USER'S MANUAL
Rev. 12/2010

REVO TC

TEMPERATURE CONTROLLER

00005

PART 1

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1 Important warnings for safety 8
2 Note 9
3 Identification and Order Code 10
3.1 Identification of the unit 10
3.2 Order Code 11
4 Technical Specifications 12
4.1 Environmental installation conditions 12
4.2 Derating Curve 12
5 Installation 12
5.1 Dimensions and Weight 13
5.2 Fixing holes 13
6 Wiring instructions 14
6.1 Out Terminal (Terminal block M1) 14
6.2 Supply Terminal (Terminal block M2) 14
6.3 Communication Terminal RS485 (Terminal block M3) 14
6.4 Input Terminal (Terminal block M4) 14
6.5 Connection Diagram 15
6.6 Access to Ln – Tn terminal Screw 17
7 TU Module Basic 18
8 Control Panel 19
9 Display 21
9.1 Indicators 22
9.2 Possible outputs REVO TCM (Temperature Controller only) 22
9.3 Possible outputs REVO TC (SSR + Temperature Controller) 22
10 Operative Mode 23
11 Functions 24
11.1 Special Functions 24
11.2 Manual Mode 25
11.3 Showing break-down alarm 25
11.4 Showing leakage alarm 26
11.5 Showing loop-break alarm 26
12 Function "Soft start" 26
13 Detection of malfunctions 27
14 Programming Procedure 28
14.1 Programming procedure Diagram 28
14.2 SET POINT Group (SP) 29
14.3 ALARM Group (AL) 31
14.3.1 Alarm Function 33
14.3.2 Alarm Hysteresis 36

14.3.3 Alarm Out 36
14.3.4 Action of alarm output. 37
14.3.5 Resetting of an Alarm 37
14.3.6 Alarm mask 38
14.4 Control Group (Cntr) 39
14.5 OUT Group(Out) 42
14.6 Group EHt (Functions setted also from input1 and input2) 44
14.7 Group dEF (default of run time Loading) 46
14.8 Group PAL 1 (Pallet 1 control parameters) 46
14.9 Group PAL2 (Pallet 2 control parameters) 48
14.10 Group PAL3 (Pallet 3 control parameters) 48
15 SELF-TUNING Algorithms 51
15.1 PreTune 51
15.2 SelfTune 52
16 Serial RS485 and USB communication interface 53
17 Configuration Mode 54
17.1 Description 54
17.2 Configuration procedure diagram 55
17.3 Group INPUT (inP) 57
17.4 Group I/O (io) 59
17.4.1 Out 1 59
17.4.2 OUT 2 60
17.4.3 OUT 3 or Di 1 61
17.4.4 Out 4 63
17.4.5 General 64
17.5 ALARM Group(AL) 65
17.5.1 Alarm 1 65
17.5.2 Alarm 2 66
17.5.3 Alarm 3 67
17.6 Heating Break-Down Group (Hbdu) 68
17.7 Loop break Group(LbAL) 68
17.8 SELFTUNE Group(tunE) 69
17.9 SOFT START Group (SoFt) 70
17.10 Gruppo PARAMETRI VARI (n ,SC) 70
17.11 RS485 Group (r485) 73
17.12 Default Configuratiov Group (dEF) 74
17.13 Notes 75
18 Serial communications 76

18.1 introduction to Modbus Protocol 76
18.2 TABLE 0 78
18.3 WORDS ADDRESS 78
18.4 BITS 87
18.5 TABLE 1 (WEST 6600) 88
18.6 Status Table (Word 7) 89
19 Default Parameter Loading 91
19.1 User procedure 91
19.2 Loading Default operative parameter 91
19.3 Default configuration parameter Loading 92
19.3.1 European table 93
19.3.2 Americana table 96
20 Calibration Procedure 101
20.1 Description 101
20.2 Guidelines for calibration 101
20.3 Calibration from keypad 102
20.3.1 TC and linear input calibration 103
20.3.2 Cold Junction Calibration 104
20.3.3 RTD Input Calibration 105
20.3.4 Input Calibration mA 106
20.3.5 Input 10 V Calibration 107
20.3.6 Current transformer Input calibration 108
20.4 Calibration from serial 109
20.4.1 Input TC and LINEAR Input calibration 109
20.4.2 Cold Junction Calibration 110
20.4.3 RTD Input Calibration 110
20.4.4 Input Calibration mA 111
20.4.5 Input 10 V Calibration 112
20.4.6 Calibrazione Input Trasformatore Amperometrico 113
20.5 Caricamento valori di calibrazione di default 113
21 Tables: 114
21.1 Table 1 114
21.2 Table 2 114
22 Test Hardware via seriale 115
22.1 Display Test 116
22.2 Led Test 116
22.3 FUNC key Test 116
22.4 MAN Key Test 116
22.5 UP key Test 116
22.6 DOWN key Test 116
22.7 EEPROM Test 116

22.8 Relè 1 Test 116
22.9 Relè 2 Test 116
22.10 Relè 3 Test 117
22.11 Relè 4 Test 117
22.12 Out 4 mA Test 117
22.13 Out 20 mA Test 117
22.14 Input 1 Test 117
22.15 Input 2 Test 117
22.16 10 mV measure Test 118
22.17 60 mV measure Test 118
22.18 4 mA measure Test 118
22.19 20 mA measure Test 118
22.20 0 ohm measure Test 119
22.21 300 ohm measure Test 119
22.22 1 V measure Test 119
22.23 10 V measure Test 119
22.24 RJ Test 120
22.25 TA 5 mA measure Test 120
22.26 TA 50 mA measure Test 120

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Dichiarazione di Conformità CE
CE Declaration of Conformity

PRODUTTORE:
PRODUCT MANUFACTURER: CD Automation S.R.L.

INDIRIZZO:
ADDRESS: Via Pablo Picasso 34//36
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Dichiara che il prodotto:
Declare that the product:

Revo TC

SODDISFA I REQUISITI DELLA NORMA :

Specifica di sicurezza	EN60947-1 :2008
	EN60947-4-3:2001
Specifica sulle emissioni	EN60947-4-3:2000
Specifica sulle Immunità	EN60947-4-3:2000

FULFILS THE REQUIREMENTS OF THE STANDARD:

Electrical safety Standard	EN60947-1 :2008
	EN60947-4-3:2001
Generic Emission standard	EN60947-4-3:2000
Generic Immunity standard	EN60947-4-3:2000

CDAutomation dichiara che I prodotti sopra menzionati sono conformi alla direttiva

CDAutomation declares that The products above mentioned they am conforming to the directive

EMC 2004/108/CEE e alla direttiva Bassa Tensione (low Voltage) **2006/95/CEE**

DESCIZIONE DEL PRODOTTO: Unità di controllo potenza elettrica
PRODUCT DESCRIPTION: Elettric power controll

UTILIZZO: Controllo processi termici
SCOPE OF APPLICATION: Thermal controll process

Data di emissione: 20/04/2010
Issued on: 20/04/2010

Amministratore Unico e
Legale Rappresentante
Claudio Brizzi

1 Important warnings for safety

This chapter contains important information for the safety. The not observance of these instructions may result in serious personal injury or death and can cause serious damages to the Thyristor unit and to the components system included.
The installation should be performed by qualified persons.

The Thyristor unit are integral part of industrial equipments. When it is supply, the Thyristor unit is subject to dangerous tensions.

- Don't remove the protection Cover.
- Don't use these unit in aerospace applications and/ or nuclear.

The nominal current corresponds to use at temperature not superior to 45°C.

- The Thyristor unit must be mounted in vertical position and without obstruction above and below to allow a good flow ventilation.
- The hot air of one thyristor unit must not invest the unit positioned above.
- For side by side placed leave a space of 15mm between the unit.

A suitable device must ensure that the unit can be electrically isolated from the supply, this allows the qualified people to work in safety.

Protection (Protection, Protezione)
The unit have IP20 protection rating as defined by the specific international. Is necessary consider the place of installation.

Earth (Terre, Messa a terra)
For safety, the Thyristor unit with isolated heat-sink must be connected to earth.
Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

Electronic supply (Alimentation électronique, Alimentazione elettronica)
The electronic circuit of the Thyristor unit must be supplied by dedicated voltage for all electronic circuits and not in parallel with coil contactors, solenoids and other.
It's recommended to use a shielded transformer.

Electric Shock Hazard (Risque de choque électrique, Rischi di scosse elettriche)
When the Thyristor unit is energized, after the power supply is shut off, wait least a minute for allow the discharge of the internal capacitors where there is a dangerous tension. Before working, make sure that:

- Only authorized personnel must perform maintenance, inspection, and replacement operations.
- The authorized personnel must read this manual before to have access to the unit.
- Unqualified People don't perform jobs on the same unit or in the immediate vicinities.

Important warnings (Attention, Avvertenze importanti)
During the operations with units under tension, local regulations regarding electrical installation should be rigidly observed:

- Respect the internal safety rules.
- Don't bend components to maintain insulation distances.
- Protect the units from high temperature humidity and vibrations.
- Don't touch components to prevent electrostatic discharges on them.
- Verify that the size is in line with real needs.
- To measure voltage current etc. on unit, remove rings and other jewels from fingers and hands.
- Authorized personnel that work on thyristor unit under power supply voltage must be on insulated board

This listing does not represent a complete enumeration of all necessary safety cautions.

Electromagnetic compatibility
(Compatibilità électromagnétique, Compatibilità elettromagnetica)
Our thyristor units have an excellent immunity to electromagnetic interferences if all suggestions contained in this manual are respected. In respect to a good Engineering practice, all inductive loads like solenoids contactor coils should have a filter in parallel.

Emissions (Emission, Emissioni)
All solid-state power controllers emit a certain amount of radio-frequency energy because of the fast switching of the power devices.
The CD Automation's Thyristor unit are in accord with the EMC norms, CE mark.
In most installations, near by electronic systems will experience no difficulty with interference. If very sensitive electronic measuring equipment or low-frequency radio receivers are to be used near the unit, some special precautions may be required. These may include the installation of a line supply filter and the use of screened (shielded) output cable to the load.

2 Note

Warning: This icon is present in all the operational procedures where the Improper operation may result in serious personal injury or death

Caution: This icon is present in all the operational procedures where the Improper operation can cause damage for the unit.

CD Automation reserves the right to modify the own products and this manual without any advise.

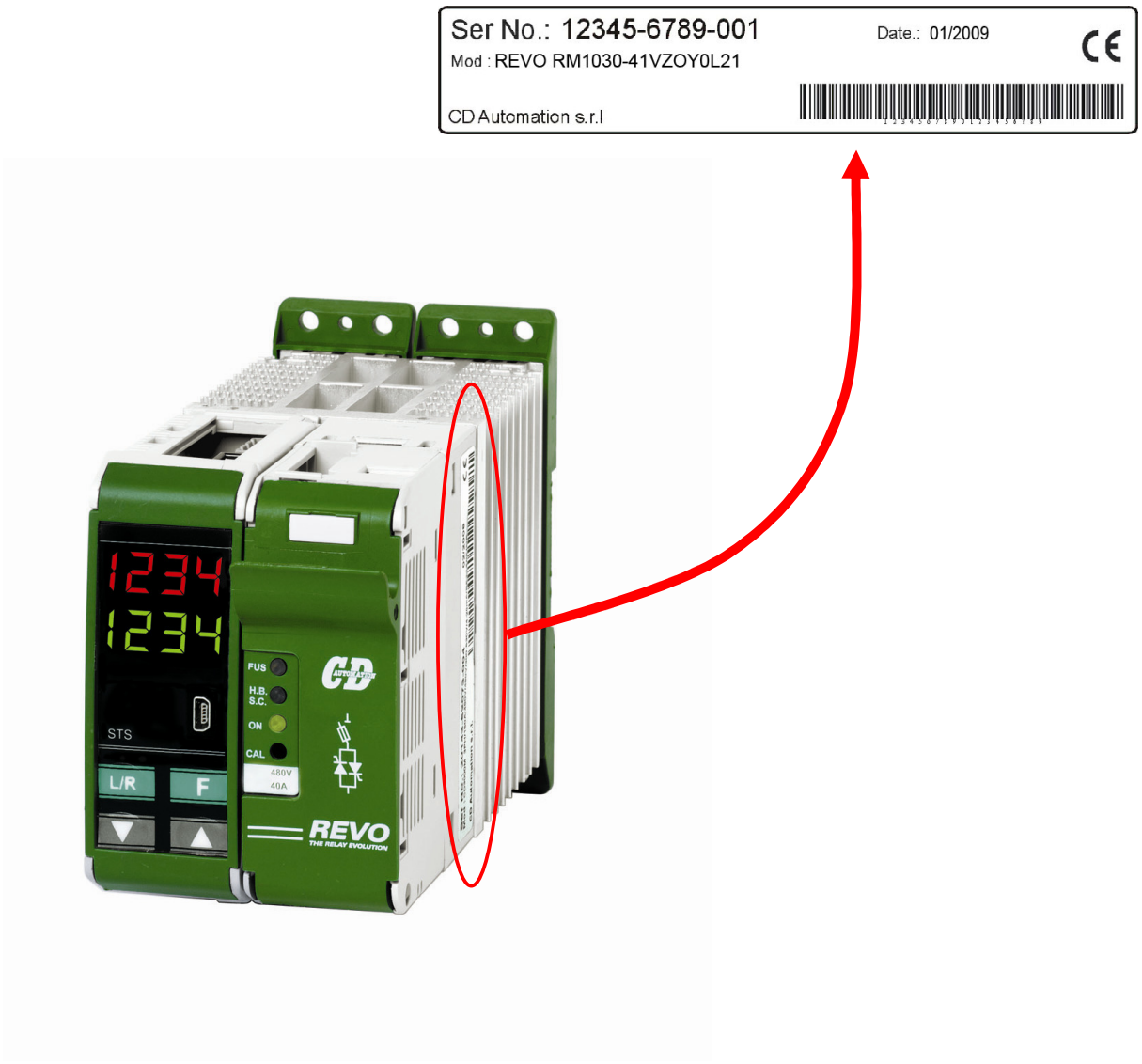
CE

3 Identification and Order Code

3.1 Identification of the unit

Attenzione: *Prima dell'installazione, assicurarsi che l'unità a thyristor non abbia subito danni durante il trasporto. In caso di danneggiamento, notificarlo immediatamente al corriere..*

The identification's label give all the information regarding the factory settings of the Thyristor unit, this label is on the unit, like represented in figure.
Verify that the product is the same thing as ordered.



3.2 Order Code

	1	2	3	4	5	6		7	8	9	10	11	12	13	14	15	16
REVO TC	R	T	_	_	_	_	-	_	_	_	_	_	_	_	_	_	_

3 Phase Controlled

Description code	Numeric code
1 PHASE UNIT 1PH	1
2 PHASE UNIT 2PH	2
3 PHASE UNIT 3PH	3

4,5,6 Phase Current 1PH/2PH/3PH

Description code	Numeric code
30A	0 3 0
35A	0 3 5
40A	0 4 0
60A	0 6 0
90A	0 9 0
120A	1 2 0
150A	1 5 0
180A	1 8 0
210A	2 1 0

7 Max Voltage

Description code	Numeric code
480V	4
600V	6

8 Aux. Voltage supply

Description code	Numeric code
12:24V ac dc	4

9 Input

Description code	Numeric code
Thermocouple	T
Pt 100	N
0:10V dc	V
4:20mA	A

10 Output 2

Description code	Numeric code
Relay Output 2	R
Heating Only	0

11 Output 3

Description code	Numeric code
1 off D/I 24v d.c.	1
1 off D/O Relay contact	2

Note (1): **Fixed fuses over 40A**

12 Fuse & Option

Description code	Numeric code
For All Units .=< 40A Fuse + Fuseholder	F
Fuse + Fuseholder + TA	Y
Fuse + Fuseholder +TA +HB with screw terminal	H
Fuse + Fuseholder +TA +HB with Flat Cable	X
For All Units > 40 A Fixed Fuse Standard	F
Fixed Fuse + TA	Y
Fixed Fuse + TA + HB	H

13 110 Fan Option

Description code	Numeric code
Without fan unit ≤ 90A	0
With Fan at 110V Unit> 90A	1
With 220V Fan Unit> 90A	2

LEGEND
CT = Current Transformer
HB = Heater Break Alarm

14 Approvals

Description code	Numeric code
CE EMC For European Market	0
cUL For American Market up to 210A	L

15 Manual

Description code	Numeric code
None	0
Italian Manual	1
English Manual	2
German Manual	3
French Manual	4

16 Version

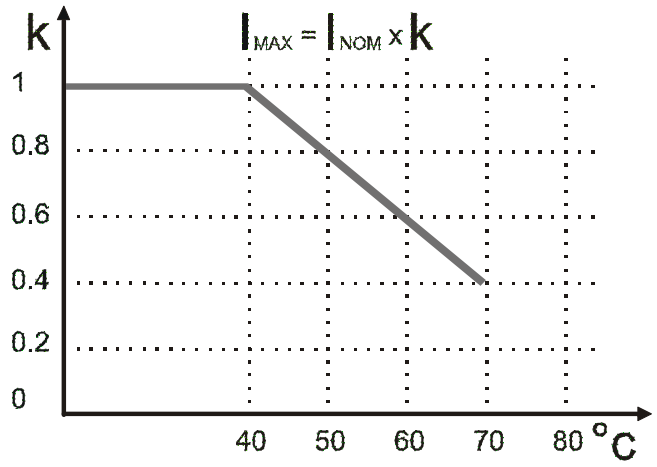
Description code	Numeric code
Standard unit with a single fuse	1
Unit with 2 Fuses + Fuse Holder .=<40A (Just on single phase units)	2
Units with 2 Fuse + Fuses + Fuse Holder .=<40A (Available with single-phase units)	3

4 Technical Specifications

4.1 Environmental installation conditions

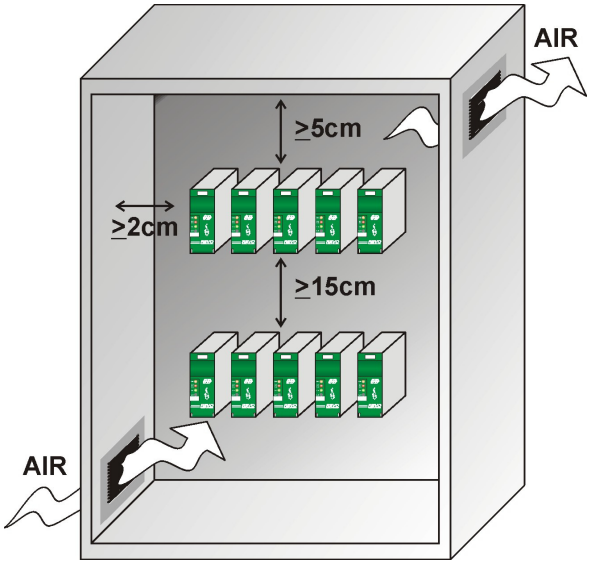
Ambient temperature	0-40°C at nominal current. Over 40°C use the derating curve.
Storage temperature	-25°C a 70°C
Installation place	Don't install at direct sun light, where there are conductive dust, corrosive gas, vibration or water and also in salty environmental.
Altitude	Up to 1000 meter over sea level. For higher altitude reduce the nominal current of 2% for each 100m over 1000m
Humidity	From 5 to 95% without condense and ice
Pollution Level	Up to 2nd Level ref. IEC 60947-1 6.1.3.2

4.2 Derating Curve

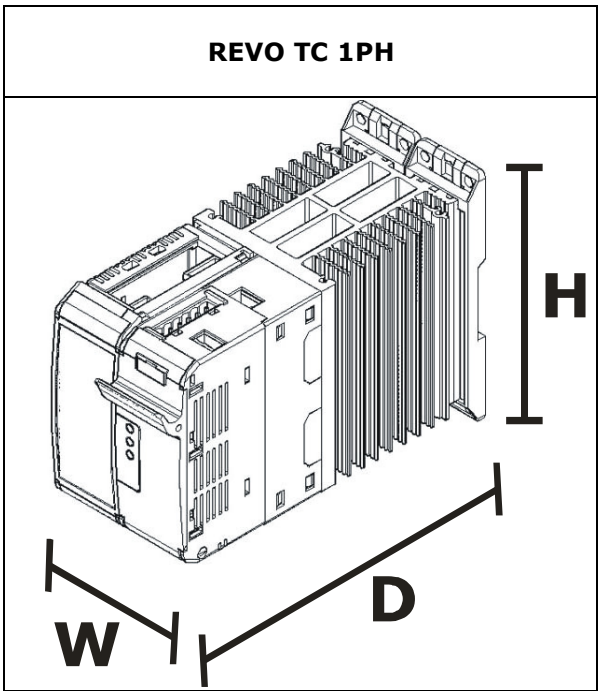


5 Installation

Before to install, make sure that the Thyristor unit have not damages.
If the product has a fault, please contact the dealer from which you purchased the product.
Verify that the product is the same thing as ordered.
The Thyristor unit must be always mounted in vertical position to improve air cooling on heat-sink.
Maintain the minimum distances in vertical and in horizontal as represented.
When more unit has mounted inside the cabinet maintain the air circulation like represented in figure.
Sometimes is necessary installing a fan to have better air circulation.

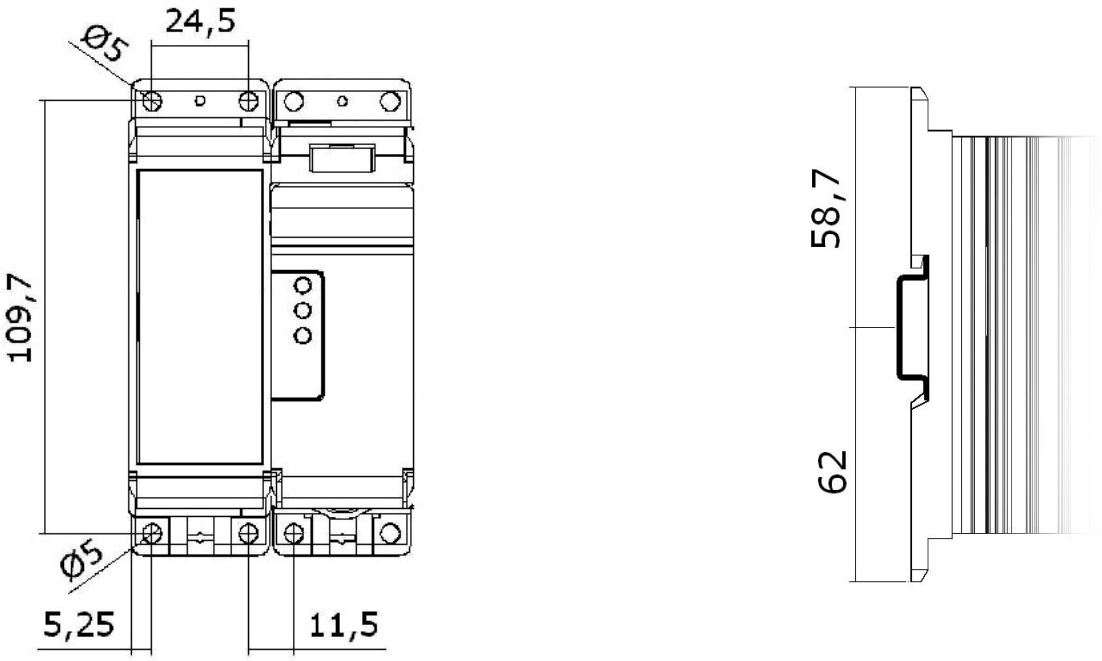


5.1 Dimensions and Weight



W(mm)	H(mm)	D(mm)	Weight (kg)
72	121	185	1,15

5.2 Fixing holes



6 Wiring instructions

Warning: *Before connecting or disconnecting the unit check that power and control cables are isolated from voltage sources.*

6.1 Out Terminal (Terminal block M1)

Terminal	Description	SSR Out	DI Input	Relay Out	Digital Input/Output
1	OUT4	SSR–	DI2	C	DI/O 2
2	OUT4	SSR+	DI2	NO	DI/O 2
3	OUT3	SSR–	DI1	C	DI/O 1
4	OUT3	SSR+	DI1	NO	DI/O 1
5	OUT2	SSR–	_	C	_
6	OUT2	SSR+	_	NO	_
7	TA	_	_	_	_
8	TA	_	_	_	_
9	OUT1	SSR–	_	C	_
10	OUT1	SSR+	_	NO	_

"-" = Not available

6.2 Supply Terminal (Terminal block M2)

Terminal	Description
11	Supply 24Vdc/ac
12	Supply 24Vdc/ac

6.3 Communication Terminal RS485 (Terminal block M3)

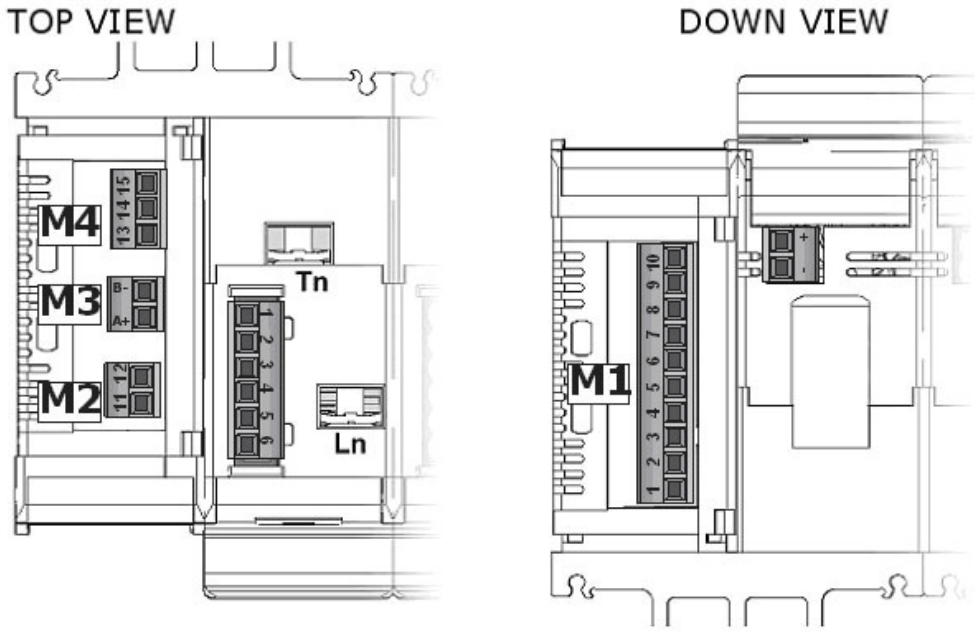
Terminal	Description
A+	RS485 A +
B-	RS485 B -

6.4 Input Terminal (Terminal block M4)

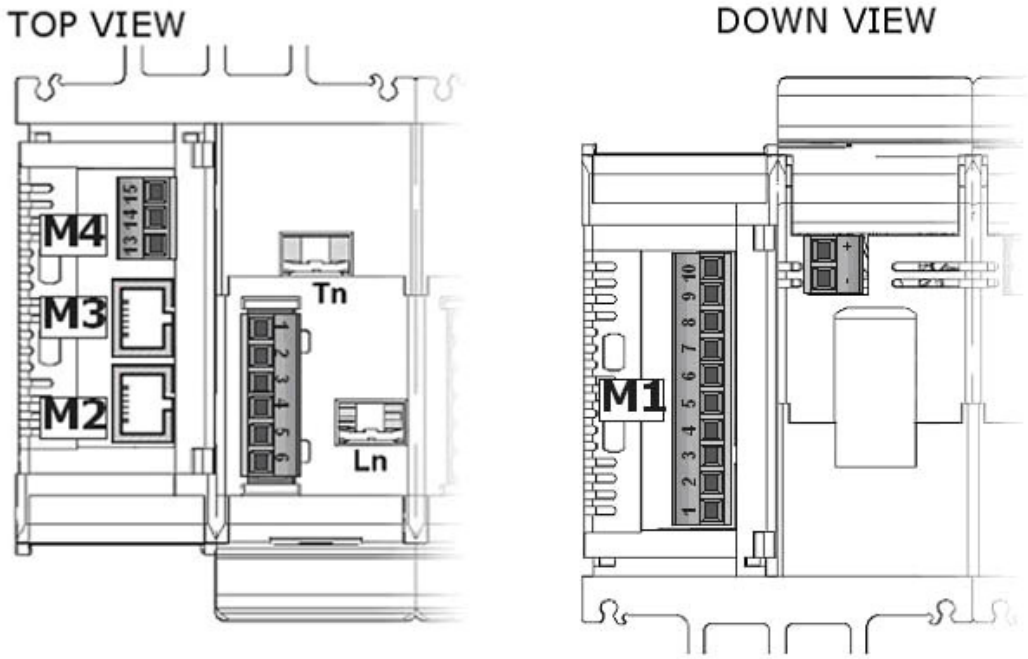
Terminal	Description			
13		PT100		
14	TC+	PT100	V+	mA+
15	TC-	Compensazione	V-	mA-

6.5 Connection Diagram

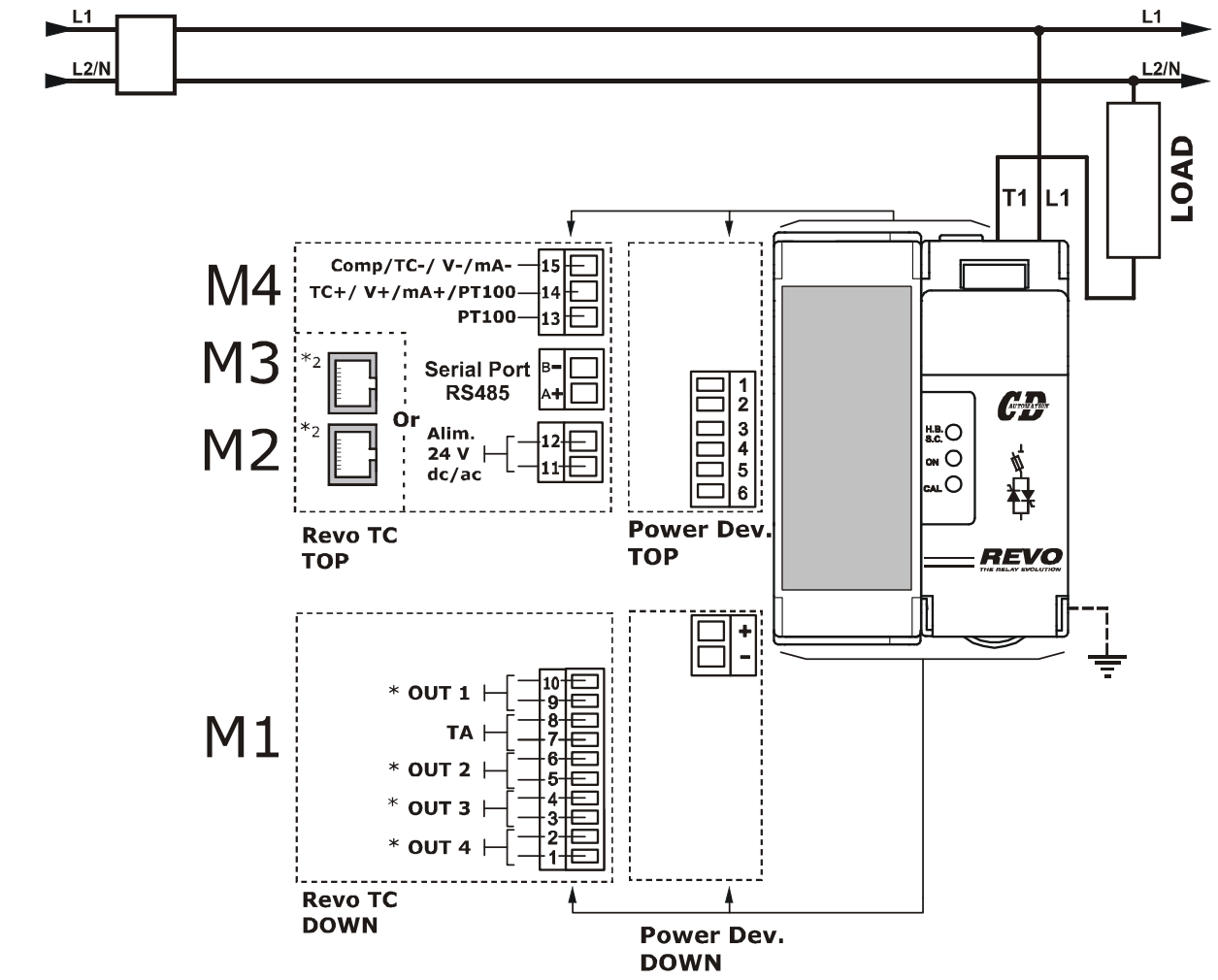
Revo TC Basic:



Revo TC with flat wiring system Option:



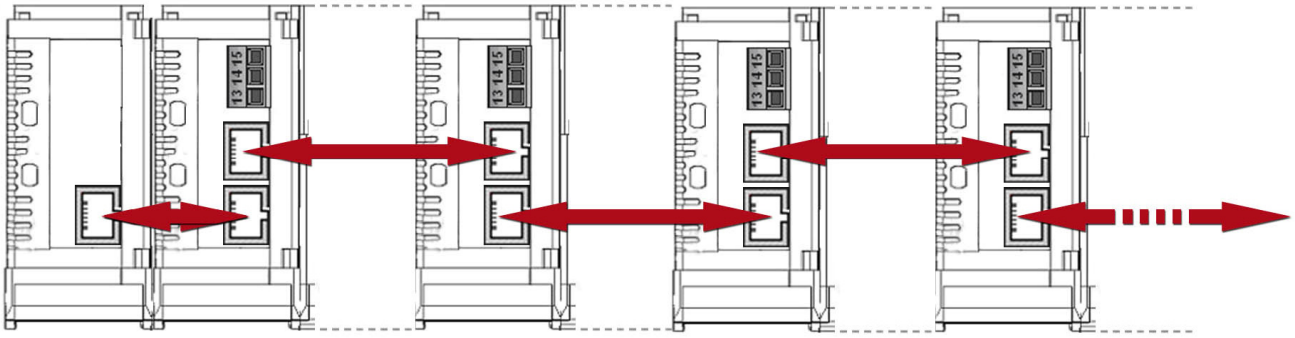
Caution: *this procedure must be performed only by qualified persons.*



* See Out terminal chapter for more informations

*2 Only with flat wiring system Option: connect with proper cable (RJ45 Cat 5E Patch Cable UTP) as shown:

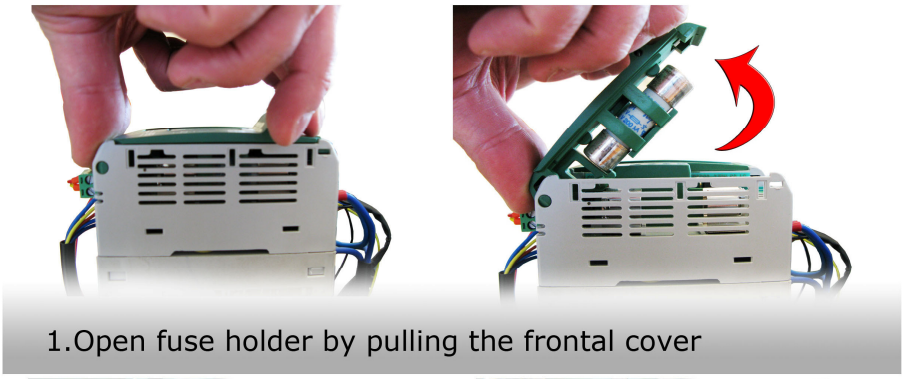
TU MODULE



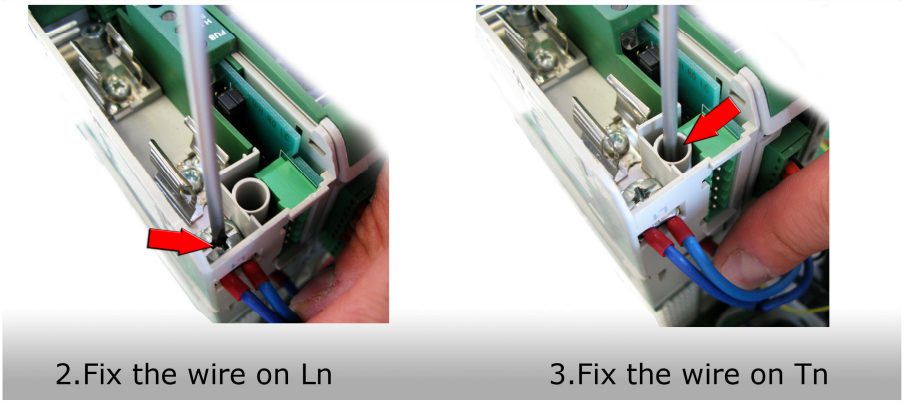
The cable supplyed by CD Automation are

Lenght	Code
0,15 m	ICOC U5EB-001
0,3 m	ICOC U5EB-003-GREE
0,5 m	ICOC U5EB-005-GREE
1 m	ICOC U5EB-010-GREE
2 m	ICOC U5EB-020-GREE
3 m	ICOC U5EB-030-GREE
5 m	ICOC U5EB-050-GREE
7,5 m	ICOC U5EB-075-GREE
10 m	ICOC U5EB-100-GREE
15 m	ICOC U5EB-150-GREE

6.6 Access to Ln – Tn terminal Screw

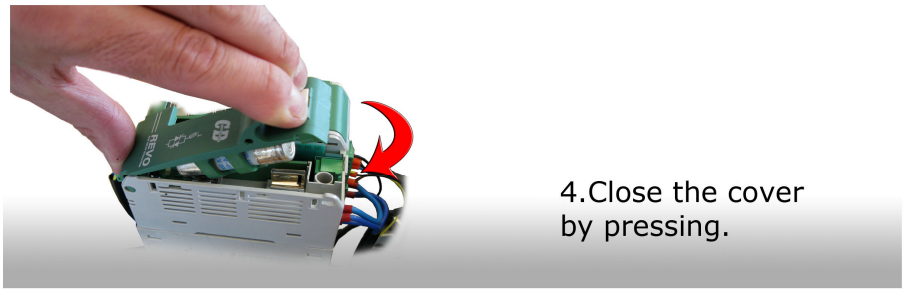


1.Open fuse holder by pulling the frontal cover



2.Fix the wire on Ln

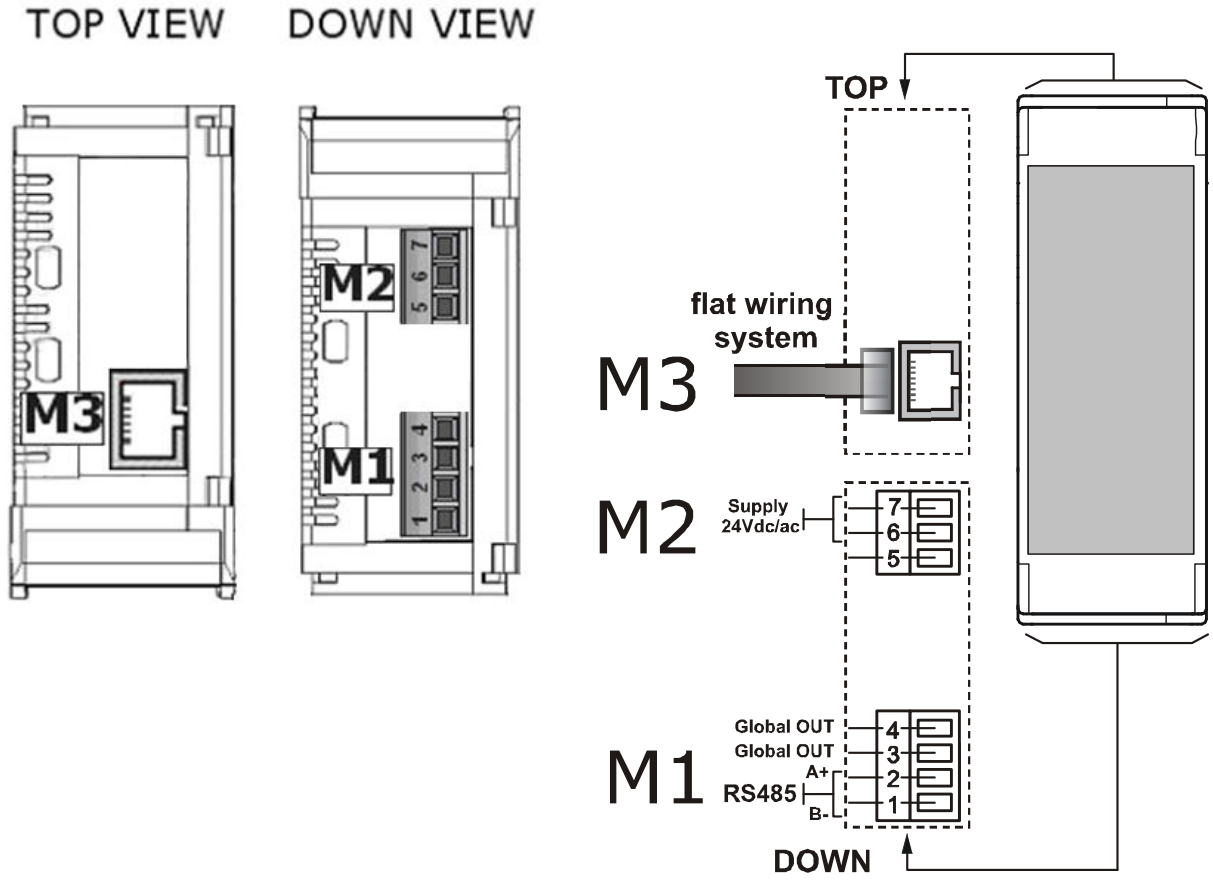
3.Fix the wire on Tn



4.Close the cover
by pressing.

7 TU Module Basic

Revo TU is a termination unit that provides the power supply and RS485 comms (modbus RTU) for up to max 10 REVO TC units.



Terminal block M1

Terminal	Description
1	RS485 B -
2	RS485 A +
3	Global Output
4	Global Output

Terminal block M2

Terminal	Description
5	Not Used
6	Supply 24Vdc/ac
7	Supply 24Vdc/ac

Terminal Block M3 for flat wiring system

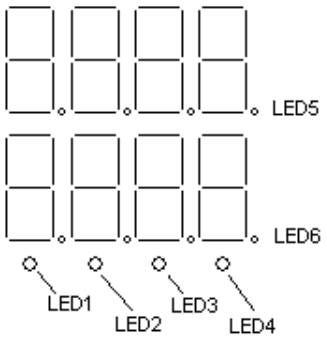
8 Control Panel

The keyboard is composed of **four push button** properly identified and protected: depending on the status of each device button assumes a specific function, as described below.

Text or Combination	Description of function associated
▲	Configuration and operational Skip to next parameter or group Configuration and ongoing operational and edit Increases the value of the parameter currently displayed Operating with manual output Increases the value of control output Automatic Operation If enabled, after 3 sec ill set point increases
▼	Configuration and operational Skip to the previous group or parameter Configuration and ongoing operational and edit Decreases the value of the parameter currently displayed Operating with manual output Decreases the value of control output Automatic Operation If enabled, after 3 sec the set point decreases
FUNC	Operating Release Avoid the Change of the value displayed through the upper LCD. Accept the changed value Operating T> 3 sec Special Views: load current, leakage current, heating power, the cooling power, firmware version. Configuration Avoid the Change of the value of information displayed through the upper LCD. Accept the changed value
MAN	Operating Exit the current group While editing a parameter abort editing Operating T> 3 sec Set automatic or manual control mode Configuration Exit the current group While editing a parameter abort editing

(▲/▼) + MAN	Operating during numeric editing Reaches the max / min set for the actual parameter Configuration during numeric editing Reaches the max / min set for the current parameter
FUNC + MAN	Operating *t > 3 sec.* Input in configuration mode
▲ + FUNC	Operating *t > 3 sec.* Lamp test
▼ + FUNC	Operating t > 3 sec. Input in calibration mode
▼ + MAN	Operativo Show on the display below the load current or SetPoint

9 Display



During operation, normal operating, the top display shows the process variable while the lower display the current setpoint.

> Note: if the restriction is enabled to changes in setpoint (SPU, SPD), the setpoint value displayed may not match the actual value. In fact, if the group parameter SPUS misc configuration is set to appear FNSP the SP arrival, otherwise the current SP.

If properly enabled in the configuration you can increase or decrease the setpoint value directly from the operating mode.

To this should be button for 3 seconds. taken down ▼ or ▲

At this point the change is enabled. Each press of two buttons will cause the 'increase or decrease of the SP.

Failure pressure of either button for more than 5 seconds will stop the 'edit.

To resume editing the SP press again require either button for 3 seconds.

If properly enabled configuration by pressing the UP and MAN on the lower display shows the current in the load. To return to the set point, press the same buttons.

9.1 Indicators

LED1	Switched on when the output 1 is ON state.
LED2	Switched on when the output 2 is ON state.
LED3	Switched on when the output 3 is ON state.
LED4	Switched on when the output 4 is ON state.
LED5	Flashing when the function tune is working and in calculating mode.
LED6	Flashing when the function adaptive is working.

The Led 1, 2, 3 o 4 , if assigned to the status of the alarm 3, take the following feature:

- If the alarm 3 is in OFF state and also alarms Breakdown, leakage or loop-break are in OFF state the assigned LEDs are off
- If the alarm 3 is in ON state and also alarms breakdown, leakage or loop-break are in OFF state the assigned LEDs are On
- If the alarm 3 is in OFF state and one or more of the alarm of breakdown, leakage or di loop-break are in ON state, the assigned LEDs flashes every 1 second.
- If the alarm 3 is in ON state and one or more of the alarm of breakdown, leakage or loop-break are in ON state, the assigned LEDs flashes every 0.5 seconds.

9.2 Possible outputs REVO TCM (Temperature Controller only)

Uscita	RELAY TC07-02	SSR TC07-03	Analogic TC07-01	DI Input TC07-05	Input/Output TC07-04
OUT1	X	X	X	-	-
OUT2	X	X	-	-	-
OUT3	X	X	X	X	X
OUT4	X	X	-	X	X

"-" = Not available

9.3 Possible outputs REVO TC (SSR + Temperature Controller)

Uscita	RELAY TC07-02	SSR TC07-03	Analogic TC07-01	DI Input TC07-05	Input/Output TC07-04
OUT1	-	Fixed	-	-	-
OUT2	X	-	-	-	-
OUT3	X	-	--	X	-
OUT4	Fixed	-	-	-	-

"-" = Not available

10 Operative Mode

Description**:**

In operating mode, parameters can be viewed and modified in the present state of the device: to access the programming procedure, press the **FUNC** button and release it within 3 seconds.

The lower display shows the ID of the current group, while the upper display shows the string "Edt" permanently: the ▲ and ▼ buttons let you select the group to change, and allows the **FUNC** key to enter the selected group.

For each parameter in the group selected, the lower display shows the ID parameter as the upper display shows the current value: to switch to other parameters of the group acts on the ▲ and ▼.

Pressing the **FUNC** enter into modification of the displayed parameter (the upper display starts flashing).

With the ▲ and ▼ changing the current value displayed on the bottom.

Press the **FUNC** key to store the value currently displayed, pressing the MAN you exit without saving changes the new value.

For a list of parameters, see Chapter **<Programming procedure>**

11 Functions

11.1 Special Functions

By pressing for 3 sec the keys **UP** and **MAN** and the lower display, if enabled, the load current.
The next press the same button for 3 seconds will return to the SetPoint

By pressing the **FUNC** key for 3 seconds, you can see on the lower display in the following order:

- A character **A** followed by the value of the load current output.
- A character **b** followed by the leakage current value of output.
- A character **H** followed by the output value of heating (0-100%)
- A character C followed by cooling output value (0 - 100%)
- A **t** character followed by the value of the cold junction temperature detected
- A **v** character followed by the firmware version

Some information is only available if the instrument is properly configured.
The display returns to normal operating mode by pressing the **MAN**.
Pressing the **▲ + FUNC** for 3 seconds activates the lamp test: all segments of all digits of the display and front LEDs are switched on and off with 1 Hz frequency (duty-cycle 50%) until next keypress **MAN**.

11.2 Manual Mode

The manual mode can be activated by holding down the MAN button for 3 seconds, if enabled in the configuration (group misc parameter mnFn <> nonE) and only in normal operating mode.

Il display superiore visualizza la variabile di processo.
Esistono 3 modalità di funzionamento manuale (sempre definite in configurazione nel gruppo misc parametro mnFn):

The upper display shows the process variable.
There are 3 modes of operation manual (always defined in the configuration parameter group misc mnFn):

- **Classic Manual Mode**:
  The operator sets the percentage of output power from 0 to 100% for heating only operation, from -100% to 100% for operating heating / cooling.
  The lower display shows the current power preceded by the letter **P.**
  The change from automatic mode to manual mode (and vice versa) will be in bumpless mode only if the integral action has not been previously excluded.
  If the transfer AUTO ► MAN occurred during selftune, at the return in the AUTO mode the instrument will operate in auto-tuning adaptive abled.

- **OFF Mode**: the operator determines the release of relay heating (if output in mA or V brings the power to 0).
- **Displayed load current mode**: in this case does not change any control over the load, but show the load current.

When switch on, the device is always in AUTO mode or, if properly selected in configuration ,the state in which it was turned off.

11.3 Showing break-down alarm

The alarm condition detected in the measurement of current through the current transformer is indicated in **OR** on the relay or on the relays assigned to alarm 3.
The current sampling is done only if the state's output, which is inserted in the current transformer is maintained for at least 200ms **ON**: if during the current cycle time is not carried out any sampling, the value shown by the lower display will be "----".
This is shown only present if the group parameter HCEn Hbdu configuration is set to ON.

11.4 Showing leakage alarm

The alarm condition detected in the measurement of current through the current transformer is indicated in **OR** on the relay or on the relays assigned to alarm 3.

Il The current sampling is done only if the state's output, which is inserted in the current transformer is unenergized for at least 200ms:if during the current cycle time is not carried out any sampling, the value shown by the lower display will be "----".

This view is only present if the group parameter HCEn Hbdu configuration is set to ON.

11.5 Showing loop-break alarm

- uscita di controllo al minimo e azione *reverse*
- uscita di controllo al massimo e azione *direct*

Analogamente, la variabile di processo deve crescere se:

- uscita di controllo al minimo e azione *direct*
- uscita di controllo al massimo e azione *reverse*

La condizione di allarme viene segnalata in **OR** sul relè o sui relè assegnati all' allarme 3.

The loop-break alarm is generated by the dedicated algorithm when the control output is at the minimum / maximum value and the process variable changes in the time pre-chosen of amplitude below the threshold set in the configuration.

The process variable must decrease if:

- Control output to the minimum and Reverse Action
- Control output to the maximum and direct action

Similarly, the process variable must grow if:

- Control output to the minimum and direct action
- Control output to the maximum and reverse action

The alarm condition is reported in **OR** on the relay or the relays assigned to the alarm 3.

12 Function “Soft start”

When the instrument is switched on the function "soft start" protects temporarily the limit the output power. By limiting the heating power of switch on it’s possible to reduce the thermal stress to the heating elements. The user can configure the time and temperature threshold of the function "soft start".

13 Detection of malfunctions

The instrument can detect the following abnormal conditions of the process variable:

- *over-range*
- *under-range*
- *sensor leads break*

The condition of over-range is displayed by the characters ***"Undr"*** flashing in the upper display.

The condition of over-range is displayed with ***"oVrr"*** in the upper display.

Table 1 shows the state of OUT1 and OUT2 at the conditions of range of under-and over-range, according to the device settings (control mode heating / cooling and SEcF parameter value). The first four lines delineate the **standard configuration.**

			OUT1		**OUT2**	
condition	**Heating/ Cooling**	**SEcF**	***reverse***	***direct***	***reverse***	***direct***
under-range	**NO**	**0**	**ON**	**OFF**	**---**	**---**
over-range	**NO**	**0**	**OFF**	**ON**	**---**	**---**
under-range	**SI**	**0**	**ON**		**OFF**	
over-range	**SI**	**0**	**OFF**		**ON**	
under-range	---	1	SEcO		SecO	
over-range	---	1	SEcO		SecO	
under-range	---	2	*standard*		*standard*	
over-range	---	2	SEcO		SecO	
under-range	---	3	SEcO		SecO	
over-range	---	3	*standard*		*standard*	

Table 1: security state Stati di sicurezza of the output in out-of-range condition.

Breakage of the temperature sensor can be reported as:

- *over-range* o *under-range* (configurable) for input TC/mV
- *over-range* for input RTD
- *under-range* for input mA / V (only with *zero elevation*)

14 Programming Procedure

14.1 Programming procedure Diagram

Figure 1 shows the state diagram of the programming process through which shows the strings displayed by the two front LCD display.

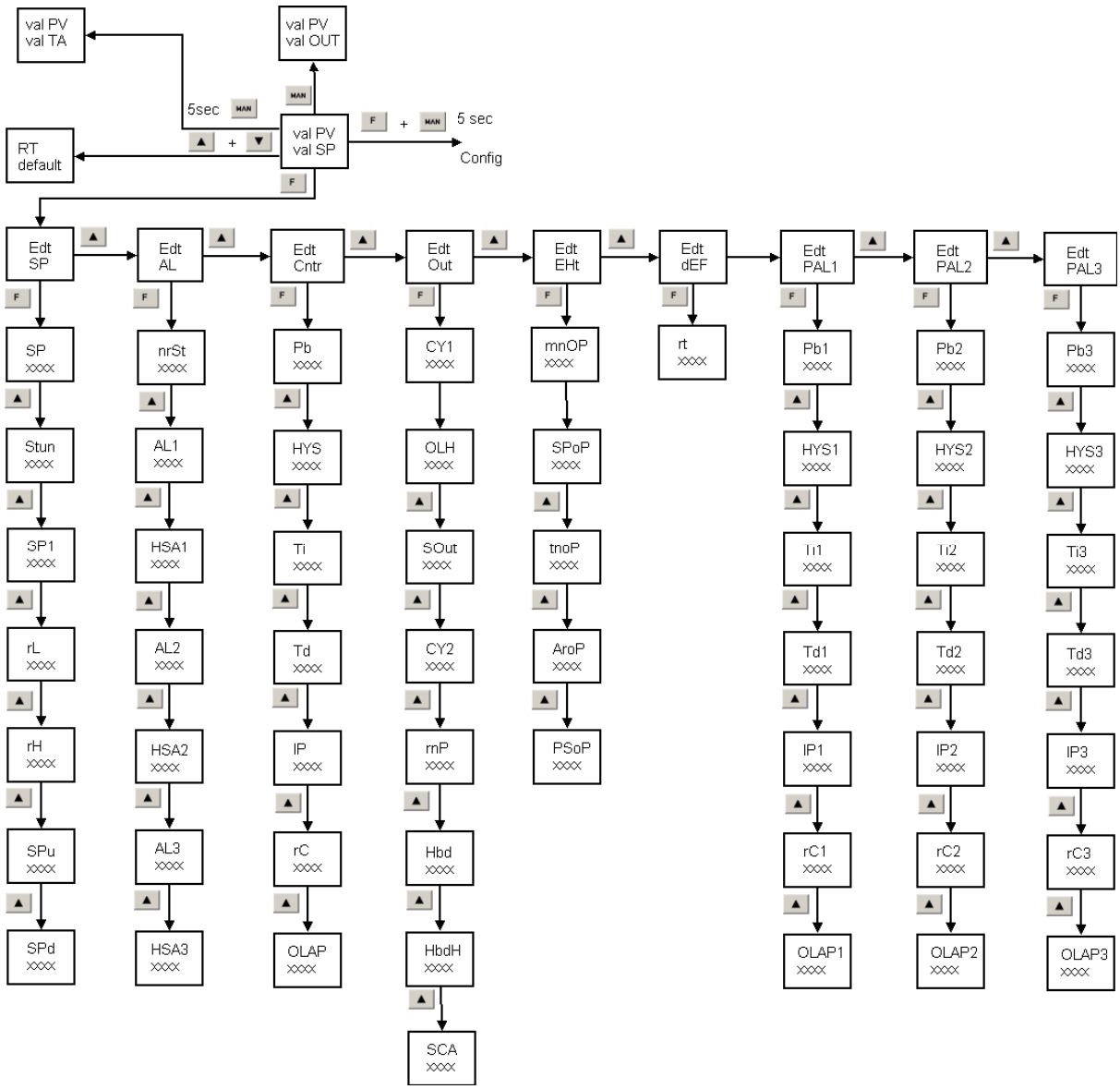


Fig 1

14.2 SET POINT Group (SP)

SETPOINT

Upper Display → SP

Lower Display → Valore di setpoint

Range

rL ↔ rH

SELFTUNE

(available only if can be activated)

Upper Display → StUn

Lower Display → ***On*** or ***Off***

AUXILIARY SETPOINT

Upper Display → SP 1

Lower Display → Setpoint value

Range

rL ↔ rH

LOWER SETPOINT LIMIT

Upper Display → rL

Lower Display → Lower limit value

Range

LoSc ↔ rH

UPPER SETPOINT LIMIT

Upper Display → rH

Lower Display → Upper limit value

Range

rL ↔ H ,Sc

***RATE OF CHANGE* FOR POSITIVE CHANGES OF SETPOINT**

Upper Display → SPu

Lower Display → Value of *rate of change* applied to any positive change in setpoint.

Range

1 ↔ 100 digit/min

Inf : rate of change forced to a Step.

***RATE OF CHANGE* FOR NEGATIVE CHANGES OF SETPOINT**

Upper Display → SPd

Lower Display → Valore del *rate of change* applicato a ogni variazione negativa del setpoint.

Range

1 ↔ 100 digit/min

Inf : rate of change forced to a Step.

14.3 ALARM Group (AL)

SILENCED ALARM

(appears only with at least one of programmable alarms with manual reset)

Upper Display → mrSt
Lower Display → on

Functioning:

To silence the active alarms stored, press key **F U N C** .

ALARM1 THRESHOLD

Upper Display → AL1
Lower Display → Actual value

Range

Process alarm

Span limit

Band alarm

0 ↔ 500

Deviation alarm

-500 ↔ 500

HYSTERESIS ALARM1

Upper Display → HSA1
Lower Display → Actual value

Range

0.1% ↔ 100.0% of the span or 1LSD

ALARM2 THRESHOLD

Upper Display → AL2

Lower Display → Actual value

Range

Process alarm

Limit of span

Band alarm

0 ↔ 500

Deviation alarm

-500 ↔ 500

ISTERESI ALARM2

Upper Display → HSA2

Lower Display → Actual value

Range

0.1% ↔ 100.0% of the span or 1LSD

ALARM3 THRESHOLD

Upper Display → AL3

Lower Display → Actual value

Range

Process alarm

Limit of span

Band alarm

0 ↔ 500

Deviation alarm

-500 ↔ 500

ISTERESI ALARM3

Upper Display → HSA3

Lower Display → Actual value

Range

0.1% ↔ 100.0% of the span or 1LSD

14.3.1 Alarm Function

General notes:

An automatic regulation, control and / or supervision takes into consideration different alarms.

In general, the alarms are "digital" elements or rather elements that can take only two values (true or false) because rhe condition that describes the alarm can only be 'true' (ON) or "false" (OFF).

The condition that describes the alarm is usually summarized by the ALARM FUNCTION because it defines its behavior.

Over the years, depending on the specific needs of various systems have been developed many different types of alarm

(for example alarms, trends, alarms group, put alarms, etc. ....).

Here we will only considering alarms normally implemented on this controller.

The Functions of the alarms in the controller are 3 as follows:

1) Process alarm (or absolute)

2) Band Alarm

3) Deviation Alarm

---

1) Process alarm (or absolute)

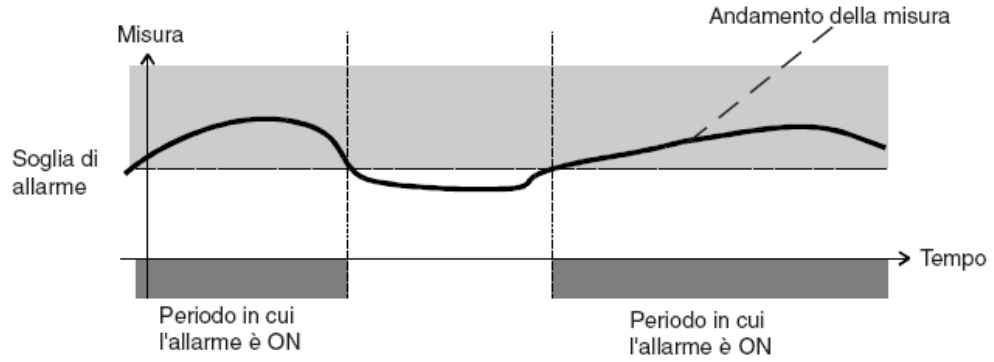
The process alarm can be of **two types:**

A) Up alarm

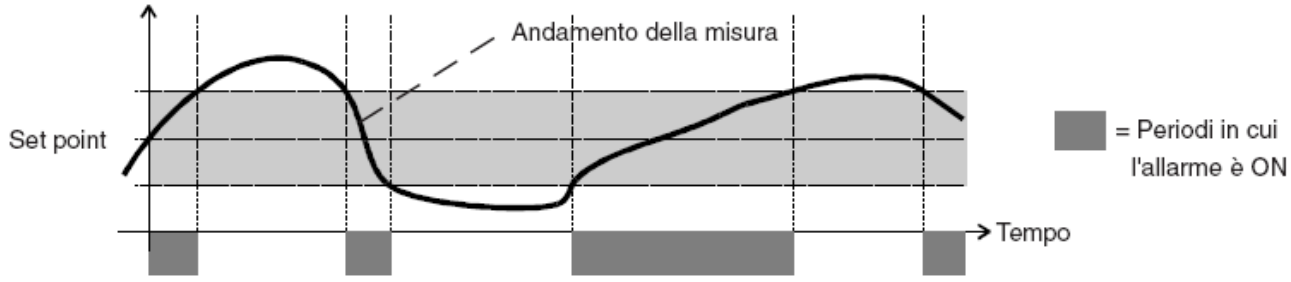
B) Low alarm

Generally, the process alarm is an alarm which compares the instantaneous value of the measure (**M**) with the value assigned to the alarm (**SA)** (Threshold value)

A) If it is an **Up alarm**, the alarm will be ON when the measured value exceeds the threshold value



B)If it is a **Low alarm**, the alarm will be ON when the measured value is less than the threshold value (M < AS).



2) Band Alarm

We define "Contolling system" any automated system capable of performing the necessary actions to maintain the controlled variable (which usually coincides with the measured variable) as close as possible to a certain value (which is called set point)

The band alarm is a type of alarm that can only be done on a " Contolling system" beacuse it links the value of the threshold on the Set point (**SP**).

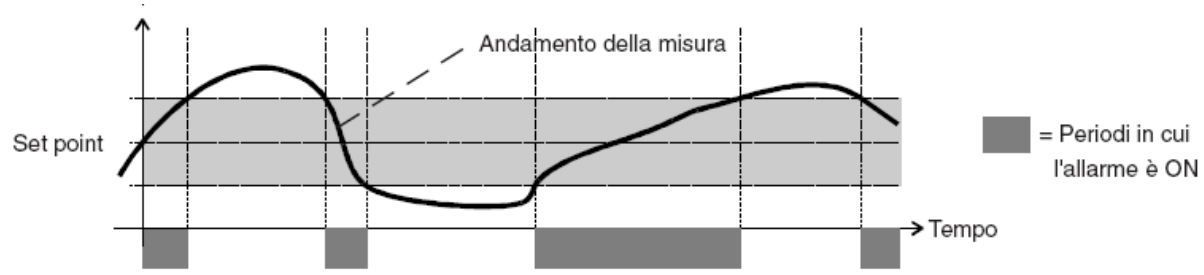
In the Band alarm, the alarm threshold defines an area around the set point.

Again there are **two possibilities**:

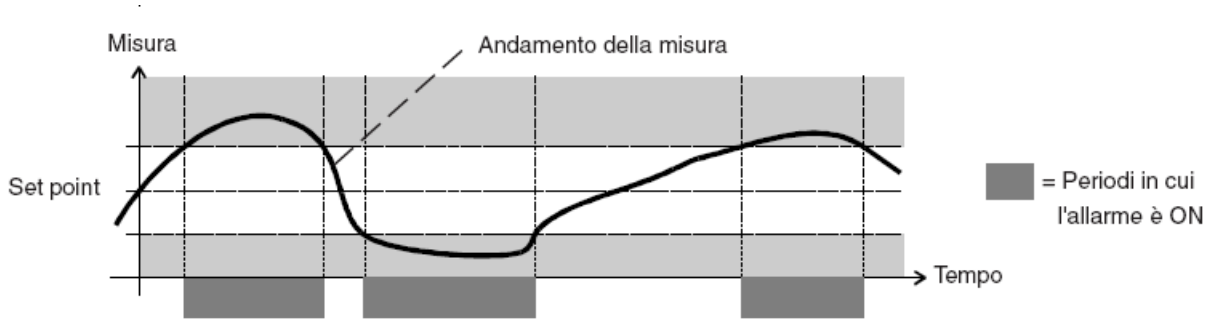
A) ON State when the measure is **within** the bandwidth [(SP - SA)< M < (SP + SA)]

B) ON State when the measure is **outside** the bandwidth [M<(SP - SA) or M>(SP + SA)]

A) ON State within the bandwidth



B) ON State outside the bandwidth



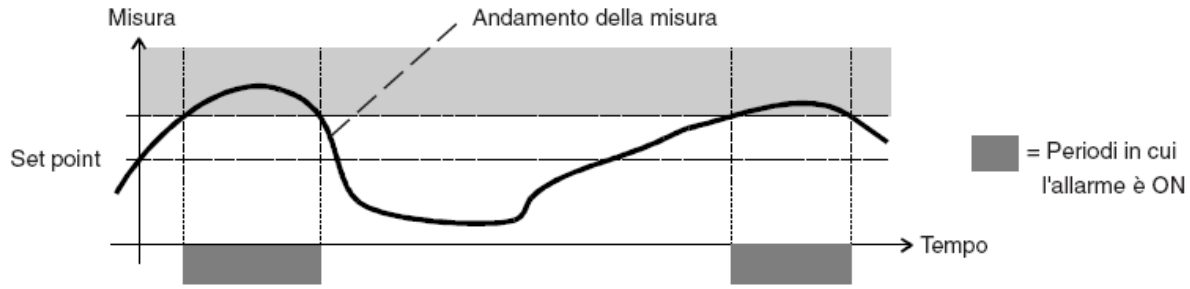
3) Deviation Alarm

Also the deviation alarm can only be done on a " Controlling system" because it links the value of the threshold set point but in some ways is a cross between Process and Band alarm .

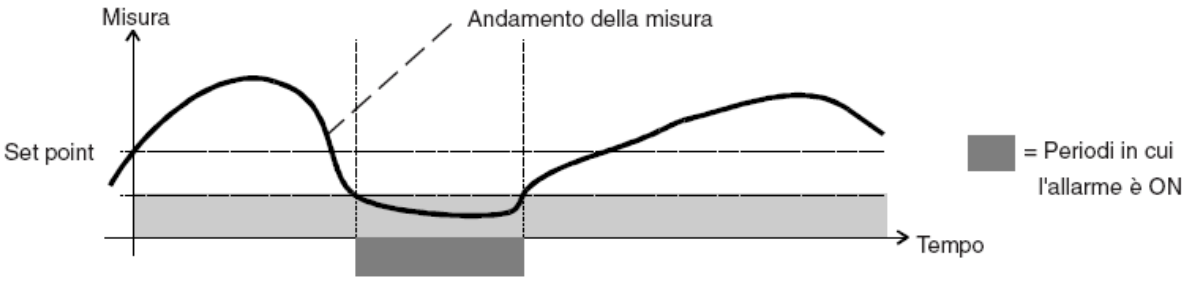
For this reasons the deviation alarm acts as a process alarm where the alert threshold is added or removed from the set point.

Again there are **two possibilities**:

A) deviation alarm **Up** [M > (SP + SA)]



B) Deviation alarm **Down** [M < (SP – SA)]



Note:

The band and deviation alarms automatically moving the absolute value of the threshold when you change the set point value.

The process alarm, however, is indifferent to changes of set points.

14.3.2 Alarm Hysteresis

The purpose of the hysteresis is to prevent, when the measurement is near the thresholdand there are disturbances on the measure, the alarm state changes continuously from ON to OFF and vice versa.
To do this it's possible to define a "safety margin" so that the alarm goes ON when the measure reaches a specified value (A) but does not go OFF before the measure reaches another value (B) more closely to the optimal condition.
Value (A) Is used as the threshold and value (B) as the threshold more or less hysteresis;
The following example will clarify the foregoing.
Considering that we want to set a Low alarm process that goes ON at least 300 ° C (value A) and returns to OFF only when the measure has risen to 360 ° C (B value).
In this case the setting of the threshold is 300 (° C)
In questo caso il valore di soglia da impostare è 300 (°C) while the hysteresis have to be set equal to 60(°C).
note. The hysteresis value is expressed on the instrument in % of full scale.

14.3.3 Alarm Out

Generally the state of an alarm is made visible to the user and can also produce physical actions on the system.
The status indication of an alarm can be:
1) Visual indication (a LED on the front of the instrument panel)
2) Software indication(state of a boolean variable on the serial communication)
3) State of a physical Out (normally a relay)
Note:
a) These three indications are present both individually than simultaneously.
b) At" State of a physical Out " are associated also physical action on the system.

14.3.4 Action of alarm output.

(also indicated as "Alarm Action")
When an alarm status is associated with the state of a physical output (ex. relay)
Quando allo stato di un allarme è associato lo stato di un uscita fisica (es. relè) it's necessary to define the relationship between the alarm state and relay state.
Two action are possibile:
1) Direct action: out ON when the alarm is ON (ex.: excited relay when the alarm is ON)
2) Riverse action: Out OFF when the alarm is ON (ex.: un-excited relay when the alarm is ON)
Direct action is the most commonly used but you must remember that the reverse action allows to have an alarm signal when the instrument does not work or is off(because the ON state of alarm is indicated by the OFF state of output, when the instrument is switched off or not working the output will be definitely OFF).
In the case of relay output , the status of Output may not be sufficient to describe the state of the contact. In fact, when the output relay is provided with changeover contacts it is clear that the choice of the normally closed contact (NC) or normally open (NO) allows for equal status of the relay to reverse the state of the contact.
However remains the considerations valid regarding the possibility of having an alarm signal when the instrument is switched off or not working (reverse action).

14.3.5 Resetting of an Alarm

The alarms we have seen are based on the concept that when the measure falls in the OFF area the alarm also goes OFF **automatically.** In these cases it is said that the alarm is equipped with automatic reset.
In some cases it is preferable that the alarm still remains in the ON condition even after the measure is back in the OFF zone, the alarm will return to the OFF condition only after a physical action (pressing a key or other). In this case we say that the alarm has a manual reset.
The reason of this choice is due to the level of danger of the anomaly reported from the alarm, an overcurrent can damage the system and cause fire or dangerous situations for the users
Forcing the user to perform an action also ensures that we take note of the report and eliminate the cause of the problem before resetting the system.
Alarms with manual reset may have different behaviors depending on different situations but, generally, one can identify two families of behavior:

1) Alarm with unconditioned reset
Are those alarms that, when performed manually reset, set the alarm to OFF condition even if the alarm condition is still present.
A typical example are the alarms that drive the sirens, once the user reaches the machinery switch off the siren and then performs the necessary actions to remove the alarm condition. To get a further alarm signal is necessary that the measure goes to the area OFF and back in the ON area.

2) Alarm with conditioned reset

Are alarms that, when is running the manual reset ,activate the alarm in OFF condition only if the alarm condition is no longer present.

For the conditioned alarms we have two types:

I. Alarms that require manual reset only after alarm condition has been eliminated (Otherwise remain in alarm). **This is the type of reset on this controller.**

II. Alarms that, if they are resetted when the alarm condition is still present, store the reset and run automatically when the alarm condition disappears.

It should however be noted that, even for resetting, has been developed a multitude of variations and types to meet the varied needs of the plant. As mentioned above describes only the most common condition and those normally present on the controllers.

14.3.6 Alarm mask

As we have said in many cases the alarm produces a physical action on the system.

Obviously, however, the alarm is usually set to report defects when the system is "fully operational".

The conditions of the plant startup or after a set point change does not satisfy the condition "fully operational" and can cause unwanted alarmi.

To avoid unwanted alarms were studied different solutions according to the type of system where the alarm is applied.

In the controller has been implemented a solution due to the measure.

If at the start up is detected an alarm condition, this condition is ignored until the measure reaches the area where the alarm is OFF, then the alarm resumed normal function.

If the alarm is programmed as band alarm or deviation, the standby function masks the alarm condition in start un and set point variation, until the value of process variable reaches the alarm threshold with hysteresis .

If is a process alarm the alarm conditions mask only during start up.

Se l'allarme è di processo, maschera le condizioni di allarme solamente in accensione.

14.4 Control Group (CntR)

PROPORTIONAL BAND

Upper Display → Pb

Lower Display → Actual value

Range

No selftune with *O2Fn ≠ Cool*

1.0% ↔ 100.0% dello span

No selftune with *O2Fn = Cool*

1.5% ↔ 100.0% dello span

Selftune with *O2Fn ≠ Cool*

LPb2 ↔ HPb

Selftune with *O2Fn = Cool*

LPb1 ↔ HPb

HYSTERESIS

(available only with ON/OFF – CntF = onoF (miSC group of configuration))

Upper Display → HYS

Lower Display → Actual value for ON/OFF

Range

0.1% ↔ 10.0% of span or 1LSD

INTEGRAL TIME

(available only with PID or PI - CntF <> onoF (miSC group of configuration))

Upper Display → ti

Lower Display → Actual value

Range

00.01 ↔ 20.00 mm.ss

Beyond the maximum value, on display the integral action is excluded.

With selftune activated, the lower limit is given by Lti

DERIVATIVE TIME

(availabele only with PI - CntF = Pi (miSC group of configuration))

Upper Display → td
Lower Display → Actual value

Range

00.01 ↔ 10.00 mm.ss

With selftune activated, the derivative time is equal to tI / 4

INTEGRAL PRELOAD

(availabele only with PID or PI - CntF <> onoF (miSC group of configuration))

Upper Display → iP
Lower Display → Actual value

Range

With O2Fn ≠ Cool

0 ↔ 100

With O2Fn = Cool

-100 ↔ 100

RELATIVE COOLING GAIN

(availabele only with PID or PI - CntF <> onoF (miSC group of configuration) with at least one output set as cooling)

Upper Display → rC
Lower Display → Actual value

Range

0.20 ↔ 1.00

When selftune is active and rCEn = On the range become

PAL = AIr

0.85 ↔ 1.00

PAL = OIL

0.80 ↔ 0.90

PAL = H2O

0.30 ↔ 0.60

DEAD BAND/OVERLAP through HEATING/COOLING OUTPUT

(available only with PID oe PI - CntF <> onoF (miSC group of configuration)) with at least one output set as cooling)

Upper Display → oLAP
Lower Display → Valore attuale.

Negative values indicate dead band, positive values indicate overlap.

Range

-20 ↔ 50

14.5 OUT Group(Out)

TIME OF CICLE OUT1

(available only with at least one output set as heating not analogic)

Upper Display → CY1

Lower Display → Actual Value.

Range

1 ↔ 200 seconds

SUPERIOR LIMIT OUTPUT

Upper Display → oLH

Lower Display → Actual Value.

Range

With O2Fn ≠ Cool

0 ↔ 100

With O2Fn = Cool

-100 ↔ 100

TIME OF CICLE OUT2

(available only with at least one output set as heating not analogic)

Upper Display → CY2

Lower Display → Actual Value.

Range

1 ↔ 200 seconds

MAXIMUM RAMP-UP VARIATION ON OUTPUT

Upper Display → rnP

Lower Display → Actual Value.

Range

1% ↔ 25% for second.

Over the max value the display show ***"inf"*** and the limitation is excluded.

THRESHOLD VALUE FOR BREAK-DOWN ALARM

(available only if HCEn = On)

Upper Display → Hbd

Lower Display → Actual Value (A)

Range

0 ↔ FULL SCALE (see HCHS)

Note

- When the output that is added to the current transformer is in excited state of relays, the instrument measures the current absorbed by the load and generates an alarm if the current is below the value of Hbd parameter (a low current indicates a break-down partial or full load).

- The resolution of the threshold value is equal to 0.1A for range up to 20A, 1A to 20A to 100A range.

HYSTERESIS VALUE FOR BREAK-DOWN ALARM

(available only if HCEn = On)

Upper Display → HbdH

Lower Display → Actual Value

Range

0 ↔ 1.0

THRESHOLD VALUE FOR SHORT CIRCUIT ALARM

(available only if HCEn = On)

Upper Display → SCA

Lower Display → Actual Value (A)

Range

0 ↔ FULL SCALE (see HCHS)

Note

- When OUT1 relay is in unexcited state, the instrument measures the leakage current in the load and generates an alarm if the current exceeds the value of the parameter SCA (a high current indicates a partial break or total of the relay or SSR).

- The resolution of the threshold value is equal to 0.1A for range up to 20A, 1A to 20A to 100A range.

14.6 Group EHt (Functions setted also from input1 and input2)

The functions

- Auto/Manual
- SP/SP1
- Tune Insertion
- Silencing the alarm
- Control group selection

may be controlled from key panel, from serial or contact of input. To avoid conflicts, through this group, is possible to select from which of these functions will be controlled.

FUNCTION COMMAND AUTO/MANUAL

(available only if is present a contact module or digital IO on Input1 or Input2 and if one of the two input is configured by command Auto/Manual)

Upper display → mnoP

Lower display → Actual Value

Range

Sutc →Command from Input

Serh → Command from key penel or serial

FUNCTION COMMAND SP/SP1

(available only if is present a contact module or digital IO on Input1 or Input2 and if one of the two input is configured by command SP/SP1)

Upper display → SPoP

Lower display → Actual Value

Range

Sutc → Command from Input

Serh → Command from key penel or serial

COMMAND TUNE INSERTION

(available only if is present a contact module or digital IO on Input1 or Input2 and if one of the two input is configured for tune insertion)

Upper display → tnoP

Lower display → Actual Value

Range

Sutc → Command from Input

Serh → Command from key penel or serial

COMMAND ALARM SILENCING

(available only if is present a contact module or digital IO on Input1 or Input2 and if one of the two input is configured for alarm silencing)

Upper display → AroP

Lower display → Actual Value

Range

Sutc → Command from Input

Serh → Command from key penel or serial

COMMANDO CONTROL GROUP SELECTION

(available only if is present a contact module or digital IO on Input1 or Input2 and if one of the two input is configured for control group selection)

Upper display → Actual Value

Lower display → PSoP

Range

Sutc → Command from Input

Serh → Command from key penel or serial

14.7 Group dEF (default of run time Loading)

Upper display	→	rt
Lower display	→	on

By pressing the key **FUNC** the default value are loaded

14.8 Group PAL 1 (Pallet 1 control parameters)

PROPORTIONALE BAND

Upper display	→	Pb1
Lower display	→	Actual Value

Range

No selftune with O2Fn ≠ Cool

1.0% ↔ 100.0% of span

No selftune with O2Fn = Cool

1.5% ↔ 100.0% of span

Selftune with O2Fn ≠ Cool

LPb2 ↔ HPb

Selftune with O2Fn = Cool

LPb1 ↔ HPb

HYSTERESIS

(available only with ON/OFF – CntF = onoF (group miSC of configuration))

Upper display	→	HYS1
Lower display	→	Actual Value for ON/OFF

Range

0.1% ↔ 10.0% of span or 1LSD

INTEGRAL TIME

(available only with PID o PI - CntF <> onoF (group miSC of configuration))

Upper display → ti1

Lower display → Actual Value

Range

00.01 ↔ 20.00 mm.ss

Beyond the maximum value, the display of the integral action is excluded.

With selftune activated, the lower limit is given by Lti

DERIVATIVE TIME

(available only with PI - CntF = Pi (group miSC of configuration))

Upper display → td

Lower display → Actual Value

Range

00.01 ↔ 10.00 mm.ss

With selftune activated, the derivative time is equal to tI / 4

INTEGRAL PRELOAD

(available only with PID or PI - CntF <> onoF (group miSC of configuration))

Upper display → iP1

Lower display → Actual Value

Range

With O2Fn ≠ Cool

0 ↔ 100

With O2Fn = Cool

-100 ↔ 100

RELATIVE COOLING GAIN

(available only with PID or PI - CntF <> onoF (group miSC of configuration))

Upper display → rC1

Lower display → Actual Value

Range

0.20 ↔ 1.00

When selftune is actve and rCEn = On the range become

PAL = AIr

0.85 ↔ 1.00

PAL = OIL

0.80 ↔ 0.90

PAL = H2O

0.30 ↔ 0.60

DEAD BAND/OVERLAP TRA HEATING/COOLING OUTPUT

(available only with PID or PI - CntF <> onoF (group miSC of configuration)) e con o2Fn = Cool)

Upper display → oLAP1

Lower display → Actual Value

Negative value indicates the dead band, positive value indicates the overlap.

Range

-20 ↔ 50

14.9 Group PAL2 (Pallet 2 control parameters)

See gruop 1

14.10 Group PAL3 (Pallet 3 control parameters)

See gruop 1