Operation Manual R2-120TC

Index

1 - Size

The size of modules R2-120TC are shown in figure 1.1 .

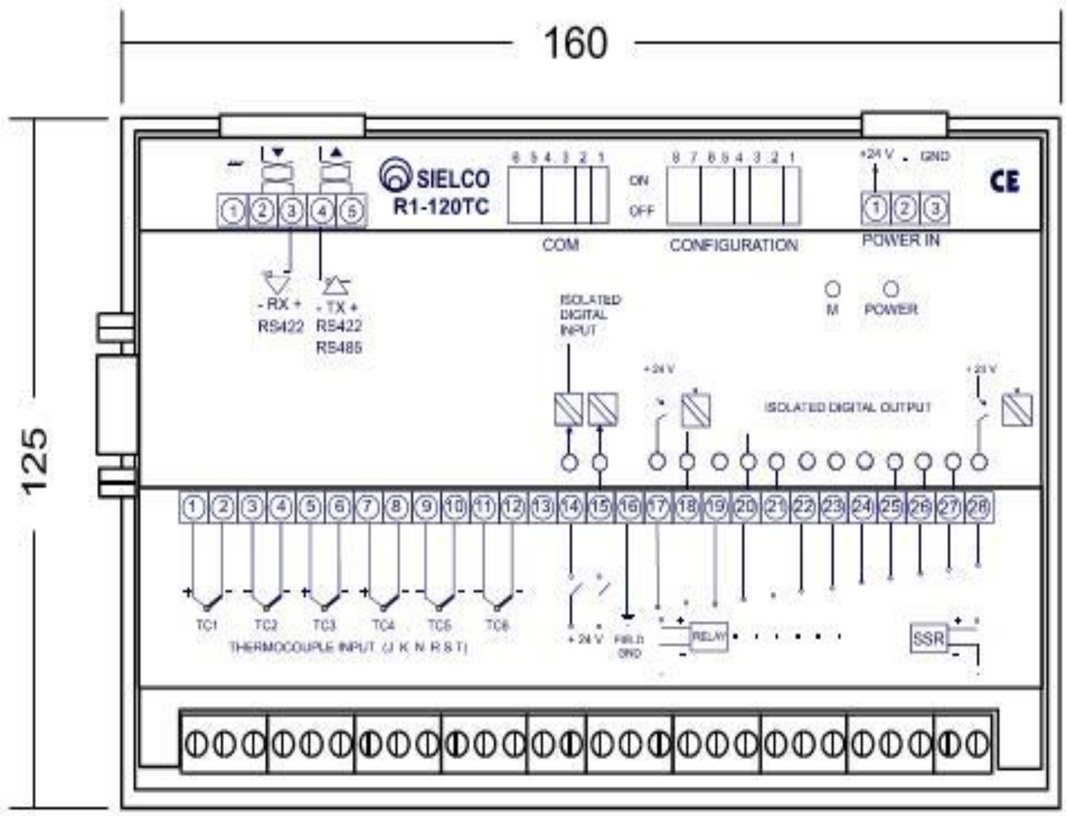

Figure 0.1 -1 Dimensions of the regulator R2-120TC.

2 - Fixing Mode

All the products of the series R2-120TC are equipped with a plastic holder for mounting on DIN rail EN EN and are shielded by a metallic screen against EMI disturbances.

On the hood of the cover are shown schematically the indications for the interconnection of the regulator with the power supply, the communication bus , the thermocouple sensors and actuators.

3- Electrical Connections

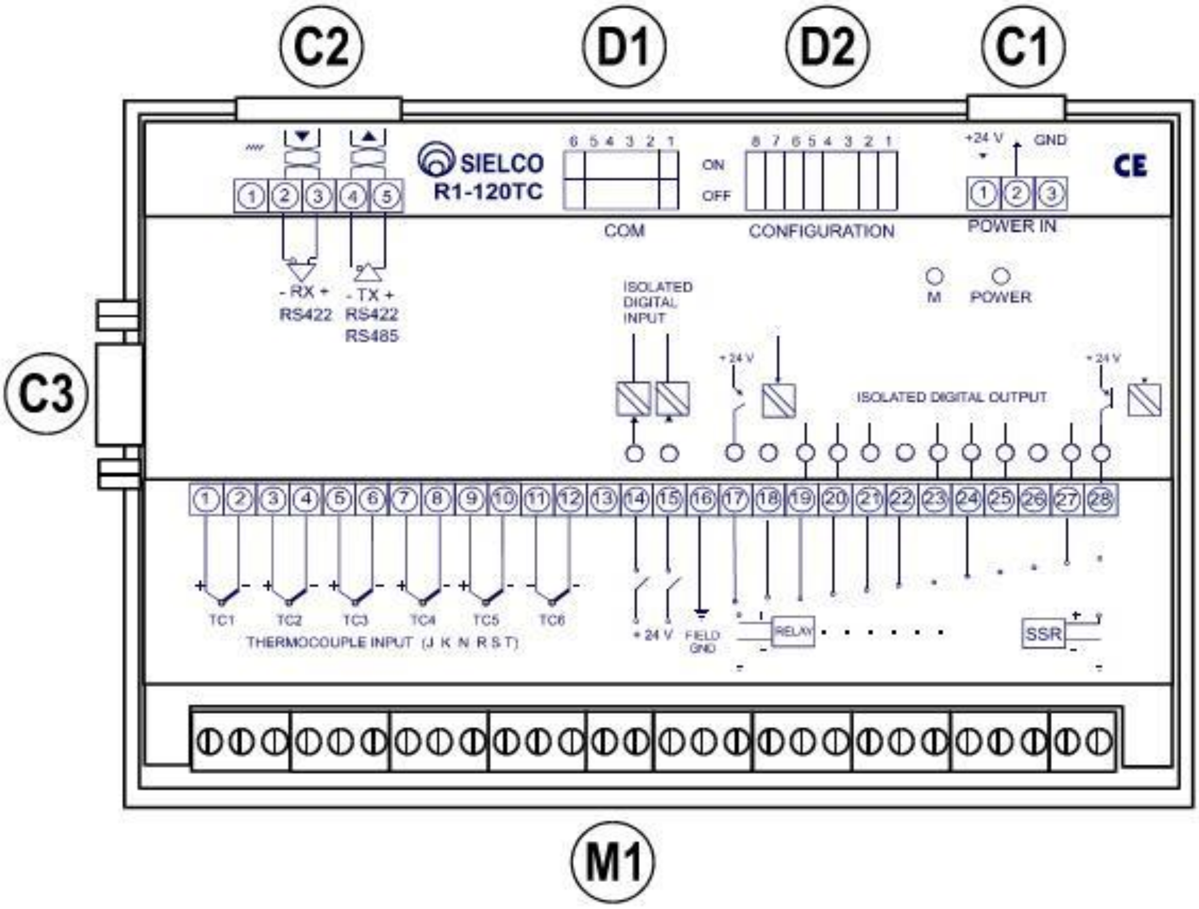

Figure 0.3 -2 Diagram R1-120TC

	Description
[M1]	Terminal board inputs (terminals from no. 1 to no. 15) And outputs (terminals from no. 17 to no. 28)
[C1]	Connector for 24 Vdc power supply
[C2]	Connector for serial connection RS422/485
[C3]	Connector for connection console F1-10
[D1]	Dip Switches for the selection of line RS422/RS485
[D2]	Dip Switches for the selection of the address of the device and the protocol of communication
Power	Led supply presence
Led M	Led to self-test
Led TX	Led transmitted data over serial
RX Led	Led data received on serial
Led 14-15	Status of the 2 digital inputs
Led 17-28	State of the 12 digital outputs

[M1] - Terminal inputs and outputs

	TC PLUG INPUT
1	Channel 1 positive
2	Channel 1 negative
3	Channel 2 positive
4	Channel 2 negative
5	Channel 3 positive
6	Channel 3 negative
7	Channel 4 positive
8	Channel 4 negative
9	Channel 5 positive
10	Channel 5 negative
11	Channel 6 positive
12	Channel 6 negative

	DIGITAL INPUT
14	Digital Input 1
15	Digital Input 2

	FIELD GROUND
16	Mass of field

	DIGITAL OUTPUT
17	Digital Output 1
18	Digital Output 2
19	Digital Output 3
20	Digital Output 4
21	Digital Output 5
22	Digital Output 6
23	Digital Output 7
24	Digital Output 8
25	Digital Output 9
26	Digital Output 10
27	Digital Output 11
28	Digital Output 12

The sensor of the cold junction is housed inside the terminal 13

[C1] - Connector for 24 Vdc power supply

	ALIM
1	+24 Vdc
2	FIELD GND
3	MECH. GND

[C2] - connector for serial connection RS422/485

	RS422		**RS485**
1	SERIAL GND	**1**	SERIAL GND
2	RX-	**2**	N. C.
3	RX+	**3**	N. C.
4	TX-	**4**	TX- /RX-
5	TX+	**5**	TX+ /RX+

4 - Supply

The regulator must be fed with a dc power supply 24Vdc (12V < Vcc < 36V) via the connector C1 and absorbs the maximum a current Icc =170 mA at 24 Vdc, excluding any load due to the digital outputs (max 100mA per output). The outputs are PNP transistor sourcing current to the load in active state.

5 - Analog Inputs

The regulator has 6 inputs for thermocouples or for weak signals in voltage type 0-50 mV (terminal block M1).

Were developed 2 models respectively R1-120TC and R2-120TC.

The model R1 has all thermocouples with the negative in common is connected to the ground.

The model R2 has the thermocouples insulated from each other and from ground with a resistance of about 500k ohms.

The models are from the electrical point of view, plant engineering and functional identical.

If you use thermocouples, connect only sensors of type J, K, N, R, S, T complying with IEC standards

The thermocouples are isolated from one another and toward earth from resistors of 500 Kohm in the model R2-120TC

The regulator performs automatic compensation of the cold junction.

The temperature of cold joints is measured to the interconnection of thermocouple cable with the instrument. It should be, in order to get the maximum accuracy on the compensation that the ambient temperature of the card is uniform in the connection area of thermocouple cable.

You need to accurately measure the electromotive force that the connections to the regulator should be carried out with extension cables suitable for the type of thermocouple used. For the purchase of the optional extension cable contact the supplier of thermocouple sensors.

6 - Digital Inputs to control

The regulators R1/2 -120TC are equipped with 2 logic inputs to common negative terminal (M1). The input is active (ON) for voltages between 7 and 36 Vdc, off (OFF) for voltages between 0 and 5 Vdc. The active state is off and reported by an led at the input terminal.

7 - Digital Outputs adjustment and alarm

The regulator R1-120TC has 12 digital outputs. The logical outputs are optically isolated, a PNP transistor to the +24V "open collector" with suppression diode, resettable fuse and with Imax to output per channel of 100mA; see fig. 0.4.

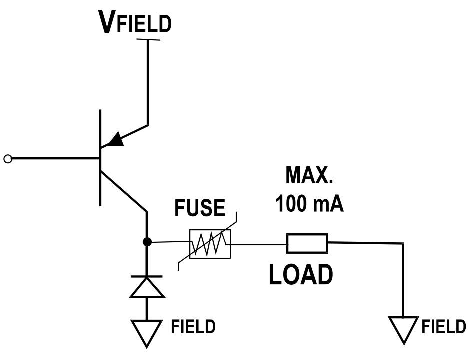

Figure 0.4 -3 Digital Outputs

The outputs can be used for controlling relay or solid state relays (SSR).

In the case of a connection to a static relay, ensure that its internal resistance limits the current to the value given above.

In the case of a connection to a traditional relay, check that the current of the output is sufficient to control the excitation circuit.

THE better use of the regulator , is obtained by using as actuators of SSR (SSR).

Only in this case in fact, you can make the best use the PID algorithm to choking of time which ensures the best accuracy on adjustment.

(See also chapter adjustment).

In case you use relays which, in turn, control inductive loads, it is recommended that you connect in parallel a protection filter according to table 1. In the filters use capacitors to polyester .

LOAD (But)	C (F)μ	Vmax (V)	R ()Ω	P (W)
< 40	0.047	400	100	0.5
< 150	0.1	400	22	2
< 500	0.33	400	47	2
> 500	1	400	---	---

Table 0.1 -1 Filters for inductive loads.

The connection of the relays ' outside the R1-120 TC , is made by connecting terminal on the regulator output to the positive pole of the excitation circuit of the relay., and the negative pole to the electrical ground of field of the R1-120 TC (terminal 16).

8 - Serial Connection to an operator interface

The regulator R1/2 -120TC can be connected:

- A HMI or SCADA for the supervision and configuration through a serial connection RS422 or RS485: (connector C2) and MODBUS RTU protocol or ASCUS selectable
- A panel additional operator (Model F1-10) programming and supervision (connector C3, see appendix of the manual).

The serial communication of the regulator must be set to the mode RS422 or RS485 using the dipswitches D1 (table 0.4).

RS422

	6	5	4	3	2	1
ON		■				
OFF	■		■	■	■	■

RS485

	6	5	4	3	2	1
ON	■					
OFF		■	■	■	■	■

Table 0.2 - Configuration of the line type serial (RS422/RS485) with dip switches D1

ATTENTION: Do Not are allowed configurations in which both the selector #5 that the no. 6 are simultaneously ON or OFF.

The selectors from no. 1 to no. 4 are confidential and are to keep in the OFF position.

9 - Ground Connections and shields

EARTH CONNECTION

For a proper functioning is strongly recommended that the following grounded:

- The mechanical mass of the pin card no. 3 of the connector C1 must be connected directly to ground;
- The negative of the power supply (pin #2 of the connector C1) should be connected locally to the ground;
- Over serial lines long or particularly disturbed connect ground of serial channel to ground via a resistor of 100 Ω.

It is important that the masses are brought to the ground in an independent manner and in any case, it is to avoid sharing portions of earth with power devices.

SHIELDS OF THE INPUTS

To improve the quality of the reception of the signals, thermocouple inputs are interconnected in differential form and insulated from each other and ground .

We recommend that you follow the following requirements:

- Use shielded cables and twisted;
- Always keep the connection cables as short as possible;
- Is preferable to perform a separate pipe between signals from the sensors and wires carrying power signals;
- Connect all of the socks of the cables for connecting the probes to the mass in arrival on the regulator: pin no. 3 of the connector C1.

SERIAL CONNECTION CABLE

Use a shielded cable to 1 (RS 485) or 2 (RS 422) pairs of twisted conductors conforms to the standards EIA RS-422, EIA RS-485, connecting the shield to ground .

10 - Communication Protocol

The communication protocol software is realized according to the standard MODBUS ASCII or RTU): the selection of the protocol takes place via the selector #7 of the dipswitch D2 (ON = RTU, OFF = ASCII).

Setting up the transmission parameters (Standard ASCUS)

Baud rate	9600 / 19200
Date bits	7
Parity bit	Even
Stop bit	1

Setting up the transmission parameters (Standard RTU)

Baud rate	9600 / 19200
Date bits	8
Parity bit	None
Stop bit	1

The selection of the baud rate is set using the selector #8 of the dipswitch
(ON = 19200, OFF = 9600).

11 - Identification of the units in the network RS485/RS422

Can be connected up to 63 regulators R1-120TC to the same master unit (PC or HMI) The identification of the modules takes place according to the binary notation, using the dipswitches [D2]. Leave free configuration 0.

			ADDRESS					
	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
	BAUD	*PROT.*	*25*	*24*	*23*	*22*	*21*	*20*
ON	19200	RTU						
OFF	9600	ASCII						

Table 0.3 - Configuration of the address of the regulator R1-120TC via dip switches [D2].

12 - Principles of operation

The regulator is used in the processes of temperature control and performs the function of control in an autonomous way . The system uses algorithms with PID control loops in real time absolutely accurate and reliable. The unit independently controls 6 loop , reading the input temperature directly using thermocouples and commanding 2 digital outputs for each loop for adjustment and/or alarms as a function of the regulation strategy adopted.

The compensation of the temperature of the cold junction is made through a precise measurement of the temperature of the cold junction by a PT100 inserted into the device.

Controlling configuration

The possible strategies for regulation are :

0 = No regulation (the outputs associated with the loop are kept inactive)

1= Hot (the output associated in the loop (primary) is activated when it is necessary to heat the material)

2= Cold (the output associated in the loop (primary) is activated when it is necessary to cool the material)

3 = Hot/cold (the output associated in the loop (primary) is activated when it is necessary to heat the material , the second output associated in the loop (secondary) is activated when it is necessary to cool the material).

In the latter case (seldom used) not alarm outputs are available for that loop .

The operator should check that its process falls into one of the 3 possible strategies and must choose the most suitable one . The strategies are independent for each loop .

Once choosed the controlling strategy , the loop can be programmed to be in one of the following states of operation .

(0 =off, 1 =manual, 2 =automatic, 3 =autotuning)

With functioning disabled, there is no regulation action.

In manual operation, the percentage of output on the output of adjustment is controlled directly by the operator.

In the operation in autotuning, the temperature is made to oscillate around the set point value; at the end of the procedure the values of the coefficients PID are updated automatically and the status of operation is forced back to automatic state. The parameters found by the algorithm are optimized for that process , and however you can change them by operator .

If you want to change the parameters , previously put the loop in the disabled state .

External Security :

The controller inhibits all the physical outputs unless:

The digital input 1 is kept externally active

Settable parameters to govern the process

The configuration of the adjustment is made by setting, independently for each loop, the coefficients that define the regulating action of the PID algorithm. The parameters to be set depend on the process of adjustment that can be different in each case.

It is recommended that the first time that the regulator is used combined with a certain process to launch the autotuning procedure and subsequently save the recipe and then proceed with manual adjustments of the parameters.

- Repeat Cycle of the PID algorithm (xxx sec)
- Proportional Band (xxx. °C)
- Deadband (xx. x °C)
- Time of integral action (xxxx sec)
- Action Time derivative (xxxx sec)
- Lower Band of integral action (xxx. °C)
- Upper Band of integral action (xxx. °C)

- Proportional Band cold (xxx. °C)
- Dead Band hot / cold (+ / -xx. x °C)

The deadband allows you to inhibit the intervention of the PID algorithm in the case of small differences between the values of the measured temperature and set point value.

The values of the bands top and bottom of integral action normally coincide with the value of the proportional band; may be reduced to correct any overshoot in the case of variation of set point .

The deadband hot/cold defines the interval between the end of the heating action and the beginning of the cooling action. If this band has a negative sign, this means that there is an interval in which both actions are active.

.

The device R1-120TC allows you to perform the autotuning to only one loop at a time. If the user attempts to set the operational status autotuning on more than one loop, the setting on the loop current is refused and the operational status of this loop is forced to "disabled". However, is kept operational status of autotuning on the first loop in which it was set. At the end of the autotuning a loop you can proceed with the autotuning another loop.

THE PID algorithm provides to set the relative percentages to the outputs of adjusting primary and secondary.

Input Configuration

The configuration of the inputs provides for the setting of the type of sensor, the options of reading and the eventual offset to apply to the reading.

- Types of sensor provided
  (None, linear 0-50 mv, TcJ, Tck, TcN, TcR, TCS, TCT)
  Read options:
  - Filter on temperature reading
  - *Rounding*
- Offset temperature xx. x °C)

If it is not configured any sensor , the temperature value corresponding bed is placed at 0

The offset allows to translate the temperature read . This offset (expressed in °C) is applied only to sensors of thermocouple type.

The filter in reading is used to mitigate the influence of the disturbances in the detection of the temperature; with filter present the instant readings are replaced with dynamic medium calculated on the basis of the values recorded during the last 8 samples.

The rounding is useful for filtering the variations of temperature less than one degree.

Outputs Configuration setting

The configuration of the outputs allows you to define, for each of the 6 pairs of outputs available (1 pair for each loop), the following parameters:

- Type of outputs (primary and secondary), value expressed in hexadecimal
  - Primary On/Off type
  - Primary partialisation in time (SSR)
  - Secondary alarm type
  - Secondary type On/Off
  - Primary and secondary incremental

Cycle On/Off output (xxx sec)	Primary and secondary
- Minimum Value SSR (xxx %)	Only primary
- Maximum Value SSR (xxx %)	Only primary
- Value of rail SSR (xxx. % /sec)	Only primary
- Time valve stroke (xxx sec)	Primary, secondary
- extratime for valve (xxx sec)	Primary, secondary
- Valve Deadband (xxx sec)	Primary, secondary

In the case of configured output as On/Off, switching occurs at the minimum values (0 %) and maximum (100 %); in the case of partialisation in time , the duty cycle is set to 1 second.

The minimum and maximum values are valid only in the case of outputs of the type SSR and limit the travel of the output of adjustment; (limitation of the output power), the value of rail allows you to set the maximum variation according to the output of adjustment.(limitation of sudden changes in absorption).

Adjusting to motorized valves.

The regulator can be used for adjusting by actuators consist of motorized valves, In this case:

The time parameter of the valve stroke and the time needed, expressed in seconds, to move the valve from fully closed position to that of fully open.

The time-travel and the extra time for which remains active the output of closed (or open) when the valve has already reached the position of closed (or open)

The deadband specifies the limit (in seconds) below which the PID algorithm does not change the position of the valve. This parameter is useful to avoid the continuous small movements in opening and closing of the valve.

Set-point configuration

The configuration of the set-point is made by setting, independently for each loop, the coefficients and the options that govern how to change the actual set point.

At each instant, the regulator acts having as reference the actual set point.

The parameters which will oversee the trend of the set point are :

Type of set-point:
- (Programmed by operator, temperature loop 1, ... , loop 6)

Options

Option soft-start
Holdback option

- Set-point final 1
- Set-point final 2

- Step increment/decrement set-point (xxx. °C)
- Incrementing Cycle set-point (xxx sec)
- decrementing cycle set-point (xxx sec)

At each cycle the set point advances one step (in degrees)
.

The parameter “ type of set-point “ allows you to use as a set-point , the value set by the operator (type = 0) or the value of the temperature measured by one of the 6 inputs (type = 1.. 6).

The option "soft start" means that, after a power fail or a deactivation, the current set point is forced to coincide with the value of the process variable detected.

The option "holdback" means that, in the event of an alarm (relative high or low), the set point change is frozen until the alarm conditions disappear .

The set-point 1 or 2 is selected on the basis of the state of the second digital input (non active input = set-point 1, active input = set-point 2).

The actual set point tends toward the final set point with a ramp that depends on the set parameters; A correct use of these parameters (step and cycle , increment and decrement) allows to obtain ramps with the desired slope and therefore they can be used to obtain thermal cycles by using an HMI interface operator (see application : APP-R2-120TC).

Alarm Configuration

The alarm configuration allows you to define alarm conditions independent for each loop; these conditions depend on the values assigned to the following alarm thresholds:

- Relative threshold of low temperature (xxxx.x °C)
- Relative threshold of high temperature (xxxx.x °C)
- Minimum temperature threshold (xxxx.x °C)
- Maximum temperature threshold (xxxx.x °C)

The thresholds for high and low specify the maximum permissible difference between measured temperature and temperature set-point; the thresholds of minimum and maximum specify the minimum and maximum values tolerated for the sensed temperature.

Alarm conditions resulting from the comparison with the alarm thresholds are available in the port of state alarms; alarm conditions can be used to generate a particular alarm be directed onto the secondary output of the loop using the following parameters:

- Mask alarm
    - Bit 0: broken probe
    - Bit 1: alarm low
    - Bit 2: alarm for high
    - Bit 3: alarm minimum
    - Bit 4: alarm of maximum
    - Bit 5: -----
    - Bit 6: -----
    - Bit 7: -----

- Temporal Filter alarm activation (xxx sec)

The mask of alarm allows you to generate an alarm; the temporal filter allows you to filter on alarm of short duration.

Supervision

For each of the loops are available, in addition to write ports views in the preceding paragraphs, also the following ports of reading:

- Temperature measured in tenths of a degree (xxxx.x °C)
- Actual Temperature set-point in tenths of a degree (xxxx.x °C)
- Primary Outlet for adjustment (xxx. %)
- Secondary Output adjustment (xxx. %)

- Operating Status

- 0 = disabled
- 1 = manual
- 2 = automatic
- 3 = autotuning

- Alarm Conditions
  - Bit 0: broken probe
  - Bit 1: alarm low
  - Bit 2: alarm for high
  - Bit 3: alarm minimum
  - Bit 4: alarm of maximum
  - Bit 5: -----
  - Bit 6: -----
  - Bit 7: -----

Led to self-test

The led self-test provides a brief indication of the state of functioning of the regulator; there are 3 situations:

- LED always on or always off; indicates a total stop of the processing unit; can be caused by a power supply is not correct or from an unrecoverable failure;

- Constant flashing fast; reports the operation of the device in initialization mode (duration about 10 sec., and in this time, the device does not communicate with supervisor and the control logic is not performed);

- 3 Short flashes and a long pause; reports the normal operation of the devices

13 Modbus Functions

The device R2-120TC is fully manageable through the physical interface RS485/422 and the Modbus RTU protocol /ASCUS by means of supervision (HMI or PC /SCADA or PLC) that supports this protocol.
Shown below are tables with the addresses of the " holding register " (Tags) associated with the functions of the device. Below the table with the addresses of the coils.
The modbus functions supported by the device are :

Function 3 (read Holding register). It is recommended for each reading read the single door , While being supported reading in block of consecutive ports .

Function 6 (write holding register). Also in this case, the command must be run address for address

The function 01 Reading of individual bits (coils)

The function 05 Writing of individual bits (coils)

In the table of the holding register is indicated in addition to the address (Tag) and port its name :

1)Type of number (word length) : bin , int 8 , int 16 ,int 32, int 64, float 32 , float 64

2) Radix: 2 , 8 , 16 , 10 , 10U
Binary, octal, hexadecimal, decimal , decimal sign without

3) Ing. Unit : The value engineering used for that given . Es. °C

4) High-low lines ,minimal and max for that given in value engineering

5) Value and format : Table of reference for the calculation of the value to write and/or read. Number Format (+ /- and positioning of the comma.

6) R/W if the door can be either read or written. R if the door can only be written

7) Value recipe of default . The value with which the regulator is released by factory

All the holding register of the R1/2 -120TC are readable and writable

Representation of variables in modbus protocol :

Remember that modbus conveys the whole number (e.g. nnnn).

In input to the device :
The comma will be positioned by the device, according to the expected format (e.g. nnn.n , see column 5 of table).

In output from the device:
Symmetrically the device sends the integer . The HMI will place the comma as a function of the expected format for that.

The value that was transmitted and received at some addresses (see the table), can internally contain numeric subfields that can be associated to different parameters.
These cases are described in this manual by specific tables . From these tables you can obtained which is the value to insert in the modbus command at that specific address.

14 Controlling The regulation

(State of the Loop and the Type of regulation)

The operator can with these commands act on the operation of each control loop , shutting down the operation and putting the loop manually, can govern the outputs manually, or by controlling a cycle of autotuning to identify the best PID parameters. It can remove from service the loop (loop disabled). These states are mutually exclusive.

The values to be written to set the desired state are reported in table 1 A/B

The value to be assigned to the door " regulation options " also determines the type of regulation for that loop (if no Reg

- hot - cold - hot cold). The value to write is derived from table 1 A/B

Holding registers

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe

125	Loop 1 - Regulation options	Int. 16	10U	#	0	223	Tab1	R/W	0
126	Loop 2 - Regulation options	Int. 16	2	#	0	223	Tab1	R/W	0
127	Loop 3 - Regulation options	Int. 16	2	#	0	223	Tab1	R/W	0
128	Loop 4 - Regulation options	Int. 16	2	#	0	223	Tab1	R/W	0
129	Loop 5 - Regulation options	Int. 16	2	#	0	223	Tab1	R/W	0
130	Loop 6 - Regulation options	Int. 16	2	#	0	223	Tab1	R/W	0

The rules for calculating the values of the parameters to enter are described in the following tables.

Weights	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
No adjustment	0	0	X	X	X	0	0	0
Hot	0	1	X	X	X	0	0	0
Regulating cold	1	0	X	X	X	0	0	0
Hot /cold	1	1	X	X	X	0	0	0

Regulating Options (Tab.1A)

Weights	128	64	32	16	8	4	2	1
Disabled	X	X	X	0	0	0	0	0
Manual	X	X	X	0	1	0	0	0
Automatic	X	X	X	1	0	0	0	0
Tuning	X	X	X	1	1	0	0	0

State of the loop (Tab. 1/B)

The regulating options include the status of the loop (tab 1 /B) and the type of regulation adopted (table . 1/A.

The value in decimal (number 16-bit integer without sign) to be inserted in the port is obtained as the weighted sum at the desired conditions of both tables.

Es. 0 Disables the loop, and does not allow any regulation

Es. 64 Maintains disabled the loop but activates the type of hot regulation

The starting command for a normal regulator warm (secondary output available for alarm) is obtained by inserting the value 80, with this value the loop is placed in automatic state and the " hot regulation " allows the departure .

The actuators will be activated if the external input 1 is active,

The autotuning is obtained by inserting the value 88 (also in this case the actuators must be enabled with digital input 1 active).

With the loop in the " disabled state " power is removed from the ouputs , (safety condition).

With the loop in " manual state " the % power programmed at the address " primary output value " will be present in the output even if it is not configured any type of regulation. In this state the ouput power can be controlled by external devices through Modbus commands (es. PLC or HMI). Still the input readings of the variables are preserved .

15 Characteristic parameters of the regulation

The parameters can be automatically calculated through the autotuning procedure and then changed by the operator on the basis of process behaviaur .

ADD RESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
131	Loop 1 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		
132	Loop 2 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		

133	Loop 3 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		
134	Loop 4 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		
135	Loop 5 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		
136	Loop 6 - PID regulation cycle	Int 16	10U	Sec.	1	240	Nnn		
137	Loop 1 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
138	Loop 2 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
139	Loop 3 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
140	Loop 4 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
141	Loop 5 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
142	Loop 6 - Proportional band	Int 16	10U	°C	1	4000	Nnn.n		
		Int 16	10U	°C					
143	Loop 1 - Dead band	Int 16	10U	°C	0	400	NOS		
144	Loop 2 - Dead band	Int 16	10U	°C	0	400	NOS		
145	Loop 3 - Dead band	Int 16	10U	°C	0	400	NOS		
146	Loop 4 - Dead band	Int 16	10U	°C	0	400	NOS		
147	Loop 5 - Dead band	Int 16	10U	°C	0	400	NOS		
148	Loop 6 - Dead band	Int 16	10U	°C	0	400	NOS		
		Int 16	10						
149	Loop 1 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		
150	Loop 2 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		
151	Loop 3 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		

152	Loop 4 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		
153	Loop 5 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		
154	Loop 6 - Integral time	Int 16	10U	Sec.	0	4000	NNNN		
155	Loop 1 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
156	Loop 2 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
157	Loop 3 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
158	Loop 4 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
159	Loop 5 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
160	Loop 6 - Derivative time	Int 16	10U	Sec.	0	4000	NNNN		
161	Loop 1 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
162	Loop 2 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
163	Loop 3 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
164	Loop 4 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
165	Loop 5 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
166	Loop 6 - Lower integral band	Int 16	10U	°C	0	4000	Nnn.n		
		Int 16	10U	°C					
167	Loop 1 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		
168	Loop 2 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		

169	Loop 3 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		
170	Loop 4 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		
171	Loop 5 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		
172	Loop 6 - Upper integral band	Int 16	10U	°C	0	4000	Nnn.n		
		Int 16	10U	°C					
173	Loop 1 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
174	Loop 2 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
175	Loop 3 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
176	Loop 4 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
177	Loop 5 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
178	Loop 6 - Cold proportional band	Int 16	10U	°C	1	4000	Nnn.n		
179	Loop 1 - Cold dead band	Int 16	10	%	-500	500	±NOS		
180	Loop 2 - Cold dead band	Int 16	10	%	-500	500	±NOS		
181	Loop 3 - Cold dead band	Int 16	10	%	-500	500	±NOS		
182	Loop 4 - Cold dead band	Int 16	10	%	-500	500	±NOS		
183	Loop 5 - Cold dead band	Int 16	10	%	-500	500	±NOS		
184	Loop 6 - Cold dead band	Int 16	10	%	-500	500	±NOS		

16 Inputs Configuration

The parameters define the type of input for each channel

The device also accepts the linear inputs 0-50 mv .

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
006	Input Type ch 1	Int 16	10U	#	0	199	Tab 2	R/W	66 (Thermocouple J)
007	Input Type Ch2	Int 16	10U	#	0	199	Tab 2	R/W	66
008	Type of doorstep CH3	Int 16	10U	#	0	199	Tab 2	R/W	66
009	Input Type CH4	Int 16	10U	#	0	199	Tab 2	R/W	66
010	Input Type CH5	Int 16	10U	#	0	199	Tab 2	R/W	66
011	Input Type CH6	Int 16	10U	#	0	199	Tab 2	R/W	66

The rules for calculating the values of the parameters to enter are described in the following tables.

Table 2 : values to insert into the ports from 06 to 11

Weights	128	64	32	16	8	4	2	1
Input Type								
None	X	1	X	X	X	0	0	0

0-50 MV	X	1	X	X	X	0	0	1
Thermocouple J	X	1	X	X	X	0	1	0
Trmocoppia K	X	1	X	X	X	0	1	1
N Thermocouple	X	1	X	X	X	1	0	0
R Thermocouple	X	1	X	X	X	1	0	1
S Thermocouple	X	1	X	X	X	1	1	0
T Thermocouple	X	1	X	X	X	1	1	1

Enter the value in decimal as weighted sum of the condition desired

E.g. , J thermocouple . Enter the value 66 (decimal unsigned integer)

Es. Temocoppia S = Enter the value 64 +4 + 2 = 70

Offset temperature

The parameters define an offset value that is added (+) or removed (- sign) to each temperature reading .serve to compensate for differences in temperature between the hot spot and the placement of the sensor). The value is the tenth of a degree is also used to compensate for errors in reading the sensor calibration ( ).

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
012	Offset channel 1	Int 16	10	°C	-999	+999	±NOS	R/W	0
013	Channel Offset 2	Int 16	10	°C	-999	+999	±NOS	R/W	0
014	Channel Offset 3	Int 16	10	°C	-999	+999	±NOS	R/W	0
015	Channel Offset 4	Int 16	10	°C	-999	+999	±NOS	R/W	0
016	Channel Offset 5	Int 16	10	°C	-999	+999	±NOS	R/W	0
017	Channel Offset 6	Int 16	10	°C	-999	+999	±NOS	R/W	0

17 Configuration set point

The set point desired by the operator takes the name of : set final end point and is programmed at the addresses 95 .. 106

THE PID algorithm in real time bases its action on the actual set point , which tends to the final set point with a time trend programmable from operator through the tags from 107 to 124.

The parameters which determine the evolution of the actual (or current) set point :

a) The time increment (Increment cycle)
b) The increment/decrement (increment /decrement step).
   The combination of these two parameters determine with accuracy the transient evolution of the set point toward the final set point .

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe

089	Loop 1 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128
090	Loop 2 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128
091	Loop 3 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128
092	Loop 4 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128
093	Loop 5 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128
094	Loop 6 - Set-point type and options	Int 16	10U	#	0	199	Tab 3		128

The rules for calculating the values of the parameters to enter are described in the following tables.

128	**64**	**32**	**16**	**8**	**4**	**2**	**1**	**Powers of 2**
X	X	X	X	X	0	0	0	Programed
X	X	X	X	X	0	0	1	Ch1
X	X	X	X	X	0	1	0	Ch2
X	X	X	X	X	0	1	1	Ch3
X	X	X	X	X	1	0	0	Ch4
X	X	X	X	X	1	0	1	Ch5
X	X	X	X	X	1	1	0	Ch6
X	X	X	X	X	1	1	1	Ch7
0	1	0	0	0	X	X	X	Soft start
1	0	0	0	0	X	X	X	Hold back

Table 3 : calculation of the parameter relative to the set point (addresses from 89 to 94)

The value is obtained as the weighted sum of the condition desired.

E.g. if you want a set point programmed by the operator with soft start off and hold back on , you will write in the corresponding address the decimal value 128

Es.Se you want the set point coincides with the temperature read from the channel 4 and soft start without hold back you will write the value 64+4 = 68

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
095	Loop 1 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
096	Loop 2 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
097	Loop 3 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
098	Loop 4 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
099	Loop 5 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
100	Loop 6 - Final set-point 1	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
101	Loop 1 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
102	Loop 2 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
103	Loop 3 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
104	Loop 4 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
105	Loop 5 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
106	Loop 6 - Final set-point 2	Int 16	10	°C	-1000	+20000	±Form nnnn.n		
107	Loop 1 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		
108	Loop 2 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		
109	Loop 3 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		
110	Loop 4 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		
111	Loop 5 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		
112	Loop 6 - Set-point step	Int 16	10U	°C	1	4000	Nnn.n		

113	Loop 1 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
114	Loop 2 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
115	Loop 3 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
116	Loop 4 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
117	Loop 5 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
118	Loop 6 - Set-point increment cycle	Int 16	10U	Sec.	1	240	Nnn		
			10U						
119	Loop 1 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		
120	Loop 2 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		
121	Loop 3 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		
122	Loop 4 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		
123	Loop 5 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		
124	Loop 6 - Set-point decrement cycle	Int 16	10U	Sec.	1	240	Nnn		

18 OUTPUTS Configuration

The outputs are 2 for each loop . They are associated with the input and are not independent of each other. The configurations that can assume and then the values to be set in modbus gates are summarized in table 4). The combination of the outputs must be congruent with the adjustment process adopted , the type , and the function used for the actuators.

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
029	Output 1 & 2 - Type	Int 16	10U	#	0	34	Tab.4	W/R	1
030	Output 3 & 4 - Type	Int 16	10U	#	0	34	Tab.4	W/R	1
031	Output 5 & 6 - Type	Int 16	10U	#	0	34	Tab.4		1
032	Output 7 & 8 - Type	Int 16	10U	#	0	34	Tab.4		1

033	Output 9 & 10 - Type	Int 16	10U	#	0	34	Tab.4		1
034	Output 11 & 12 - Type	Int 16	10U	#	0	34	Tab.4		1

The rules for calculating the values of the parameters to enter are described in the following tables.

Table 4 : values to insert into the address from 29 to 34

Weights	128	64	32	16	8	4	2	1
ON-OFF	X	X	X	X	X	X	0	0
SSR	X	X	X	X	X	X	0	1
Incremental	X	X	X	X	X	X	1	0

Tab4/1 (primary output – usually employed for regulating)

Weights	128	64	32	16	8	4	2	1
Alarm	X	X	0	0	X	X	X	X
ON-OFF	X	X	0	1	X	X	X	X
Incremental	X	X	1	0	X	X	X	X

Tab4/2 (secondary output – usually employed for Alarm)

The value in decimal to insert in the door is obtained as the weighted sum

In correspondence with the conditions required in both tables.

Es. Output 1 (primary) used for regulating (PID on SSR) and Output 2 (secondary) used as alarm

Enter the value : 01 decimal

E.g. , Output 1 (primary) used to adjust the position of a motorized valve , Ouput 2 (secondary) necessarily used for the positioning of the valve :

In this second case no output physical alarm is available for that loop. The alarm is detected and processed at supervisory level or HMI.

Enter the value : 32 + 2 = 34

Please Note: only use the values specified in table . Decimal values are not provided for can be handled by the device, but the value returned from the port may not coincide with the value written. This may be detected as a protocol error.

The recommended value in the majority of thermal processes of " hot regulation " is the value 1 (SSR -ALL), where the static relay ensures quick action of choking of the power to the load by minimizing the temperature oscillation, and the output 2 provides the output to the alarms.

19 Alarm Configuration

The alarm thresholds are configured in the ports from 185 to 208 (SEE TABLE)

Thresholds in relative (deviation of the set point) , have meaning only as decimal values positive integers , and are indicated as low /high level .

The absolute thresholds can be with + or - sign .

They are are named as minimum / maximum level.

In the R2-120 alarms are not " retentive type " , i.e. when the conditions which caused the alarm disappear , the alarms are reset.

(Specifically " alarm detection " devices have been designed by Sielco Elettronica , (D2-60 TC) , that keep the alarm condition once activated until operator comes to reset the alarms.)

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R/W	Default value recipe
185	Loop 1 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
186	Loop 2 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
187	Loop 3 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
188	Loop 4 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
189	Loop 5 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
190	Loop 6 - Alarm Low level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
191	Loop 1 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
192	Loop 2 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
193	Loop 3 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
194	Loop 4 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
195	Loop 5 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	
196	Loop 6 - Alarm High level	Int 16	10U	°C	0	20000	Form nnnn.n	R/W	

197	Loop 1 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
198	Loop 2 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
199	Loop 3 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
200	Loop 4 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
201	Loop 5 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
202	Loop 6 - Alarm Minimum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
203	Loop 1 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
204	Loop 2 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
205	Loop 3 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
206	Loop 4 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
207	Loop 5 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	
208	Loop 6 - Alarm Maximum level	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R/W	

209	Loop 1 - Alarm mask	Int 16	10U	#	0	31	Tab 5.	R/W	
210	Loop 2 - Alarm mask	Int 16	10U	#	0	31	"	R/W	
211	Loop 3 - Alarm mask	Int 16	10U	#	0	31	"	R/W	
212	Loop 4 - Alarm mask	Int 16	10U	#	0	31	"	R/W	
213	Loop 5 - Alarm mask	Int 16	10U	#	0	31	"	R/W	

214	Loop 6 - Alarm mask	Int 16	10U	#	0	31	"	R/W	
								R/W	
215	Loop 1 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	
216	Loop 2 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	
217	Loop 3 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	
218	Loop 4 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	
219	Loop 5 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	
220	Loop 6 - Alarm filter ON	Int 16	10U	Sec.	0	240	Nnn	R/W	

The rules for calculating the values of the parameters to enter are described in the following tables.

Weights	16	8	4	2	1
Maximum Alarm	1	0	0	0	0
Minimum Alarm	0	1	0	0	0
High Alarm	0	0	1	0	0
Low Alarm	0	0	0	1	0
Probe Alarm	0	'0	0	0	1

Table 5

Configuration table of mask alarms

The value in decimal to insert in the door is obtained as the weighted sum

In correspondence of the conditions desired.

Ex. Brake sensor + Low Alarm + Minimum Alarm = 11

The mask alarms prevents that alarms not selected act on the respective output . The physical output is " the logical OR " of the selected alarms .

The presence of the mask does not prevent that the alarms are displayed on the operator panel F1-10 if used.

The time of filter will filter alarms for the selected duration.

Supervision

These addresses are only used for read purpose . they give the situation of the operational status of the regulator

ADDRESS	DESCRIPTION	Type	Radix	Ing.Unit	MIN	MAX	VALUE and format	R	Default value recipe
221	Loop 1 - Primary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
222	Loop 1 - Secondary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
223	Loop 1 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
224	Loop 1 - Alarms	Int 16	10U	#	0	31	NN Table 5	R	
225	Loop 1 - Status	Int 16	10U	#	0	3	N Tab.1B	R	
		Int 16						R	
226	Loop 2 - Primary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
227	Loop 2 - Secondary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
228	Loop 2 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
229	Loop 2 - Alarms	Int 16	10U	#	0	31	Nn Tab.6	R	
230	Loop 2 - Status	Int 16	10U	#	0	3	N Tab.5B	R	

		Int 16						R	
231	Loop 3 - Primary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
232	Loop 3 - Secondary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
233	Loop 3 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
234	Loop 3 - Alarms	Int 16	10U	#	0	31	Nn Table 5	R	
235	Loop 3 - Status	Int 16	10U	#	0	3	N Tab.1B	R	
		Int 16						R	
236	Loop 4 - Primary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
237	Loop 4 - Secondary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
238	Loop 4 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
239	Loop 4 - Alarms	Int 16	10U	#	0	31	Nn Table 5	R	
240	Loop 4 - Status	Int 16	10	#	0	3	N Tab.1B	R	
		Int 16						R	
241	Loop 5 - Primary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
242	Loop 5 - Secondary Output Value	Int 16	10U	%	0	1000	Nnn.n	R	
243	Loop 5 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
244	Loop 5 - Alarms	Int 16	10	#	0	31	Table 5	R	
245	Loop 5 - Status	Int 16	10	#	0	3	N Tab.1B	R	
		Int 16						R	
246	Loop 6 - Primary Output Value	Int 16	10	%	0	1000	Nnn.n	R	
247	Loop 6 - Secondary Output Value	Int 16	10	%	0	1000	Nnn.n	R	
248	Loop 6 - Actual Set-point	Int 16	10	°C	-1000	+20000	±Form nnnn.n	R	
249	Loop 6 - Alarms	Int 16	10	#	0	31	Nn Table 5	R	
250	Loop 6 - Status	Int 16	10	#	0	3	N Tab.1B	R	
		Int 16						R	

251	Digital inputs status	Int 16	10	#	0	3	N	R	
252	Digital outputs status	Int 16	10	#	0	4095	NNNN	R/W	
		Int 16	10					R	
253	Tuning phase	Int 16	10	#	0	6	N	R	
254	Tuning set-point	Int 16	10		-1000	+2000 0	±Form nnnn.n	R	
255	Tuning timer 1	Int 16	10	Sec	0	65535	Nnnnn	R	
256	Tuning timer 2	Int 16	10	Sec	0	65535	Nnnnn	R	
257	Tuning low temperatures	Int 16	10		-1000	+2000 0	±Form nnnn.n	R	
258	Tuning high temperatures	Int 16	10		-1000	+2000 0	±Form nnnn.n	R	
		Int 16	10					R	
259	Current start step	Int 16	10		0	6	N	R	

ADDRESS	DESCRIPTION	READ ONLY
1000	Digital Input 1	•
1001	Digital Input 2	•
1002	Digital Output 1	W/R
1003	Digital Output 2	W/R
1004	Digital Output 3	W/R
1005	Digital Output 4	W/R
1006	Digital Output 5	W/R

1007	Digital Output 6	W/R
1008	Digital Output 7	W/R
1009	Digital Output 8	W/R
1010	Digital Output 9	W/R
1011	Digital Output 10	W/R
1012	Digital Output 11	W/R
1013	Digital Output 12	W/R