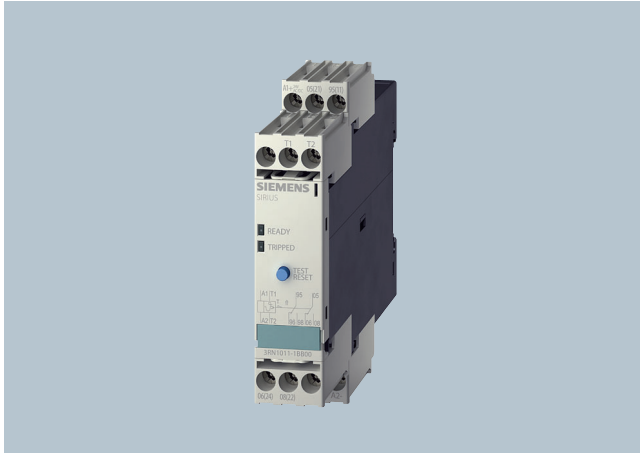


Monitoring Relays

3RN1 Thermistor Motor Protection

For PTC sensors

Overview



Thermistor motor protection devices are used for direct monitoring of the motor winding temperature. For this purpose, the motors are equipped with temperature-dependent resistors (PTC) that are directly installed in the motor winding and abruptly change their resistance at their limit temperature.

Design

The 3RN1 tripping units are suitable for use in any climate and finger-safe according to EN 50274. They comply with:

- IEC 60947-8

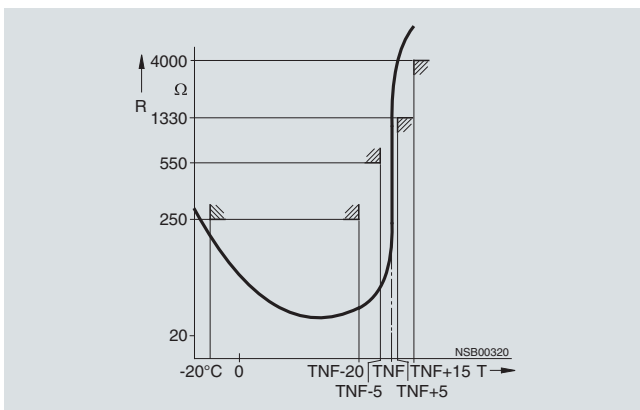
The terminals of the auxiliary contacts are designated in accordance with EN 50005.

The 3RN1 tripping units are suitable for snap-on mounting onto TH 35 standard mounting rails according to EN 60715 or for screw fixing using an adapter (Accessories).

Any mounting position is possible.

For devices with the "Manual RESET" function, the test function can be activated and a trip simulated by pressing the blue Test/RESET button for longer than 2 seconds.

If a Type A temperature sensor is connected to a Type A tripping unit, compliance with the operating temperatures is assured (on pick-up and reset) according to IEC 60034-11-2 and IEC 60947-8.



The characteristic curves of the Type A temperature sensors are described in IEC 60947-8, DIN 44081 and DIN 44082.

Use in areas subject to explosion hazard for gases

All devices are approved for Equipment Group II, Category (2) in Area "G" (areas that contain explosive gases, vapor, spray and air mixtures).

With PTB 01 ATEX 3218 ex II (2) G, compliance with 94/9 EC directive Appendix II is confirmed. The safety devices must be selected with suitable settings for the safe operation of motors of the "Increased safety" (EEx e) and "Flameproof enclosure" (EEx d) types of protection and are used outside the area subject to explosion hazard.

PTB 01 ATEX 3218 ex II (2) G

The increased danger in areas subject to explosion hazard demands careful analysis of the operating manual, the safety and commissioning instructions and the standard (EN 60079-14) for electronic equipment in areas subject to gas explosion hazards.

A risk analysis must be performed for the complete plant or machine. If this risk analysis results in a minimal potential for danger (Safety Category 1), all 3RN1 TMS tripping units can be implemented taking into account the safety notes. In the case of plants or machines with a high potential risk, versions with integrated short-circuit detection in the sensor circuit are necessary.

Use in areas subject to explosion hazard for dust

PTB 01 ATEX 3218 ex II (2) GD

3RN10 11-.B/-G, 3RN10 12-.B/-G and 3RN10 13-...0 tripping units can be used as protective devices for motors in areas subject to gas explosion hazard for protection against impermissible overheating due to overload. If the ATEX marking has the extension "D:=Dust", these units can also be used as protective devices for motors in areas subject to dust explosion hazard (EN 50281-1-1).

Additional information is provided in the EC type test certificate which can be obtained from the Internet. The units comply with the requirements of the following classes:

Device	Class
3RN10 00, 3RN10 10, 3RN10 11-.C, 3RN10 12-.C, 3RN10 22, 3RN10 62	EN 954-1: Category 1
3RN10 11-.B, 3RN10 11-.G, 3RN10 12-.B, 3RN10 12-.G, 3RN10 13	EN 954-1: Category 2

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For PTC sensors

The measuring circuit leads must be routed as separate control cables. It is not permitted to use cores from the supply line of the motor or any other main supply cables. If extreme inductive or capacitive interference is expected as a result of power lines routed in parallel, shielded control cables must be used.

Cable routing

Maximum cable length for sensor circuit cables

Conductor cross-section	Cable length for tripping units	
	Without short-circuit detection 3RN10 00, 3RN10 10 3RN10 11-.C, 3RN10 12-.C 3RN10 22, 3RN10 62	With short-circuit detection ¹⁾ 3RN10 11-.B/-G 3RN10 12-.B/-G 3RN10 13
mm ²	m	m
2.5	2 x 2800	2 x 250
1.5	2 x 1500	2 x 150
0.5	2 x 500	2 x 50

¹⁾ A short-circuit in the sensor circuit will be detected up to this maximum cable length.

Notes:

Tripping of the thermistor motor protection relay even in combination with a converter must directly result in disconnection. This must be implemented with circuitry.

Mounting and installation must only be performed by qualified personnel who observe the applicable regulations! For mounting, use mounting instruction No.: 3ZX1012-0RN10-1AA1.

The 3RN10 is not intended for installation in hazardous areas. For installation in areas subject to explosion hazards, the 3RN10 must be enclosed in a flameproof casing.

For tripping units with a 24 V AC/DC control voltage, electrical separation must be secured with a battery network or a safety transformer according to DIN VDE 0551.

When tripping units with Auto-RESET function are used, a reset is performed automatically after the cooling time has expired. It must be ensured by means of an external interlock (latching with a separate ON and OFF button) that the machine to be monitored does not start up again spontaneously.

Units with the "Auto-RESET" function must not be used in applications in which the unexpected restart can lead to personal injury or property damage.

In the case of tripping units without short-circuit detection, during commissioning or after modifications or maintenance work (assembly, disassembly) on the equipment, the sensor resistance must be measured using a suitable measuring device. For resistances of < 50 Ω the sensor circuit must be checked for a short-circuit.

If 3RN10 00 units are used to protect EEx e motors, separate monitoring of the control voltage is recommended because there is no Ready LED to indicate connection to the supply voltage.

If 3RN10 13-.BW01 units are used to protect EEx e motors, separate monitoring of the control voltage is recommended because the switching state of the auxiliary contacts does not change if the control voltage fails (use of a bistable relay is recommended).

Before commissioning, the effectiveness of the protection function must be checked.

3RN10 62 tripping units for multiple motor protection

Function

The 3RN1 tripping units operate in accordance with the closed-circuit principle and therefore monitor themselves for open circuit (except: warning output in the case of 3RN10 22). A momentary voltage failure of less than 50 ms does not change the status of the auxiliary contacts. The 3RN10 11, 3RN10 12 and 3RN10 13 units with 2 changeover contacts are also equipped with short-circuit detection in the sensor circuit. The unit will trip in the event of a short-circuit in the sensor circuit (resistance in sensor circuit < 20 Ω).

All tripping units (except for 24 V AC/DC) feature electrical separation between the control circuit and the sensor circuit.

3RN10 00 compact tripping units

The compact tripping unit is equipped with a red LED (TRIPPED) for the tripped indicator and a changeover contact.

After the unit has tripped, it is automatically reset once the thermistors have cooled down. The root of the changeover contact is connected to the control voltage (95 is connected to terminal A1).

This unit is particularly suitable in circuits in which the control circuit and signaling circuit have the same potential, e. g. in local control cabinets.

3RN10 10, 3RN10 11, 3RN10 12, 3RN10 13 standard tripping units

The standard devices are equipped with two LEDs (READY and TRIPPED) for an operating and tripped display and are available with either 1 NO + 1 NC or with 2 CO contacts. They are available depending on the version with automatic RESET (3RN10 10), manual/remote RESET (3RN10 11) or manual/automatic and remote RESET (3RN10 12 and 3RN10 13). Remote RESET can be achieved by connecting an external pushbutton with a normally-open function to terminals Y1 and Y2. If terminals Y1 and Y2 are bridged, tripping will be followed by an automatic RESET.

The 3RN10 11, 3RN10 12 and 3RN10 13 units with 2 COs also have short-circuit monitoring in the sensor circuit.

The 3RN10 12 and the 3RN10 13 are non-volatile. This means that even if the control supply voltage fails, a trip preceding it will be latched.

In the case of the 3RN10 13 tripping unit, tripping due to a short-circuit in the sensor circuit will be indicated by a flashing red LED. The monostable version also indicates open circuit in the sensor circuit by flashing of the red LED.

3RN10 22 "Warning and disconnection" tripping units

Two sensor circuits can be connected to one 3RN10 22 tripping unit that acts on one output relay with 1 NO contact for warning and 1 CO for disconnection. Temperature sensors with different rated response temperatures TNF are used to implement the "Warning" and "Disconnection" functions. When the "Warning" sensor circuit responds, a yellow LED is lit and when the "Disconnection" circuit responds, a red LED is lit.

The sensor circuits have a different reset response and operating behavior:

"Warning" (terminals 2T1, T2) only features automatic RESET and uses the open-circuit principle.

"Disconnection" (terminals 1T1, T2) can be changed from manual RESET to automatic RESET by linking terminals Y1 and Y2. Remote RESET is implemented by connecting an external pushbutton with a normally-open function.

Up to 6 sensor circuits can be connected to the 3RN10 62 tripping unit, all of which act on one output relay. The simultaneous

Monitoring Relays

3RN1 Thermistor Motor Protection

For PTC sensors

protection of several motors (up to 6) is an advantage for multi-motor drives (e. g. if one motor is overloaded, all the other motors of the drive will be shut down). Apart from the red LED "TRIPPED", which signals the switching state of the tripping unit, a LED is assigned to each sensor circuit which indicates the sensor circuit that has responded. Unused sensor circuits must be short-circuited.

The reset response of the 3RN10 62 tripping units can be changed from manual RESET to automatic RESET by linking terminals Y1 and Y2. Remote RESET is implemented by connecting an external pushbutton with a normally-open function.

Response of the tripping units in the event of control voltage failure

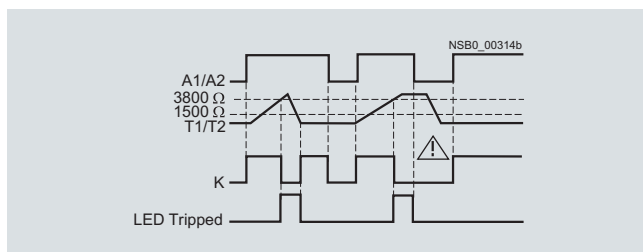
Behavior	Monostable	Non-volatile, monostable	Bistable
	3RN10 00 3RN10 10 3RN10 11	3RN10 12 3RN10 13-...0 3RN10 22 3RN10 62	3RN10 13-...01
In case of failure of the control voltage	Device trips	Device trips	No change in switching state of the auxiliary contacts
In case of return of the control voltage without a preceding tripping operation	Device resets	Device resets	No change in switching state of the auxiliary contacts
In case of return of the control voltage after a preceding tripping operation	Device resets	The device remains tripped	No change in switching state of the auxiliary contacts

Protective separation

All circuits (outputs, control circuits, sensor and RESET circuits) of the 3RN10 13-1BW10 and 3RN10 13-1GW10 multifunction tripping units (wide voltage range, monostable output relay and screw connection) are safely separated from each other up to a rated voltage of 300 V according to DIN VDE 0100-410 (IEC 60364-4-41) and EN 60947-1.

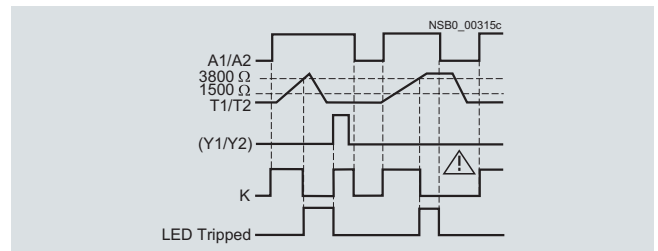
Function diagrams

3RN10 00/3RN10 10 (Auto-RESET)

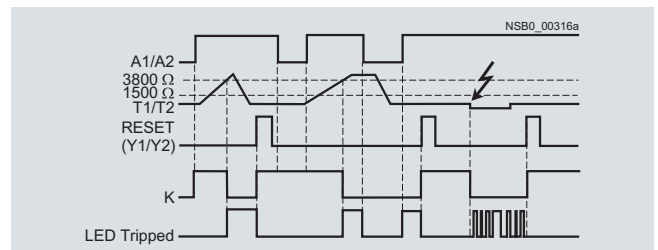


1) For versions with 2 CO and short-circuit detection in the sensor circuit see function diagram 3RN10 13.

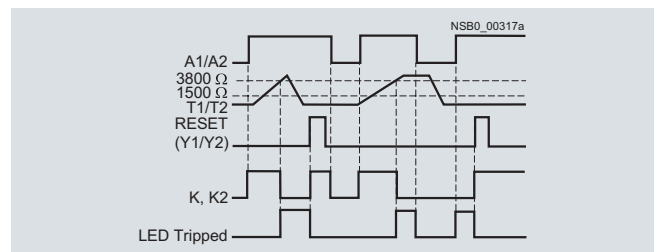
3RN10 11¹⁾



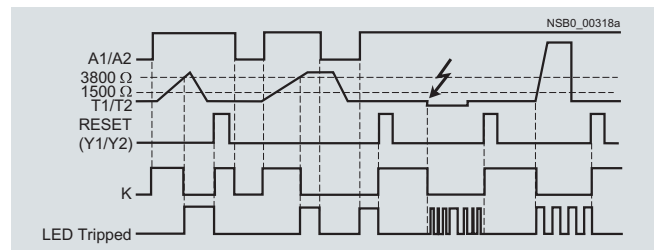
3RN10 13-...01



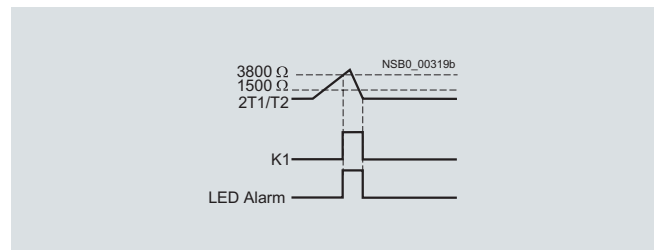
3RN10 12¹⁾/3RN10 22/3RN10 62





3RN10 13-...0



3RN10 22 only



Technical specifications

Type	Compact units		Standard devices			Multi-function units	Warning + tripping	Multiple motor protection
	3RN10 00	3RN10 10	3RN10 11	3RN10 12	3RN10 13	3RN10 22	3RN10 62	
General data								
Width	mm	22.5						45
Mounting position		Any						
Number of connectable sensor circuits		1				2	6	
Response in the event of control voltage failure		1)						
Manual RESET		No	Yes					
Automatic RESET		Yes	No	Yes				
Remote RESET		No	Yes ²⁾	Yes				
TEST pushbutton		No	Yes					
Short-circuit detection for sensor circuit		No	Yes (for 2 CO units)			Yes	No	
Short-circuit and open-circuit indication		No				Yes ³⁾	No	
Warning and disconnection in one unit		No					Yes	No
Tripping units								
Rated insulation voltage U_i (degree of pollution 3)	V	300						
Permissible ambient temperature	°C	-25 ... +60						
Permissible storage temperature	°C	-40 ... +80						
EMC tests		IEC 60947-8, IEC 61000-6-2, IEC 61000-6-4						
Degree of protection acc. to IEC 60529		IP20						
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-type terminals						
• Solid	mm ²	2 x (0.25 ... 1.5)						
• Finely stranded with end sleeves	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)						
Sensor circuit								
Measuring circuit load at $R_F \leq 1.5 \text{ k}\Omega$	mW	≤ 5						
Voltage in sensor circuit at $R_F \leq 1.5 \text{ k}\Omega$	V	≤ 2						
Response temperature (depends on sensor)	°C	60 ... 180						
Coupling time (depends on sensor)	s	About 5						
Summation PTC resistance R_F (per sensor loop)	k Ω	≤ 1.5						
Response value	k Ω	3.4 ... 3.8						
Return value	k Ω	1.5 ... 1.65						
Response tolerance	°C	± 6						

¹⁾ See Catalog LV 1, Selection and ordering data.

²⁾ Remote RESET possible by disconnecting control voltage.

³⁾ Open circuits are only indicated by monostable versions (3RN10 13-...0).

Monitoring Relays

3RN1 Thermistor Motor Protection

For PTC sensors

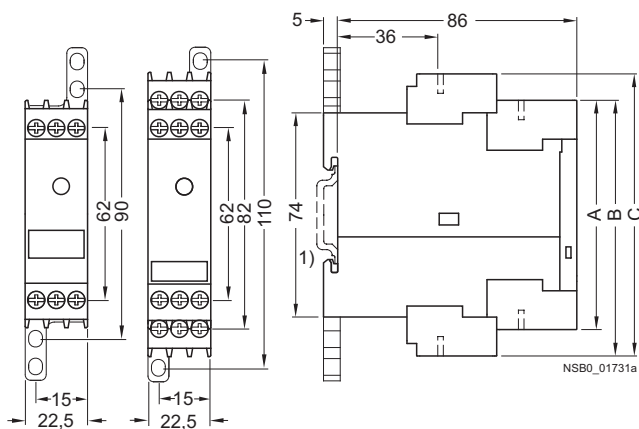
Type	Compact units		Standard devices				Multi-function units	Warning + tripping	Multiple motor protection
	3RN10 00	3RN10 10	3RN10 11	3RN10 12	3RN10 13	3RN10 22			
Control circuit									
Rated control supply voltage U_s	1)								
Operating range	0.85 ... 1.1 x U_s								
• 110/230 V AC	0.85 ... 1.1 x U_s								
• 24 ... 240 V AC/DC	0.85 ... 1.1 x U_s								
• 24 V AC/DC	0.85 ... 1.2 x U_s for DC operation, 0.85 ... 1.1 x U_s for AC operation								
Rated power	< 2								
• AC/DC	W								
Max. mains buffering time	ms	50							
Auxiliary circuit									
Conventional thermal current I_{th}	A	5							
Rated operational current I_e	3								
• AC-15 at 240 V	A	3							
• DC-13 at 24 V	A	1							
DIAZED fuse	A	6 ²⁾							
CSA and UL rated data, control circuit									
Rated control voltage 50/60 Hz	300								
• AC	V	300							
• DC	V	300							
Switching capacity	R 300/B 300								
Protective separation up to 300 V acc. to DIN 60947-1	--					3RN10 13-1BW10, 3RN10 13-1GW10		--	

1) See Catalog LV 1, Selection and ordering data.

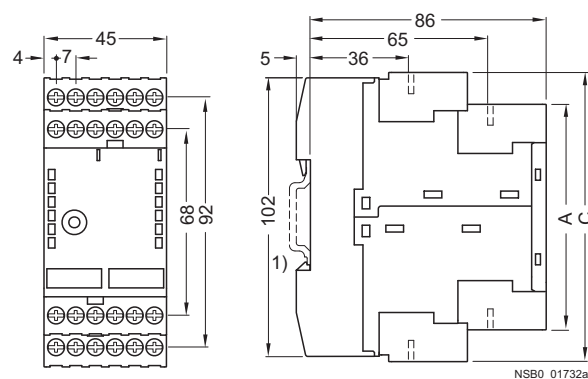
2) $I_n > 1$ kA weld-free according to EN 60947-5-1.

Dimensional drawings

3RN1 with 1 ... 2 sensor circuits



3RN10 62



Type	3RN10 00	3RN10 10-C	3RN10 10-B 3RN10 10-G 3RN10 11 3RN10 12 3RN10 13 3RN10 22
	A	B	C

Removable terminal

Screw-type terminal	83	92	102
Spring-loaded terminal	84	94	103

1) For standard mounting rail according to EN 60715.

Type	3RN10 62	
	A	C

Removable terminal

Screw-type terminal	83	106
Spring-loaded terminal	84	108

1) For standard mounting rail according to EN 60715.

Monitoring Relays

3RN1 Thermistor Motor Protection

For PTC sensors

Schematics

Circuit diagrams

Illustrated with control voltage applied

Illustrated with control voltage not applied

Illustrated with control voltage applied

Illustrated with control voltage not applied

General item codes

A1, A2, A3 Connections of the control voltage
 N Amplifier
 T/R TEST/RESET button
 Y1, Y2 Connections for remote RESET (jumpered = Auto-RESET)
 ↑ The double arrow indicates an operating state which deviates from the standard representation of the contact according to DIN 40900, Part 7 (Here: Position of the contacts when control voltage is applied to terminals A1 and A2)

Item codes for 3RN10

H1 "READY" LED
 H2 "TRIPPED" LED
 K Output relay
 T1, T2 Connections of the sensor loop

Item codes for 3RN10 22

H1 "READY" LED
 H2 "TRIPPED" LED
 H3 "ALARM" LED
 K1 Output relay for warning threshold ("ALARM" LED)
 K2 Output relay for disconnection ("TRIPPED" LED)
 1T1 and T2 Connections of the sensor loop
 2T1 and T2 Connections of the sensor loop

⚠ Important!

Close unconnected sensor circuits.

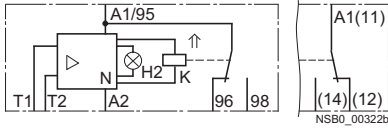
Item codes for 3RN10 62

H1 to H6 LED for the tripped sensor loop
 H7 "READY" LED
 H8 "TRIPPED" LED
 K Output relay
 1T1, 1T2 Connections of the 1st sensor loop
 6T1, 6T2 Connections of the 6th sensor loop

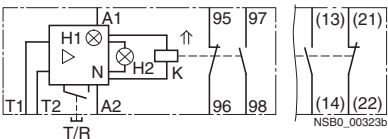
⚠ Important!

Close unconnected sensor circuits.

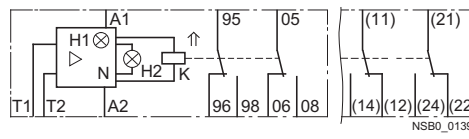
3RN10 00, 1 CO



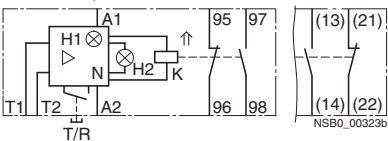
3RN10 10, 1 NO + 1 NC



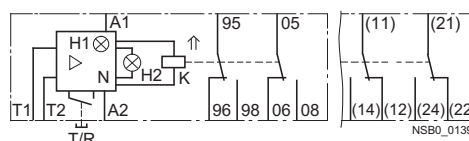
3RN10 10, 2 COs



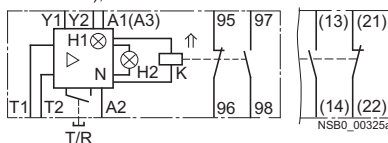
3RN10 11¹⁾, 1 NO + 1 NC



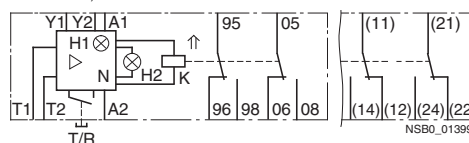
3RN10 11, 2 COs



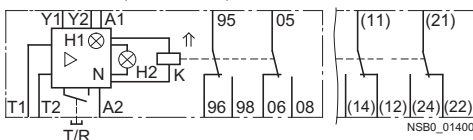
3RN10 12¹⁾, 1 NO + 1 NC



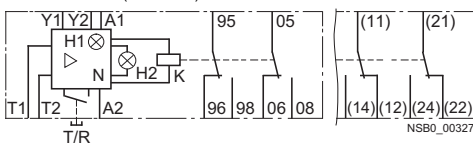
3RN10 12, 2 COs



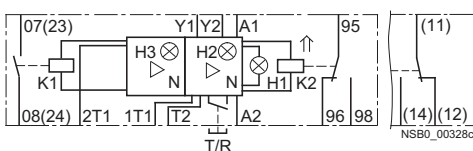
3RN10 13-...0 (monostable)



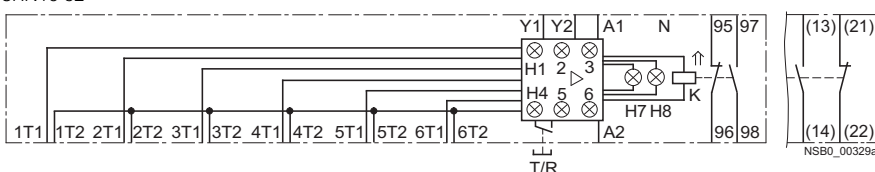
3RN10 13-...1 (bistable)



3RN10 22



3RN10 62



¹⁾ For units with combination voltages 230 V/110 V AC (3RN10 11-.CK00 and 3RN10 12-.CK00) the following applies:
 A1 and A2: 230 V AC, A3 and A2: 110 V AC.