R2-50 model

Programmable multifunction controller

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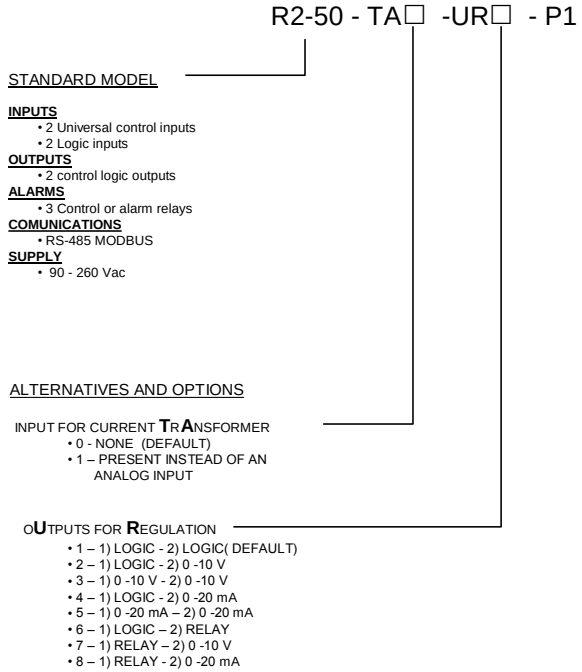
1. Installation

1.1 Packaging check

Before starting installation, it is necessary to check that the packaging contents is in compliance with your order. In the packaging there must be:

n° 1 R2-50 controller
n° 2 plastic fastening elements
n° 1 instruction manual

Check that the model module code (side label) is in compliance with the ordered code. If it is not correct, please contact Sielco..



Verify that the manual edition correspond to the purchase year.
R2-50 controllers are covered by 1 year of warranty except for damages caused by tampering or wrong wiring. The label on the controller side certicates the purchase date.

1.2 Dimensions

The R2-50 controller dimensions are shown in figure 1.

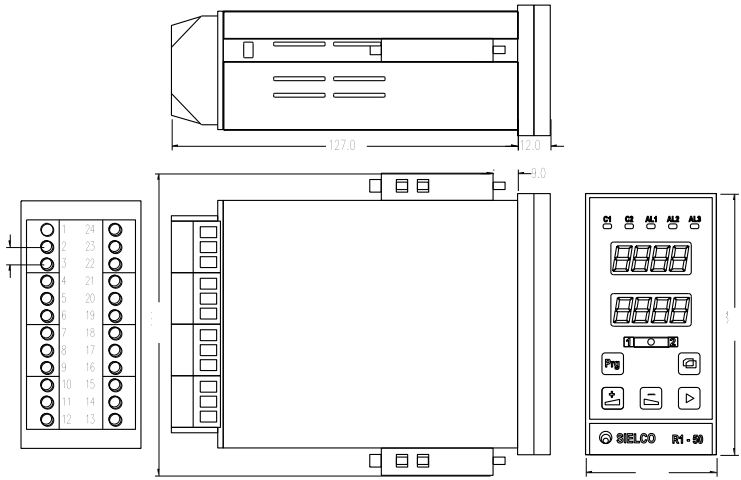


Fig 1 - R2-50 controller dimensions

1.3 Fixing method

R2-50 controllers are mounted on the panel by the plastic fastening provided elements. Panel window dimensions are shown in figure 2.

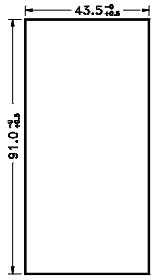


Fig. 2 – Window dimensions

Panel thickness must be less than 8 mm. Before starting R2-50, it is necessary to read carefully this manual.

2. Electric wiring

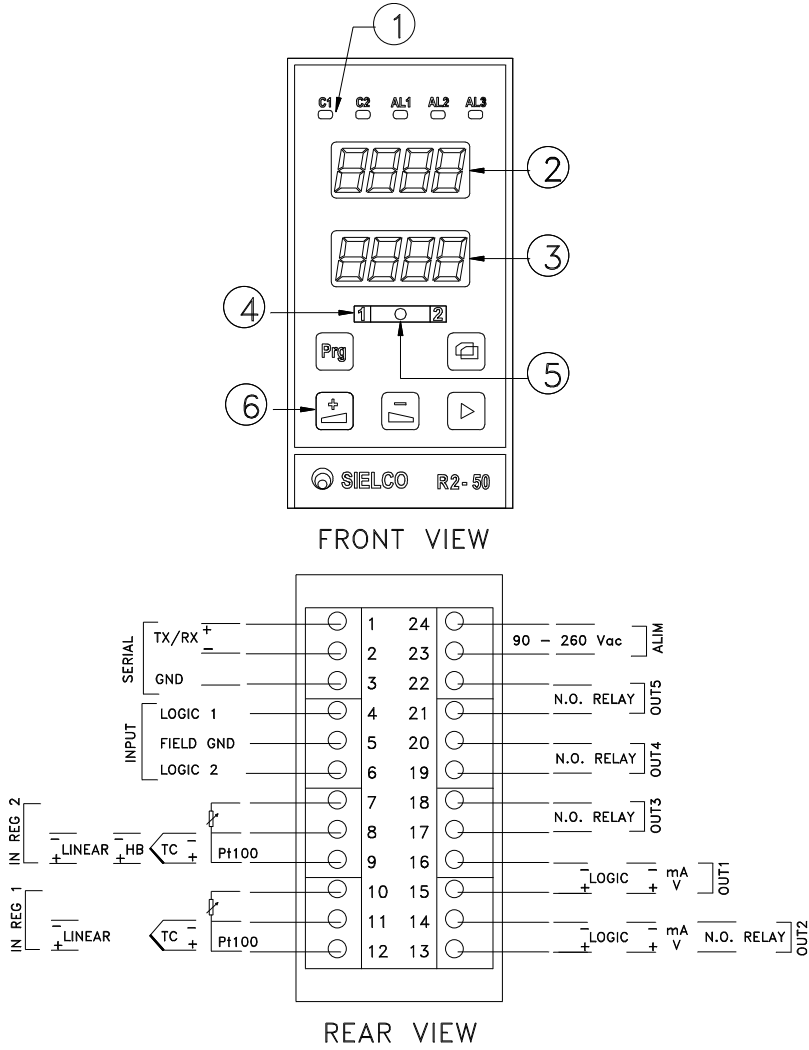


Fig 3 - R2-50 forntal and rear view

2.1 Controller physical description

Dual loop R2-50 controllers are provided by an user interface consisting of: (see figure 3):

1 Signalling leds (see par 4.4):
- **C1** - First loop output duty cycle
- **C2** - Second loop output duty cycle
- **A1** - Alarm 1
- **A2** - Alarm 2
- **A3** - Alarm 3

2 Measured variable display (ONLINE mode)

3 Set-point display (ONLINE mode)

4 Visualized loop led (1 or 2)

5 Autotest and communication (see par 3 and par 4.5)

6 Control keys
- **Prog**
- **Page**
- **Inc**
- **Dec**
- **Enter**

R2-50 dual loop controllers have: (see figure 3):

IN REG 1 .... control input (Pt-100, TC, 0-50mV, 0-5V, 0-10V, 0-20mA, 4-20mA)
IN REG 2 .... control input (Pt-100, TC, 0-50mV, 0-5V, 0-10V, 0-20mA, 4-20mA)
INPUT..... common ground digital inputs
OUT1 ..... control output (LOGIC, 0-10V, 4-20mA)
OUT2 ..... control output (LOGIC, 0-10V, 4-20mA, RELAY)
AL1 ..... alarm 1 (RELAY)
AL2 ..... alarm 2 (RELAY)
AL3 ..... alarm 3 (RELAY)
SERIAL ..... RS-485 communication serial channel
ALIM ..... supply (90 - 260V)

The output type depends on the ordered configuration.

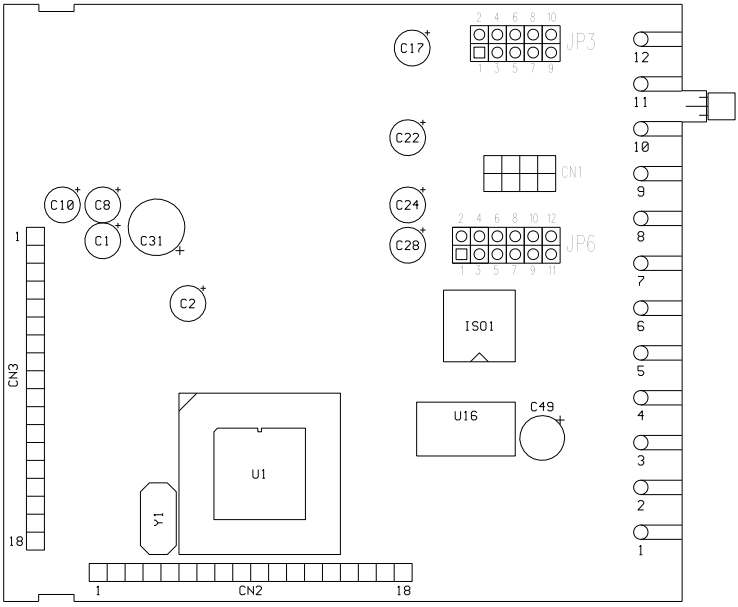
2.2 Supply and absorption

The controller power supply must be compliant with the ordered model:

A) **P1** option model
90-260Vac 50/60Hz supply (switching type)
(PA 8 VA at 230Vac).

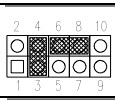
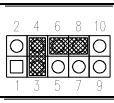
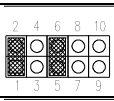
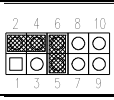
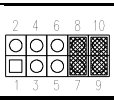
2.3 Control and command inputs

R2-50 controllers have 2 control inputs that can be set as Pt100, *TC*, *0-50mV*, *0-5V*, *0-10V*, *0-20mA*, *4-20mA* directly by the user moving jumpers or at the order.
The jumpers are on RP2/1 controller logic board. To reach the board it is necessary to open the controller, unscrewing the frontal screw and to pull out the board group. This operation must be executed with switched off and unwired controller. Do not use eccessive force pulling out and inserting boards.

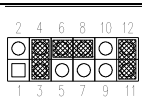
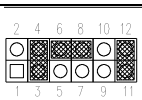
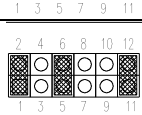
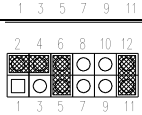
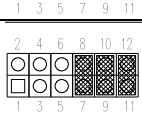
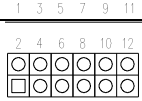


Analog inputs hardware configuration is made setting JP3 and JP6 as shown in the following tables:

Input 1 JP3 configuration

Input Type	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	
TC - RTD	open	close	open	open	open	
50 mV	open	close	open	open	open	
5 V	close	open	close	open	open	
10V	open	open	close	open	open	
20 mA	open	open	open	close	close	

Input 2 JP6 configuration

Input Type	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10	11 - 12	
TC - RTD	open	close	open	open	open	close	
50 mV	open	close	open	open	open	close	
5 V	close	open	close	open	open	close	
10V	open	open	close	open	open	close	
20 mA	open	open	open	close	close	close	
HB	open	open	open	open	open	open	

2.3.1 Pt-100 inputs

If you are using this kind of sensors, be sure that they are in compliance with IEC 751 standard. Choosing the sensor, be sure that the wires (2 or 3) connected to the sensor are electrically isolated from its metallic case. Dispersion currents towards the sensor metallic case can affect the precision of the reading.
Pt100 sensors can be connected with 2 or 3 wires. For the connection see figure 3 and 4.

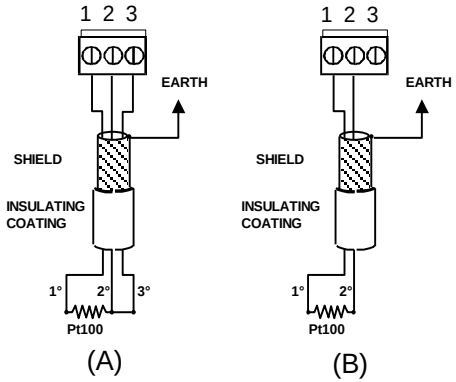


Fig 4 - 3 wires Pt100 connection (A).
2 wires Pt100 connection (B)

If you are using a 2 wires connection, you have to put line resistance value in the controller (see setting procedures). Measure the line resistance using an external device (ohmmeter), keeping the conductors unwired on the controller. Do not execute resistance measures with external devices directly on the controller if the power supply is on.
The cable loop resistance must be < di 40 ohm (measure taken between the two loop screws connected to the first and second PT100 wires with PT100 shortcircuited Pt100).
The recommended cable is a twisted pairs conductors cable (the first wire must be twisted with the second one) with shielding and self-extinguishing insulating coating.
Do not connect Pt100 using single wires not belonging to the same cable: the outward wire resistance (first wire connected at the first screw of each set of three) must be the same of the inward wire one (second wire connected at the second screw of each set of three).

2.3.2 Termocouple inputs

If you are using these kind of sensors, connect only *J, K, N, R, S, T* type termocouple in compliance with IEC 751 standard.
The controller make automatically the cold junction compensation. Connect "**positive**" and "**negative**" termocouples wires respectively to n°12 and n°11 screws (first input) and n°9 and n°8 (second input) see figure 3 .

2.3.3 Voltage inputs

R2-50 controllers accept *0-50mV, 0-5V, 0-10V* type voltage inputs. If you are using theese kind of inputs, connect "**positive**" and "**negative**" sensor wires respectively to n°12 and n°11 screws (first input) and n°9 and n°8 (second input) see figure 3 .

2.3.4 Current inputs

It is possible to connect *0-20mA* o *4-20mA* current output sensors to R2-50 controller. Sensor signals must be connected to n°12 screw for the first input, and n°9 for the second one. Sensor must be supplied separately and n°11 and n°8 controller screws (respectly first and second input) must be connected to the sensor ground power supply (see fig.3 and 5). In case of cascade sensor connection to more devices or more inputs of the same device, connect last device input "**negative**" screw to the sensor ground power supply (see fig. 5).
P.S. R2-50 current analog inputs impedance is 2.2 Ω.

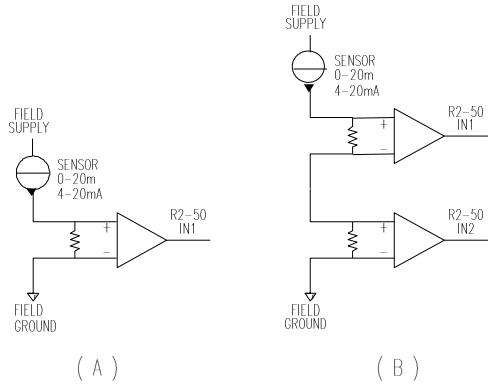


Fig 5 - 4-20 mA sensor simple connection (A)
4-20 mA sensor cascade connection (B)

2.3.5 Digital inputs

R2-50 controllers are equipped with 2 digital optoisolated inputs that can be simply acquired or used to command the regulation. To activate the inputs,

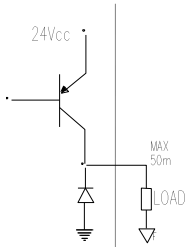
connect together 4 and 5 screws (1° input) and 5 and 6 (2° input) by a simple contact (relay or mechanical switch).

2.4 Control outputs

R2-50 controller has 2 control outputs selectable at the order between *logic, 0-10V, 0-20mA or relay*.
Verify the choosen option, checking the ordering code on the controller side (see par.1.1).

2.4.1 Logic outputs

Logic outputs are optically isolated, with *24 V PNP transistor* (output Imax for channel is 50mA) and can be used to command solid state relays (SSR). Verify that the internal solid state relay resistance limits the current to the above value. Verify that the SSR model is in compliance with what specified above. Connect "**positive**" and "**negative**" wires coming from SSR respectly to n°15 and n°16 (first output), and n°13 and n°14 (second output) see figure 3



2.4.2 Analog outputs

Analog outputs are optically isolated of 0-10V or 0-20mA type depending on the option choosen. Connect "**positive**" and "**negative**" wires coming from the actuator respectly to n°15 and n°16 (first output), and n°13 and n°14 (second output) see figure 3

2.5 Alarm or control relay outputs

R2-50 controllers have 3 alarm or control relay outputs with contact type configurable by software.
All relays support 5A current at 250Vac with resistive load. Using these outputs to drive inductive load. It can be a good thing to connect a protection filter in parallel as shown in table 1. For filters use film capacitors.

LOAD (mA)	C (µF)	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	-------	-------

Tab 1 – Inductive load filters

2.6 Personal computer

R2-50 controller can be connected to a PC for programming and supervision (through serial channel)
To connect to R2-50 controllers it is necessary to use a RS485 serial interface that usually are not standard equipment in personal computers. Sielco produce C1-25 model , a RS232-422/485 serial interface converter with triple optical isolation that can be connected to Pc serial port (COM) and to R2-50 screws as shown in table 2.

	C1-25		***R2-50***	
n°	**RS485**		**RS485**	**n°**
1	GND	---	GND	3
2	n.c.			
3	n.c.			
4	TX- / RX-	---	TX- / RX-	2
5	TX+ / RX+	---	TX+ / RX+	1
6	0V			
7	+24V			

Tab 2 -C1-25 - R2-50 (RS 485) connection.

In case of alternative products choice, it is better to choose optically isolated products with galvanically isolated grounds

2.7 Shielding

2.7.1 Serial channel shielding

For a safe serial communication can be useful to:

- Use shielded and twisted cable in compliance with EIA RS485 (ie. BELDEN 9841) standard
- Cable shield must be connected to n°3 ground screw
- It is a good thing to avoid to share the same wire path with power devices as inverter, drives etc.

2.7.2 Inputs shielding

Temperature reading is based on low intensity signal detection (Pt100, TC, 0-50mV) or average intensity signal detection (0-10V, 4-20mA).
To improve the sensors reading particularly in environment noise affected by power devices (motor driver , power contact etc.), follow these shielding rules:

- Use shielded and twisted cables for sensors connection..

- Keep connection cables as short as possible.
- It is a good thing to avoid to share the same wire path with power devices as inverter, drives etc..
- Connect all sensor cable metal shields to the controller **negative** screw (n°8, n°11), leaving them non connected by the sensor side (Parasite currents on the shields can induce disturbances that can affect PT100 reading).

The above rules are particularly important if you use low intensity signal sensors.

2.7.3 Outputs shielding

In case of analog outputs :

- Use shielded and twisted cables
- Keep connection cables as short as possible.
- It is a good thing to avoid to share the same wire path with power devices as inverter, drives etc.
- Connect all sensor cable metal shields to the controller **negative** screw (n°14, n°16), leaving them non connected by the actuator side

3. Communication

3.1 Electrical interface

R2-50 controller is provided with a RS-485 serial interface through which it is possible to connect up to 250 controllers to the same master unit (PC or console) with the same interface and a ModBus (ASCII or RTU) communication protocol.
To connect the module to a bus, it is a good thing to use a shielded twisted pairs conductor cable, using shield for the ground

4. Operation

4.1 Operator interface

The operator interface is based on menu at different levels. First level menu are: main menu, program supervision menu and configuration menu; with the key "arrow" you can pass from a menu to another; with the key "page" you can go through the items of the same menu. The configuration menu is an index menu; with the key "Prg" you can go down to a lower level menu; with the key "arrow" you can go back to the higher level menu. To modify a value press keys "inc" or "dec"; to confirm the modification, press the key "Prg"; to abort the modification, press the key "arrow". In case of parameters defined by conditions (bit), each display shows two conditions; by pressing keys "inc" and "dec" you select one of the four possible combinations (00, 01, 10, 11) and by pressing key "page" you change the dispaly; to confirm the modification, press the key "Prg"; to abort the modification, press the key "arrow".

4.2 Main menu

The first page of the main menu (default page) shows the values of the process variables PV1 and PV2 relative to loop 1 and 2 (led 1 and 2 on); the following two pages show the values of the process variable (upper display) and of the set point variable (lower display) relative to loop 1 (led 1 on) and loop 2 (led 2 on). If the controller can't read correct values of PV1 and PV2, the indication FAIL will appear.
The set point values displayed in the first two pages refer to the effective set point which is calculated according the set point ramp value; to display or modify the final set point value, it is necessary to press keys "inc" or "dec"; with the key "Prg" the modification is confirmed.
The set point value is displayed only in "automatic operating mode"; otherwise the following indications appear:

"MAn"	manual operating mode
"dIS"	regulation disabled
"tUnE"	autotuning procedure

The other pages of the main menu refer to:

"ALAr."	1	PV1 alarm conditions
"ALAr."	2	PV1 alarm conditions
"ALAr."		General alarm conditions
"out."	1	First control output
"out."	2	Second control output

The lower display show the name (4 letters) of the parameter and the upper display show the value; leds "1" and "2" light according to loop 1 or 2.
Operating mode can be automatic ("Aut") or manual ("MAn"); with keys "inc" e "dec" it is possible do change the operating mode.
The alarm conditions displayed have been filtered according to the "alarm conditions mask"; the following indicates the correspondence between alarm condition, internal codification (bit) and display indication

PV1 alarm conditions	*bit*	*display*
- low value alarm	0	-------|
- high value alarm	1	------|-
- minimum value alarm	2	-----|--
- maximum value alarm	3	----|---
- reading alarm	4	---|----

PV2 alarm conditions	*bit*	*display*
- low value alarm	0	-------|
- high value alarm	1	------|-
- minimum value alarm	2	-----|--
- maximum value alarm	3	----|---
- reading alarm	4	---|----

General alarm conditions	*bit*	*display*
- comunication alarm	0	-------|
- configuration alarm	1	------|-
- first output set by the program	2	-----|--
- second output set by the program	3	----|---
- end of program output	4	---|----

Regulation outputs are displayed us a percentage (from 0.0% to 100.0%); values can be mopdified by the operator only during manual operating mode.

4.3 Program supervision menu

Various pages of the menu allow controlling of the current status of the program; displayed parameters are following:

"Pr.St."	Program status (on/off)
"ProG."	Current program (0, 1 .. 8)
"StEP"	Current program step
"rAMP" o "rESt"	Time elapsed from start of ramp (rAMP) or from start of rest (rESt)

4.4 Configuration menu

Configuration menu has various item, each of which refers to a lower level menu:

InP.	LISt	Process variables configuration menu
out.	LISt	Regulation outputs configuration menu
StP.	LISt	Set point configuration menu
Pr.C.	LISt	Program configuration menu
rEG.	LISt	Control configuration menu
AL.Co.	LISt	Alarm conditions configuration menu
AL.ou.	LISt	Alarms configuration menu
CLk.	LISt	Clock configuration menu
SEr.I.	LISt	Serial interface configuration menu
dIAG.	LISt	Maintenance menu
CAL.	LISt	Calibration menu

To go into the desired menu, select the menu (LISt) by mean of key "page" and then press key "Prg".
Each menu has many pages (parameters); each page shows the parameter name through lower display and the parameter value through upper display; leds "1" and "2" indicate if the parameter refers to loop 1 (led 1 on) or to loop 2 (led 2 on) or to both (led 1 and 2 on). To scroll among the various pages of the menu, press key "page"; to modify a parameter value, press key "inc" or "dec"; to confirm the modification, press key "prg"; to abort the modification, press key "arrow".

4.4.1 Process variables configuration menu

These are two menu which allow configuration of the main process variable (PV1) and the secondary process variable (PV2):

InP.1	LISt
InP.2	LISt

For each of the two menu, parameters are the following:

"I.tyP."	1,2	Input type
"rES."	1,2	Line resistance
"CALC."	1,2	Line resistance automatic calculation
"PEr.L."	1,2	Perc. low scale value (%)
"PEr.H."	1,2	Perc. high scale value (%)
"InP.L."	1,2	Low scale value (units)
"InP.H."	1,2	High scale value (units)
"root"	1,2	Square root extraction

"toL."	1,2	Tolerance (0.1, 0.2, 0.5, 1.0)
"I.FIL."	1,2	Reading filter (yES/no)
"DEC.P."	1,2	Decimal point (yES/no)

Input type allows selecting the type of sensor which is used to read the process variable; the following possibilities are provided:

rtd	Pt100
tC-J	TC J
tC-k	TC K
tC-n	TC N
tC-r	TC r
tC-S	TC S
tC-t	TC T
0-50	0-50 millivolt
0-5	0-5 Volt
0-10	0-10 Volt
0-20	0-20 mA
4-20	4-20 mA
tr.A.	current transformer (only for secondary variable PV2)

Type tr.A (only for PV2) allows the control of the heating current read by mean of a current transformer; the current value is updated only if the current is present for more than 30 milliseconds. The line resistance must be set only in case of Pt100 input; setting to "yES" the "CALC" parameter, the controller automatically calculates the line resistance value. The percentage low scale value (PEr.L.) and high scale value (PEr.H.) are useful only in case of linear sensors (V or mA); together with effective low scale value (InP.L.) and high scale value (InP.H.) they allow conversion from a percentage value into a value expressed in engineered units; the parameters InP.L. and InP.H. delimit the validity range of the measured value. In case of input from current transformer (tr.A.), the coil ratio must be selected in such a way that the input value should be less than 50 mA; to have a value in Ampere, it is possible to choose between two methods; with the first method it is necessary to set PEr.H. = 100.0% and InP.H. = half of the coil ratio (without decimal point); with the second method, both values are set to 100.0% and than updated according to percentage value read by the instrument and to real value read with an external tester. Setting PEr.L. and InP.L. to 0 and setting PEr.H. and InP.H. to 100.0%, the process variable is read as a percentage value. The parameter "root" allows application of square root on the read value; the square root is applicable only in case of linear sensors. The parameter "toL." allows rounding the process variable value to 0.1, 0.2, 0.5 or 1.0 units.
The parameter "I.FIL." allows application of a dinamic average on a 8 seconds basis. The parameter "dEC.P." allows display of the process variable value with or without decimal point.

4.4.2 Control outputs configuration menu

These are two menu which allow configuration of the main and secondary control output:

out.1 LISt
out.2 LISt

For each menu, items are the following:

"o.tyP."	1,2	Output type
"o.CyC."	1,2	Output cycle (sec)
"out.L."	1,2	Minimum value (%)
"out.H."	1,2	Maximum value (%)
"out.r."	1,2	Ramp value (%/sec)
"o.d.b."	1,2	Dead band in case of motor control output (%)
"run.t."	1,2	Work time in case of motor control output (sec)
"run.E."	1,2	Additional work time in case of valve open or close (%)

Control output type allow selecting among these possibilities:

nonE	no control ouptput
rEL.	relay output (On/Off)
loG.	logic output (On/Off)
SEr.	double output for motor control
SSr	logic output for SSR
0-10	analog output 0-10 V
0-20	analog output 0-20 mA
4-20	analog output 4-20 mA

The following table shows the correspondance between control outputs (main and secondary) and phisical outputs (out.1, out.2, out.3, out.4, out.5).

Output	**Main**	**Secondary**
Logic	out.1	out.2
Analog	out.1	out.2
Relay	out.3	out.2
Double relay (motor)	out.3 - out.5	out.2 - out.4

Output cycle is meaningful only in case of logic output for SSR; it specifies the cycle time in seconds. Minimum and maximum value limit the range of the control output; the ramp value limits the slope in case of change of the control output (percentage/second). The last three parameters are meaningful only in case of motor control output; the dead band allows not to open/close the valve in case of little differences respect to set-point; work time indicates total time required to open or close the valve; the additional work time allows open/close command to be active also in case of valve completely open or close (by this way it is possible to reset valve position).

4.4.3 Set-point configuration menu

These are two menu which allow configuration of the main and secondary set-point variables:

StP.1 LISt
StP.2 LISt

For each menu, items are the following:

"SP.L."	1,2	Minimum set-point value
"SP.H."	1,2	Maximum set-point value
"SP.uP"	1,2	Up ramp time (hh:mm o mm.ss)
"SP.dn"	1,2	Down ramp time (hh:mm o mm.ss)
"SoFt."	1,2	"Soft start" option
"HoLd."	1,2	"Holdback" option
"tIME"	1,2	Hours/minutes (HH.MM) minutes/seconds (MM.SS)

Minimum and maximum set-point value specify range of both set-point and process variables. Up and down ramp time allow setting the slope in case of set-point change; the parameter specifies total time required to pass from minimu to maximum value (or viceversa). With the "soft-start" option, the present set-point is forced equal to process variable value after a power off or a manual operating mode. With the "holdback" option, the set-point ramp is frozen in case of low or high alarm; as soon as alarms disappear, the set-point ramp starts again. The "tIME" parameter allows setting of ramp time in hours/minutes or in minutes/seconds.

4.4.4 Program configuration menu

These are three menu which allow setting of general parameters, programs and program steps:

CyCL. LISt

ProG LISt
StEP LISt

4.4.4.1 General parameters

Program general parameters are follwing:

"StAt."	Program status (oFF, InP.1, InP.2, CLk., on)
"St.Pr."	Starting sub-program
"SP.1"	Set point 1
"SP.2"	Set point 2
"SoFt"	"Soft start" option
"HoLd"	"Holdback" option
"tIME"	Hours/minutes (HH.MM) minutes/seconds (MM.SS)

The parameter "StAt." specifies program start/stop: by the operator (on/off), through logic input 1 (InP.1) and 2 (InP.2) or according to the internal clock (CLk.). The "St.Pr." parameter specifies the first sub-program to be executed. The "SP.1" and "SP.2" parameters specify if the set-points for loops 1 and 2 must be controlled by the program or not; for instance, setting SP.1 = yES and SP. 2 = no, the set-point 1 (first loop) will be controlled by the program while the set-point 2 (second loop) will be controlled by the set-point menu. With the "soft-start" option, the present set-point is forced equal to process variable value after a power off or a manual operating mode. With the "holdback" option, the set-point ramp is frozen in case of low or high alarm; as soon as alarms disappear, the set-point ramp starts again. The "tIME" parameter allows setting of ramp time in hours/minutes or in minutes/seconds.

4.4.4.2 Sub-programs

Sub-programs are numbered from 1 to 8; each sub-program is made of a number of steps; when a sub-program ends, it is possible to start with another sub-program or to stop the procedure. To select a sub-program it is necessary to set the sub-program number in the parameter "ProG"; the following parameters refer to the selected sub-program:

"bEG."	Starting step
"End"	Last step
"rEP."	Repetions number
"Cont."	Next program

All steps included between "bEG" and "End" are executed; the sequence is repeated "rEP" times; after sub-program is executed, it is possible to start with another sub-program ("Cont."<>0) or to stop the procedure ("Cont"=0).

At the end of the procedure, the "end of program" condition goes on; this condition goes off only when the program stops.

4.4.4.3 Program steps

Up to 30 steps can be set; each step is made of a ramp time and a rest time; during ramp time, set point change until they reach final step values; during rest time, the set-point do not change; before ramp and rest it is possible to force 2 output conditions.
To select a step, it is necessary to wirte the step number in the parameter "StEP"; the following parameters refer to the selected step:

"SEt.P."	1	Set point 1
"SEt.P."	2	Set point 2
"rAMP"		Ramp time (hh:mm o mm:ss)
"rESt"		Rest time (hh:mm o mm:ss)
"out"		Output conditions before ramp and rest

Setting "rAMP" and "rESt" parameters, it is possible to set ramp and rest time; the parameter "out" allows setting two output conditions before ramp and rest; to link these output conditions to physical outputs, refer to paragraph 4.4.7

- first output active at ramp start	-------|
- second output active at ramp start	------|-
- first output active at rest start	-----|--
- second output active at rest start	----|---

With the "soft-start" option, after a power off the present set-point is forced equal to process variable value; then the present set-point reaches the final step set-point with the step ramp value .
With the "holdback" option, in case of low or high alarm the step time is frozen; as soon as alarms disappear, the step time starts again.

4.4.5 Control configuration menu

These are three menus which allows configuring the general control strategy and the PID parameters relative to loops 1 and 2:

rEG.S. LISt
rEG.1 LISt
rEG.2 LISt

4.4.5.1 General control strategy

"StrA."	Strategy type
"PErC."	Percentage value

The StrA. parameters selects the strategy type; the parameter PErC has different meanings which depend on the selected strategy type. Strategy types are the following:

Sy.--	One heat or cool control loop
Sy.Sy.	Two heat or cool control loops
HC.--	One heat/cool control loop
Hr.--	One special heat/cool control loop
Hr.Sy.	One heat or cool control loop and one special heat/cool control loop
Hr.Hr.	Two special heat/cool control loops
CASC.	Cascade control loops
rEMo.	One heat or cool control loop with remote set-point (or ratio set-point)
o.r.1	Double loop with override control (minimum)
o.r.2	Double loop with override control (maximum)
o.r.3	Double loop with override control (medium)
FEEd.	One feed forward control loop
SEr.C.	Valve control with potentiometer input
SEr.r.	Valve control with potentiometer feedback

The special heat/cool control loop differs from standard heat/cool control loop because the cool control output can be only relay type.

With the Sy.-- control strategy, there is only one heat or cool control loop; the main control output is used as loop control output; the secondary control output can be set by the operator; the secondary process variable (PV2) is compared with the set-point.

With the Sy.Sy control strategy, there are two heat or cool control loops; main and secondary control outputs are used as control outputs for loop 1 and 2.

With the HC.-- control strategy, there is only one heat/cool control loop; main and secondary control outputs are used as heat and cool control outputs; the secondary process variable (PV2) is compared with the set-point.

With the Hr.-- control strategy, there is only one special heat/cool control loop; main control output is used as heat control output and relay output out.3 is used as cool control output; the secondary process variable (PV2) is compared with the set-point.

With the Sy.--, HC.-- and Hr.-- control strategies, the second loop can be used to verify if the secondary process variable differs from set-point; this is useful,

for istance, to verify if the heating current read through a current transformer differs from the expected value (set-point).

With the Hr.Sy. control strategy, there are two control loops; the first loop is a special heat/cool control loop whith the main control output as heat control output and the relay output out.3 as cool control output; the second loop is a heat or cool control loop whith the secondary control output as heat or cool control output.

With the Hr.Hr. control startegy, there are two special heat/cool control loops; in the first loop the main control output is used as heat control output and the relay output out.3 as cool control output; in the second loop the secondary control output is used as heat control output and the relay output out.4 as cool control output.

With the CASC. control strategy, there are two cascaded control loops; the set-point of the secondary control loop is calculated according to the following formula: SP = SP2 + (Pout / 100) x (PErC. / 100) x (InP.H. - InP.L.) where Pout is the control output of the primary control loop; the control output of the secondary control loop is managed as the effective control output of the process

With the rEMo. control strategy, the secondary process variable PV2 is used to implement a ratio control loop or a control loop with remote set-point; the set-point of the primary control loop is calculated according to the following formula: SP = SP1 + PV2 x (PErC. / 100)
With the o.r.1 or the o.r.2 control strategy (override), there are two control loops but only one control output which is the lower (o.r.1) or the higher (o.r.2) of the two control outputs which are calculated by the two contro loops; after each cycle, the integral value of the two loops is forced to be the same

With the o.r.3 override control strategy, the control output (Pout) is calculated according to the formula: Pout = P1 x (PErC. / 100) + P2 x (PErC. / 100).

With the FEEd. control strategy, the process variable PV2 is used to add a feed-forward action to the standard PID action; the feed-forward action is calculated according to the formula: FF = PErC. x (PV2 - InP.L.) / (InP.H. - InP.L.)

With the SEr.C. and SEr.r. control strategies, it is possible to implement a control loop where the position of a motor valve is controlled by mean of a open/close control output and a slidewire feedback signal (PV2); the feedback signal can be used to verify (SEr.C.) or to modify (SEr.r.) the effective position of the valve; in both cases the secondary output is the effective

control output and the primary output is use to power the slidewire; the value of the feed current is calculated as a percentage (PErC.) of 20 mA

4.4.5.2 Control parameters

For each of the two control menu, items are the following:

"r.tyP."	1,2	Control type (HEAt, CoLd)
"r.CyC."	1,2	PID repetition cycle (sec)
"P.bAn."	1,2	Prortional band (units)
"r.d.b."	1,2	Dead band (units)
"Int.t."	1,2	Integral time (seconds)
"dEr.t."	1,2	Derivative time (seconds)
"InP.r."	1,2	Impulse reaction value (default = 3)
"In.dn."	1,2	Lower integral band (units)
"In.up"	1,2	Upper integral band (units)
"CoL.b."	1,2	Cool prortional band (units)
"H-C.b."	1,2	Heat/cool dead band (percentage)
"tUnE"	1,2	Autotuning enable
"MAn."	1,2	Manual (yES) or automatic (no) operating mode
"EnAb."	1,2	PID control enable (yES, CLk., InP.1, InP.2, no)

Impulse reaction value dEr.t. allows a modification of the derivative action which takes into account the whole trend of the process variable and not only the last change; default value is 3.
Lower and upper integral band values usually are the same as proportional band value; they can be modified to reduce a possible overshoot in case of set-point change.
Setting to "yES" the parameter "tUnE", it is possible to start the procedure which automatically calculates the PID parameters; the procedure starts only if the loop is in automatic operating mode with PID control enabled; when the procedures is finished, the condition "tUnE" resets.
The parameter "EnAb." allows enabling PID control (yES), disabling PID control (no) or enabling/disabling PID control according to logic inputs (InP.1, InP.2) or internal clock (CLk.).

4.4.6 Alarm conditions configuration menu

These are two menu which allow configuration of the alarm conditions related to PV1 and PV2:

AL.C.1 LISt
AL.C.2 LISt

For each menu, items are the following:

"rEL.L."	1,2	relative low value
"rEL.H"	1,2	relative high value
"AbS.L."	1,2	absolute minimum value
"AbS.H."	1,2	absolute maximum value
"FILt"	1,2	alarm conditions mask

The relative alarm conditions arise if the difference between the process and the set-point value exceeds the relative value; the absolute alarm conditions arise if the set-point exceeds the minimum or the maximum value.
The alarm condition mask allows disabling the alarm conditions which are not meaningful; with the "+" and "-" keys it is possible to set the mask relative to a pair of alarm conditions; with the key "page", it is possible to select a different pair of alarm conditions; the following indicates the correspondence between alarm condition, internal codification (bit) and display indication:

Alarm conditions	*bit*	*display*
- low value alarm	0	-------|
- high value alarm	1	------|-
- minimum value alarm	2	-----|--
- maximum value alarm	3	----|---

4.4.7 Alarm outputs configuration menu

These are three menu which allow configuration of three alarms and of related three alarm outputs:

AL.o.1	LISt
AL.o.2	LISt
AL.o.3	LISt

For each menu, items are the following:

"FIL.1"	1,2	PV1 alarm conditions mask
"FIL.2"	1,2	PV2 alarm conditions mask
"FIL.G."	1,2	General alarm conditions mask
"A.FIL."	1,2	Alarm enable filter (sec)
"d.FIL."	1,2	Alarm disable filter (sec)
"rEtE"	1,2	Alarm retention (yES, no)
"Cont."	1,2	Alarm mode (no.oP, no.CL.)
"out."	1,2	Alarm output (nonE, out.1, out.2, out.3, out.4, out.5)

The alarm conditions mask allows defining an alarm as a combination (OR) of alarm conditions; the following indicates the correspondence between alarm condition mask, internal codification (bit) and display indication:

PV1 alarm conditions	*bit*	*display*
- low value alarm	0	-------|
- high value alarm	1	------|-
- minimum value alarm	2	-----|--
- maximum value alarm	3	----|---
- reading alarm	4	---|----

PV2 alarm conditions	*bit*	*display*
- low value alarm	0	-------|
- high value alarm	1	------|-
- minimum value alarm	2	-----|--
- maximum value alarm	3	----|---
- reading alarm	4	---|----

General alarm conditions	*bit*	*display*
- comunication alarm	0	-------|
- configuration alarm	1	------|-
- first output set by the program	2	-----|--
- second output set by the program	3	----|---
- end of program output	4	---|----

For each alarm it is possible to assign two time filters (enable and disable) and the retention option; the status of the three alarms is displayed on the front of the instrument by the three leds ALL1, ALL2 e ALL3.
The three alarms can be associated to three different relais outputs and the normally open (no.oP) or normally close (no.CL.) condition can also be defined.

4.4.8 Clock configuration menu

This menu is meaningful only if the clock option is in; the menu allows clock setting and programming of cyclic start/end conditions; theese conditions can be used to start/end the PID control (item "EnAb" in the control configuration menu) or the program (item "StAt." in the program configuration menu).

"tIME"	setting of minutes and seconds
"dAy"	setting of the day (Mon., tuE, WEd, tHu, FrI, SAt, Sun)
"S.tIM."	start time
"S.dAy"	start day (if every day, set ALL)
"E.tIM."	end time
"E.dAy"	end day (if no end, set n.Sto.)

4.4.9 Serial interface configuration menu

"Addr."	instrument address (1 - 255)
"bAud"	baud rate (9600 o 19200)
"Prot."	MODBUS "ASCII" o "rtu" protocol

4.4.10 Maintenance menu and calibration menu

These menu must be used only under supervision of SIELCO technical assistance.

4.5 Front leds

The self-test led gives a synthetic indication about the operation of the controller; there are three possibilities:

1. a no flicker situation (the led is always on or off) signals that the cpu is not working; it can depend on a power loss or a fault
2. a fast flicker with on and off pulses of the same width signals that the initialization procedure is running; this procedure starts after a restart and it takes about 10 seconds; when the initialization procedure is running, the serial comunication is disabled.
3. a slow flicker with on and off pulses of the same width signals that the controller is working properly

The two leds "1" and "2" indicate if the display information refers to loop 1, loop 2 or both.

The three leds A1, A2 and A3 indicate the presence of alarm1, alarm 2 or alarm 3.

The two leds C1 and C2 indicate the status of the primary and the secondary control output; according to the output type, there are the following possibilities

- in case of logic output, the led goes on or off according to the status of the control output
- in case of analog output, the led goes on if the control output value is greater then zero
- in case of double output for valve control, a slow or fast flicker indicates that the valve is opening or closing

5. Gates summary tables

Address	Description	Dimension	Signed	Operation	Default value	Minimum	Maximum	Measure unit
1	Dispositive model	WORD	NO	R	50	--	--	--
2	Software version	WORD	NO	R	324	--	--	--
3	ID01	WORD	NO	R	AAAAh	--	--	--
4	ID02	WORD	NO	R	00000h	--	--	--
5	Ch1 Temperature	WORD	YES	R	--	-2999	+20000	°C*10
6	Ch1 SetPoint	WORD	YES	R	--	-2999	+20000	°C*10
7	Ch1 Alarm	BYTE	NO	R	--	0	63	(1)
8	Stato Ch1	BYTE	NO	R	--	0	3	(2)
9	Ch2 Temperature	WORD	YES	R	--	-2999	+20000	°C*10
10	Ch2 SetPoint	WORD	YES	R	--	-2999	+20000	°C*10
11	Ch2 Alarm	BYTE	NO	R	--	0	63	(1)
12	Ch2 state	BYTE	NO	R	--	0	3	(2)
13	General Alarm	BYTE	NO	R	--	0	31	(3)
14	Led Display	BYTE	NO	R	--	0	255	(4)
15	Output 1	WORD	NO	R	--	0	1000	%*10
16	Output 2	WORD	NO	R	--	0	1000	%*10
17	Digitali Input	BYTE	NO	R	--	0	3	(5)
18	Ch1 Input Type	BYTE	NO	R/W	0	0	11	(6)
19	Ch1 Line resistance	WORD	NO	R/W	0	0	4000	Ohm*100
20	Min Ch1	WORD	YES	R/W	0	-200	+1200	%*10
21	Max Ch1	WORD	YES	R/W	0	-200	+1200	%*10
22	Ch1 MinimumTemperature	WORD	YES	R/W	0	-2999	+2000	°C*10
23	Ch1 MaximumTemperature	WORD	YES	R/W	0	-2999	+2000	°C*10
24	Ch1 Input Option	BYTE	NO	R/W	0	0	255	(7)
25	Ch1 Input Resolution	BYTE	NO	R/W	0	0	3	(8)
26	Ch2 Input Type	BYTE	NO	R/W	0	0	11	(6)
27	Ch2 Line resistance	WORD	NO	R/W	0	0	4000	Ohm*100
28	Min Ch2	WORD	YES	R/W	0	-200	+1200	%*10
29	Max Ch2	WORD	YES	R/W	0	-200	+1200	%*10
30	Ch2 MinimumTemperature	WORD	YES	R/W	0	-2999	+2000	°C*10
31	Ch2 MaximumTemperature	WORD	YES	R/W	0	-2999	+2000	°C*10
32	Ch2 Input Option	BYTE	NO	R/W	0	0	35	(7)
33	Ch2 Input Resolution	BYTE	NO	R/W	0	0	3	(8)
34	Output 1 manual value	WORD	NO	R/W	--	0	1000	%*10
35	Output 1 type	BYTE	NO	R/W	4	0	7	(9)
36	Output 1 cycle	BYTE	NO	R/W	1	1	255	Sec.
37	Output 1 minimum value	WORD	NO	R/W	0	0	1000	%*10
38	Output 1 maximum value	WORD	NO	R/W	1000	0	1000	%*10
39	Output 1 ramp	WORD	NO	R/W	1000	1	1000	(%*10)/Sec.
40	Valve 1 dead band	WORD	NO	R/W	20	0	1000	%*10
41	Valve 1 run time	BYTE	NO	R/W	30	1	255	Sec.
42	Valve 1 additional run time	WORD	NO	R/W	0	0	1000	%*10
43	Output 2 manual value	WORD	NO	R/W	--	0	1000	%*10
44	Output 2 type	BYTE	NO	R/W	4	0	7	(9)
45	Output 2 cycle	BYTE	NO	R/W	1	1	255	Sec.
46	Output 2 minimum value	WORD	NO	R/W	0	0	1000	%*10
47	Output 2 maximum value	WORD	NO	R/W	1000	0	1000	%*10
48	Output 2 ramp	WORD	NO	R/W	1000	1	1000	(%*10)/Sec.
49	Valve 2 dead band	WORD	NO	R/W	20	0	1000	%*10
50	Valve 2 run time	BYTE	NO	R/W	30	1	255	Sec.
51	Valve 2 additional run time	WORD	NO	R/W	0	0	1000	%*10

52	Ch1 SetPoint	WORD	YES	R/W	1000	-2999	+20000	°C*10
53	Ch1 minimum setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
54	Ch1 maximum setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
55	Ch1 Hours/Min. up ramp time	BYTE	NO	R/W	0	0	59	Hours/Min.
56	Ch1 Min./Sec. up ramp time	BYTE	NO	R/W	0	0	59	Min./Sec.
57	Ch1 Hours/Min. down ramp time	BYTE	NO	R/W	0	0	59	Hours /Min.
58	Ch1 Min./Sec. down ramp time	BYTE	NO	R/W	0	0	59	Min./Sec.
59	Ch1 SetPoint Options	BYTE	NO	R/W	0	0	130	(10)
60	Ch2 SetPoint	WORD	YES	R/W	1000	-2999	+20000	°C*10
61	Ch2 minimum setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
62	Ch2 maximum setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
63	Ch2 Hours/Min. up ramp time	BYTE	NO	R/W	0	0	59	Hours /Min.
64	Ch2 Min./Sec. up ramp time	BYTE	NO	R/W	0	0	59	Min./Sec.
65	Ch2 Hours/Min. down ramp time	BYTE	NO	R/W	0	0	59	Hours /Min.
66	Ch2 Min./Sec. down ramp time	BYTE	NO	R/W	0	0	59	Min./Sec.
67	Ch2 SetPoint Options	BYTE	NO	R/W	0	0	130	(10)
68	Ch1 low alarm threshold	WORD	NO	R/W	50	1	5000	°C*10
69	Ch1 high alarm threshold	WORD	NO	R/W	50	1	5000	°C*10
70	Ch1 mimum alarm threshold	WORD	YES	R/W	0	-2999	+20000	°C*10
71	Ch1 maximum alarm threshold	WORD	YES	R/W	0	-2999	+20000	°C*10
72	Ch1 alarm mask	BYTE	NO	R/W	15	0	15	(11)
73	Ch2 low alarm threshold	WORD	NO	R/W	50	1	5000	°C*10
74	Ch2 high alarm threshold	WORD	NO	R/W	50	1	5000	°C*10
75	Ch2 mimum alarm threshold	WORD	YES	R/W	0	-2999	+20000	°C*10
76	Ch2 maximum alarm threshold	WORD	YES	R/W	0	-2999	+20000	°C*10
77	Ch2 alarm mask	BYTE	NO	R/W	15	0	15	(11)
78	Ch1 alarm mask for alarm 1	BYTE	NO	R/W	31	0	31	(12)
79	Ch2 alarm mask for alarm 1	BYTE	NO	R/W	0	0	31	(12)
80	General alarm mask for alarm 1	BYTE	NO	R/W	0	0	31	(13)
81	Activation delay for alarm 1	BYTE	NO	R/W	5	0	255	Sec.
82	Deactivation delay for alarm 1	BYTE	NO	R/W	5	0	255	Sec.
83	Alarm 1 options	BYTE	NO	R/W	0	0	3	(14)
84	Alarm 1 output	BYTE	NO	R/W	0	0	5	(15)
85	Ch1 alarm mask for alarm 2	BYTE	NO	R/W	0	0	31	(12)
86	Ch2 alarm mask for alarm 2	BYTE	NO	R/W	31	0	31	(12)
87	General alarm mask for alarm 2	BYTE	NO	R/W	0	0	31	(13)
88	Activation delay for alarm 2	BYTE	NO	R/W	5	0	255	Sec.
89	Deactivation delay for alarm 2	BYTE	NO	R/W	5	0	255	Sec.
90	Alarm 2 options	BYTE	NO	R/W	0	0	3	(14)
91	Alarm 2 output	BYTE	NO	R/W	0	0	5	(15)
92	Ch1 alarm mask for alarm 3	BYTE	NO	R/W	0	0	31	(12)
93	Ch2 alarm mask for alarm 3	BYTE	NO	R/W	0	0	31	(12)
94	General alarm mask for alarm 3	BYTE	NO	R/W	3	0	31	(13)
95	Activation delay for alarm 3	BYTE	NO	R/W	5	0	255	Sec.
96	Deactivation delay for alarm 3	BYTE	NO	R/W	5	0	255	Sec.
97	Alarm 3 options	BYTE	NO	R/W	0	0	13	(14)
98	Alarm 3 output	BYTE	NO	R/W	0	0	5	(15)
99	Ch1 control type	BYTE	NO	R/W	0	0	1	(16)
100	Ch1 control cycle	BYTE	NO	R/W	1	1	255	Sec.
101	Ch1 proportional band	WORD	NO	R/W	100	1	3000	°C*10
102	Ch1 integral time	WORD	NO	R/W	240	0	9999	Sec.
103	Ch1 derivative time	WORD	NO	R/W	1	0	9999	Sec.
104	Ch1 impulse response	BYTE	NO	R/W	3	1	30	#
105	Ch1 integral low limit	WORD	NO	R/W	100	1	3000	°C*10
106	Ch1 integral high limit	WORD	NO	R/W	100	1	3000	°C*10
107	Ch1 inverse proportional band	WORD	NO	R/W	100	1	3000	°C*10
108	Ch1 powers dead band	WORD	YES	R/W	0	-999	+1000	%*10
109	Ch2 control type	BYTE	NO	R/W	0	0	1	(16)
110	Ch2 control cycle	BYTE	NO	R/W	1	1	255	Sec.
111	Ch2 proportional band	WORD	NO	R/W	100	1	3000	°C*10
112	Ch2 integral time	WORD	NO	R/W	240	0	9999	Sec.

113	Ch2 derivative time	WORD	NO	R/W	1	0	9999	Sec.
114	Ch2 impulse response	BYTE	NO	R/W	3	1	30	#
115	Ch2 integral low limit	WORD	NO	R/W	100	1	3000	°C*10
116	Ch2 integral high limit	WORD	NO	R/W	100	1	3000	°C*10
117	Ch2 inverse proportional band	WORD	NO	R/W	100	1	3000	°C*10
118	Ch2 powers dead band	WORD	YES	R/W	0	-999	+1000	%*10
119	Ch1 operating mode	BYTE	NO	R/W	0	0	3	(17)
120	Ch2 operating mode	BYTE	NO	R/W	0	0	3	(17)
121	Ch1 control activation mode	BYTE	NO	R/W	0	0	2	(18)
122	Ch2 control activation mode	BYTE	NO	R/W	0	0	2	(18)
123	Ch1 manual activation mode	BYTE	NO	R/W	0	0	2	(19)
124	Ch2 manual activation mode	BYTE	NO	R/W	0	0	2	(19)
125	Control strategy	BYTE	NO	R/W	0	0	13	(20)
126	Strategy percentage	WORD	NO	R/W	500	0	1000	%*10
127	Actual hours	BYTE	NO	R	--	0	23	Hours
128	Actual minutes	BYTE	NO	R	--	0	59	Minutes
129	Day of week	BYTE	NO	R	--	1	7	(25)
130	Activation hour	BYTE	NO	R/W	8	0	23	Hours
131	Activation minute	BYTE	NO	R/W	0	0	59	Minutes
132	Activation day	BYTE	NO	R/W	0	0	7	(25)
133	Deactivation hour	BYTE	NO	R/W	18	0	23	Hours
134	Deactivation minute	BYTE	NO	R/W	0	0	59	Minutes
135	Deactivation day	BYTE	NO	R/W	0	0	8	(25)
136	Ch1 calibration request	BYTE	NO	R/W	0	0	8	(26)
137	Ch1 calibration parameter 21	WORD	NO	R/W	?	0	65535	--
138	Ch1 calibration parameter 22	WORD	NO	R/W	?	0	65535	--
139	Ch1 calibration parameter 30	WORD	NO	R/W	?	0	65535	--
140	Ch1 calibration parameter 31	WORD	NO	R/W	?	0	65535	--
141	Ch1 calibration parameter 32	WORD	NO	R/W	?	0	65535	--
142	Ch1 calibration parameter 41	WORD	NO	R/W	?	0	65535	--
143	Ch1 calibration parameter 42	WORD	NO	R/W	?	0	400	Ohm*100
144	Ch1 calibration parameter TA	WORD	NO	R/W	?	0	65535	--
145	Ch2 calibration request	BYTE	NO	R/W	0	0	8	(26)
146	Ch2 calibration parameter 21	WORD	NO	R/W	?	0	65535	--
147	Ch2 calibration parameter 22	WORD	NO	R/W	?	0	65535	--
148	Ch2 calibration parameter 30	WORD	NO	R/W	?	0	65535	--
149	Ch2 calibration parameter 31	WORD	NO	R/W	?	0	65535	--
150	Ch2 calibration parameter 32	WORD	NO	R/W	?	0	65535	--
151	Ch2 calibration parameter 41	WORD	NO	R/W	?	0	65535	--
152	Ch2 calibration parameter 42	WORD	NO	R/W	?	0	400	Ohm*100
153	Ch2 calibration parameter TA	WORD	NO	R/W	?	0	65535	--
154	Calibration parameter 10	WORD	NO	R/W	?	0	65535	
155	Calibration parameter 51	WORD	YES	R/W	200	-400	+400	°C*10
156	Calibration parameter 52	WORD	NO	R/W	?	0	65535	--
157	Ch1 control dead band	WORD	NO	R/W	0	0	3000	°C*10
158	Ch2 control dead band	WORD	NO	R/W	0	0	3000	°C*10
159	Stato del ciclo termico	BYTE	NO	R	--	0	2	(21)
160	Executed program	BYTE	NO	R	--	1	8	#
161	Executed step	BYTE	NO	R	--	1	32	#
162	Ramp/Pause elapsed hours	BYTE	NO	R	--	0	99	#
163	Ramp/Pause elapsed minutes	BYTE	NO	R	--	0	59	#
164	Ramp/Pause elapsed seconds	BYTE	NO	R	--	0	59	#
165	Program start mode	BYTE	NO	R/W	0	0	3	(22)
166	Start program	BYTE	NO	R/W	0	0	8	#
167	Program options	BYTE	NO	R/W	0	0	130	(23)
168	Program 1 start step	BYTE	NO	R/W	0	1	8	#
169	Program 1 last step	BYTE	NO	R/W	0	1	8	#
170	Program 1 repeats	BYTE	NO	R/W	0	1	255	#
171	Successive program to program 1	BYTE	NO	R/W	0	0	8	#
172	Program 2 start step	BYTE	NO	R/W	0	1	8	#
173	Program 2 last step	BYTE	NO	R/W	0	1	8	#

174	Program 2 repeats	BYTE	NO	R/W	0	1	255	#
175	Successive program to program 2	BYTE	NO	R/W	0	0	8	#
176	Program 3 start step	BYTE	NO	R/W	0	1	8	#
177	Program 3 last step	BYTE	NO	R/W	0	1	8	#
178	Program 3 repeats	BYTE	NO	R/W	0	1	255	#
179	Successive program to program 3	BYTE	NO	R/W	0	0	8	#
180	Program 4 start step	BYTE	NO	R/W	0	1	8	#
181	Program 4 last step	BYTE	NO	R/W	0	1	8	#
182	Program 4 repeats	BYTE	NO	R/W	0	1	255	#
183	Successive program to program 4	BYTE	NO	R/W	0	0	8	#
184	Program 5 start step	BYTE	NO	R/W	0	1	8	#
185	Program 5 last step	BYTE	NO	R/W	0	1	8	#
186	Program 5 repeats	BYTE	NO	R/W	0	1	255	#
187	Successive program to program 5	BYTE	NO	R/W	0	0	8	#
188	Program 6 start step	BYTE	NO	R/W	0	1	8	#
189	Program 6 last step	BYTE	NO	R/W	0	1	8	#
190	Program 6 repeats	BYTE	NO	R/W	0	1	255	#
191	Successive program to program 6	BYTE	NO	R/W	0	0	8	#
192	Program 7 start step	BYTE	NO	R/W	0	1	8	#
193	Program 7 last step	BYTE	NO	R/W	0	1	8	#
194	Program 7 repeats	BYTE	NO	R/W	0	1	255	#
195	Successive program to program 7	BYTE	NO	R/W	0	0	8	#
196	Program 8 start step	BYTE	NO	R/W	0	1	8	#
197	Program 8 last step	BYTE	NO	R/W	0	1	8	#
198	Program 8 repeats	BYTE	NO	R/W	0	1	255	#
199	Successive program to program 8	BYTE	NO	R/W	0	0	8	#
200	Step 1 Ch1 setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
201	Step 1 Ch2 setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
202	Step 1 hours/minutes ramp	BYTE	NO	R/W	0	0	99	Hours /Min.
203	Step 1 minutes/seconds ramp	BYTE	NO	R/W	0	0	59	Min./Sec.
204	Step 1 hours/minutes pause	BYTE	NO	R/W	0	0	99	Hours /Min.
205	Step 1 minutes/seconds pause	BYTE	NO	R/W	0	0	59	Min./Sec.
206	Step1 ramp/pause outputs	BYTE	NO	R/W	0	0	15	(24)
…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…	…
403	Step 30 Ch1 setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
404	Step 30 Ch2 setPoint	WORD	YES	R/W	0	-2999	+20000	°C*10
405	Step 30 hours/minutes ramp	BYTE	NO	R/W	0	0	99	Hours /Min.
406	Step 30 minutes/seconds ramp	BYTE	NO	R/W	0	0	59	Min./Sec.
407	Step 30 hours/minutes pause	BYTE	NO	R/W	0	0	99	Hours /Min.
408	Step 30 minutes/seconds pause	BYTE	NO	R/W	0	0	59	Min./Sec.
409	Step 30 ramp/pause outputs	BYTE	NO	R/W	0	0	15	(24)