TLK 43
MICROPROCESSOR-BASED DIGITAL ELECTRONIC REGULATOR

TECHNICAL DATA

MECHANICAL DATA	
Housing	Self-extinguishing plastic, UL 94 V0
Dimensions	48x48 mm (1/16 DIN) – depth 98 mm
Weight	190 g approx.
Connections	2,5 mm^2 screw terminal block
Mounting	Flush in panel in 45,5 x 45,5 mm hole
Front panel protection	IP 54 mounted in panel with gasket
ELECTRICAL DATA	
Power supply	24 VAC/VDC, 100…240 VAC +/-10%
AC Frequency	50 / 60 Hz
Power consumption	10 VA approx.
INPUT DATA	
Thermocouple	J, K, S, B, C, E, L, N, R, T – According to IEC 584-2 accuracy class 1 or 2
Thermoresistance	Pt 100 – According to IEC 751 accuracy class A or B
Thermistor	PTC KTY 81-121 (990 Ω at 25°C) ; NTC 103AT-2 (10 kΩ at 25°C)
Current input	0/4...20 mA
Voltage input	0…50 mV, 0…60 mV, 12…60 mV, 0/1…5 V, 0/2…10 V
Current transformer input	CT (max 50 mA)
Infrared sensors input	Infrared sensors TECNOLOGIC IRS J and K range A
OUTPUT DATA	
Relay outputs	Up to 4 outputs: OUT1: SPST-NO (5 A-AC1, 2 A-AC3 / 250 VAC) OUT2-3-4:SPST-NO (3 A-AC1, 1 A-AC3 / 250 VAC)
Voltage output for SSR driving	7 mA at 14 VDC with protection against short-circuits
Analog output	Up to 4 outputs: 0/4…20 mA or 0/2…10 V
Auxiliary power supply output	12 VDC / 20 mA max
FUNCTIONAL DATA	
Control	ON/OFF, Neutral Zone, PID single and double action, PID for motorized actuators, programmable
Overall accuracy	+/-0.15% fs
Display resolution	According to the used probe 1/0,1/0,00001/0,001
Measurement range	According to the used probe and to the measurement unit
Unit of measurement	°C - °F, programmable
Measure sampling time	130 ms
Serial communication	RS485 with MODBUS-RTU (JBUS) protocol
Serial transmission rate	1200…38400 selectable
Display	4 digit 1 Red (PV) – 1 Green (SV) ; h= 7 mm
Parameters access	Protected by password
Operating temperature	0…55°C
Operating humidity	30…95 RH% without condensation

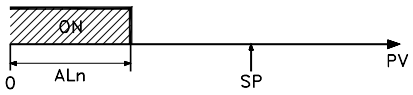
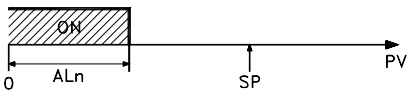
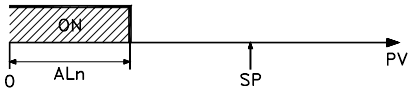
MEASUREMENT RANGE

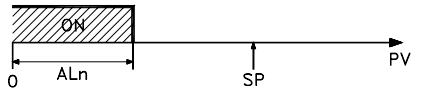
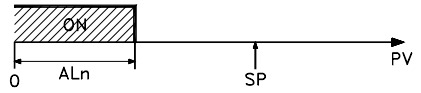
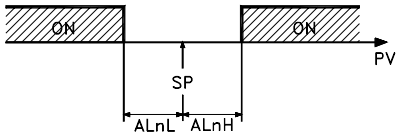
PROBE	RANGE 4 DIGIT	RANGE 4 DIGIT with D.P.
tc J **HCFG = tc** **SEnS = J**	-160 ... 1000°C -256 ... 1832°F	-160.0 ... 999.9°C -199.9 … 999.9°F
tc K **HCFG = tc** **SEnS = CrAl**	-270 ... 1370°C -454 ... 2498°F	-199.9 ... 999.9°C -199.9 ... 999.9°F
tc S **HCFG = tc** **SEnS = S**	-50 ... 1760°C -58 ... 3200°F	-50.0 ... 999.9°C -58.0 ... 999.9°F
tc B **HCFG = tc** **SEnS = b**	72 … 1820°C 162 … 3308°F	72.0 … 999.9°C 162.0 … 999.9°F
tc E **HCFG = tc** **SEnS = E**	-150 … 750°C .252 … 1382°F	-150.0 … 999.9°C -199.9 … 999.9°F
tc L **HCFG = tc** **SEnS = L**	-150 … 900°C -252 … 1652°F	-150.0 … 900.0°C -199.9 … 999.9°F
tc N **HCFG = tc** **SEnS = n**	-270 … 1300°C -454 … 2372°F	-199.9 … 999.9°C -199.9 … 999.9°F
tc R **HCFG = tc** **SEnS = r**	-50 ... 1760°C -58 ... 3200°F	-50.0 ... 999.9°C -58.0 ... 999.9°F
tc T **HCFG = tc** **SEnS = t**	-270 … 400°C -454 … 752°F	-199.9 … 400.0°C -199.9 … 752.0°F
tc C **HCFG = tc** **SEnS = C**	0 … 2320°C 32 … 4208°F	0.0 … 999.9°C 32.0 … 999.9°F
IRS range « A » **HCFG = tc** **SEnS = Ir.J - Ir.CA**	-46 … 785°C -50 … 1445°F	-46.0 … 785.0°C -50.8 … 999.9°F
Pt 100 **HCFG = rtd** **SEnS = Pt1**	-200 ... 850°C -328 ... 1562°F	-99.9 … 850.0°C -99.9 … 999.9°F

PROBE	RANGE 4 DIGIT	RANGE 4 DIGIT with D.P.
PTC **HCFG = rtd** **SEnS = Ptc**	-55 ... 150°C -67 ... 302°F	-55.0 ... 150.0°C -67.0 ... 302.0°F
NTC **HCFG = rtd** **SEnS = ntc**	-50 ... 110°C -58 ... 230°F	-50.0 … 110.0°C -58.0 … 230.0°F
0…20 mA **HCFG = I** **SEnS = 0.20**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
4…20 mA **HCFG = I** **SEnS = 4.20**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
0…50 mV **HCFG = UoLt** **SEnS = 0.50**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
0…60 mV **HCFG = UoLt** **SEnS = 0.60**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
12…60 mV **HCFG = UoLt** **SEnS = 12.60**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
0…5V **HCFG = UoLt** **SEnS = 0.5**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
1…5 V **HCFG = UoLt** **SEnS = 1.5**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
0…10 V **HCFG = UoLt** **SEnS = 0.10**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999
2…10 V **HCFG = UoLt** **SEnS = 2.10**	-1999 ... 9999	-199.9 … 999.9 -19.99 … 99.99 -1.999 … 9.999

ALARM OUTPUTS

The alarm functioning is depending on the Process Value and it's programmable through a 4 figures code; depending on the value of the suitable parameters, it's possible to have 6 different types of alarms :

	Alarm type	Alarm output
1	<u>Absolute Low alarm:</u> it's activated when the Process Value is lower than the alarm threshold	
2	<u>Absolute High alarm:</u> it's activated when the Process Value is higher than the alarm threshold	
3	<u>Absolute Low band alarm:</u> it's activated when the Process Value is lower than the low alarm threshold or higher than the high threshold alarm	

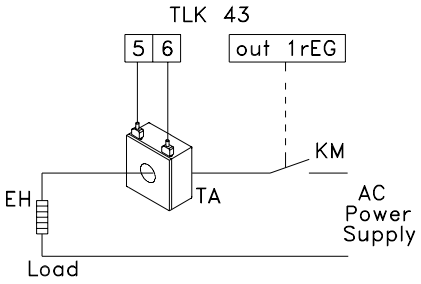
4	Low Deviation alarm: it's activated when the Process Value is lower than (SetP+ low threshold)	
5	High Deviation alarm: it's activated when the Process Value is higher than (SetP+ high threshold)	
6	Deviation band alarm: it's activated when the Process Value is lower than (SetP+low threshold) and higher than (SetP+ high threshold)	

Alarms hysteresis

The alarms functioning is influenced by the hysteresis phenomenon which works asymmetrically. In case of low alarm, the alarm is activated when the Process Value goes under the threshold alarm and it's deactivated when the Process Value goes upper than the alarm threshold; in case of high alarm, it's vice versa.

HEATER BREAK ALARM FUNCTION

The HB alarm show the break of the heating element; it's available only when the instrument is equipped with input for signals coming from current transformers (max 50 mA); this input is able to measure the load current driven by output configured by alarm. The HB Alarm hysteresis is automatically calculated by the instrument as 1% for the fixed sets.

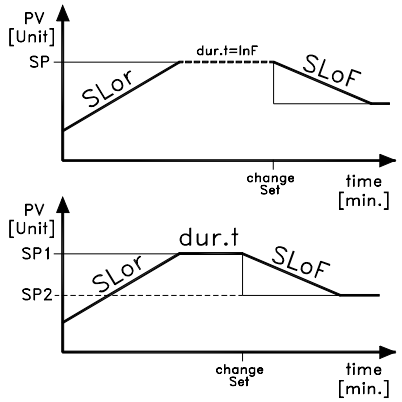


LOOP BREAK alarm function

The LB alarm is needed to signalise the interruption of the control loop, because of a thermocouple shortcircuit or inversion or interruption of the load.

RAMP FUNCTION

The function of ramp and fall it's needed to reach the Set Point value within a predefined time, which has to be programmed in advance and has to be necessarily longer than the one of the process controlled. The meaning of this function is not to place under thermal stress the treated materials. 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, with a simple automatic cycle. That function is available for all the programmable control types.



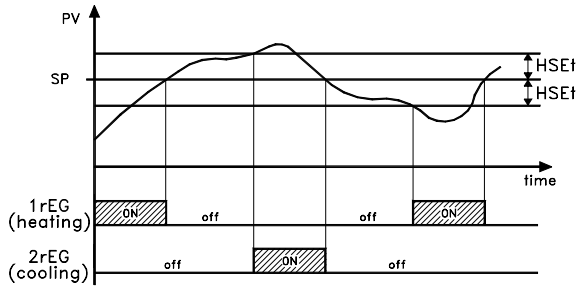
CONTROL MODE FEATURES

ON / OFF CONTROL

This control works on output 1rEG, depending on the Set Point, on the functioning mode and on the hysteresis programmed. The control is symmetrical or asymmetrical. Symmetrical means that the output is ON untill when the Process Value has reached (SP+hysteresis) or when has reached (SP-hysteresis).Asymmetrical means that the output is ON up to the reaching of the Set Point, to become again ON when it has reached (SP-hysteresis).

NEUTRAL ZONE CONTROL

This type of control concerns both outputs and it is used to control a plant which is equipped with a heating and a refrigerant element. This control works on the outputs depending on the measure, on the Set Point and on the hysteresis programmed.

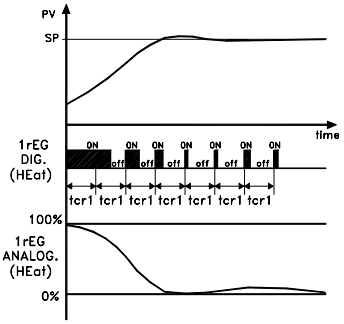


PID CONTROL

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.

PID CONTROL Single action

The single action PID control works on the output 1rEG depending on the active Set Point, on the functioning mode and on the instrument's PID algorithm with two degress of freedom.



PID CONTROL Double action

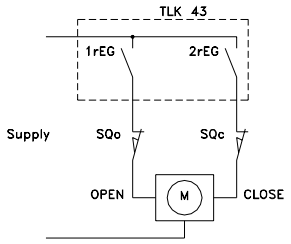
The double action PID is obtainable when 2 outputs are programmed respectively 1rEG and 2rEG and is used to control plants where there is an element which causes a positive increment (ex. Heating) and an element which causes a negative increment (ex. Cooling). This type of control works on the outputs 1rEG and 2rEG depending on the active Set Point and on the instrument's PID algorithm with two degrees of freedom.

PARAMETERS PROGRAMMING	PARAMETERS PROGRAMMING
Proportional band 0 … 9999	Proportional band 0 … 9999
Manual reset -100.0 … 100.0%	Manual reset -100.0 … 100.0%
Output 1rEG cycle time 0.1 … 130.0 s	Output 1rEG cycle time 0.1 … 130.0 s
Integral action time OFF … 9999 s	Output 2rEG cycle time 0.1 … 130.0 s
Derivative action time OFF … 9999 s	Integral action time OFF … 9999 s
Fuzzy Overshoot Control 0.00 … 2.00	Derivative action time OFF … 9999 s
	Fuzzy Overshoot Control 0.00 … 2.00
	Prat: Ratio between cooling power and heating power

The parameter **Fuzzy Overshoot Control** permits to avoid the variable overshoots at the start up of the process or at the changing of the Set Point.

PID CONTROL for motorized actuators

This kind of control it's used to control the plants equipped with motorised actuators, with opening and closing controls and that without commands remain in the reached point. This kind of action can happen only when the instruments has both control outputs, so that from one output depends the opening command while from other output depends the closing command of the actuator. This type of control works on the outputs 1rEG and 2rEG depending on the active Set Point and on the instrument's PID algorithm with two degrees of freedom. The control system used doesn't need a retraction to establish the actual position of the actuator. When the actuator is not equipped with stroke-end safety contacts, that stop the action at travel end, it's necessary to equip the plant with these stroke-end as shown:



PARAMETERS PROGRAMMING

Proportional band 0 … 9999
Manual reset -100.0 … 100.0%
Integral action time OFF … 9999 s
Derivative action time OFF … 9999 s
Fuzzy Overshoot Control 0.00 … 2.00
Travel time: it's the time needed by the actuator to switch from "all opened" to "all closed" position.
Minimum regulation value: it's the value that the regulation (in %) has to have reached before having effect on the output.
Positioning at Switching on: it's the position that has to assume the actuator when the instrument is switched on.

AUTOTUNING FUNCTION

This function permits to automatically tune the PID parameters, after the Set Point programming. The calculated values are automatically stored, at the end of the Autotuning cycle, into the PID parameters. That function permits the PID parameters calculation through a tuning cycle FS type and, at the end of this operation, the parameters are stored into the instrument's memory and remain constants during the control. The Autotuning cycle duration has been limited at 12 hours maximum.

SELFTUNING FUNCTION

It's an algorithm that permits to calculate the PID parameters during the control. It has the meaning to correct the control errors caused by the process variations. It's type **rule based "TUNE-IN"** and automatically works in order to optimise the control.

SOFT-START FUNCTION

That 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, driver by instrument, could be damaged by power too high supplied when the application is not yet in the normal rating. When the Soft-Start is active, it's not possible to execute the Autotuning, because it may gives an excessive power.

LIMITING FUNCTION OF CONTROL POWER

It allows to limit the control power in separate way on the two control outputs within a minimum and maximum limit . The use of this function is possible only in the single and double action PID control mode and serves to contain some mechanical problems of the actuators(i.e. valves that don't open thin to a certain power threshold). The limiting function is not active when the control is in manual mode.

SPEED LIMITING FUNCTION OF CONTROL POWER VARIATION

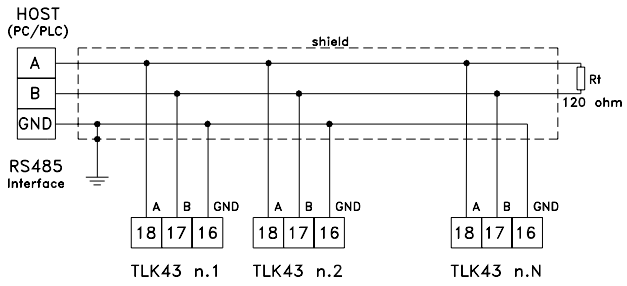
It allows to limit the variation speed of the control power in exit, in separate way for the two control outputs; it is active only for the single and double action PID control mode and it is useful for the actuators that need a slow but progressive variation of power. The limiting function is not active when the control is in manual mode.

SPLIT RANGE FUNCTION

It allows to delay or to anticipate the intervention of two actuators controlled by the same instrument, so that their actions doesn't overlap or overlaps thin to mix the actions of both. In practice two offsets of power are planned, one for the direct action and one for that inverse, they establish the beginning of the intervention of the actuator controlled by the related output.

RS 485 SERIAL INTERFACE

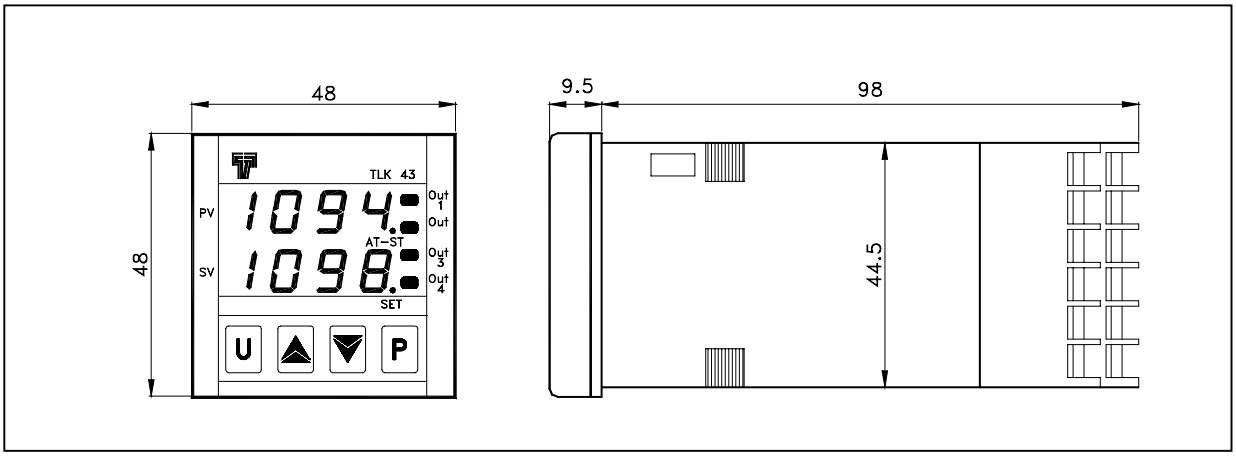
The serial interface RS 485 permits to connect the instrument into a net on which are presents regulators or PLC all depending typically on a supervisor. Through this system it's possible to centralise all the information, to modify the working conditions, to store data. The software protocol adopted is a derivative from the MODBUS RTU or JBUS protocol (AEG Schneider Automation, Inc. Trade Mark)



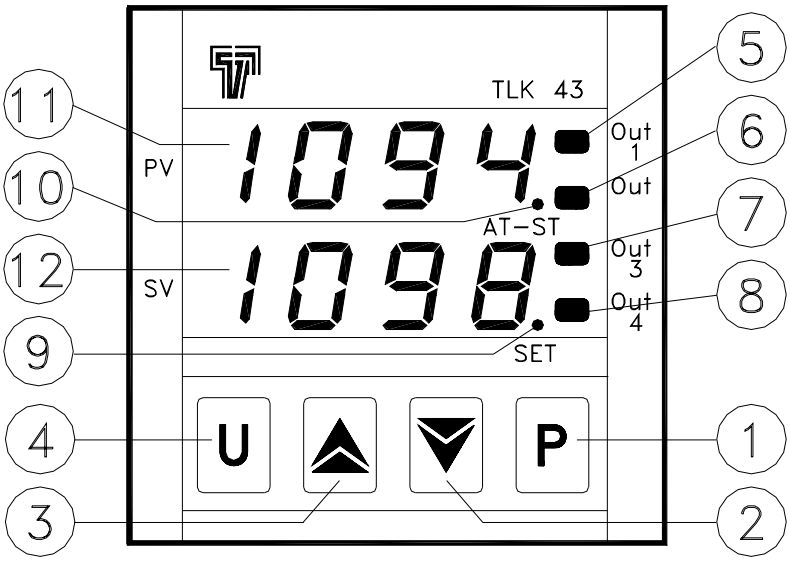
ADVANTAGES FOR THE USERS

- To monitor and store all the variables and alarms of the plant managed by the instruments
- To create and print tables and graphics relative to the historical trend of the measured variables
- To modify the Set Point value and the parameters programming
- To operate remotely as well as locally
- To link up to 32 instruments on the same line

MECHANICAL DIMENSIONS (mm)



FRONT PANEL DESCRIPTION



1 - Key P It's used to get into the parameters programming and to confirm the programmed parameter.

2 - Key DOWN In the programming phase, it decreases of one unit the figure on which it's located the slider. In the normal functioning, it visualises the current measured by input TA HB.

3 – Key UP In the programming phase, it increases of one unit the figure on which it's located the slider. In the normal functioning, it visualises the output control power.

4 – Key U Key with function programmable as: Activate Autotuning and Selftuning functions, swap the instrument into manual control, acknowledge the alarm, change the active Set Point, deactivate the control.

5 – Led OUT1 Lighted, it signalises that output OUT1 is active.

6 – Led OUT2 Lighted, it signalises that output OUT2 is active.

7 – Led OUT3 Lighted, it signalises that output OUT3 is active.

8 - Led OUT4 Lighted, it signalises that output OUT4 is active.

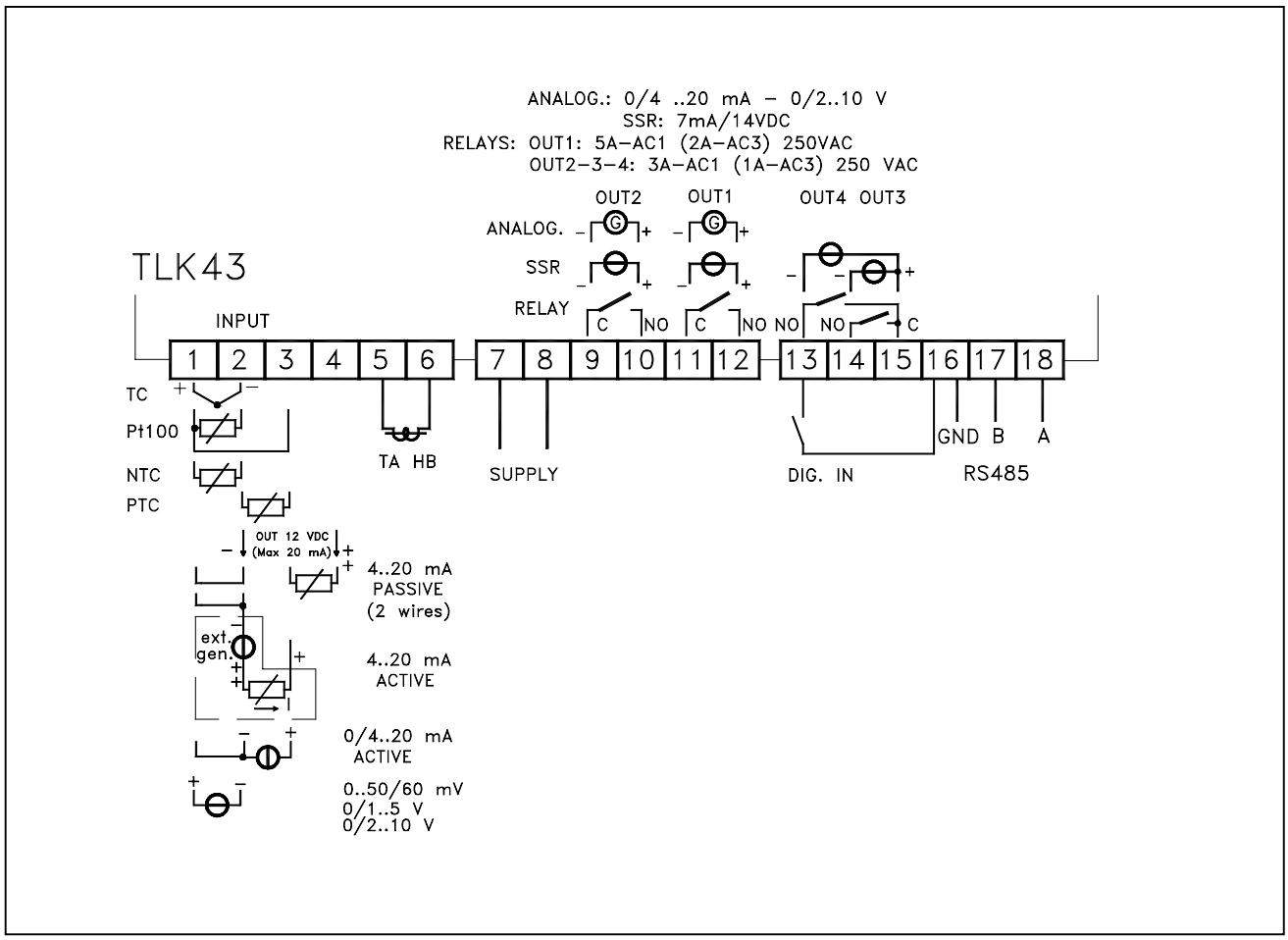
9 - Led SET Lighted, it signalises the input in programming mode.

10 - Led AT/ST If it's flashing, the instrument is executing the AUTO-TUNING. If it's permanently lighted the instrument is executing the SELF-TUNING.

11 – Display PV It signalises the process value.

12 – Display SV It signalises the active Set value, but it's possible visualise other values.

CONNECTIONS DIAGRAM



CERTIFICATIONS AND CONFORMITY

▲ CE Conformity: CEE EMC 89/36 (EN 61326)
CEE LT 73/23 and 93/68 (EN 61010-1)
▲ UL Conformity: File n. E 206847

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