



## DIGITAL P.I.D. THERMOREGULATOR with one output

# EC 4-173

### GENERAL CHARACTERISTICS

- \* Frontal size: 48 x 48 mm.
- \* Power-supply: 230 Vac (standard).
- \* Configuration parameters accessible through Password.
- \* Custom configuration through keyboard (standard) or Personal Computer (on request).
- \* Easy integration with remote-assistance or remote-managing.
- \* 3 digits display, height 12,5 mm.
- \* P.I.D. temperature regulation.
- \* "Auto-tuning" function studied to compute the optimal value of the parameters used during the temperature regulation.
- \* 1 widely configurable temperature alarm.
- \* 1 relay-output (8 A at 250 Vac).

**EC 4-173** is a digital one output **P.I.D. temperature controller** designed to cover a temperature range from 0 to +999 °C, meeting the needs of a wide part of the applications of **accuracy** in heating field.

In factory, the instrument gets set to accept, at the input, "J" (Iron-Constantan) or "K" (Chromel-Alumel) thermocouples and is provided of a **"Auto-tuning"** function activable through a key located on the front panel of the instrument, it is studied to permit the instrument to compute the **optimal value** of the parameters used during the temperature regulation, in order to use them during the conclusive part of the regulation. The SPDT relay-output can manage (up to) 8 A loads at 250 Vac and it is supplied in standard version; as option it is possible to request an output with low-voltage signal, suitable to drive the SSR modules (solid state relay).

The flashing signals on the display have been studied in order to catch user's attention in case of not proper functioning: defective probe, temperature outside the limits permitted by the used probe or corrupted memory-data.

The instrument is provided of one **temperature alarm** that can be disabled, configurable in six different ways of working; the intervention of the alarm determines the appearing on the display of the indication "AL1" alternated to the temperature read by the probe.

## MOUNTING

For a proper mounting take note of the attached indications; be sure that the conditions of use (voltage of power-supply, environment temperature, humidity) are inside the indicated limits.

Do not overload the relay-output keep inside the indicated limits.








**WARNING: the instrument is not protected from overloads; so it is necessary to give the output the suitable protections.**

**The power-supply is protected by an internal fusible.**













## CONFIGURATION

There are two Levels of configuration (Level 2 is protected by Password):



### Level 1

Push  and  at the same time for 4 seconds at least: the parameter **PA** appear on the display.  
 Push  or  to select the parameter to modify at Level 1.  
 Push  and  or  to modify the selected parameter.

### Level 2





From Level 1 push  or  to select the parameter **PA**.  
 Push  and  or  to set "-19".  
 Push  and  at the same time for 4 seconds at least: the first parameter of Level 2 will appear on the display.  
 Push  or  to select the parameter to modify at Level 2.  
 Push  and  or  to modify the selected parameter.


### How to leave CONFIGURATION

Push  and  at the same time for 4 seconds at least or wait 50 seconds at least without operating on the keyboard (exit for time-out) or try to switch the power-supply off and then, switch it on after 1 second at least since the last modify.

## WORKING TEMPERATURE SETTING

In normal operating conditions the instrument displays the value read by the probe.

Push and release the key  to display the actual setpoint value: the led "**out**" flashes to indicate that a procedure of setpoint setting is on run; to change the value operate on the keys  or  within 4 seconds since the pressure on the key .

The exit from the procedure of setpoint setting can be obtained pushing and releasing the key  or waiting 4 seconds at least without operating on the keyboard (exit for time-out).

**NOTES** - the setpoint is programmable within the limits set through the parameters **r1** and **r2**.

## SIGNALS AND ALARMS

The led **"out"**, when lighted, indicates that the output is activated; if it is flashing it indicates that a procedure of setpoint setting is on run.

**"E0"** flashing on the display indicates one of the following defects: not proper kind of probe, defective probe, wrong connection or temperature outside the limits permitted by the used probe; check the value given to the parameter **/0**, the functioning of the probe and the connection between instrument and probe (the output is deactivated).

**"E0C"** flashing on the display indicates a cold junction compensation failure; try to switch the power-supply off and then, switch it on (the output is deactivated).

**"E2"** flashing on the display indicates the failure of memorised configuration-data; try to switch the power-supply off and then, switch it on (the output is deactivated).

**"---**" flashing on the display indicates that during the **"Auto-tuning"** function the instrument has not been able to compute some useful data for the regulation; see **"AUTO-TUNING"** FUNCTION to understand reasons and remedies (the output is deactivated).

If the display shows the temperature read by the probe alternated to the signal **"tun"** it means that an **"Auto-tuning"** function is on run.



If the display shows a proper value alternated to the signal **"AL1"** it means that the temperature read by the probe is outside the limit programmed with the parameter **A1**.

## "AUTO-TUNING" FUNCTION

The "Auto-tuning" function has been studied to permit the instrument to calculate (during the process) the optimal value of the parameters used during the temperature regulation, in order to use them during the conclusive part of the regulation.

Before activating an "Auto-tuning" function it is possible to determine the kind of requested temperature regulation:

- P.I.D. (parameters **PI** and **Pd** > 0)
- P.I. (parameter **PI** > 0 and parameter **Pd** = 0)
- P.D. (parameter **PI** = 0 and parameter **Pd** > 0)
- P. (parameters **PI** and **Pd** = 0).


If the parameter **P2** is programmed at 1, it is possible to activate an "Auto-tuning" function pushing the key  for 4 seconds at least: the display shows the temperature read by the probe alternated to the indication "tun"; the keyboard of the instrument is locked except the key .

The function is essentially based on two phases:


- an initial phase during which the instrument regulates the temperature using the data programmed before the function activation, until the reaching of a threshold depending on the initial environment temperature where the probe has been put and also depending on the setpoint
- a final phase during which the instrument activates the output at its maximum power, it computes the characteristics of the connected load (also according to the controlled system) and determines the optimal value of the parameter **Pb** (**PI** and **Pd** too, if > 0 at the moment of the function activation).

If during the final phase the instrument has been able to compute some useful data for the regulation, the function automatically ends; in this case the instrument continues the temperature regulation using the data computed during the final phase of the function and displaying the temperature read by the probe.

Vice versa, if during the final phase the instrument has not been able to compute some useful data for the regulation, the display shows "---" flashing and the output gets deactivated.

To leave this alarm condition, it is necessary to push the key  for 4 seconds at least or try to switch the power-supply off and then, switch it on: in this case the instrument restores the temperature regulation using the data programmed before the activation of an "Auto-tuning" function (normally an "Auto-tuning" function does not have success because at the moment of its activation the environment temperature where the probe has been put is close to the setpoint or because during the final phase some noises have happened).

### NOTES

- the data computed during an "Auto-tuning" function get memorised by the instrument to be restored at its following start
- an "Auto-tuning" function on run can be deactivated pushing the key  for 4 seconds at least; in this case the instrument restores the temperature regulation using the data programmed before the function activation.

### CONFIGURATION PARAMETERS

	CODE	PARAMETER	DESCRIPTION	MIN.	MAX.	U.M.	ST.
(1)	PA	Password		-99	100	----	----
	/	<b>PROBE</b>					
	/0	kind of probe	10="J" TC; 11="K" TC	10	11	----	*
(1)	/1	calibration (measure offset)		-10	+10	°C	0
	/2	digital filter (speed response) 0=0s; 1=0,4s; 2=1,2s; 3=2,8s; 4=6,0s; 5=12,4s; 6=25,2s		0	6	----	3
	r	<b>TEMPERATURE REGULATOR</b>					
	r1	minimum setpoint admitted		0	+999	°C	0
	r2	maximum setpoint admitted		0	+999	°C	(2)
	P	<b>P.I.D. REGULATOR</b>					
	P0	offset band		-99	+99	°C	0
	PI	integral time		0	999	sec.	100
	P2	Auto-tuning enabling	0=NO; 1=YES	0	1	----	1
	Pb	proportional band		+1	+250	°C	+30
	Pc	P.I.D. cycle time		1	120	sec.	30
	Pd	derivative time		0	250	sec.	35
	A	<b>ALARM</b>					
	A0	alarm hysteresis (differential)		+1	+99	°C	+1
	A1	alarm setpoint		-99	+999	°C	0
	A3	alarm disabling time since instrument power-on		0	999	min.	0
	A4	alarm mode		see TABLE			1
	L	<b>NETWORK CONNECTION</b>					
	L1	instrument address		1	15	----	1
	L2	instrument group		0	7	----	0
	L3	time-out link		2	250	sec.	7
	L4	baud rate		0	3	baud	1

### NOTES

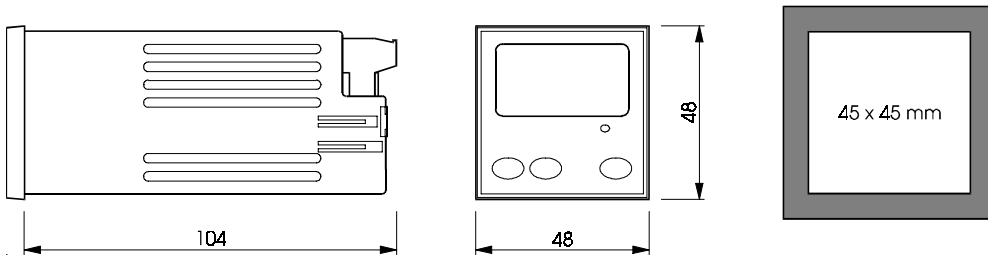
- (\* ) = depends on the kind of probe.
- (1) = configuration parameter present on Level 1.
- (2) = for "J" thermocouples r2 = 700 °C; for "K" thermocouples r2 = 999 °C.

### TABLE

parameter A4	alarm mode
1	disabled
2	absolute minimum alarm
3	absolute maximum alarm
4	minimum alarm relative to setpoint
5	maximum alarm relative to setpoint
6	minimum alarm relative to setpoint with automatic enabling and recompute
7	maximum alarm relative to setpoint with automatic enabling and recompute

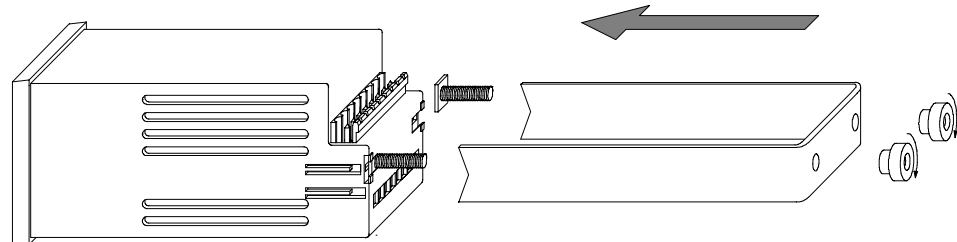
## SIZE AND PIERCING TEMPLATE

Measure in mm.



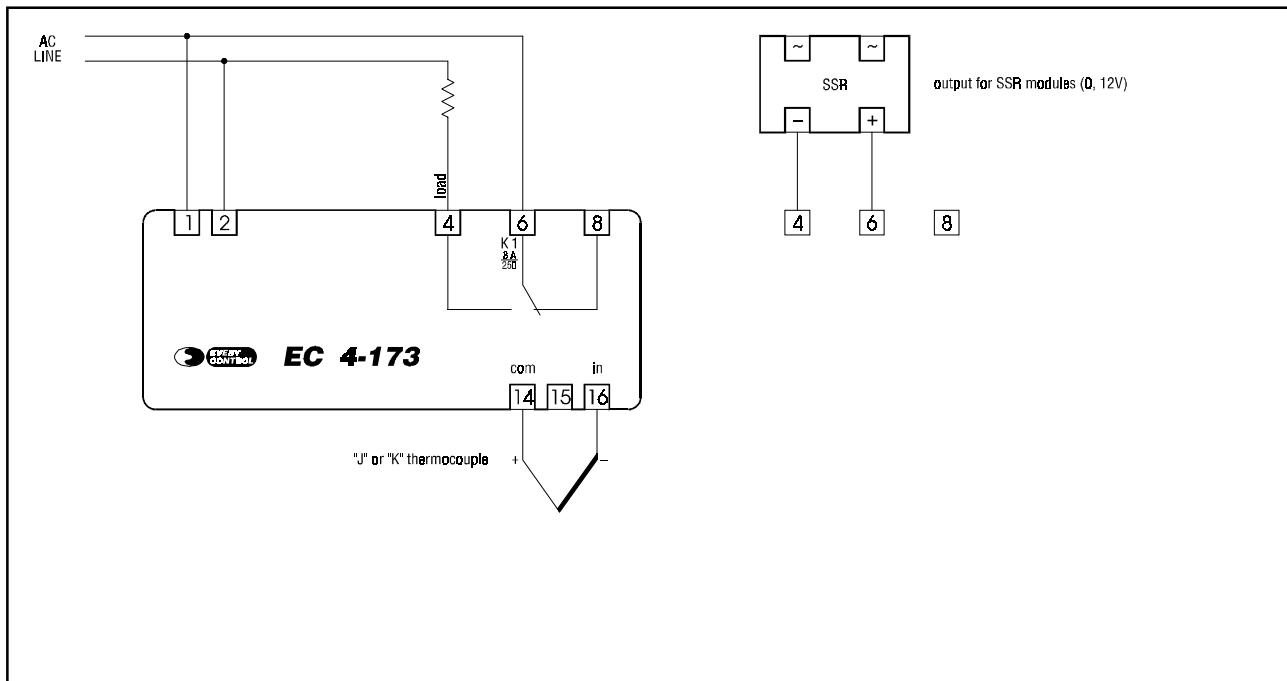
## MOUNTING

With U-bracket.  
The panel thickness will be between 1 and 5 mm.



## ELECTRICAL CONNECTIONS

Example of typical application.



## ELECTROMECHANICAL CHARACTERISTICS

**Case:** self-extinguishing plastic (PPO) black, according to UL94 V-0.  
**Size:** 48 x 48 x 95 mm.  
**Mounting:** panel mounting with U-bracket.  
**Environment temperature:** from 0 to +60 °C.  
**Humidity:** 10 ... 90% not condensing.  
**Connections:** extractable screw connectors.  
**Power-supply:** 230 Vac 50-60 Hz 2 VA (standard); others on request.  
**Insulation class:** II (only with ac power-supply).  
**Inputs for measure:** 1 configurable for "J" or "K" thermocouple.  
**Range of measure:** from -99 to +700 °C ("J" thermocouple); from -99 to +999 °C ("K" thermocouple).  
**Range of regulator programming:** from 0 to +999 °C.  
**Display:** 3 digits display, height 12,5 mm; output status indicator.  
**Resolution:** 1 °C.

**Outputs:** 1 SPDT 8 A/250 Vac relay (K 1).  
**Serial port for data exchange:** TTL with EVCBUS protocol (on request).