

SIEMENS



Industrial Controls

Monitoring and Control Devices
3RS1 / 3RS2 Temperature Monitoring Relays

Manual

Edition

06/2013

Answers for industry.

Industrial Controls

Monitoring and control devices 3RS1 / 3RS2 temperature monitoring relays

Manual

| | |
|---|----------|
| <u>Introduction</u> | 1 |
| <u>Safety information</u> | 2 |
| <u>System overview</u> | 3 |
| <u>Temperature monitoring relays for analog setting</u> | 4 |
| <u>Temperature monitoring relays with digital setting</u> | 5 |
| <u>Accessories</u> | 6 |
| <u>References</u> | A |
| <u>Parameters</u> | B |
| <u>Dimension Drawings</u> | C |
| <u>Characteristic curves</u> | D |
| <u>Correction sheet</u> | E |

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

| |
|--|
| ⚠ DANGER |
| indicates that death or severe personal injury will result if proper precautions are not taken. |
| ⚠ WARNING |
| indicates that death or severe personal injury may result if proper precautions are not taken. |
| ⚠ CAUTION |
| indicates that minor personal injury can result if proper precautions are not taken. |
| NOTICE |
| indicates that property damage can result if proper precautions are not taken. |

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

| |
|--|
| ⚠ WARNING |
| Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed. |

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Table of contents

| | | |
|----------|---|-----------|
| 1 | Introduction | 7 |
| 2 | Safety information | 9 |
| 2.1 | Standards..... | 9 |
| 2.2 | Product-specific safety information..... | 10 |
| 2.3 | Approvals, test certificates, characteristics..... | 11 |
| 3 | System overview | 13 |
| 3.1 | Product description..... | 13 |
| 3.2 | Connection systems..... | 14 |
| 3.2.1 | Screw-type connection..... | 14 |
| 3.2.2 | Spring-loaded connection..... | 15 |
| 3.2.3 | Device replacement by means of removable terminals..... | 18 |
| 3.3 | Assembly..... | 19 |
| 3.4 | Connecting up..... | 21 |
| 3.4.1 | Connecting thermocouples..... | 21 |
| 3.4.2 | Connecting resistance sensors..... | 22 |
| 3.5 | Application planning..... | 24 |
| 3.6 | Overview of the functions..... | 25 |
| 4 | Temperature monitoring relays for analog setting | 27 |
| 4.1 | Applications..... | 27 |
| 4.2 | Versions..... | 28 |
| 4.3 | Operator controls and connection terminals..... | 29 |
| 4.4 | Function..... | 33 |
| 4.5 | Operation..... | 35 |
| 4.6 | Diagnostics..... | 36 |
| 4.6.1 | Diagnostics with LED..... | 36 |
| 4.6.2 | RESET following a fault..... | 37 |
| 4.7 | Circuit diagrams..... | 37 |
| 4.8 | Technical data..... | 39 |
| 4.8.1 | 3RS10 temperature monitoring relay..... | 39 |
| 4.8.2 | 3RS11 temperature monitoring relays..... | 41 |
| 5 | Temperature monitoring relays with digital setting | 43 |
| 5.1 | Applications..... | 43 |
| 5.2 | Versions..... | 44 |
| 5.3 | Operator controls and connection terminals..... | 45 |

| | | |
|----------|---|-----------|
| 5.4 | Function..... | 48 |
| 5.5 | Operation..... | 55 |
| 5.6 | Diagnostics..... | 59 |
| 5.6.1 | Diagnostics with LED | 59 |
| 5.6.2 | Indications on the display..... | 60 |
| 5.6.3 | Operating display and status display | 61 |
| 5.6.4 | RESET following a fault | 62 |
| 5.7 | Circuit diagrams | 63 |
| 5.8 | Measuring ranges | 65 |
| 5.9 | Technical data..... | 66 |
| 5.9.1 | 3RS104. temperature monitoring relays | 66 |
| 5.9.2 | Temperature monitoring relays 3RS114..... | 68 |
| 5.9.3 | 3RS2.4. temperature monitoring relays | 70 |
| 6 | Accessories | 73 |
| 6.1 | Sealable cover | 73 |
| 6.2 | Push-in lugs | 74 |
| A | References | 75 |
| B | Parameters | 77 |
| C | Dimension Drawings..... | 83 |
| D | Characteristic curves | 87 |
| E | Correction sheet | 89 |
| | Index..... | 91 |

Introduction

Purpose of the manual

This manual describes the 3RS1 / 3RS2 temperature monitoring relays. The manual provides overview information for integrating the temperature monitoring relays into the system environment, and it describes the hardware components and software components of the temperature monitoring relays.

You can use the information in this manual to commission the temperature monitoring relays.

Required basic knowledge

To understand these operating instructions you should have a general knowledge of automation engineering and low-voltage switchgear.

Scope of the manual

The manual is valid for these monitoring relays. It contains a description of the devices that is valid at the time of publication.

Further documentation

To install and connect the monitoring relays, you require the operating instructions of the monitoring relays used.

The Appendix "References (Page 75)" has a list of the operating instructions.

Recycling and disposal

These devices can be recycled thanks to their low pollutant content. For environmentally-friendly recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Up-to-the-minute information

You can obtain further assistance by calling the following numbers:

Technical Assistance:

Telephone: +49 (0) 911-895-5900 (8 a.m. to 5 p.m. CET)

Fax: +49 (0) 911-895-5907

or on the Internet at:

E-mail: (<mailto:technical-assistance@siemens.com>)

Internet: (www.siemens.com/industrial-controls/technical-assistance)

Correction sheet

A correction sheet is included at the end of the manual. Please use it to record your suggestions for improvements, additions and corrections, and return the sheet to us. This will help us to improve the next edition of the manual.

Safety information

2.1 Standards

Applicable standards

The temperature monitoring relays meet the requirements of the following standards:

Table 2- 1 Standards - monitoring relays

| | |
|--------------------------------|--|
| Device standards | <ul style="list-style-type: none"> • IEC / EN 60947-1 "Low-voltage switchgear and controlgear: General rules" • IEC / EN 60947-5-1 "Control circuit devices and switching elements: Electromechanical control circuit devices"; VDE 0660 "Low-voltage switchgear" • DIN EN 50042 "Terminal marking" |
| EMC standard ¹⁾ | <ul style="list-style-type: none"> • IEC / EN 61000-6-2 "Generic standards - Immunity for industrial environments" • IEC / EN 61000-6-4 "Generic standards - Emission standard for industrial environments" |
| Resistance to extreme climates | <ul style="list-style-type: none"> • IEC 60721-3-3 "Classification of environmental conditions" <p>The monitoring relays are climate-proof according to IEC 60721-3.</p> |
| Touch protection | <ul style="list-style-type: none"> • IEC / EN 60529 "Degrees of protection provided by enclosures" <p>Monitoring relays are safe to touch in accordance with IEC / EN 60529.</p> |


¹⁾ This is a device of Class A. When used in domestic areas, the device can cause radio interference. Users may have to take suitable measures.

Reference


SIRIUS components have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals appears in Chapter 10 of the Catalog IC 10 - SIRIUS "Industrial Controls" (www.siemens.com/industrial-controls/catalogs), and more information, as well as an option to download certificates, can be obtained on the Internet (www.siemens.com/automation/csi_en).

2.2 Product-specific safety information

Hazardous Voltage

| |
|--|
|  WARNING |
| Hazardous Voltage. Will cause death or serious injury. Turn off and lock out all power supplying this device before working on this device. |

Intended use

| |
|---|
|  WARNING |
| Intended use Can Cause Death, Serious Injury, or Property Damage. The devices may only be used for the applications described in the catalog and the technical description, and only in conjunction with equipment or components from other manufacturers which have been approved or recommended by Siemens. This product can function correctly and reliably only if it is transported, stored, assembled, and installed correctly, and operated and maintained as recommended. Before you run any sample programs or programs that you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself. |

Radio interference

Note

The devices have been built as Class A devices.
Use of these devices in domestic areas can result in radio interference!

2.3 Approvals, test certificates, characteristics

Approvals, test certificates, characteristics

You can find an overview of the certifications available for low-voltage controls and distribution products and other technical documentation, updated daily, on the Internet (www.siemens.com/industrial-controls/support).

You will find further information in the Catalog IC 10 - SIRIUS "Industrial Controls," Chapter 10 (www.siemens.com/industrial-controls/catalogs).

System overview

3.1 Product description

Product description

The temperature monitoring relays are used for measuring temperatures in solid, liquid, and gaseous media. The temperature is sensed by the sensors in the medium and evaluated by the device. It is monitored for overshoot, undershoot or, on digital device versions, remaining within a working range (range function).

The family comprises the following devices:

- Devices for analog setting, with one or two limit values
- Digital devices for 1 sensor (e.g. alternative to temperature controllers for low-end applications)
- Digital devices for up to 3 sensors (optimized for monitoring large motors)

The functions of the 3RS1 / 3RS2 digital and analog temperature monitoring relays are shown in Chapter "Overview of the functions (Page 25)."

3.2 Connection systems

3.2.1 Screw-type connection


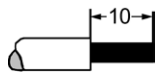
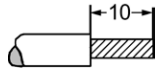
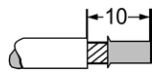
Screw-type connection

Use the following tool to establish the connection: All SIRIUS monitoring relays feature size PZ 2 screws for Pozidriv screwdrivers.

The devices have screw terminals with captive screws and washers. The screw terminals also allow for the connection of 2 conductors with different cross-sections.

Connection cross-sections of the removable terminal blocks with screw-type connections

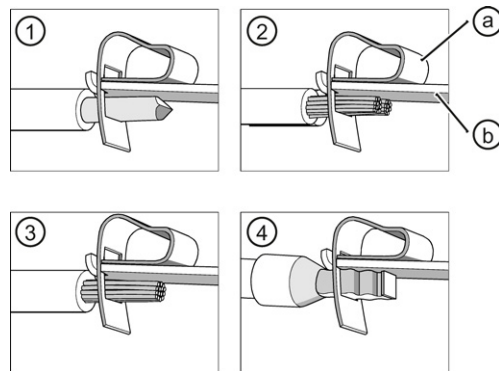
Table 3- 1 Removable terminal block with screw-type connections - monitoring relays

| | | Removable terminal |
|------------------------------------|---|----------------------------------|
| Tool |  | Pozidriv size PZ 2, Ø 5 to 6 mm |
| Tightening torque | | 0.8 to 1.2 Nm |
| Solid and stranded |  | 1 x (0.5 to 4) mm ² |
| | | 2 x (0.5 to 2.5) mm ² |
| Finely stranded without end sleeve |  | --- |
| Finely stranded with end sleeve |  | 1 x (0.5 to 2.5) mm ² |
| | | 2 x (0.5 to 1.5) mm ² |
| AWG | | 2 x (20 to 14) |

3.2.2 Spring-loaded connection

Spring-loaded connection

Without exception, all SIRIUS monitoring relays have spring-loaded connections. They make wiring quick and maintenance-free, while also meeting high demands in terms of vibration and shock resistance.



- ① Solid
- ② Finely stranded
- ③ Stranded
- ④ Finely stranded with end sleeve
- a Spring-loaded terminal
- b Busbar

Figure 3-1 Spring-loaded terminal

The conductors can be clamped directly or you can pre-treat them to add a form of splice protection. This could involve attaching end sleeves or pin cable lugs to the ends of the conductors; the tidiest solution is to use conductors whose ends have been sealed by means of ultrasound.

The devices are equipped with a two-wire connection, i.e. two independent connections per current path. Just one conductor is connected to each clamping point. The spring-loaded terminal presses the conductor against the busbar, which curves around inside the terminal. The high contact pressure per unit area achieved in this way is gas-tight. The spring-loaded terminal presses flat against the conductor, but does not damage it. The spring force of the spring-loaded terminal has been dimensioned such that the clamping force adjusts to the conductor diameter automatically. This ensures that any conductor deformation caused by settling, creepage, or yielding is compensated for. The clamping point cannot become loose of its own accord. This connection is vibration- and shock-proof. Vibrations or shocks will not damage the conductor, nor will they cause contact separation. These terminals are particularly well suited for use with machines and systems which are subject to stresses such as these, e.g. vibrators, rail vehicles, and elevators.

The contact pressure between the conductor and the busbar is set to an optimum level, so this clamp connection is appropriate for high-voltage applications, as well as for transferring voltages and currents in the mV or mA range within instrumentation and electronic components.

Catalog IC10 "Industrial Controls" (www.siemens.com/industrial-controls/catalogs) offers a standard screwdriver (3 mm slot) that can be used as the operating tool for opening the spring-loaded connections.


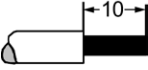
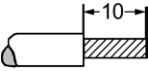
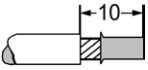
Spring-loaded terminal for 3RS monitoring relay

Table 3-2 Connecting the monitoring relay spring-loaded terminal

| Step | Operating instruction | Image |
|------|---|-------|
| 1 | Insert the screwdriver into the topmost (A) or bottommost (B) operating slot on the right-hand side. | |
| 2 | Press the screwdriver up (A) or down (B), then push it into the operating slot as far as it will go. The screwdriver blade keeps the spring-loaded terminal open automatically. | |
| 3 | Insert the conductor into the oval connection slot. | |
| 4 | Remove the screwdriver. The terminal closes and the conductor is now securely clamped. | |

Connection cross-sections of the removable terminal blocks with spring-loaded connections

Table 3- 3 Removable terminal block with spring-loaded connections - monitoring relays

| | | Removable terminal |
|------------------------------------|---|-----------------------------------|
| Tool |  | Ø3.0 x 0.5 (3RA2908-1A) |
| Solid and stranded |  | 2 x (0.25 to 1.5) mm ² |
| Finely stranded without end sleeve |  | 2 x (0.25 to 1.5) mm ² |
| Finely stranded with end sleeve |  | 2 x (0.25 to 1.5) mm ² |
| AWG | | 2 x (24 to 16) |

3.2.3 Device replacement by means of removable terminals



⚠ DANGER
Hazardous Voltage
 Will cause death or serious injury.
 Turn off and lock out power before working on this equipment.

The removable terminals of the monitoring relays facilitate device replacement when necessary. The mechanical coding on the terminals prevents mix-ups.

Note

The terminals can only be dismantled in the following order due to their arrangement on the monitoring relay:

1. Lower, front terminal (A)
2. Lower, rear terminal (B)
3. Upper, front terminal (C)
4. Upper, rear terminal (D)

| Step | Operating instruction | Figure |
|-------|---|--------|
| 1 | Press the interlock in the direction of the removable terminal. | |
| 2 | Remove the terminal to the front. | |
| 3 / 4 | Attach the new terminal and press the terminal into the device until the interlock audibly engages. | |

Note

The procedure is similar on devices with fewer connection terminals.

3.3 Assembly

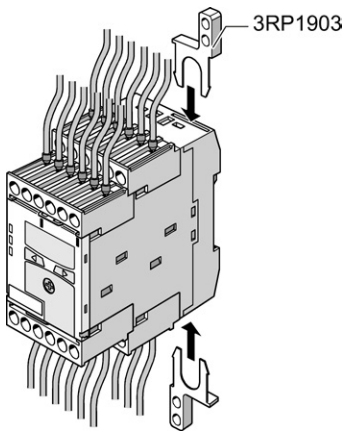
Mounting position

It can be mounted in any position.

Screw mounting

The figure below shows the screw mounting using the example of a digital temperature monitoring relay.

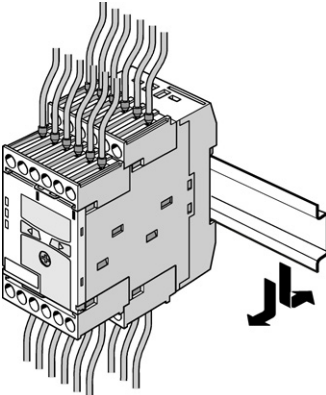
Table 3- 4 Installation of the temperature monitoring relay (screw mounting)

| Step | Instructions | Figure |
|------|---|--|
| 1 | Slide the push-in lugs into the openings on the monitoring relay at the top and bottom, and use the screwdriver to secure the device by screwing suitable screws through the holes in the push-in lugs. |  The diagram illustrates the screw mounting process for a temperature monitoring relay. It shows a perspective view of the relay with several wires connected to its top and bottom terminals. Two metal push-in lugs are shown being inserted into the top and bottom of the relay. A screwdriver is shown driving a screw through the hole in the top lug to secure it. A label '3RP1903' points to the top lug. The bottom lug is also shown being secured with a screw. |

Standard rail mounting:

The figure below shows rail mounting using the example of a temperature monitoring relay for digital setting.

Table 3- 5 Mounting the temperature monitoring relay (mounting on and removing from standard rail)

| Step | Instructions | Figure |
|------|---|--|
| 1 | Position the device on the top edge of the mounting rail and press it down until it snaps onto the bottom edge of the rail. To disassemble the device, press it down, pushing against the mounting springs, and swivel the device to remove it |  |

3.4 Connecting up

3.4.1 Connecting thermocouples

A thermocouple is a sensor for electrical temperature monitoring. It is made from 2 different interconnected metals. A difference in temperature between the points where the two metals come into contact (measuring junction) and the evaluation unit produces a thermal e.m.f. that is directly dependent on this difference (Seebeck effect). As well as the difference in temperature, the types of metal used also determine the thermal e.m.f. Different types of metal can be combined to create thermocouples with different measuring ranges.

A typical example is the type K thermocouple, which is made from a nickel/chrome wire and a nickel/aluminum wire. The thermal e.m.f. is approx. 4 mV/100 K.

The main advantage of thermocouples is the wide temperature range they are able to cover.

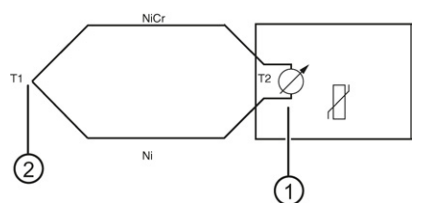
Characteristic curves for thermocouples are shown in the chapter titled "Characteristic curves (Page 87)".

The thermoelectric effect is used to measure a temperature difference between the measuring junction and the evaluation unit.

The absolute temperature is, therefore, calculated from the ambient temperature of the evaluation unit and the temperature difference measured by the thermocouple.

This principle assumes that the evaluation unit knows the temperature at the terminal point T2. For this purpose the 3RS11 / 3RS21 temperature monitoring relays feature built-in reference junction compensation to identify this reference temperature for inclusion in the result of the measurement. The thermal sensors and cables must be isolated in order to avoid distorting the measurement.

Only compensating lines that are made from the same material as the thermocouple itself may be used to extend the connection cable. Using a different type of conductor will distort the measurement.



- ① Internal reference compensation
- ② Measuring point

Figure 3-2 Connection of thermocouple, 3RS11/3RS21

You can find more information on the Internet at Temperature sensors (<http://www.automation.siemens.com/w1/automation-technology-temperature-sensors-18625.htm>) and EPHY-MESS GmbH (<http://www.ephy-mess.de/>)

3.4.2 Connecting resistance sensors

A resistance sensor is an electrical component which uses the temperature dependency of the electrical resistance of a conductor to measure temperature.

Different types of resistance sensor are available: PTC (positive temperature coefficient) and NTC (negative temperature coefficient).

PTC thermistors (e.g. PT100/PT1000 or KTY83/KTY84) are most commonly used in industrial temperature measurement applications.

The characteristic curve of KTY type resistance sensors is considerably less linear than that of PT sensors. However, it exhibits a change in resistance in the event of temperature fluctuations that is approximately twice as high. KTY type temperature sensors are, therefore, highly sensitive but have a relatively small temperature measuring range.

Characteristic curves for resistance sensors are shown in the chapter titled "Characteristic curves (Page 87)".

Two-wire measurement

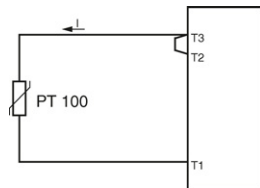


Figure 3-3 Two-wire measurement

Note

When using two-wire temperature sensors, a jumper must be connected between terminals T2 and T3. The sensor resistance and the cable resistance are added together in the case of two-wire temperature sensors. The resulting systematic error must be taken into account when the evaluation unit is calibrated.

The error generated by the cable amounts to approx. 2.5 K/Ω. If the resistance of the cable is not known and cannot be measured, the cable errors can also be estimated using the following table.

Temperature drift dependent on cable length and cross-section with PT100 type sensor and 20 °C ambient temperature, in K:

| Cable length in m | Cross-section in mm | | | |
|-------------------|---------------------|------|------|------|
| | 0.5 | 0.75 | 1 | 1.5 |
| 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 1.8 | 1.2 | 0.9 | 0.6 |
| 25 | 4.5 | 3.0 | 2.3 | 1.5 |
| 50 | 9.0 | 6.0 | 4.5 | 3.0 |
| 75 | 13.6 | 9.0 | 6.8 | 4.5 |
| 100 | 18.1 | 12.1 | 9.0 | 6.0 |
| 200 | 36.3 | 24.2 | 18.1 | 12.1 |
| 300 | 91.6 | 60.8 | 45.5 | 30.2 |

Three-wire measurement

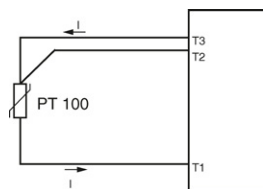


Figure 3-4 Three-wire measurement

To minimize the effects of cable resistances, a three-wire circuit is usually used. The additional cable means that two measuring circuits can be formed, one of which is used for reference (wheatstone bridge). The processing unit can then automatically calculate the cable resistance and take it into account.

3.5 Application planning

The temperature monitoring relays are suitable for use in the following areas, for example:

- Cold climate technology
- Ambient temperatures
- Boiler systems
- Solid bodies (e.g. foil welding jaws)
- Exhaust temperatures
- Enameled ceramic tempering furnaces
- Furnace vault monitoring

The following information must be taken into account when planning applications involving the SIRIUS monitoring relays.

Installation altitude

The monitoring relays are approved for installation altitudes up to 2,000 m. The reduced air density at altitudes higher than 2,000 meters affects the electrical characteristics of the monitoring relays. The reduction factors which have to be taken into account when using monitoring relays at altitudes higher than 2,000 m can be obtained on request on the Internet (www.siemens.com/automation/csi_en).

Operating conditions and resistance to extreme climates

The monitoring relays are climate-proof. They are intended for use in enclosed spaces in which no severe operating conditions prevail (e.g. dust, caustic vapors, hazardous gases). Appropriate measures must be taken when installing in areas subject to dust and humidity. Condensation on the devices is not permissible.

Special application environments

The SIRIUS devices have been approved by a whole range of bodies for various sectors (shipbuilding, etc.). An up-to-date list of approvals is provided in Chapter 10 of the Catalog IC 10 - SIRIUS "Industrial Controls." You will find more information and an option to download certificates on the Internet (www.siemens.com/automation/csi_en).

3.6 Overview of the functions

Function

Table 3- 6 Functions of the 3RS1 / 3RS2 temperature monitoring relays

| Function | Temperature monitoring relays | | | | | | | | | | | | | | | |
|--|-------------------------------|----|----|----|----|----|----|---------------------|----|-------|----|----|----|----|----|---------------------|
| | 3RS10 | | | | | | | 3RS20 ²⁾ | | 3RS11 | | | | | | 3RS21 ²⁾ |
| | 00 | 10 | 20 | 30 | 40 | 41 | 42 | 40 | 41 | 00 | 01 | 20 | 21 | 40 | 42 | 40 |
| Settings | a | a | a | a | d | d | d | d | d | a | a | a | a | d | d | d |
| Connectable sensor type | | | | | | | | | | | | | | | | |
| Resistance sensors | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | -- | -- | -- | -- | -- | -- | -- |
| Thermocouple | -- | -- | -- | -- | -- | -- | -- | -- | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Number of sensors that can be monitored | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Temperature monitoring | | | | | | | | | | | | | | | | |
| Temperature monitoring for overshoot | ✓ | -- | ✓ | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Temperature monitoring for undershoot | -- | ✓ | -- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | -- | -- | -- | -- | ✓ | ✓ | ✓ |
| Number of limit values that can be set ¹⁾ | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |

1) The device versions with two limit values can be switched between the open-circuit principle NO and the closed-circuit principle NC.

2) Temperature scale of the sensors in degrees Fahrenheit [°F].

✓: Function available

--: Function not available

a : Analog setting

d: Digital setting

Temperature monitoring relays for analog setting

4.1 Applications

The 3RS10/3RS11 temperature monitoring relays for analog setting can be used in almost any application in which limit temperatures must not be overshoot or undershot, e.g. for shutdown on violation of set limit temperatures or for output of alarm signals. The devices are used in the following applications and more:

Table 4- 1 Applications of 3RS10/3RS11 temperature monitoring relays for analog setting

| Function | Application |
|--|---|
| <ul style="list-style-type: none"> • Motor protection and plant protection • Temperature monitoring in control cabinets • Frost monitoring • Temperature limits for process variables • Control of plants and machinery • Motor monitoring • Monitoring bearings • Gear oil monitoring • Monitoring of coolants | <ul style="list-style-type: none"> • Packaging industry • Electroplating • Air conditioning systems • Ventilation systems • Solar collectors • Heat pumps • Hot water supplies |

4.2 Versions

Connection systems

The monitoring relays are available with the following connection system options:

- Screw-type connection system
- Spring-loaded connection system

Types of sensor

The temperature monitoring relays for analog setting support the connection of the following types of sensor, depending on the version:

Resistance sensors:

- PT100 (monitoring for overshoot and undershoot)

Thermocouples:

- Type J (monitoring for overshoot)
- Type J (monitoring for overshoot)

Limit values that can be set

The temperature monitoring relays for analog setting are alternately available for monitoring:

- one limit value
- two limit values

Chapter "Overview of the functions (Page 25)" shows the different device variants and their functions.

4.3 Operator controls and connection terminals

Front view / terminal assignment (for thermocouples and with one settable limit value)

| Front view | Description |
|---------------------------------|---|
| | Position digits |
| | ① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. |
| | ② Rotary button for setting: Limit value for overshoot / undershoot ϑ_1 |
| | ③ Rotary button for setting of the hysteresis for limit value ϑ_1 |
| | ④ Symbol of the temperature sensor |
| | ⑤ Device order number |
| | ⑥ Label |
| | ⑦ Status display: LED contact symbol (ready for operation) and LED for limit value ϑ_1 |
| | Terminal labels |
| | A1+ Rated control supply voltage ~ / + |
| | A2- Rated control supply voltage ~ / - |
| | T+, T- Sensor connection for thermocouple |
| | 11NC Output relay K1 NC contact |
| | 12NC Output relay K1 NC contact |
| 13NO Output relay K1 NO contact | |
| 14NO Output relay K1 NO contact | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 37)."

Front view / terminal assignment (for thermocouples and with two settable limit values)

| Front view | Description |
|-------------------------------------|--|
| | Position digits |
| | ① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. |
| | ② Rotary button for setting the relay switching response |
| | ③ Rotary button for setting: Limit value for overshoot / undershoot ϑ_1 |
| | ④ Rotary button for setting of the hysteresis for limit value ϑ_1 |
| | ⑤ Rotary button for setting: Limit value for overshoot / undershoot ϑ_2 |
| | ⑥ Device order number |
| | ⑦ Label |
| | ⑧ Status display: LED contact symbol (ready for operation) and LEDs for limit values ϑ_1 and ϑ_2 |
| | Terminal labels |
| | A1+ Rated control supply voltage ~ / + |
| | A2- Rated control supply voltage ~ / - |
| | A3 Rated control supply voltage ~ |
| | T+, T- Sensor connection for thermocouple |
| | 14NO Output relay K1 NO contact |
| 11C Output relay K1 CO contact root | |
| 12NC Output relay K1 NC contact | |
| 23NO Output relay K2 NO contact | |
| 24NO Output relay K2 NO contact | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 37)."

Front view / terminal assignment (with resistance sensors and with one settable limit value)

| Front view | Description | |
|------------|---|---|
| | Position digits | |
| | ① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. | |
| | ② Rotary button for setting: Limit value for overshoot / undershoot ϑ_1 | |
| | ③ Rotary button for setting of the hysteresis for limit value ϑ_1 | |
| | ④ Symbol of the temperature sensor | |
| | ⑤ Device order number | |
| | ⑥ Label | |
| | ⑦ Status display: LED contact symbol (ready for operation) and LEDs for limit value ϑ_1 | |
| | Terminal labels | |
| | A1+ | Rated control supply voltage ~ / + |
| | A2- | Rated control supply voltage ~ / - |
| | A3 | Rated control supply voltage ~ |
| | T1, T2, T3 | Sensor connection for resistance sensor |
| | 11NC | Output relay K1 NC contact |
| 12NC | Output relay K1 NC contact | |
| 13NO | Output relay K1 NO contact | |
| 14NO | Output relay K1 NO contact | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 37)."

Front view / terminal assignment (for resistance sensors and with two settable limit values)

| Front view | Description | | | | | | | | | | | | | | | | | | |
|------------|---|---|------------------------------------|-----|------------------------------------|----|--------------------------------|------------|---|------|----------------------------|-----|---------------------------------|------|----------------------------|------|----------------------------|------|----------------------------|
| | <p>Position digits</p> <p>① Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals.</p> <p>② Rotary button for setting the relay switching response</p> <p>③ Rotary button for setting: Limit value for overshoot / undershoot ϑ_1</p> <p>④ Rotary button for setting of the hysteresis for limit value ϑ_1</p> <p>⑤ Rotary button for setting: Limit value for overshoot / undershoot ϑ_2</p> <p>⑥ Device order number</p> <p>⑦ Label</p> <p>⑧ Status display: LED contact symbol (ready for operation) and LEDs for limit values ϑ_1 and ϑ_2</p> <p>Terminal labels</p> <table border="1"> <tr> <td>A1+</td> <td>Rated control supply voltage ~ / +</td> </tr> <tr> <td>A2-</td> <td>Rated control supply voltage ~ / -</td> </tr> <tr> <td>A3</td> <td>Rated control supply voltage ~</td> </tr> <tr> <td>T1, T2, T3</td> <td>Sensor connection for resistance sensor</td> </tr> <tr> <td>14NO</td> <td>Output relay K1 NO contact</td> </tr> <tr> <td>11C</td> <td>Output relay K1 CO contact root</td> </tr> <tr> <td>12NC</td> <td>Output relay K1 NC contact</td> </tr> <tr> <td>23NO</td> <td>Output relay K2 NO contact</td> </tr> <tr> <td>24NO</td> <td>Output relay K2 NO contact</td> </tr> </table> | A1+ | Rated control supply voltage ~ / + | A2- | Rated control supply voltage ~ / - | A3 | Rated control supply voltage ~ | T1, T2, T3 | Sensor connection for resistance sensor | 14NO | Output relay K1 NO contact | 11C | Output relay K1 CO contact root | 12NC | Output relay K1 NC contact | 23NO | Output relay K2 NO contact | 24NO | Output relay K2 NO contact |
| | A1+ | Rated control supply voltage ~ / + | | | | | | | | | | | | | | | | | |
| | A2- | Rated control supply voltage ~ / - | | | | | | | | | | | | | | | | | |
| | A3 | Rated control supply voltage ~ | | | | | | | | | | | | | | | | | |
| | T1, T2, T3 | Sensor connection for resistance sensor | | | | | | | | | | | | | | | | | |
| | 14NO | Output relay K1 NO contact | | | | | | | | | | | | | | | | | |
| | 11C | Output relay K1 CO contact root | | | | | | | | | | | | | | | | | |
| | 12NC | Output relay K1 NC contact | | | | | | | | | | | | | | | | | |
| | 23NO | Output relay K2 NO contact | | | | | | | | | | | | | | | | | |
| | 24NO | Output relay K2 NO contact | | | | | | | | | | | | | | | | | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 37)."

4.4 Function

General functionality

The temperature monitoring relays for analog setting detect the temperature using the sensors in the medium, evaluate them, and monitor the temperature for overshoot or undershoot. The output relay opens or closes at the limit values as set in the parameterization.

The device versions with one settable limit value work on the closed-circuit current principle.

The versions with two settable limit values can switch between the open-circuit principle and the closed-circuit principle.

As parameters, the temperature limit values and the hysteresis can be set.

The temperature monitoring relays are powered with a rated control supply voltage of 24 V AC / DC, 24 to 240 V AC / DC or 110 V / 230 V AC via terminals A1+ / A2- / A3, depending on the version.

You will find the setting ranges and factory settings of the available parameters in Chapter "Operation (Page 35)."

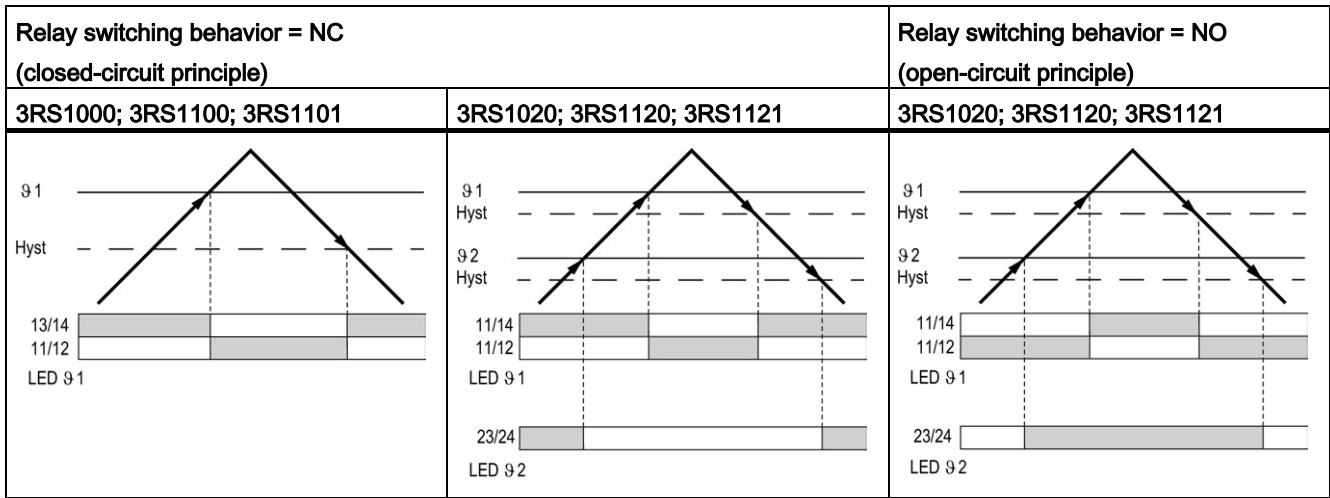
You will find a description of each parameter in Chapter "Parameters (Page 77)."

Monitoring

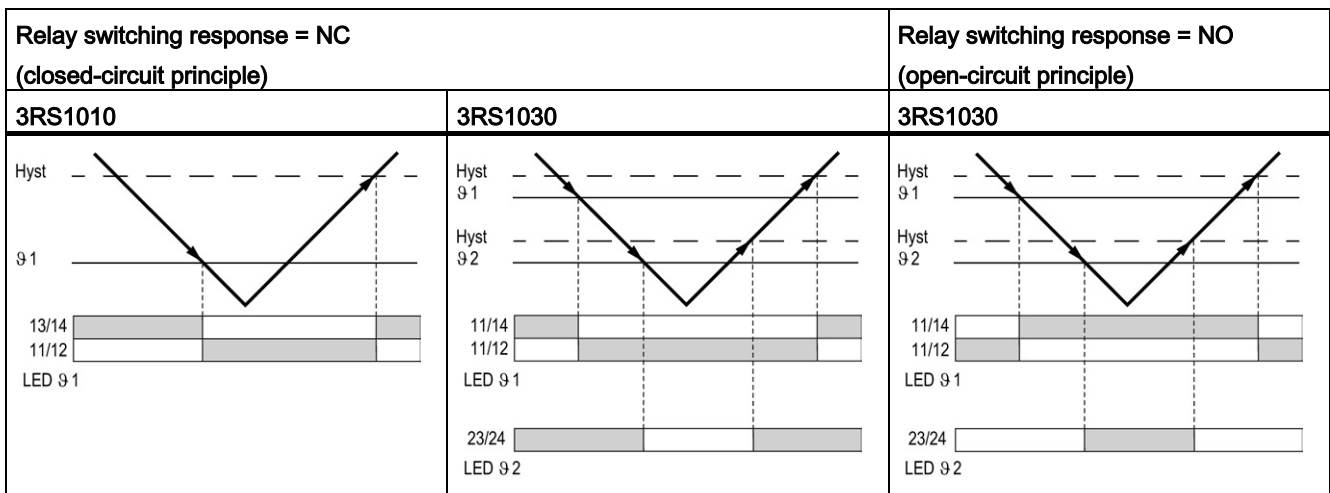
If the temperature reaches the set limit ϑ_1 , the output relay K1 will change its switching state (output relay K2 responds in the same way to ϑ_2). The delay time for temperature monitoring relays with analog setting is 0 s. The output relays revert to their original state as soon as the temperature reaches the set hysteresis value.

4.4 Function

Function charts (temperature monitoring mode: overshoot)



Function charts (temperature monitoring mode: undershoot)



4.5 Operation

Parameters

The following parameters can be set by operating the relevant rotary button with a screwdriver:

Table 4- 2 Parameter information, 3RS1 temperature monitoring relays with analog setting

| Parameters | Operating elements ¹⁾ | Order number | Setting range | | Increment | Factory setting |
|--|-----------------------------------|---------------|---------------|---------------|------------|-----------------|
| | | | Minimum value | Maximum value | | |
| Limit value for overshoot (ϑ1) | 3 ⁵⁾ / 2 ⁴⁾ | 3RS1...-...0. | -50 °C | 50 °C | Continuous | Minimum value |
| | | 3RS1...-...1. | 0 °C | 100 °C | | |
| | | 3RS1...-...2. | 0 °C | 200 °C | | |
| | | 3RS1...-...3. | 0 °C | 600 °C | | |
| | | 3RS1...-...4. | 500 °C | 1000 °C | | |
| Limit value for undershoot (ϑ2) | 5 ⁵⁾ | 3RS1...-...0. | -50 °C | 50 °C | Continuous | Minimum value |
| | | 3RS1...-...1. | 0 °C | 100 °C | | |
| | | 3RS1...-...2. | 0 °C | 200 °C | | |
| | | 3RS1...-...3. | 0 °C | 600 °C | | |
| | | 3RS1...-...4. | 500 °C | 1000 °C | | |
| Hysteresis (Hyst) ²⁾ | 4 ⁵⁾ / 3 ⁴⁾ | 3RS1 | 2 % | 20 % | Continuous | 2 % |
| Relay switching response (closed-circuit principle NC / open-circuit principle NO) ³⁾ | 2 ⁵⁾ | 3RS1 | NC | NO | -- | NC |

¹⁾ The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 29)."

²⁾ On devices with two limit values, the hysteresis for limit 1 can be set between 2 and 20 %. For limit value 2 the hysteresis is permanently set to 5 %.

³⁾ The relay switching behavior can only be parameterized for devices with two settable limit values. Devices with one settable limit value work on the closed-circuit principle NC.

⁴⁾ On devices with one settable limit value.

⁵⁾ On devices with two settable limit values.

The number of limit values that can be set on 3RS1 temperature monitoring relays with analog setting is stated in Chapter "Overview of the functions (Page 25)."

Chapter "Circuit diagrams (Page 37)" contains typical circuit diagrams for the various device versions.

The parameters are defined in Chapter "Parameters (Page 77)."

4.6 Diagnostics

Required tools


To set the parameters, you can use the same screwdriver as for mounting the temperature monitoring relays.



4.6 Diagnostics

4.6.1 Diagnostics with LED

LED statuses

On the temperature monitoring relays with analog setting, two or three status LEDs indicate the operating status of the temperature monitoring relay:

- LED 
- ϑ_1 LED
- ϑ_2 LED

| Display | Meaning | Devices with one limit value | | Devices with two limit values | |
|---|---|------------------------------|---------|-------------------------------|---------|
| | | 11 / 12 | 13 / 14 | 14 / 11 / 12 | 23 / 24 |
| ϑ_1 LED on | Temperature ϑ_1 overshoot or undershot (output relay K1 switched) | | | | |
| ϑ_2 LED on | Temperature ϑ_2 overshoot or undershot (output relay K2 switched) | | | | |
| LED  off | Voltage not present at A1 - A2 | | | | |
| LED  on | Voltage present at A1 - A2 | | | | |

The switching response of the output relay is explained in Chapter "Function (Page 33)."

4.6.2 RESET following a fault

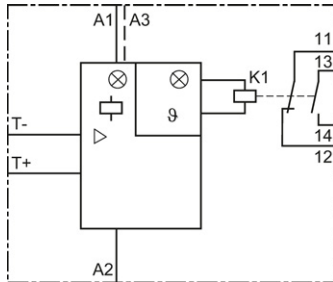
RESET

A reset is performed automatically as soon as an error that previously occurred has been eliminated and the measured temperature falls below or rises above the hysteresis limit again.

4.7 Circuit diagrams

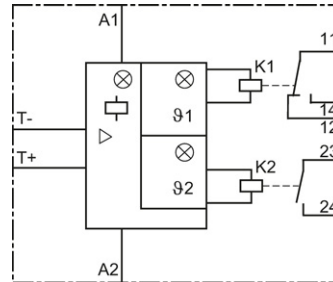
Temperature monitoring relays with analog setting for thermocouples

3RS1120 / 3RS1121



3RS1100 / 3RS1101 temperature monitoring relays

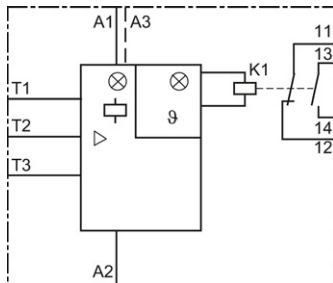
3RS1100 / 3RS1101



3RS1120 / 3RS1121 temperature monitoring relays

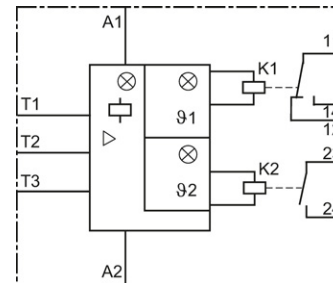
Temperature monitoring relays with analog setting for resistance sensors

3RS1000 / 3RS1010



3RS1000 / 3RS1010 temperature monitoring relays

3RS1020 / 3RS1030



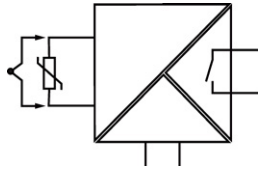
3RS1020 / 3RS1030 temperature monitoring relays

3-way electrical isolation

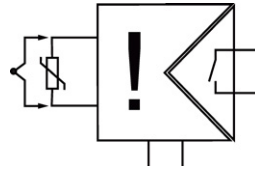
Note

All devices with the exception of the 24 V AC / DC variants feature 3-way electrical isolation.

For 24 V AC/DC variants, the supply voltage and the temperature measurement circuit are electrically connected.



24 - 240 V AC/DC, 115 / 230 V AC (3-way electrical isolation)



24 V AC/DC

Further information on the connecting terminals and the permissible conductor cross-sections is provided in Chapter "Connection systems (Page 14)."

4.8 Technical data

4.8.1 3RS10 temperature monitoring relay

General technical details

| | | 3RS10...D.. | 3RS10...K.. | 3RS10...W.. |
|--|----|-------------|-------------|-------------|
| type of voltage | | AC/DC | AC | AC/DC |
| Supply voltage frequency 1 for auxiliary and control current circuit | | | | |
| • initial rated value | Hz | 50 | | |
| • final rated value | Hz | 60 | | |
| Control supply voltage 1 at 50 Hz for AC | | | | |
| • rated value | V | 24 | 110 | — |
| • initial rated value | V | — | | 24 |
| • final rated value | V | — | | 240 |
| Control supply voltage 1 at 60 Hz for AC | | | | |
| • rated value | V | 24 | 110 | — |
| • initial rated value | V | — | | 24 |
| • final rated value | V | — | | 240 |
| Control supply voltage 1 for DC | | | | |
| • rated value | V | 24 | — | |
| • initial rated value | V | — | | 24 |
| • final rated value | V | — | | 240 |
| Control supply voltage 2 | | | | |
| • at 60 Hz for AC rated value | V | — | 230 | — |
| • at 50 Hz for AC rated value | V | — | 230 | — |
| Number of measuring circuits | | 1 | | |
| Product function defect storage | | No | | |
| Product function reset external | | No | | |
| Item designation according to DIN EN 61346-2 | | K | | |
| Item designation according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | | K | | |
| Ambient temperature | | | | |
| • during operating | °C | -25 ... +60 | | |

Measurable temperatures

| | | 3RS10..-...0. | 3RS10..-...1. | 3RS10..-...2. |
|------------------------|----|---------------|---------------|---------------|
| Measurable temperature | °C | -50 ... +50 | 0 ... 100 | 0 ... 200 |

Mechanical configuration

| | | 3RS100.- 1.... | 3RS101.- 1.... | 3RS102.- 1.... | 3RS103.- 1.... | 3RS100.- 2.... | 3RS102.- 2.... | 3RS103.- 2.... |
|---|----|---------------------------|-------------------|-------------------|-------------------|-------------------------|-------------------|-------------------|
| Design of the electrical connection for auxiliary and control current circuit | | screw-type terminals | | | | spring-loaded terminals | | |
| Design of the electrical connection jumper socket | | Yes | | | | | | |
| Design of the sensor connectable | | PT100 (resistance sensor) | | | | | | |
| Number of NC contacts for auxiliary contacts | | 1 | | 0 | | 1 | | 0 |
| Number of NO contacts for auxiliary contacts | | 1 | | | | | | |
| Number of change-over switches for auxiliary contacts | | 0 | | 1 | | 0 | | 1 |
| Width | mm | 22.5 | | | | | | |
| Height | mm | 83 | 92 | 102 | | 84 | | 103 |
| Depth | mm | 91 | | | | | | |

4.8.2 3RS11 temperature monitoring relays

General technical details

| | | 3RS110.-..D.. | 3RS110.-..K.. | 3RS11 2.-..D.. | 3RS112.-..W.. |
|---|----|---------------|---------------|----------------|---------------|
| type of voltage | | AC/DC | AC | AC/DC | |
| Supply voltage frequency 1 for auxiliary and control current circuit | | | | | |
| • rated value | Hz | — | | | |
| • initial rated value | Hz | 50 | | | |
| • final rated value | Hz | 60 | | | |
| Supply voltage frequency 2 for auxiliary and control current circuit rated value | Hz | — | | | |
| Control supply voltage 1 at 50 Hz for AC | | | | | |
| • rated value | V | 24 | 110 | 24 | — |
| • initial rated value | V | — | | | 24 |
| • final rated value | V | — | | | 240 |
| Control supply voltage 1 at 60 Hz for AC | | | | | |
| • rated value | V | 24 | 110 | 24 | — |
| • initial rated value | V | — | | | 24 |
| • final rated value | V | — | | | 240 |
| Control supply voltage 1 for DC | | | | | |
| • rated value | V | 24 | — | 24 | — |
| • initial rated value | V | — | | | 24 |
| • final rated value | V | — | | | 240 |
| Control supply voltage 2 | | | | | |
| • at 50 Hz for AC rated value | V | — | 230 | — | |
| • at 60 Hz for AC rated value | V | — | 230 | — | |
| Product function defect storage | | No | | | |
| Product function reset external | | No | | | |
| Number of measuring circuits | | 1 | | | |
| Number of NC contacts for auxiliary contacts | | 1 | | 0 | |

4.8 Technical data

| | 3RS110.-.D.. | 3RS110.-.K.. | 3RS11 2.-.D.. | 3RS112.-.W.. |
|--|--------------|--------------|---------------|--------------|
| Number of NO contacts for auxiliary contacts | 1 | | | |
| Number of change-over switches for auxiliary contacts | 0 | | 1 | |
| Item designation | | | | |
| • according to DIN EN 61346-2 | K | | | |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | K | | | |
| Ambient temperature | | | | |
| • during operating | °C | -25 ... +60 | | |

Measurable temperatures

| | 3RS11.-.2. | 3RS11.-.3. | 3RS11.-.4. |
|-------------------------------|--------------|------------|---------------|
| Measurable temperature | °C 0 ... 200 | 0 ... 600 | 500 ... 1 000 |

Mechanical configuration

| | 3RS1100-1.... | 3RS1101-1.... | 3RS1120-1.... | 3RS1121-1.... | 3RS1100-2.... | 3RS1120-2.... |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-------------------------|---------------|
| Design of the electrical connection for auxiliary and control current circuit | screw-type terminals | | | | spring-loaded terminals | |
| Design of the electrical connection jumper socket | Yes | | | | | |
| Design of the sensor connectable | type J (thermocouple) | type K (thermocouple) | type J (thermocouple) | type K (thermocouple) | type J (thermocouple) | |
| Width | mm | 22.5 | | | | |
| Height | mm | 102 | | | 103 | |
| Depth | mm | 91 | | | | |

Temperature monitoring relays with digital setting

5.1 Applications

The digitally adjustable temperature monitoring relays can be used in virtually any application in which limit temperatures must not be overshoot or undershot (to monitor set temperature limits and output alarm signals, for example).

The temperature monitoring relays for one sensor are an effective alternative to temperature controllers in low-end applications (two-step control or three-step control). Two-step control enables the devices to be used as heating thermostats, for example. As three-step controllers, the devices can switch between heating and cooling automatically dependent upon temperature, for example.

The temperature monitoring relays with up to 3 resistance sensors have been designed specifically to monitor motor windings and motor bearings.

The temperature monitoring relays are used, for example, in the following applications:

Table 5- 1 Applications involving digitally adjustable temperature monitoring relays

| Function | Application |
|---|---|
| <ul style="list-style-type: none"> • Protection of plants and the environment • Exhaust temperature monitoring • Temperature monitoring in control cabinets • Frost monitoring • Temperature limits for process variables • Control of plants and machinery • Motor monitoring • Monitoring bearings • Gear oil monitoring • Monitoring of coolants | <ul style="list-style-type: none"> • Packaging industry • Electroplating • Air conditioning systems • Ventilation systems • Solar collectors • Heat pumps • Hot water supplies |

5.2 Versions

Connection systems

The monitoring relays are available with the following connection system options:

- Screw-type connection system
- Spring-loaded connection system

Types of sensor

The digitally adjustable temperature monitoring relays feature connection options for the following types of sensor, dependent upon version:

Resistance sensors:

- PT100/PT1000
- KTY83/KTY84
- NTC)¹⁾

¹⁾ NTC type: B57227-K333-A1 (100 °C: 1.8 kΩ; 25 °C: 32.762 kΩ)

Thermocouples:

- Type B
- Type J
- Type K
- Type R
- Type S
- Type T
- Type E
- Type N

5.3 Operator controls and connection terminals

Front view / terminal assignment (temperature monitoring relay with digital setting for thermocouples)

| Front view | Description | |
|------------|--|---|
| | Position digits | |
| | ① | Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | Rotary button for selecting parameters |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Status display: LED "91" and "92" (contact symbols) and "READY" LED (device in monitoring mode) |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | Terminal labels | |
| | A1+ | Rated control supply voltage ~ / + |
| A2- | Rated control supply voltage ~ / - | |
| T+, T- | Sensor connection for thermocouples | |
| Y1, Y2 | Connection for memory jumper (on 3RS1140 only) | |
| Y3, Y4 | Reset input (on 3RS1142 only) | |
| 18NO | Output relay K1 NO contact | |
| 15C | Output relay K1 CO contact root | |
| 16NC | Output relay K1 NC contact | |
| 28NO | Output relay K2 NO contact | |
| 25C | Output relay K2 CO contact root | |
| 26NC | Output relay K2 NC contact | |
| 33NO | Output relay K3 NO contact | |
| 34NO | Output relay K3 NO contact | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 63)."

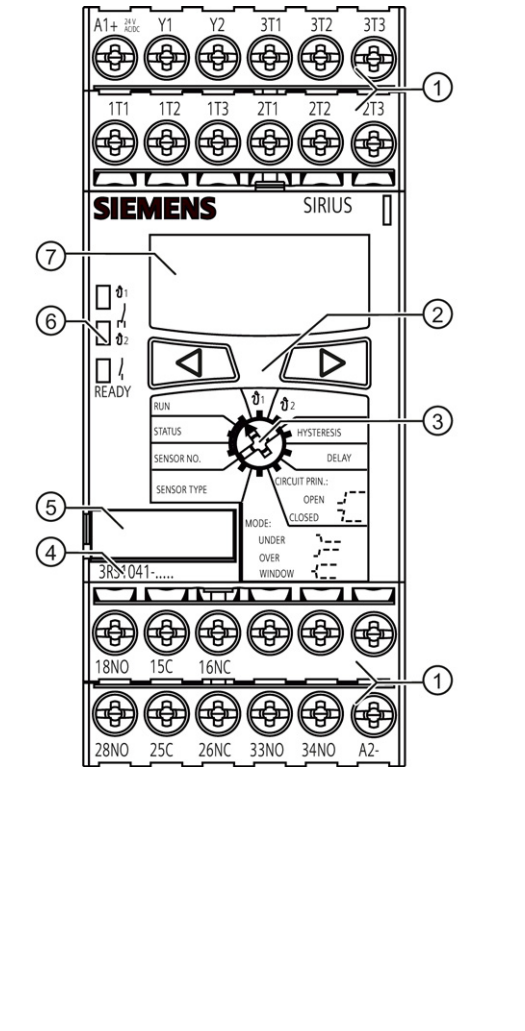
Front view / terminal assignment (temperature monitoring relay with digital setting for a resistance thermometer)

| Front view | Description | |
|------------|---------------------------------|---|
| | Position digits | |
| | ① | Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. |
| | ② | Arrow keys for menu navigation |
| | ③ | Rotary button for selecting parameters |
| | ④ | Device order number |
| | ⑤ | Label |
| | ⑥ | Status display: LED "ϑ1" and "ϑ2" (contact symbols) and "READY" LED (device in monitoring mode) |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics |
| | Terminal labels | |
| | A1+ | Rated control supply voltage ~ / + |
| | A2- | Rated control supply voltage ~ / - |
| | T1, T2, T3 | Sensor connection for resistance sensors |
| | Y1, Y2 | Connection for memory jumper (on 3RS1040 only) |
| | Y3, Y4 | Reset input (on 3RS1042 only) |
| 18NO | Output relay K1 NO contact | |
| 15C | Output relay K1 CO contact root | |
| 16NC | Output relay K1 NC contact | |
| 28NO | Output relay K2 NO contact | |
| 25C | Output relay K2 CO contact root | |
| 26NC | Output relay K2 NC contact | |
| 33NO | Output relay K3 NO contact | |
| 34NO | Output relay K3 NO contact | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 63)."

Front view / terminal assignment (temperature monitoring relays with digital setting for up to three resistance sensors)

| Front view | Description | | |
|--|---|---|--|
|  | Position digits | | |
| | ① | Terminal block (removable): Connection is possible using screw terminals or spring-loaded terminals. | |
| | ② | Arrow keys for menu navigation | |
| | ③ | Rotary button for selecting parameters | |
| | ④ | Device order number | |
| | ⑤ | Label | |
| | ⑥ | Status display: LED "ϑ1" and "ϑ2" (contact symbols) and "READY" LED (device in monitoring mode) | |
| | ⑦ | Display for parameterization, actual-value indication, and diagnostics | |
| | Terminal labels | | |
| | A1+ | Rated control supply voltage ~ / + | |
| | A2- | Rated control supply voltage ~ / - | |
| | 1T1, 1T2, 1T3 2T1, 2T2, 2T3 3T1, 3T2, 3T3 | Sensor connection for resistance sensors | |
| | Y1, Y2 | Connection for memory jumper | |
| | 18NO | Output relay K1 NO contact | |
| | 15C | Output relay K1 CO contact root | |
| 16NC | Output relay K1 NC contact | | |
| 28NO | Output relay K2 NO contact | | |
| 25C | Output relay K2 CO contact root | | |
| 26NC | Output relay K2 NC contact | | |
| 33NO | Output relay K3 NO contact | | |
| 34NO | Output relay K3 NO contact | | |

You will find further information on the connection terminals and the permissible conductor cross-sections in Chapter "Connection systems (Page 14)."

You can find information on connection in Chapter "Circuit diagrams (Page 63)."

5.4 Function

General functionality

The 3RS10 / 3RS11 / 3RS20 / 3RS21 temperature monitoring relays with digital setting can be used for measuring temperatures in solid, liquid, and gaseous media. The temperature is sensed by the sensors in the medium and evaluated by the device. It is monitored for overshoot, undershoot, or staying within a working range (range function). The temperature monitoring relays with digital setting have 2 separately settable limit values, are non-volatile, and can be operated on either the open-circuit principle or the closed-circuit principle.

The devices differ in the number of resistance sensors that can be evaluated.

The 3RS1040, 3RS2040, 3RS1140, 3RS2140, 3RS1042, and 3RS1142 temperature monitoring relays can be set digitally for one sensor and are a good alternative to temperature controllers for low-end applications (two-step control or three-step control).

Two-step control enables the devices to be used as heating thermostats, for example. As three-step controllers, the devices can switch between heating and cooling automatically dependent upon temperature, for example.

The 3RS1041 and 3RS2041 temperature monitoring relays can be set digitally and can evaluate up to three resistance sensors at the same time. The devices have been designed specifically for monitoring motor windings and motor bearings.

The temperature monitoring relays are powered with a rated control supply voltage of 24 V AC/DC or 24 to 240 V AC/DC via terminals A1+ / A2, depending on the version.

Monitoring


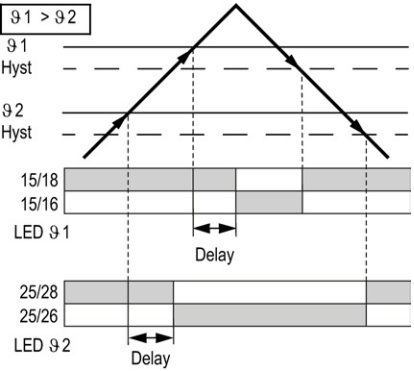
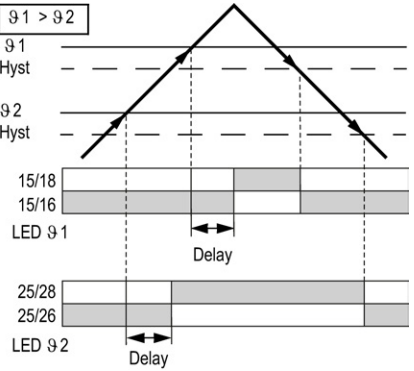

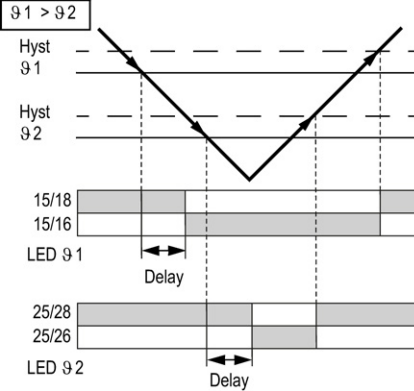
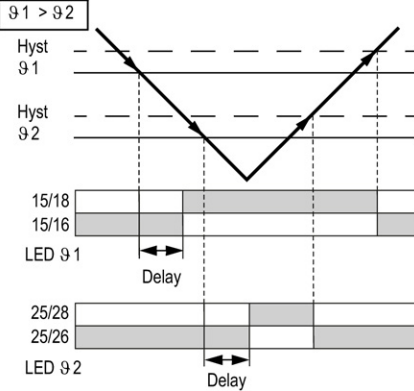
When the temperature reaches the set limit value ϑ_1 , the output relay K1 changes its switching state once the set time t has elapsed. The delay time can be set. The output relays revert to the original state immediately when the temperature reaches the set hysteresis value. (Reset response is configured as autoreset.) The output relay K2 responds to reaching the lower limit value ϑ_2 in the same way.

Each of the 2 limit values ϑ_1 and ϑ_2 can be set for overshoot or undershoot to be monitored. This means that it is possible to use one limit value to output a warning indicating that a limit value is about to be overshoot or undershot. The other limit value can be used for tripping or to implement two-step or three-step control.


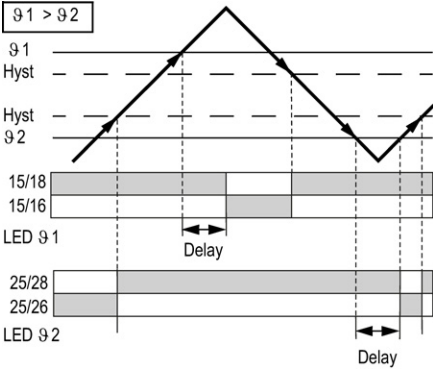
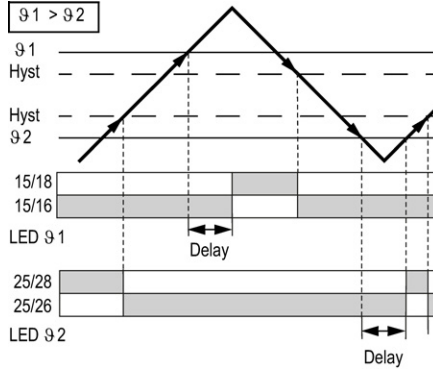
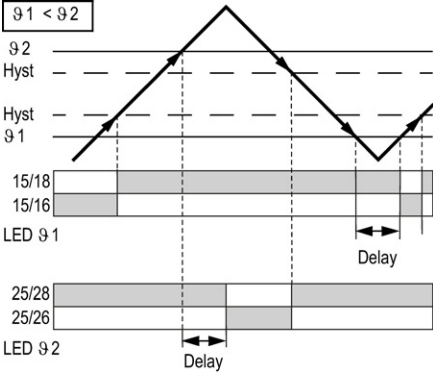
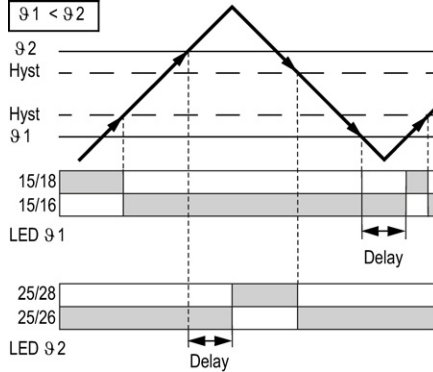
Note

The "Temperature monitoring mode" parameter can be used to set the required type of monitoring (monitoring for overshoot, monitoring for undershoot, or range monitoring).

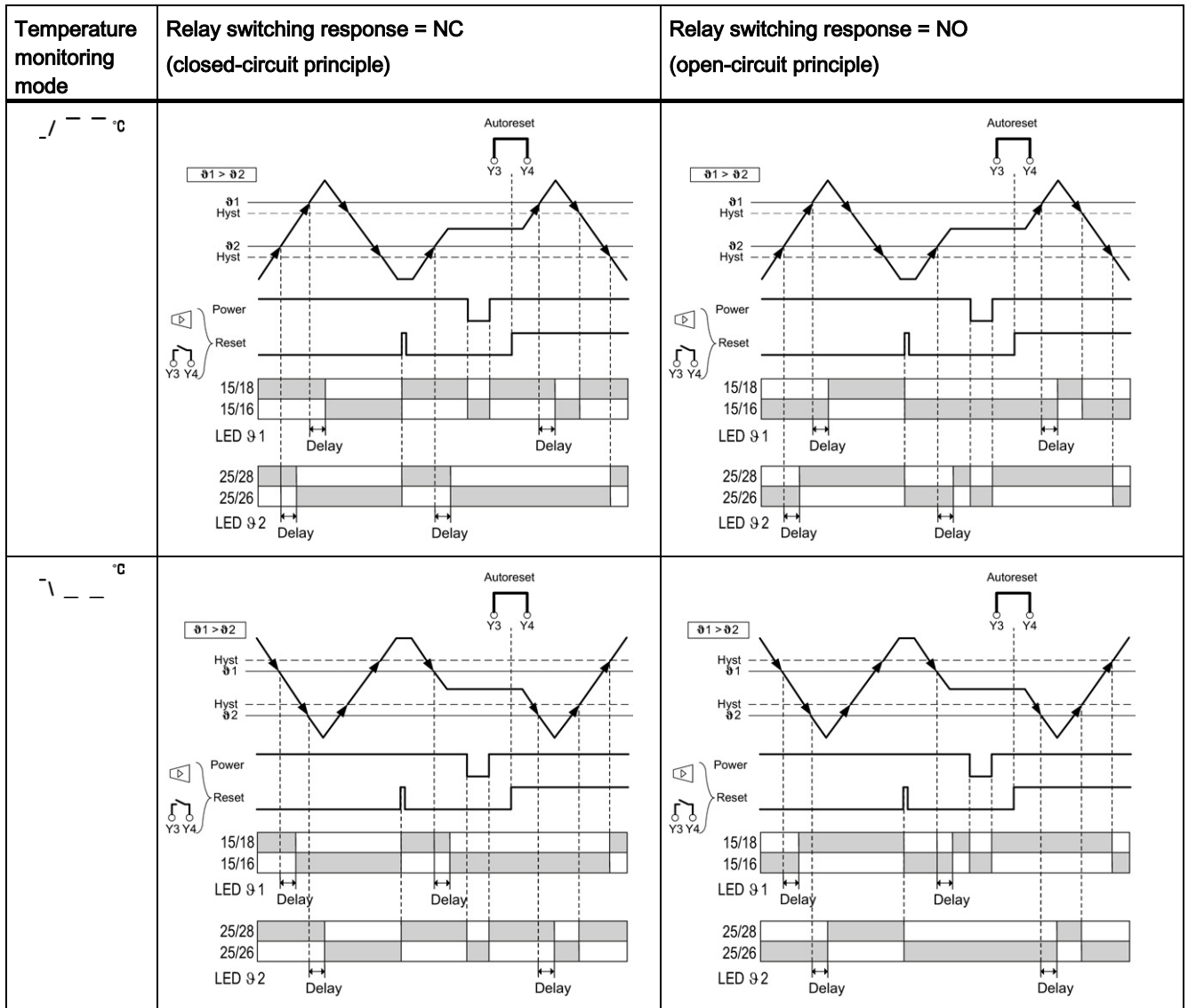
Function charts 3RS1040 / 3RS2040, 3RS1140 / 3RS2140, and 3RS1041 / 3RS2041

| Temperature monitoring mode | Memory = no (Y1 / Y2) Relay switching response = NC (closed-circuit principle) | Memory = no (Y1 / Y2) Relay switching response = NO (open-circuit principle) |
|---|---|--|
|  | <p>$\vartheta_1 > \vartheta_2$</p>  | <p>$\vartheta_1 > \vartheta_2$</p>  |
|  | <p>$\vartheta_1 > \vartheta_2$</p>  | <p>$\vartheta_1 > \vartheta_2$</p>  |

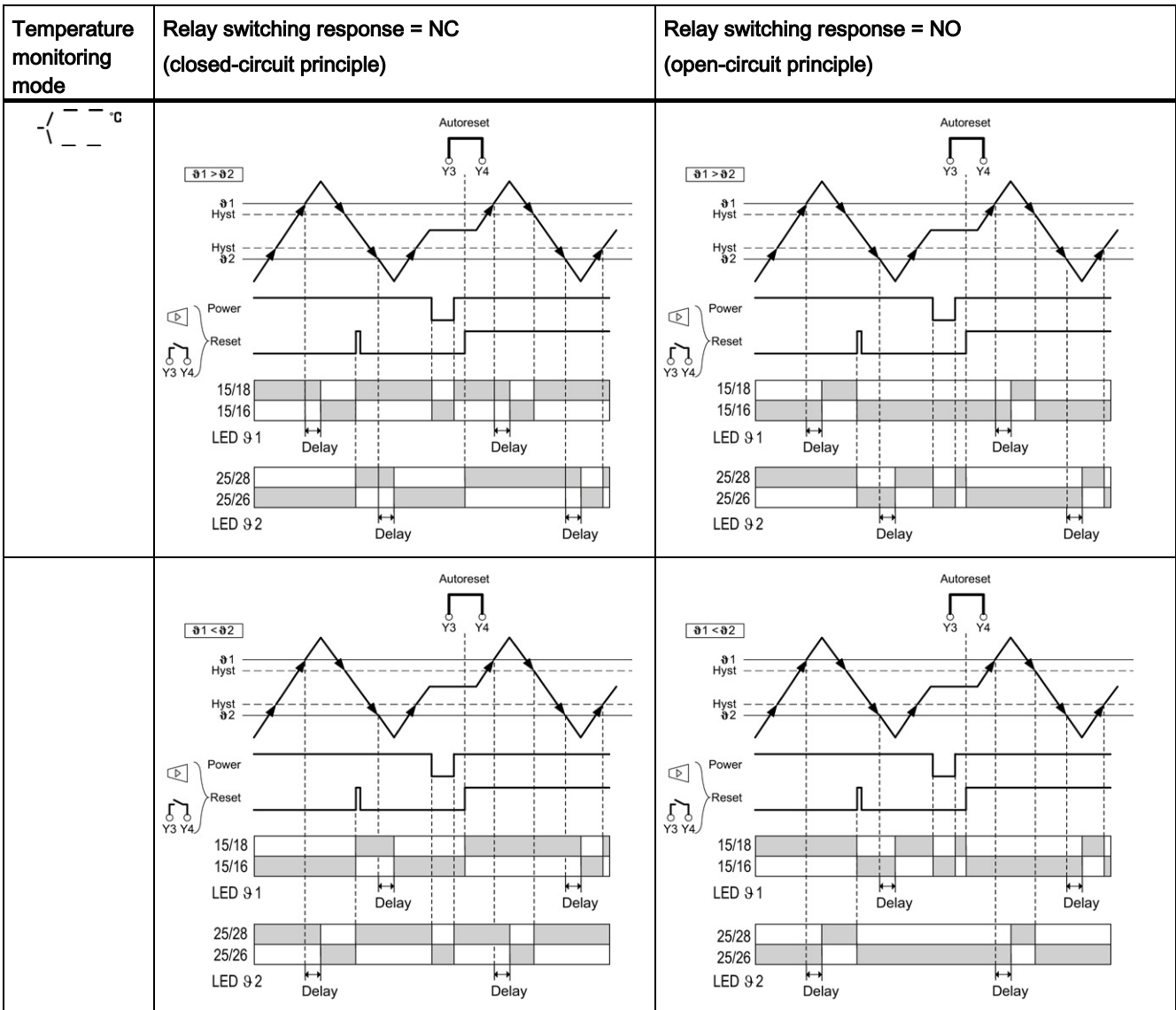
5.4 Function

| Temperature monitoring mode | Memory = no (Y1 / Y2) Relay switching response = NC (closed-circuit principle) | Memory = no (Y1 / Y2) Relay switching response = NO (open-circuit principle) |
|---|---|--|
|  | <p>91 > 92</p>  | <p>91 > 92</p>  |
| | <p>91 < 92</p>  | <p>91 < 92</p>  |

Function charts for 3RS1042 / 3RS1142



5.4 Function



Memory function

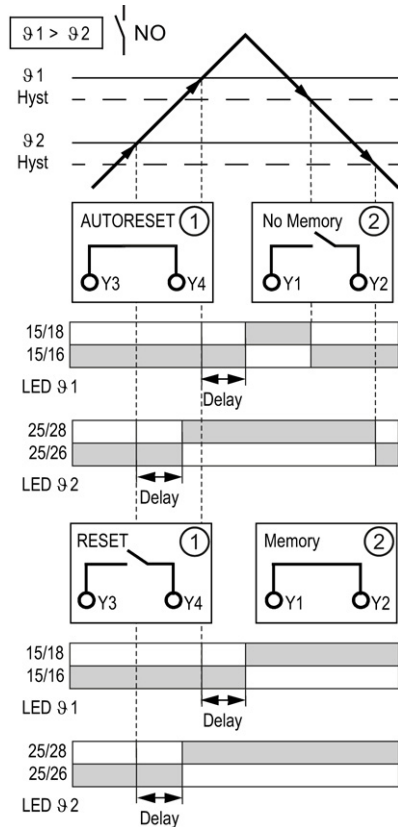
The temperature monitoring relays for digital setting have a memory function that is activated in different ways in different device variants. The memory function is illustrated below based on the example of a temperature overshoot.

When the temperature reaches the set limit value ϑ_1 , the output relay K1 changes its switching state once the set time t has elapsed. (Output relay K2 responds to ϑ_2 in the same way.) The device variants respond as described below:

- **3RS1.40 / 41 temperature monitoring relays:**
 - On 3RS1.40/41 temperature monitoring relays, the memory function is deactivated by default (No Memory). The output relays revert to the initial state immediately as soon as an error that occurred previously has been dealt with and the temperature falls back below the set hysteresis value.
 - If you install a jumper between terminals Y1/Y2, activate the memory function (memory). The output relays only revert to the original state when the temperature falls below the set hysteresis value and the terminals Y1/Y2 have been briefly jumpered. If the rotary knob is in the "RUN" position, the temperature monitoring relays can also be reset by pressing the right arrow key.
- **3RS1.42 temperature monitoring relays:**
 - The memory function for 3RS1.42 temperature monitoring relays is enabled by default (RESET). The output relays only revert to the original state when the temperature falls below the set hysteresis value and the terminals Y3/Y4 have been briefly jumpered. If the rotary knob is in the "RUN" position, the temperature monitoring relays can also be reset by pressing the right arrow key.

5.5 Operation

- If you jumper terminals Y3/Y4 permanently, you deactivate the memory function (AUTORESET). The output relays revert to the initial state immediately as soon as an error that occurred previously has been dealt with and the temperature falls back below the set hysteresis value.



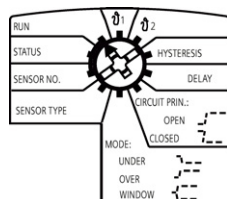
- ① 3RS1.42 temperature monitoring relays:
- ② 3RS1.40 / 3RS1.41 temperature monitoring relays

Figure 5-1 Typical circuit diagram for memory function

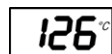
5.5 Operation

Parameters

The temperature monitoring relays with digital setting have a rotary button and two arrow keys to switch between display of the current measured value ("RUN") and setting of the basic device parameters.



When the rotary button is set to "RUN", the display shows the current temperature measured value.



If the rotary button is set to "STATUS" (only on temperature monitoring relays for up to three resistance sensors), the display shows the temperature sensor status of the individual sensors. You will find information about displaying the temperature sensor status in Chapter "Operating display and status display (Page 61)."

Setting parameters

You set the parameters locally via the display using the two arrow keys as follows:


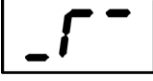
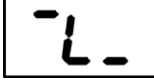
1. Turn the rotary button to the parameter you wish to set
2. Use the arrow keys to select the value of the parameter.

Parameter information

You can set the following parameters:

Table 5-2 Parameter information, 3RS1 / 3RS2 temperature monitoring relays with digital setting

| Parameters | | Setting range | | Increment | Factory setting |
|----------------|---------------|---------------|---------------|----------------|-----------------|
| | | Minimum value | Maximum value | | |
| Limit value ϑ1 | 3RS1...-...0. | -50 °C | 50 °C | 1 °C / 1 °F | 80 °C / 176 °F |
| | 3RS2...-...0. | -58 °F | 122 °F | | |
| | 3RS1...-...1. | 0 °C | 100 °C | | |
| | 3RS2...-...1. | 32 °F | 212 °F | | |
| | 3RS1...-...2. | 0 °C | 200 °C | | |
| | 3RS2...-...2. | 32 °F | 392 °F | | |
| | 3RS1...-...3. | 0 °C | 600 °C | | |
| | 3RS2...-...3. | 32 °F | 1112 °F | | |
| | 3RS1...-...4. | 500 °C | 1000 °C | | |
| | 3RS2...-...4. | 932 °F | 1832 °F | | |
| | 3RS1...-...5. | -50 °C | 500 °C | | |
| | 3RS2...-...5. | -58 °F | 932 °F | | |
| | 3RS1...-...6. | -99 °C | 999 °C | | |
| | 3RS2...-...6. | -99 °F | 1830 °F | | |
| | 3RS1...-...7. | 0 °C | 750 °C | | |
| | 3RS2...-...7. | 32 °F | 1382 °F | | |
| 3RS1...-...8. | -99 °C | 1800 °C | 1 °C / 1 °F | 50 °C / 122 °F | |
| 3RS2...-...8. | -99 °F | 3272 °F | | | |
| 3RS1...-...0. | -50 °C | 50 °C | | | |
| 3RS2...-...0. | -58 °F | 122 °F | | | |
| 3RS1...-...1. | 0 °C | 100 °C | | | |
| 3RS2...-...1. | 32 °F | 212 °F | | | |
| 3RS1...-...2. | 0 °C | 200 °C | | | |
| 3RS2...-...2. | 32 °F | 392 °F | | | |
| 3RS1...-...3. | 0 °C | 600 °C | | | |
| 3RS2...-...3. | 32 °F | 1112 °F | | | |
| 3RS1...-...4. | 500 °C | 1000 °C | | | |
| 3RS2...-...4. | 932 °F | 1832 °F | | | |
| 3RS1...-...5. | -50 °C | 500 °C | | | |
| 3RS2...-...5. | -58 °F | 932 °F | | | |
| 3RS1...-...6. | -99 °C | 999 °C | | | |
| 3RS2...-...6. | -99 °F | 1830 °F | | | |
| 3RS1...-...7. | 0 °C | 750 °C | | | |
| 3RS2...-...7. | 32 °F | 1382 °F | | | |
| 3RS1...-...8. | -99 °C | 1800 °C | | | |
| 3RS2...-...8. | -99 °F | 3272 °F | | | |

| Parameters | | Setting range | | Increment | Factory setting |
|--|---|---|--|-------------|---|
| | | Minimum value | Maximum value | | |
| Hysteresis (Hyst) ²⁾ | — | 1 °C / 1 °F | 99 °C / 99 °F | 1 °C / 1 °F | 5 °C / 5 °F |
| Tripping delay time (Delay) | — | 0.1 s | 999.0 s | 0.1 s | 0 s |
| Relay switching response (closed-circuit principle NC / open-circuit principle NO) | — |  |  | — |  |
| | | NC | NO | | NC |
| Type of temperature sensor ³⁾ | — | — | — | — | PT100 |
| Number of temperature sensors ⁴⁾ | — | 1 | 3 | — | 3 |
| Temperature monitoring mode ⁵⁾ | — | — | — | — | OVER |

1) The position digits refer to the front view in Chapter "Operator controls and connection terminals (Page 45)."

2) The set hysteresis applies to both limit values set.

3) Resistance sensors (PT100, PT1000, KTY83-110, KTY84, NTC) or thermocouples (J, K, T, E, N, S, R, B). The thermocouples S, R, B can only be set on the 3RS1142 device! As NTC resistance sensors, only types B 57227-K333-A1 and Q63022-K7182-S1 are permitted.

4) Number of temperature sensors used: 1, 2 or 3 (on 3RS1041 and 3RS2041 only)

5) Monitoring for overshoot (OVER), monitoring for undershoot (UNDER) or range monitoring (WINDOW).

Note

Resistance sensor NTC

Open-circuit detection is no longer possible when using a resistance sensor!

The parameters are defined in Chapter "Parameters (Page 77)."

Code input on temperature monitoring relays

On temperature monitoring relays, menu guidance is possible after a code has been entered for the device in question.

The following graphic shows the procedure for correct code entry:

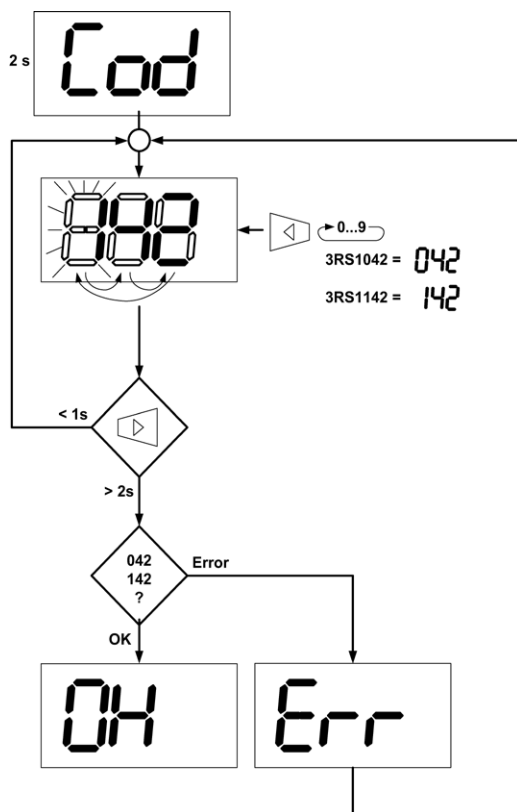


Figure 5-2 Code entry for temperature monitoring relays

Parts of the order numbers for the device must be entered using the arrow keys:

- "042" (3RS1042)
- "142" (3RS1142)

Pressing the Enter key for more than 2 s causes "OK" to appear on the display if the entry was correct. In the event of a fault, the display shows "Err" and the code must be entered again.

5.6 Diagnostics

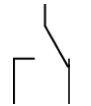






5.6.1 Diagnostics with LED

LED statuses

The 3RS1 / 3RS2 temperature monitoring relays with digital setting are in monitoring mode if the READY LED is on:

Three status LEDs indicate the operating state of the temperature monitoring relays with digital setting:

- READY LED
- ϑ_1 LED
- ϑ_2 LED

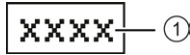
| Display | Meaning | Output relay K1 | Output relay K2 | Output relay K3 |
|----------------------|--|---|---|---|
| | | 18 / 15 / 16 | 28 / 25 / 26 | 33 / 34 |
| ϑ_1 LED on | Temperature ϑ_1 overshoot or undershot (output relay K1 switched) |  | — |  |
| ϑ_2 LED on | Temperature ϑ_2 overshoot or undershot (output relay K2 switched) | — |  |  |
| READY LED not lit | <ul style="list-style-type: none"> • No voltage applied • Wire break or short-circuit affecting the sensor cables (resistance sensors) • Wire break (thermocouples) |  |  |  |

You will find more information about the switching response of the output relays in Chapter "Function (Page 48)."

5.6.2 Indications on the display

Indication on the display


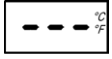
The display features an area for indicating the temperature measured value or an error symbol.



① Temperature measured value or error symbol

Meaning of the information on the display

The following statuses and faults are indicated on the display as a diagnostics message with flashing symbols:

| Symbol | Meaning |
|---|---|
| 126 °C | Measured temperature is displayed |
|  | <ul style="list-style-type: none"> • Setting of $\vartheta 1$ and $\vartheta 2$ is outside the permissible temperature range of the sensor • Sensor short-circuit • Sensor wire break • Hysteresis > 80 K/80 ° for NTC • Incorrect code entry (3RS1042 / 3RS1142) |
|  | Measured value ϑ is outside the permissible temperature range of the sensor |

You will find more information about the switching response of the output relays in Chapter "Function (Page 48)."

5.6.3 Operating display and status display

Operating display for device versions with up to three resistance sensors

When the rotary button is set to "RUN" and multiple resistance sensors are being used on 3RS1041 or 3RS2041 devices, the display shows the following values one after the other:

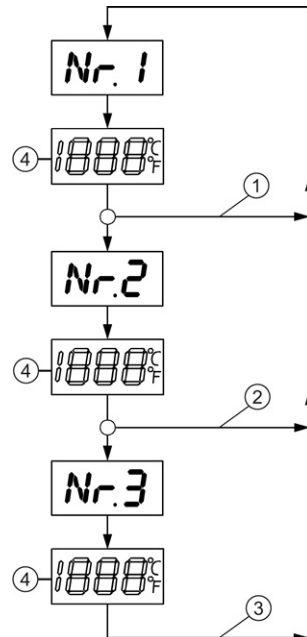


Figure 5-3 Display for operation 3RS1041 / 3RS2041

- ① Number of sensors 1
- ② Number of sensors 2
- ③ Number of sensors 3
- ④ Current measured value of the corresponding resistance sensor

Status display for device versions with up to three resistance sensors

For temperature monitoring with a monitoring relay for up to three resistance sensors, the status of each sensor can be indicated on the display.

The graphic below shows the status display for the different monitoring types one below the other:

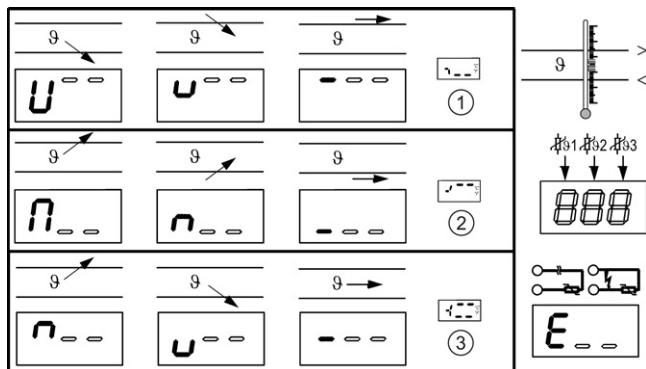


Figure 5-4 Status display 3RS1041 / 3RS2041

- ① Temperature undershoot
- ② Temperature overshoot
- ③ Range monitoring

You will find more information about the switching response of the output relays in Chapter "Function (Page 48)."

5.6.4 RESET following a fault

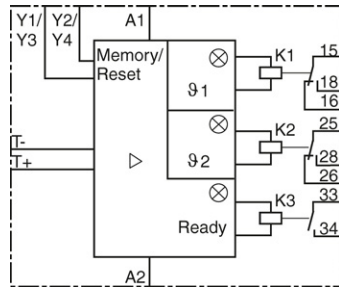
RESET

How you reset the temperature monitoring relays depends on the memory function. You can find information about the memory function in the chapter titled "Function (Page 48)".

5.7 Circuit diagrams

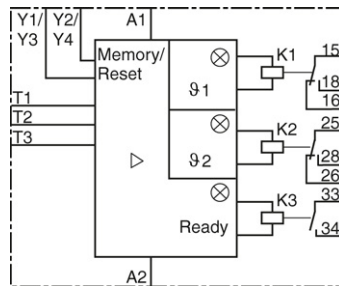
Temperature monitoring relays with digital setting for thermocouples

3RS1140 / 3RS1142 / 3RS2140

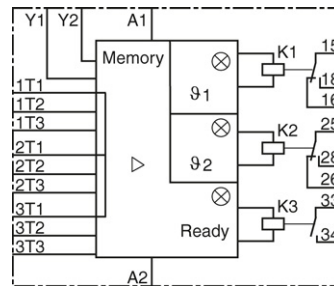


3RS1140 / 3RS1142 / 3RS2140 temperature monitoring relays

Temperature monitoring relays with digital setting for resistance sensors

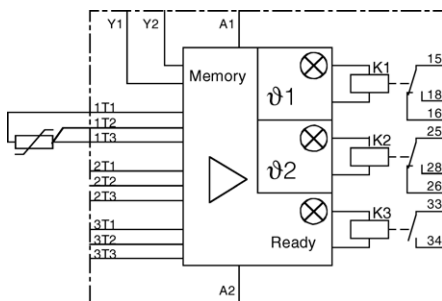


3RS1040 / 3RS1042 / 3RS2040 temperature monitoring relays

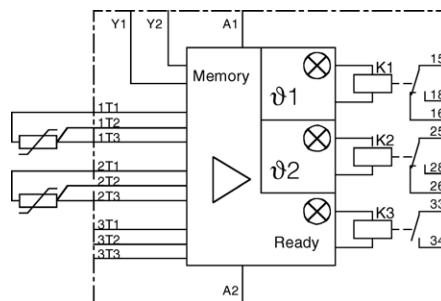


3RS1041 / 3RS2041 temperature monitoring relays

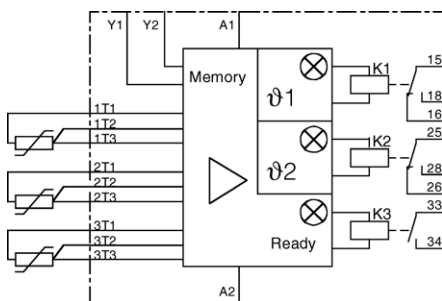
Connection examples 3RS1041 / 3RS2041 resistance sensors



Connection 1 3RS1041 / 3RS2041 resistance sensor



Connection 2 3RS1041 / 3RS2041 resistance sensors



Connection 3 3RS1041 / 3RS2041 resistance sensors

5.8 Measuring ranges

Measuring ranges for thermocouples

Dependency on sensor type restricts not only short-circuit detection and open-circuit detection but also the measuring range. The following tables list the measuring ranges of the thermocouples in °C and °F.

Table 5- 3 Measuring ranges for thermocouples

| Sensor type | Short-circuit | Wire break | 3RS1140 | 3RS2140 | 3RS1142 |
|-------------|---------------|------------|-----------------------|-----------------------|-----------------------|
| | | | Measuring range in °C | Measuring range in °F | Measuring range in °C |
| J | --- | ✓ | -99 ... +999 | -99 ... +1830 | -99 ... +1200 |
| K | --- | ✓ | -99 ... +999 | -99 ... +1830 | -99 ... +1350 |
| T | --- | ✓ | -99 ... +400 | -99 ... +752 | -99 ... +400 |
| E | --- | ✓ | -99 ... +999 | -99 ... +1830 | -99 ... +999 |
| N | --- | ✓ | -99 ... +999 | -99 ... +1830 | -99 ... +999 |
| S | --- | ✓ | --- | --- | 0 ... +1750 |
| R | --- | ✓ | --- | --- | 0 ... +1750 |
| B | --- | ✓ | --- | --- | +400 ... +1800 |

✓ = Detection possible

--- = Detection not possible

Measuring ranges for resistance sensors

Dependency on sensor type restricts not only short-circuit detection and open-circuit detection but also the measuring range. The following tables list the measuring ranges of the resistance sensors in °C and °F.

Table 5- 4 Measuring range for resistance sensors

| Sensor type | Short-circuit | Wire break | 3RS1040 / 3RS1041 | 3RS2040 | 3RS1042 |
|-------------------|---------------|------------|-----------------------|-----------------------|-----------------------|
| | | | Measuring range in °C | Measuring range in °F | Measuring range in °C |
| PT100 | ✓ | ✓ | -50 ... +500 | -58 ... +932 | -50 ... +750 |
| PT1000 | ✓ | ✓ | -50 ... +500 | -58 ... +932 | -50 ... +900 |
| KTY83-110 | ✓ | ✓ | -50 ... +175 | -58 ... +347 | -50 ... +175 |
| KTY84 | ✓ | ✓ | -40 ... +300 | -40 ... +572 | -40 ... +300 |
| NTC ¹⁾ | ✓ | --- | +80 ... +160 | +176 ... 320 | +80 ... +160 |

¹⁾ NTC type: B57227-K333-A1 (100 °C: 1.8 kΩ; 25 °C: 32.762kΩ).

✓ = Detection possible

--- = Detection not possible

5.9 Technical data

5.9.1 3RS104. temperature monitoring relays

General technical details

| | 3RS1040-..D.. | 3RS1040-..W.. | 3RS1041-..W.. | 3RS1042-..D.. | 3RS1042-..W.. |
|---|---------------|---------------|---------------|---------------|---------------|
| type of voltage | AC/DC | | | | |
| Supply voltage frequency 1 for auxiliary and control current circuit initial rated value | Hz 50 | | | | |
| Supply voltage frequency 1 for auxiliary and control current circuit final rated value | Hz 60 | | | | |
| Control supply voltage 1 at 50 Hz for AC | | | | | |
| • rated value | V 24 | — | — | 24 | — |
| • initial rated value | V — | 24 | — | — | 24 |
| • final rated value | V — | 240 | — | — | 240 |
| Control supply voltage 1 at 60 Hz for AC | | | | | |
| • rated value | V 24 | — | — | 24 | — |
| • initial rated value | V — | 24 | — | — | 24 |
| • final rated value | V — | 240 | — | — | 240 |
| Control supply voltage 1 for DC | | | | | |
| • rated value | V 24 | — | — | 24 | — |
| • initial rated value | V — | 24 | — | — | 24 |
| • final rated value | V — | 240 | — | — | 240 |
| Number of measuring circuits | 1 | | 3 | 1 | |
| Product function | | | | | |
| • defect storage | Yes | | | | |
| • reset external | Yes | | | | |

| | 3RS1040-..D.. | 3RS1040-..W.. | 3RS1041-..W.. | 3RS1042-..D.. | 3RS1042-..W.. |
|--|---------------|---------------|---------------|---------------|---------------|
| Item designation | | | | | |
| <ul style="list-style-type: none"> according to DIN EN 61346-2 | K | | | | |
| <ul style="list-style-type: none"> according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | K | | | | |
| Ambient temperature | | | | | |
| <ul style="list-style-type: none"> during operating | °C | -25 ... +60 | | | |

Measurable temperatures

| | 3RS104-...5. | 3RS104-...7. |
|------------------------|-----------------|--------------|
| Measurable temperature | °C -50 ... +500 | -50 ... +750 |

Mechanical configuration

| | 3RS104-1.... | 3RS104-2.... |
|---|--|-------------------------|
| Design of the electrical connection for auxiliary and control current circuit | screw-type terminals | spring-loaded terminals |
| Design of the electrical connection jumper socket | Yes | |
| Design of the sensor connectable | PT100/1000, KTY83/84, NTC (resistance sensors) | |
| Number of NO contacts for auxiliary contacts | 1 | |
| Number of change-over switches for auxiliary contacts | 2 | |
| Width | mm 45 | |
| Height | mm 106 | 108 |
| Depth | mm 91 | |

5.9.2 Temperature monitoring relays 3RS114.

General technical details

| | 3RS11 4.-.D.. | 3RS11 4.-.W.. |
|---|---------------|---------------|
| type of voltage | AC/DC | |
| Supply voltage frequency 1 for auxiliary and control current circuit | | |
| • rated value | Hz — | |
| • initial rated value | Hz 50 | |
| • final rated value | Hz 60 | |
| Supply voltage frequency 2 for auxiliary and control current circuit | | |
| • rated value | Hz — | |
| Control supply voltage 1 at 50 Hz for AC | | |
| • rated value | V 24 | — |
| • initial rated value | V — | 24 |
| • final rated value | V — | 240 |
| Control supply voltage 1 at 60 Hz for AC | | |
| • rated value | V 24 | — |
| • initial rated value | V — | 24 |
| • final rated value | V — | 240 |
| Control supply voltage 1 for DC | | |
| • rated value | V 24 | — |
| • initial rated value | V — | 24 |
| • final rated value | V — | 240 |
| Control supply voltage 2 | | |
| • at 50 Hz for AC rated value | V — | |
| • at 60 Hz for AC rated value | V — | |
| Product function defect storage | Yes | |
| Product function reset external | Yes | |
| Number of measuring circuits | 1 | |
| Number of NC contacts for auxiliary contacts | 0 | |
| Number of NO contacts for auxiliary contacts | 1 | |
| Number of change-over switches for auxiliary contacts | 2 | |

| | 3RS11 4-..D.. | 3RS11 4-..W.. |
|--|----------------|---------------|
| Item designation | | |
| • according to DIN EN 61346-2 | K | |
| • according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | K | |
| Ambient temperature | | |
| • during operating phase | °C -25 ... +60 | |

Measurable temperatures

| | 3RS114-...6. | 3RS114-...8. |
|-------------------------------|-----------------|----------------|
| Measurable temperature | °C -99 ... +999 | -99 ... +1 800 |

Mechanical configuration

| | 3RS114.- 1.D6. | 3RS114.- 1.D8. | 3RS114.- 1.W8. | 3RS114.- 1.W6. | 3RS114.- 2.D6. | 3RS114.- 2.D8. | 3RS114.- 2.W6. | 3RS114.- 2.W8. |
|--|-----------------------------------|-------------------|-------------------|-------------------|-------------------------|-------------------|-------------------|-------------------|
| Design of the electrical connection for auxiliary and control current circuit | screw-type terminals | | | | spring-loaded terminals | | | |
| Design of the electrical connection jumper socket | Yes | | | | | | | |
| Design of the sensor connectable | type J, K, T, E, N (thermocouple) | | | | | | | |
| Width | mm | 22.5 | 45 | | | | | |
| Height | mm | 106 | | | 108 | | | |
| Depth | mm | 91 | | | | | | |

5.9.3 3RS2.4. temperature monitoring relays

General technical details

| | | 3RS2.40- 1.D.. | 3RS2.40- 1.W.. | 3RS2.40- 2.D.. | 3RS2.40- 2.W.. | 3RS2.41- 1.W.. | 3RS2.41- 2.W.. |
|---|----|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| type of voltage | | AC/DC | | | | | |
| Supply voltage frequency 1 for auxiliary and control current circuit | | | | | | | |
| • rated value | Hz | — | | | | | |
| • initial rated value | Hz | 50 | | | | | |
| • final rated value | Hz | 60 | | | | | |
| Supply voltage frequency 2 for auxiliary and control current circuit | | | | | | | |
| • rated value | Hz | — | | | | | |
| Control supply voltage 1 at 50 Hz for AC | | | | | | | |
| • rated value | V | 24 | — | 24 | — | | |
| • initial rated value | V | — | 24 | — | 24 | | |
| • final rated value | V | — | 240 | — | 240 | | |
| Control supply voltage 1 at 60 Hz for AC | | | | | | | |
| • rated value | V | 24 | — | 24 | — | | |
| • initial rated value | V | — | 24 | — | 24 | | |
| • final rated value | V | — | 240 | — | 240 | | |
| Control supply voltage 1 for DC | | | | | | | |
| • rated value | V | 24 | — | 24 | — | | |
| • initial rated value | V | — | 24 | — | 24 | | |
| • final rated value | V | — | 240 | — | 240 | | |
| Control supply voltage 2 | | | | | | | |
| • at 50 Hz for AC rated value | V | — | | | | | |
| • at 60 Hz for AC rated value | V | — | | | | | |
| Product function defect storage | | Yes | | | | | |
| Product function reset external | | Yes | | | | | |

| | 3RS2.40-1.D.. | 3RS2.40-1.W.. | 3RS2.40-2.D.. | 3RS2.40-2.W.. | 3RS2.41-1.W.. | 3RS2.41-2.W.. |
|---|---------------|---------------|---------------|---------------|---------------|---------------|
| Number of measuring circuits | 1 | | | | 3 | 1 |
| Number of NC contacts for auxiliary contacts | 0 | | | | | |
| Number of NO contacts for auxiliary contacts | 1 | | | | | |
| Number of change-over switches for auxiliary contacts | 2 | | | | | |
| Item designation | K | | | | | |
| <ul style="list-style-type: none"> according to DIN EN 61346-2 according to DIN 40719 extendable after IEC 204-2 according to IEC 750 | K | | | | | |
| Ambient temperature | °C | | | | | |
| <ul style="list-style-type: none"> during operating | -25 ... +60 | | | | | |

Measurable temperatures

| | 3RS204.-..... | 3RS214.-..... |
|-----------------------------------|-----------------|----------------|
| Measurable Fahrenheit-temperature | °F -58 ... +932 | -99 ... +1 830 |

Mechanical configuration

| | 3RS204.-1.... | 3RS214.-1.... | 3RS204.-2.... | 3RS214.-2.... |
|---|--|-----------------------------------|--|-----------------------------------|
| Design of the electrical connection for auxiliary and control current circuit | screw-type terminals | | spring-loaded terminals | |
| Design of the electrical connection jumper socket | Yes | | | |
| Design of the sensor connectable | PT100/1000, KTY83/84, NTC (resistance sensors) | type J, K, T, E, N (thermocouple) | PT100/1000, KTY83/84, NTC (resistance sensors) | type J, K, T, E, N (thermocouple) |
| Width | mm | 45 | | |
| Height | mm | 106 | | 108 |
| Depth | mm | 91 | | |

Accessories

6.1 Sealable cover

Description

There is a uniform sealable cover for the monitoring relays with an overall width of 22.5 mm. The sealable cover can be used to secure the actuators (rotary buttons, sliding switches, and keys) of the monitoring relays against unauthorized or unintentional manipulation.

Siemens also offers a sealable membrane (3TK2820-0AA00) for securing the monitoring relays with analog setting. The sealable membrane is affixed to the front of the device and secures rotary buttons and sliding switches against unintentional manipulation.

Note

The sealable membrane does not protect keys against unauthorized or unintentional manipulation.

Mounting

The figure below shows how to mount the sealable cover 3RP1902 on the monitoring relay.

Table 6- 1 Mounting the sealable cover on the monitoring relay

| Step | Operating instruction | Image |
|------|--|-------|
| 1 | Break off the clip on the sealable cover. | |
| 2 | Insert the sealable cover into the openings on the monitoring relay. | |
| 3 | Swing the sealable cover up. | |
| 4 | Insert the clip into the opening until it engages. | |
| 5 | Seal the clip to secure it against unauthorized removal. | |

6.2 Push-in lugs

Description

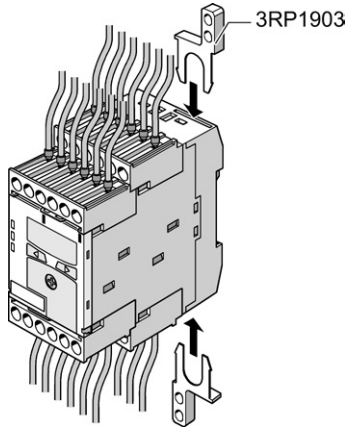
The 3RP1903 push-in lugs are available for the monitoring relays.

With the help of the push-in lugs, the monitoring relays can be secured with screws on a level surface (e.g. a wall). Two push-in lugs are required per device.

Installation

The following figure shows how to attach the 3RP1903 push-in lugs to the temperature monitoring relay.

Table 6-2 Installing the push-in lugs on the temperature monitoring relay

| Step | Operating instruction | Image |
|------|--|---|
| 1 | Insert the push-in lugs into the openings at the top and bottom of the monitoring relay and screw them tight with a screwdriver. |  The diagram illustrates the installation of 3RP1903 push-in lugs on a temperature monitoring relay. The relay is shown from a perspective view. Two lugs are being inserted into the top and bottom openings of the relay. A screwdriver is used to tighten the lugs. The lugs are labeled '3RP1903'. |

References

Further references

You will find further information on the 3RS1 / 3RS2 temperature monitoring relays Hotspot-Text (<http://support.automation.siemens.com/WW/view/en/20356134/133300>) on the Internet.

In addition to this manual, please refer to the operating instructions and manuals for any accessories. You can download the relevant documentation from the Internet (www.siemens.de/automation/csi/manual). Simply enter the order number of the relevant item into the search field.

Operating instructions

| Title | Order number |
|---|--------------------|
| SIRIUS temperature monitoring relays (3RS1040 / 1140 3RS1041 / 2041, 3RS2040 / 2140) | 3ZX1012-0RS10-0AA0 |
| SIRIUS temperature monitoring relays (3RS1042 / 1142) | 3ZX1012-0RS10-2AA2 |
| SIRIUS temperature monitoring relays (3RS1000 / 1010 / 1020 / 1030, 3RS1100 / 1101 / 1120 / 1130, 3RS1110 / 1111 / 1121 / 1131) | 3ZX1012-0RS10-1AA1 |

Parameters

Tripping delay time

If the measured value overshoots or undershoots the set limit value, the delay time that can be set using the "Tripping delay time" parameter starts. On expiry of this time, the switching contact changes state and a message may be sent via IO-Link.

Rotary button setting: Delay

ϑ1 limit value and ϑ2 limit value

The temperature monitoring relays monitor 1 or 2 measured values for overshoot or undershoot. On the device versions with digital setting, the measured value can be parameterized as a "Limit value ϑ1" or "Limit value ϑ2" for overshoot or undershoot. For the device variants with analog setting, different options are available.

If both the "ϑ1 limit value" and "ϑ2 limit value" are set to overshoot or undershoot, one of the parameters can be used as a warning threshold to output a warning message before a measured value is undershot or overshoot.

If the set limit value is overshoot or undershot, the output relay changes its switching state after the set delay time has expired. If the measured value has reached the set hysteresis value, the output relay immediately reverts to its original state.

You can find information about the switching response of the output relays in the "Function" chapter for the corresponding relay.

Rotary button setting:

- ϑ1
- ϑ2

Hysteresis

Hysteresis is the continuation of an effect within the hysteresis range after its cause has been removed; its purpose is to prevent repeated response in the threshold value range.

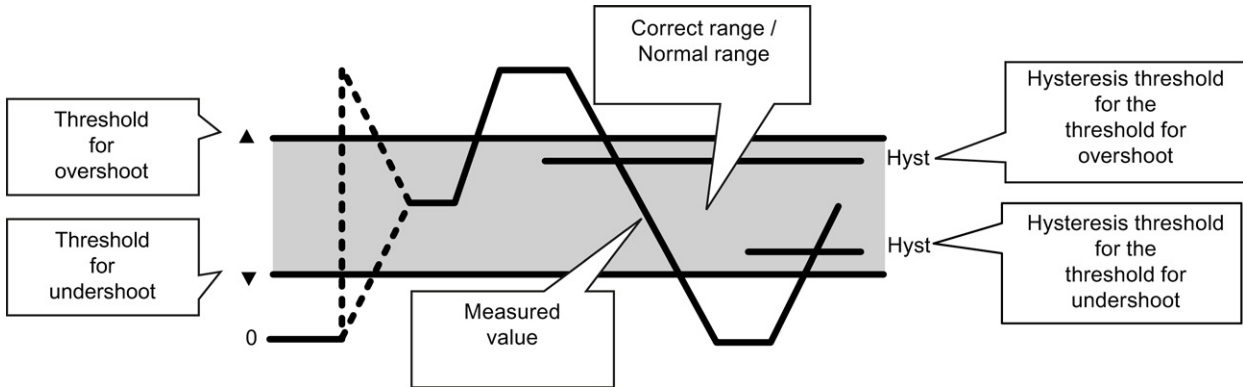


Figure B-1 Explanation of hysteresis

If, after the upper threshold value has been overshoot to such an extent that switching was necessary, the measured value returns to the normal range, and switching over to the correct range will not take place until a measured value which undershoots the hysteresis threshold has been reached. The same applies if the lower threshold value is undershot.

The hysteresis is only active if the "Reset response" parameter is set to autoreset.

Note

The hysteresis value of the warning threshold is permanently set to 3.1 % of the actual warning threshold.

Rotary button setting:

- Analog temperature monitoring relays: Hyst
- Digital temperature monitoring relays: Hysteresis

Relay switching response

The "Relay switching response" parameter allows the user to adjust the switching response of an output relay. Several variations can be distinguished here:



- Closed-circuit principle (NC)

With the closed-circuit principle, the output relay picks up when the voltage is applied (normally-open contact (NO) closed). The output relay drops out in the event of an error (normally-closed contact (NC) closed). If the supply voltage fails, the output relay also returns to this position so that a supply voltage failure is detected and reported.

- Open-circuit principle (NO)

With the open-circuit principle, the output relay only picks up in the event of an error (normally-open contact (NO) closed). Interruptions to the supply voltage or the rated control supply voltage are not displayed.

Rotary button setting and possible indications on the display :

| Rotary button setting | Display | Meaning |
|-----------------------|--|---------------------------|
| Circuit Prin.: Closed |  | Closed-circuit principle: |
| Circuit Prin.: Open |  | Open-circuit principle: |

Temperature sensor type

The "Temperature sensor type" parameter specifies the type of resistance sensor or thermocouple used. In the case of resistance sensors, a distinction is made between two-wire measurement and three-wire measurement. Both measuring procedures are described in the chapter titled "Connecting up (Page 21)".

Rotary button setting: Sensor Type

Possible indications on the display:

- 100 (PT100)
- 1000 (PT1000)
- K83 (KTY83)
- K84 (KTY84)
- NTC (NTC)
- J (J)
- K (K)
- T (T)
- E (E)
- N (N)
- S (S)
- R (R)
- b (b)

The measuring ranges of the different types of temperature sensor are listed in the chapter titled "Measuring ranges (Page 65)".




Number of temperature sensors

The 3RS1041 / 3RS2041 device versions support connection of up to three temperature sensors of the same type (resistance sensors).

The number of temperature sensors can be set locally using the rotary knob and the two buttons on the device.

Rotary button setting: Sensor NO.

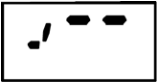
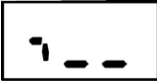
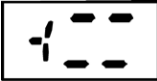
Possible indications on the display:

| Indication on the display | Meaning |
|---|--|
|  | A temperature sensor (T1) activated. |
|  | Two temperature sensors (T1 and T2) activated. |
|  | Three temperature sensors (T1, T2 and T3) activated. |

Temperature monitoring mode

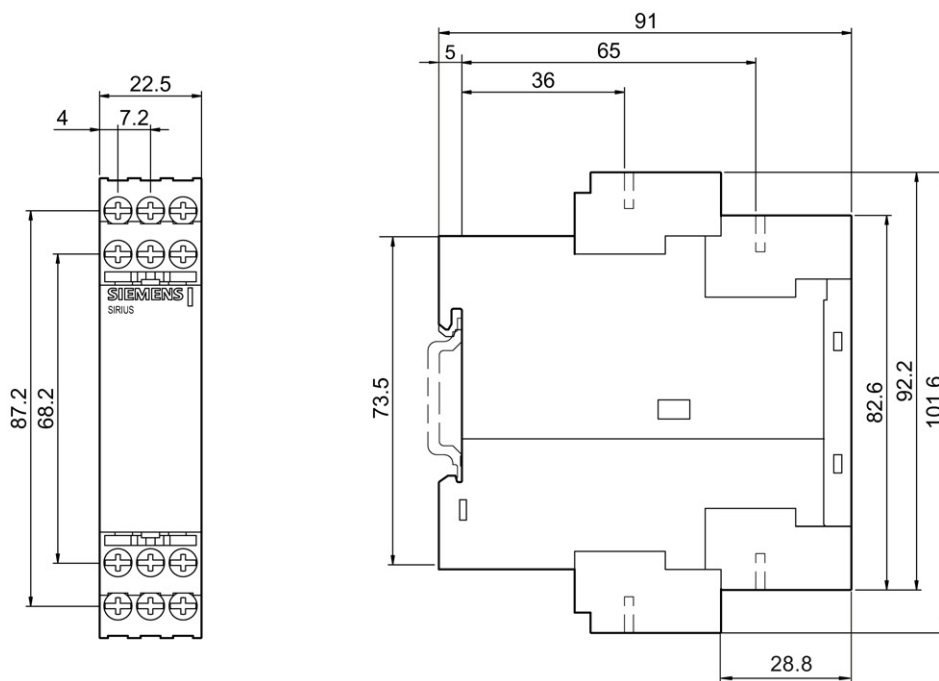
The parameter defines the temperature monitoring mode (overshoot, undershoot, or range monitoring) of a selected temperature sensor (resistance sensor). Up to three different temperature sensors (resistance sensors) can be connected to the 3RS1041 and 3RS2041 device versions. All 3 temperature sensors monitor the same temperatures.

Rotary button setting and possible indications on the display :

| Rotary button setting | Display | Meaning |
|-----------------------|---|----------------------|
| Mode: Over |  | Upper limit violated |
| Mode: Under |  | Lower limit violated |
| Mode: Window |  | Range monitoring |

Dimension Drawings

3RS1. temperature monitoring relays with analog setting (screw terminals)



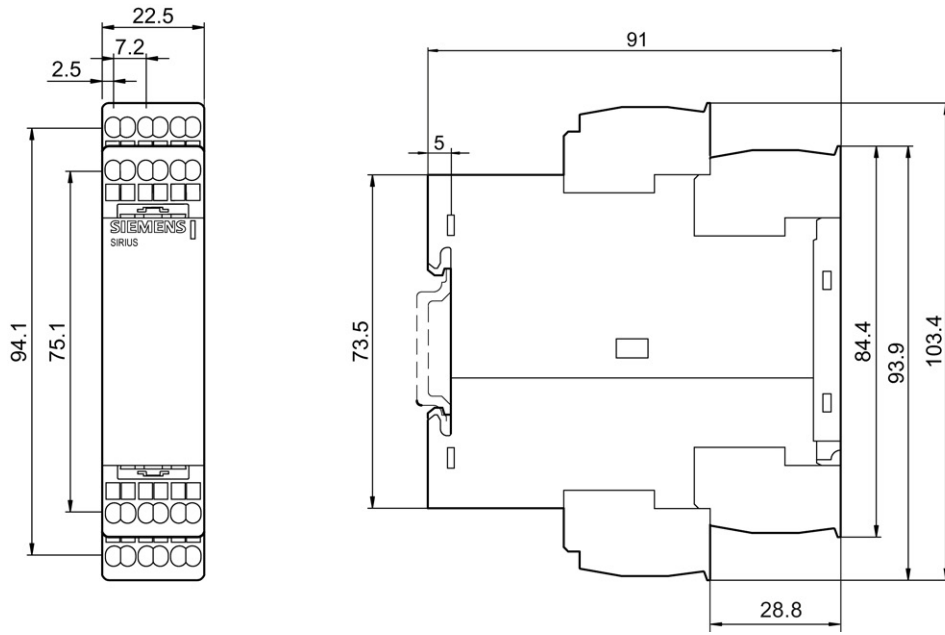
The dimension drawing is valid for the following device versions:

3RS1000-1. / 3RS1010-1. / 3RS1100-1. / 3RS1101-1. temperature monitoring relays

3RS1020-1. / 3RS1030-1. / 3RS1120-1. / 3RS1121-1. temperature monitoring relays

Figure C-1 3RS1. temperature monitoring relays with analog setting with screw-type connections

3RS1. temperature monitoring relays with analog setting (spring-loaded terminals)



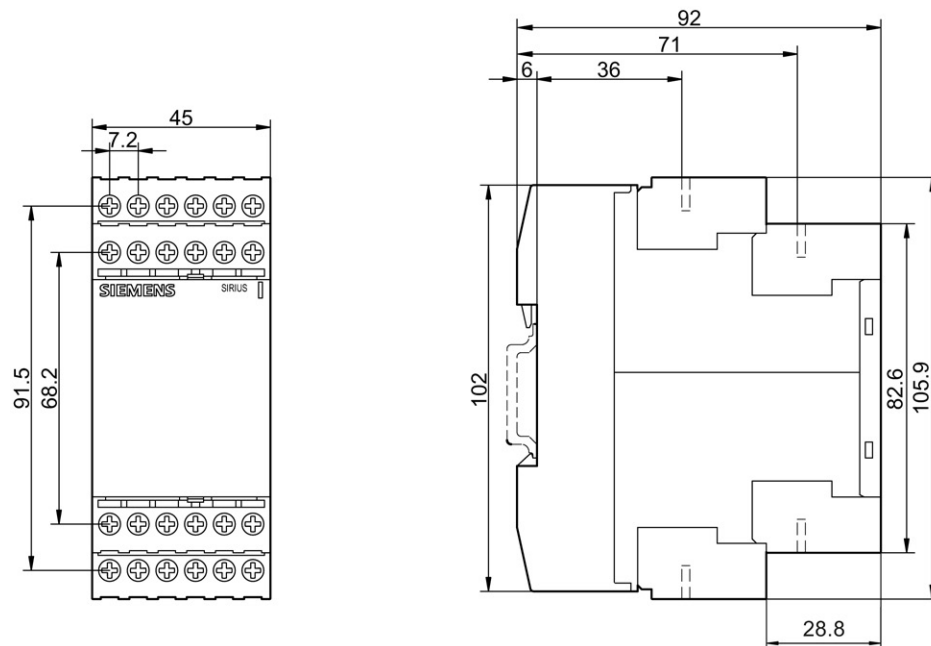
The dimension drawing is valid for the following device versions:

3RS1000-2. /- 3RS1100-2. temperature monitoring relays.

3RS1020-2. / 3RS1030-2. / 3RS1120-2. temperature monitoring relays

Figure C-2 3RS1. temperature monitoring relays with analog setting with spring-loaded connections

3RS1. / 3RS2. temperature monitoring relays with digital setting (screw terminals)



The dimension drawing is valid for the following device versions:

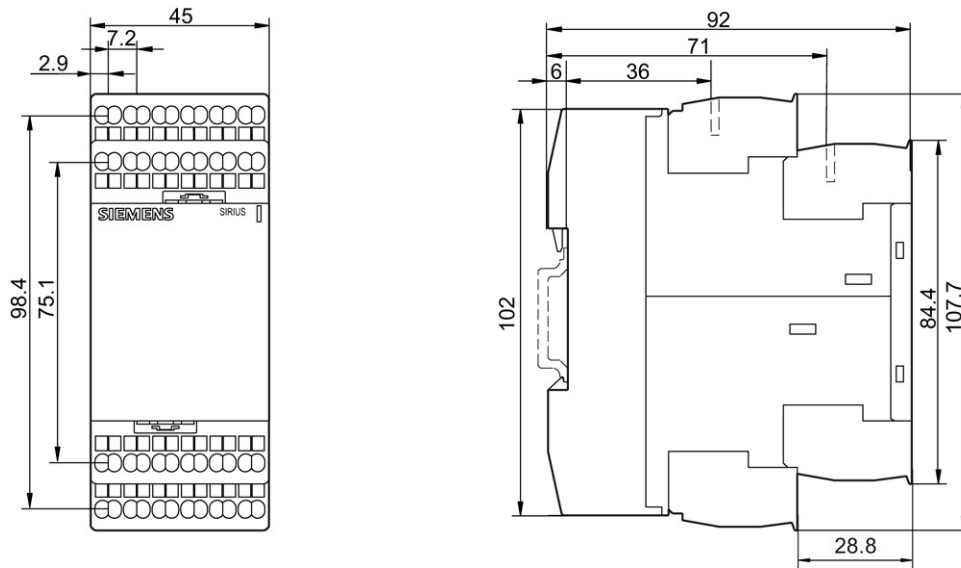
3RS1040-1. / 3RS2040-1. / 3RS1140-1. / 3RS2140-1. temperature monitoring relays

3RS1042-1. / 3RS1142-1. temperature monitoring relays

3RS1041-1. temperature monitoring relay

Figure C-3 3RS1. / 3RS2. temperature monitoring relays with digital setting with screw-type connections

3RS1. / 3RS2. temperature monitoring relays with digital setting (spring-loaded terminals)



The dimension drawing is valid for the following device versions:

3RS1040-2. / 3RS2040-2. / 3RS1140-2. / 3RS2140-2. temperature monitoring relays

3RS1042-2. / 3RS1142-2. temperature monitoring relays

3RS1041-2. temperature monitoring relay

Figure C-4 3RS1. / 3RS2. temperature monitoring relays with digital setting with spring-loaded connections

Characteristic curves

Characteristic curves of thermocouples

The following characteristic curves show the temperature ranges of the thermocouples.

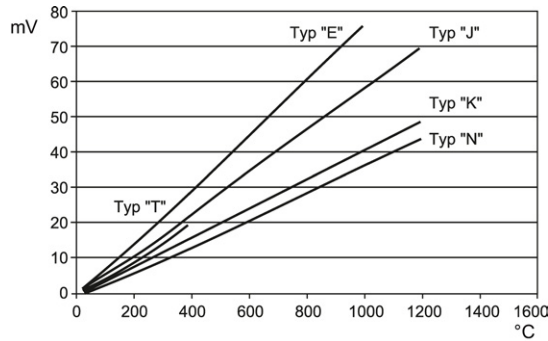


Figure D-1 Thermocouples J, K, T, E, N

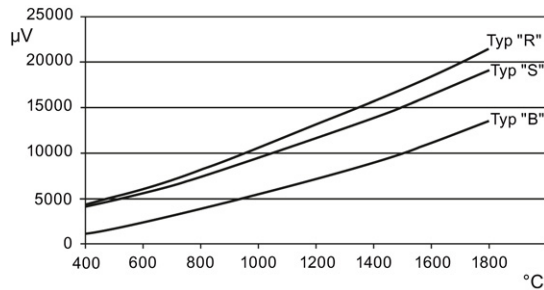


Figure D-2 Thermocouples S, R, B

Characteristic curves of resistance sensors

The following characteristic curves show the temperature ranges of the resistance sensors.

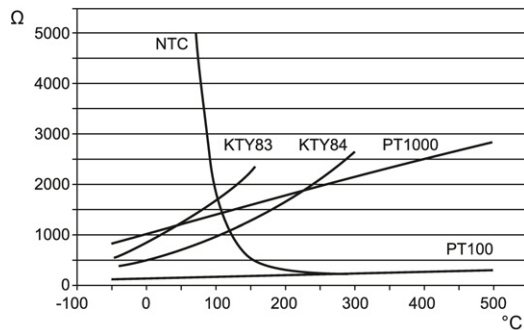


Figure D-3 Temperature ranges of the resistance sensors

Correction sheet



Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

Fax response

| | |
|--|---|
| To SIEMENS AG I IA CE MK&ST 3 92220 Amberg / Germany | From (please complete): Name Company/Department Address |
|--|---|

Fax: +49 (0)9621-80-3337

Manual title:

Table E- 1 Errors, comments, and suggestions for improvements

| |
|--|
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

Index

A

- Accessories
 - Push-in lugs, 74
- Accessories - 3UG4 monitoring relays
 - Sealable cover, 73
- Application areas, 43
- Application environment, 24
- Applications, 27
- Approvals, 11
- Assembly
 - Screw mounting, 19
 - Standard rail, 20

B

- Basic knowledge, 7

C

- Cable error, 23
- Certifications, 11
- Characteristic curves
 - Resistance sensors, 87
 - Thermocouples, 87
- Characteristics, 11
- Closed-circuit principle, 79
- Code input, 58
- Correction sheet, 89
- Corrections, 8

D

- Device replacement, 18
- Display, 60
- Disposal, 7

F

- Factory setting, 56
- Factory settings, 35
- Front view, 30, 31, 32, 45, 46, 47
- Front view, 30, 31, 32, 45, 46, 47
- Function chart, 34, 49, 51

H

- Hysteresis, 78

I

- Installation altitude, 24
- Internal circuit diagram, 37, 63, 64

L

- LED display, 36, 59
- Limit value for undershoot or overshoot, 77

M

- Measuring ranges
 - Resistance sensor, 65
 - Thermocouples, 65
- Memory function, 53
- Mounting position, 19

N

- Number of temperature sensors, 81

O

- Open-circuit principle, 79
- Operating conditions, 24
- Operating instructions, 75
- Operator controls, 55

P

- Parameters, 35, 55, 56
- Push-in lugs, 74

R

- Recycling, 7
- Reference junction compensation, 21
- References, 75

Relay switching response, 79
Removable terminals, 18
Resistance sensor, 22
Resistance to extreme climates, 24

S

Scope of validity
 Manual, 7
Screw mounting, 19
Screw-type connection system
 Connection cross-sections, 14
Screw-type connections, 14
Sealable cover, 73
Snap-on mounting, 20
Spring-loaded connection system, 15, 16
 Connection cross-sections, 17
Standards, 9
Status display, 61, 62

T

Technical Assistance, 8
Temperature monitoring mode, 81
Temperature sensor type, 80
Terminal assignment, 29, 30, 31, 32, 45, 46, 47
Test certificates, 11
Thermocouple, 21
Three-wire measurement, 23
Tools, 36
Tripping delay time, 77
Two-wire measurement, 22
Types of sensor, 28, 44

Service & Support

Download catalogs and information material:
www.siemens.com/sirius/infomaterial

Newsletter - always up to date:
www.siemens.com/sirius/newsletter

E-Business in the Industry Mall:
www.siemens.com/sirius/mall

Online-Support:
www.siemens.com/sirius/support

Contact for all technical information:
Technical Assistance
Tel.: +49 (911) 895-5900
e-mail: technical-assistance@siemens.com
www.siemens.com/sirius/technical-assistance

Siemens AG
Industry Sector
Postfach 23 55
90713 FUERTH
GERMANY

Subject to change without prior notice
Order No.: 3ZX1012-ORS10-1AC1

© Siemens AG 2011

