PIXSYS

elettronica

- REGOLATORE
- CONTROLLER

ATR620

Manuale Installatore
User Manual

20 Introduction

Programmers ATR620 are the results of a wide experience with applications for temperature and process control by Pixsys (www.pixsys.net).
High configurability of both hardware and software resources allows the installer to configure the controller assuring both user-friendliness for the operator and at the same time the programming of complex and accurate firing profiles.
To program a cycle means basically to enter couples of values time /temperaure (setpoint) for each segment of the cycle. Each controller can be connected to one or two sensors; the output options include relays and SSR control. Other resources are available for the management of alarms, auxiliary and digital commands. Possibility to integrate the unit into supervisory systems or communication networks is assured by RS485 and protocol Modbus-RTU with Master/Slave modality.
Memory card allows to quickly copy parameters and cycle data, keeping record of the different configurations.
****Chapters 26.1 and 27.1 specifically focus on the operating instructions for the users.**

21 Models

The series ATR620 includes two versions: the following table allows to choose the correct model.

21.1 Ordering codes

ATR620-	☐	☐	☐	
Inputs	2			2 Inputs TC-RTD-V/mA
Outputs		1		2 relays + 1 output SSR
		2		3 relays
Power supply			ABC	24/230/115Vac ±15% 50/60Hz

22 Technical data

22.1 Main features

Visualizers	4 displays 0,56 inches 4 displays 0,28 inches
Operating temperature	0-45℃, humidity 35..95uR%
Sealing	IP54 Frontal, IP30 box, IP20 terminals block
Material	Noryl 94V1 self-extinguishing
Weight	400g

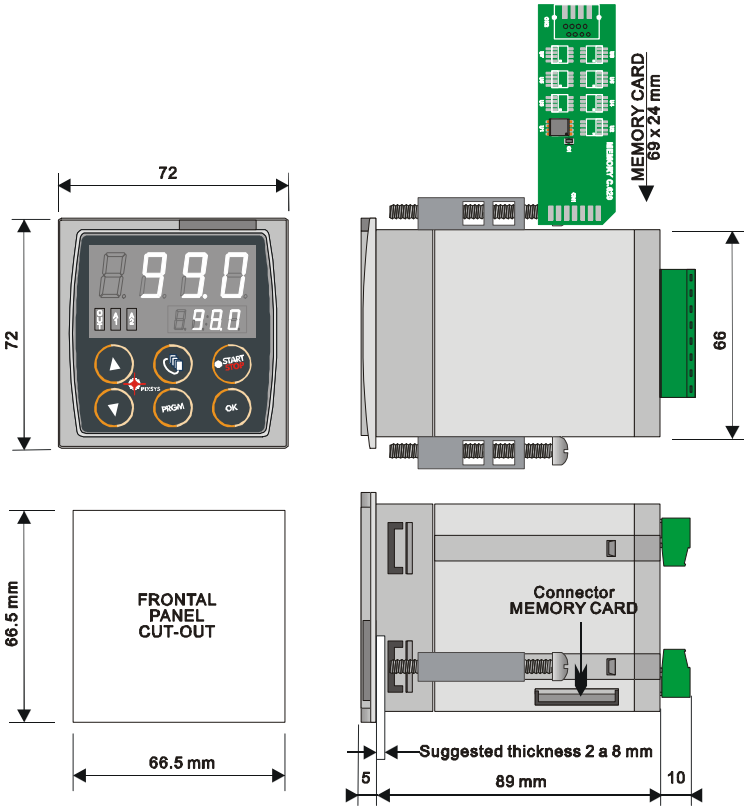
22.2 Hardware data

Analog input	**1**: AN1, AN2 Software configurable **Input An. 1** Thermocouple K, S, T, R, J, E RTD type PT100, Ni100 **Input An. 2** Thermocouple K, S, T, R, J, E Input 0-1V, 0-10V,0-20mA, 4-20mA	Accuracy (25℃) 0.2 % ± 1 digit for input TC, RTD , V, mA
Relay outputs	2/3 relays: OUT, A1, (A2) Configurable for command or alarm	Contacts 8A-250V~
SSR output	1 output: A2 Configurable for command or alarm	Output 12Vdc 30mA
Serial input	**1**: RS485 , Modbus protocol	
Digital input	**1**: IN1, IN2 Configurable as Input START/STOP, signal OPEn, HOLD input	

22.3 Software data

Control algorithm	ON-OFF with hysteresis, P, PI, PID, PD time proportioning
Proportional band	0...9999℃ or ℉
Integral time	0...9999 sec (0 excludes)
Derivative time	0,0...999,9 sec (0 excludes)
Software functions	Auto-Tuning , configurable alarms
Programmable cycles	15 cycles, max 20 segments (steps) for each cycle + function “simple controller” with programmable setpoint
Remote control	Setpoint received by analog or serial input
Manual function	Increase/decrease manually the percentage of output (manual control of power)

23 Sizes and installation

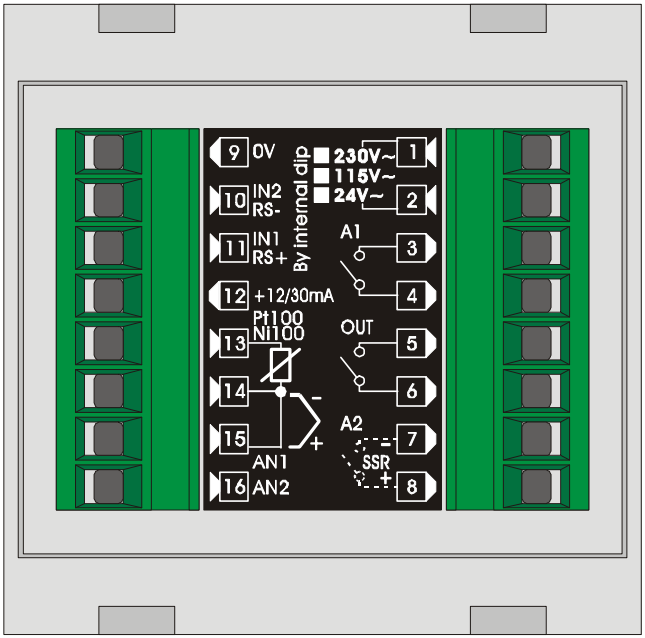


24 Electrical wirings

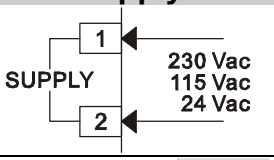
Altough this controller has been designed to resist noises in an industrial environment, please notice the following safety guidelines:

- Separate control wires from power wires
- Avoid mounting close to remote control switching systems, electromagnetic relays, powerful engines
- Avoid proximity of power systems, especially those with phase control

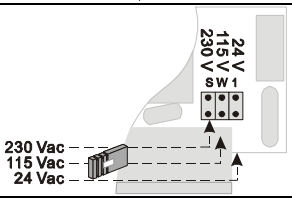
24.1 Wiring diagram



Power supply

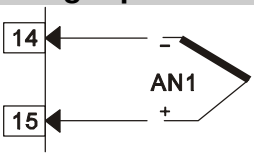


24/115/230Vac ±15% 50/60Hz
(selction by internal jumper)
Default selection: 230 Volt



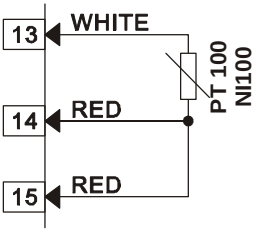
Version ATR620-xxABC
Set SW1 as in the drawing beside to select proper power supply

Analog input AN1



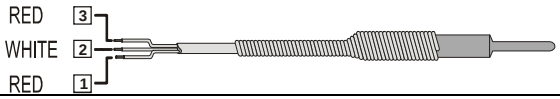
Thermocouples type K, S, T, R, J, E

- Respect polarity
- When extending thermocouples be sure to use the correct extension/compensating cable

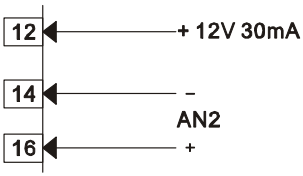


PT100, NI100

- For a three-wire wiring use cables with the same diameter
- For two-wire wiring, short-circuit terminals 14 and 15



Analog input AN2

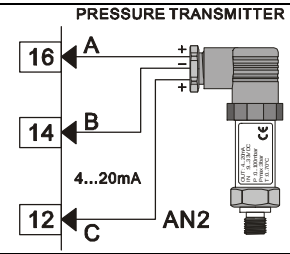
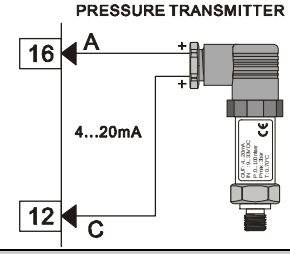
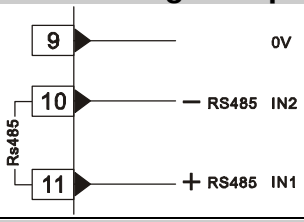
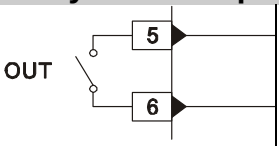
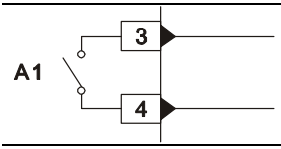
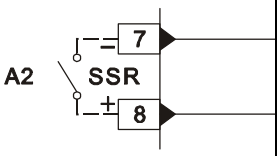


Thermocouples type K, S, T, R, J, E

- Respect polarity
- When extending thermocouples be sure to use the correct extension/compensating cable

Signals 0-1V, 0-10V, 0-20mA, 4-20mA

- Respect polarity

	Signals 0/4….20mA with 3-wires sensor Respect polarity A=Sensor output B=Sensor ground C=Sensor supply
	Signals 0/4….20mA with 2-wires sensor Respect polarity A=Sensor output C=Sensor supply
Serial or digital input	
	Configurable as serial input or two digital inputs • RS485 Modbus
Relay / SSR outputs	
	Contact capacity 8A/250V~ resistive • Configurable as command or alarm • Configurable as N.O. or N.C.
	Contact capacity 8A/250V~ resistive • Configurable as command or alarm • Configurable as N.O. or N.C.
	**Version ATR620-21ABC:** • Capacity 12V/30mA **Version ATR620-22ABC:** • Contacts capacity 8A/250V~ resistive Configurable for control or alarm N.O. or N.C.

25 Displays and keys

25.1 Numerical indicators (displays)

1	123.4 **GREEN**	Visualize usually process value (ex. Value read by thermocouple), but may also visualize setpoint value, time elapsed after cycle start[1] , step number[2] , percentage value of output , value of entering parameter during configuration [15].
2	123.4 **RED**	Visualization on this dispay is programmable and may be chosen as setpoint value, elapsed time or step/cycle in progress. Visualize number of entering parameter during configuration. Visualize Step-time (ex.:01-T) or step-setpoint (ex.:01-S) which is being entered during cycle programming.

[1] Example 0 1.05 for 1 hour, 5 minutes

[2] Example St. 3 for step no. 3

[15] See chap.26

25.2 Leds

3	OUT	ON when output OUT is active
4	A1	ON when output A1 is active
5	A2	ON when output A2 is active
6	START STOP	ON with cycle in progress, flashing if function “Simple controller” in progress, remote setpoint, manual control, serial communication.

25.3 Keys

7	▲	• Scroll or modify parameters during configuration • Scroll available cycles (to start or modify) • Modify time or setpoint values when programming cycles • Modify setpoint when function “Simple controller” (TERM) is working • Fast advancement with cycle in progress
8	▼	• Scroll or modify parameters during configuration • Scroll available cycles (to start or modify) • Modify time or setpoint values when programming cycles • Modify setpoint when function “Simple controller” (TERM) is working • Fast go back with cycle in progress
9		• Visualize duration of latest completed cycle if controller is in **STOP** mode • Second process only if enabled • Scroll flashing digit to modify values during configuration of parameters • With cycle in progress, visualize (cycling) setpoint value and **if configured** also other data.
10	PRGM	• Enter list of available cycles or configuration mode when the controller is in STOP mode • Press it for more than 1 second to enter functions menu with cycle in progress
11	START STOP	• Start new cycle or stop cycle in progress • ESCAPEkey when the controller is in configuration mode
12	OK	• Confirm entered value or selected function

26 Programming and configuration

There are two different levels of programming :

1. **Programming of cycles** (for **operator/user**) means entering of time/setpoint values for each step/segment of cycle.
2. **Configuration** (for **manufacturer/installer of plant)** means entering of basic parameters (sensor type, outputs functioning, operating of auxiliary output ..).

26.1 Programming (or modifying) cycle data

⚠ With or without starting setpoint, with or without timed auxiliary outputs ***

***The above specifications underline the possibility given to the installer (plant's manufacturer) to choose the sequence of operations required for the programming of a firing cycle.
This paragraph includes all available options. In case that the installer decides to chose a simplified programming with less options, it is highly recommended to prepare additional/separate instructions specifying only the selected sequence. The file of this paragraph is available in the Download section at www.pixsys.net and it may be used for this purpose.
Set the controller to StoP mode and follow the points below

	Press	Display	Do
1		Red display shows c ic. 1.	
2			Increase or decrease to visualize visualizzare c ic. 1 for cycle no.1 c ic.2 for cycl no.2 up to c i5 for cycle no. 15.

26.1.1 Programming of starting set-point (if configured)

	Press	Display	Do
3		Red display shows 00-S[16] or St. 0 , then SEt. 1 (see configuration of visualization Par.19, 4th digit). Green display shows the "starting setpoint". Otherwise go to point 5.	At any time press to quit the programming mode and save modified data..
4		Increase/decrease value on green display.	Enter starting setpoint (ex. Temperature at cycle start)

[16] The first two digits indicate number of step. Last digit shows t entering the time value/duration of step or S entering setpoint value (ex.:temperature value to reach within the programmed time)

26.1.2 Cycle programming (programming of steps/ segments)…

	Press	Display	Do
5		Red display shows 01-t or number of step which is being modified (for a few seconds), then tiME. Red display shows time value (duration) of step.	
6		Increase / decrease the value on green display N.B.:Max. 20 steps can be programmed for each cycle. Then the controller automatically goes to point 12.	Enter **<u>duration</u>** of step as hours:minutes ** Enter --.-- for endless time or enter End for cycle end (in case that not all available steps are required) and skip to point 12.
7		Red display shows 01-S or number of step which is being modified and then SEt.1. Green display shows setpoint of step (temperature to reach within the selected time)	Use arrow keys + to enter setpoint value (temperature required at end of each step)

26.1.3 Programming of auxiliary output (if configured)

	Press	Display	Do
8		Green display shows A 1on or A 1oF.	If output A1 is not programmed as timed auxiliary, go to point 10.
9			Select the state of auxiliary output during the step: A 1on for active or A 1oF for not active
10		Green display shows A2on or A2oF.	If output A2 is not programmed as timed auxiliary, go back to point 5
11			Select the state of auxiliary output during the step: A 1on for active or A 1oF for not active **.** **Go back to point 5.**

26.1.4 End of programming…

	Press	Display	Do
12		The controller returns to STOP mode, storing the programmed cycle. Red display shows StoP.	In case that outputs (A1, A2) are programmed as auxiliaries, repeat points 9 and 11 to program the state of outputs after cycle stop.

27 Start of a cycle

27.1 Cycle start and programming of delaied start

Red display shows StoP.

	Press	Display	Do
1		Red display shows available cycles	
2			Increase or decrease until the chosen cycle is visualized C iC. 1 (for cycle no.1), C iC.2 (for cycle no.2)...
3	or	Cycle starts. Buzzer rings. Green display shows process value, red display shows the value which has been selected on P-51, 1st digit	
If function "Delayed start" is enabled (see P-01, 2nd digit) follow the table below			
4	or	Red display shows Att., green display shows flashing the programmed time.	
5		Increase or decrease the waiting time after cycle Start (Hours:Minutes).	
6		Start of waiting time. At elapsing of programmed time, cycle will start..	Press to modify time value

27.2 Function “Fast advancement”

During cycle execution or in case of restart after an interruption, it may be useful to change the programmed time value of the running cycle (onwards or backwards) to meet the required setpoint.

	Press	Display	Do
1		Forwards or backwards on cycle (each beep of internal buzzer means one minute).	To stop the cycle and set the controller in StoP mode before end of cycle press .

27.3 Function SIMPLE CONTROLLER[17] with cycle in execution

This function can be activated **during** cycle execution.

	Press	Display	Do
1		Red display shows tErn flashing.	Keep pressing the key for approx. 1 second.
2		Red display shows tErn. The controller activates the output to hold the programmed temperature	
3		Modify setpoint value. Red display shows SEt. 1 and green display shows new setpoint for a few seconds.	To quit the function press (the controller returns to the the cycle which was previously in execution).

[17] Access to this function can be denied to the operator on P-01, 2nd digit

27.4 Function SIMPLE CONTROLLER in STOP mode.

Set the controller to StoP mode.

	Press	Display	Do
1		Red display shows available options	
2			Increase until tErn is visualized
3		Red display shows SEt. 1 , Green display shows setpoint value.	
4		Increase or decrease setpoint value	Enter required setpoint value.
5		The controller activates the output to hold the programmed temperature..	
6		Values are visualized cycling.	To modify setpoint SEt. 1 press and/or arrow keys (again and arrow keys for SEt.2) To quit the function press .

27.5 Auto-tuning

Auto-tuning[18] function can be started if the controller is configured as **SIMPLE CONTROLLER**.
Process value must be **at least 35% lower than setpoint value** (to avoid overshooting of temperature above setpoint value). If two process are enabled, please go to P-19/1st digit, to choose the process to which Autotuning will refer.

	Press	Display	Do
1	PRGM	tunE is flashing on red display.	Keep pressing for 1 second.
2	OK	Red display shows tunE The controller starts the self-calibration cycle	Wait until the writing disappers. To stop the function before it is completed, press START STOP.

27.6 Activate remote setpoint by input 2 [19]

Set the controller to StoP mode and follow the points below.

	Press	Display	Do
1	START STOP	Red display shows available options.	
2	▲ ▼		Increase or decrease until rEn. is visualized
3	OK O START STOP	Green display shows process value. The controller activates control output.	To quit the function press START STOP

[18] Access to this function can be denied to the operator on P-01, 2nd digit
[19] To configurate this function, select 0 (remote setpoint) on 4th digit of P-01 and " Remote setpoint by analog input AN2" on 4th digit of P-05.

27.7 Activate remote setpoint by serial input[20]

Set the controller to StoP mode.
To start the function by serial input, write 1 at modbus address 15: this operation must be repeated at least every 8 seconds, otherwise the controller will return to StoP mode
To quit the function write 0 at the same address.
Setpoint values must be entered at Modbus address 9 for process 1 and at address 10 for process 2.

[20] To configurate this function, select 0 (remote setpoint) on 4th digit of P-01 and " Remote setpoint by analog input AN2" on 4th digit of P-05

27.8 Manual control of output[21]

This functions allows to control/modify manually the command output to exclude automatical control of process. The output is activated as percentage 0 - 100% according to the time basis entered on parameter P-30 (cycle time).

Set the controller to StoP mode and follow the points below:

	Press	Display	Do
1		Red display shows available options	
2			Increase/decrease until nAn. is visualized
3		Green display shows percentage of outputThe controller activates the output.	
4		Visualize percentage value of output 1 (cycling also value of output 2 if enabled).	To modify percentage press funtil red display shows Pou 1 (or Pou2 if two process are enabled) and press to modify value. To quit the function press

[21] Access to this function can be denied on P-01, 3rd digit.

28 Configuration for installer

28.1 Modify numeric value of parameter

The following options are available :

1. If all 4 digits are flashing, press to change the parameter.

2. If all 4 digits are visualized but only one is flashing, press to modify it and then to reach the following digit .

28.2 Modify configuration parameter

To modify configuration parameters (see chap. 29), the controller must be in StoP mode.

	Press	Display	Do
1		Red display shows available options	
2			Increase/decrease until conF. is visualized
3		Green display shows 0000 and 1st digit is flashing. Red display shows PASS.	
4	+	Modify the flashing digit on green display	Enter password 1234

	Press	Display	Do
5		Red display shows P-01, green display shows value of parameter	
6		Increase / decrease number of parameter	Visualize number of parameter which must be modified
7		Green display shows the flashing value of selected parameter.	
8		Increase / decrease value of visualized parameter.	Enter new value
9		Value of parameter stops flashing	To modify other parameters go back to point 6.
10		End of configuration. The controller is in StoP mode. ** If Memory Card is connected, its values will be up-dated with new data within a few seconds.	

28.3 Memory Card

Parameters and cycle data can be easily and quickly copied from one controller to other controllers using the Memory Card. **The controller must be switched off before entering the Card**. Please **check also entry direction** : the small scanning must be turned towards the back panel and the small IC must be turned towards the external side of the box. When the controller is switched-on, the green display shows nEnO and the red display shows no[22].

	Press	Display	Do
1		visualize YES, visualize no.	Select YES to load values of memory card on the controller. Select no to keep values of the controller unchanged.
2		The controller loads the values and starts the self-check	

⚠**To update values of Memory Card**, follow the above described operations selecting no on red display so that values of Card are not loaded on the controller [23]. Enter configuration mode and **modify at least one parameter**. Quitting the configuration mode, a beep of internal buzzer will confirm that the new values are saved.

[22] Only if values stored on Memory are correct

[23] If the controller shows nEnO at starting, it means that no values are stored on memory, but it is possible to copy and update them

29 List of configuration parameters

P-01 General configuration

This parameter selects the type of P.I.D. action, enables operator's access to special functions like manual control of output percentage 0-100%, Autotuning, delayed start, operating as "Simple controller" with fixed setpoint beside standard programming function, possibility to modify cycle data during the cycle, programming of a starting setpoint (to assure the programmed rising gradient in case that kiln temperature at cycle start is too high), number of cycles available to the operator, remote control for cascade applications..

1st Digit – Type of PID control

0	Single reverse action (Heating)
1	Single direct action (Cooling)

2nd Digit – Access to following functions:

	Auto-tuning	Simple controller	Delaied start
0	No	No	No
1	Yes	No	No
2	No	Yes	No
3	Yes	Yes	No
4	No	No	Yes
5	Yes	No	Yes
6	No	Yes	Yes
7	Yes	Yes	Yes

3rd Digit – Access to following functions

	Manual % Output	Starting setpoint	Modify data during the cycle
0	No	No	No
1	Yes	No	No
2	No	Yes	No
3	Yes	Yes	No
4	No	No	Yes
5	Yes	No	Yes
6	No	Yes	Yes
7	Yes	Yes	Yes

4th Digit – Cycles available to the operator		
	0	No cycles available Remote setpoint enabled
	1…9	1..8 cycles available for the operator Select 9 for 15 cycles / 20 steps each
P-02	Configuration analog input AN1	
	Select type of thermocouple or RTD connected to input AN1, visualization range and ***process corresponding to this input****.*	
	1st Digit – Type of sensor	
	0	Not used
	1	Thermocouple or RTD (selected on 2nd digit)
	2nd Digit – Type of thermocouple/RTD	
	0	Type K (-250/1350℃)
	1	Type S (-50/1750℃)
	2	Type T (-250/400℃)
	3	Type R (-50/1750℃)
	4	Type J (-200/1000℃)
	5	Type E (-250/1000℃)
	6	PT100 (-100/600℃)
	7	NI100 (-60/180℃)
	3rd Digit – Decimal point	
	0	No decimal point
	1	Visualization with decimal point
	4th Digit – Select corresponding process	
	0	Process 1
	1	Process 2
P-03	Configuration of analog input AN2	
	Select type of thermocouple or signal V/mA connected to input AN2, visualization range and process corresponding to this input	
	1st Digit – Type of sensor	
	0	Not used
	1	Thermocouple (selected on 2nd digit)
	2	Tension 0-1V
	3	Tension 0-10V
	4	Current 0-20mA
	5	Current 4-20mA
	2nd Digit – Type thermocouple/RTD	
	0	Type K (-250/1350℃)
	1	Type S (-50/1750℃)

	2	Type T (-250/400℃)
	3	Type R (-50/1750℃)
	4	Type J (-200/1000℃)
	5	Type E (-250/1000℃)
	3rd Digit - Decimal point	
	0	No decimal point
	1	Visualization with one decimal point
	2	Visualization with 2 decimal points (only V /mA)
	3	Visualization with 3 decimal points (only V /mA)
	4th Digit – Select process	
	0	Process 1 (* ex. Pressure or humidity sensor connected to analog input AN2 is Process 1)
	1	Process 2
P-04	Reserved	
P-05	Configuration control outputs and source of setpoints	

*(ex.: **TC1 on AN1** configured as **process 1 on Out** and **TC2 on AN2** as **process 2 on A1**) and select source of setpoint (** Only Setpoint1 changes according to the programmed cycle, while Setpoint2 can only be fixed.*

	1st Digit – Control output process 1	
	2nd Digit – Control output process 2	
	0	No output or disabled process
	1	Relay OUT contact N.O.
	2	Relay OUT contact N.C.
	3	Relay A1 contact N.O.
	4	Relay A1 contact N.C.
	5	Relay or SSR A2 contact N.O.
	6	Relay or SSR A2 contact N.C.
	7	Open/Close contact N.O. (Open OUT, Close A1)
	8	Open/Close contact N.C. (Open OUT, Close A1)

	3rd Digit–Source of setpoint for process 1 + process 2	
	Process 1	Process 2
0	Setpoint1 (cycle data)	Setpoint1 (cycle data)
1	Setpoint1 (cycle data)	Setpoint2 (fixed)
2	Setpoint2 (fixed)	Setpoint1 (cycle data)

	4th Digit – Select remote setpoint	
	0	Remote setpoint by analog input AN2 Control input AN1
	1	Setpoint by serial input: process 1 – word modbus 9 process 2 – word modbus 10
P-06	Lower limit setpoint 1 (-999/3000 digit)	
P-07	Upper limit setpoint 1 (-999/3000 digit)	
	Selectable limits of setpoint 1	
P-08	Lower limit range AN2 only for V/mA (-999/3000 digit).	
P-09	Upper limit range AN2 only for V/mA(-999/3000 digit).	
	Limits of scale (values to visualize if input AN2 is configured as V/mA	
P-10	Alarms hysteresis (-999/3000 digits).	
	Hysteresis for alarms tresholds.This function is useful to avoid disturbing oscillations of outputs	
P-11	Configuration alarm no.1 corresponding to output OUT	
P-12	Configuration alarm no.2 corresponding to output A1	
P-13	Configuration alarm no.3 corresponding to output A2	
	These parameters allow to select the operating mode for the relay or SSR outputs <u>when they are not used for process control</u> (see P-05). *Beside alarm modes described on chap. 30, available options include also auxiliary functions related to time (steps), to rising/dwell/cooling gradient or to the state of controller (during cycle execution or at cycle end).* ***Setpoint values (comparison values)** must be entered on parameters* **P-14..16.**	
	1st Digit –Type of operation	
---	**0**	Output not used as alarm/auxiliary/event
ALL	**1**	Independent related to process (3rd Digit)
EVN	**2**	Active in RUN (N.O. or N.C. selected on 2nd Digit)
ALL	**3**	Independent related to setpoint
ALL	**4**	Band (setpoint – process)
EVN	**5**	Active at cycle end
ALL	**6**	Deviation (setpoint – process)
AUX	**7**	Timed, related to step (On or Off for each step)
AUX	**8**	Active for rising steps or dwells
AUX	**9**	Active for cooling steps

	2nd Digit –Operating zone for alarm and state of contact	
	0	Active “**under**” (independent or deviation alarm) or “**inside**” (band alarm), Contact N.O.
	1	Active “**over**” (independent or deviation alarm) or “**outside**” (band alarm), Contact N.O.
	2	Active “**under**” (independent or deviation alarm) or “**inside**” (band alarm), Contact N.C.
	3	Active “**over**” (independent or deviation alarm) or “**outside**” (band alarm), Contact N.C.
	4…7	As 0, 1, 2, 3 active ONLY in **RUN** (during cycle)
	3rd Digit – Select process for alarm	
	0	Process 1
	1	Process 2
	4th Digit –Type of alarm action on cycle	
	0	No action on cycle, no acoustic signal of buzzer, no visualization on display Output is commuted (change of relay or SSR contact).
	1	Cycle stop with acoustic and visual signal[24]. Output is commuted, buzzer is activated, display flashes, cycle stops and controller goes to to STOP mode.
	2	Only acoustic signal Output is not commuted, buzzer is activated, display flashes.
P-14	Setpoint value for alarm no.1 -999/3000 digit (℃ for temperature)	
P-15	Setpoint value for alarm no.2 -999/3000 digit (℃ for temperature)	
P-16	Setpoint value for alarm no.3 da-999/3000 digit (℃ for temperature)	
P-17	Configuration digital input IN1[25]	
P-18	Configuration digital input IN2	
	Operating mode for digital inputs IN1..2. Impulse means contact closed (or open) for min. 150msec.	
	1st Digit –Operating mode of digital input	
	0	Input not used

[24] Visual signal for active alarm is AL.1 or AL.2 until OK is pushed to confirm it.

[25] Inputs not available if using RS485.

1	Input START at impulse (>= 150 msec)
2	Input STOP at impulse (>= 150 msec)
3	Input START/STOP at impulse (>= 150 msec)
4	RUN input when active. The controller executes the cycle programmed on 3rd digit (or function selected on 4th digit) until contact is closed (or open).
5	Temporary cycle block, flashing OPEn (Normally connected to the door switching).
6	Cycle stop with acoustic and visual signal. Visualize in. 1 for IN1 or in. 2 for IN2, buzzer is active until OK is pressed.
7	Input HOLD. Cycle is stopped and setpoint can be modified by frontal keys.
8	Impulse input for step advancement (one step forwards) during cycle.

2nd Digit – Type of contact	
0	Activation with closed contact
1	Activation with open contact

3rd Digit – Function or cycle to activate	
0	Activate function selected on 4th digit
1…9	Activate cycle no.1…9

4th Digit – Special function to activate	
0	"Simple controller"
1	Remote controller (if **P-01/ 4thDigit** selected as **0**)
2	Manual control (modify percentage of control output 0…100%)
3	Last executed cycle
4	Simple controller (also during cycle execution)

P-19	Configuration Auto-tuning and visualization of step
	Select on which process Autotuning will be completed and which values will be visualized in RUN mode.

1st Digit – Configuration Autotuning	
0	Autotuning only on process 1
1	Autotuning only on process 2
2	Autotuning both on process 1 and process 2

2nd Digit – Control of heating elements power

	0	Only process1
	1	Only process 2
	2	Add process 1 and process 2
	3rd Digit – Real time/duration of cycle[26]	
	0	No
	1	yes
	4th Digit – Visualization of step	
	0	Step number always visualized in programming mode
	1	Step number visualized only at beginning of step (equivalent to the operating in programming mode of series ATR610)
P-20	Power of heating elements (0.0/999.9 Kwatt).	
	Enter power of heating elements group. If the programmed value is different from 0, it will be possible to visualize power consumption (expressed as Kwatt/hour) at cycle end pressing key	
P-21	Waiting for step end (1/1440 min, 0 excludes waiting function)	
	Enter max. waiting time for step end. For further details see 31.3	
P-22	Max. gap at step end to activate waiting function (1/200 digit).	
	When the gap setpoint-process 1 is lower than this value, the controller jumps to next step of cycle without waiting for the time entered on P-21. For further details see 31.3	
P-23	Recovery of interrupted cycle	
	This parameter enables recovery of interrupted cycle after a power failure. For further details see 31.1-31.2	
	0	Cycle recovery □isabled
	1	Cycle recovery enabled (see 31.1)
	2-9999	Recovery gradient (rising) as degree/hour (see 31.2)
P-24	Reserved	

[26] Pressing , during cycle, the visualized time value will be the time elapsed after cycle start, not the programmed time. PPressing after cycle Stop to visualize duration of last cycle.

P-25	Filter on analog inputs (1/20 averages).
	Value of software filter which is active on the reading of sensors connected to inputs AN1 and AN2. *In case of disturbed signals, filter should be increased, reducing reading speed .*
P-26	Offset calibration for input AN1 (-15.0/15.0 digit)
P-27	Gain calibration for input AN1 (-10.0%…+10.0%)
	These parameters allow to adjust eventual errors on visualization, caused by damages or mistakes on thermocouples wirings or compensated cables. *Example: if melting point of a ceramic cone is 1000℃ while the controller shows 990℃, enter 1.0 on P-27 to get the correct value on display*
P-28	End of ON/OFF control (-999/3000 digit)
	Below this value, the controller modulates the output as ON/OFF excluding P.I.D. action. To use only On/off mode, enter a value above the upper limit of scale 1. To exclude ON/OFF control enter a value below the lower limit of scale 1.
P-29	Reserved
P-30	Cycle time or servomotor time (value declared by manufacturer) in zone 1 (1/120 sec).
	*This parameters selects **cycle time** for time-proportioned outputs (PID or manual control of output %).* *Ex. 10 sec. On P-30 means 60% of output when output is active for 6.0 seconds/not active for 4.0 seconds and so on.*
P-31	Limit of command signal for zone 1(10/100%)
	Max. limit of command signal expressed as % Ex.: Enter 60 on this parameter to allow max. 60% power of heating elements on electrical kilns.
P-32	Reserved
P-33	Reserved
P-34	Reserved
P-35	ON/OFF hysteresis; P.I.D. dead band (-99.9/300.0 digit)
P-36	Proportional band (0-3000 digit). (0 excludes P.I.D.)
P-37	Integral time (0/9999 sec). (0 excludes integral)

P-38	Derivative time (0.0/999.9 sec). (0 excludes derivative)
	Parameters for P.I.D. control on process 1. Dead band limits the zone where PID is not active - Proportional band refers to inertia of process and is expressed as units (ex. ℃) – Integral time express inertia of process as s econds – Derivative time has a damping function and is usually ¼ of integral time
P-39	Lower limit Setpoint2 (-999/9999 digit).
P-40	Upper limit Setpoint2 (-999/9999 digit).
	Lower and upper limits of **Setpoint2** *when both inputs are active but only one is referring to the programmed cycle (**see P-05, 3rd Digit**) and the second one is referring to a fixed setpoint (which is setpoint2)*
P-41	Offset calibration input AN2 (-15.0/15.0 digit)
P-42	Gain calibration input AN2 (-10.0%…+10.0%)
	These parameters act to adjust eventual errors of sensors or to fix correspondance with a precise point of the scale
P-43	Cycle time or servomotor time (value declared by manufacturer) in zone 2 (1/120 sec).
	Cycle time *for time-proportioned outputs (see **P-30**). This parameter is configured only if two zones are enabled (An1 and AN2 both configurated).*
P-44	Limit of command signal for zone 2 (10/100%)
	*See **P-31**.*
P-45	ON/OFF hysteresis; P.I.D. dead band (-99.9/300.0 digit)
P-46	Proportional band (0-3000 digit). (0 excludes P.I.D)
P-47	Integral time (0/9999 sec). (0 excludes integral)
P-48	Derivative time (0.0/999.9 sec). (0 excludes derivative)
	Parameters for P.I.D. control on zone 2
P-49	Configuration serial input
	Select baud rate, format and answer delay in Modbus (delay varies according to baudrate).

1st Digit – Baud rate	
0	4800 bit/sec
1	9600 bit/sec (default)
2	19200 bit/sec
3	31250 bit/sec
4	38400 bit/sec
2nd Digit – Format	
0	8, N, 1 (default)

1	8, O, 1
2	8, E, 1
3	8, N, 2
4	8, O, 2
5	8, E, 2
3rd Digit – Enable Modbus delay	
0	Delay desabled.
1	Delay enabled (15, 12, 9, 6, 3 ms).
4th Digit – Enable software upgrade via serial input	
0	software upgrade via serial input desabled
1	software upgrade via serial input enabled

P-50	Slave address (0/99, 0 forMaster function).
	Select Modbus address of Slave. Enter 0 for Master. (see 32.2).
P-51	Data visualization on display
	Select visualization for second display and which data can be visualized pressing *.*
1st Digit – Visualization on second display	
0	Process 2 (ex. temperature of second thermocouple)
1	Setpoint programmed for step end (ex.temperature expected at end of running step)
2	Control Setpoint (updated according to programmed gradient)
3	Number of cycle in execution
4	Time elapsed after cycle START (hours:minutes)
5	Number of step in execution

2nd Digit – Visualization of data during the cycle pressing "Scroll" key

	Chronometer (hours:minutes)	**% output** (0…100%)	**Step number** (1…20 max)
0	No	No	No
1	Yes	No	No
2	No	Yes	No
3	Yes	Yes	No
4	No	No	Yes
5	Yes	No	Yes
6	No	Yes	Yes

7	Yes	Yes	Yes

3rd Digit – Select type of degrees

0	Celsius (℃).
1	Fahrenheit (℉).

4th Digit – Brightness display 2

0	Higher brightness.
1	Lower brightness

P-52 Block of cycle programming, enable endless step and waiting function for multi-loop applications

1st digit:modify of some or all cycles can be locked to avoid that specific programmed options are lost due to wrong programming.
2nd digit: enable/desable possibility to program endless steps (step ends only when the operator presses Stop key- see 26.1.2)
3rd digit: this option is relevant only for plants with two or more control loops, it defines max. temperature gap between two or more zones (ex. kiln with two control zones); if this gap is bigger than programmed value, cycle stops and controller waits until uniform values are reached. Beside Waiting function as described on 31.3, this option assures reliable control of cycle data.

1st Digit –Cycle programming block

0	No block
1..8	Block programming of cycles 1….8
9	Block programming of all cycles

2nd Digit – Endless step

0	Endless step enabled
1	Endless step desabled

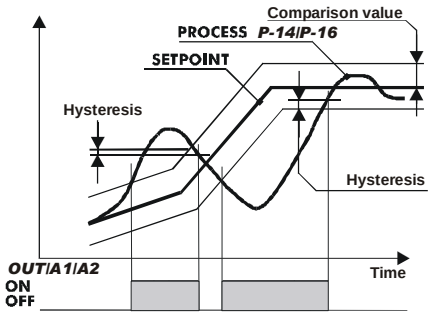
3rd Digit – Double loop: max. gap between process 1-2 for setpoint block (see 31.4).

0	Gap process 1-2 not considered
1	Gap process 1-2 5 units (ex: 5℃)
2	Gap process 1-2 10 units (ex: 10℃)
3	Gap process 1-2 15 units (ex: 15℃)
4	Gap process 1-2 20 units (ex: 20℃)
5	Gap process 1-2 30 units (ex: 30℃)
6	Gap process 1-2 40 units (ex: 40℃)
7	Gap process 1-2 50 units (ex: 50℃)
8	Gap process 1-2 60 units (ex: 60℃)
9	Gap process 1-2 70 units (ex: 70℃)

30 Alarms operating

Three alarms can be programmed and be connected to outputs OUT, A1, A2 (if they are not used for control). The following graphs describe the programmable operatings.

Band alarm (setpoint-process)

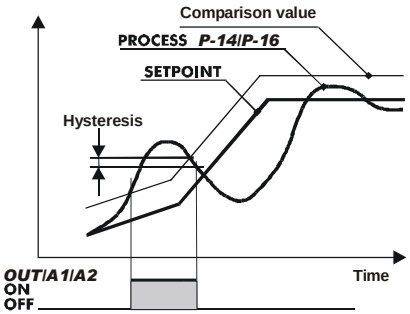


Alarm can be :

- active outside band
- active inside band

Example: outside

Deviation alarm (setpoint-process)

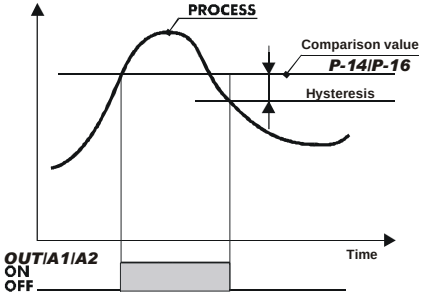


Alarm can be :

- active above comparison value
- active below comparison value

Example: upper deviation

General alarm (process)

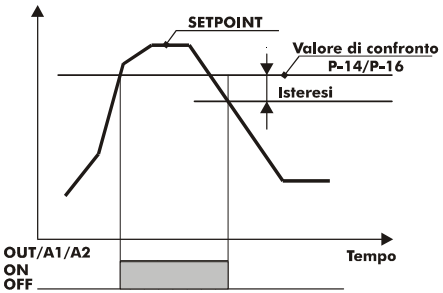


Alarm can be :

- active over process value
- active below process value

Example: above process value

General alarm (setpoint)



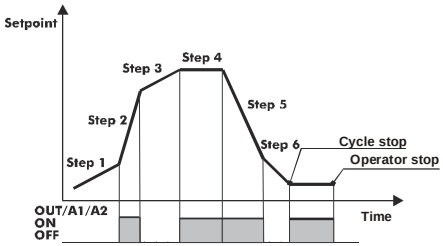
Alarm can be :

- active over setpoint
- active below setpoint

Example: over above.

Cycle stop and/or acoustic signal can be programmed for each type of alarm operating.

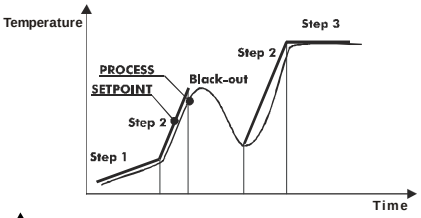
Programmable timed operating (auxiliary)



ON or OFF state of auxiliary output is programmable for each segment/step of the cycle. State is programmable also at cycle end. See 26.1.3

31 Special software functions

31.1 Recovery of interrupted cycle with automatic gradient



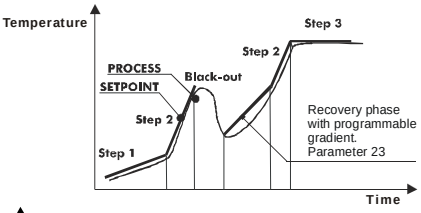
⚠ **To desable this function, enter 0 (zero) on parameter 23** P-23**.**

Recovery function is particularly useful for temperature control on kilns. At restarting after a power failure ATR620 can resume the interrupted cycle, assuring optimal cycle execution.

4. Power failure during a rising step: recovery gradient will be the same as the step in progress. Setpoint value will be the same as sensor temperature.
5. Power failure during a dwell (holding step): two options are available. If the gap process-setpoint is not bigger than value entered on P-22, cycle will be resumed from the point of interrumption. If the gap is bigger than this value, cycle will be resumed from previous step and will follow point1.
6. Power failure during cooling steps: setpoint follows the temperature of sensor and controller will not foresee any rising step (safety feature for glass kilns) , skipping to next step if required.

****** After a power failure chronometer always starts from 00:00

31.2 Recovery of interrupted cycle with programmable gradient



⚠ **To desable this function, enter 0 (zero) on parameter 23** P-23.

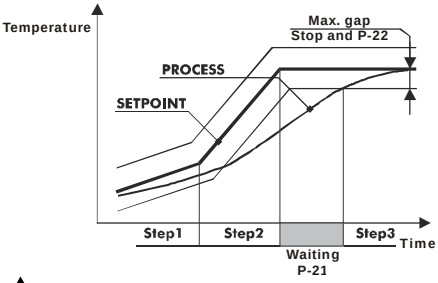
⚠ **Recovery is active only for positive or null steps .**

⚠ **To quit recovery function manually press** ▼ **or** ▲ .

At restart if process value (kiln temperature) is lower than setpoint value, ATR620 stops the cycle in progress and executes a rising step with the programmable gradient entered on P-23 to gain the setpoint which had been reached before power failure. Cycle restarts from this point.

During recovery stage, led START STOP is flashing, chronometer is not counting and display shows rEc. instead of step number.

31.3 Waiting function



⚠ **To desable this function enter 0 on** P-21.

⚠ **When the function Waiting is active,** chronometer is not counting and display 2 shows uAit instead of step number

This function is specifically useful to control firing cycles on kilns whenever the plant is unable to follow the gradients programmed by the operator.

If the gap process-setpoint is bigger than the value entered on parameter 22, the controller will start next step only after waiting for the time entered on parameter 21 or when the gap is lower than value of parameter 22 (see graph beside).

⚠ **To quit the function manually, press** ▲

31.4 Double loop: control the gap between processes

⚠ **To desable this function, enter 0 (zero) on 3rd Digit of parameter 52 P-52.**	During rising or cooling steps, the controller will monitor the gap between processes. If this function is enabled, when the gap is bigger than value entered on 3rd digit of parameter 52, setpoint is blocked until the gap becomes lower than this value.

32 Communication protocol Modbus RTU

32.1 Main features

ATR620 has been conceived for control and communication by Terminals via Modbus RTU protocol. It is provided with serial port RS485 for programming of configuration parameters and reading of analog inputs.

Baud-rate	Selectable by parameters 38400 bits/sec 31250 bits/sec 19200 bits/sec 9600 bits/sec 4800 bits/sec
Format	Selectable by parameters Default: 8, N, 1 (8bit, no parity, 1 stop)
Supported functions	BITS READING (0x01, 0x02) WORD READING (max 1 word) (0x03, 0x04) SINGLE BIT WRITING (0x05) SINGLE WORD WRITING (0x06) MULTIPLE BITS WRITING (0x0F) MULTIPLE WORD WRITING (max 30 word) (0x10)

32.2 Function Master

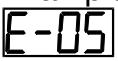
Software functions of ATR620 include operating as Master. This feature allows serial communication of several controllers to control more zones of the same kiln. Function is enabled entering 0 on parameter 50. Master will communicate Start/Stop of cycle and setpoint values to the connected slave units (which must be configurated for remote setpoint on parameters 1 and 5). Communication follows the broadcast mode: all controllers receive data. If Waiting function is enabled on Master, it will read process values of the first 16 connected controllers (slave address 1 to 16 on parameter 50) and it will check eventual delay of any connected zone.

32.3 Word addresses ATR620

Modbus address	Description	Read Write	Reset value
1	Process AN1	R	0
2	Process AN2	R	0
3	Ambient temperature	R	0
4	Output % process 1	R/W	0
5	Output % process 2	R/W	0
6	Setpoint 1	R/W	EEP
7	Setpoint 2	R/W	EEP
8	Remote setpoint	R	EEP
9	Setpoint 1 via serial communication	R/W	EEP
10	Setpoint 2 via serial communication	R/W	EEP
11	Delaied start (waiting time at start)	R/W	EEP
15	Start via serial communication	R/W	0
21	Parameter 1	R/W	EEP
22	Parameter 2	R/W	EEP
23	Parameter 3	R/W	EEP
24	Reserved	R	?
25	Parameter 5	R/W	EEP
26	Parameter 6	R/W	EEP
27	Parameter 7	R/W	EEP
28	Parameter 8	R/W	EEP
29	Parameter 9	R/W	EEP
30	Parameter 10	R/W	EEP
31	Parameter 11	R/W	EEP
32	Parameter 12	R/W	EEP
33	Parameter 13	R/W	EEP
34	Parameter 14	R/W	EEP

35	Parameter 15	R/W	EEP
36	Parameter 16	R/W	EEP
37	Parameter 17	R/W	EEP
38	Parameter 18	R/W	EEP
39	Parameter 19	R/W	EEP
40	Parameter 20	R/W	EEP
41	Parameter 21	R/W	EEP
42	Parameter 22	R/W	EEP
43	Parameter 23	R/W	EEP
44	Reserved	R	?
45	Parameter 25	R/W	EEP
46	Parameter 26	R/W	EEP
47	Parameter 27	R/W	EEP
48	Parameter 28	R/W	EEP
49	Parameter 29	R/W	EEP
50	Parameter 30	R/W	EEP
51	Parameter 31	R/W	EEP
52	Reserved	R	?
53	Reserved	R	?
54	Reserved	R	?
55	Parameter 35	R/W	EEP
56	Parameter 36	R/W	EEP
57	Parameter 37	R/W	EEP
58	Parameter 38	R/W	EEP
59	Parameter 39	R/W	EEP
60	Parameter 40	R/W	EEP
61	Parameter 41	R/W	EEP
62	Parameter 42	R/W	EEP
63	Parameter 43	R/W	EEP
64	Parameter 44	R/W	EEP
65	Parameter 45	R/W	EEP
66	Parameter 46	R/W	EEP
67	Parameter 47	R/W	EEP
68	Parameter 48	R/W	EEP
69	Parameter 49	R/W	EEP
70	Parameter 50	R/W	EEP
71	Parameter 51	R/W	EEP
72	Parameter 52	R/W	EEP

33 Error messages

In case that the plant does not work properly, the controller stops the eventual cycle in progress and shows an error message for the fault condition.
Example: a damaged thermocouple will be noticed with error code  flashing on display1. For details see table below.

#	Cause	Do
E-01	Programming error E^2PROM.	Contact technical support
E-03	Wrong cycle data	Program a new cycle
E-04	Wrong configuration data probable lost of calibration values	Verificare che i parametri di configurazione siano corretti.
E-05	Disconnected thermocouple or temperature out of range	Check sensors connection, eventually contact technical support
E-07	Wrong recovery data. Recovery function not available	Confirm and start a new cycle
E-11	Cold junction failure or ambient temperature out of range	Contact technical support

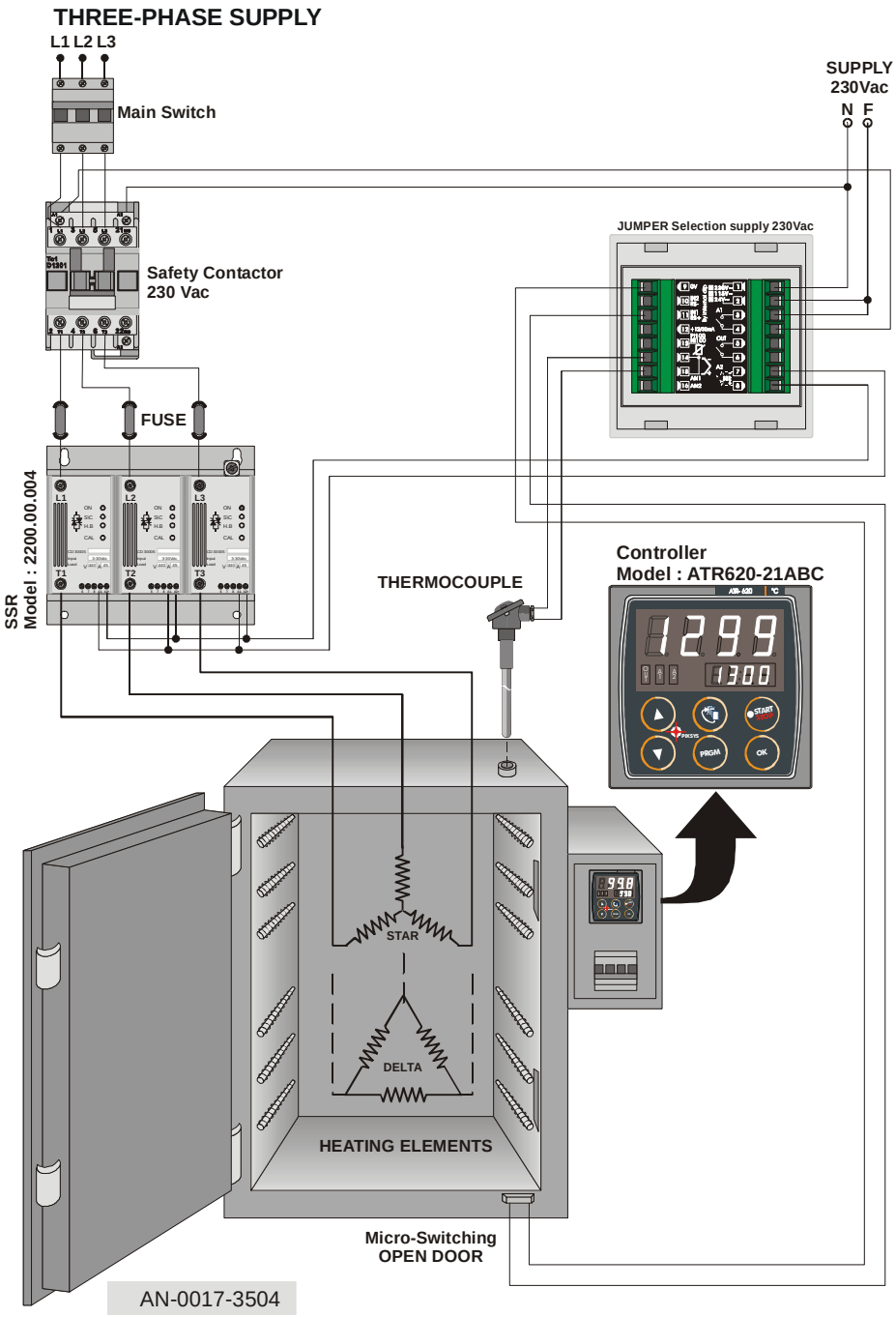
34 Application on industrial kilns

Controller ATR620 has a wide range of applications on industrial kilns, environmental chambers, furnaces, dryers…
Certainly some of the most common application fields are electrical kilns for ceramics, glass, metalworking. Below some examples with a short list of main configuration parameters.

35 Kiln with single thermocouple and SSR control

This is probably the most typical application of controller ATR620, using only main capabilities of the unit and still keeping high user-friendliness..
On electrical kilns ATR620 performs control loop for the programmed cycle reading thermocouple value and controlling SSR. In case that alarm conditions, as overshooting of max. temperature, are noticed relay A1 is activated to open the circuit with safety contactor, along with acoustic signal of internal buzzer and a flashing signal on display. Should the kiln door accidentally open, this is also an alarm condition: cycle is stopped and a corresponding message is visualized on display.
Programming of main parameters:

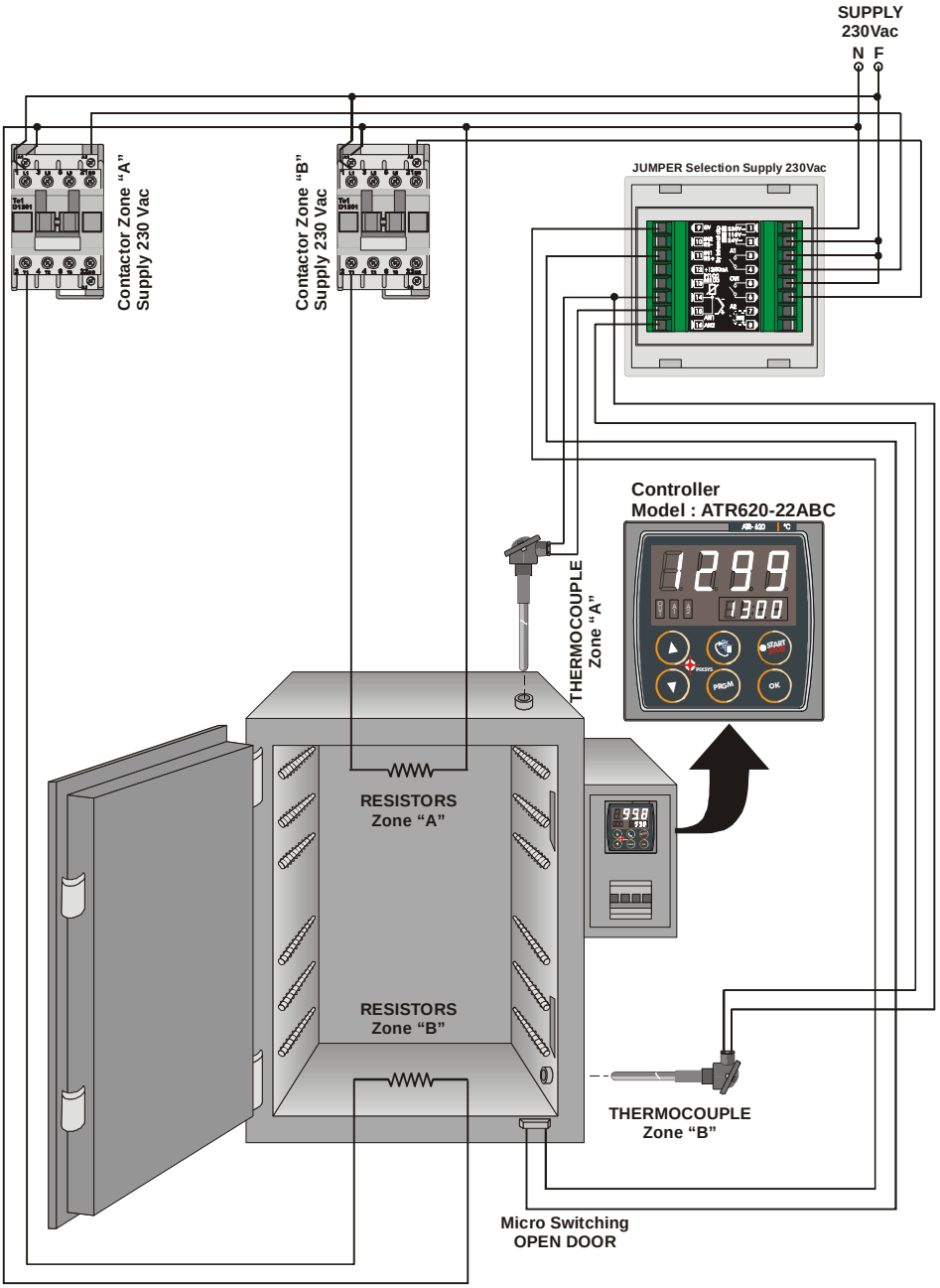
P-01	0009	15 cycles available, 20 steps each Special functions are desabled
P-02	1000	Select thermocouple K (ex.:1100 for TC typeS)
P-05	5000	Select SSR control output for process 1
P-06	0	Minimum temperature (lower limit scale) 0℃
P-07	1350	Max. temperature (upper limit scale) 1350℃
P-12	1101	Max. temperature alarm with cycle block
P-15	1300	Alarm setpoint: if kiln temperature is over 1300℃, the cycle is stopped.
P-17	5100	Alarm on digital input for cycle block and signal “Open door”


THREE-PHASE SUPPLY
L1 L2 L3
Main Switch
SUPPLY
230Vac
N F
Safety Contactor
230 Vac
JUMPER Selection supply 230Vac
FUSE
SSR
Model : 2200.00.004
L1
L2
L3
T1
T2
T3
THERMOCOUPLE
Controller
Model : ATR620-21ABC
STAR
DELTA
HEATING ELEMENTS
Micro-Switching
OPEN DOOR
AN-0017-3504

36 Kiln with 2 thermocouples and contactor control

On bigger kilns it may be necessary to introduce more precise and accurate control of internal temperature, for example in high kilns heat may concentrate on the highest part, leading to a relevant gap of temperature between bottom and top levels. Correct placement of heating elements and a double control loop can achieve uniform temperature for optimal firing cycle.
In this configuration two outputs of ATR620 are configured as control of two processes (corresponding to TC1 and TC2), the third is available for alarm/auxiliary/event.
Programming of main parameters:

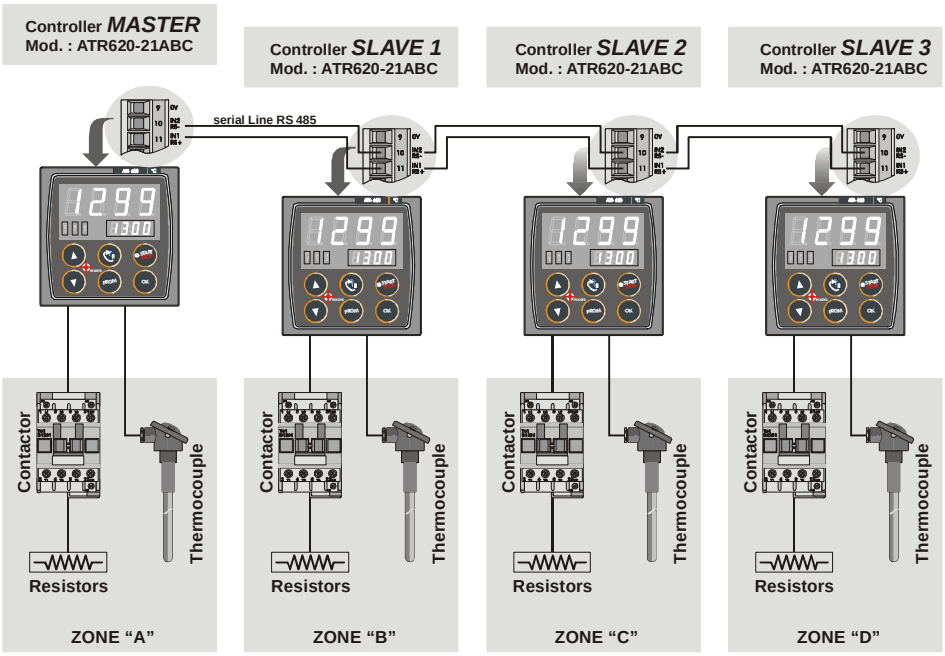
P-01	0009	15 cycles available, 20 steps each Special functions are desabled
P-02	1000	Select thermocouple K on input AN1, process 1
P-03	1001	Select thermocouple K on input AN2, process 2
P-05	1300	Select control output process 1 - 2 on OUT and A1
P-06	0	Minimum temperature (lower limit scale) 0℃
P-07	1350	Max. temperature (upper limit scale) 1350℃
P-13	0000	Available for alarm / auxiliary / event
P-17	5100	Alarm on digital input for cycle block and signal “Open door”
P-52	004-	Max. gap process 1/process 2 : 20℃, Above this value cycle is stopped until temperature is uniform .

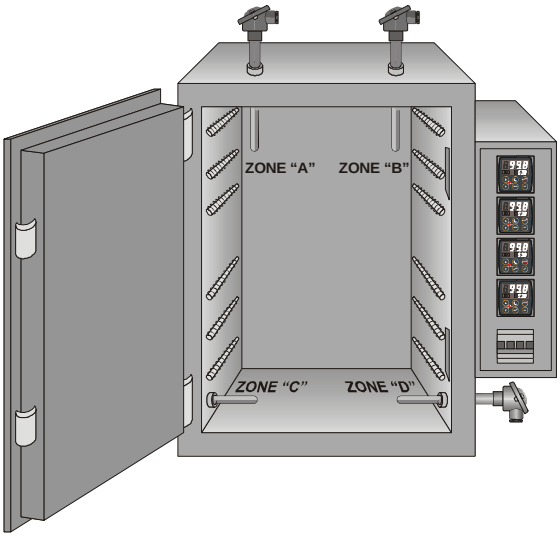

SUPPLY
230Vac
N F
Contactor Zone "A"
Supply 230 Vac
Contactor Zone "B"
Supply 230 Vac
JUMPER Selection Supply 230Vac
Controller
Model : ATR620-22ABC
THERMOCOUPLE
Zone "A"
RESISTORS
Zone "A"
RESISTORS
Zone "B"
THERMOCOUPLE
Zone "B"
Micro Switching
OPEN DOOR

37 Kiln with 4 thermocouples - 4 units ATR620 Configuration Master/Slave

Configuration Master/Slave is suitable also for plants requiring more than two control loops. Still it is necessary to program one single unit, simplifying programming and operating.
The following example describes a kiln with four control loops. Up to 16 units can be connected if Waiting function is active to monitor and compensate temperature gap among different zones, or up to 32 units if this is not required. Digital input capabilities are not available in this configuration because serial communication is activated.
Programming of main parameters (values for Master in brackets):

P-01	0000 (0009)	Remote setpoint active only on Slaves Last digit set to 9 for Master Special functions desabled
P-02	1000	Select thermocouple K on input AN1, process 1
P-05	1001 (1000)	Control output for process 1 on OUT, Remote setpoint by serial input only for slaves
P-06	0	Minimum temperature (lower limit scale) 0℃
P-07	1350	Max. temperature (upper limit scale) 1350℃
P-17/18	0000	Digital inputs desabled
P-21	(120)	Max. waiting time at step end: 120 minutes
P-22	(20)	Max. gap setpoint/process and between processes Above this value cycle stops until temperature returns to limits
P-49	2010	Baudrate, format, communication delay
P-50	1…3 (0)	Slave address 1 to 3 Enter address 0 for Master


Controller MASTER
Mod. : ATR620-21ABC
Controller SLAVE 1
Mod. : ATR620-21ABC
Controller SLAVE 2
Mod. : ATR620-21ABC
Controller SLAVE 3
Mod. : ATR620-21ABC
serial Line RS 485
Contactor
Resistors
Thermocouple
ZONE "A"
ZONE "B"
ZONE "C"
ZONE "D"


ZONE "A"
ZONE "B"
ZONE "C"
ZONE "D"

AN-0019-3504

38 Configuration table

Date:	**Model ATR620:**
Installer:	**Plant:**
Notes:	

P-01	General configuration	
P-02	Analog input AN1	
P-03	Analog input AN2	
P-04	Reserved	
P-05	Control output and source of setpoint	
P-06	Lower limit setpoint 1 (-999/3000 digit)	
P-07	Upper limit setpoint 1 (-999/3000 digit)	
P-08	Lower limit range AN2 for V/mA(-999/3000digit)	
P-09	Lower limit range AN2 for V/mA (-999/3000digit)	
P-10	Alarms hysteresis (-999/3000)	
P-11	Configuration alarm no.1 (OUT)	
P-12	Configuration alarm no.2 (A1)	
P-13	Configuration alarm no.3 (A2)	
P-14	Setpoint alarm no.1(-999/3000 digit)	
P-15	Setpoint alarm no.2(-999/3000 digit)	
P-16	Setpoint alarm no.3(-999/3000 digit)	
P-17	Configuration digital input IN1	
P-18	Configuration digital input IN2	
P-19	Configuration Autotuning,step visualization	
P-20	Power heating elements (0.0/999.9 KWatt)	
P-21	Waiting for step end (1/1440 min)	
P-22	Max gap at step end (1/200 digit)	
P-23	Cycle recovery	
P-24	Reserved	
P-25	Filter analog inputs (1/20 medie)	
P-26	Offset calibration AN1 (-15.0/15.0 digit)	
P-27	Gain calibration AN1(-10.0%…+10.0%)	
P-28	End ON/OFF control (-999/3000digit)	
P-29	Reserved	

P-30	Max. time for impulse zone 1 (1/120sec)	
P-31	Limit of control signal zone 1 (10/100%)	
P-32	Reserved	
P-33	Reserved	
P-34	Reserved	
P-35	ON/OFF hysteresis;PID dead band (-99.9/300.0digit)	
P-36	Proportional band (0-3000digit)	
P-37	Integral time (0/9999 sec).	
P-38	Derivative time (0.0/999.9 sec).	
P-39	Lower limit scale 3 (-999/3000 digit)	
P-40	Upper limit scale 3 (-999/3000 digit)	
P-41	Offset AN2 (-15.0/15.0 digit)	
P-42	Gain AN2(-10.0%…+10.0%)	
P-43	Max. time for impulse zone 2 (1/120sec)	
P-44	Limit of control signal zone 2 (10/100%)	
P-45	ON/OFF hysteresis;PID dead band (-99.9/300.0digit)	
P-46	Proportional band (0-3000digit)	
P-47	Integral time (0/9999 sec).	
P-48	Derivative time (0.0/999.9 sec).	
P-49	Configuration serial input	
P-50	Slave address (1/99).	
P-51	Visualization in RUN/START mode	
P-52	Programming block, endless step	