AUTOMATISMOS
Control y Programación S.L.U.

MULTIFUNCTION DIGITAL TEMPERATURE CONTROLLER

XCT82R

- Multi-input, configurable by external DIP switch.
- 8 A control relay and 2 alarm relays of 5 A.
- Adjustable temperature range and scale.
- Full PID, 2 autotuning options.
- 2 configurable alarms with 9 operating modes.
- IP65 front protection.



Multi-input digital temperature controller with 2 autotuning functions and full PID. Programmable ramp, temperature offset, programming locks by DIP switches on the side of the unit, etc. Easy access to the temperature and alarm setpoints through direct keys without entering programming, and clear display.

CE

SPECIFICATIONS

Housing	Grey UL94 - V - 0 Polycarbonate
Panel mounting	Snap-in bracket
Size	48mm x 48mm
Weight	210 g
Panel cut-out	45mm x 45mm
Protection	IP65 front
Connector	Undecal connector
Memory	EEPROM (maintenance-free)

POWER SUPPLY

Voltage	24 / 48 / 110 / 230 VAC 50/60 Hz Voltage depending on model
Consumption	2,6 VA

ENVIRONMENTAL CONDITIONS

Operating temperature	- 10º C + 55ºC
Relative humidity	< 85 %

FUNCTIONS

Inputs	RTD: Pt100 (IEC), 2 or 3 wires Thermocouple: J, K and T
Control action	Autotuning (SP or 10% SP) ON – OFF, PID - 2
Alarms	2 alarms with 9 operating modes
Probe break	By maximum and by minimum value
Locks	Setpoint lock Parameter lock

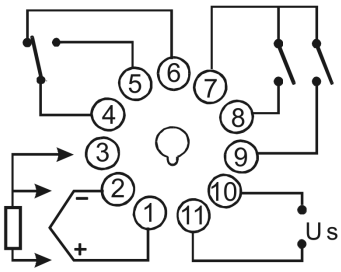
OUTPUT

Output	Control relay + 2 alarm relays
Output relay	1 x SPST 8 A
Alarm relay	2 x SPST 5 A · 1/8 HP 125 VAC / 250 VAC 5 A 30 VDC / 250 VAC resistive

STANDARDS

CE compliance	2014/35/UE ; 2014/30/UE

WIRING DIAGRAM

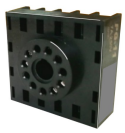


10 - 11	Power supply
1 - 2	Thermocouple
1 - 2 - 3	RTD
7 - 8	Alarm 1
7 - 9	Alarm 2
4 - 5 - 6	Output

ACCESSORIES



SOCKET ZB11-0
Undecal socket for DIN rail



SOCKET PG11
Undecal socket with rear screw



MEMBRANE XAMPDH
Silicone protective membrane 48 × 48 mm



BLANKING COVER TC11
Blanking cover for 48 × 48 mm panel cut-out

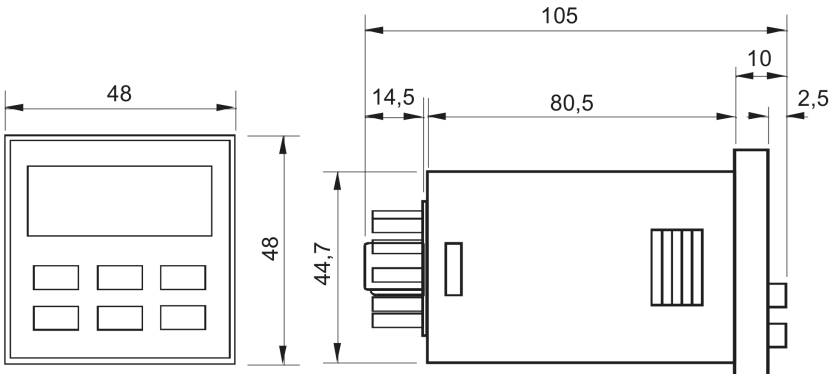
ORDERING CODES

XCT82 R / S

R	Relay control output · 1 x SPST 8 A
S	SSR control output (terminals 4 +, 5 −)

E.g.: XCT82R · controller with relay output · XCT82S · controller with SSR output

DIMENSIONS



OPERATING OPTIONS

DIP switch changes must always be made with the unit disconnected from the mains, proceeding as indicated below. The numbers shown represent each of the switches. See fig. 8.



Fig. 8

1	**INPUT TYPE SELECTION**	
	DIP 1 ◄ DIP 2 ► **RTD PT100 (IEC)** DIP 1 ► DIP 2 ◄ **THERMOCOUPLE**	
2	The remaining options must not be used because they cause a MEASUREMENT ERROR. Once the input type has been selected, the probe type must be selected with the SENS parameter in the parameter menu.	
3	◄	**PROGRAMMING NOT ALLOWED. In this position no parameter can be changed except the setpoint, which has its own selector.**
	►	**PROGRAMMING ALLOWED. In this position all parameters can be programmed. As before, the setpoint has its own selector.**
4	◄	**DISPLAY OF BASIC PARAMETERS. Only the parameters considered of regular use are displayed: P, I, D, CP, AT1, AT2, ALH1, ALH2, RET, DP and SENS.**
	►	**DISPLAY OF ALL PARAMETERS. All the control parameters of the unit are displayed.**
5	◄	**RESET OF NON-ESSENTIAL PARAMETERS. ON. This function sets the values of the parameters considered non-essential, so that they have no influence on operation. These parameters are ARW, US, LS, SHIFT, SRR and RS.**
	►	**RESET OF NON-ESSENTIAL PARAMETERS. OFF. Allows the non-essential parameters to be changed.**
6	◄	**SETPOINT LOCKED. Prevents the setpoint value from being changed.**
	►	**SETPOINT NOT LOCKED. Allows the setpoint to be changed.**
7	◄	**ON - OFF CONTROL MODE. Selects the ON - OFF operating mode.**
	►	**P.I.D. CONTROL MODE. Selects the P.I.D. operating mode.**

PROGRAMMING

1.- SETPOINT AND ALARM DISPLAY

When the unit is powered, the display shows the process variable PV (red) and the setpoint SV (green). With the SEL keys, alarm 1 and alarm 2 can be displayed, provided that parameters AT1 and AT2 allow it. These parameters select the alarm type and are found in the parameter menu. Pressing the SEL keys alternately returns to the setpoint and process variable display. This procedure is cyclic and bidirectional, as shown in figure 4.

1.1.- SETPOINT (SP)

The setpoint can be changed with the bidirectional SET keys within the limits set by parameters US and LS (upper and lower limit values, respectively). The US and LS values can be changed in the parameter menu as

indicated in section 2.11.

1.2.- ALARM 1 (*)

When AL1 is shown on the display, its value can be changed with the bidirectional SET keys.

1.3.- ALARM 2 (*)

When AL2 is shown on the display, its value can be changed with the bidirectional SET keys.

(*) In operation, when the alarms are activated, point A shown in figure 5 flashes. At the same time, the green display shows the abbreviation A1, A2 or A12, also flashing.

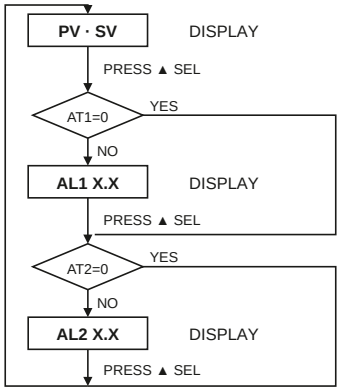


Fig. 4



Fig. 5 · Point A

2.- PARAMETER MENU FOR PID MODE

Before powering the unit, the appropriate operating mode must be selected with DIP no. 7, as indicated in the OPERATING OPTIONS section.

This menu contains the more complex parameters, which must be changed with greater care. Pressing the PROG key shows the % indication. Holding it down for 5 s gives access to the parameter menu. The programming diagram for this mode is in section 5, figure 6.

2.1.- CONTROL PERCENTAGE

The first indication shown is the percentage of the control output. This value cannot be changed and only reflects the internal calculation of the unit, according to the working conditions. The symbol is %.

2.2.- AUTOTUNING

This automatic function calculates and sets parameters P, I, D according to the analysed system. When the process ends, the unit starts the appropriate control. Before running this function, the other parameters must be selected. This parameter allows three settings: 0, 1, 10.

0	No autotuning is performed.
1	Autotuning based on the setpoint.
10	Autotuning based on 10% below the setpoint. While the unit performs this function, point A shown in figure 5 flashes. At the same time, the red display shows the abbreviation Atn, also flashing.

2.3.- PROPORTIONAL BAND

Shown with 4 digits, three of them integers, indicating the value of the action band in degrees. A high P value tends to give slow control but without overshoot. Conversely, a low P value tends to control quickly but with overshoot. This value is limited to 600.0 degrees.

2.4.- INTEGRAL (I) (reset)

This parameter is expressed in seconds and indicates how often the integral factor changes the control output, according to the error. The lower the integral value, the more frequent the effect of the integral factor on the output. This parameter is limited to 3600 seconds.

2.5.- DERIVATIVE (D)

This parameter is expressed in seconds and indicates how effectively a drop or rise in temperature is corrected, taking into account its slope. The higher the value, the greater the effect. Special care must be taken when selecting the derivative parameter, since an excessive value may cause an undesired oscillation around the setpoint. Like the integral, this value is limited to 3600 seconds.

2.6.- MANUAL RESET (BIAS)

When the selected integral is zero, a new parameter called BIAS, or manual reset, appears. It is a percentage value that is added to the value generated by the control system. When a zero integral is selected, the initial BIAS value is 50%, which can be freely changed according to the working conditions.

2.7.- CYCLE TIME (CP)

Indicates how often the output action takes place. It can be programmed from 1 to 99 seconds. The shorter the action time, the more effective the control; however, when the system output uses a relay, its electromechanical life must be taken into account and the time should be programmed as long as possible.

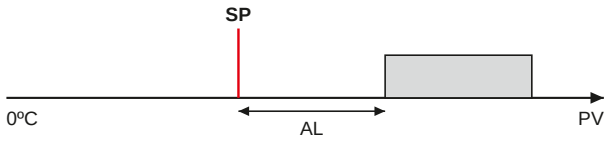
2.8.- ANTI-RESET WINDUP

A parameter that improves the PID system of previous generations. It controls the integral action at the right moment to avoid overshoot. Initially this parameter is set to 100%, which means that the integral factor is allowed during the whole control process. Any reduction of this parameter limits the integral action, avoiding the overshoot mentioned above. Experimentally, once the behaviour of the system is known, a correct value for this parameter is a percentage approximately equal to twice the output percentage.

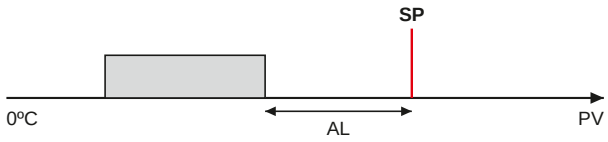
2.9.- AT1 ALARM 1 TYPE, AT2 ALARM 2 TYPE

These parameters set the type of each alarm independently. Any combination of alarm types is possible. There are 10 positions (0 to 9); option zero disables alarm 1 or 2. The other settings (1 to 9) correspond to the descriptions below.

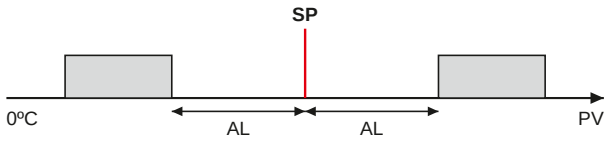
1 High alarm relative to the setpoint (activates above the alarm value).



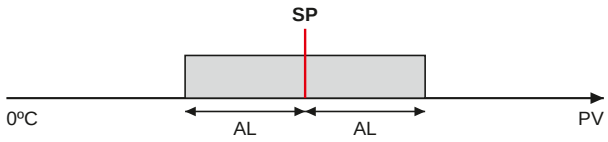
2 Low alarm relative to the setpoint (activates below the alarm value).



3 Symmetrical alarm relative to the setpoint (activates above and below the high and low alarm values).



4 Inverted symmetrical alarm relative to the setpoint (activates between the high and low alarm values).



5 High alarm relative to the setpoint with standby sequence. Same operating diagram as alarm type 1.

6 Low alarm relative to the setpoint with standby sequence. Same operating diagram as alarm type 2.

7 Symmetrical alarm relative to the setpoint with standby sequence. Same operating diagram as alarm type 3.

8 Absolute high alarm.



9 Absolute low alarm.



2.10.- ALH1 / ALH2. ALARM HYSTERESIS

These parameters set the hysteresis of each alarm. The minimum value is 0.1, to prevent the alarm from tripping repeatedly.

2.11.- US / LS. SETPOINT UPPER AND LOWER LIMITS

These parameters limit the maximum and minimum setpoint values. When the sensor type is selected, the unit automatically sets the maximum and minimum allowed values, as shown in the sensor table in section 2.17.

2.12.- SHIFT. PROCESS VARIABLE (PV) OFFSET

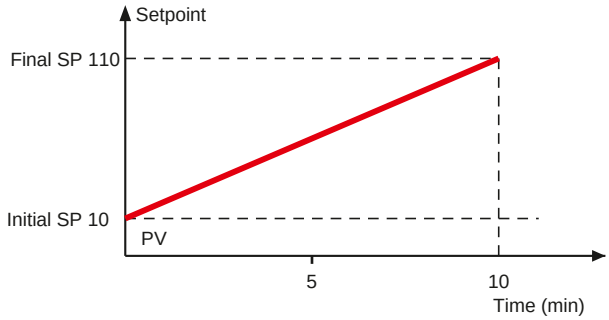
A value in degrees that modifies the process variable (PV) reading.

2.13.- RET. AUTOMATIC EXIT FROM THE PARAMETER MENU

Selects the time after which the unit leaves the display and programming of the parameter menu. The timing starts when the user stops operating the unit. If RET=0 is selected, the automatic exit is disabled.

2.14.- SRR. SETPOINT RAMP RATE

This parameter is set in degrees per minute. It allows the control point to be approached without overshoot. The controller always shows the real setpoint, but internally it works with a setpoint that depends on the temperature measured when the ramp starts, the value set in SRR and the time elapsed since the ramp started. In this way the temperature rises gradually, following a preset slope.



Example: a ramp of 10 ºC/min means that 10 minutes are needed to go from 10 ºC to 110 ºC, assuming that 10 ºC is the initial temperature (initial setpoint) and the setpoint is 110 ºC.

2.15.- RS. RAMP START SELECTION

Sets the conditions under which the setpoint ramp is executed.

RS=0	The ramp only takes place if the setpoint is changed, provided that the SRR value is not zero.
RS=1	The ramp takes place when the unit is powered and in the situation described above.

2.16.- DP. DECIMAL POINT SELECTION

When working with Pt100 and T sensors in degrees Celsius and Fahrenheit, the temperature is shown with 3 integer digits and one decimal. When the J sensor is used in degrees Celsius, the display is the same. In the other cases no decimals are shown. With the DP parameter the decimal digit can be removed by selecting DP=0. Otherwise, with DP=1, the temperature is shown with decimals where applicable.

2.17.- SENS. SENSOR TYPE AND WORKING UNIT SELECTION

Selects the sensor and, at the same time, the working unit to be used. Remember that DIP 1 and 2 must be set correctly, as indicated in the OPERATING OPTIONS section. The available settings are shown in the following table:

TEMPERATURE SENSOR	TEMPERATURE RANGE	
	ºC	ºF
PT100 (IEC)	- 199,9 to 700,0	- 199,9 to 999,9
J	- 99,9 to 900,0	- 100 to 1500
T	- 199,9 to 400,0	- 199,9 to 700,0
K	- 200 to 1300	- 300 to 2300

3.- PARAMETER MENU IN ON – OFF MODE

Before powering the unit, the appropriate mode must be selected with DIP no. 7, as indicated in the OPERATING OPTIONS section.

This menu contains the more complex parameters, which must be changed with greater care. Pressing the PROG key shows the % indication. Holding it down for 5 seconds gives access to the parameter menu. The programming diagram for this mode is in section 5, figure 7.

3.1.- CONTROL PERCENTAGE

The first indication shown in this menu is the percentage of the control output. This value cannot be changed and only reflects the internal calculation of the unit, according to the working conditions. It shows 0% or 100% depending on the ON – OFF control state. The symbol is %.

3.2.- HYS. SETPOINT HYSTERESIS

A parameter relative to the setpoint that sets the value at which the output switches off. The minimum value is 0.1, to prevent the output from switching repeatedly. The other parameters are: AT1, AT2, ALH1, ALH2, SHIFT, RET, DP and SENS. They work exactly as described in section 2.

4.- ERROR MESSAGES

When the unit is powered, it first shows for a few seconds the selected probe and unit, and then the operating mode in use. After that, the process variable (PV) and the setpoint (SV) should appear. If not, an error message will be shown:



If this error appears, check the following:

1. Check the position of DIP 1 and 2.
2. Check that the probe has been selected correctly, as described in section 2.17.
3. Check the connection of the probe to the terminals according to the wiring diagram.
4. Check the link between terminals 2 and 3 of the terminal block in the case of an RTD.



If this error appears, check the following:

1. Check that the ambient operating temperature of the unit does not exceed 60 ºC or fall below –10 ºC.
2. If a thermocouple has been selected, the link between terminals 2 and 3 of the terminal block, used for RTDs, must be removed.

5.- PROGRAMMING DIAGRAMS

PARAMETER MENU FOR P.I.D.

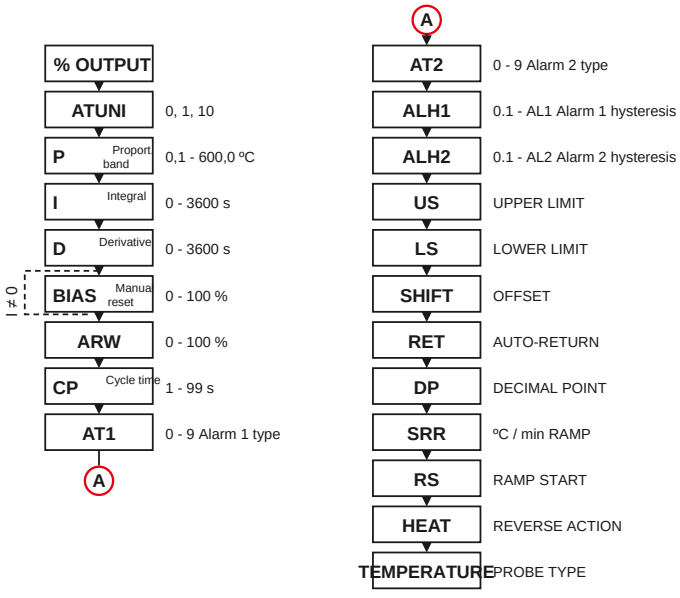


Fig. 6

PARAMETER MENU FOR ON – OFF MODE

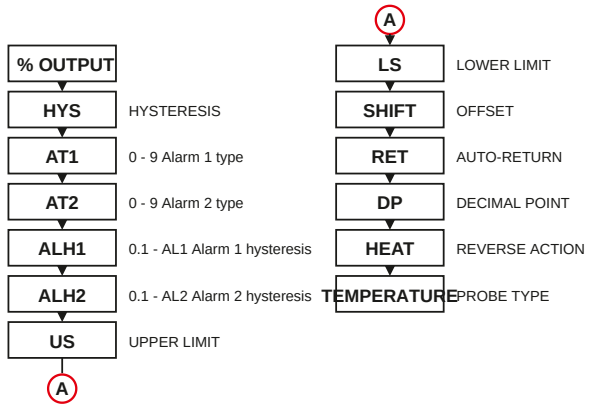


Fig. 7