



CD Automation S.r.l.

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Declaration of conformity

Declaration of conformity-Dichiarazione di Conformità



PRODUCT MANUFACTURER/ PRODUTTORE:



CD Automation S.R.L.
Controllers, Drives & Automation

Via Picasso, 34/36 - 20025 Legnano (MI)- Italy
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E-mail: info@cdautomation.com - Web: www.cdautomation.com

Declare that the product / Dichiaro che il prodotto:

COMPACT

PRODUCT DESCRIPTION: Temperature Controller
SCOPE OF APPLICATION: Thermal control process
DESCRIZIONE DEL PRODOTTO: Termoregolatore
UTILIZZO: Controllo processi termici

Con la presente l'azienda dichiara sotto la propria responsabilità che il prodotto sopracitato soddisfa per progettazione e costruzione i requisiti della Direttiva "compatibilità elettromagnetica" e "sostanze pericolose". La conformità è stata verificata con l'ausilio delle seguenti Norme Armonizzate se applicabili:

The company declares herewith on own responsibility that the above-mentioned products meet the requirements of the EMC and hazardous substances directives. Conformity has been verified with reference to the following Harmonized Standards.

EN 61000-6-2 (2019-06)

EN 61000-6-4 (2020-03)

EN 61326-1 (2013-07)

CDAutomation declares that the products above mentioned are conforming to the directive
CDAutomation dichiara che i prodotti sopra menzionati sono conformi alla direttiva
Bassa Tensione (low Voltage) EMC directive updated 2014/30/EU,
Low Voltage Directive updated 2014/35/EU

Issued on: 18/03/2022
Data di emissione: 18/03/2022

Amministratore Unico e
Legale Rappresentante
Simone Brizzi



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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.

In the manual are used symbols to give more evidence at the notes of safety and operativity for the attention for the user:

	This icon is present in all the operational procedures where the Improper operation may result in serious personal injury or death by Electrical Shock Hazard Symbol (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.
	Warning or Hazard that needs further explanation than the label on unit can provide. Consult User's Guide for further information.
	Unit is compliant with European Union directives. See Declaration of Conformity for further details on Directives and Standards used for Compliance.
	ESD Sensitive product, use proper grounding and handling techniques when installing or servicing product.
	Do not throw in trash, use proper recycling techniques or consult manufacturer for proper disposal.

A **"NOTE"** marks a short message to alert you to an important detail.

A **"CAUTION"** safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A **"WARNING"** safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

Safety notes



WARNING! Risk of Fire and Electric Shock. This product is "Open Type Process Control Equipment". It must be mounted in an enclosure that does not allow fire to escape externally.



WARNING! If the output relays are used past their life expectancy, contact fusing or burning may occasionally occur. Always consider the application conditions and use the output relays within their rated load and electrical life expectancy. The life expectancy of output relays varies considerably with the output load and switching conditions.



WARNING! To avoid damage to property and equipment, injury and loss of life, adhere to applicable electrical codes and standard wiring practices when installing and operating this product. Failure to do so could result in damage, injury and death.



WARNING! All service including inspection, installation, wiring, maintenance, troubleshooting, fuse or other user serviceable component replacement must be performed only by properly qualified personnel. Service personnel must read this manual before proceeding with work. While service is being performed unqualified personnel should not work on the unit or be allowed in the immediate vicinity.



WARNING! Do not use in aerospace or nuclear applications.



WARNING! The device's protection rating is IP20 with all covers installed and closed. It must be installed in an enclosure that provides all the necessary additional protections appropriate for the environment and application.



CAUTION: Devices shall be supplied with limited energy according to UL 61010-1 3rd Ed, section 9.4 or LPS in conformance with UL 60950-1 or SELV in conformance with UL 60950-1 or Class 2 in compliance with UL 1310 or UL 1585.



CAUTION: A malfunction in the Digital Controller may occasionally make control operations impossible or prevent alarm outputs, resulting in property damage. To maintain safety in the event of malfunction of the Digital Controller, take appropriate safety measures, such as installing a monitoring device on a separate line.



CAUTION: To avoid compromising the insulation, do not bend wire or other components beyond their bend radius specifications.



CAUTION: Protect the device from high temperature, humidity and vibrations.



CAUTION: Install an appropriately sized RC filter across contactor coils, relays and other inductive loads.



NOTE: Provide a local disconnect to isolate the device for servicing.

Precautions for safe use

Be sure to observe the following precautions to prevent operation failure, malfunction, or adverse affects on the performance and functions of the product. Not doing so may occasionally result in unexpected events. Do not handle the Digital Controller in ways that exceed the ratings.

- The product is designed for indoor use only. Do not use or store the product outdoors or in any of the following places:
 - Places directly subject to heat radiated from heating equipment.
 - Places subject to splashing liquid or oil atmosphere.
 - Places subject to direct sunlight.
 - Places subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).
 - Places subject to intense temperature change.
 - Places subject to icing and condensation.
 - Places subject to vibration and large shocks.
- Installing two or more controllers in close proximity might lead to increased internal temperature and this might shorten the life cycle of electronic components. It is strongly recommended to install cooling fans or other air-conditioning devices inside the control cabinet.
- Always check the terminal names and polarity and be sure to wire properly. Do not wire the terminals that are not used.
- To avoid inductive noise, keep the controller wiring away from power cables that carry high voltages or large currents. Also, do not wire power lines together with or parallel to Digital Controller wiring. Using shielded cables and using separate conduits or ducts is recommended. Attach a surge suppressor or noise filter to peripheral devices that generate noise (in particular motors, transformers, solenoids, magnetic coils or other equipment that have an inductance component). When a noise filter is used at the power supply, first check the voltage or current, and attach the noise filter as close as possible to the Digital Controller. Allow as much space as possible between the Digital Controller and devices that generate powerful high frequencies (high-frequency welders, high-frequency sewing machines, etc.) or surge.
- A switch or circuit breaker must be provided close to device. The switch or circuit breaker must be within easy reach of the operator, and must be marked as a disconnecting means for the controller.
- The device must be protected by a fuse 1 A (cl. 9.6.2).
- Wipe off any dirt from the Digital Controller with a soft dry cloth. Never use thinners, benzine, alcohol, or any cleaners that contain these or other organic solvents. Deformation or discoloration may occur.
- The number of non-volatile memory write operations is limited. Therefore, use EEPROM write mode when frequently overwriting data, e.g.: through communications.

Environmental policy / WEEE

Do not dispose electric tools together with household waste material.

According to European Directive 2012/19/EU on waste electrical and electronic equipment and its implementation in accordance with national law, electric tools that have reached the end of their life must be collected separately and returned to an environmentally compatible recycling facility.



Maintenance

Check periodically if the screw for the power cables and safety earth are tightened correctly
(See Connection Diagram)

Warranty condition

Producer gives a 12 months warranty to its products.

The warranty is limited to repairing and parts substitution in our factory and does exclude products not properly used and fuses.

Warranty does not include products with serial numbers deleted. The faulty product should be shipped to Producer at customer's cost and our Service will evaluate if product is under warranty terms.

Substituted parts remain of Producer property.



General terms and conditions of sale:

<https://www.cdautomation.com/it/cd-automation-condizioni-general/>



Return Material Authorization (RMA)

Customers wishing to return any items, whether they are incorrectly supplied, faulty or damaged in transit, must first complete a Return Material Authorisation (RMA) form to obtain an RMA number from the Service Department.

A full repair service is available for customers. Prior to submitting the RMA form and returning products, customers are recommended to contact the technical support team to determine whether the issue can be resolved with telephone support.

How the RMA service works

The RMA form and details are available on our web sites:

<https://www.cdautomation.com/returns-material-authorisation/>

When completing the RMA form, please be as specific as possible about the problem, including any pertinent application details. The more information given, the more quickly and more thoroughly the problem can be solved. The minimum information required is:

1. The Full Model Number
2. Quantity of units being returned
3. The units Serial Number(s)
4. A description of the problem ("faulty" or "unknown" is not sufficient)



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1

Introduction

Thank you for choosing a CD Automation controller.

The COMPACT series integrates in a single device the main elements of the control loop: reading of temperature sensor, control output by SSR module, reading and control of the current on the load by means of integrated current CT. Serial communication RS485 and ModbusRTU or CANopen protocol allow the connection to PC/HMI Panels for supervisory functions/remote control.

This device is provided with alarms functions, management of double action installation and possibility to be used as expansion controlled by PLC.

1.1 Safety guidelines

Read carefully the safety guidelines and programming instructions contained in this manual before connecting/using the device.

Disconnect power supply before proceeding to hardware settings or electrical wirings to avoid risk of electric shock, fire, malfunction.

Do not install/operate the device in environments with flammable/explosive gases.

This device has been designed and conceived for industrial environments and applications that rely on proper safety conditions in accordance with national and international regulations on labour and personal safety. Any application that might lead to serious physical damage/ life risk or involve medical life support devices should be avoided.

Device is not conceived for applications related to nuclear power plants, weapon systems, flight control, mass transportation systems.

Only qualified personnel should be allowed to use device and/or service it and only in accordance to technical data listed in this manual.

Do not dismantle/modify/repair any internal component.

Device must be installed and can operate only within the allowed environmental conditions.

Overheating may lead to risk of fire and can shorten the lifecycle of electronic components.

1.2 Limitation in use

This product is a temperature controller which was developed, designed and manufactured on the premise that it would be used for general machinery.

In particular, if this product is to be used for applications that require the utmost safety as described below, please take into consideration of the safety of the entire system and the machine by adopting such means as a fail-safe design, a redundancy design as well as the conducting of periodical inspections.

- Safety devices for the purpose of protecting the human body.
- Direct control of transportation equipment.
- Airplanes.
- Space equipment.
- Atomic equipment, etc.

Please do not use this product for applications which directly involve human lives.

1.3 Over-Temperature Protection

Any control system design should take into account that any part of the system has the potential to fail.

For temperature control systems, continued heating should be considered the most dangerous conditions, and the machine should be designed to automatically stop heating if unregulated due to the failure of the control unit or for any other reason.

The following are the most likely causes of unwanted continued heating:

- 1) Controller failure with heating output constantly on
- 2) Disengagement of the temperature sensor from the system
- 3) A short circuit in the thermocouple wiring
- 4) A valve or switch contact point outside the system is locked to keep the heat switched on.

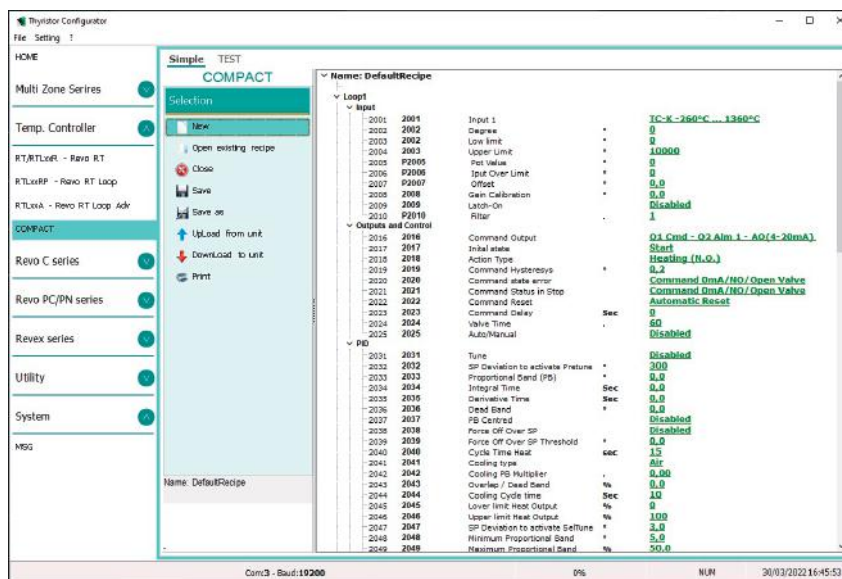
In any application where physical injury or destruction of equipment might occur, we recommend the installation of independent safety equipment, with a separate temperature sensor, to disable the heating circuit in case of overheating.

The controller alarm signal is not designed to function as a protective measure in case of controller failure.

2

Configurator Software

Thyristor configurator software is free and is possible download it from our site.



Software Configurator download link:

https://www.cdautomation.com/download/cd-automation/software/ThyristorConfigurator_ver6.exe



A standard Micro USB cable (our code is CCX) is required to connect COMPACT to the computer. The Windows driver for the USB connection is installed by the setup software installer.

3

Order Code

3.1 Identification of the unit



Caution: Before to install, make sure that the unit have not damages. If the product has a fault, please contact the dealer from which you purchased the product.

The identification label give all the information regarding the factory settings of the 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
ORDER CODE	C	O	M	P	A	C	T	-	-	-	-	-	-	-	-	-	-

INPUT	1 2 3 4 5 6 7
description	cod.
N° 1 configurable input (Single Loop Controller)	C O M P A C T

OUTPUT 1 - Heating or Alarm	8
description	cod.
SSR Logic 0:24V	S
OUTPUT 2 - Cooling PID or Alarm	9
description	cod.
SSR Logic 0:24V	S

OUTPUT 3 - Control Output or Retransmission	10
description	cod.
4-20 mA	A

Integrated Communication - Wiring	11
description	cod.
RS485 Modbus RTU - Screw Terminal Wiring	M
CANopen - Screw Terminal wiring	C

HEATER BREAK Input	12
description	cod.
Heater Break Alarm input for Current Transformer (CT not included)	H

POWER SUPPLY	13
description	cod.
12-24V ac dc	4

Approval	14
description	cod.
CE EMC for European market	0

MANUAL	15
description	cod.
None	0
English	1
Italian	2

VERSION	16
description	cod.
Version 1	1

4

Technical Specifications

4.1 General features

Operating temperature:	0-45°C, humidity 35..95uR%
Material:	Box: PC UL94V0 self-extinguishing; front panel: PC UL94V0 self-extinguishing
Protection:	IP20 (box and terminal blocks)

4.2 Hardware features

Power supply	24 VDC $\pm 15\%$	Consumption: 3 VA
Analogue input	1: AN1 Configurable via software. Input: Thermocouple type K, S, R, J, T, E, N, B. Automatic compensation of cold junction from 0..50°C. Thermoresistance: PT100, PT500, PT1000, Ni100, PTC1K, NTC10K (3435K). Input V/I: 0-10 V, 0-20 or 4-20 mA, 0-60 mV. Pot. input: Configurable 1..150k Ω , 1: C.T.: 50 mAAC 50/60 Hz	Tolerance (25 °C) +/-0.3% ± 1 digit (su F.s.) for thermocouple, thermoresistance and V/mA. Cold junction accuracy 0.1 °C/°C Impedence: 0-10 V: Ri>110 k Ω 0-20 mA: Ri<50 Ω 4-20 mA: Ri<50 Ω 0-60 mV: Ri>500 k Ω
Logic output	2 SSR. Configurable as command or alarm output	+24VDC $\pm 15\%$ / 50mA
Analogue output	1 0/4..20 mA. Configurable as command output, alarm output or retransmission	0..20 mA: 42500 points, $\pm 0.3\%$ on F.S. 4..20 mA 34000 points, $\pm 0.3\%$ on F.S.

4.3 Software features

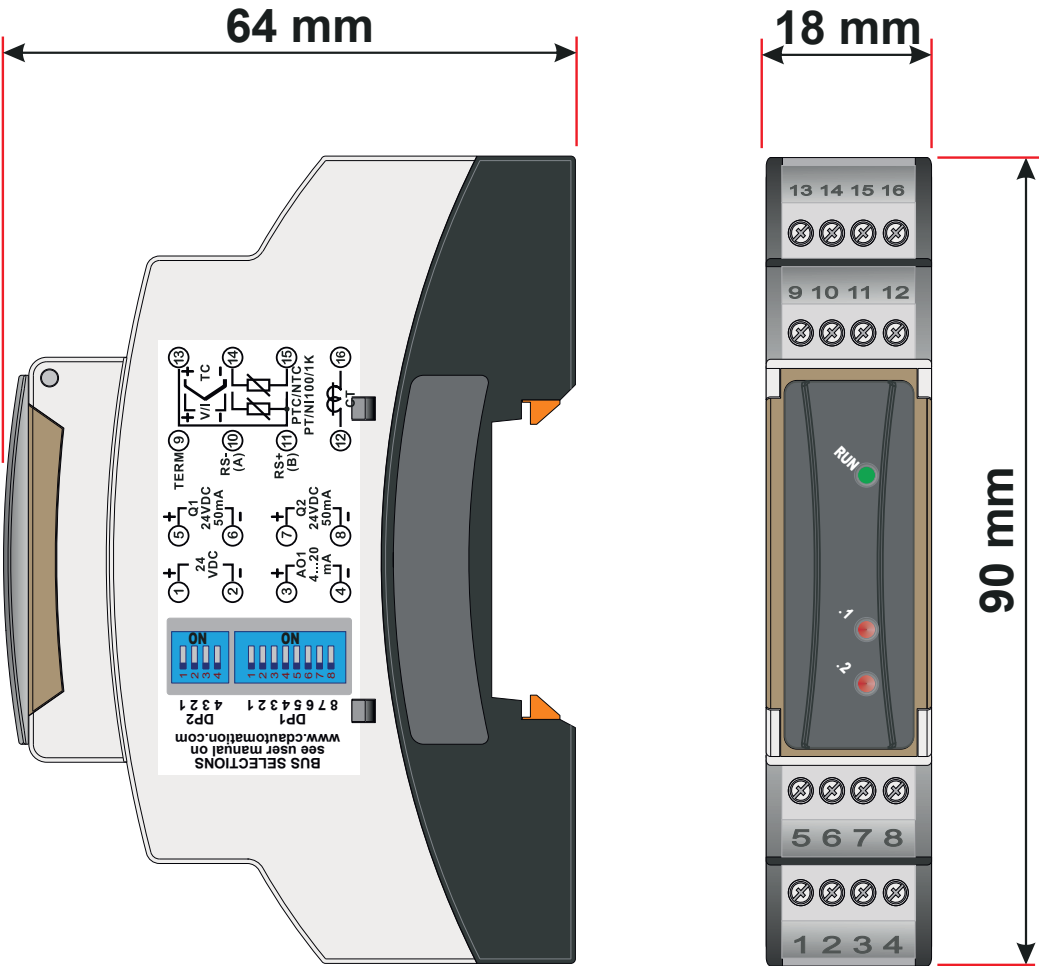
Control type	ON-OFF with hysteresis. P, PI, PID, PD proportional time.
Proportional band	0..999°C or °F
Integral time	0.0..999.9 s (0 excludes integral function)
Derivative time	0.0..999.9 s (0 excludes derivative function)
Controller functions	Manual or automatic tuning, configurable alarm, Start/Stop.

5

Installation

5.1 Dimensions and weight

Weight: approx 30 gr



6

Wiring instructions

This controller has been designed and manufactured in conformity to Low Voltage Directive 2014/35/EU (LVD) and EMC Directive 2014/30/EU (EMC). For installation in industrial environments please observe following safety guidelines:

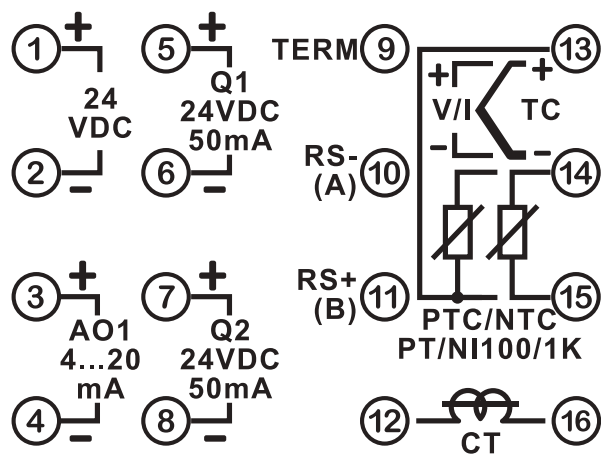
- Separate control line from power wires.
- Avoid proximity of remote control switches, electromagnetic contactors, powerful engines and use specific filters.
- Avoid proximity of power groups, especially those with phase control.
- It is strongly recommended to install adequate mains filter on power supply of the machine where the controller is installed, particularly if supplied 230Vac. The controller is designed and conceived to be incorporated into other machines, therefore CE marking on the controller does not exempt the manufacturer of machines from safety and conformity requirements applying to the machine itself.
- Wiring of pins use crimped tube terminals or flexible/rigid copper wire with diameter 0.25 to 1.5 mm² (min. AWG28, max. AWG16, operating temperature: min. 70°C). Cable stripping length 7 to 8 mm.
- If accessible Safety Extra Low Voltage (SELV) circuits are to be connected to Signal input terminal, SSR Drive output terminal, Current output terminal or Communication (RS485) terminal, ensure to provide a basic insulation between the SELV circuits and these terminals (For example, use transformer which has a basic insulation or higher degree of insulation). The basic insulation requires a clearance at least 1.5 mm and a creepage of at least 3.0 mm. If such insulation is not provided, the UL61010 and EN61010 safety compliance may become invalid.
- For 24V DC/AC power supply model, if the equipment is connected to the Safety Extra Low Voltage (SELV) circuit, a basic insulation must be provided between the SELV circuit and the power input terminals. Otherwise, the power input terminals must be connect to Extra Low Voltage (ELV) circuit so as to prevent the electric shock.
- For CT input, use Current Transfer which has specification as shown below in order to prevent the electric shock and spread of fire.

1) Over Voltage Category	II
2) Pollution Degree	2
3) Required level of Insulating	BASIC INSULATION, SUPPLEMENTARY INSULATION, or REINFORCED INSULATION
4) Maximum Voltage line to neutral	300Vac rms or 300Vdc

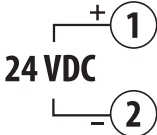


Warning: Before connecting or disconnecting the unit, check that power and control cables are isolated from voltage sources.

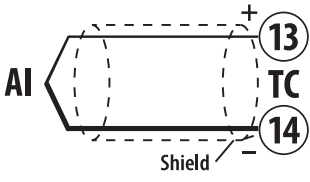
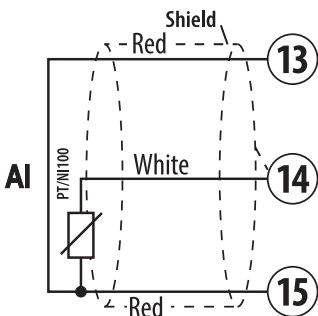

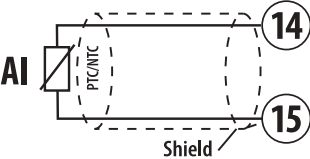
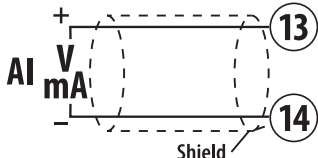
6.1 Wiring diagram



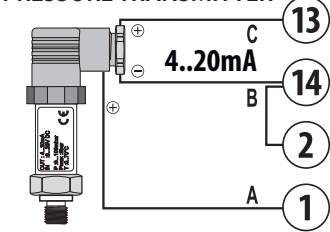
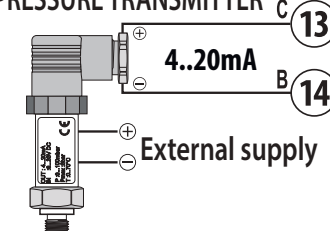
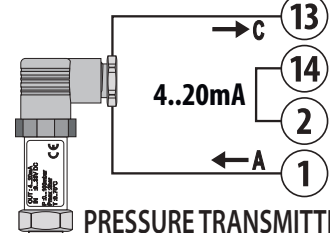
6.2 Power Supply

	Power supply 24 VDC $\pm 15\%$ - 3 VA
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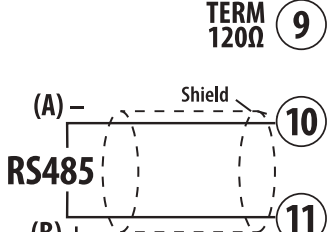
6.3 Analogue input

	<p>For thermocouples K, S, R, J, T, E, N, B.</p> <ul style="list-style-type: none">• Comply with polarity• For possible extensions, use compensated cable and terminals suitable for the thermocouples used (compensated)• When shielded cable is used, it should be grounded at one side only
	<p>For thermoresistances PT100, Ni100.</p> <ul style="list-style-type: none">• For the three-wire connection use wires with the same section• For the two-wire connection short-circuit terminals 13 and 15• When shielded cable is used, it should be grounded at one side only 
	<p>For thermoresistances NTC, PTC, PT500, PT1000 and linear potentiometers</p> <p>When shielded cable is used, it should be grounded at one side only to avoid ground loop currents</p>
	<p>For linear signals in Volt and mA</p> <p>Comply with polarity</p> <p>When shielded cable is used, it should be grounded at one side only to avoid ground loop currents</p>

6.4 Examples of connection for Volt and mA inputs

 <p>PRESSURE TRANSMITTER</p>	<p>For linear signals 0/4..20 mA with three-wires sensors.</p> <p>Comply with polarity: C= Sensor output B= Sensor ground A= Sensor supply (24VDC) Short circuit pins 2 and 14.</p>
 <p>PRESSURE TRANSMITTER</p>	<p>For linear signals 0/4..20 mA with external power supply for sensor.</p> <p>Comply with polarity: C= Sensor output B= Sensor ground</p>
 <p>PRESSURE TRANSMITTER</p>	<p>For linear signals 0/4..20 mA with two-wires sensors.</p> <p>Comply with polarity: C= Sensor output A= Sensor supply (24VDC) Short circuit pins 2 and 14.</p>

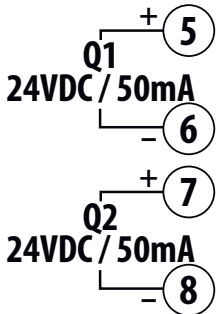
6.5 Serial input

 <p>TERM 120Ω</p> <p>RS485</p>	<p>Communication RS485 Modbus RTU Slave galvanically insulated from the sensor.</p> <p>Short circuit pins 9 and 10 to connect a 120Ω bus termination resistance.</p>
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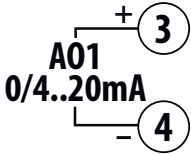
6.6 CT input

	Input for CT 50mA. Sampling time 100 μ s. Current measure true RMS for Heater Break Alarm and overcurrent alarm functions.
---	--

6.7 Digital outputs

	Digital output 24VDC \pm 15% / 50mA
---	--




6.8 Analogue output

	Linear output(mA) (galvanically insulated from the sensor) configurable as command output or retransmission signal
---	--


7

Leds and key function

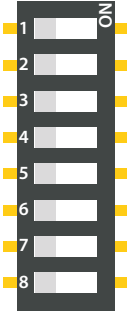
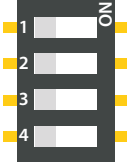
7.1 Meaning of status lights (LED)

 Green	RUN	Blink when serial communication is active
 Red	OUT1	<ul style="list-style-type: none"> • In standard condition is the output OUT1 status. • During test status (pressing key), if the command output is OUT1, blinks with frequency 50ms. • With current tune function, at the end of current acquisition by the CT, blinks with frequency 0.5s if the operation has been done successfully. • If in error, it blinks in alternation with the led OUT2 (ex. Broken sensor).
 Red	OUT2	<ul style="list-style-type: none"> • In standard condition is the output OUT2 status. • During test status (pressing key), if the command output is OUT2, blinks with frequency 50ms. • With current tune function, at the end of current acquisition by the CT, blinks with frequency 0.5s if the operation has been done successfully. • If in error, it blinks in alternation with the led OUT1 (ex. Broken sensor).

7.2 Key

	<ul style="list-style-type: none"> • Tune current Function press for more than 3 seconds to start the H.B. tune function, if function done the Q1 and Q2 led will blinks with frequency of 50ms. • If pressed during the modbus address assignment function, it stores the value assigned by the master (only if the dip1 is all in OFF).
---	---

7.3 Dip switch

	<p>DIP 1 – Slave address</p> <ul style="list-style-type: none">• If contacts 1..8 are OFF, modbus slave address is selected by parameter Slave Address in "Serial port" section (par 111) .• Or is the modbus slave address, in binary code from 1 to 254. <p>Some example are indicated below:</p> <p>00000001=1; 00000010=2; 00000011=3; 00000100=4; 00000101=5; 00000110=6; 00000111=7; 01111101=125; 01111110=126; 01111111=127; 11111011=251; 11111100=252; 11111101=253; 11111110=254.</p>
	<p>DIP 2 - Baud rate</p> <ul style="list-style-type: none">• If contacts 1..3 are OFF, modbus baud rate is selected by parameter "Baudrate" in "Serial port" section (Par 112)• Or is selected with dip 1,2,3 combination. See following values: <p>001=4800; 010=9600; 011=19200; 100=28800; 101=38400; 110=57600; 111=115200</p> <p>DIP 2 - loading default values function</p> <ul style="list-style-type: none">• If contact 4 is ON, used to reset all parameter to factory default values (See par "Controller Functions").• If contact 4 is OFF, controller is in normal condition

8

Controller functions

8.1 Loading default values

This procedure allows to restore to factory default settings.

There are two reset function available:

1. Close contact 4 of the dip switch 2 and reopen it at restart.
2. Write 9999 on word modbus 500. After write it, restarts the device.

8.2 Controller Start / Stop and setpoint modification

With parameter "Initial State" on "Option and Control"(par 2017) section, is possible select the controller start condition.

To **Start and Stop** the controller read and write parameter 1204.

To change **Setpoint** value read and write parameter 1201.

To change **Alarm1 and Alarm2 setpoint** value read and write parameter 1202 1203.

8.3 Automatic tuning with setpoint change

Select parameter "Tune" on "PID" section to "Selftune" (Par 2031 = 1).

Automatic tuning is always active and analyses constantly the difference setpoint-process. If this difference is greater than the value selected on parameter "SP Deviation" on "PID" section (Par 2047), the controller optimize the PID parameter.

8.4 Manual tuning

Select parameter "Tune" on "PID" section to "Pretune" (Par 2031 = 2).

The Pretune procedure allows the user deciding when to update PID parameters.

This procedure is activated writing 1 on the word modbus 1205.

The threshold of PID parameters Tune calculation are calculate as:

Tune threshold = Setpoint (Par 1201) – **Par. "Pretune – SP Deviation"** (Par. 2032)

Ex.: if setpoint is 100.0°C and Par. **"Pretune – SP Deviation"** is 20.0°C, the threshold to calculate PID parameters is (100.0–20.0) = 80.0°C.

N.B.: for greater accuracy in the calculation of PID parameters it is recommended to launch the manual tuning when the process is far from setpoint.

8.5 AutoTuning Launch "Once"

Select parameter "Tune" on "PID" section to "Once" (word 2031 = 3)

Autotuning procedure is executed only once at next controller restart. If the procedure doesn't work, will be executed at next restart.

8.6 Output Automatic/Manual % control

This function allows to select automatic functioning or manual command of the output percentage. With parameter "Auto/Manual Enable" of section "Output and Control" (Par 2025), you can select some methods.

- "Auto/Manual Enable" = "Disabled" (Par 2025 = 0)

Is not possible Set Manual mode

- "Auto/Manual Enable" = "Enable" (Par 2025 = 1)

Allows to modify, using the Par 1206 the Auto/Manual status:

after writing 1 it is possible to change the output percentage on Par 1206 (range 0-10000). To return to automatic mode, write 0 on Par. 1206.

- "Auto/Manual Enable" = "Enable with memory" (Par 2025 = 2)

enables the same functioning, but with two important variants:

1. If there is a temporary lack of voltage or after switch-off, the manual functioning will be maintained as well as the previously set output percentage value.
2. If the sensor breaks during automatic functioning, the controller moves to manual mode while maintaining the output percentage command unchanged as generated by the P.I.D. immediately before breakage.

8.7 Heater Break Alarm on CT (Current Transformer)

With this feature the controller read the load current and understand if the load is always open or partial break, and if the actuator connected is in short circuit.

To enable this function set the parameter "CT Function" on "Current Transformer" section to 50 Hz (Par.2090 = 1) or 60Hz (Par.2090 = 2) and set the right size of current transformer connected on parameter "Size" (Par 2091).
Es: with a CT 50/0.05 set "Size" = 50.

After, set the required current alarm threshold information with parameter "H.B. threshold" (Par 2092) in Ampere. Otherwise it is possible to set it with automatic function, pressing for more than 3 seconds the frontal pushbutton.

If require is possible add a delay time for alarm activation with parameter "Delay" (Par. 2094) in seconds.

The alarm will be linked to ALM1 or ALM2, setting value "H.B. + overcurrent" on Parameter "Alarm1 Type" in "ALM1" section, or in Parameter "Alarm2 Type" in "ALM2" section.

To enable an overcurrent control, set the required threshold in Ampere, on parameter "Overcurrent alarm threshold" (Par. 2093) in "Current Trnasformer" section.

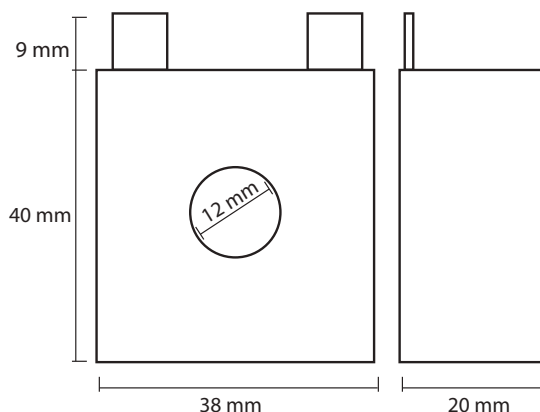
Current transformer detail

For current until 25A --> 25A/0,05

For current until 50A --> 50A/0,05

For current until 100A --> 100A/0,05

Dimensions



8.8 Dual Action Heating-Cooling

Controller is suitable also for systems requiring a combined heating-cooling action.

The command output has to be configured as PID for Heating (parameter "Proportional Band" Par 2033 greater than 0) in "PID" section, while the alarm 1 and 2 has to be configured as Cooling (et to "cooling" parameter "Alarm1 Type" on "ALM1" section or parameter "Alarm2 Type" on "ALM2" section).

The command output must be connected to the actuator responsible for heating, while the alarm will control cooling action.

Parameters to be configured for the **heating PID** are:

- **"Proportional Band"** (Par. 2033): Heating proportional band
- **"Integral Time"** (Par. 2034): Integral time of heating and cooling
- **"Derivative Time"** (Par. 2035): Derivative time of heating and cooling
- **"Cycle time Heat"** (Par. 2040): Heating time cycle

Parameters to be configured for the **cooling PID** are:

- **"Alarm2 Type"** (Par. 2056) or **"Alarm2 Type"** (Par.2068) = Cooling
- **"Cooling PB multiplier"** (Par. 2042): Proportional and multiplier
- **"Overlap/Dead Band"** (Par. 2043): Overlapping / Dead band
- **"Cycle Time Cooling"** (Par 2044): Cycle Time for cooling action
- p.b.M. (that ranges from 1.00 to 5.00) determines the proportional band of cooling action basing on the formula:

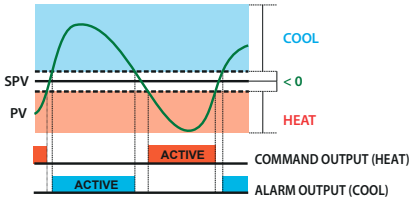
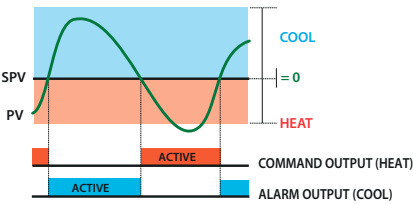
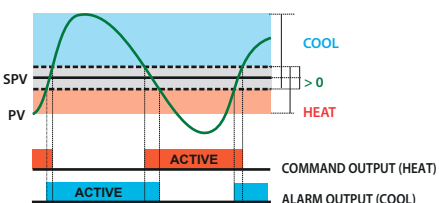
Proportional band for cooling action = **"Proportional Band"** x **"Cooling PB multiplier"** (value range from 1 to 5).

Integral and derivative time are the same for both actions.

The par. **"Overlap/Dead Band"** determines the percentage overlapping between the two actions.

For systems in which the heating output and cooling output must never be simultaneously active a dead band (**"Overlap/Dead Band"** ≤ 0) must be configured, vice versa you can configure an overlapping (**"Overlap/Dead Band"** > 0).

The following figure shows an example of dual action P.I.D. (heating-cooling) with **"Integral Time"** = 0 and **"Derivative Time"** = 0.

	<p>PB Cooling = "Proportional Band" × "Cooling PB multiplier"</p> <p>"Overlap/Dead Band" < 0</p> <p>PB Heating Command Heating Command Cooling</p>
	<p>PB Cooling = "Proportional Band" × "Cooling PB multiplier"</p> <p>"Overlap/Dead Band" = 0</p> <p>PB Heating Command Heating Command Cooling</p>
	<p>PB Cooling = "Proportional Band" × "Cooling PB multiplier"</p> <p>"Overlap/Dead Band" > 0</p> <p>PB Heating Command Heating Command Cooling</p>

Parameter **"Cooling Type"** (Par. 2041) pre-selects the proportional band multiplier and the cooling PID cycle time like describe below

Cooling Type	Cooling PB multiplier	Cycle Time Cooling
Air	1.00	10
Oil	1.25	4
Water	2.50	2

Once selected the parameter "Cooling Type", parameters "Cooling PB multiplier", ou.d.b and "Cycle Time Cooling" can however be modified.

8.9 Soft-Start function

The controller is provided with two types of softstart, selectable on parameter "S.S. Type" in "Soft start" section (Par.2080).

- 1 "S.S. Type" = "Ratio" (Par.2080 = 1)
Enables Ratio Softstart. At starting the controller reaches setpoint basing on the ratio set on parameter "Ratio" (Par. 2081) in Unit/hour (ex. °C/h). If parameter "time" (Par. 2084) is different to 0, at starting when the time selected on parameter "Time" is elapsed, the controller stops to follow the gradient and reaches setpoint with the maximum power.
- 2 "S.S. Type" = "Percentage" (Par.2080 = 2)
Enables output percentual Softstart. On par "Threshold" (Par. 2083) it is possible to set the threshold under which starts the softstart. On parameter "Percentage" (Par. 2082) an output percentage is selectable (0 to 100), which controller keeps until the process exceeds the threshold set on parameter 83 or until the time in minutes set on parameter 84 SS.ti. ("Softstart Time" word 2084) expires.

8.10 Retransmission function on analogue output

The analogue output if not used as command output, can be used to retransmit process/ setpoint/ current read by the C.T. input/ output percentage.

Select on parameter "Retransmission" (Par. 2100) the value to be retransmitted. Select on parameter "Retransmission Type" (Par. 2101) the output type.

On parameter "Lower Limit" (Par. 2102) and "Upper Limit" (Par. 2103) input value rescale limits.

8.11 LATCH ON Function

When use input like "potentiometer" or with linear input "0..10V", "0..60mV", "0..20mA", "4..20mA" in "Input" section, it is possible to set a start value of the scale with parameter "Low Limit" (Par 2003) to the minimum position of the sensor and value of the scale end with parameter "Upper Limit" (Par 2004) to the maximum position of the sensor.

Enabling LATCH-ON Function (Parameter "Latch-on set to "standard" par. 2009) is possible tune during normal operation following this procedure.

	Press	Display	Action
1	1300	Write 1 to enable Latch on. Write 0 to end procedure	Place the sensor on minimum operating value
2	1301	Write 1 to fix value on minimum	Place sensor on maximum operating value (corresponding to "Upper Limit")
3	1302	Write 1 to fix value on maximum	To exit standard procedure write 0 on 1300 or wait 120 seconds. With "virtual zero" put the sensor on zero point.
4	1303	Write 1 to fix zero virtual value. Write 2 to reset zero virtual value.	To exit procedure write 0 on word 1300.

It is also possible to fix the point in which the controller will display 0 (however keeping the scale range between "Low Limit". and "Upper Limit") using the "virtual zero" option by setting 2 or 3 in parameter 9 Ltch. Setting 2 virtual zero can be modified in each moment while setting 1, Latch-On function ends after 120 seconds.

Then refer to the following table for the calibration procedure:



8.12 Expansion function

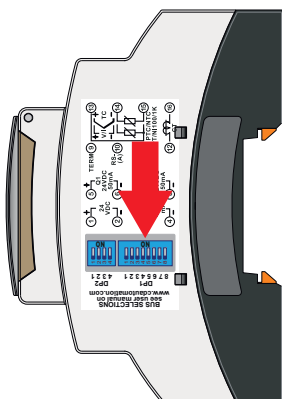
Selecting "Enable" on parameter "Expansion Function" on "Expansion Module" section, the controller works as a normal expansion I/O module. Controller functions (temperature control, alarms, softstart etc..) are disabled and outputs management will be done only by an external master via communication channel (Es. PLC, HMI panel...).

It is possible to configure output status at starting and in case of error, programming parameters 2122...2131 (see chapter "Table of configuration Parameters"). To command output and read input refer to Parameter 1500..1508 (see chapter "Serial Communication").

9

Serial communication

The controller is equipped with RS485 and can receive/broadcast data via serial communication using MODBUS RTU protocol. The device can only be configured as a Slave. This function enables the control of multiple controllers connected to a supervisory system/SCADA.



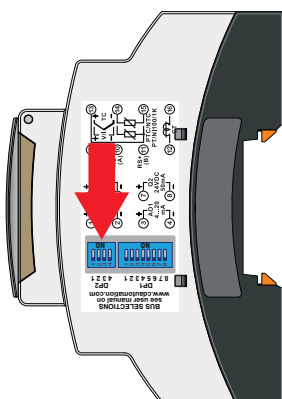
If contacts of dip-switch 1 are all open the slave address is set to parameter "slave address" in "RS485" section (Par. 2111).

The range addresses are from 1 to 254.

NOTE: On the same network must not be controllers with the same address.

To set the address by dipswitch see Paragraph 7.3

Address 255 can be used by the Master to communicate with all the connected equipment (broadcast mode), while with 0 all the devices receive the command, but no response is expected.



If Dip-Switch 2 contacts are opened, the baud rate is selected on parameter "Baudrate" in "RS485" section. (Par. 2112).

To set the address by dipswitch see Paragraph 7.3

Controller can introduce a delay (in milliseconds) of the response to the master request. This delay are set on parameter "Serial delay" (Par. 2114).

Each parameter modification is saved by the controller in the EEPROM memory (100000 writing cycles), while the setpoints are saved with a delay of 10 seconds after the last modification.

NB: Changes made to words that are different from those reported in the following table can lead to malfunction.

Modbus RTU protocol features	
Baud-rate	Selectable by dipswitch or parameter "Baudrate" on "Serial port" section (Par 2112) Value 0: 4800bit/s Value 4: 38400bit/s Value 1: 9600bit/s Value 5: 57600bit/s Value 2: 19200bit/s Value 6: 115200bit/s Value 3: 28800bit/s
Format	Selectable by parameter "Serial port parameter" on "Serial port" section (Par 2113) Value 0: 8N1 Value 3: 8N2 Value 1: 8E1 Value 4: 8E2 Value 2: 8O1 Value 5: 8O2
Supported functions	WORD READING (max 20 word) (0x03, 0x04) SINGLE WORD WRITING (0x06) MULTIPLE WORDS WRITING (max 20 word) (0x10)

RO = Read Only	R/W = Read/Write	WO = Write Only
-----------------------	-------------------------	------------------------

Modbus address	Description	Read Write	Reset value
0	Type of device	RO	490
1	Software version	RO	Flash
2	Boot version	RO	Flash
3	Slave address	RO	Eepr/dip
6	Baud rate	RO	Eepr/dip
50	Automatic addressing	WO	-
51	Installation code comparison for automatic learning of slave address	WO	-
500	Loading default values (write 9999)	R/W	0
501	Controller Restart (write 9999)	R/W	0
1000	Process (tenth of degree)	RO	-
1001	Command setpoint (tenth of degree)	R/W	EEPROM
1002	Alarm 1 setpoint (tenth of degree)	R/W	EEPROM
1003	Start/Stop 0 = controller in STOP 1 = controller in START	R/W	0
1004	With SelfTuning tuning (word 2031 = 1): 0 = autotuning function OFF 1 = autotuning in progress	RO	0
	With PreTuning tuning (word 2031 = 2): 0 = autotuning function OFF 1 = autotuning ON	R/W	0
1005	Automatic/manual selection 0=automatic 1>manual	R/W	0

Modbus address	Description	Read Write	Reset value
1006	Output status (0=off, 1=on) Bit 0 = OUT1 Bit 1 = OUT2	RO	0
1007	Led status (0 = OFF, 1 = ON) Bit0 = Red led OUT1 (Q1) Bit1 = Red led OUT2 (Q2) Bit2 = Green led	RO	0
1008	Alarm status (0=absent, 1=present) Bit0 = Alarm 1 Bit1 = Alarm 2	RO	0
1009	Error flags Bit0 = Cold junction error Bit1 = Process error (sensor) Bit2 = Error in eeprom writing Bit3 = Error in eeprom reading Bit4 = Error missing calibration Bit5 = Generic error Bit6 = Hardware error Bit7 = Error H.B.A. (SSR in short circuit) Bit8 = Error H.B.A. (SSR/open charge) Bit9 = Error H.B.A. (partial break of the charge) Bit10 = Overcurrent error	RO	0
1010	Cold junction temperature (degree with tenth)	RO	-
1011	Command output percentage (0-10000) Heating output percentage in double loop	R/W	0
1012	Cooling output percentage in double loop (0-10000)	RO	0
1013	Current CT (ampere with tenth)	RO	0
1014	Current CT ON (ampere with tenth)	RO	0
1015	Current CT OFF (ampere with tenth)	RO	0
1016	Key status (0=released, 1=pressed)	RO	0
1017	Dip 1 value	RO	0
1100	Process (if temperature, no tenth)	RO	-
1101	Command setpoint (if temperature, no tenth)	R/W	EEPROM
1102	Alarm 1 setpoint (if temperature, no tenth)	R/W	EEPROM
1103	Command output percentage (0-1000) Heating output percentage in double loop	R/W	0
1104	Heating output percentage (0-100) Heating output percentage in double loop	R/W	0
1105	Cooling output percentage in double loop (0-1000)	RO	0
1106	Cooling output percentage in double loop (0-100)	RO	0
1107	Output status (0=off, 1=on) Bit 0 = OUT1 Bit 1 = OUT2	RO	0

Modbus address	Description	Read Write	Reset value
1108	Command output percentage (0-10000) Heating output percentage in double loop	R/W	0
1200	Process (if temperature, with tenth)	RO	?
1201	Command setpoint (if temperature, with tenth)	R/W	EEPROM
1202	Alarm 1 setpoint (if temperature, with tenth)	R/W	EEPROM
1203	Alarm 2 setpoint (if temperature, with tenth)	R/W	EEPROM
1204	Start/Stop 0 = controller in STOP 1 = controller in START	R/W	0
1205	With automatic tuning (word 2031 = 1): 0 = autotuning function OFF 1 = autotuning in progress	RO	0
	With manual tuning (word 2031 = 2): 0 = autotuning function OFF 1 = autotuning ON	R/W	0
1206	Automatic/manual selection 0 = automatic; 1 = manual	R/W	0
1207	Real value (gradient) command setpoint (if temperature, with tenth)	R	0
1208	Alarm status (0=absent, 1=present) Bit0 = Alarm 1 Bit1 = Alarm 2	RO	0
1209	Command output manual reset: write 0 to reset command output. In reading 0 = can not be reset, 1 = can be reset	R/W	0
1210	Alarms manual reset: write 0 to reset all alarms. In reading 0 = can not be reset, 1 = can be reset Bit0 = Alarm 1 Bit1 = Alarm 2	R/W	0
1211	Remote alarm 1 state (0=absent, 1=present)	R/W	0
1212	Remote alarm 2 state (0=absent, 1=present)	R/W	0
1213	AO value by serial (Par:100 = 6)	R/W	0

Modbus address	Description	Read Write	Reset value
1214	Error flags 1 Bit0 = Cold junction error Bit1 = Process error (sensor) Bit2 = Error in eeprom writing Bit3 = Error in eeprom reading Bit4 = Error missing calibration Bit5 = Generic error Bit6 = Hardware error Bit7 = Error H.B.A. (SSR in short circuit) Bit8 = Error H.B.A. (SSR/open charge) Bit9 = Error H.B.A. (partial break of the charge) Bit10 = Overcurrent error	RO	0
1215	Error flags 2 Bit0 = Error eeprom calibrations Bit1 = Error eeprom calibration constants Bit2 = Error eeprom parameters Bit3 = Error eeprom setpoint Bit4 = Error eeprom service datas A Bit5 = Error eeprom service datas B Bit6 = Error eeprom service datas C	RO	0
1216	Command output percentage (0-10000) Heating output percentage in double loop	R/W	0
1217	Cooling output percentage in double loop (0-10000)	RO	0
1218	Command output percentage (0-1000) Heating output percentage in double loop	R/W	0
1219	Cooling output percentage in double loop (0-1000)	RO	0
1220	Command output percentage (0-100) Heating output percentage in double loop	R/W	0
1221	Cooling output percentage in double loop (0-100)	RO	0
1222	Current CT (ampere with tenth)	RO	0
1223	Current media CT (ampere with tenth)	RO	0
1224	Current CT ON (ampere with tenth)	RO	0
1225	Current CT OFF (ampere with tenth)	RO	0
1226	Cold junction temperature (degree with tenth)	RO	-
1227	Output status (0=Off, 1=On) Bit 0 = OUT1 Bit 1 = OUT2	RO	0
1228	Led status (0 = Off, 1 = On) Bit0 = Red led OUT1 (Q1) Bit1 = Red led OUT2 (Q2) Bit2 = Green led (RUN)	RO	0
1229	Key status 0 = released, 1 = pressed	RO	0

Modbus address	Description	Read Write	Reset value
1230	Dip 1 value	RO	0
1231	Dip 2 value	RO	0
1232	Process (if temperature, no tenth)	RO	-
1233	Command setpoint (if temperature, no tenth)	R/W	EEPROM
1234	Alarm 1 Setpoint (if temperature, no tenth)	R/W	EEPROM
1235	Alarm 2 Setpoint (if temperature, no tenth)	R/W	EEPROM
1300	Latch on setting	R/W	0
1301	Latch on lower limit calibration	R/W	0
1302	Latch on upper limit calibration	R/W	0
1303	Latch on virtual zero calibration	R/W	0
1400	Serial process reset. Write 1 to disable the serial process. (process = AI1)	R/W	0
1401	Word serial process. AI1 is not considered	RO	?
1500	Process (if temperature, with tenth)	RO	?
1501	CT instantaneous current (ampere with tenth)	RO	0
1502	Current CT ON (ampere with tenth)	RO	0
1503	Current CT OFF (ampere with tenth)	RO	0
1504	Key status 0 = released 1 = pressed	RO	0
1505	Dip 1 value	RO	0
1506	Dip 2 value	RO	0
1507	Digital output status (0=Off, 1=On) (0=off, 1=on Bit 0 = OUT1(Q1) Bit 1 = OUT2 (Q2)	R/W	0
1508	Analogue output value	R/W	0
2001	Parameter 1	R/W	EEPROM
2002	Parameter 2	R/W	EEPROM
...	Parameter ...	R/W	EEPROM
2143	Parameter 143	R/W	EEPROM

10

Controller control type

Controller integrates different types of control type of the command output, selecting parameter "Control Type" in "PID" section, as follows (Par 2052):

0: "PID" = "ZC Time control"

For this type of control it is necessary to use a "zero-crossing" SSR. Activation and deactivation of the output is related to the time selected on parameter "Cycle Time Heat" (Par 2040).

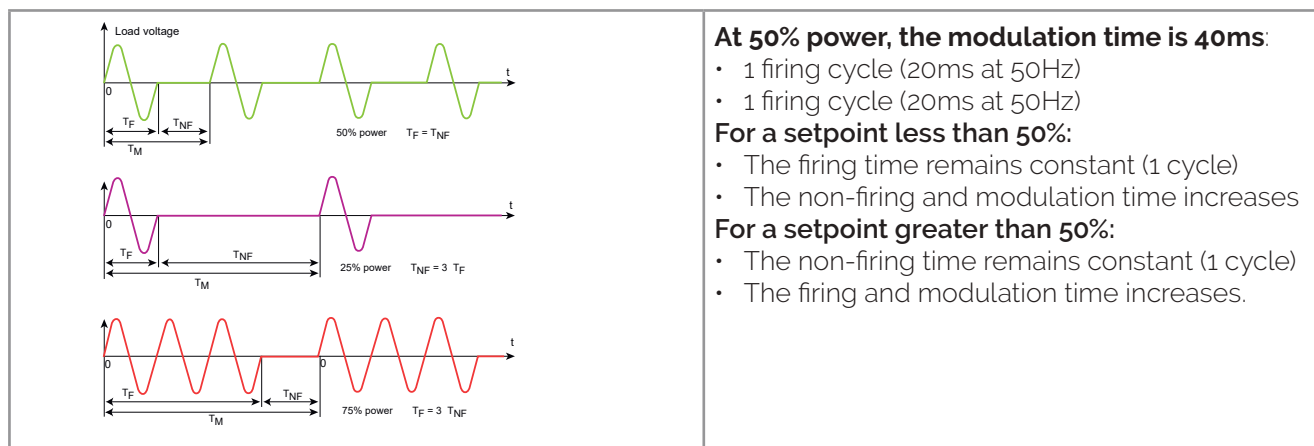
Ex.: selecting a time of 10 s and supposing a 30% percentage, the output will remain active for 3 s and inactive for 7 s.

1: "PID" = "BF1 50Hz"

3: "PID" = "BF1 60Hz"

For this type of control it is necessary to use a "zero-crossing" SSR.

The "Burst-fire" control (1 cycle) is a duty cycle mode which consists of supplying a series of complete mains voltage cycles to the load.



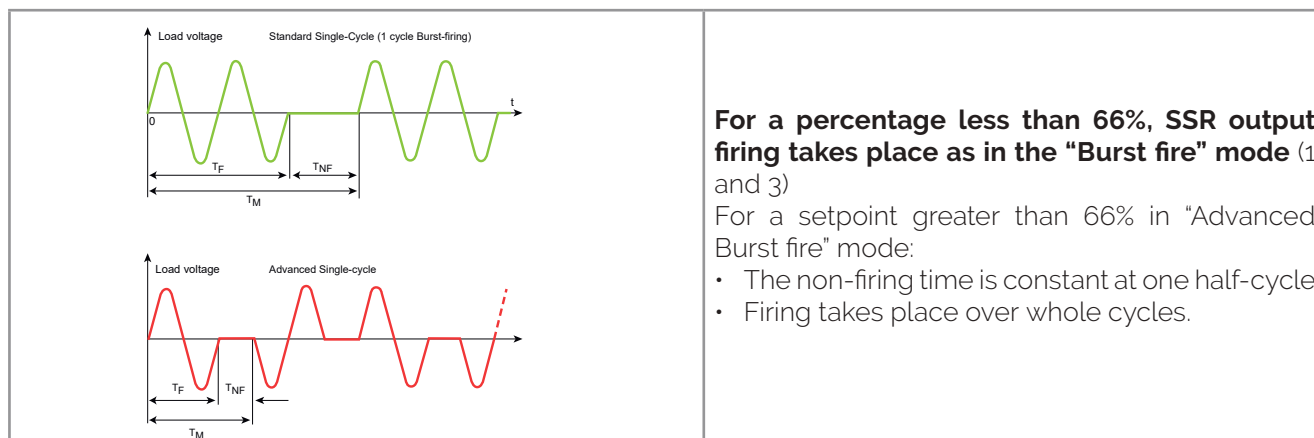
2: "PID" = "BF Adv 50Hz"

4: "PID" = "BF Adv 60Hz"

For this type of control it is necessary to use a "zero-crossing" SSR.

In order to minimise power fluctuation during the modulation period, the "advanced Burst fire" SSR output firing mode uses:

- A complete number of cycles for firing
- A complete number of half-cycles for non-firing



In a short-wave infrared application, "advanced Burst fire" firing mode reduces the brightness of the infrared elements and thus minimises annoying visual flickering.

11

Table of configuration parameters

11.1 Analogue Input

1001 – Input Type (Word ModBus 2001)

Analogue input configuration / sensor selection

0	Tc-K	-260 °C..1360 °C. (Default)
1	Tc-S	-40 °C..1760 °C
2	Tc-R	-40 °C..1760 °C
3	Tc-J	-200 °C..1200 °C
4	Tc-T	-260 °C..400 °C
5	Tc-E	-260 °C..980 °C
6	Tc-N	-260 °C..1280 °C
7	Tc-B	100 °C..1820 °C
8	Pt100	-100 °C..600 °C
9	Ni100	-60 °C..180 °C
10	NTC10K	-40 °C..125 °C
11	PTC1K	-50 °C..150 °C
12	Pt500	-100 °C..600 °C
13	Pt1000	-100 °C..600 °C
14	0..10 V	
15	0..20 mA	
16	4..20 mA	
17	0..60 mV	
18	Potentiometer	(set the value on parameter 5)

2002 - Degree (Word ModBus 2002)

0: °C Centigrade (Default)

1: °F Fahrenheit

2: °K Kelvin

2003 - Low limit (Word modbus 2003)

Range AN1 lower limit only for linear input.

Ex: with input 4..20 mA this parameter takes value associated to 4 mA.

-32767..+32767, Default: 0.

2004 - High limit (Word modbus 2004)

Range AN1 upper limit only for linear input.

Ex: with input 4..20 mA this parameter takes value associated to 20 mA.

-32767..+32767. Default:10000

2005 - Pot. Value (Word modbus 2005)

Select potentiometer value

1..150 kohm. Default: 10kohm

2006 - Input Over Limit (Word modbus 2006)

If linear input, allows process to go over limits (Par. 2003 and 2004).

0: **Disabled** (Default)

1: **Enabled**

2007 - Offset (Word modbus 2007)

Value added / subtracted to the process visualization (usually correcting the value of environmental temperature).

-10000..+10000 [digit1] (degrees.tenths for temperature sensors). **Default** 0.

2008 - Gain Calibration (Word modbus 2008)

Percentage value that is multiplied for the process value (allows to calibrated the working point). Ex: to correct the range from 0..1000°C showing 0..1010°C, set the par. to -1.0.

-1000 (100.0%)...+1000 (+100.0%), **Default**: 0.0.

2009 - Latch-On (Word modbus 2009)

Automatic setting of limits for linear inputs and potentiometers.

0: **Disabled** (Default)

1: **Standard**

2: **Virtual zero**

3: **Linear virtual zero**

2010 - Filter (Word modbus 2010)

Analogue input reading filter: increases process stability on word 1000, 1100, 1200, 1232.

1 ... 50. (**Default**: 1)

2011-2015 - Reserved Parameters - Group A

Reserved parameters

11.2 Output and Control**2016 - Command Output (Word modbus 2016)**

Command output type selection

0: **Q1 Cmd - Q2 Alm 1 - AO (4-20mA) Alm 2**

Command Q1; Alarm 1 Q2; Alarm 2 AO (0..20 mA). (Default)

1: **Q1 Cmd - Q2 Alm 1 - AO (0-20mA) Alm 2**

Command Q1; Alarm 1 Q2; Alarm 2 AO (4..20 mA).

2: **Valve Cmd : Q1 - Q2 - AO (4-20mA) Alm 2**

Valve command: Q1 (open) - Q2 (close); Alarm 1 AO (0..20 mA)

3: **Valve Cmd : Q1 - Q2 - AO (0-20mA) Alm 2**

Valve command: Q1 (open) - Q2 (close); Alarm 1 AO (4..20 mA)

4: **AO (0-20mA) - Q1 Alm1 - Q2 Alm2**

Command AO (0...20 mA); Alarm 1 Q1; Alarm 2 Q2.

5: **AO (4-20mA) - Q1 Alm1 - Q2 Alm2**

Command AO (4...20 mA); Alarm 1 Q1; Alarm 2 Q2.

	Command	Alarm 1	Alarm 2
0	Q1	Q2	AO (0..20 mA)
1	Q1	Q2	AO (4..20 mA)
2	Q1 (open), Q2 (close)	AO (0..20 mA)	-
3	Q1 (open), Q2 (close)	AO (4..20 mA)	-
4	AO (0..20 mA)	Q1	Q2
5	AO (4..20 mA)	Q1	Q2

2017 - Initial State (Word modbus 2017)

Selects controller status at starting.

0: **Start** (Default)

1: **Stop**

2: **Stored**. Backs the controller to the Start/Stop status existing before the switching-off.

2018 - Action type (Word modbus 2018)

0: **Heating** (N.O.) (Default)

1: **Cooling** (N.C.)

2019 - Command Hysteresis (Word modbus 2019)

Hysteresis in ON/OFF

-10000...+10000 [digit] (degrees.tenths for temperature sensors). **Default 2**.

2020 - Command State Error (Word modbus 2020)

State of contact for command output in case of error.

0: **Command 0mA/NO/Open Valve**

0 mA if command on AO.

Open contact if command on Q1.

Open valve if valve command. (Default)

1: **Command 4mA/NC/Close Valve**

4 mA if command on AO.

Closed contact if command on Q1.

Closed valve if valve command.

2: **Command 20mA/NO/Open Valve**

20 mA if command on AO.

Open contact if command on Q1.

Open valve if valve command.

3: **Command 21.5mA/NC/Close Valve**

21.5 mA if command on AO.

Closed contact if command on Q1.

Closed valve if valve command.

2021 - Command State Stop (Word modbus 2021)

State of contact for command output with controller in STOP

0: **Command 0mA/NO/Open Valve**

0 mA if command on AO.

Open contact if command on Q1.

Open valve if valve command. (Default)

1: **Command 4mA/NC/Close Valve**

4 mA if command on AO.

Closed contact if command on Q1.

Closed valve if valve command.

2: **Command 20mA/NO/Open Valve**

20 mA if command on AO.

Open contact if command on Q1.

Open valve if valve command.

3: **Command 21.5mA/NC/Close Valve**

21.5 mA if command on AO.

Closed contact if command on Q1.

Closed valve if valve command.

2022 - Command Reset (Word modbus 2022)

Type of reset for state of command contact (always automatic in P.I.D. functioning)

0: **Automatic reset** (Default)

1: **Manual reset** (by word 1029)

2: **Manual reset stored** (keeps relay status also after an eventual power failure)

2023 - Command Delay (Word modbus 2023)

Command delay (only in ON / OFF functioning).

-3600..+3600 seconds. **Default:** 0.

Negative: delay in switching off phase.

Positive: delay in activation phase.

2024 - Valve Time (Word modbus 2024)

Valve time.

1...300 seconds. **Default:** 60.

2025 - Automatic / Manual (Word modbus 2025)

Enable automatic / manual selection.

0: **Disabled** (Default)

1: **Enabled**

2: **Enabled with memory**

2026+2030 - Reserved Parameters - Group B

Reserved parameters

11.3 Autotuning and P.I.D.**2031 - Tune (Word modbus 2031)**

Autotuning type selection.

0: **Disabled** - (Default)

1: **SelfTune** - Calculation of P.I.D. parameters at starting and at command setpoint modification.

2: **Pretune** - P.I.D. with automatic parameters calculation by word 1004 or 1205

3: **Once** - P.I.D. with parameters calculation only once at starting

2032 - Pretune Setpoint Deviation Tune (Word modbus 2032)

Selects deviation from command setpoint as threshold used by manual tuning to calculate P.I.D. parameters.

0-10000 [digit] (degrees.tenths for temperature sensors). **Default:** 300.

2033 - Proportional Band (Word modbus 2033)

Process inertia in units

0 ON / OFF if also t.i. is equal to 0. (**Default**)

1...10000 [digit] (degrees.tenths for temperature sensors).

2034 - Integral Time (Word modbus 2034)

Process inertia in seconds.

0 (0.0s)...20000 (2000.0s) tenths of second (0 = Integral action disabled), **Default** 0

2035 - Derivative Time (Word modbus 2035)

Derivative time. Normally $\frac{1}{4}$ of integral time.

0(0.0s)...10000(1000.0s) tenths of second (0 = Derivative action disabled), **Default** 0

2036 - Dead Band (Word modbus 2036)

Dead Band.

0...10000 [digit] (degrees.tenths for temperature sensors) (**Default:** 0)

2037 - Proportional Band Centered (Word modbus 2037)

Defines if the proportional band has to be centered on setpoint. In double loop functioning (heating/cooling) is always disabled.

0: **Disabled**. Band under (heating) or over (cooling) (**Default**)

1: **Centered** - Centered band

2038 - Force Off Over Setpoint (Word modbus 2038)

In P.I.D. functioning enables the command output switching off, when passing a specific threshold (setpoint + Par.2037).

0: **Disabled** (Default)

1: **Enabled**

2039 - Force Off Deviation Threshold (Word modbus 2039)

Selects command setpoint deviation to calculate the intervention threshold of "Off Over Setpoint" function.

-10000...+10000 [digit] (degrees.tenths for temperature sensors) (**Default:** 0)

2040 - Cycle Time Heat (Word modbus 2040)

Cycle time (for PID on teleruptor 15s; for PID on SSR 2s.)

1-300 seconds (**Default:** 15s)

2041 - Cooling type (Word modbus 2041)

Type of refrigerant fluid type for heating/cooling PID.

Enable cooling output on par. ALM1 or ALM2.

0: **Air** (Default)

1: **Oil**

2: **Water**

2042 - Cooling P.B.Multiplier (Word modbus 2042)

Proportional band for cooling action is done by the value of par. 2030 multiplied for this value.

100(1.00)...500(5.00). **Default:** 100(1.00)

2043 - Overlap / Dead Band (Word modbus 2043)

Dead band combination for heating / cooling P.I.D.

-200(-20.0%)...500(50.0%)

Negative: dead band.

Positive: overlapping. **Default:** 0 (0.0%)

2044 - Cooling Cycle Time (Word modbus 2044)

Cycle time for cooling output.

1-300 seconds (**Default:** 10s)

2045 - Lower limit Heat Output (Word modbus 2045)

Selects min. value for command output percentage.

0%...100%, **Default:** 0%.

2046 - Upper limit Heat Output (Word modbus 2046)

Selects max. value for command output percentage.
0%...100%, **Default:** 100%.

2047 - SelTune - SP Deviation (Word modbus 2047)

Selects the max. process-setpoint gap over that the automatic tuning recalculates PID parameters.
0-10000 [digit] (degrees.tenths for temperature sensors). **Default:** 30

2048 - Minimum Proportional Band (Word modbus 2048)

Selects the min. proportional band value selectable by the automatic tuning.
0-10000 [digit] (degrees.tenths for temperature sensors). **Default:** 50

2049 - Maximum Proportional Band (Word modbus 2049)

Selects the max. proportional band value selectable by the automatic tuning.
0-10000 [digit] (degrees.tenths for temperature sensors). **Default:** 500

2050 - Minimum Integral Time (Word modbus 2050)

Selects the min. integral time value selectable by the automatic tuning.
0 (0.0s)...10000 (1000.0s) seconds. **Default:** 400 (40.0s).

2051 - Overshoot Control Level

The overshoot control function prevents said event from happening during startup or upon modification of the setpoint. Setting this value too low could cause the overshoot to not be fully absorbed, while higher values might increase the time needed to reach the setpoint.

Disab.	Lev. 4	Lev. 8
Lev. 1	Lev. 5 (Def.)	Lev. 9
Lev. 2	Lev. 6	Lev. 10
Lev. 3	Lev. 7	

2052 - Output Control Type

Select output control type in case of PID regulation.

0: **ZC** - Time control **Default**

1: **BF 1 50Hz** - Burst fire control 50 Hz

2: **BF Adv 50Hz** - Advanced Burst fire control 50 Hz

3: **BF 1 60Hz** - Burst fire control 60 Hz

4: **BF Adv 60Hz** - Advanced Burst fire control 60 Hz

2053÷2055 - Reserved Parameters - Group C

Reserved parameters

11.4 Alarm 1

2056 - Alarm 1 Type (Word modbus 2056)

The Alarm 1 Type selection.

- 0: **No Function** - Disabled. (Default)
- 1: **Process High** - Absolute alarm (threshold) referred to process active above
- 2: **Process Low** - Absolute alarm (threshold) referred to process active below
- 3: **Band** - Band alarm
- 4: **Upper Deviation** - Upper deviation alarm
- 5: **Lower Deviation** - Lower deviation alarm
- 6: **Absolute High on SP** - Absolute alarm referred to active setpoint above
- 7: **Absolute Low on SP** - Absolute alarm referred to active setpoint below
- 8: **Run/Stop State** - Controller status RUN / START
- 9: **Cooling** - Cold action in double loop
- 10: **H.B. + Overcurrent** - Heater Break Alarm and Overcurrent Alarm
- 11: **Sensor Break** - Sensor error. Active alarm in case of broken sensor.
- 12: **Remote** - Remote. Alarm enabled by word 1211

2057 - Output Type (Word modbus 2057)

Alarm 1 output contact and intervention type.

- 0: **NO** - Normally open, active at start (Default)
- 1: **NC** - Normally closed, active at start
- 2: **NO Active after SP** - Normally open, active on reaching alarm¹
- 3: **NC Active after SP** - Normally closed, active on reaching alarm¹

2058 - Hysteresis (Word modbus 2058)

Alarm 1 Hysteresis

-10000...+10000 [digit] (degrees.tenths for temperature sensors). **Default** 0.5.

2059 - Alarm 1 in Error (Word modbus 2059)

State of contact for alarm 1 output in case of error.

- 0: **Out 0mA/NO** - 0 mA if alarm 1 on AO. Open contact if alarm 1 on Q1 or Q2. Default
- 1: **Out 4mA/NC** - 4 mA if alarm 1 on AO. Closed contact if alarm 1 on Q1 or Q2.
- 2: **Out 20mA/NO** - 20 mA if alarm 1 on AO. Open contact if alarm 1 on Q1 or Q2
- 3: **Out 21.5mA/NC** - 21.5 mA if alarm 1 on AO. Closed contact if alarm 1 on Q1 or Q2.

2060 - Alarm 1 in Stop State (Word modbus 2060)

Alarm 1 output contact state with controller in STOP

- 0: **Out 0mA/NO** - 0 mA if alarm 1 on AO. Open contact if alarm 1 on Q1 or Q2. Default
- 1: **Out 4mA/NC** - 4 mA if alarm 1 on AO. Closed contact if alarm 1 on Q1 or Q2.
- 2: **Out 20mA/NO** - 20 mA if alarm 1 on AO. Open contact if alarm 1 on Q1 or Q2
- 3: **Out 21.5mA/NC** - 21.5 mA if alarm 1 on AO. Closed contact if alarm 1 on Q1 or Q2.
- 4: **Active** - Active alarm in Stop

2061 - Alarm 1 Reset (Word modbus 2061)

Alarm 1 contact reset type.

- 0: **Auto** - Automatic reset (Default)
- 1: **Manual** - Manual reset (by Par 1210)
- 2: **Manual (Stored)** - Manual reset stored. (keeps relay status after a power failure too)

¹ On activation, the output is inhibited if the controller is in alarm mode. Activates only if alarm condition reappears, after that it was restored.

2062 - Alarm 1 Delay (Word modbus 2062)

Alarm 1 Delay. -3600..+3600 seconds. **Default:** 0.

Negative: delay in alarm output phase.

Positive: delay in alarm entry phase.

2063÷2067 - Reserved Parameters

Reserved parameters

11.5 Alarm 2**2068 - Alarm 2 Type (Word modbus 2068)**

The alarm intervention is related to Alarm 2.

0: **No Function** - Disabled. (Default)

1: **Process High** - Absolute alarm (threshold) referred to process active above

2: **Process Low** - Absolute alarm (threshold) referred to process active below

3: **Band** - Band alarm

4: **Upper Deviation** - Upper deviation alarm

5: **Lower Deviation** - Lower deviation alarm

6: **Absolute High on SP** - Absolute alarm referred to active setpoint above

7: **Absolute Low on SP** - Absolute alarm referred to active setpoint below

8: **Run/Stop State** - Controller status RUN / START

9: **Cooling** - Cold action in double loop

10: **H.B. + Overcurrent** - Heater Break Alarm and Overcurrent Alarm

11: **Sensor Break** - Sensor error. Active alarm in case of broken sensor.

12: **Remote** - Remote. Alarm enabled by word 1211

2069 - Output Type (Word modbus 2069)

Alarm 2 output contact and intervention type.

0: **NO** - Normally open, active at start (Default)

1: **NC** - Normally closed, active at start

2: **NO Active after SP** - Normally open, active on reaching alarm^{1 P. 33}

3: **NC Active after SP** - Normally closed, active on reaching alarm^{1 P. 33}

2070 - Hysteresis (Word modbus 2070)

Alarm 2 Hysteresis

-10000..+10000 [digit] (degrees.tenths for temperature sensors). **Default** 0.5.

2071 - Alarm 2 in Error (Word modbus 2071)

State of contact for alarm 1 output in case of error.

0: **Out 0mA/NO** - 0 mA if alarm 2 on AO. Open contact if alarm 2 on Q1 or Q2. Default

1: **Out 4mA/NC** - 4 mA if alarm 2 on AO. Closed contact if alarm 2 on Q1 or Q2.

2: **Out 20mA/NO** - 20 mA if alarm 2 on AO. Open contact if alarm 2 on Q1 or Q2

3: **Out 21,5mA/NC** - 21.5 mA if alarm 2 on AO. Closed contact if alarm 2 on Q1 or Q2.

2072 - Alarm 2 in Stop State (Word modbus 2072)

Alarm 2 output contact state with controller in STOP

0: **Out 0mA/NO** - 0 mA if alarm 2 on AO. Open contact if alarm 2 on Q1 or Q2. Default

1: **Out 4mA/NC** - 4 mA if alarm 2 on AO. Closed contact if alarm 2 on Q1 or Q2.

2: **Out 20mA/NO** - 20 mA if alarm 2 on AO. Open contact if alarm 2 on Q1 or Q2

3: **Out 21,5mA/NC** - 21.5 mA if alarm 2 on AO. Closed contact if alarm 2 on Q1 or Q2.

4: **Active** - Active alarm in Stop

2073 - Alarm 2 Reset (Word modbus 2073)

Alarm 2 contact reset type.

0: **Auto** - Automatic reset (Default)

1: **Manual** - Manual reset (by Par 1210)

2: **Manual (Stored)** - Manual reset stored. (keeps relay status after a power failure too)

2074 - Alarm 2 Delay (Word modbus 2074)

Alarm 2 Delay. -3600..+9360 seconds. **Default:** 0.

Negative: delay in alarm reset.

Positive: delay in alarm activation.

2075÷2079 - Reserved Parameters

Reserved parameters

11.6 Soft Start**2080 - Soft-Start Type (Word modbus 2080)**

Enables and selects soft-start type

0: **Disabled** (Default)

1: **Gradient**

2: **Percentage**

2081 - Ratio (Word modbus 2081)

Rise / fall gradient for soft-start.

1..10000 Digit/hour (tenths of degree/hour if temperature). (**Default:** 1000)

2082 - Percentage (Word modbus 2082)

Value of the output percentage during Soft-start.

0..100%. (**Default:** 50%)

2083 - Threshold (Word modbus 2083)

Threshold under which the device enables percentage soft-start function, at starting.

-10000...10000 [digit] (degrees.tenths for temperature sensors) (**Default:** 1000)

2084 - Time (Word modbus 2084)

Max. softstart duration: if the process doesn't reach the threshold entered on parameter 50 within the selected time, the controller will start to regulate on setpoint value.

0: Disabled

1..1440min (**Default:** 15 minutes)

2085÷2089 - Reserved Parameters

Reserved parameters

11.7 Current transformer

2090 - CT Function (Word modbus 2090)

Enables C.T. input and selects the net frequency

0: **Disabled** (Default)

1: **50Hz**

2: **60Hz**

2091 - Size (Word modbus 2091)

Selects amperometric transformer full-scale

1.200 Ampere (**Default**: 50)

2092 - H.B. Alarm Threshold (Word modbus 2092)

Heater Break Alarm activation threshold

0.0: Disabled

0.1..200.0 Ampere.

2093 - Overcurrent Alarm Threshold (Word modbus 2093)

Overcurrent alarm threshold

0.0: Disabled

0.1..200.0 Ampere.

2095÷2099 - Reserved Parameters

Reserved parameters

11.8 Retransmission

2100 - Retransmission (Word modbus 2100)

Retransmission for output 0/4..20 mA. Parameters 2098 and 2099 define upper/lower limit of operating sequence

0: **Disabled** (Default)

1: **Process** – Process variable

2: **Command setpoint**

3: **Alarm 1 setpoint**

4: **Alarm 2 setpoint**

5: **CT Current** - Ampere from current transformer

6: **Remote value** retransmission (word 1213)

2101 - Retransmission Type (Word modbus 2101)

Select the type of Retransmission

0: 0...20 mA

1: 4...20 mA (**Default**)

2102 - Lower Limit (Word modbus 2102)

Linear output lower limit range (value related to 0/4 mA)

-32767..+32767 [digit] (degrees for temperature sensors), **Default**: 0.

2103 - Upper Limit (Word modbus 2103)

Linear output upper limit range (value related to 20 mA)

-32767..+32767 [digit] (degrees for temperature sensors), **Default**: 10000.

2104 - InError (Word modbus 2104)

Selects the value of the analogue output in Volt in case of error

0: 0 mA (**Default**)

1: 4 mA

2: 20 mA

3: 21.5 mA

2105 - In Stop (Word modbus 2105)

Defines the analogue output value with controller in STOP

0: 0 mA (**Default**)

1: 4 mA

2: 20 mA

3: 21.5 mA

4: Retransmission active in STOP

2106÷2110 - Reserved Parameters

Reserved parameters

11.9 Serials**2111 - Slave Address (Word modbus 2111)**

Selects slave address for serial communication when all DIP 1 contacts are set on OFF

1...254. Default: 247.

2112 - Baudrate (Word modbus 2112)

Selects slave address for serial communication when all DIP 2 contacts are set on OFF

0: **4800** bit/s

1: **9600** bit/s

2: **19200** bit/s (Default)

3: **28800** bit/s

4: **38400** bit/s

5: **57600** bit/s

6: **115200** bit/s

2113 - Serial Port Parameters (Word modbus 2113)

Selects the type of format for the modbus RTU communication

0: **8-N-1** 8 bit, no parity, 1 stop bit (Default)

1: **8-E-1** 8 bit, even parity, 1 stop bit

2: **8-O-1** 8 bit, odd parity, 1 stop bit

3: **8-N-2** 8 bit, no parity, 2 stop bit

4: **8-E-2** 8 bit, even parity, 2 stop bit

5: **8-O-2** 8 bit, odd parity, 2 stop bit

2114 - Serial Delay (Word modbus 2114)

Selects the serial delay.

0...100 ms. **Default:** 0 ms.

2115 - Watch-dog time (Word modbus 2115)

Selects the Watch-dog time. If no communication is available within the selected time, the controller will switch-off the command output.

0: Offline disabled (**Default**)

0..6000 tenths of seconds (Es. 100 = 10.0 s)

2116÷2120 - Reserved Parameters

Reserved parameters

11.10 Expansion**2121 - Expansion Function (Word modbus 2121)**

Enables "Expansion module" mode

0: Disabled (**Default**)

1: Enabled

2122 - Initial Output status (Word modbus 2122)

Selects output state at starting

Bit 0 Q1 (0 = off; 1 = on) **Default:** 0

Bit 1 Q2 (0 = off; 1 = on) **Default:** 0

2123 - In Error Output status strategy (Word modbus 2123)

Defines if the output has to commute into a default state in case of error or W.D error. If the error is eliminated, the output keeps the default state.

Bit 0 Q1 (0 = unvaried; 1 = commute) **Default:** 0

Bit 1 Q2 (0 = unvaried; 1 = commute) **Default:** 0

2124 - In Error Output status (Word modbus 2124)

Defines values to be assumed by the outputs in case of error or off-line.

Bit 0 Q1 (0 = off; 1 = on) **Default:** 0

Bit 1 Q2 (0 = off; 1 = on) **Default:** 0

2125 - Analogue Output Type (Word modbus 2125)

Select the type of Analogue Output

0: 0...20 mA

1: 4...20 mA (**Default**)

2126 - Lower Limit Analogue Output (Word modbus 2126)

Analogue output lower limit range (value related to 0/4 mA)

-32767..+32767 [digit] **Default:** 0.

2127 - Upper Limit Analogue Output (Word modbus 2127)

Analogue output upper limit range (value related to 20 mA)

-32767..+32767 [digit] **Default:** 10000.

2128 - Initial Value Analogue Output (Word modbus 2128)

Selects analogue output value at starting

-32767..+32767 [digit] **Default:** 0

2129 - In Error Mode Analogue output strategy(Word modbus 2129)

Defines if the analogue output has to commute to a default value in case of error or W.D. error. If the error is eliminated, the output keeps the default value

0: AO unvaried in case of error (Default)

1: AO commuted in case of error

2130 - Error Value Analogue Output (Word modbus 2130)

Defines the value assumed by the output in case of error or off-line

-32767..+32767 [digit] Default: 0.

2131 - Current Transformer Output (Word modbus 2131)

Defines digital output connected to the current transformer

0: Q1 (Default)

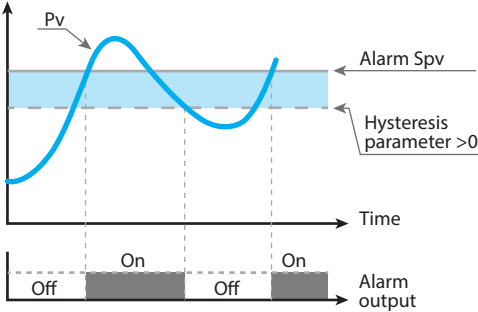
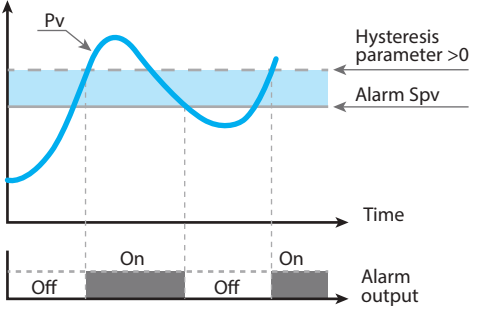
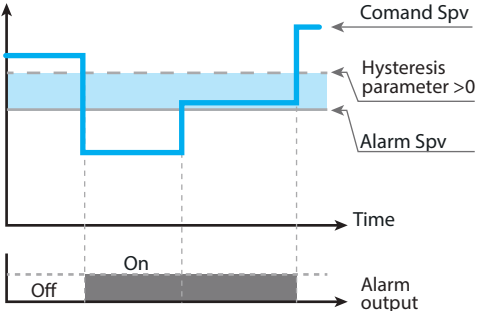
1: Q2

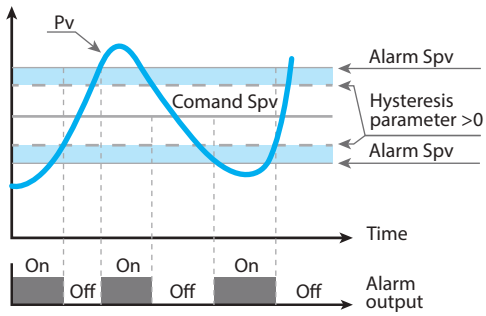
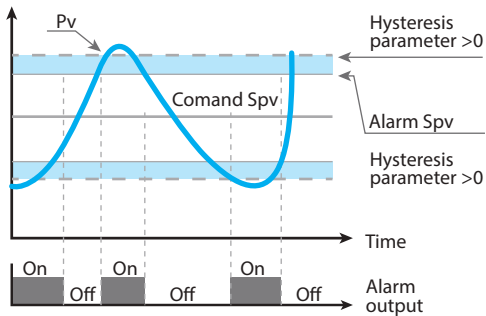
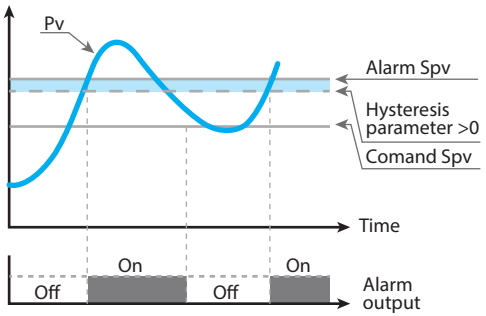
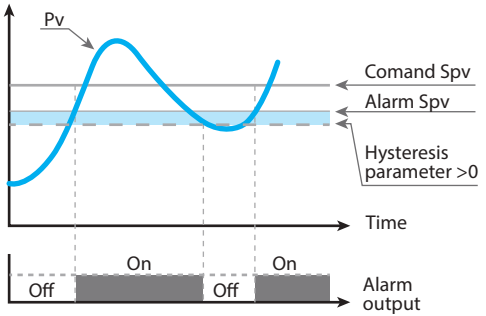
2132÷2136 - Reserved Parameters

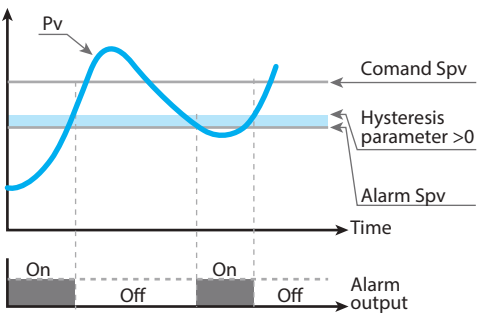
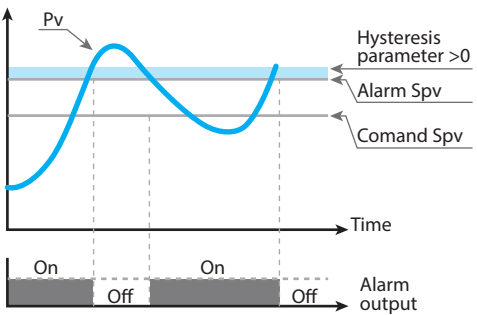
Reserved Parameters

12

Alarm Intervention Modes

Process High Alarm or Threshold Alarm (Par. 2056 = 1)	
	Process High alarm. Hysteresis value greater than "0"
	Process High alarm. Hysteresis value less than "0"
Absolute alarm or threshold alarm referring to command setpoint (word 2056 = 6)	
	<p>Absolute alarm referred to command setpoint. Hysteresis value greater than "0"</p> <p>Command setpoint can be modified by RS485 (Par. 1201).</p>

Band alarm (word 2056 = 3)	
	Band alarm hysteresis value greater than "0"
	Band alarm hysteresis value less than "0"
Upper deviation alarm (Par. 2056 = 4)	
	Upper deviation alarm value of alarm setpoint greater than "0" and hysteresis value greater than "0". With hysteresis value less than "0" the dotted line moves under the alarm setpoint.
	Upper deviation alarm value of alarm setpoint less than "0" and hysteresis value greater than "0". With hysteresis value less than "0" the dotted line moves under the alarm setpoint.

Lower deviation alarm (word 2056 = 5)	
 <p>The graph plots Process Value (Pv) on the y-axis against Time on the x-axis. A horizontal line represents the Command Setpoint (Comand Spv). A light blue shaded band represents the alarm range, bounded by the Alarm Setpoint (Alarm Spv) and a lower threshold. The Alarm Spv is above the Comand Spv. A hysteresis band is shown between the Alarm Spv and the lower threshold. The Pv curve starts below the Comand Spv, rises above the Alarm Spv, then falls below the lower threshold. The Alarm output is 'On' when the Pv is above the Alarm Spv and 'Off' when it falls below the lower threshold. The hysteresis parameter is greater than 0.</p>	<p>Lower deviation alarm value of alarm setpoint greater than "o" and hysteresis value greater than "o". With hysteresis value less than "o" the dotted line moves under the alarm setpoint.</p>
 <p>The graph plots Process Value (Pv) on the y-axis against Time on the x-axis. A horizontal line represents the Command Setpoint (Comand Spv). A light blue shaded band represents the alarm range, bounded by the Alarm Setpoint (Alarm Spv) and a lower threshold. The Alarm Spv is below the Comand Spv. A hysteresis band is shown between the Alarm Spv and the lower threshold. The Pv curve starts below the Comand Spv, rises above the Alarm Spv, then falls below the lower threshold. The Alarm output is 'On' when the Pv is above the Alarm Spv and 'Off' when it falls below the lower threshold. The hysteresis parameter is greater than 0.</p>	<p>Lower deviation alarm value of alarm setpoint less than "o" and hysteresis value greater than "o". With hysteresis value less than "o" the dotted line moves under the alarm setpoint.</p>

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Table of Anomaly Signals

If some error occur, the controller switch off the outputs values and set the flag on Par 100g (error flags table). For other signals see table below:

	Cause	What to do
BIT2	Error in E2PROM cell programming	Call Assistance
BIT0	Cold junction sensor fault or room temperature outside of allowed limits	Call Assistance
BIT3	Incorrect configuration data. Possible loss of calibration values	Check if the configuration parameters are correct
BIT1	Thermocouple open or temperature outside of limits	Check the connection with the sensors and their integrity
BIT4	Missing calibration data	Call Assistance



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