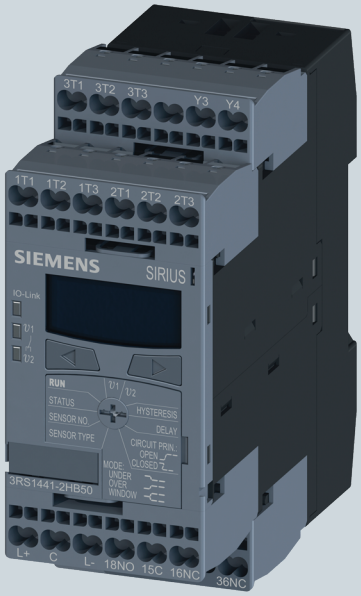
Monitoring and Control Devices

3RS14 / 3RS15 Temperature Monitoring Relays for IO-Link

Manual · 06/2011



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Monitoring and control devices 3RS14 / 3RS15 temperature monitoring relays for IO-Link

Manual

06/2011

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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

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

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.

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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.

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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.

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Introduction

1

Purpose of the manual

This manual describes the 3RS1 temperature monitoring relays for IO-Link. 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 69)" 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

2.1 Standards

Applicable standards

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

Table 2- 1 Standards - monitoring relays

Device standards	• 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)]	• 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	• IEC 60721-3-3 "Classification of environmental conditions" The monitoring relays are climate-proof according to IEC 60721-3.
Touch protection	• IEC / EN 60529 "Degrees of protection provided by enclosures" Monitoring relays are safe to touch in accordance with IEC / EN 60529.

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).

IO-Link

You can find more information about communication via IO-Link, and about the valid standards for monitoring relays for IO-Link, on the Internet (http://www.io-link.com/en).

Note

The monitoring relays for IO-Link conform to the IO-Link Communication Specification V1.0.

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.

Important note for maintaining the operational safety of your system

⚠ WARNING

Hazardous Voltage

Can Cause Death, Serious Injury, or Property Damage.

Please take note of our latest information

Systems with safety-related characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with certain actions when monitoring the product. For this reason, we publish a special newsletter containing information on product developments and features that are (or could be) relevant to operation of safety-related systems. You should subscribe to the corresponding newsletter in order to obtain the latest information and to allow you to modify your plant accordingly. Please go to the

Internet (www.siemens.com/industrial-controls/newsletter)

and register for the following Newsletter under "Service & Support":

- IO-Link (in the Automation folder)

To receive this newsletter, select the "Updates" check box.

Radio interference

NOTICE

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

3.1 Product description

Product description

The new SIRIUS 3RS14/3RS15 temperature monitoring relays for IO-Link are used to measure temperatures in solid, liquid, and gaseous media. The temperature is sensed by the sensors in the medium and evaluated by the device. Up to 2 limit values for overshoot, undershoot, or staying within a working range (range function) are monitored. In addition to providing warning and shutdown functions in the event of temperature deviations, the devices can be used as temperature controllers (single-step control, two-step control, or three-step control).

The devices differ in terms of the type and number of temperature sensors that can be connected to them:

- 3RS14: Connection for 1 or up to 3 resistance sensors
- 3RS15: Connection for 1 thermocouple

The 3RS14/3RS15 temperature monitoring relays for IO-Link offer many other performance features in addition to monitoring functions:

- Transmission of measured values (including resolution and unit) to the higher-level control.
  Local display and transmission of the temperature unit (°C or °F) can be parameterized. The temperature measured value transferred from temperature monitoring relays with more than one resistance sensor can be adjusted. Some device versions allow you to set which value is transferred cyclically.
- Transfer of alarm flags to the higher-level control.
- Comprehensive diagnostics capability by querying the precise cause of the error in the diagnostic data record.
- Remote parameterization is also possible (instead of local parameter assignment).
- Fast parameterization of identical devices by duplicating the parameter assignment in the higher-level control.
- Parameter transfer by means of Upload to the higher-level control via- IO-Link call or by parameter server[1)] when using an IO-Link master in
  IO-Link Communication Specification V1.1 or higher).
- Local parameter assignment can be disabled via IO-Link.

- To prevent automatic startup after a power failure and in order not to lose diagnostic data, errors can be configured so that they are saved to non-volatile memory.
- Linking to a higher-level control makes it possible to assign parameters to the monitoring relays via a display unit. The measured values can be displayed directly in a control room or at the machine/control cabinet.

[1] The parameter server provides an assurance of consistent central data management in the event of changes to parameters (made locally or via the control). The "Parameter server" function supports the automatic backup of parameter data (automatic re-assignment of parameter data if a device is replaced).

Up until now, using redundant sensors and/or analog signal converters to transfer measured values to a higher-level control incurred significant additional expense and wiring effort. Combining the autonomous monitoring relays with IO-Link communication reduces this wiring outlay and cuts costs.
As the availability of up-to-date measured values means that the higher-level control can take care of the control tasks within the plant, the continued availability of the output relays on the monitoring relays increases the plant's operational reliability (e.g. by shutting down the plant if limit values that cannot be achieved under normal operating conditions are overshot).

The monitoring relays continue to function autonomously in spite of the IO-Link connection. Parameters can be assigned locally at the device, independently of a higher-level control. As long as the 24 VDC power supply is available, the monitoring relays will function should the controller fail or not yet be available.

3.2 Connection systems

3.2.1 Screw-type connection

Screw-type connection

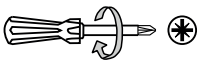
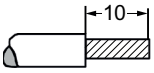
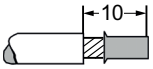
Use the following tool to establish the connection: All SIRIUS monitoring relays feature size PZ 2 screws for Pozidriv screwdrivers.

This means that the same tool, torque, and conductor cross-section is used when working on all SIRIUS monitoring relays. The stripped lengths are identical too; this is important for pre-assembled cables.

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

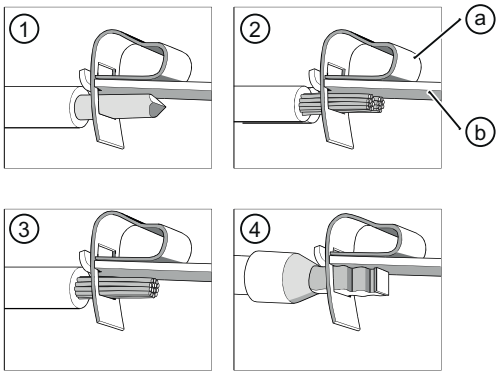
Table 3- 1 Removable terminal block with screw-type connections - monitoring relays

		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) mm² 2 x (0.5 to 2.5) mm²
Finely stranded without end sleeve		---
Finely stranded with end sleeve		1 x (0.5 to 2.5) mm² 2 x (0.5 to 1.5) mm²
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.

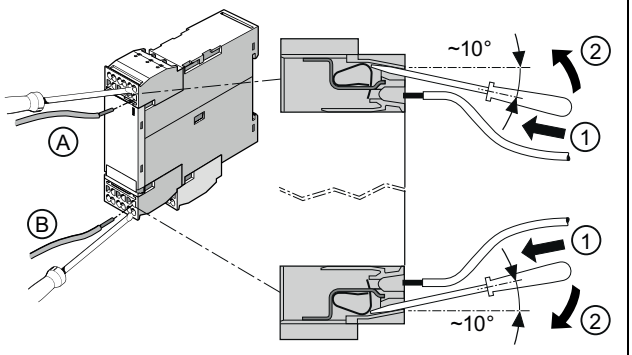
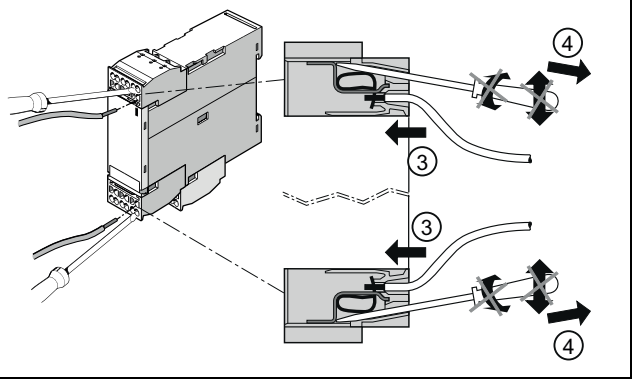
The devices are equipped with a two-wire connection, i.e. two independent connections per current path. Just one conductor is connected to each clamping point. The spring-loaded terminal presses the conductor against the busbar, which curves around inside the terminal. The high contact pressure per unit 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.

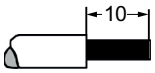
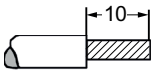
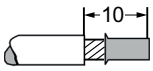
Spring-loaded terminal for 3RS monitoring relay

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		Ø 3.0 x 0.5 (3RA2808-1A)
Solid and stranded		2 x (0.25 to 1.5) mm²
Finely stranded without end sleeve		2 x (0.25 to 1.5) mm²
Finely stranded with end sleeve		2 x (0.25 to 1.5) mm²
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.

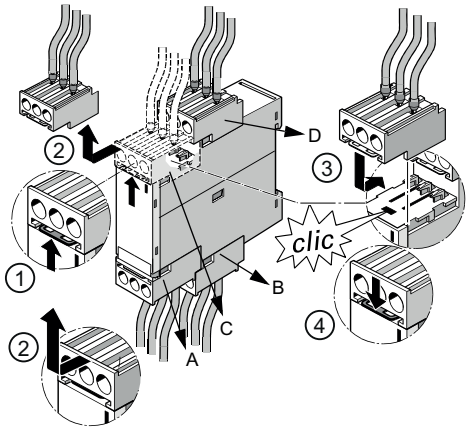
Turn off and lock out power before working on this equipment.

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	Image
1	Press the interlock.	
2	Remove the terminal.	
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.

3.2.4 Connection options for IO-Link

The IO-Link device is connected to the IO-Link master via the removable terminal and supplied with 24 V DC via this connection.

DANGER

Hazardous Voltage

If voltages are too high, the IO-Link device can be damaged and electric shock can result.

Use only power supplies that comply with the requirements of protective extra-low voltage (PELV in accordance with IEC EN 50178).

DANGER

Hazardous Voltage

Will cause death or serious injury.

Turn off and lock out power before working on this equipment.

There are 2 ways of supplying the monitoring relays with voltage via the control circuit.

Option 1: Connection to IO-Link master

Connect the IO-Link device to the master via the 3 cables L+, C, and L-. The IO-Link device is supplied with voltage via the 2 cables L+ and L-. The monitoring relay communicates with the master via cable C.

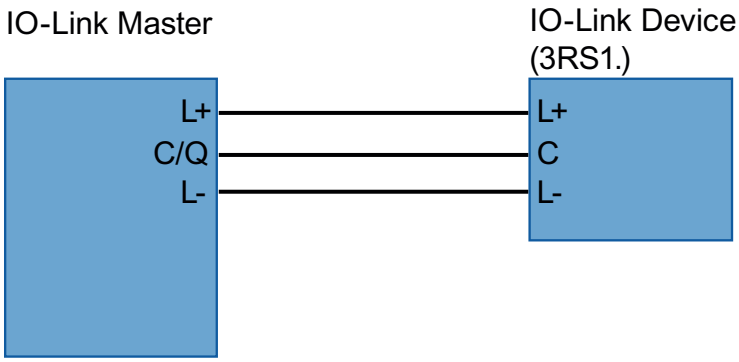


Figure 3-2 Connection to IO-Link master

Option 2: Direct voltage supply with 24 V DC

If no master is available, you can operate the IO-Link device with a 24 V DC voltage source.

For this purpose, connect the IO-Link device with the voltage source via the two cables L+ and L-. Since cable C is not used in this case, communication via IO-Link is not possible.

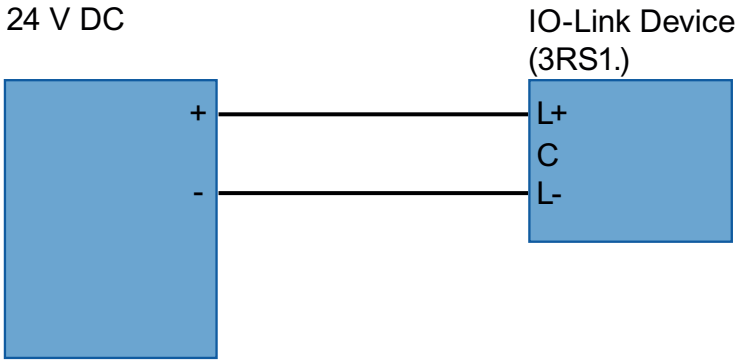


Figure 3-3 Direct voltage supply with 24 V DC

The pin assignments of the available IO-Link devices are described in the relevant product chapters.

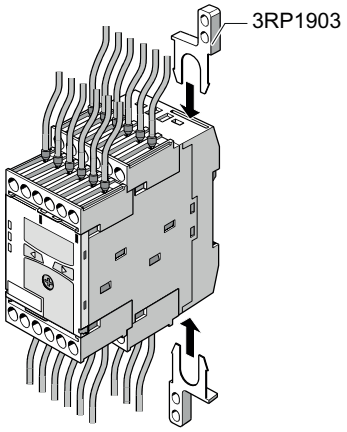
3.3 Installation

Mounting position

It can be mounted in any position.

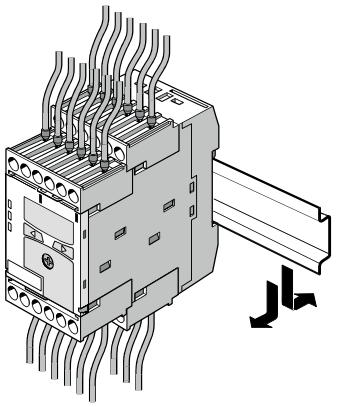
Screw mounting

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

Step	Operating instruction	Image
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.	

Standard rail mounting:

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

Step	Operating instruction	Image
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

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.

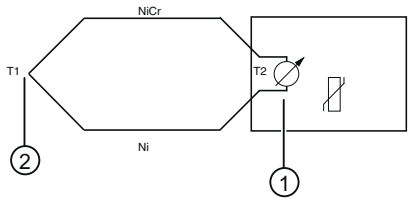
Characteristic curves for thermocouples are shown in the chapter titled "Characteristic curves (Page 83)".

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 3RS1540 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 3-4 Thermocouple connection, 3RS1540

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 83)".

Two-wire measurement

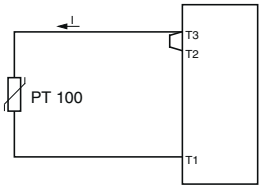


Figure 3-5 Two-wire measurement

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

Cable length in m	Cross-section in mm			
	0.5	0.75	1	1.5
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

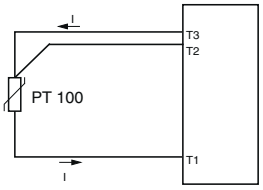


Figure 3-6 Three-wire measurement

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). Suitable enclosures are available as accessories for installation in dusty and damp spaces. 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 temperature monitoring relays for IO-Link

Function	Temperature monitoring relays		
	3RS14		3RS15
	40	41	40
Connectable sensor type			
Resistance sensors	✓	✓	--
Thermocouple	--	--	✓
Number of sensors that can be monitored	1	3	1
Temperature monitoring			
Temperature monitoring for overshoot	✓	✓	✓
Temperature monitoring for undershoot	✓	✓	✓
Number of limit values that can be set[1)]	2	2	2

[1)] It is possible to switch between the open-circuit principle NOand the closed-circuit principle NC.

✓: Function available

--: Function not available

Digitally adjustable temperature monitoring relays for IO-Link

4

4.1 Application areas

The digitally adjustable temperature monitoring relays can be used in virtually any application in which limit temperatures must not be overshot 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 4- 1 Applications involving digitally adjustable temperature monitoring relays

Function	Application
• 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	• 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 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)]

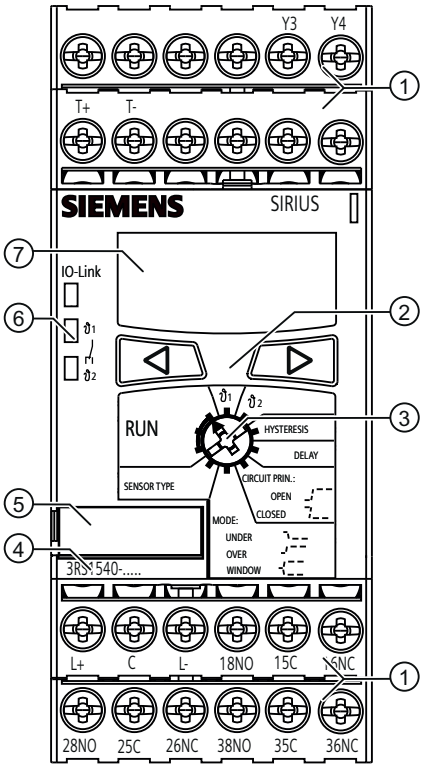
[1)] NTC type: B57227-K333-A1 (100 °C: 1.8 kΩ; 25 °C: 32.762 kΩ)

Thermocouples:

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

4.3 Operator controls and connection terminals

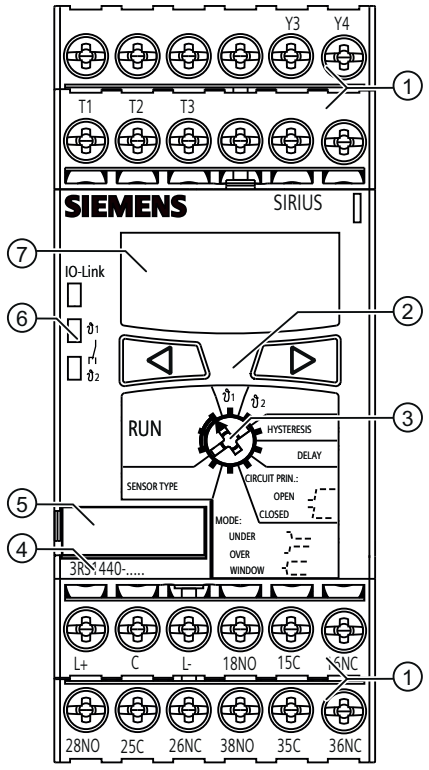
Front view/Terminal assignment (digital temperature monitoring relays for thermocouples)

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: "ϑ1" LED and "ϑ2" (contact symbols) and "IO-Link" LED (device in monitoring mode)
	⑦	Display for parameterization, actual-value indication, and diagnostics
	Terminal labels	
	L+	Supply voltage for IO-Link
	C	Communication signal
	L-	IO-Link ground
	T+, T-	Sensor connection for thermocouples
	Y3, Y4	Reset input
	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
	38NO	Output relay K3 NO contact
	35C	Output relay K3 CO contact root
	36NC	Output relay K3 NC contact

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection systems (Page 15)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 51)".

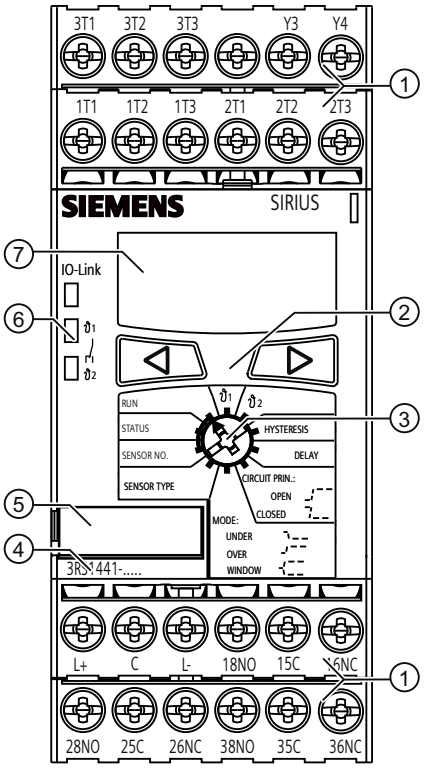
Front view/Terminal assignment (digital temperature monitoring relays for 1 resistance sensor)

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: "ϑ1" LED and "ϑ2" (contact symbols) and "IO-Link" LED (device in monitoring mode)
	⑦	Display for parameterization, actual-value indication, and diagnostics
	Terminal labels	
	L+	Supply voltage for IO-Link
	C	Communication signal
	L-	IO-Link ground
	T1, T2, T3	Sensor connection for resistance sensors
	Y3, Y4	Reset input
	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
	38NO	Output relay K3 NO contact
	35C	Output relay K3 CO contact root
	36NC	Output relay K3 NC contact

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection systems (Page 15)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 51)".

Front view/Terminal assignment (digital temperature monitoring relays for up to 3 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: "ϑ1" LED and "ϑ2" (contact symbols) and "IO-Link" LED (device in monitoring mode)
	⑦	Display for parameterization, actual-value indication, and diagnostics
	Terminal labels	
	L+	Supply voltage for IO-Link
	C	Communication signal
	L-	IO-Link ground
	1T1, 1T2, 1T3	Sensor connection for resistance sensors
	2T1, 2T2, 2T3	
	3T1, 3T2, 3T3	
	Y3, Y4	Reset input
	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
	38NO	Output relay K3 NO contact
	35C	Output relay K3 CO contact root
	36NC	Output relay K3 NC contact

You can find additional information on the connection terminals and the permissible conductor cross-sections in the Chapter "Connection systems (Page 15)".

You can find information on connecting in the Chapter "Circuit diagrams (Page 51)".

4.4 Functionality

General functionality

3RS14 and 3RS15 digitally adjustable temperature monitoring relays for IO-Link can be used to measure 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 digital temperature monitoring relays have 2 separately adjustable limit values, are non-volatile, and can be operated according to either the open-circuit principle or the closed-circuit principle.

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

3RS1440 and 3RS1540 temperature monitoring relays for IO-Link are digitally adjustable for one sensor. They are an effective 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.

3RS1441 temperature monitoring relays for IO-Link are digitally adjustable and can evaluate up to 3 resistance sensors at the same time. The devices have been designed specifically for monitoring motor windings and motor bearings.

Power is supplied to the temperature monitoring relays directly by IO-Link (L+/L-) or via an external 24 VDC voltage source. If power is supplied via an external 24 VDC voltage source, the devices will function even without IO-Link communication.

As long as a power supply is available and there is no internal device fault or temperature sensor fault, the output relay K3 is picked up (monitoring mode is active).

Monitoring

When the temperature reaches the set limit value $\vartheta 1$, 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 $\vartheta 2$ in the same way.

Each of the 2 limit values $\vartheta 1$ and $\vartheta 2$ 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 overshot 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).

IO-Link

Parameter assignment of the monitoring relays is also possible via IO-Link. They transfer the following data cyclically (e.g. to a higher-level control):

- A selected measured value
- States of the output relays
- Group error (GE)/general warning (GW)

Diagnostic data and measured values are transferred acyclically. The diagnostic mechanism of IO-Link is used to send event-driven error messages (event codes) to the IO-Link master.

Memory function

The digitally adjustable temperature monitoring relays for IO-Link have a memory function. The memory function is illustrated below based on the example of a temperature overshoot.

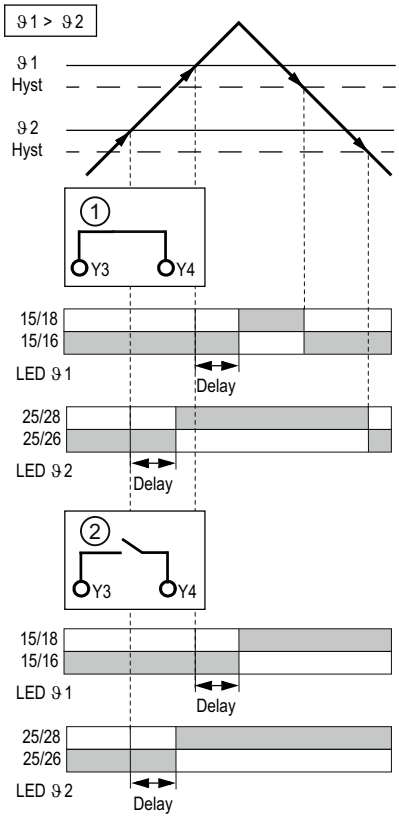
When the temperature reaches the set limit value ϑ1, the output relay K1 changes its switching state once the set time t has elapsed. (Output relay K2 responds to ϑ2 in the same way.) The temperature monitoring relays for IO-Link behave as described below:

- On temperature monitoring relays for IO-Link, the memory function is activated by default (manual RESET). The output relays only revert to the original state when the temperature falls below or exceeds the set hysteresis value and you take one of the following actions:
  - Jumper terminals Y3/Y4 briefly
  - Turn the rotary knob to "RUN" and press the right arrow key
  - Perform a manual reset via IO-Link

  Note

  The outputs are reset (manual RESET) via IO-Link via the process image output (PIQ) by setting the "Reset" control command (see the chapter titled "Process image output (PIQ) and input (PII) (Page 87)").

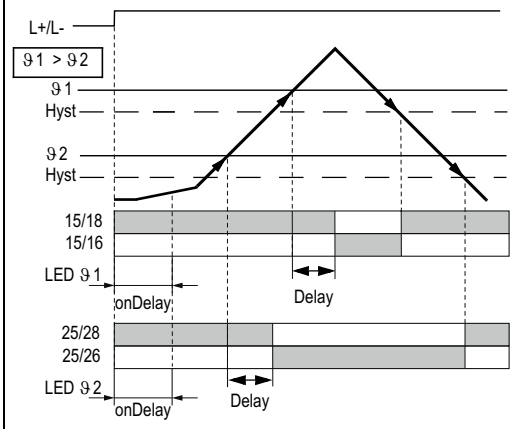
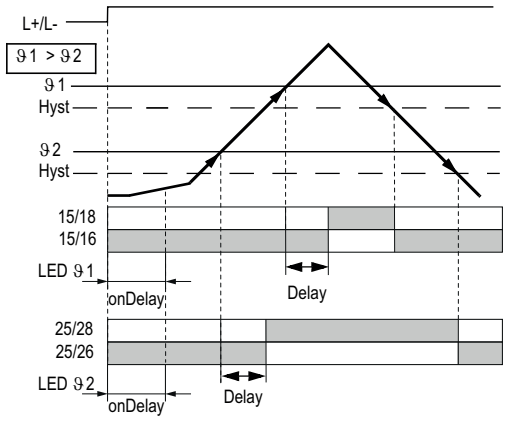
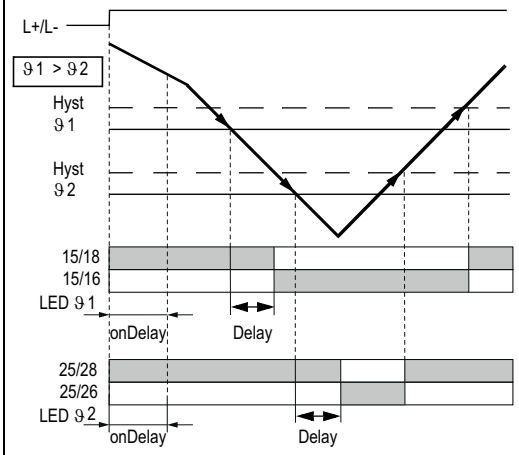
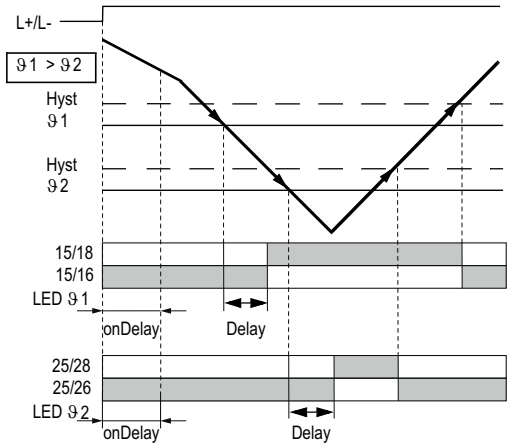
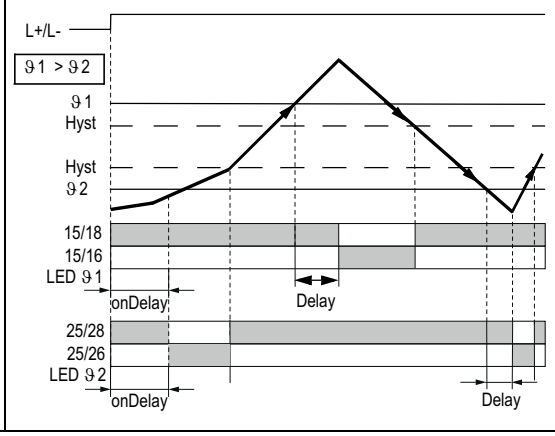
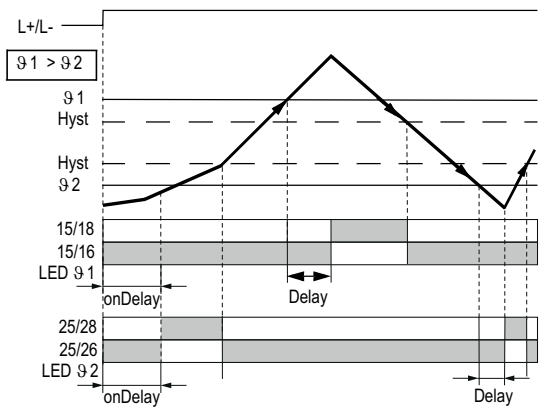
- If you jumper terminals Y3/Y4 permanently, you deactivate the memory function (AUTORESET). The output relays revert to the initial state immediately as soon as an error that occurred previously has been dealt with and the temperature falls below or exceeds the set hysteresis value.

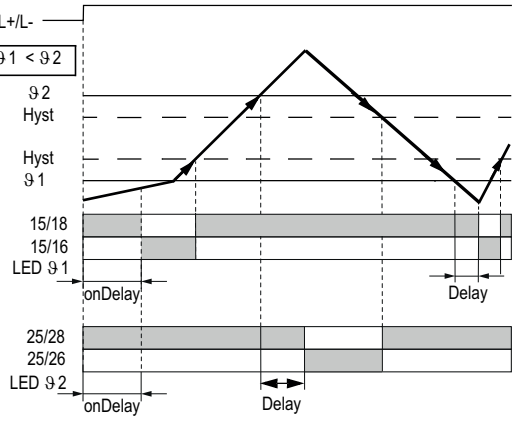
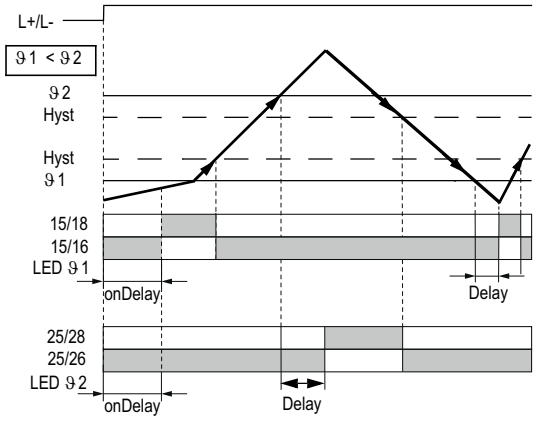


① AUTORESET
② Manual RESET

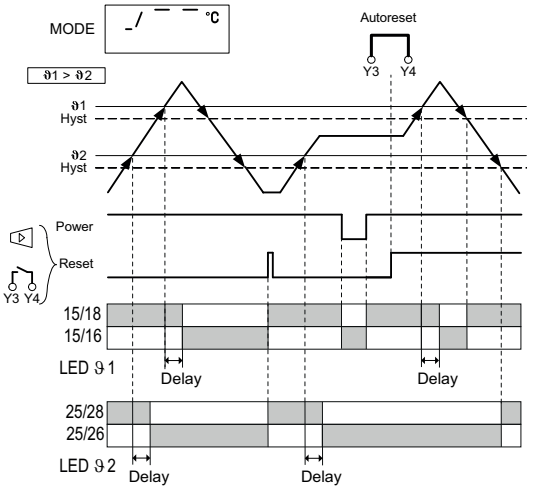
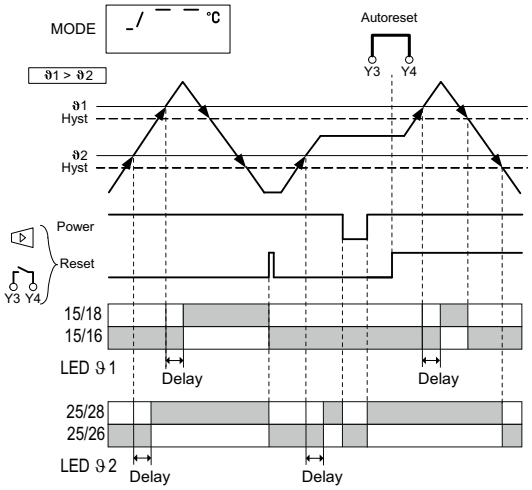
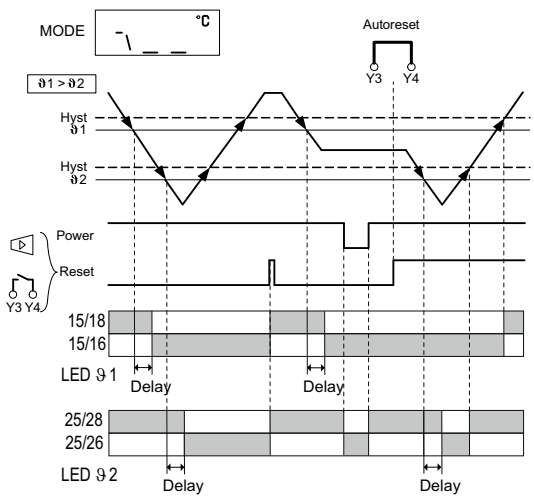
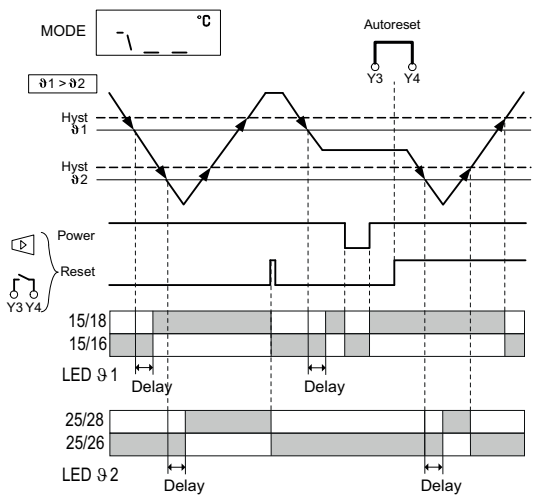
Figure 4-1 Typical circuit diagram for memory function

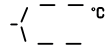
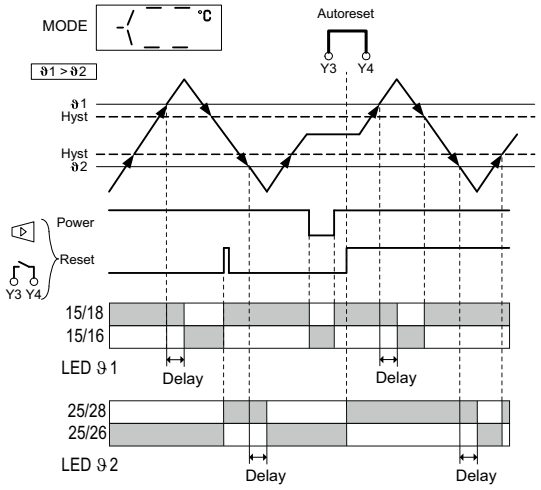
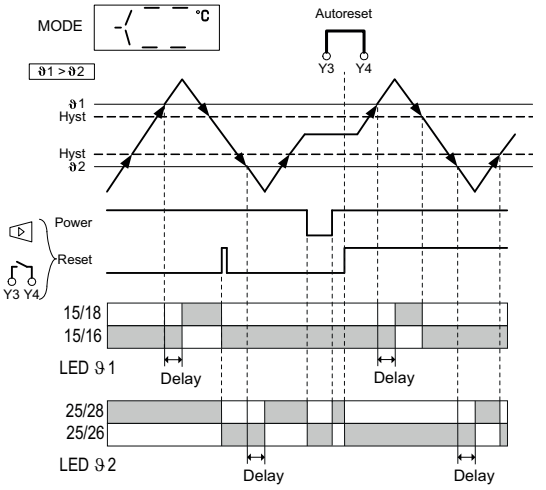
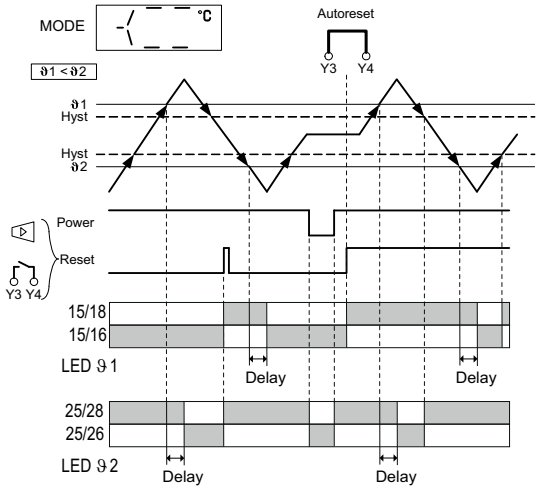
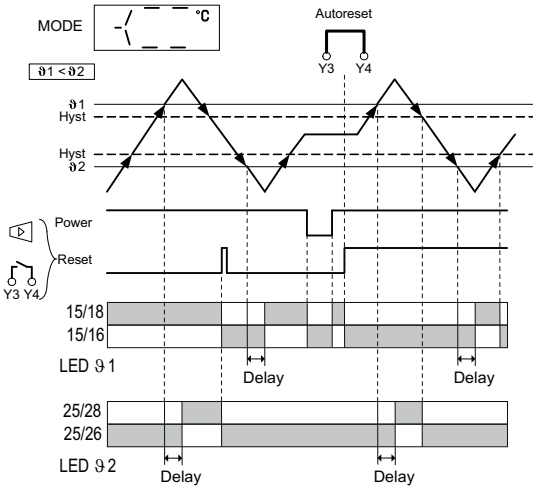
Function diagrams for 3RS1440 and 3RS1441

Temperature monitoring mode	Memory = no (Y3/Y4) Relay switching response = NC (closed-circuit principle)	Memory = no (Y3/Y4) Relay switching response = NO (open-circuit principle)
		
		
		

Temperature monitoring mode	Memory = no (Y3/Y4) Relay switching response = NC (closed-circuit principle)	Memory = no (Y3/Y4) Relay switching response = NO (open-circuit principle)
		

Function diagrams for 3RS1540

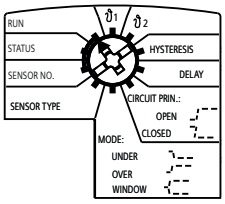
Temperature monitoring mode	Relay switching response = NC (closed-circuit principle)	Relay switching response = NO (open-circuit principle)
-/ ‾ ‾ °C		
-\ _ _ °C		

Temperature monitoring mode	Relay switching response = NC (closed-circuit principle)	Relay switching response = NO (open-circuit principle)
		
		

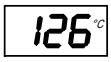
4.5 Operation

Parameters

3RS1 temperature monitoring relays for IO-Link have 1 rotary button and 2 arrow keys to switch between the display of the current measured value ("RUN") and the setting of the basic device parameters. Parameter assignment is also possible via IO-Link.



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



In the event of faults or errors, the display facilitates troubleshooting.

If the rotary button is set to "STATUS" (only on temperature monitoring relays for up to 3 resistance sensors), the display shows the temperature sensor status of the individual sensors. For information about displaying the tempeature sensor status, please see the chapter titled "Operating display and status display (Page 46)".

Setting parameters

You set the parameters locally via the display using the 2 arrow keys as follows:

1. Turn the rotary button to the corresponding parameter.
2. Use the arrow keys to select the value of the parameter.

Note

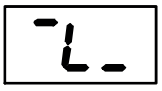
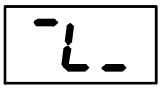
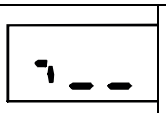
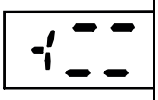
The rotary button does not have to be in a specific position when setting parameters via IO-Link.

For more information about configuration via IO-Link, see the chapter titled "Configuring the IO-Link (Page 61)".

Parameter information

The following table lists the possible parameter settings for the 3RS1 temperature monitoring relay for IO-Link:

Table 4- 2 Parameter settings, 3RS1 digital temperature monitoring relay for IO-Link

Parameter		Setting range		Increment	Factory setting
		Minimum value	Maximum value		
Limit value ϑ1	3RS1440/3RS1441	-50 °C/-58 °F	750 °C / 1382 °F	1 °C/1 °F	80 °C/176 °F
	3RS1540	-99 °C/-146.2 °F	1800 °C / 3272 °F		
Limit value ϑ2	3RS1440/3RS1441	-50 °C/-58 °F	750 °C / 1382 °F	1 °C/1 °F	50 °C/122 °F
	3RS1540	-99 °C/-146.2 °F	1800 °C / 3272 °F		
Warning threshold for ϑ1[4]	3RS1440/3RS1441	-50 °C/-58 °F	750 °C / 1382 °F	1 °C/1 °F	75 °C/167 °F
	3RS1540	-99 °C/-146.2 °F	1800 °C / 3272 °F		
Warning threshold for ϑ2[4]	3RS1440/3RS1441	-50 °C/-58 °F	750 °C / 1382 °F	1 °C/1 °F	45 °C/113 °F
	3RS1540	-99 °C/-146.2 °F	1800 °C / 3272 °F		
Hysteresis (Hyst)[1]		1 °C/1 °F	99 °C/99 °F	1 °C/1 °F	5 °C/5 °F
Tripping delay time (Delay) for ϑ1 and ϑ2		0 s	999.9 s	0.1 s	0 s
ON-delay time (onDelay)[4]		0 s	999.9 s	0.1 s	0 s
ON-delay time (at power ON)[4]		Disabled	Enabled	--	Enabled
ON-delay time (at manual reset)		Disabled	Enabled	--	Enabled
Relay switching response (closed-circuit principle NC / open-circuit principle NO)				--	
		NC	NO		NC
Type of temperature sensor[2]		--	--	--	PT100
Number of temperature sensors[3]		--	--	--	3
Temperature monitoring mode			 	--	
		OVER	UNDER	WINDOW	--	OVER
Temperature unit		0 = °C	1 = °F		--	0 = °C
Group diagnostics[4]		Disabled	Enabled		--	Enabled
Group error diagnostics[4]		Disabled	Enabled		--	Enabled
Local limit value modification[4]		Disabled	Enabled		--	Enabled
Local parameter modification[4]		Disabled	Enabled		--	Enabled

Parameter		Setting range		Increment	Factory setting
		Minimum value	Maximum value		
Local reset[4)]		Disabled	Enabled	--	Enabled
Retentive error memory[4)]		Disabled	Enabled	--	Disabled
Analog value coding[4)]		0 (disabled)	255	--	5

[1)] The set hysteresis applies to both limit values set.

[2)] Resistance sensors (PT100, PT1000, KTY83-110, KTY84, NTC) or thermocouples (J, K, T, E, N, S, R, B) Thermocouples S, R, B are only adjustable on the 3RS1540!

[3)] Number of temperature sensors used: 1, 2, or 3 (3RS1441 only)

[4)] The parameter can only be set via IO-Link.

Note

Resistance sensor NTC

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

You can find more information about status display in the chapter titled

"Operating display and status display (Page 46)".

The parameters are defined in the chapter titled "Parameters (Page 71)".

You can find more information about possible parameter settings for the 3RS1440/3RS1441/3RS1540 temperature monitoring relays for IO-Link in the chapter titled "Process data and data sets (Page 85)".

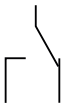
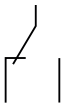
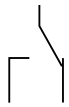
4.6 Diagnostics

4.6.1 Diagnostics with LED

LED statuses

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

- LED IO-Link
- ϑ1 LED
- ϑ2 LED

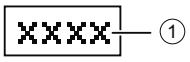
Display	Meaning	Output relay K1	Output relay K2	Output relay K3
		16 / 15 / 18	26 / 25 / 28	36 / 35 / 38
ϑ1 LED lit	Temperature ϑ_1 overshot or undershot or internal fault or sensor fault if open-circuit principle NO is set (output relay K1 switched).			
ϑ2 LED lit	Temperature ϑ_2 overshot or undershot or internal fault or sensor fault if open-circuit principle NO is set (output relay K2 switched).			
LED IO-Link green	IO-Link communication active	--	--	--
LED IO-Link red	IO-Link communication error			

You can find more information about the switching response of the output relays in the chapter titled "Functionality (Page 34)".

4.6.2 Indications on the display

Display information

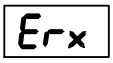
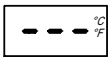
The display features an area for indicating the temperature measured value or an error symbol.



① Temperature measured value or error symbol

Meaning of the information on the display

The following states and errors are shown on the display:

Symbol	Meaning
126 °C	Measured temperature is displayed
°C / °F	Flashing temperature unit: Delay time is running
 [1]	• Setting of ϑ1 and ϑ2 is outside the permissible temperature range of the sensor • Sensor short-circuit • Sensor wire break • Hysteresis > 80 K/80 ° for NTC
	Measured value ϑ is outside the permissible temperature range of the sensor

[1] x = error number. The possible errors are listed in the "Diagnostics and messages" table in the chapter titled "Diagnostics via IO-Link (Page 48)".

You can find more information about the switching response of the output relays in the chapter titled "Functionality (Page 34)".

4.6.3 Operating display and status display

Operating display for device versions with up to 3 resistance sensors

When the rotary button is set to "RUN" and multiple resistance sensors are being used on 3RS1441 devices, the display shows the following values one after the other:

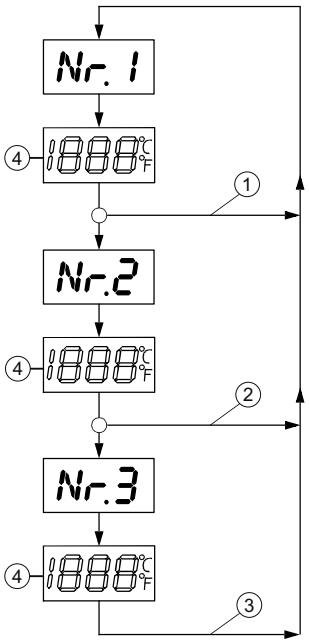


Figure 4-2 Operating display for 3RS1441

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 3 resistance sensors

For temperature monitoring with multiple resistance sensors, the status of an individual sensor can be shown on the display.

The following graphic shows the status display with 1 resistance sensor for temperature undershoot, temperature overshoot, and range monitoring as an example:

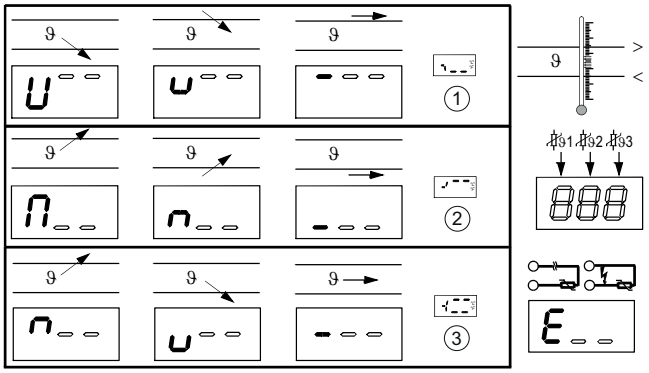


Figure 4-3 Status display 3RS1441

① Temperature undershoot

② Temperature overshoot

③ Range monitoring

You can find more information about the switching response of the output relays in the chapter titled "Functionality (Page 34)".

4.6.4 Diagnostics via IO-Link

Temperature monitoring relays for IO-Link also support diagnostics via IO-Link.

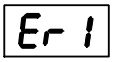
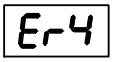
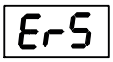
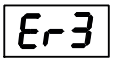
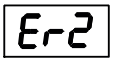
The manufacturer-specific diagnostics listed in the table are reported via the diagnostics mechanism of IO-Link. The table below provides information on possible causes and remedial measures:

Table 4- 3 Possible causes and remedial measures

Diagnostics and message	Possible cause	Possible remedial measure
Invalid parameter	The set parameter is invalid.	Specify a parameter in accordance with the parameter table in the Chapter "Operation (Page 41)".
Self-test error/internal error	Fault in internal test.	Return the device to the manufacturer.
Limit value for overshoot violated	The temperature set is higher than the limit value set for overshoot.	• Reduce the temperature. • Set a higher limit value.
Limit value for undershoot violated	The temperature set is lower than the limit value set for undershoot.	• Increase the temperature. • Set a lower threshold.
Temperature sensor 1, 2, or 3 - measuring range overshoot	The temperature is outside the permissible temperature range of the temperature sensor used.	Install and configure a suitable temperature sensor.
Temperature sensor 1, 2, or 3 - wire break	• The connection to the short-circuited temperature sensor has been interrupted. • The temperature sensor is defective.	• Check the connection to the temperature sensor. • Use a new temperature sensor.
Temperature sensor 1, 2, or 3 - short-circuit	• The connection to the temperature sensor has been interrupted. • The temperature sensor is defective.	• Check the connection to the temperature sensor. • Use a new temperature sensor.

The table below indicates how the manufacturer-specific diagnostics are reported:

Table 4- 4 Diagnostics and messages

Diagnostics and message	IO-Link for event code [1]	PII [2]		Data set 92	Display information
		GE [3]	GW [4]		
Invalid parameter	0x6320	x	—	x	
Self-test error/internal error	0x5000	x	—	x	 or 
Limit value for overshoot violated	0x8C10	x	—	x	Current temperature measured value (message via IO-Link)
Limit value for undershoot violated	0x8C30	x	—	x	Current temperature measured value (message via IO-Link)
Temperature sensor 1, 2, or 3 - measuring range overshoot	0x8C20	x	—	x	
Temperature sensor 1, 2, or 3 - wire break	0x8CA6	x	—	x	
Temperature sensor 1, 2, or 3 - short-circuit	0x8CA1	x	—	x	

[1] The manufacturer-specific diagnostic events listed in the table are reported to the IO-Link master via the diagnostics mechanism of IO-Link.

[2] With the "process input image" (see "Process image output (PIQ) and input (PII) (Page 87)"), you can determine via the group error (GE) bit or general warning (GW) bit in the user program whether detailed information on diagnostics or messages is present in diagnostic data set 92. If bit (= 1) is set, you can obtain detailed information on what caused a "group error" or "general warning" by reading data set 92.

[3] GE = Group error: You can find detailed information in diagnostics data set 92 (see the Chapter "Diagnostics - data set (index) 92 (Page 90)").

[4] GW = General warning: You can find detailed information in diagnostics data set 92 (see the Chapter "Diagnostics - data set (index) 92 (Page 90)").

x: Bit set

○: Not relevant

4.6.5 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 "Functionality (Page 34)".

4.7 Circuit diagrams

Digitally adjustable temperature monitoring relays for resistance sensors for IO-Link

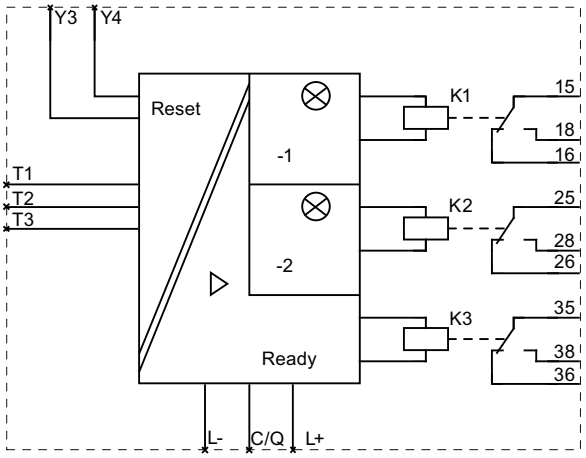


Figure 4-4 3RS1440 temperature monitoring relays

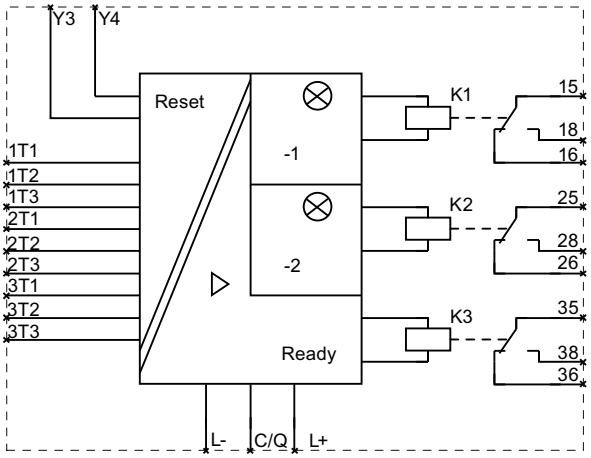


Figure 4-5 3RS1441 temperature monitoring relays

Digitally adjustable temperature monitoring relays for thermocouples for IO-Link

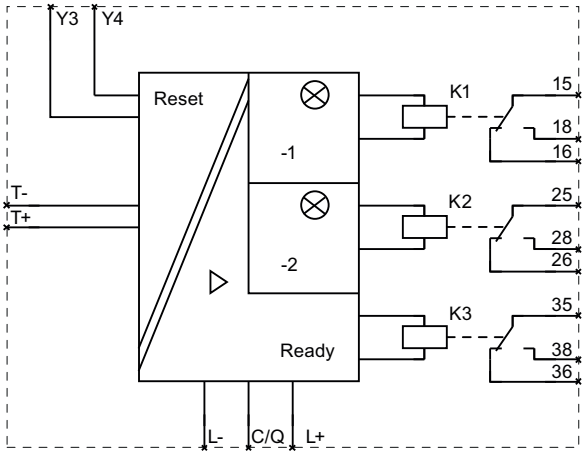


Figure 4-6 3RS1540 temperature monitoring relays

4.8 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 table lists the measuring ranges of the thermocouples in °C and °F.

Table 4- 5 Measuring ranges for thermocouples

Sensor type	Short-circuit	Wire break	3RS1540	
			Measuring range in °C	Measuring range in °F
J	---	✓	-99 … +1200	-146.2 … +2192
K	---	✓	-99 … +1350	-146.2 … +2462
T	---	✓	-99 … +400	-146.2 … +752
E	---	✓	-99 … +999	-146.2 … +1830,2
N	---	✓	-99 … +1300	-146.2 … +2372
S	---	✓	0 … +1750	+32 … +3182
R	---	✓	0 … +1750	+32 … +3182
B	---	✓	400 … +1800	+752 … +3272

✓ = Detection possible

--- = Detection not possible

Measuring range for resistance sensors

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

Table 4- 6 Measuring range for resistance sensors

Sensor type	Short-circuit	Wire break	3RS1440		3RS1441	
			Measuring range in °C	Measuring range in °F	Measuring range in °C	Measuring range in °F
PT100	✓	✓	-50 … +750	-58 … +1382	-50 … +750	-58 … +1382
PT1000	✓	✓	-50 … +500	-58 … +932	-50 … +500	-58 … +932
KTY83-110	✓	✓	-50 … +175	-58 … +347	-50 … +175	-58 … +347
KTY84	✓	✓	-40 … +300	-40 … +572	-40 … +300	-40 … +572
NTC[1)]	✓	---	+80 … +160	+176 … +320	+80 … +160	+176 … +320

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

✓ = Detection possible

--- = Detection not possible

Note

The "Parameters (Page 71)" parameter is used to switch over between the temperature units degrees Celsius [°C] and degrees Fahrenheit [°F].

4.9 Technical data

4.9.1 3RS14 temperature monitoring relays

General technical details

		3RS1440-.....	3RS1441-.....
type of voltage		DC	
Control supply voltage 1 for DC			
• rated value	V	24	
• initial rated value	V	18	
• final rated value	V	30	
Number of measuring circuits		1	3
Product function			
• defect storage		Yes	
• reset external		Yes	
Measurable temperature	°C	-50 … +750	
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	

Mechanical design

		3RS14..-2....	3RS14..-1....
Design of the electrical connection for auxiliary and control current circuit		spring-loaded terminals	screw-type terminals
Design of the sensor connectable		PT100/1000, KTY83/84, NTC (resistance sensors)	
Number of change-over switches for auxiliary contacts		3	
Width	mm	45	
Height	mm	108	106
Depth	mm	91	

Communication

		3RS14..-.....
Protocol will be supported IO-Link protocol		Yes
IO-Link transfer rate		COM2 (38,4 kBaud)
Point-to-point cycle time between master and IO-Link device minimum	s	0.01
Data volume		
• of the address range of the outputs with cyclical transfer total	byte	2
• of the address range of the inputs with cyclical transfer total	byte	4

4.9.2 3RS15 temperature monitoring relays

General technical details

		3RS1540-2HB80	3RS1540-1HB80
type of voltage		DC	
Control supply voltage 1 for DC rated value	V	24	
Control supply voltage 1 for DC initial rated value	V	18	
Control supply voltage 1 for DC final rated value	V	30	
Product function			
• defect storage		Yes	
• reset external		Yes	
Number of measuring circuits		1	
Number of change-over switches for auxiliary contacts		3	
Measurable temperature	°C	-99 … +1 800	
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 phase	°C	-25 … +60	

Mechanical design

		3RS1540-2HB80	3RS1540-1HB80
Design of the electrical connection			
• for auxiliary and control current circuit		spring-loaded terminals	screw-type terminals
• jumper socket		Yes	
Design of the sensor connectable		type J, K, T, E, N, R, S, B (thermocouple)	
Width	mm	45	
Height	mm	108	106
Depth	mm	91	

Communication

		3RS1540-1HB80	3RS1540-2HB80
Protocol will be supported IO-Link protocol		Yes	
IO-Link transfer rate		COM2 (38,4 kBaud)	
Point-to-point cycle time between master and IO-Link device minimum	s	0.01	
Data volume			
• of the address range of the outputs with cyclical transfer total	byte	2	
• of the address range of the inputs with cyclical transfer total	byte	4	

Accessories

5

5.1 Push-in lugs

Description

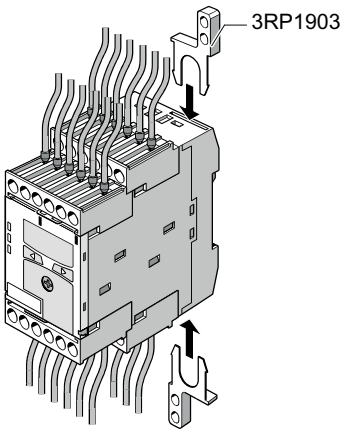
The 3RP1903 push-in lugs are available for the monitoring relays.

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 5- 1 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.	

Configuring the IO-Link

6

6.1 Configuring with STEP7

6.1.1 Requirements

Procedure when configuring IO-Link master and IO-Link devices

Configuration takes place in two steps with STEP 7, V5.4 SP5 or higher:

1. In *HW Config*, configure the IO-Link master (with GSD if necessary), e.g. the 4SI SIRIUS electronics module or 4SI IO-Link (both require at least firmware version 1.0.1).
2. With the Port-Configurator-Tool *S7-PCT (V2.0 or higher)* you configure the connected monitoring relay for IO-Link (IO-Link Device).

Requirements

- STEP 7 V5.4 SP5 or higher
- The Port-Configurator-Tool *S7-PCT (V2.0 or higher* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/de/33102519/133100).
- The associated IO-Link IODD file is installed in (IO Device Description*S7-PCT*. You can download the IODD files for the SIRIUS Devices from the Internet (http://support.automation.siemens.com/WW/view/de/29801139/133100).
- Optional: The GSD files are installed in HW Config. You can download the GSD files for the ET200S from the Internet (http://www.siemens.com/comdec).
- Optional: Install the function block FB ""IOL_CALL" " for backing up/restoring IO-Link master parameters and IO-Link device parameters.
  You can obtain the function block on the Internet (http://support.automation.siemens.com/WW/view/de/33102519/133100).
  You can find further information on the function block in "Module replacement (Page 66)".

6.1.2 Configuration with STEP 7 and S7-PCT

Configuring the IO-Link master in *HW Config*

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. In the hardware catalog of *HW Config* , select the IO-Link master (e.g. in the ET 200S or ET 200eco PN distributed I/O system).
3. Drag-and-drop the IO-Link master (e.g. the 4SI SIRIUS electronics module) from the hardware catalog to the configuration table.
4. Select the IO-Link master in the configuration table.
5. Press the right mouse button and select "**Object Properties**" from the shortcut menu.
   Result: The "**Properties**" window of the IO-Link master opens.
6. On the "**Addresses**" tab, set the length of the inputs and the length of the outputs to 16 Bytes and confirm with "**OK**".
7. Parameterize the IO-Link master.

Configuring the I/O device with the Port Configurator tool

1. In the Configuration table, select the IO-Link master (e.g. the 4SI SIRIUS electronics module).
2. Right-click and select "**Launch IO-Link Configurator**" in the shortcut menu.
   Result:*S7-PCT* is started.
3. Select the SIRIUS monitoring relay IO-Link in the hardware catalog of S7-PCT.
4. Start by parameterizing the SIRIUS monitoring relay IO-Link (IO-Link device).
   Additional information is available in the *S7-PCT* online help.

6.1.3 Configuration with STEP 7 and S7-PCT (GSD version)

Configuring the IO-Link master in *HW Config* with GSD

1. Start the SIMATIC Manager and configure the project as described in the *STEP 7* online help.
2. In the hardware catalog of *HW Config* , select the IO-Link master (e.g. in the ET 200S or ET 200eco PN distributed I/O system).
3. Drag-and-drop the IO-Link master from the hardware catalog to the configuration table.
4. Parameterize the IO-Link master.

Configuring the I/O device with the Port Configurator tool

1. In the Configuration table, select the IO-Link master (e.g. the 4SI SIRIUS electronics module).
2. Right-click and select "**Start Device Tool**" in the shortcut menu. Click on "S7-PCT" in the submenu.

   Result: *S7-PCT* will be started.
3. Select the SIRIUS monitoring relay IO-Link in the hardware catalog of S7-PCT.
4. Start by parameterizing the SIRIUS monitoring relay IO-Link (IO-Link device). Additional information is available in the *S7-PCT* online help.

6.2 Configuring without STEP7

6.2.1 Requirements

Basic procedure when configuring IO-Link master and IO-Link devices with S7-PCT stand-alone

1. You configure the connected monitoring relay (IO-Link device) with the Port Configurator tool *S7-PCT (V2.0 or higher)*.

Requirements

- The Port Configurator tool *S7-PCT (V2.0 or higher)* is installed on the PG/PC.

  You can either install *S7-PCT* together with STEP 7 V5.4 SP5 or higher, or you can download it from the Internet (http://support.automation.siemens.com/WW/view/de/33102519/133100).
- The associated IO-Link IODD file (IO-Link Device Description) is installed in *S7-PCT*. You can download the IODD files for the SIRIUS devices from the Internet (http://support.automation.siemens.com/WW/view/de/29801139/133100).

Note

Configuring with S7-PCT Stand-Alone is not possible for the CPU versions of the ET 200.

6.2.2 Configuring without STEP 7

Configuring the I/O device with the Port Configurator tool

1. Start the S7-PCT Port Configurator Tool.
2. Create a new project or open an existing project as described in the online help.
3. Select an IO-Link master.
4. Select the SIRIUS monitoring relay IO-Link in the hardware catalog of S7-PCT.
5. Load the configuration into the IO-Link master before parameterizing the monitoring relay.
6. Start by parameterizing the SIRIUS monitoring relay IO-Link (IO-Link device).
   Additional information is available in the *S7-PCT* online help.

Note

To be able to access the IO-Link master or an IO-Link device online, communication between the ET 200 and the higher-level controller must be active (BF-LED on ET 200 interface module is off).

6.3 Module replacement

6.3.1 Module replacement (replacement of an IO-Link device)

Parameter data and configuration data specially optimized for a specific application are stored in an IO-Link Device. This data deviates in many cases from the default values stored in the IO-Link Device.

In the event of replacement of an IO-Link Device (referred to below as "module"), the optimized data must be transferred to the new module.

Data can be transferred via two channels:

- Module replacement with PG/PC
- Module replacement without PG/PC

6.3.2 Module replacement with PG/PC

Procedure

In the event of a replacement, a PG/PC is available with the SIMATIC project of the plant.

With the data stored in the SIMATIC project, and the S7-PCT, you transfer the parameters belonging to the replaced Device to the new Device.

6.3.3 Module replacement without PG/PC

Procedure

On completion of commissioning, a PG/PC with the project is no longer available. For backing up and restoring the parameter data and configuration data from or to a module, the function block (FB) "IOL_Call" is available for the SIMATIC controllers of the S7-300 and S7-400 families.

With this function block, you back up all relevant data records of a module after commissioning, in a data block (DB), for example. In the event of a replacement, you write the relevant data from the data block to the replaced module with the IOL_Call.

Refer to the Appendix "Process data and data sets (Page 85)" for data records to be backed up in the case of a module.

Note

An IO-Link Device is a module that communicates with the IO-Link master via its communication connection. With the special cases "SIRIUS 3RA64/65 compact starter " and "SIRIUS 3RA2711 function modules", where group formations of up to four starters are possible, the above information refers to the replacement of the first load feeder. Replacement of load feeders 2 to 4 of a group of four does not require any supplementary measures.

Requirements

- Install the demo project "IOL-CALL".
  You can download the "IOL-CALL" and the description from the Internet (http://support.automation.siemens.com/WW/view/en/33102519/133100).
- Copy the IO-Link Call function block FB1 (including data block DB10) to a STEP 7 project.
- Use the IO-Link Call function block FB1 as described in the demo project.

Automatic saving of parameter data

If IO-Link masters meeting IO-Link Communication Specification V1.1 are available, the "Parameter server" function can be used to back up parameter data from the devices automatically on the server.
When devices are replaced, this parameter data is written back to the new device automatically on system startup. The monitoring relay for IO-Link supports this functionality as standard.

6.4 Integration into the SIMATIC environment

Integration into the SIMATIC environment

Faceplates embedded in a demo project are offered for download for human machine interfacing and diagnostics for Siemens IO-Link Devices in conjunction with a SIMATIC and WinCC flexible 2008.

The faceplates can be transferred from the demo project to your own WinCC flexible 2008 project.

Faceplates are available for the process data and the diagnostics data.

You can download the project from the Internet (http://support.automation.siemens.com/WW/view/en/38006560) free of charge.

6.5 Acyclic data exchange with the FB IOL_CALL

For acyclic data exchange, the function block "IOL-CALL" is available as a download for controllers of the S7--400 and S7--300 families.

The block supports you in the following tasks:

- Parameterizing the monitoring relays with IO-Link during operation
- Executing IO-Link port functions
- Backing up/restoring IO-Link device parameters
- Backing up/restoring IO-Link master parameters

Requirements

- Install the demo project "IOL-CALL".
  You can download the demo project on the Internet (http://support.automation.siemens.com/WW/view/de/33102519/133100).
- Copy the IO-Link Call function block FB1 (including data block DB10) to a STEP 7 project.
- Use the IO-Link Call function block FB1 as described in the demo project.

References

A

Further references

You can find more information about the 3RS1 temperature monitoring relay for IO-Link on the Internet (http://support.automation.siemens.com/WW/view/en/20356134/133300).

You can find more information about Siemens IO-Link masters in the corresponding manuals for the electronics modules 4SI IO-Link and 4SI SIRIUS (IP20), as well as for ET 200eco PN (IP65).

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 for IO-Link (3RS1440, 3RS1441, 3RS1540)	3ZX1012-0RS20-1AA1

Parameters

B

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

ON-delay time

The setting of the "ON-delay time" parameter prevents limit violations such as undershoots while the system engages from generating a switching response.

The ON-delay time starts in the following cases depending on parameter assignment:

- **At Power-ON**

  Re-connection of the supply voltage (Power-ON) of the device after switching off the current flow (zero current).

- **At manual reset**

  A fault is acknowledged by a manual reset. Following this, the device behaves in the same way as when the supply voltage is switched on again.

Starting the ON-delay time via IO-Link

The ON-delay time can also take place via the process image output (PIQ) by setting the "Start ON-delay time" control command.

The requirements governing the starting of the ON-delay time (Power-ON and/or manual reset) can only be modified via IO-Link. The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Rotary button setting: None

ϑ1 limit value and ϑ2 limit value

The temperature monitoring relays monitor 1 or 2 measured values for overshoot or undershoot. The measured value can be set as a "ϑ1 limit value" or a "ϑ2 limit value" for overshoot or undershoot.

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 overshot.

If the set limit value is overshot or undershot, the output relay changes its switching state at the end of the set delay time, and an IO-Link message may be sent. If the measured value has reached the relevant set hysteresis value, the output relay returns immediately to its original state and a new IO-Link message may be sent.

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

Warning threshold for ϑ1 and warning threshold for ϑ2

The temperature monitoring relays monitor 1 or 2 measured values for overshoot or undershoot. The measured value can be set as a "Warning threshold forϑ1" or a "Warning threshold forϑ2" for overshoot or undershoot.

The "Warning threshold for ϑ1" and "Warning threshold for ϑ2" parameters can only be set on devices for IO-Link (3RS1440, 3RS1441, and 3RS1540). The parameters specify the limit before tripping due to measured value overshoot or undershoot.

When the set warning threshold is overshot or undershot, this is transferred cyclically via IO-Link (general warning in the process input image) and the corresponding bits are set in the diagnostics data set.

Rotary button setting: None

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.

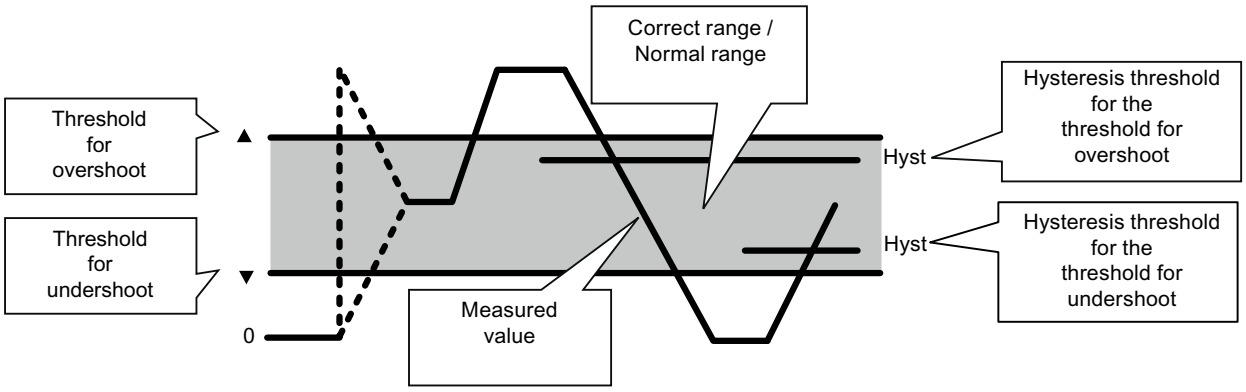


Figure B-1 Explanation of hysteresis

If, after the upper threshold value has been overshot 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 is set to Autoreset (terminals Y3 and Y4 are jumpered permanently).

Note

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

Rotary button setting: 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:

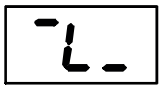
- Closed-circuit principle (NC)

  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 between two-wire measurement and three-wire measurement.
Both measuring procedures are described in the chapter titled "Connecting (Page 23)".

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 53)".

Number of temperature sensors

The 3RS1441 version supports the connection of up to 3 temperature sensors of the same type (resistance sensors).

The "Number of temperature sensors" parameter can be set either locally using the rotary button and the 2 buttons on the device or via IO-Link.

Rotary button setting: Sensor NO.

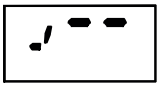
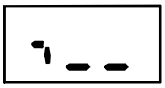
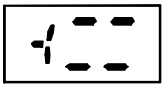
Possible indications on the display:

Indication on the display	Meaning
	Temperature sensor 1 activated, temperature sensor 2 deactivated, temperature sensor 3 deactivated.
	Temperature sensor 1 deactivated, temperature sensor 2 activated, temperature sensor 3 deactivated.
	Temperature sensor 1 deactivated, temperature sensor 2 deactivated, temperature sensor 3 activated.
	Temperature sensor 1 activated, temperature sensor 2 activated, temperature sensor 3 deactivated.
	Temperature sensor 1 activated, temperature sensor 2 deactivated, temperature sensor 3 activated.
	Temperature sensor 1 deactivated, temperature sensor 2 activated, temperature sensor 3 activated.
	Temperature sensor 1 activated, temperature sensor 2 activated, temperature sensor 3 activated.

Temperature monitoring mode

The "Temperature monitoring mode" parameter defines the temperature monitoring mode (overshoot, undershoot, or range monitoring) of a selected temperature sensor (resistance sensor). The 3RS1441 version supports the connection of up to 3 different temperature sensors (resistance sensors). 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

Temperature unit

The "Temperature unit" parameter allows the user to switch between the temperature scales degrees Celcius (°C) and degrees Fahrenheit (°F). When switching over the display from degrees Celsius to degrees Fahrenheit, all of the parameter settings (e.g. limit values, warning thresholds) retain their value.

All values can be converted according to the following formulas:

Table B- 1 Conversion of temperature measured values

°C → °F	°F → °C
$T_{Fahrenheit} = T_{Celsius} \bullet 9/5 + 32$	$T_{Celsius} = (T_{Fahrenheit} - 32) \bullet 5/9$

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Group diagnostics

The "Group diagnostics" parameter enables the user to enable or completely disable "Automatic signaling" via the fieldbus. The message bits "Group error" and "General warning" in the process image are not affected by this.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Group error diagnostics

The "Group error diagnostics" parameter enables the user to suppress "Automatic signaling" of all error messages via the fieldbus.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Local threshold change

The "Local threshold change" parameter enables the user to set product-specific limit values and warning thresholds for undershoot and overshoot locally on the monitoring relay. If the parameter is disabled, local setting on the device is prevented.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Local parameter change

The "Local parameter change" parameter enables the user to set product-specific parameters (e.g. delay times, hysteresis, or the relay switching response) locally on the monitoring relay. If the parameter is disabled, local setting on the device is prevented.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Local reset

The "Local reset" parameter enables the user to acknowledge the error message pending once an error has been detected directly on the monitoring device so that the normal monitoring function can be resumed. This requires the monitoring relay to be set to manual reset. If the parameter is disabled, fault acknowledgment on the device is prevented.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Retentive error memory

The "Retentive error memory" parameter enables the user to save all error messages in the device in the event of a power failure. The monitoring device is not reset in the event of power failure. If the parameter is enabled, automatic restart of the system is prevented if power is restored while a fault is active. This increases plant safety.

If the parameter is disabled, fault messages are discarded on power recovery.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Analog value coding

The "Analog value coding" parameter enables the user to transfer not just the measured value but also the unit and resolution of the analog measured value via the process image. This parameter can be used for device-specific setting of the value to be sent cyclically.

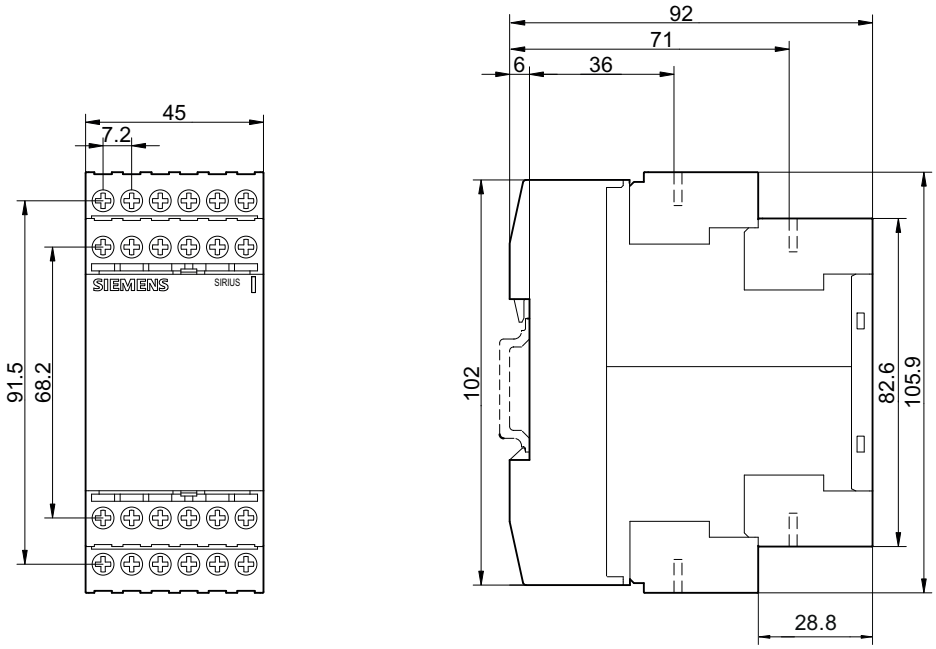
The Chapter "Analog value coding (Page 86)" contains a table listing the units and resolutions of the analog measured values to be transferred, as well as the assignment to the relevant monitoring relays.

The possible settings for this parameter are listed in the chapter titled "Process data and data sets (Page 85)". Changes to this parameter can only be made via IO-Link.

Dimension drawings

C

3RS1. digitally adjustable temperature monitoring relays for IO-Link (screw terminal)



The dimension drawing is valid for the following device versions:

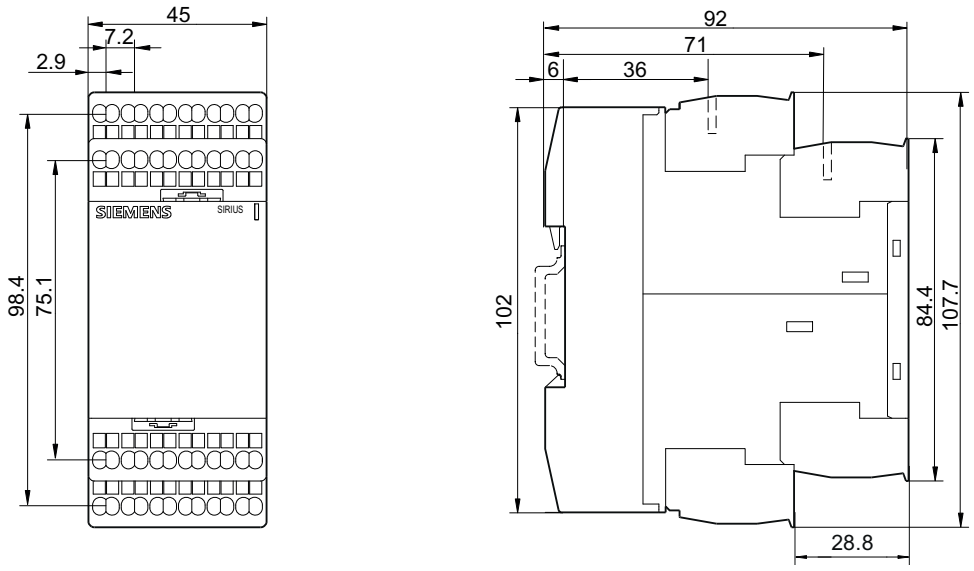
3RS1440-1. temperature monitoring relay

3RS1540-1. temperature monitoring relay

3RS1441-1. temperature monitoring relay

Figure C-1 3RS1. digitally adjustable temperature monitoring relays for IO-Link with screw terminal

3RS1. digitally adjustable temperature monitoring relays for IO-Link (spring-loaded terminal)



The dimension drawing is valid for the following device versions:

3RS1440-2. temperature monitoring relay

3RS1540-2. temperature monitoring relay

3RS1441-2. temperature monitoring relay

Figure C-2 3RS1. digitally adjustable temperature monitoring relays for IO-Link with spring-loaded terminal

Characteristic curves

D

Characteristic curves of thermocouples

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

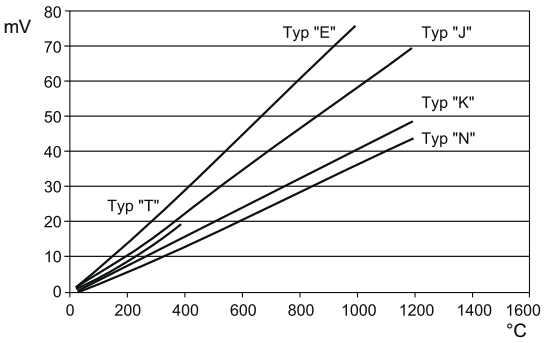


Figure D-1 Thermocouples J, K, T, E, N

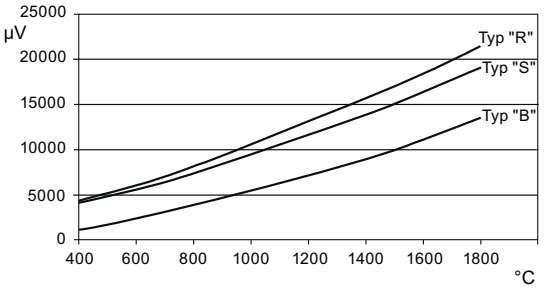


Figure D-2 Thermocouples S, R, B

Characteristic curves of resistance sensors

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

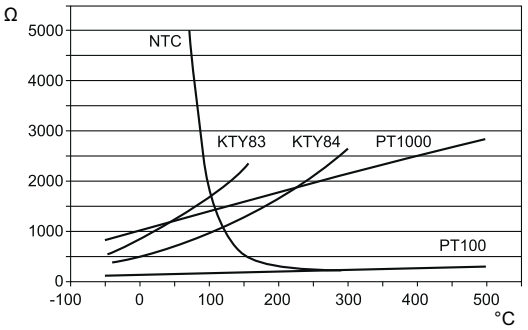


Figure D-3 Temperature ranges of the resistance sensors

Process data and data sets

E

E.1 Structure of the data sets

Overview of the data sets

Table E- 1 Data sets - overview

Data set		Name	Access	Value	Length (bytes)
Address (dec)	Subindex supported				
0x00 (0)	Yes	**Parameter Page 0**	r	—	16
0x10 (16)	No	Vendor Name	r	Siemens AG	11
0x11 (17)	No	Vendor Text	r	Internet (http://support.automation.siemens.com/WW/view/en/37432258/133100)	64 max.
0x12 (18)	No	Product Name	r	*Device name*[1](e.g. SIRIUS Temperature Monitoring Relay for IO-Link)	64 max.
0x13 (19)	No	Product ID	r	*Order no.*[1] (e.g. 3RS1440-1HB50)	14
0x16 (22)	No	Hardware Revision	r	*Hardware version* [1]	7
0x17 (23)	No	Firmware Revision	r	*Firmware version* [1]	7
0x18 (24)	No	Application Specific Name	r/w	—	64 max.

[1] Value varies for each temperature monitoring relay.

r: readable

w: writeable

E.2 Analog value coding

Analog value coding

The table below shows the coding, the unit and the resolution of the analog measured values to be transferred, as well as the assignment to the relevant monitoring relays.

Table E- 2 Analog value coding

Coding	Meaning	Unit	Resolution	3RS		
				1440	1441	1540
1	Temperature sensor 1	°C	1	✓	✓	✓
2	Temperature sensor 2	°C	1		✓	
3	Temperature sensor 3	°C	1		✓	
4	Minimum temperature of all temperature sensors T_{min}	°C	1	✓	✓	✓
5	Maximum temperature of all temperature sensors T_{max}	°C	1	✓	✓	✓
6	Average value of all temperatures T_{avg}	°C	1	✓	✓	✓
7	Temperature sensor 1	°F	1	✓	✓	✓
8	Temperature sensor 2	°F	1		✓	
9	Temperature sensor 3	°F	1		✓	✓
10	Minimum temperature of all temperature sensors T_{min}	°F	1	✓	✓	✓
11	Maximum temperature of all temperature sensors T_{max}	°F	1	✓	✓	✓
12	Average value of all temperatures T_{avg}	°F	1	✓	✓	✓

E.3 Process image output (PIQ) and input (PII)

Process image output (PIQ)

The process image output contains the control commands for the 3RS1440/3RS1441/3RS1540 temperature monitoring relays.

Table E- 3 PIQ - control commands

DO (2 bytes)	PIQ
DO0.0	1: Start ON-delay time
DO0.1	---
DO0.2	---
DO0.3	1: Reset
DO0.4	---
DO0.5	---
DO0.6	---
DO0.7	---
DO1.0 - DO1.7	---

Process image inputs (PII)

The process image input contains the most important status information of the 3RS1440/3RS1441/3RS1540 temperature monitoring relay.

Table E- 4 PII - status information

DI (4 bytes)	PII
DI0.0	Ready
DI0.1	---
DI0.2	1: Group error
DI0.3	1: General warning
DI0.4	Status output relay K1 1: Relay contact .5/8 closed 0: Relay contact .5/6 closed
DI0.5	Status output relay K2 1: Relay contact .5/8 closed 0: Relay contact .5/6 closed
DI0.6	Status output relay K3 1: Relay contact .5/8 closed 0: Relay contact .5/6 closed
DI0.7	---
DI1.0 - DI1.4	Analog value coding bits 0 to 4
DI1.5	---
DI1.6	---
DI1.7	---
DI2.0 - DI3.7	Analog value[1)]

[1)] The analog value is a 16-bit integer value. The complete measured value is produced together with the analog value coding (DI1.0 - DI1.4), which defines the unit and resolution of the analog value.

E.4 Identification data

Identification data

Identification data refers to data stored in a module that supports users in the following areas:

- When checking the system configuration
- When locating modified system hardware
- When troubleshooting a system.

Modules can be uniquely identified using the identification data.

Identification data

DPP [1] Index (dec)	Data set Index (dec)	Access	Parameter	Length (bytes)	Default setting
0x07 (7)	—	r	Vendor ID	2	0x00
0x08 (8)	—	r			0x2A
0x09 (9)	—	r	Device ID	3	0x09
0x0A (10)	—	r			0x07
0x0B (11)	—	r			0x01 (3RS1440) 0x11 (3RS1441) 0x21 (3RS1540)
—	0x10 (16)	r	Vendor Name	11	SIEMENS AG
—	0x11 (17)	r	Vendor Text	64 max.	Internet (http://support.automation.siemens.com/WW/view/en/37432258/133100)
—	0x12 (18)	r	Product Name	64 max.	SIRIUS Temperature Monitoring Relay for IO-Link
—	0x13 (19)	r	Product ID	14	3RS1440-1HB50 3RS1440-2HB50 3RS1441-1HB50 3RS1441-2HB50 3RS1540-1HB80 3RS1540-2HB80
—	0x16 (22)	r	Hardware Revision	7	*Hardware version* [2]
—	0x17 (23)	r	Firmware Revision	7	*Firmware version* [2]
—	0x18 (24)	r / rw	Application Specific Name	64 max.	—

[1] Direct Parameter Page

[2] Value varies for each temperature monitoring relay.

E.5 Diagnostics - data set (index) 92

Data set (index) 92 - diagnostics

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table E- 5 Data set (index) 92 - diagnostics

Byte.Bit	Description
Operating system functions 3RS1	
16.0	Ready
16.1	Group error
16.2	General warning
16.3	*Reserved*
16.4	*Reserved*
16.5	Parameter assignment active
16.6	Invalid parameter
16.7	Self-test error/internal error
18.0 ... 19.7	Parameter error number
Temperature monitoring	
26.0	ON-delay time running
26.1	Tripping delay time running (limit value ϑ1 or limit value ϑ2)
26.2	*Reserved*
27.0	Limit value ϑ1 overshot
27.1	Limit value ϑ2 undershot
27.2	Warning limit for ϑ1 overshot
27.3	Warning limit for ϑ2 undershot
27.4	Reset response (0: Manual reset; 1: Autoreset or permanent jumper between terminals Y3 and Y4)
27.5	*Reserved*
28.0	Temperature sensor 1 - Measuring range overshoot
28.1	Temperature sensor 1 - Wire break
28.2	Temperature sensor 1 - Short-circuit
28.3	*Reserved*
29.0	Temperature sensor 1 - Measured value is above the two limit values (monitoring for overshoot)
29.1	Temperature sensor 1 - Measured value is above the first limit value (monitoring for overshoot)
29.2	Temperature sensor 1 - Measured value is within range of limit values

Byte.Bit	Description
29.3	Temperature sensor 1 - Measured value is below the first limit value for overshoot (monitoring for undershoot)
29.4	Temperature sensor 1 - Measured value is below the two limit values (monitoring for undershoot)
30.0	Temperature sensor 1 - Measured value is above the two warning thresholds (monitoring for overshoot)
30.1	Temperature sensor 1 - Measured value is above the first warning threshold (monitoring for overshoot)
30.2	Temperature sensor 1 - Measured value is within range of warning thresholds
30.3	Temperature sensor 1 - Measured value is below the first warning threshold for overshoot (monitoring for undershoot)
30.4	Temperature sensor 1 - Measured value is below the two warning thresholds (monitoring for undershoot)
31.0	*Reserved*
31.1	*Reserved*
31.2	*Reserved*
31.3	*Reserved*
31.4	*Reserved*
	Temperature sensor 2 (3RS1441 only)
32.0	Temperature sensor 2 - Measuring range overshoot
32.1	Temperature sensor 2 - Wire break
32.2	Temperature sensor 2 - Short-circuit
32.3	*Reserved*
33.0	Temperature sensor 2 - Measured value is above the two limit values (monitoring for overshoot)
33.1	Temperature sensor 2 - Measured value is above the first limit value (monitoring for overshoot)
33.2	Temperature sensor 2 - Measured value is within range of limit values
33.3	Temperature sensor 2 - Measured value is below the first limit value for overshoot (monitoring for undershoot)
33.4	Temperature sensor 2 - Measured value is below the two limit values (monitoring for undershoot)
34.0	Temperature sensor 2 - Measured value is above the two warning thresholds (monitoring for overshoot)
34.1	Temperature sensor 2 - Measured value is above the first warning threshold (monitoring for overshoot)
34.2	Temperature sensor 2 - Measured value is within range of warning thresholds
34.3	Temperature sensor 2 - Measured value is below the first warning threshold for overshoot (monitoring for undershoot)
34.4	Temperature sensor 2 - Measured value is below the two warning thresholds (monitoring for undershoot)
35.0	*Reserved*
35.1	*Reserved*
35.2	*Reserved*
35.3	*Reserved*
35.4	*Reserved*

Byte.Bit	Description
	Temperature sensor 3 (3RS1441 only)
36.0	Temperature sensor 3 - Measuring range overshoot
36.1	Temperature sensor 3 - Wire break
36.2	Temperature sensor 3 - Short-circuit
36.3	*Reserved*
37.0	Temperature sensor 3 - Measured value is above the two limit values (monitoring for overshoot)
37.1	Temperature sensor 3 - Measured value is above the first limit value (monitoring for overshoot)
37.2	Temperature sensor 3 - Measured value is within range of limit values
37.3	Temperature sensor 3 - Measured value is below the first limit value for overshoot (monitoring for undershoot)
37.4	Temperature sensor 3 - Measured value is below the two limit values (monitoring for undershoot)
38.0	Temperature sensor 3 - Measured value is above the two warning thresholds (monitoring for overshoot)
38.1	Temperature sensor 3 - Measured value is above the first warning threshold (monitoring for overshoot)
38.2	Temperature sensor 3 - Measured value is within range of warning thresholds
38.3	Temperature sensor 3 - Measured value is below the first warning threshold for overshoot (monitoring for undershoot)
38.4	Temperature sensor 3 - Measured value is below the two warning thresholds (monitoring for undershoot)
39.0	*Reserved*
39.1	*Reserved*
39.2	*Reserved*
39.3	*Reserved*
39.4	*Reserved*

E.6 Measured values - data set (index) 94

Data set (index) 94 (measured values)

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table E- 6 Data set (index) 94 (measured values)

Byte.Bit	Description
Temperature monitoring	
16.0 … 17.7	Temperature in °C (temperature sensor 1)
18.0 … 19.7	Temperature in °F (temperature sensor 1)
20.0 ... 21.7	Temperature in °C (temperature sensor 2) (3RS1441 only)
22.0 ... 23.7	Temperature in °F (temperature sensor 2) (3RS1441 only)
24.0 ... 25.7	Temperature in °C (temperature sensor 3) (3RS1441 only)
26.0 … 27.7	Temperature in °F (temperature sensor 3) (3RS1441 only)
28.0 … 29.7	Temperature T_{min} in °C
30.0 … 31.7	Temperature T_{min} in °F
32.0 … 33.7	Temperature T_{max} in °C
34.0 … 35.7	Temperature T_{max} in °F
36.0 … 37.7	Temperature T_{avg} in °C
38.0 … 39.7	Temperature T_{avg} in °F

E.7 Parameters - data set (index) 131

Data set (index) 131 - parameters

Note

Bits that are not described in the tables below are reserved and should be ignored.

Note

Sub-indices are not supported.

Table E- 7 Data set (index) 131 - parameters

Byte.Bit	Description
Operating system functions	
16.0	Group diagnostics Default: [1] [0] disabled [1] enabled
16.1	Group error diagnostics Default: [1] [0] disabled [1] enabled
16.2	*Reserved*
16.3	*Reserved*
16.4	Local threshold change Default: [1] [0] disabled [1] enabled
16.5	Local parameter change Default: [1] [0] disabled [1] enabled
16.6	Local reset Default: [1] [0] disabled [1] enabled
16.7	Retentive error memory Default: [0] [0] disabled [1] enabled
17.0 ... 17.7	Analog value coding Type: BYTE Default: 5 Min: 0 (disabled) Max: 255

Byte.Bit	Description	
Temperature monitoring		
24.0 ... 24.1	*Reserved*	
24.2 ... 24.4	Temperature monitoring mode Default: [0] [0] Overshoot [1] Undershoot [2] Range monitoring	
24.5 ... 24.7	Temperature unit Default: [0] [0] °C (degrees Celsius)[1] °F (degrees Fahrenheit)	
25.0 ... 25.1	ON-delay time (at Power ON) Default: [1] [0] disabled [1] enabled	
25.2 ... 25.3	ON-delay time (at manual reset) Default: [1] [0] disabled [1] enabled	
25.4 ... 25.5	*Reserved*	
	3RS1441/3RS1540	**3RS1440**
26.0 ... 27.7	ON-delay time Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s	
28.0 ... 29.7	Tripping delay time (if the temperature is overshot or undershot) Type: INT Resolution: 0.1 s = 1 Default: 0 Min: 1 or 0 (disabled) Max: 9999 * 0.1 s = 999.9 s	
30.0 ... 31.7	*Reserved*	
32.0	Number of temperature sensors Temperature sensor 1 Default: 1 Min: 0 (disabled) Max: 1 (enabled)	
	3RS1441	**3RS1440/3RS1540**
32.1	Number of temperature sensors Temperature sensor 2 Default: 1 Min: 0 (disabled) Max: 1 (enabled)	0 (disabled)

Byte.Bit	Description	
	3RS1441	**3RS1440/3RS1540**
32.2	Number of temperature sensors Temperature sensor 3 Default: 1 Min: 0 (disabled) Max: 1 (enabled)	0 (disabled)
33.0 ... 33.7	Temperature sensor type	
	3RS1440/3RS1441 (resistance sensor)	**3RS1540** (thermocouple)
	Default: 128	Default: 1
	128 ≙ PT100	—
	129 ≙ PT1000	—
	130 ≙ KTY83	—
	131 ≙ KTY84	—
	132 ≙ NTC	—
	—	1 ≙ J
	—	2 ≙ K
	—	3 ≙ T
	—	4 ≙ E
	—	5 ≙ N
	—	6 ≙ S
	—	7 ≙ R
	—	8 ≙ B
34.0 ... 35.7	Limit value ϑ1 Type: INT Default: 80 Min: -50 °C (resistance sensors)/-99 °C (thermocouples) Max: 750 °C (resistance sensors)/1800 °C (thermocouples)	
36.0 ... 37.7	Limit value ϑ2 Type: INT Default: 50 Min: -50 °C (resistance sensors)/-99 °C (thermocouples) Max: 750 °C (resistance sensors)/1800 °C (thermocouples)	
38.0 ... 39.7	Warning threshold for ϑ1 Type: INT Default: 75 Min: -50 °C (resistance sensors)/-99 °C (thermocouples) Max: 750 °C (resistance sensors)/1800 °C (thermocouples)	
40.0 ... 41.7	Warning threshold for ϑ2 Type: INT Default: 45 Min: -50 °C (resistance sensors)/-99 °C (thermocouples) Max: 750 °C (resistance sensors)/1800 °C (thermocouples)	
42.0 ... 43.7	*Reserved*	
44.0 ... 45.7	*Reserved*	

Byte.Bit	Description
46.0 ... 47.7	Hysteresis Type: INT Default: 5 °C/5 °F Min: 1 °C/1 °F or 0 (disabled) Max: 99 °C/99 °F
48.0 ... 48.1	Relay switching response Default: [0] [0] Closed-circuit principle (NC) [1] Open-circuit principle (NO)
48.2 ... 48.3	*Reserved*
48.4 ... 48.5	*Reserved*

Correction sheet

F

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.

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

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