PIXSYS

elettronica

CONTROLLER

ATR420

User Manual

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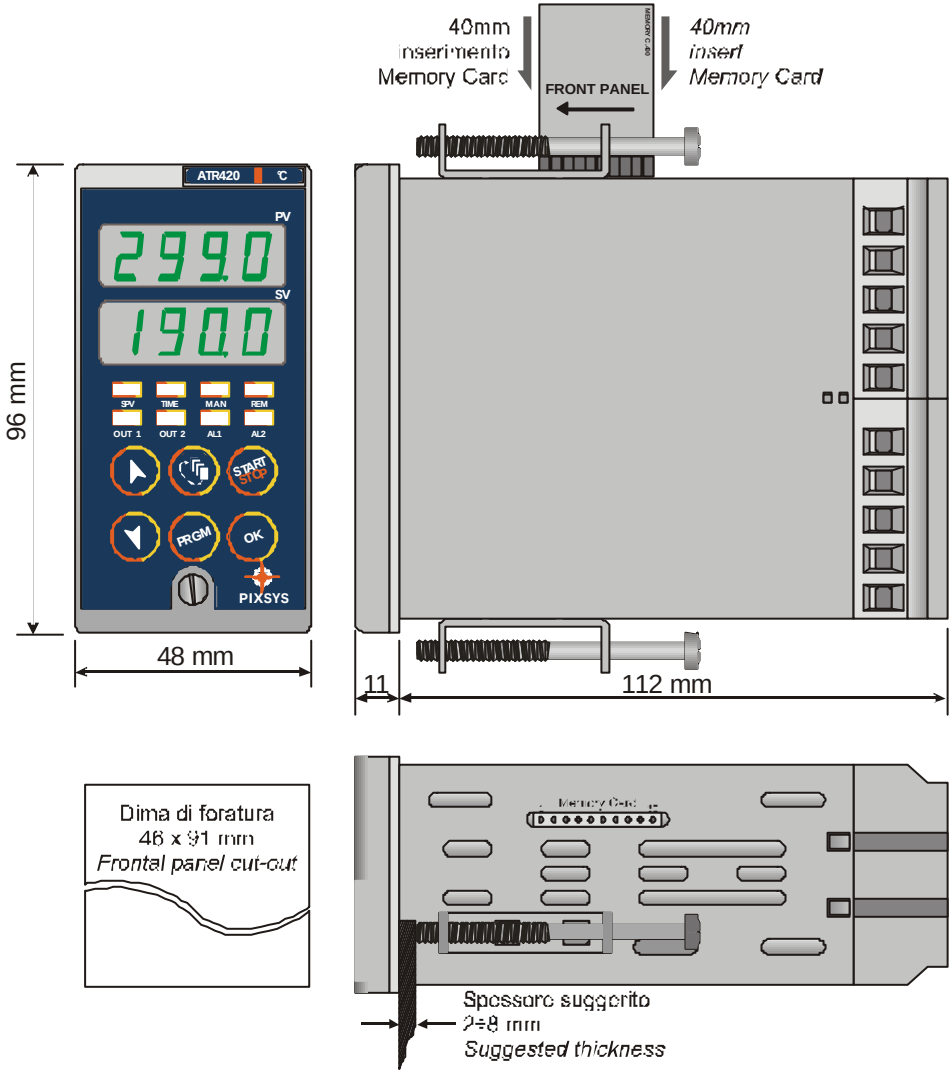
Introduction

The controller ATR420 integrates control and regulation functions for process automation. It is provided with RS485 and MODBUS protocol and it maintains the key-features of all Pixsys instruments such as free configurable input and a wide range of parameters to make it easily adaptable and highly flexible.
To simplify the configuration, a special Memory Card has been conceived to copy all parameters and eventually store them for historical archive.
Sealing of cover according to IP54. Frontal extraction of electronics for easy maintenance.

1. Ordering code

ATR420-	☐	☐	☐	
Input	1			1 Input TC-RTD-signals V, mA
Output		1		2 relay outputs + 1 SSR output
Power supply			AD	24/12V AC ±15% 50/60Hz
			BC	230/115V AC ±15% 50/60Hz

2. Sizes and installation



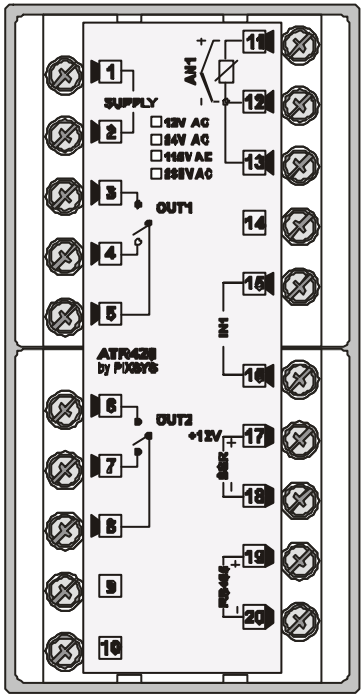
3. Electrical wirings



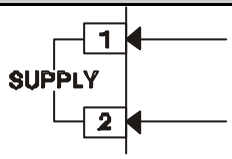
Altough this controller has been conceived to resist the worst noises in an industrial environment, please notice the following safety guidelines:

- 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

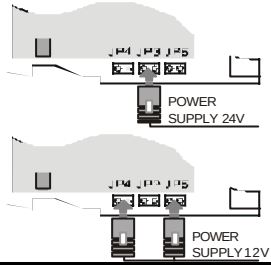
3.1 Wiring plan



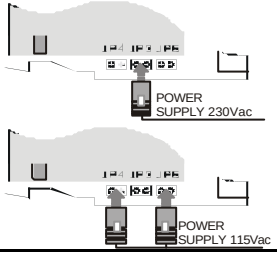
Power supply



- 24/12V AC ±15% 50/60Hz (selection by internal jumper)
- 230/115V AC ±15% 50/60Hz (selection by internal jumper)

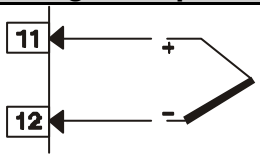


- Version ATR420-XXAD
- Select JP4 and JP5 for 12V AC
- Select JP3 for 24V AC



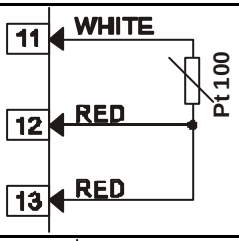
- Version ATR420-XXBC
- Select JP4 and JP5 for 115V AC
- Select JP3 for 230V AC

Analogical input



1. Thermocouples K, S, R, J

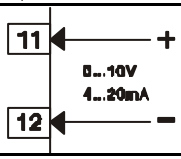
- Respect polarities
- For eventual extensions, use compensating cable and terminals suitable for the used thermocouple



2. For PT100, NI100

- For a three-wire wiring use cables with the same diameter

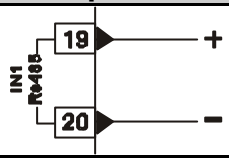


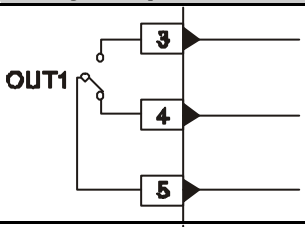
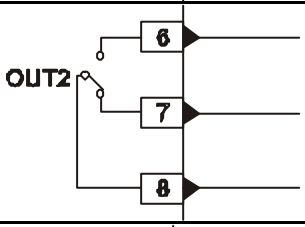
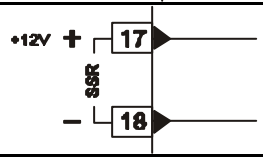


3. Signals V, mA

- Respect polarities

Digital input	
	• Digital input, configurable from parameter 17 as N.O. and N.C.

Serial input	
	• RS485 Modbus

Relay outputs / SSR output	
	Contacts capacity 8A/250V~ resistive • Control relay setting 0 on parameter 5 (**P-05**). • Relay alarm 1 with SSR control setting 1 on parameter 5 (**P-05**).
	Contacts capacity 8A/250V~ resistive • Relay alarm 2.
	Capacity 12V/30mA • Control output for SSR • Alarm 1 with control OUT1

4. Displays and keys



4.1 Displays		
1		It usually visualizes the process value. During configuration it will visualize the number of entering parameter
2		This display can visualize setpoint, output percentage, elapsed time for timer, running step. During configuration it will visualize the value of entering parameter.

4.2 Meaning of leds		
3		ON when display 1 or display 2 visualize setpoint value
4		ON when display 1 or display 2 visualize time value
5		ON when the unit is functioning as simple controller , not as programmer
6		ON when the controller is answering a serial polling
7		ON when control output is active
8		ON when OUT2 is active
9		ON when alarm 1 or auxiliary 1 is active
10		ON when alarm 2 or auxiliary 2 is active

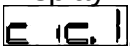
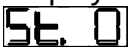
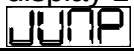
4.3 Keys		
11		• Scroll through the parameters during the configuration. • Scroll the cycles to program or to start • Modify time and setpoint values during cycle programming • Modify setpoint when the function HOLD is active • Fast advancement on cycle
12		• Scroll through the parameters during the configuration. • Scroll the cycles to program or to start • Modify time and setpoint values during cycle programming • Modify setpoint when the function HOLD is active • Fast go-back
13		• Visualize duration of last executed cycle with controller in STOP-mode • Move to next flashing digit during parameters configuration • Scroll and visualize timer, step, output % and setpoint during cycle execution
14		• Enter cycles selection and configuration mode when the controller is in STOP-mode • Press it for ab. Durante un ciclo, se sec. During cycle execution to start or stop the function HOLD.
15		• START a new cycle or STOP the running cycle • ESCAPE –key if programming parameters or cycles.
15		• Confirm the selected value or function.

5. Configuration and programming

1. Configuration means programming of basic parameters (type of input/output, alarms operating….)
2. Cycle programming means entering values of time and setpoint/temperature for each step/segment of the cycle

5.1 Entering or modifying a cycle

The controller must be in STOP-mode.

	Press	Display	Do
1		Display 2 visualizes 	
2		Visualize  (for cycle no. 1),  (for cycle no. 2) and so on	Press one of the arrow keys until the chosen program is visualized
3		Display 2 visualizes  . Display 1 visualizes the waiting time before START and led TIME is ON. If this function is not required , go to point 5	Anytime press  to quit the programming mode , storing the modified data.
4		Increase / decrease the value on display 1.	Enter the value for waiting time before cycle start. Setting value 0, display 1 visualizes 

5		Display 2 visualizes St. 0 . Display 1 visualizes the starting setpoint and led SPV is ON. Otherwise go to point 7	
6		Increase/ decrease value on display 1.	Enter the value of starting setpoint, which means the reference value for the controller to rate the gradient of first step (this is usually the ambient 25°C).
7		Display 2 visualizes the step which is being modified. Display 1 visualizes the duration of the step and the led TIME is On.	
8		Increase/decrease the value on display 1.	Enter the duration of step (hours : minutes) Choose End for end of the cycle and go to point 15.
9		Display 2 visualizes the step which is being modified . Display 1 visualizes setpoint and led SPV is ON	
10		Increase/decrease the value on display	Enter setpoint value

11		If auxiliary output 1 is not timed, go to point 13 Display 1 visualizes A 1on or A 1oF and led A1 is ON	
12		Press  to visualize A 1oF , press  to visualize A 1on.	Set the state of auxiliary output for each step: A 1on for active output or A 1oF for desabled output
13		If auxiliary output 2 is not timed, go to point Display 1 visualizes A2on o A2oF and led A2 is ON	
14		Press  to visualize A2oF or press  to visualize A2on.	Set the state of auxiliary output for each step: A2oF for active output or A2oF for desabled output **Go back to point 7**
15		If auxiliary outputs1 or 2 are not timed, the controller returns to STOP-mode and stores the cycle. Display 2 visualizes StoP.	If outputs are programmed as auxiliaries, repeat points 12 and 14 for the state of outputs at cycle end (after STOP)

6. Cycle start and special functions

6.1 Cycle start

The controller must be in STOP-mode.

	Press	Display	Do
1		Display 2 visualizes cycle selection	
2		 (for cycle no.1),  (for cycle no.2) …	Scroll the available cycles, until the chosen one is visualized on display
3	 or	Cycle starts and internal buzzer beeps. Display 1 visualize process value, display 2 visualizes setpoint value	

⚠ Function FAST ADVANCEMENT

With cycle in progress, press  or  to scroll the cycle onwards or backwards (each beep of the buzzer means one minute)

⚠ Function HOLD (with cycle in progress)

Press  for about 1 sec. to start the function HOLD. This means that the controller stops the cycle in progress and holds the temperature until the function is stopped. Setpoint value can also be changed by pressing  . To stop the function and restart the cycle , press  for about 1 sec.

⚠ To stop the cycle before it is completed and set the controller to STOP-mode , press  .

6.2 Function “SIMPLE CONTROLLER”

Instead of standard operation as a programmer, the ATR420 can also function as a controller referring to the given setpoint.
The controller must be in STOP-mode to activate the function.

	Press	Display	Do
1		Display 2 visualizes cycles selection	
2		Scroll the available cycles until tEr0 is visualized. Led TRM is ON.	
3		Display 2 visualizes setpoint value . Led TRM starts flashing. Control output is activated .	
4		Increase or decrease the setpoint value on display 2.	Change setpoint if required. To quit the function, press  .

6.3 Auto-tuning

Auto-tuning function can be started if the function SIMPLE CONTROLLER is running. **Process value must be at least 35% lower than setpoint value** .

	Press	Display	Do
1		tunE flashing on display 2.	

3		tunE is visualized The controller starts the auto-tuning function	Wait until setpoint value is visualized again . To quit the function before it is completed, press 

7.Configuration

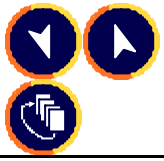
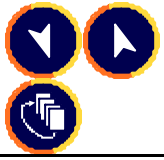
7.1 Change of numeric value

1. If all digits are flashing, press  to change the parameter value.
2. If all digits are visualized and only one is flashing, press   to change it and press  to move to the next digit.

7.2 Change of configuration parameters

To change the configuration parameters (see chap. 8) , the controller must be in STOP-mode.

	Press	Display	Do
1		Display 2 visualizes cycles selection	
2			Scroll the cycles until conF. is visualized
3		Display 1 visualizes 0000 and the 1st digit flashes. Display 2 visualizes PASS.	

	Press	Display	Do
4		Modify the 1st flashing digit	Enter password 1234 (see 7.1 , 7.2)
5		Display 1 visualizes P-01, display 2 visualizes parameter value	
6		Increase or decrease number of parameter	Scroll parameters until the selected parameter is displayed
7		Display 2 visualizes teh flashing value.	
8		Increase or decrease the value	See 7.1 for chnge of numeric value
9		Parameter value stops flashing.	To change another parameter go back to point 6.
10		Press the key when configuration or change of pameter have been completed. The controller is set to STOP-mode.	

7.3 Memory Card

Parameters and cycle values can be copied and stored on another controller by means of the Memory Card. Before you insert the Card, **the controller must be switched-off** . Please **check also entry direction** (see label on the Card) . When the controller is switched-on, display 1 visualizes MEM and display 2 visualizes no[1].

	Press	Display	Do
1		 visualizes YES, visualizes no.	Select YES if values stored on the Memory Card must be loaded on the controller. Selecting no the data of the controller will be kept unchanged.
3		The controller loads the value and the beep of internal buzzer confirms that data have been copied. Controller is ready	

⚠ Updating of Memory Card.

See also previous point., select no on display 2 to update the values of Memory Card [2]. Enter configuration mode and **change at least one parameter**. Quitting the configuration mode, the beep of internal buzzer will confirm that new values have been stored.

[1] If data stored on Memory Card are correct.

[2] In case that the controller does not visualize MEM , this means that no data are stored on the Card, but values can be updated

8. Configuration parameters

P-01	General configuration
	Define the type of PID action, enable or desable starting setpoint and waiting, select the number of cycles.
	1st Digit – Type of PID action
0	Single reverse action
1	Single direct action
	2nd Digit – Enable starting setpoint of cycle
0	Starting Setpoint enabled
1	Starting setpoint desabled
	3rd Digit – Enable waiting before cycle start
0	Waiting enabled
1	Waiting desabled
	4th Digit – Select number of cycles available for the operator
1..4	1..4 cycles available

P-02	Configuration of universal analogical input AN1
	Select type of di sensor , visualization and measure unit
	1st Digit – Thermocouple / Thermoresistence
0	Type K (-200/1370°C)
1	Type S (-120/1840°C)
2	Type R (-120/1840°C)
3	Type J (-200/1220°C)
4	PT100 (-210/870°C)
5	NI100 (-70/190°C)
6	Input 0…10V
7	Input 0…20mA
8	Input 4…20mA
	2nd Digit – Decimal point
0	No decimal point
1	Visualization with decimal point
	3rd Digit – Select measure unit
0	°C
1	°F

P-03	Reserved

P-04	Reserved

P-05	Configuration of control output	
	Select control output	
	0	Control relay OUT1- Alarm 1 SSR - Alarm2 OUT2
	1	Control SSR - Alarm 1 OUT1 – Alarm 2 OUT2

P-06	Lower limit of setpoint (-999/9999 digit)
P-07	Upper limit of setpoint (-999/9999 digit)
	Set the limits of setpoint which may be entered by the operator

P-08	Lower limit of scale (-999/9999 digit).
P-09	Upper limit of scale (-999/9999 digit).
	Set the limits of the scale for the rating of values to visualize in case that inputs are configured as V or mA.

P-10	Alarms hysteresis (-99.9/999.9 digit).
	Hysteresis for the rating of alarms operation . Useful to avoid dangerous oscillations of outputs.

P-11	Reserved

P-12	Configuration alarm no.1
P-13	Configuration alarm no.2

Alarms operation (see graphs of chap. 5). Acoustic / visual signal joined to cycle stop can be selected. Comparison values for graphs are defined by parameters **P-15**..**16.**

1st Digit –Type of operating

0	Not used
1	Absolute - related to process
2	Band
3	Upper deviation
4	Lower deviation
5	Absolute - related setpoint
6	Timed - related to step

2nd Digit –Operation zone

0	"**Under**" by absolute or deviation alarm "**inside**" by band alarm
1	"**Over**" by absolute or deviation alarm. "**Outside**" by band alarm

3rd Digit –Type of action on cycle

0	No action
1	Acoustic signal only
2	Cycle stop , 0% output , acoustic and visual [3] signal.
3	Cycle stop,100% output , acoustic and visual [3] signal

P-14	Reserved

P-15	Comparison value for alarm no.1 (-999/9999 digit).
P-16	Comparison value for alarm no.2 (-999/9999 digit).

[3] Visual signal is 

or 

to indicate the active alarm;

It stays until the key 

is pressed by the operator.

P-17	Configuration of digital input IN1
	Select the operating of digital input. Impulse means closed / open contact for at least 150msec
	1st Digit – Operating of input
	0 Not used
	1 Input START/STOP at impulse (>= 150 msec)
	2 RUN while active. The controller is ON and executes the cycle which is selected on the 3rd digit of this parameter, until the contact is closed (or open)
	3 Temporary stop of cycle ; writing OPEn flashing
	4 Input HOLD. Setpoint may be changed by keyboard
	5 Input MASTER/SLAVE. If input is active the controller works as slave unit, if not it works as Master
	2nd Digit – Type of contact
	0 Active with closed contact
	1 Active with open contact
	3rd Digit - Cycle or function to start
	0 Start the last cycle
	1…4 Start cycle no.1...4

P-18	Reserved

P-19	Reserved

P-20	Reserved

P-21	Waiting for step end (1/1440 min. 0 disables the function)
	See 10.2 for details

P-22	Max. gap from step end (1/200 digit).
	When the gap between setpoint-process1 is lower this value, the controller skips to the following step without waiting for the time programmed on **P-21***. For further detail, see 11.2.*

P-23	Recovery of interrupted cycle
	Enable the recovery of an interrupted cycle in case of black-out . For further details see 10.1.
	0 Cycle recovery desabled
	1 Cycle recovery enabled

P-24	Reserved

P-25	Reserved

P-26	Offset correction for input AN1 (-15.0/15.0 digits)
P-27	Gain calibration for input AN1 (-10.0%…+10.0%)
	Add to the value measured by the sensor a certain number of units or a percentage value in order to correct the visualized value.

P-28	Reserved

P-29	ON/OFF hysteresis or dead band (-99.9/999.9 digit).
	Hysteresis for control output in ON/OFF mode. Useful to avoid dangerous oscillations when process is very close to setpoint value.

P-30	Max. time for impulse (1/120 sec).
	Cycle time for time-proportioning outputs. Example: if P-30 is set as 10 seconds, this means 60% output when the output is active for 6.0 seconds, not active for 4.0 seconds and so on.

P-31	Reserved

P-32	Reserved

P-33	Reserved

P-34	Reserved

P-35	Reserved

P-36	Proportional band (0-9999 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)
	Set the parameters for P.I.D..

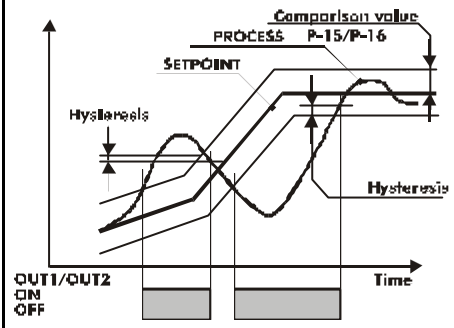
P-49	Configuration of serial input
	Select baud rate ìand enable abilita answer delay for MODBUS according to baud rate
	1st Digit – Baud rate
0	Baud rate 38400
1	Baud rate 19200
2	Baud rate 9600
3	Baud rate 4800
	2nd Digit – Answer delay Modbus
0	Delay Modbus desabled
1	Delay Modbus enabled (3, 6, 9, 12 ms).

P-50	Slave address (1/99).
	Modbus address for slave module

9. Alarms operating

Two alarms can be programmed and connected to outputs (OUT1, OUT2, SSR). The graphs below describe the programmable operatings.

Band alarm (setpoint-process)

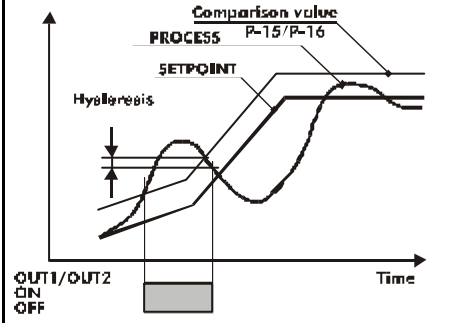


Band alarm active:

- outside
- inside

Example: outside

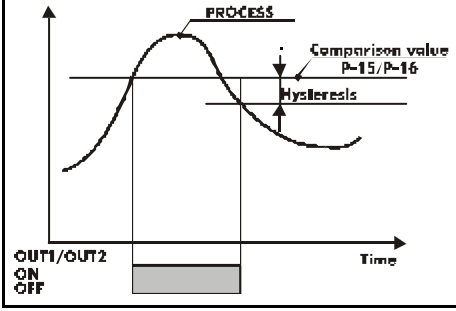
Deviation alarm (setpoint-process)



- Upper deviation
- Lower deviation

Example: upper deviation

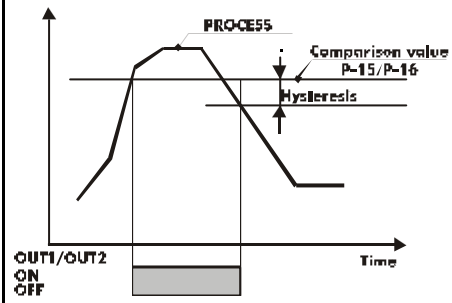
Independent alarm (process)



- Active over
- Active under

Example : active over

Independent alarm (setpoint)

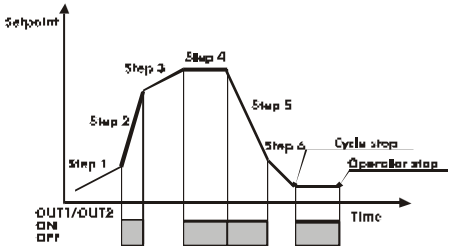


- Active over
- Active under

Example: active over

All operatings can be joined to cycle stop and/or acoustic / visual signal .

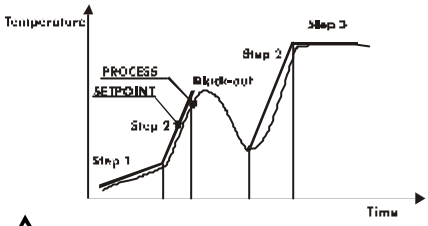
Programmable operating (timed ⏲)



ON- or OFF-state of auxiliary output can be selected for each step of the cycle. State is selectable also at cycle end. See 5.1.

10. Software functions

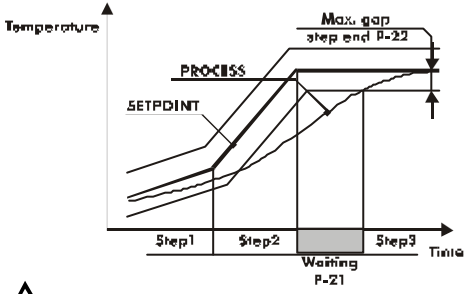
10.1 Recovery of interrupted cycle



⚠ **To desable the function, set parameter 23 to 0 (zero)**

Cycle recovery is particularly useful for firing plants. After a black-out, the controller ATR420 can restart the cycle from the point at which it was interrupted. The gradient will be the same of the running step.

10.2 Waiting



⚠ **To desable the function, set parameter 21 at 0 (zero) .**

When the function Waiting is working, the chronometer stops and display 2 visualizes  instead of step number.

The function is useful for firing cycles on industrial kilns in case that the plant is unable to reach the programmed temperature (setpoint) in the given time. If the gap between process value and setpoint is bigger than the value entered on parameter 22, the next step will start only after elapsing of the time programmed on parameter 21 or when the gap is lower than parameter 22 (see graph beside) .

To quit the function manually, press  **.**

11. Protocol Modbus RTU

11.1 Main features

ATR420 is conceived for use and remote connection via MODBUS protocol. Serial RS485 enables the programming and the reading of sensor input.

Baud-rate	Selectable by parameter 38400 bits/sec 19200 bits/sec 9600 bits/sec 4800 bits/sec
Format	8, N, 1(8bit, no parity, 1 stop)
Supported functions	WORD READING (max 1 word) (0x03, 0x04) SINGLE WORD WRITING (0x06)

11.2 Addresses of words ATR420

MODBUS ADDRESS	DESCRIPTION	READ/WRITE	RESET VALUE[3]
1	**Process**	R	0
2	**Operating temperature**	R	0
3	**Setpoint**	R	0
4	**Percentage of output**	R	0
5	**Parameter 1 (P-01)**	R/W	EEP
6	**Parameter 2 (P-02)**	R/W	EEP
7	**Parameter 5 (P-05)**	R/W	EEP
8	**Parameter 6 (P-06)**	R/W	EEP
9	**Parameter 7 (P-07)**	R/W	EEP
10	**Parameter 8 (P-08)**	R/W	EEP
11	**Parameter 9 (P-09)**	R/W	EEP
12	**Parameter 10 (P-10)**	R/W	EEP
13	**Parameter 12 (P-12)**	R/W	EEP
14	**Parameter 13 (P-13)**	R/W	EEP

[3] According to initialization value at starting, the following possibilities are given:

1. "EEP" value stored on Eeprom.
2. "?" values unknown at starting

15	**Parameter 15 (P-15)**	R/W	EEP
16	**Parameter 16 (P-16)**	R/W	EEP
17	**Parameter 17 (P-17)**	R/W	EEP
18	**Parameter 21 (P-21)**	R/W	EEP
19	**Parameter 22 (P-22)**	R/W	EEP
20	**Parameter 23 (P-23)**	R/W	EEP
21	**Parameter 26 (P-26)**	R/W	EEP
22	**Parameter 27 (P-27)**	R/W	EEP
23	**Parameter 29 (P-29)**	R/W	EEP
24	**Parameter 30 (P-30)**	R/W	EEP
25	**Parameter 36 (P-36)**	R/W	EEP
26	**Parameter 37 (P-37)**	R/W	EEP
27	**Parameter 38 (P-38)**	R/W	EEP
28	**Parameter 49 (P-49)**	R/W	EEP
29	**Parameter 50 (P-50)**	R/W	EEP
50	**Byte Display1 (4^{th} digit)**	R	EEP
51	**Byte Display1 (3^{rd} digit)**	R	EEP
52	**Byte Display1 (2^{nd} digit)**	R	EEP
53	**Byte Display1 (1^{st} digit)**	R	EEP
54	**Byte Display2 (4^{th} digit)**	R	EEP
55	**Byte Display2 (3^{rd} digit)**	R	EEP
56	**Byte Display2 (2^{nd} digit)**	R	EEP
57	**Byte Display2 (1^{st} digit)**	R	EEP
58	**Byte Led**	R	EEP
59	**Byte keys**	W	EEP

12. Error messages

In case that the plant does not work properly, the controller stops the running cycle and shows a fault condition. See table below for description of fault messages.

#	Cause	Do
E-01	Programming error E^2PROM.	-
E-03	Wrong cycle data	Program a new cycle.
E-04	Wrong configuration data . Possible lost of configuration data	Check configuration parameters.
E-05	Disconnected or open sensor / temperature out of range	Check sensors connection
E-07	Wrong cycle data. Recovery function not available	Confirm and start a new cycle
E-11	Cold junction failure. Ambient temperature out of range	-

13. Technical data	
13.1 Main features	
Visualizers	8 displays (0,56 inches)
Operating conditions	0-45°C, humidity 35..95uR%
Sealing	IP54 Frontal
Material	ABS self-exstinguish
Weight	450g
Sizes	48x96(frontal)x135mm

13.2 Hardware data		
Analogical inputs	**1**: AN1,	
	Configurable **Input no.1** Thermocouple K, S, R, J Thermoresistances PT100, Ni100 Input V/I 0-10V, 0-20mA, 4-20mA	Accuracy (25°C) 0.2 % ± 1 digit for input TC, RTD, V/I
Relay outputs	**2** relays: OUT1, OUT2	
	Configurable as control and alarm	Contacts capacity 8A-250V~
SSR output	**1** linear output	
	Configurable as control or alarm	Output 12Vdc 30mA
Serial input	**1**: RS485	
	Serial input, MODBUS protocol	
Digital input	**1**: IN1	
	Cofigurable as input START, STOP, signal OPEn, input HOLD	

13.3 Main software data	
Control action	ON-OFF with hysteresis P, PI, PID, PD time-proportioning
Proportional band	0...9999°C or °F
Integral time	0...9999 sec (0 excludes Integral)
Derivative time	0,0...999,9 sec (0 excludes Derivative)
Functions	Auto-Tuning , programmable alarms
Programmable cycles	4 cycles - max 15 segments (step) Operation as simple controller with programmable setpoint also available

Configuration table

Date:	**Model ATR420:**
Installer:	**Plant:**
Notes:	

P-01	General configuration	
P-02	Configuration analogical input AN1	
P-03	Reserved	
P-04	Reserved	
P-05	Configuration of control output	
P-06	Lower limit of setpoint(-999/9999 digit)	
P-07	Upper limit of setpoint (-999/9999 digit)	
P-08	Lower limit of scale (-999/9999 digit)	
P-09	Upper limit of scale (-999/9999 digit)	
P-10	Alarms hysteresis (-99.9/999.9)	
P-11	Reserved	
P-12	Configuration alarm no.1	
P-13	Configuration alarm no.2	
P-14	Reserved	
P-15	Comparison value for alarm no.1(-999/9999 digit)	
P-16	Comparison value for alarm no.2(-999/9999 digit)	
P-17	Configuration for digital input IN1	
P-18	Reserved	
P-19	Reserved	
P-20	Reserved	
P-21	Waiting for step end (1/1440 min)	
P-22	Max. gap for step end (1/200 digit)	
P-23	Cycle recovery	
P-24	Reserved	
P-25	Reserved	
P-26	Offset correction AN1 (-15.0/15.0 digit)	
P-27	Gain calibration AN1(-5.0%…+5.0%)	

P-28	Reserved	
P-29	ON/OFF hysteresis or Dead band (-99.9/999.9 digit)	
P-30	Max. time for impulse (1/120sec)	
P-31	Reserved	
P-32	Reserved	
P-33	Reserved	
P-34	Reserved	
P-35	Reserved	
P-36	Proportional band (0-9999 digit)	
P-37	Integral time (0/9999 sec).	
P-38	Derivative time (0.0/999.9 sec).	
P-49	Configuration of serial input	
P-50	Slave address (1/99).	

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