Pixsys®
ELECTRONICS

# ATR 121

## Controller / Regolatore


User manual / Manuale d'uso

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# Introduction

Thank you for choosing a Pixsys controller.
Versions with three digits display are available and the device fits a wide range of applications with the most diverse sensors like temperature/humidity/pressure sensors or linear potentiometers.
Output options include both relay and SSR logic, but it is possible to configure the unit also as indicator for installations that do not require control or alarm ouputs.

PID and Autotune allow to adapt the regulation algorithm to the installation , while LATCH ON function speeds up the device calibration when linear potentiometers are used.

As on the latest Pixsys instrumentation, the configuration is further simplified by the Memory cards which are provided with internal battery and therefore do not require cabling to power the controller.

# 1 Safety guidelines

Read carefully the safety guidelines and programming instructions contained in this manual before connecting/ using the device.
Disconnect power supply before proceeding to hardware settings or electrical wirings to avoid risk of electric shock, fire, malfunction.
Do not install/operate the device in environments with flammable/explosive gases.
This device has been designed and conceived for industrial environments and applications that rely on proper safety conditions in accordance with national and international regulations on labour and personal safety. Any application that might lead to serious physical dama ge/ life risk or involve medical life support devices should be avoided.
Device is not conceived for applications related to nuclear power plants, weapon systems, flight control, mass transportation systems.
Only qualified personnel should be allowed to use device

and/or service it and only in accordance to technical data listed in this manual.
Do not dismantle/modify/repair any internal component.
Device must be installed and can operate only within the allowed environmental conditions. Overheating may lead to risk of fire and can shorten the lifecycle of electronic components.

## 1.1 Organization of safety notices

Safety notices in this manual are organized as follows:

| Safety notice | Description |
|---|---|
| **Danger!** | Disregarding these safety guidelines and notices can be life-threatening. |
| **Warning!** | Disregarding these safety guidelines and notices can result in severe injury or substantial damage to property. |
| **Information!** | This information is important for preventing errors. |

## 1.2 Safety Precautions

| | |
|---|---|
| This product is UL listed as open type process control equipment. | **Danger!** |
| If the output relays are used past their life expectancy, contact fusing or burning may occasionally occur.<br>Always consider the application conditions and use the output relays within their rated load and electrical life expectancy. The life expectancy of output relays varies considerably with the output load and switching conditions. | **Danger!** |
| Loose screws may occasionally result in fire.<br>For screw terminals of relays and of power supply, tighten screws to tightening torque of 0,5 Nm. | **Warning!** |

| | |
|---|---|
| A malfunction in the Digital Controller may occasionally make control operations impossible or prevent alarm outputs, resulting in property damage. To maintain safety in the event of malfunction of the Digital Controller, take appropriate safety measures, such as installing a monitoring device on a separate line. | **Warning!** |

## 1.3 Precautions for safe use

Be sure to observe the following precautions to prevent operation failure, malfunction, or adverse affects on the performance and functions of the product. Not doing so may occasionally result in unexpected events. Do not handle the Digital Controller in ways that exceed the ratings.

- The product is designed for indoor use only. Do not use or store the product outdoors or in any of the following places.
  - Places directly subject to heat radiated from heating equipment.
  - Places subject to splashing liquid or oil atmosphere.
  - Places subject to direct sunlight.
  - Places subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).
  - Places subject to intense temperature change.
  - Places subject to icing and condensation.
  - Places subject to vibration and large shocks.
- Installing two or more controllers in close proximity might lead to increased internal temperature and this might shorten the life cycle of electronic components. It is strongly recommended to install cooling fans or other air-conditioning devices inside the control cabinet.
- Always check the terminal names and polarity and be sure to wire properly. Do not wire the terminals that are not used.
- To avoid noise, keep the controller wiring away from power cables that carry high voltages or large currents.

Also, do not wire power lines together with or parallel to Digital Controller wiring. Using shielded cables and using separate conduits or ducts is recommended. Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component). When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the Digital Controller. Allow as much space as possible between the Digital Controller and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.

- A switch or circuit breaker must be provided close to device. The switch or circuit breaker must be within easy reach of the operator, and must be marked as a disconnecting means for the controller.
- The device must be protected by a fuse 1A.
- Wipe off any dirt from the Digital Controller with a soft dry cloth. Never use thinners, benzine, alcohol, or any cleaners that contain these or other organic solvents. Deformation or discoloration may occur.
- The number of non-volatile memory write operations is limited. Therefore, use EEprom write mode when frequently overwriting data.

## 1.4 Environmental policy / WEEE

Do not dispose electric tools together with household waste material.
According to European Directive 2012/19/EU on waste electrical and electronic equipment and its implementation in accordance with national law, electric tools that have reached the end of their life must be collected separately and returned to an environmentally compatible recycling facility.

# 2 Model identification

| | |
|---|---|
| ATR121-AD | 12..24Vac ±10% 50/60Hz<br>12..35Vdc |
| ATR121-B | 230 Vac ±10% 50/60 Hz (galvanical isolation 2500V) |

# 3 Technical features

## 3.1 General features

| | |
|---|---|
| Display | 3 displays (0,56 inch) on ATR121<br>+ 3 leds (**OUT1**, **OUT2** , **L1**) |
| Environmental conditions | Temperature 0-45 °C, Humidity 35..95 uR% (without condense)<br>Max. altitude: 2000m |
| Sealing | Front panel: IP54 (IP65 with gasket) - Box: IP30 - Terminals: IP20 |
| Material | Polycarbonate UL94V2 self-extinguishing |
| Weight | Approx. 100 gr. |
| Power consumption | ATR121-B: 3 VA max<br>ATR121-AD: 2,4 VA max |

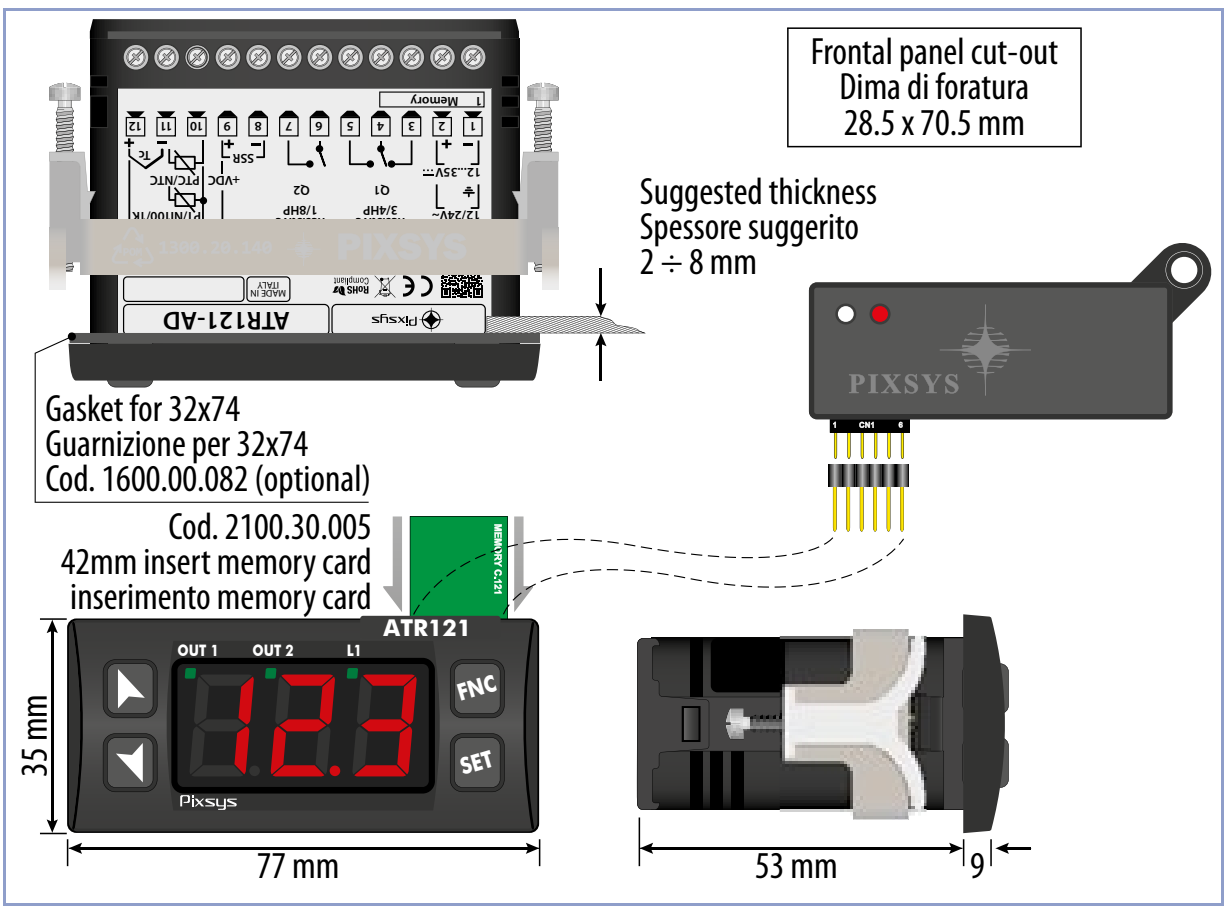
# 4 Hardware features

| | | |
|---|---|---|
| Analogue inputs | **AN1**. Configurable via software.<br>**Thermocouple type**: K, S, R, J.<br>**Thermoresistance**: PT100, PT500, PT1000, Ni100, PTC1K, NTC10K (β 3435K).<br>**Linear**: 0-10V, 0-20 or 4-20mA, 0-40mV<br>**Potentiometers**: 6KΩ, 150KΩ, | Acuracy: Ris. 16bit.<br>**For Thermocouple:** @25°C ±0,5% (full scale) or ± 1 digit, automatic compensation of cold junction from 0°C to 50°C.<br>For linear input: 0/4..20mA: 30000 points, 0..10V: 40000 points.<br>For potentiometers: 40000 points<br>**Impedance**:<br>**0-10V**: Ri>110KΩ<br>**0-20mA**: Ri<5Ω<br>**4-20mA**: Ri<5Ω |
| Relay outputs | **2** relays (ATR121-AD-B)<br>Configurable as command and/or alarm output | Contacts:<br>**Q1**: 8A-250V~ for resistive loads<br>**Q2**: 5A-250V~ for resistive loads |
| SSR output | 1 SSR Configurable as command output and/or alarm output. | For ATR121-B<br>• 8Vdc/20mA<br>For ATR121-AD<br>• 15Vdc/30mA (if 12Vac)<br>• 30Vdc/30mA (if 24Vac)<br>• If DC supply is used, output voltage is equal to supply voltage with max 30mA. |

## 4.1 Software features

| | |
|---|---|
| Regulation algorithms | ON-OFF with hysteresis.<br>P, PI, PID, PD with proportional time |
| Proportional band | 0..999°C or °F |
| Integral time | 0..999s (0 excludes integral function) |
| Derivative time | 0..999s (0 excludes derivative function) |
| Controller functions | Manual or automatic Tuning, configurable alarm, protection of command and alarm setpoints, heating/ cooling PID function. |

# 5 Dimensions and installation

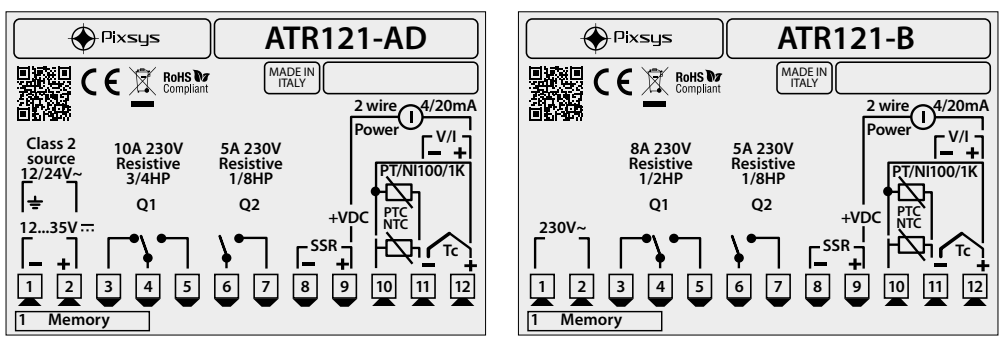


## 5.1 Electrical wirings

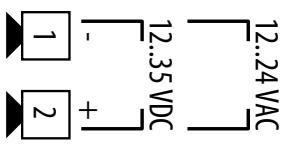
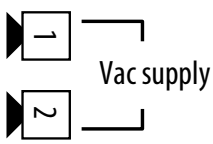
Although this controller has been designed to resist electromagnetic interferences in industrial environments, please observe following safety guidelines:

- Separate control line from power wires.
- Avoid proximity of remote control switches, electromagnetic contactors, powerful engines and in all instances use specific filters.
- Avoid proximity of power groups, especially those with phase control.
- Wiring of pins use crimped tube terminals or flexible/rigid copper wire with diameter 0,2 to 1,5 mm$^2$ (min. AWG24, max. AWG16, operating temperature: min. 70°C). Cable stripping lenght 7 to 8 mm.

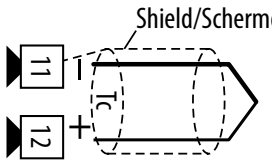
## 5.2 Wiring diagram




### 5.2.a Power supply

| | |
|---|---|
|  | ATR121-AD: Class 2 source<br>12..24Vac ±10% 50Hz/60Hz<br>12..35Vdc (comply with polarity)<br>Use copper conductors only<br>Categoria di sovratensione: II |
|  | ATR121-B:<br>230Vac ±10% 50/60Hz<br>Use copper conductors only<br>Categoria di sovratensione: II |

## 5.2.b AN1 Analogue Input

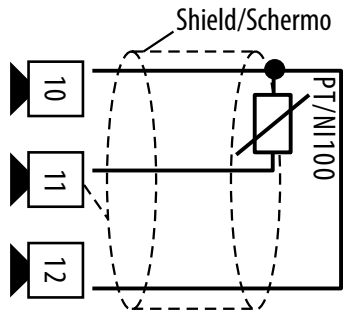



**For thermocouples K, S, R, J.**

- Comply with polarity
- For possible extensions, use compensated cable and terminals suitable for the thermocouples used(compensated)
- When shielded cable is used, it should be grounded at one side only

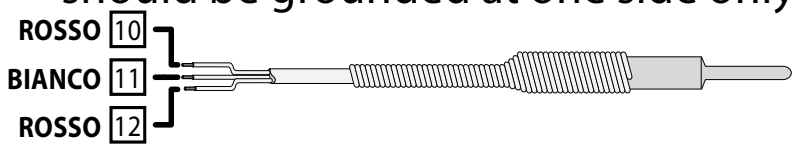
(**only for models: AD**)

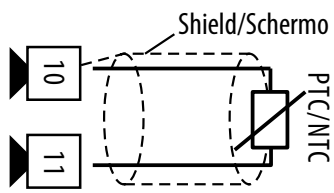
For a correct functioning of the device, use sensors insulated from the ground. Otherwise, use a single transformer isolated for each instrument.




**For thermoresistances PT100, NI100**

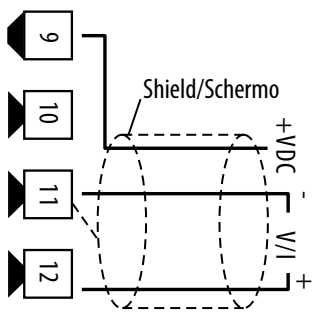
- For the three-wire connection use wires with the same section
- For the two-wire connection short-circuit terminals 10 and 12
- When shielded cable is used, it should be grounded at one side only




**For thermoresistances NTC, PTC, PT500, PT1000 e potentiometers**

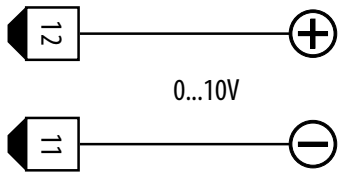
- When shielded cable is used, it should be grounded at one side only to avoid ground loop currents




**For linear signals V/mA**

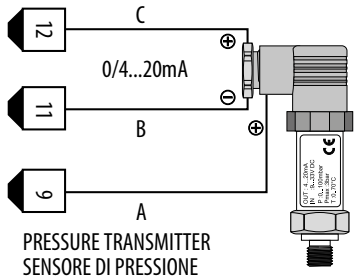
- Comply with polarity
- When shielded cable is used, it should be grounded at one side only

## 5.2.c Examples of connection for linear input




**For signals 0..10V**

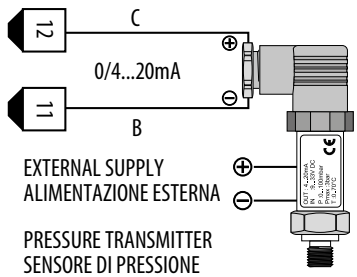
- Comply with polarity




For signals 0/4..20mA with **three-wire sensor**

- Comply with polarity

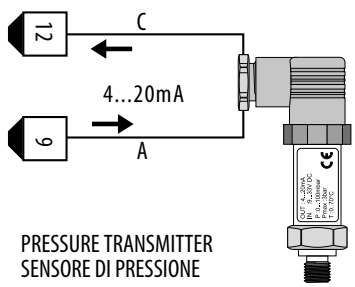
C = Sensor output
B = Sensor ground
A = Sensor power supply (12V/30mA)
Versions AD: 12..24Vdc / 30mA
Versions B: 8Vdc / 20 mA




For signals 0/4..20mA with **external power of sensor**

- Comply with polarity

C = Sensor output
B = Sensor ground

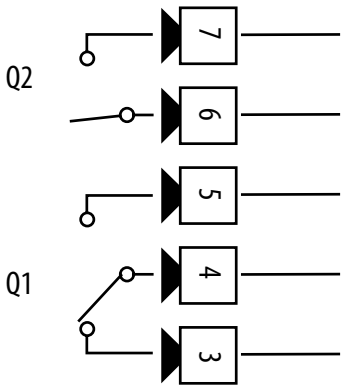



For signals 0/4...20mA with **two-wire sensor**

- Comply with polarity

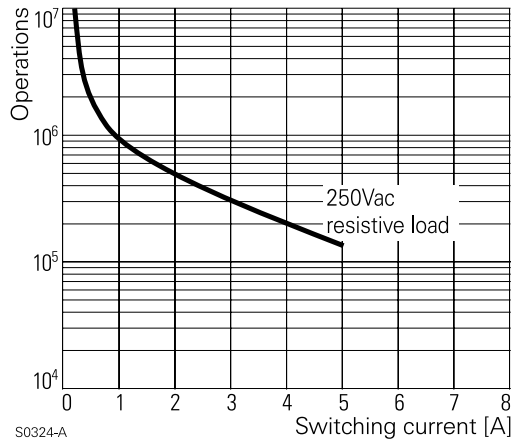
C = Sensor output
A = Sensor power supply
Ver. AD: 12..24Vdc / 30mA
Ver. B: 8Vdc / 20 mA

## 5.2.d Relay outputs

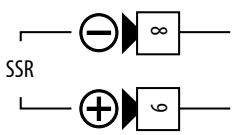



Current ratings:

- **Q1**: 8A, 250Vac, resistive loads, $10^5$ operations
- **Q2**: 5A, 250Vac, resistive loads, $10^5$ operations

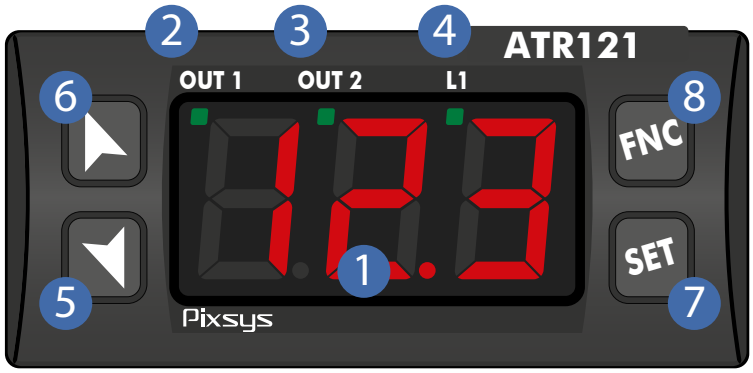



## 5.2.e SSR output




SSR command output 12V/30mA
Ver. AD: 12..24Vdc / 30mA
Ver. B: 8Vdc / 20 mA

# 6 Display and keys functions




## 6.1 Numeric indicators (Display)

| | | |
|---|---|---|
| 1 | 1234 | Normally displays the process. |

## 6.2 Meaning of status lights (Led)

| | | |
|---|---|---|
| 2 | **OUT1** | ON when **command output** is active. When it flashes, display shows the command output setpoint (which can be modified by arrow keys). |
| 3 | **OUT2** | ON when **alarm output** is active. When it flashes, display shows the alarm output setpoint (which can be modified by arrow keys). |
| 4 | **L1** | ON when the controller communicates via serial port. |

## 6.3 Keys

| | | |
|---|---|---|
| 5 | ◥ | • Allows to decrease main setpoint.<br>• During configuration it allows to scroll through parameters and to modify them togheter with **SET**<br>• If pressed after **SET**, it allows to decrease the setpoints (command with OUT1 flashing/ alarm with OUT2 flashing). |
| 6 | ◣ | • Allows to increase main stepoint.<br>• During configuration it allows to scroll through parameters and to modify them togheter with **SET**.<br>• If pressed after **SET**, it allows to increase the setpoints (command with OUT1 flashing/ alarm with OUT2 flashing). |
| 7 | **SET** | • If pressed once it allows to visualize the command setpoint.<br>• If pressed twice it allows to visualize the alarm setpoint.<br>• Allows to modify configuration parameters. |
| 8 | **FNC** | • Allows to run the manual Tuning function.<br>• Allows to enter/exit from configuration. |

# 7 Controller functions

## 7.1 Modifying main setpoint and alarm setpoint values

Setpoint value can be changed by keyboard as follows:

| | Press | Display | Do |
|---|---|---|---|
| 1 | ▲ ▼ or **SET** | Display shows the command setpoint and OUT1 flashes. | Increase or decrease the main setpoint value. Afer 4s display shows the process. |
| 2 | Press twice **SET** | Display shows the alarm setpoint and OUT2 flashes. | Increase or decrease the alarm setpoint value. After 4s display shows the process. |

# 8 Tuning

Tuning procedure allows to calculate PID parameters to obtain a optimal regulation. It means a stable control of temperature/process on setpoint without fluctuations and fast response to deviations from setpoint caused by external noises.

Tuning procedure includes calculation and setting of the following parameters:

- **Proportional band** (system inertia, in °C for temperature).
- **Integral time** (system inertia expressed in time).
- **Derivative time** (defines the intensity of the controller reaction to the variation of the measured value, normally ¼ of integral time). During Tuning procedure, it is not possible to change the setpoint.

## 8.1 Auto-tune

Tuning procedure calculates the controller parameters, can be manual/automatic according to selection on par. 27 tun.

## 8.2 Manual tuning

Manual procedure allows the user greater flexibility to decide when to update PID algorithm parameters. It can be enabled selecting Man on par. 27 tun.

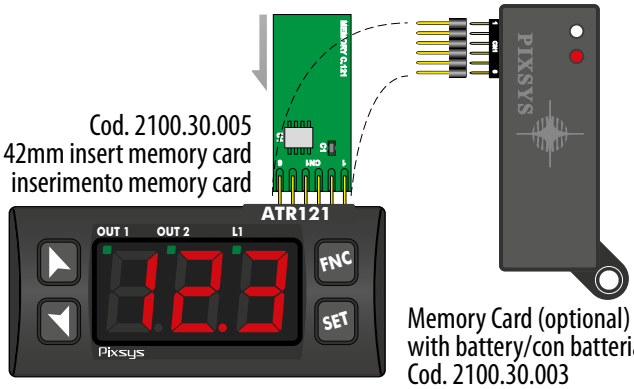
**Tuning launch:** press **FNC**, display shows t.oF, pressing ▶ it visualizes process value and tun (alternately) up to procedure completion (it can take some minutes). To cancel procedure press **FNC** and after ◀ to select t.oF.

## 8.3 Automatic tuning

Automatic tuning activates whenever the controller is switched on or when the setpoint is modified to a value over 35%. It can be enabled selecting AUt on par. 27 tun.

To exit Tuning and keep P.I.D. values unchanged, press **FNC** then ◀ to select t.oF.

## 8.4 Memory card (optional)




Parameters and setpoint values can be duplicated from one controller to another using the Memory card.

2 modes are available:

- **With the controller connected to the power supply:** Insert the memory card **when the controller is off**. At starting display shows (**only if the correct values are saved in the memory card**). Pressing ▶ display shows M-Ld. Confirming with **FNC**, the controller loads the new data and starts again. Pressing ◀ display shows M-no and the controller starts keeping values unchanged.

- **With the controller not connected to power supply:**
  The memory card is equipped with an internal battery with an autonomy of about 1000 operations (button battery 2032, replaceable). Insert the memory card and press the programming button .
  When writing the parameters, the led turns red and on completing the procedure it turns green. It is possible to repeat the procedure without any particular attention.
  **NB**: it is not possible to transfer parameters to a device with different code: red LED is ON.

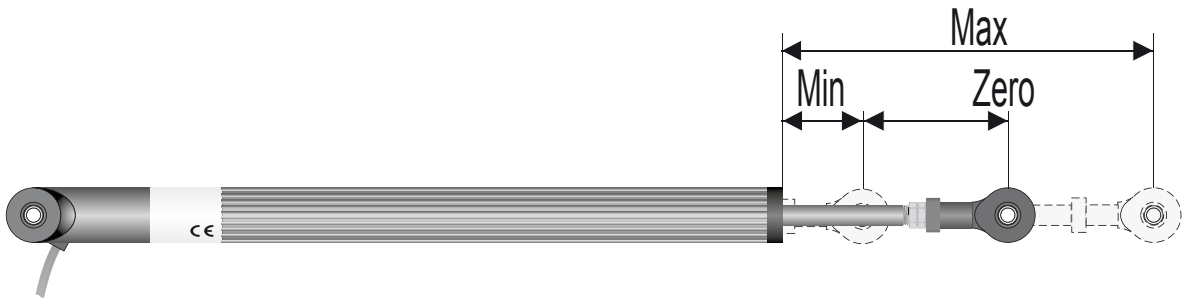
**Updating Memory Card**
Insert memory card when controller is on, to copy parameters. Enter configuration and change at least one parameter. Exit configuration. Changes are saved automatically.

## 8.5 Latch ON function

For use with input Pot (potentiometer ≤ 6K) and Pot2 (potentiometer ≤150K ) and with linear inputs (0..10Volt, 0/4..20mA), it is possible to associate start value of the scale (par. Lo. n.) to the minimum position of the sensor and value of the scale end (par. Hi. n.) to the maximum position of the sensor.
It is also possible to fix the point in which the controller will display 0 (however keeping the scale range between Lo. n. and Hi. n. ) using the *"virtual zero"* option by setting u.0m or u.0s on par. 8 LAt.
If u.0S is SELECTED, Ithe virtual zero will reset after each activation of the device; with u.0N, the virtual zero remains fixed once tuned. To use the LATCH ON function configure according to required operation the par. 8 LAt. The tuning procedure starts by exiting the configuration after changing the parameter.

For the calibration procedure refer to the following table:

| | Press | Display | Do |
|---|---|---|---|
| 1 | **FNC** | Exit parameters configuration. Device visualizes alternately process and LAt | Place the sensor on minimum operating value (associated with Lo. n) |
| 2 | ◀ | Set the value on minimum. Display shows LoU | Place the sensor on maximum operating value (associated with Hi. n) |
| 3 | ▶ | Set the value to maximum. The display shows HiG | To exit standard procedure press . For *"virtual zero"* settings place the sensor on the zero point. |
| 4 | **SET** | Set the virtual zero value. Display shows uir<br>N.B.: For selection of u.05 the procedure in point 4 should be followed on each re-activation. | To exit procedure press **FNC**. |

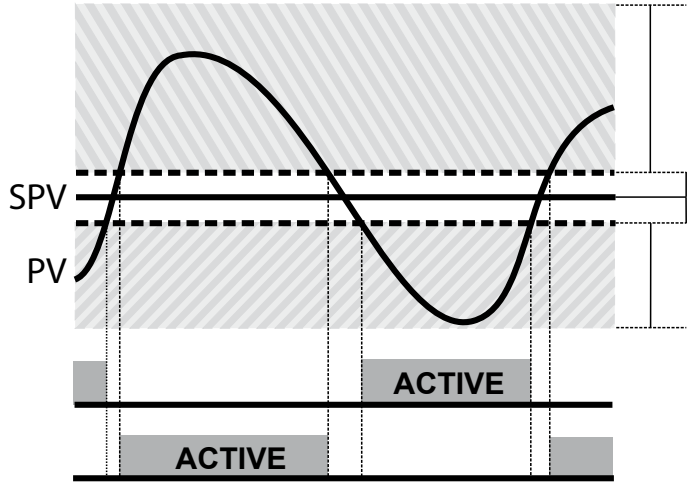
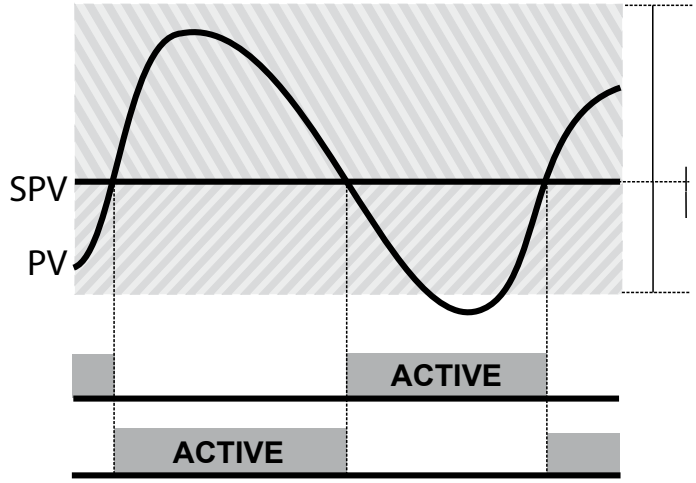
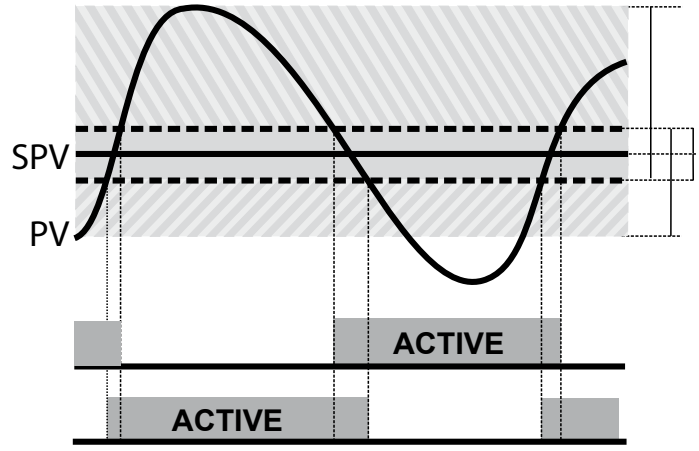


## 8.6 Dual action Heating-Cooling

The ATR121/141 is suitable also for systems requiring a combined heating-cooling action. Command output must be configured as Heating PID (par.11 rEG. = HEA and par. 15 P.b. greater than 0), and one of the alarm must be configured as cooling action (par. 19 AL. = coo. Command output must be connected to the actuator responsible for heating action while the alarm output will control cooling action.

- **Parameters to configure for the Heating PID are:**
  rEG. = HEA Command output type (Heating)
  P.b.: Heating proportional band
  t.i.: Integral time of heating and cooling
  t.d.: Derivative time of heating and cooling
  t.c.: Heating time cycle

- **Parameters to configure for the Cooling PID are:**
  AL. = coo: Alarm selection as cooling
  P.b.M: Proportional band multiplier
  ou.d: Overlapping/Dead band
  t.c.2: Cycle time for cooling output
  Parameter P.b.M (that ranges from 1.00 to 5.00) determines the proportional band of cooling basing on the formula:
  **Cooling proportional band** = P.b. * P.b.M
  This gives a proportional band for cooling which will be the same as heating band if P.b.M = 1.00, or 5 times greater if P.b.M = 5.00.
  **Integral time and derivative time** are the same for both actions.
  Parameter ou.d determines the overlapping percentage between the two actions. For systems in which the heating and cooling output must never be simultaneously active a dead band (ou.d ≤ 0), can be configured, and viceversa an overlapping (ou.d > 0):

| | |
|---|---|
| 1 |  <br>P.b x P.b.M = **COOL**<br>ou.d.b. < **0**<br>P.b (**HEAT**)<br>COMMAND OUTPUT (**HEAT**)<br>ALARM OUTPUT (**COOL**) |
| 2 |  <br>P.b x P.b.M = **COOL**<br>ou.d.b. = **0**<br>P.b (**HEAT**)<br>COMMAND OUTPUT (**HEAT**)<br>ALARM OUTPUT (**COOL**) |
| 3 |  <br>P.b x P.b.M = **COOL**<br>ou.d.b. > **0**<br>P.b (**HEAT**)<br>COMMAND OUTPUT (**HEAT**)<br>ALARM OUTPUT (**COOL**) |

Parameter t.c.2 has the same meaning of the cycle time t.c. for heating. Parameter co.F (cooling fluid) pre-selects the proportional band multiplier P.b.M and the cooling PID cycle time t.c.2 basing on the type of cooling fluid:

| co.F | Cooling fluid type | P.b.n | t.c.2 |
|---|---|---|---|
| Air | Air | 1.00 | 10 |
| oil | Oil | 1.25 | 4 |
| H2o | Water | 2.50 | 2 |

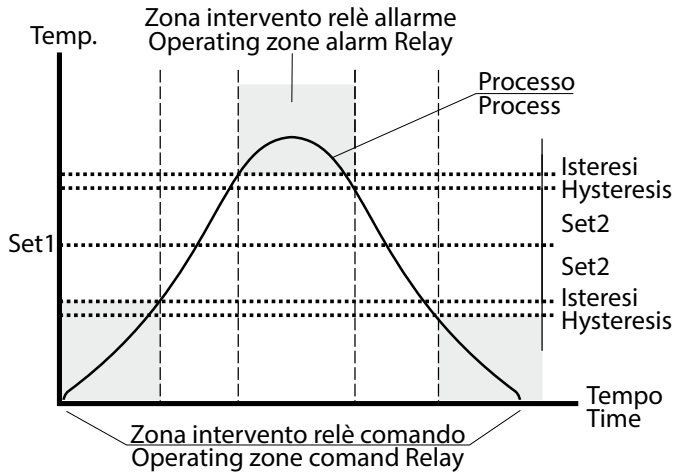
# 9 Dead band function

The dead band function (enabled selecting F.b.n on par. 28 Fnc) creates a band within which the relays are both open or closed.

In heating functioning (par. rEG. selected on HEA), the intervention threshold of the alarm relay will be SET1 - SET2 (with hyseresis selected on par. Syc) while the intervention threshold of the command relay will be SET1 + SET2 (the hysteresis is always Syc).

A band is created within which the relays are both open and where the alarm relay operates above while the command relay operates under the band limit.

In cooling functioning (par. reG. selected on co or) the intervention thresholds of the two relays are reversed.




When this function is active, standard alarm operation (band, deviation, etc..) is inhibited.

# 10 Configuration

## 10.1 Loading default values

This procedure allows to restore factory settings of the device.

| | Press | Display | Do |
|---|---|---|---|
| 1 | **FNC** for 3s | Display shows 000 with the 1st digit flashing. | |
| 2 | ▶ or ◀ | Change the flashing digit and move to the next one pressing **SET**. | Enter password 999 |
| 3 | **SET** to confirm | Instrument loads default settings and restarts. | |

## 10.2 Modify configuration parameters

| | Press | Display | Do |
|---|---|---|---|
| 1 | **FNC** for 3s | Display shows 000 with the 1st digit flashing | |
| 2 | ▶ or ◀ | Change the flashing digit and move to the next one using the **SET** key. | Enter the configuration password " 123" (" 1234" on ATR141). |
| 3 | **SET** to confirm | Display shows the first parameter of configuration table. c.ou for ATR121 c.out for ATR141 | |
| 4 | ▶◀ | Slide up/down through parameters | |

| | Press | Display | Do |
|---|---|---|---|
| 5 | **SET** + ▶ and ◀ | Increase or decrease the value displayed by pressing firstly **SET** and then an arrow key. | Enter the new data which will be saved on releasing the keys. To change another parameter return to point 4. |
| 6 | **FNC** | End of configuration parameter change. The controller exits from programming. | |

# 11 Configuration parameters

## 01 c.ou Command output

Selects command output type.

o1.2 > **Default** (factory defaults)
o1.5
SSr
o2.1
SEr (Alarm not available with this selection)

| | Command | Alarm |
|---|---|---|
| o1.2 | Q1 | Q2 |
| o1.5 | Q1 | SSR |
| SSr | SSR | Q1 |
| o2.1 | Q2 | Q1 |
| SEr | Q1 (open) Q2 (close), SSR (close) for -T version | - |

## 02 SEn Sensor

Analogue input configuration.
For a correct functioning of the device, use sensors insulated from the ground. Otherwise, use a single transformer isolated for each instrument.

| | |
|---|---|
| tcK | Tc-K -260 °C..1360 °C (**default**)1 p. 38 |
| tc.S | Tc-S -40 °C..1760 °C1 p. 38 |
| tc.r | Tc-R -40 °C..1760 °C1 p. 38 |
| tc.J | Tc-J -200 °C..1760 °C1 p. 38 |
| Pt | PT100 -200 °C..600 °C |
| Pt1 | PT100 -200 °C..140 °C (restricted range) |
| ni | Ni100 -60 °C..180 °C |
| ntc | Ntc 10KΩ -40 °C..125 °C |
| Ptc | Ptc 1KΩ -50 °C..150 °C |
| Pt5 | Pt500 -100 °C..600 °C |
| P1K | Pt1000 -100 °C..600 °C |
| 0.10 | 0..10V |
| 0.20 | 0..20mA |
| 4.20 | 4..20mA |
| Po1 | Potent. ≤ 6KΩ F.S. |
| Po2 | Potent. ≤ 150KΩ F.S. |

## 03 d.P. Decimal point

Selects number of displayed decimal points.

| | |
|---|---|
| 0 | No decimal (**default**) |
| 0.0 | 1 decimal |
| 0.00 | 2 decimals |

## 04 Lo.S Lower Limit Setpoint

-199..999

Value expressed in degrees.tenths for temperature sensors or in digits2 p. 38 for linear sensors and potentiometers (**default** 0.0).

## 05 H.S. Upper Limit Setpoint

-199..999

Value expressed as degrees.tenths for temperature sensors and digits[2 p. 38] for linear sensors and potentiometers (**default**: 999 for ATR121 and 1750 for ATR141).

## 06 Lo.n Lower Linear Input

Range AN1 lower limit only for linear signals.
Example: with input 4..20 mA this parameter takes value associated to 4 mA
-199..999
Value in digit (**default** 0)

## 07 H.n Upper Linear Input

Range AN1 upper limit only for linear signals.
Example: with input 4...20 mA this parameter takes value associated to 20 mA
-199..999
Value in digit (**default** 999)

## 08 LAt Latch On function

Automatic setting of limits for linear potentiometers and linear inputs.

| | |
|---|---|
| OFF | Disabled (**default**) |
| Std | Standard |
| u.On | Virtual Zero Stored |
| u.OS | Virtual Zero Initialized |

## 09 cA.o Offset calibration

Number added/subtracted to the process value visualized on display (usually correcting the ambient temperature value). -19.9..99.9
Value expressed in degrees.tenths for temperature sensors and digits for linear sensors and potentiometers (**default** 0.0).

## 10 cA.G Gain calibration

Percentage value that is multiplied for the process value (allows to calibrated the working point)
-19.9%..99.9%. Percentage (**default** 0.0)

## 11 rEG. Regulation type

| | |
|---|---|
| HEA | Heating (N.A.) (**Default**) |
| coo | Cooling (N.C.) |
| A.r. | Absolute alarm with manual reset |
| A.r.A | Absolute alarm with manual reset and relay status stored in case of power failure. |
| H.o.o | Heating with PID always to 0 if the process is over the setpoint. |

## 12 S.c.c. Command state error

State of contact for command output in case of error

| | |
|---|---|
| c.o. | Open contact (**default**) |
| c.c. | Closed contact |

## 13 Ld1 Command led

State of the OUT1 led corresponding to the relevant contact

| | |
|---|---|
| c.o. | ON with open contact |
| c.c. | ON with closed contact (**default**) |

## 14 HY.c Command hysteresis

Hysteresis in ON/OFF or dead band in PID
-199..999
Value expressed as degrees.tenths for temperature sensors and digits[2 p. 38] for linear sensors and potentiometers (**default** 0.0)

## 15 P.b. Proportional band

Proportional band Process inertia in units (in °C if temperature) 0..999 0 = On/Off
Value degrees.tenths for temperature sensors and digit[2] [p. 38] for linear sensors and potentiometers (**default** 0)

## 16 t. i. Integral time

Process inertia in seconds
0..999 s (0 = integral disabled) (**default** 0)

## 17 t.d. Derivative time

Normally ¼ of integral time
0..999 s (0 = derivative disabled) (**default** 0)

## 18 t.c. Cycle time

Cycle time (for PID on remote control switch 10/15 sec, for PID on SSR 1s) or servo time (value declared by servo-motor manufacturer).
1..300 s. Selecting 0 cycle time becomes 100ms (**default** 10)

## 19 AL. Alarm

Alarm intervention is related to SET2.

| | |
|---|---|
| A. A | Absolute alarm, referring to process (threshold alarm) **default** |
| A. b | Band alarm *(par. 12.c)* |
| A.d.S | Upper deviation alarm *(par. 12.d)* |
| A.d. i | Lower deviation alarm *(par. 12.e)* |
| A.A.S | Absolute alarm, referring to SET1 |
| coo | Cooling action *(par. 8.6)* |
| M.r. | Absolute alarm with manual reset. After the alarm activation, the output can be released pressing **FNC**. |
| M.r.M | Absolute alarm with manual reset and relay status memory in case of power failure. After the alarm activation, the output can be released pressing **FNC**. |

## 20 c.r.A Alarm state output

Output contact and intervention type

n.o.S Normally open, active at start (**default**)

n.c.S Normally closed, active at start

n.o.r Normally open, active on reaching alarm[3 p. 38]

n.c.r Normally closed, active on reaching alarm[3 p. 38]

## 21 S.c.A Alarm state error

State of contact for alarm output in case of error (eg. broken probe)

c.o. Open contact (**default**)

c.c. Closed contact

## 22 Ld2 Alarm led

Defines the state of OUT2 led corresponding to the relative contact

c.o. ON with open contact.

c.c. ON with closed contact (**default**)

## 23 HY.A Alarm Hysteresis

-199..999 Value degrees.tenths for temperature sensors and digit[2 p. 38] for linear sensors and potentiometers (**default** 0.0)

## 24 dE.A Alarm delay

-180..180 s

Negative: delay in alarm exit phase.

Positive: delay in alarm entry phase. (**default** 0)

## 25 P.SE. Setpoint protection

Allows or not to modify the setpoint by keyboard.

FrE Both set can be modified (**default**)

Pr.S OUT1 command setpoint protection

Pr.A OUT2 alarm setpoint protection

ALL Both set protection

## 26 F.L Conversion filter

ADC Filter: Number of input sensor readings to calculate the mean that defines process value. **NB**: When means increase, control loop speed slows down
1..15 sample means 15Hz (**default** 10)

## 27 tun Tune

Autotuning type selection *(par. 8.1)*

| | |
|---|---|
| oFF | Disabled (**default**) |
| AUt | Automatic. PID parameters are calculated at activation and at change of setpoint |
| MAn | Manual. Autotuning launched by keyboard |

## 28 Fnc Operating / visualization mode

Select operating mode and visualization options

| | |
|---|---|
| d.SE | Double setpoint (**default**) |
| S.SE | Single setpoint |
| u.S | Only visualizer/indicator |
| F.b.M | Dead band function *(par. 9)* |
| MA.1 | Function hide process and setpoint |
| 1.do | Domotics 1: turns off display and leds after 15" from the last keys operation. |
| 2.do | Domotics 2: turns off only the display after 15" from the last keys operation. |
| 3.do | Domotics 3: turns off the display (but not the decimal point) after 15" from the last keys operation. |
| S.S.u | Setpoint visualizer: setpoint is always displayed. To visualize the process press **FNC**. |

## 29 GrA Degree selection

Select degree type

| | |
|---|---|
| °C | Centigrade (**default**) |
| °F | Fahrenheit |

## 33 co.F Cooling fluid

Type of refrigerant fluid for heating / cooling PID *(par. 8.6)*

- Air Air (**default**)
- oil Oil
- H2o Water

## 34 P.b.M Proportional band multiplayer

1.00..5.00 Proportional band for cooling action is given by par. P.b. multiplied for this value (**default** 1.00)

## 35 ou.d Overlap / dead band

Dead band combination for heating/cooling action in heating / cooling PID.mode
-20.0..50.0% of par. P.b. value (**default** 0).
Negative indicates dead band value, positive means overlap.

## 36 t.c.2 Cooling cycle time

Cycle time for cooling output
1..300 s (**default** 10)

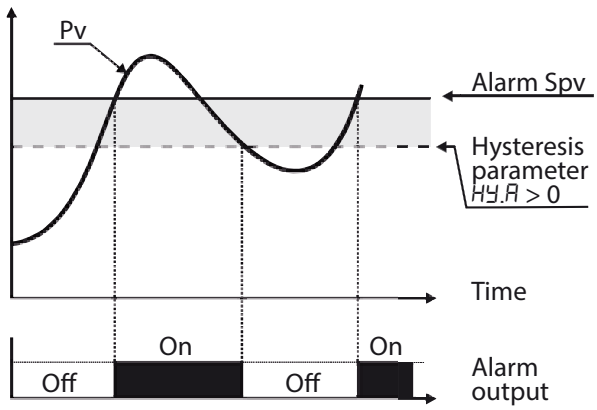
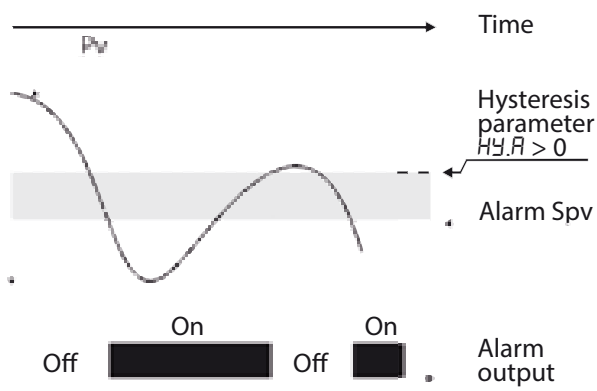
## 37 FL.u Visualization filter

Slows down the refresh of display, to simplify reading

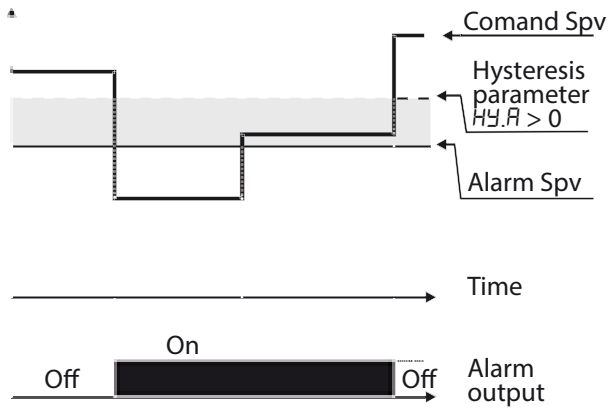
- oFF Disabled (max. speed for display refresh) (**default**)
- on.F First order filter
- S. 2 2 Samples Mean
- S. 3 3 Samples Mean
- S. 4 4 Samples Mean
- S. 5 5 Samples Mean
- S. 6 6 Samples Mean
- S. 7 7 Samples Mean
- S. 8 8 Samples Mean
- S. 9 9 Samples Mean
- S.10 10 Samples Mean

# 12 Alarm intervention modes

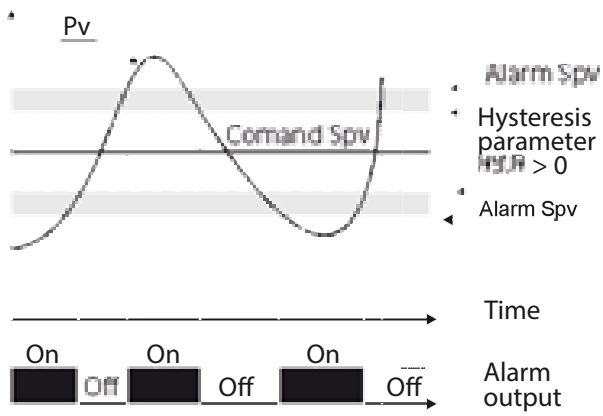
## 12.a Absolute alarm or threshold alarm (A. A selection)

| | | |
|---|---|---|
| 1 |  | Absolute alarm with controller in heating functioning (par. 11 rEG. come HEA) and hysteresis (par. 23 HY.A) in absolute value. |
| 2 |  | Absolute alarm with controller in cooling functioning (par. 11 rEG. come coo) and hysteresis (par. 23 HY.A) in absolute value. |

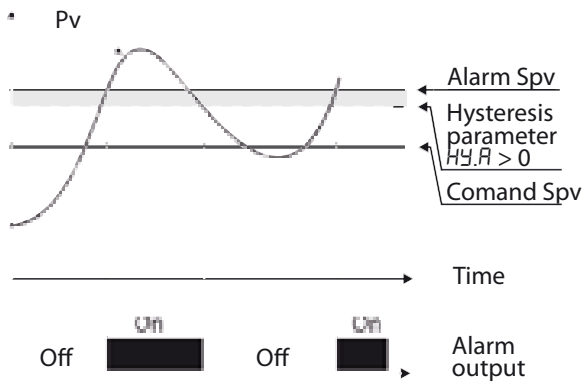
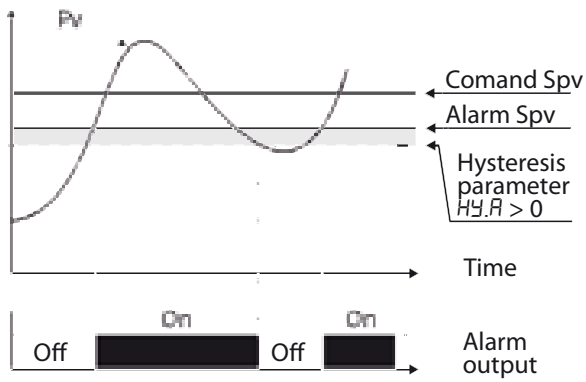
## 12.b Absolute alarm or threshold alarm referring to command setpoint (A.AS selection)

| | | |
|---|---|---|
| 1 |  | Absolute alarm refers to the command set, with the controller in heating functioning (par. 11 rEG. come HEA) and hysteresis (par. 23 HY.A) in absolute value. The command set can be modified pressing the arrow keys or using the serial port RS485 commands. (only on ATR121/141-ADT). |

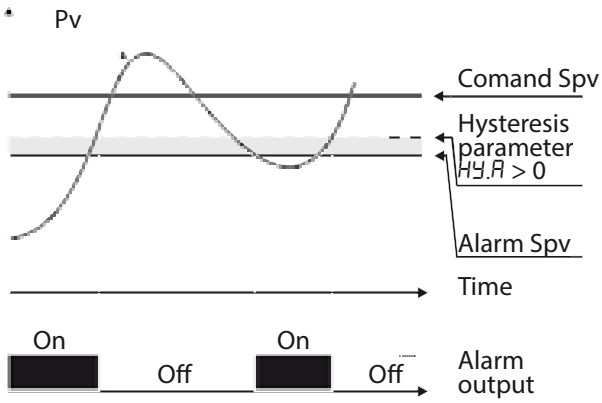
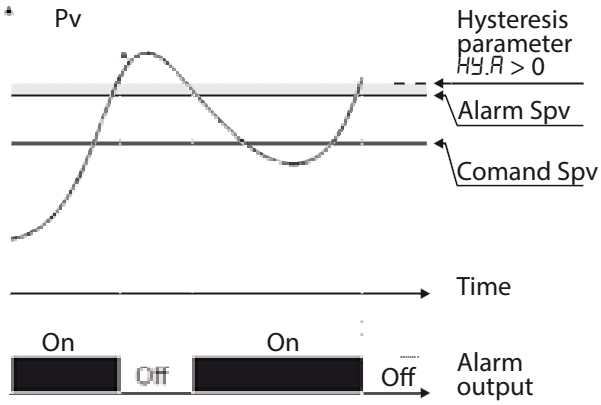
## 12.c Band alarm (A. b selection)

| | | |
|---|---|---|
| 1 |  | Band alarm with hysteresis.<br>N.B.: hysteresis (par. 23 HY.A) can not be lower than 0. The alarm value is the upper or lower deviation from the command setpoint that enables the output.<br>Exemple:<br>• command set = 100°C<br>• alarm set = 5°C<br>• alarm active if temperature > 105°C or temperature < 95°C |

## 12.d Upper deviation alarm (A.d.S selection)

| | | |
|---|---|---|
| 1 |  | Upper deviation alarm value of alarm setpoint greater than “0”.<br>N.B.: hysteresis (par. 23 HY.A) can not be lower than 0. |
| 2 |  | Upper deviation alarm value of alarm setpoint less than “0”.<br>N.B.: hysteresis (par. 23 HY.A) can not be lower than 0. |

## 12.e Lower deviation alarm (A.d.1 selection)

| | | |
|---|---|---|
| 1 |  | Lower deviation alarm value of alarm setpoint greater than “0”. N.B.: hysteresis (par. 23 HY.A) can not be lower than 0. |
| 2 |  | Lower deviation alarm value of alarm setpoint less than “0”. N.B.: hysteresis (par. 23 HY.A) can not be lower than 0. |

# 13 Table of anomaly signals

If installation malfunctions, controller will switch off regulation output as selected on par. 12 S.c.c./21 S.c.A and will report the anomaly.
Example: controller will report failure of a connected thermocouple visualizing e-5 (flashing).
For other signals, see table below.

| | Cause | Do |
|---|---|---|
| E-1 | Error in EEPROM cell programming | Call Assistance |
| E-2 | Cold junction sensor fault or room temperature outside of allowed limits | Call Assistance |
| E-4 | Incorrect configuration data. Possible loss of calibration values | Verify configuration parameters |
| E-5 | Thermocouple open or temperature outside of limits | Check the connection with the sensors and their integrity. Verify configuration parameters |
| E-8 | Missing calibration data | Call Assistance |

# 14 Qr-code

The code Qr-Code printed on the device label allows to verify the warranty or any hardware/software upgrade. It allows also to download and visualize user manuals direclty on mobile devices.

## 14.1 3D file

Are you a mechanical designer looking for the 3D model files of the enclosure? Download them from Documentation Area.

## Notes / Updates

1. *On ATR121 version the upper limit is 999 °C.*
2. *The display of decimal point depends on the setting of parameter SEn. and the parameter d.P.*
3. *On activation, the output is inhibited if the controller is in alarm mode. Activates only if alarm condition reappears, after that it was restored.*

# Configuration parameters

| | | | |
|---|---|---|---|
| 36 | t.c2 | Cooling cycle time | 33 |
| 37 | FL.u | Visualization filter | 33 |