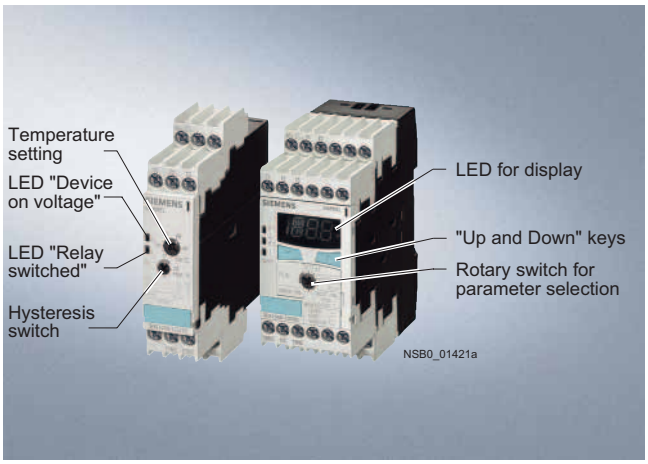
Overview



The 3RS10/3RS11 temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is sensed by the sensor in the medium, evaluated by the device and monitored for overshoot or undershoot or for staying within an operating range (window function).

The range comprises adjustable analog units with one or two threshold values, digital units for 1 sensor, which are also a good alternative to temperature controllers for the low-end range, and digital units for up to 3 sensors which have been optimized for monitoring large motors.

Design

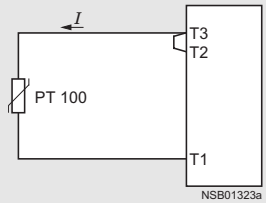
The temperature monitoring relays comply with:

- IEC 60721-3-3 "Environmental conditions"
- IEC 60947-5-1; VDE 0660 "Low-voltage controlgear, switchgear and systems – Electromechanical controlgear"
- EN 61000-6-4 "Basic specification for emitted interference (Industry)"
- EN 61000-6-2 "Basic specification for interference immunity (Industry)"
- EN 50042 "Designations for terminals"
- UL/CSA
- CCC.

Connection of resistance-type thermometers

2-wire measurement

When 2-wire temperature sensors are used, the resistances of the sensor and wiring are added. The resulting systematic error must be taken into account when the signal evaluation unit is calibrated. A jumper must be clamped between terminals T2 and T3 for this purpose.



Wiring errors

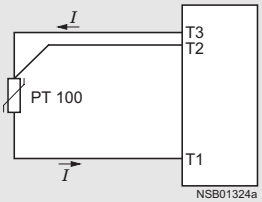
The errors that are generated by the wiring comprise approximately 2.5 Kelvin/Ω. If the resistance of the cable is not known and cannot be measured, the wiring errors can also be estimated using the following table.

Temperature drift dependent on the length and cross-section of the cable with PT100 sensors and an ambient temperature of 20 °C, in K:

Cable length in m	Cross-section mm²			
	0.5	0.75	1	1.5
0	0.0	0.0	0.0	0.0
10	1.8	1.2	0.9	0.6
25	4.5	3.0	2.3	1.5
50	9.0	6.0	4.5	3.0
75	13.6	9.0	6.8	4.5
100	18.1	12.1	9.0	6.0
200	36.3	24.2	18.1	12.1
500	91.6	60.8	45.5	30.2

3-wire measurement

To minimize the effects of the line resistances, a three-wire circuit is often used. Using the additional cable, two measuring circuits can be formed of which one is used as a reference. The signal evaluation unit can then automatically calculate the line resistance and take it into account.



General data

Connection of thermoelements

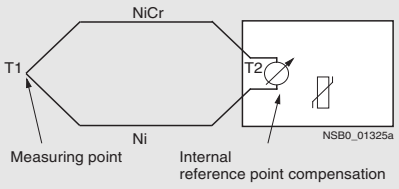
Based on the thermo-electrical effect, a differential temperature measurement will be performed between the measuring point and the signal evaluation unit.

This principle assumes that the signal evaluation unit knows the temperature at the clamping point (T2). For this reason, the 3RS11 temperature monitoring relay has an integral compensator that determines this comparison temperature and builds it into the result of the measurement. The thermal sensors and cables must be insulated therefore.

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

Temperature detection is therefore possible (T1) without needing to know the precise ambient temperature of the clamping point at the signal evaluation unit (T2).

The connecting cable is only permitted to be extended using connecting leads that are made from the same material as the thermoelement. If a different type of conductor is used, an error will result in the measurement.



You can find more information on the Internet at:

http://www.feldgeraete.de/76/produkte/fuw.html
http://www.ephy-mess.de

or from

EPHY-MESS GmbH

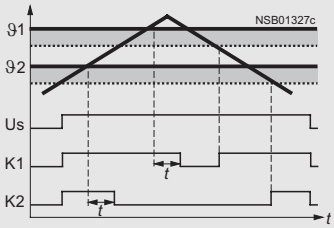
Function

Once the temperature has reached the set threshold value ϑ1, the output relay K1 changes its switching state as soon as the set time t has elapsed (K2 responds in the same manner to ϑ2). The delay time can only be adjusted with digital units (on analog units t = 0).

The relays return to their original state as soon as the temperature reaches the set hysteresis value.

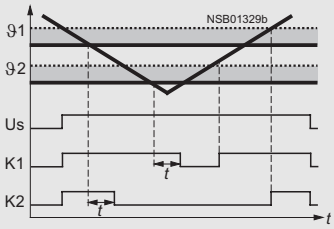
Temperature overshoot

Closed-circuit principle



Temperature undershoot

Closed-circuit principle



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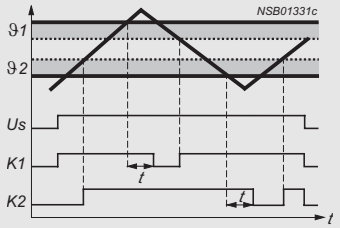
Window monitoring (digital units only)

Once the temperature has reached the upper threshold value ϑ1, the output relay K1 changes its switching state as soon as the set time t has elapsed. The relay returns to its original state as soon as the temperature reaches the set hysteresis value.

K2 responds in the same manner to the lower threshold value of ϑ2.

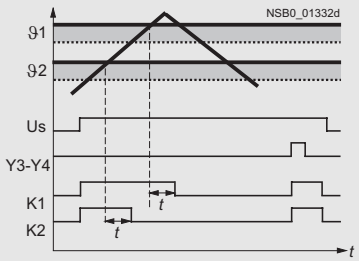
Closed-circuit principle



Principle of operation with memory function (3RS10 42, 3RS11 42), based on the example of temperature overshoot

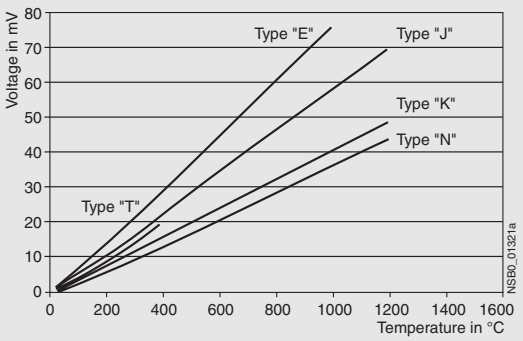
Once the temperature has reached the set threshold value ϑ1, the output relay K1 changes its switching state as soon as the set time t has elapsed (K2 responds in the same manner to ϑ2). The relays only return to the original state when the temperature falls below the set hysteresis value and when terminals Y3 and Y4 have been briefly jumpered.

Closed-circuit principle

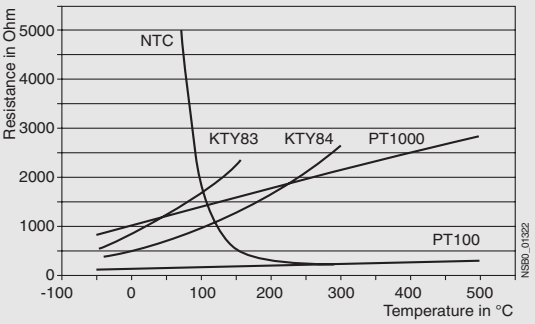


Characteristic curves

For thermoelements



For resistance sensors

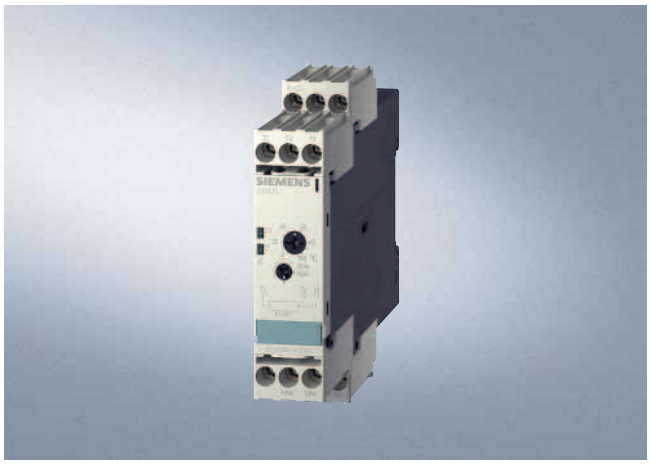


7

3RS10, 3RS11 Temperature Monitoring Relays

Relays, analogically adjustable, for 1 sensor

Overview



The 3RS10/3RS11 analog temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is sensed by the sensors in the medium, evaluated by the device and monitored for overshoot or undershoot. When the threshold values are reached, the output relay switches on or off depending on the parameterization.

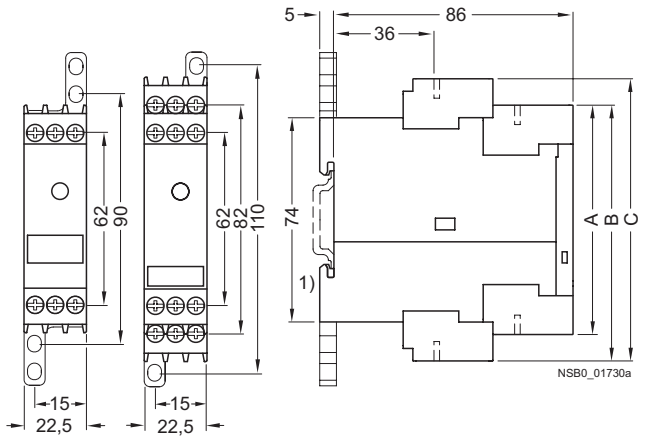
Technical specifications

Type		3RS10 00	3RS10 10	3RS11 00	3RS11 01	3RS10 20	3RS10 30	3RS11 20	3RS11 21
General data									
Sensor type		PT100		TC type J	TC type K	PT100		TC type J	TC type K
Width	mm	22.5							
Operating range		0.85 ... 1.1 x U_s							
Rated power	W/VA	< 2/4							
Auxiliary circuit									
Contacts		1 NO + 1 NC				1 CO + 1 NO			
Rated operational currents I_e									
• AC-15 at 230 V, 50 Hz	A	3							
• DC-13 at:									
- 24 V	A	1							
- 240 V	A	0.1							
DIAZED fuse									
• gL/gG operational class	A	4							
Short-circuit current (at 250 V)	kA	1							
Electrical endurance AC-15 at 3A		100000							
Mechanical endurance Mechanical operating cycles		3 x 10^6							
Tripping units									
• **Measuring accuracy at 20°C ambient temperature** (T20)		Typically < ± -5 % from upper limit of scale							
• **Reference point accuracy**		--		< ±5 K		--		< ±5 K	
• **Deviations due to ambient temperature** in % of measuring range		< 2		< 3		< 2		< 3	
• **Hysteresis settings**									
- for temperature 1		2 ... 20 % from upper limit of scale							
- for temperature 2		5 % of upper limit of scale							
Sensor circuit									
• **Typical sensor circuits**									
- PT100	mA	Typically 1		--		Typically 1		--	
- PT1000	mA	Typically 0.2		--		Typically 0.2		--	
• **Open-circuit detection**		No							
• **Short-circuit detection**		No							
• **3-wire conductor connection** [1]		Yes		-		Yes		-	
Enclosures									
Environmental influences									
Permissible ambient temperature	°C	-25 ... +60							
Permissible storage temperature	°C	-40 ... +80							
Permissible mounting positions		Any							
Degree of protection acc. to EN 60529		Terminals: IP20; Cover: IP40							
Rated insulation voltage U_i (degree of pollution 3)	V	300							
Connection type		**Screw terminals**							
• Terminal screw		M3 (for standard screw driver size 2 and Pozidriv 2)							
• Solid	mm^2	1 x (0.5 ... 4)/2 x (0.5 ... 2.5)							
• Finely stranded with end sleeve	mm^2	1 x (0.5 ... 2.5)/2 x (0.5 ... 1.5)							
• AWG cables, solid or stranded	AWG	2 x (20 ... 14)							
• Tightening torque	Nm	0.8 … 1.2							
Connection type		**Spring-loaded terminals**							
• Solid	mm^2	2 x (0.25 ... 1.5)							
• Finely stranded, with end sleeves acc. to DIN 46228	mm^2	2 x (0.25 ... 1.5)							
• Finely stranded	mm^2	2 x (0.25 ... 1.5)							
• AWG cables, solid or stranded	AWG	2 x (24 ... 16)							
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm							
Shock resistance acc. to IEC 60068-2-27		12 shocks (half-sine 15 *g*/11 ms)							

[1] 2-wire connection of resistance sensors with wire bridge between T2 and T3.

Relays, analogically adjustable, for 1 sensor

Dimensional drawings



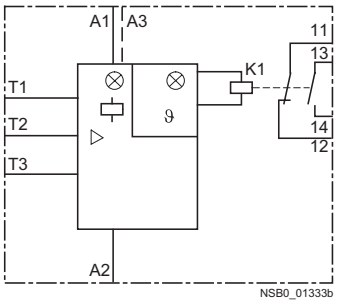
Type	3RS10 00	3RS10 10	3RS11 0 3RS11 1 3RS1. 2 3RS1. 3
	A	B	C
Removable terminal			
Screw-type terminal	83	92	102
Spring-loaded terminal	84	94	103

1) For standard mounting rail according to DIN EN 60715

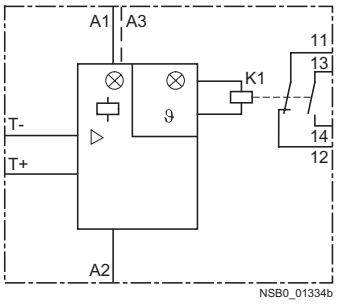
Schematics

Connection examples

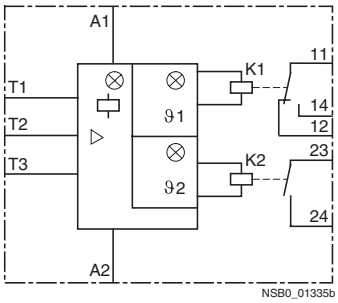
3RS10 00, 3RS10 10



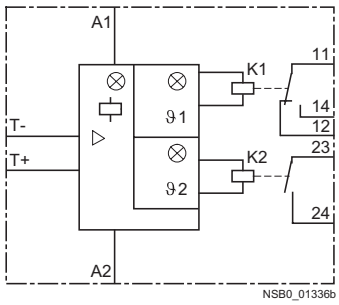
3RS11 00, 3RS11 01



3RS10 20, 3RS10 30



3RS11 20, 3RS11 21



General item codes

A1= 24 V AC/DC, 230 V AC, 24 ... 240 V AC/DC

A3= 110 V AC

A2= M

K1, K2 output relays

Item code for 3RS10 00, 3RS10 10, 3RS11 00, 3RS11 01, 3RS10 20, 3RS10 30, 3RS11 20, 3RS11 21

ϑ = LED: "Device connected to voltage"

ϑ1 = LED: "Relay 1 tripped"

ϑ2 = LED: "Relay 2 tripped"

T1 to T3 = Sensor connection for resistance sensor

T+/T- = Sensor connection for thermoelements

Caution!

When resistance sensors with two-wire connection are used, T2 and T3 must be jumpered.

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3RS10, 3RS11 Temperature Monitoring Relays

Relays, digitally adjustable, for 1 sensor

Overview

The 3RS10/3RS11 temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is sensed by the sensor in the medium, evaluated by the device and monitored for overshoot or undershoot or for staying within an operating range (window function).

The relays are also an excellent alternative to temperature controllers in the low-end performance range (2- or 3-point closed-loop control).

Technical specifications

Type		3RS10 40/3RS10 42/3RS20 40	3RS11 40/3RS21 40	3RS11 42
General data				
Width	mm	45		
Operating range	V	0.85 ... 1.1 x U_s		
Rated power	W/VA	< 4 / 7		
Auxiliary circuit				
Contacts		1 CO + 1 CO + 1 NO		
Rated operational currents I_e • AC-15 at 230 V, 50 Hz • DC-13 at: - 24 V - 240 V	 A A A	 3 1 0.1		
DIAZED protection gL/gG operational class	A	4		
Electrical endurance AC-15 at 3A	A	100000		
Mechanical endurance Mechanical operating cycles		30 x 10^6		
Tripping units				
Measuring accuracy at 20°C ambient temperature (T20)		< ±2 K, ± 1 digit	< ±5 K, ± 1 digit	< ±7 K, ± 1 digit
Reference point accuracy		--	< ±5 K	
Deviations due to ambient temperature in % of measuring range	%	0.05 °C per K deviation from T20		
Measuring cycle	ms	500		
Hysteresis settings for temperature 1		1 ... 99 Kelvin, for both values		
Adjustable delay time	s	0 ... 999		
Sensor circuit				
Typical sensor circuits • PT100 • PT1000/KTY83/KTY84/NTC	 mA mA	 Typically 1 Typically 0.2	 -- --	 -- --
Open-circuit detection		Yes[1]	Yes	Yes
Short-circuit detection		Yes	No	No
3-wire conductor connection		Yes[2]	--	--
Enclosures				
Environmental influences • Permissible ambient temperature • Permissible storage temperature • Permissible mounting positions	 °C °C	 -25 ... +60 -40 ... +80 Any		
Degree of protection acc. to EN 60529		Terminals: IP20; Cover: IP40		
Rated insulation voltage U_i (degree of pollution 3)	V AC	300		
Connection type		**Screw terminals**		
• Terminal screw • Solid • Finely stranded with end sleeve • AWG cables, solid or stranded • Tightening torque	 mm^2 mm^2 AWG Nm	M3 (for standard screw driver size 2 and Pozidriv 2) 1 x (0.5 ... 4)/2 x (0.5 ... 2.5) 1 x (0.5 ... 2.5)/2 x (0.5 ... 1.5) 2 x (20 ... 14) 0.8 … 1.2		
Connection type		**Spring-loaded terminals**		
• Solid • Finely stranded, with end sleeves acc. to DIN 46228 • Finely stranded • AWG cables, solid or stranded	mm^2 mm^2 mm^2 AWG	2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 2 x (24 ... 16)		
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm		
Shock resistance acc. to IEC 60068-2-27		12 shocks (half-sine 15 *g*/11 ms)		

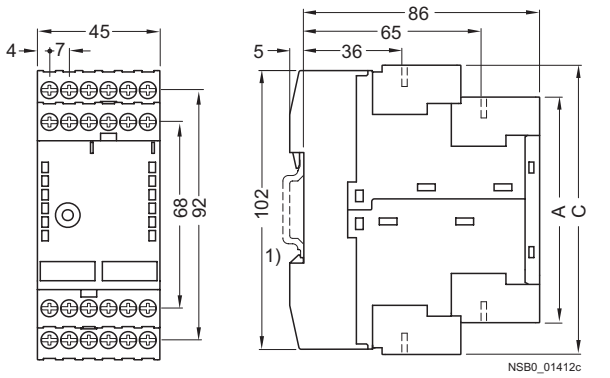
[1] Not for NTC B57227-K333-A1 (100 °C: 1.8 k; 25 °C: 32.762 k).

[2] 2-wire connection of resistance sensors with wire bridge between T2 and T3.

3RS10, 3RS11 Temperature Monitoring Relays

Relays, digitally adjustable, for 1 sensor

Dimensional drawings



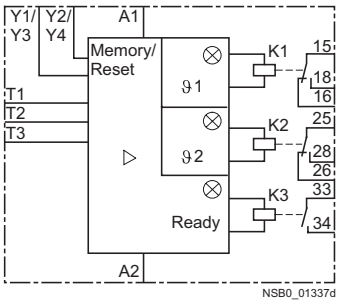
Type	3RS10, 3RS11, 3RS20, 3RS21 digital	
	A	C
Removable terminal		
Screw-type terminal	83	106
Spring-loaded terminal	84	108

1) For standard mounting rail according to EN 60715.

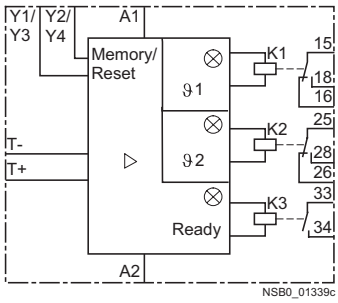
Schematics

Connection examples

3RS10 40, 3RS10 42, 3RS20 40



3RS11 40, 3RS11 42, 3RS21 40



General item codes

A1, A2, A3 terminals for rated control supply voltage

K1, K2, K3 output relay

Item code

ϑ1 = LED: "Relay 1 tripped"

ϑ2 = LED: "Relay 2 tripped"

Ready = LED: "Device is ready for operation"

T1 to T3 = Sensor connection for resistance sensor

T+/T- = Sensor connection for thermoelements

Y1/Y2 connection for memory jumper for 3RS10 40, 3RS11 40, 3RS20 40, 3RS21 40 or Y3/Y4 Reset input for 3RS10 42, 3RS11 42

Caution!

When resistance sensors with two-wire connection are used, T2 and T3 must be jumpered.

Relays, digitally adjustable for up to 3 sensors

Overview

The 3RS10 41 temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is sensed by the sensor in the medium, evaluated by the device and monitored for overshoot or undershoot or for staying within an operating range (window function). The evaluation unit can evaluate up to 3 resistance sensors at the same time and is specially designed for monitoring motor windings and bearings.

3RS10, 3RS11 Temperature Monitoring Relays

Relays, digitally adjustable for up to 3 sensors

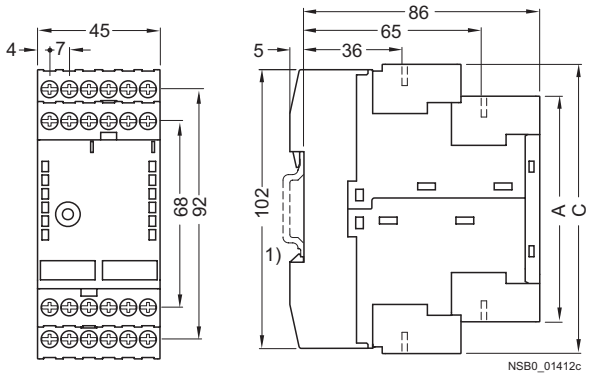
Technical specifications

Type		**3RS10 41**
General data		
Width	mm	45
Operating range	V	0.85 ... 1.1 x U_s
Rated power	W/VA	< 4 / 7
Auxiliary circuit		
Contacts		1 CO + 1 CO + 1 NO
Rated operational currents I_e		
• AC-15 at 230 V, 50 Hz	A	3
• DC-13 at:		
- 24 V	A	1
- 240 V	A	0.1
DIAZED fuse		
• gL/gG operational class	A	4
Electrical endurance AC-15 at 3A	A	100000
Mechanical endurance Mechanical operating cycles		30 x 10^6
Tripping units		
Measuring accuracy at 20°C ambient temperature (T20)		< ±2 K, ±1 digit
Deviations due to ambient temperature in % of measuring range	%	0.05 per K deviation from T20
Measuring cycle	ms	500
Hysteresis settings for temperature 1		1 ... 99 Kelvin, for both values
Adjustable delay time	s	0 ... 999
Sensor circuit		
Typical sensor circuits		
• PT100	mA	Typically 1
• PT1000/KTY83/KTY84/NTC	mA	Typically 0.2
Open-circuit detection		Yes[1]
Short-circuit detection		Yes
3-wire conductor connection		Yes[2]
Enclosures		
Environmental influences		
• Permissible ambient temperature	°C	-25 ... +60
• Permissible storage temperature	°C	-40 ... 80
• Permissible mounting positions		Any
Degree of protection acc. to EN 60529		Terminals: IP20; Cover: IP40
Rated insulation voltage U_i (degree of pollution 3)	V AC	300
Connection type		**Screw terminals**
• Terminal screw		M3 (for standard screw driver size 2 and Pozidriv 2)
• Solid	mm^2	1 x (0.5 ... 4)/2 x (0.5 ... 2.5)
• Finely stranded with end sleeve	mm^2	1 x (0.5 ... 2.5)/2 x (0.5 ... 1.5)
• AWG cables, solid or stranded	AWG	2 x (20 ... 14)
• Tightening torque	Nm	0.8 ... 1.2
Connection type		**Spring-loaded terminals**
• Solid	mm^2	2 x (0.25 ... 1.5)
• Finely stranded, with end sleeves acc. to DIN 46228	mm^2	2 x (0.25 ... 1.5)
• Finely stranded	mm^2	2 x (0.25 ... 1.5)
• AWG cables, solid or stranded	AWG	2 x (24 ... 16)
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm
Shock resistance acc. to IEC 60068-2-27		12 shocks (half-sine 15 *g*/11 ms)

[1] Not for NTC B57227-K333-A1 (100 °C: 1.8 k; 25 °C: 32.762 k).

[2] 2-wire connection of resistance sensors with wire bridge between T2 and T3.

Dimensional drawings

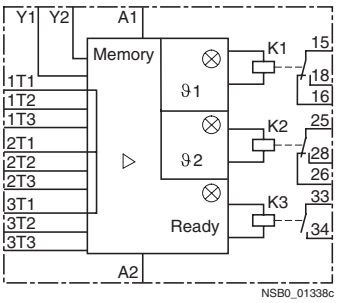


Type	3RS10, 3RS11, 3RS20, 3RS21 digital	
	A	C
Removable terminal		
Screw-type terminal	83	106
Spring-loaded terminal	84	108

1) For standard mounting rail according to EN 60715.

Schematics

Connection example



General item codes

A1, A2, A3 terminals for rated control supply voltage

K1, K2, K3 output relay

Item codes for 3RS10 41

ϑ1 = LED: "Relay 1 tripped"

ϑ2 = LED: "Relay 2 tripped"

Ready = LED: "Device is ready for operation"

1T1 to 1T3 = Sensor connection for resistance sensor 1

2T1 to 2T3 = Sensor connection for resistance sensor 2

3T1 to 3T3 = Sensor connection for resistance sensor 3

Y1/Y2 connection for memory jumper

Caution!

When resistance sensors with two-wire connection are used, T2 and T3 must be jumpered.