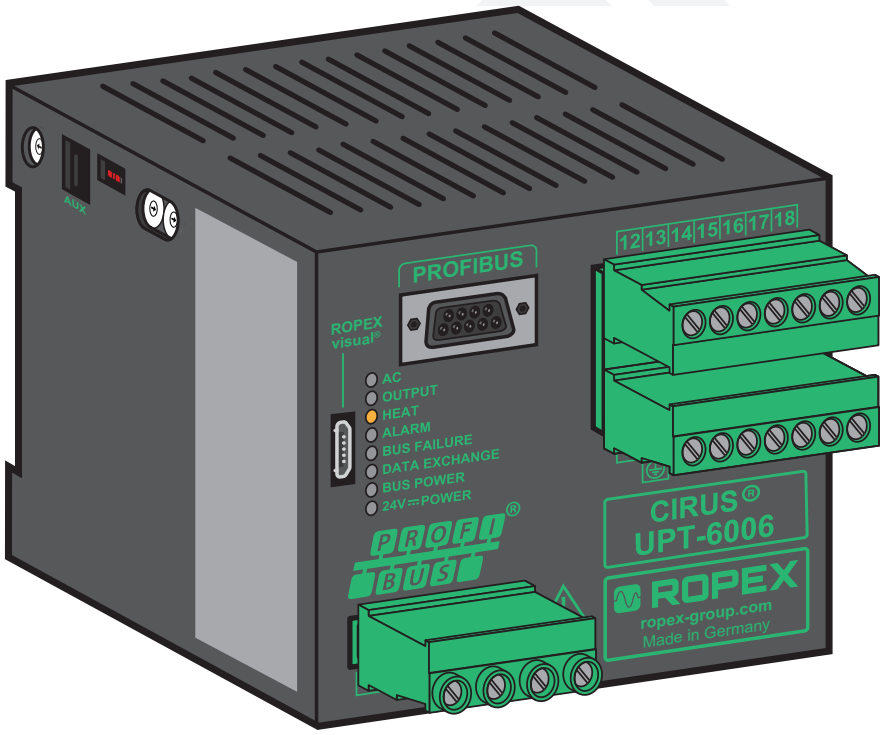
ROPEX

Temperature controller

CIRUS® UPT-6006

Installation and operating instructions for qualified professionals



W600602

Version 4 | 01/2025

1/29/2025

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Revision history

Version	Change	Refer to section
2	Parameter data expanded: Startup delay after reset (index 46/47) and maximum measurement pause (index 48)	Parameter data [▶ 49] DPV1 parameter data slot 1, index 4 and higher
	DPV1 parameter data expanded: TCR calculator in slot 1, index 190 to index 193	DPV1 parameter data slot 1, index 190 and higher [▶ 63]
	New section	TCR calculator [▶ 55]
	New section	Restart delay after reset [▶ 59]
3	Addition: List "Blocking AUTOCAL function"	Automatic zero calibration AUTOCAL (AC) [▶ 41]
	Addition: Note	Alarm active (AL) [▶ 45]
	Addition: Standby function active (bit SA)	Standby active (SA) [▶ 47]
	Addition: 24 VDC supply switch-on current and control mode	Technical data [▶ 81]
4	Documentation revised	All
	Section "Commissioning" revised	Startup [▶ 27]
	Current transformer PEX-W4 removed	Current transformer [▶ 18]
	New section	Updating firmware version [▶ 78]
	Line voltage between two outer conductors and power supply increased to 480 V	Technical data [▶ 81]
	Declaration of conformity amended	EU-Konformitätserklärung [▶ 85]
	New section added to include an example of electrical cabinet wiring and examples of electrical connections	Appendix [▶ 87]

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1 Information on these operating instructions

1.1 Purpose of operating instructions

These operating instructions are a component of the product and provide information on the temperature controller CIRUS® *UPT-6006*.

It contains information on these and other topics:

- Assembly
- Installation
- Operation
- Maintenance

1.2 Target group

These instructions are intended to be used by qualified specialists.

1.3 Validity of the operating instructions

These instructions apply to all models of the temperature controller CIRUS® *UPT-6006* manufactured November 2019 and later.

1.4 Related documents

- Data sheets and instructions for the line filters *LF-06480*, *LF-35480*, *LF-10520, LF-20520, LF-30520* and *LF-50520*
- Operating instructions for the current transformer *PEX-W5*
- Data sheet and manufacturer's documentation for the pulse transformer
- Your application report

1.4.1 Related software applications

- Operating instructions for the visualization software *ROPEXvisual*®
- Operating instructions for the application software *ROPEXupdate*

1.5 Storing documentation

▶ Keep these operating instructions for later reference.

▶ Ensure that all information and functions that the user may require are readily available.

1.6 Quality of device

For quality assurance purposes, the device is repeatedly inspected over the course of manufacturing. This ensures that the device leaves ROPEX in perfect condition.

1.7 Typography

These instructions apply the following typography rules:

Text	Product name and designation Example: *UPT-6006*
	References to other documents Example: Refer to the *Application report* for more information.
"Text"	Composite terms and references to illustrations Examples: Position "0", thermal pre-treatment of heating element "burned in"
TEXT	Function Example: Activate AUTOCAL LED Example: LED AUTOCAL
`Text`	Menu item Example: Touch `Update`button Key Example: Touch `Manual` button Bit Example: Bit `Start`
`Text > Text`	Menu path Example: `Help > Supported devices`
[►24]	Reference to page number Example: Further information can be found in the section "Technical data" [►24]
…	How to show "to" Example: The cold resistance of the heating element decreases by approx. 2…3 %.

Single-step instructions

For single-step instructions or instructions where the chronology is not important, single-step instructions are used as follows:

✓ One or more prerequisites (optional) to be able to perform the next step.

► Step.

Multiple-step instructions

For multiple-step instructions and instructions where the chronology is important, multiple-step instructions are used as follows:

✓ One or more prerequisites (optional) to be able to perform the next steps.

1. First step
   ⇨ Intermediate result
2. Second step
   ⚠ **WARNING! Warning note as part of a step.**

⇨ Result

2 Intended use

The device has been designed and tested in accordance with the latest state of technology. To prevent personal injury as well as damage to equipment, use the device properly and only as intended.

The temperature controller regulates the temperature of heating elements used to seal and cut thermoplastic films.

The temperature controller may be operated only with suitable adhesives in a proper and complete control loop.

Only suitable CIRUS® heating elements shall be installed and operated.

The device may be used only when it is completely assembled and is functioning as intended. The device may never be opened, repaired or modified in any way.

The device is developed, designed and built for industrial and commercial use only.

Personal use, e.g. in private households, is prohibited.

The device is intended to be used only by persons with the following knowledge and skills:

- Qualified technicians who, based on their professional training or experience, are familiar with pulse sealing.

Any other use besides the intended use is prohibited. The manufacturer will not be liable for damage resulting from unintended use. When any changes are made to the product, including in the course of assembly and installation, all warranty claims will be forfeited.

Consult all instructions and follow them carefully whenever working on the device.

2.1 Ambient conditions

Ambient conditions	Limits
Altitude	Up to 2000 m
Ambient temperature	+5…+45 °C
Maximum relative humidity	80 % at temperatures up to +31 °C decreasing linearly to 50 % relative humidity at +45 °C

3 Safety

3.1 Safety regulations

Always read the safety regulations carefully before using the device!

Install device

Installation, startup and work on the device may be carried out only by qualified professionals. The persons must be familiar with the inherent dangers and warranty conditions.

- ▶ Install the device according to generally accepted engineering standards.

Preventing electric shock

Line voltage is being applied to the electrical connections. This can cause electric shock.

- ▶ Before beginning any work, switch off the voltage supply and secure it to prevent it from being switched on again.
- ▶ Protect the device from humidity.

Requirements at installation site

The device can malfunction or be damaged if the temperature is too high or too low, or if the humidity is too high.

- ▶ Install the device indoors in a dry room that is always frost-free.
- ▶ Never install the device outdoors.
- ▶ Comply with the ambient temperature indicated on the ID plate and in the applicable documentation.
- ▶ Protect the device from liquids and sustained high humidity. Never allow condensation to form in the device.
- ▶ Never cover the device with any objects.
- ▶ Comply with the specified minimum distance between devices.

Safe operation of the device

- ▶ Operate the device only fully assembled and installed.
- ▶ Make sure that the device is undamaged, complete and correctly assembled.
- ▶ In addition to these device instructions, observe the prohibition, warning and mandatory signs on the device.

3.2 How warnings are structured

These instructions contain various warnings of varying degrees, each preceded by a symbol or signal word. The symbol and the signal word indicate the hazard level.

How warnings are structured

Warnings that precede an action to be taken are shown as follows:



⚠ DANGER

Type and source of hazard

Explanation of type and source of hazard / description of consequences

- ▶ Measures to avert the hazard

Meaning of signal words

Signal	Definition
DANGER	Imminent risk of casualties or serious injury, if the hazard cannot be averted.
WARNING	Possible risk of serious injury, if the hazard cannot be averted.

Signal	Definition
CAUTION	Possible risk of minor injury, if the hazard cannot be averted.
NOTE	Property damage or malfunction, if the hazard cannot be averted.

Meaning of symbols

Symbol	Definition
	General indication of hazard
	Danger, high voltage
	Fire hazard
	Note indicating potential property damage

3.3 Symbols on the device

Symbol	Definition
	Conformity of the temperature controller is valid only when the device is used with the required components. Read the operating instructions thoroughly before using the device. Observe all warnings contained in the instructions.
	Protective grounding to discharge transient overvoltage.
	Read the operating instructions thoroughly before using the device.

3.4 Conformity

We confirm as the manufacturer that this product has been developed and manufactured according to relevant standards and guidelines.

3.5 Rules

Comply with the following rules and regulations:

Legal requirements

- Statutory provisions regarding accident prevention
- Statutory provisions regarding environmental protection
- Occupational safety regulations

Standards

- Applicable safety regulations of the respective country
- DIN 46228 End sleeves

- DIN EN 60715:2018-07/VDE 0660-520:2018-07 Dimensions of low-voltage switchgear and controlgear - Standardized mounting on rails for mechanical support of switchgear, controlgear and accessories
- DIN EN 55011/VDE 0875-11 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
- DIN EN 55032:2016-02/VDE 0878-32:2016-02 Electromagnetic compatibility of multimedia equipment - Emission Requirements
- DIN EN IEC 61558-1/VDE 0570-1 Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests (IEC 61558-1)
- DIN EN IEC 61784-2 Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC/IEEE 8802-3
- DIN EN IEC 60947-1:2022-03/VDE 0660-100:2022-03 Low-voltage switchgear and control gear - Part 1: General rules
- DIN EN 61158-6-3 Industrial communication networks - Fieldbus specifications - Part 6-3: Application layer protocol specification - Type 3 elements
- IEC 61010-1:2010 A1:2016 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

Directives

- 2014/30/EU Electromagnetic compatibility
- 2014/35/EU Low voltage
- 2011/65/EU Directive on the use of certain restricted substances in electrical and electronic equipment (RoHS directive).

3.6 Obligation of user

To ensure that the device functions properly, follow these instructions:

- To ensure safe operation, comply with the safety and warning notes contained in these instructions.
- Read the operating instructions thoroughly before using the device.
- Always operate the device in compliance with the conditions stated under "Technical Data."
- Store the operating instructions near the device.
- Only properly trained electricians may perform installation, startup and maintenance. Such persons are familiar with the equipment and the warranty conditions.

4 Description of project

4.1 Functioning

The temperature controller CIRUS® *UPT-6006* works in the control loop like this:

The resistance of the heating element changes along with the temperature of the heating element.

The resistance of the heating element is determined by measuring the current and voltage. This value is then used to calculate and display the actual temperature of the heating element, as well as to compare it to the specified setpoint.

The measurement is taken at a 50 Hz grid, corresponding to 50 times/sec or a 60 Hz grid, corresponding to 60 times/sec.

When the measurements deviate from the setpoint, the pulse transformer primary voltage is adjusted applying the phase angle principle. The resulting change of current in the heating element causes a temperature change, thus leading to a change in resistance. The temperature controller CIRUS® *UPT-6006* measures and evaluates the change in resistance. Based on the adjustment and the setpoint, the temperature controller CIRUS® *UPT-6006* adjusts the control variables.

4.2 Application

The temperature controller CIRUS® *UPT-6006* is part of the series 6000.

The temperature controller CIRUS® *UPT-6006* shall be used only to regulate the temperature of heating elements used to seal and cut thermoplastics.

4.3 Overview

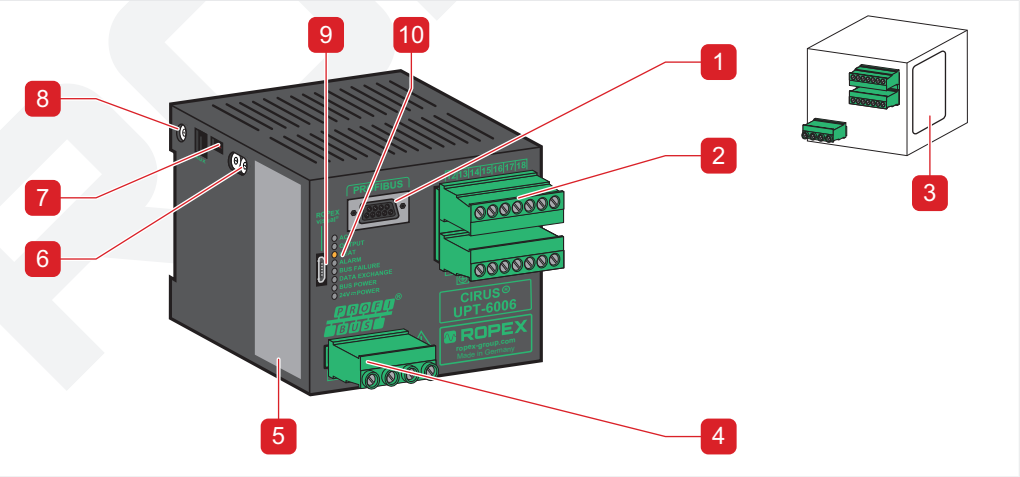


Illustration 1: Overview of temperature controller UPT-6006

1	PROFIBUS® port	2	Terminals 5 to 18
3	Terminal diagram	4	Terminals 1 to 4
5	ID plate	6	Coding dial, station address
7	Alarm relay slide	8	Coding dial, temperature range and alloy
9	USB port	10	LEDs

4.3.1 ID plate

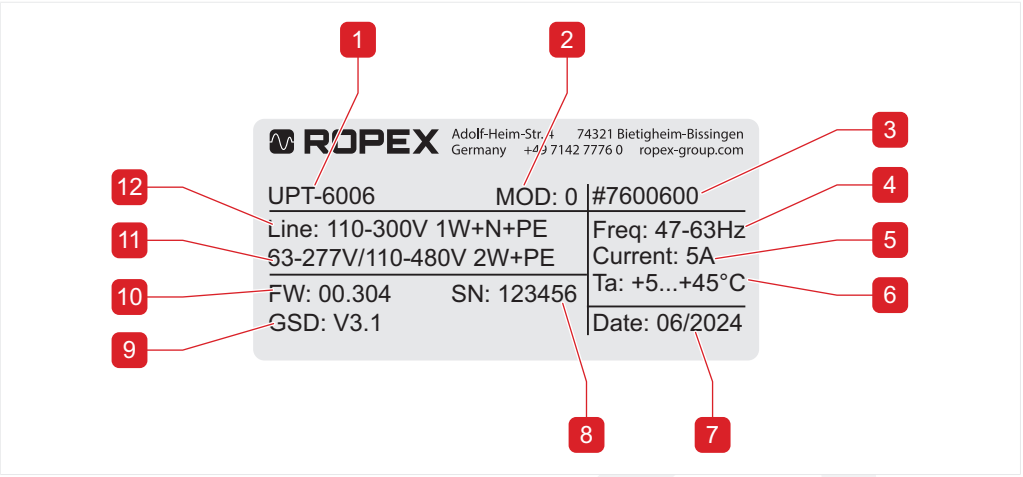


Illustration 2: ID plate temperature controller UPT-6006

1	Temperature controller *UPT-6006*	2	Modification
3	Article number	4	Frequency
5	Continuous current	6	Ambient temperature
7	Manufacturing date	8	Serial number
9	Version of GSD file	10	Firmware version
11	Line voltage / connection, two-phase	12	Line voltage / connection, single-phase

The ID plate is located on the side of the device.

4.3.2 Dimensions

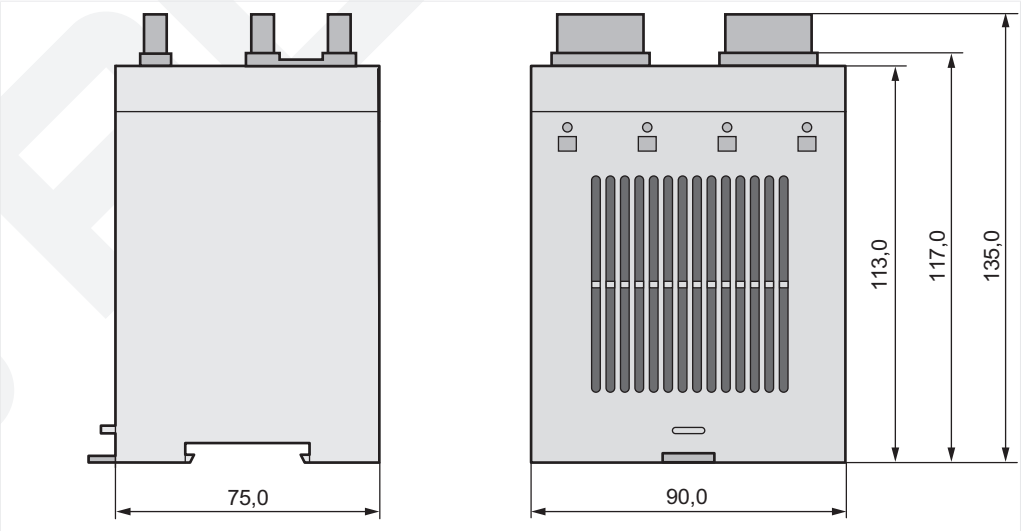


Illustration 3: Dimensions in mm (with terminal strips)

4.4 Essential system components

4.4.1 Control loop components

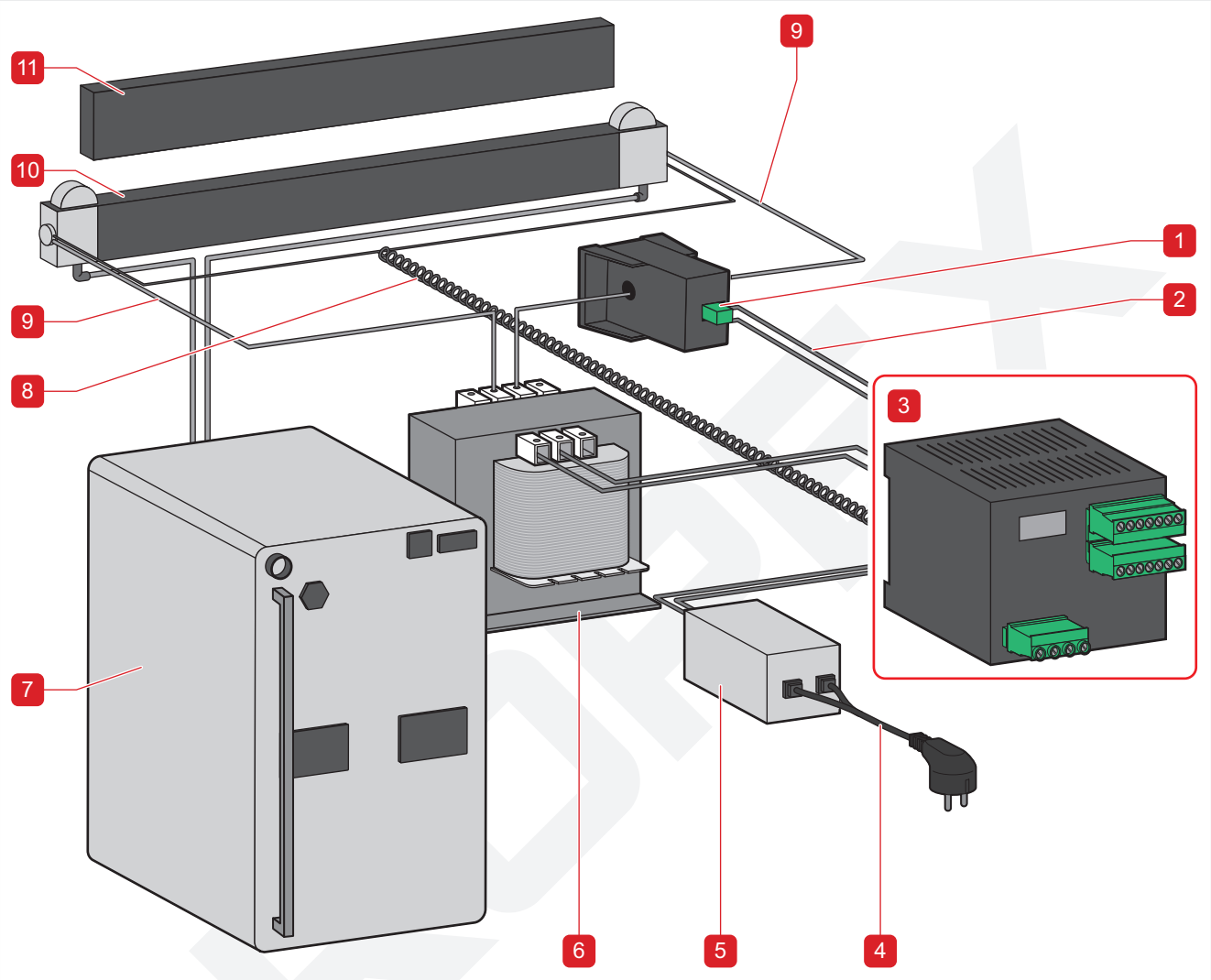


Illustration 4: Control loop components (diagram)

Pos.	Component	For further notes and information, refer to section
1	Current transformer	Current transformer [▶ 18]
2	Measurement cable, current I_R	
3	Temperature controller	Connection diagram [▶ 25]
4	Power supply	
5	Line filter	Line filters [▶ 18]
6	Pulse transformer	Pulse transformer [▶ 17]
7	Cooling unit	
8	Measurement cable, voltage U_R	Measurement cable [▶ 19]
9	Secondary circuit lines	
10	Heating element/ UPT heat-sealing bar	Heating element [▶ 17]
11	Silicone bracket + silicone profile	

Note The application report is needed to position and determine the essential components.

4.4.2 Heating element



⚠ DANGER

Fire hazard due to overheating of heating element

A defect in the control loop can cause the heating element to overheat and components to catch fire.

- ▶ Install a contactor Kb in the control loop.
- ▶ Install a temperature monitor at the sealing bar.



⚠ DANGER

Fire hazard due to unsuitable heating element

An unsuitable heating element can overheat and cause components to catch fire. The heating element can burn through, creating an arc in a certain limited space.

- ▶ Install touch protection.
- ▶ Use only heating elements intended specifically for this purpose.
- ▶ Comply with the application report.

For operation with the temperature controller CIRUS® , only CIRUS® heating elements are suitable.

Notes

A suitable temperature coefficient (TCR) of the heating element is essential to the measurement principle.

If the temperature coefficient of the heating element is greater than the set value, the actual temperature is lower than the displayed temperature.
But if the temperature coefficient of the heating element is less than the set value, the actual temperature is higher than the displayed temperature.

The resistance value rises as the heating element gets warmer. If the temperature coefficient of the heating element is below the permitted range, the control loop can fluctuate or the heating element can overheat.

Preventing measurement errors

Due to its design, the base resistance of the heating elements increases steadily during operation.

- ▶ To prevent measurement errors, perform AUTOCAL about every 100,000 heat-sealing cycles.

4.4.3 Pulse transformer



⚠ DANGER

Danger, high voltage and overheating

Incorrect assembly and installation of the pulse transformer impair electrical safety.

- ▶ Install touch protection.
- ▶ Select the proper cable cross-section.
- ▶ Comply with the application report.

The pulse transformer is a component of the control loop. It is attached between the temperature controller and the voltage supply connection to the heating element. The pulse transformer supples the voltage required by the heating element and is designed for the individual application; refer to the application report.

The following requirements have to be met:

- The dimensions of the pulse transformer should be suitable for the control loop.

- Primary and secondary voltage
- Output
- Duty cycle of transformer

- This transformer must be designed according to EN 61558 or UL 5085 (isolating transformer with reinforced insulation)
- Single-chamber model

Assembly and installation

The following are important for the assembly and installation of the pulse transformer:

- The touch protection must comply with national installation and construction requirements.
- Use the cable cross-sections stated in the application report.
- Clamp the cables to the pulse transformer terminals. Check the terminals regularly to ensure that they are mounted tightly.

4.4.4 Current transformer

NOTICE

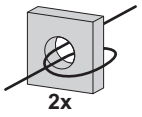
Malfunction due to use of devices from other manufacturers

Devices from other manufacturers can lead to malfunctions in the control loop.

▶ Use only original ROPEX current transformers or ROPEX monitoring current transformers.

The current transformer is a component of the control loop. It may be used only to measure the current, enabling the temperature controller to determine the heating element temperature.

Observe the following notes and comments:



- The current transformer may be started up only when it is properly connected to the temperature controller; refer to section Connection diagram [▶ 25].
- If the secondary peak current I_2 is less than 30 A, the secondary high-current wire must be passed through the current transformer at least twice; refer to the application report.
- If the cross-section is too large or the insulation too thick, use an *HCB-1* high-current rail to route the cable through the current converter. Further information can be found in the respective operating instructions.
- ROPEX monitoring assemblies such as the Current Balance Monitor *CBM-2* can be used to increase operating safety. Further information can be found in the respective operating instructions.
- External monitoring assemblies such as insulation monitors or a voltage monitoring device can also be used. Refer to the manufacturer's operating instructions for more information.

4.4.5 Line filters

CE conformity of the temperature controller can only be achieved with the mains filters recommended and supplied by ROPEX. The mains filters damp the reaction of the phase-angle control on the line and protect the temperature controller against line disturbances.

Follow these instructions:

▶ Always use a ROPEX mains filter.

▶ Install unfiltered and filtered lines in separate wiring ducts.

- ▶ Follow the instructions in the mains filter operating instructions.
- ▶ Comply with the application report.

4.4.6 Measurement cable

Use a twisted measurement cable supplied by ROPEX:

- *UML-1*
- *UML-2*

The measurement cables *UML-1 and UML-2* are twisted cables used for voltage measurement in conjunction with temperature controllers RESISTRON® and CIRUS®.

- ▶ Connect the measurement cable directly to the contacts or the previously installed cables.

Further information can be found on the measurement cable data sheets.

4.5 Optional system components

4.5.1 Booster

If the continuous current is greater than 5 A or the pulsed current is greater than 25 A, use a booster.

Refer to the application report for more information.

Also refer to

- How to order [▶ 83]

5 Assembly and installation

5.1 Transporting and checking device

To prevent damage, always transport and store the device in the original box.

After transporting the device, visually inspect the device for any damage.

5.2 Scope of delivery

Check the delivery for damage and verify that it is complete.

Delivery includes:

- Temperature controller with terminal strips in place.

5.3 Installation site requirements

Installation site



NOTICE

Liquids and dust can damage the equipment

Liquids and dust that penetrate the device can impair proper functioning. Electrical components can become corroded.

- ▶ Set up and operate the device only in a clean, dust-free environment.
- ▶ Protect the device from moisture, water, cleaning solutions and conductive liquids.
- ▶ Ensure that the area is well ventilated.

The installation site must be dry and frost-free at all times.

Machine-side supply voltage



NOTICE

Equipment damage caused by incorrect supply voltage

Supply voltage that is too high or too low can damage the device.

- ▶ Adjust the machine-side supply voltage to suit the permitted voltage and frequency range of the temperature controller.
- ▶ Observe the information on the ID plate.

5.4 Device assembly

Observe this warning before beginning any work on the system:

⚠ DANGER

Risk of death by electric shock

There is dangerous voltage at the electrical connections to the temperature controller, the system components and the heat-sealing bar.

- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the voltage supply or line voltage.
- ▶ Secure to prevent it from being switched on again.
- ▶ Verify that there is no voltage being supplied.

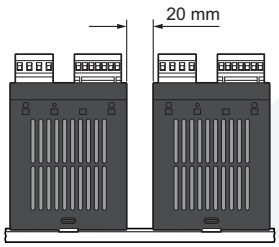
Access to coding dial

Tip If the temperature controller is to be configured using the coding dials, switch on the dial before attaching the temperature controller to the top hat rail. Refer to section Temperature controller configuration [▶ 32] for further information. Once the temperature controller is attached to the top hat rail it is difficult to access the coding dial.

To attach the temperature controller, proceed as follows:

Prerequisite ✓ Line voltage and the 24 VDC supply voltage are switched off and secured from being switched on again.

1. Verify that the circuit is de-energized.
2. Attach the temperature controller to a top hat rail TS35 (DIN EN 50022) in the electrical cabinet.
   The moving clip required for fastening faces down for mounting on a horizontal top hat rail.
   End holders to mechanically fix the device must be fitted at both ends.
3. A minimum safety clearance of 20 mm all round (e.g. from other devices and wiring) must be allowed when installing the device.



Example of installation in electrical cabinet An example of the layout and wiring of system components can be found in the Appendix [▶ 87].

5.5 Installation of device

⚠ DANGER

Risk of death by electric shock

There is dangerous voltage at the electrical connections to the temperature controller, the system components and the heat-sealing bar.

- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the voltage supply or line voltage.
- ▶ Secure to prevent it from being switched on again.
- ▶ Verify that there is no voltage being supplied.

Proceed as follows to install the temperature controller:

Prerequisite

✓ Line voltage and the 24 VDC supply voltage are switched off and secured from being switched on again.

✓ Installation of the temperature controller is completed.

1. Completely wire the system; refer to section Rules [▸ 11], section Power supply [▸ 23] Anschlussschema, section Control loop components [▸ 15] and to the application report.
   Note: Wires used for control or measuring connections must always be laid inside the building.
2. Check that the wiring complies with applicable national and international installation requirements.
3. An overcurrent protective device with a maximum rating of 10 A must be installed [1)].
   ⇨ If one such device is not adequate for the heat-sealing application, two separate overcurrent protective devices should be provided – one for the temperature controller and one for the sealing application: refer to the application report.
   The overcurrent protective device must be located directly adjacent to the device.
   The minimum possible specification for this device based on the calculated currents is indicated in the application report. If a larger overcurrent protective device is fitted, match the current carrying capacity of the other components accordingly (e.g. cables, pulse transformer, etc.).
4. Provide a disconnecting device when the system is installed; it must be marked as belonging to the system and placed in a readily accessible position.
   If a circuit breaker is used, it can also perform the function of this device.
5. Check all of the terminals in the system to ensure that they are mounted tightly, including the terminals for the pulse transformer windings.

Notes

The control loop can function properly only when the system components are the right size. Refer to the application report for more information.

To ensure proper and stable control, do **not** install additional resistance in the secondary circuit. Additional resistance in the secondary circuit, e.g. circuit breakers, long lines, plug connections, etc. have an impact on control and can cause the system to malfunction.

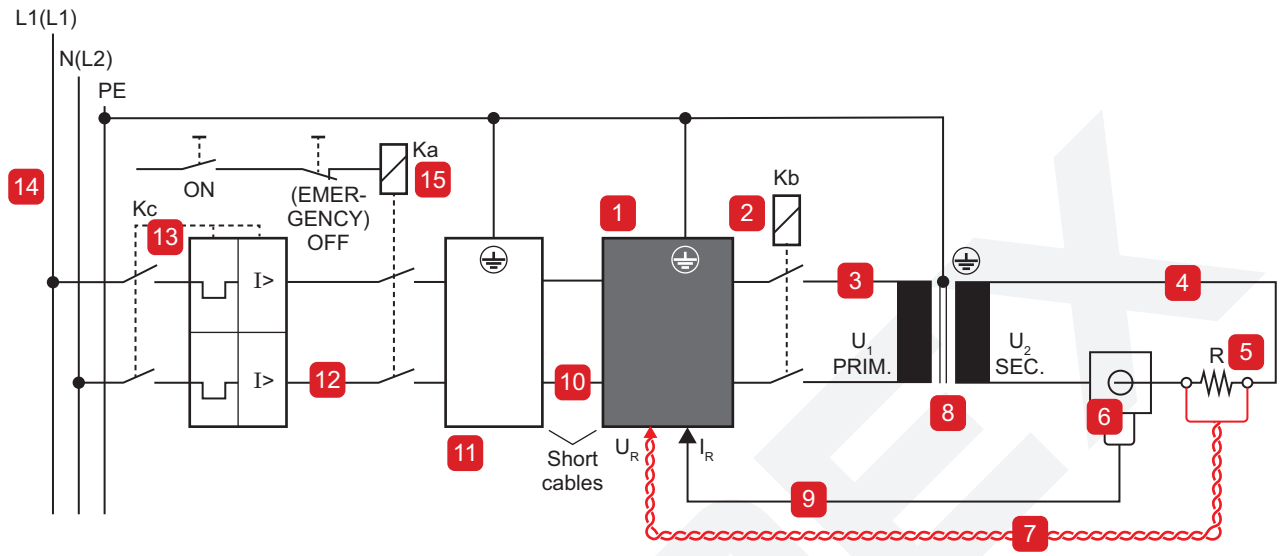
1 Examples:

- Circuit breaker pursuant to EN 60898 (characteristic B, C, D, K or Z)
- Circuit breaker pursuant to UL 489 (characteristic B, C, D, K or Z)
- Fuse gG pursuant to IEC 60269
- Fuse "class CC" or "Class JJ pursuant to UL 248

5.5.1 Power supply

The following illustration shows a standard application.

When making electrical connections, refer to the section Connection diagram and to the application report.



7 Always twist (min. 20 twists/meter → "Twisted test lead" accessory)

4 9 Twisting (min. 20 beats/meter) necessary if several control circuits are used together are relocated ("crosstalk").

3 10 12 Twisting (min. 20 beats/meter) is recommended to improve the EMC behavior.

Pos.	Component	Notes and requirements	Refer to section
1	Temperature controller		
2	Contactor Kb	To increase machine safety	Contactor Kb [▶ 24]
3	Primary pulse transformer lines		Application report
4	Secondary line	Sealing bar connection to the pulse transformer. Use high-quality connecting elements that ensure low contact resistance with long-term stability.	Application report
5	Heating element		Heating element [▶ 17] Application report
6	Current transformer	**NOTICE! Observe the number of ducts for passing the secondary cable through the current transformer.**	Current transformer [▶ 18] Application report
7	Measurement cable, voltage U_R	**NOTICE! Use twisted measuring cables provided by ROPEX.** **NOTICE! Input voltage max. 120 V.**	Measurement cable [▶ 19] Application report
8	Pulse transformer		Pulse transformer [▶ 17] Application report
9	Measurement cable, current I_R		Measurement cable [▶ 19] Application report

Pos.	Component	Notes and requirements	Refer to section
10	Filtered lines (lines between line filter and temperature controller)		Application report
11	Line filter	Do not install unfiltered and filtered lines in the same wiring ducts.	Line filters [▶ 18] Application report
12	Unfiltered lines (lines between voltage supply and line filter)		Application report
13	Overcurrent protective device Kc	Example: 2-pin circuit breaker or fuses **NOTICE! Protects only from short-circuit. Does not protect the temperature controller.**	Application report
14	Grid	To improve the immunity to interference, the system can be connected to the same phase when the output is low. Observe the requirements specified by the electric company in regard to a symmetrical grid load.	
15	Contactor Kb	For EMERGENCY OFF or EMERGENCY STOP (all-pole)	

5.5.1.1 Contactor Kb

To improve the safety of the machine, a contactor Kb can be installed in the control circuit.

The contactor Kb causes load break (all-pole), e.g. in conjunction with the alarm output of the temperature controller

A contactor Kb can also be installed in the control loop, e.g. when the system has to be switched off by the machine controller (PLC) or when a door contact is required.

The load on the contactor Kb is a factor of the specific application; refer to the application report.

Tips Trigger the contactor Kb via the temperature controller alarm relay.

- ▶ To do this, set the alarm output to inverse ("de-energized at alarm") and connect the 24-VDC supply voltage for the contactor to the NO and C contacts of the alarm relay.

To prevent errors, switch on the 24-VDC supply voltage before the temperature controller receives a RESET signal.

5.5.2 Connection diagram

Additional protective equipment as well as the controller for the equipment should be provided on site.

When making electrical connections, also refer to the section Power supply [▶ 23] as well as to the application report.

The following illustrations show examples of standard applications.

Connection diagram for system without booster

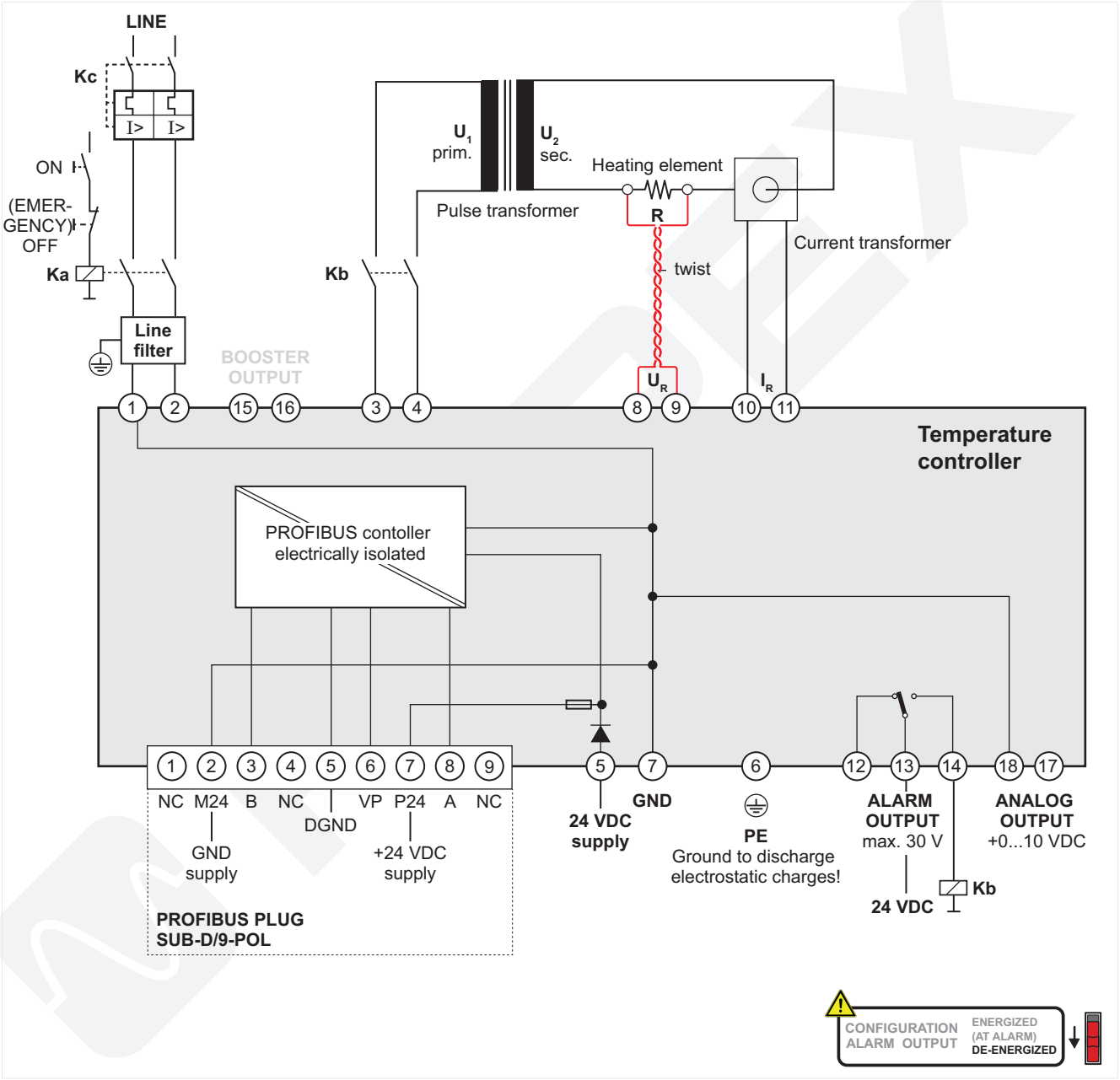


Illustration 5: Connection diagram, example of system without booster

Connection diagram for system with booster

NOTICE

Electromagnetic compatibility disruption as a result of cables that are too long

If the lines to the external booster are too long or the wires are not twisted, errors can occur when triggering the pulse transformer.

- ▶ The connecting line should be no longer than 1 m.
- ▶ Twist the wires.

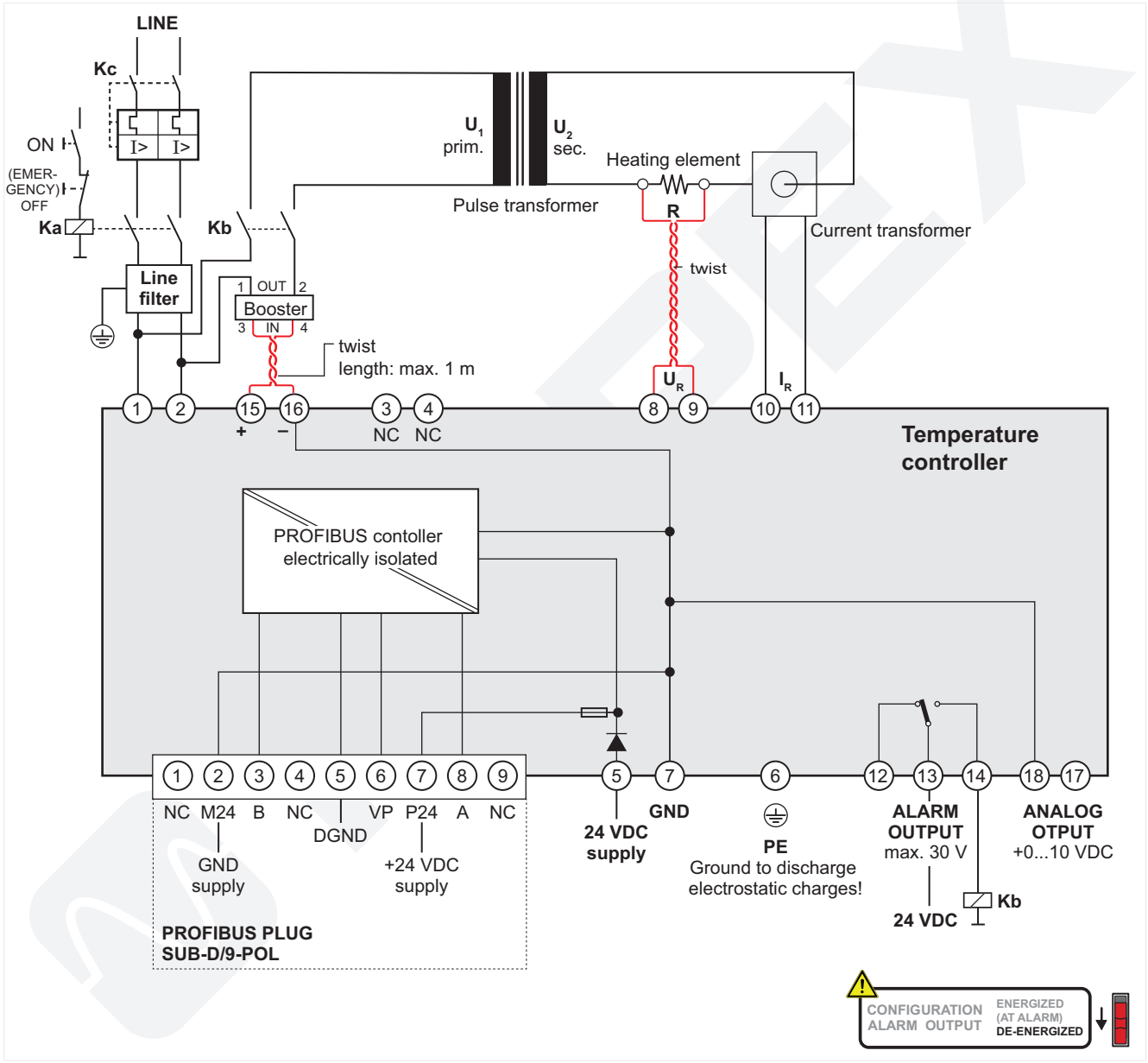


Illustration 6: Connection diagram, example of system with booster

Observe booster polarity

- ▶ Connect the booster to terminals 15+16.
  - Connect booster terminal 3 to the temperature controller terminal 15
  - Connect booster terminal 4 to the temperature controller terminal 16

Wiring in electrical cabinet

An example of the layout and wiring of system components in the electrical cabinet can be found in the appendix under Example of electrical cabinet wiring [▷ 88].

6 Startup

NOTICE

Malfunctioning due to use of devices from other manufacturers

Devices from other manufacturers can lead to malfunctions in the control loop.

- ▶ Use only original ROPEX accessories.
- ▶ Use only system components manufactured by ROPEX or that are approved for use with ROPEX equipment.

Proceed as follows to start up the temperature controller:

6.1 Initial startup

Prerequisites The following requirements have to be met:

- The device is completely assembled.
- All connections for the device have been made.
- Line voltage and 24 VDC supply voltage are switched off.
- Confirmation that equipment is de-energized.
- Heating element is cold.

	Startup step	Reaction of temperature controller	
1.	**When setting the station address via the PROFIBUS® network:** Ensure that both coding dials for the station address are set to "**0**". **When setting the station address via the coding dials:** Set the station address of the device using the coding dials; refer to Setting coding dials for station address [▶ 33].		
2.	Integrate the GSD file into the PROFIBUS® master.		
3.	The communication protocol determined the protocol used to communicate with the PROFIBUS® master. Select communication protocol "compact," "expanded" or "complete."		
4.	Set the parameters.		
5.	Switch on the 24 VDC supply voltage.		**AC** flickers or flashes briefly, indicating that switchon has been done correctly.
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.
6.	After successful switchon.		**AC** flashes slowly (1 Hz).
			**BUS FAILURE** flashes (4 Hz)[4].
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.

4 If the temperature controller is disconnected, the LED goes off after about three seconds.

	Startup step	Reaction of temperature controller	
7.	**When setting the station address via the PROFIBUS® network:** Use the PROFIBUS® tool to assign the station name.		
8.	Use the hardware configuration tool to establish connections and start PROFIBUS® communication.		
9.	Start the higher-level controller and ensure that it sends only zero values to the temperature controller.		**AC** flashes slowly (1 Hz).
			**BUS FAILURE** goes off.
			**DATA EXCHANGE** lights up as soon as the connection has been established.
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.
10.	Switch on line voltage.		**AC** goes off
			**ALARM** flashes quickly (4 Hz), if AUTOCAL is necessary. [2]
			**DATA EXCHANGE** illuminated.
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.
11.	Activate the AUTOCAL feature: ▶ In the PROFIBUS® protocol, set the AC bit (AUTOCAL); refer to section Automatic zero calibration AUTOCAL (AC) [▶ 41].		**AC** is illuminated for the duration of calibration (approx. 10…15 seconds).
			**ALARM** goes off
		The AA bit is set during this process (AUTOCAL active), and at the actual value output (terminals 17+18), there is voltage of approx. 0 VDC. If an analog temperature display is connected, it shows 0…3 °C.	
12.	When the AA bit is active, reset the AC bit.		**AC** flashes quickly (4 Hz), if AUTOCAL is necessary. [2]
		If the AC bit is not reset, **AC** continues to flash quickly, even if the function AUTOCAL has been completed successfully. The function AUTOCAL is requested but cannot be executed.	
13.	Check whether zero calibration was successful.	**Zero calibration was successful:** The AA bit is deleted again (AUTOCAL active).	
			**AC** goes off

[2] AUTOCAL may be required even if ALARM is not flashing quickly.

	Startup step	Reaction of temperature controller	
13.	Check whether zero calibration was successful.	Voltage of 0.66 VDC automatically sets at the actual value output (at the 300 °C range and temperature AUTOCAL = 20 °C) or 0.4 VDC (at the 500 °C range).	
		Zero calibration failed: The AL bit has been set (ALARM active)[3)]	
			**ALARM** flashes slowly (1 Hz).
		The temperature controller is not configured properly; refer to section Error messages [▶ 71]. Repeat zero calibration.	
14.	Check heatup and control function: 1. Via the network protocol, specify a defined temperature (setpoint) and set the ST bit. 2. Read out the temperature via the analog output or the actual value in the network protocol, and check the course of the temperature.		**HEAT** illuminated.
			**OUTPUT** illuminated analog to the phase-angle control. The heating element heats up.
		The RA bit (**R**egelung **a**ktiv, controller active) is active.	

Ending startup

	▶ Adjust the correction factor; refer to section Correction factor.
	The temperature controller is ready.

6.2 Restarting device

The system has to be restarted when any changes are made, e.g. replacement of the heating element.

Prerequisites The following requirements have to be met:

- The device is completely assembled.
- All connections for the device have been made.
- Line voltage and 24 VDC supply voltage are switched off.
- Confirmation that equipment is de-energized.
- Heating element is cold.

	Startup step	Reaction of temperature controller	
1.	Switch on the 24 VDC supply voltage. Start the higher-level controller and check that all of the control bits are set to "0".		**AC** flickers or flashes briefly, indicating that switchon has been done correctly.
			**DATA EXCHANGE** lights up as soon as the connection has been established.
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.
2.	After successful switchon.		**AC** flashes slowly (1 Hz).

3 The WA bit can also be active.

	Startup step	Reaction of temperature controller	
2.	After successful switchon.		**DATA EXCHANGE** lights up as soon as the connection has been established.
3.	Switch on line voltage.		**AC** goes off
			**ALARM** flashes quickly (4 Hz), if AUTOCAL is necessary.
			**DATA EXCHANGE** illuminated.
			**BUS POWER** illuminated.
			**24 VDC POWER** illuminated.
4.	Activate the AUTOCAL feature: ▶ In the PROFIBUS® protocol, set the AC bit (AUTOCAL); refer to section Automatic zero calibration AUTOCAL (AC) [▶ 41].		**AC** is illuminated for the duration of calibration (approx. 10…15 seconds).
			**ALARM** goes off
		The AA bit is set during this process (AUTOCAL active), and at the actual value output (terminals 17+18), there is voltage of approx. 0 VDC. If an analog temperature display is connected, it shows 0…3 °C.	
5.	When the AA bit is active, reset the AC bit.		**AC** flashes quickly (4 Hz), if AUTOCAL is necessary. [2)]
		If the AC bit is not reset, **AC** continues to flash quickly, even if the function AUTOCAL has been completed successfully. The function AUTOCAL is requested but cannot be executed.	
6.	Check whether zero calibration was successful.	**Zero calibration was successful:** The AA bit is deleted again (AUTOCAL active).	
			**AC** goes off
		Voltage of 0.66 VDC automatically sets at the actual value output (at the 300 °C range and temperature AUTOCAL = 20 °C) or 0.4 VDC (at the 500 °C range).	
		Zero calibration failed: The AL bit has been set (ALARM active)[6)]	
			**ALARM** flashes slowly (1 Hz).
		The temperature controller is not configured properly; refer to section Error messages [▶ 71]. Repeat zero calibration.	

6 The WA bit can also be active.

	Startup step	Reaction of temperature controller	
7.	Check heatup and control function: 1. Via the network protocol, specify a defined temperature (setpoint) and set the ST bit. 2. Read out the temperature via the analog output or the actual value in the network protocol, and check the course of the temperature.		**HEAT** illuminated.
			**OUTPUT** illuminated analog to the phase-angle control. The heating element heats up.
		The RA bit (**R**egelung **a**ktiv, controller active) is active.	

Ending startup

	▶ Adjust the correction factor; refer to section Correction factor.
	The temperature controller is ready.

6.3 LED behavior upon startup

During startup, the LEDs can behave as follows:

("O" means: LED is OFF)

LED AUTOCAL	LED ALARM	LED OUTPUT	Causes and measures
Beginning FW 304: Flickers 2 s and flashes briefly	O	O	Boot loader starts. Switchon was done properly ▶ Continue startup
Beginning FW 303: Flashes briefly	O	O	Switchon was done properly ▶ Continue startup
Flashes slowly (1 Hz)	Flashes briefly 	O	Configuration has been changed. 1. Check temperature controller configuration. 2. Perform AUTOCAL again.
Flashes slowly (1 Hz)	O	O	No line voltage being applied. ▶ Switch on line voltage.
Flickers 2 s and flashes briefly, repetitively 	O	O	The 24 VDC supply voltage is too low or not stable. ▶ Check the 24 VDC supply voltage.
O	O	Brief pulses every 0.4 s 	Continue startup

LED AUTOCAL	LED ALARM	LED OUTPUT	Causes and measures
O	FLASHES quickly (4 Hz) 	O	Continue startup
O	Remains ON 	O	For error diagnosis, refer to Error messages [▶ 71].

Further information on LED behavior can be found in section .

6.4 Temperature controller configuration



⚠ WARNING

Danger, supply voltage at device

Line voltage is being applied to the electrical connections on the device.

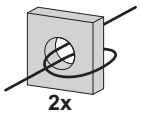
- ▶ Electrical installation may be performed only by qualified electricians.
- ▶ Switch off the current supply.
- ▶ Secure the current supply to prevent it from being switched on again.

Prerequisite

- The temperature controller is voltage-free.

6.4.1 Current transformer configuration

Configuration of the current transformer for the secondary peak current is set within the range 30…500 A.



When the secondary current I_2 is set to less than 30 A, check that the secondary high-current wire has been laid at least twice through the current converter; refer to the application report.

6.4.2 Setting the coding dial for the temperature range



⚠ DANGER

Fire hazard due to uncontrolled heatup

Using heating elements with temperature coefficients that are too low or incorrect coding of the temperature controller causes uncontrolled heatup. The heating element can burn through, creating an arc in a certain limited space.

- ▶ Install touch protection.
- ▶ Use a heating element with the proper temperature coefficient.
- ▶ Set the correct temperature coefficient in the temperature controller.
- ▶ Set the correct temperature range in the temperature controller.

Use the coding dial to adapt the temperature controller to the desired sealing temperature range.

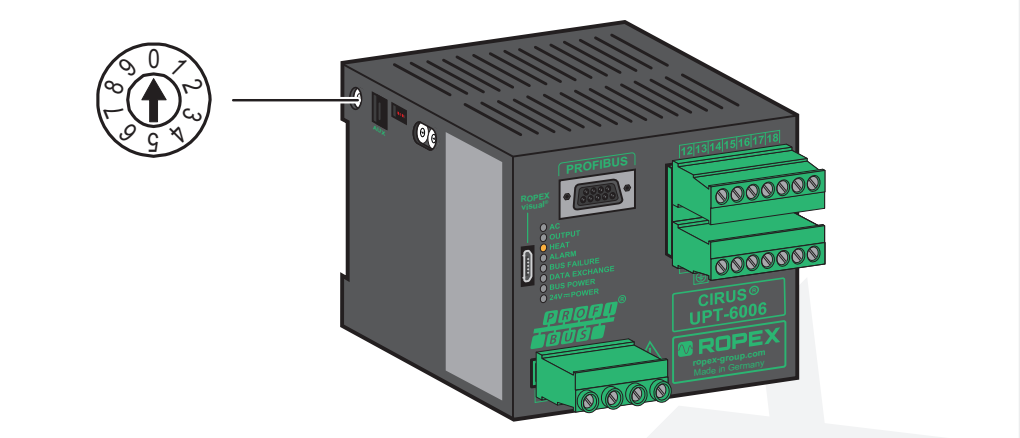


Illustration 7: Position of coding dials for the temperature range

Coding dial position	Temperature range x°C	Temperature coefficient (TCR)
0 (default)	300 °C	1700 ppm/K
4	500 °C	1700 ppm/K
9	▶ Set the parameters in the visualization software.	

Notes Select dial position "9" to access other temperature ranges and and alloys via the visualization software.

The higher-level controller transmits the parameter data to the temperature controller. This can overwrite the coding dial setting for the temperature range and alloy. Check the coding dial setting.

Also refer to

- Temperature range [▶ 51]
- USB interface [▶ 67]
- Operating instructions for the visualization software *ROPEXvisual*®

6.4.3 Setting coding dials for station address

Using the two coding dials for the station address, set the last two characters in the station address in the PROFIBUS® network.

Changes do not take effect until the 24 VDC supply voltage on the temperature controller is switched off and then back on.

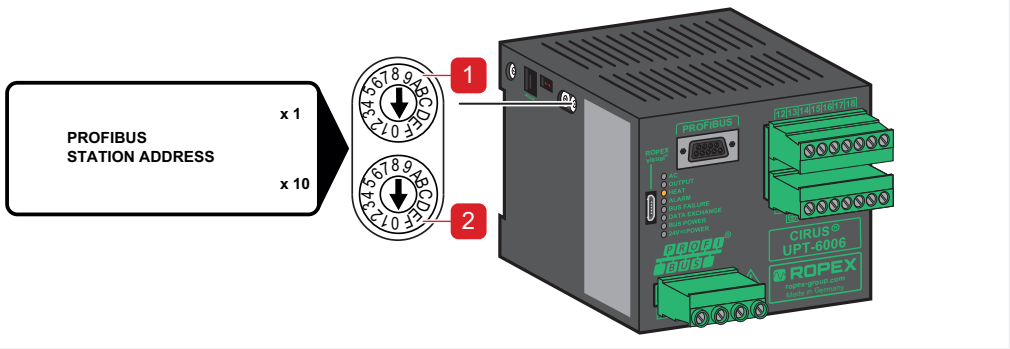


Illustration 8: Position of coding dials for the station address

Coding dial	Setting range	Adjustable numbers of the station address	Default
1	0…9	01	1

Coding dial	Setting range	Adjustable numbers of the station address	Default
2	0…9	00	0

The station address of the temperature controller is formed depending on the coding dial setting as follows:

Setting	Station address
00	Adjustable via SSA within the range 0...126
01…99	• Fixed address within the range 1...9 • Saved address assigned via Set Slave Address (SSA) is reset to 126

Tip When the station name has been set with the coding dials, a device can be changed in a machine without the hardware configuration tool. Simply set the coding dials on the replaced temperature controller exactly the same way.

If the station address of the temperature controller was set via Set Slave Address (SSA) using a suitable hardware configuration tool, the permanently saved station address can be deleted again with the coding dials.
To delete the station address in this case, select one of the positions 1… 99 when the temperature controller is de-energized and switch on the temperature controller. The 24 VDC supply voltage is sufficient. A connection to the PROFIBUS® network is not required.

Notes Resetting the device to the factory default by setting the coding dial deletes the saved Identification and Maintenance data (I&M data[7]) in addition to the station address.

If the station address is to be assigned via the network protocol via SSA (e.g. using a project and configuration tool), the coding dial setting "00" has to be selected.

When the station address is assigned using the coding dials, the station address does not need to be deleted.

6.4.4 Alarm relay configuration

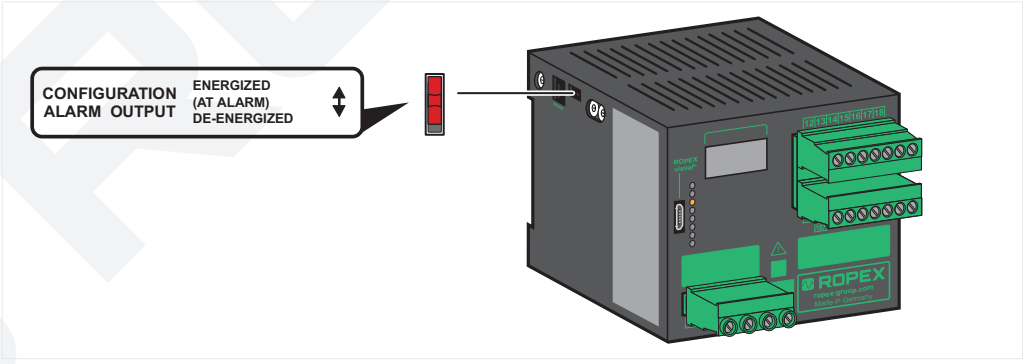
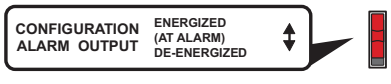
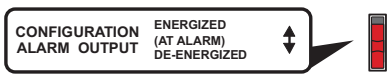


Illustration 9: Configuring alarm relay

Jumper position	Meaning
	ENERGIZED: Alarm relay normally open contact closed by alarm (default)
	DE-ENERGIZED: Alarm relay normally open contact opened by alarm

[7] I&M data is information saved on the module.

7 Display and operating elements

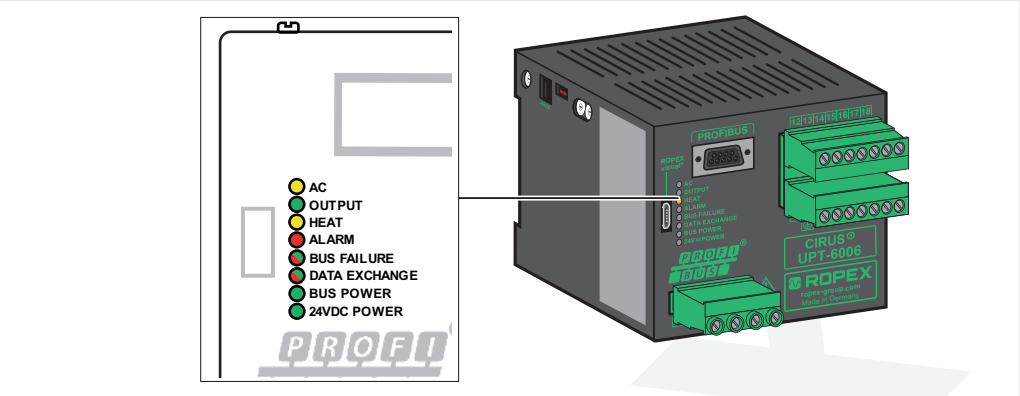


Illustration 10: Display of operating status

The LEDs indicate the operating status of the temperature controller.

Type of flashing

LED	Status	
●	Remains on/off	
☀	Flashing	1 Hz (slowly)
☀		2 Hz
☀		4 Hz (quickly)
☀	Flickers	8 Hz

Overview of LEDs

LED	Flashes slowly (1 Hz)		Flashes quickly (4 Hz)		Remains on	
AC (AUTOCAL)	RS bit set (reset) or waiting for line voltage; refer to section Standby active (SA) [▶ 47].	☀	AUTOCAL requested but feature is blocked (e.g. START is active); refer to section Automatic zero calibration AUTOCAL (AC) [▶ 41].	☀	AUTOCAL is performed.	●
	LED flashes at different frequency: 24 VDC supply voltage is too low.					
	LED flickers approx. 2 seconds: Boot loader[8)] starts.					
OUTPUT	—		In control mode, the brightness is proportional to the heating current. In measuring mode or during the cooling phase of the heat-sealing band, the LED indicates the measuring pulses by flashing briefly.			●

8 Available beginning with firmware version 304

LED	Flashes slowly (1 Hz)		Flashes quickly (4 Hz)		Remains on	
HEAT	—		START requested but feature is blocked (e.g. AUTOCAL is active, set-point < 40 °C); refer to section Start (ST) [▶ 42].		START is performed.	
ALARM	Configuration error, AUTOCAL was not successful; refer to section Error messages [▶ 71].		Temperature controller calibrated incorrectly; perform AUTOCAL.		For a list of errors, refer to section Error messages [▶ 71].	
BUS FAILURE	Incorrect or no configuration of I/O data.		Incorrect or no parameterization.		Communication with PROFIBUS®-Master aborted.	
DATA EXCHANGE	—		PLC stopped; refer to section Clear mode [▶ 41].		Communication with PROFIBUS® Master active.	
BUS POWER	—		—		Internal supply voltage is OK.	
24 V POWER	—		—		The external 24 VDC supply voltage is being applied.	

8 Functions and settings

8.1 Communication via interface

Information on the PROFIBUS® interface can be found in the description of the PLC.

The temperature controller can communicate via the PROFINET interface, provided the 24 VDC supply voltage (terminals 5+7) is applied.

8.2 Device master file (GSD)

Project tools for the PROFIBUS® Master to be created and configures interpret the content of the GSD files of the slaves and use the information to create a master parameter set for the PROFIBUS® Master. The PROFIBUS® controls the user data traffic.

The GSD file : *ROxy07EA.GSD* (*xy*: GSD version; e.g. "30" for version "v3.0") contains all of the information on the temperature controller required to create and configure the project, e.g.:

- Baud rate
- Parameter descriptions
- Error messages

The GSD file (.GSD or .GSE) and the image files .DIB to visualize the status can be obtained

- by sending an e-mail to info@ropex.de
- or downloaded from our website http://www.ropex-group.com/products/downloads

Practical tip The temperature controller *UPT-6006* is downward compatible with the temperature controller *UPT-606*.
This allows the temperature controller to be operated with older versions of the GSD. Not all of the features are available in this case,

8.3 Communication protocol

The PROFIBUS® protocol can be configured on the temperature controller as follows:

- Compact
- Expanded
- Complete

Log		Function
Compact	16 bits for input data and 16 bits for output data	For communication with the temperature controller.
Expanded	2 × 16 bits for input data and 2 × 16 bits for output data	Setpoint and actual value of the temperature controller are separate from status information and control functions. Thus simple decoding with PROFIBUS® Master.
Complete	2 × 16 bits for input data and 4 × 16 bits for output data	Also supplies the start temperature upon activation of the ST bit. Allows one of the up to eight calibration data sets to be selected.

Note Bits 0…7 form the low byte and bits 8…15 the high byte ("INTEL format").

8.3.1 Protocol "Compact" with 4-bit error code

The 16-bit **input data** contains the setpoint and the control functions as follows:

	Control function				Spare			Setpoint / AC temperature								
Name	RS	ST	AC	MP	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 16-bit **output data** contains the actual value or the error code and status information as follows:

													Error no. when AL = 1			
	Status information							Actual value (compact), when AL = 0								
Name	AA	AG	AL	TE	TO	RA	VZ						A3	A2	A1	A0
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.3.2 Protocol "Compact" with 10-bit error code

Note The 10-bit error codes have to be activated in the parameter data.

The 16-bit **input data** contains the setpoint and the control functions as follows:

	Control function				Spare			Setpoint / AC temperature								
Name	RS	ST	AC	MP	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 16-bit **output data** contains the actual value or the error code and status information as follows:

														Error no. when AL = 1			
	Status information							Actual value (compact), when AL = 0									
Name	AA	AG	AL	TE	TO	RA	VZ/ A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

8.3.3 Protocol "Expanded" with 4-bit error code

The 2x16-bit **input data** contains the setpoint in word 1 and the control functions in word 2 as follows:

1	Spare							Setpoint / AC temperature								
Name	0	0	0	0	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare												Control function			
Name	0	0	0	0	0	0	0	0	0	0	0	0	MP	RS	ST	AC
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 2 x 16 bit **output data** contains the actual value in word 1, the status information and error codes in word 2 as follows:

1	Actual value (signed)															
Name	VZ															
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare	Error code	Spare	Status information

Name	0	0	0	0	A3	A2	A1	A0	0	0	AA	AG	AL	TE	TO	RA
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.3.4 Protocol "Expanded" with 10-bit error code

Note The 10-bit error codes have to be activated in the parameter data.

The 2x16-bit **input data** contains the setpoint in word 1 and the control functions in word 2 as follows:

1	Spare							Setpoint / AC temperature								
Name	0	0	0	0	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare					Channel			Spare			Control function				
Name	0	0	0	0	0	CH2	CH1	CH0	0	0	0	MA	MP	RS	ST	AC
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 2 x 16 bit **output data** contains the actual value in word 1, the status information and error codes in word 2 as follows:

1	Actual value (signed)															
Name	VZ															
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Error code										Status information					
Name	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	AA	AG	AL	TE	TO	RA
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.3.5 Protocol "Complete" with 4-bit error code

The 2x16-bit **input data** contains the setpoint in word 1 and the control functions in word 2 as follows:

1	Spare							Setpoint / AC temperature								
Name	0	0	0	0	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare					Channel			Spare			Control function				
Name	0	0	0	0	0	CH2	CH1	CH0	0	0	0	MA	MP	RS	ST	AC
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 4x16 bit **output data** contains the actual value in word 1, the status information in word 2, the error code in word 3 and the start temperature in word 4 as follows:

1	Actual value (signed)															
Name																
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare				Channel			Status information								
Name	0	0	0	MU	CH2	CH1	CH0	SA	IA	WA	AA	AG	AL	TE	TO	RA
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

3	Error code															
Name	0	0	0	0	0	0	0	0	0	0	0	0	A3	A2	A1	A0
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

4	Start temperature (signed)															
Name																
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.3.6 Protocol "Complete" with 10-bit error code

Note The 10-bit error codes have to be activated in the parameter data.

The 2x16-bit **input data** contains the setpoint in word 1 and the control functions in word 2 as follows:

1	Spare							Setpoint / AC temperature								
Name	0	0	0	0	0	0	0									
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare					Channel			Spare			Control function				
Name	0	0	0	0	0	CH2	CH1	CH0	0	0	0	MA	MP	RS	ST	AC
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The 4x16 bit **output data** contains the actual value in word 1, the status information in word 2, the error code in word 3 and the start temperature in word 4 as follows:

1	Actual value (signed)															
Name																
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

2	Spare				Channel			Status information								
Name	0	0	0	MU	CH2	CH1	CH0	SA	IA	WA	AA	AG	AL	TE	TO	RA
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

3	Error code															
Name	0	0	0	0	0	0	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

4	Start temperature (signed)															
Name																
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

8.4 Input data

The input data is transmitted from the PROFIBUS® Master to the temperature controller.
The input data contains the setpoint value and the control functions for the temperature controller, e.g. START or AUTOCAL.

The input data is shown as control bits.

8.4.1 Clear mode

If the PROFIBUS® Master does not send any data, all of the bits in the temperature controller are set to 0 (inactive).

If heat-sealing is in progress as this occurs, the process is aborted.

8.4.2 Automatic zero calibration AUTOCAL (AC)



NOTICE

Property damage if the heating element overheats

When the function AUTOCAL is performed while the heating element is warm, zero calibration will be faulty, leading to poor sealing results.

► Wait until the heating element and tool have cooled off.

Perform zero calibration (AUTOCAL) in the following cases:

- Every 100,000 heat-sealing cycles.
- After the heating element has been changed.
- When secondary lines have been replaced and terminals tightened.
- When the system has been changed, e.g. changing secondary voltage.
- When the temperature coefficient has been changed.

Tip If the ambient temperature changes, automatic zero calibration (AUTOCAL) is not necessary.

AUTOCAL blocked **The AUTOCAL function is blocked:**

- During the first 10 seconds after both voltage supplies are switched on, if no alarm is reported.
- During the first 10 seconds after resetting the temperature controller, if no alarm is reported.
- As long as the temperature controller detects that a heating element is cooling off.
- If the `Start` bit is activated (ST bit = 1).
  The HEAT LED is illuminated or flashing.
- If the `Reset` bit is activated (RS bit = 1).
  The AUTOCAL LED flashes slowly (1 Hz).
- If error codes 101 to 103, 201 to 203 or 9xx occur directly after switching on the temperature controller.
- If the temperature controller has operated correctly at least once after being switched on and error codes 201 to 203 or 9xx occur.
- If the line voltage is missing.
  The AUTOCAL LED flashes slowly (1 Hz).
- As long as there is no voltage after the 24 VDC supply voltage is switched on.

Notes If the AUTOCAL function is blocked, the temperature controller reports `Autocal blocked` in the output data (AG bit = 1). If there is an AUTOCAL request in the input data at the same time (AC bit = 1), the AUTOCAL LED flashes quickly (4 Hz).

The AC bit can be reset as soon as the temperature controller has activated the bit AA in its status information.

If the AC bit remains set beyond the end of the AUTOCAL function, the AUTOCAL LED flashes at a rate of 4 Hz. A flashing LED indicates that the request is still current but cannot be performed. The AA bit remains active until AC has been reset. This makes it easy to implement a "handshake" process.

Automatic zero calibration AUTOCAL (AC) means that manual zero calibration on the temperature controller is not necessary. This function adjusts the temperature controller to the current and voltage signals present in the system. The temperature controller adjusts itself to the value predefined in the parameter data. If no parameter data is transferred by the PROFIBUS® Master, the default value is 20 °C.

If the temperature of the heating element fluctuates, the AUTOCAL function is executed up to three times. If the function still cannot be executed successfully, an error message appears.

Also refer to

- AUTOCAL blocked (AG) [▶ 45]
- Calibration temperature [▶ 53]
- Error messages [▶ 71]

8.4.3 Start (ST)

When the `Start` bit is set (ST bit = 1), the device's internal set/actual comparison is enabled.
The heating element is heated to the setpoint temperature. It remains at this temperature either until the ST bit is reset or until the actual heating time exceeds the preset heating time limit.

The LED HEAT remains illuminated during the heating time.

A start request is **not** processed as long as:

- The AUTOCAL function is active.
- The temperature controller indicates a fault.
- The setpoint is lower that 40 °C.
- The RS bit is set.

The heatup process is terminated:

- By resetting the ST bit.
- If a communication error occurs.
- If an error occurs.
- If the RS bit is activated.
- If the heating time limit is not at 0 and the set time has elapsed.

The alarm relay is switched if the ST bit is set while a warning with error code 104…106, 111…114, 211, 302, or 303 is indicated. The heating element is not heated.

Also refer to

- Heating time limit
- Error messages [▶ 71]

8.4.4 Reset (RS)

The bit `Reset` resets the temperature controller if the temperature controller shows a fault.

As long as the RS bit is set.

- AUTOCAL and START prompt are not accepted.
- The power unit is not triggered.
- The temperature controller does not generate any measuring pulses.
- As a result, the actual value is no longer updated.
- Only error codes 201…203, 901, 913 are evaluated and output by the error diagnosis function.

The reset request is not accepted until the RS bit is reset.

Resetting the temperature controller does not interrupt the PROFIBUS® communication.

While the RS signal is being activated, the analog actual value output (terminals 17+18) goes to 0…3 °C (meaning approx. 0 VDC). The bit `Standby active` (SA bit) is active.
The digital actual value in the cyclical data goes to 0.

AUTOCAL is not aborted.

Resetting RS bit

After the RS bit is reset, the temperature controller performs internal initialization for approx. 500 ms. Then next sealing process can be started.

If a Kb contactor is used to deactivate the control loop, it must be reliably energized again 200 ms at the latest after the RS bit is reset.
Note the contactor switching and delay times[9]. If it is energized too late, an error message appears on the temperature controller.

Also refer to

- Power supply [▶ 23]
- Restart delay after reset [▶ 59]

8.4.5 Measurement pause (MP)

No more measuring pulses are generated by the temperature controller once the `Measurement pause` (MP bit) is set.

Only error codes 201…203, 901, 913 are evaluated and output by the error diagnosis function. In addition, the actual value is no longer updated. The last valid value before the MP bit was set is output. As soon as the MP bit is deleted, new measuring pulses are generated, all diagnoses are activated, and the actual value is updated again.

The MP bit is only active in measurement mode. The bits ST, RS, and AC take priority.

Example

The bit is suitable for applications in which the electrical connections of the heating element must be disconnected during normal operation, without triggering a fault (e.g. sliding rail contacts).

Unlike the RS bit (RESET), the MP bit does not delete any error messages when it is set. The temperature controller is active again as soon as the MP bit is reset; in other words there is no initialization phase.

When the temperature controller is switched on, it does not evaluate the MP bit until the system test (including the functional test of the heat-sealing band) has been successfully completed. This can take several hundred milliseconds.

8.4.6 Master AUTOCAL (MA)

Setting the bit `Master AUTOCAL` (MA bit) starts calibration.

The MA bit can be used as an alternative to the AC bit (automatic zero calibration AUTOCAL) to start calibration.

Master AUTOCAL saves the resistance as an additional reference value. It is not overwritten during automatic zero calibration (AUTOCAL). Master AUTOCAL and AUTOCAL behave the same in all other ways. The LED indicators also apply to both AUTOCAL and master AUTOCAL.

Example

The function master AUTOCAL can be performed after replacing the heating element. The heating element resistance is saved as a reference value. This reference value serves to calculate the deviation from the calibration value for all subsequent calibrations (initiated with the AC bit).

9 The restart delay is adjustable to the contactor beginning with the firmware version 301.

8.4.7 Channel selection (CH0…CH2)

The temperature controller has separate memories for up to eight calibration data records. A calibration data record contains the values determined by the temperature controller during the AUTOCAL function.

Storing the calibration data records allows the operator to alternate between different heat-sealing bands without having to run the AUTOCAL function every time the heat-sealing band is changed. AUTOCAL has to be executed only when a new heating element is connected.

Since different calibration values, AUTOCAL temperatures, temperature coefficients and correction factors are stored in the temperature controller for this purpose, the required calibration data record 0…7 can be selected with the three bits CH0…CH2.

Example This function is useful, for instance, in applications where frequent changes in format are necessary.
The tools can then be changed as required in order to handle the different formats.

A channel containing the relevant calibration data record is assigned to each tool. Once all tools have been calibrated with a unique channel assignment, they can be changed at any time simply by selecting the appropriate channel.

Tip If the application does not require any format changes, the channel can remain set to 0. In this case, the temperature controller behaves in exactly the same way as older models, where different calibration data records are not supported.

It is possible to switch to another channel during the AUTOCAL function; however, the temperature controller continues working with the original channel until the AUTOCAL function has finished. The channel currently being used by the temperature controller is shown in the status information; refer to 4 x 16 bit **output data**, byte 2, bit no. number 9-11 (channel CH0, CH1 and CH2).

Also refer to

- Communication protocol [▶ 37]

8.4.8 Setpoint

The setpoint is scaled in steps of 1 °C.

In the first input word, the setpoint is at bits 8...0. Bit 0 is counted as well. This allows values up to 511 to be shown.

Minimum setpoint The minimum setpoint is 40 °C.

Maximum setpoint The maximum setpoint is limited as factor of the set temperature range.

ROPEXvisual® It is also possible to set the maximum setpoint via the visualization software. Further information can be found in the operating instructions for the visualization software *ROPEXvisual®*.

Note Setpoints entered in *ROPEXvisual®* are permanently saved. If the setpoint is to later be transferred via a PLC, the saved value has to be set to zero.

If the calibration temperature is set to -1 in the parameter data, the setpoint determines the AUTOCAL temperature when automatic zero calibration is activated.

8.5 Output data

The term "output data" refers to the data that is transferred to the PROFIBUS® Master. It contains the current actual value as well as all important information on the current status of the temperature controller.
If a fault is signaled, it can be diagnosed accurately with the help of the error code.

8.5.1 AUTOCAL active (AA)

The bit `Autocal active` (AA bit) indicates that the AUTOCAL function is being performed.

8.5.2 AUTOCAL blocked (AG)

If the bit `Autocal blocked` is set, the AUTOCAL function is blocked.

The AUTOCAL function is blocked, if

- START is active or the heating element is still in the cooling phase.
- The bit `Standby active` is set (SA bit = 1); refer to section <dynamic_link linkid="148993932" use="grab" dynamic="true">Standby aktiv (SA)</dynamic_link>.
- The bit `Reset` is set (RS bit = 1).
- Certain alarm messages have been issued.

Also refer to

- Automatic zero calibration AUTOCAL (AC) [▶ 41]
- Reset (RS) [▶ 42]
- Standby active (SA) [▶ 47]
- Error messages [▶ 71]

8.5.3 Alarm active (AL)

If the bit `Alarm active` (AL bit) is set, an alarm has been triggered but not yet reset.

The error codes provide information on the cause.

Note In order to determine whether the temperature controller is ready for the sealing process, the bits `Alarm active` (AL), `AUTOCAL active` (AA) **and** `Standby active` (SA) have to be queried. If all bits are set to "0", all prerequisites are fulfilled and the sealing process can begin.

Also refer to

- Standby active (SA) [▶ 47]
- Error messages [▶ 71]

8.5.4 Warning active (WA)

The bit `Warning active` (WA bit) can be set in addition th the bit `Alarm active` (AL bit).

If the WA bit (WA bit = 1) is set and an alarm is signaled, this indicates a warning. In this case, the alarm relay is not active.
If there is a START prompt (ST bit = 1), the alarm relay is activated and the WA bit is reset (WA bit = 0).

8.5.5 Temperature achieved (TE)

The bit `Temperature achieved` (TE bit) is set if the actual temperature reaches 95% of the setpoint temperature.

This status bit is reset again as soon as control mode is exited (ST bit = 0) or an alarm occurs (AL bit = 1).

8.5.6 Temperature OK (TO)

The temperature controller checks whether the actual temperature is within an adjustable tolerance range ("OK window") above and below the setpoint temperature.

The low ($\Delta\vartheta_{low}$) and high ($\Delta\vartheta_{high}$) tolerance limits can be changed independently of one another in the parameter data.

The following settings are possible:

- "Off"
  The TO bit is always reset.

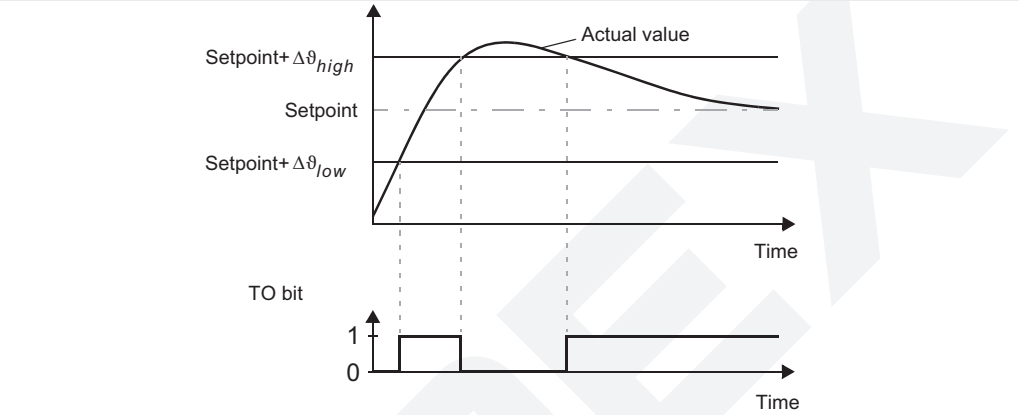


Illustration 11: Graph showing "Active when Act=Set," default

- **"Active when Act=Set" (default)**
  The TO bit is set if the actual temperature is within the specified temperature tolerance range.
  If the actual temperature is outside of the tolerance range, the TO bit is reset:

Unlike the status bit `Temperature reached` (TE bit), the actual temperature is evaluated independently of the control mode.

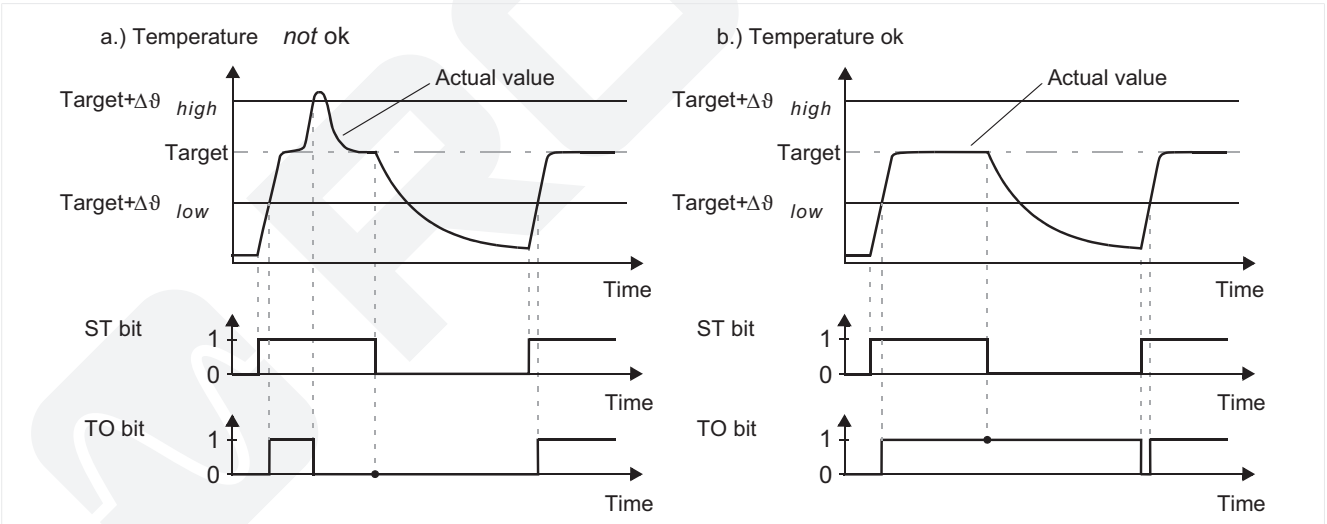


Illustration 12: Graph showing "Active when Act=Set"

- **Active when Act=Set, with latch function**
  A heat-sealing cycle starts when the ST bit is set. The TO bit is set when the actual temperature reaches the temperature tolerance range for the first time during a heat-sealing cycle.
  If the actual temperature leaves the tolerance range again while the ST bit is still set, the TO bit is reset (Refer to Figure a.)
  If the actual temperature does not leave the tolerance range while the ST bit is still set, the TO bit is not reset until the start of the next heat-sealing cycle (latch function, Figure b.). The switching state of the TO bit can thus be queried after the ST bit has been reset and before the start of the next heat-sealing cycle.

The TO bit can be set only via the parameter data in the PROFIBUS® Master (also via acyclical communication).

The tolerance limits can be set up to ±99 K.

8.5.7 Control active (RA)

When the bit `Control active` (RA bit) has been set, the temperature controller has successfully accepted the START request and entered control mode.

8.5.8 Sign (VZ)

In the compact protocol, the bit `Sign` (VZ bit) indicates whether the actual value is a positive value (VZ bit = 0) or a negative (VZ bit = 1) value.

8.5.9 Information active (IA)

The bit `Information active` is reserved for future use and is not currently supported (IA bit = 0).

8.5.10 Standby active (SA)

The bit `Standby active` (SA bit) has the following functions:

- The so-called "handshake" procedure for the RS bit (reset).
  To enable the "handshake" procedure, the 24 VDC supply voltage to the temperature controller and line voltage have to be switched on.
  The SA bit becomes active when the RS bit (reset) **or** the MP bit (measurement pause) is set to "1" ("handshake" procedure).
  The controller detects when the temperature controller has accepted the RS bit or the MP bit. The controller can then delete the RS bit or the MP bit again.
- The 24 VDC supply voltage of the temperature controller is switched on and the temperature controller is waiting for line voltage.
  When the temperature controller is waiting for the line voltage to be switched on for the first time, the SA bit becomes active.

Example In order to be able to assess the behavior of the temperature controller, refer to the examples of the statuses of the supply voltage and the resulting statuses of the temperature controller in the table. The table represents a chronological sequence.

	24 VDC supply voltage to temperature controller	**Line voltage**	**Bit set (1) or not set (0)**			**Status of bits/result**
			Input data	**Output data**		
1.	Off	Off				Temperature controller and machine control are not communicating.
2.	On	Off	Bit RS = 0	Bit SA = 1 Bit AL = 0		No reset, standby active, no alarm SA bit is active, because line voltage is switched off.
3.	On	On	Bit RS = 0	Bit SA = 0 Bit AL = 0		No reset, no standby active, no alarm Sealing process is possible.
4.	On	Off	Bit RS = 0	Bit SA = 0 Bit AL = 1		No reset, no standby active, alarm active Error code 201 Line voltage missing.

	24 VDC supply voltage to temperature controller	Line voltage	Bit set (1) or not set (0)			Status of bits/result
			Input data	Output data		
5.	On	On	Bit RS = 0	Bit SA = 0 Bit AL = 1		No reset, no standby active, alarm active
						Error code 201 Line voltage is present, but the alarm is not acknowledged.
6.	On	On	Bit RS = 1	Bit SA = 1 Bit AL = 1		Reset active, standby active (”hand-shake” procedure), alarm active
						Error code 201 As long as the RS bit is set to "1", error code 201 will continue to be displayed. To set the AL bit to "0", acknowledge the error.
7.	On	On	Bit RS = 0	Bit SA = 0 Bit AL = 0	[10]	No reset, no standby active, no alarm
						The alarm is acknowledged, i.e. the error is cleared, and reset is completed. The temperature controller sets the SA bit to “0”. Sealing process is possible.

Note In order to determine whether the temperature controller is ready for the sealing process, the bits `Alarm active` (AL), `AUTOCAL active` (AA) **and** `Standby active` (SA) have to be queried. If all bits are set to "0", all prerequisites are fulfilled and the sealing process can begin.

Also refer to

- Alarm active (AL) [▶ 45]
- Error messages [▶ 71]

8.5.11 Measurement interruption (MU)

Available beginning with firmware version This function is available with firmware version 300 and higher.

The bit `Measurement interruption` (MU bit) is active as long as the temperature controller does not perform a temperature measurement during the control phase (ST = 1).

If e.g. the actual value is greater than the setpoint value (setpoint exceeded) the MU bit is active. This can be used to evaluate whether measurement interruptions occur during the heating pulse. It could be an indication of excessive temperature, which can result in a bad sealing seam.

As soon as a measurement is performed again, the MU bit goes back to 0.

[10] If the alarm is acknowledged, but the line voltage is still switched off, error code 901 will immediately be displayed. If the line voltage is then switched on and the alarm is acknowledged once again, the temperature controller goes into measurement and control mode.

8.5.12 Actual value

When the compact protocol is used, the actual value is always a positive number. The bit `Sign` (VZ bit) indicates whether the actual value is a positive value (VZ bit = 0) or a negative (VZ bit = 1) value.
In the event of an alarm, the actual value contains the error code.

When the expanded or complete protocol is used, all 16 bits of the first word have to be evaluated as a number preceded by a sign (two's complement view).
In the event of an alarm, if reset is active or during calibration, the actual value is 0.
The error codes are contained in separate bits.

8.5.13 Error code

If a fault is signaled (AL bit = 1), the exact cause can be determined with the help of the error code. The error code is contained in the third word at bit position 0…9.

If an alarm is signaled, AL bit = 1, the exact cause can be determined with the error code.
The parameter "Error code format" determines whether error codes are shown as two-digit or three-digit numbers. When two-digit error codes are used, some alarms are combined to form groups. Errors identified with three-digit error codes can be determined in detail.

In the compact protocol, the error code is shown in place of the actual value in bit 0...3 (error code format = 4-bit) or in bit 0...9 (error code format = 10-bit).

In the expanded and complete protocol, the error code is shown in the second word at bit position 8...11 (error code format = 4-bit) or bit position 6...15.

To transmit error messages to the PROFIBUS® Master, the PROFIBUS® diagnosis is used as well.
The error messages corresponding to each error code are already stored in the device master file (GSD) When the device diagnosis of the temperature controller is queried when using the PROFIBUS® Master, the error codes are automatically shown as plain text.
The language is determined by the GSD file.

Note Regardless of what the parameter "Error number format" is set to, 10-bit error codes are **always** transmitted via the PROFIBUS® diagnosis.

Also refer to

- Error messages [▶ 71]

8.6 Parameter data

8.6.1 How are values interpreted?

Decimal values are transmitted as integers and have to be evaluated differently when reading and writing. This procedure applies to all subslots.

Example The heating time limit is within the range 0...9.9 s.

But the temperature controller values are within the range of 0...99.

On the PLC side, the application programmer has to divide the temperature controller values by 10 when reading and multiply them by 10 when writing.

8.6.2 Parameter data slot 1, index 0 - 57

Available beginning with firmware version Available beginning with firmware version 301: Indexes 56 to 57

Index	Function	Unit	Default[11]	Value range
0…3	Reserved		-	-
4	Temperature range and alloy		10	0 4 9 10 11
5	Low threshold for temperature OK	K	10	3…99
6	High threshold for temperature OK	K	10	3…99
7	Calibration temperature, channel 0	°C	20	-1[12] 0…40
8	Heating time limit (100 ms steps)	0.1 sec	0	0…99 (0…9.9 s)
9	Expanded device diagnosis		Activated	Deactivated Activated
10	Measuring pulse duration (100 ms steps)	17 (0.1 ms)	17	17…30 (1.7…3.0 ms)
11	Data format		High/low byte (Inlet)	High/low byte (Intel) Low/high byte (Motorola)
12	Correction factor, channel 0	%	100	25…200
13/14	Maximum start temperature	°C	100	20…500
15	Error code format	Bit	10	4 10
16/17	Temperature coefficient, channel 0	ppm/K	1700	400…4000
18	Temperature range	°C	300	200 300 400 500
19/20	Maximum temperature	°C	300	200…500
21	Temperature diagnosis		Deactivated	Deactivated Activated
22/23	Temperature diagnosis delay (10 ms steps)	17 (10 ms)	0	0…999 (0…9.99 s)
24/25	Heatup time monitoring (10 ms steps)	17 (10 ms)	0	0…999 (0…9.99 s)
26	Temperature OK bit (output 1)		Active when Tact=Tset	Off Active when Tact = Tset Active when Tact = Tset with latch
27	Hold mode		Off	Off On 2 seconds

11 The default value is stored in the device master file (GSD) and transferred by the PROFIBUS master to the temperature controller when the system is started up.

12 Value_-1 The calibration temperature can be changed via the cyclical input data; refer to Calibration temperature.

Index	Function	Unit	Default[11)]	Value range
28	Calibration temperature, channel 1	°C	20	-1[12)] 0…40
29	Correction factor, channel 1	%	100	25…200
30/31	Temperature coefficient, channel 1	ppm/K	1700	400…4000
32	Calibration temperature, channel 2	°C	20	-1[12)] 0…40
33	Correction factor, channel 2	%	100	25…200
34/35	Temperature coefficient, channel 2	ppm/K	1700	400…4000
36	Calibration temperature, channel 3	°C	20	-1[12)] 0…40
37	Correction factor, channel 3	%	100	25…200
38/39	Temperature coefficient, channel 3	ppm/K	1700	400…4000
40	Calibration temperature, channel 4	°C	20	-1[12)] 0…40
41	Correction factor, channel 4	%	100	25…200
42/43	Temperature coefficient, channel 4	ppm/K	1700	400…4000
44	Calibration temperature, channel 5	°C	20	-1[12)] 0…40
45	Correction factor, channel 5	%	100	25…200
46/47	Temperature coefficient, channel 5	ppm/K	1700	400…4000
48	Calibration temperature, channel 6	°C	20	-1[12)] 0…40
49	Correction factor, channel 6	%	100	25…200
50/51	Temperature coefficient, channel 6	ppm/K	1700	400…4000
52	Calibration temperature, channel 7	°C	20	-1[12)] 0…40
53	Correction factor, channel 7	%	100	25…200
54/55	Temperature coefficient, channel 7	ppm/K	1700	400…4000
56/57	Restart delay after reset (in 10 ms)	17 (10 ms)	0.2 sec	0…999 (0…9.99 s)

8.6.3 Description of parameter data

8.6.3.1 Temperature range

The temperature range can be selected with this parameter. The setting of the coding dial can be overwritten by changing the default value (10).



⚠ DANGER

Fire hazard due to uncontrolled heatup

Using heating elements with temperature coefficients that are too low or incorrect coding of the temperature controller causes uncontrolled heatup. The heating element can burn through, creating an arc in a certain limited space.

- ▶ Install touch protection.
- ▶ Use a heating element with the proper temperature coefficient.
- ▶ Set the correct temperature coefficient in the temperature controller.
- ▶ Set the correct temperature range in the temperature controller.



⚠ DANGER

Fire hazard due to uncontrolled heatup

Setting temperature coefficients that are too high leads to uncontrolled heatup. The heating element can burn through, creating an arc in a certain limited space.

- ▶ Install touch protection.
- ▶ Use only temperature coefficients that are plausible for the heating element.

Note Always consult with ROPEX before setting ranges over 300 °C. The serviceable life of the heating elements falls drastically when operating at high sealing temperatures.

Parameter data When the value for the temperature range is configured in the Parameter data, index 4, the position of the coding dial is ignored.

Parameter data, index 4 Value	Coding dial position	Temperature range	Temperature coefficient TCR
0	Not relevant	300 °C	1700 ppm/K
4		500 °C	1700 ppm/K
9		▶ Set the parameters in the visualization software	
11		Parameter index 18	Parameter index 16/17, as well as the channel-specific temperature coefficients 30/31, 34/35, 38/39, 42/43, 46/47, 50/51, 54/55
10[13)]	The temperature range is configured using the coding dial, see table below.		

Coding dial

Parameter data, index 4 Value	Coding dial position	Temperature range	Temperature coefficient TCR
10[13)]	**0**[13)]	300 °C	1700 ppm/K
	4	500 °C	1700 ppm/K
	9	▶ Set the parameters in the visualization software	

Always execute the AUTOCAL function after changing the parameters temperature range or temperature coefficient.

[13] Default

8.6.3.2 Low temperature OK threshold

The low threshold value for temperature OK is the low threshold value for the "OK window."

The number indicates in Kelvin how far the threshold is below the setpoint.

8.6.3.3 High temperature OK threshold

The high threshold value for temperature OK is the high threshold value for the "OK window."

The number indicates in Kelvin how far the threshold is above the setpoint.

8.6.3.4 Calibration temperature

The calibration temperature is set to 20 °C by default. It can be changed to another value between 0 °C and 40 °C in order to adapt it to the temperature of the cold heating element.

The calibration temperature can be

- Specified with the aid of the hardware configuration tool, e.g. STEP7 or TIA portal by Siemens.
- Changed during operation via the acyclical services, if the PROFIBUS® Master supports acyclical services.
- Changed via the cyclical input data, if the value "-1" for the calibration temperature is shown in the parameter data.

After changing the calibration temperature, execute the AUTOCAL function.

Alternative

With the respective setting in the parameter data, the calibration temperature can be specified by means of the input data "setpoint" and "AC temperature" whenever the zero point is calibrated. It can be specified within the range of 0…+40 °C.
In the parameter data, the parameter "Calibration data" has to be set to "0xFF" instead of "-1".
The specified calibration temperature must be entered in the input data "setpoint" and "AC temperature" when the AUTOCAL function is activated (AC bit = 1). This specified value must not be changed until the AUTOCAL function has finished.

Calibration

If the specified calibration temperature is too high (greater than 40 °C) or if the specified value fluctuates, an error message with the error code 115, 116 is signaled.

The AUTOCAL request (AC bit = 1) is executed by the temperature controller, provided the AUTOCAL function is not blocked (AG bit= 0).

The automatic calibration takes approx. 6…15 sec. The heating element is not heated additionally during this process. The yellow LED on the front panel lights up while the AUTOCAL function is executing and the temperature controller shows "AUTOCAL active" (AA bit = 1) in the output data.

The actual value output (terminals 17+18) changes to 0…3 °C (corresponds to approx. 0 VDC).
The digital actual value in the cyclical data goes to 0.

Also refer to

- Automatic zero calibration AUTOCAL (AC) [▶ 41]
- Input data, Setpoint [▶ 44]
- Calibration temperature [▶ 53]

8.6.3.5 Heating time limit

The heating time limit provides additional protection against unwanted continuous heating.

The temperature controller automatically deactivates the heating pulse after the set heating time limit has elapsed, if the ST bit remains set for longer than the time specified with this limit. The ST bit must be reset before the temperature controller can be started up again.

8.6.3.6 Expanded device diagnosis

The expanded device diagnosis uses the diagnostic channel of the PROFIBUS® protocol to display any temperatures directly on the PROFIBUS® Master. There is a text message stored in the device master file (GSD) for each error, which is automatically displayed in plain text on the PROFIBUS® master, provided the temperature controller has this capacity.

Expanded device diagnosis can be activated or deactivated by means of the parameter no. 9. Expanded device diagnosis is active in the standard setting.

The device status can be checked by means of the user data, regardless of this parameter.

DPV1 protocol expansion (alarm model)

Expanded device diagnosis is not available when using the DPV1 protocol expansion. In this case, the corresponding DPV1 alarm model has to be used. The DPV1 diagnosis alarm is switched on and off with parameter no. 9 of the GSD file.

If the existing expanded device diagnosis is to continue to be used, e.g. due to software compatibility, a GSD version older than v2.0 has to be used. This causes the DPV1 functionality for the temperature controller to be automatically switched off in the PROFIBUS® Master.

Also refer to

- Restart delay after reset [▶ 59]
- DPV1 alarm model [▶ 60]

8.6.3.7 Measuring pulse duration

The length of the measuring pulses generated by the temperature controller can be set with this parameter.

It may be necessary to set a measuring pulse longer than the default 1.7 ms for certain applications. Refer to the application report for more detailed information, or consult support:

Contact | We are happy to provide support | ROPEX (ropex-group.com)

8.6.3.8 Data format

This parameter specifies the order of the bytes ("Little Endian (Intel)" or "Big Endian (Motorola)") in the cyclical data. This setting applies to both input and output data.

Also refer to

- Communication protocol [▶ 37]

8.6.3.9 Correction factor

The correction factor Co is used to adjust the temperature controller to suit the actual properties of the machine, e.g. type of heating element, specification of the pulse transformer, length of connecting lines, cooling, etc.

The correction factor can be set individually for each channel.

Proceed as follows:

1. Make the following temperature settings.
   Setpoint temperature: 160…180 °C
   heat sealing time: 0.20…0.30 sec
2. Refer to section Start (ST) [▶ 42] for information on how to trigger heating pulses.
3. Adjusting the correction factor Co
   50% or value recommended in the application report minus 25 %.
4. Slowly increase the correction factor until the displayed hold value is the same as the setpoint temperature.
5. When the machine is operated or when changes are made to the setpoint or the sealing time, always check the correction factor and adjust it if needed.

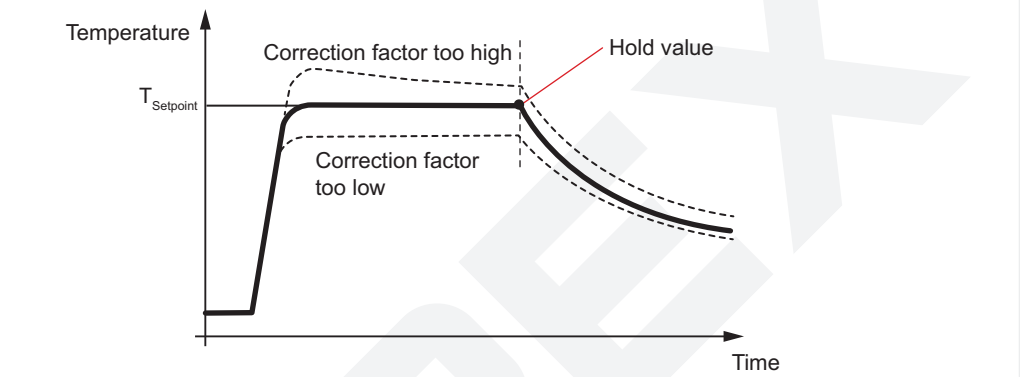


Illustration 13: Correction factor

8.6.3.10 Error code format

This parameter specifies the length of the error code in the cyclical data.

Any length between 4-bit and 10-bit can be selected.

Setting	Result	Refer to section
4-bit	Generates 2-digit error codes within the range 1...13.	Error messages [▶ 71]
10-bit	Generates 3-digit error codes	

Also refer to

- Communication protocol [▶ 37]

8.6.3.11 TCR calculator

Available beginning with firmware version

This function is available with firmware version 301 and higher.

The TCR calculator can be used to determine the temperature coefficient (TCR) of the heating element used.

Application

The real temperature coefficient of the heating element often differs from the standard value. The material composition and processing influence the properties of the heating element. This causes the temperature display of the temperature controller to differ from the real temperature of the heating element. Using the TCR calculator allows the TCR value to be easily corrected and the temperature display of the temperature controller and the real temperature of the heating element to be better matched.

Calculation

To calculate the TCR value, the temperature at the heating element is measured in control mode (ST bit = 1) using an external temperature sensor, e.g. a thermocouple or IR temperature. The measured temperature is transferred to the temperature controller in Slot 1, index 190/191. The calculated temperature coefficient can be read out from Slot1, index 192/193. The temperature coefficient is only calculated in control

mode (ST bit = 1). Reading back the calculated TCR value must be done during active control operation, i.e. during an active heating pulse, as the internal measured value of the current heating element temperature is used for the calculation.

Value	Error when calculating temperature coefficient
0	• Calculated temperature coefficient too low • No active control mode
65535	• Calculated temperature coefficient too high

To use the calculated TCR value, it must be set for the corresponding channel as the temperature coefficient in Slot 1, index 13/14 (channel 0), index 26/27 (channel 1), index 29/30 (channel 2), etc. (temperature coefficient. In addition, the value 11 (variable) must be used in Slot 1, index 4 (alloy / temperature range).

8.6.3.12 Temperature diagnosis

An additional temperature diagnosis can be activated in the parameter data (GSD file). The temperature controller checks whether the actual temperature is within an adjustable tolerance range ("OK window") above and below the setpoint temperature.

Default The limits are set to -10 K and +10 K by default.

If the ACTUAL temperature is within the specified tolerance range when the START signal is activated, the temperature diagnosis is activated as well. If the ACTUAL temperature leaves the tolerance range, the corresponding error code (307, 308) appears and the alarm relay is switched; refer to section Error messages.

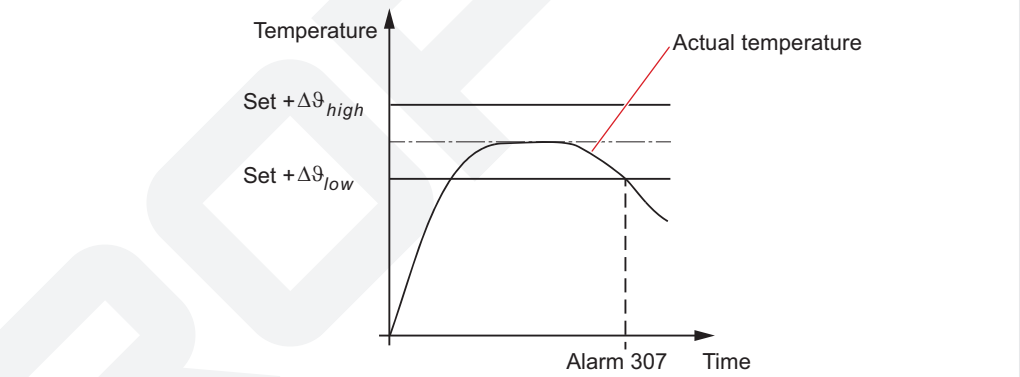


Illustration 14: Temperature diagnosis

The low ($\Delta\vartheta_{low}$) and high ($\Delta\vartheta_{high}$) tolerance limit is the same as for temperature OK monitoring.

If the actual temperature does not exceed the low tolerance limit or fall below the high tolerance limit, the corresponding error code (309, 310) appears and the alarm relay is switched. Temperature diagnosis was not switched on until the START signal was deactivated.

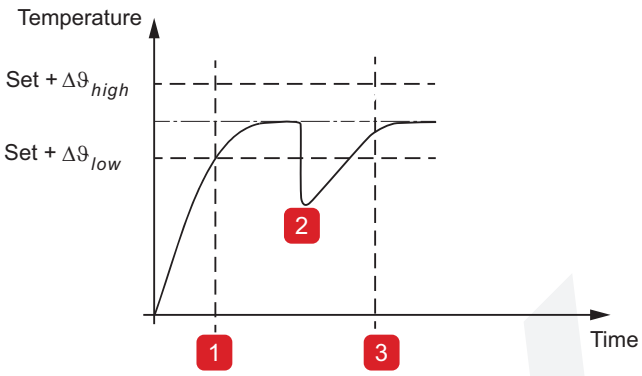


Illustration 15: Temperature diagnosis delay

1	Start of delay time for temperature diagnosis	2	Value falling below the low tolerance limit is ignored.
3	Temperature diagnosis delay has expired		

An additional delay (0...9.99 seconds) can be set in thein the parameter data (GSD file) .

The first time the value falls below the low tolerance limit 1, temperature diagnosis is not activated until the configured delay time has elapsed.

The temperature diagnosis function can thus be selectively deactivated 2, e.g. if the temperature drops temporarily owing to the closure of the sealing jaws.

Note The high and low tolerance limits cannot be set in the visualization software.

Also refer to

- Temperature OK (TO) [▶ 46].

8.6.3.13 Heatup timeout

Additional heatup timeout can be activated in the in the parameter data (GSD file).

The time required to reach the setpoint temperature may be longer in the event of an electrical error, e.g. a broken cable or incorrect heating element. When heatup timeout is set to the value required for the respective application, errors of this type can be detected.

Default Heatup time out off

Heatup timeout is activated when the ST bit is activated. The temperature controller monitors the time that it takes for the actual temperature to reach 95 % of the setpoint temperature. If this time is longer than the configured time, the corresponding error code (304) appears and the alarm relay switches; refer to section Error messages.

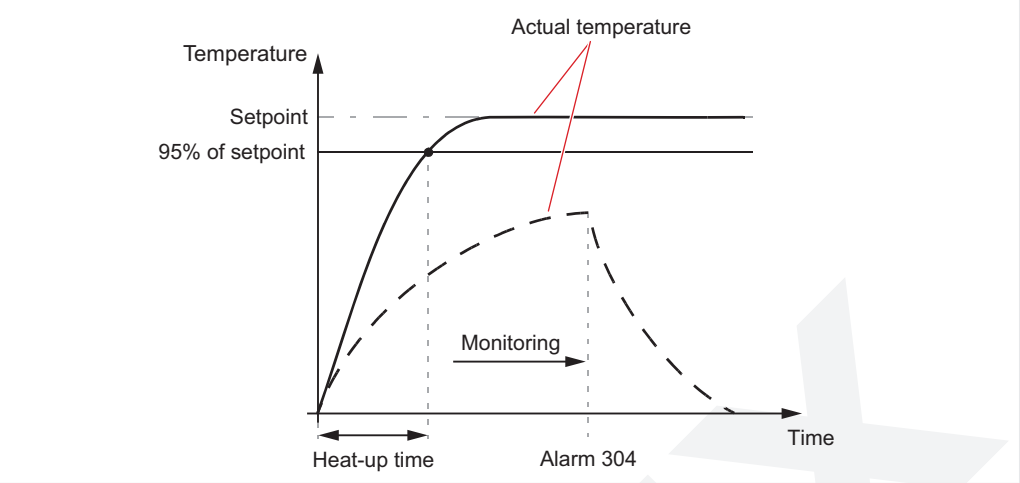


Illustration 16: Heatup timeout

To be able to use it, the "Heatup timeout" in the parameter data has to be enabled.

8.6.3.14 Hold mode

The actual temperature output via the PROFIBUS® protocol can be configured in the parameter data (GSD file) as follows:

Setting	Meaning
Off	The current actual temperature is shown in realtime.
On	The current actual temperature is output at the end of the last heat-sealing phase. When the temperature controller is switched on, the current actual temperature is indicated up until the end of the first heating phase.
2 sec.	The last actual temperature is output for an additional 2 seconds at the end of a heat-sealing phase. Then the actual temperature is shown in realtime until the end of the next heat-sealing phase.

Default Hold mode off

Hold mode only applies to the actual temperature that is output via the PROFIBUS® protocol and the digital temperature display in the ROPEX visualization software. It has no effect on the actual temperature that appears at the temperature controller's analog output or is plotted in the graphics window of the visualization software.

The various hold modes are shown below:

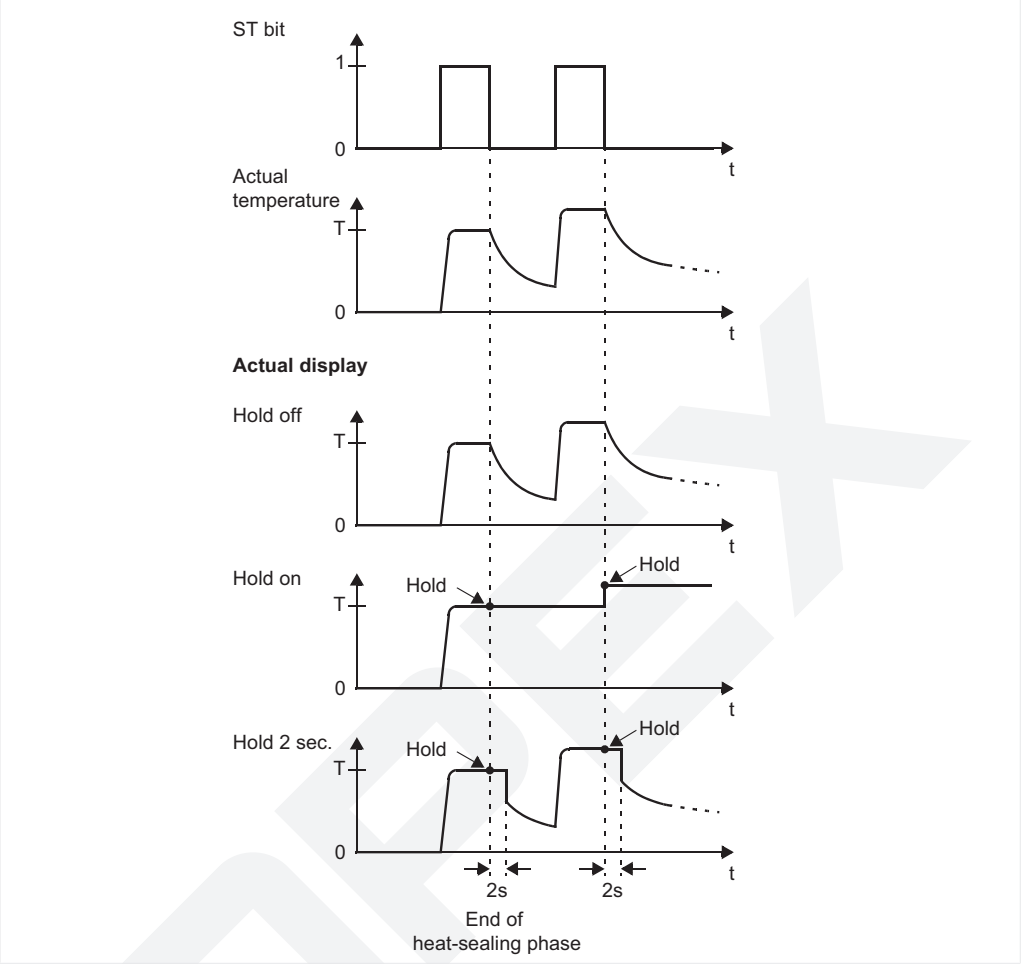


Illustration 17: Hold mode. Example: second pulse with greater setpoint

The settings for hold mode are made in the in the parameter data.

8.6.3.15 Restart delay after reset

Available beginning with firmware version

This function is available with firmware version 301 and higher.

After acknowledging an alarm with the reset signal (RS bit), the temperature controller waits until any contactor connected has closed the heat-sealing band again. When the waiting time has elapsed, the temperature controller generates measuring pulses again. With the aid of the measuring pulses, the temperature controller determines the actual temperature and performs error diagnosis.
This restart delay is 0.2 s by default and can be adjusted with Parameter index 56/57. This allows slower switching contactors to be used.

With firmware version 301

In older firmware versions, the restart delay is not included as a parameter. The restart delay is set to 0.2 s. This value cannot be changed.

8.7 DPV1 protocol expansions

8.7.1 Identification and maintenance (I&M features)

The I&M features are used to identify and inventory PROFIBUS devices.

The I&M features are accessed via slot 0.

The temperature controller supports the following I&M features:

Function	Contents	Text box	Size in bytes

I&M0	• Device
	  • Manufacturer code
	  • Order number
	  • Serial number
	• Hardware and software revisions
		Readable	

I&M1	• Function	Writable and readable	32
	• Installation location		22
I&M2	Installation date	Writable and readable	16
I&M3	Description	Writable and readable	54
I&M4	Signature	Writable and readable	54

8.7.2 DPV1 alarm model

In DPV1 mode, the temperature controller sends `Diagnosis alarms`.

Notes The data in italics is the standard diagnosis and the bold data is the expanded diagnosis.

The values in the following table show an example for error number 103 (0x67).

Mode	Setting of parameter `Expanded device diagnosis`			
	`Activated`		`Activated for SFM`[15]	
	Incoming	**Outgoing**	**Incoming**	**Outgoing**
DPV0	*08 0C 00 00 07 EA* **06 81 00 D1 67 00**	*00 0C 00 00 07 EA* **06 81 00 DA 00 00**	*08 0C 00 00 07 EA* **06 81 00 C1 67 00 06 81 00 00 67 00**	*00 0C 00 00 07 EA* **06 81 00 CA 00 00 06 81 00 00 00 00**
DPV1[14]	*08 0C 00 00 07 EA* **06 01 00 A1 67 00**	*00 0C 00 00 07 EA* **06 01 00 AA 00 00**	*08 0C 00 00 07 EA* **06 81 00 00 67 00 06 01 00 B1 67 00**	*00 0C 00 00 07 EA* **06 01 00 BA 00 00**

8.7.3 DPV1 parameter data

The basic settings and functions of the temperature controller are set via the parameter data in the GSD file.

In some PLC systems, the settings in the GSD file can be changed only when a project is created. Changes cannot be made during machine or system operation.

With the DPV1 protocol expansion, the settings and functions can be changed during operation of the temperature controller. This means that, for example, the temperature coefficient for the heating element can be adjusted via the PLC controller during the validation process.

The temperature controller parameters can be read as well as written via the acyclical service. Access to the parameter files via slot index addressing is random.

Note The temperature controller does not save the received parameters.

15 Reporting system error (SFM)

14 In DPV1 mode, the alarms have to be acknowledged by the PROFIBUS master. The temperature controller supports alarm acknowledgment via the Service Access Point (SAP) 51 as well as via SAP50. This has the advantage that during read access via SAP51, an alarm can be acknowledged via the additional SAP50.

When the temperature controller or bus is restarted, the parameters that have been changed from the static configuration have to be transmitted again.

Practical tip Consult with the manufacturer of the PLC to find out how the PLC supports the DPV1 protocol expansion.

8.7.4 DPV1 parameter data slot 0

Index	Parameter	Default	Value range
255	I&M features		• Article number • Serial number • Version numbers • Manufacturer ID
0	Cyclical data		

8.7.5 DPV1 parameter data slot 1, index 4 and higher

Available beginning with firmware version Available beginning with firmware version 301: Indices 56 to 57

Index	Parameter	Unit	Default	Value range
4	Alloy/range		10	0: 1700 ppm/K, 300 °C 4: 1700 ppm/K, 500 °C 9: PC configuration 10: Coding dial 11: variable
5	Low temperature threshold	K	10	3…99
6	High temperature threshold	K	10	3…99
7	Calibration temperature, channel 0	°C	20	0…40 -1: variable via cyclical data
8	Heating time limit (0.1 s)	0.1 sec	0 (= no limit)	0…99
9	Device diagnosis		1	0: deactivated 1: activated
10	Measuring pulse duration (0.1 ms)	17 (0.1 ms)	17	17…30 (1.7...3.0 ms)
11	Data format		0	0: Intel 1: Motorola
12	Correction factor, channel 0	%	100	25…200
13	Maximum start temperature	°C	100	20…500
15	Error code format		1	0: 4-bit (2-digit) 1: 10-Bit (4-digit)
16	Temperature coefficient, channel 0	ppm/K	1700	400…4000
18	Temperature range	°C	1	0: 200 1: 300 2: 400 3: 500
19	Maximum temperature	°C	300	200…500
21	Temperature diagnosis		0	0: deactivated 1: activated

Index	Parameter	Unit	Default	Value range
22	Diagnosis delay (0.01 s)	17 (10 ms)	0	0…999 (0...9.99 s)
24	Heatup time monitoring (0.01 s)	10 ms	0	0…999 (0 = deactivated 0.01...9.99 s)
26	Output 1 (temp OK bit)		1	0: off 1: active when Tact = Tset 2: active when Tact = Tset with latch
27	Hold mode		0	0: off 1: on 2: 2 sec.
28	Calibration temperature, channel 1	°C	20	-1, 0…40
29	Correction factor, channel 1	%	100	25…200
30/31	Temperature coefficient, channel 1	ppm/K	1700	400…4000
32	Calibration temperature, channel 2	°C	20	-1, 0…40
33	Correction factor, channel 2	%	100	25…200
34/35	Temperature coefficient, channel 2	ppm/K	1700	400…4000
36	Calibration temperature, channel 3	°C	20	-1, 0…40
37	Correction factor, channel 3	%	100	25…200
38/39	Temperature coefficient, channel 3	ppm/K	1700	400…4000
40	Calibration temperature, channel 4	°C	20	-1, 0…40
41	Correction factor, channel 4	%	100	25…200
42/43	Temperature coefficient, channel 4	ppm/K	1700	400…4000
44	Calibration temperature, channel 5	°C	20	-1, 0…40
45	Correction factor, channel 5	%	100	25…200
46/47	Temperature coefficient, channel 5	ppm/K	1700	400…4000
48	Calibration temperature, channel 6	°C	20	-1, 0…40
49	Correction factor, channel 6	%	100	25…200
50/51	Temperature coefficient, channel 6	ppm/K	1700	400…4000
52	Calibration temperature, channel 7	°C	20	-1, 0…40
53	Correction factor, channel 7	%	100	25…200
54/55	Temperature coefficient, channel 7	ppm/K	1700	400…4000
56/57	Restart delay after reset (0.01 s)	s	20	0…999

8.7.6 DPV1 parameter data slot 1, index 100 and higher

The following data can be read out in slot 1, index 100 and higher

Index	Function	Default	Value range
100/101	Time: Milliseconds (only full seconds)		0…59000
102	Time: Minutes		0…59
103	Time: Hours		0…23

Index	Function	Default	Value range
104	Date: Days (weekday in the top three bits not supported)		1…31
105	Date: Month		1…12
106	Date: Year		0…99
107…110	Operating hours (in 0.1 h)	0	0...999999999 (0...99999999.9 h)
111…114	Non-clearable total cycle counter	0	0…999999999
115…118	Clearable total cycle counter	0	0…999999999
119…122	Cycle counter, channel 0	0	0…999999999
123…126	Cycle counter, channel 1	0	0…999999999
127…130	Cycle counter, channel 2	0	0…999999999
131…134	Cycle counter, channel 3	0	0…999999999
135…138	Cycle counter, channel 4	0	0…999999999
139…142	Cycle counter, channel 5	0	0…999999999
143…146	Cycle counter, channel 6	0	0…999999999
147…150	Cycle counter, channel 7	0	0…999999999

8.7.7 DPV1 parameter data slot 1, index 180 and higher

The temperatures are available in slot 1, index 180 and higher.

The values are readable but not writable.

Index	Function	Default	Value range
180/181	Start temperature		-99…500 °C
182/183	Device temperature		-60…190 °C

8.7.8 DPV1 parameter data slot 1, index 190 and higher

Available beginning with firmware version

Slot 1, index 190 to index 193 are available with firmware version 301 and higher.

Slot 1, index 190 contains the elements required for the TCR calculator.

The external measured temperature is writable, the calculated temperature coefficient is readable.

Index	Function	Default	Value range
190/191	External measured temperature	40	40…600 °C
192/193	Calculated temperature coefficient	0	400…4000 ppm/K 0 (error) 65535 (error)

8.7.9 DPV1 parameter data slot 1, index 200 and higher

The channel-specific deviations from the calibration data are available at slot 1, index 200 and higher.

The values are read only, with the exception of index 216. Index 216 is writable, and the value is saved.

The absolute calibration resistances are available from index 217.

Index	Function	Default	Value range
200/201	Calibration deviation [0.01 %], channel 0	0	-10000…10000 (-100.00…100.00 %)
202/203	Calibration deviation [0.01 %], channel 1	0	-10000…10000 (-100.00…100.00 %)
204/205	Calibration deviation [0.01 %], channel 2	0	-10000…10000 (-100.00…100.00 %)
206/207	Calibration deviation [0.01 %], channel 3	0	-10000…10000 (-100.00…100.00 %)
208/209	Calibration deviation [0.01 %], channel 4	0	-10000…10000 (-100.00…100.00 %)
210/211	Calibration deviation [0.01 %], channel 5	0	-10000…10000 (-100.00…100.00 %)
212/213	Calibration deviation [0.01 %], channel 6	0	-10000…10000 (-100.00…100.00 %)
214/215	Calibration deviation [0.01 %], channel 7	0	-10000…10000 (-100.00…100.00 %)
216DPV 1 parameter data slot 1, index 200 and higher [▶ 65]	Passes through current transformer	1	1…9
217/218	Calibration resistance [0.1 mΩ], channel 0	0	0…65535 (0…6553.5 mΩ)
219/220	Calibration resistance [0.1 mΩ], channel 1	0	0…65535 (0…6553.5 mΩ)
221/222	Calibration resistance [0.1 mΩ], channel 2	0	0…65535 (0…6553.5 mΩ)
223/224	Calibration resistance [0.1 mΩ], channel 3	0	0…65535 (0…6553.5 mΩ)
225/226	Calibration resistance [0.1 mΩ], channel 4	0	0…65535 (0…6553.5 mΩ)
227/228	Calibration resistance [0.1 mΩ], channel 5	0	0…65535 (0…6553.5 mΩ)
229/230	Calibration resistance [0.1 mΩ], channel 6	0	0…65535 (0…6553.5 mΩ)
231/232	Calibration resistance [0.1 mΩ], channel 7	0	0…65535 (0…6553.5 mΩ)
233/234	Initial calibration resistance [0.1 mΩ], channel 0	0	0…65535 (0…6553.5 mΩ)

Index	Function	Default	Value range
235/236	Initial calibration resistance [0.1 mΩ], channel 1	0	0…65535 (0…6553.5 mΩ)
237/238	Initial calibration resistance [0.1 mΩ], channel 2	0	0…65535 (0…6553.5 mΩ)
239/240	Initial calibration resistance [0.1 mΩ], channel 3	0	0…65535 (0…6553.5 mΩ)
241/242	Initial calibration resistance [0.1 mΩ], channel 4	0	0…65535 (0…6553.5 mΩ)
243/244	Initial calibration resistance [0.1 mΩ], channel 5	0	0…65535 (0…6553.5 mΩ)
245/246	Initial calibration resistance [0.1 mΩ], channel 6	0	0…65535 (0…6553.5 mΩ)
247/248	Initial calibration resistance [0.1 mΩ], channel 7	0	0…65535 (0…6553.5 mΩ)

The value of the turns through the current transformer is available at index 126. This value can also be written and will be stored retentively in the temperature controller's memory with every change. The correct calculation of the absolute calibration resistances is only possible if the real count of wire passes through the current transformer is given in this parameter.

8.8 Undervoltage detection



NOTICE

Property damage due to insufficient line or 24 VDC supply voltage

A line voltage or 24 VDC supply voltage that is too low can lead to faulty sealing.

▶ Use an external voltage monitoring device

Trouble-free operation of the temperature controller is guaranteed within the line voltage and 24 VDC supply voltage tolerance range.

If the 24 VDC supply voltage drops below the lower limit, the temperature controller switches to standby mode. No more heat-sealing processes take place and no more measuring pulses are generated. Normal operation resumes when the input voltage returns to the specified tolerance range again.

Standby mode is indicated by 0…3 °C, approx. 0 V, at the analog output. In addition, the SA bit is set in the status word for the cyclical output data.

8.9 Analog temperature display

The temperature controller supplies an analog voltage signal 0…10 VDC at the terminals 17+18.

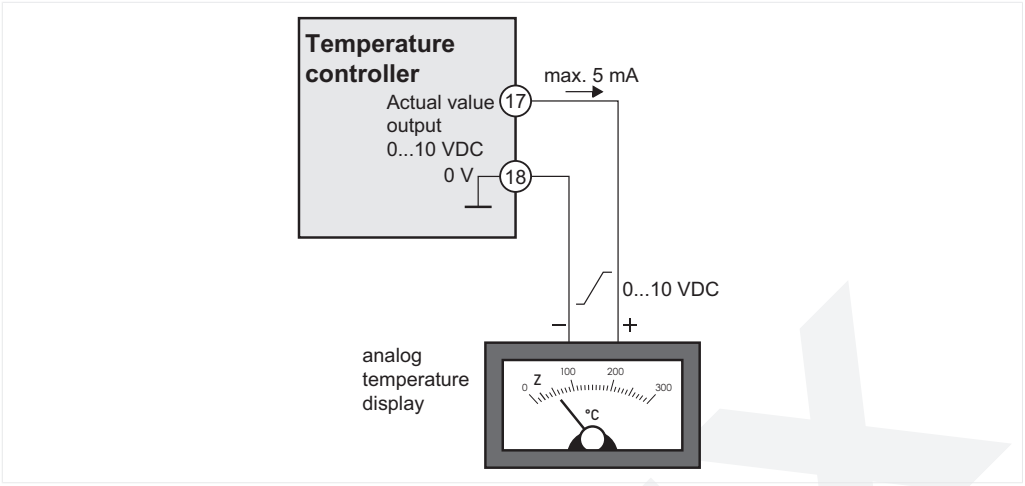


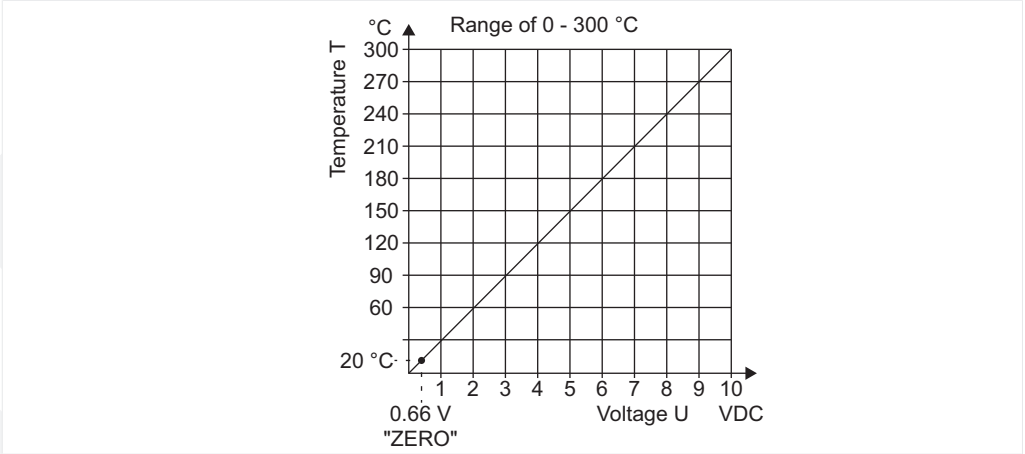
Illustration 18: Example of temperature controller with analog temperature display

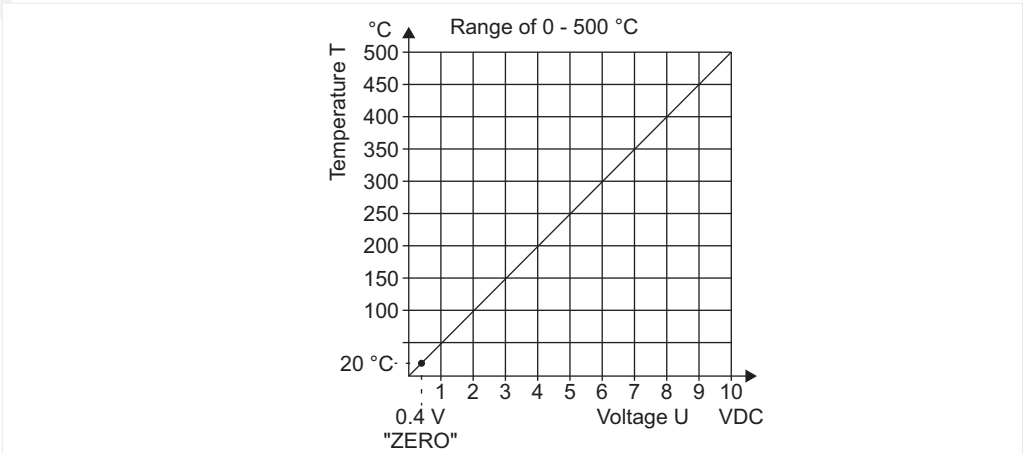
To allow the temperature of the heating element to be displayed, connect a temperature gauge to the actual value output.

The analog temperature display can be used e.g.

- To compare the setpoint and actual temperature.
- To specify the heat-up rate.
- To check whether the setpoint is reached within the required time.
- To observe how the heating element cools off.
- To detect disruptions in the control circuit, e.g. loose connections, contact and cabling problems, power disruptions.
- To detect adjacent control loops that disturb one another.

When an alarm occurs, the analog output shows differentiated error messages.





The correlation between the change in the output voltage and the actual temperature is linear.

Also refer to

- Error messages [▶ 71]

8.10 USB interface

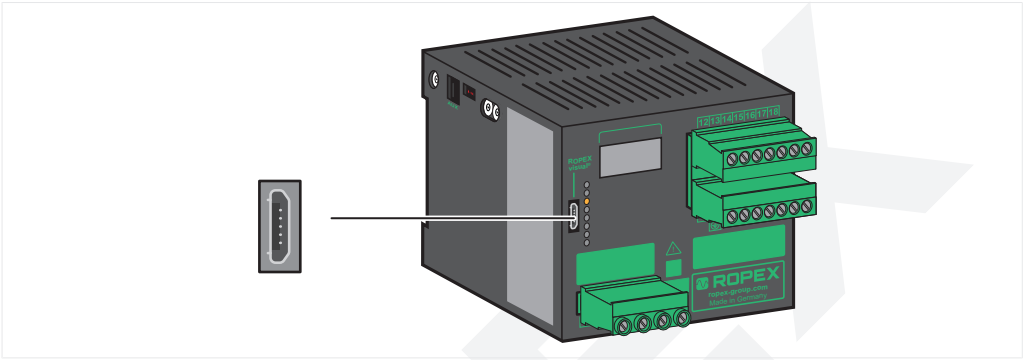


Illustration 19: USB interface

The temperature controller has a USB interface.

The micro USB interface enables a data connection to be set up to *ROPEXvisual*®, the ROPEX visualization software.

The visualization software is used for system diagnostics and process visualization.

Downloads Further information can be found in the operating instructions for the visualization software *ROPEXvisual*®. The operating instructions and software can be found on our website at http://www.ropex-group.com/products/downloads.

Menu path `Products > Downloads >` REGISTER

Tip Enter the search term "visual."

8.11 AUX interface

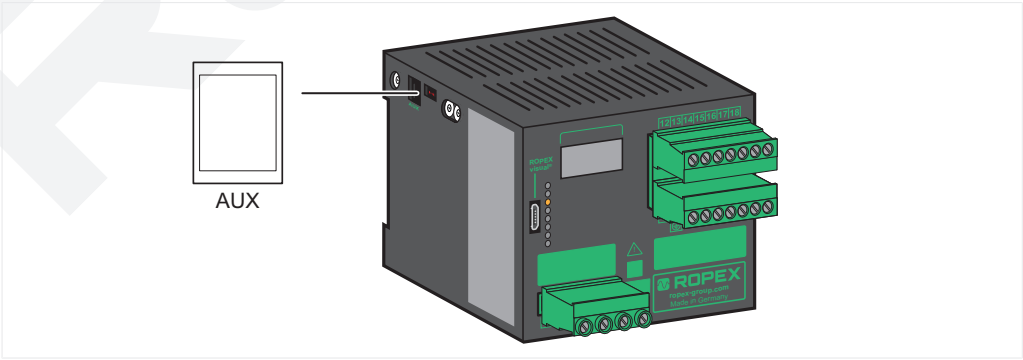


Illustration 20: AUX interface

The temperature controller has a AUX interface.
The AUX interface gives ROPEX customer service the information needed for diagnostics and maintenance.

▶ Doe **not** use the AUX interface.

8.12 Total cycle counter

The number of heat-sealing cycles executed since the temperature controller was delivered is saved in the internal memory (ST bit = 1).

This is a read-only counter and cannot be reset.

It can be displayed:

- With the visualization software
- Via the acyclical service of the PROFIBUS-DP interface, slot 1, index 111… 114

Also refer to

- DPV1 parameter data slot 1, index 100 and higher [▶ 62]
- Operating instructions for the visualization software *ROPEXvisual*®

8.13 Operating hours counter

The number of operating hours since the temperature controller was delivered is saved.

This is a read-only counter and cannot be reset.

The counter works with a resolution of 6 minutes.

It can be displayed:

- With the visualization software
- Via the acyclical service of PROFIBUS-DP interface, slot 1, index 107...110

Also refer to

- DPV1 parameter data slot 1, index 100 and higher [▶ 62]
- Operating instructions for the visualization software *ROPEXvisual*®

8.14 Data memory

To simplify error diagnoses during operation, the RES-5010 controller has a data memory for:

- Error messages
- AUTOCAL processes
- Integrated clock
  All messages are saved in the data memory, along with the date and time of occurrence (time stamp). If the time or date is changed via the visualization software or acyclical services, an entry in the protocol is made in the data memory.

The 400 most recent messages are stored.

These messages can be displayed:

- With the aid of the visualization software

Note The stored messages can be exported as a csv-file. If needed, ROPEX can evaluate the exported file and create an error diagnosis.

Also refer to

- Automatic zero calibration AUTOCAL (AC) [▶ 41]
- Built-in clock [▶ 68]
- Error messages [▶ 71]
- Operating instructions for the visualization software *ROPEXvisual*®

8.15 Built-in clock

The temperature controller has a built-in clock.

All messages are saved in the data memory, along with their date and time of occurrence (time stamp) Error messages can thus be accurately correlated whenever a problem needs to be analyzed.

The built-in clock can be set and read out using:

- The visualization software
- Acyclical service of the PROFIBUS-DP interface, slot 1, index 100...106

A maintenance-free capacitor is used to operate the clock. No battery is needed for operation.

The temperature controller must remain switched on for at least 3 hours to make sure the clock's capacitor is fully charged. When the temperature controller is switched off, the fully charged capacitor can keep the clock running for approximately 2 to 4 weeks. If the temperature controller is switched off for longer, the date and time will have to be set again.

The capacitor is not charged when it leaves the factory. If the error messages are to be saved in the data memory along with their date and time of occurrence, set the clock when starting up the temperature controller.

The temperature controller can be operated even when the clock is not set. In this case, the dates and times that are saved in the data memory will be invalid. This does not, however, impact how the temperature controller behaves.

Also refer to

- DPV1 parameter data slot 1, index 100 and higher [▶ 62]
- Data memory [▶ 68]
- Operating instructions for the visualization software *ROPEXvisual*®

9 Monitoring and error detection

9.1 System monitoring and alarm output

To increase operational safety and prevent faulty heat-sealing, the temperature controller monitors both external wiring as well the internal system.

Error messages and diagnoses are detected by means of hardware and software applications. This allows the source of faulty operation of the temperature controller to be localized.

A system fault is reported or differentiated by means of the following indications.

Who reports?	How is the fault reported?	Meaning
Red ALARM LED on temperature controller	Flashes quickly (4 Hz)	The values measured for current, voltage or resistance do not correspond to the values saved upon the last successful AUTOCAL process. There is an electrical error or a modified heating element. ▶ Execute AUTOCAL functions (error codes 104…106, 211, 302, 303). Note: If a START signal is sent during this state, the LED remains illuminated.
	Flashes slowly (1 Hz)	The system configuration is incorrect and zero calibration (AUTOCAL function) was unsuccessful (error codes 111…114); refer to section Temperature controller configuration [▶ 32]. Note: If a START signal is sent during this state, the LED remains illuminated.
	Illuminated continuously	Indicates that there are faults that prevent startup (error codes 101 …103, 107, 108, 201…203, 304, 307, 308, 9xx). Tip: There are usually external wiring faults.
Alarm relay (relay contact terminals 12+13+14) default[18)]	NOT ACTIVE	• When the red ALARM LED on the temperature controller flashes quickly. • When the red ALARM LED on the temperature controller flashes slowly.
	ACTIVE	• When the red ALARM LED on the temperature controller remains illuminated.
Error code shown via the PROFIBUS® protocol	The error code is contained in the third word at bit positions 0…9; refer to section Error code [▶ 49].	If an error occurs, the AL bit is set and possibly also the WA bit.

[18] If the alarm relay has a different configuration than the default, the states are reversed; refer to section Alarm relay configuration [▶ 34].

Who reports?	How is the fault reported?	Meaning
Error code indicated via the actual value output 0…10 VDC (terminals 17+18)	13 voltage levels	In the event of a fault, the temperature display is no longer required. This is why, in the event of an alarm, the analog output serves as the error output. Instead, 13 voltage levels between 0…10 VDC are output. The voltage levels are assigned to groups of error codes; refer to section Error messages [▶ 71].
	Error codes	For statuses that require AUTOCAL, or if the device configuration is incorrect (error codes 104…106, 111…114, 211, 302, 303), the signal at the actual value output alternates at 1 Hz between the voltage value corresponding to the error and the end of the scale (10 VDC, i.e. 300 °C or 500 °C). If the START signal is present in one of these states, the voltage value does not change any more.
	Temperature display	If a temperature meter is connected to the temperature controller's analog output, the temperature indication can be directly assigned to the group of the error codes.

Activating alarm messages

An alarm message can be reset by activating the RS bit or by switching the temperature controller on/off (24 VDC supply). If an error message is reset with the RS bit, it is not actually reset until the RS bit is deactivated.

Tip

Invalid alarm messages can occur if the temperature controller is switched off. The alarm messages occur because the operating status of the temperature controller is not defined.
This must be taken into account when they are evaluated by the higher-level controller (e.g. a PLC) in order to avoid false alarms.

9.2 Error messages

The error messages are encoded and saved in the communication protocol.

The error diagnosis can also be accessed as follows:

- PROFIBUS® diagnosis (extended device diagnosis)
  The error codes appear as plain text in the project tool, as they are stored in the GSD file.

Tip

To facilitate error diagnosis, the temperature controller emits 13 voltage levels via the analog output. The voltage levels correspond to the 4-bit error code. In the temperature controller, the error message is more precisely differentiated and is encoded as an error code. The error code is a 3-digit number.

The three-digit error codes can be displayed as follows:

- PROFIBUS® interface
- Visualization software *ROPEXvisual*®

Notes

In order to avoid incorrect evaluations, the evaluation of the analog output for the detection of an error message – e. g. in the higher-level control unit – must be carried out with an adapted tolerance window. Comply with the analog output tolerances.

The following three tables show the assignment of the three-digit error codes to the voltage level at the analog output. They also contain the causes and the measures required to remedy the error.

Also refer to

- Technical data [▶ 81]
- Operating instructions for the visualization software *ROPEXvisual®*

9.2.1 Part 1 of 3: Troubleshooting

The errors are reported as faults.

- The analog output emits constant voltage, the level of which is associated with a set of error codes.
- ALARM LED remains illuminated.
- Alarm relay is active.

Number of voltage level	Error code	Analog signal voltage [V]	Error message and cause	Action if heating element is started up for the first time	Action if machine is already in operation, heating element not changed
1	101	0.66	No current signal	Fault area 1 [19]	
2	102	1.33	Voltage signal missing	Fault area 3 [19]	
3	103	2.00	Voltage and current signals missing	Fault area 2 [19]	Fault area 2 and 9 [19]
4	107	2.66	Temperature drop	And/or fault areas 4, 5 and 6 (loose contact)[19]	
	108		Temperature spike		
	307		Temperature too low: • Temperature did not remain within the tolerance range during sealing.	▶ Check dimensioning of the pulse transformer. ▶ Check heat extraction through the sealing process. ▶ Verify application through sealing tests.	
	308		Temperature too high: • Temperature did not remain within the tolerance range during sealing		
	309		Temperature too low: • Tolerance range was not reached		
	310		Temperature too high: • Tolerance range was not reached		
5	201	3.33	Line frequency missing/fluctuates	▶ Check mains power supply: • Line frequency • Harmonics • Voltage fluctuations	
	202		Line frequency too high / fluctuates		
	203		Line frequency too low / fluctuates		

[19] Refer to the wiring diagram Fault areas and causes [▶ 75] for further information.

Number of voltage level	Error code	Analog signal voltage [V]	Error message and cause	Action if heating element is started up for the first time	Action if machine is already in operation, heating element not changed
6	304	4.00	Heatup time too long	▶ Reset temperature controller. ▶ Check dimensioning of the pulse transformer. ▶ Check parametrized heating time. ▶ Check lines and contacts.	▶ Reset temperature controller. ▶ Check lines and contacts. ▶ Check sealing process.
	305		Start temperature too high	▶ Reset temperature controller. ▶ Check cooling system. ▶ Check maximum start temperature.	
7	901	4.66	Line voltage / synchronizing signal missing	▶ Check line voltage	
	913		Triac defective	▶ Replace temperature controller.	
	914 915		Internal error: • Comparator in measuring module defective		
	916		Internal error: • Test mode not ended successfully		
	917 918		Jumper for alarm output not plausible	▶ Check jumper.	
	938 939 940 941		Internal error: • Capacitor in measuring module defective	▶ Replace temperature controller.	

9.2.2 Part 2 of 3: Troubleshooting

The errors are initially reported as warnings.

- Analog output alternates between two values.
- ALARM LED flashes at 4 Hz.
- Alarm relay not active.

After the START signal is activated, the errors are reported as faults.

- Analog output no longer alternates; refer to bold value (e.g. **5.33**).
- ALARM LED remains illuminated.
- Alarm relay is active.

Number of voltage level	Error code	Analog signal voltage [V][20]	Error message and cause	Action if heating element is started up for the first time	Action if machine is already in operation, heating element not changed
8	104	**5.33**/10	Current signal incorrect: • Pulse transformer incorrectly dimensioned	▶ Check transformer specifications. ▶ Perform **AUTOCAL**. Refer to fault areas 7 and 8[21]	Refer to fault areas 4, 5 and 6 (loose wire)[21]
	105		Voltage signal incorrect: • Pulse transformer incorrectly dimensioned		
	106		Voltage and current signal incorrect: • Pulse transformer incorrectly dimensioned		
	302		Temperature too low: • Calibration not performed • Loose contact • Ambient temperature fluctuates	▶ Perform **AUTOCAL**. And/or fault areas 4, 5 and 6 (loose contact):[21]:	
	303		Temperature too high: • Calibration not performed • Loose contact • Ambient temperature fluctuates		
9	211	**6.00**/10	Data error	▶ Perform **AUTOCAL**.	

9.2.3 Part 3 of 3: Troubleshooting

Note This section shows error messages that may occur if the AUTOCAL function is not ended properly.

The errors are initially reported as warnings.

- Analog output alternates between two values.
- ALARM LED flashes at 1 Hz.
- Alarm relay not active.

After the START signal is activated, the errors are reported as faults.

- Analog output no longer alternates; refer to bold value (e.g. **6.66**).
- ALARM LED remains illuminated.
- Alarm relay is active.

20 The voltage at the analog output alternates between the two values.

21 Refer to the wiring diagram Fault areas and causes [▶ 75] for further information.

Number of voltage level	Error code	Analog signal voltage [V][22]	Error message and cause	Action if heating element is started up for the first time	Action if machine is already in operation, heating element not changed
10	111	**6.66**/10	Current signal incorrect Calibration not possible	Fault area 8[23] ▶ Check configuration ▶ Perform AUTOCAL.	Fault areas 4, 5 and 6 (loose wire)[23]
11	112	**7.33**/10	Voltage signal incorrect Calibration not possible	Fault area 7[23] ▶ Check configuration ▶ Perform AUTOCAL.	
12	113	**8.00**/10	Voltage and current signal incorrect Calibration not possible	Fault areas 7 and 8[23] ▶ Check configuration ▶ Perform AUTOCAL.	
13	114	**8.66**/10	Temperature fluctuates Calibration not possible	Fault areas 4, 5 and 6 (loose wire)[23] ▶ Perform AUTOCAL.	
	115		External calibration temperature too high Calibration not possible	▶ Perform AUTOCAL with an external calibration temperature ≤ 40 °C.	
	116		External calibration temperature fluctuates Calibration not possible	▶ Perform AUTOCAL with a stable external calibration temperature.	

9.3 Fault areas and causes

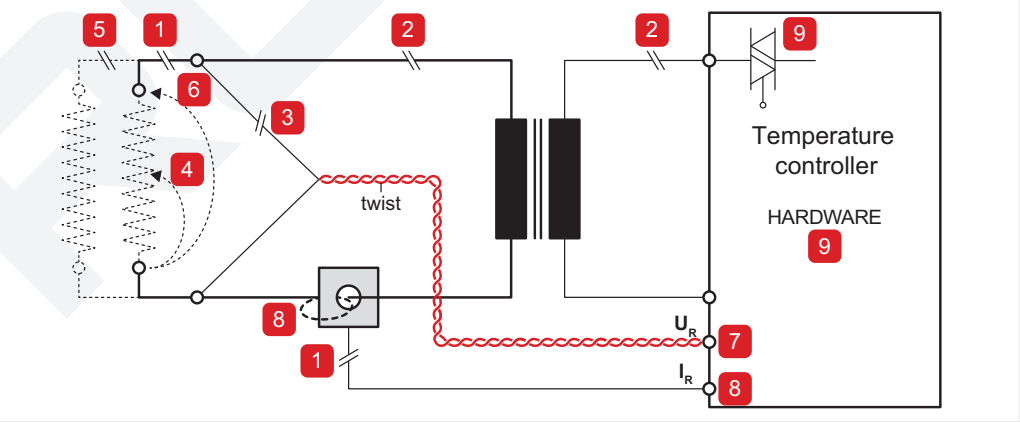


Illustration 21: Fault areas and causes

The following table explains the possible causes.

Fault area	Explanation	Possible causes
1	Load circuit interrupted after U_R pickup point	• Wire break, heating element defective. • Contact to heating element is defective.
	Current transformer signal interrupted	• $I_R$measurement cable from current transformer interrupted.

22 The voltage at the analog output alternates between the two values.

23 Refer to the wiring diagram Fault areas and causes [▶ 75] for further information.

Fault area	Explanation	Possible causes
2	Primary circuit interrupted	• Wire break, triac in controller defective. • Primary winding of pulse transformer interrupted. • Kb contactor open.
	Secondary circuit interrupted before U_R pickup point.	• Wire break • Secondary winding of pulse transformer interrupted.
3	No U_R signal	• Measurement cable interrupted.
4	Partial bypass (delta R)	• Heating element partially bypassed by conducting part, e.g. clamp, opposite heat-sealing bar.
5	Parallel circuit interrupted	• Wire break, heating element defective. • Contact to heating element is defective.
6	Total bypass	• Heating element incorrectly installed, no insulation at heat-sealing bar ends or insulation incorrectly installed. • Heating element completely bypassed by conducting part.
7	U_R signal incorrect	• Secondary voltage U_2 outside of permissible range of 0.4…120 VAC.
8	I_R signal incorrect	• Current I_2 outside of permissible range of 30…500 A.
	Turns incorrectly passed through current transformer	▶ Check number of turns: Two or more turns required for currents < 30 A.
9	Internal device fault / no line voltage	• Hardware fault: ▶ Replace temperature controller. • Jumper for alarm output defective or not in correct position. • No line voltage.

10 Replacing heating element



⚠ WARNING

Hot surfaces pose a risk of burns

The heating element is very hot when it is operating.

► Allow all system components to cool off.

Replace the heating element in the event of

- Mechanical defects or deformation.
- Scaled or oxidized contact of the heating element.
- Burned in residue.
- Damaged labels.

To replace the heating element, proceed as follows:

Prerequisite The following requirements have to be met:

✓ The heating element is cooled to ambient temperature.

✓ All of the components near the heating element have cooled off:
Silicone, PTFE cover and heat-sealing bar

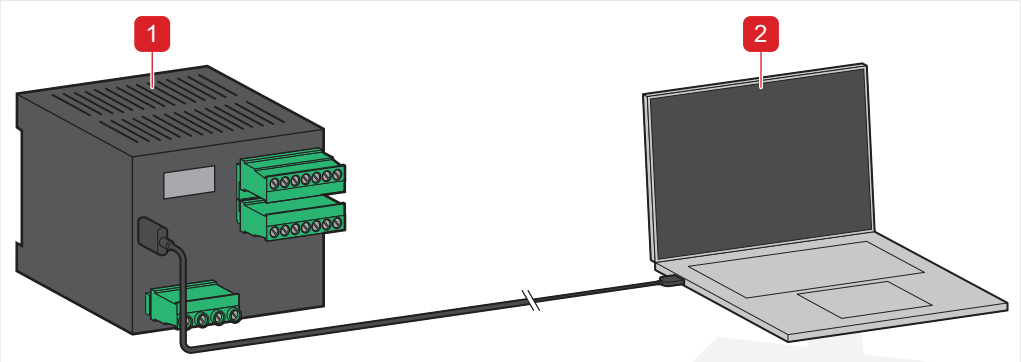
1. Disconnect the supply voltage from the temperature controller (all-pole), verify that the circuit is de-energized and secure to prevent being switched on again.
2. Remove heating element.
3. Install heating element.
4. Adjust the correction factor Co.
5. Every time the heating element has been replaced, perform zero calibration with the function AUTOCAL.
6. Check and adjust the temperature coefficients if necessary.

⇨ Heating element has been replaced. Correction factor is set and zero point is calibrated.

Also refer to

- Correction factor [▸ 54]
- Automatic zero calibration AUTOCAL (AC) [▸ 41].

11 Updating firmware version



1	Temperature controller with USB interface	2	Computer with USB interface

With the *ROPEXupdate* application software, the firmware version of your ROPEX temperature control device as well as the application software itself can be updated.

Compatibility

The application software *ROPEXupdate* is compatible with different firmware versions of the temperature controllers. When a temperature controller is connected, the firmware version is read.

Also refer to

- Operating instructions for the application software *ROPEXupdate*

12 Maintenance



NOTICE

Dust deposits can impair proper functioning.

Dust can hinder proper functioning of the temperature controller.

- ▶ When it is de-energized, dust can be removed from the temperature controller with dry compressed air.
- ▶ Install a temperature controller in the electrical cabinet or terminal box for protection class IP 54 or higher.



NOTICE

Contamination with liquids can impair proper functioning

Contamination with liquids can hinder proper functioning of the temperature controller.

- ▶ Install a temperature controller in the electrical cabinet or terminal box for protection class IP 54 or higher.

The temperature controller requires no special maintenance.

Regular inspection and/or tightening of the terminals – including the terminals for the winding connections on the pulse transformer – is recommended.

13 Disposal

This device is subject to directive 2012/19/EU concerning the reduction of the increasing amount of waste of electrical and electronic equipment and the disposal of such waste in an environmentally sound way.

To guarantee proper disposal and/or to recover reusable materials, please take the device to a designated municipal collection point for electrical and electronic devices.

Observe local regulations.

The device can also be returned to the manufacturer instead.



The device shall not be disposed of as residual waste.

14 Technical data

14.1 Technical data

NOTICE

Risk of defects and loss of warranty when operation of the device does not comply with technical specifications

Operating the device in noncompliance with the technical specifications can cause defects and result in loss of warranty.

▶ Comply with the technical specifications.

Device	Technical data
Design	• Installation in an electrical cabinet • Snaps onto a standard top hat rail TS35 (35 mm) pursuant to EN 50022
Dimensions	Base area 90 × 75 mm Housing depth: 113 mm Depth (with terminal strips): 135 mm

Line voltage	• Connected between the neutral conductor and an outer conductor:
	110 VAC -15 %…300 VAC +10 %
	
	or
	
	• Connected between two outer conductors
	  • Through July 2024:
	  110 VAC -15 %…415 VAC +10 %
	  • Beginning August 2024:
	  110 VAC -15 %…480 VAC +10 %
	▶ The voltage between the line conductor and ground shall not be more than 300 VAC.

Power supply system	• Balanced TN or TT system with max. 480 VAC • Installation category III ▶ Operation in an IT system is permitted only in agreement with ROPEX. Consult ROPEX, e-mail info@ropex.de.
Line frequency	47…63 Hz automatic adjustment to frequencies in this range
Current consumption max. (primary current of pulse transformer)	• I_{max} = 5 A (duty cycle = 100 %) • I_{max} = 25 A (duty cycle = 20 %, cycle duration 1 min)
Supply voltage	• 24 VDC ±10 %, I_{max} = 200 mA (control mode), 1 A (switch-on current) • SELV or PELV supplied from max. 300 VAC, Cat II ▶ Connect the 24 VDC supply voltage either via the terminals 5 and 7 or via the PROFIBUS plug at pin 2 and pin 7.
Measuring range	• Secondary voltage U_R: 0.4…120 VAC • Secondary current I_R: 30…500 A (with current transformer PEX-W5) ▶ Refer to the application report.

Device	Technical data

InterfacePROFIBUS-DP	• Baud rate
	9.6 kbit/s; 19.2 kbit/s; 45.45 kbit/s; 93.75 kbit/s; 187.5 kbit/s; 500 kbit/s; 1.5 Mbit/s; 3 Mbit/s; 6 Mbit/s; 12 Mbit/s
	• I/O data length:
	  • Up to 4 bytes input data
	  • Up to 8 bytes output data
	• Freeze Mode, Sync Mode, Clear Mode, Auto Baud, configurable device parameters, Data Byte Swapping, PROFIBUS address via coding dial 1…99 or via Set Slave Address (SSA) 0…126
	• Plug according to IEC 61158

Heating element and temperature range	Temperature range can be set with: • Coding dial • PROFIBUS® interface • Visualization software The following parameters can be set: • Temperature range: 200 °C, 300 °C, 400 °C or 500 °C ▶ Refer to the application report.
Analog output (actual value) Terminals 17+18	0…10 VDC, I_{max} = 5 mA Equivalent to 0…300 °C or 0…500 °C Accuracy: ±1 % plus 50 mV
Alarm relay Terminals 12, 13, 14	U_{max} = 30 V (DC/AC), I_{max} = 1 A, changeover contact, potential-free
Power loss	max. 20 W
Ambient conditions	• Max. altitude: 2000 m • Ambient temperature: +5…+45 °C • Maximum relative humidity: 80% at temperatures up to +31 °C, decreasing linearly to 50% relative humidity at +45 °C.
Degree of protection	IP20
Protection class	Protection class I
Weight	Approx. 0.7 kg (incl. Terminal strip)
Housing material	Plastic, polycarbonate, UL-94-V0
Connecting cable (type / cross sections)	• Rigid or flexible; 0.2…2.5 mm² (AWG 24…12) plug-in terminals • Plug-in terminals: Torque: 0.5…0.6 Nm (screwdriver: SZS 0.6×3.5 mm) ▶ If ferrules are used, they must be crimped in accordance with DIN 46228 and IEC / EN 60947-1. This is essential to ensure proper electrical contact in the terminals.

14.2 Modification

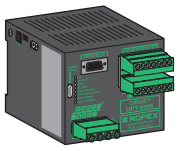
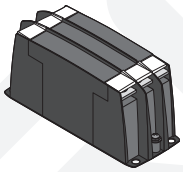
Owing to its universal design, the temperature controller is suitable for a wide range of heat-sealing applications.

There are device modifications available for special applications (MOD).

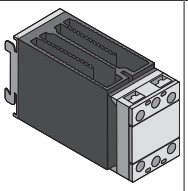
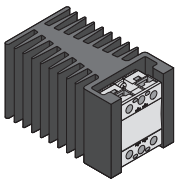
The modifications must be ordered separately.

Modification	Function	Use
MOD 01	Additional booster for low secondary voltage (U_R = 0.2…60 VAC).	Essential e.g. when using very short or low-resistance heating elements.

14.3 How to order

Illustration	Device	Article number
	Temperature controller UPT-6006	7600600
	Modification MOD … (optional) Example: MOD 01 additional booster for low voltage[25)]	800001
System components		
	Current transformer PEX-W5	885107
	Line filter LF-06480 Continuous current 6 A, 480 VAC (with UL certification)	885500
	Line filter LF-35480 Continuous current 35 A, 480 VAC	885506
	Line filter LF-10520 Continuous current 10 A, 520 VAC (with UL and CSA certification)	885504
	Line filter LF-20520 Continuous current 20 A, 520 VAC (with UL and CSA certification)	885510
	Line filter LF-30520 Continuous current 30 A, 520 VAC (with UL and CSA certification)	885511
	Line filter LF-50520 Continuous current 50 A, 520 VAC (with UL and CSA certification)	885509
	Pulse transformer • For design and order specifications, refer to the application report • Design pursuant to EN 61558 • Available with UL certifications and thermal switch, if necessary.	

25 Example for ordering a temperature controller with additional booster for low voltage: + MOD 01
The order is then: Art. no. + 800001.

Illustration	Device	Article number
	Booster B-075480 pulse loaded 75 A, 480 VAC	885306
	Booster B-100400 pulse loaded 100 A, 400 VAC	885304
	Booster B-100480 pulse loaded 100 A, 480 VAC	885307
	Lines	For design and order specifications, refer to the application report
Accessories		
	High-current rail HCB-1 • Optional for current transformer PEX, when the cable cross-section is too large	885110
	Current balance monitor CBM-2	885217
	High-current rail HCB-2 • Optional for CBM-2, when the cable cross-section is too large	885218
	Upstream transformer An upstream transformer can be individually designed and supplied upon request.	

EU Declaration of Conformity

The Manufacturer

ROPEX Industrie-Elektronik GmbH
Adolf-Heim-Str. 4
74321 Bietigheim-Bissingen
Germany

hereby declare that the following product

Designation	RESISTRON® and CIRUS® temperature controller		
Type	RES-5006 RES-5007 RES-5008 RES-5009 RES-5010 RES-5011 RES-5012 RES-5027 UPT-6006 UPT-6010 UPT-6011 UPT-6012	Article number	7500600 7500700 7500800 7500900 7501000 7501100 7501200 7502700 7600600 7601000 7601100 7601200
Operating principle	Impulse sealing of films and plastics		

is in conformity with the provisions of the following EU directives (inclusive amendments)

- 2014/30/EU Electromagnetic Compatibility Directive (EMC Directive)
- 2014/35/EU Directive on electrical equipment designed for use within certain voltage limits (Low Voltage Directive)
- 2011/65/EU Directive on the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive)

References of standards for this declaration of conformity, or parts thereof:
Harmonized standards of Europe:

- Safety
  - EN 61010-1:2010+A1:2019 / IEC 61010-1:2010+A1:2016
    Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
  - EN IEC 61010-2-030:2021 / IEC 61010-2-030:2017
    Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits
- Electromagnetic compatibility
  - EN IEC 61000-6-2:2019
    Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
    (Immunity: Severity level industrial)
  - EN IEC 61000-6-4:2019
    Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
    (Emission: Limit class A)
- Restriction of hazardous substances
  - EN IEC 63000:2018
    Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Note

This declaration of conformity certifies that the product itself complies with the above-mentioned directives.

The CE mark on the product does not relieve the machinery manufacturer of his duty to verify the conformity of the completely installed, wired and operationally ready system in the machine with the EMC directive.

Comments

RESISTRON® and CIRUS® temperature controllers with accessories are not independently operable devices. They are used by the machinery manufacturer to form a sealing system by adding EMC-relevant components such as filters, transformers, heatsealing bands and wiring. The final configuration may vary significantly in terms of performance and physical dimensions.

All information provided by us in connection with the line filter is merely intended as a guide and is based on a typical system setup. It serves to demonstrate that compliance with the EMC directive can be achieved by using a line filter that is suitable for the overall system.

The line filter and current transformer must, however, be determined on the basis of the respective application.

We also wish to point out that the transformer which is used must be designed in accordance with VDE 0551/ EN 61558 or UL 5085 for safety reasons.

Bietigheim-Bissingen, March 1, 2024

i.V.

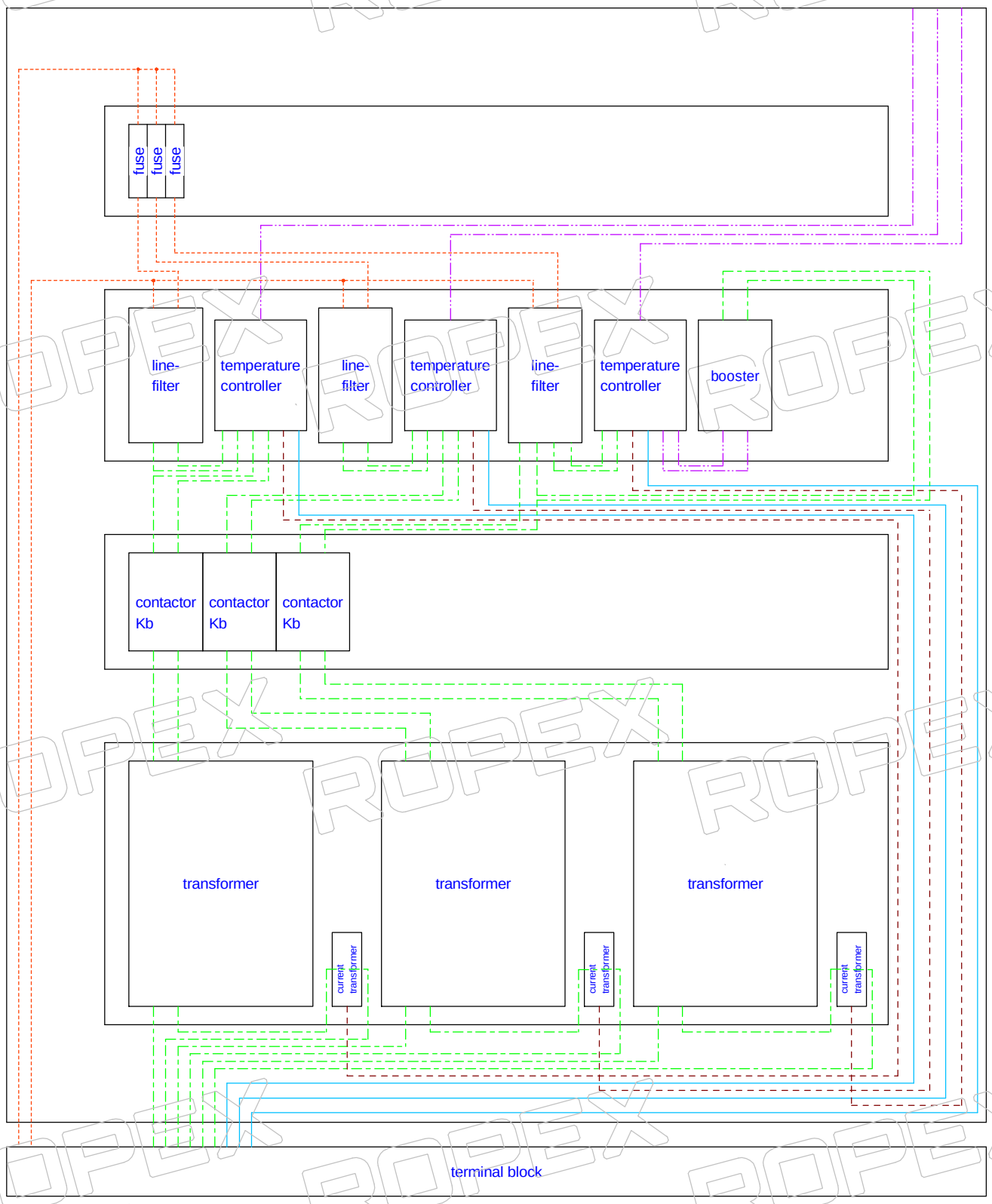
Uwe Dietrich | Director Research & Development

16 Appendix

The following pages show examples for the arrangement and wiring of the system components in the electrical cabinet as well as examples comparing the right way and wrong way to wire the devices.

Arrangement and wiring inside the cabinet

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legend:
- not filtered
- filtered
- IR measurement
- UR measurement
- control wires to PLC

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16.2 Examples of electrical connections

Connection to one heating element

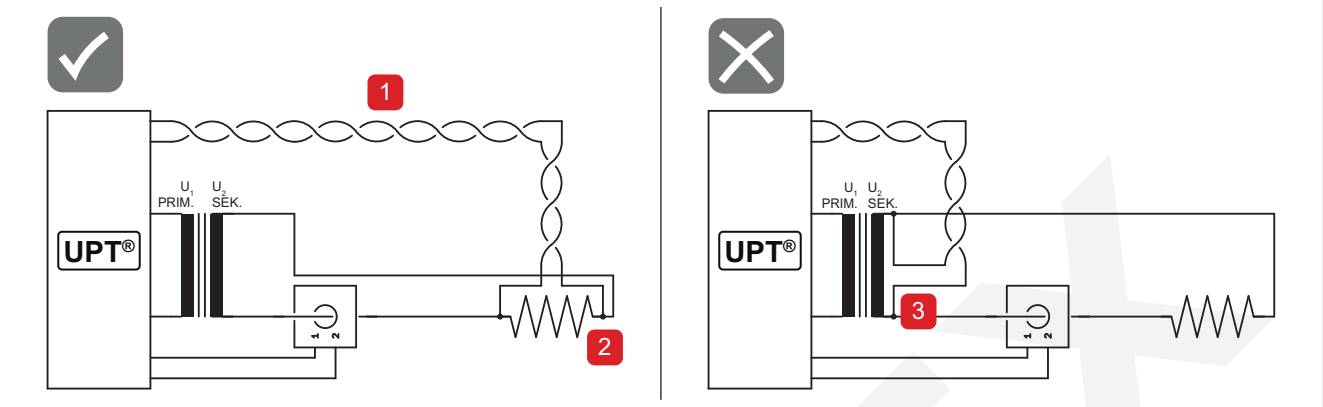


Illustration 22: Component wiring, example 1

Example 1

- ▶ Connect the measurement cable (1) directly to the heating element. Background information: To prevent measurement errors caused by unintentionally measuring the line resistances, do not connect to the pulse transformer (3).
- ▶ Lay the lines going in opposite directions close together.

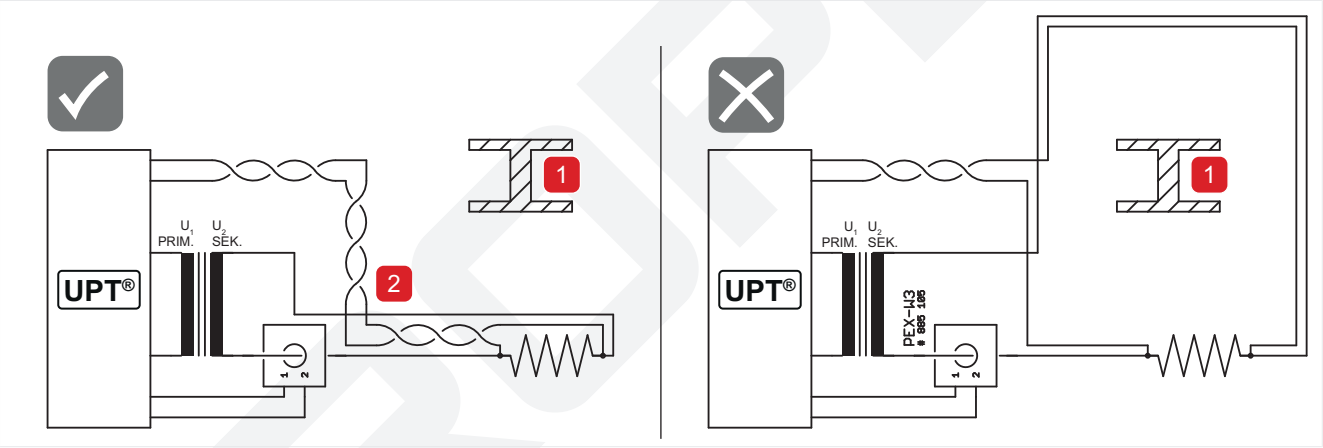


Illustration 23: Component wiring, example 2

Example 2

- ▶ When objects have to be circumvented, especially iron or steel parts such as I-beams (1), lay the lines going in opposite directions on the same side whenever possible.
- ▶ Laying measuring cable (2) as twisted pair.

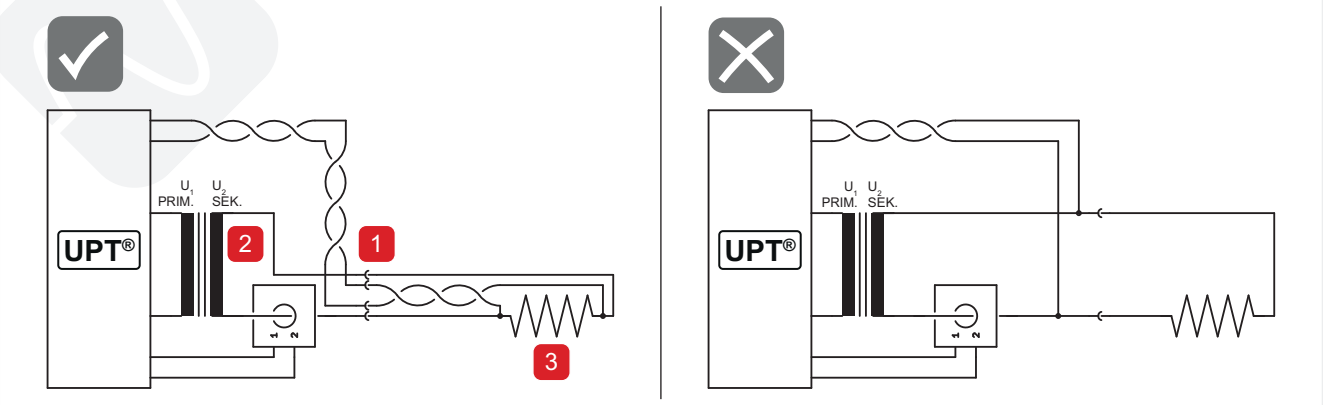


Illustration 24: Component wiring, example 3

Example 3 If plug connectors or clamping points (1) have to be installed between the pulse transformer (2) and the heating element, the measurement cable has to be connected with its own clamping points. This prevents measurement errors caused by low contact resistances in the clamping points.

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