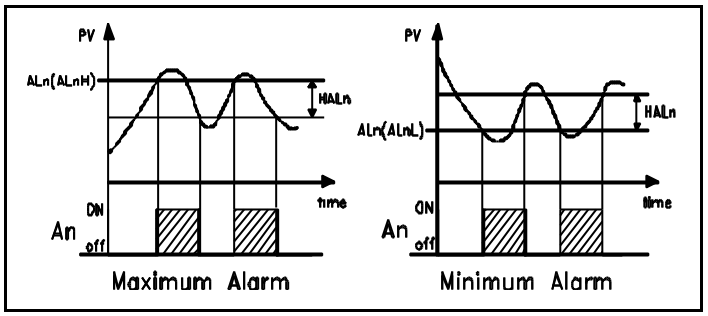


ALARM AKNOWLEDGEMENT: : It's possible to have 2 different behaviours of the alarm output, depending on the value added to par. "Abn".
+ 0 = ALARM NOT AKNOWLEDGED: The alarm remains always active in the alarm conditions.
+ 8 = ALARM AKNOWLEDGED: The alarm is active in alarm conditions and can be deactivated through key "U" if properly programmed ("USrb"=ASi), also if the alarm conditions are still existing.

"ALni" – ALARM ACTIVATION IN CASE OF MEASURING ERROR: it permits to establish in which way the alarm has to behave in case of measuring error (yES=alarm active; no=alarm deactivated)

4.9.2 – ALARMS HYSTERESIS

The alarm functioning is depending on the alarm hysteresis (par. "HALn"), which works in asymmetric way.
In case of low alarm, the alarm will be activated when the process value goes under the alarm threshold value and will be deactivated when it goes higher than the alarm threshold + "HALn" ; in case of high alarm, the alarm will be activated when the process value goes higher than the alarm threshold value and will be deactivated when it goes under the alarm threshold - "HALn".



For the band alarms, the example of the low alarm is applicable to the low threshold ("ALnL") while the example of the high alarm is applicable to the high threshold ("ALnH").

4.10 - HEATER BREAK ALARM FUNCTION (HB)

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

The Heater Break alarm function (Breakage of the heating element) is available only when the instrument is equipped with the input (TAHB) to measure the current.
This input accepts signals coming from current transformers (TA) with output 50 mA.
The first operation to do, in order to obtain a correct current measuring, is to set on par. **"IFS"** the current that the instrument has to measure at the end of scale of the input TA (50 mA).
It's necessary to establish to which output the alarm has to correspond.
To do this it's necessary to set, in the group **"]Out",** the parameter relative to the output to be used ("O1F" , "O2F" ,"O3F" ,"O4F") programming the parameter as :

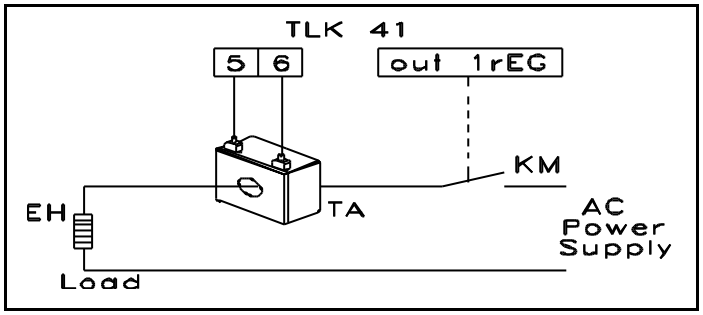
= AInO if the alarm output has to be active when the alarm is active while it's deactivated when the alarm is not active.
= AInC if the alarm output has to be active when the alarm is not active while it's deactivated when the alarm is active.

Enter then into group **"]Hb"** and program on parameter **"OHb"**, on which output the alarm signal has to be addressed.
The functioning mode of the alarm is instead defined on par. **"HbF"** which can be set in the following way :

= 1 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** .
= 2 : The alarm is active when, with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. **"IHbH"** .
= 3 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** or with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. **"IHbH"**.
= 4 : The alarm is active when the current measured by the input TAHB is lower than the value programmed on par. **"IHbL"** or the measured current is higher than the value programmed on par. **"IHbH"**, independently by the state of the output 1rEG.

On par. "IHbL" it has to be set the value of the current normally absorbed by the load when output 1rEG is active, while on par. "IHbH" the current normally absorbed by the load when output 1rEG is not active.
The programming of these parameters has to be carried on considering also the fluctuations of the net tensions to avoid undesired alarms.
As regard the hysteresis of HB alarm, this is automatically calculated by the instrument as 1% of the programmed thresholds.
During the functioning it's possible to visualize the current measured by the input TAHB when output 1rEG is activated, pushing key "DOWN" and the current measured when output 1rEG is deactivated, pushing contemporarily keys "DOWN" and "U".
To exclude the Heater Break alarm it's enough to set "OHb" = OFF.

Note : The HB current measure is valid if the output 1rEG is activated (or deactivated) for 264 ms. at least.
This means that, if the cycle time ("tcr1") is = 1 sec, the HB alarm is able to intervene only when the output power is higher than 26,4%.



4.11 - LOOP BREAK ALARM FUNCTION

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

On all the instruments, it's available the Loop Break alarm which intervenes when for any reason (short-circuit of a thermocouple, thermocouple inversion, load interruption) the loop control is interrupted.
First of all, it's necessary to establish to which output the alarm has to correspond.
To do this it's necessary to set, in the group **"]Out",** the parameter relative to the output to be used ("O1F" , "O2F" ,"O3F" ,"O4F") programming the parameter as :

= 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.

Enter then group **"]LbA"** and program on par. **"OLbA"**, on which output the alarm signal has to be addressed.
The Loop Break alarm is activated if the output power remains at the 100% of the value for the time programmed on par. **"LbAt"** (expressed in sec.).
To avoid false alarms, the value of this parameter has to be set considering the time the plant spends to reach the Set point when the measured value is far away from it (for example at the plant start-up).
At the alarm intervention the instrument visualizes the message **"LbA"** and behaves as in case of a measuring error giving a power output as programmed on par. **"OPE"** (programmable in the group **"]InP")**.
To restore the normal functioning after the alarm, do select control mode "OFF" and then re-program the automatic control ("rEG") after have checked the correct functioning of probe and actuator.
To exclude the Loop Break alarm it's enough to set "OLbA" = OFF.

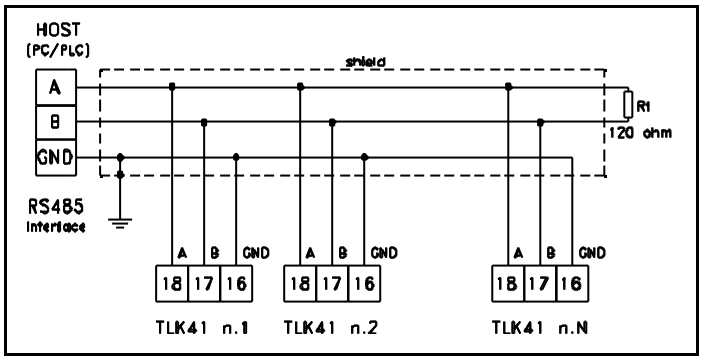
4.13 – FUNCTIONING OF KEY "U"

The function of key "U" can be defined through par. **"USrb"** contained in the group ""]PAn".**
The parameter can be programmed as :

= noF : no function
= tunE : Pushing the key for 1 sec. at least, it's possible to activate/deactivate the Autotuning or the Selftuning
= OPLO:Pushing the key for 1 sec. at least, it's possible to swap from the automatic control (rEG) to the manual one (OPLO) and vice versa.
= Aac : Pushing the key for 1 sec. at least, it's possible to acknowledge the alarm. (see par. 4.9.1)
= Asi : Pushing the key for 1 sec. at least, it's possible to acknowledge an active alarm (see par. 4.9.1)
= CHSp: Pushing the key for 1 sec. at least, it's possible to select on rotation one of the 4 pre-programmed Set Point.
= OFF : Pushing the key for 1 sec. at least, it's possible to swap from the automatic control (rEG) to the OFF control (OFF) and vice versa.

4.14 - RS 485 SERIAL INTERFACE

The instrument can be equipped with a RS 485 serial communication interface, by means of which it's possible to connect the regulator with a net on which are connected other instruments (regulators or PLC) all depending typically on a personal computer used as plant supervisor. Through a personal computer it's possible to acquire all the functioning information and to program all the instrument's configuration parameters. The software protocol adopted for TLK41 is a MODBUS RTU type widely used in several PLC and supervision programs available on the market (TLK41 protocol manual is available on request).
The interface circuit allows the connection of up to 32 instruments on the same line.
To maintain the line on rest conditions it's required to connect a 120 Ohm resistance (Rt) at the end of the line.
The instrument is equipped with two terminals called A and B which have to be connected with all the namesake terminals of the net. For the wiring operation it's enough then to interlace a double cable (telephonic type) and to connect on ground all the GND terminals. Nevertheless, particularly when the net results very long or noised and being present potential differences between the GND terminals, it's advisable to adopt a screened cable wired as in the drawing.



If the instrument is equipped with 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 programmable just from the keyboard, if programmed as "LorE" it's programmable both from the keyboards and serial line.
When it's tried to enter the programming from the keyboard whilst is having place a communication through the serial door, the instrument visualise **"buSy"** to indicate the busy state.

5 – PROGRAMMABLE PARAMETERS

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.

5.1 – PARAMETERS TABLE

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 inputs)

Par.		Description	Range	Def.	Note
9	**HCFG**	Input type	tc / rtd / I / UoLt / SEr	tc	
10	**SEnS**	Probe type	tc : J / CrAL / S / Ir.J / Ir.CA rtd : Pt1 / Ptc / ntc I : 0.20 / 4.20 UoLt : 0.50 / 0.60 / 12.60 / 0.5 / 1.5 / 0.10 / 2.10	J	
11	**SSC**	Low scale limit in case of input with V / I signals	-1999 ÷ FSC	0	
12	**FSC**	High scale limit in case of input with V / I signals	SSC ÷ 9999	0	
13	**dp**	Number of decimal figures	tc/rtd : 0 / 1 UoLt / I / SEr: 0 ÷ 3	0	
14	**Unit**	Temperature unit of measurement	tc/rtd : °C / °F	°C	
15	**FiL**	Input digital filter	0FF÷ 20.0 sec.	0.1	
16	**OFSt**	Measuring Offset	-1999 ÷ 9999	0	
17	**rot**	Rotation of the measuring straight line	0.000 ÷ 2.000	1.000	
18	**InE**	"OPE" functioning in case of measuring error	Our / Or / Ur	OUr	
19	**OPE**	Output power in case of measuring error	-100 ÷ 100 %	0	

Group "Out" (parameters relative to the outputs)

Par.		Description	Range	Def.	Note
20	**O1F**	Functioning of output 1	1.rEG / 2.rEG ALno / Alnc OFF	1.rEG	
21	**O2F**	Functioning of output 2	1.rEG / 2.rEG ALno / Alnc OFF	ALno	
22	**O3F**	Functioning of output 3	1.rEG / 2.rEG ALno / Alnc OFF	ALno	
23	**O4F**	Functioning of output 4	1.rEG / 2.rEG ALno / Alnc OFF	ALno	

Group "AL1" (parameters relative to alarm AL1)

Par.		Description	Range	Def.	Note
24	**OAL1**	Output where alarm AL1 is addressed	Out1 / Out2 Out3 / Out4 OFF	Out2	
25	**AL1t**	Alarm AL1 type	LoAb / HiAb LHAb / LodE HidE / LHdE	LOAb	
26	**Ab1**	Alarm AL1 functioning	0 ÷ 15	0	
27	**AL1**	Alarm AL1 threshold	-1999 ÷ 9999	0	
28	**AL1L**	Low threshold band alarm AL1	-1999 ÷ 9999	0	
29	**AL1H**	High threshold band alarm AL1	-1999 ÷ 9999	0	
30	**HAL1**	Alarm AL1 hysteresis	OFF ÷ 9999	1	
31	**AL1d**	Activation delay of alarm AL1	OFF ÷ 9999 sec.	OFF	
32	**AL1i**	Alarm AL1 activation in case of measuring error	no / yES	no	

Group "AL2" (parameters relative to alarm AL2)

Par.		Description	Range	Def.	Note
33	**OAL2**	Output where alarm AL2 is addressed	Out1 / Out2 Out3 / Out4 OFF	OFF	
34	**AL2t**	Alarm AL2 type	LoAb / HiAb LHAb / LodE HidE / LHdE	LOAb	
35	**Ab2**	Alarm AL2 functioning	0 ÷ 15	0	
36	**AL2**	Alarm AL2 threshold	-1999 ÷ 9999	0	
37	**AL2L**	Low threshold band alarm AL2	-1999 ÷ 9999	0	
38	**AL2H**	High threshold band alarm AL2	-1999 ÷ 9999	0	
39	**HAL2**	Alarm AL2 hysteresis	OFF ÷ 9999	1	
40	**AL2d**	Activation delay of alarm AL2	OFF ÷ 9999 sec.	OFF	
41	**AL2i**	Alarm AL2 activation in case of measuring error	no / yES	no	

Group "AL3" (parameters relative to alarm AL3)

Par.		Description	Range	Def.	Note
42	**OAL3**	Output where alarm AL3 is addressed	Out1 / Out2 Out3 / Out4 OFF	OFF	
43	**AL3t**	Alarm AL3 type	LoAb / HiAb LHAb / LodE HidE / LHdE	LOAb	
44	**Ab3**	Alarm AL3 functioning	0 ÷ 15	0	
45	**AL3**	Alarm AL3 threshold	-1999 ÷ 9999	0	
46	**AL3L**	Low threshold band alarm AL3	-1999 ÷ 9999	0	
47	**AL3H**	High threshold band alarm AL3	-1999 ÷ 9999	0	
48	**HAL3**	Alarm AL3 hysteresis	OFF ÷ 9999	1	
49	**AL3d**	Activation delay of alarm AL3	OFF ÷ 9999 sec.	OFF	
50	**AL3i**	Alarm AL3 activation in case of measuring error	no / yES	no	

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

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

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

Par.		Description	Range	Def.	Note
53	**OHb**	Output where alarm HB is addressed	Out1 / Out2 Out3 / Out4 OFF	OFF	
54	**IFS**	High scale limit for input TA HB	0.0 ÷ 100.0	100.0	
55	**HbF**	Alarm HB function	1 / 2 / 3 / 4	1	
56	**IHbL**	Low alarm HB threshold (with Out 1.rEG ON)	0.0 ÷ IFS	0.0	
57	**IHbH**	High alarm HB threshold (con Out 1.rEG OFF)	IHbL ÷ IFS	100.0	

Group "rEG" (parameters relative to the control)

Par.		Description	Range	Def.	Note
58	**Cont**	Control type	Pid / On.FA On.FS / nr	Pid	
59	**Func**	Functionin mode output 1rEg	HEAt / CooL	HEAt	
60	**HSEt**	ON/OFF control Hysteresis	-1999 ÷ 9999	1	
61	**Auto**	Autotuning Fast enable	OFF / 1 / 2 / 3	1	
62	**SELF**	Selftuning enable	no / yES	no	
63	**Pb**	Proportional band	0 ÷ 9999	50	
64	**Int**	Integral time	OFF ÷ 9999 sec.	200	
65	**dEr**	Derivative time	OFF÷ 9999 sec.	50	
66	**FuOc**	Fuzzy overshoot control	0.00 ÷ 2.00	0,5	
67	**tcr1**	Cycle time of output 1rEg	0.1 ÷ 130.0 sec.	20,0	
68	**Prat**	Power ratio 2rEg / 1rEg	0.0 ÷ 999.9	1.0	
69	**tcr2**	Cycle time of 2rEg	0.1 ÷ 130.0 sec.	10.0	
70	**rS**	Manual reset	-100.0÷100.0 %	0.0	
71	**SLor**	Gradient of rise ramp	0.00 ÷ 99.99 / InF unit/min.	InF	
72	**dur.t**	Dwell time	0.00 ÷ 99.59 / InF hrs.-min.	InF	
73	**SLoF**	Gradient of fall ramp	0.00 ÷ 99.99 / InF unit / min.	InF	
74	**St.P**	Soft-Start power	OFF / -100 ÷ 100 %	OFF	
75	**SSt**	Soft-Start time	OFF / 0.1÷7.59 / InF hrs.-min.	OFF	

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

Par.		Description	Range	Def.	Note
76	**USrb**	Functioning of key "U"	noF / tunE / OPLO / Aac / ASi / CHSP / OFF	noF	
77	**diSP**	Variable visualized on the display	dEF / Pou / HbA / HbL / SP.F / SP.o / AL1 / AL2 / AL3	dEF	
78	**AdE**	Shift value for the shift index functioning	OFF...9999	2	
79	**Edit**	Fast programming of active Set Point and alarms	SE / AE / SAE / SAnE	SAE	

Group "SEr" (parameters relative to the serial communication)

Par.		Description	Range	Def.	Note
80	**Add**	Station address in case of serial communication	0 … 255	1	
81	**baud**	Transmission speed (Baud rate)	1200 / 2400 / 9600 / 19.2 / 38.4	9600	
82	**PACS**	Access at the programming through serial port	LoCL / LorE	LorE	

5.2 – PARAMETERS DESCRIPTION

GROUP "]SP" (PARAMETERS RELATIVE TO THE SET POINT):

They allow the control Set programming and the Set functioning modalities.
nSP – NUMBER OF THE PROGRAMMABLE SET POINT: It permits to define the number of the Set Point which are desired to be programmed and stored (from 1 to 4).
SPAt – ACTIVE SET POINT : Whenever are stored more than one Set Point, it permits to select the active Set Point.
SP1 - SET POINT 1: Value of the Set Point n. 1
SP2 - SET POINT 2: Value of the Set Point n. 2 (it appears if "nSP" >2 only)
SP3 - SET POINT 3: Value of the Set Point n. 3 (it appears if "nSP" >3 only)
SP4 - SET POINT 4: Value of the Set Point n. 4 (it appears if "nSP" =4 only)
SPLL – LOW SET POINT: Lower value programmable as Set Point
SPHL – HIGH SET POINT : Higher value programmable as Set Point

GROUP "]InP" (PARAMETERS RELATIVE TO THE INPUTS):

They permit to define the visualization modalities of the variable measured by the probe.
HCFG – INPUT TYPE : It permits to select the input type : thermocouples (tc), thermoresistances or thermistors (rtd), normalized signals in current (I), in tension (UoLt) or a measure coming from the serial line (SEr).
SEnS – PROBE TYPE: Depending on what programmed on par. "HCFG" it permits to select the type of probe :
- thermocouples ("HCFC"=tc): J (J), K (CrAL), S (S) or GREISINGER infrared sensors IRTC1 serie with J (Ir.J) or K (Ir.CA) linearization.
- thermoresistances/thermistors ("HCFC"=rtd): Pt100 IEC (Pt1) or thermistors PTC KTY81-121 (Ptc) or NTC 103AT-2 (ntc)
- normalized signals in current ("HCFC"=I): 0..20 mA (0.20) or 4..20 mA (4.20)
- normalized signals in tension ("HCFC"=UoLt): 0..50 mV (0.50), 0..60 mV (0.60), 12..60 mV (12.60), 0..5 V (0.5), 1..5 V (1.5), 0..10 V (0.10) or 2..10 V (2.10).

SSC – LOW SCALE LIMIT IN CASE OF INPUT WITH V/I SIGNALS : This is the value the instrument has to visualise when at the input it's present the minimum value measurable on the scale (0/4 mA, 0/12 mV, 0/1 V or 0/2 V).
FSC – HIGH SCALE LIMIT IN CASE OF INPUT WITH V/I SIGNALS : This is the value the instrument has to visualise when at the input it's present the maximum value measurable on the scale (20 mA, 50 mV, 60 mV, 5 V or 10 V).
dP – NUMBER OF DECIMAL FIGURES: It permits to decide if the measuring resolution has to be 1 (0), 0.1 (1), 0.01 (2), 0.001 (3). In case of temperature probes the allowed resolutions are 1° (0) and 0.1° (1).
Unit – TEMPERTURE UNIT OF MEASUREMENT : When the temperature is measured by temperature probes, this parameter permits to define if the visualisation is expressed as degree Centigrade (°C) or Fahrenheit (°F).
Filt – INPUT DIGITAL FILTER : It permits to program the constant of time as software filter referred to the measured input value (in sec.) in order to reduce the sensibility at the noises (increasing the time of reading).
OFSt – MEASURING OFFSET: Positive or negative Offset which is added to the value measured by the probe.
rot – ROTATION OF THE MEASURING STRAIGHT LINE: It permits to obtain that the offset programmed on par. "OFSt" is not constant for all the measures. Programming "rot"=1.000, the value "OFSt" is simply added to the value red by the probe before the visualisation and it results constant for all the measures. If instead it's desired to have the programmed offset not constant for all the measures, it's possible to effectuate the calibration on two desired values.
In this case, to define the values to be programmed on par. "OFSt" and "rot", it's necessary to enforce the following formulae :

"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's then deriving that the instrument will visualise : **DV = MV x "rot" + "OFSt"**
where: DV = visualised value; MV= measured value
InE – "OPE" FUNCTIONING IN CASE OF MEASURING ERROR: It defines which are the error conditions of the input allowing the instrument to give as output the power programmed on par. "OPE". The possibilities are :
= Or : the condition occurs in case of overrange or probe breakage
= Ur : the condition occurs in case of underrange or probe breakage
= Our : the condition occurs in case of overrange or underrange or probe breakage
OPE – OUTPUT POWER IN CASE OF MEASURING ERROR: It permits to program the power that the instrument has to give as output in case of measuring error. For the ON/OFF regulators the power is calculated considering a cycle time equal to 20 sec.

GROUP "] Out" (PARAMETERS RELATIVE TO THE OUTPUTS):

They permit to program the outputs functioning.
O1F – FUNCTIONING OF OUTPUT OUT 1: It defines the functioning of output OUT 1 as: control output 1 (1.rEG), control output 2 (2.rEG), alarm output as normally open (ALno), output alarm normally closed (ALnc), output not used (OFF).
O2F - FUNCTIONING OF OUTPUT OUT 2: Similar to "O1F" but referred to output OUT2.
O3F - FUNCTIONING OF OUTPUT OUT 3: Similar to "O1F" but referred to output OUT3.
O4F - FUNCTIONING OF OUTPUT OUT 4: Similar to "O1F" but referred to output OUT4.

GROUP "]AL1" (PARAMETERS RELATIVE TO ALARM AL1):

They permit to program the functioning of the process alarm AL1.
OAL1 – OUTPUT WHERE ALARM AL1 IS ADDRESSED: It defines on which output the alarm AL1 has to be addressed.
AL1t – ALARM AL1 TYPE: It permits to decide which type of behaviour has to have the alarm AL1, through 6 different selections :
= LoAb – ABSOLUTE LOW ALARM : The alarm is activated when the process value goes under the alarm set on parameter "AL1".
= HiAb - ABSOLUTE HIGH ALARM: The alarm is activated when the process value goes higher than alarm set on parameter "AL1".
= LHAb - ABSOLUTE BAND ALARM: The alarm is activated when the process value goes under the alarm set on parameter "AL1L" or goes higher than alarm set on parameter "AL1H".

= LodE – DEVIATION LOW ALARM: The alarm is activated when the process value goes under [SP – AL1]
= HidE – DEVIATION HIGH ALARM: The alarm is activated when the process value goes higher than [SP + AL1]
= LHdE – DEVIATION BAND ALARM: The alarm is activated when the process value goes under [SP – AL1L] or goes higher than [SP + AL1H]
Ab1 – ALARM AL1 FUNCTIONING: It permits to define the alarm AL1 functioning programming a number comprised between 0 and 15.
The number to be programmed, that corresponds to the desired functioning, is obtained adding the values reported in the following description :
ALARM BEHAVIOUR AT THE SWITCH ON:
+0 = NORMAL BEHAVIOUR: The alarm is always activated when there are alarm conditions.
+1 = ALARM NOT ACTIVATED AT THE SWITCH ON: Whether, at the switch on, the instrument is in alarm conditions, the alarm is not activated. It will be activated only when the process value is out and back again in alarm conditions.
ALARM DELAY:
+0 = ALARM NOT DELAYED: The alarm is immediately activated when the alarm condition has come to pass.
+2 = ALARM DELAYED: When the alarm condition has come to pass, it starts the counting of the delay, as programmed on par. "ALnd" (expressed in sec.) and only after the elapsing of that time the alarm will be activated.
ALARM LATCH: :
+ 0 = ALARM NOT LATCHED: The alarm remains active in the alarm conditions only.
+ 4 = ALARM LATCHED: The alarm is active in the alarm conditions and remains active also if these conditions are not existing anymore, until when key "U", properly programmed ("USrb"=Aac) has been pushed
ALARM AKNOWLEDGEMENT: :
+ 0 = ALARM NOT AKNOWLEDGED: The alarm remains always active in the alarm conditions.
+ 8 = ALARM AKNOWLEDGED: The alarm is active in alarm conditions and can be deactivated through key "U" if properly programmed ("USrb"=ASi), also if the alarm conditions are still existing.
AL1 – ALARM AL1 THRESHOLD : Alarm AL1 threshold for low and high alarms.
AL1L – LOW THRESHOLD BAND ALARM AL1 : Alarm AL1 low threshold when the alarm is a band type.
AL1H – HIGH THRESHOLD BAND ALARM AL1: Alarm AL1 high threshold when the alarm is a band type.
HAL1 - ALARM AL1 HYSTERESIS: Asymmetrical semi-band relative to the alarm AL1 threshold which defines the deactivation value of alarm AL1.
AL1d – ACTIVATION DELAY OF ALARM AL1: It permits to define the activation delay of the alarm AL1 when it's activated the delay function on par. "Ab1".
AL1i – ALARM AL1 ACTIVATION IN CASE OF MEASURING ERROR: It permits to define if, in measuring error conditions, the alarm has to be active ("yES") or not ("no").

GROUP "]AL2" (PARAMETERS RELATIVE TO ALARM AL2):

They permit to program the functioning of the process alarm AL2.
OAL2 - OUTPUT WHERE ALARM AL2 IS ADDRESSED: It defines on which output the alarm AL2 has to be addressed.
AL2t - ALARM AL2 TYPE: Similar to "AL1t" but referred to alarm AL2.
Ab2 - ALARM AL2 FUNCTIONING: Similar to "Ab1t" but referred to alarm AL2.
AL2 - ALARM AL2 THRESHOLD : Similar to "AL1" but referred to alarm AL2.
AL2L - LOW THRESHOLD BAND ALARM AL2 : Similar to "AL1L" but referred to alarm AL2.

AL2H - HIGH THRESHOLD BAND ALARM AL2 : Similar to “AL1H” but referred to alarm AL2.
HAL2 - ALARM AL2 HYSTERESIS: Similar to “HAL1” but referred to alarm AL2.
AL2d - ACTIVATION DELAY OF ALARM AL2: Similar to “AL1d” but referred to alarm AL2.
AL2i - ALARM AL2 ACTIVATION IN CASE OF MEASURING ERROR: Similar to “AL1i” but referred to alarm AL2.

GROUP "]AL3" (PARAMETERS RELATIVE TO ALARM AL3):

They permit to program the functioning of the process alarm AL3.
OAL3 - OUTPUT WHERE ALARM AL3 IS ADDRESSED: It defines on which output the alarm AL3 has to be addressed.
AL3t - ALARM AL3 TYPE: Similar to "AL1t" but referred to alarm AL3.
Ab3 - ALARM AL3 FUNCTIONING: Similar to "Ab1t" but referred to alarm AL3.
AL3- ALARM AL3 THRESHOLD : Similar to "AL1" but referred to alarm AL3.
AL3L - LOW THRESHOLD BAND ALARM AL3 : Similar to "AL1L" but referred to alarm AL3.
AL3H - HIGH THRESHOLD BAND ALARM AL3 : Similar to "AL1H" but referred to alarm AL3.
HAL3 - ALARM AL3 HYSTERESIS: Similar to "HAL1" but referred to alarm AL3.
AL3d - ACTIVATION DELAY OF ALARM AL3: Similar to "AL1d" but referred to alarm AL3.
AL3i - ALARM AL3 ACTIVATION IN CASE OF MEASURING ERROR: Similar to "AL1i" but referred to alarm AL3.

GROUP "LbA" (PARAMETERS RELATIVE TO THE LOOP BREAK ALARM):

It contains the parameters relative to the Loop Break alarm (control loop interruption), which intervenes when, for any reason (short-circuit of a thermocouple, load interruption, etc) the control loop is interrupted.
OLbA – OUTPUT WHERE THE LOOP BREAK ALARM IS ADDRESSED: It defines on which output the LOOP BREAK alarm has to be addressed.
LbAt – TIME NECESSARY TO ACTIVATE THE LOOP BREAK ALARM : Delay time at the intervention of the Loop Break alarm. The alarm intervenes when the output power remains at the 100% for the time programmed on this parameter (in sec.)

GROUP "]Hb" (PARAMETERS RELATIVE TO THE HEATER BREAK ALARM):

It contains the parameters relative to the Heater Break alarm (heating element breakage).
This function is present only when the instrument is equipped with the input (TAHB) to measure the current absorbed by the load. This input accepts signals coming from current transformers (TA) with output higher than 50 mA.
OHb – OUTPUT WHERE HEATER BREAK ALARM IS ADDRESSED: It defines on which output the HEATER BREAK alarm has to be addressed.
IFS – HIGH SCALE LIMIT FOR INPUT TA HB: Value that the instrument has to visualise when as input TA HB It's present a value of 50 mA.
HbF – ALARM HB FUNCTION: It defines the functioning of the Heater Break alarm as:
= 1 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. "IHbL" .
= 2 : The alarm is active when, with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. "IHbH" .
= 3 : The alarm is active when, with output 1rEG active, the current measured by the input TAHB is lower than the value programmed on par. "IHbL" or with output 1rEG not active, the current measured by the input TAHB is higher than the value programmed on par. "IHbH".
= 4 : The alarm is active when the current measured by the input TAHB is lower than the value programmed on par. "IHbL" or the measured current is higher than the value programmed on par. "IHbH", independently by the state of the output 1rEG.
IHbL – LOW ALARM HB THRESHOLD: Do program the value of the current normally absorbed by the load driven by the output 1reG, when this is active.
IHbH – HIGH ALARM HB THRESHOLD: Do program the value of the current normally absorbed by the load driven by the output 1reG, when this is not active.

GROUP "]rEG" (PARAMETERS RELATIVE TO THE CONTROL):

It contains the parameters relative to the control functioning.
Cont – CONTROL TYPE: It permits to select one of the possible control mode offered by the instrument : PID (Pid), ON/OFF with asymmetrical hysteresis (On.FA), ON/OFF with symmetrical hysteresis (On.FS), Neutral Zone ON/OFF (nr).
Func – FUNCTIONING MODE OUTPUT 1rEG: It permits to decide if the control output 1rEG has to actuate a reverse action, as for example a Heating process ("HEAt") or a direct action, as for example a Cooling process ("CooL").
HSEt –ON/OFF CONTROL HYSTERESIS: Semi-band relative to the Set Point which definers the activation and deactivation values of the control output/s in case of ON/OFF control (On.FA, On.FS, nr).
Auto – AUTOTUNING FAST ENABLE : this parameter permits to decide how the Autotuning has to be executed . The possible selections are :
= 1 - if it's desired to have the autotuning automatically, each time the instrument is switched on, at the condition that the process value is lower (with "Func" =HEAt) or higher (with "Func" =CooL) than SP/2
= 2 - if it's desired to have the autotuning automatically, the next time the instrument is switched on, at the condition that the process value is lower (with "Func" =HEAt) or higher (with "Func" =CooL) than SP/2, and once the tuning is finished, the par. "Auto" IS automatically swap into the OFF state
= 3 - - if it's desired to activate the autotuning manually, through the selection of par. "tunE" in the main menu or though key "U" properly programmed as "USrb" = tunE. In this case the autotuning starts without any control on the process value condition. It's recommended to use this option, starting the autotuning when the process value is as far as possible from the Set Point because, in order to feature the Autotuning FAST with its best performances , it's preferable to respect this condition
= OFF - Autotuning disabled.
When it's occurring an Autotuning cycle, led AT blinks.
SELF – SELFTUNING ENABLE: Parameter used to enable (yES) or disable (no) the Selftuning function. Once the function has been enabled, the Selftuning has to be started selecting item "tunE", in the main menu, or through key U properly programmed ("USrb" = tunE).When the Selftuning function is active, led AT is permanently lighted, and all the PID parameters ("Pb", "Int", "dEr", ecc.) are not visualised anymore.
Pb – PROPORTIONAL BAND: Width of the band around the Set Point within which the proportional control is performed.
Int – INTEGRAL TIME: Integral time to be programmed in the PID algorithm, expressed in sec.
dEr – DERIVATIVE TIME: : Derivative time to be programmed in the PID algorithm, expressed in sec.
FuOc - FUZZY OVERSHOOT CONTROL: Parameter that permits to eliminate the variable over-shoots at the start up of the process or at the changing of the Set Point. A low value of this parameter reduces the overshoot while a high value increase it.
tcr1 – CYCLE TIME OF OUTPUT 1rEG : Cycle time of output 1rEG with PID control mode, expressed in sec..
Prat – POWER RATIO 2rEG / 1rEG : Parameter where it's possible to program the power ratio between the element controlled by output 2rEG (ex.Cooling) and the element controlled by output 1rEG (ex. Heating) in case of PID double action control.
tcr2 - CYCLE TIME OF OUTPUT 2rEG : Cycle time of output 2rEG with PID double action control mode, expressed in sec..
rS - MANUAL RESET: Power Offset added to the power increase of the proportional term, in order to eliminate the error when it's not present the integral value. This parameter is only visualised when "Int" =0.

Parameters relative to the ramps, allowing the reaching of the Set Point in a predetermined time.
Furthermore, once the first Set (SP1) has been reached, it's possible to have the automatic commutation on the second Set (SP2) after a programmable time, obtaining in this way a simple thermal cycle (functions available for all the control types)

SLor – GRADIENT OF RISE RAMP: Gradient of rise ramp to actuate when the process value is lower than the active Set Point, expressed in unit/minute.
Programming the parameter = InF the ramp is not active.
dur.t - DWELL TIME: Dwell time of the Set Point SP1 before the automatic commutation on SP2 (expressed in hrs. and min.)
Through this parameter, once the first Set (SP1) has been reached, it's possible to have the automatic commutation on the second Set (SP2) after a programmable time, obtaining in this way a simple thermal cycle.
Programming the parameter = InF the function is not active.
SLoF - GRADIENT OF FALL RAMP: Gradient of fall ramp to actuate when the process value is higher than the active Set Point, expressed in unit/minute.
Programming the parameter = InF the ramp is not active.

Parameters relative to the Soft-Start function, which allows to limit the control power, at the instrument switch on, for a predetermined time. This function is only available for PID control, furthermore when the Soft Start is active, it's not possible to have the Autotuning function as this could supply an excessive power.

St.P - SOFT START POWER:
If parameter "SSt" is programmed with a values different from OFF, this is the power given as output at the instrument switch on, for the time "SSt".
In the practice, the instrument works in manual condition and commutates into automatic control at the elapsing of time "SSt".

If instead par. “St.P” = OFF and on par. “SSt” is programmed a value, at the switch on, the power calculated by the PID controller is divided for the time “SSt”, with the meaning to calculate a ramp. The output power starts from 0 and is progressively increased, basing on the calculated ramp, up to the reaching of time “SSt” or until when the power overcomes the power calculated by the PID controller.
SSt - SOFT START TIME (for PID control only): Duration time in hours and min. of the Soft-Start described on pa. “St.P”.
To disable the Soft-Start function it’s enough to program par. “Sst” = OFF.

GROUP "]PAn" (PARAMETERS RELATIVE TO THE USER INTERFACE) :

It contains the parameters relative to the key U and display functioning.
Usrb – FUNCTIONING OF KEY U : It permits to decide which function is associated to key U. The possible selection are :
= noF : no function
= tunE : Pushing the key for 1 sec. at least, it's possible to activate/deactivate the Autotuning or the Selftuning
= OPLO : Pushing the key for 1 sec. at least, it's possible to swap from the automatic control (rEG) to the manual one (OPLO) and vice versa.
= Aac : Pushing the key for 1 sec. at least, it's possible to acknowledge the alarm.
= Asi : Pushing the key for 1 sec. at least, it's possible to acknowledge an active alarm
= CHSp : Pushing the key for 1 sec. at least, it's possible to select on rotation one of the 4 pre-programmed Set Point.
= OFF : Pushing the key for 1 sec. at least, it's possible to swap from the automatic control (rEG) to the OFF control (OFF) and vice versa.
diSP - VARIABLE VISUALISED ON THE DISPLAY: Parameter trough which it's possible to decide what is visualised on the display : the process variable (= dEF), the control power (= Pou), the active Set Point (= SP.F), the Set Point active when there are ramps (= SP.o) or the alarm thresholds AL1, 2 or 3 (= AL1, AL2 or AL3).
AdE – SHIFT VALUE FOR THE SHIFT INDEX FUNCTIONING: It permits to decide the functioning mode of the 3 led shift index. The lighting of the green led "=" indicates that the process value is within the range [SP+AdE ... SP-AdE], the lighting of the red led "-" indicates that the process value is lower than the value [SP-AdE] and the lighting of the red led "+"indicates that the process value is higher than the value [SP+AdE].
Edit – FAST PROGRAMMING OF ACTIVE SET POINT AND ALARMS: It permits to decide which are the Set programmable with the fast procedure. The parameter can be programmed as :
=SE: The active Set Point is modifiable while the alarm thresholds are not modifiable
=AE :The active Set Point is not modifiable while the alarm thresholds are modifiable
=SAE: Whether the active Set Point or the alarm thresholds are modifiable
=SAnE: Whether the active Set Point or the alarm thresholds are not modifiable

GROUP "]SEr" (PARAMETERS RELATIVE TO THE SERIAL COMMUNICATION):

If the instrument is equipped with RS485 serial communication these parameters allow the device configuration in order to communicate.
Add – STATION ADDRESS IN CASE OF SERIAL COMMUNICATION : It's used to set the instrument address in the communication net. Do program a different number for each station, from 1 to 255.
baud – TRANSMISSION SPEED (BAUD RATE): Do program the data transmission speed of the network on which is connected the instrument. The possible selection are 1200, 2400, 9600, 19.2 (19200), 38.4 (38400).
All the stations must have the same transmission speed.
PACS ACCESS AT THE PROGRAMMING THROUGH SERIAL PORT : Programming access. If programmed as "LoCL" this means that the instrument is programmable just from the keyboard, if programmed as "LorE" it's programmable both from the keyboards and serial line.

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 (underrange)	
oooo	The measured variable is higher than the probe's limits (overrange)	
ErAt	Autotuning not possible because the process value is lower (or higher) than SP/2 or because it has been activated the Soft-Start function.	Swap the instrument into OFF control (OFF) and successively into automatic control (rEG) in order to make disappear the error message. Once the error has been found, try to repeat the autotuning.
noAt	Autotuning not finished within 12 hours	Check the functioning of probe and actuator and try to repeat the autotuning.
LbA	Loop control interrupted (Loop break alarm)	Check the functioning of probe and actuator and swap the instrument into (reG) control
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 to clean the instrument with a cloth slightly wet of water or not abrasive cleaners or containing solvents which may damage the instrument.

6.3 – GUARANTEE AND REPAIRS

The instrument is under warranty against construction vices or defected material, noticed within 12 months from delivery date. The guarantee is limited to the repairs or to the substitution of the instrument. The eventual opening of the housing, the violation of the instrument or the wrong use and installation of the product means the automatic decay of the guarantee. In case of defective instrument, noticed within or out of the guarantee period, do contact our sales department to obtain the shipment authorisation. The defective product must be shipped to GREISINGER with the detailed description of the failures found and without any fees or charge for GREISINGER, safe different agreements.

7 – TECHNICAL DATA

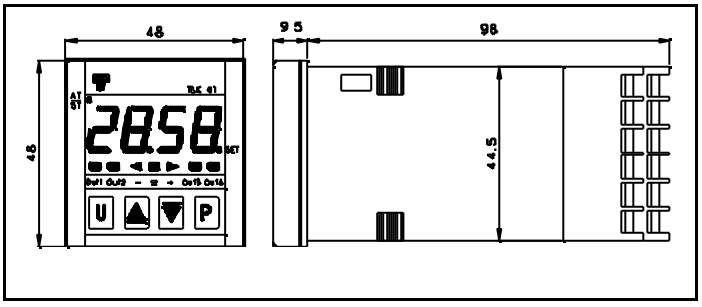
7.1 – ELECTRICAL FEATURES

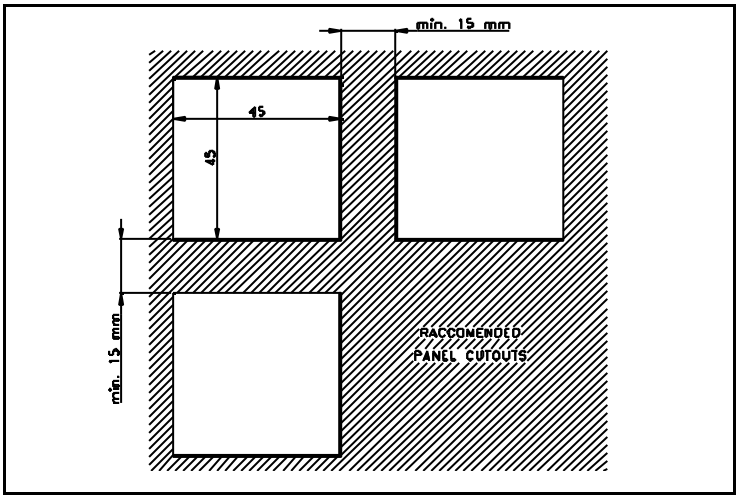
Power supply: 18...30 VAC/VDC, 90... 240 VAC +/- 10%
Frequency AC: 50/60 Hz
Power consumption: 8 VA approx.
Input/s: 1 input for temperature probes: tc J,K,S ; RTD Pt 100 IEC; PTC KTY 81-121 (990 Ω @ 25 °C); NTC 103AT-2 (10KΩ @ 25 °C) or mV signals 0...50 mV, 0...60 mV, 12 ...60 mV or normalized signals 0/4...20 mA, 0/1...5 V , 0/2...10 V.
1 input for current transformer (50 mA max.)
Output/s: Up to 4 outputs. Relay SPST-NO (5 A-AC1, 2 A-AC3 / 250 VAC) ; or in tension to drive SSR (20mA/ 14VDC).
Auxiliary supply output: 12 VDC / 25 mA Max.
Electrical life for relay outputs: 100000 operat.
Installation category: II
Protection class against electric shock: Class II for Front panel
Insulation: Reinforced insulation between the low voltage section (supply and relay outputs) and the front panel; Reinforced insulation between the low voltage section (supply and relay outputs) and the extra low voltage section (inputs, SSR outputs); SSR outputs optoisolated respect to the input. 50V insulation between RS485 and extra low voltage section.

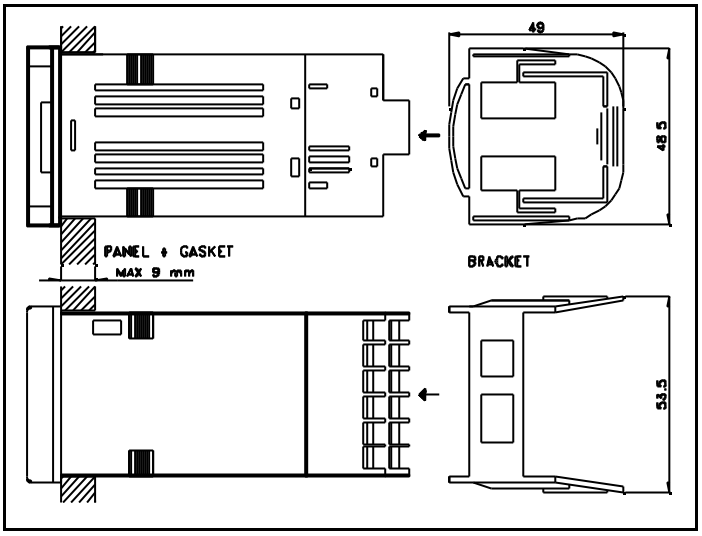
7.2 – MECHANICAL FEATURES

Housing: Self-extinguishing plastic, UL 94 V0
Dimensions: 48 x 48 mm DIN, depth 98 mm
Weight: 190 g approx.
Mounting: Flush in panel in 45,5 x 45,5 mm hole
Connections: 2,5 mm2 screw terminals block
Degree of front panel protection : IP 54 mounted in panel with gasket
Pollution situation: 2
Operating temperature: 0 ... 55 °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: +/- 0,15 % fs
Sampling rate: 130 ms.
Serial Interface : RS485 optoisolated
Communication protocol: MODBUS RTU (JBUS)
Baud rate: Programmable from 1200 ... 38400 baud
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	without D.P.	with D.P.
tc J **"HCFG" = tc** **"SEnS" = J**	-160 ... 1000 °C - 256 ... 1832 °F	-160.0 ... 999.9 °C -199.9 ... 999.9 °F
tc K **"HCFG" = tc** **"SEnS" = CrAl**	-270 ... 1370 °C - 454 ... 2498 °F	-199.9 ... 999.9 °C -199.9 ... 999.9 °F
tc S **"HCFG" = tc** **"SEnS" = S**	-50 ... 1760 °C -58 ... 3200 °F	-50.0 ... 1760.0 °C -58.0 ... 999.9 °F
Pt100 (IEC) **"HCFG" = rtd** **"SEnS" = Pt1**	-200 ... 850 °C -328 ... 1562 °F	-99.9 ... 850.0 °C -99.9 ... 999.9 °F
PTC (KTY81-121) **"HCFG" = rtd** **"SEnS" = Ptc**	-55 ... 150 °C -67 ... 302 °F	-55.0 ... 150.0 °C -67.0 ...302.0 °F
NTC (103-AT2) **"HCFG" = rtd** **"SEnS" = ntc**	-50 ... 110 °C -58 ... 230 °F	-50.0 ... 110.0 °C -58.0 ... 230.0 °F
0 ... 50 mV **"HCFG" = UoLt** **"SEnS" = 0.50**	-1999 ... 9999	-199.9 ... 999.9 -19.99 ... 99.99 -1.999 ... 9.999
0..20 mA **"HCFG" = I** **"SEnS" = 0.20**		
4..20 mA **"HCFG" = I** **"SEnS" = 4.20**		

0 ... 60 mV **“HCFG” = UoLt** **“SEnS” = 0.60**
12 ... 60 mV **“HCFG” = UoLt** **“SEnS” = 12.60**
0 ... 5 V **“HCFG” = UoLt** **“SEnS” = 0.5**
1 ... 5 V **“HCFG” = UoLt** **“SEnS” = 1.5**
0 ... 10 V **“HCFG” = UoLt** **“SEnS” = 0.10**
2 ... 10 V **“HCFG” = UoLt** **“SEnS” = 2.10**

7.6 – INSTRUMENT ORDERING CODE

TLK 41 a b c d e f g ii

a : POWER SUPPLY
L = 18 ... 30 VAC/VDC
H = 90 ... 240 VAC

b : OUTPUT OUT1
R = Relay
O = 20 mA/14 VDC x SSR

c : OUTPUT OUT2
R = Relay
O = 20 mA/14 VDC x SSR

d : OUTPUT OUT3
R = Relay
O = 20 mA/14 VDC x SSR

e : OUTPUT OUT4
R = Relay
O = 20 mA/14 VDC x SSR

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

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

h : OPTIONAL PROBES
- = None

ii = SPECIAL CODES