THERMOSALD ISX32

A MODULAR SYSTEM FOR PULSE SEALING AND CUTTING



USER AND INSTALLATION MANUAL

V01

(Revision 06 dated 28/05/2026)

3E S.r.l. - Via del Maccabreccia 46 - 40012 CALDERARA DI RENO (BOLOGNA)
Tel. +39 051 6466225 – 051 6466228 **E-Mail:** sales@3e3e3e.com
Fax +39 051 6426252 **Web:** www.3e3e3e.com

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1 INTRODUCTION

This USER MANUAL is the only complete document associated with the product presented on the cover and contains all the information for using it correctly.

Before using this product, be sure to have read chapter 2 - SAFETY WARNINGS AND CERTIFICATIONS.

1.1 REVISIONS OF THIS MANUAL

Rev.	***Date***	***Description***
01	02/04/2024	Initial document for internal use.
02	16/07/2024	Minor changes.
03	23/07/2024	Official revision
04	06/05/2025	Panel menu tree update Figure. AC and DC diagram update Figure 25and Figure 26. Removal of variables ID 523, ID 524, ID 525, and ID 526. Revision of par. 5.6.3.1. Revision of par. 6.4 and par. 7.11.2. Update of PT100 range and accuracy par. 19.5. Waveforms updated, par. 7.4.1.1. Chap. 17: update A44, A204, A205, A206, A274, A276, A277, A278, A424, A425, A426, and A427. Revision of par. 5.6.3.7. Chap. 17: A269 removed. Par. 6.11 e 7.14: variables ID 1600, ID 1609, ID 1610, and ID 1618 removed. Added guidelines on maximum cable length, par 5.2, par. 5.3, par. 5.4, par. 5.5, par. 5.6.3.1, par. 5.6.3.9, par. 5.6.3.10.2, par. 5.6.3.10.3, par. 7.1, par. 7.2, par. 8.1.1, par. 8.1.2, par. 8.1.3, par. 9.1, par. 11.1.
05	08/09/2025	Corrected references in par. 6.4, 7.2. Coprocessor warning and alarm description updated, par. 6.8 and chap. 17. A55, A155, W75, and W175 removed.

		Update of par. 9.2.1. Update of chap. 14. Modified parameter values for “Balancing period [sx10]”. Added information on conductor cross-sections and maximum torques, par. 5.2, par. 5.5, par. 5.6.3.4, par. 5.6.3.5, par. 5.6.3.6, par. 8.1.1, par. 8.1.3, par. 9.1. Reviewed par. 2.1. Reviewed guidelines regarding application reliability, ch. 2. Added “Maximum number of switchings” parameter. Added information of “QUOTA AMBIENTE LAVORO” cap. 14, par. 19.1, par. 19.2, par. 19.3, par. 19.4. “No. of LOG elements”, “LOG element selection”, and “Selected LOG element value” variables added. Added variable “Invalid reading/writing variable ID”.
06	28/05/2026	Reviewed connector CN1 current limits par. 5.6.3.4. Update of par. 5.6.3.2. Ch. 17: update A46, A89. Update of par. 7.15. Added CC-Link IE TSN par. 7.12 and par. 15.3. ID 10, ID 11 variables removed. Update of par. 2.1. Updated earth symbols in sections 5.6.1 and 5.6.2

2 SAFETY WARNINGS AND CERTIFICATIONS

In order to use the product presented on the cover and documented in this USER MANUAL, it is necessary to have adequate technical training in the sector, to consult and follow carefully this USER MANUAL and to adhere to the current SAFETY REGULATIONS. Improper use of the device can lead to dangerous conditions for the operator and for things and people in the whereabouts.

The following symbol is used throughout this manual to highlight particularly important information as far as safety is concerned:





Use the thermoregulator in compliance with the regulations outlined in par. 2.1 and 2.1.2. The thermoregulator, a type 1 action device, in accordance with the standard set out in paragraph 2.1.2, cannot be classified as a safety element.



Make the CONNECTIONS as outlined in chapter 5 - CONNECTIONS.



Use only certified sealing elements (e.g. sealing bands, wires) with a SUITABLE TEMPERATURE COEFFICIENT (>=800PPM/K) specified by the sealing element manufacturer (see par. 6.3.2).



Carry out the CONFIGURATION as outlined in chapter 6 - CONFIGURATION, DIAGNOSTICS.



COMMISSION this product as outlined in chapter 12 - COMMISSIONING.



Carry out MAINTENANCE as outlined in chapter 13 - MAINTENANCE INSTRUCTIONS.



Do not use the device in an explosive environment or with explosive materials.



Do not use the device with flammable material without taking the necessary precautions.



Do not use the device in ATEX zones 20 and 21.



Do not use the device in an ATEX zone 22 environment. In this case, it is mandatory to make the area of the sealing element explosion-proof.

To increase the reliability of the application, consider the following measures:

- **Use a double check on the MAX TEMPERATURE (see par. 6.2) provided in redundant models (see chapter 15) with COPROCESSOR (see chapter 10).**



- **Use the TEMPERATURE PROBES (see par.6.3.1) provided in the related models (see chapter 15).**
- **Use the fieldbus to perform runtime monitoring via the PLC of the critical "Temperature coefficient" variables (see par.6.3.2), "Calibration temperature [°C]" (see par. 6.3) and "Maximum Temperature [°C]" (see par. 6.2).**
- **There are models in which the maximum temperature and coefficient are limited (see chapter 15)**

2.1 CONFORMITY TO STANDARDS

2.1.1 CE MARKING

This device complies with the essential requirements of the following EU Directives applicable to the product:

- *ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the approximation of the laws of the member states relating to electromagnetic compatibility and repealing Directive 89/336/EC*

  Reference standards:

  - ***IEC 61326-1:2020 issue 3***
  - ***EN 61326-1:2021***

- *LOW VOLTAGE DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonization of the laws of the Member states relating to electrical equipment designed for use within certain voltage limits.*

  Reference standards:

  - ***IEC 60730-1:2013 Issue 5 + AMD1:2015***
  - ***EN 60730-1:2016 Issue 5 + AMD1:2019***
  - ***IEC 60730-2-9:2015 Issue 4.0 + AMD1:2018 + AMD2:2020***
  - ***EN IEC 60730-2-9:2019 Issue 4.0.***

- *DIRECTIVE **2002/95/EC** OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.*

- *DIRECTIVE **2002/96/EC** OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on waste electrical and electronic equipment (WEEE).*

- *DIRECTIVE **2011/65/EC** OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.*

2.1.1.1 DECLARATION OF CONFORMITY

UE DECLARATION OF CONFORMITY
DICHIARAZIONE DI CONFORMITA' UE

Ref. document n. XXX(26)_UE

Manufacturer's name:
Nome del fabbricante:
3E Srl

Manufacturer's address:
Indirizzo del fabbricante:
Via del Maccabreccia, 46 – 40012 – Calderara di Reno (BO) - ITALY

declare that the product
dichiara che il prodotto

Model:
Modello:
Thermosald ISX32-3E5206HPSACV01_COBU08PR

Specific function:
Funzione specifica:
SISTEMA MODULARE PER SALDATURA E TAGLIO AD IMPULSI

is comply to essentials requirements according to the following European Directives
è conforme ai requisiti essenziali delle seguenti Direttive Europee

LVD 2014/35/UE, EMC 2014/30/UE and RoHS 2011/65/EU reference to the following harmonized standards
Bassa Tensione 2014/35/EU, EMC 2014/30/EU e RoHS 2011/65/EU in riferimento alle seguenti normative armonizzate

EN 60730-1:2024	Automatic electrical controls – Part 1: General requirements
EN IEC 61326-1 :2021	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN IEC 61000-3-2 :2019	Electromagnetic Compatibility (Part 3-2): Limits for harmonics current emissions (I<16A). Electromagnetic Compatibility
EN 61000-3-3 :2013 +A1 +A2	Electromagnetic Compatibility (Part 3-3): Limits of voltage supply systems for equipment with rated current ≤16A per phase.

Accessories included in the following Declaration: none.
Accessori inclusi nella presente dichiarazione: nessuno.

This declaration is issued under the sole responsibility of importer on the basic of the verifications performed.
Questa dichiarazione è rilasciata sotto esclusiva responsabilità dell'importatore sulla base dei risultati delle verifiche eseguite.

Bologna (BO), 12 January 2026.

General Manager or Technical Director

Sign/firma

2.1.2 cETLus MARKING (United States and Canada)

Reference standards:

- ***UL 60730-1:2016 Issue 5***
- ***CSA E60730-1:2015 Issue 5***
- ***UL 60730-2-9:2017 Issue 4.0***
- ***CAN/CSA E60730-2-9:18 Issue 4.0***

2.1.3 OTHER STANDARDS

The device complies with FCC and ICES standards.

3 DESCRIPTION

3.1 INTRODUCTION ON THE MARKET

THERMOSALD ISX32 is a modular line of configurable and compatible products designed to meet all the requirements of the pulse sealing and cutting market.
THERMOSALD ISX32 is the result of the company's many years of experience in this technology and is fully compatible with all previous Thermosald PWM, Thermosald SCR, Thermosald UPSCR, Thermosald ISC, and ISX thermoregulators.

Its modularity and high configurability allow you to choose the right model, from the most low-cost one equipped only with Ethernet port and server to the most expensive and sophisticated one with COPROCESSOR and the main FIELDBUSES.

The know-how described above and the experience gained with the previous Thermosald ISX product family made it possible to natively develop both traditional AC and the more recent DC control technologies directly on the Thermosald ISX32. Both technologies are available on thermoregulator models suitable for low to medium power consumption applications, as well as on models equipped with servo-ventilation for cooling, designed for high power consumption applications.

The above DC models are designed for ultra-high-speed applications and to ensure operation even in working environments where the power grid is severely disrupted.

3.2 PRODUCT DESCRIPTION, APPLICATIONS AND ADVANTAGES

Like the previous pulse thermoregulators, THERMOSALD ISX32 can heat a sealing band, a cutting/sealing wire, or a heating element and to keep it at the set temperature without using additional probes. This technology makes it possible to obtain very high working speeds for sealing and/or cutting polyethylene, polypropylene, ecological and heat-sealable plastic films in general.

The product may be used on all packaging machines with sealing and/or cutting requirements: vertical and horizontal filling machines, shrink wrappers, shoppers, vacuum packing machines, palletizers, etc.

Temperature is controlled directly on the heating element, the control allows the temperature to be maintained even at high speeds, avoids temperature drift between the first seal and the subsequent ones during the production run, and prevents overheating of the support bars and consequent mechanical problems caused by expansion. Any cooling air blow and/or other measures can further increase the speed and improve the quality of the seal.

Thermosald ISX32 is able to heat the heating element via closed-loop phase angle control of the mains frequency or the current supplied by a DC power supply. It reads the voltage and current on the heating element itself, then calculates its resistance and consequently the temperature, which is a function of the resistance itself.

The current for AC models is supplied by a power transformer and by a direct current power supply for DC models.

The thermoregulator is capable of adapting to a very wide range of supply voltages and currents. This architecture enables the user to design the application with virtually no voltage or current limits: the task of correctly sizing the application shifts entirely to the external power supply (see par. 5.6.3.1).

3.3 MAIN TECHNICAL FEATURES

The following is a list of the most important technical and functional features of the new THERMOSALD ISX32 outlining first the new features introduced in this new model followed by those from previous models.

3.3.1 NEW FEATURES OF ISX32 MODELS

- **CERTIFICATION FOR THE NORTH AMERICA/CANADA MARKET**
  Thermoregulator completely re-designed to meet the requirements to access this market.

- **SINGLE VOLTAGE RANGE**
  The low voltage option of the small sized heating elements has been removed: all thermoregulators models operate both at low and high voltages.

- **ETHERNET PORT**
  In order to establish a native connection to the device, providing a communication channel that is always available for several useful services for the user.

- **FIRMWARE UPDATE**
  The firmware can be updated remotely upon user request, enabling 3E s.r.l. to maintain its devices over time and provide customers with the latest versions of the thermoregulator's features.

- **WEB SERVER**
  The presence of a web server natively integrated into the thermoregulator provides users with a web page available in 5 languages for configuration and basic diagnostics, making the need for an operator panel optional.

- **SERVICE**
  Upon user request, the thermoregulator can connect to the network for remote assistance by the 3E Technical Support. Using a dedicated diagnostic tool and coordinating with the user, they will be able to remotely monitor the application to troubleshoot any issues that may arise in the field.

3.3.2 FEATURES INHERITED FROM PREVIOUS MODELS

- **FULLY AUTOMATIC CALIBRATION**
  To perform calibration simply without selectors and trimmers. The thermoregulator adapts to any sealing band used through automatic calibration.

- **DETAILED DIAGNOSTICS FOR TROUBLESHOOTING**
  A powerful diagnostic system alerts the user to any issue that occurs in the machine, ranging from a wiring error during installation to a failure during standard operation.
  On all models, in the event of warnings or alarms, the LEDs flash to indicate exactly the number.
  In all models there is a relay contact that opens in the event of an alarm and disconnect the power supply to the hearing elements.
  On models with a Coprocessor, this contact is made redundant.

- **GROUND CURRENT SENSOR**
  To stop the machine in the event of current leakage from the grounded sealing band and consequent sealing malfunction.

- **ON-LINE ANALYSIS OF RESISTANCE, VOLTAGE, AND CURRENT VALUES OF THE SEALING BAND**
  The device allows you to view and compare theoretical, commissioning, and run time values of resistance, voltage, current, and power to help the operator diagnose any machine problems.

- **ALPHANUMERIC DISPLAY IN 5 LANGUAGES WITH IP65 OPTION**

- **THERMOREGULATOR PARAMETERIZATION WITH DIGITAL TEMPERATURE SETTING AND EDITING OF SEALING PARAMETERS**

- **24VDC LOW VOLTAGE POWER SUPPLY**
  It allows you to use the same thermoregulator regardless of the mains voltage.

- **POWER SUPPLY ON THE TRANSFORMER'S SECONDARY (SAC MODELS) OR FROM A DC POWER SUPPLY UNIT (SDC MODELS)**

- **CALIBRATION IN ENVIRONMENTS WITH SUB-ZERO TEMPERATURES**

- **TEMPERATURE PROBE OPTION FOR ACCURATE CALIBRATION**

- **COMPATIBILITY WITH ALL MAJOR FIELDBUSES**

- **COPROCESSOR OPTION FOR REDUNDANT CONTROL**

- **ONBOARD PLC OPTION WITH SEALING TIMES**
  To allow you to use the thermoregulator with timeframes and internal logic for the complete control of small semi-automatic sealing machines.

- **COMPATIBILITY WITH ALL PREVIOUS MODELS ALSO ANALOG**
  To allow the replacement of obsolete models in the machine and ensure continuity in spare parts.

- ***0-5V or 0-10V ANALOG INPUTS* FOR SETTING PRE-HEATING AND SEALING TEMPERATURE VIA POTENTIOMETER OR PLC ANALOG OUTPUT**

- **0-5V ANALOG OUTPUT TO THE PLC FOR CURRENT TEMPERATURE AND ALARMS**

- **REGULATOR ENABLE**
  To disable the thermoregulator output via software.

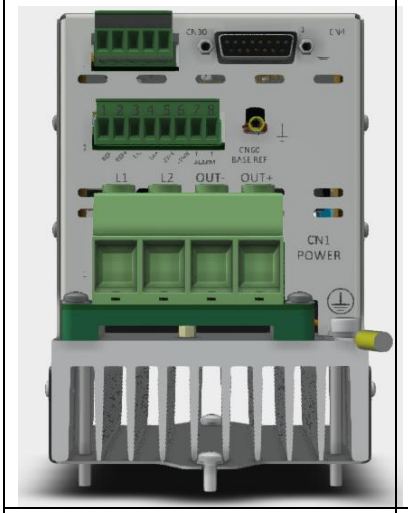
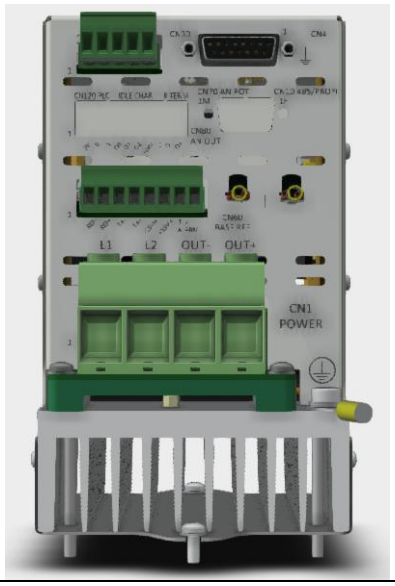
- **POSSIBILITY OF COMPENSATING THE TEMPERATURE OF THE DRIFT SEALING BAND DUE TO THE SEALING AREA BEING MUCH SMALLER THAN THE TOTAL LENGTH**

- **SPEED**
  50/60Hz mains frequency control (AC models)
  250Hz high frequency control (DC models)

- **COOLING**
  The HP models feature automatic device temperature control, which envisages the starting of the cooling fans in the event of device overheating and an alarm in case of cooling system failure.

3.4 CONFIGURATIONS

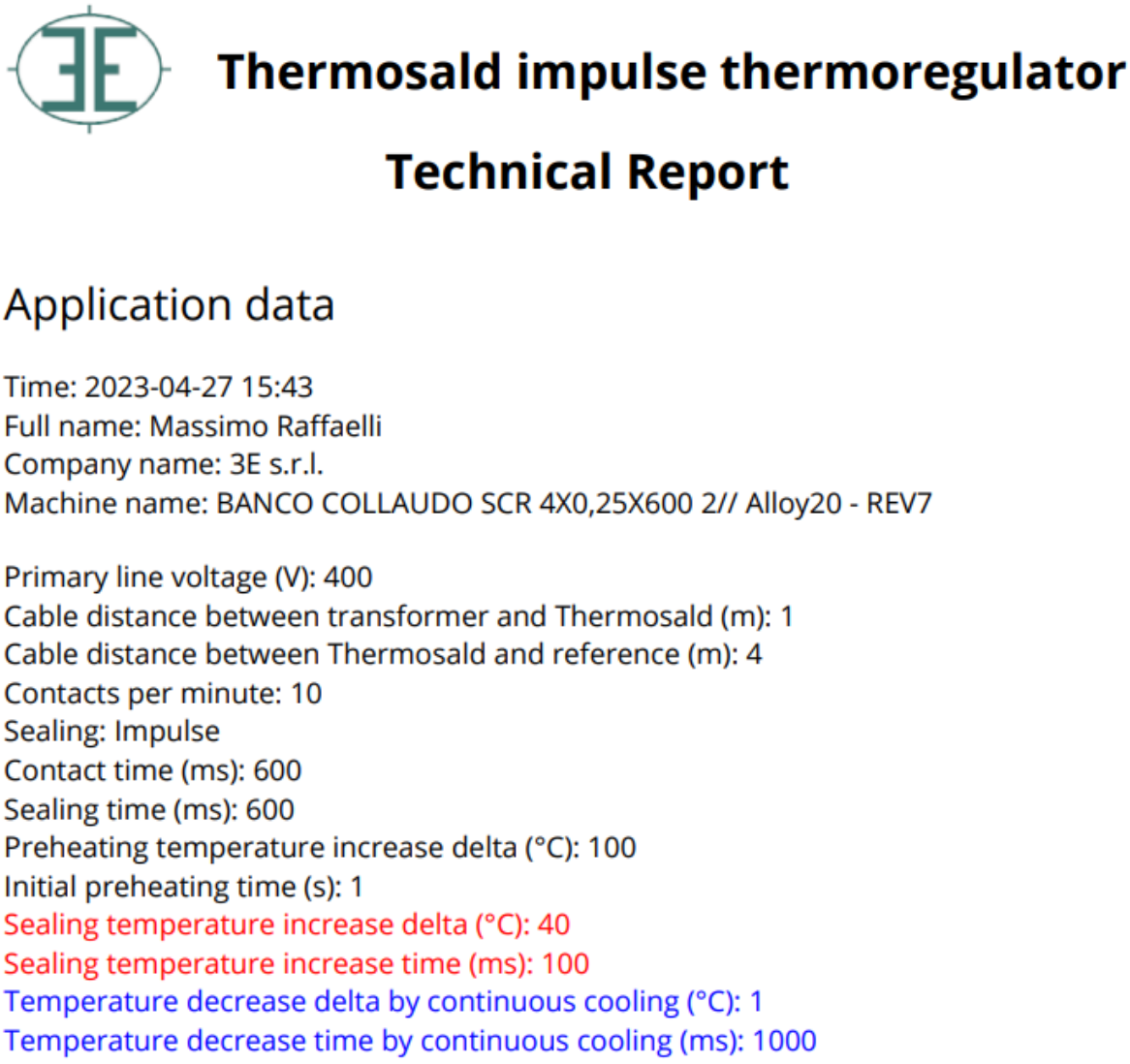
Based on the same core dimensions (see chap. 18), the thermoregulator increases in height to accommodate the necessary options.

<table>
<tr><th>4 LEVELS
(3ES204 models)</th><th>5 LEVELS
(3ES205 models)</th><th>6 LEVELS
(3ES206 models)</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>+1 for FIELDBUS
On BU models except for BU13 (see chap. 7).

+1 FOR ANALOGIC and/or PLC
On AN, PL, and AP models (see chap. 8 and 9).</td><td>+1 FOR COPROCESSOR
On CO models (see chap. 10).
On PR models (see chap. 11), arrangement for temperature probe.</td></tr>
<tr><td colspan="3">INTERFACE LEVEL
On all models.</td></tr>
<tr><td colspan="3">CONTROL LEVEL
On all models.
On PR models (see chap. 11) arrangement for temperature probe.</td></tr>
<tr><td colspan="3">POWER SUPPLY LEVEL
On all models.</td></tr>
<tr><td rowspan="2">POTENZA LEVEL</td><td>ALTERNATING CURRENT
On SAC models.</td><td>DIRECT CURRENT
On SDC models.</td></tr>
<tr><td>STANDARD POWER
On SP models.</td><td>HIGH POWER
On HP models.</td></tr>
</table>

3.5 APPLICATION DEFINITION AND TECHNICAL REPORT

When defining a new application it is advisable to contact 3E for the analysis of the technical problems and the choice of the components to be used. During this stage 3E will be able to draw up the Technical Report with all the relevant information.



Thermosald impulse thermoregulator

Technical Report

Application data

Time: 2023-04-27 15:43
Full name: Massimo Raffaelli
Company name: 3E s.r.l.
Machine name: BANCO COLLAUDO SCR 4X0,25X600 2// Alloy20 - REV7

Primary line voltage (V): 400
Cable distance between transformer and Thermosald (m): 1
Cable distance between Thermosald and reference (m): 4
Contacts per minute: 10
Sealing: Impulse
Contact time (ms): 600
Sealing time (ms): 600
Preheating temperature increase delta (°C): 100
Initial preheating time (s): 1
Sealing temperature increase delta (°C): 40
Sealing temperature increase time (ms): 100
Temperature decrease delta by continuous cooling (°C): 1
Temperature decrease time by continuous cooling (ms): 1000

Figure 1

4 INTERFACES

There are several modes that allow interaction with the thermoregulator to activate commands, configure it, or diagnose its operation.

- LED interface (see par. 4.1)
- Wired command interface (see par. 5.5)
- Integrated web server (see par. 4.2)
- Multilanguage panel (see par. 4.3)
- Service (see par. 4.4)
- Fieldbus (see chap. 7)
- Analog (see chap. 8)

4.1 LED INTERFACE

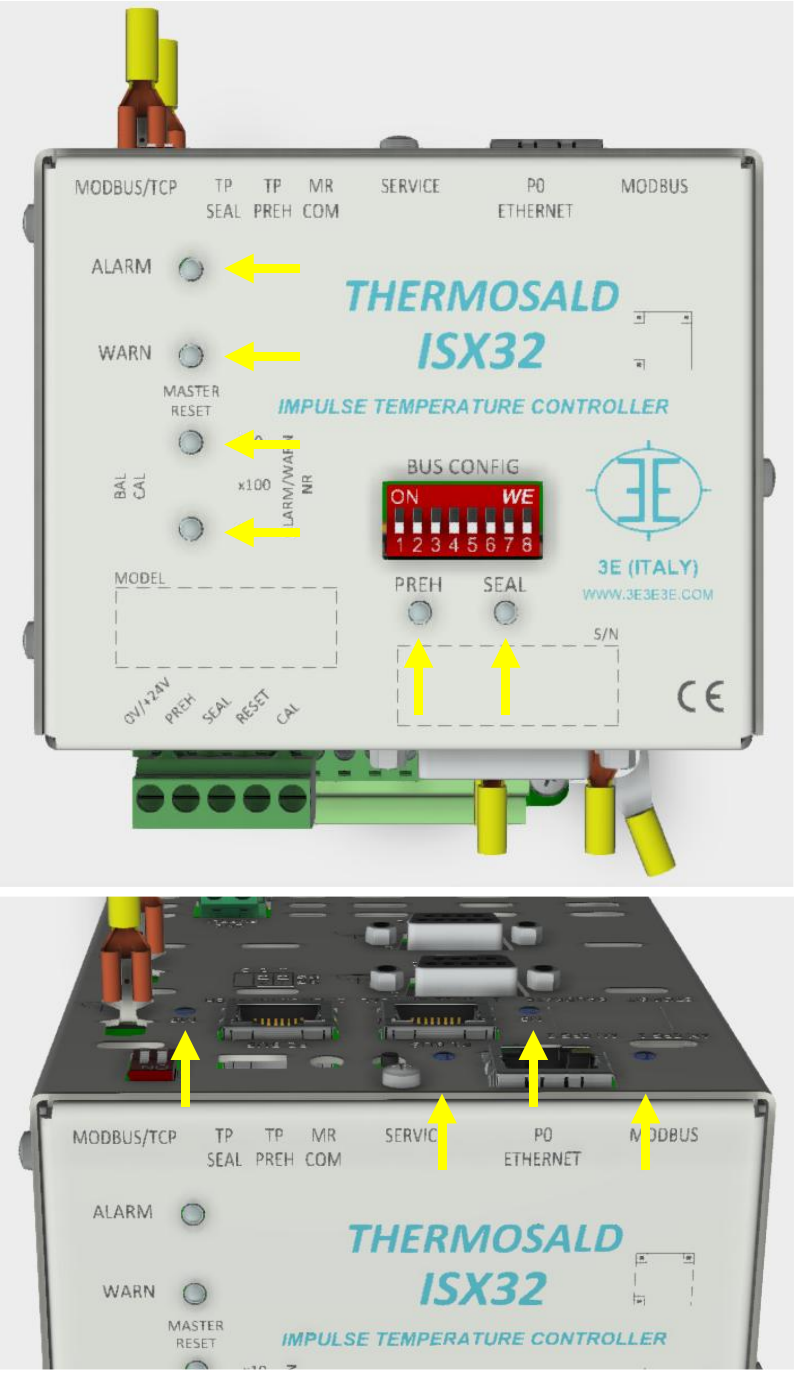


Figure 2

Previous figure shows the LED interfaces that are on the device's upper and lower guard. For further details, please refer to next chapters.

4.2 INTEGRATED WEB SERVER

The integrated web server is accessible on the Ethernet port of the device (see par. 5.3) on any browser by digiting the IP address or the name of the device. The thermoregulator web page is as shown in Figure 3.

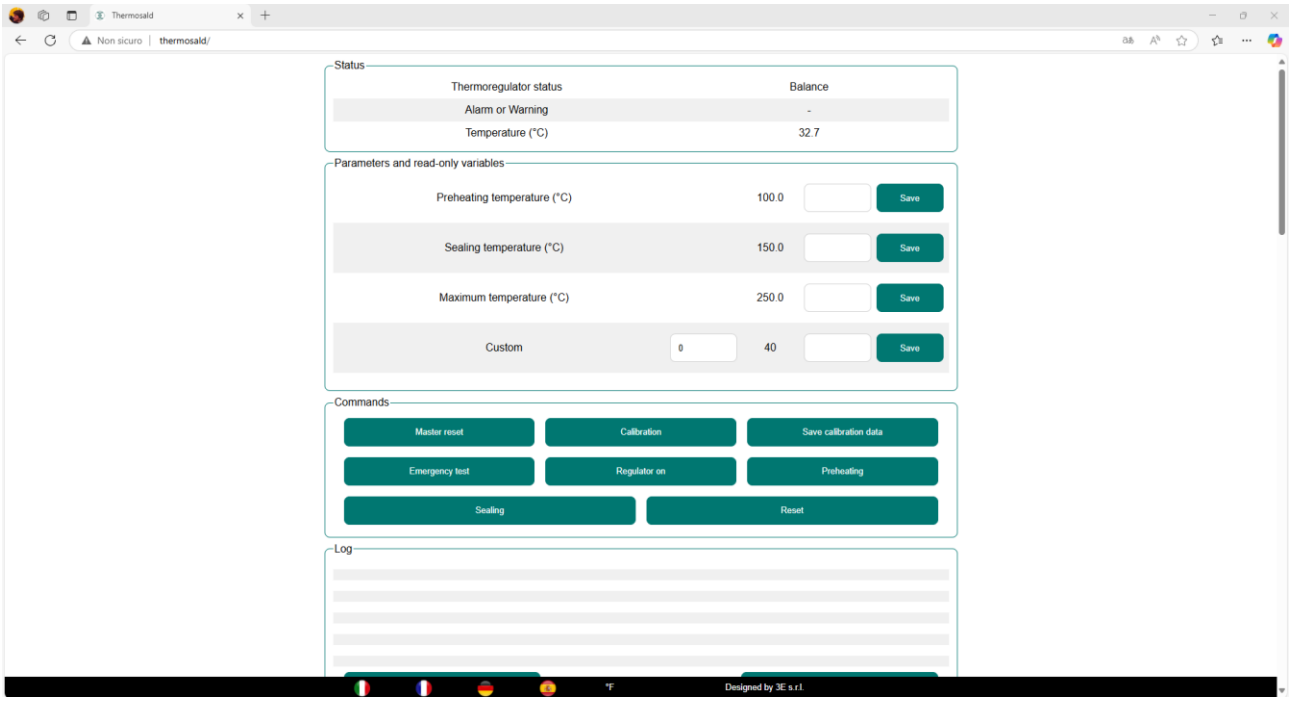


Figure 3

As shown in Figure 4, the “custom” box is available that enables the user to read or write any parameter or read-only variable of the thermoregulator.

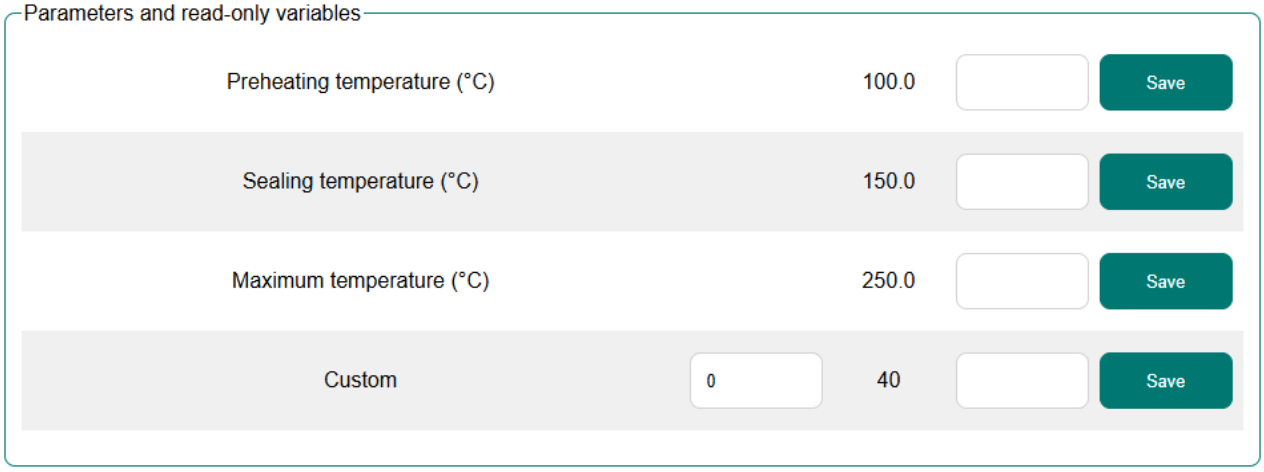


Figure 4

As shown in Figure 5 an integrated oscilloscope is available, allowing users to plot and analyse the heating element's behaviour by displaying temperature, voltage, and current.



Figure 5

For further details, please refer to next chapters.

4.3 MULTILANGUAGE PANEL



Figure 6

The diagram in Figure 7 shows the menu structure of the panel starting from the main page to the different submenus.

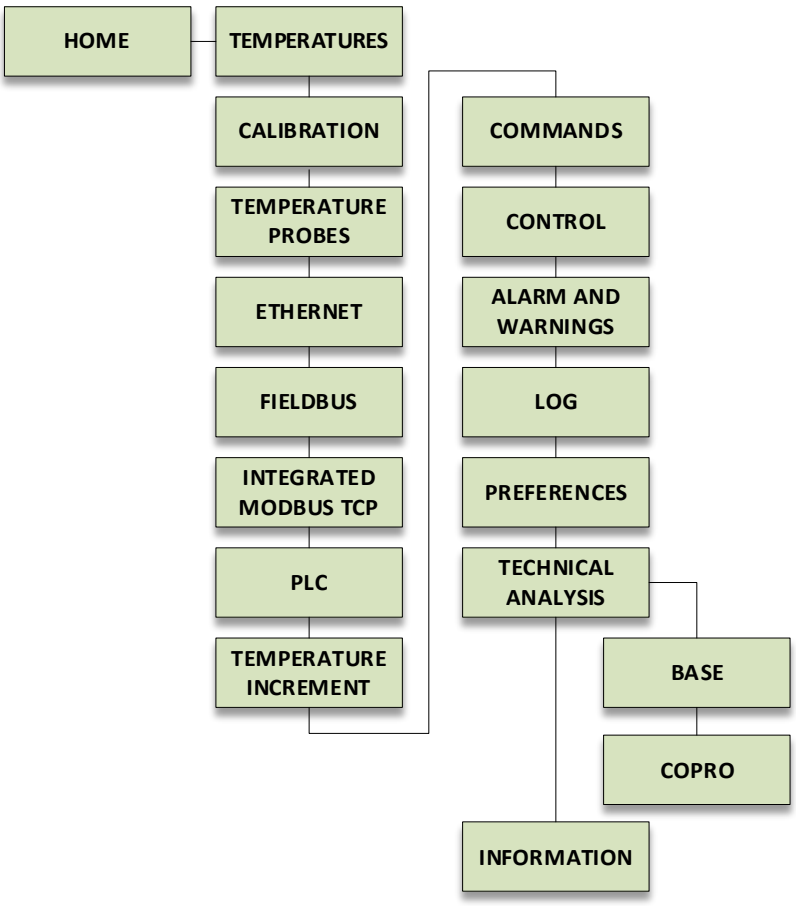


Figure 7

Below is some general information on using the multilingual panel. For further details, please refer to next chapters.

4.3.1 BROWSING

To access the pages of a submenu, press the MODE key (see Figure 8 and Figure 9) and then the “UP ARROW” or “DOWN ARROW” keys (see Figure 10).

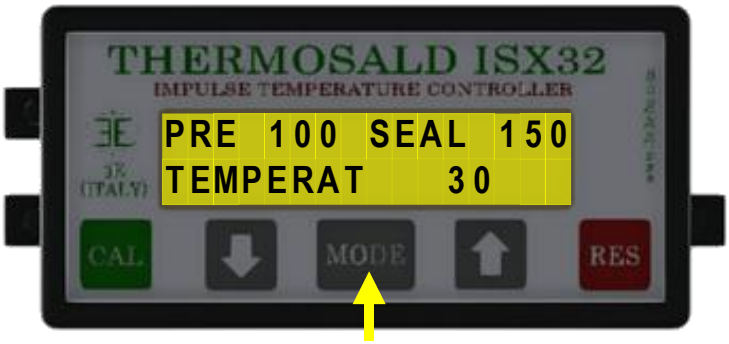


Figure 8

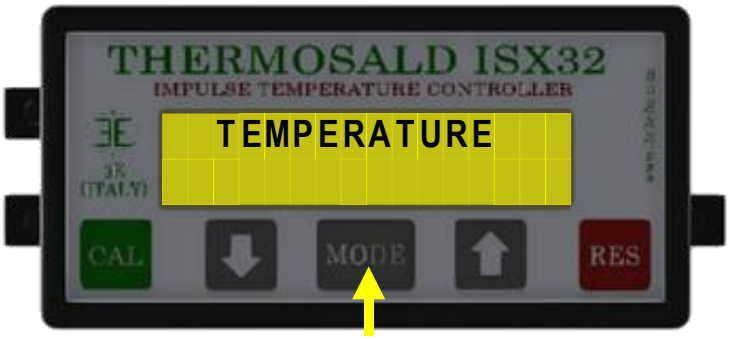


Figure 9

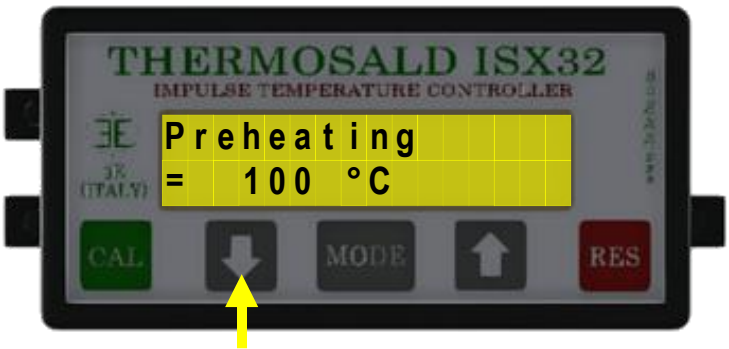


Figure 10



Figure 11

From any page, pressing the RES button (see Figure 12 and Figure 13) repeatedly allows you to return to the home page (see Figure 14).



Figure 12

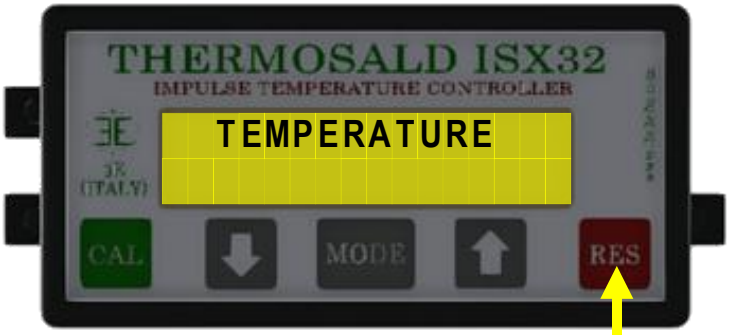


Figure 13

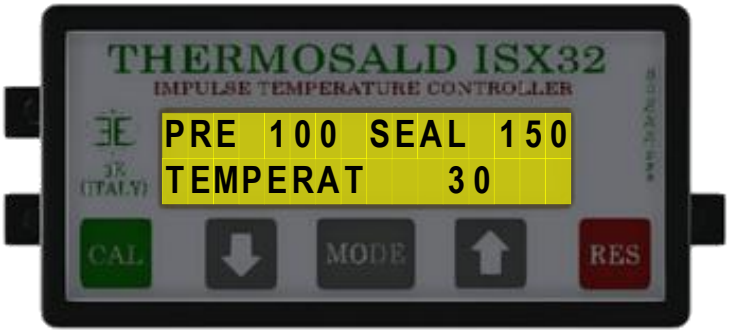


Figure 14

4.3.2 Editing a parameter

Proceed as follows to edit any displayed parameter:

1) Touch the MODE button to access the edit status:

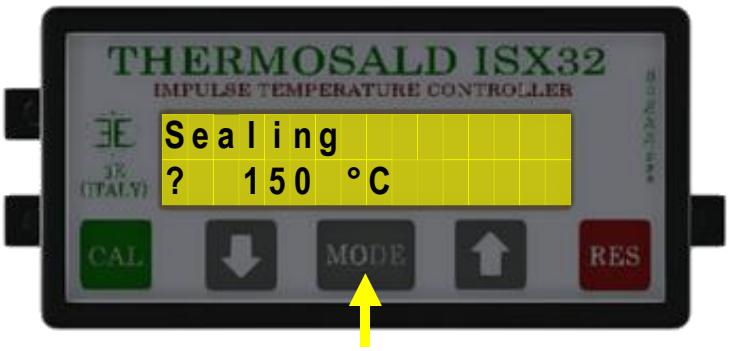


Figure 15

2) Press “UP ARROW” or “DOWN ARROW” keys to change the data:

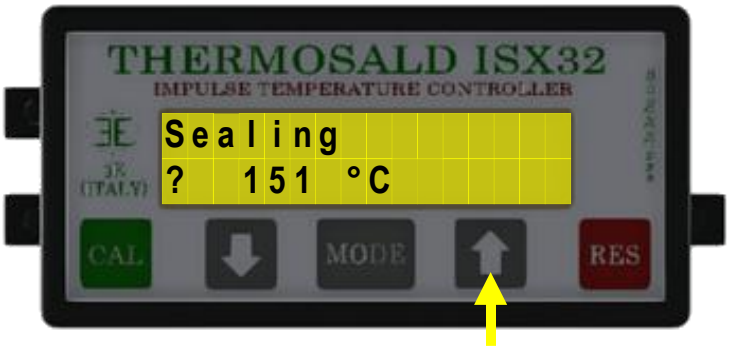


Figure 16

3) Press the MODE button to exit the edit status:

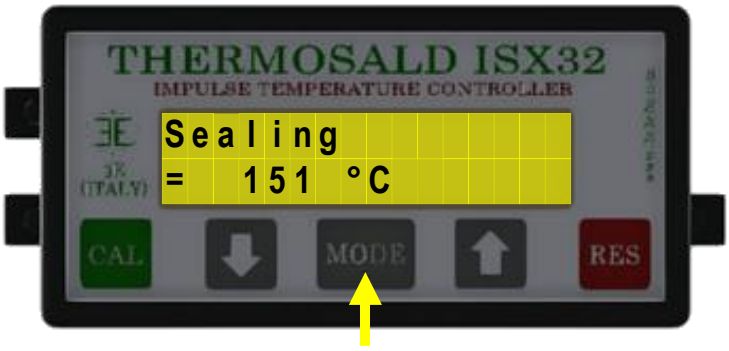


Figure 17

4.3.3 DIAGNOSTICS

The following table shows the various diagnostic messages that may appear on the panel that warn the user about any problems about its operation.

MESSAGE	DESCRIPTION
…	No data received from the thermoregulator. Contact 3E Technical Support.
>>>	Panel firmware update in progress. Wait until the update is complete.
!!!	Panel firmware update error. Contact 3E Technical Support.

4.4 SERVICE

Service is a dedicated tool for 3E Technical Support that allows the user to connect to the Thermosald via the device's Ethernet port, whether it is located on the same local network or on a remote network connected to the Internet.

The features provided by the Service tool are:

- Device advanced control
- Device advanced diagnostics
- Device and display firmware update

4.4.1 Point-to-point or local network connection of the Service

You only need to start the Service to connect to the thermoregulator and then select the required device. The device can be identified via its IP or name.



When the thermoregulator is connected to the Service it is advisable to coordinate with 3E Technical Support before taking any action on the device. A dedicated LED lights up when the connection to the Service is established (see par. 6.4.1).

4.4.2 Service remote connection

To connect to the thermoregulator, the remote connection must be enabled via the button on the device (see Figure 18) or via webserver (see Figure 19).
The port used by the service is TCP 49445 and the destination server is www.3e3e3e.com.

Now service can be started and the required device can be selected. The device can be identified via its IP or it serial number.

When the remote connection with the Service is established, it is advisable to coordinate with 3E Technical Support before taking any action on the device. A dedicated LED lights up when the remote connection is established (see par. 6.4.1).



Figure 18



Figure 19

5 CONNECTIONS

The following chapter features the thermoregulator connections that are always available on all models. If a model with fieldbus is used (see chap. 7), Analogic (see chap. 8) or PLC (see chap. 9) additional connections are available and reference is made to the dedicated chapters for their details.

Before making any CONNECTIONS you should carefully have read chapter 2 - SAFETY WARNINGS AND CERTIFICATIONS

This device must be installed in accordance with the requirements of the IEC - EN60204 standard.

5.1 FIXING THERMOREGULATOR



Screw the thermoregulator by means of the appropriate fixing holes inside the electrical panel on a grounded metal plate.

The thermoregulator must be installed in a vertical position, protected from agents such as dust, water, corrosive acids.

Connect the protective earth to the PE bolt of the thermoregulator, marked by the yellow/green indicator on the heat-sink, using a wire with a core section greater than or equal to that of the power cables (see par. 5.6.3.10.2). It is advisable to connect the ground conductor directly to the metal support plate as close as possible.

The device does not require a specific ventilation but it must be installed in a sufficiently ventilated area.

5.2 24V DC POWER SUPPLY CONNECTION

The CN2 port (see Figure 20 and Table1) provides the thermoregulator with its 24VDC main operating power supply. The maximum cable length is 30 meters.

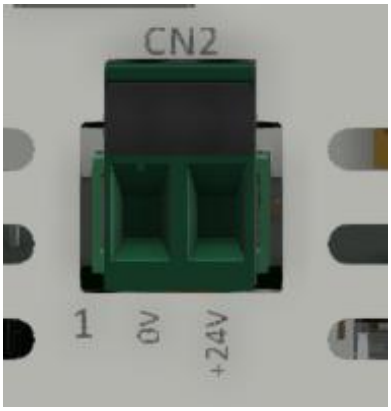


Figure 20

CN2 SUPPLY			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN 1	0 V	0 VDC	24 VDC +/- 15% (0.5A max consumption) 0 VDC (isolated from ground) Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN 2	+24 V	24 VDC	

Table1

5.3 Ethernet port connection

The P0 ETHERNET port may be used through a standard RJ45 connector (see Figure 21). The maximum cable length is 30 meters.
The maximum speed supported by the Ethernet port is 100 Mbps, the LEDs on the RJ45 connector indicate the network activity.
As previously mentioned, the Ethernet port is natively present on all models and it is used for various functions the details of which are specified in the next chapters.
For the configuration of the Ethernet parameters and the detailed diagnostics, please refer to par. 6.4.

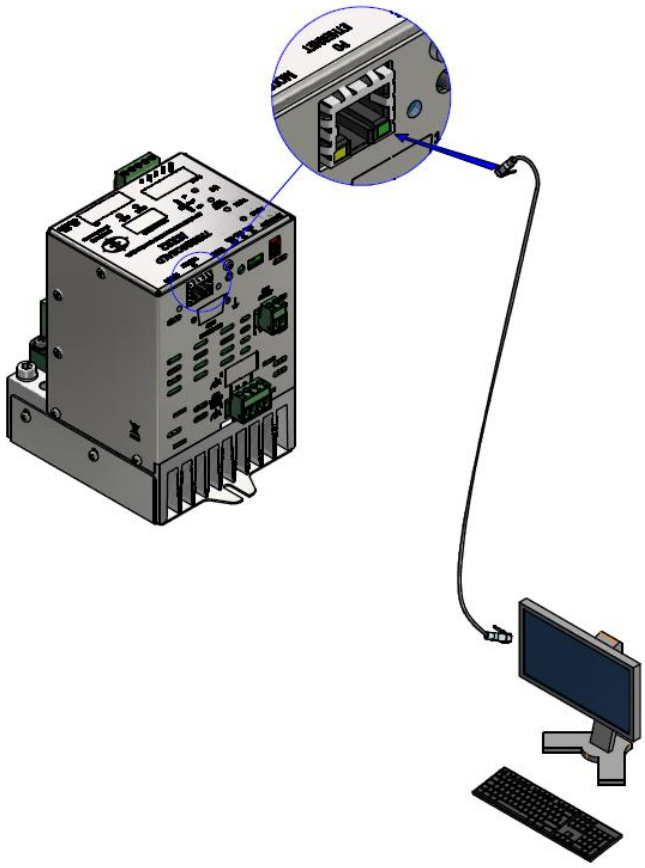


Figure 21

5.4 CONNECTION TO OPERATOR PANEL

The CN4 port for the connection to the operator panel (see Figure 22) is natively available on all models but the use of the panel is optional and not essential for the operation of the thermoregulator. The operator panel is therefore supplied as an optional (see par. 19.1).

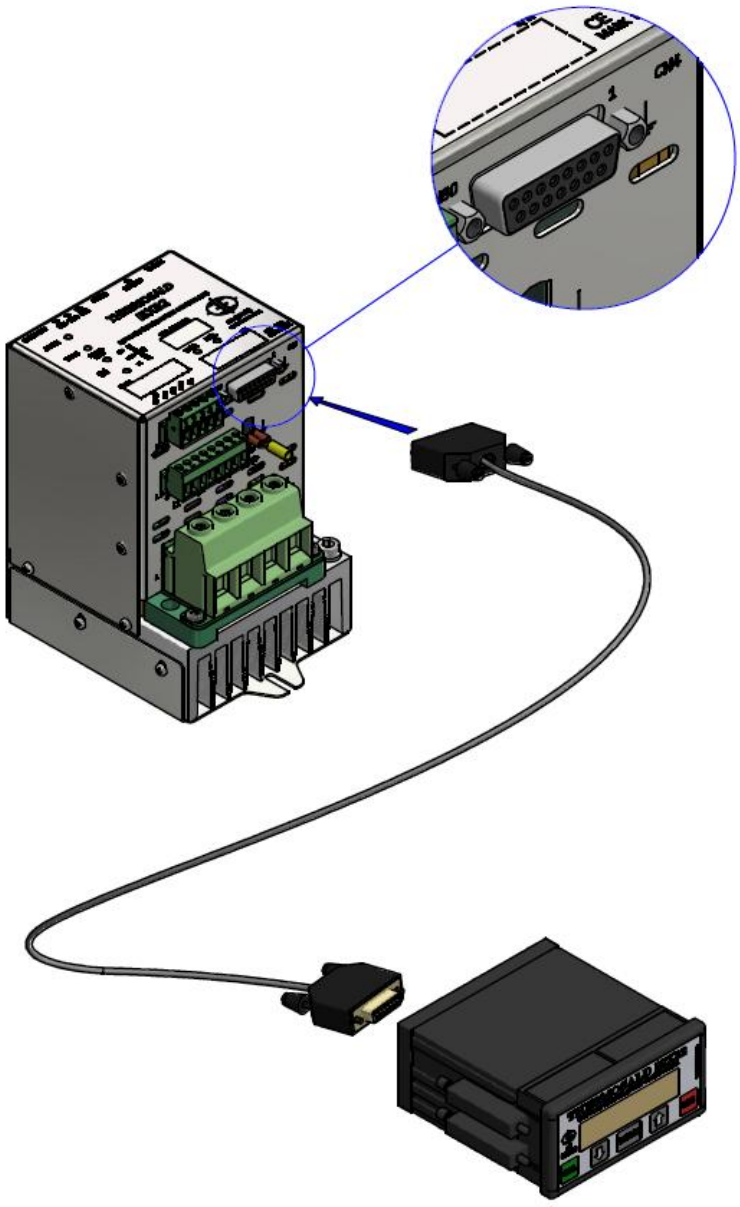


Figure 22

For the connection, it is advisable to use the cables supplied by 3E available in various lengths (see par. 19.1).

Table2however, shows the connector pinout if you wish to carry out the wiring independently. The following precautions must be kept in mind

- The connection cable between the thermoregulator and the display panel must be shielded with pin-to-pin connection on the thermoregulator side.
- The cable section must be at least 0.25 sq. mm for a maximum length of 20 m or at least 0.35 sq. mm for a maximum length of 50mt.
- If the cables are longer than 10 meters, we recommend doubling the power cables connected to PIN1 and PIN2.
- The maximum cable length is 30 meters.



Figure 23

CN4			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	+5 VDC	5 Vdc power supply	
PIN2	0 V	0 Vdc power supply	
PIN3	SPI-SDO	Communication	
PIN4	SPI-SCK	Communication	
PIN5	SPI-SDI	Communication	
PIN6		Reserved do not use	
PIN7			
PIN8			
PIN9	SPI-SS	Communication	
PIN10		Reserved do not use	
PIN11		Reserved do not use	
PIN12		Reserved do not use	
PIN13		Reserved do not use	
PIN14		Reserved do not use	
PIN15		Reserved do not use	

Table2

5.5 DIGITAL COMMAND CONNECTIONS

The standard wired commands interface is always available on all models (see Figure 24and Table3). The maximum cable length is 30 meters.
If Fieldbuses are present (see chap. 7), these commands are also available via software and the wired connection can be avoided. We recommend software-based control only if the fieldbus can ensure real-time communication. For further details on the use of wired commands see par. 6.6.

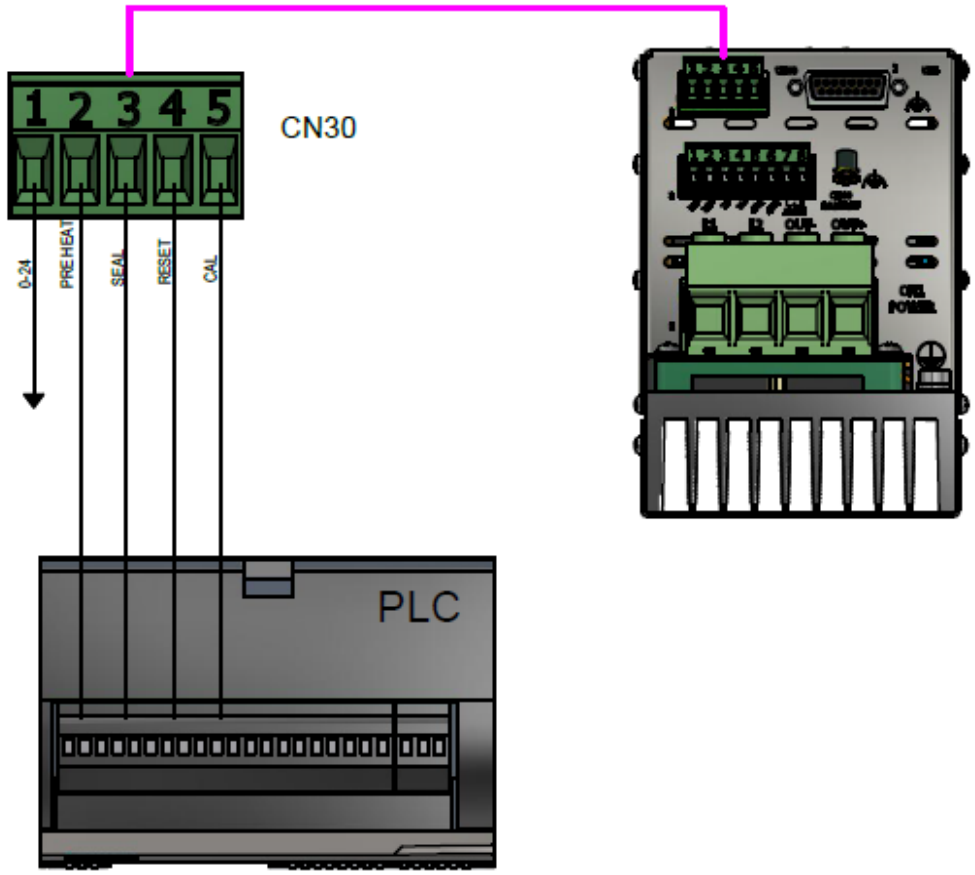


Figure 24

CN30			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	0 V/+24 V	COMMON 0V for active high signals 24V for active low signals	Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN2	PREH	PREHEATING INPUT Active=24V if PIN1=0V Active=0V if PIN1=24V	10 mA max @ 0/24 VDC Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN3	SEAL	SEALING INPUT Active=24V if PIN1=0V Active=0V if PIN1=24V	
PIN4	RESET	RESET INPUT Active=24V if PIN1=0V Active=0V if PIN1=24V	
PIN5	CAL	CALIBRATION INPUT Active=24V if PIN1=0V Active=0V if PIN1=24V	

Table3

5.6 POWER CONNECTIONS, VOLTAGE REFERENCES, CURRENT SENSOR, AND ALARM CONTACT

Following paragraphs show the different connection diagrams based on the thermoregulator model used.

The following table shows the meaning of the symbols used in the power connection diagrams as per following paragraphs.

KA0	Auxiliary relay for alarm output to PLC and emergency contactor
KM0	Emergency contactor
SB	Emergency contactor reset button
SE	E-Stop mushroom-shaped button

5.6.1 POWER CONNECTIONS - AC CONTROL ON SECONDARY (SAC Models)

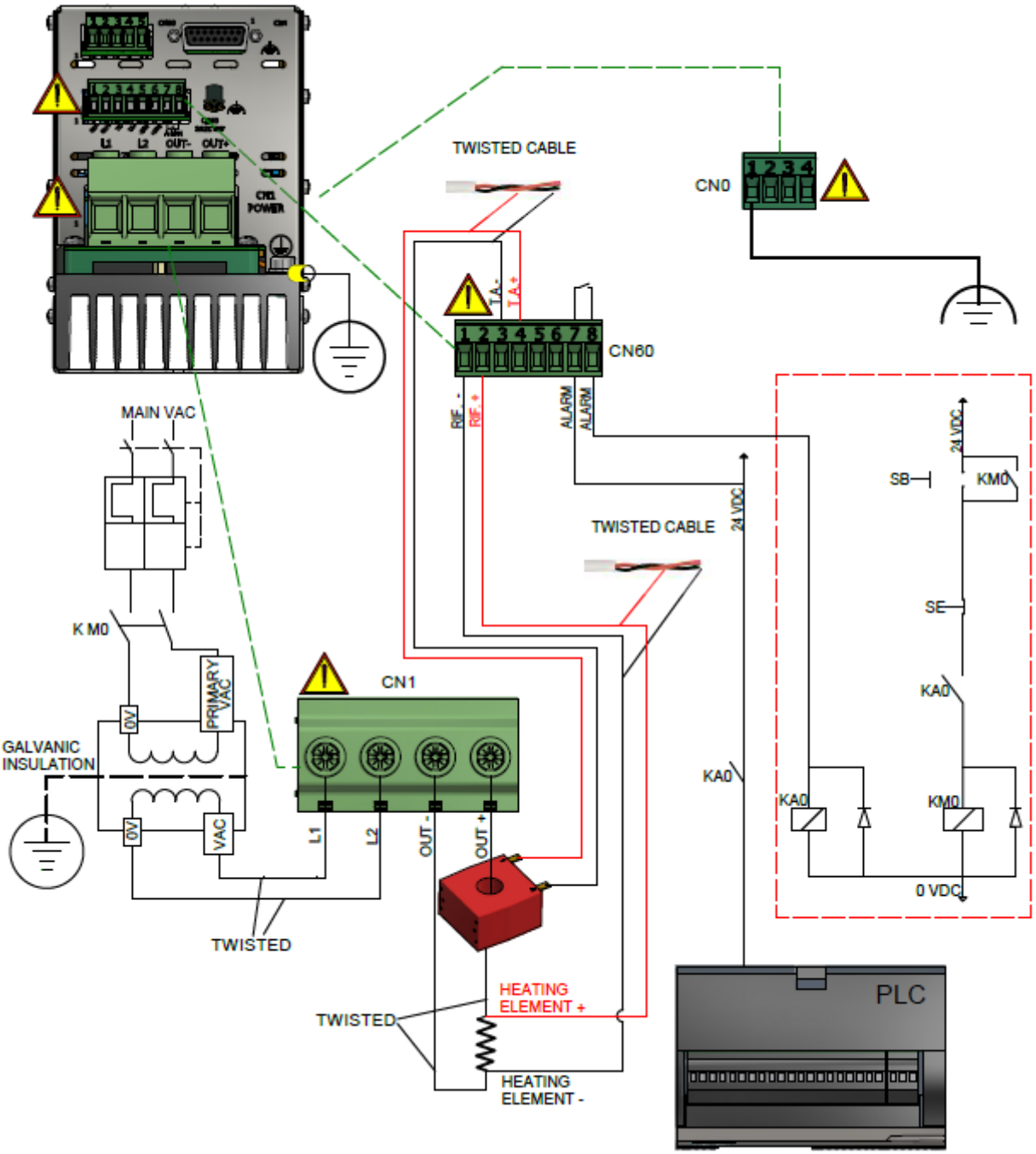


Figure 25

5.6.2 POWER CONNECTIONS - DC CONTROL (SDC Models)

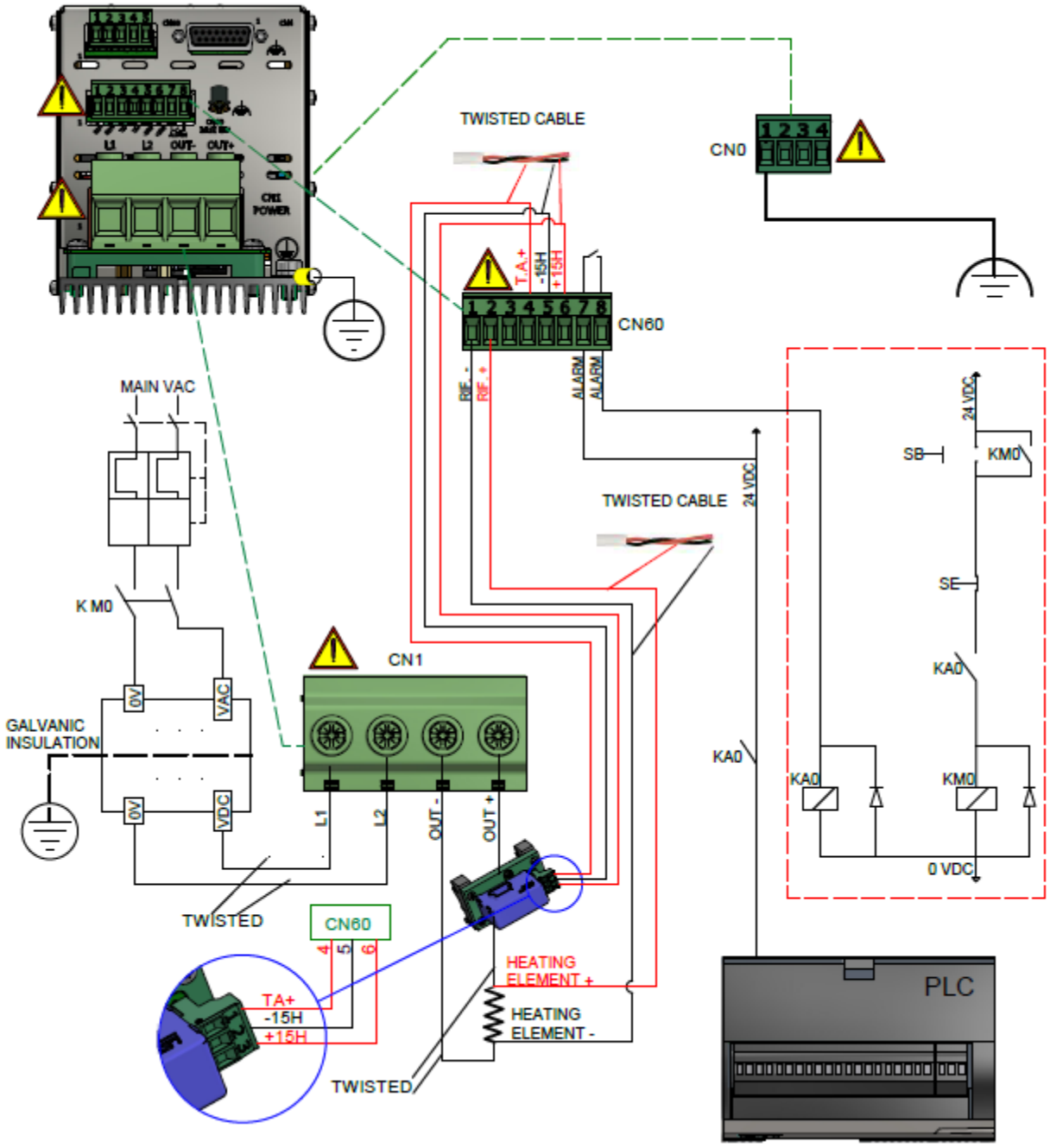


Figure 26

5.6.3 CONNECTIONS TECHNICAL NOTES

The following is a list of all the components needed to make the final application and some important technical tips.

Before carrying out any operation, disconnect the electrical panel and check that there is no voltage at the mains connection terminals.

5.6.3.1 Power transformer, DC PSU



The power transformer (SAC models) or the DC PSU (SDC models) are used to power the sealing bar as shown in the previous diagrams: in general, the choice of the power transformer model or power supply unit depends on the geometric characteristics of the heating elements, their wiring configuration if multiple elements are used, the operating temperatures, and the cycle times of the final application.

In both cases, galvanic isolation between the input and output of the power supply is required to prevent operator electrocution in the event of contact with the heating element. It remains understood that the heating element is to be considered a non-accessible part during operation, while maintenance on the heating element itself must always be performed with the machine powered down.

It is recommended to size the power transformer or DC power supply unit together with 3E based on the information of the Technical Report (see par. 3.5).

The transformer or power supply unit suggested in the Technical Report must always be properly verified on the final application.

It is recommended to place the transformer or DC power supply unit in the same enclosure as the thermoregulator and adjacent to it.
Generally, there are no constraints on the maximum cable length for the transformer, whereas for the DC power supply unit, the maximum expected length is 30 meters

Cables must be twisted. Practical experience across numerous applications has shown that composite cables can be used as an alternative to the twisted pair.

To make the correct choice of the power cables' core section, refer to the “Technical Report” (see par. 3.5).

5.6.3.1.1 Constructional notes on the power transformer (SAC models)

It is advisable to use transformers with overlapped windings to improve the magnetic coupling between primary and secondary. Envisage the screen between primary and secondary to avoid mains voltage leakage on the secondary and improve noise immunity. The screen must be grounded using an appropriate cable.
The transformer structure is grounded by mechanical fastening to the metal plate of the cabinet, which in turn shall be properly grounded.

5.6.3.1.2 DC power supply unit (SDC models)

Unlike the power transformer, when the power supply is interrupted, the DC power supply unit may cause a noticeable delay in turning off the output. It is recommended to verify that this delay is compatible with the application, to prevent the thermoregulator, when it still detects input power, from continuing to pulse the heating elements unintentionally.

5.6.3.2 POWER LINE PROTECTIONS

It is recommended to size the protections using a suitable device based on the estimated real RMS current of the application (see Technical Report) rather than on the full-wave current.



The protections suggested in the Technical Report must always be properly verified on the application.

5.6.3.2.1 SAC Models

Install a D-curve thermal-magnetic circuit breaker (or a time-delay fuse) on the transformer's primary winding to disconnect the mains as indicated in the diagrams par. 5.6.1.
To select the protection, refer to the “'Theoretical RMS current on the primary (A)” value reported in the protection section of the 'Technical Report' (see par. 3.5).
Due to the inrush current or the “Theoretical full-wave RMS current on the primary (A)”, which are higher than the previously mentioned value, it may be necessary to increase the protection size.
To test system safety, it is necessary to verify that the short circuit at the thermoregulator input between PIN1 and PIN2 of CN1 (see par. 5.6.3.4) triggers the protection."

At the engineer's discretion, to increase system safety, a protection device (thermal-magnetic circuit breaker or fast-acting fuse) can also be provided on the transformer's secondary.
To select the protection, refer to the “Theoretical RMS current (A) on the secondary” value reported in the protection section of the 'Technical Report' (see par. 3.5).
Due to the “Theoretical full-wave RMS current (A) on the secondary”, which is higher than the previously mentioned value, it may be necessary to increase the protection size.
To test system safety, it is necessary to verify that the short circuit at the thermoregulator input between PIN1 and PIN2 of CN1 (see par. 5.6.3.4) triggers the protection."

5.6.3.2.2 SDC Models

To select the protection devices for isolating the mains as indicated in the diagrams in par. 5.6.2, refer to the DC power supply unit manual.

To select the protection on the secondary, refer to the “Theoretical RMS current (A) on the secondary” value reported in the protection section of the 'Technical Report' (see par. 3.5).
If the DC power supply unit output is not equipped with a suitable protection, you need to install a protection (Curve D thermal-magnetic circuit breaker or a time-delayed fuse) on this port.

Due to the “Theoretical full-wave RMS current (A) on the secondary”, which is higher than the previously mentioned value, it may be necessary to increase the protection size.

To test system safety, it is necessary to verify that the short circuit at the thermoregulator input between PIN1 and PIN2 of CN1 (see par. 5.6.3.4) triggers the protection."

5.6.3.3 MAINS FILTER

For Thermosald ISX32, which works by reducing the mains wave on the transformer's secondary, there are no cases of interference with other nearby devices; as such, you can avoid installing the mains filter, in compliance with EMC regulations.

5.6.3.4 POWER CONNECTOR

CN1 POWER


WARNING HAZARDOUS VOLTAGES

PIN	NAME	DESCRIPTION	NOTES
PIN1	L1	ALTERNATING POWER SUPPLY (Models with SAC option) DC + POWER SUPPLY (Models with SDC option)	For detailed information on the power supply see Table5. Max cable section: 35 mm² Max. torque: 2.5 Nm
PIN2	L2	ALTERNATING POWER SUPPLY (Models with SAC option) DC - POWER SUPPLY (Models with SDC option)	
PIN3	OUT-	HEATING ELEMENTS -	
PIN4	OUT+	HEATING ELEMENTS +	

Table4

POWER SUPPLY	**SAC Models:** 4V-140V POWER TRANSFORMER SECONDARY MAINS FREQUENCY: 50–60Hz with automatic recognition **SDC Models:** 2V-140V DC POWER SUPPLY UNIT
FULL-WAVE RMS CURRENT	**SAC SP Models:** 10A-360A **SAC HP Models:** 10A-360A **SDC SP Models:** 5A-125A **SDC HP models:** 5A-200A
MAX. RMS CURRENT	**SAC SP Models:** 80A **SAC HP Models:** 125A (UL 125A, IEC 125A) **SDC SP Models:** 25A **SDC HP models:** 80A

Table5



The power supply secondary must be dedicated to a single thermoregulator and must be left floating.
If the thermoregulator is used inside a UL508 panel, this panel must be classified as an 'Industrial Control Panel'.

This secondary is referenced to earth through the thermoregulator itself: PIN2 and PIN3 of connector CN1 (see Table4) are connected to earth internally with a total resistance of 10,200 Ω via PIN1 of connector CN0 (see Figure 27 e Table6).

5.6.3.5 CN0 CONNECTOR

CN0 EARTH WARNING HAZARDOUS VOLTAGES			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	EARTH	FUNCTIONAL EARTH FOR GROUND LEAKAGE DETECTION	The connection of this pin is recommended but optional. Alternatively, it is possible to connect an RCD to PIN1 and PIN2 of connector CN1 (see Figure 8 and Table 4). Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN2		Do not use	
PIN3		Do not use	
PIN4		Do not use	

Table6

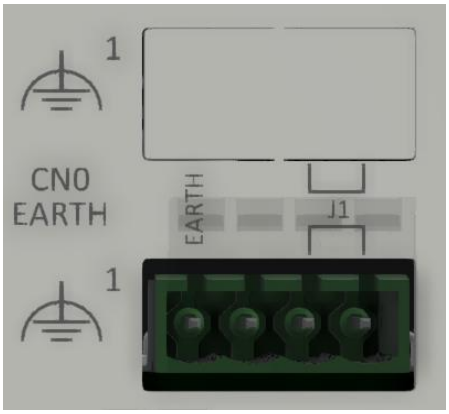


Figure 27

5.6.3.6 REFERENCES AND ALARM CONNECTOR

CN60 BASE REF


WARNING HAZARDOUS VOLTAGES

CN61 COPRO REF


WARNING HAZARDOUS VOLTAGES

PIN	NAME	DESCRIPTION	NOTES
PIN1	REF-	REFERENCE VOLTAGE -	1mA max Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN2	REF+	REFERENCE VOLTAGE +	
PIN3	A.T.-	SENSOR CURRENT -	400mA max Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN4	A.T.+	SENSOR CURRENT +	
PIN5	-15VH	SENSOR CURRENT - POWER SUPPLY (Models with SDC option)	150mA max Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN6	+15VH	SENSOR CURRENT + POWER SUPPLY (Models with SDC option)	
PIN7	ALARM	ALARM (N.O. CONTACT)	5A @ 30 V Max cable section: 2.5 mm² Max. torque: 0.6 Nm
PIN8	ALARM	ALARM (N.O. CONTACT)	

Table7

With reference to Table7 and Figure 28, for models with the CO option, an additional reference cable for voltage feedback from the heating elements and an additional reference cable for current feedback from an additional external current sensor must be connected to CN61, similarly to CN60.
The coprocessor alarm contact must also be connected to the safety chain in series with the main alarm contact of connector CN60.

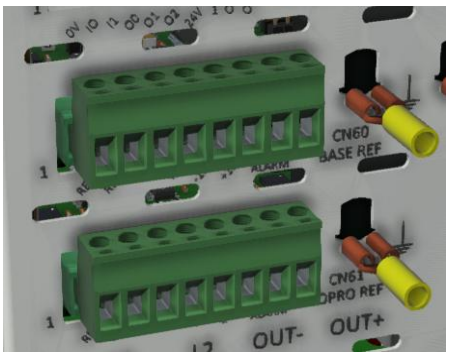


Figure 28

5.6.3.7 Current transformer (SAC Models)



The current transformer must be mounted inside the electrical panel near the thermoregulator.
Pins 4 and 1 of the current transformer must be connected respectively to PIN3 and PIN4 of the CN60 connector (and CIN61 for the CO models) by means of a twisted cable, as shown in par. 5.6.1. Alternatively, a composite cable can be used.
The suggested cable section is 1 sq. mm, for further information, please refer to Table7.
For the correct orientation of the C.T. see par. 5.6.1.



For the connection to PIN4 and PIN1 of the current transformer, you need to use the quick-connect terminals supplied with it, which feature an appropriate locking system. Then, electrically insulate the connection area to prevent operator electrocution, using the heat-shrink sleeve and the protection cover supplied (see Figure 29).

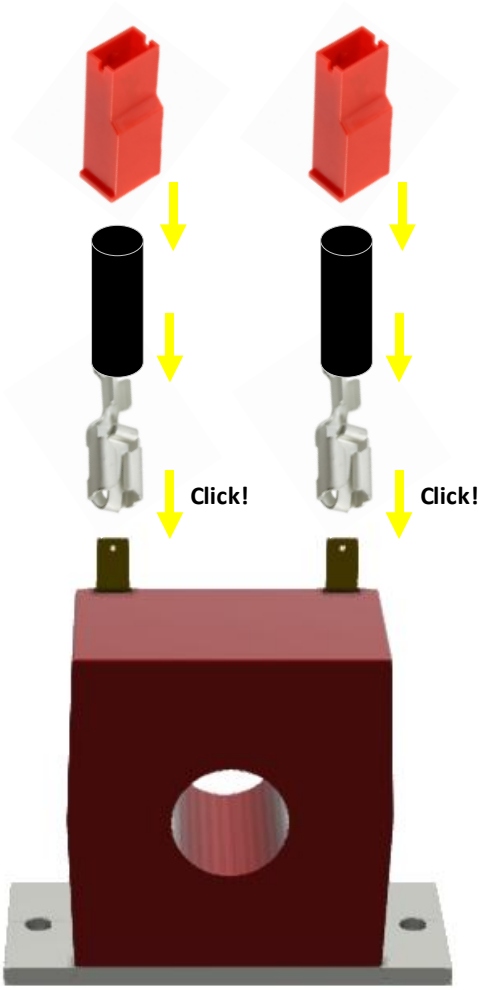
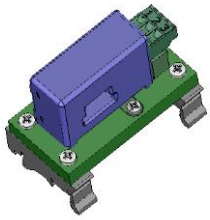


Figure 29

5.6.3.8 Current sensor (SDC models)



The current sensor must be mounted inside the electrical panel near the thermoregulator.
PIN1, PIN2, AND PIN3 must be connected respectively to PIN4, PIN5, and PIN6 of the CN60 connector (and CIN61 for the CO models) by means of twisted cables, as shown in par. 5.6.2. Alternatively, a composite cable can be used.
The suggested cable section is 1 sq. mm, for further information, please refer to Table7.
For the correct orientation of the C.T. see par. 5.6.2.

Pay close attention to the wiring, as an incorrect configuration could damage the sensor or thermoregulator circuits.

5.6.3.9 SAFETY CHAIN WIRING

The safety chain must be made as shown in the base drawing (see par. 5.6). The maximum cable length is 30 meters.

The emergency output contact of the thermoregulator opens in the event of an alarm and must interrupt the thermoregulator's power supply. It is suggested to perform this interruption electromechanically by means of a power contactor suitably sized for the currents involved, without going through the PLC, then simultaneously sending the information to the PLC.



This approach allows the thermoregulator to intervene in no time directly on the power supply, independently from the PLC software management.

In the very rare case of failure of the electronic power switch inside the thermoregulator, the contactor is the only way to avoid uncontrolled overheating up to the breakage of the sealing elements.
This fault can be simulated by short-circuiting PIN1 and PIN4 of the power terminal strip (see par. 5.6**).**



Provide for an emergency stop button as indicated in the diagrams (par ref. 5.6); this button must have a non-automatic reset, and be located in a non-hazardous area easily accessible to the operator; it must stop sealing and cut off power immediately.



Disconnect the thermoregulator power circuit when the machine's mechanical protections are open.

5.6.3.10 SEALING BARS WIRING

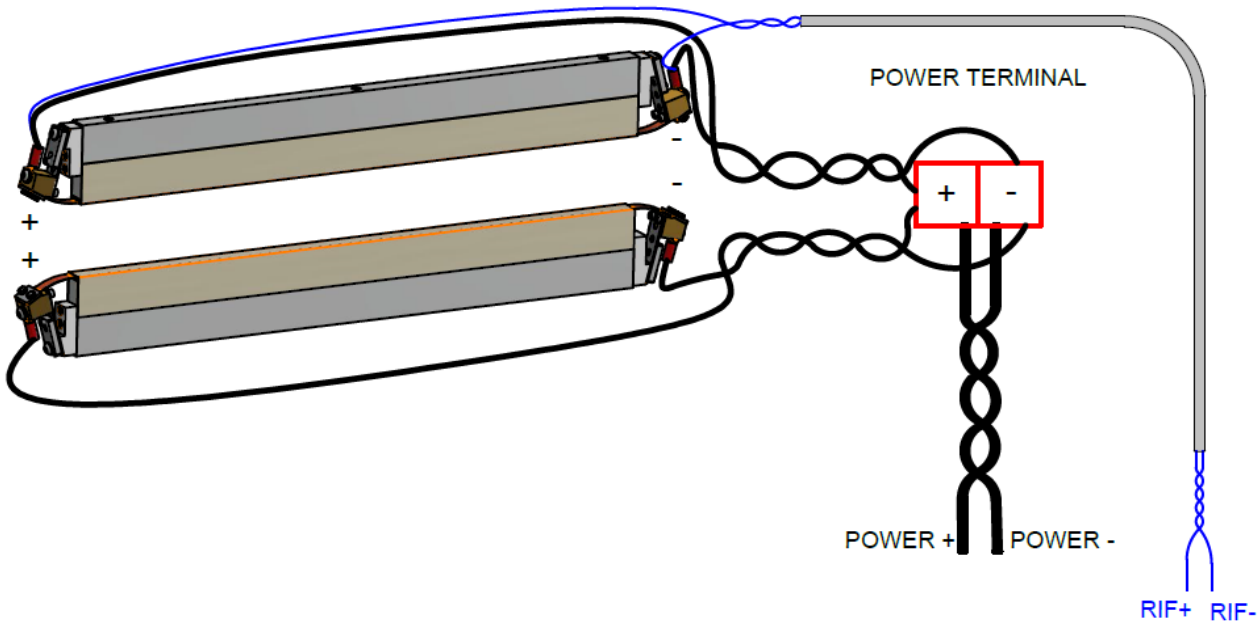


Figure 30

5.6.3.10.1 Sealing bars

As outlined in chapter 2, the thermoregulator does not constitute a safety element. Due to a control circuit failure, the heating element temperature could increase indefinitely until it breaks, resulting in the interruption of the heating current. We recommend considering this scenario in the risk analysis of the application.

Make sure that the bars provide excellent insulation of the sealing element to earth so as to avoid areas with overtemperatures (see par. 6.11.1). To avoid short circuits, it is advisable to position and/or treat the heating elements so that there is no accidental contact with the machine's metal structure.

It is essential to ensure that the opposing sealing rods are perfectly aligned so as to avoid areas with overtemperatures (see par. 6.11.1**).**

5.6.3.10.2 Power cables



It is essential to ensure optimal contact for all power connections.



It is essential to ensure that on opposing heating bars the heating elements are consistently polarized as shown in the diagram in Figure 30, so as to avoid areas with overtemperatures (see par. 6.11.1**).**

Figure 30 shows the wiring carried out with two heating elements in parallel. The power cables of each heating element exit from the same side; reduce as much as possible the loop area created by connecting the bar terminals.
As soon as possible the cables must be twisted up to the power terminal strip on-board the machine. The same for the second heating element. Practical experience across numerous applications has shown that composite cables can be used as an alternative to twisted pairs.

Therefore, the parallel connection is made on the terminal strip on-board the machine. However, this terminal strip is not binding; it is also possible to route the cables from both heating elements directly to the thermoregulator terminal strip, making the parallel connection on the latter.

If a single heating element is used, simply refer to the connection diagram of one of the two bars.

The power cables between the power terminal strip and the thermoregulator must be twisted. Practical experience across numerous applications has shown that composite cables can be used as an alternative to the twisted pair.

No loops must be present that could produce significant inductive effects.

To make the correct choice of the power cables' core section, refer to the “Technical Report” (see par. 3.5).

The maximum cable length is 30 meters.

5.6.3.10.3 Reference cables

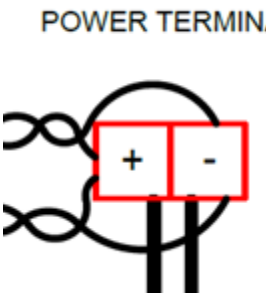
The reference cables for the voltage feedback (see par. 5.6) must be twisted.
The suggested cable section is 1 sq. mm, for further information, please refer to Table7.
Simple composite cables have also been used successfully on numerous applications.

The ideal connection requires these cables to be fixed directly onto the terminals of one of the two heating elements, as indicated in Figure 30. In this case, reduce the loop area created by connecting the bar terminals.
To reduce the risk of reference cable breakage due to movement, in most applications it is an excellent compromise to connect these cables to the machine terminal strip close to the heating elements (see 5.6.3.10.4), unlike what shown in Figure 30.

No loops must be present that could produce significant inductive effects.

The maximum cable length is 30 meters.

5.6.3.10.4 Power terminal strip on-board the machine



The power terminal strip, which as previously specified is not a binding element, must ensure an excellent contact. It is advisable to use screw contacts and to place the terminal strip as close as possible to the heating bars.

5.6.3.10.5 Use of multiple thermoregulators

If multiple thermoregulators are used, this machine terminal strip must be placed in an independent box, one for each thermoregulator, as shown in Figure 31. This ensures that the cables of one thermoregulator do not interconnect with the cables of another thermoregulator.
The same wiring criteria must be adopted even if the terminal strip is not used.

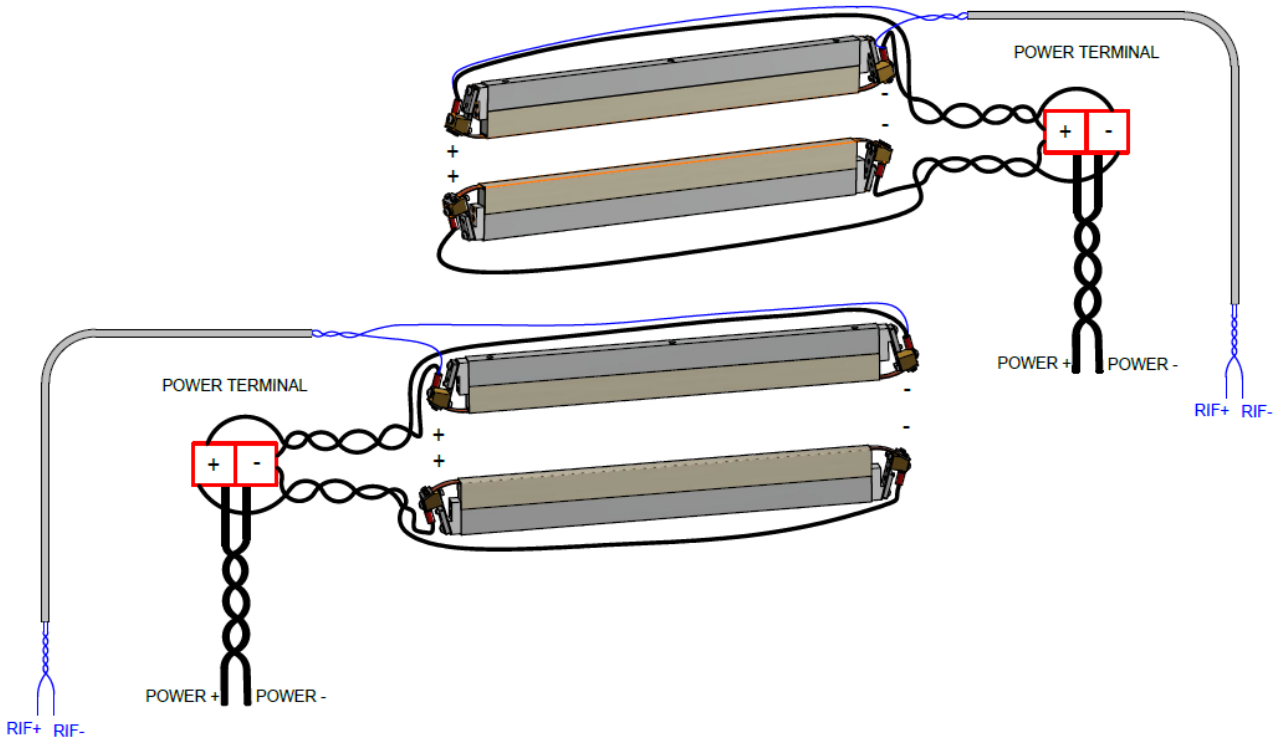


Figure 31

5.6.3.11 Wiring validation

The thermoregulator has passed the immunity tests carried out in a heavy industrial environment; however, the cable route should be kept as separate as possible from the cables of other devices, especially if electrically very noisy (electric sealing machines, brushless drives, inverters, brakes). Strictly avoid proximity to coiled power cables, as this causes severe electromagnetic coupling that even shielding may fail to reduce.

The final validation of the correct operation of the application must be carried out by verifying temperature stability under balanced conditions , as indicated in par. 12.1.

6 CONFIGURATION, DIAGNOSTICS, AND CONTROLS

This paragraph describes all the functions implemented in the thermoregulator and relating parameters and information.

Before starting the CONFIGURATION you should carefully have read chapter 2 - SAFETY WARNINGS AND CERTIFICATIONS

NOTE TO APPLICATION SOFTWARE DEVELOPERS

Some of the parameters in the following tables are marked with:

- "**A**": variables required for the final application
- "**B**": variables recommended for the final application

Similar to the configuration of the embedded web server (see par. 4.2), it is recommended to provide two generic fields for advanced users, allowing them to read and write to any address. This can be highly useful for performing detailed troubleshooting in the field and resolving specific issues, potentially even remotely.

6.1 THERMOREGULATOR STATUS

The thermoregulator is always in one of the states described in Table8 below (see variable “Thermoregulator state”)." The state variable can be used by the fieldbus interface developer to synchronize their application with the thermoregulator.

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Thermoregulator status **(A)**	[000]=Power off [001]=Regulator off [002]=Wait for power off [017]=Not calibrated [096]=Balancing [100]=Reserved do not use [112]=Preheating [128]=Sealing [136]=Master reset in progress [153]=Calibration in progress [154]=Scaling [155]=Reserved do not use [158]=Reserved do not use [170]=Reserved do not use [187]=Reserved do not use [200]=Emergency test in progress [238]=Alarm	774	+
Machine not calibrated	[0]=Machine calibrated [1]=Machine not calibrated	12	+

Table8

You can always check the status of the thermoregulator (see also Table8) from the webserver (see Figure 32).

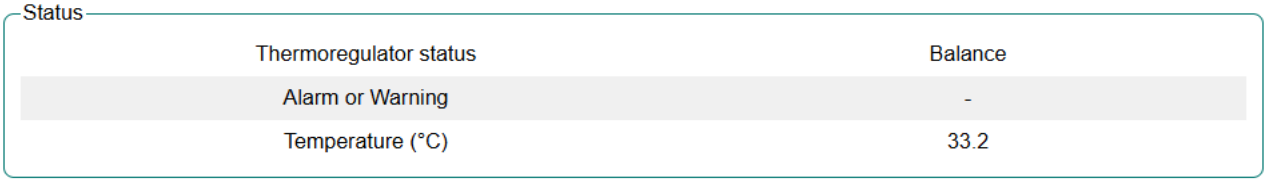


Figure 32

Upon power-up, before receiving power, the machine is in the 'Power off' state. In this status the thermoregulator generates warning 33. For the details about the status of the LEDs and panel see par. 6.8.

If power is present but the thermoregulator is disabled (if the corresponding function is used see par. 6.7.5), machine status is “Regulator off”. In this status the thermoregulator generates warning 31. For the details about the status of the LEDs and panel see par. 6.8.

When power and the regulator are enabled, the thermoregulator switches to either the 'Not calibrated' or 'Steady-state' state, depending on whether the machine is uncalibrated or calibrated, respectively (see also 'Uncalibrated machine', a variable implemented for backward compatibility but not strictly necessary for new applications).

In the “Not calibrated” state, the 4 LEDs “ALARM”, “WARN”, “BAL/CAL” (see Figure 33) flashes simultaneously. For further details about how to enable and manage the calibration from panel, please refer to par 0.
In the steady state the thermoregulator is calibrated and displays the current temperature. For further details, see par. 6.11.1.

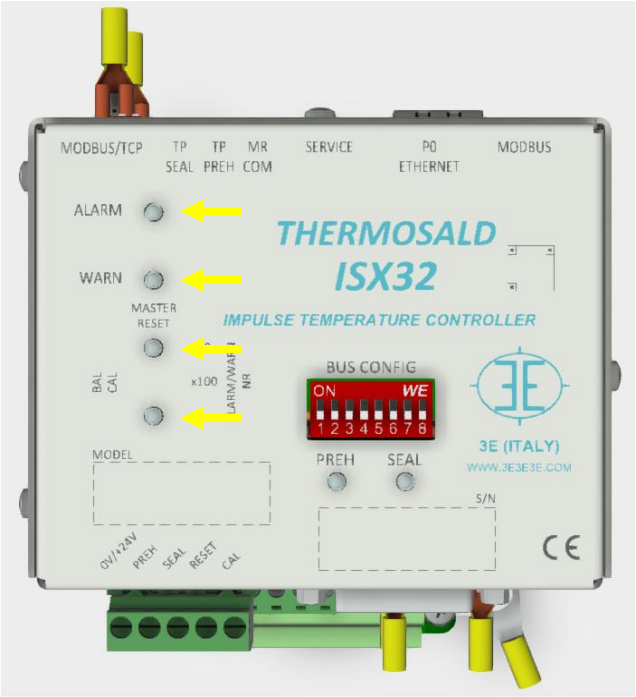


Figure 33

Upon power disconnection, the thermoregulator may temporarily enter the “Wait for Power Off” state before stabilizing in the 'Power Off' state.

If from the “Power off”, “Not calibrated” or “Steady” state (see also par 6.3), a calibration command is received, (see par. 6.6), the thermoregulator switches to the “Calibration in progress” state (and eventually to “Scaling”).
In the “Calibration in progress” and “Scaling” state, the 2 LEDs “BAL/CAL” (see Figure 34) flash simultaneously. For further details about how to enable and manage the calibration from panel, please refer to par 0.
During calibration, warning 38 may be displayed (for details about LEDs and panel status, see par. 6.8). If necessary, wait until the temperature stabilizes. Warning 38 resets automatically as soon as the band stabilized and calibration is complete.
Once calibration is successfully completed, the status changes to “Steady state”.

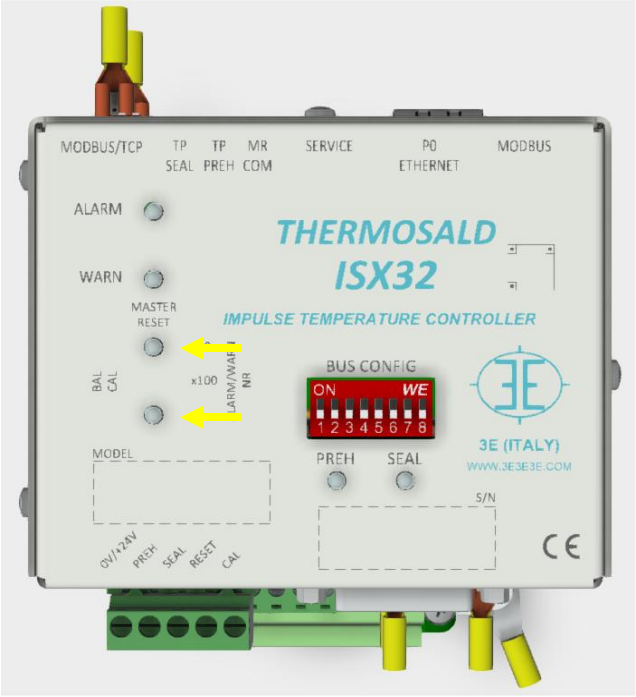


Figure 34

If the Preheating or Sealing commands are enabled from the “Steady” state (see par. 6.6), the machine switches to “Preheating” or “Sealing” status respectively.
The Preheating and Sealing commands can be enabled simultaneously. In this case the “Sealing” status takes priority.

The emergency test can be enabled via the corresponding command in the “Not calibrated” or “Steady” states (see par. 6.6): in this case, the state changes to “Emergency test in progress” until the test is completed, before switching back to the previous state. In the “Emergency test in progress” status, the panel provides feedback the operator (see Figure 35).



Figure 35

If the “Master reset” command is enabled (see par. 6.6) the thermoregulator switches to “Master reset in progress” until the operation is complete. During the Master Reset, the 4 LEDs “ALARM”, “WARN”, “BAL/CAL” remain ON for a few seconds (see par. Figure 36).

For further details about how to enable and manage the Master Reset from panel, please refer to par. 6.6.10.2.
Subsequent statuses may be “Not calibrated” or “Power off” depending on whether power is present or not.

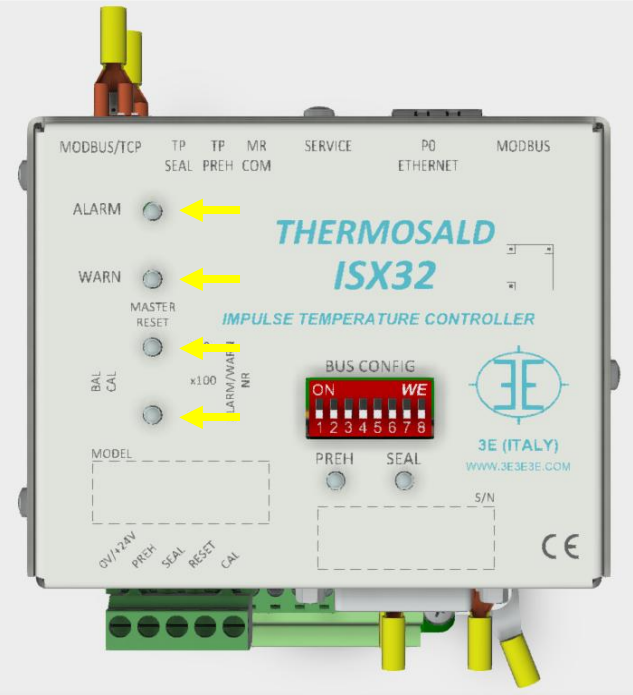


Figure 36

In case of any alarm triggered, the thermoregulator switches immediately to “Alarm” status. For the details about the status of the LEDs and panel see par. 6.8.

6.2 PRE-HEATING, SEALING, AND MAX TEMPERATURE

Preheating and sealing are the two states in which the thermoregulator works in closed loop and maintains the temperature set points on the sealing element set on the respective parameters, listed in the table below. For temperature management in models equipped with the analogue option, refer to par. 8.
Preheating allows you to bring the heating element to a lower temperature than the sealing temperature, based on the application, in order to reach the sealing temperature quickly and ensure repeatability. The typical combined use of preheating and sealing is shown in more detail later in 16.

Preheating and sealing can be activated by the PRE-HEATING and SEALING commands. For the details about how to enable commands see par. 6.6.

If the current temperature (see par. 6.11) exceeds the value of the “Maximum Temperature [°C]” parameter, the thermoregulator generates an alarm



For applications in which the maximum temperature is critical, it is advisable to check at runtime through the PLC that the value of the “Maximum Temperature [°C]" parameter does not deviate from the desired value.

The following Table9 shows the available parameters.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Pre-heating temperature [°C] **(A)**	Allows you to set the pre-heating temperature	269	100 90 (Models TM200)	-100	Maximum temperature [°C]
Sealing temperature [°C] **(A)**	Allows you to set the sealing temperature	270	150 140 (Models TM200)	-100	Maximum temperature [°C]
Maximum temperature [°C] **(A)**	Allows you to set the sealing element's max temperature	262	250 200 (Models TM200)	-100	500 200 (Models TM200)

Table9

The parameters in Table9 are easily accessible via webserver (see Figure 37) and panel (see Figure 38).

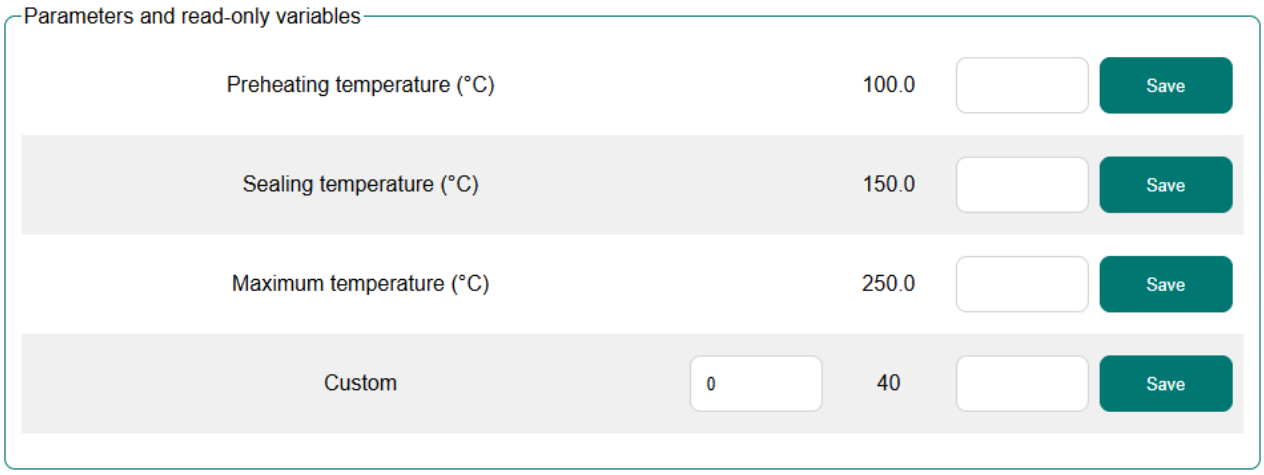


Figure 37

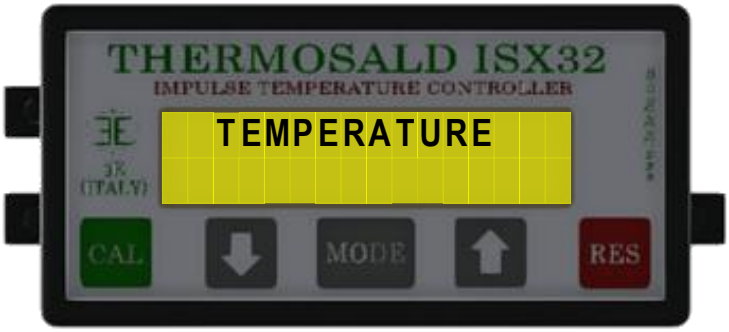


Figure 38

6.3 CALIBRATION

Thermosald must be calibrated upon delivery from the factory or following a master reset to adapt to the voltages and operating currents..



Calibration must be carried out with the machine cold and with stable temperature to allow the sealing element to be very close to the room temperature set in the CALIBRATION TEMPERATURE parameter or, if the TEMPERATURE PROBE is present, to be very close to the temperature of the probe (see par. 6.3.1**).**

The calibration can always be activated from the “Not calibrated”, “Steady”, or “Power off” states (see also par. 6.1). For the details about how to enable commands see par. 6.6. To complete the calibration, the thermoregulator must receive power from the transformer or DC power supply unit.

The calibration can be performed anytime if necessary even after the first time, for example if the type of sealing band connected to the thermoregulator is changed or if maintenance is carried out.
It is advisable to carry out calibrations following the first one in the following order:

- Cut off power by switching to “Power off” status with warning 33.
- Enable the CALIBRATION command and wait for the “Calibration in progress” status with warning 32.
- Connect the power and await until the calibration is complete and the “Steady” state is reached.

The calibration procedure can be interrupted by activating the RESET command (see par. 6.6). Interruption of the calibration procedure generates an alarm, which must then be reset.

When you perform the first calibration after a master reset, the thermoregulator stores the data of this first calibration so that they can later be compared with the data in real time (see par. 6.11).
The data of subsequent calibrations are not stored by the machine: if you wish to overwrite the data of one calibration with those of a subsequent one, use the SAVE FIRST CALIBRATION DATA (see par. 6.6).

The following Table10 and Table11 show the available parameters and information.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Calibration temperature [°C] **(A)**	Set temperature at the end of calibration. If calibration is performed with the probe, it shows the value read by the probe.	258	30	-100	Max temperature [°C]
Heating elements stabilization time [s]	During the element stabilization time, the thermoregulator stops pulsing to bring the band temperature as close to ambient temperature as possible. It can be useful if the temperature probe is used.	1563	0 without probe connected 120 with probe connected	0	1800
Calibration level [%]	Allows you to change the calibration level. It can be useful to reduce it in case of unstable mains supply. After editing this parameter a new calibration is required.	22	80 AC models 90 DC models	1	98
Maximum temperature gradient [°C/s * 10]	Indicates the maximum temperature cooling rate, above which the band is not considered stable. Increasing this parameter may result in loss of accuracy.	264	4	1	65535

Table10

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Resolution [Bin/°C*100]	System resolution	15	+
Copro resolution [Bin/°C*100]	System resolution	1300	+

Table11

6.3.1 CALIBRATION WITH TEMPERATURE PROBE

At the end of the calibration procedure the thermoregulator sets as temperature of the heating element the value contained in the "Calibration temperature" parameter. In the absence of the temperature probe the user can act on this parameter according to the room temperature and thus vary the machine's calibration point, i.e. the temperature in a balanced status at the end of calibration.



Instead, temperature probes (see par. 11.1) allows you to set this parameter automatically, and must be positioned on the bar or in the immediate vicinity of the heating element to ensure the most reliable measurement possible.



For applications in which the maximum temperature is critical, it is advisable to check at runtime through the PLC that the value of the "*Calibration Temperature [°C]*" parameter does not deviate from the desired value.

The temperature probe can be connected to models equipped with the PR option and can be configured via the corresponding “Calibration temperature probe type” parameter.

This parameter is automatically configured during a master reset; it identifies the detected probe, which will then be used for calibration. If both 3ES109B1 and PT100 sensors are connected, the first one will be selected. However, the parameter can be changed later.

At any time, if the probe set in the “Calibration temperature probe type” parameter (see Table12) is not detected, an alarm is triggered.



On models equipped with a COPROCESSOR, the *"Calibration temperature [°C]"* parameter of the COPROCESSOR and the *"Calibration temperature [°C]"* parameter of the BASE must not differ by more than 6 degrees.
If the two respective temperature probes are used (see par. 11.1) they must be properly placed in order to detect comparable temperature.



On models equipped with COPROCESSOR the probes must be both connected or both disconnected.
On models where the maximum temperature is limited, both probes must be connected and of the same type: the “Calibration temperature probe type” cannot be 0 and the “Calibration temperature [°C]” parameter cannot be changed.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Calibration temperature probe type	[0]=No probe [1]=Probe 3ES109 [2]=Probe PT100	24	See ”**Description**”		

Table12

6.3.2 TEMPERATURE COEFFICIENT

The Temperature Coefficient (see Table13) is the parameter that allows you to adapt the thermoregulator to the type of material used for the sealing element in order to obtain the set temperature. Before changing the value of this parameter, it is advisable to contact the 3E Technical Support.

The initial setting of the TEMPERATURE COEFFICIENT must be equal to the value of the temperature coefficient of the sealing element used.

After any change to the TEMPERATURE COEFFICIENT, it is advisable to compare the current temperature indicated by the thermoregulator with the actual temperature of the heating element (see par. 6.11.1)

For applications where the maximum temperature is critical, it is advisable to check at runtime, through the PLC, that the value of the "Temperature coefficient" parameter does not deviate from the desired value.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Temperature coefficient [PPM]	1210 (Steel) 3800 (Kovar)	14	1210 900 CM1210 models	600 600 CM1210 models	8000 1210 CM1210 models

Table13

The parameters and information in Table10, Table13, Table12, and Table11are also accessible from the panel (see Figure 39).



Figure 39

6.4 Ethernet

The Ethernet communication parameters are listed in Table14 and are accessible via the embedded web server (see Figure 40) and the panel (see Figure 41).

PARAMETERS	
Name	**Default**
Name	THERMOSALD
DHCP	No
IP Address	192.168.0.55
Subnet Mask	255.255.255.0
Gateway	192.168.0.1

Table14

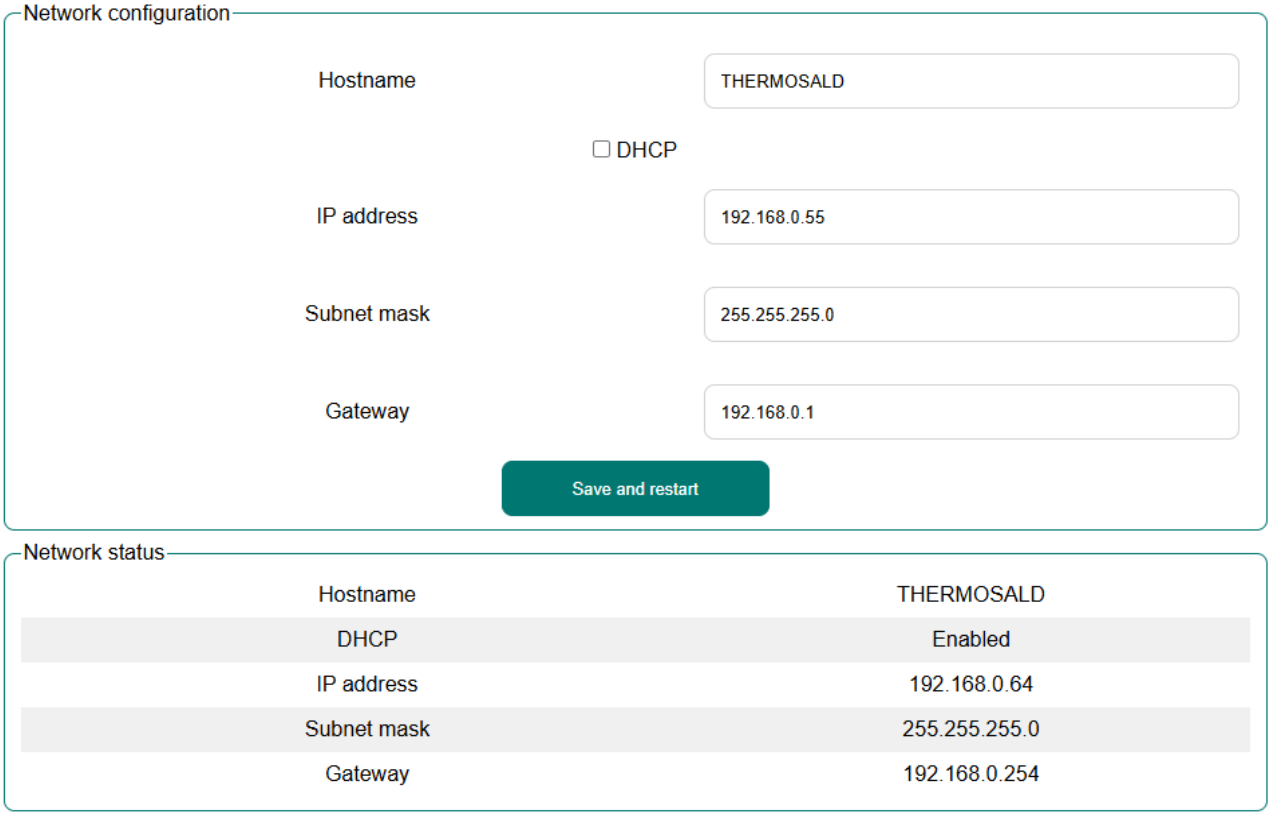


Figure 40

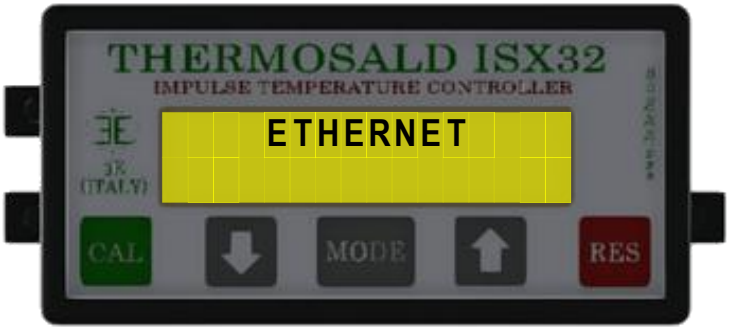


Figure 41

In the BU13 modules, byte 4 of the IP address can be configured in binary using the “BUS CONFIG” DIP switch as shown in Figure 43.
The same behaviour can be obtained on all the other BU models by enabling of the PIN2 dip switch “MODBUS/TCP” (see Figure 42). Factory’s default setting of this PIN is disabled.



Figure 42



Figure 43

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table15shows some address configuration examples.
The valid addresses fall within range 1-247.

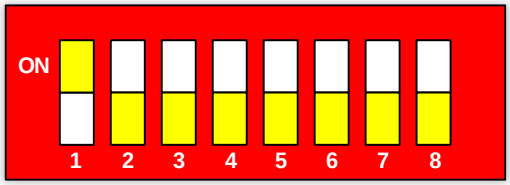
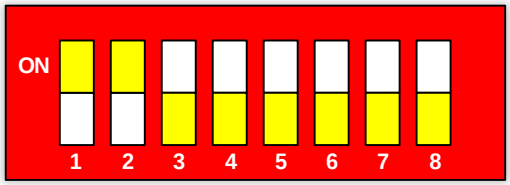
IP ADDRESS = xxx.xxx.xxx.xx1	SW2[1]=ON SW2[2..8]=OFF	
IP ADDRESS = xxx.xxx.xxx.xx3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table15

If the status of the dip switches is changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The dip switch set to 0 is used to enable the address configuration via software. When the dip switch is set to 0, the thermoregulator uses the last configured value.

If the dip switch is set to a value that differs from 0, the DHCP parameter is automatically disabled.

The factory's thermoregulator dip switch setting is 0.

6.4.1 Diagnostics

The LED located next to the “SERVICE” button and shown in Figure 44 provides some pieces of useful information on the Ethernet connection status.



Figure 44

LED status	Meaning
OFF	Network disconnected.
Pulse of 200ms every 2 seconds	Network connected.
Pulse of 500ms every 1 second	Network connected. Connection to Service in progress or wating for remote connection stabilization.
Fixed access	Network connected. Service connected or remote connection established.
Fast flashing	Network error.

Table16

6.5 TEMPERATURE INCREASE

This function makes it possible to compensate for the decrease in sealing temperature caused by the width of the product to be sealed being much smaller (e.g. 1/3) than the useful sealing area (central area of the strip without coppering).
The "Sealing temperature increase" parameter is the total increase in sealing temperature in degrees. The increase occurs:

- In pulsed sealing on the falling edge of the sealing command.
- In continuous sealing, with the sealing command always active, on the rising edge of the preheating command.

For the details about how to enable commands see par. 6.6.
The “No. of Seals Increase” parameter is the number of seals required to obtain the complete increase in sealing temperature set in the "Sealing temperature increase" parameter.
The "Time increase to restore" parameter is the time in seconds needed to restore the initial SEALING TEMPERATURE conditions.

The following Table17 shows the available parameters.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Increase: temperature [°C]	Total temperature increase for sealing band compensation	266	0	0	255
Increase: pulses	Number of seals for temperature increase	267	0	0	255
Increase: recovery time [s]	Initial temperature recovery time	284	0	0	255

Table17

The parameters in Table17 are accessible from the panel (see Figure 45).

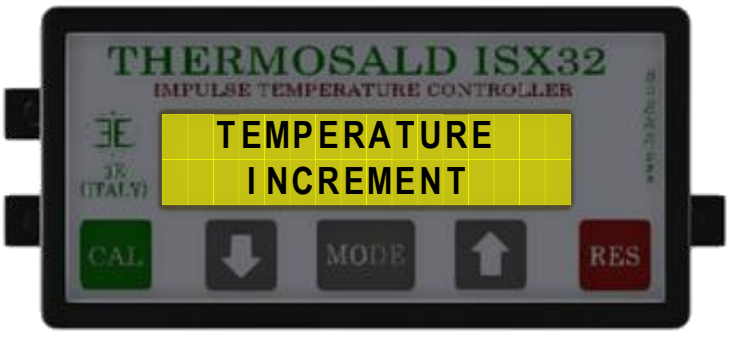


Figure 45

6.6 COMMANDS

The thermoregulator provides a series of commands that are described in the next paragraphs. The activation of some commands can change the thermoregulator status (see par. 6.1).

6.6.1 Calibration

The thermoregulator calibration can be started through this command (see par. 6.3).

6.6.2 Reset

It allows restoring an alarm or warning condition and setting the thermoregulator back to working condition after the problem that caused the alarm or the warning has been solved. In addition, this command interrupts all the automatic long-running procedures that would otherwise prevent the user from performing other operations (e.g., calibration).

6.6.3 Master Reset

By means of the “Master Reset” operation you can restore the status of the Thermosald to the factor’s values.



After a Master Reset, set the thermoregulator parameters to the desired values before using the device.

The command does not restore any parameter of the Ethernet communication (see par. 6.4) or the related fieldbus (see chap. 7).

However, it is also possible to restore the communication parameters by activating the Master Reset via the MR COM button (see Figure 46).
Upon pressing the button, the 6 LEDs on the device will flash in sequence (see Figure 47) and then the Master Reset is performed.

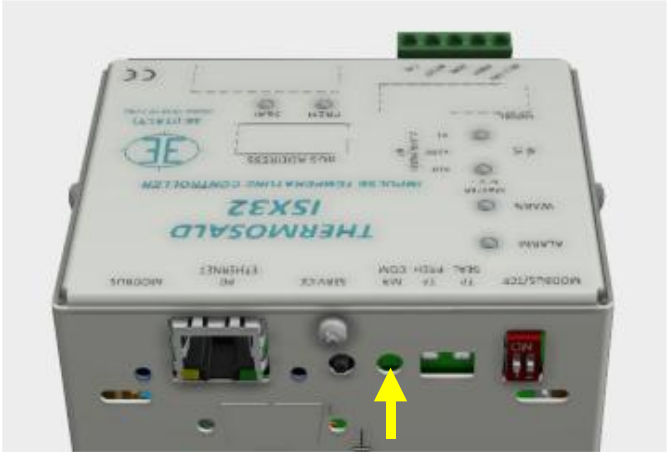


Figure 46

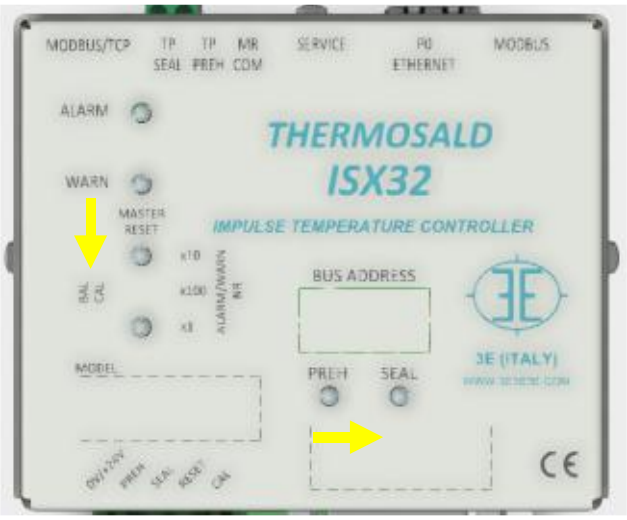


Figure 47

6.6.4 Emergency test

The thermoregulator has an alarm output contact (see par. 5.6) that open when an alarm condition occurs: this contact must be connected to the safety chain and must be capable of interrupting the power supply in the event of faults, thereby bringing the system to a safe condition.

You can check the correct operation of the system safety chain by means of this command. On activating the command the alarm output relay must open, the power circuit must consequently open and remain switched off. If the thermoregulator does not detect the power drop (due to a malfunction along the safety chain) an alarm is triggered.

6.6.5 Pre-heating, Sealing

These two commands switch the thermoregulator into the preheating or sealing state, respectively (see also par. 6.2).

The two PREH and SEAL LEDs on the device (see Figure 48) signal when the respective PREHEATING and SEALING commands are active.



Figure 48

Indicators (“P” and “S”, respectively) are also displayed on the main panel page to show that the commands are active (see Figure 49).

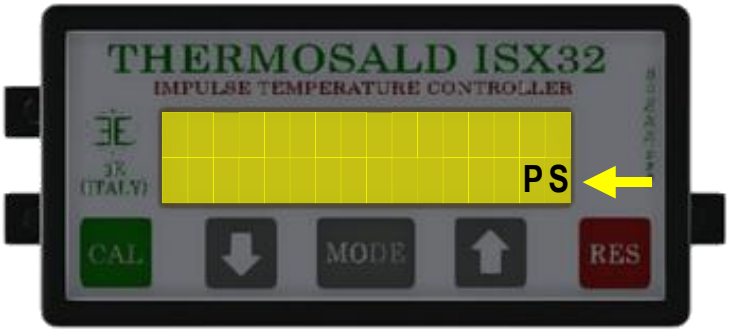


Figure 49

The current status of the preheating and sealing commands is also available on the test points shown in Figure 50, which can be used in the field for operational checks. It is recommended to contact 3E Technical Support before connecting an instrument to monitor these signals.

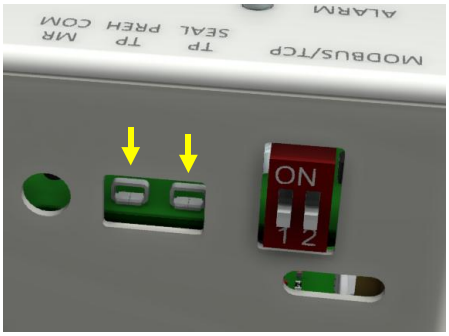


Figure 50

6.6.6 SALVE CALIBRATION DATA

For the description of this command, please refer to par. 6.3.

6.6.7 REGULATOR

The thermoregulator power output can be enabled or disabled through this command (see also par. 6.7.5)

The commands can be enabled from different channels: digital command terminal strip (see par. 6.6.8), web server (see par. 6.6.9), panel (see par. 6.6.10), fieldbus (see par. 6.6.11), and Service.
The corresponding function is enabled as long as a command is activated from at least one of these sources.
Disconnection from the digital command terminal strip, web server, panel, and Service will deactivate any commands coming from these sources.
Fieldbus disconnection, however, does not cause the commands to be disabled (see also chap. 7).

6.6.8 Digital command terminal strip

As previously noted, the RESET, CALIBRATION, PREHEATING, and SEALING signals are accessible via the connector.

The RESET is triggered if its corresponding signal is detected as active for at least 100 ms.
The CALIBRATION procedure is triggered if the corresponding signal is detected as active for at least 3 seconds.

The simultaneous activation of the RESET and CALIBRATION signals for at least 6 seconds allows the user to perform a MASTER RESET.

The reading of the inputs of the PREHEATING and SEALING commands is filtered over a timeframe configurable via the parameter shown in Table18.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Preheating/sealing signals filter		1104	2	1	100

Table18

6.6.9 Web server

All the thermoregulator commands can be enabled from the webserver (see Figure 51)

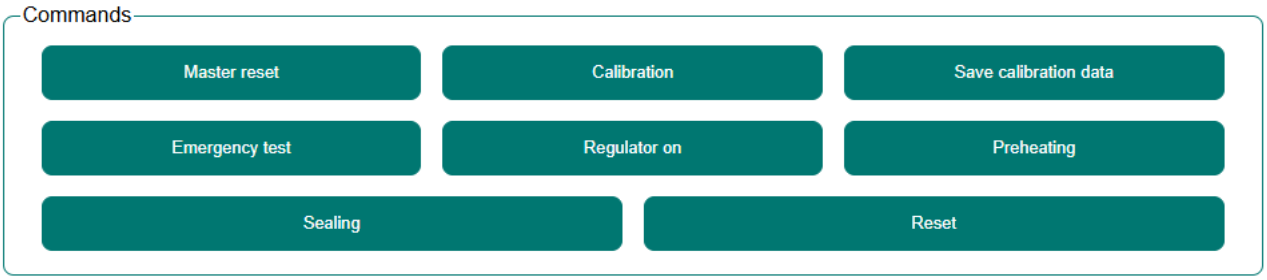


Figure 51

6.6.10 Panel

All commands are available and can be activated from the COMMANDS submenu (see Figure 52), except for CALIBRATION, RESET, and MASTER RESET. These must be activated directly via the specific “CAL” and “RES” buttons on the physical keypad (see Figure 53) or combinations thereof.



Figure 52



Figure 53

6.6.10.1 CALIBRATION activation

After a factory reset (see par. 6.1 and 6.3), the panel shows the screen as per Figure 54to enable the thermoregulator activation. Upon pressing the “CAL” key, a confirmation is requested (see Figure 55) and the operation can be confirmed or cancelled via the “MODE” and “RES” buttons. Upon pressing the “MODE” key, the screen as per Figure 56 is displayed and the screen as per Figure 57 when the calibration is complete.



Figure 54

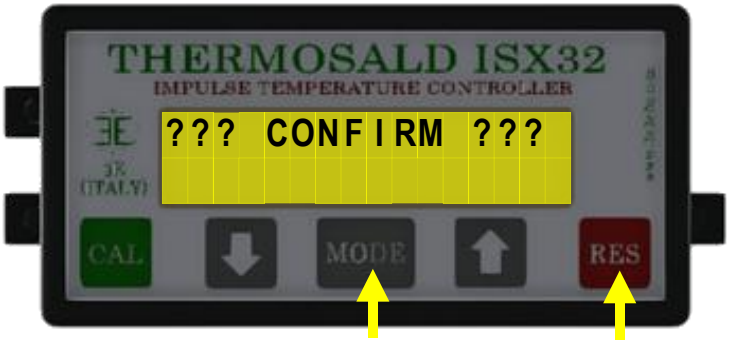


Figure 55



Figure 56

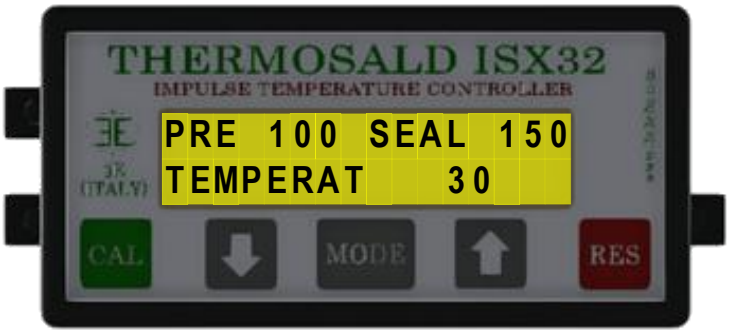


Figure 57

Even after the first calibration following a factory reset (see par. 6.1 and 6.3), it is always possible to initiate calibration by pressing the “CAL” button (see Figure 58). Like the sequence previously described, upon pressing the “CAL” key, a confirmation is requested (see Figure 55) and the operation can be confirmed or cancelled via the “MODE” and “RES” buttons. If the calibration is confirmed, the screens in Figure 56 and Figure 57 will be displayed.

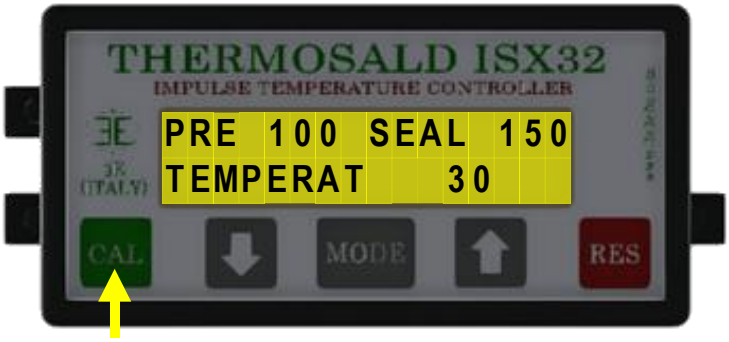


Figure 58

6.6.10.2 MASTER RESET activation

To activate the MASTER RESET (see par. 6.1) from the panel, press and hold the 'DOWN ARROW' and 'UP ARROW' buttons simultaneously for 6 seconds (see Figure 59). Upon activation, the display will show the screen in Figure 60.

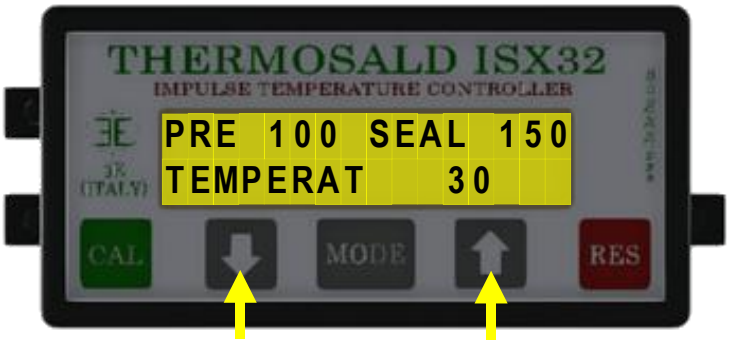


Figure 59



Figure 60

6.6.11 Fieldbus

In case a model equipped with the fieldbus option is used, all thermoregulator commands can be activated by writing the specific code relating to the command you wish to activate to the address shown in the following table.

READ-ONLY INFORMATION				
Name	**Description**	**ID**	**Min**	**Max**
Command code	[014]=Alarms reset [015]=Calibration [016]=Reserved do not use [017]=Reserved do not use [018]=Reserved do not use [019]=Reserved do not use [020]=Emergency test [023]=Reserved do not use [026]=Save calibration data [027]=Reserved do not use [028]=Reserved do not use [031]=Pre-heat on [032]=Pre-heat off [033]=Sealing on [034]=Sealing off [035]=Reserved do not use [036]=Reserved do not use [041]=Regulator on [042]=Regulator off [099]=Master reset	1285	See ”**Description**”	

Otherwise, the commands can also be activated through the Command Word (see par. 6.6.11.1 below).

6.6.11.1 Command Word

Via the Command Word, the thermoregulator commands can be activated—and deactivated in the case of level-triggered commands—by setting the values of the corresponding bits to 1 (or to 0 to deactivate for level-triggered commands) (see Table19).

For all fieldbuses, with the exception of Modbus RTU and Embedded Modbus TCP in “Standard Mode”, the Command Word is mapped directly to one of the interface registers or fields.

For Modbus RTU and Embedded Modbus TCP in “Standard Mode”, there is a direct mapping between the bits of the Command Word and the Modbus COIL objects, shown in Table19.

Command Word	**BIT**	**Modbus COIL**	**Description**
BYTE HIGH	7	15	Regulator on (level)
	6	14	Reserved do not use
	5	13	Reserved do not use
	4	12	Reserved do not use
	3	11	Master reset (pulse > 5ms)
	2	10	Reserved do not use
	1	9	Sealing on (level)
	0	8	Pre-heating on (level)
BYTE LOW	7	7	Save calibration data (pulse > 5ms)
	6	6	Emergency test (pulse > 5ms)
	5	5	Reserved do not use
	4	4	Reserved do not use)
	3	3	Reserved do not use
	2	2	Reserved do not use
	1	1	Calibration (pulse > 5ms)
	0	0	Alarm reset (pulse > 5ms)

Table19

6.7 CONTROL

The following Table20, Table21, Table22, Table23, Table24 and Table25 shown the available parameters.

6.7.1 PID

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Heating ramp [degrees/100ms]	Speed of temperature increase resulting from a preheating or sealing command [U/M degrees / 100 ms]. Increasing this parameter means decreasing the time needed to bring the sealing band to temperature and thus increasing the speed, decreasing the stability, and decreasing the life of the sealing band.	0	40	0	255
Proportional gain KV	Proportional loop gain. Increasing this parameter means increasing the response speed of the loop and thus making the system more ready. Excessive increase can lead to system instability and, as such, temperature oscillation.	1	AC 600 DC 240	0	65535
Integral gain KI	Integral loop gain. Increasing this parameter means increasing the temperature accuracy and the speed of reaching the desired temperature. To increase system stability, increase this parameter. Excessive increase can lead to a temperature overflow resulting from a preheating or sealing command.	1617	AC 60 DC 5	0	65535
Derivative gain KD	Derivative loop gain. Increasing this parameter increases the response speed of the loop and therefore makes the system readier to variations. Excessive increase can lead to system instability and, as such, temperature oscillation.	8	AC 100 DC 80	0	65535
Maximum number of switching operations		1150	50	1	65535

Table20

6.7.2 Earth fault detection

As previously described, the thermoregulator is capable of detecting earth leakage current. To ensure correct operation, the earth must be connected to the relevant connectors, as indicated in par. 5.6.
The magnitude of the current earth leakage can be monitored via the Technical Analysis (see par. 6.11).

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Earth leakage threshold [%]	Earth leakage tolerance	1562	5	1	100

Table21

6.7.3 PARTIAL SHORT CIRCUIT DETECTION

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Partial short circuit [%]	It allows the detection of a partial short circuit on the heating element.	1614	5	0	100

Table22

6.7.4 PARALLEL HEATING BAND BREAKAGE DETECTION

This function allows the detection of the breakage of one or more bands connected in parallel, by setting the detection of a specific resistance change relative to the resistance acquired during calibration. Exceeding this change triggers a thermoregulator alarm condition.

It is advisable to maintain a safety margin relative to the theoretical value. For example:
4 bands in parallel -> 30%
3 bands in parallel -> 45%
2 bands in parallel -> 90%

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Max resistance delta for parallel breakage [%]	**Allowed resistance variation relative to calibration resistance**	785	90	0	100

Table23

6.7.5 REGULATOR ENABLE

The regulator's enabling function allows keeping the regulator disabled and then activating the adjustment through the relating command (see par. 6.6).
When the regulator is disabled, the thermoregulator triggers the Warning 31.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Regulator enabled	[0]=Disables the adjustment [1]=Enables the adjustment	28 001CH	1	See "**Description**"	

Table24

6.7.6 ADVANCED CONFIGURATION PARAMETERS

The table below shows the advanced configuration parameters. They are intended for an advanced user and it is recommended that you always contact 3E Technical Support before making any changes.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Steady-state period [sx10]	Pulse interval under balanced conditions	541	AC 20 DC 10	1	100
Timeout power off [s x 10]	Maximum power disconnection time (SAC and PRI models)	273	5	0	255
Power off threshold [%]	Voltage level relative to the maximum supply value to enter Power Off state. (SDC models)	782	70	1	100
Reading margin [us]	Allows you to change the reading time of the AD converters. Modifying this parameter makes it possible to correct abnormal operation of the power transformer if it is undersized.	25	1200 (AC) 400 (DC)	1000 (AC) 200 (DC)	2000 (AC) 1000 (DC)
Minimum phase [us]	Allows you to decrease the regulator's max phase	275	AC 600 DC 150	AC 300 DC 150	65535
Maximum sealing command time [s x 10]	Sealing time check. This parameter is used to set the maximum time of the sealing command; if the duration of the sealing command exceeds this value, the thermoregulator triggers	263	0	0	65535

	alarm F085. For applications with the sealing command always active, or to deactivate the control, this parameter must be set to 0.				
End of sealing temperature latch	[0]=the current temperature is continuously updated [1]=at the end of sealing, the current temperature stores the end-of-seal temperature for 3 seconds. If the sealing command lasts less than 3 seconds, the most recent end of sealing data.	268	0	-	-
Maximum end of sealing temperature warning delta [°C]		1054	4	1	50
Maximum end of sealing temperature alarm delta [°C]		1055	20	1	100

Table25

The parameters in Table20, Table21, Table22, Table23, Table24, and Table25 are also accessible from the panel (see Figure 61).



Figure 61

6.8 ALARMS AND WARNINGS

Thermosald is equipped with powerful diagnostics capable of detecting on-site problems related to the application and thus generating some alarms or warnings.
In the event of an alarm, in order to avoid hazardous situations on the final application, Thermosald opens the internal alarm relay in order to interrupt current on the heating element (see par. 5.6).
The occurrence of a warning does not cause the alarm relay to open.
An alarm always has priority over a warning.

In the event of an alarm, the red ALARM LED on the device illuminates immediately to alert the user (see Figure 62).
In this condition, the alarm number can be identified by counting the LED flashes (see Figure 62):

- Red LED + green LED (X100) for hundreds (e.g., 0 flashes = 0 / 9 flashes = 900)
- Green LED (X10) for tens (e.g., 0 flashes= 0 / 9 flashes = 90)
- Red LED (X1) for units (e.g., 0 flashes = 0 / 9 flashes = 9)

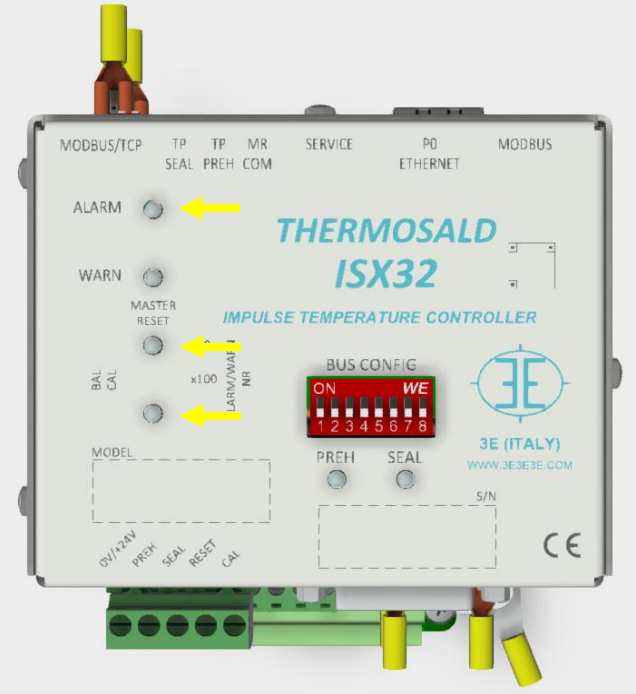


Figure 62

The yellow WARNING LED informs the user of the warning condition (see Figure 63).
The number of warnings can be identified by counting the flashes of the LEDs according to the logic described above for the alarm.

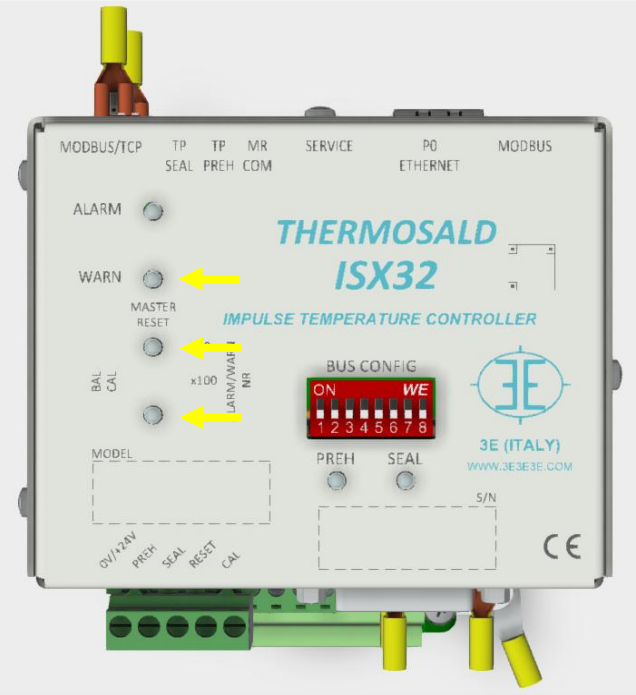


Figure 63

To understand how to clear an alarm or a warning by removing its causes, please refer to chap. 17. In general, once the problem has been solved, the alarm or the warning must be reset via the reset command (see par. 6.6). However, some warnings, such as Warning 33 or 38, can clear automatically once the warning condition is resolved and there is no loss of information for the user.

In addition to the classic global warning management inherited from previous models, the thermoregulator features advanced warning management. This allows the user to enable or disable individual warnings when the global parameter 'Global warning time [s]' is set to its default value of 10, as described in Table26: a specific parameter is associated with each warning.

If necessary, for example to resume the production cycle, some alarms can be disabled, but this operation must be performed with great caution because it could lead to hazardous situations: it is therefore advisable to contact 3E Technical Support before disabling any alarm. Disabling the alarm must in any case be considered temporary and immediate action must be taken to clear the alarm causes.

If a warning strictly linked to an alarm is disabled (see for example warning 57/157 and alarm 58/158, or warning 66/166 and alarm 59/159), disabling the warning will inevitably

also disable the related alarm. Even in this case, the operation must be carried out with great caution, and the same precautions described above for disabling alarms apply.

The following Table26 and Table27 show the available parameters and information.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Alarm disable (1)	Allows the disabling of an alarm.	9	0	0	Maximum number of alarm see ANNEX - LIST OF ALARMS AND WARNINGS (CAUSES - REMEDIES)
Alarm disable (2)		13	0	0	
Alarm disable (3)		1536	0	0	
Alarm disable (4)		1537	0	0	
Alarm disable (5)		1538	0	0	
Global warning time [s]	If set to the maximum value of 10, each specific warning is managed according to the procedures specified in the 'Warning Time' parameters of the individual warnings. If set to a value lower than 10, it acts globally on all warnings, overriding the procedures specified in the “Warning Time” parameters of the individual warnings. That is: the warning is triggered for the number of seconds specified by this parameter; if set to 0, the warning is not triggered.	265	10	0	10
Warning time 20 [s]	The warming is triggered for the seconds indicated by this parameter; if set to 0 the message is not displayed; if set to a maximum value of 10 seconds the warning is triggered until the next reset.	1540	10	0	10
Warning time 22 [s]		1542	10	0	10
Warning time 39/139 [s]		1545	10	0	10
Warning time 57/157 [s]		1097	10	0	10
Warning time 66/166 [s]		1098	10	0	10
Warning time 400 [s]		1100	10	0	10
Warning time		1101	10	0	10

401 [s]					
Warning time 402 [s]		1102	10	0	10
Warning time 403 [s]		1103	10	0	10
Warning time 405 [s]		1105	10	0	10
Warning time 406 [s]		1106	10	0	10
Warning time 407 [s]		1107	10	0	10
Warning time 409 [s]		1109	10	0	10
Warning time 410 [s]		1110	10	0	10
Warning time 411 [s]		1111	10	0	10
Warning time 439/539 [s]		1112	10	0	10

Table26

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Alarm/warning number **(A)**	Indicates the current alarm or warning. Use the “Thermoregulator status” variable (see par. 6.1) to distinguish between alarm and warning.	769	+
Current alarm	Indicates the current alarm.	1046	+
Current warning	Indicates the current warning.	1047	+
Invalid reading/writing variable ID	It indicates the variable connected to the invalid reading/writing variable from fieldbus.	1113	+

Table27

The current alarm or warning is always visible from the webserver (See Figure 64) and from the panel (see Figure 65).

Status

Thermoregulator status	Balance
Alarm or Warning	-
Temperature (°C)	33.2

Figure 64

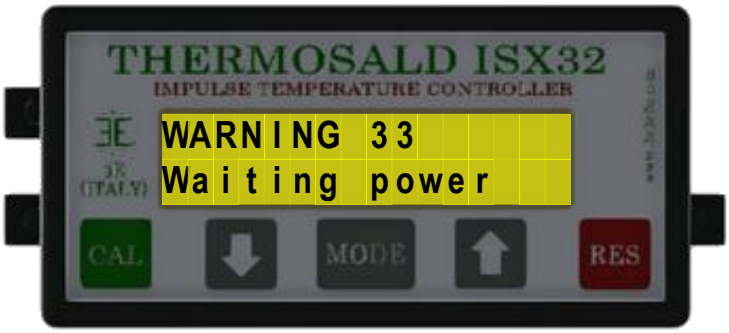


Figure 65

The parameters and information in Table26 and Table27 are also accessible from the panel (see Figure 66)



Figure 66

The following commands are also available via the panel:

- “SPECIFIC WARNINGS: ENABLE ALL”,
- “SPECIFIC WARNINGS: DISABLE ALL”

6.9 LOG

The warning and alarm log of the thermoregulator is saved in non-volatile memory for later analysis, even after the device is powered off.

The list of events can be displayed in the main page of the web server (see Figure 67), in the dedicated menu of the display (see Figure 68) or from the fieldbus (see Table28 and Table29).

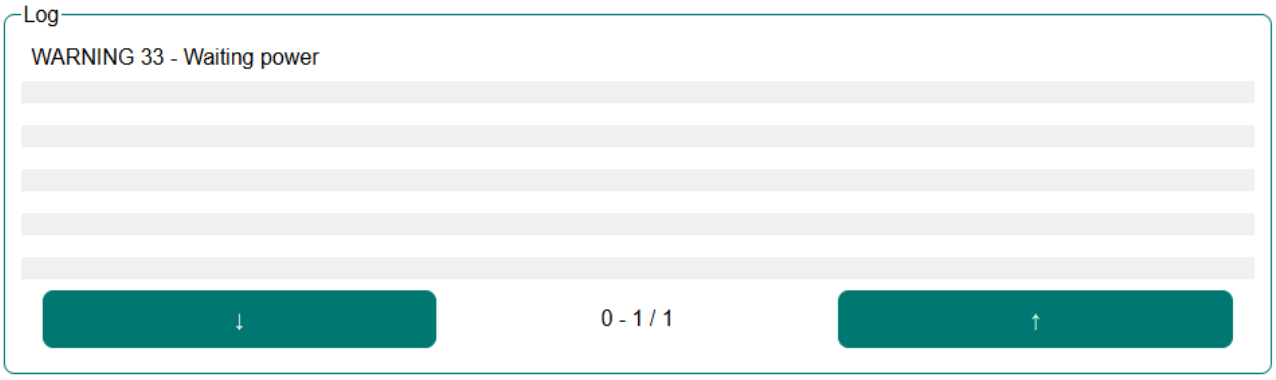


Figure 67



Figure 68

The following Table28 e Table29 show the available parameters and information.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
LOG element selection	The elements are sorted from the most recent (index = 0) to the oldest (index = LOG element number -1)	1401	0	0	LOG element number - 1

Table28

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
LOG element no.	It indicates the number of element in the LOG, from 0 to 4096.	1400	+
Selected LOG element value	[0]=Element reading invalid, you need to wait for the correct value [-1]=Power on event [-2]=Overflow event [N]=Alarm/warning number	1402	-/+

Table29

6.10 PREFERENCES

The following is a list of parameters that allow for user customization of the thermoregulator, the panel, and the web server.

The following Table30, Table31 and Table32 shown the available parameters.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Language	Language configuration: [0]=ITALIAN [1]=ENGLISH [2]=FRENCH [3]=GERMAN [4]=SPANISH	257	0	See ”**Description**”	
Temperature range	Temperature display: [0]=° Centigrade [1]=° Fahrenheit	259	0	See ”**Description**”	
Fast sealing setpoint change	[0]=It is not possible to change temperature from main page [1]= Allows you to view and change the sealing temperature on the main page using the “UP ARROW” and “DOWN ARROW” keys.	281	0	See ”**Description**”	

Table30

6.10.1 CONFIGURATION PROTECTION

The configuration protection function prevents the panel user from changing all or part of the parameters, depending on thermoregulator parameters.

The global password locks the change of all parameters from panel and the activation of all commands from panel.

The partial password unlocks the change from panel of following parameters:

- Pre-heating temperature [°C]
- Sealing temperature [°C]
- Calibration temperature [°C]
- Increase: temperature [°C]
- Increase: pulses
- Increase: recovery time [s]
- Fast sealing setpoint change

The emergency test, calibration, and Reset commands are also unlocked.

To use this function, you must assign a value different from 0 to the "Password" parameter.

When changing the password enabling from the panel, you will be prompted to enter it.
When changing the password from the panel, you will be prompted to enter the current password first, followed by the new password.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Password	[0]=Password disabled [1]=Partial password enabled [2]=Total password enabled	19	0	See ”**Description**”	
Password key	Password value	20	0	0	9999

Table31

6.10.2 CONFIGURATION BACKUP

The permanent memory of the default thermoregulator is written at each parameter change. In case the fieldbus is used and the parameters are stored in the PLC and/or you need to edit parameters frequently during operation, you can disable the writing in the permanent memory to avoid damaging it by changing the parameter indicated in the following table.
It is possible to monitor the number of writes to non-volatile memory for verification purposes (see par. 6.12)

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Salve configuration from bus	[0]=Disabled [1]=Enabled	779	1	See "**Description**"	

Table32

The parameters in Table30, Table31 Table32 are also accessible from the panel (see Figure 69).

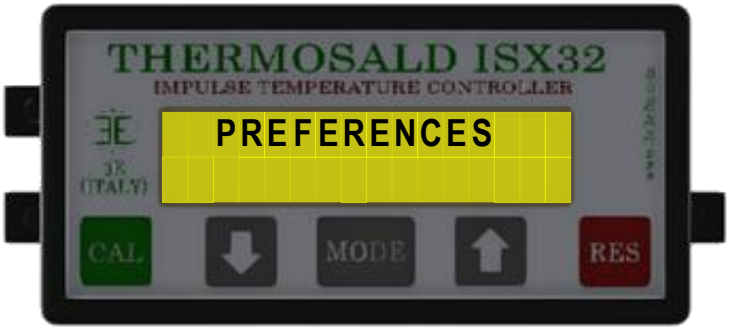


Figure 69

6.11 Technical analysis

The technical analysis allows the user to perform all the on-site diagnostic checks to monitor the proper functioning of the final application. In particular, the technical analysis allows you to compare the actual data read on site with the limits of the device, the data stored during calibration and with the theoretical data in the Technical Report of the application released by 3E.

6.11.1 CURRENT TEMPERATURE

Once calibrated, with or without a temperature sensor, the thermoregulator is able to provide the user with a current temperature datum.
In the event of no power, reading, or calibration, i.e. in the "Power off" (Warning 33) and "Regulator off" (Warning 31), and “Not calibrated” states, the temperature is -273 °C.
The "BAL" LEDs on the thermoregulator (see Figure 70) indicate the current temperature status with respect to the currently set temperature: if the current temperature is lower than the set temperature, the red LED will be on; if the current temperature is higher than the set temperature, the green LED will be on; if the current temperature is within tolerance, both LEDs will be on.

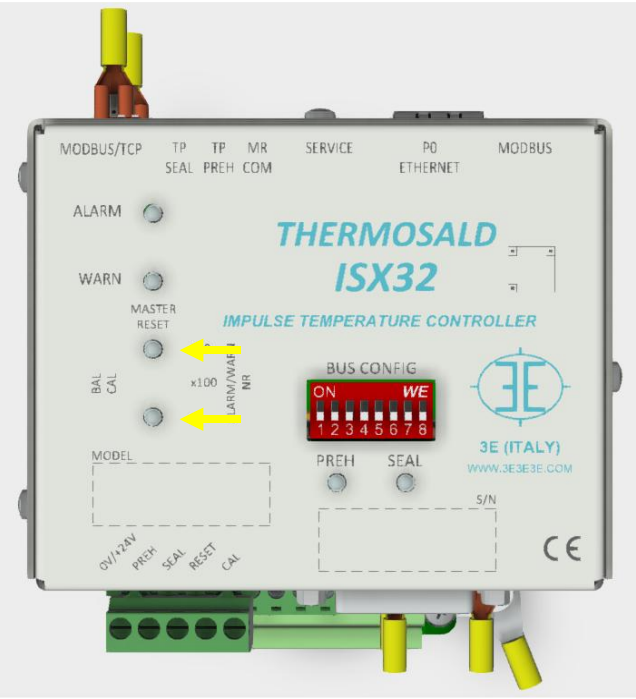


Figure 70

The temperature supplied by the thermoregulator has a degree resolution and is an average temperature: pay attention to the areas where the sealing element is not in contact with the material, and if

necessary provide for adequate copper plating or other mechanical devices, and keep the sealing element resting evenly on the entire bar. Any active area of the sealing element not in contact with the product will increase in temperature, resulting in a consequent decrease in temperature of the remaining part.



The temperature detected by the thermoregulator during heating may not exactly match the actual temperature of the heating element, partly due to the position of the voltage feedback signal. If you wish to align the actual temperature of the sealing element with the temperature detected by the thermoregulator, perform experimental measurements with an external thermometer and, if there are small differences, adjust the TEMPERATURE COEFFICIENT (see par. 6.3.2**).**



In the event of a short circuit between the sealing element and the ground, the thermoregulator stops regulation and instantly opens the emergency contact to prevent the temperature from rising if there are multiple short circuit points. Only at the exact moment of the short circuit, a current to earth of less than 30mA may still flow.



If the electrical polarization of opposing sealing elements is performed correctly as shown in Figure 30 in par. 5.6.3.10, no sparks or overtemperature zones can be generated. If this polarization is not observed, the thermoregulator may not detect the fault.

The following Table33 shows the information available for this function.

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Temperature [°C] **(A)**	Indicates the sealing element's current temperature	768	-/+
I0 First calibration full wave rms current (A) **(B)**	First calibration full wave rms current Stored automatically during first calibration or after first calibration data backup command	527	+
R0 First calibration resistance [Ohm x100] **(B)**	Calibration resistance Stored automatically during first calibration or after first calibration data backup command	528	+
V0 First calibration RMS voltage [V] **(B)**	First calibration wave rms voltage Stored automatically during first calibration or after first calibration data backup command	529	+

P0 First calibration full wave active power [W] **(B)**	First calibration full wave active power	530	+
IL Last calibration full wave effective [A] **(B)**	Last calibration full wave rms current	1028	+
RL Last calibration resistance [Ohm x100] **(B)**	Last calibration resistance	1029	+
VL First calibration RMS voltage [V] **(B)**	First calibration rms voltage	1030	+
PL Last calibration full wave active power [W] **(B)**	Last calibration full wave active power	1031	+
I Current full wave rms current [A] full wave rms current [A] **(B)**	Current full wave rms current	770	+
R Current resistance [ohm x100] **(B)**	Current resistance	771	+
V Current rms voltage [V] **(B)**	Current rms voltage	772	+
P Current full wave active power [W] **(B)**	Current full wave active power	773	+
Transformer/power supply no-load RMS voltage [V x 100]	Transformer/power supply no-load RMS voltage	1049	+
Transformer/power supply no-load RMS voltage pre-alarm [V x 100]		1607	+
Transformer/power supply on-load RMS voltage [V x 100]	Transformer/power supply on-load RMS voltage	1050	+
Earth leakage [%]		1599	+
Rms current [Ax10]		1602	+

Sealing pulse rms current [Ax10]		1601	+
Active power [W]		1603	+
Sealing pulse active power		1605	+
SIF [%]		1604	+
Sealing pulse SIF [%]		1606	+
Full duty cycle [%]	100=Full duty operation, optimal working condition 0= Operating mode protected, working condition to be improved	1611	+
Full duty cycle on sealing pulse [%] **(B)**	Full duty cycle. The data is updated during the sealing pulse. 100=Full duty operation, optimal working condition 0= Operating mode protected, working condition to be improved	778	+
Base internal probe temperature [°C]		1619	-/+
Number of EEPROM writes from power-on	Stores the actual number of writes made in permanent memory since the last power-up	1048	+
Number of total EEPROM writes	Stores the actual number of writes made to non-volatile memory since leaving the factory.	1108	+
Panel connection	[0]=Not active [1]=Active	1204	+
COPRO temperature [°C]	Indicates the current temperature of the sealing element read by the COPRO	1305	-/+
I0 First calibration full wave rms current copro [A]	First calibration full wave rms current COPRO Stored automatically during first calibration or after first calibration data backup command	1024	+

R0 First copro calibration resistance [Ohm x100]	COPRO Calibration Resistance Stored automatically during first calibration or after first calibration data backup command	1025	+
V0 First copro calibration RMS voltage [V]	First COPRO calibration wave rms voltage Stored automatically during first calibration or after first calibration data backup command	1026	+
P0 First copro calibration full wave active power [W]	First COPRO calibration full wave effective power (V x I x “Duty cycle”)	1027	+
IL Last copro calibration full wave rms current [A]	Last COPRO calibration full wave rms current	1032	+
RL Last copro calibration resistance [Ohm x100]	Last COPRO calibration resistance	1033	+
VL Last copro calibration RMS voltage [V]	Last COPRO calibration rms voltage	1034	+
PL Last copro calibration full wave active power [W]	Last COPRO calibration full wave active power (V x I x “Duty cycle”)	1035	+
I Current copro full wave rms current [A] **(B)**	Current full wave rms current	1301	+
R Current copro resistance [ohm x100] **(B)**	Current resistance	1302	+
V Current copro rms voltage [V] **(B)**	Current rms voltage	1303	+
P Current copro full wave active power [W] **(B)**	Current full wave active power	1304	+
Transformer/power supply no-load RMS voltage copro [V x 100]		1306	+
Transformer/power supply no-load RMS voltage pre-alarm copro [V x 100]		1608	+
Transformer/power supply on-load RMS voltage copro [V x 100]		1307	+

Earth leakage copro [%]		1621	+
Rms current copro [Ax10]		1308	+
Sealing pulse rms current copro [Ax10]		1309	+
Active power copro [W]		1310	+
Sealing pulse active power copro [W]		1311	+
SIF copro [%]		1312	+
Sealing pulse SIF copro [%]		1313	+
Base copro internal probe temperature [°C]		1620	-/+

Table33

The parameters in Table33 are easy accessible via webserver (see Figure 71 e Figure 72) and panel (See Figure 73, Figure 74, Figure 75, and Figure 76).

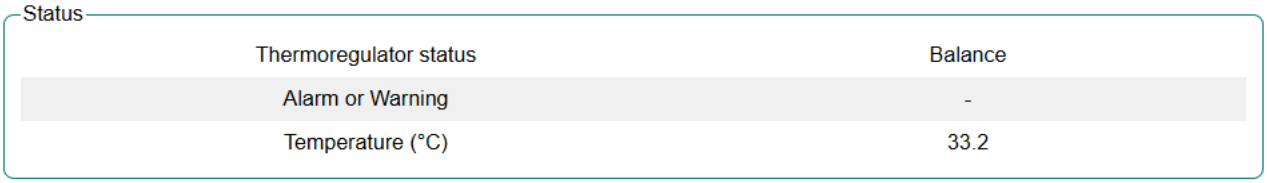


Figure 71

Theoretical analysis

-

Browse...

Import

Technical analysis

Resistance (theoretical, R0, RL and current - Ω)	0.00	0.24	0.24	0.24
Full-wave effective current (theoretical, I0, IL and current - A)	0.0	85.8	85.8	85.4
Effective voltage (theoretical, V0, VL and current - V)	0.0	20.5	20.5	20.5
Full-wave effective power (theoretical, P0, PL and current - VA)	0	1757	1757	1747
Transformer/power supply effective voltage (no load, loaded and pre-alarm - V)	24.8	24.0	24.8	
A69A269 current (current and pre-alarm - mA)	0.0	0.0		
Power load (continuous and sealing impulse - %)	0	0		
SIF (continuous and sealing impulse - %)	0	0		
Effective power (continuous and sealing impulse - VA)	2	2		
Effective current (continuous and sealing impulse - A)	3.1	3.0		

Figure 72

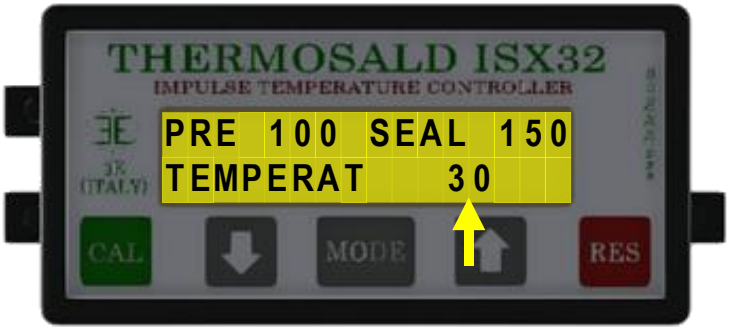


Figure 73

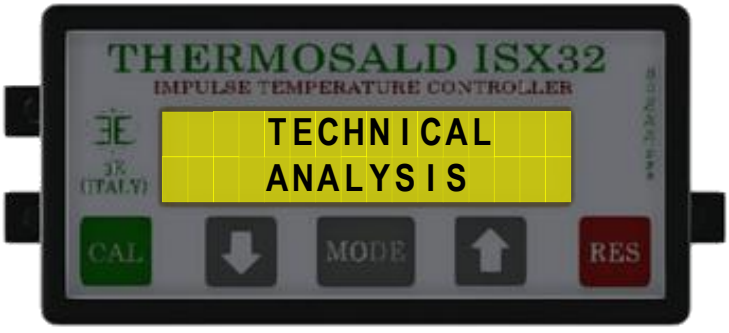


Figure 74



Figure 75



Figure 76

6.12 INFORMATION

The following Table34 shows the information available.

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Model	[10]=Reserved do not use [11]=Reserved do not use [200]=ISX32	21	+
Primary	[0]=SAC [1]=Reserved do not use [2]=SDC	16	+
Maximum temperature and temperature coefficient fixed parameters option	[0]=Not present [1]=Reserved do not use [2]=Reserved do not use [3]=Reserved do not use [4]=TM200 CM1210 [5]=Reserved do not use	781	+
Coprocessor present	[0]=Not present [1]=Present	1053	+
Analog presence/PLC	[0]=Analog/PLC not present [1]=Analog [2]=PLC [3]=Analog/PLC	1205	+
I Maximum full wave rms current [A]	See par. 5.6.	531	+
Master board firmware version major	Master board firmware version X.Y.Z number X	1547	+
Master board firmware version minor	Master board firmware version X.Y.Z number Y	1548	+
Master board firmware version revision	Master board firmware version X.Y.Z number Z	1549	+
Base board firmware version major	Base board firmware version X.Y.Z number X	1550	+
Base board firmware version minor	Base board firmware version X.Y.Z number Y	1551	+
Base board firmware version revision	Base board firmware version X.Y.Z number Z	1552	+
Copro board firmware version major	Copro board firmware version X.Y.Z number X	1553	+
Copro board firmware version minor	Copro board firmware version X.Y.Z number Y	1554	+
Copro board firmware version revision	Copro board firmware version X.Y.Z number Z	1555	+

Analogue Plc board firmware version major	Analogue Plc board firmware version X.Y.Z number X	1556	+
Analogue Plc board firmware version minor	Analogue Plc board firmware version X.Y.Z number Y	1557	+
Analogue Plc board firmware version revision	Analogue Plc board firmware version X.Y.Z number Z	1558	+
Display board firmware version major	Display board firmware version X.Y.Z number X	1559	+
Display board firmware version minor	Display board firmware version X.Y.Z number Y	1560	+
Display board firmware version revision	Display board firmware version X.Y.Z number Z	1561	+

Table34

The parameters in Table34 are easily accessible via webserver (see Figure 77) and panel (see Figure 78).

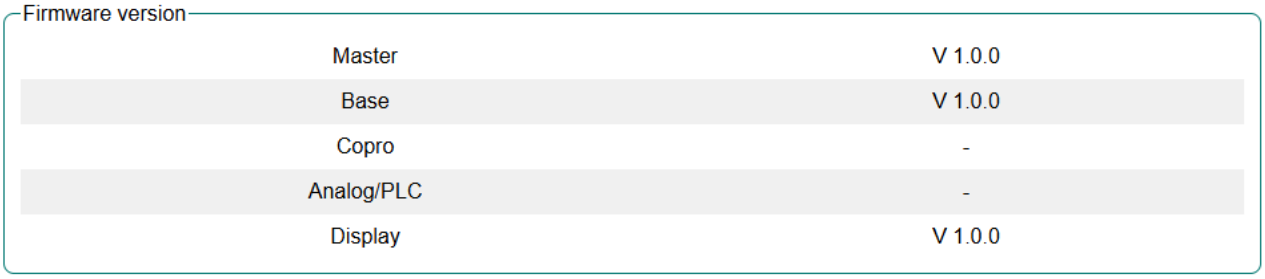


Figure 77



Figure 78

7 FIELDBUS (BU models)

The Thermosald ISX32 can be optionally equipped with many different communication interfaces to the most common industrial fieldbuses, which can be used to exchange information with a PC or PLC supervisor.

The descriptions of each fieldbus in the following sections provide the minimum information required to manage the specific Thermosald ISX32 device. For all details regarding the specific fieldbus and its operating mechanisms, please refer to the specific reference standard.

The thermoregulator always acts as a slave in communication with the supervisor.
Any disconnection from the fieldbus is not managed by the thermoregulator, and it is the supervisor's responsibility to take action regarding this event, such as locking down the system." The supervisor can check device availability at any time by polling the device itself, for example by reading a specific variable at regular intervals.

The Thermosald ISX32 is equipped with a powerful diagnostic system designed to support communication interface developer.
For further details on warnings related to communication issues, please refer to par. 6.8 and chap. 17.

7.1 Connection to Ethernet-based fieldbus

This connection is available for all Ethernet-based fieldbuses

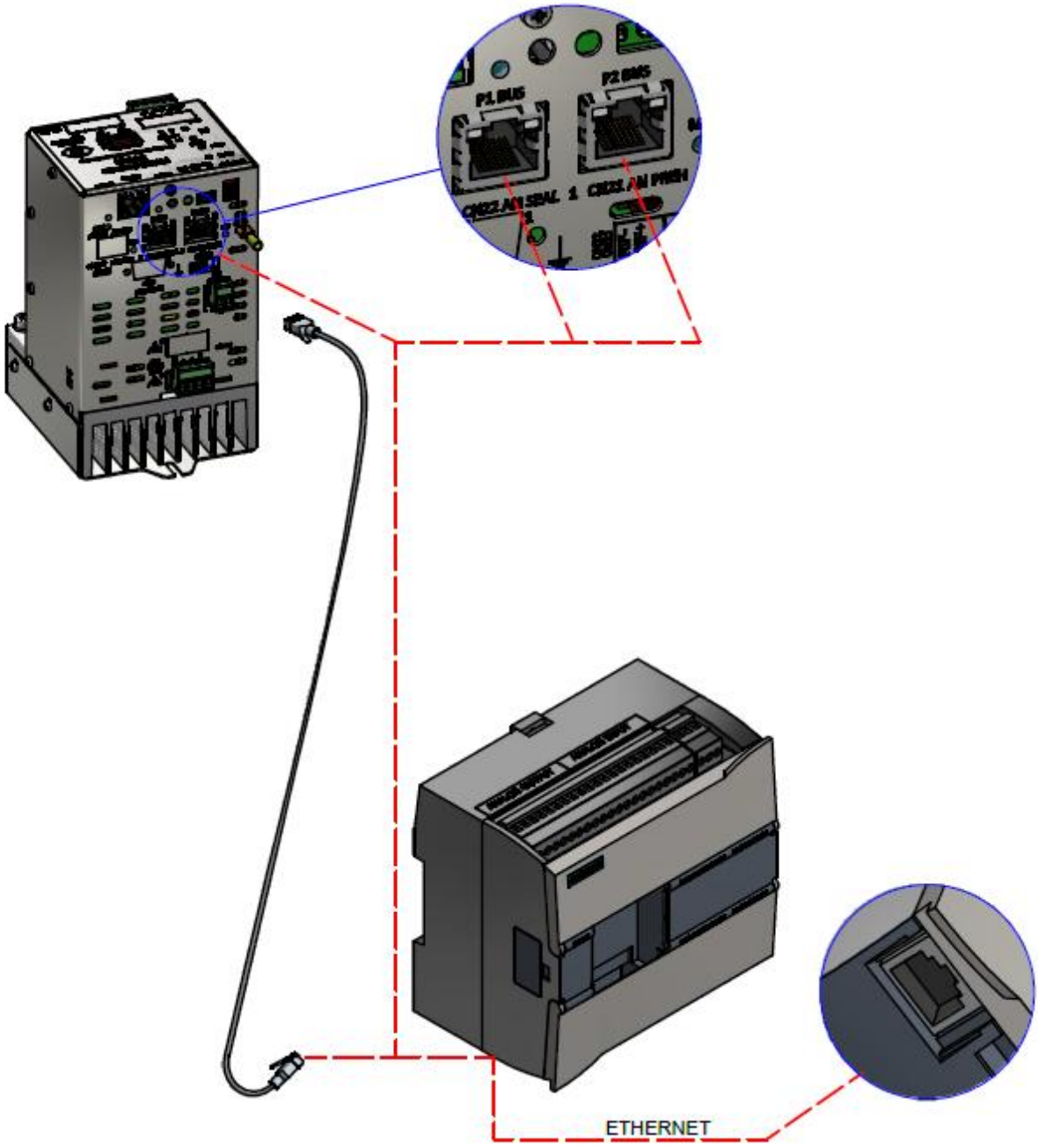


Figure 79

The Ethernet switch shown in Figure 80consists of two RJ45 “P1 BUS” and “P2 BUS” connectors. The built-in switch makes it easy to daisy-chain multiple devices on the bus. The maximum cable length is 30 meters.

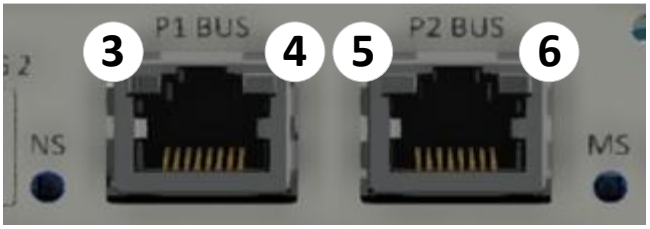


Figure 80

The maximum speed supported by the Ethernet ports is 1 Gbps

The operation of the LEDs on the RJ45 connectors (see Figure 80) is summarized in the following table.

LED	Meaning
3/5 Off 4/6 Off	No connection.
3/5 Yellow Flashing 4/6 Off	Ethernet connection present (10 Mbit/s), activity.
3/5 Green Flashing 4/6 Off	Ethernet connection present (100 Mbit/s), activity.
3/5 Green Flashing 4/6 Green Flashing	Ethernet connection present (1 Gbit/s), activity.

Table35

For more information, please refer to the next paragraphs.

7.2 Connection to Modbus RTU Slave RS485 or Profibus fieldbus"

This connection is available for Modbus RTU Slave RS485 and Profibus.

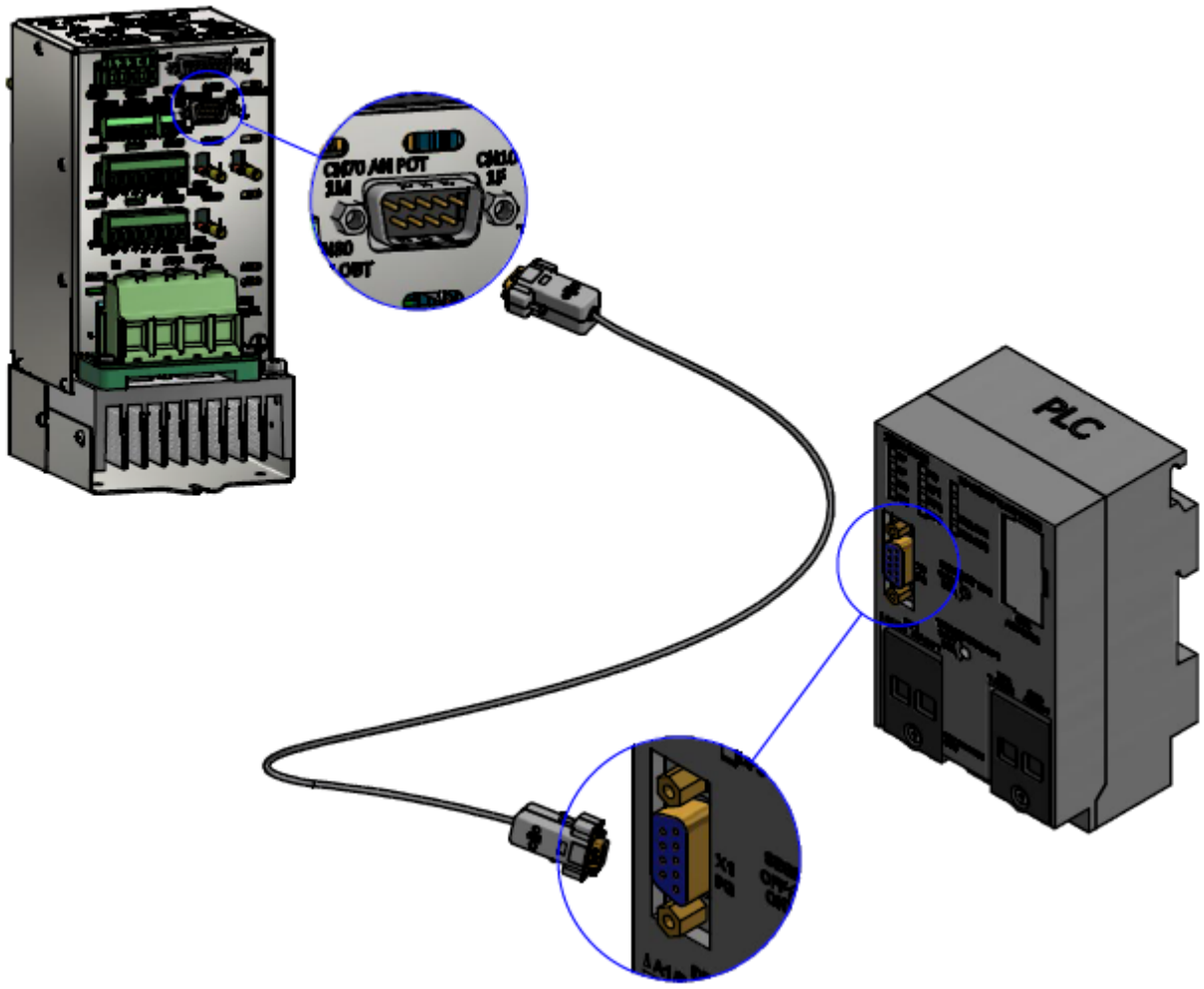


Figure 81



Figure 82

The CN10 connector, shown in Figure 81 and Figure 82, can be used for the Modbus RTU interface or for the Profibus interface, depending on the thermoregulator model. The maximum cable length is 30 meters.

In particular, the pinout shown in the following table follows the Profibus standard specification, and therefore differs from the specification given in the Modbus RTU standard (see par. 7.4). For further information regarding the Modbus RTU interface connections please refer to par. 7.4.1.

CN10 485/PROFI			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1			
PIN2			
PIN3		Profibus B- / RS485 A+	
PIN4		Profibus Enable Output	Available for specific use
PIN5		Isolated 0V output	Available for the connection of the 0Vs (see par. 7.4.1)
PIN6		Isolated +5V output	Do not use
PIN7			
PIN8		Profibus A+ / RS485 B-	
PIN9			

For more information, please refer to the next paragraphs.

7.3 CONFIGURATION AND DIAGNOSTICS

The parameters and information of the fieldbus are accessible both via webserver (see Figure 83 and Figure 84) and panel (see Figure 85).

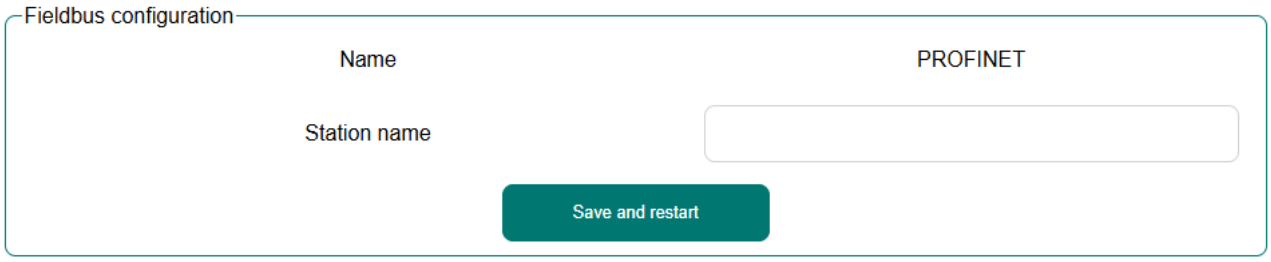


Figure 83

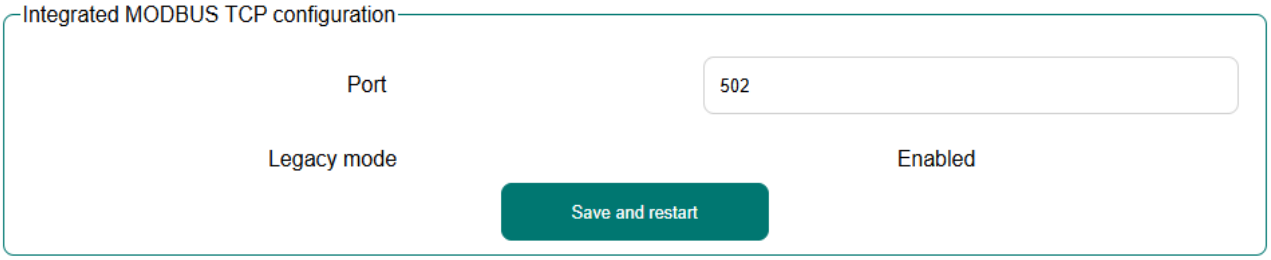


Figure 84

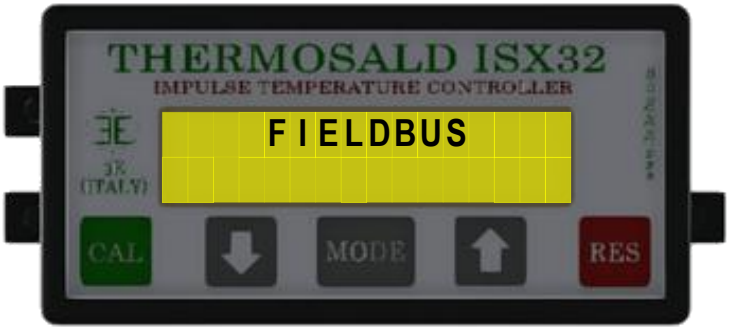


Figure 85

7.4 Modbus RTU Slave RS485 HALF DUPLEX

The implementation is based on the standard reference documents “MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3” and “MODBUS over Serial Line Specification and Implementation Guide V1.02”, which can be found at the URL www.modbus.org.

The device acts as a communication slave, the mode is “RTU” (Remote Terminal Unit), and the physical layer is “RS485” (TIA/EIA-485 Two-Wire).

7.4.1 Connections

For the details on the connections, please refer to par. 7.2.

A shielded cable with a both sided grounded shield at both ends must be used for connection.

When the RS485 bus does not transmit, the following condition must be met:

A+ - B- > 200mV

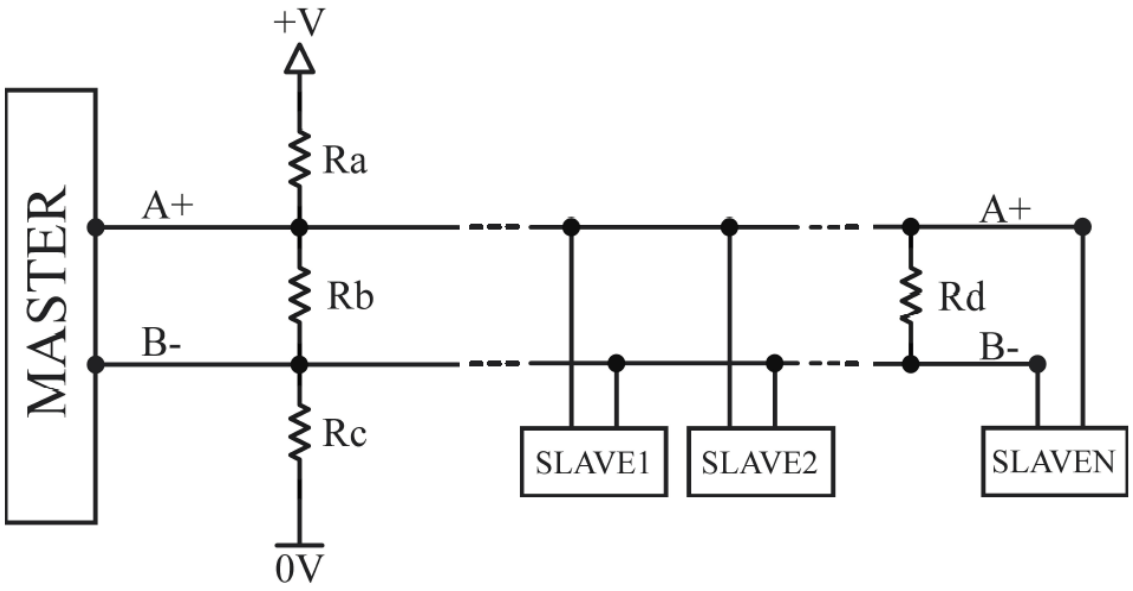
Note for connection with Siemens: A+ must be connected to Siemens channel B+; B- must be connected to Siemens channel A- (+ with + and - with -).

7.4.1.1 Pull-up, pull-down resistors and termination of lines A+ and B-

For the correct operation of the bus, you need to insert the pull-up and pull-down resistors, which at times are preinstalled in the line master, on lines A+ and B-; otherwise an external power supply unit must be inserted.

In general it is preferable to connect the 0V of the slaves to the 0V of the master and to the 0V of the power supply unit (usually, earth grounded).

Connection example:



Bus configurations example:

RA=RC Pull-up/Pull-down (Ω)	RB A+ - B- (Ω)	RD Termination (Ω)	V A+ - B- (mV)	NOTES
390	220	-	1100	-
390	220	220	620	Termination only if necessary
1000	220	-	495	-
1000	220	220	260	Termination only if necessary

If Profibus cables are used for connection, leave all terminations open, including the last one.

Should you need to terminate the line, use an external RD resistor.

In the event that pull-up and pull-down resistors are not present on the bus, it is possible to activate the biasing circuit inside the thermoregulator by setting pins 1 and 2 of the “R TERM” dip switch to ON, as shown in Figure 86. The values of the internal biasing circuit are: RA=RC=390Ω, RB=220Ω. The thermoregulator factory default setting for pins 1 and 2 of the “R TERM” dip switch is OFF.

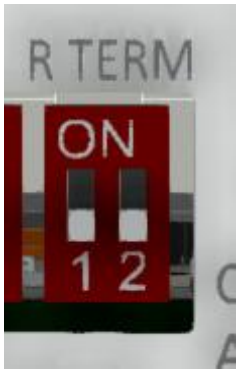


Figure 86

Below are some typical waveforms relating to a single message (see Figure 87) or to a series of Modbus RTU messages (see Figure 88):

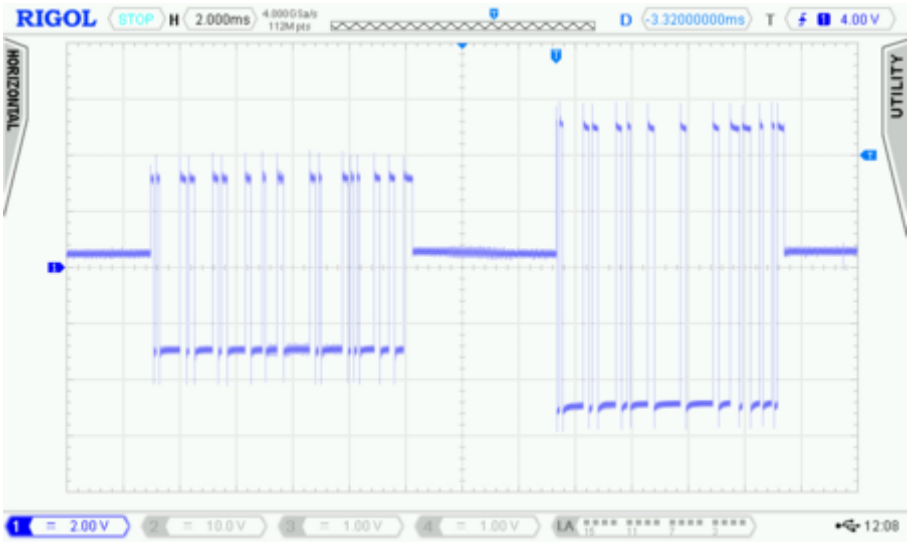


Figure 87

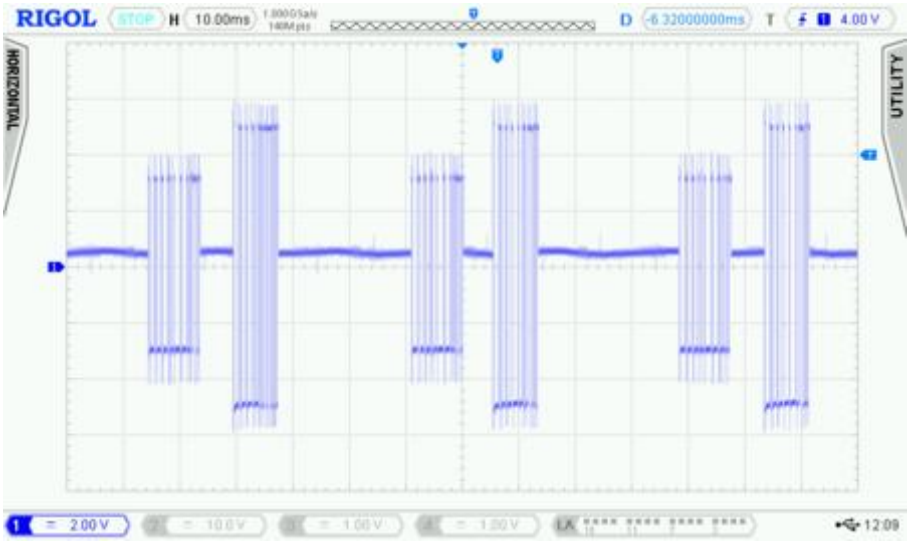

RIGOL
STOP
H 10.00ms
D -6.32000000ms
T 4.00 V
HORIZONTAL
UTILITY
1 2.00 V
12:09

Figure 88

7.4.2 Configuration

For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

The baud rate can be configured based on the following table via the BAUDRATE dip switch (see Figure 89. If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

PIN1	PIN2	PIN3	Baud rate
0	0	0	9600
1	0	0	19200
0	1	0	28800
1	1	0	38400
0	0	1	48000
1	0	1	57600
0	1	1	76800
1	1	1	115200

For backward compatibility reasons, the thermoregulator leaves the factory with the baud rate configured at 9600 and not at 19200 as required by the standard.



Figure 89

As per standard, communication features 1 start bit and 8 data bits.

The baud rate can be configured table via the “STOP BIT dip switch (see Figure 90) based on the following Table36. If the dip switch is changed, you must turn the thermoregulator off and then back on again to acquire the new value.

PIN1	PIN2	Parity	Frame
0	0	NONE (Legacy 1 STOP BIT)	START,1,2,3,4,5,6,7,8,STOP
1	0	NONE (2 STOP BIT)	START,1,2,3,4,5,6,7,8,STOP,STOP
0	1	EVEN	START,1,2,3,4,5,6,7,8,PARITY,STOP
1	1	ODD	START,1,2,3,4,5,6,7,8,PARITY,STOP

Table36

For backward compatibility reasons, the thermoregulator leaves the factory with parity configured at NONE (2 STOP BITS) 2 not at EVEN as required by the standard. The current parity bit value can be read via fieldbus on the related Modbus RTU parity variable (see Table37).

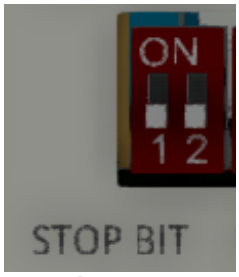


Figure 90

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Modbus RTU parity	[000]= NONE (Legacy 1 STOP BIT) [001]= NONE (2 STOP BITS) [002]= EVEN [003]= ODD	272	+

Table37

The address can be set via binary configuration using the 'BUS CONFIG' DIP switch as shown in Figure 91.



Figure 91

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table38 shows some address configuration examples.
The valid addresses fall within range 1-247.

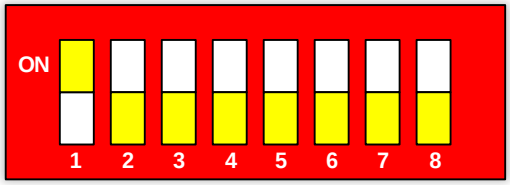
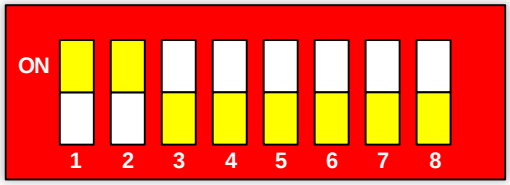
DEVICE ADDRESS = 1	SW2[1]=ON SW2[2..8]=OFF	
DEVICE ADDRESS = 3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table38

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

If all dip switch PINS are set to 0, the address can be set via software. When the dip switch is set to 0, the thermoregulator uses the last configured address.

The factory's thermoregulator dip switch setting is address 1.

Two modes are provided for managing the Idle Time: "Automatic" and "Legacy".

The "Automatic" mode provides automatic calculation of the Idle Time based on the currently set baud rate, as required by the standard, and shown in Table39.

Baud rate	Idle Time
9600	≃4 ms
19200	≃2 ms
28800	1.75 ms
38400	1.75 ms
48000	1.75 ms
57600	1.75 ms
76800	1.75 ms
115200	1.75 ms

Table39

The "Legacy" mode enables you to configure the Idle Time through the related "Modbus RTU Legacy mode Idle Time" [ms] parameter (See Table Table40) which enables the use of the thermoregulator for example with particularly slow master legacy.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Modbus RTU: Lagacy mode Idle Time [ms]	[2]=2 .. [10]=10 (Default), .. [50]=50 .. [100]=100	274	10	2	100

Table40

The "IDLE CHAR" dip switch shown in Figure 92 enables you to switch from one mode to another provided that the thermoregulator is switch off and on according to the configuration shown in Table41.



Figure 92

PIN1	Idle Time Mode
0	Automatic
1	Legacy

Table41

The factory's thermoregulator dip switch setting is "Automatic" mode.

To properly size the master timeout it is possible to calculate the Response Time of the thermoregulator which depends on the Idle Time (only in "Legacy" mode) and the Transmission time, using the following formula:

"Lagacy" mode
Max Response time = 10 ms + Idle Time * 1.5 + Transmission time

"Automatic" mode
Max Response time = 10 ms + Transmission time

The maximum Transmission Time value is 290 ms @ 9600 bps.

If the broadcast communication (address 0) is used, the Turnaround Delay—which is the time guaranteed by the master between sending a broadcast and the subsequent packet—must be at least the following:

"Lagacy" mode
Min Turnaround Delay = 10ms + Idle Time * 1.5

"Automatic" mode
Min Turnaround Delay = 10ms

7.4.3 Modbus Objects and Commands

For the Modbus parameters managed by the thermoregulator, see paragraphs 7.14 and 6.6.11.1.
For the details of the Modbus commands managed by the thermoregulator, see par. 7.13.

7.4.4 Diagnostics

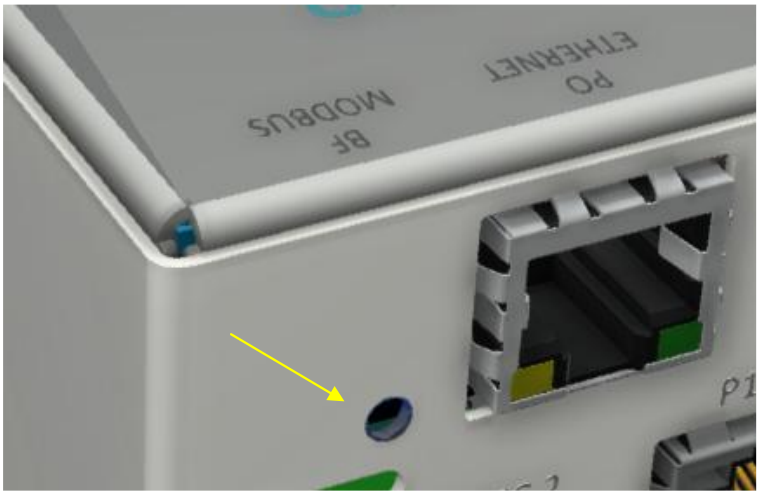


Figure 93

The LED shown in Figure 93 lights up when communication is active and turns off if there is no communication No specific LEDs for frame receipt and transmission are provided

The LED will turn off after the configurable timeout on the Modbus RTU Master Timeout [s x 10] parameter shown in the table below to indicate the absence of communication.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
Modbus RTU Master Timeout [s x 10]	Time after which, if not queried, Thermosald considers the connection aborted with the master.	1045	50 (5s)	1 (0.1s)	600 (60s)

For specific signals relating to device power-on and error management provided by the standard, please refer to the general implementation provided in the thermoregulator (see par. 6.8 for enabling and disabling specific alarms and warnings).

7.4.5 COMMISSIONING

Proceed as follows:

1. Connect as described in par. 7.4.1 pay attention that all electric requirements for the operation are met.
2. Configure the communication parameters as indicated in par. 7.4.2.
3. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
4. When communicating with the device (see par. 7.4.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.4.4.

7.4.5.1 Notes on specific targets

If using a Proface panel, use the 1÷N register range to address range 0÷N-1.

7.5 Profibus

7.5.1 CONNECTIONS

For the details on the connections, please refer to par. 7.2.

7.5.2 CONFIGURATION

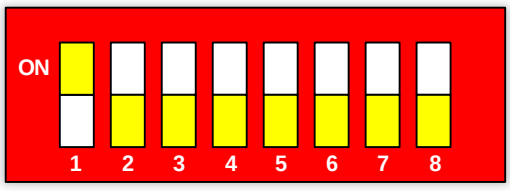
For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

The address can be set via binary configuration using the 'BUS CONFIG' DIP switch as shown in Figure 91.



Figure 94

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table42shows some address configuration examples.
The valid addresses fall within range 1-125.

DEVICE ADDRESS = 1	SW2[1]=ON SW2[2..8]=OFF	

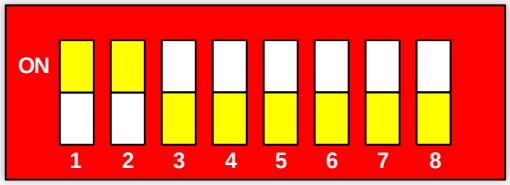
DEVICE ADDRESS = 3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table42

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The configuration corresponding to address 0 as envisaged by the standard, is used to enable the address setting via software. When the dip switch is set to 0, the thermoregulator uses the last configured address.

The factory's thermoregulator dip switch setting is address 1.

7.5.3 PROFIBUS V5 interface

7.5.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT8	Code	See par. 7.15.
01	UINT16	ID (Byte High)	
		ID (Byte Low)	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value (Byte High)	
		Value (Byte Low)	
03	UINT16	Command word (Byte High)	See par. 6.6.11.1.
		Command Word (Byte Low)	

7.5.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT8	Code echo	See par. 7.15.
01	UINT16	ID echo (Byte High)	
		ID echo (Byte Low)	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo (Byte High)	
		Value echo (Byte Low)	
03	INT16	Temperature [°C] (Byte High, ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
		Temperature [°C] (Byte Low, ID 768)	
04	UINT16	Alarm/warning number (Byte High, ID 769)	
		Alarm/warning number (Byte Low, ID 769)	
05	UINT8	Thermoregulator status (ID 774)	
06	UINT8	Reserved do not use	
07	UINT8	Reserved do not use	

7.5.4 DIAGNOSTICS

The following table describes the operation of the LED interface located on the rear of the equipment (see Figure 95).



Figure 95

LED OPERATION MODE (NS)	Meaning
OFF	Power supply missing Offline
ON (green)	Online, DATA EXCHANGE
Flashing (green)	Online, CLEAR
1 Flashing (Red)	PARAMETRIZATION error
2 Flashings (Red)	CONFIGURATION error

LED MS (Module Status)	Meaning
OFF	Initialization missing (Contact 3E Technical Support)
ON (green)	Normal operation
Flashing (green)	Initialization performed, presence of diagnostic events. (Contact 3E Technical Support)
ON (Red)	Internal error (Contact 3E Technical Support)

For additional warning please refer to the general implementation of the thermoregulator (please refer to 6.8 for enabling and disabling specific alarms and warnings).

7.5.5 COMMISSIONING

Proceed as follows:

1. Connect the Profibus cable as described in par. 7.5.1.
2. Configure the communication parameters as indicated in par. 7.5.2.
3. Download the appropriate GSD archive, e.g. "*Thermosald ISX BUS Profibus GSD V5*", from the website www.3e3e3e.com.
4. Extract the contents of the archive and install the 3E__0C4E.gsd and 3E__0C4E.bmp GSD files in the PROFIBUS configuration tool being used. Select the ThermoSald module.
5. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
6. When communicating with the device (see par. 7.5.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.5.4.

7.5.5.1 Installations

Thermosald has already been successfully integrated into various systems including Siemens, Hilscher.

7.6 Profinet RT/IRT

7.6.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1 using a proper Ethernet cable.

7.6.2 CONFIGURATION

7.6.2.1 Profinet RT/IRT

For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

The device can be set in order to operate in RT or IRT mode by setting the “SW8” pin of dip switch “BUS CONFIG” before switching on the Thermosald as shown in Table42.



Figure 96 – RT/IRT

	OFF	ON
SW8	RT mode	IRT mode

Table43

The factory’s thermoregulator setting is RT mode.

7.6.2.2 Communication parameters

For Profinet communication, it is necessary to configure the device name.
The name can be configured via the Profinet network or through the panel, or the web server. The Ip Address and Subnet Mask cannot be changed.

PARAMETERS	
Name	**Default**
Station name	“”
Ip Address	0.0.0.0
Subnet Mask	0.0.0.0

Table44

By factory default, the thermoregulator has no PROFINET name or IP address programmed.
These parameters can be set later by the master via software.
Alternatively, there are some ad hoc applications, such as the Proneta tool distributed by Siemens (www.siemens.com), which allow the Profinet parameters of the device to be configured using a PC.

7.6.2.3 GSDML

The GSDML files listed in Table45 can be downloaded from the web site www.3e3e3e.com.

Mode	File
RT	*"Thermosald Profinet RT V5.1.2"*
IRT	*"Thermosald Profinet IRT V1.0.0"*

Table45

The contents of the chosen archive must be installed into the catalogue of the PROFINET configuration tool being used.

Then, the device must be selected and added:

- "3E s.r.l."
- "Slave"
- "Thermosald Profinet RT V5.1.2" (RT mode)
  or
  "Thermosald Profinet IRT V1.0.0" (IRT mode)

WARNING: The GSDML files automatically map the device, strictly respecting the order (output, input, and related fields) and variable types exactly as described in par. 7.6.3. However, it is recommended to verify that the mapping has been performed correctly.

7.6.3 Interfaces

7.6.3.1 Profinet RT V5

7.6.3.1.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT8	Code	See par. 7.15.
01	UINT16	ID (Byte High)	
		ID (Byte Low)	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value (Byte High)	
		Value (Byte Low)	
03	UINT16	Command Word (Byte High)	See par. 6.6.11.1.
		Command Word (Byte Low)	

7.6.3.1.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT8	Code echo	See par. 7.15.
01	UINT16	ID echo (Byte High)	
		ID echo (Byte Low)	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo (Byte High)	
		Value echo (Byte Low)	
03	INT16	Temperature [°C] (Byte High, ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
		Temperature [°C] (Byte Low, ID 768)	
04	UINT16	Alarm/warning number (Byte High, ID 769)	
		Alarm/warning number (Byte Low, ID 769)	
05	UINT8	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (Byte High, ID 770)	
		I Current full wave rms current [A] (Byte Low, ID 770)	

07	UINT16	R Current resistance [ohm x100] (Byte High, ID 771)	
		R Current resistance [ohm x100] (Byte Low, ID 771)	
08	UINT16	V Current rms voltage [V] (Byte High, ID 772)	
		V Current rms voltage [V] (Byte Low, ID 772)	
09	UINT16	P Current full wave active power [W] (Byte High, ID 773)	
		P Current full wave active power [W] (Byte Low, ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (Byte High, ID 778)	
		Full duty cycle on sealing pulse [%] (Byte Low, ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (Byte High, ID 527)	
		I0 First calibration full wave rms current [A] (Byte Low, ID 527)	
12	UINT16	R0 First calibration resistance [Ohm x100] (Byte High, ID 528)	
		R0 First calibration resistance [Ohm x100] (Byte Low, ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (Byte High, ID 529)	
		V0 First calibration RMS voltage [V] (Byte Low, ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (Byte High, ID 530)	
		P0 First calibration full wave active power [W] (Byte low, ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (Byte High, ID 258)	
		Calibration temperature [°C] (Byte Low, ID 258)	
16	UINT16 Note: The read value must be	Max. Temperature [°C] (Byte High, ID 262)	
		Max. Temperature [°C] (Byte Low, ID 262)	

	interpreted in two's complement as it can potentially be negative.		
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Preheating temperature [°C](Byte High, ID 269)	
		Preheating temperature [°C](Byte Low, ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (Byte High, ID 270)	
		Sealing temperature [°C] (Byte Low, ID 270)	

7.6.3.2 Profinet IRT V1

7.6.3.3 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	See par. 7.15.
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	
03	UINT16	Command Word	See par. 6.6.11.1.

7.6.3.4 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT16	Code echo	See par. 7.15.
01	UINT16	ID echo	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
03	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details on the variables, please refer to chap. 6.
04	UINT16	Alarm/warning number (ID 769)	
05	UINT16	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (ID 770)	
07	UINT16	R Current resistance [ohm x100](ID 771)	
08	UINT16	V Current rms voltage [V] (ID 772)	
09	UINT16	P Current full wave active power [W] (ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (ID 527)	
12	UINT16	R0 First calibration resistance	

		[Ohm x100] (ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
16	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Max temperature [°C] (ID 262)	
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	

7.6.4 DIAGNOSTICS

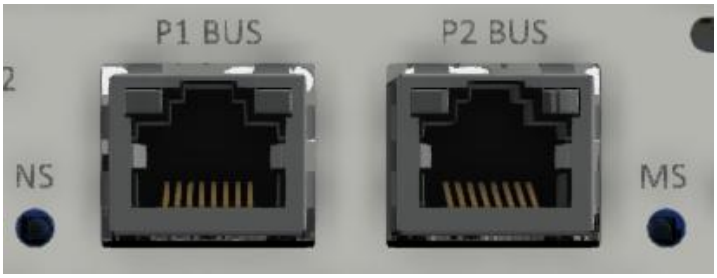


Figure 97

For the diagnostics of the LED on the RJ45 connectors, please refer to 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 99)

LED NS (Network Status)	LED MS (Module Status)	Meaning
OFF	x	Power supply missing. Connection with master absent.
ON (green)	x	Connection with master established. Master RUNNING.
1 Flashing (green)	x	Connection with master established. Master STOPPED or I/O data incorrect. Profinet IRT synchronization not finished.
Flashing (green)	x	Node identification on the network.
ON (Red)	x	Module fault, contact 3E Technical Support.
1 Flashing (Red)	x	Name not configured.
2 Flashings (Red)	x	IP address not configured.
3 Flashes (Red)	x	Actual identification different from expected identification.
x	OFF	Power supply missing. Module initializing now.
x	ON (green)	Regular operation.
x	1 Flashing (green)	Presence of diagnostic events.
x	ON (Red)	Module fault, contact 3E Technical Support.
x	Green/Red Flashing	Firmware update in progress.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par. 6.8 for enabling and disabling specific alarms and warnings).

7.6.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.6.1.
2. Configure the communication parameters as indicated in par. 7.6.2.
3. Use the GSDML file as described in par.7.6.2.3.
4. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
5. When communicating with the device (see par. 7.6.3) you can check the correct interaction operation using the diagnostic utilities described in par.7.6.4.

7.6.5.1 Installations

Thermosald has already been successfully integrated into various systems including Siemens, Hilscher.

7.7 Ethernet/IP

7.7.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1.

7.7.2 CONFIGURATION

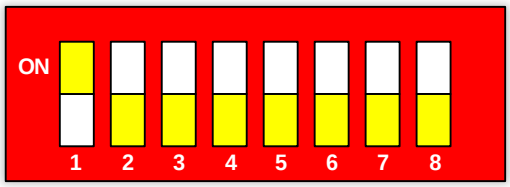
For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

Byte 4 of the IP address can be configured in binary using the “BUS CONFIG” DIP switch as shown in Figure 94.



Figure 98

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table42shows some address configuration examples.
The valid addresses fall within range 1-254.
Address 255 is not valid as it is a broadcast address.

IP ADDRESS = xxx.xxx.xxx.xx1	SW2[1]=ON SW2[2..8]=OFF	

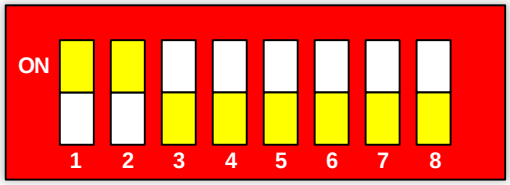
IP ADDRESS = xxx.xxx.xxx.xx3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table46

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The dip switch set to 0 is used to enable the address configuration via software. When the dip switch is set to 0, the thermoregulator uses the last configured value.

The factory's thermoregulator dip switch setting is 0.
The IP factory' setting is shown in the following table.

PARAMETERS	
Name	**Default**
DHCP	OFF
Ip Address	192.168.0.55
Subnet Mask	255.255.255.0

7.7.3 Ethernet interface/IP V5

7.7.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	See par. 7.15.
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	
03	UINT16	Command Word	See par. 6.6.11.1.

7.7.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT16	Code echo	See par. 7.15.
01	UINT16	ID echo	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
03	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
04	UINT16	Alarm/warning number (ID 769)	
05	UINT16	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (ID 770)	
07	UINT16	R Current resistance [ohm x100](ID 771)	
08	UINT16	V Current rms voltage [V] (ID 772)	
09	UINT16	P Current full wave active power [W] (ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (ID 527)	

12	UINT16	R0 First calibration resistance [Ohm x100] (ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
16	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Max temperature [°C] (ID 262)	
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	

7.7.4 DIAGNOSTICS

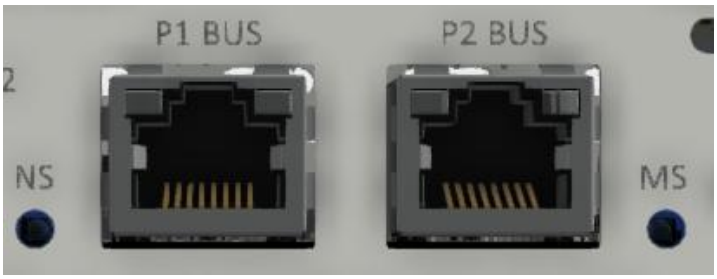


Figure 99

For the diagnostic of the LED on the RJ45 connectors, please refer to 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 99).

LED NS (Network Status)	**LED MS (Module Status)**	**Meaning**
OFF	x	Power supply missing. IP address not configured.
ON (green)	x	Online, one or more connections established.
Flashing (green)	x	Online, no connection established.
ON (Red)	x	Duplicate IP address. Module fault, contact 3E Technical Support.
Flashing (Red)	x	Timeout of one or more connections.
x	OFF	Power supply missing.
x	ON (green)	Scanner RUNNING.
	Flashing (Green)	Module not configured. Scanner IDLE.
x	ON (Red)	Module fault. Contact 3E Technical Support.
x	Flashing (Red)	Module configured, stored parameters are not consistent with currently used parameters.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par.6.8 for enabling and disabling specific alarms and warnings).

7.7.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.7.1.
2. Configure the communication parameters as indicated in par. 7.7.2.
3. Download the appropriate EDS archive, e.g. "*Thermosald ISX BUS Ethernet/IP EDS V5*", from website www.3e3e3e.com.
4. Extract the contents of the archive and install the EDS file in the Ethernet/IP configuration tool being used.
5. Assign a size of 8 bytes (4 words) to the output (PLC Master output -> Thermosald Slave).
6. Assign a size of 38 bytes (19 words) to the input (Thermosald Slave -> PLC Master input).
7. When communicating with the device (see par. 7.7.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.7.4.

7.7.5.1 Tools not compatible with the EDS interchange format

If the tool does not support the EDS interchange format, proceed as follows:

- No. of instances: 2.
- Input instance (Thermosald Slave -> PLC Master): ID:100, Size:38 bytes, Ownership:Exclusive, Priority:Scheduled, Connection:Point to Point, Use Run Idle:False.
- Output instance (PLC Master -> Thermosald Slave): ID:150, Size:8 bytes, Ownership:Exclusive, Priority:Scheduled, Connection:Point to Point, Use Run Idle:True.

7.7.5.2 Installations

Thermosald has already been successfully integrated into various systems including Omron, Yaskawa, Beckhoff, Rockwell, Hilscher.

7.7.5.3 Software change of IP address

The thermoregulator leaves the factory with address 192.168.0.55 and netmask 255.255.255.0. The IP address and the netmask can be set by the master via software.
Alternatively, the easiest way to configure the network parameters is via the device panel or web server.
There are some ad hoc applications, such as HMS Anybus “IP Config”. For the download of this tool, refer to the HMS Anybus website (www.anybus.com).

7.8 Powerlink

7.8.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1.

7.8.2 CONFIGURATION

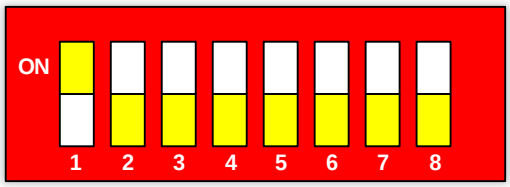
For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

The address can be set via binary configuration using the 'BUS CONFIG' DIP switch as shown in Figure 94.



Figure 100

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table42shows some address configuration examples.
The valid addresses fall within range 1-239.

DEVICE ADDRESS = 1	SW2[1]=ON SW2[2..8]=OFF	

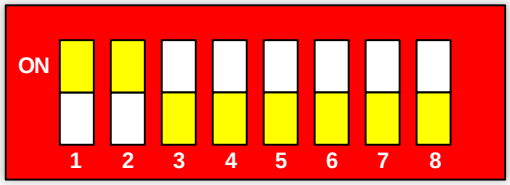
DEVICE ADDRESS = 3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table47

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The configuration corresponding to address 0 is used to enable the address setting via software. When the dip switch is set to 0, the thermoregulator uses the last configured address.

The factory's thermoregulator dip switch setting is address 1.

7.8.3 Powerlink V5 interface

7.8.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	See par. 7.15.
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	
03	UINT16	Command Word	See par. 6.6.11.1.

7.8.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT16	Code echo	See par. 7.15.
01	UINT16	ID echo	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
03	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
04	UINT16	Alarm/warning number (ID 769)	
05	UINT16	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (ID 770)	
07	UINT16	R Current resistance [ohm x100](ID 771)	
08	UINT16	V Current rms voltage [V] (ID 772)	
09	UINT16	P Current full wave active power [W] (ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (ID 527)	

12	UINT16	R0 First calibration resistance [Ohm x100] (ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
16	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Max temperature [°C] (ID 262)	
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	

7.8.4 DIAGNOSTICS

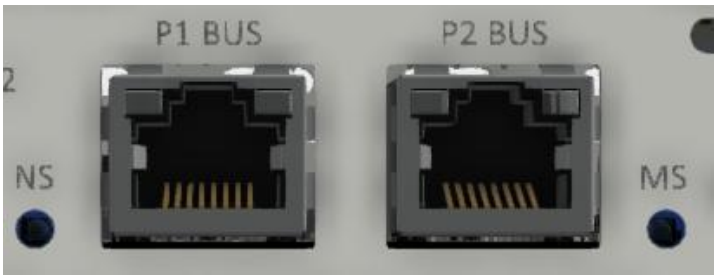


Figure 101

For the diagnostics of the LED on the RJ45 connectors, please refer to par. 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 101).

STS LED (NS)	ERR LED (MS)	Meaning
Flashing (50ms, Green)	x	Ethernet level connected. Powerlink traffic not detected.
1 Flashing (green)	x	Only asynchronous data.
2 Flashings (green)	x	Synchronous and asynchronous data. PDO data not present. In this status, the sent process data are declared not valid and the received process data must be ignored.
3 Flashes (green)	x	Ready for normal operation. Synchronous and asynchronous data. PDO data not present. In this status, the sent process data are declared not valid and the received process data must be ignored.
ON (green)	x	Regular operation. Synchronous and asynchronous data. PDO data sent and received.
Flashing (200ms, Green)	x	Module stopped, due to controlled shutdown for example. PDO data not present. In this status, the sent process data are declared not valid and the received process data must be ignored.
x	ON (Red)	Module fault. Contact 3E Technical Support.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par.6.8 for enabling and disabling specific alarms and warnings).

7.8.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.8.1.
2. Configure the communication parameters as indicated in par. 7.8.2.
3. Download the appropriate XDD archive, e.g. "*Thermosald ISX BUS Powerlink XDD V5*", from website www.3e3e3e.com.
4. Extract the contents of the archive and install the XDD file in the Powerlink configuration tool being used.
5. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
6. When communicating with the device (see par. 7.8.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.8.4.

7.8.5.1 Installations

Thermosald has already been successfully integrated into various systems including B&R.

7.9 MODBUS TCP

7.9.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1.

7.9.2 CONFIGURATION

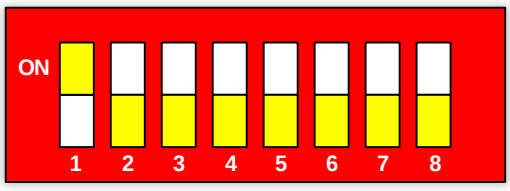
For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

Byte 4 of the IP address can be configured in binary using the “BUS CONFIG” DIP switch as shown in Figure 102.



Figure 102

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table48shows some address configuration examples.
The valid addresses fall within range 1-254.
Address 255 is not valid as it is a broadcast address.

IP ADDRESS = xxx.xxx.xxx.xx1	SW2[1]=ON SW2[2..8]=OFF	

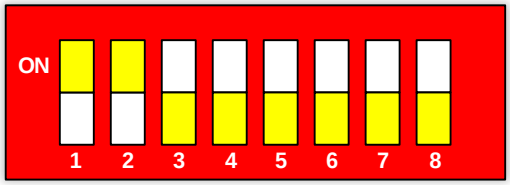
IP ADDRESS = xxx.xxx.xxx.xx3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table48

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The dip switch set to 0 is used to enable the address configuration via software. When the dip switch is set to 0, the thermoregulator uses the last configured value.

The factory's thermoregulator dip switch setting is 0.
The IP factory' setting is shown in the following table.

PARAMETERS	
Name	**Default**
DHCP	OFF
Ip Address	192.168.0.55
Subnet Mask	255.255.255.0

The port used by the protocol is 502.

7.9.3 Modbus Objects and Commands

The interface with the thermoregulator consists of the HOLDING REGISTER objects that are described in the following paragraphs.
For the details of the Modbus commands managed by the thermoregulator, see par. 7.13.

7.9.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	See par. 7.15.
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	
03	UINT16	Command Word	See par. 6.6.11.1.

7.9.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
2048	UINT16	Code echo	See par. 7.15.
2049	UINT16	ID echo	
2050	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
2051	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
2052	UINT16	Alarm/warning number (ID 769)	
2053	UINT16	Thermoregulator status (ID 774)	
2054	UINT16	I Current full wave rms current [A] (ID 770)	
2055	UINT16	R Current resistance [ohm x100](ID 771)	
2056	UINT16	V Current rms voltage [V] (ID 772)	
2057	UINT16	P Current full wave active power [W]	

		(ID 773)	
2058	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
2059	UINT16	I0 First calibration full wave rms current [A] (ID 527)	
2060	UINT16	R0 First calibration resistance [Ohm x100] (ID 528)	
2061	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
2062	UINT16	P0 First calibration full wave active power [W] (ID 530)	
2063	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
2064	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Max temperature [°C] (ID 262)	
2065	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
2066	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	

7.9.4 DIAGNOSTICS

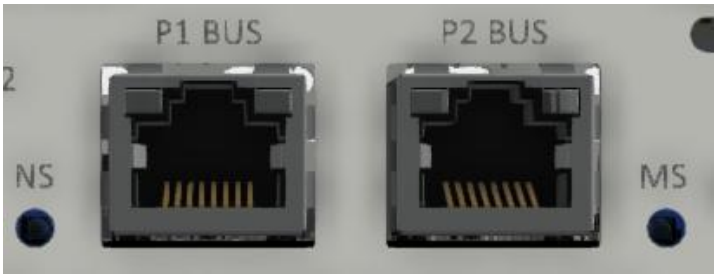


Figure 103

For the diagnostic of the LED on the RJ45 connectors, please refer to par. 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 103).

LED NS (Network Status)	**LED MS (Module Status)**	**Meaning**
OFF	x	Power supply missing or IP address not configured. Module fault. Contact 3E Technical Support.
ON (Green)	x	Received at least one Modbus message.
Flashing (Green)	x	Awaiting the first Modbus message.
ON (Red)	x	Duplicate IP address. Module fault.
Flashing (Red)	x	Modbus messages timeout.
x	OFF	Power supply missing.
x	ON (Green)	Regular operation.
x	ON (Red)	Module fault. Contact 3E Technical Support.
x	Flashing (Red)	Module fault. Contact 3E Technical Support.
x	Green/Red Flashing	Firmware update in progress.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par.6.8 for enabling and disabling specific alarms and warnings).

7.9.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.9.1.
2. Configure the communication parameters as indicated in par. 7.9.2.
3. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
4. When communicating with the device (see par. 7.9.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.8.4. 7.9.4.

7.9.5.1 Software change of IP address

The thermoregulator leaves the factory with address 192.168.0.55 and netmask 255.255.255.0. The IP address and the netmask can be set by the master via software.
Alternatively, the easiest way to configure the network parameters is via the device panel or web server.
There are some ad hoc applications, such as HMS Anybus “IP Config”. For the download of this tool, refer to the HMS Anybus website (www.anybus.com).

7.10 EtherCAT

7.10.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1.

7.10.2 CONFIGURATION

7.10.2.1 Communication parameters

No communication parameter to be configured.

7.10.3 ETHERCAT interface

7.10.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	See par. 7.15.
03	UINT16	Command Word	See par. 6.6.11.1.

7.10.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT16	Code echo	See par. 7.15.
01	UINT16	ID echo	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
03	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
04	UINT16	Alarm/warning number (ID 769)	
05	UINT16	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (ID 770)	
07	UINT16	R Current resistance [ohm x100](ID 771)	
08	UINT16	V Current rms voltage [V] (ID 772)	
09	UINT16	P Current full wave active power [W] (ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (ID 527)	
12	UINT16	R0 First calibration resistance [Ohm x100] (ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
16	UINT16	Max temperature [°C]	

	Note: The read value must be interpreted in two's complement as it can potentially be negative.	(ID 262)	
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	

7.10.4 DIAGNOSTICS

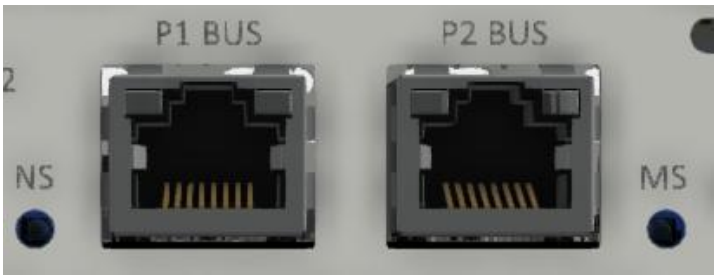


Figure 104

For the diagnostic of the LED on the RJ45 connectors, please refer to par. 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 104).

RUN LED (NS)	**ERR LED (MS)**	**Meaning**
OFF	x	Power supply missing or “INIT” status.
ON (Green)	x	“OPERATIONAL” status.
Flashing (Green)	x	“PRE-OPERATIONAL” status.
1 Flashing (Green)	x	“SAFE-OPERATIONAL” status.
Fast flashing	x	“BOOT” status.
ON (Red)	x	Module fault. Contact 3E Technical Support.
x	OFF	Power supply missing or no errors.
x	Flashing (Red)	Configuration not valid. Contact 3E Technical Support.
x	1 Flashing (Red)	Unexpected change of status. Contact 3E Technical Support.
x	2 Flashings (Red)	Watchdog timeout. Contact 3E Technical Support.
x	ON (Red)	Module fault. Contact 3E Technical Support.
x	Fast flashing	Problem in “BOOT” status. Contact 3E Technical Support.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par. 6.8 for enabling and disabling specific alarms and warnings).

7.10.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.10.1.
2. Configure the communication parameters as indicated in par. 7.10.2.
3. Download the archive containing the appropriate interchange file, "*Thermosald ISX EtherCAT_ESI_5_1_0"*, from website www.3e3e3e.com.
4. Extract the contents of the archive and install the ESI file in the catalogue of the Ethercat configuration tool being used.
5. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
6. When communicating with the device (see par. 7.10.3) you can check the correct interaction operation using the diagnostic utilities described in par. 7.10.4.

7.10.5.1 Installations

Thermosald has already been successfully integrated into various systems including Beckhoff, Hilscher.

7.11 Integrated Modbus TCP (models with "BU13" option)

The integrated Modbus TCP protocol utilizes the Ethernet communication channel natively present on the thermoregulator.
It is available on all "BU13" models and can generally be enabled on all "BU" models.

The implementation is based on the standard reference documents "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3" and "MODBUS MESSAGING ON TCP/IP IMPLEMENTATION GUIDE V1.0b", which can be found at the URL www.modbus.org.

7.11.1 CONNECTIONS

For the Ethernet connection, please refer to par.5.3.

7.11.2 CONFIGURATION

The port used by Modbus TCP is configurable (see Table49).

PARAMETERS	
Name	**Default**
Port	502

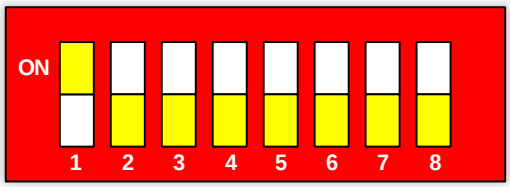
Table49

Byte 4 of the IP address can be configured in binary using the “BUS CONFIG” DIP switch as shown in Figure 102.



Figure 105

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table50shows some address configuration examples.
The valid addresses fall within range 1-247.

IP ADDRESS = xxx.xxx.xxx.xx1	SW2[1]=ON SW2[2..8]=OFF	

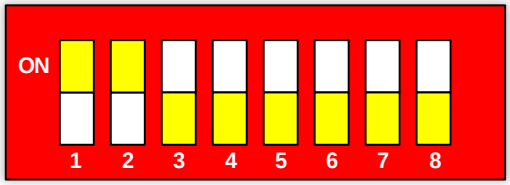
IP ADDRESS = xxx.xxx.xxx.xx3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table50

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The dip switch set to 0 is used to enable the address configuration via software. When the dip switch is set to 0, the thermoregulator uses the last configured value.

The factory's thermoregulator dip switch setting is 0.

The following table describes the option that can be configured through ""MODBUS/TCP" dip switch (see Figure 106).

PIN	DESCRIPTION
PIN1	If disabled, the bus will be in Legacy mode: for the Modbus objects managed by the thermoregulator, see par. 7.9.3. If enabled, the bus will be in Standard mode: for the Modbus objects managed by the thermoregulator, see paragraphs 7.14 and6.6.11.1. By factory default, the pin is disabled.
PIN2	Modbus TCP enabling If another fieldbus is present on the thermoregulator, activating this pin allows the 'BUS CONFIG' dip switch (see Figure 105) to be used for the integrated Modbus TCP. If the Modbus RTU is provided, the "MODBUS" LED is also used for the Integrated Modbus TCP and no longer used for the Modbus RTU. By factory default, the pin is disabled.

Table51



Figure 106

For the configuration of the Ethernet communication parameters, please refer to par. 6.4.

For the configuration of all the fieldbus parameters, please refer to the general description in par.7.3.

7.11.3 Modbus Objects and Commands

For the Modbus objects managed by the thermoregulator, see par.7.11.2.
For the details of the Modbus commands managed by the thermoregulator, see par. 7.13.

7.11.4 DIAGNOSTICS

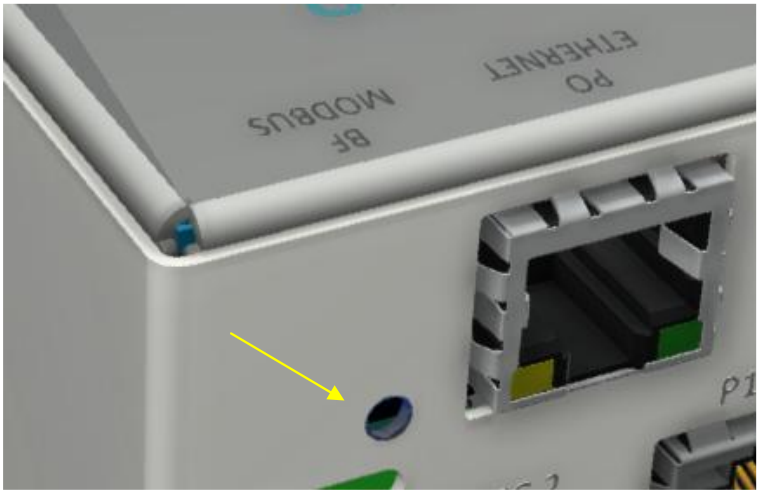


Figure 107

The LED shown in Figure 107 lights up when communication is active and turns off if there is no communication

In the event of failure on the communication channel, the LED turns off after a timeout of approx. 1 second to indicate connection closure.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par. 6.8 for enabling and disabling specific alarms and warnings).

7.11.5 COMMISSIONING

Proceed as follows:

1. Connect the Ethernet cable as described in par. 7.11.1.
2. Configure the communication parameters as indicated in par. 7.11.2.
3. Configure the communication parameters on the master side, ensuring they are consistent with the parameters configured on the slave.
4. When communicating with the device (see par. 7.11.3 you can check the correct interaction operation using the diagnostic utilities described in par. 7.11.4.

7.12 CC-Link IE TSN

7.12.1 CONNECTIONS

The thermoregulator can be connected to the bus via the connectors shown in par. 7.1.

7.12.2 CONFIGURATION

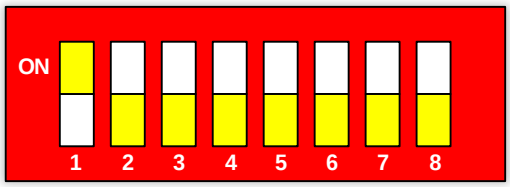
For the configuration of all the fieldbus parameters, please refer to the general description in par. 7.3.

Byte 4 of the IP address can be configured in binary using the “BUS CONFIG” DIP switch as shown in Figure 94.



Figure 108

PIN1 corresponds to the least significant bit and PIN8 corresponds to the most significant bit.
Table42 shows some address configuration examples.
The valid addresses fall within range 1-254.
Address 255 is not valid as it is a broadcast address.

IP ADDRESS = xxx.xxx.xxx.xx1	SW2[1]=ON SW2[2..8]=OFF	

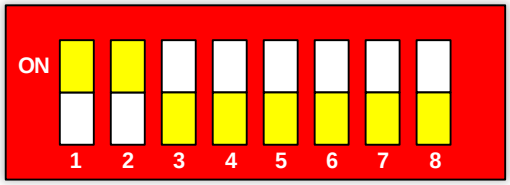
IP ADDRESS = xxx.xxx.xxx.xx3	SW2[1]=ON SW2[2]=ON SW2[3..8]=OFF	

Table52

If the dip switch status has been changed, you must turn the thermoregulator off and then back on again to acquire the new value.

The dip switch set to 0 is used to enable the address configuration via software. When the dip switch is set to 0, the thermoregulator uses the last configured value.

The factory's thermoregulator dip switch setting is 0.
The IP factory' setting is shown in the following table.

PARAMETERS	
Name	**Default**
DHCP	OFF
Ip Address	192.168.0.55
Subnet Mask	255.255.255.0

7.12.3 CC-Link IE TSN V1 interface

7.12.3.1 PLC MASTER ► THERMOSALD SLAVE

OUTPUT	Byte/Word	Description	Notes
00	UINT16	Code	See par. 7.15.
01	UINT16	ID	
02	UINT16 Note: Variables that can take a negative value must be written in two's complement.	Value	
03	UINT16	Command Word	See par. 6.6.11.1.

7.12.3.2 MASTER PLC ◄ SLAVE THERMOSALD

INPUT	Byte/Word	Description	Notes
00	UINT16	Code echo	See par. 7.15.
01	UINT16	ID echo	
02	UINT16 Note: Variables that can take a negative value must be interpreted in two's complement.	Value echo	
03	INT16	Temperature [°C] (ID 768)	These fields contain direct access to the values of some commonly used variables. For the details of the variables, refer to chapter 6.
04	UINT16	Alarm/warning number (ID 769)	
05	UINT16	Thermoregulator status (ID 774)	
06	UINT16	I Current full wave rms current [A] (ID 770)	
07	UINT16	R Current resistance [ohm x100](ID 771)	
08	UINT16	V Current rms voltage [V] (ID 772)	
09	UINT16	P Current full wave active power [W] (ID 773)	
10	UINT16	Full duty cycle on sealing pulse [%] (ID 778)	
11	UINT16	I0 First calibration full wave rms current [A] (ID 527)	

12	UINT16	R0 First calibration resistance [Ohm x100] (ID 528)	
13	UINT16	V0 First calibration RMS voltage [V] (ID 529)	
14	UINT16	P0 First calibration full wave active power [W] (ID 530)	
15	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	*Calibration temperature [°C]* (ID 258)	
16	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Max temperature [°C] (ID 262)	
17	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Pre-heating temperature [°C] (ID 269)	
18	UINT16 Note: The read value must be interpreted in two's complement as it can potentially be negative.	Sealing temperature [°C] (ID 270)	
19	UINT16	Do not use	

7.12.4 DIAGNOSTICS

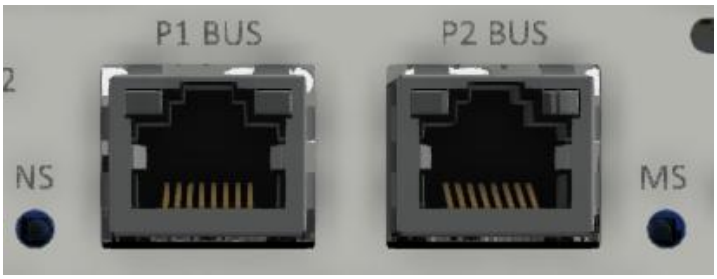


Figure 109

For the diagnostic of the LED on the RJ45 connectors, please refer to par. 7.1.

The following table describes the operation of the LED interface located on the sides of the Ethernet switch (see Figure 109).

DLINK LED (NS)	ERROR LED (MS)	Meaning
OFF	OFF	Module starting up.
Flashing (Green)	OFF	Module started up, no connection established.
1 Flashing (Green)	OFF	Connection established, no data exchange.
ON (Green)	OFF	Connection established.
OFF	Flashing (Red)	Network error detected.
OFF	ON (Red)	Duplicate IP address. Module fault, contact 3E Technical Support.
ON (Red)	ON (Red)	Module fault, contact 3E Technical Support.

For additional warnings please refer to the general implementation of the thermoregulator (please refer to par. 6.8 for enabling and disabling specific alarms and warnings).

7.12.5 COMMISSIONING

Proceed as follows:

8. Connect the Ethernet cable as described in par. 7.12.1.
9. Configure the communication parameters as indicated in par. 7.12.2.
10. Download the appropriate CSPP archive, e.g. "*Thermosald CSPP CC-Link IE TSN V1.0.0*", from website www.3e3e3e.com.
11. Extract the contents of the archive and install the CSPP file in the configuration tool being used.
12. It is recommended to set the 'Cyclic Transmission Time' parameter to a value of no less than 50 µs.
13. When communicating with the device (see par. 7.12.3)you can check the correct interaction operation using the diagnostic utilities described in par. 7.12.4.

7.12.5.1 Installations

Thermosald has already been successfully integrated into Mitsubishi systems.

7.12.5.2 Software change of IP address

The thermoregulator leaves the factory with address 192.168.0.55 and netmask 255.255.255.0. The IP address and the netmask can be set by the master via software.
Alternatively, the easiest way to configure the network parameters is via the device panel or web server.
There are some ad hoc applications, such as HMS Anybus "IP Config". For the download of this tool, refer to the HMS Anybus website (www.anybus.com).

7.13 Modbus commands

Each byte contained in the telegrams shown below is encoded in binary format as required by Modbus RTU and Modbus TCP.

Note: Registers that can take a negative value must be interpreted and/or written in two's complement.

For all details for the specific Modbus commands, please refer to the document of the related standard “MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3” available at the URL www.modbus.org.

The following table lists the available Modbus commands that can be used with the thermoregulator, depending on the type of Modbus used.

Command code	Modbus RTU	Integrated Modbus TCP Standard mode	Modbus TCP	Integrated Modbus TCP Lagacy mode
01 (Read Coils)	It allows the Command Word bit reading, see par. 6.6.11.1.		-	
03 (Read Holding Registers)	It allows reading 1 or x internal variables of the thermoregulator, see par. 7.14.		It allows reading 1 or x registers of the Modbus TCP legacy interface, see par. 7.9.3.	
05 (Write Single Coil)	It allows writing the 1 bit status of the Command Word, see par. 6.6.11.1.		-	
06 (Write Single Register)	It allows writing 1 internal variable of the thermoregulator, see par. 7.14.		It allows writing 1 register of the Modbus TCP legacy interface, see par. 7.9.3.	
15 (Write Multiple Coils)	It allows writing the status of 1 or n bits of the Command Word, see par. 6.6.11.1.		-	
16 (Write Multiple Registers)	It allows writing 1 or n internal variables of the thermoregulator, see par. 7.14.		It allows writing 1 or n registers of the Modbus TCP legacy interface, see par. 7.9.3.	
23 (Read/Write Multiple	It allows writing and then		It allows writing and then	

registers)	reading 1 or n internal variables of the thermoregulator, see par. 7.14.	reading 1 or n registers of the Modbus TCP legacy interface, see par. 7.9.3.
43/14 (Read Device Identification)	It allows identifying the device.	

Table53

7.14 List of internal variables

For all fieldbuses, with the exception of Modbus RTU and Embedded Modbus TCP in “Standard Mode”, the following internal variables must be read or written through the sequences described in par. 7.15.
Some of the internal variables may also be available as read-only directly on the interface fields. For more details see the interface of the specific fieldbus.

For Modbus RTU and Embedded Modbus TCP in “Standard Mode”, there is a direct mapping between the internal variables and the HOLDING REGISTER objects or the Modbus. The internal variable ID exactly matches the HOLDING REGISTER address.

ID	Variable name
0	Heating ramp [degrees/100ms]
1	Proportional gain KV
2	-
3	-
4	-
5	-
6	-
7	-
8	Derivative gain KD
9	Alarm disable (1)
10	-
11	-
12	Machine not calibrated
13	Alarm disable (2)
14	Temperature coefficient [PPM]
15	Resolution [Bin/°C*100]
16	Primary
17	-
18	PLC: Programme
19	Password
20	Password key
21	Model
22	Calibration level [%]
23	-
24	Calibration temperature probe type
25	Reading margin [us]
26	-
27	-
28	Regulator enabled
256	-
257	Language
258	Calibration temperature [°C]
259	Temperature range
260	-
261	-
262	Maximum temperature [°C]
263	Maximum sealing command time [s x 10]
264	Maximum temperature gradient [°C/s * 10]
265	Global warning time [s]
266	Increase: temperature [°C]

267	Increase: pulses
268	End of sealing temperature latch
269	Pre-heating temperature [°C]
270	Sealing temperature [°C]
271	-
272	Modbus RTU parity
273	Timeout power off [s x 10]
274	Modbus RTU: Lagacy mode Idle Time [ms]
275	Minimum phase [us]
276	PLC: Max. bar closing time [s x 100]
277	PLC: Preheating time with open bar [s x 100]
278	PLC: Sealing time [s x 100]
279	PLC: Cooling time at the end of sealing [s x 100]
280	PLC: Closed bar time at the end of sealing [s x 100]
281	Fast sealing setpoint change
282	-
283	-
284	Increase: recovery time [s]
512	-
513	-
514	-
515	-
516	-
517	-
518	-
519	-
520	-
521	-
522	-
523	-
524	-
525	-
526	-
527	I0 First calibration full wave rms current [A]
528	R0 First calibration resistance [Ohm x100]
529	V0 First calibration RMS voltage [V]
530	P0 First calibration full wave active power [W]
531	I Maximum full wave rms current [A]
532	-
533	-
534	-
535	-
536	-
537	-
538	-
539	-
540	-
541	Steady-state period [sx10]
768	Temperature [°C]
769	Alarm/warning number
770	I Current full wave rms current [A]
771	R Current resistance [ohm x100]
772	V Current rms voltage [V]
773	P Current full wave active power [W]
774	Thermoregulator status
775	-

776	Type of temperature probe connected.
777	3ES109: temperature [°C]
778	Full duty cycle on sealing pulse [%]
779	Salve configuration from bus
780	-
781	Maximum temperature and temperature coefficient fixed parameters option
782	Power off threshold [%]
783	-
784	-
785	Max resistance delta for parallel breakage [%]
1024	I0 First calibration full wave rms current copro [A]
1025	R0 First copro calibration resistance [Ohm x100]
1026	V0 First copro calibration RMS voltage [V]
1027	P0 First copro calibration full wave active power [W] (B)
1028	IL Last calibration full wave effective [A]
1029	RL Last calibration resistance [Ohm x100]
1030	VL Last calibration RMS voltage [V]
1031	PL Last calibration full wave active power [W]
1032	IL Last copro calibration full wave rms current [A]
1033	RL Last copro calibration resistance [Ohm x100]
1034	VL Last copro calibration RMS voltage [V]
1035	PL Last copro calibration full wave active power [W]
1036	-
1037	-
1038	-
1039	-
1040	-
1041	-
1042	-
1043	-
1044	-
1045	Modbus RTU Master Timeout [s x 10]
1046	Current alarm
1047	Current warning
1048	Number of EEPROM writes since power-on
1049	Transformer/power supply no-load RMS voltage [V x 100]
1050	Transformer/power supply on-load RMS voltage [V x 100]
1051	-
1052	PLC: Max. bar opening time [s x 100]
1053	Coprocessor present
1054	Maximum end of sealing temperature warning delta [°C]
1055	Maximum end of sealing temperature alarm delta [°C]
1097	Warning time 57 [s]
1098	Warning time 66 [s]
1100	Warning time 400 [s]
1101	Warning time 401 [s]
1102	Warning time 402 [s]
1103	Warning time 403 [s]
1104	Preheating/sealing signals filter
1105	Warning time 405 [s]
1106	Warning time 406 [s]
1107	Warning time 407 [s]
1108	Number of total EEPROM writes
1109	Warning time 409 [s]
1110	Warning time 410 [s]
1111	Warning time 411 [s]

1112	Warning time 439 [s]
1113	Invalid reading/writing variable ID
1150	Maximum number of switching operations
1200	Type of copro temperature probe connected.
1201	3ES109: copro temperature [°C]
1202	PT100: copro temperature [°C]
1203	-
1204	Panel connection
1205	Analog presence/PLC
1285	Command code
1300	Copro resolution [Bin/°C*100]
1301	I Current full wave rms current copro [A]
1302	R Current copro resistance [ohm x100]
1303	V Current copro rms voltage [V]
1304	P Current copro full wave active power [W]
1305	COPRO temperature [°C]
1306	Transformer/power supply no-load RMS voltage copro [V x 100]
1307	Transformer/power supply on-load RMS voltage copro [V x 100]
1308	Rms current copro [Ax10]
1309	Sealing pulse rms current copro [Ax10]
1310	Active power copro [W]
1311	Sealing pulse active power copro [W]
1312	SIF copro [%]
1313	Sealing pulse SIF copro [%]
1400	LOG element no.
1401	LOG element selection
1402	Selected LOG element value
1536	Alarm disable (3)
1537	Alarm disable (4)
1538	Alarm disable (5)
1540	Warning time 20 [s]
1541	-
1542	Warning time 22 [s]
1544	-
1545	Warning time 39 [s]
1546	PT100: temperature [°C]
1547	Master board firmware version major
1548	Master board firmware version minor
1549	Master board firmware version revision
1550	Base board firmware version major
1551	Base board firmware version minor
1552	Base board firmware version revision
1553	Copro board firmware version major
1554	Copro board firmware version minor
1555	Copro board firmware version revision
1556	Analogue Plc board firmware version major
1557	Analogue Plc board firmware version minor
1558	Analogue Plc board firmware version revision
1559	Display board firmware version major
1560	Display board firmware version minor
1561	Display board firmware version revision
1562	Earth leakage threshold [%]
1563	Heating elements stabilization time [s]
1564	PT100: cable section [mm² * 1000]
1565	PT100: cable length [m * 10]
1599	Earth leakage [%]

1601	Sealing pulse rms current [Ax10]
1602	Rms current [Ax10]
1603	Active power [W]
1604	SIF [%]
1605	Sealing pulse active power
1606	Sealing pulse SIF [%]
1607	Transformer/power supply no-load RMS voltage pre-alarm [V x 100]
1608	Transformer/power supply no-load RMS voltage pre-alarm copro [V x 100]
1611	Full duty cycle [%]
1612	-
1613	-
1614	Partial short circuit [%]
1615	-
1616	-
1617	Integral gain KI
1619	Base internal probe temperature [°C]
1620	Base copro internal probe temperature [°C]
1621	Earth leakage copro [%]

7.15 Reading and writing internal variables

The following paragraphs describe the sequences for reading and writing the internal variables of the thermoregulator. These sequences can be used for all fieldbuses except for Modbus RTU and Embedded Modbus TCP in “Standard Mode”, which enables to read and write the variables directly via the Modbus HOLDING REGISTERS (see par. . 7.14).

Read command 3: write the identifier of the variable to read on the ***ID*** output and code 3 to the ***Codice*** output. The writing of ***Codice*** can be simultaneous but never prior to that of the ***ID***.
The thermoregulator responds on the ***Code echo*** input with code 3, on the ***Eco ID*** input with the echo of the requested identifier, on the ***Eco Valore*** input with the value of the variable for which reading has been requested.
To complete the reading command, the ***Codice*** output must be set to value 0 again and wait for 0 on the ***Eco Codice*** input. Alternatively, you can directly execute a writing sequence.

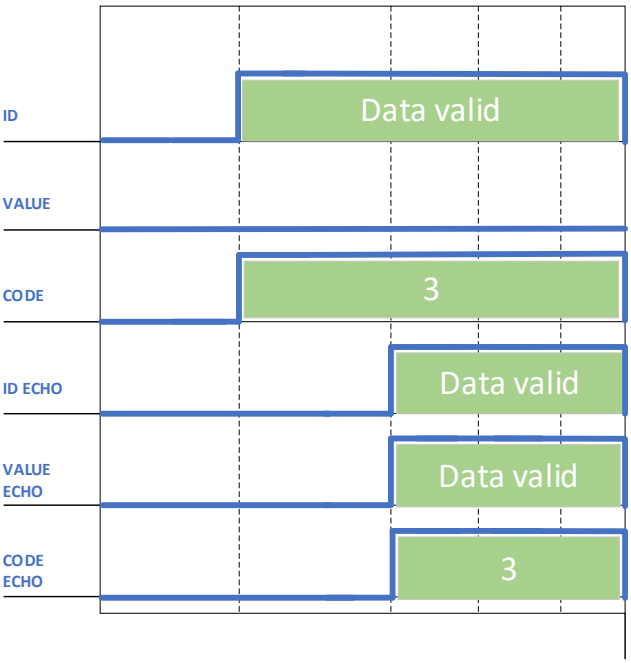


Figure 110 - Command 3

Write command 6: write the identifier of the variable to write on the ***ID*** output, the value of the variable to write on the ***Valore*** output, and code 6 on the ***Codice*** output. The writing of ***Codice*** can be simultaneous but never prior to that of the **ID** and ***Valore.***.
The thermoregulator responds on the ***Eco Codice*** input with code 6, on the ***Eco ID*** input with the echo of the requested identifier, on the ***Eco Valore*** input with the value of the variable for which writing has been requested.
To complete the writing command, the ***Codice*** output must be set to value 0 again and wait for 0 on the ***Eco Codice*** input. Alternatively, you can directly execute a writing sequence.

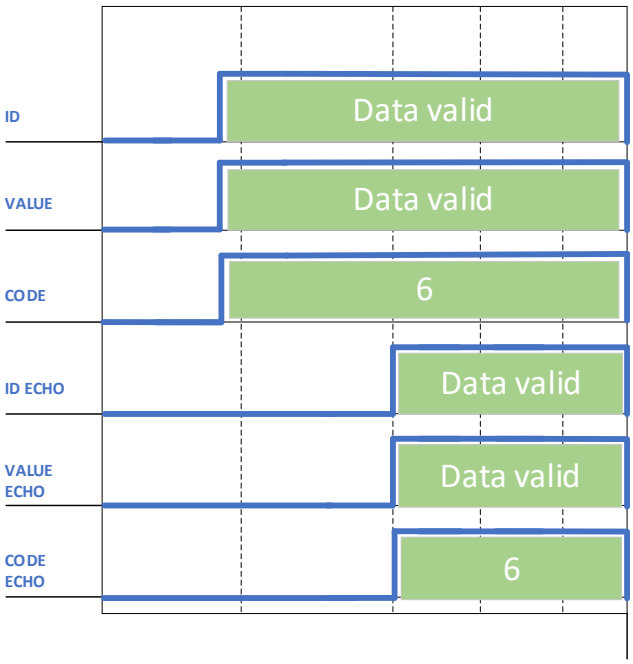


Figure 111 - Command 6

Avoid continuous write commands because they may damage the thermoregulator's internal EEPROM. Also see par. 6.10.2.

For details on the byte sizes of ***Codice***, ***Eco Codice, ID, Eco ID, Valore,*** and ***Eco Valore*** please refer to the specific fieldbus (see par. 7.5.3 et seq.).

8 ANALOG (AN and AP models)

8.1 Analog interface connection

ANALOG (AN and AP models)

8.1.1 Connection with PLC

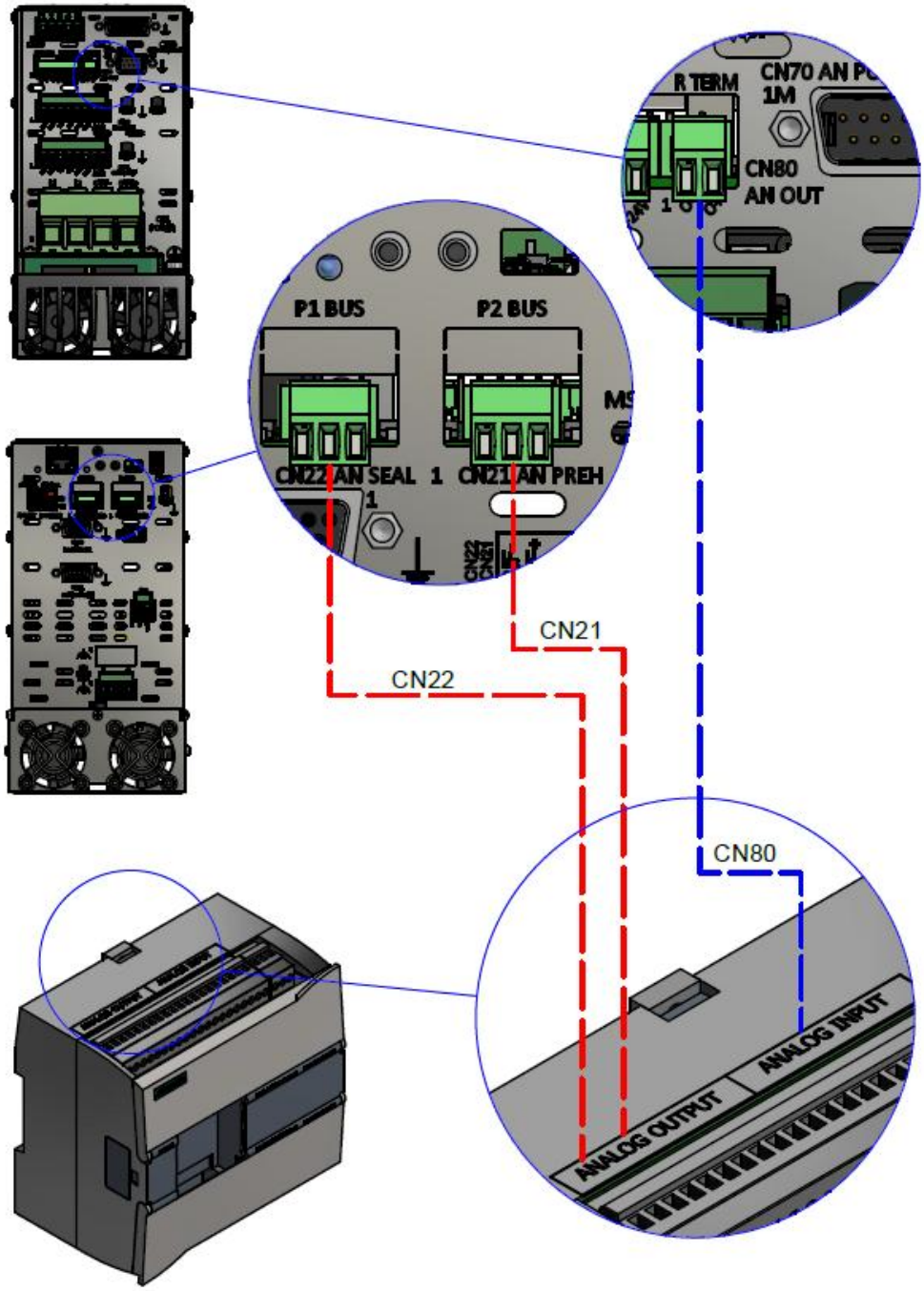


Figure 112



Figure 113

The connection to connectors CN22 and CN21 (see Figure 113) must be made using shielded cables with the shields connected at both ends. On the thermoregulator side, connect the shield to the slots provided on the casing for Faston connections. The maximum cable length is 30 meters.

CN22 AN SEAL			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	REF -	REFERENCE SEALING -	5mA max @ 5VDC 10mA max @ 10VDC Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN2	REF +	REFERENCE SEALING +	
PIN3			

CN21 AN PREH			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	REF -	REFERENCE PREHEATING -	5mA max @ 5VDC 10mA max @ 10VDC Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN2	REF +	REFERENCE PREHEATING +	
PIN3			

For the connector of the analogue output, see par. 8.1.3.

8.1.2 Connection to potentiometers and voltmeter

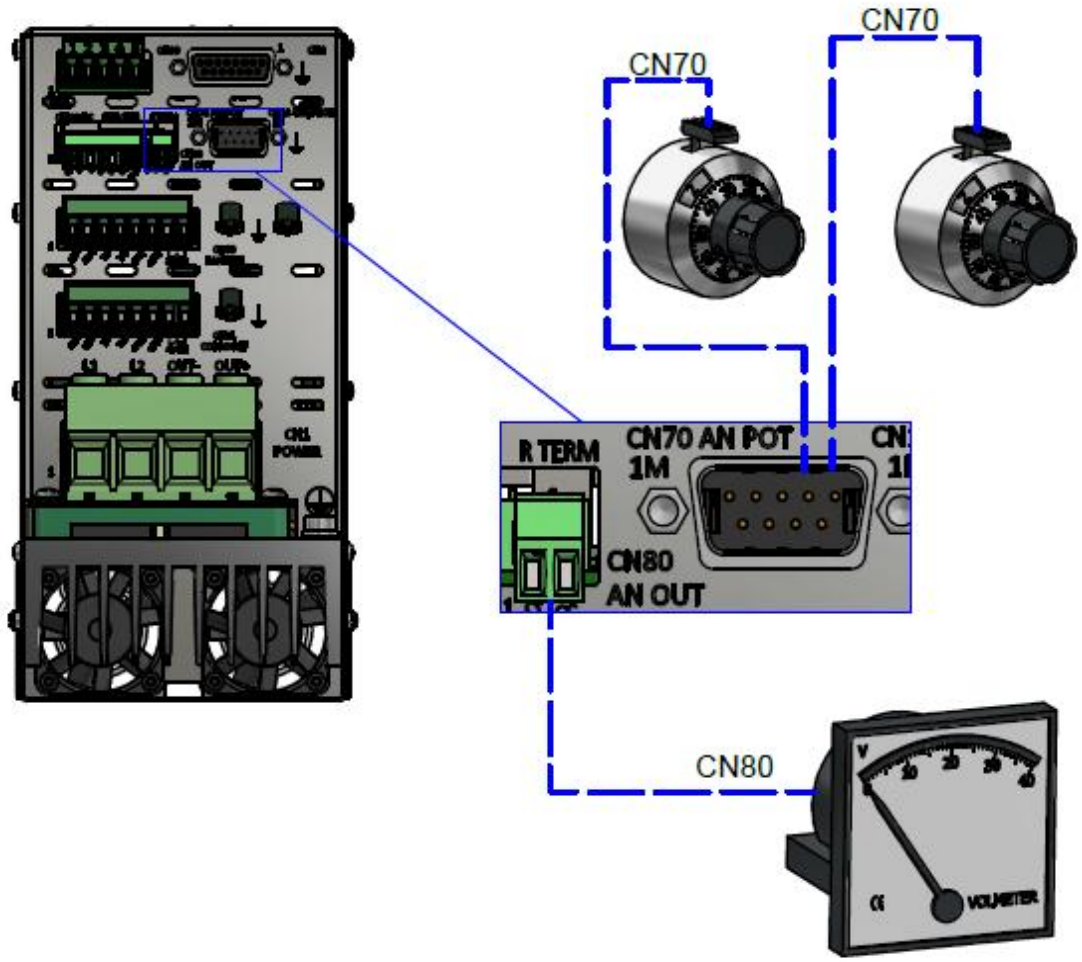


Figure 114

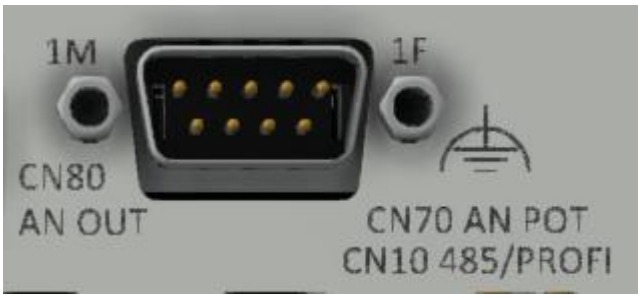


Figure 115

The connection to connector CN70 (see Figure 115) must be made using a shielded cable with the shield connected at both ends.
On thermoregulator side, the shield is connected to the connector cap. The maximum cable length is 30 meters.

CN70 AN POT			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	POT PRE +	POTENTIOMETER 10K PREHEATING +	0.3mA max @ 3VDC
PIN2	POT PRE RIF	POTENTIOMETER 10K PREHEATING RIF	
PIN3	POT PRE -	POTENTIOMETER 10K PREHEATING -	
PIN4		Reserved do not use	
PIN5		Reserved do not use	
PIN6	POT SALD +	POTENTIOMETER 10K SEALING +	0.3mA max @ 3VDC
PIN7	POT SALD RIF	POTENTIOMETER 10 K SEALING REF	
PIN8	POT SALD -	POTENTIOMETER 10 K SEALING -	
PIN9		Reserved do not use	

For the connector of the analogue output, see par. 8.1.3.

8.1.3 Analogue output

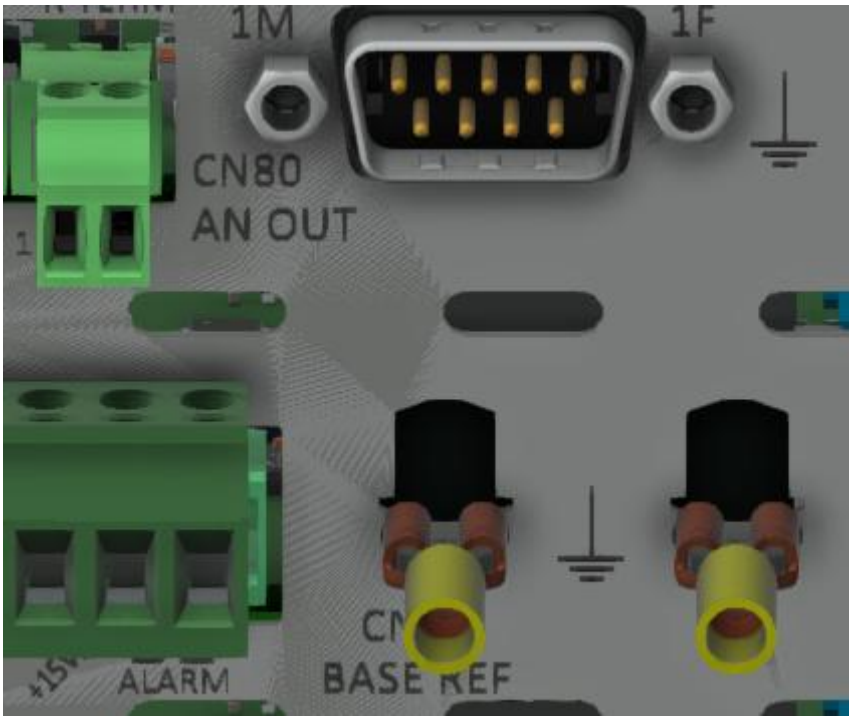


Figure 116

The analogue output must be connected to a differential analogue input (e.g., PLC or Voltmeter) through the CN80 connector (see Figure 116) using a shielded cable on both sides. On the thermoregulator side, connect the shield to the slots provided on the casing for Faston connections. The maximum cable length is 30 meters.

CN80 AN OUT			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN 1	O-	ANALOGUE REF-	5mA max @ 5VDC Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN 2	O+	ANALOGUE REF+	

8.2 Configuration and diagnostics

On models equipped with the analogue option, you can manage the set point value of the preheating and sealing temperatures (see par. 6.2) through the analogue signals. These signals can generally come from analogue references originating, for example, from the PLC, which must be connected to connectors CN21 and CN22 (see par. 8.1.1), or from potentiometers, which must be connected to the CN70 AN POT connector (see par. 8.1.2).

It is possible to configure the operating mode via analogue reference or potentiometer using the AN CFG 1 dip switch (see Figure 117 – AN CFG 1 e Table 54 – AN CFG 1)



Figure 117 – AN CFG 1

	SW1	**SW2**
Analogue disabled	OFF	OFF
5V REFERENCE on connectors CN21 and CN22 (Factory's default)	ON	OFF
10V REFERENCE on connectors CN21 and CN22	OFF	ON
Use of potentiometers on CN70	ON	ON

Table 54 – AN CFG 1

It is also possible to configure different operating modes via the AN CFG 2 dip switch (see Figure 118 – AN CFG 2andTable 55 – AN CFG 2)



Figure 118 – AN CFG 2

	OFF	ON
SW1	Full scale value 300 ° (Factory's default)	Full scale value 500 °
SW2	The preheating and sealing setpoints coming from the analogue board are limited only by the full scale value set on SW1. (Factory's default)	The preheating and sealing setpoints coming from the analogue board are limited only by the actual value of the corresponding parameters.
SW3	 Resolution with 5V reference and full scale value 300 °: 16.66mv/°C Resolution with 5V reference and full scale value 500 °: 10.00mv/°C Resolution with 10V reference and full scale value 300 °: 33.33mv/°C Resolution with 10V reference and full scale value 500 °: 20.00mv/°C	Lagacy mode Resolution with 5V reference and full scale value 300 °: 13.33mv/°C Resolution with 5V reference and full scale value 500 °: 8.00mv/°C Resolution with 10V reference and full scale value 300 °: 26.66mv/°C Resolution with 10V reference and full scale value 500 °: 16.00mv/°C (Factory's default)

Table 55 – AN CFG 2

The analogue preheating and sealing references must be maintained at the desired value for the duration of the relevant preheating and sealing command.

If the configuration involves the use with potentiometers and the preheating or sealing command is activated in the absence of a connection to the relevant potentiometer, the thermoregulator will switch to an alarm condition.

If the configuration involves the use with analogue references and the preheating or sealing command is activated in the absence of a connection to the relevant potentiometer, the thermoregulator will check that the level of the relevant analogue signal never falls below 200 mV. Otherwise an alarm is triggered.
If, for example, the thermoregulator is configured with a 300° full scale, a 5V reference, and legacy mode, it will never be possible to set a heating temperature lower than approximately 15°C (200mV / 13.33 mV/°C).
Even in the absence of a connection, the thermoregulator will switch to an alarm condition.

The models equipped with the analogue option, a 0-5V analogue output on the CN80 connector (see par. 8.1.3) which provides diagnostic information on the thermoregulator depending on the status of the thermoregulator.

Here below the description of the analogue output:

- **Normal operating condition without power**
  Analog output value: 0V.

- **Normal operating condition with power on**
  The analogue output value indicates the current temperature with resolution of 10mv/degree (e.g. 1V = 100 degrees).

- **Alarm condition**
  The alarm condition can be detected by the emergency contact on the CN3 connector (see par. 5.6).
  The analogue output value indicates the current alarm with the mapping shown in the table below (see also 17).

Output value ± 0.05 [V]	Alarm
1.0	78
1.5	46
2.0	48, 49
2.5	69
3.0	89
3.5	93
4.0	94
4.5	97, 76
5.0	Generic alarm: see the green-red LED interface on the device for details about the alarm.

9 PLC (PL and AP models)

9.1 CONNECTIONS

This connection is available on the PL or AP models.

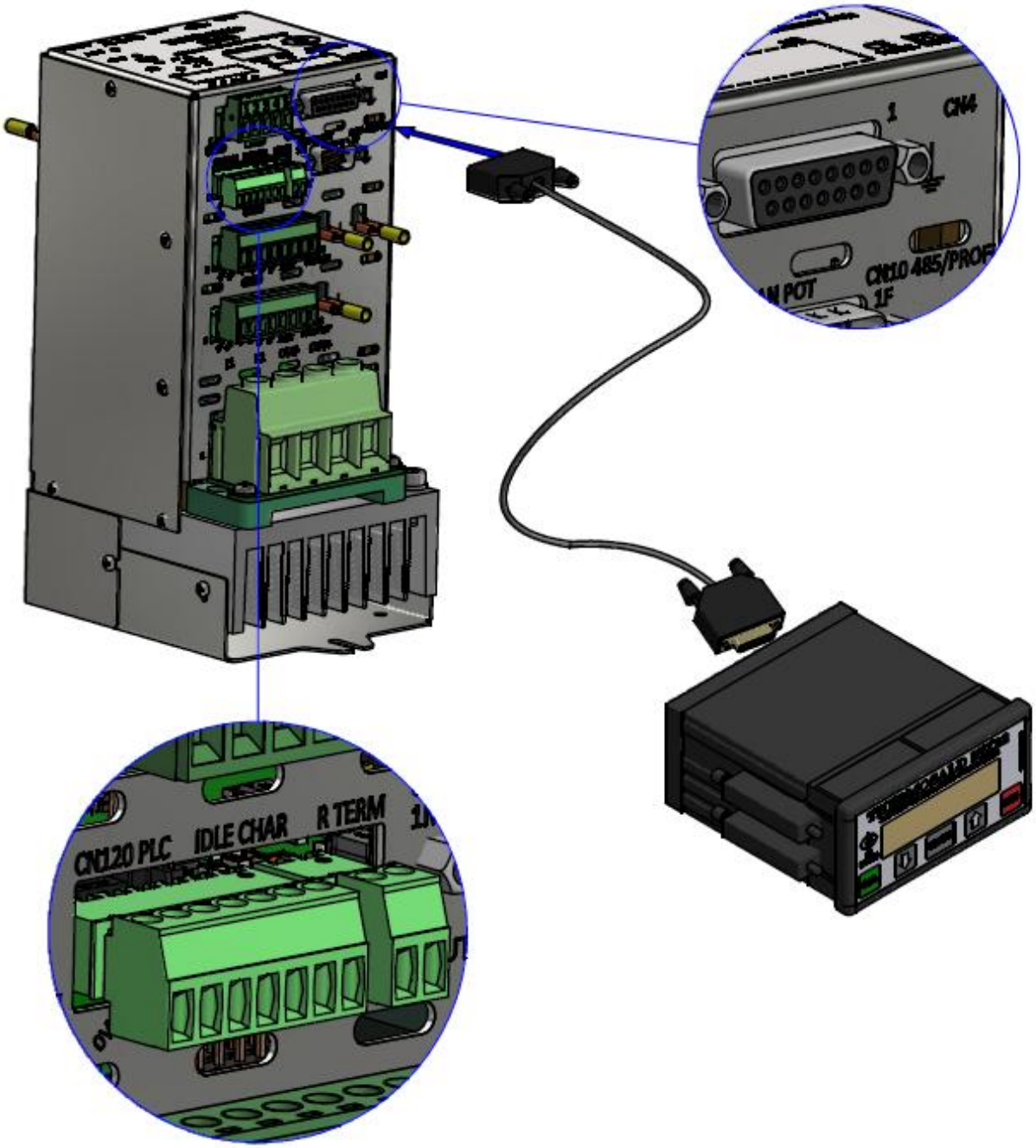


Figure 119



Figure 120

CN120 PLC			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	0 V	Common	Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN2	I0	Disabled=0V, Enabled=24V	10 mA max @ 24 VDC Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN3	I1	Disabled=0V, Enabled=24V	
PIN4	O0	Disabled=0V, Enabled=24V	500 mA max @ 24V Max cable section: 1.5 mm² Max. torque: 0.25 Nm
PIN5	O1	Disabled=0V, Enabled=24V	
PIN6	O2	Disabled=0V, Enabled=24V	
PIN7	+24 V	24V machine input for output management.	1.5A max @ 24V Max cable section: 1.5 mm² Max. torque: 0.25 Nm

The maximum cable length is 30 meters.

It is advisable to wire the INPUT/OUTPUT signals on connector CN120 by providing appropriate redundancies in the final application, in order to prevent dangerous situations for the user. As outlined in chapter 2, the thermoregulator does not constitute a safety element.

9.2 CONFIGURATION AND DIAGNOSTICS

On the models equipped with this function some predefined programs are available to allow the user to solve some common applications by properly connecting the digital inputs and outputs available on the CN120 connector (see par. 9.1).
The following table shows the list of all the parameters related to this functionality.

The following Table56 shows the available parameters.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
PLC: Programme	[0]=OFF [1]=Programme 1 … [1]=Programme N	18	1 (Models equipped with PLC option) 0 (other models)	0	N (Models equipped with PLC option) 0 (other models)
PLC: Preheating time with open bar [s x 100]	tPreHeatDelayBC	277	40	0	1000
PLC: Sealing time [s x 100]	tS	278	80	0	65535
PLC: Cooling time at the end of sealing [s x 100]	tCEoS	279	0	0	65535
PLC: Closed bar time at the end of sealing [s x 100]	tBCEoS	280	20	0	65535
PLC: Max. bar closing time [s x 100]	TMaxBC	276	100	0	255
PLC: Max. bar opening time [s x 100]	TMaxBO	1052	100	0	255

Table56

The parameters in Table56 are also accessible from the panel (see Figure 121).



Figure 121

9.2.1 PLC Program 1 operation (PLC enable = 1)

Program 1 (see ANNEX - SEALING CYCLE) uses the output signals O0, O1, and O2 as bar closing command, cooling activation and active sealing cycle information, respectively, the I0 input signal as closed bar sensor, and the I1 input signal for starting the sequence related to the program, as described below and shown by the graph in Figure 122.
If the I1 signal is off, the thermoregulator remains in a balanced status and the O0 and O2 outputs are disabled.

The sequence is triggered by activating the I1 command, which brings the thermoregulator into the preheating status. At the same time, output O2 is activated to indicate that the sealing cycle is running. After a tPreHeatDelayBC time, the bar closing command is activated and the thermoregulator remains in the preheating status until the I0 bar closed end stroke. When the I0 limit switch is activated, the thermoregulator switches to the sealing status and remains there for a tS time. After this time has elapsed, the machine returns to the balancing status and activates the O1 cooling command. After a tCEoS time has elapsed, the O1 cooling command is deactivated, and after a tBCEoS time, the O0 bar closing command is deactivated. At the same time the O2 output is deactivated which informs that the sealing cycle is complete and the thermoregulator then waits for I1 being disabled and then enabled again to restart with a new sequence.

If during the sequence the thermoregulator is in “Power off” or “Not calibrated” status, the alarm 207 is triggered.

If during the sequence, I1 is deactivated or the “PLC: Programme” parameter is set to 0, the thermoregulator triggers alarm 5.

If, at any time, the closed-bar command is not consistent with the end-of-stroke status, alarm 45 is generated when the TMaxBC or TMaxBO delays expire (see ANNEX - LIST OF ALARMS AND WARNINGS (CAUSES - REMEDIES)).

Any alarm always resets the sequence and deactivates outputs O0, O1, and O2.

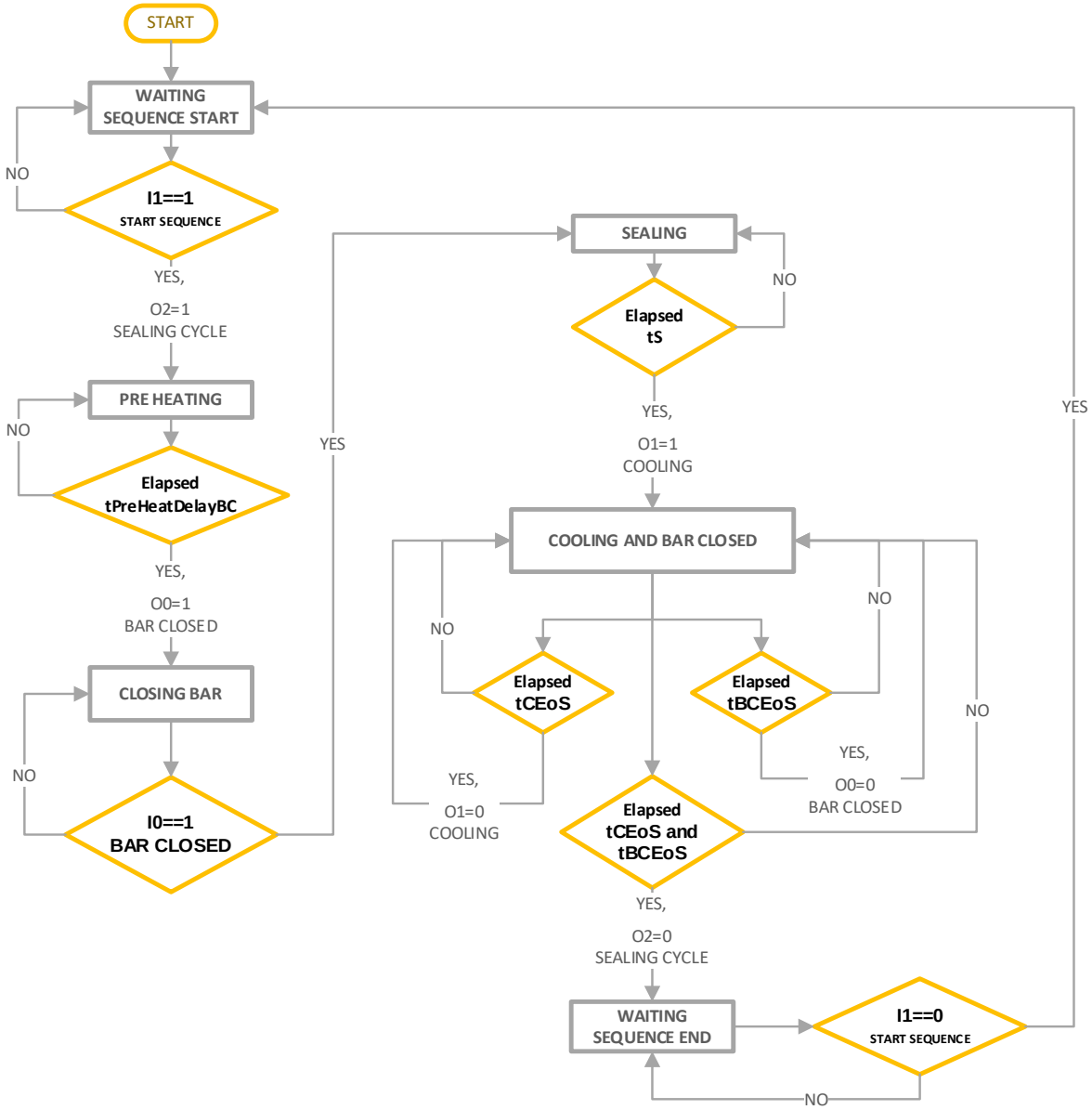


Figure 122 – Program 1 Sequences

10 COPROCESSOR



Models equipped with coprocessors implement hardware and software redundancy on maximum temperature control.

They are extremely reliable products, built with the following features:

- 2 independent circuits for reading the current of the sealing band
- 2 independent circuits for reading the voltage of the sealing band
- 2 independent control circuits, microprocessor + coprocessor
- 2 independent probes for precise calibration
- 2 independent alarm output contacts to secure the power circuit
- 1 power supply controlled by the 2 microprocessors



For applications where very tight temperature tolerances are required, refer to par. 6.11.1.

11 TEMPERATURE PROBES (PR models)

11.1 CONNECTIONS

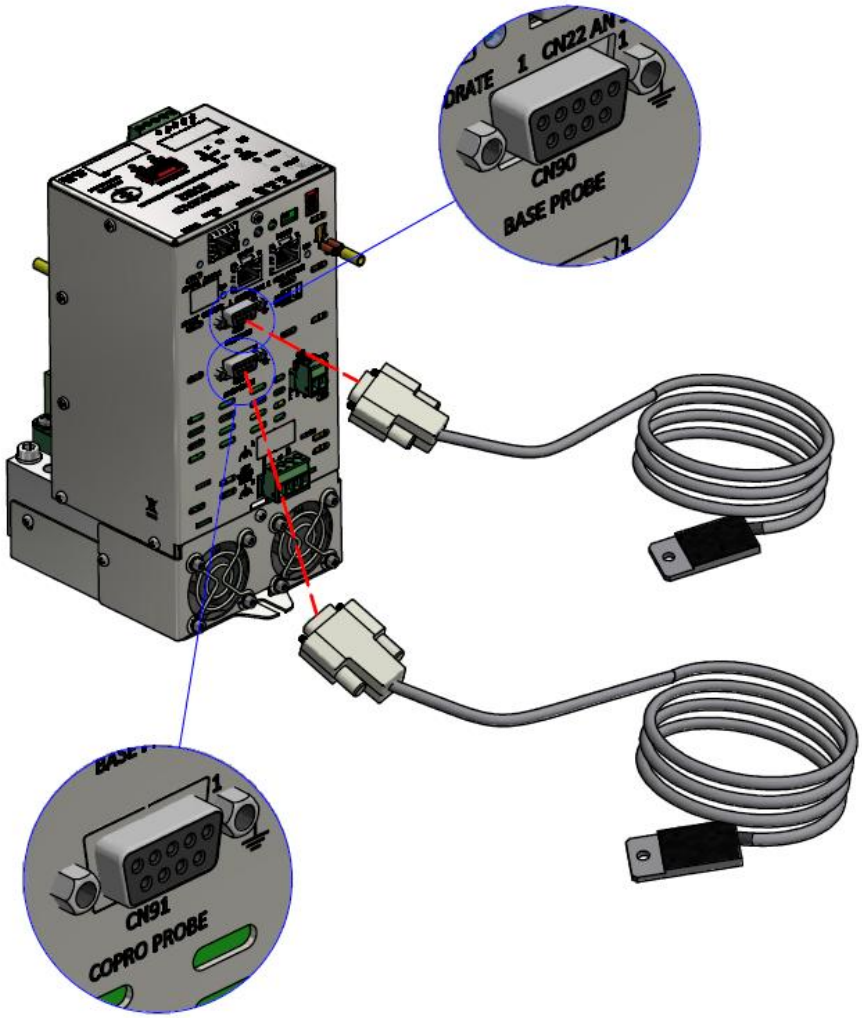


Figure 123

The thermoregulator can be optionally equipped with an external temperature sensor for use in calibration procedures (see chap. 6).
The sensor can be item 3ES109B1 (see par. 19.4 and Figure 123) or a commercial PT100 probe, for example item 3EA0016 (see par. 19.5).
The two sensors can also be connected simultaneously.

If the PT100 prove is used, enter the features of the cables used via the parameters listed in par. 11.2.

The above figure shows the configuration of a Thermosald with a Coprocessor option with two 3ES109B1 temperature probes connected.
The probe can also be requested on models without Coprocessor.

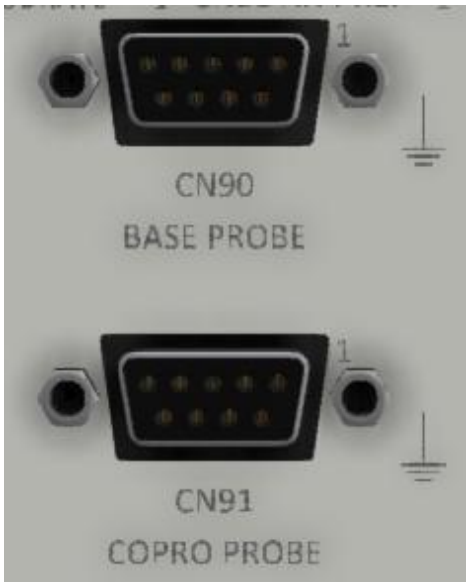


Figure 124 – CN90 and CN91 (CO models)

CN90 BASE PROBE			
CN91 COPRO PROBE (CO models)			
PIN	**NAME**	**DESCRIPTION**	**NOTES**
PIN1	3ES109B1 probe	Green wire	
PIN2	3ES109B1 probe	Brown wire	
PIN3	PT100 probe		
PIN4	PT100 probe		
PIN5			
PIN6			
PIN7	3ES109B1 probe	Yellow wire	
PIN8			
PIN9	3ES109B1 probe	White wire	

Table57

The shield of 3ES109B1 must be connected to the connector shell (sensor side is not connected). Connect the metal case of the sensor to a grounded metal part of the machine.

The shield of the PT100 cable must be connected both to the connector shell and at the probe side.

The maximum probe cable length is 30 meters.

11.2 CONFIGURATION AND DIAGNOSTICS

The “Connected temperature probe type” variables, differentiated by connector type (base unit or coprocessor), allow identifying how many and which probes are connected.

When the probes are connected, the read values are contained in the relevant “Probe temperature” variables, differentiated by probe type (3ES109 or PT100) and by connector (base unit or coprocessor).

For further details on the temperature probes type 3ES109 and PT100 please refer to chap. 19.

The following Table58 and Table59 show the available parameters and information.

PARAMETERS					
Name	**Description**	**ID**	**Default**	**Min**	**Max**
PT100: cable section [mm² * 1000]		1564	250	1	65535
PT100: cable length [m * 10]		1565	30	0	65535

Table58

READ-ONLY INFORMATION			
Name	**Description**	**ID**	**Sign**
Type of temperature probe connected.	[0]=No probe connected [1]=3ES109 [2]=PT100 [3]=3ES109+PT100	776	+
3ES109: temperature [°C]		777	-/+
PT100: temperature [°C]		1546	-/+
Type of copro temperature probe connected.	[0]=No probe connected [1]=3ES109 [2]=PT100 [3]=3ES109+PT100	1200	+
3ES109: copro temperature [°C]		1201	-/+
PT100: copro temperature [°C]		1202	-/+

Table59

The parameters and information in Table58 and Table59 are also accessible from the panel (see Figure 125).

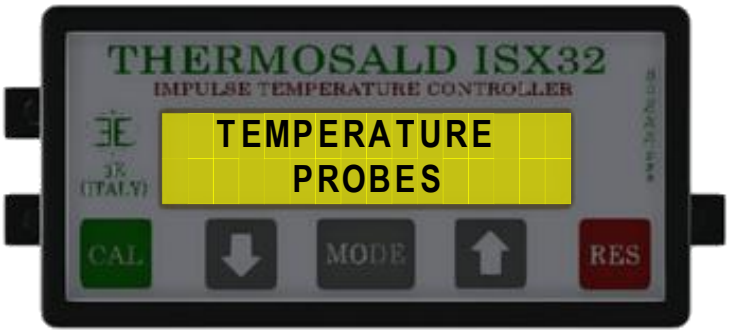


Figure 125

12 COMMISSIONING

Before starting a COMMISSIONING procedure you should carefully have read chapter 2 - SAFETY WARNINGS AND CERTIFICATIONS

The commissioning procedure is used to set the thermoregulator to full operating condition.

Before starting a commissioning procedure, it is advisable to have available the TECHNICAL REPORT of the application (see par. 3.5 - APPLICATION DEFINITION AND TECHNICAL REPORT).

During commissioning, it is advisable to compare the values of the TECHNICAL ANALYSIS (see par. 6.11) with those of the TECHNICAL REPORT and to write down their respective values.

At the end of the commissioning procedure, it is advisable to take note of the EDITED PARAMETERS and file them together with the TECHNICAL REPORT and the TECHNICAL ANALYSIS.

12.1 COMMISSIONING INSTRUCTIONS

1. The thermoregulator leaves the factory in Master Reset condition (see par. 6.1). You can restore this condition at any time (see par. 6.6.3).

2. Before starting the commissioning check that no alarm is triggered (see par. 6.1 and 6.8).
   To solve an alarm, see ANNEX - LIST OF ALARMS AND WARNINGS (CAUSES - REMEDIES).

3. Check that the machine is in the powered-off status and that the preheating and sealing commands are off: the thermoregulator triggers warning status 33 (see par. 6.1 e 6.8).

4. Ensure that the heating elements are at room temperature

5. Switch on power: the thermoregulator switches to awaiting calibration status (see par. 6.1).

6. Check the proper operation of the safety alarm output contact: using the “Emergency test command” (see par. 6.6.4).

7. Start calibration (see par. 6.3). When calibration is complete, the machine is able to show the current temperature on the sealing band (see par. 6.11.1) and it is ready for operation.

8. Check that the balancing temperature does not fluctuate more than ±1 degree.

9. Before setting the operating temperatures, see par. 12.2. Set the desired preheating and sealing temperature (see par. 6.2) and activate the corresponding commands (see par. 6.6). For any further information on how to set the sealing cycle, refer to ANNEX - SEALING CYCLE..

12.2 Temperature problems related to burning-in of some materials



Once some materials are brought back to room temperature after the first heating, show a variation in balancing temperature for reasons related to their molecular structure.

If possible, use sealing elements either made from materials not subject to this type of problem or already stabilized. For any further information, contact 3E Technical Support.

If using non-stabilized materials, you should perform some heating and cooling cycles as follows:

1. Heat the sealing element to the optimal operating temperature for a few seconds.
2. Deactivate the heating, monitor the current temperature, and wait for the heating element to cool down until it stabilizes.
3. If the current balancing temperature (see par. 6.11.1) is lower than the calibration temperature (see par. 6.3), a new calibration must be performed, and you must restart from step 1.
   When the balancing temperature is greater than or equal to the calibration temperature, go to step 4.
4. Save the calibration data in order to set the values of the last calibration as official first calibration data (see par. 6.3).

13 MAINTENANCE INSTRUCTIONS

Before starting a MAINTENANCE intervention you should carefully have read chapter 2 - SAFETY WARNINGS AND CERTIFICATIONS

13.1 REPLACING THE SEALING ELEMENTS WITH COLD MACHINE

(Bars at room temperature - scheduled intervention)

1) Clear the preheating and sealing commands, switch off power, let the sealing bars cool down.
2) Mount the new heating elements with adequate accuracy, making sure that the connections are optimal.
3) Perform a new calibration while power is on.

13.2 REPLACING THE SEALING ELEMENTS WITH WARM MACHINE

(Bars at working temperature - rapid intervention)

Not to be performed. Refer to par. 13.1.

13.3 CHANGING THE TYPE OF HEATING ELEMENT

1) Clear the preheating and sealing commands, switch off power, let the sealing bars cool down.
2) Mount the new sealing elements.
3) Perform a new calibration with power off. See par. 6.3.

13.4 MAINTENANCE OF THERMOREGULATOR, TRANSFORMER/DC POWER SUPPLY UNIT, AT/ CURRENT SENSOR



To be scheduled with periodic interventions according to the working environment.

1) Check that all connection terminals are properly screwed in place.
2) Check the proper operation of the safety alarm output contact: using the “Emergency test command” (see par. 6.6.4).
3) Check that the balancing temperature does not fluctuate more than ±1 degree.

13.5 SEALING BAR MAINTENANCE



To be scheduled with periodic interventions according to the working environment.

1) Check that the feedback reference terminals and the power terminals are well screwed in place.
2) Check that the terminals of the heating element are in a state of excellent conductivity, and that there is no oxidation or bad contact: otherwise, perform thorough maintenance.
3) Check the insulating material supports of the heating element and the Teflon.
4) Check that any copper plating on the heating elements is not worn.
5) Check that the heating element is not about to break down. If this is the case, replace it in order to avoid breakage during work and possible sparks.

14 TECHNICAL DATA

REPETITIVENESS	≅ +/- 1 °C
WORKING ENVIRONMENT TEMPERATURE	0 °C - 40 °C
WORKING ENVIRONMENT HUMIDITY	<50%
WORKING ENVIRONMENT ALTITUDE	Up to 3000 metres above sea level
PROTECTION	IP20 POLLUTION DEGREE II (see par. 2.1.2)
OVERVOLTAGE CATEGORY	III (see par. 2.1.2)
WEIGHT	**4 levels** 1.6 Kg **5 levels** 1.8 Kg **6 levels** 2 Kg

15 ORDERING DATA

15.1 THERMOREGULATOR CODING

3 DIGITS	3 DIGITS	2 DIGITS	3 DIGITS	3 DIGITS	1 DIGIT	2 DIGITS	4 DIGITS		2 DIGITS	1 DIGIT	2 DIGITS
3ES	204=ISX32 4 LEVELS 205=ISX32 5 LEVELS 206=ISX32 6 LEVELS	SP=STANDARD POWER HP=HIGH POWER	SAC=SECONDARY AC SDC=SECONDARY DC	V01=Version V1 VXX=Version VXX	-	CO=COPROCESSOR	BU01=MODBUS RTU BU02=PROFIBUS BU08=PROFINET BU09=ETHERNET/IP BU10=MODBUS TCP BU11=ETHERCAT BU12=POWERLINK BU13=INTEGRATED MODBUS TCP BU14=CC-LINK IE TSN		PR=PROBE	-	04=OPTION TM200 CM1210
							2 DIGITS				
							AN=ANALOGICAL PL=PLC AP=ANALOGICAL + PLC				

To understand the impact of the different options on the machine structure, please refer to PAR. 3.4.

15.1.1 SP/HP OPTIONS
The SP and HP models differ in that the latter are equipped with forced ventilation and a higher-performance power component.

15.1.2 SAC/SDC OPTIONS
The SAC models control the secondary of a single-phase AC power transformer.
The SDC models control the secondary of an AC power supply unit.

15.1.3 Version
Identify the commercial version of the product as a whole.
The same version may generally include product modifications that do not have a significant impact on the user.

15.1.4 CO option
The 3ES206 models feature an additional control board that allows for redundancy of the heating element control electronics, further increasing product reliability and safety.

15.1.5 BU option
The 3ES204 (BU13 only), 3ES205, and 3ES206 models can be equipped with an optional fieldbus communication interface. For more details see par. 7.

15.1.6 AN/PL/AP options
The 3ES205 and 3ES206 models can be configured with an analogue interface (AN), a PLC interface (PL), or both (AP). For more details see chapters 8 and 9.

15.1.7 PR option
This option is available on request for all models and adds an external temperature probe connection port. For more details see paragraphs 11.1 and chap. 11.
On 3ES206 models with the CO option, this port is redundant.

15.1.8 Other options
The last two digits of the code identify additional options, such as software limits for temperature coefficient and maximum temperature parameters.

15.2 Manuals

All manuals in different languages can be downloaded from the 3E website www.3e3e3e.com.

15.3 Interchange files for models with fieldbus option

Backward-compatible with Thermosald ISX:

ITEM NUMBER	DESCRIPTION
3ES100_BUS_GSD_V5	Thermosald ISX BUS Profibus GSD V5
3ES100_BUS_GSDML_V5	Thermosald ISX BUS Profinet GSDML V5
3ES100_BUS_EDS_V5	Thermosald ISX BUS Ethernet/IP EDS V5
3ES100_BUS_ESI_V5_1_0	Thermosald ISX BUS EtherCAT ESI V5.1.0
3ES100_BUS_XDD_V5_1_0	Thermosald ISX BUS Powerlink XDD V5.1.0

New items implemented on Thermosald ISX32:

ITEM NUMBER	DESCRIPTION
3ES200_GSDML_RT_V5_1_2	Thermosald GSDML Profinet RT V5.1.2 (compatible with 3ES100_BUS_GSDML_V5)
3ES200_GSDML_IRT_V1_0_0	Thermosald GSDML Profinet IRT V1.0.0
3ES200_CSPP_V1_0_0	Thermosald CSPP CC-Link IE TSN V1.0.0

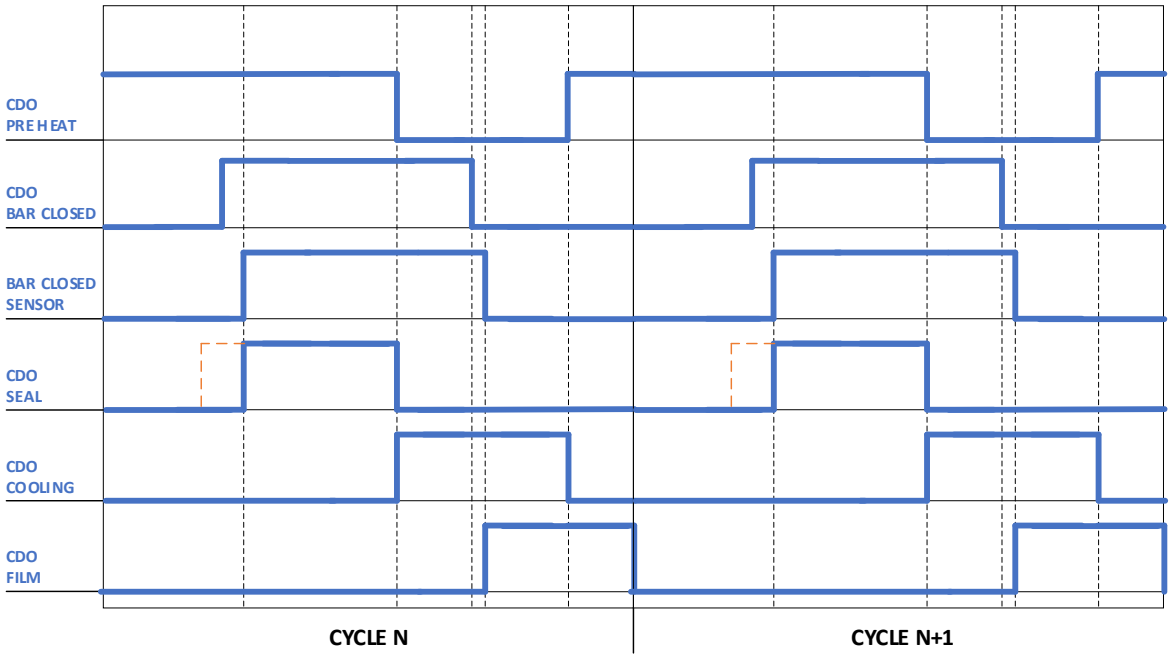
15.4 DEVICE IDENTIFICATION

The thermoregulator is labelled with a serial number that uniquely identifies the product and contains year, month of production and progressive number as in the following example:

S.N.= 20011234

16 ANNEX - SEALING CYCLE

N.B. - the suggested sealing cycle is only an example and should not be considered strictly a usage diagram. Experience has shown that timeframes must be modified according to the specific application, i.e. materials, dimensions, times, etc.
For further information, contact 3E Technical Support.



CDO PRE-HEAT	Pre-heating command.
CDO BAR CLOSED	Closed bar command.
CLOSED BAR SENSOR	Closed bar sensor.
CDO SEAL	Sealing command. To ensure optimal sealing repetitiveness, you should synchronize command activation with activation of the closed bar sensor, which should always be used in applications using pneumatic bars. In some applications you may consider anticipating the sealing command as shown in the figure by the orange hatching, but be careful in any case since the pressure of the bar favours uniform distribution of temperature in all points.
CDO COOLING	Cooling command.
CDO FILM	Film feed command.

17 ANNEX - LIST OF ALARMS AND WARNINGS (CAUSES - REMEDIES)

For details on alarms and warnings, their management and resetting, refer to par. 6.8.

NOTE 1: If the thermoregulator and the panel are completely off, check the 24V power supply.

NOTE 2: If the thermoregulator and the panel are on, and "3E s.r.l. THERMOSALD" remains displayed on the panel, check the display connection cable.

ALARM/WARNING	DESCRIPTION	REMEDY
A1	-	
A2	-	
A3	-	
A4	-	
A5	PLC sequence interrupted	The sequence of the current PLC program has been interrupted due to a loss of the sequence input signal. Execute the sequence again, ensuring it is not interrupted. For further details, see par. 9.
A6	-	
A7	-	
A8	-	
A9	-	
A10	-	
A11	-	
A12	-	
A13	-	
A14	-	
A15	-	
A16	-	
A17	-	
A18	-	
A19	-	
W20	Modbus RTU checksum error	Inconsistent checksum detected Check the bus wiring quality.
W21	-	
W22	Modbus RTU stop bit error	Inconsistent stop bit detected Check the bus

		wiring quality and that the baud rate setting is consistent.
A23	-	
W24	-	
W25	-	
A26	-	
A27	-	
A28	-	
A29	Temperature probes inconsistent during calibration	Base and coprocessor calibration temperatures are not consistent. Verify that the temperature probes are positioned to detect the same temperature. For further details, see par. 6.3.1.
W31	Regulator off	Activate the "Regulator on" command or enable the "Regulator enabled" parameter.
W32	Awaiting power for calibration	Enable power to complete calibration (see also W33). This warning resets automatically.
W33	Awaiting power	Check CN1 connector. Check power transformer circuit or power supply unit. Enable power. This warning resets automatically.
A34	-	
A35	-	
A36	-	
A37	Selected temperature probe non present	Check that the prove specified in parameter “Calibration temperature probe type” is connected (see par. 11.1).
W38	Awaiting temperature stabilization during	Wait for the heating element temperature to

	calibration	stabilize. This warning resets automatically. If the problem persists, check the power chain connections from the thermoregulator to the heating elements. If multiple thermoregulators are present, carefully inspect the insulation.
W39	Temperature too low at the end of sealing	The sealing command has been disabled with a too low temperature compared to the corresponding setpoint “Sealing temperature” (e.g. on the first sealings). The tolerance can be configured via the “Maximum end of sealing temperature warning delta [°C]” parameter. Increase the sealing time or decrease the delta between the “Preheating temperature” and “Sealing temperature” setpoints. Alternatively, increase the 'Heating ramp' parameter. Check for any unintended switchings on the sealing command. Verify that the connections for the power cables, as well as the current and voltage feedbacks from the heating elements, are stable.
A40	Calibration with regulator off	Activate the "Regulator on" command or enable the "Regulator enabled" parameter. Then activate

		the calibration command again.
A41	-	
A42	-	
A43	-	
A44	Short circuit on DC output	Check the power circuit. Power off and on the thermoregulator.
A45	Bar opening or closing timeout	Bar closed sensor disabled with bar closed command or bar closed sensor enabled with no bar closed command. Check sensor, connections (see par. 9.1) and parameters (see par. 9.2).
A46	No current	Check the connection of the current sensor or the two current sensors on the models with coprocessor (see par. 5.6). Verify that the power cables to the heating elements are not broken. Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. Check that the power cable connected to PIN L2 of CN1 is not interrupted. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical Support to decrease the value of the Calibration level [%] parameter.
A47	Current sensor reversed	Check the connection of the current sensor or the two current sensors on the

		models with coprocessor (see par. 5.6). Check the orientation of the current sensor compared to the cable.
A48	Invalid preheating analogue reference	Check the preheating potentiometer connections or the analogue preheating reference (see par. 8).
A49	Invalid sealing analogue reference	Check the sealing potentiometer connections or the analogue sealing reference (see chap. 8).
W50	Power supply unit temperature too low	Ensure the power supply unit is properly sized for the application. If need be, decrease the value of parameter “Power off threshold [%].
A55	-	
A56	Invalid min phase	Change the “Minimum phase [us]” value.
W57	Too long period	Check the quality of the power chain wiring between power transformer and Thermosald. Check the quality of the power transformer primary wiring. Verify the mains power quality, ensuring there are no harmonics and no voltage dips. Check the Technical Report to ensure the power transformer is properly sized for the application. If the problem persists, contact 3E Technical Support to increase the “Minimum phase [us]” parameter.

		Also see A58.
A58	Too long period	Check the quality of the power chain wiring between power transformer and Thermosald. Check the quality of the power transformer primary wiring. Verify the mains power quality, ensuring there are no harmonics and no voltage dips. Check the Technical Report to ensure the power transformer is properly sized for the application. If the problem persists, contact 3E Technical Support to increase the “Minimum phase [us]” parameter. Also see W57.
A59	Too short period	Check the quality of the power chain wiring between power transformer and Thermosald. Check the quality of the power transformer primary wiring. Verify the mains power quality, ensuring there are no harmonics and no voltage dips. Check the Technical Report to ensure the power transformer is properly sized for the application. If the problem persists, contact 3E Technical Support to increase the

		“Minimum phase [us]” parameter. Also see W66.
A60	Calibration interrupted	Reset the alarm and repeat calibration
A61	-	
A62	-	
A63	-	
A64	-	
A65	-	
W66	Too short period	Check the quality of the power chain wiring between power transformer and Thermosald. Check the quality of the power transformer primary wiring. Verify the mains power quality, ensuring there are no harmonics and no voltage dips. Check the Technical Report to ensure the power transformer is properly sized for the application. If the problem persists, contact 3E Technical Support to increase the “Minimum phase [us]” parameter. Also see A59.
A67	Temperature > maximum temperature	Ensure that the setpoint is not too high. Verify the maximum temperature parameter. Check the power chain connections from the thermoregulator to the heating elements.

		Should one or more parallel-connected heating elements become completely disconnected, check that the “Maximum resistance delta for parallel failure [%]” parameter is correctly set for the configuration used."
A68	-	
A69	Earth leakage	With the CN0 connector disconnected, check for any earth leakage in the thermoregulator power circuit: heating elements, relevant power cables, and reference cables.
A70	-	
A71	-	
A72	-	
A73	-	
A74	Internal temperature too high	Verify that the electrical panel is adequately ventilated. Check fans operation (HP models) Verify with the Technical Report that the application has been properly sized.
W75	-	
A76	Current too high	Check if there is a short circuit on the heating element. Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical

		Support to decrease the value of the Calibration level [%] parameter.
A77	-	
A78	Heating without calibration	Remove the heating commands and carry out calibration.
A79	Emergency test failed	Check for the integrity of the safety chain (see par. 5.6.3.9).
A80	Backfire circuit broken	Contact 3E Technical Support.
A81	EEPROM not programmed or corrupted	Contact 3E Technical Support.
A82	-	
A83	Voltage references reversed	Check the voltage references: CN1/3 corresponds to CN60/1, CN1/4 corresponds to CN60/2.
A84	Heating with regulator off	Enable the regulator.
A85	Sealing time too long	Verify that the sealing command time is consistent with the “Maximum sealing command time [s x 10]” parameter.
A87	-	
A88	-	
A89	Parallel breakdown	Check the heating elements. Verify the value of the parameter 'Maximum heater delta for parallel breakdown [%]'. 6.7.4).
A90	Current too high	Check if there is a short circuit on the heating element or on the power circuit between the thermoregulator and the heating element. Verify with the Technical Report that the application has been properly sized.
A91	Power component overheating	Verify with the Technical Report that the application

		has been properly sized.
A92	Unexpected current	Check the power chain connections from the thermoregulator to the heating elements. If multiple thermoregulators are present, carefully inspect the insulation.
A93	Sealing without power	Enable power to seal (see also W33).
A94	Interrupted voltage references	Check the voltage references: CN60/1 and CN60/2. Check the power chain connections from the thermoregulator to the heating elements. If multiple thermoregulators are present, carefully inspect the insulation.
A95	-	
A96	Voltage too high	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical Support to decrease the value of the Calibration level [%] parameter.
A97	Partial short circuit	Partial short circuit detected on the heating elements. Check for the absence of liquids or any other conductive material on the heating elements. Verify that the heating elements are properly insulated from the bars. Check that the correct heating elements and the

		correct transformer/power supply unit are installed, and verify the power circuit wiring, paying particular attention to the insulation if multiple thermoregulators are present. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical Support to increase the “Partial short circuit [%] value or decrease the “Heating ramp” parameter.
A98	Unexpected current	Check the power chain connections from the thermoregulator to the heating elements. If multiple thermoregulators are present, carefully inspect the insulation.
A99	-	
A100	-	
A101	-	
A102	-	
A103	-	
A104	-	
A107	-	
A108	-	
A109	-	
A110	-	
A129	-	
W132	-	
W133	Awaiting power (coprocessor)	See W33.
A134	-	
A137	Selected temperature probe non present (coprocessor)	See A37.
W138	-	
W139	Temperature too low at the end of sealing (coprocessor)	See W39.
A143	-	

A144	Short circuit on DC output (coprocessor)	See A44.
A145	-	
A146	No current (coprocessor)	See A46.
A147	Current sensor reversed (coprocessor)	See A47.
W150	Power supply unit temperature too low (coprocessor)	See W50.
A151	-	
A152	-	
A153	-	
A154	-	
A155	-	
A156	Invalid min phase (coprocessor)	See A56.
W157	Too long period (coprocessor)	See W57.
A158	Too long period (coprocessor)	See A58.
A159	Too short period (coprocessor)	See A59.
A160	-	
A161	-	
A162	-	
A163	-	
A164	-	
A165	-	
W166	Too short period (coprocessor)	See W66.
A167	Temperature > maximum temperature (coprocessor)	See A67 and A89.
A168	-	
A169	Earth leakage (coprocessor)	See A69.
A170	-	
A171	-	
A172	-	
A173	-	
A174	Internal temperature too high (coprocessor)	See A74.
W175	-	
A176	Current too high	See A76.

	(coprocessor)	
A178	-	
A179	-	
A180	-	
A181	-	
A182	-	
A183	Voltage references reversed (coprocessor)	See A83.
A184	-	
A185	-	
A186	-	
A187	-	
A189	-	
A190	Current too high (coprocessor)	See A90.
A191	-	
A192	Unexpected current (coprocessor)	See A92.
A193	-	
A194	Interrupted voltage references (coprocessor)	See A94.
A195	-	
A196	Voltage too high (coprocessor)	See A96.
A197	-	
A198	Unexpected current (coprocessor)	See A98.
A199	-	
A200	Timeout Base > Master	Contact 3E Technical Support.
A201	Timeout Copro > Master	Contact 3E Technical Support.
A202	Timeout AN/PLC > Master	Contact 3E Technical Support.
A203	EEPROM failure	Contact 3E Technical Support.
A204	Timeout Master > Base	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A205	Timeout Master > Copro	Check for the 24VDC power supply on connector

		CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A206	Timeout Master > AN/PLC	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A207	PLC sequence interrupted	Check for the power presence. Make sure that the regulator is enabled. Make sure that the machine is calibrated or await until any calibration procedures are complete.
A208	Inconsistent Fieldbus	Contact 3E Technical Support.
A209	Inconsistent AC/DC	Contact 3E Technical Support.
A210	Inconsistent SP/ HP	Contact 3E Technical Support.
A211	Inconsistent SEC/PRI	Contact 3E Technical Support.
A212	Inconsistent PR	Contact 3E Technical Support.
A213	Inconsistent AN or AP	Contact 3E Technical Support.
A214	Inconsistent PL or AP	Contact 3E Technical Support.
A215	Inconsistent CO	Contact 3E Technical Support.
A216	IC2 failure	Contact 3E Technical Support.
A217	IC3 failure	Contact 3E Technical Support.
A218	IC4 failure	Contact 3E Technical Support.
A219	IC5 failure	Contact 3E Technical Support.
A220	IC6 failure	Contact 3E Technical Support.
A221	Driver Anybus	Contact 3E Technical

		Support.
A222	Anybus communication	Contact 3E Technical Support.
A223	Unexpected Anybus error	Contact 3E Technical Support.
A224	Ethernet driver	Contact 3E Technical Support.
A225	ADC failure	Contact 3E Technical Support.
A226	Anybus not initialized	Contact 3E Technical Support.
A227	Anybus failure	Contact 3E Technical Support.
A228	Anybus not supported	Contact 3E Technical Support.
A229	Anybus failure	Contact 3E Technical Support.
A230	Inconsistent CO	Contact 3E Technical Support.
A231	Inconsistent SEC/PRI	Contact 3E Technical Support.
A232	Inconsistent AN, AP, or PL	Contact 3E Technical Support.
A239	Temperature too low at the end of sealing	The sealing command has been disabled with a too low temperature compared to the corresponding setpoint “Sealing temperature” (e.g. on the first sealings). The tolerance can be configured via the “Maximum end of sealing temperature alarm delta [°C]” parameter. Increase the sealing time or decrease the delta between the “Preheating temperature” and “Sealing temperature” setpoints. Alternatively, increase the 'Heating ramp' parameter. Check for any unintended switchings on the sealing

		command. Verify that the connections for the power cables, as well as the current and voltage feedbacks from the heating elements, are stable.
A240	Temperature too high at the end of sealing	The sealing command has been disabled with a too high temperature compared to the corresponding setpoint “Sealing temperature” (e.g. on the first sealings). The tolerance can be configured via the “Maximum end of sealing temperature alarm delta [°C]” parameter. Increase the sealing time or decrease the delta between the “Preheating temperature” and “Sealing temperature” setpoints. Alternatively, increase the 'Heating ramp' parameter. Check for any unintended switchings on the sealing command. Verify that the connections for the power cables, as well as the current and voltage feedbacks from the heating elements, are stable.
A271	+3V AN/PLC failure	Contact 3E Technical Support.
A272	Temperature sensor failure	Contact 3E Technical Support.
A274	+5 V failure	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists,

		contact 3E Technical Support.
A275	Inconsistent dip switch board	Contact 3E Technical Support.
A276	+15VH failure	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A277	-15VH failure	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A278	-5 V failure	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A279	Emergency test failed (coprocessor)	See A79.
A280	Backfire circuit broken (coprocessor)	See A80.
A287	-	
A288	-	
A291	Power component overheating(coprocessor)	See A91.
A292	Rms current too high	Verify with the Technical Report that the application has been properly sized.
A300	Unexpected current	Check the power chain connections from the thermoregulator to the heating elements. If multiple thermoregulators are present, carefully inspect the insulation.
A301	Factory setting missing	Contact 3E Technical Support.
A316	IC2 failure (coprocessor)	See A216.
A317	IC3 failure	See A217.

	(coprocessor)	
A318	IC4 failure (coprocessor)	See A218.
A319	IC5 failure (coprocessor)	See A219.
A320	IC6 failure (coprocessor)	See A220.
A325	ADC failure (coprocessor)	See A225.
A339	Temperature too low at the end of sealing (coprocessor)	See A239.
A340	Temperature too high at the end of sealing (coprocessor)	See A240.
A372	Temperature sensor failure (coprocessor)	See A272.
A376	+15VH failure (coprocessor)	See A276.
A377	-15VH failure (coprocessor)	See A277.
A380	DC synchronization	Contact 3E Technical Support.
A392	Rms current too high (coprocessor)	See A292.
W400	Invalid Command Word bits	Check the value on “Command Word” (see par. 6.6.11.1).
W401	Inconsistent multiple Command Word bits	Check the value on “Command Word” (see par. 6.6.11.1).
W402	Invalid command code	Check the value on “Command code” variable (see par. 6.6.11).
W403	Invalid command	Check the command code used (see par. 7.13 and7.15).
W404	-	
W405	Invalid variable	Make sure that the required parameter exists (see par. 7.13 and 7.15). The variable can be identified on “Invalid reading/writing variable ID£
W406	Read-only variable	Remove the write command of read-only variables.

		The variable can be identified on “Invalid reading/writing variable ID£
W407	Invalid value	Check the ranges of the written variables. The variable can be identified on “Invalid reading/writing variable ID£
A408	Invalid BUS CONFIG dip switch	The “BUS CONFIG” dip switch is in an invalid configuration: correct the configuration and restart the device.
W409	Modbus RTU parity	Check the parity wiring and configuration (see par. 7.4).
W410	Invalid Modbus command fields	Check the message sent by the master (see par. 7.13).
W411	Invalid Modbus RTU slave address	Check the address sent by the master (see par. 7.4).
A412	Calibration timeout	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, contact 3E Technical Support.
A413	Voltage too low during calibration	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, contact 3E Technical Support to decrease the value of the Calibration level [%] parameter.
A414	Voltage too high during calibration	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists,

		contact 3E Technical Support to increase the value of the “Calibration level [%]” parameter.
A415	Current too low during calibration	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, contact 3E Technical Support to decrease the value of the Calibration level [%] parameter.
A416	Current too high during calibration	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, contact 3E Technical Support to increase the value of the “Calibration level [%]” parameter.
A417	Emergency test interrupted	Reset the alarm and repeat the emergency test.
A418	+5VH failure	Contact 3E Technical Support.
A419	+3V3H failure	Contact 3E Technical Support.
A420	ADC reference A failure	Contact 3E Technical Support.
A421	ADC reference B failure	Contact 3E Technical Support.
A422	No voltage	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical

		Support to decrease the value of the Calibration level [%] parameter.
A423	Voltage too low	Check for the correct heating elements and transformer/power supply unit, and verify the power circuit wiring. If the problem persists, repeat the calibration with power off (see par. 6.3). If the problem persists, contact 3E Technical Support to decrease the value of the Calibration level [%] parameter.
A424	Master power supply missing	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A425	Base power supply missing	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A426	Copro power supply missing	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A427	AN/PLC power supply missing	Check for the 24VDC power supply on connector CN2 and reset the alarm. If the problem persists, contact 3E Technical Support.
A428	PT100 ADC failure	Contact 3E Technical Support.
W439	Temperature too high at	The sealing command has

	the end of sealing	been disabled with a too high temperature compared to the corresponding setpoint “Sealing temperature” (e.g. on the first sealings). The tolerance can be configured via the “Maximum end of sealing temperature warning delta [°C]” parameter. Increase the sealing time or decrease the delta between the “Preheating temperature” and “Sealing temperature” setpoints. Alternatively, increase the 'Heating ramp' parameter. Check for any unintended switchings on the sealing command. Verify that the connections for the power cables, as well as the current and voltage feedbacks from the heating elements, are stable.
A500	Unexpected current (coprocessor)	See A300.
A512	Calibration timeout (coprocessor)	See A412.
A513	Voltage too low during calibration (coprocessor)	See A413.
A514	Voltage too high during calibration (coprocessor)	See A414.
A515	Current too low during calibration (coprocessor)	See A415.
A516	Current too high during calibration (coprocessor)	See A416.
A518	+5VH failure	See A418.

	(coprocessor)	
A519	+3V3H failure (coprocessor)	See A419.
A520	ADC reference A failure (coprocessor)	See A420.
A521	ADC reference B failure (coprocessor)	See A421.
A522	No voltage (coprocessor)	See A422.
A523	Voltage too low (coprocessor)	See A423.
A528	PT100 ADC failure (coprocessor)	See A428.
W539	Temperature too high at the end of sealing (coprocessor)	See W439.

18 ANNEX - MECHANICAL DIMENSIONS

SP SAC MODELS

The measurements in Figure 126 are expressed in mm.

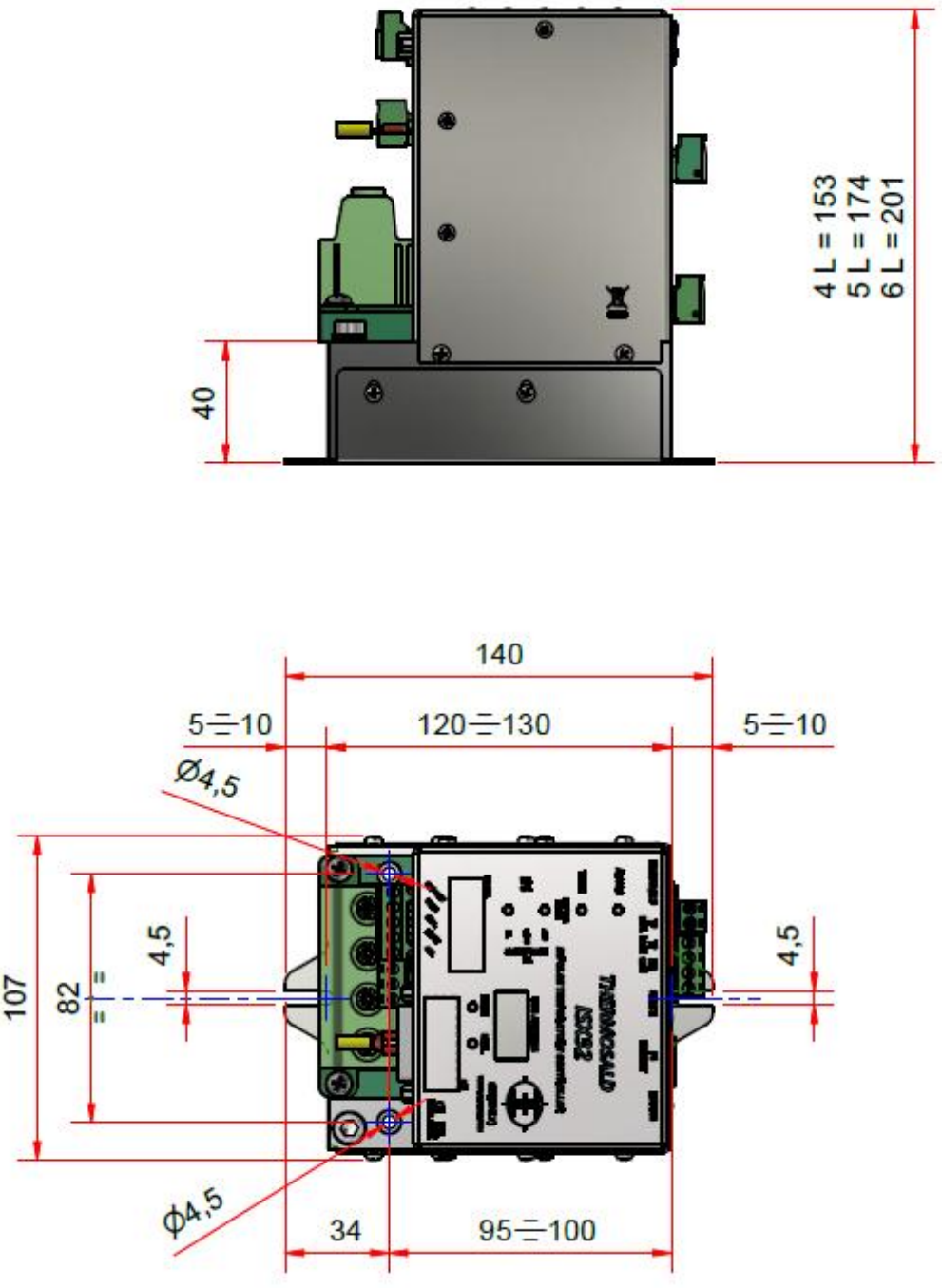


Figure 126

SP SDC MODELS

The measurements in Figure 127 are expressed in mm.

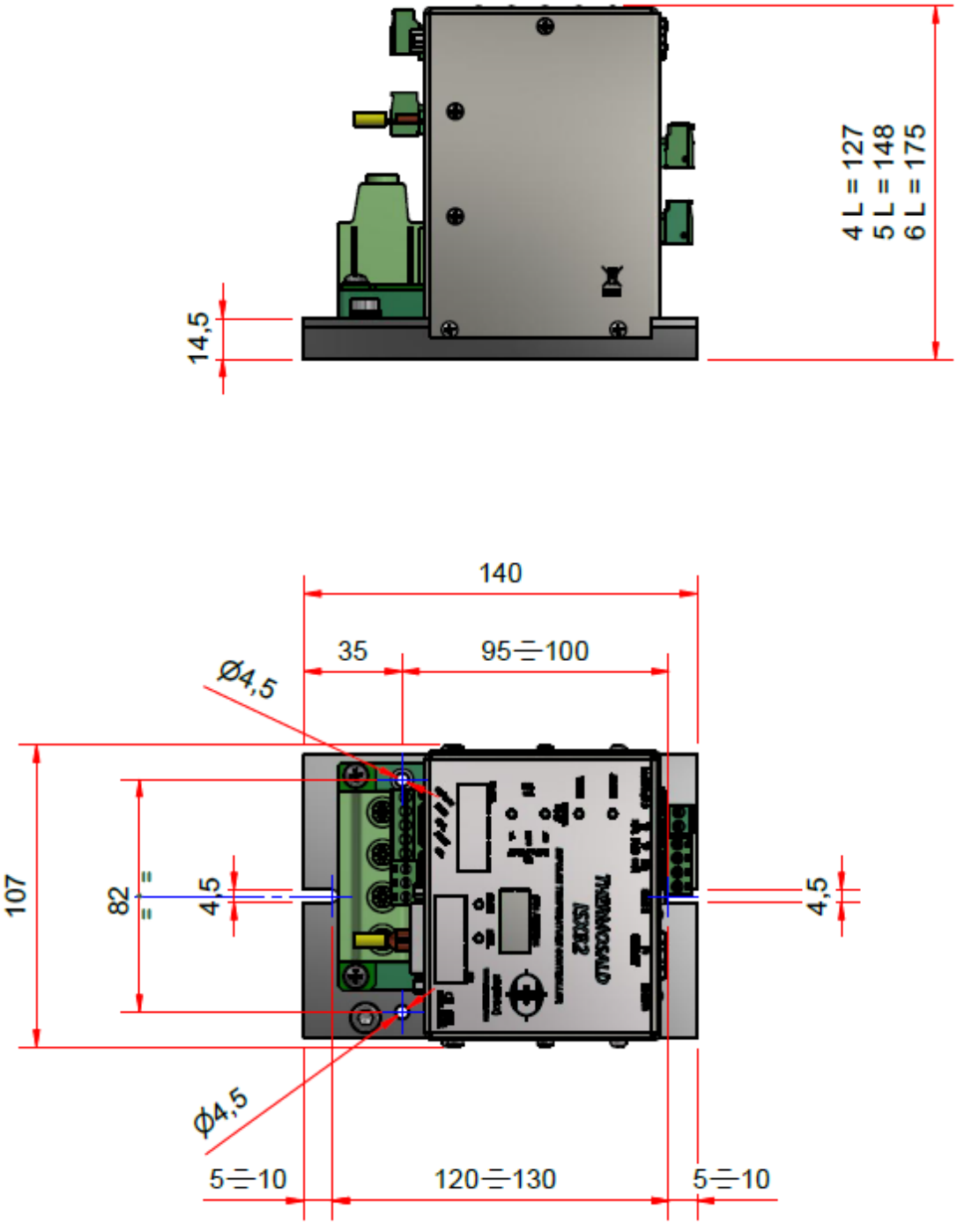


Figure 127

HP MODELS

The measurements in Figure 128 are expressed in mm.

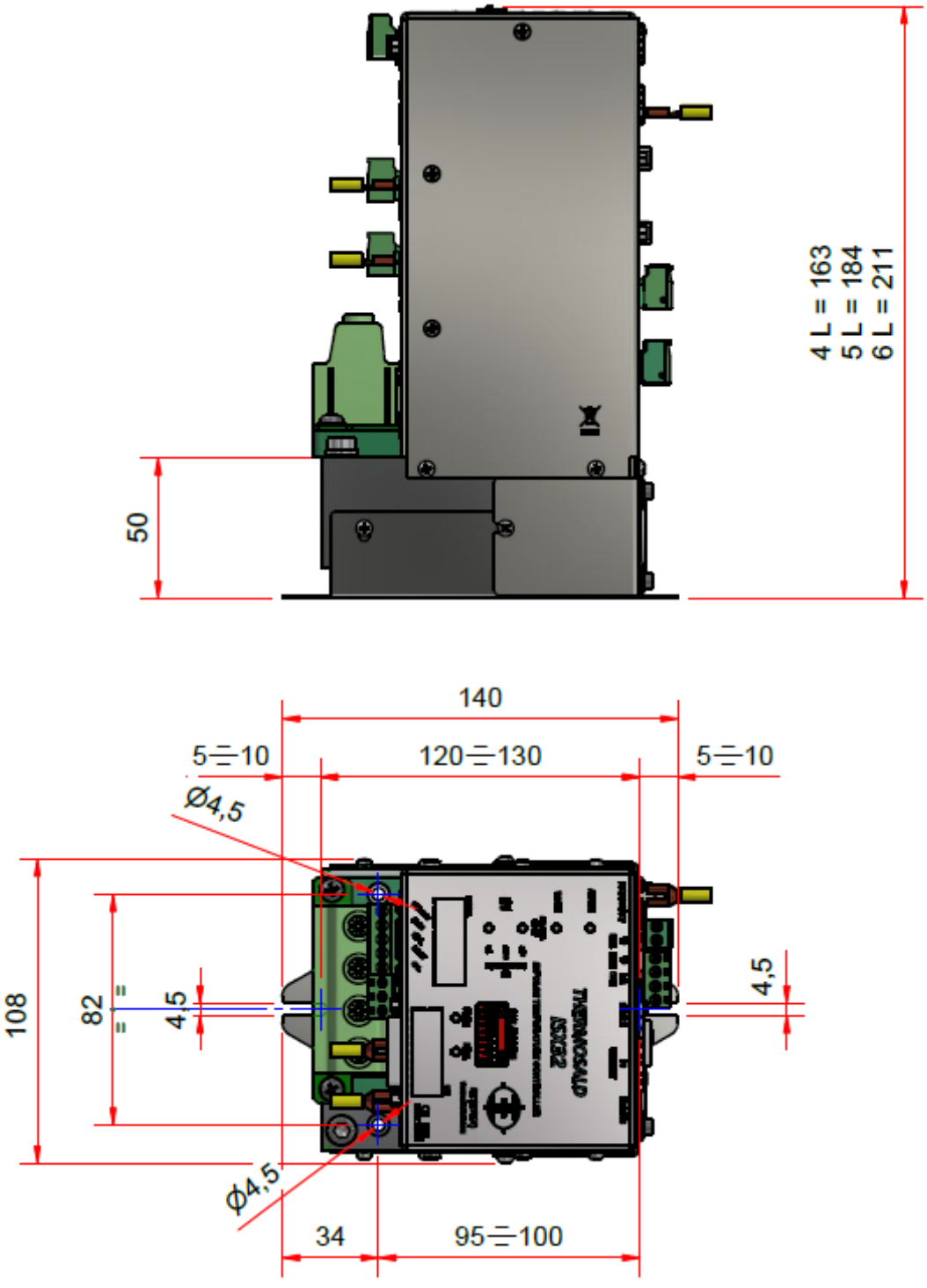


Figure 128

19 ANNEX - ACCESSORIES

19.1 Panel, panel cables and accessories

ITEM NUMBER	DESCRIPTION
3ES200A008	ISX32 PANEL
3ES080A001/1	THERMOSALD PANEL CABLE 1
3ES080A001/3	THERMOSALD PANEL CABLE 3
3ES080A001/5	THERMOSALD PANEL CABLE 5
3ES080A001/10	THERMOSALD PANEL CABLE 10
3ES080A001/20	THERMOSALD PANEL CABLE 20
3ES080A001/50	THERMOSALD PANEL CABLE 50
3ES108Z=IP65	THERMOSALD ISX - IP65 PANEL OPTION

The multilanguage panel is labelled with a serial number that uniquely identifies the product and contains year, month of production and progressive number as in the following example:

S.N.= 20011234

Technical data

WORKING ENVIRONMENT TEMPERATURE	5 °C - 40 °C
WORKING ENVIRONMENT HUMIDITY	<50%
WORKING ENVIRONMENT ALTITUDE	Up to 3000 metres above sea level
PROTECTION	IP44 (IP65 with option 3ES108Z=IP65) POLLUTION DEGREE II (see par. 2.1.2)
OVERVOLTAGE CATEGORY	III (see par. 2.1.2)
WEIGHT	0.15 Kg

The measurements in Figure 130 are expressed in mm.
The dashed line indicates the suggested drilling template.
For the overall dimensions, it is advisable to also consider the depth of the cable connector; with reference to Figure 129, the measurement of B is approximately 40mm.

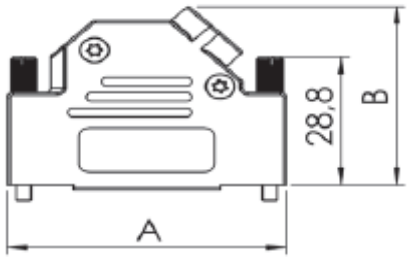


Figure 129

NOTE: with IP65 protection, code 3ES108Z=IP65, the drilling template must be 94mm x 47mm and mmmaximum external dimension of the front panel is 102m m x 54mm instead of 96x48.

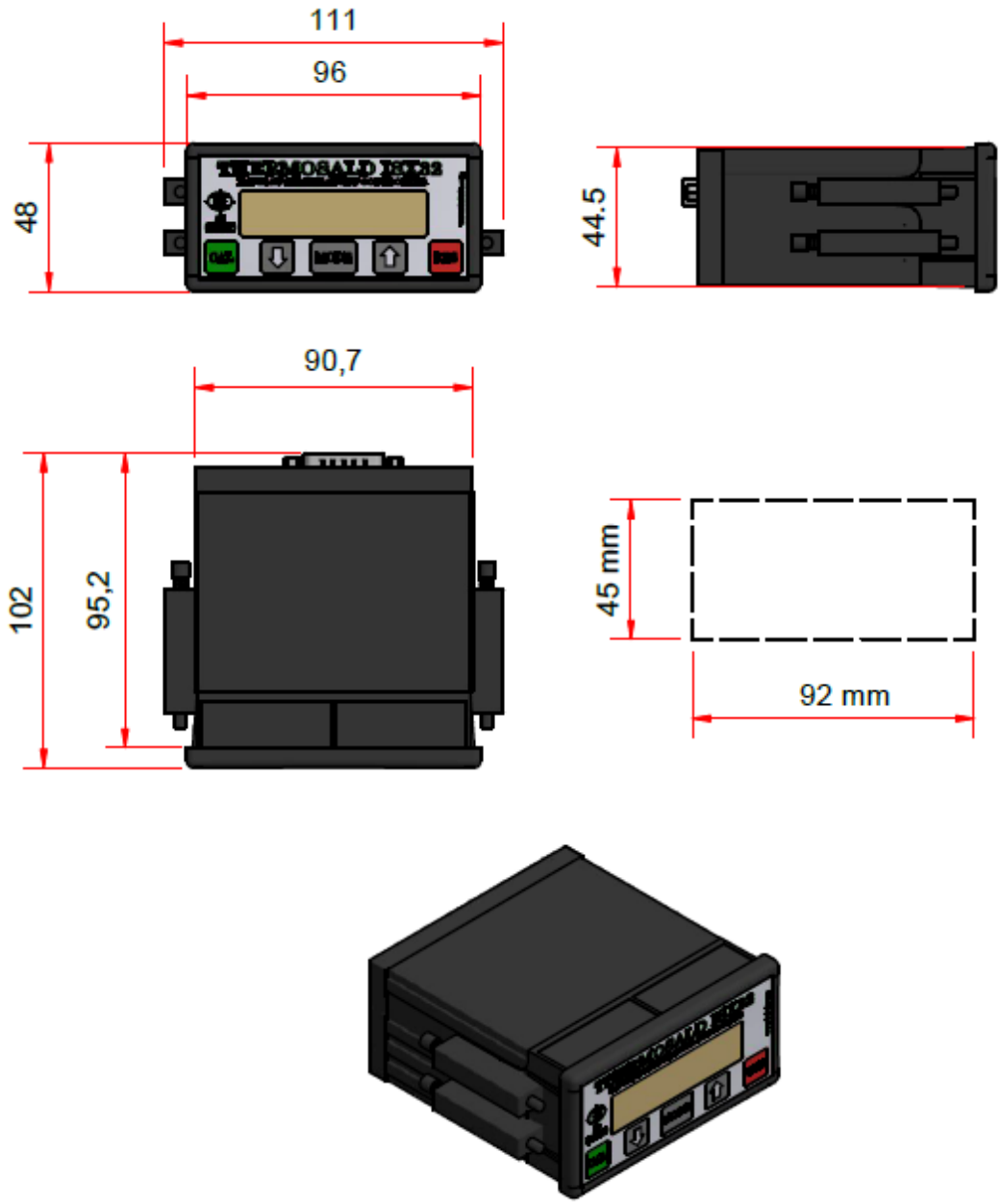


Figure 130

19.2 3ES080A002 Current sensor

ITEM NUMBER	DESCRIPTION
3ES080A002	THERMOSALD CURRENT TRANSFORMER

This current transformer must be used only for the AC models. Models with COPROCESSOR option require two elements.

Technical data

WORKING ENVIRONMENT TEMPERATURE	5 °C - 40 °C
WORKING ENVIRONMENT HUMIDITY	<50%
WORKING ENVIRONMENT ALTITUDE	Up to 3000 metres above sea level
PROTECTION	IP20 POLLUTION DEGREE II (see par. 2.1.2)
OVERVOLTAGE CATEGORY	III (see par. 2.1.2)
WEIGHT	0.2 Kg

The measurements in Figure 131 are expressed in mm.

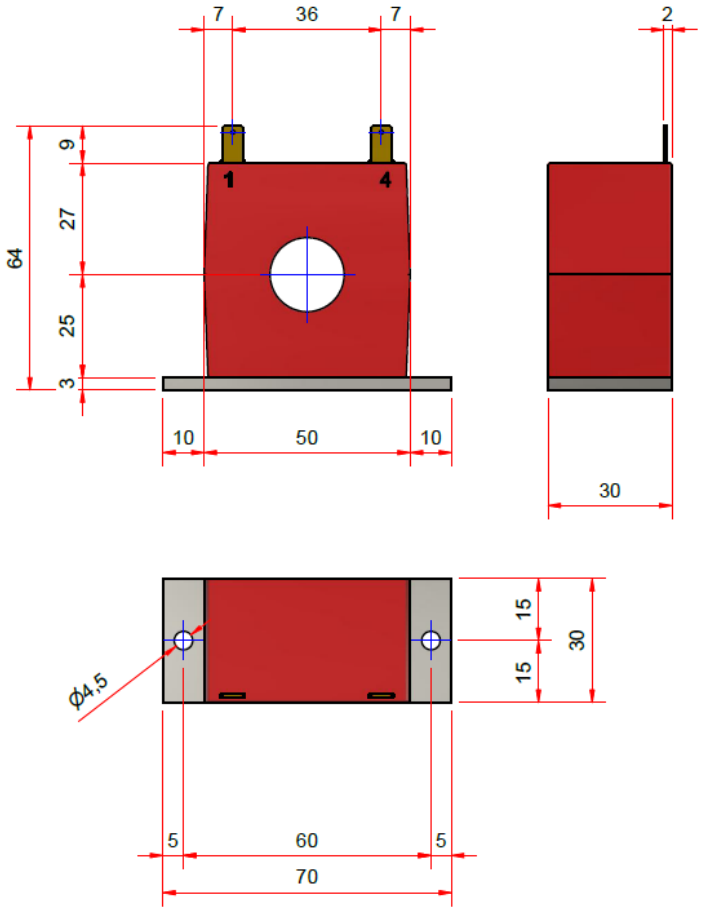


Figure 131

19.3 3ES200A001 Current sensor

ITEM NUMBER	DESCRIPTION
3ES200A001	ISX32 DC CURRENT SENSOR

This current transformer must be used only for the DC models. Models with COPROCESSOR option require two elements.

Technical data

WORKING ENVIRONMENT TEMPERATURE	5 °C - 40 °C
WORKING ENVIRONMENT HUMIDITY	<50%
WORKING ENVIRONMENT ALTITUDE	Up to 3000 metres above sea level
PROTECTION	IP20 POLLUTION DEGREE II (see par. 2.1.2)
OVERVOLTAGE CATEGORY	III (see par. 2.1.2)
WEIGHT	0.08 Kg

The measurements in Figure 132 are expressed in mm.

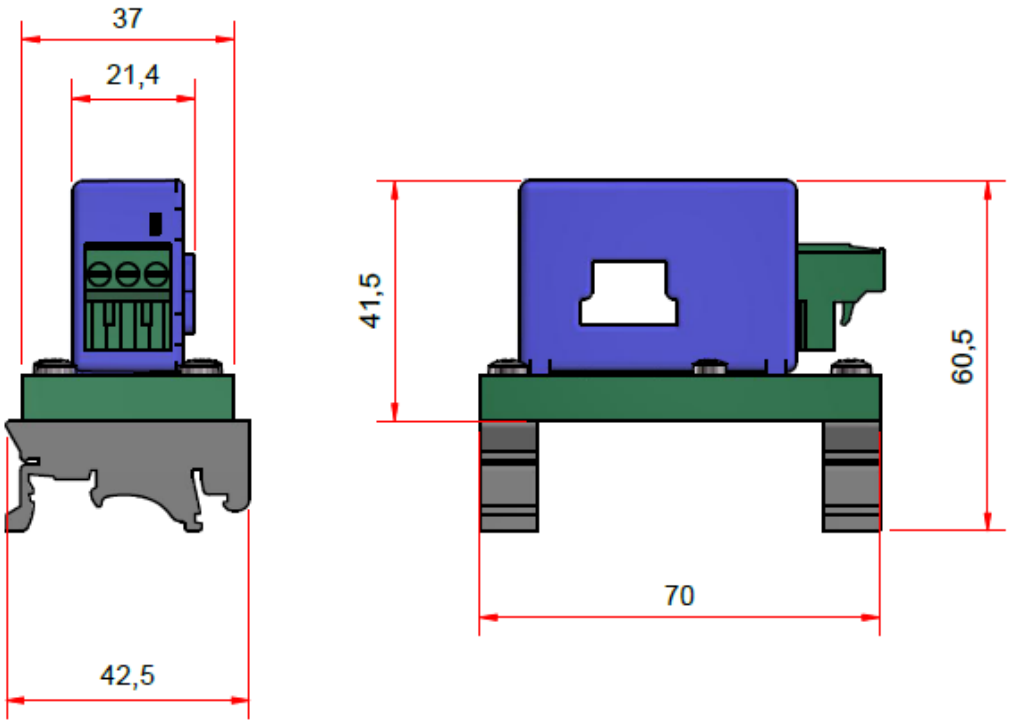


Figure 132

19.4 3ES109B1 Temperature probe

ITEM NUMBER	DESCRIPTION
3ES109B1	THERMOSALD ISX – PRECISION SENSOR 3MT CABLE

This digital probe is supplied with a 3-meter cable, but the cable length can reach up to 100 meters.

Technical data

WORKING ENVIRONMENT TEMPERATURE	-40 °C - 125 °C
ACCURACY	±3 °C
WORKING ENVIRONMENT HUMIDITY	<50%
WORKING ENVIRONMENT ALTITUDE	Up to 3000 metres above sea level
PROTECTION	IP44 POLLUTION DEGREE II (see par. 2.1.2)
OVERVOLTAGE CATEGORY	III (see par. 2.1.2)
WEIGHT	0.16 Kg

The measurements in Figure 133 are expressed in mm.

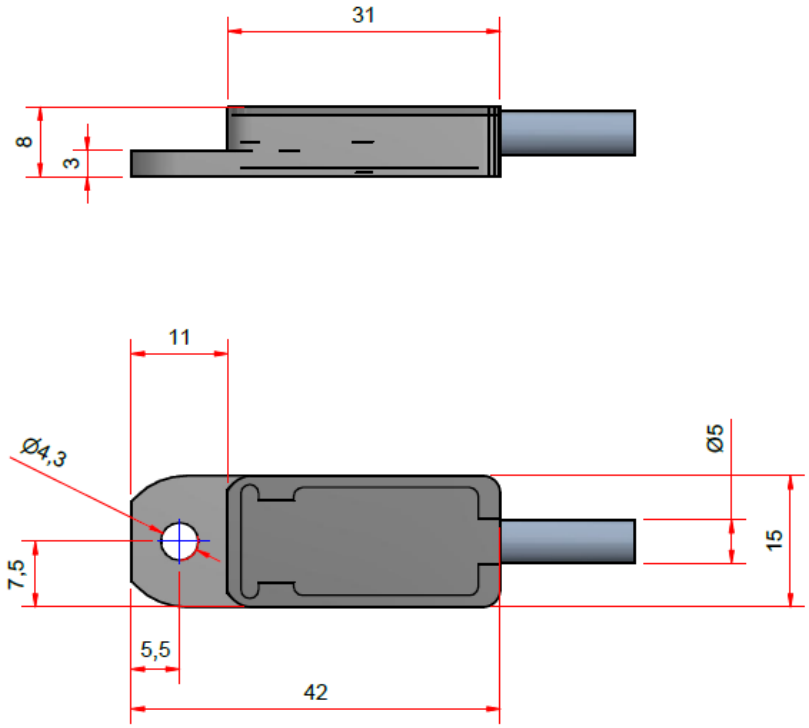


Figure 133

19.5 3EA0016 Temperature probe

ITEM NUMBER	DESCRIPTION
3EA0016	PTFC101B1A0 SENSOR

This PT100 probe has been tested with conductors with a cross-section of 0.25 mm² and a length of up to 100 meters.
Under these conditions, the measuring range is -50°C..500°C
Accuracy is ±1 °C.

19.6 Adaptation Kit for previous machines

Thermosald ISX32 can replace all previous-generation thermoregulators (Thermosald SCR, Thermosald PWM, Thermosald UPSCR, Thermosald ISC, and Thermosald ISX).
If 24V is not present in the panel, it is necessary to provide a 24V power supply, such as the one used by the PLC.
Depending on the models, an electrical adapter kit and optionally a panel mounting frame are available if you are switching from UPSCR.

ITEM NUMBER	DESCRIPTION
3ES108Z=ISX-UPSCR	THERMOSALD ISX – ISX PANEL FRAME OPTION ON UPSCR TEMPLATE
3EA0013	POWER SUPPLY VIN=230-500 VAC VOUT=24 VDC CABUR CSW121C
3EA0014	POWER SUPPLY VIN=230-500 VAC VOUT=24 VDC SIEMENS 6EP1333-3BA10

19.7 Sealing bars, terminals, wiring accessories

3E can supply different types of bars, sealing terminals and accessories for general wiring. For further information, please contact 3E Technical Support.

Here are some examples:

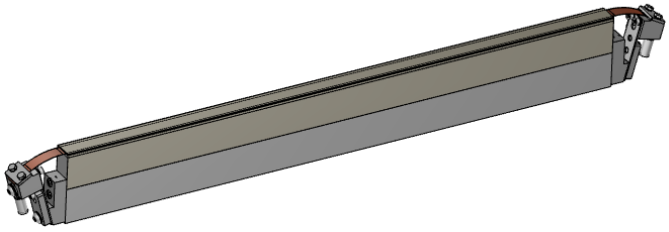


Figure 134 - Sealing bar

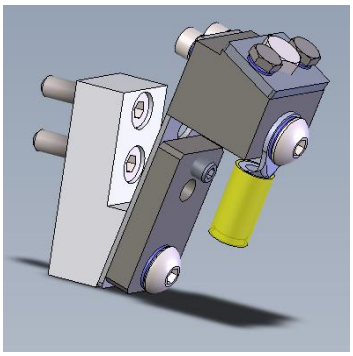


Figure 135 – Terminal

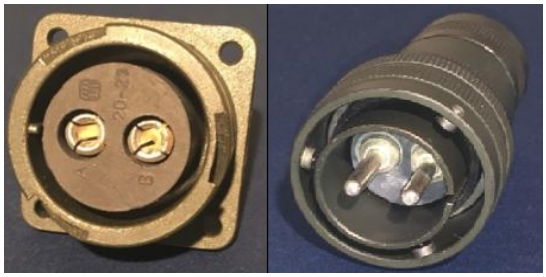


Figure 136 – Power connectors



Figure 137 – Potentiometer and cap

19.8 Power transformer and DC power supply unit

3E can supply the power transformer or the DC power supply unit.
In order to choose the correct model, contact 3E Technical Support Office (see par. 5.6.3.1).

19.9 Consumable materials

3E can supply sealing bands, straps and sealing wires with different profiles and also copper-plated, silver-plated, nickel-plated or Teflon-plated, according to specific drawings. In addition, Teflon and non-conductors with different profiles, also according to specific drawings.
For further information, please contact 3E Technical Support.

Here are some examples:

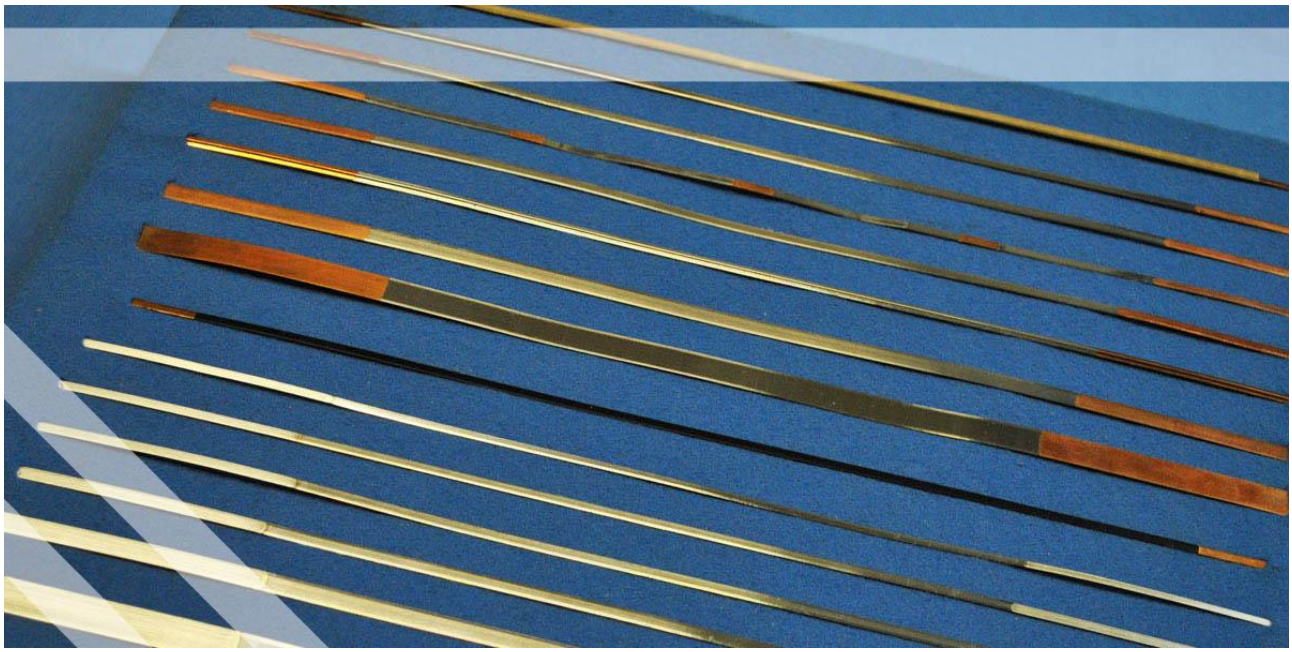


Figure 138 - Coppered, silver-plated and nickel-plated sealing bands



Figure 139 - Sealing bands with eyelets



Figure 140 - Sealing elements according to drawing



Figure 141 – Sealing straps

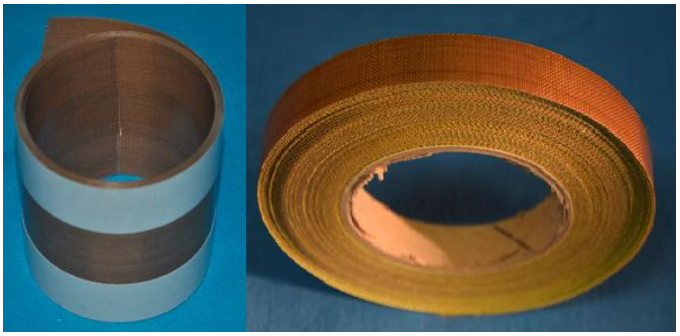


Figure 142 – Teflon

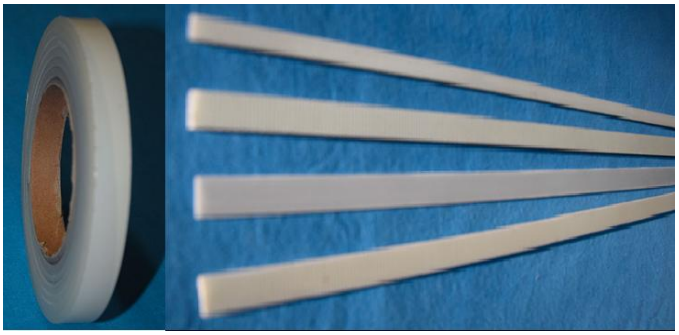


Figure 143 - Non-conductors

20 ANNEX – DISPOSAL

Pursuant to Directive 2012/19/EU, implemented and transposed by Legislative Decree No. 49 of March 14, 2014, this equipment is marked with the following crossed-out wheeled bin symbol.



It is forbidden to dispose of this product as ordinary municipal waste: it must be taken to an authorized WEEE (Waste Electrical and Electronic Equipment) collection centre established by the Public Administration.
The aforementioned legislation provides for penalties in case of illegal disposal of WEEE (Waste Electrical and Electronic Equipment)

