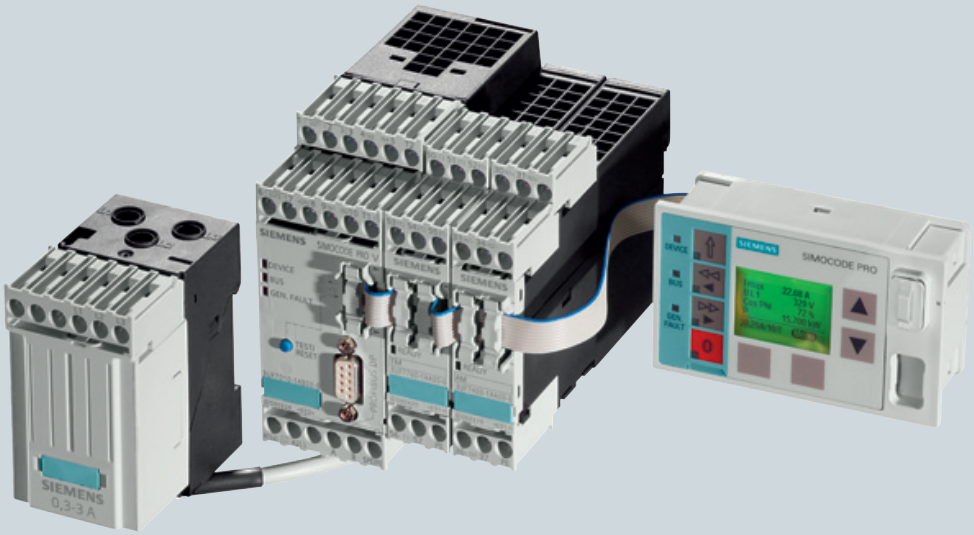
Monitoring and Control Devices

SIMOCODE 3UF • LOGO! • Timing Relays • Monitoring Relays • Safety Relays • Interface Converters

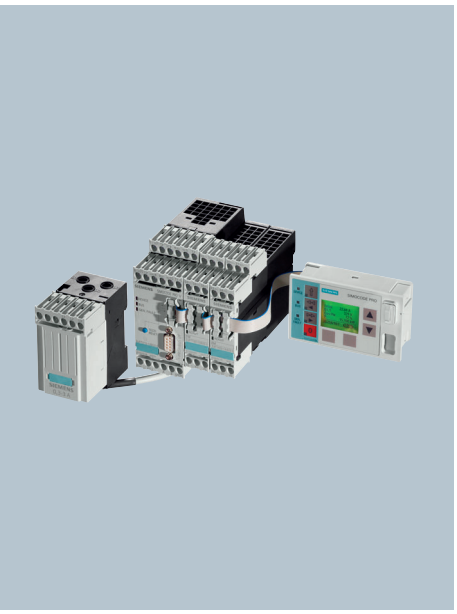
Reference Manual · June 2010



Industrial Controls

SIEMENS

Monitoring and Control Devices



[1] See Catalog ST 70 · 2009 "Products for Totally Integrated Automation and Micro Automation".

[2] See System Manual "Modular Safety System 3RK3".

Introduction

Overview

The advantages at a glance


3UF7


6ED1 052


3RP15

		Type	Page
SIMOCODE 3UF motor management and control devices			
SIMOCODE pro 3UF7	• Compact, modular design • Unique flexibility in terms of functionality and hardware configuration • Wide functional range from the distributed I/O system to the autonomous motor management system • All control functions from the direct-on-line starter to the pole-changing switch with reversing contactor • All motor sizes • Integration in all PROFIBUS-capable automation systems • Application in low-voltage controlgear for motor control centers in the process industry • Increases plant availability • Saves costs during construction, commissioning and operation of the plant • Extensive data of the motor feeder available everywhere on the PROFIBUS • All protection, monitoring and control functions for the motor feeder in a single system	3UF7	6
3UF18 current transformers for overload protection	• Protection transformer for activating overload relays or for use with SIMOCODE 3UF • Ensures proportional current transfer up to a multiple of the primary rated current	3UF18	32
LOGO! logic modules			
LOGO! logic modules	• Compact, user-friendly and low-cost solution for simple control tasks • Universal: - Building installation and wiring (lighting, shutters, awnings, doors, access control, barriers, ventilation systems ...) - Control cabinet installation - Machine and device construction (pumps, small presses, compressors, hydraulic lifts, conveyors ...) - Special controls for conservatories and greenhouses - Signal preprocessing for other controllers • Flexible expansion depending on the application		
LOGO! Modular basic versions	• With display, pushbuttons and an interface for connecting expansion units	6ED1 052-1	38
LOGO! Modular pure versions	• Without display and pushbuttons but with an interface for connecting expansion units	6ED1 052-2	39
LOGO! Modular expansion modules	• For connection to LOGO! Modular basic versions with digital inputs and outputs or analog inputs and outputs	6ED1 055-1	ST 70[1)]
LOGO! Modular communication modules	• For integrating LOGO! in an *instabus* KNX *EIB* system or as an AS-Interface slave	6BK1 700, 3RK1 400	ST 70[1)]
LOGO! Power	• Power supply for converting the mains voltage of 100 ... 240 V AC into an operational voltage of 24 V DC or 12 V DC	6EP1 3	ST 70[1)]
LOGO! Contact	• Switching module for switching resistive loads and motors directly	6ED1 057-4	ST 70[1)]
LOGO! Software	• For switchgear program generation on the PC	6ED1 058	40
3RP, 3RT19 timing relays			
3RP15 timing relays in industrial enclosure, 22.5 mm	• Low-cost solution with monofunctions such as response delay, off-delay, clock-pulse, wye-delta function and multi-function • Wide voltage range versions	3RP15	46
3RP20 timing relays, 45 mm	• The solution for small mounting depths • The low mounting height reduces the tier spacing	3RP20	52
3RT19 16, 3RP19 26 timing relays for mounting onto contactors	• Saves space because the relay is mounted onto the contactor • Wiring advantages thanks to direct contacting to the contactor	3RT19 16, 3RT19 26	55

[1)] See Catalog ST 70 · 2009 "Products for Totally Integrated Automation and Micro Automation".

The advantages at a glance

3UG45 11

3UG46 16

3UG46 33

		Type	Page
3UG monitoring relays for electrical and additional measurements			
Line monitoring			
Phase sequence	• Low-cost solution for monitoring the phase sequence	3UG45 11	59
Phase sequence, phase failure, phase unbalance	• Wide voltage range from 160 ... 690 V	3UG45 12	59
Phase sequence, phase failure, phase unbalance and undervoltage	• Analogically adjustable • Wide voltage range from 160 ... 690 V	3UG45 13	60
	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide voltage range from 160 ... 690 V	3UG46 14	60
Phase sequence, phase failure, phase unbalance over limit values, overvoltage and undervoltage	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide voltage range from 160 ... 690 V	3UG46 15	61
Phase sequence, phase and N conductor failure, phase unbalance over limit values, overvoltage and undervoltage		3UG46 16	61
Automatic correction of the direction of rotation in case of wrong phase sequence, phase failure, phase unbalance, overvoltage and undervoltage		3UG46 17	61
Automatic correction of the direction of rotation in case of wrong phase sequence, phase and N conductor failure, phase unbalance, overvoltage and undervoltage		3UG46 18	61
Voltage monitoring			
Voltage monitoring with internal power supply for overvoltage and undervoltage	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide measuring ranges • Version for wide voltage range	3UG46 33	65
Voltage monitoring with auxiliary voltage for overvoltage and undervoltage		3UG46 31, 3UG46 32	66
Current monitoring			
Current monitoring with auxiliary voltage for overshoot and undershoot	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide measuring ranges • Version for wide voltage range	3UG46 21, 3UG46 22	69
Power factor and active current monitoring (motor load monitoring)			
Power factor and active current monitoring with internal power supply for overshoot, undershoot or window monitoring	• For load monitoring over the entire torque range • Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide voltage range from 90 ... 690 V	3UG46 41	73
Residual current monitoring			
Residual current monitoring relays	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Adjustable threshold values for warning and disconnection • For plant monitoring • Wide voltage range from 90 ... 690 V	3UG46 24	78
Summation current transformers	• Detects fault currents in machines and plants	3UL22	83
Insulation monitoring			
Monitoring of the insulation resistance for ungrounded AC or DC networks from 1 to 110 kΩ	• Test button • With or without memory • Switchable measuring range	3UG30 81, 3UG30 82	84
Level monitoring			
Fill level and resistance	• As single-step or two-step controls for inlet or outlet monitoring of conducting liquids or as resistance threshold switch • Adjustable, wide range from 2 ... 200 kΩ • UNDER/OVER adjustable	3UG45 01	88
Level monitoring sensors	• Wire, rod or bow electrodes	3UG32	92
Speed monitoring			
Speed monitoring for overshoot, undershoot or window monitoring	• Digitally adjustable with LCD for indication of ACTUAL value and device status • Wide measuring ranges • Version for wide voltage range • Together with a sensor for monitoring continuous pulses • With or without memory • Adjustable delay times	3UG46 51	93

Introduction

The advantages at a glance

3RS10

3RN1

3TK28

		Type	Page
3RS10, 3RS11 temperature monitoring relays			
For monitoring the temperatures of solids, liquids, and gases			
Relays, analog adjustable, for 1 sensor	• Separate versions for overshoot and undershoot • For simple monitoring tasks • For PT100 or thermoelements J and K • Variable hysteresis	3RS10, 3RS11	100
Relays, digitally adjustable, for 1 sensor	• For two-step or three-step controls • For monitoring heat generation plants • For PT100/1000, KTY83/84, NTC or thermoelements type J, K, T, E, N, R, S, B	3RS10, 3RS11, 3RS20, 3RS21	104
Relays, digitally adjustable for up to 3 sensors	• For simultaneously monitoring several sensors • Especially suited for monitoring motor winding temperatures • For PT100/1000, KTY83/84, NTC	3RS10	107
3RN1 thermistor motor protection			
For PTC sensors	• Relays for monitoring motor winding temperatures with type A PTC sensors • Integrated with ATEX approval • Closed-circuit principle • Depending on the version: with short-circuit and open-circuit detection, protection against voltage failure, manual/auto/remote RESET, 1 CO, 1 NO + 1 NC, 2 CO, 1 NO + 1 CO or 2 CO hard gold-plating	3RN1	110
3TK28 safety relays			
With electronic enabling circuits	• Permanent function checking • No wear because switched electronically • High switching frequency • Long electrical endurance • Evaluation of solid-state sensors • Sensor lead up to max. 2000 m • Cascading possible • Insensitive to vibrations and dirt • Compact design, low weight • Approved for the world market	3TK28 4	118
With relay enabling circuits	• Compact design • Floating safe outputs • Also suitable for press and punch controls • Can be used up to an ambient temperature of max. 70 °C	3TK28 2, 3TK28 3	127
With contactor relay enabling circuits	• Enabling circuits, floating • AC-15/DC-13 switching capacity • Protective separation • Long mechanical and electrical endurance • Certified as a complete unit • Fault minimization and cost reduction through factory wiring • Low installation costs	3TK28 5	138
With special functions	• Floating safe outputs • Signaling outputs for status and diagnostic signals • Safe standstill monitoring	3TK28 1	143

The advantages at a glance

3RK3

3RS17

		Type	Page
3RK3 modular safety system			
Freely configurable, modular safety relays	• More functionality and flexibility through freely configurable safety logic • For all safety applications thanks to compliance with the highest safety requirements (Category 4 according to EN 954-1, Performance Level e according to ISO 13849-1 or SIL3 according to IEC 62061) • Can be used globally • Modular hardware configuration • Parameterization by means of software instead of wiring • Removable terminals for greater plant availability	3RK3	See System Manual "Modular Safety System 3RK3"
3RS17 interface converters			
Converters for standard signals and non-standard variables	• All terminals protected against polarity reversing and overvoltage up to 30 V • For electrical separation and conversion of analog signals • Short-circuit resistant outputs • From 6.2 mm width • Switchable multi-range converters • Versions with manual/automatic switch for setpoint selection • Versions for conversion of analog variables into frequency	3RS17	147

Options

On the following pages you will find selection tables for monitoring and control devices.

⊕	Screw terminals
⊞	Spring-type terminals
	These connections are indicated in the Technical specifications by orange backgrounds.

"Increased safety" type of protection EEx e/d according to ATEX directive 94/9/EC

The communication-capable, modularly designed SIMOCODE pro motor management system (SIRIUS Motor Management and Control Devices) protects motors of types of protection EEx e and EEx d in potentially explosive areas.

ATEX approval for operation in areas subject to explosion hazard

The SIRIUS 3RN1 thermistor motor protection relay for PTC sensors is certified according to ATEX Ex II (2) G and GD for gases and dust.

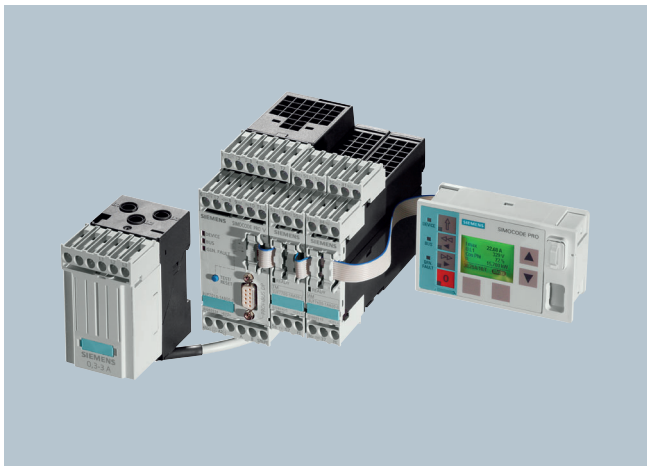
The SIRIUS SIMOCODE pro 3UF7 motor management system is certified for the protection of motors in areas subject to explosion hazard according to

- ATEX Ex I (M2); equipment group I, category M2 (mining)
- ATEX Ex II (2) GD; equipment group II, category 2 in area GD

See Catalog LV 1, Chapter 20 "Appendix" --> "Standards and approvals" --> "Type overview of approved devices for potentially explosive areas (ATEX explosion protection)".

SIMOCODE pro 3UF7 motor management and control devices

Overview



SIMOCODE pro V with current/voltage measuring module, expansion modules and operator panel with display

SIMOCODE pro is a flexible, modular motor management system for motors with constant speeds in the low-voltage performance range. It optimizes the connection between I&C and motor feeder, increases plant availability and allows significant savings to be made for startup, operation and maintenance of a system.

When SIMOCODE pro is installed in the low-voltage switchboard, it is the intelligent interface between the higher-level automation system and the motor feeder and includes the following:

- Multifunctional, solid-state full motor protection which is independent of the automation system
- Integrated control functions instead of hardware for the motor control
- Detailed operating, service and diagnostics data
- Open communication through PROFIBUS DP, the standard for fieldbus systems

SIMOCODE ES is the software package for SIMOCODEpro parameterization, start-up and diagnostics.

Design

General

SIMOCODE pro is a modularly constructed motor management system which is subdivided into two device series with different functional scopes:

- SIMOCODE pro C and
- SIMOCODE pro V.

Both series (systems) are made up of different hardware components (modules):

System	SIMOCODE pro C	SIMOCODE pro V
Modules	• Basic unit 1 • Current measuring module • Operator panel (optional)	• Basic unit 2 • Current measuring module or current/voltage measuring module • Decoupling module (optional) • Operator panel or operator panel with display (optional) • Expansion modules (optional)

Per feeder each system always comprises one basic unit and one separate current measuring module. The two modules are connected together electrically through the system interface with a connection cable and can be mounted mechanically connected as a unit (one behind the other) or separately (side by side). The motor current to be monitored is decisive only for the choice of the current measuring module.

An operator panel for mounting in the control cabinet door is optionally connectable through a second system interface on the basic unit. Both the current measuring module and the operator panel are electrically supplied by the basic unit through the connection cable. More inputs, outputs and functions can be added to basic unit 2 (SIMOCODE pro V) by means of optional expansion modules, thus supplementing the inputs and outputs already existing on the basic unit.

All modules are connected by connection cables. The connection cables are available in various lengths. The maximum distance between the modules (e.g. between the basic unit and the current measuring module) must not exceed 2.5 m. The total length of all the connection cables in a single system must not be more than 3 m.

SIMOCODE pro designed for mixed operation

Depending on functional requirements, the two systems can be used simultaneously without any problems and without any additional outlay in a low-voltage system. SIMOCODE pro C is fully upward-compatible to SIMOCODE pro V. The same components are used. The parameterization of SIMOCODE pro C can be transferred without any problems. Both systems have the same removable terminals and the same terminal designations.

SIMOCODE pro 3UF7 motor management and control devices

SIMOCODE pro C, basic unit 1

The compact system for

- Direct-on-line and reversing starters
- For actuation of a circuit breaker (MCCB)

with up to 4 binary inputs, up to 3 monostable relay outputs and one thermistor connection (binary PTC)

The basic unit 1 is available in two different versions for the following supply voltages:

- 24 V DC
- 110 ... 240 V AC/DC

SIMOCODE pro C, basic unit 1

Inputs:
4 binary inputs, with internal supply from 24 V DC

Outputs:
3 (2+1) monostable relay outputs

Thermistor connection for binary PTC

PROFIBUS interface:
- 9-pole SUB-D or
- Terminal connection

Connection of the supply voltage:
- 24 V DC or
- 110 ... 240 V AC/DC

Test/reset button

3 LEDs

2 system interfaces for connection of
- a current measuring module and
- an operator panel

Basic unit 1 is suitable for standard rail mounting or, with additional push-in lugs, for fixing to a mounting plate.

SIMOCODE pro V, basic unit 2

The variable system which offers all SIMOCODE pro C functions plus many additional functions. Basic unit 2 supports the following control functions:

- Direct-on-line and reversing starters
- Wye/delta starters, also with direction reversal
- Two speeds, motors with separate windings (pole-changing switch); also with direction reversal
- Two speeds, motors with separate Dahlander windings (also with direction reversal)
- Positioner actuation
- Solenoid valve actuation
- Actuation of a motor starter protector or circuit breaker (MCCB)
- Soft starter actuation (also with direction reversal)

Basic unit 2 has 4 binary inputs, 3 monostable relay outputs and one thermistor connection (binary PTC). The type and number of inputs and outputs can be increased by means of additional expansion modules.

Basic unit 2 is available in two different versions for the following supply voltages:
- 24 V DC
- 110 ... 240 V AC/DC

SIMOCODE pro V, basic unit 2

Inputs:
4 binary inputs, with internal supply from 24 V DC

Outputs:
3 (2+1) monostable relay outputs

Thermistor connection for binary PTC

PROFIBUS interface:
- 9-pole SUB-D or
- Terminal connection

Connection of the supply voltage:
- 24 V DC or
- 110 ... 240 V AC/DC

Test/reset button

3 LEDs

2 system interfaces for connection of
- a current measuring module or current/voltage measuring module,
- expansion modules and
- an operator panel.

Basic unit 2 is suitable for standard rail mounting or, with additional push-in lugs, for fixing to a mounting plate.

SIMOCODE pro 3UF7 motor management and control devices

Current measuring modules (current ranges)

The current measuring module is selected for each feeder according to the rated motor current to be monitored. Available for this purpose are various current measuring modules for current ranges from 0.3 ... 630 A. The current measuring module is connected to the basic unit by a connection cable and is supplied with electricity by the basic unit through this connection cable. Current measuring modules up to 100 A are suitable for standard rail mounting or can be fixed directly to the mounting plate by means of additional push-in lugs. Similarly, current measuring modules up to 200 A can also be mounted on standard mounting rails or be fixed directly to mounting plates by means of fixtures integrated in the enclosure. Finally, current measuring modules up to 630 A can only be mounted with the integrated screw fixtures.

Note:
Current measuring modules for up to 100 A current setting can be mechanically connected to the corresponding basic unit and mounted with it as a unit (one behind the other). For larger current measuring modules, only separate mounting is possible.

Current measuring modules for the following current ranges are offered:

- 0.3 ... 3 A with straight-through current transformer
- 2.4 ... 25 A with straight-through current transformer
- 10 ... 100 A with straight-through current transformer
- 20 ... 200 A with straight-through current transformer or busbar connection
- 63 ... 630 A with busbar connection

For motor currents up to 820 A, a current measuring module for 0.3 ... 3 A, for example, can be used in combination with a 3UF1 8 interposing/current transformer.

Current/voltage measuring modules (voltage range)

Current/voltage measuring modules have the same functions as the current measuring modules. However, they can only be used in combination with basic unit 2. They offer the same current ranges for the rated motor current. Mounting on standard mounting rails, on mounting plates or directly on the contactor is also the same as with the current measuring modules. They can also measure voltages up to 690 V in the main circuit, which is necessary for calculating or monitoring power-related measured variables. Current/voltage measuring modules have additional removable terminals, to which the voltages of all three phases of the main circuit are connected (3-pole). An additional 3-core cable can be used, for example, to directly connect the main circuit from the busbar terminals of the current/voltage measuring modules to the voltage measuring terminals.

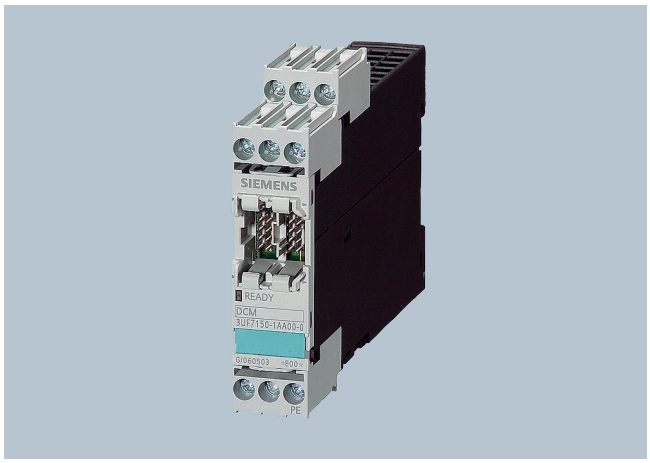
Note:
Current/voltage measuring modules can only be mounted separately from the associated basic unit 2. If the current/voltage measuring module is used in non-grounded networks or in networks with insulation measurement or monitoring, then a decoupling module must be used in addition.

Width				
45 mm	**55 mm**	**120 mm**	**145 mm**	
				**Current measuring modules**
				**Current/voltage measuring modules**
Current setting				To measure and monitor motor currents up to 820 A, matching 3UF18 intermediate current transformers are available for the current measuring modules and current/voltage measuring modules.
0.3 ... 3 A; 2.4 ... 25 A	**10 ... 100 A**	**20 ... 200 A**	**63 ... 630 A**	
Straight-through transformers				
		Busbar connection		

Sizes and current setting of the current measuring modules and the current/voltage measuring modules

SIMOCODE pro 3UF7 motor management and control devices

Decoupling module for current/voltage measuring modules



Decoupling module

If the voltage and power measuring module from SIMOCODE pro is used in non-grounded networks, then a decoupling module must be installed on the system interface upstream from each current/voltage measuring module. If the voltage and power measuring module from SIMOCODE pro is used in networks with additional insulation measurement or insulation monitoring, then a decoupling module must be installed likewise upstream from each current/voltage measuring module. If 3UF7 10 current-only measuring modules are used in these networks, then additional decoupling modules must not be used under any circumstances.

Note:
When a decoupling module is used, restrictions on the number of connectable expansion modules must be observed *(see page 13).*

Operator panels

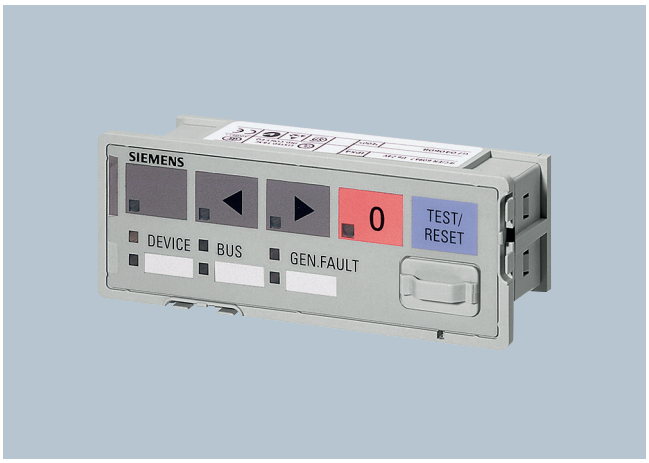
The operator panel is used to control the motor feeder and can replace all conventional pushbuttons and indicator lights to save space. This means that SIMOCODE pro or the feeder can be operated directly at the control cabinet and that the system interface is connected externally for easier parameterization or diagnostics using a PC or programming device, for example.

The operator panel is connected to the basic unit over a connection cable from its rear system interface and is supplied electrically from the basic unit.

The operator panel has 5 freely assignable buttons and a total of 10 LEDs, of which 7 LEDs can be used as required and assigned to any status signal.

A PC or programming device can be connected to the front system interface over the PC cable.

The operator panel is mounted in the control cabinet door or the front plate of, for example, a withdrawable unit and satisfies degree of protection IP54 with the system interface covered.

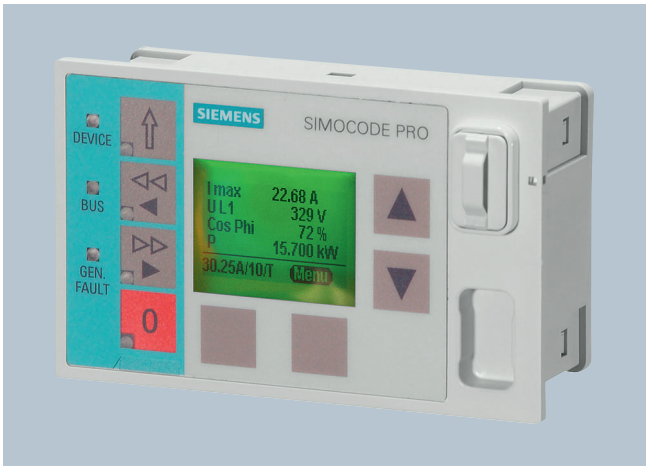


Operator panel for SIMOCODE pro

- 10 LEDs
- Test/reset button
- 4 control keys
- 2 system interfaces on the front with interface covers

SIMOCODE pro 3UF7 motor management and control devices

Operator panels with display



Operator panel with display for SIMOCODE pro V

As an alternative to the 3UF7 20 standard operator panel for SIMOCODE pro V there is also an operator panel with display: the 3UF7 21 is thus able in addition to indicate current measured values, operational and diagnostics data or status information of the motor feeder at the control cabinet. This operator panel can be used solely with basic unit 2 (SIMOCODE pro V), product version E03 and higher. It includes all the status LEDs also found on the basic unit and provides access to the system interface outside the control cabinet. The pushbuttons of the operator panel can be used to control the motor while at the same time the display indicates measured actual values, status information, fault messages or the device-internal fault protocol.

Overview of features:

- 7 LEDs, 4 of them user-assignable (4 green LEDs are integrated in the motor control pushbuttons, preferably for the feedback of switching states, e. g. On, Off, Left, Right, etc.)
- 4 user-assignable buttons for controlling the motor feeder
- 4 buttons for navigating in the display menu, 2 of them as softkeys with function options (e. g. Test/Reset)
- 2 system interfaces on the front with interface covers

Using the display settings each user can select for himself how the measured values are presented as standard and how the displayed unit is converted (e. g. °C -> °F). The menu language is also switchable. Following options are available:

- English
- Finnish
- French
- German
- Italian
- Polish
- Portuguese
- Spanish

Note:
The operator panel with display can be used solely with basic unit 2, product version E03 and higher. Furthermore, if the operator panel with display is used, restrictions on the number of connectable expansion modules must be observed (see page 13).

Inscription software for pushbuttons and LEDs on the operator panels

All operator panels come with prefabricated labeling strips. Using the latest version of the labeling software "SIRIUS Label Designer" it is also possible to produce user-specific inscription for the keys and LEDs of the operator panels from SIMOCODE pro.

Note:
The multilingual software is available free of charge from http://www.siemens.com/simocode

Three different types of prepunched labeling strips are available for printing and can be ordered as an accessory part. With the help of a laser printer it is then easy to label the keys or LEDs of the 3UF7 20 operator panel or the keys of the 3UF7 21 operator panel with display.

Expansion modules for additional I/Os and functions

With basic unit 2 (SIMOCODE pro V), it is possible to expand the number and type of inputs and outputs in order to implement additional functions, for example. Each expansion module has two system interfaces on the front. Through the one system interface the expansion module is connected to the system interface of basic unit 2 using a connection cable, for example; through the second system interface, further expansion modules or the operator panel can be connected. The power supply for the expansion modules is provided by the connection cable through basic unit 2.

All expansion modules are suitable for standard rail mounting or can be directly fixed to a mounting plate using additional push-in lugs. Basic unit 2 can be extended on the whole with up to 5 expansion modules.

Expansion with additional binary I/Os through digital modules

Up to two digital modules can be used to add additional binary inputs and relay outputs to basic unit 2. The input circuits of the digital modules are supplied from an external power supply. The following versions are available:

- 4 inputs, supplied externally with 24 V DC and 2 monostable relay outputs
- 4 inputs, supplied externally with 110 ... 240 V AC/DC and 2 monostable relay outputs
- 4 inputs, supplied externally with 24 V DC and 2 bistable relay outputs
- 4 inputs, supplied externally with 110 ... 240 V AC/DC and 2 bistable relay outputs

Up to two digital modules can be connected to one basic unit 2. All versions can be combined with each other.

3UF7 300-1AB00-0 (left) and 3UF7 300-1AU00-0 (right) digital modules

4 binary inputs, externally supplied with
- 24 V DC or
- 110 ... 240 V AC/DC

2 relay outputs
- Monostable or
- Bistable (the switching state of the relay outputs is also maintained following failure of the supply voltage on basic unit 2)

1 Ready LED

2 system interfaces for connection
- to basic unit 2,
- of expansion modules,
- of a current measuring module or current/voltage measuring module,
- of an operator panel.

Note:
For the implementation of some motor control functions, in addition to the relay outputs on basic unit 2, at least one further digital module is required.

Expansion with a ground-fault monitoring module with an external summation current transformer

Instead of ground-fault monitoring using the current measuring modules or current/voltage measuring modules, it may be necessary, especially in high-impedance grounded networks, to implement ground-fault monitoring for smaller ground fault currents using a summation current transformer. A ground-fault module can be used to add an additional input to basic unit 2 for connection of a summation current transformer (3UL2 20.-.A).

Maximum one ground-fault module can be connected to one basic unit 2.

3UF7 500-1AA00-0 ground-fault module

1 input for connecting a summation current transformer (3UL2 20.-.A)

1 Ready LED

2 system interfaces for connection
- to basic unit 2,
- of expansion modules,
- of a current measuring module or current/voltage measuring module,
- of an operator panel.

Note:
For the corresponding summation current transformers for rated fault currents of 0.3 A, 0.5 A or 1 A see page 83.

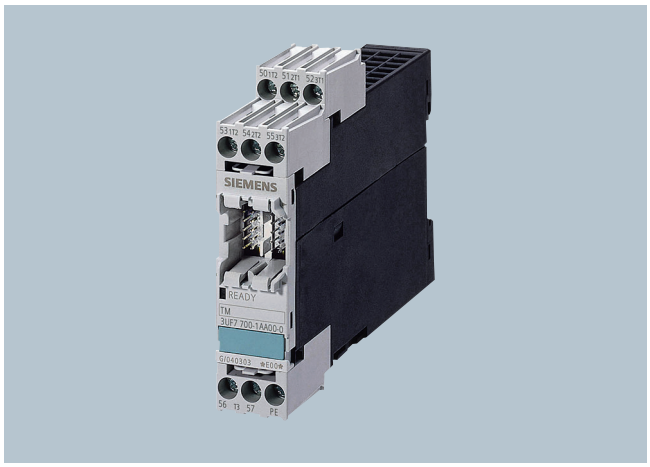
SIMOCODE pro 3UF7 motor management and control devices

Expansion of analog temperature monitoring with a temperature module

Independently of the thermistor motor protection of the basic units, up to 3 analog temperature sensors can be evaluated using a temperature module.
The temperatures measured here can be completely integrated in the process, monitored and supplied to a higher-level automation system through PROFIBUS. The temperature module can be used, for example, for analog monitoring of the temperature of the motor windings or bearings or for monitoring the coolant or gear oil temperature. Various sensor types are supported (resistance sensors) for use in solid, liquid or gaseous media:

- PT100/PT1000
- KTY83/KTY84
- NTC

Maximum one temperature module can be connected to one basic unit 2. The same sensor type must be used in all sensor measuring circuits.



3UF7 700-1AA00-0 temperature module

3 inputs for connecting up to 3 resistance sensors in 2-wire or 3-wire circuits

1 Ready LED

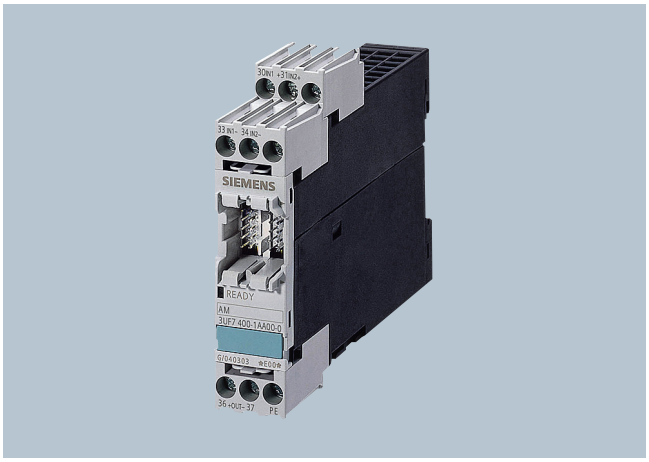
2 system interfaces for connection

- to basic unit 2,
- of expansion modules,
- of a current measuring module or current/voltage measuring module,
- of an operator panel.

Expansion with additional inputs/outputs by means of an analog module

Basic unit 2 can be optionally expanded with analog inputs and outputs (0/4 ... 20 mA) by means of the analog module. It is then possible to measure and monitor any process variable that can be mapped on a 0/4 ... 20 mA signal. Typical applications are, for example, level monitoring for the implementation of dry run protection for pumps or monitoring the degree of pollution of a filter using a differential pressure transducer. In this case the automation system has free access to the measured process variables. The analog output can be used, for example, to visualize process variables on a pointer instrument. The automation system also has free access to the output through PROFIBUS.

Maximum one analog module can be connected to one basic unit 2. Both inputs are set to a measuring range of either 0 ... 20 mA or 4 ... 20 mA.



3UF7 400-1AA00-0 analog module

Inputs:
2 inputs, passive, for measuring 0/4 ... 20 mA signals

Outputs:
1 output to output a 0/4 ... 20 mA signal

1 Ready LED

2 system interfaces for connection

- to basic unit 2,
- of expansion modules,
- of a current measuring module or current/voltage measuring module,
- of an operator panel.

Protective separation

All circuits in SIMOCODE pro are safely separated from each other according to IEC 60947-1, Annex N. That is, they are designed with double creepages and clearances. In the event of a fault, therefore, no parasitic voltages can be formed in neighboring circuits. The instructions of Test Report No. 2668 must be complied with.

EEx e and EEx d types of protection

The overload protection and the thermistor motor protection of the SIMOCODE pro system comply with the requirements for overload protection of explosion-protected motors to the type of protection:

- EEx d "flameproof enclosure" e. g. according to EN 60079-1
- EEx e "increased safety" e. g. according to EN 60079-7

When using SIMOCODE pro devices with a 24 V DC control voltage, electrical separation must be ensured using a battery or a safety transformer according to EN 61558-2-6.

EC type test certificate: BVS 06 ATEX F 001
Test log: BVS PP 05.2029 EG.

Configuration instructions when using an operator panel with display and/or a decoupling module

If you want to use an operator panel with display and/or a decoupling module in the SIMOCODE pro V system, then the following configuration instructions concerning the type and number of connectable expansion modules must be observed.

The following tables show the maximum possible configuration of the expansion modules for the various combinations.

Use of an operator panel with display

Digital module	Digital module	Analog module	Temperature module	Ground-fault module
Only operator panel with display for basic unit 2 (24 V DC or 110 ... 240 V AC/DC)				
Max. 4 expansion modules can be used				
Operator panel with display and current/voltage measurement with basic unit 2 (110 ... 240 V AC/DC)				
Max. 3 expansion modules can be used or:				
--	--	✓	✓	--

Use of a decoupling module
(voltage measurement in insulated networks)

Digital module	Digital module	Analog module	Temperature module	Ground-fault module
Basic unit 2 (24 V DC)				
✓[1)]	✓[1)]	✓	✓	✓
Basic unit 2 (110 ... 240 V AC/DC)				
✓	✓	--	✓	✓
✓[1)]	✓[1)]	✓	✓	--
✓	--	✓	✓	--
✓	--	✓	--	✓

Use of a decoupling module
(voltage measurement in insulated networks)
in combination with an operator panel with display

Digital module	Digital module	Analog module	Temperature module	Ground-fault module
Basic unit 2 (24 V DC)				
✓	--	✓	✓	✓
✓	✓	--	✓	✓
Basic unit 2 (110 ... 240 V AC/DC)				
✓[2)]	--	✓	✓	✓
✓	✓	--	--	--
✓[1)]	✓[1)]	✓[3)]	--	--
✓	--	--	✓	✓

✓ Possible
-- Not possible

[1)] No bistable relay outputs and no more than 5 of 7 relay outputs active simultaneously (> 3 s).

[2)] No bistable relay outputs and no more than 3 of 5 relay outputs active simultaneously (> 3 s).

[3)] Analog module output is not used.

SIMOCODE pro 3UF7 motor management and control devices

Function

Multifunctional, solid-state full motor protection

Inverse-time delayed overload protection with adjustable tripping characteristics (Classes 5, 10, 15, 20, 25, 30, 35 and 40)

SIMOCODE pro protects induction or AC motors according to IEC 60947-4-1 requirements. The trip class can be adjusted in eight steps from Class 5 to Class 40. In this way, the break time can be adapted very accurately to the load torque which allows the motor to be utilized more effectively. In addition, the time until the overload trip is performed is calculated and can be made available to the I&C system. After an overload trip, the remaining cooling time can be displayed (characteristic curves for 2-pole and 3-pole loading in SIMOCODE pro System Manual).

Phase failure/unbalance protection

The level of the phase unbalance can be monitored and transmitted to the I&C system. If a specified limit value is violated, a defined and delayable response can be initiated. If the phase unbalance is larger than 50 %, the tripping time is also automatically reduced according to the overload characteristic since the heat generation of the motors increases in unbalanced conditions.

Stall protection

If the motor current rises above an adjustable blocking threshold (current threshold), a defined and delayable response can be configured for SIMOCODE pro. In this case, for example, the motor can be shut down independent of the overload protection. The stall protection is only enabled after the configured class time has elapsed and avoids unnecessarily high thermal and mechanical stress as well as wear of the motor.

Thermistor motor protection

This protection function is based on direct temperature measurements by means of temperature sensors in the stator windings or in the enclosure of the motor. These protection functions should be used, in particular, in motors with high switching frequencies, heavy starting, intermittent and/or braking operation, but also in the case of speeds lower than the rated speed.
SIMOCODE pro supports connection and evaluation of several PTC sensors connected in series on the basic unit. In addition, the sensor measuring circuit can be monitored for short-circuits and open-circuits. If the temperature of the motor increases beyond a defined limit or if there is a fault in the sensor measuring circuit, a defined response can be configured.

Ground-fault monitoring (internally) with a current measuring module or current/voltage measuring module

SIMOCODE pro acquires and monitors all three phase currents. With vector addition of the phase currents, the motor feeder can be monitored for possible residual currents or ground faults with the help of internal calculations. Internal ground-fault monitoring is only available for motors with three-phase connections in directly grounded networks or in networks grounded with low impedance. The response of SIMOCODE pro when a ground fault is detected can be parameterized and delayed as required.

Ground-fault monitoring (external) with summation current transformer[1)3)]

External ground-fault monitoring is normally implemented for networks that are grounded with high impedance. Using an additional summation current transformer (3UL2 20.-.A), even extremely low ground-fault currents can be measured. The response of SIMOCODE pro when a ground fault is detected can be parameterized and delayed as required. Fault current measurement is performed for each summation current transformer for the following fault currents: 0.3/0.5/1 A.

Monitoring of adjustable limit values for the motor current

Current limit monitoring is used for process monitoring independent of overload protection. Violation of a current limit value below the overload threshold can be an indication for a dirty filter in a pump or for an increasingly sluggish motor bearing, for example. Violation of the lower current limit value can be a first indication of a worn drive belt. SIMOCODE pro supports two-step monitoring of the motor current for freely selectable upper and lower current limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold.

Voltage monitoring[2)]

By measuring the voltage directly at the circuit breaker or at the fuses in the main circuit, even when the motor is deactivated, SIMOCODE pro can also obtain information about the reclosing capability of the feeder and signal it if required.
SIMOCODE pro supports two-stage undervoltage monitoring for freely selectable limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold.

Monitoring the active power[2)]

The active power characteristic of a motor provides an accurate statement of the actual loading over the complete range. Excessive loading will cause increased wear in the motor and can result in early failure. Insufficient active power can be an indication of, for example, motor idling.
SIMOCODE pro supports two-step monitoring of the active power for freely selectable upper and lower current limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold.

Monitoring the power factor[2)]

Especially in the low-end performance range of a motor, the power factor varies more than the motor current or active power. Monitoring of the power factor is therefore particularly useful for distinguishing between motor idling and fault events such as a tear in a drive belt or a crack in a drive shaft.
SIMOCODE pro supports two-stage monitoring of power factor undershoot for freely selectable limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold.

[1)] Using basic unit 2.

[2)] Using basic unit 2 with current/voltage measuring module.

[3)] An additional ground-fault module with a 3UL22 summation current transformer is required.

Temperature monitoring[1)3)]

The temperature can be monitored, for example, in the motor windings or at the bearings through up to three resistance sensors connected to the temperature module.
SIMOCODE pro supports two-stage monitoring of overheating for freely selectable limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold. Temperature monitoring is always performed with reference to the highest temperature of all sensor measuring circuits used.

Monitoring additional process variables over analog inputs (0/4 ... 20 mA)[1)4)]

The analog module enables SIMOCODE pro to measure additional process variables and monitor them. A pump can, for example, be protected against dry running in this manner with level monitoring or the degree of pollution of a filter can be measured using a differential pressure transducer. When a specified level is undershot, the pump can be deactivated and when a specified differential pressure is overshot, the filter can be cleaned. SIMOCODE pro supports two-step monitoring of the corresponding process variable for freely selectable upper and lower current limit values. The response of SIMOCODE pro can be freely parameterized and delayed if it reaches an alarm or tripping threshold.

Phase sequence detection[2)]

By detecting the phase sequence, SIMOCODE pro is able to make a statement about the direction of rotation of a motor. If the direction is incorrect, this can be reported or it can result in immediate disconnection of the affected motor.

Monitoring of operating hours, downtime and number of starts

In order to prevent plant downtime caused by motor failure due to excessive motor operating times (wear) or excessive motor downtimes, SIMOCODE pro can monitor the operating hours and downtime of a motor. When an adjustable limit value is violated, a signal or warning can be generated which can indicate that the corresponding motor must be serviced or replaced. After the motor has been replaced, the operating hours and downtimes can be reset, for example.
To avoid excessive thermal loads and early wear of the motor, it is possible to limit the number of motor startups for a specifiable period. Alarms can indicate that only a small number of possible starts remain.

SIMOCODE pro 3UF7 motor management and control devices

Flexible motor control implemented with integrated control functions

Many typical motor control functions have been predefined in SIMOCODE pro and are available for use:
- Overload relay
- Direct-on-line and reversing starters
- Wye-delta starters (also with direction reversal)[1)]
- Two speeds, motors with separate windings (pole-changing switch); also with direction reversal[1)]
- Two speeds, motors with separate Dahlander windings (also with direction reversal)[1)]
- Positioner actuation[1)]
- Solenoid valve actuation[1)]
- Actuation of a motor starter protector or circuit breaker (MCCB)
- Actuation of a 3RW soft starter also with direction reversal[1)]

These control programs already include all the software interlocks and logic operations required for operation of the required motor control functions.

It is also monitored whether the current checkback of the motor feeder corresponds with the control command. If not, SIMOCODE pro opens the motor contactor and generates a fault message.

Depending on the application, motor control can be switched over or carried out simultaneously from several control stations, e. g.:
- From the I&C system through PROFIBUS DP
- From a PC or programming device through PROFIBUS DP
- From the control cabinet door through the operator panel
- From a PC or programming device on the system interface through SIMOCODE pro
- From a local control point on the motor. In this case, the buttons, switches and indicator lights are connected to the inputs and outputs of SIMOCODE pro

Regardless of whether a control command is sent to SIMOCODE pro via PROFIBUS DP using the operator panel or via the buttons connected to the binary SIMOCODE pro inputs, SIMOCODE pro can execute these control commands simultaneously or in accordance with the enabled commands defined during parameterization.

These predefined control functions can also be flexibly adapted to each customized configuration of a motor feeder by means of freely configurable logic modules (truth tables, counters, timers, edge evaluation etc.).

In addition, special standard functions are stored in SIMOCODE pro which can also be used to extend the protection and control functions, e. g.:
- Power failure monitoring[1)] for automatic, time-staggered restart of motors following a mains failure e. g. with the help of a separate voltage relay (voltage controller).
- Fault signaling modules for external faults with or without manual or automatic acknowledgement for generating internal messages or for tripping SIMOCODE pro in response to freely definable events (e. g. overspeed monitor has been activated). Designations/names can also be assigned to the external faults which are stored in the device and which are therefore also available to the I&C system.
- Emergency start function and reset of the thermal memory of SIMOCODE pro after tripping, i. e. immediate restart is possible (important, for example, for pumps used to extinguish fires).
- Test function for the load feeder circuit when the main control switch is open to test the control circuit while the main circuit is de-energized.

1) Using basic unit 2.
2) Using basic unit 2 with current/voltage measuring module.
3) An additional temperature module is required.
4) An additional analog module is required.

SIMOCODE pro 3UF7 motor management and control devices

Detailed operational, service and diagnostics data

SIMOCODE pro provides a variety of operating, service and diagnostics data, such as:

Operating data
- The switching state of the motor (On, Off, clockwise, counter-clockwise, fast, slow) is derived from the current flow in the main circuit, so feedbacks are not required through auxiliary contacts from circuit breakers and contactors
- Current in phase 1, 2, 3 and maximum current in % of the current setting
- Voltage in phases 1, 2, 3 in V[2)]
- Active power in W[2)]
- Apparent power in VA[2)]
- Power factor in %[2)]
- Phase unbalance in %
- Phase sequence[2)]
- Temperature in sensor measuring circuits 1, 2, 3 and maximum temperature in K[1)3)]
- Current values of the analog signals[1)4)]
- Time until tripping in sec.
- Temperature rise for motor model in %
- Remaining cooling time of the motor in sec. etc.

Freely configurable logic modules (calculators[5)]) can be used for the device-internal conversion of the measured values in SIMOCODE pro V. This means, for example, that temperatures can be transmitted to the automation system in °C or °F.

Service data
- Motor operating hours (can be reset)
- Motor stop times (can be reset)
- Number of motor starts (can be reset)
- Number of remaining permissible motor starts
- Number of overload trips (can be reset)
- Feeder-related power consumption in kWh (can be reset)[6)]
- Internal comments, stored in the device for each feeder, e. g. notes for maintenance events etc.

Diagnostics data
- Numerous detailed early warning and fault messages (can also be used for further processing in the device or I&C system)
- Internal device fault logging with time stamp
- Value of the previous tripping current
- Checkback error (e. g. no current flow in the main circuit following ON control command) etc.

Safety-oriented Emergency-Stop monitoring

In principle it is possible with SIMOCODE pro to equip various control functions in addition with Emergency-Stop monitoring in order for them to be safely deactivated according to EN 954, Category 2 or 4.

Note:
Examples of functions can be found at:
http://www.siemens.com/simocode

Autonomous operation

An essential feature of SIMOCODE pro is independent execution of all protection and control functions even if communication with the I&C system breaks down. If the bus or automation system fails, the full functionality of the feeder is ensured or a predefined response can be initiated, e. g. the feeder can be shut down in a controlled manner or certain configured control mechanisms can be performed (e. g. the direction of rotation can be reversed).

1) Using basic unit 2.
2) Using basic unit 2 with current/voltage measuring module.
3) An additional temperature module is required.
4) An additional analog module is required.
5) When using basic unit 2, product version E03 and higher.
6) When using basic unit 2, product version E03 and higher, with current/voltage measuring module.

Integration

General

In addition to device function and hardware design, a great deal of emphasis is placed on the case of communication-capable controls on the user-friendliness of the parameterization software and the ability of the system to be integrated easily into various different system configurations and process automation systems. For this reason, the SIMOCODE pro system provides suitable software tools for consistent, time-saving parameterization, configuration and diagnostics:

- SIMOCODE ES for totally integrated start-up and service
- OM SIMOCODE pro object manager for total integration into SIMATIC S7
- PCS 7 function block library SIMOCODE pro for total integration into PCS 7

SIMOCODE ES

The parameterization software for SIMOCODE pro can be run on a PC or programming device under Windows 2000/XP/Vista.

With SIMOCODE ES, the SIMOCODE pro motor management system provides a user-friendly and clear-cut user interface with which to configure, operate, monitor and test SIMOCODE pro in the field or from a central location through PROFIBUS. By displaying all operating, service and diagnostics data, SIMOCODE ES supplies important information on whether maintenance work is required or, in the event of a fault, helps to prevent faults or to localize and rectify them once they have occurred.

Unnecessary plant downtimes can be prevented by changing parameters online (even during operation). The printing function integrated into SIMOCODE ES allows comprehensive documentation of all parameters according to EN ISO 7200.

In addition the graphical editor enables extremely ergonomic and user-friendly parameterization with Drag & Drop. Inputs and outputs of function blocks can be graphically linked and parameters can be set. The configured functions can be described in greater detail using comments and the device parameterization can be documented graphically – this speeds up start-up and simplifies the plant documentation.

OM SIMOCODE pro object manager

The OM SIMOCODE pro object manager is a component of SIMOCODE ES. In contrast to a conventional GSD file, it enables SIMOCODE ES to be integrated into STEP 7 for convenient device parameterization. By installing SIMOCODE ES and OM SIMOCODE pro on a PC or programming device, which is used to configure the hardware of the SIMATIC S7, SIMOCODE ES can be called directly from the hardware configuration. This allows easy and consistent S7 configuration.

Note: More information can be found in Chapter 12.

PCS 7 function block library for SIMOCODE pro

The SIMOCODE pro PCS 7 function block library can be used for simple and easy integration of SIMOCODE pro into the SIMATIC PCS 7 process control system. The SIMOCODE pro PCS 7 function block library contains the diagnostics and driver blocks corresponding with the diagnostics and driver concept of SIMATIC PCS 7 as well as the elements (symbols and faceplate) required for operator control and process monitoring. The application is integrated by graphic interconnection using the CFC Editor.

The technological and signal processing functions of the SIMOCODE pro PCS 7 function block library are based on the SIMATIC PCS 7 standard libraries (driver blocks, technological blocks) and are optimally tailored to SIMOCODE pro. Users who previously configured motor feeder circuits using conventional technology by means of signal blocks and motor or valve blocks, can now easily switch to the SIMOCODE pro PCS 7 function block library.

The SIMOCODE pro PCS 7 function block library supplied on CD-ROM allows the user to run the required engineering software on the engineering station (single license) including the runtime software for executing the AS modules in an automation system (single license). If the AS modules are to be used in additional automation systems, the corresponding number of runtime licenses are required which are supplied without a data carrier.

System manual for SIMOCODE pro

The SIMOCODE pro system manual describes the motor management system and its functions in detail. It contains information about configuration and commissioning as well as servicing and maintenance. A typical example of a reversing starter application is used to teach the user quickly and practically how to use the system. In addition to help on how to identify and rectify faults in the event of a malfunction, the manual also contains special information for servicing and maintenance.

Furthermore, the manual contains schematics, dimensional drawings and technical specifications of the system components as project planning aids.

SIMOCODE pro 3UF7 motor management and control devices

Technical specifications

General data applicable to the basic units, current measuring modules, current/voltage measuring modules, expansion modules, decoupling module and operator panel		
Permissible ambient temperature		
• During operation	°C	-25 ... +60[1]
• Storage and transport	°C	-40 ... +80[2]
Installation height above sea level	m	≤ 2000
• Permissible ambient temperature max. +50 °C (no protective separation)	m	≤ 3000
• Permissible ambient temperature max. +40 °C (no protective separation)	m	≤ 4000
Degree of protection (acc. to IEC 60529)		
• All components, (except for current measuring modules or current/voltage measuring modules for busbar connection, operator panel and door adapter)		IP20
• Current measuring modules or current/voltage measuring module with busbar connection		IP00
• Operator panel (front) and door adapter (front) with cover		IP54
Shock resistance (sine pulse)	*g*/ms	15/11
Mounting position		Any
Frequency	Hz	50/60 ±5 %
Immunity to electromagnetic interferences (acc. to IEC 60947-1)		Corresponds to degree of severity 3
• Line-induced interference, burst acc. to IEC 61000-4-4	kV kV	2 (power ports) 1 (signal ports)
• Line-induced interference, high frequency acc. to IEC 61000-4-6	V	10
• Line-induced interference, surge acc. to IEC 61000-4-5	kV kV	2 (line to earth) 1 (line to line)
• Electrostatic discharge, ESD acc. to IEC 61000-4-2	kV kV	8 (air discharge) 6[3] (contact discharge)
• Field-related interference acc. to IEC 61000-4-3	V/m	10
Immunity to electromagnetic interference (acc. to IEC 60947-1)		
• Line-conducted and radiated interference emission		EN 55011/EN 55022 (CISPR 11/CISPR 22) (corresponds to degree of severity A)
Protective separation acc. to IEC 60947-1, Annex N		All circuits in SIMOCODE pro are safely separated from each other acc. to IEC 60947-1, they are designed with doubled creepage paths and clearances In this context, compliance with the instructions in the test report "Protective separation" No. 2668 is required.
Basic units		
Mounting		Snap-on mounting onto TH 35 standard mounting rail or screw fixing with additional push-in lugs
Display		
• Red/green/yellow LED "DEVICE"		• Green: "Ready" • Red: "Function test not OK; device is disabled" • Yellow:"Memory module or addressing plug detected" • Off: "No control supply voltage"
• Green "BUS" LED		• Continuous light: "Communication with PLC/PCS" • Flashing: "Baud rate recognized/communicating with PC or programming device"
• Red "GEN. FAULT" LED		• Continuous light/flashing: "Feeder fault", e. g. overload trip
Test/Reset buttons		• Resets the device after tripping • Function test • Operation of a memory module or addressing plug
System interface		
• Front		Connection of an operator panel or expansion modules; the memory module, addressing plug or a PC cable can also be connected to the system interface for parameterizing
• Bottom		Connection of a current measuring module or current/voltage measuring module
PROFIBUS DP interface		Connection of the PROFIBUS DP cable through terminal connection or through a 9-pin sub D socket

1) For 3UF7 21: 0 ... +60 °C.

2) For 3UF7 21: -20 ... +70 °C.

3) For 3UF7 21: 4 kV.

SIMOCODE pro 3UF7 motor management and control devices

Basic units

Control circuit

Rated control supply voltage U_s (acc. to EN 61131-2)		110 ... 240 V AC/DC; 50/60 Hz	24 V DC
Operating range		0.85 ... 1.1 x U_s	0.80 ... 1.2 × U_s
Power consumption			
• Basic unit 1 (3UF7 000)		7 VA/5 W	5 W
• Basic unit 2 (3UF7 010) incl. two expansion modules connected to basic unit 2		10 VA/7 W	7 W
Rated insulation voltage U_i	V	300 (at degree of pollution 3)	
Rated impulse withstand voltage U_{imp}	kV	4	
Relay outputs			
• Number		3 monostable relay outputs	
• Auxiliary contacts of the 3 relay outputs		Floating NO contacts (NC contact response can be parameterized with internal signal conditioning), 2 relay outputs are jointly and 1 relay output is separately connected to a common potential; they can be freely assigned to the control functions (e. g. for line, star and delta contactors and for signaling the operating state)	
• Specified short-circuit protection for auxiliary contacts (relay outputs)		• Fuse links, gL/gA operational class 6 A, quick-acting 10 A (IEC 60947-5-1) • Miniature circuit breaker 1.6 A, C characteristic (IEC 60947-5-1) • Miniature circuit breaker 6 A, C characteristic (I_k < 500 A)	
• Rated uninterrupted current	A	6	
• Rated switching capacity		**AC-15** 6 A/24 V AC; 6 A/120 V AC; 3 A/230 V AC **DC-13** 2 A/24 V DC; 0.55 A/60 V DC; 0.25 A/125 V DC	
Inputs (binary)		4 inputs supplied internally by the device electronics (24 V DC) and connected to a common potential for acquiring process signals (e. g. local control station, key-operated switch, limit switch, ...), freely assignable to the control functions	
Thermistor motor protection (binary PTC)			
• Summation cold resistance	kΩ	≤ 1.5	
• Response value	kΩ	3.4 ... 3.8	
• Return value	kΩ	1.5 ... 1.65	
Conductor cross-sections			
• Tightening torque	Nm	0.8 ... 1.2	
• Solid	mm^2	1 × (0.5 ... 4.0); 2 × (0.5 ... 2.5)	
• Finely stranded with end sleeve	mm^2	1 × (0.5 ... 2.5); 2 × (0.5 ... 1.5)	
• AWG cable (solid)	AWG	1 x AWG 20 to 12/2 x AWG 20 to 14	
• AWG cable (finely stranded)	AWG	1 x AWG 20 to 14/2 x AWG 20 to 16	

Current measuring modules or current/voltage measuring modules

Mounting			
• Current setting I_e = 0.3 ... 3 A; 2.4 ... 25 A; 10 ... 100 A (3UF7 1.0, 3UF7 1.1, 3UF7 1.2)		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs	
• Current setting I_e = 20 ... 200 A (3UF7 103, 3UF7 113)		Snap-on mounting onto 35 mm standard mounting rail, screw fixing on mounting plate or direct fixing on contactor	
• Current setting I_e = 63 ... 630 A (3UF7 104, 3UF7 114)		Screw fixing on mounting plate or direct fixing on contactor	
System interface		For connection to a basic unit or decoupling module	

Main circuit

		3UF7 1.0	3UF7 1.1	3UF7 1.2	3UF7 1.3	3UF7 1.4
Current setting I_e	A	0.3 ... 3	2.4 ... 25	10 ... 100	20 ... 200	63 ... 630
Rated insulation voltage U_i (degree of pollution 3)	V	690[1]				
Rated operational voltage U_e	V	690				
Rated impulse withstand voltage U_{imp}	kV	6[2]				
Rated frequency	Hz	50/60				
Type of current		Three-phase current				
Short-circuit		Additional short-circuit protection is required in main circuit				
Accuracy of current measurement (in the range 1 x minimum current setting I_u to 8 x max. current setting I_o)	%	±3				
Typical voltage measuring ranges						
• Phase-to-phase voltage/line-to-line voltage (e. g. $U_{L1\,L2}$)	V	110 ... 690 (only the phase voltages are available in SIMOCODE pro as measured values)				
• Phase voltage (e. g. U_{L1})	V	65 ... 400				
Accuracy						
• Of voltage measurement (phase voltage U_L in the range 230 ... 400 V)	%	±3 (typical)				
• Of power factor measurement (in the rated load range power factor = 0.4 ... 0.8)	%	±5 (typical)				
• Of apparent power measurement (in the rated load range)	%	±5 (typical)				
Notes on voltage measurement						
• In non-grounded networks or in networks with integrated insulation measurement or monitoring		In these networks the current/voltage measuring module can be used only with an upstream decoupling module on the system interface.				
• Feeder lines for voltage measurement		In the feeder lines from the main circuit for voltage measurement of SIMOCODE pro it may be necessary to provide additional line protection!				

✓ Detection possible
– Detection not possible

[1] For 3UF7 103 or 3UF7 104 up to 1000 V.

[2] For 3UF7 103 or 3UF7 104 up to 8 kV.

SIMOCODE pro 3UF7 motor management and control devices

Current measuring modules or current/voltage measuring modules

Connection for main circuit

Feed-through opening (diameter)			
• Current setting I_e = 0.3 ... 3 A; 2.4 ... 25 A	mm	7.5	
• Current setting I_e = 10 ... 100 A	mm	14.0	
• Current setting I_e = 20 ... 200 A	mm	25.0	
Busbar connections[1]		3UF7 100, 3UF7 101, 3UF7 102	3UF7 103, 3UF7 104
• Current setting I_e	A	20 ... 200	63 ... 630
• Terminal screw		M8 x 25	M10 x 30
• Tightening torque	Nm	10 ... 14	14 ... 24
• Solid with cable lug	mm^2	16 ... 95[2]	50 ... 240[3]
• Stranded with cable lug	mm^2	25 ... 120[2]	70 ... 240[3]
• AWG cable	AWG	6 ... 3/0 kcmil	1/0 ... 500 kcmil
Conductor cross-sections for voltage measurement			
• Tightening torque	Nm	0.8 ... 1.2	
• Solid	mm2	1 x (0.5 ... 4.0); 2 x (0.5 ... 2.5)	
• Finely stranded with end sleeve	mm2	1 x (0.5 ... 2.5); 2 x (0.5 ... 1.5)	
• AWG cable (solid)	AWG	1 x AWG 20 to 12/2 x AWG 20 to 14	
• AWG cable (finely stranded)	AWG	1 x AWG 20 to 14/2 x AWG 20 to 16	

Decoupling modules

Mounting		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs
Display		
• Green "READY" LED		• Continuous light: "Ready"
System interfaces		Left interface for connecting to a basic unit or to an expansion module, right interface only for connecting to a current/voltage measuring module.
Conductor cross-sections		
• Tightening torque	Nm	0.8 ... 1.2
• Solid	mm2	1 x (0.5 ... 4.0); 2 x (0.5 ... 2.5)
• Finely stranded with end sleeve	mm2	1 x (0.5 ... 2.5); 2 x (0.5 ... 1.5)
• AWG cable (solid)	AWG	1 x AWG 20 to 12/2 x AWG 20 to 14
• AWG cable (finely stranded)	AWG	1 x AWG 20 to 14/2 x AWG 20 to 16

Digital modules

Mounting		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs
Display		
• Green "READY" LED		• Continuous light: "Ready" • Flashing: "No connection to the basic unit"
System interfaces		For connecting to a basic unit, another expansion module, a current measuring module or current/voltage measuring module or to the operator panel

Control circuit

Rated insulation voltage U_i	V	300 (at degree of pollution 3)
Rated impulse withstand voltage U_{imp}	kV	4
Relay outputs		
• Number		2 monostable or bistable relay outputs (depending on the version)
• Auxiliary contacts of the 2 relay outputs		Floating NO contacts (NC contact response can be parameterized with internal signal conditioning), all relay outputs are jointly connected to a common potential, they can be freely assigned to the control functions (e. g. for line, wye and delta contactors and for signaling the operating state)
• Specified short-circuit protection for auxiliary contacts (relay outputs)		• Fuse links, gL/gG operational class 6 A, quick-acting 10 A (IEC 60947-5-1) • Miniature circuit breaker 1.6 A, C characteristic (IEC 60947-5-1) • Miniature circuit breaker 6 A, C characteristic (I_K<500 A)
• Rated uninterrupted current	A	6
• Rated switching capacity		**AC-15** 6 A/24 V AC; 6 A/120 V AC; 3 A/230 V AC **DC-13** 2 A/24 V DC; 0.55 A/60 V DC; 0.25 A/125 V DC
Inputs (binary)		4 externally supplied floating inputs, 24 V DC or 110 ... 240 V AC/DC depending on the version; inputs jointly connected to common potential for sensing process signals (e. g.: local control station, key-operated switch, limit switch ...), freely assignable to the control functions
Conductor cross-sections		
• Tightening torque	Nm	0.8 ... 1.2
• Solid	mm^2	1 × (0.5 ... 4.0); 2 × (0.5 ... 2.5)
• Finely stranded with end sleeve	mm^2	1 × (0.5 ... 2.5); 2 × (0.5 ... 1.5)
• AWG cable (solid)	AWG	1 x AWG 20 to 12/2 x AWG 20 to 14
• AWG cable (finely stranded)	AWG	1 x AWG 20 to 14/2 x AWG 20 to 16

1) Screw terminal is possible using a suitable 3RT19 ... box terminal.

2) When connecting cable lugs according to DIN 46235, use the 3RT19 56-4EA1 terminal cover for conductor cross-sections from 95 mm^2 to ensure phase spacing.

3) When connecting cable lugs according to DIN 46234 for conductor cross-sections from 240 mm^2 as well as DIN 46235 for conductor cross-sections from 185 mm^2, use the 3RT19 66-4EA1 terminal cover to ensure phase spacing.

Ground-fault modules

Mounting		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs
Display • Green "READY" LED		 • Continuous light: "Ready" • Flashing: "No connection to the basic unit"
System interfaces		For connecting to a basic unit, another expansion module, a current measuring module or current/voltage measuring module or to the operator panel
Control circuit		
Connectable 3UL22 summation current transformer with rated fault currents I_N • $I_{Ground\ fault} \leq 50\ \%\ I_N$ • $I_{Ground\ fault} \geq 100\ \%\ I_N$	A	0.3/0.5/1 No tripping Tripping
Response delay (conversion time)	ms	300 ... 500, additionally delayable
Conductor cross-sections • Tightening torque • Solid • Finely stranded with end sleeve • AWG cable (solid) • AWG cable (finely stranded)	 Nm mm^2 mm^2 AWG AWG	 0.8 ... 1.2 1 × (0.5 ... 4.0); 2 × (0.5 ... 2.5) 1 × (0.5 ... 2.5); 2 × (0.5 ... 1.5) 1 x AWG 20 to 12/2 x AWG 20 to 14 1 x AWG 20 to 14/2 x AWG 20 to 16

Temperature modules

Mounting		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs			
Display • Green "READY" LED		 • Continuous light: "Ready" • Flashing: "No connection to the basic unit"			
System interfaces		For connecting to a basic unit, another expansion module, a current measuring module or current/voltage measuring module or to the operator panel			
Sensor circuit					
Typical sensor circuits • PT100 • PT1000/KTY83/KTY84/NTC	 mA mA	 1 (typical) 0.2 (typical)			
Open-circuit/short-circuit detection • For sensor type • Open circuit • Short-circuit • Measuring range	 °C	 PT100/PT1000 ✓ ✓ -50 ... +500	 KTY83-110 ✓ ✓ -50 ... +175	 KTY84 ✓ ✓ -40 ... +300	 NTC -- ✓ +80 ... +160
Measuring accuracy at 20 °C ambient temperature (T20)	K	< ±2			
Deviation due to ambient temperature (in % of measuring range)	%	0.05 per K deviation from T20			
Conversion time	ms	500			
Connection type		Two- or three-wire connection			
Conductor cross-sections • Tightening torque • Solid • Finely stranded with end sleeve • AWG cable (solid) • AWG cable (finely stranded)	 Nm mm^2 mm^2 AWG AWG	 0.8 ... 1.2 1 × (0.5 ... 4.0); 2 × (0.5 ... 2.5) 1 × (0.5 ... 2.5); 2 × (0.5 ... 1.5) 1 x AWG 20 to 12/2 x AWG 20 to 14 1 x AWG 20 to 14/2 x AWG 20 to 16			

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Analog modules		
Mounting		Snap-on mounting onto 35 mm standard mounting rail or screw fixing with additional push-in lugs
Display		
• Green "READY" LED		• Continuous light: "Ready" • Flashing: "No connection to the basic unit"
System interfaces		For connecting to a basic unit, another expansion module, a current measuring module or current/voltage measuring module or to the operator panel
Control circuit		
Inputs		
• Channels		2 (passive)
• Parameterizable measuring ranges	mA	0/4...20
• Shielding		Up to 30 m shield recommended, from 30 m shield required
• Max. input current (destruction limit)	mA	40
• Accuracy	%	±1
• Input resistance	Ω	50
• Conversion time	ms	150
• Resolution	bit	12
• Open-circuit detection		With measuring range 4 ... 20 mA
Output		
• Channels		1
• Parameterizable output range	mA	0/4...20
• Shielding		Up to 30 m shield recommended, from 30 m shield required
• Max. voltage at output		30 V DC
• Accuracy	%	±1
• Max. output load	Ω	500
• Conversion time	ms	25
• Resolution	bit	12
• Short-circuit resistant		Yes
Connection type		Two-wire connection
Electrical separation of inputs/output to the device electronics		No
Conductor cross-sections		
• Tightening torque	Nm	0.8...1.2
• Solid	mm^2	1 x (0.5...4.0); 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 cable (solid)	AWG	1 x AWG 20 to 12/2 x AWG 20 to 14
• AWG cable (finely stranded)	AWG	1 x AWG 20 to 14/2 x AWG 20 to 16
Operator panels		
Mounting		Mounted in a control cabinet door or in a front panel, IP54 with system interface cover
Display		
• Red/green/yellow LED "DEVICE"		• Green: "Ready" • Green flashing: "No connection to the basic unit" • Red: "Function test not OK; device is disabled" • Yellow: "Memory module or addressing plug detected" • Off: "No control supply voltage"
• Green "BUS" LED		• Continuous light: "Communication with PLC/PCS" • Flashing: "Baud rate recognized/communicating with PC or programming device"
• Red "GEN. FAULT" LED		• Continuous light/flashing: "Feeder fault", e. g. overload trip
• Green or yellow LEDs		For assigning to any status signals, as required
Keys		
• Test/Reset		• Resets the device after tripping • Function test • Operation of a memory module or addressing plug
• Control keys		For controlling the motor feeder, user-assignable
System interface		
• Front		For plugging in a memory module, an addressing plug or a PC cable for parameterization
• Rear		Connection to the basic unit or to an expansion module

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Operator panels with display	
Mounting	Mounted in a control cabinet door or in a front panel, IP54 with system interface cover
Display	
• Red/green/yellow LED "DEVICE"	• Green: "Ready" • Green flashing: "No connection to the basic unit" • Red: "Function test not OK; device is disabled" • Yellow: "Memory module or addressing plug detected" • Off: "No control supply voltage"
• Green "BUS" LED	• Continuous light: "Communication with PLC/PCS" • Flashing: "Baud rate recognized/communicating with PC or programming device"
• Red "GEN. FAULT" LED	• Continuous light/flashing: "Feeder fault", e. g. overload trip
• 4 green LEDs	For assigning to any status signals as required (preferably for the feedback of switching states, e. g. On, Off, Left, Right, etc.)
Displays	Graphic display for indicating current measured values, operational and diagnostics data or status information
Keys	
• Control keys	For controlling the motor feeder, user-assignable
• Arrow keys	Navigation in the display menu
• Softkeys	Various menu-dependent functions, e. g. test, reset, operation of a memory module or addressing plug
System interface	
• Front	For plugging in a memory module, an addressing plug or a PC cable for parameterization
• Rear	Connection to the basic unit or to an expansion module

SIMOCODE pro 3UF7 motor management and control devices

Short-circuit protection with fuses for motor feeders for short-circuit currents up to 50 kA and 690 V for 3UF7

Current measuring module or current/ voltage measuring module	Contactors	CLASS 5 and Class 10			CLASS 15			CLASS 20			CLASS 25		
		Rated operational current I_e/AC-3 in A at ... V											
	Type	400	500	690	400	500	690	400	500	690	400	500	690
Current setting 0.3 ... 3.0 A													
3UF7 1.0-1AA00-0	**3RT10 15**	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	3RT10 16	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Current setting 2.4 ... 25 A													
3UF7 1.1-1AA00-0	**3RT10 15**	7.0	5.0	4.0	7.0	5.0	4.0	7.0	5.0	4.0	7.0	5.0	4.0
	3RT10 16	9.0	6.5	5.2	9.0	6.5	5.2	9.0	6.5	5.2	9.0	6.5	5.2
	3RT10 17	12.0	9.0	6.3	11.0	9.0	6.3	10.0	9.0	6.3	9.5	9.0	6.3
	3RT10 23	9.0	6.5	5.2	9.0	6.5	5.2	9.0	6.5	5.2	--	--	--
	3RT10 24	12.0	12.0	9.0	12.0	12.0	9.0	12.0	12.0	9.0	12.0	12.0	9.0
	3RT10 25	17.0	17.0	13.0	17.0	17.0	13.0	16.0	16.0	13.0	15.0	15.0	13.0
	3RT10 26	25.0	18.0	13.0	18.0	18.0	13.0	16.0	16.0	13.0	15.0	15.0	13.0
	3RT10 34	25.0	25.0	20.0	25.0	25.0	20.0	22.3	22.3	20.0	20.3	20.3	20.3
	3RT10 35	25.0	25.0	24.0	25.0	25.0	24.0	25.0	25.0	24.0	25.0	25.0	24.0
Current setting 10 ... 100 A													
3UF7 1.2-1AA00-0	**3RT10 34**	32.0	32.0	20.0	25.5	25.5	20.0	22.3	22.3	20.0	20.3	20.3	20.0
	3RT10 35	40.0	40.0	24.0	33.0	33.0	24.0	29.4	29.4	24.0	28.0	28.0	24.0
	3RT10 36	50.0	50.0	24.0	38.5	38.5	24.0	32.7	32.7	24.0	29.4	29.4	24.0
	3RT10 44	65.0	65.0	47.0	56.0	56.0	47.0	49.0	49.0	47.0	45.0	45.0	45.0
	3RT10 45	80.0	80.0	58.0	61.0	61.0	58.0	53.0	53.0	53.0	47.0	47.0	47.0
	3RT10 46	95.0	95.0	58.0	69.0	69.0	58.0	59.0	59.0	58.0	53.0	53.0	53.0
	3RT10 54	100.0	100.0	100.0	93.2	93.2	93.2	81.7	81.7	81.7	74.8	74.8	74.8
	3RT10 55	--	--	--	100.0	100.0	100.0	100.0	100.0	100.0	97.5	97.5	97.5
Current setting 20 ... 200 A													
3UF7 1.3-1.A00-0	**3RT10 54**	115	115	115	93.2	93.2	93.2	81.7	81.7	81.7	74.8	74.8	74.8
	3RT10 55	150	150	150	122	122	122	107	107	107	98	98	98
	3RT10 56	185	185	170	150	150	150	131	131	131	120	120	120
Current setting 63 ... 630 A													
3UF7 1.4-1BA00-0	**3RT10 64**	225	225	225	182	182	182	160	160	160	146	146	146
	3RT10 65	265	265	265	215	215	215	188	188	188	172	172	172
	3RT10 66	300	300	280	243	243	243	213	213	213	195	195	195
	3RT10 75	400	400	400	324	324	324	284	284	284	260	260	260
	3RT10 76	500	500	450	405	405	405	355	355	355	325	325	325
	3RT12 64	225	225	225	225	225	225	225	225	225	194	194	194
	3RT12 65	265	265	265	265	265	265	265	265	265	228	228	228
	3RT12 66	300	300	300	300	300	300	300	300	300	258	258	258
	3RT12 75	400	400	400	400	400	400	400	400	400	344	344	344
	3RT12 76	500	500	500	500	500	500	500	500	500	430	430	430
	3TF68[1)]	630	630	630	502	502	502	440	440	440	408	408	408
	3TF69[1)]	630	630	630	630	630	630	572	572	572	531	531	531

[1)] Contactor cannot be mounted.

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Current measuring module or current/voltage measuring module	Contactors	CLASS 30			CLASS 35			CLASS 40			Fuse links[1] LV HRC Type 3NA / DIAZED Type 5SB / NEOZED Type 5SE; Operational class gG; Type of coordination[2] ToC 1	ToC 2	Type 3ND; Operational class aM	British Standard fuses BS 88
		Rated operational current I_e/AC-3 in A at ... V												
	Type	400 V	500 V	690 V	400 V	500 V	690 V	400 V	500 V	690 V	690 V	690 V	690 V	415 V
Current setting 0.3 ... 3.0 A														
3UF7 1.0-1AA00-0	**3RT10 15**	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	35	20	--	20
	3RT10 16	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	35	20	--	20
Current setting 2.4 ... 25 A														
3UF7 1.1-1AA00-0	**3RT10 15**	7.0	5.0	4.0	7.0	5.0	4.0	7.0	5.0	4.0	35	20	--	20
	3RT10 16	9.0	6.5	5.2	9.0	6.5	5.2	8.5	6.5	5.2	35	20	--	20
	3RT10 17	9.0	9.0	6.3	9.0	9.0	6.3	8.5	8.5	6.3	35	20	--	20
	3RT10 23	--	--	--	--	--	--	--	--	--	63	25	--	25
	3RT10 24	12.0	12.0	9.0	12.0	12.0	9.0	12.0	12.0	9.0	63	25	20	25
	3RT10 25	14.0	14.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	63	25	20	25
	3RT10 26	14.0	14.0	13.0	13.0	13.0	13.0	12.0	12.0	12.0	100	35	20	25
	3RT10 34	19.1	19.1	19.1	17.6	17.6	17.6	16.1	16.1	16.1	125	63	50	63
	3RT10 35	25.0	25.0	24.0	25.0	25.0	24.0	23.5	23.5	23.5	125	63	50	63
Current setting 10 ... 100 A														
3UF7 1.2-1AA00-0	**3RT10 34**	19.1	19.1	19.1	17.6	17.6	17.6	16.1	16.1	16.1	125	63	50	63
	3RT10 35	26.5	26.5	24.0	25.0	25.0	24.0	23.5	23.5	23.5	125	63	50	80
	3RT10 36	26.5	26.5	24.0	25.0	25.0	24.0	23.5	23.5	23.5	160	80	50	80
	3RT10 44	41.7	41.7	41.7	38.2	38.2	38.2	34.5	34.5	34.5	200	125	63	125
	3RT10 45	45.0	45.0	45.0	43.0	43.0	43.0	40.0	40.0	40.0	200	160	80	160
	3RT10 46	50.0	50.0	50.0	47.0	47.0	47.0	44.0	44.0	44.0	200	160	100	160
	3RT10 54	69.0	69.0	69.0	63.0	63.0	63.0	57.0	57.0	57.0	355	315	160	250
	3RT10 55	90.0	90.0	90.0	82.0	82.0	82.0	74.0	74.0	74.0	355	315	200	315
Current setting 20 ... 200 A														
3UF7 1.3-1.A00-0	**3RT10 54**	69.0	69.0	69.0	64.0	64.0	64.0	--	--	--	355	315	160	250
	3RT10 55	90	90	90	82	82	82	74	74	74	355	315	200	315
	3RT10 56	111	111	111	102	102	102	93	93	93	355	315	200	315
Current setting 63 ... 630 A														
3UF7 1.4-1BA00-0	**3RT10 64**	135	135	135	126	126	126	--	--	--	500	400	250	400
	3RT10 65	159	159	159	146	146	146	133	133	133	500	400	315	400
	3RT10 66	180	180	180	165	165	165	150	150	150	500	400	315	400
	3RT10 75	240	240	240	220	220	220	200	200	200	630	500	400	450
	3RT10 76	300	300	300	275	275	275	250	250	250	630	500	500	500
	3RT12 64	173	173	173	152	152	152	131	131	131	500	500	400	450
	3RT12 65	204	204	204	180	180	180	156	156	156	500	500	400	450
	3RT12 66	231	231	231	204	204	204	177	177	177	500	500	400	450
	3RT12 75	316	316	316	--	--	--	--	--	--	800	800	630	800
	3RT12 76	385	385	385	340	340	340	316	316	316	800	800	630	800
	3TF68[3]	376	376	376	344	344	344	317	317	317	800	500[4]	630	500
	3TF69[3]	500	500	500	469	469	469	438	438	438	800	630[4]	630	630

1) Note the operational voltage.

2) Assignment and short-circuit protective devices according to IEC 60947-4-1.

3) Contactor cannot be mounted.

4) Ensure that the maximum AC-3 operational current is sufficiently different from the rated fuse current.

ToC 1 Type of coordination "1"

Contactors or starters must not endanger persons or equipment in the event of a short-circuit. They do not have to be suitable for further operation without repair and the renewal of parts.

ToC 2 Type of coordination "2"

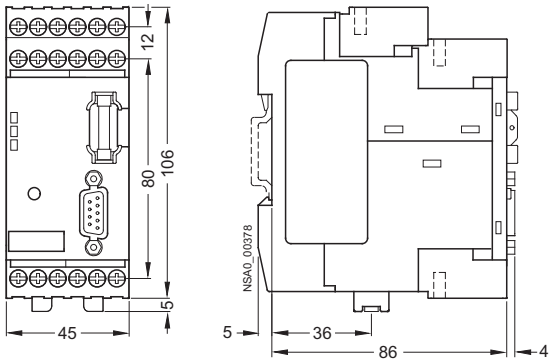
Contactors or starters must not endanger persons or equipment in the event of a short-circuit and must be suitable for continued use. There is a risk of contact welding.

These types of coordination are indicated in the Technical specifications by orange backgrounds.

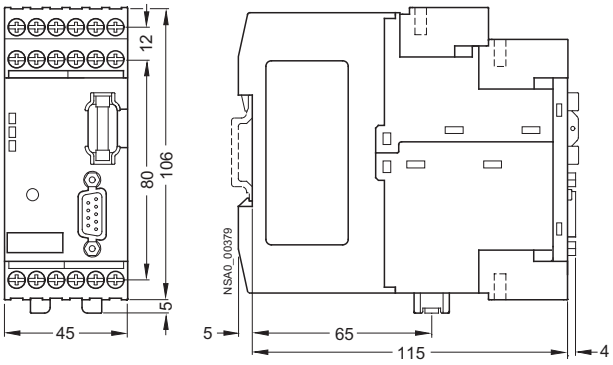
SIMOCODE pro 3UF7 motor management and control devices

Dimensional drawings

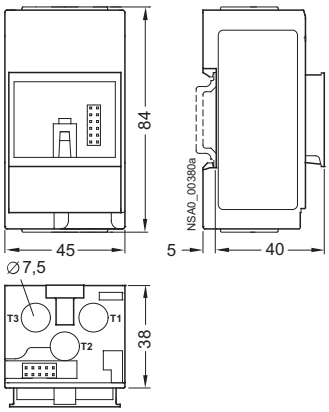
Basic unit 1, SIMOCODE pro C, 3UF7 000



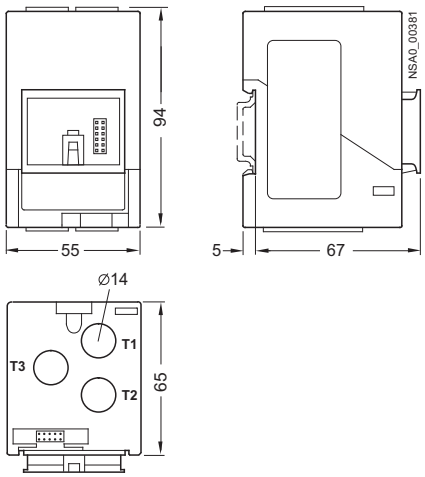
Basic unit 2, SIMOCODE pro V, 3UF7 010



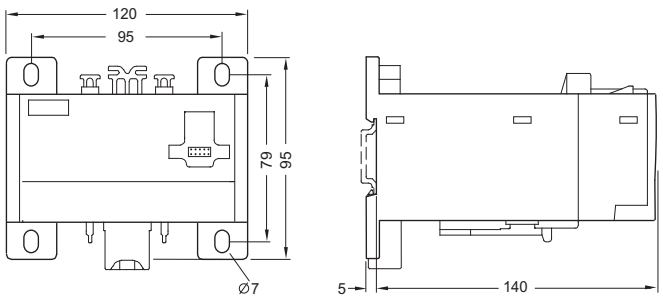
3UF7 100, 3UF7 101 current measuring module (straight-through transformer)

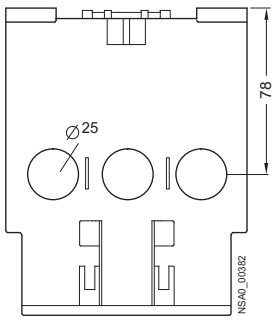


3UF7 102 current measuring module (straight-through transformer)

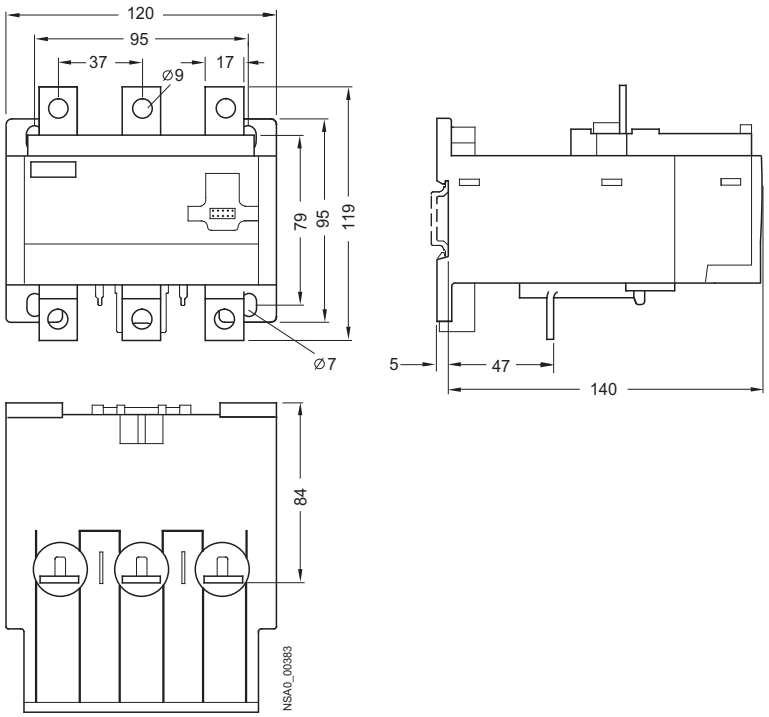


3UF7 103 current measuring module (straight-through transformer)

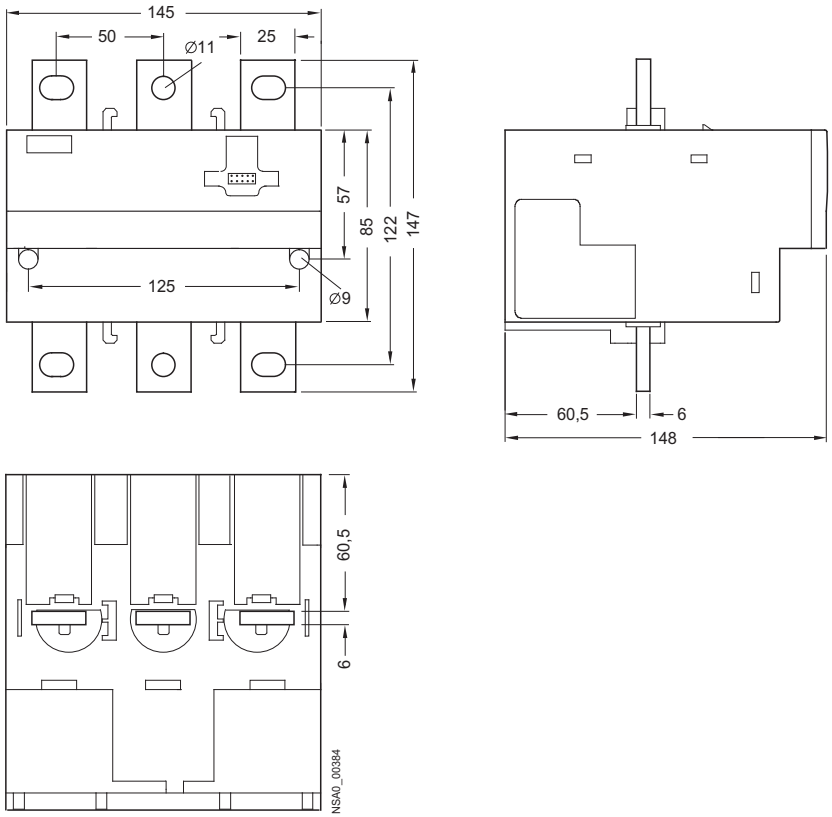




3UF7 103 current measuring module (busbar connection)

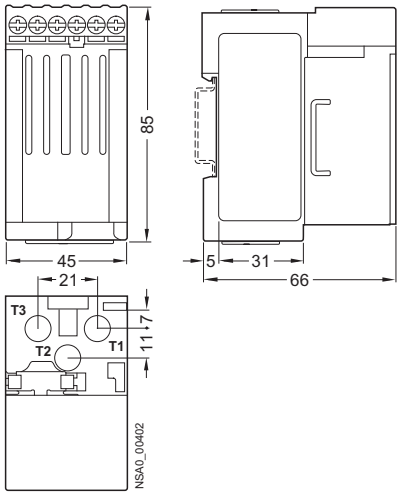


3UF7 104 current measuring module (busbar connection)

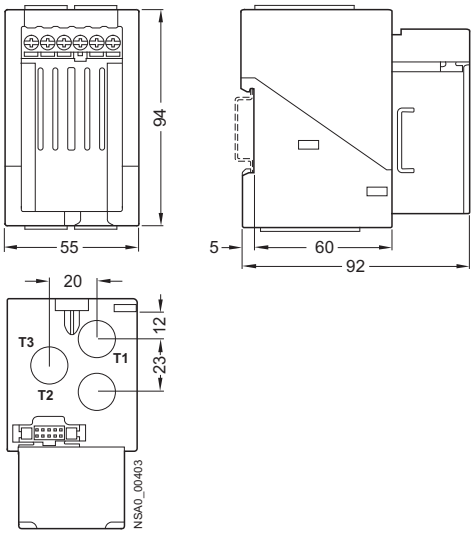


SIMOCODE pro 3UF7 motor management and control devices

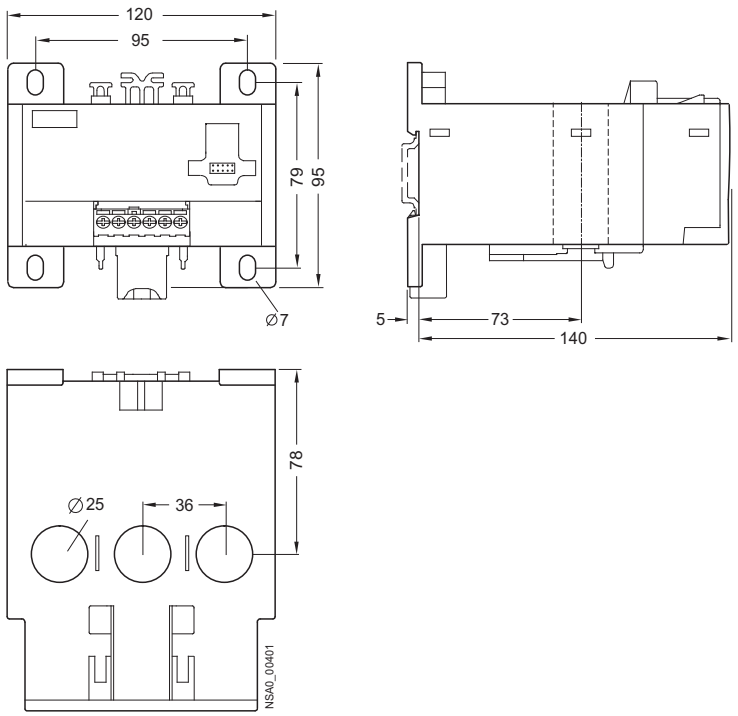
3UF7 110, 3UF7 111 current/voltage measuring module (straight-through transformer)



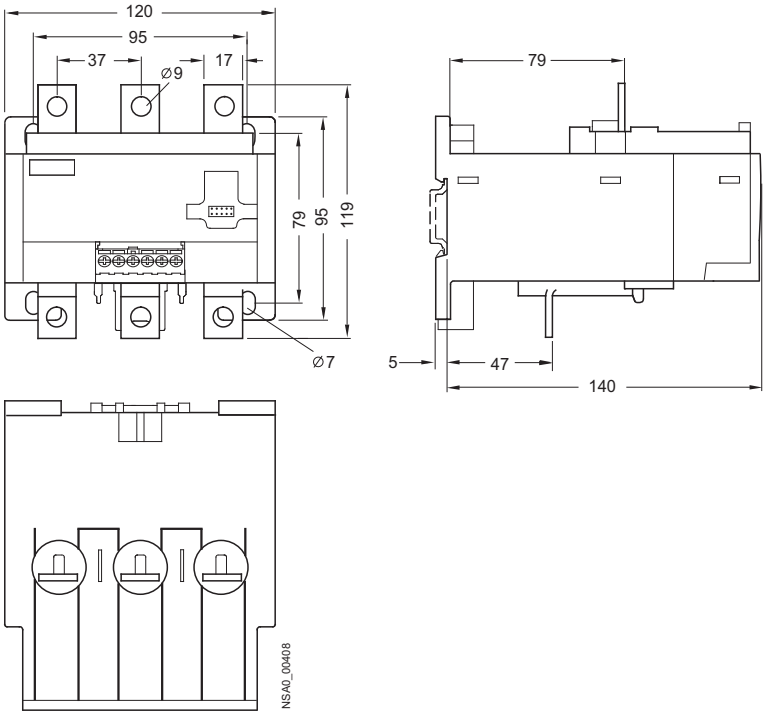
3UF7 112 current/voltage measuring module (straight-through transformer)



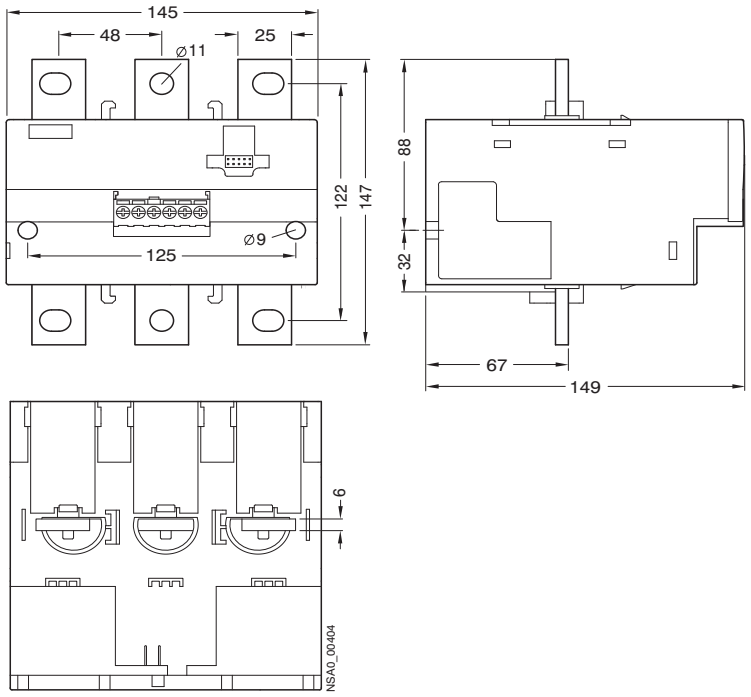
3UF7 113 current/voltage measuring module (straight-through transformer)



3UF7 113 current/voltage measuring module (busbar connection)

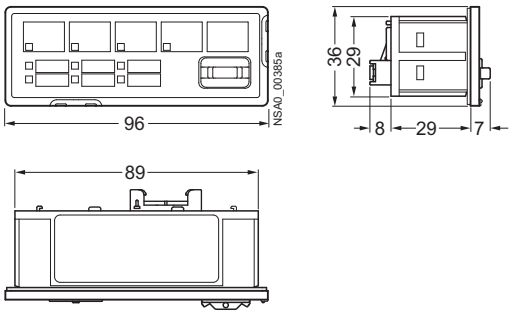


3UF7 114 current/voltage measuring module (busbar connection)

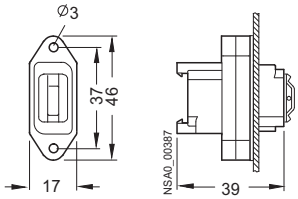


SIMOCODE pro 3UF7 motor management and control devices

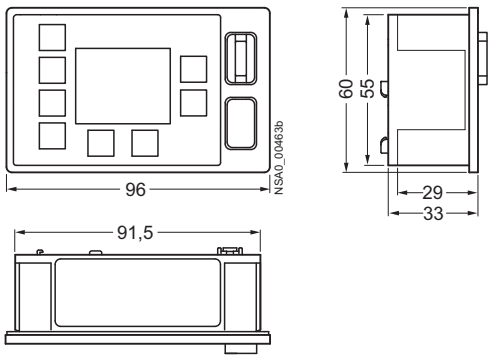
3UF7 200 operator panel



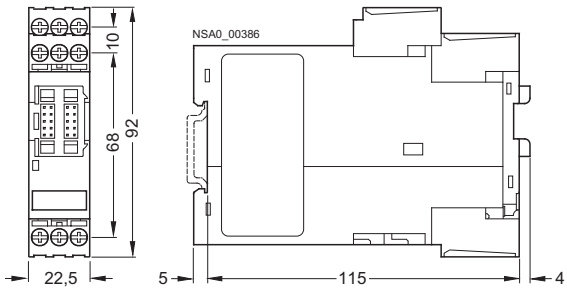
3UF7 920 door adapter



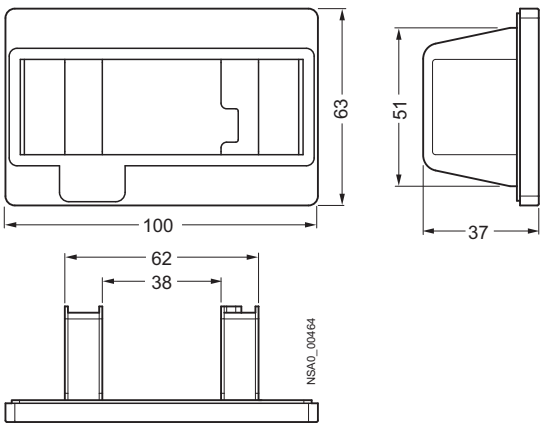
3UF7 210 operator panel with display



3UF7 3 digital module
3UF7 4 analog module
3UF7 5 ground-fault module
3UF7 7 temperature module
3UF7 15 decoupling module

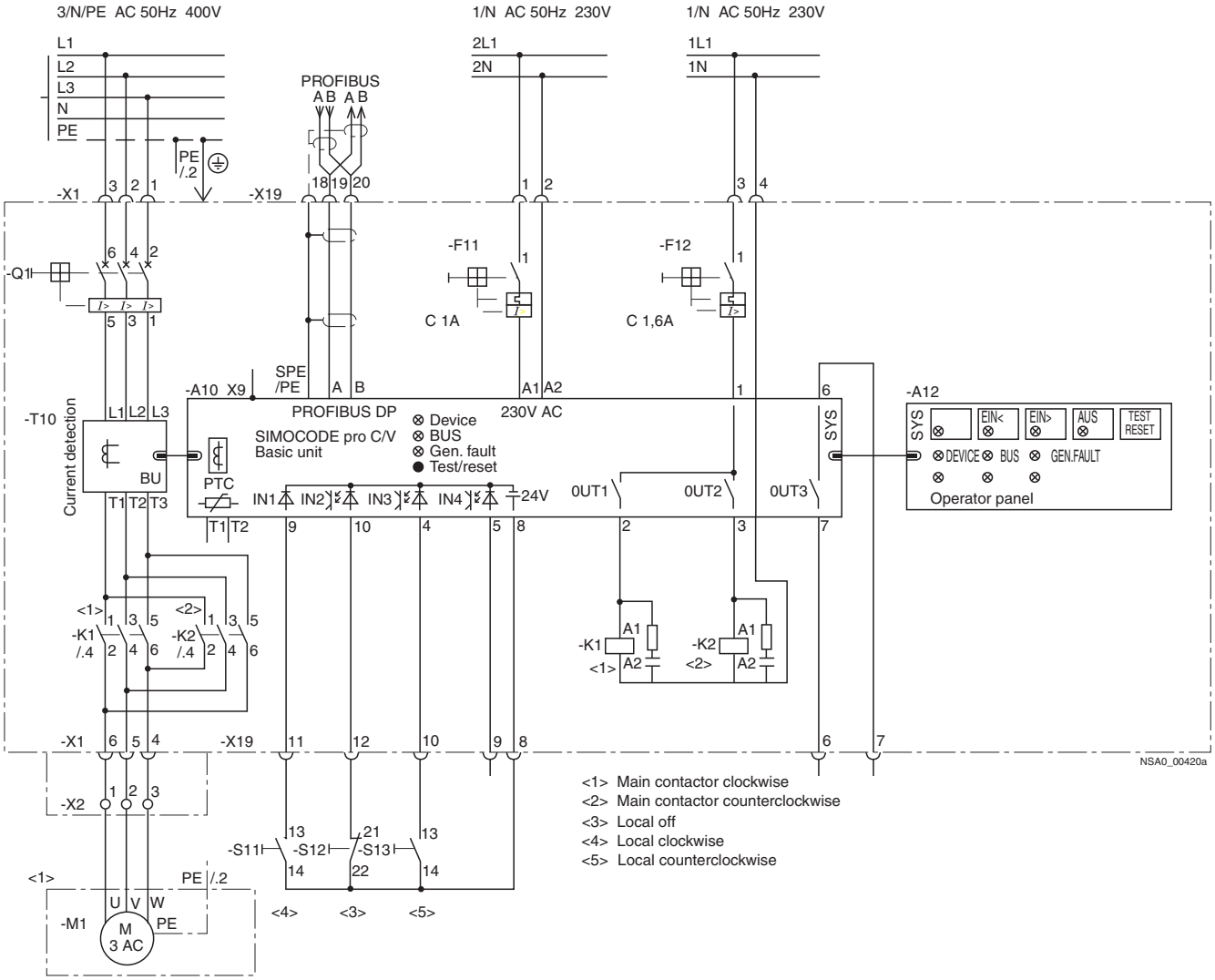


3UF7 922 adapter for operator panel



Schematics

Reversing starter with SIMOCODE pro



Circuit diagrams for additional control functions can be referred to in the SIMOCODE pro system manual

More information

System manual

For selection of equipment and for configuration, it is recommended that the 3UF7 970-0AA0.-0 system manual is consulted.

Internet

You can find further information on the Internet at:
http://www.siemens.com/simocode

3UF18 current transformers for overload protection

Overview

The 3UF18 current transformers are protection transformers and are used for actuating overload relays. Protection transformers are designed to ensure proportional current transfer up to a multiple of the primary rated current. The 3UF18 current transformers convert the maximum current of the corresponding operating range into the standard value of 1 A secondary.

Technical specifications

Climatic environmental conditions						
Temperatures						
• Operation	°C	-25 ... +60				
• Storage/transport	°C	-40 ... +85				
Temperature changes						
• Operation	°C/h	Max. 10				
• Storage/transport	°C/h	Max. 20				
Relative humidity	%	15 ... 95 (indoor, acc. to IEC 60721-3, no condensation)				
Air pressure						
• Operation	hPa	860 ... 1060				
• Storage/transport	hPa	650 ... 1060				
Contaminants						
• SO_2	ppm	0.5 (relative humidity ≤ 60 %, no condensation)				
• H_2S	ppm	0.1 (relative humidity ≤ 60 %, no condensation)				
Mechanical environmental conditions						
Vibrations (acc. to IEC 60068-2-6)	Hz Hz	10 ... 57 (for constant amplitude 0.15 nm) 57 ... 150 (for constant acceleration 2 *g*)				
Shock (acc. to IEC 60068-2-27)		12 shocks (half-sine 15 *g*/11 ms)				
Requirements acc. to IEC and EN						
Degree of protection (acc. to IEC 60529)		IP20				
Rated insulation voltage	V	690/1000 (type-dependent)				
Rating of the insulation (acc. to UL/CSA)	V	600				
Trip class (acc. to IEC 60947-4-1)		Suitable from CLASS 5 to CLASS 30				
Power loss per conducting path of the transformers		Operating range	For setting ...			
			To the lower limit		To the upper limit	
		A	mW (mVA)		mW (mVA)	
• 3UF18 45		12.5 ... 50	33 (38)		570 (650)	
• 3UF18 48		25 ... 100	110 (120)		1700 (1900)	
• 3UF18 50		32 ... 130	135 (150)		2400 (2700)	
• 3UF18 52		50 ... 200	170 (190)		2600 (2900)	
• 3UF18 56		100 ... 400	450 (500)		6500 (7000)	
• 3UF18 57		125 ... 500	850 (940)		13000 (15000)	
• 3UF18 68-3F		160 ... 630	900 (1000)		17000 (19000)	
• 3UF18 68-3G		205 ... 820	1400 (1600)		22000 (25000)	
Conductor cross-sections (one or two conductors can be connected)		Current transformers				
		On secondary side	On primary side			
			3UF18 45 3UF18 48[1] 3UF18 50[1]	3UF18 52	3UF18 56 3UF18 57[2]	3UF18 68-3FA00[2]	3UF18 68-3GA00[2]
• Terminal screw		M 3.5	For connection data see "3RT Contactors"	M 8	M 10	M 10	M 12
• Solid	mm^2	2 × 1.5 ... 2.5		--	--	--	--
• Stranded	mm^2	2 × 1.5 ... 2.5		--	--	--	--
• Finely stranded without end sleeve	mm^2	--		--	--	--	--
• Finely stranded with end sleeve	mm^2	2 × 1.5		--	--	--	--
• Finely stranded with cable lug	mm^2	--		35 ... 95	50 ... 240[3]	50 ... 240	185 ... 240
• Stranded with cable lug	mm^2	--		50 ... 120	70 ... 240[3]	70 ... 240	185 ... 240
• Connecting bars	mm	--		20 × 4	25 × 6.30 × 6	30 × 5	50 × 5
• Tightening torque	Nm	0.8 ... 1.4		10 ... 14	14 ... 24	14 ... 24	14 ... 24
• Tightening torque	lb	7 ... 12		89 ... 124	124 ... 210	124 ... 210	124 ... 210

1) With or without box terminal.

2) Conductor cross-sections for box terminals, see 3TF68 and 3TF69 contactors in the section "Contactors and Contactor Assemblies".

3) With max. conductor cross-section, a terminal cover for maintaining the phase spacing is required.

Short-circuit protection with fuses for motor feeders
for short-circuit currents up to 50 kA at 690 V[3], 50/60 Hz

Overload relay	Contactors	Rated operational current I_e AC-3 in A with 400 V and Class ...					ToC 1 Type of coordination 1[2]	ToC 2 Type of coordination 2[2]		
		5 and 10	15	20	25	30	Fuse links in A[1]			
							LV HRC, type 3NA DIAZED, type 5SB NEOZED, type 5SE gL/gG	LV HRC, type 3NA DIAZED, type 5SB NEOZED, type 5SE gL/gG	LV HRC, type 3ND aM	British Standards fuses BS 88
Operating range 0.25 ... 2.5 A										
3UF18 43-1BA00	**3RT10 15**	2.5	2.5	2.5	2.5	2.5	25	10	--	--
Operating range 1.25 ... 12.5 A										
3UF18 43-1AA00	**3RT10 15**	7	7	7	7	7	25	10	--	--
	3RT10 16	9	9	9	9	9	25	10	--	--
	3RT10 17	12	11	10	9.5	9	25	10	--	--
	3RT10 24	12	12	12	12	12	35	16	20	35
	3RT10 25	12.5	12.5	12.5	12.5	12.5	35	16	20	35
Operating range 2.5 ... 25 A										
3UF18 43-2BA00	**3RT10 15**	7	7	7	7	7	25	10	--	--
	3RT10 16	9	9	9	9	9	25	10	--	--
	3RT10 17	12	11	10	9.5	9	25	10	--	--
	3RT10 24	12	12	12	12	12	63	25	20	35
	3RT10 25	17	17	16	15	14	63	25	20	35
	3RT10 26	25	18	16	15	14	63	25	35	50
	3RT10 34	--	25	22.3	20.3	19.1	63	25	--	--
	3RT10 35	--	--	25	25	25	63	25	--	--
Operating range 12.5 ... 50 A										
3UF18 45-2CA00	**3RT10 25**	17	17	16	15	14	63	25	20	35
	3RT10 26	25	18	16	15	14	100	35	35	50
	3RT10 34	32	25.5	22.3	20.3	19.1	100	63	--	--
	3RT10 35	40	33	29.4	28	26.5	100	63	--	--
	3RT10 36	50	38.5	32.7	29.4	26.5	100	80	--	--
	3RT10 44	--	50	49	45	41.7	100	80	--	--
	3RT10 45	--	--	50	47	45	100	80	--	--
	3RT10 46	--	--	--	50	50	100	80	--	--
Operating range 16 ... 65 A										
3UF18 47-2DA00	**3RT10 34**	32	25.5	22.3	20.3	19.1	125	63	--	--
	3RT10 35	40	33	29.4	28	26.5	125	63	--	--
	3RT10 36	50	38.5	32.7	29.4	26.5	160	80	--	--
	3RT10 44	65	56	49	45	41.7	160	125	--	--
	3RT10 45	65	61	53	47	45	160	125	--	--
	3RT10 46	--	65	59	53	50	160	125	--	--
	3RT10 54	65	65	65	65	65	160	125	--	--
Operating range 25 ... 100 A										
3UF1 848-2EA00	**3RT10 44**	65	65	49	45	41.7	250	125	--	--
	3RT10 45	80	61	53	47	45	250	160	--	--
	3RT10 46	95	69	59	53	50	250	160	--	--
	3RT10 54	100	93	82	75	69	250	160	125	125
	3RT10 55	--	100	100	98	90	250	160	125	125
	3RT10 56	--	--	--	100	100	250	160	125	125

1) Note the operational voltage.

2) Assignment and short-circuit protective devices according to IEC 60947-4-1.

3) Voltage tolerance +5 %.

3UF18 current transformers for overload protection

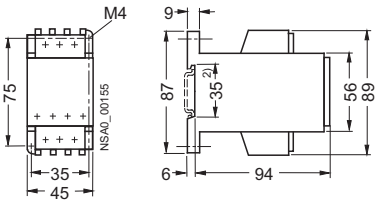
Overload relay	Contactors	Rated operational current I_e AC-3 in A with 400 V and Class ...					ToC 1 Type of coordination 1[2]	ToC 2 Type of coordination 2[2]		
		5 and 10	15	20	25	30	Fuse links in A[1]			
							LV HRC, type 3NA DIAZED, type 5SB NEOZED, type 5SE gL/gG	LV HRC, type 3NA DIAZED, type 5SB NEOZED, type 5SE gL/gG	LV HRC, type 3ND aM	British Standards fuses BS 88
Operating range 32 ... 130 A										
3UF18 50-3AA00	**3RT10 44**	65	56	49	45	41.7	250	125	--	--
	3RT10 45	80	61	53	47	45	250	160	--	--
	3RT10 46	95	69	59	53	50	250	160	--	--
	3RT10 54	115	93	82	75	69	315	224	160	160
	3RT10 55	130	122	107	98	90	315	224	160	160
	3RT10 56	--	130	130	120	111	315	224	160	160
	3RT10 64	--	--	--	130	130	315	224	160	160
Operating range 50 ... 200 A										
3UF18 52-3BA00	**3RT10 54**	115	93	82	75	69	355	224	160	200
	3RT10 55	150	122	107	98	90	355	224	160	200
	3RT10 56	185	150	131	120	111	355	224	160	200
	3RT10 64	200	182	160	146	135	355	224	160	200
	3RT10 65	--	200	188	172	159	355	224	160	200
	3RT10 66	--	--	200	195	180	355	224	160	200
	3RT10 75	--	--	--	200	200	355	224	160	200
Operating range 63 ... 250 A										
3UF18 54-3CA00	**3RT10 56**	185	150	131	120	111	355	250	160	200
	3RT10 64	225	182	160	146	135	400	250	250	355
	3RT10 65	250	215	188	172	159	500	400	315	355
	3RT10 66	--	243	213	195	180	500	400	315	355
	3RT10 75	--	250	250	250	240	500	400	400	355
	3RT10 76	--	--	--	--	250	500	400	400	355
Operating range 100 ... 400 A										
3UF18 56-3DA00	**3RT10 65**	265	215	188	172	159	500	400	315	400
	3RT10 66	300	243	213	195	180	500	400	315	400
	3RT10 75	400	324	284	260	240	630	500	400	450
	3RT10 76	--	400	355	325	300	630	500	500	450
	3TF68	--	--	400	400	400	800	500	630	450
Operating range 125 ... 500 A										
3UF18 57-3EA00	**3RT10 66**	300	243	213	195	180	500	400	315	400
	3RT10 75	400	324	284	260	240	800	500	400	450
	3RT10 76	500	405	355	325	300	800	500	500	450
	3TF68	--	500	500	479	441	800	500	630	450
	3TF69	--	--	--	500	500	800	500	630	450
Operating range 160 ... 630 A										
3UF18 68-3FA00	**3RT10 75**	400	324	284	260	240	800	500	400	450
	3RT10 76	500	405	355	325	300	800	500	500	450
	3TF68	630	630	536	479	441	1000	500	630	450
	3TF69	--	--	--	531	500	1000	500	630	450
Operating range 200 ... 820 A										
3UF18 69-3GA00	**3TF68**	630	630	536	479	441	1000	500	630	450
	3TF69	820	662	572	531	500	1000	500	630	450

1) Note the operational voltage.

2) Assignment and short-circuit protective devices according to IEC 60947-4-1.

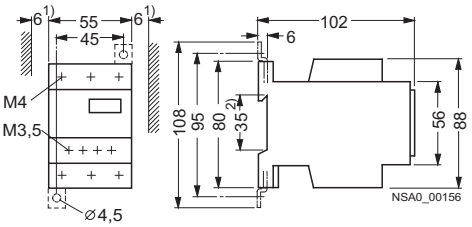
Dimensional drawings

3UF18 43 current transformer



3UF18 45 current transformer

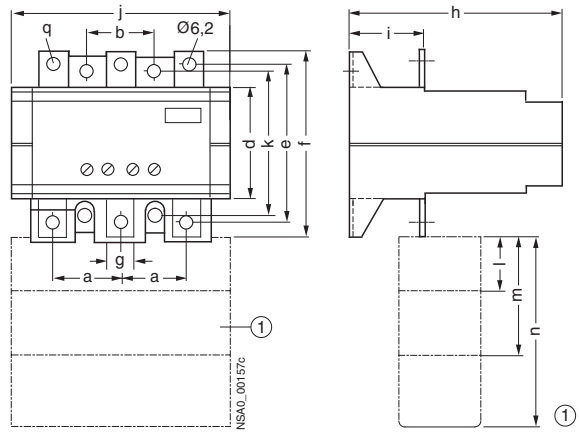
for stand-alone installation:
for screw and snap-on mounting onto TH 35 standard mounting rails according to EN 60715



1) Clearance to grounded components.

2) Snap-on mounting onto standard mounting rails EN 60715-35 x 7.5 or EN 60715-35 x 15.

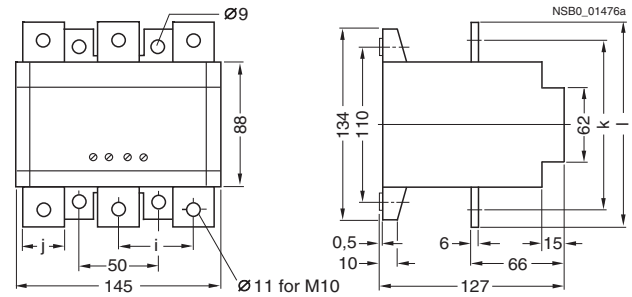
3UF18 47 to 3UF18 52 current transformers



① Additional cover, can be shortened

Transformers	Contactors	a	b	d	e	f	g	h	i	j	k	l	m	n	q
3UF1 847	3RT1 044	26,5	25	82	111	122	10,5	90	46	90	105	35	62	89	Ø 6,2
3UF1 848	3RT1 045	26,5	25	82	111	122	10,5	90	46	90	105	35	62	89	Ø 6,2
	3RT1 046														
3UF1 850		37	37,5	71,5	99	114	15	110	41	120	95	33	67	98	Ø 6,6
3UF1 852		42	37,5	71,5	102	122	20	110	42	120	95	33	67	98	Ø 9

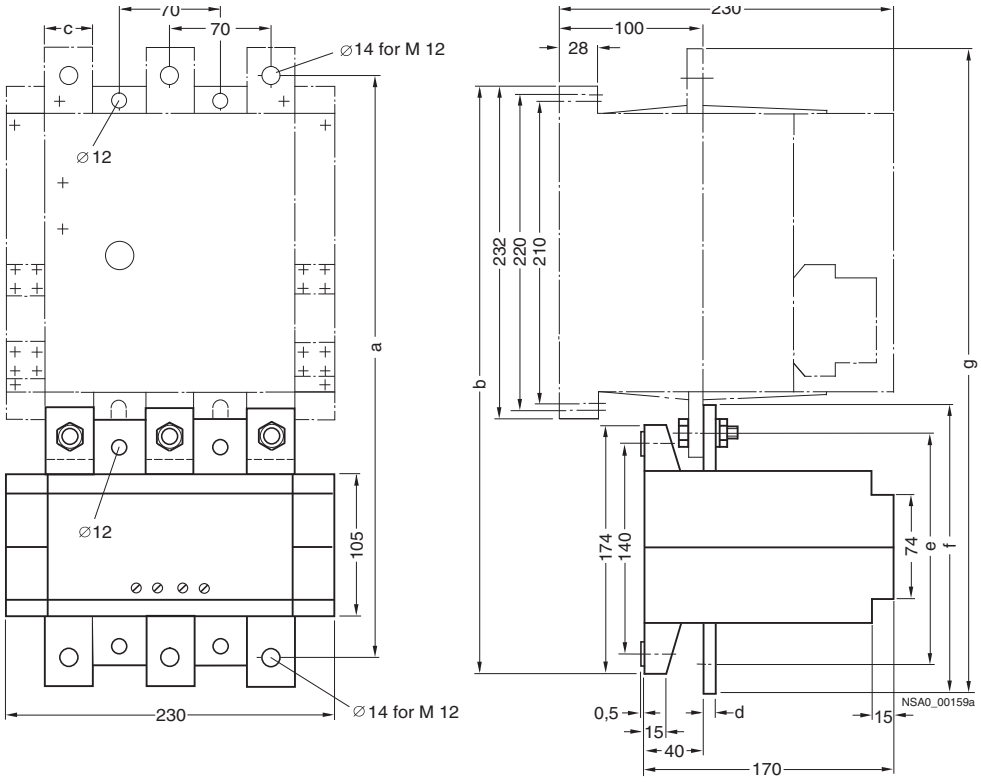
3UF18 54 to 3UF18 57 current transformers



Transformers	i	j	k	l
3UF18 54	48	25	134	159
3UF18 56	48	25	134	159
3UF18 57	52	30	133	163

3UF18 current transformers for overload protection

3UF18 68-3FA00, 3UF18 68-3GA00 current transformers
for 3TF68 contactors



Transformers	Contactors	a	b	c	d	e	f	g
3UF18 68-3FA00	3TF68	390	398	30	5	145	175	420
3UF18 68-3GA00	3TF68	410	408	40	8	155	195	450

Overview

- The compact, user-friendly, and low-cost solution for simple control tasks
- Compact, user-friendly, can be used universally without accessories
- All in one: the display and operator panel are integrated
- 4-line LOGO! TD text display can be connected directly to all LOGO! basic versions
- 39 different functions can be linked at a press of a button or with PC software; up to 200 times in total
- Functions can be changed simply using buttons; no complicated rewiring

Catalog ST 70:

Information on LOGO! can also be found in the catalog ST 70:

http://www.siemens.com/simatic/printmaterial

Design

The LOGO! modular design is available in different versions for different supply voltages (12 V DC, 24 V DC, 24 V AC, 115/230 V DC, 115/230 V AC):

- Basic versions with operator control and display panels
- Low-cost pure versions without operator control and display panels
- 4-line LOGO! TD text display can be connected directly to all LOGO! basic versions, degree of protection IP65, including connection cable

The LOGO! versions have the following distinguishing characteristics:

- R: relay output
- C: clock/time switch
- o: without display

LOGO! is simple:

- Keypad and display field in one unit; no other tools are required
- Non-volatile storage of switching program and setpoints (e. g. times) in integrated EEPROM

LOGO! is space-saving:

- e. g. LOGO! 230RC: 72 x 90 x 55 mm (W x H x D)
- Fitted mounting in the distribution box (same mounting dimensions as the RCCB)

LOGO! offers maximum flexibility and is universal:

- Expandability:
  Depending on the application, additional expansion modules can be connected

LOGO! is communication-capable:

- Optional communication modules support connection to AS-Interface and instabus *EIB* networks

Function

LOGO! is simple:

- 39 functions:
  Integrated basic functions (e. g. AND, OR) and special functions (e. g. timers, counters, latching relays, PI controllers) of the electronics
- Program generation simply by combining stored functions at the press of a button or PC software
- Easy-to-use and simple duplication of the switching program with an optional program module
- LOGO! offers maximum flexibility and is universal:
- Easy modification by reconnecting the functions at a press of a button; no need for time-consuming rewiring
- Optional operation from the PC:
  For creating, simulating, online testing and archiving the switching program on the PC, including documentation facility

LOGO! Modular basic versions

Overview

- The space-saving basic versions
- Interface for connecting expansion modules, max. 24 digital inputs, 16 digital outputs, 8 analog inputs and 2 analog outputs can be addressed
- Interface for direct connection of the new LOGO! TD text display

Design

- Relay outputs with up to 10 A output current (not LOGO! 24)
- Integrated display field with background illumination (4x12 characters)
- Integrated operator control panel
- Integrated EEPROM for storing switching program and set-points
- Optional program module
- Integrated clock with automatic summertime/wintertime changeover (not LOGO! 24)
- 8 digital inputs, 4 digital outputs
- 4 inputs as analog inputs for 12/24 V DC versions (0 ... 10 V); inputs can also be used as digital inputs
- 4 inputs for counting up to 5 kHz can be used (for DC versions only)
- Interface for connecting expansion modules, max. 24 digital inputs, 16 digital outputs, 8 analog inputs and 2 analog outputs can be addressed
- Interface for direct connection of the new LOGO! TD text displays

Function

- Integrated basic and special functions:
- Basic functions:
  AND, OR, NOT, NAND, NOR, XOR, positive/negative edge evaluation
- Special functions:
  ON delay, latching ON-delay, OFF-delay, pulse relay, latching relay, counter (forwards/backwards), time switch, interval time-delay relay, operating hours counter, threshold switch, asynchronous pulse encoder, twelve-month time switch, easy-to-use switch function, random generator, staircase lighting function according to DIN 18015-2, edge-triggered interval time-delay relay, combined ON/OFF-delay, analog comparator, analog threshold switch, analog delta threshold switch, analog watchdog, analog amplifier, text and variable display, shift register, softkey function, PI controller, ramp function, analog multiplexer, analog arithmetic function, PWM function
- 200 function blocks can be combined
- 24 flags (including start-up flag)
- Integrated retentivity
- Password protection

Optional function

- Additional know-how protection with the optional program module
- Additional 2-year buffer for the integrated real-time clock (not LOGO! 24) with the optional battery and memory module/ battery module
- 4-line LOGO! TD text display can be connected directly to all LOGO! basic versions

Overview

- The cost-optimized basic versions
- Interface for connecting expansion modules, max. 24 digital inputs, 16 digital outputs, 8 analog inputs and 2 analog outputs can be addressed
- Interface for direct connection of the new LOGO! TD text display

Design

- Relay outputs with up to 10 A output current (not LOGO! 24o).
- Integrated EEPROM for storing switching program and set-points
- Optional program module
- Integrated clock with automatic summertime/wintertime changeover (not LOGO! 24o)
- 8 digital inputs, 4 digital outputs
- 4 inputs as analog inputs for 12/24 V DC versions (0 ... 10 V); inputs can also be used as digital inputs
- 4 inputs for counting up to 5 kHz can be used (for DC versions only)
- Interface for connecting expansion modules, max. 24 digital inputs, 16 digital outputs, 8 analog inputs and 2 analog outputs can be addressed
- Interface for direct connection of the new LOGO! TD text displays

Function

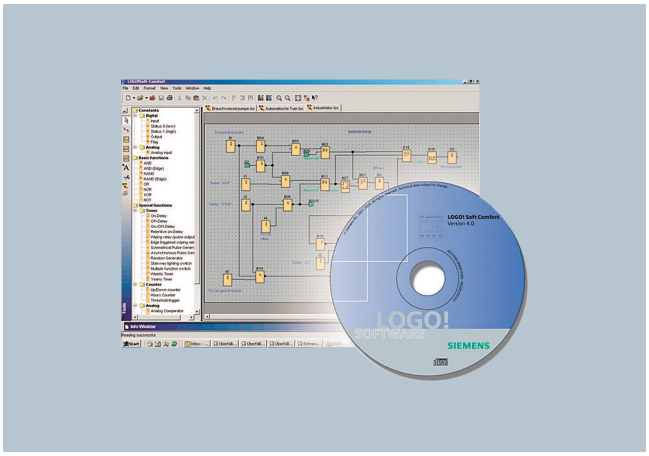
- Integrated basic and special functions:
- Basic functions:
  AND, OR, NOT, NAND, NOR, XOR, positive/negative edge evaluation
- Special functions:
  ON delay, latching ON-delay, OFF-delay, pulse relay, latching relay, counter (forwards/backwards), time switch, interval time-delay relay, operating hours counter, threshold switch, asynchronous pulse encoder, twelve-month time switch, easy-to-use switch function, random generator, staircase lighting function according to DIN 18015-2, edge-triggered interval time-delay relay, combined ON/OFF-delay, analog comparator, analog threshold switch, analog delta threshold switch, analog watchdog, analog amplifier,shift register, softkey function, PI controller, ramp function, analog multiplexer, analog arithmetic function, PWM function
- 200 function blocks can be combined
- 24 flags (including start-up flag)
- Integrated retentivity
- Password protection

Optional function

- Additional know-how protection with the optional program module
- Additional 2-year buffer for the integrated real-time clock with the optional battery and memory module/battery module
- 4-line LOGO! TD text display can be connected directly to all LOGO! basic versions

LOGO! Software

Overview



- The user-friendly software for switching program generation on the PC
- Switching program generation for function diagrams (FBD) or contact diagrams (LAD)
- Additional testing, simulation, online testing and archiving of the switching programs
- Professional documentation with the help of various comment and print functions

Design

The connection between LOGO! and the PC is established with the help of the LOGO! PC cable (serial or USB interface)

Minimum system requirements

Windows 98 SE, NT 4.0, ME, 2000, XP or Vista

- Pentium PC
- 90 Mbyte free on hard disk
- 64 Mbyte RAM
- SVGA graphics card with minimum 800x600 resolution (256 colors)

Mac OS X

- PowerMac G3, G4, G4 Cube, iMac, PowerBook G3, G4 or iBook

Linux (tested with Caldera OpenLinux 2.4)

- Runs on all Linux releases on which Java 2 SDK Version 1.3.1 runs
- Please consult your Linux release for hardware requirements

Function

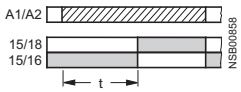
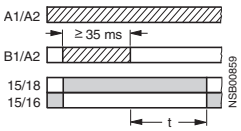
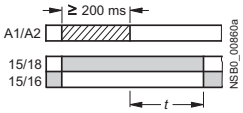
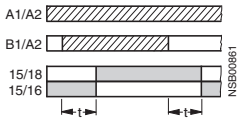
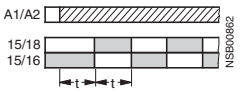
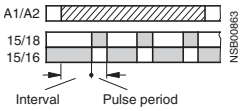
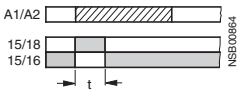
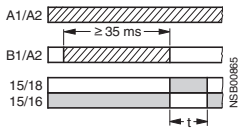
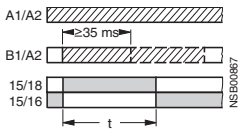
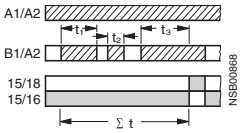
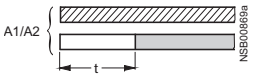
- Control program generation with the programming languages FBD and LAD (switchable). How to place the functions on the drawing board by means of "Drag and Drop" is almost self-explanatory
- Comprehensive documentation functions:
  Various print options permit professional documentation
- Program simulation (offline):
  For preliminary testing of switching programs on the PC
- Program test (online):
  The current values of LOGO! are presented on screen, for FBD and LAD
- Analog modem communication for remote servicing of LOGO! with program UP/DOWN load and online test
- Comprehensive, context-sensitive online help functions

The following functions are available:

- Basic functions (AND, OR, NOT, NAND, NOR, XOR, positive edge evaluation, negative edge evaluation)
- ON-delay
- OFF-delay
- Current impulse relay
- Latching
- Latching ON-delay
- Operating hours counter
- Interval time-delay relay/pulse output mode
- Up/down counter
- Threshold switch
- Pulse encoder
- Twelve-month time switch
- Time switch
- ON/OFF-delay
- Random generator
- Edge-triggered interval time-delay relay
- Analog threshold switch
- Analog comparator
- Analog delta threshold switch
- Analog watchdog
- Analog amplifier
- Staircase lighting switch
- Easy-to-use switch
- Message texts
- Shift register
- Softkey
- PI controller
- Ramp function
- Analog multiplexer
- Analog arithmetic function
- PWM function

Function

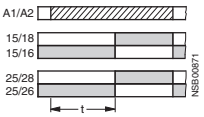
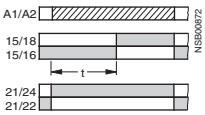
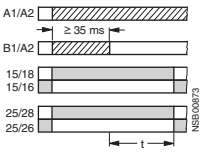
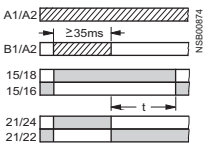
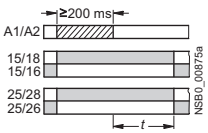
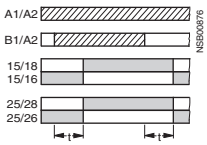
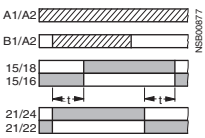
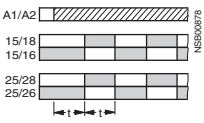
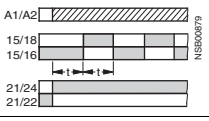
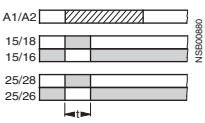
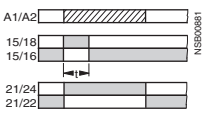
3RP15 and 3RP20 function table

Function	Function chart	3RP20 timing relay and 3RP19 01 label set		3RP15 timing relay and 3RP19 01 label set									
	Timing relay energized Contact closed Contact open	3RP20 05-.A	3RP20 25	3RP15 05-.A 3RP19 01-0A	Identification letter	3RP15 1.	3RP15 25	3RP15 27	3RP15 3.	3RP15 40	3RP15 55	3RP15 7.
1 CO contact												
With ON-delay		■	■	■	A	■	■					
OFF-delay with auxiliary voltage		■		■	B[1]				■			
OFF-delay without auxiliary voltage *Observe minimum ON period for correct operation. For 3RP15 40-..W31: U_S 24 to 40 V AC/DC: 400 ms and U_S > 40 to 240 V AC/DC: 200 ms.*										■		
ON-delay and OFF-delay with auxiliary voltage ($t = t_{on} = t_{off}$)		■		■	C[1]							
Flashing, starting with interval (pulse/interval 1:1)		■		■	D							
Clock-pulse, starting with interval (dead time, pulse time, and time setting ranges each separately adjustable)											■	
Passing make contact		■		■	E							
Passing break contact with auxiliary voltage		■		■	F[1]							
Pulse-forming with auxiliary voltage (pulse generation at the output does not depend on duration of energizing)		■		■	G[1]							
Additive ON-delay with auxiliary voltage		■		■	H[1]							
1 NO contact (semiconductor)												
ON-delay The two-wire timing relay is connected in series with the load. Timing begins after application of the exciting voltage. The semiconductor output then becomes conducting, and the load is under power.								■				

[1] Note on function with start contact: A new control signal at terminal B, after the operating time has started, resets the operating time to zero. This does not apply to G, G● and H, H●, which are not retriggerable.

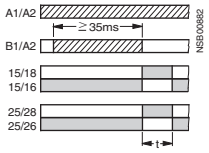
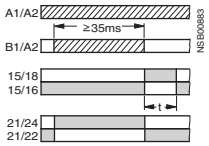
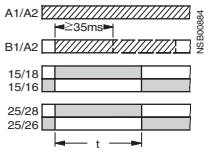
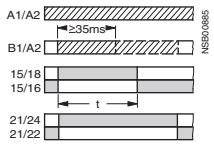
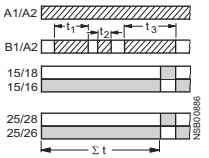
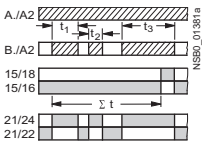
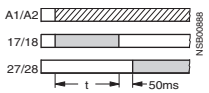
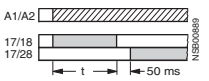
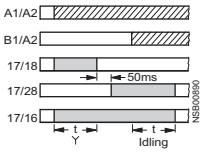
■ Function is possible

General data

Function	Function chart	3RP20 timing relay and 3RP19 01 label set		3RP15 timing relay and 3RP19 01 label set											
	Timing relay energized Contact closed Contact open	3RP20 05-.B	3RP20 25	3RP15 05-.B 3RP19 01-0B	3RP15 05-.R 3RP19 01-0A	Identification letter	3RP15 1.	3RP15 25	3RP15 27	3RP15 3.	3RP15 40	3RP15 55	3RP15 60	3RP15 7.
2 CO contacts															
With ON-delay		■		■	■	A		■						
ON-delay and instantaneous contact		■		■		A●								
OFF-delay with auxiliary voltage		■		■	■	B[1]								
OFF-delay with auxiliary voltage and instantaneous contact		■		■		B[1]								
OFF-delay without auxiliary voltage											■			
ON-delay and OFF-delay with auxiliary voltage ($t = t_{on} = t_{off}$)		■		■	■	C[1]								
ON-delay and OFF-delay with auxiliary voltage and instantaneous contact ($t = t_{on} = t_{off}$)		■		■		C●[1]								
Flashing, starting with interval (pulse/interval 1:1)		■		■	■	D								
Flashing, starting with interval (pulse/interval 1:1) and instantaneous contacts		■		■		D●								
Passing make contact		■		■	■	E								
Passing make contact and instantaneous contact		■		■		E●								

For footnote see page 43.

■ Function is possible

Function	Function chart	3RP20 timing relay and 3RP19 01 label set		3RP15 timing relay and 3RP19 01 label set												
	Timing relay energized Contact closed Contact open	3RP20 05-.B	3RP20 25	3RP15 05-.B 3RP19 01-0B	3RP15 05-.R 3RP19 01-0A	Identification letter	3RP15 1.	3RP15 25	3RP15 27	3RP15 3.	3RP15 40	3RP15 55	3RP15 60	3RP15 7.
2 CO contacts														
Passing break contact with auxiliary voltage		■		■	■	F[1]								
Passing break contact with auxiliary voltage and instantaneous contact		■		■		F●[1]								
Pulse-forming with auxiliary voltage (pulse generation at the output does not depend on duration of energizing)		■		■	■	G[1]								
Pulse-forming with auxiliary voltage and instantaneous contact) (pulse generation at the output does not depend on duration of energizing)		■		■		G●[1]								
Additive ON-delay with auxiliary voltage					■	H[1]								
Additive ON-delay with auxiliary voltage and instantaneous contact		■		■		H●[1]								
Wye-delta function		■		■		Y Δ								
2 NO contacts														
Wye-delta function Y Δ														■
3 NO contacts														
Wye-delta function with overtravel function[2] (idling)													■	

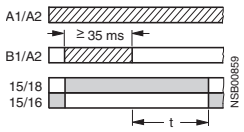
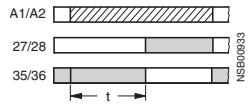
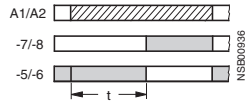
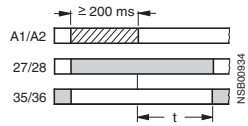
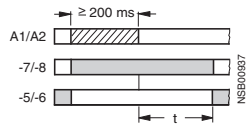
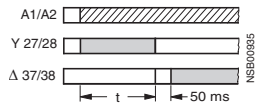
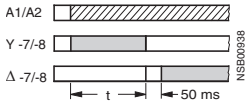
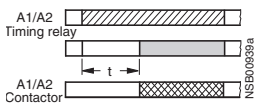
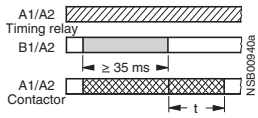
[1] Note on function with start contact: A new control signal at terminal B, after the operating time has started, resets the operating time to zero. This does not apply to G, G● and H, H●, which are not retriggerable.

[2] For function diagrams showing the various possibilities of operation of the 3RP15 60-1S.30, see page 45.

■ Function is possible

General data

Function table 3RT19 16, 3RT19 26

Function	Function chart	3RT19 16 timing relays						3RT19 26 timing relays				
	Timing relay energized Contact closed Contact open	3RT19 16-2C	3RT19 16-2D	3RP19 16-2E	3RT19 16-2F	3RT19 16-2G	3RT19 16-2L	3RT19 26-2C	3RT19 26-2D	3RT19 26-2E	3RT19 16-2F	3RT19 26-2G
1 CO contact												
OFF-delay with auxiliary voltage							■					
1 NO contact + 1 NC contact												
ON-delay (varistor integrated)				■								
With ON-delay										■		
OFF-delay without auxiliary voltage (varistor integrated)					■							
OFF-delay without auxiliary voltage											■	
2 NO contacts												
Wye-delta function (varistor integrated) 1 NO delayed, 1 NO instantaneous, dead time 50 ms						■						
Wye-delta function 1 NO delayed, 1 NO instantaneous, dead time 50 ms												■
1 NO contact (semiconductor)												
ON-delay Two-wire version (varistor integrated)		■						■				
OFF-delay with auxiliary voltage (varistor integrated)			■						■			

■ Function is possible

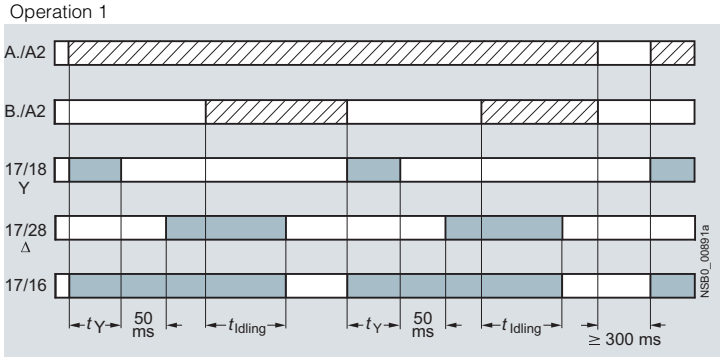
3RP15 function table

Possibilities of operation of the 3RP15 60-1S.30 timing relay

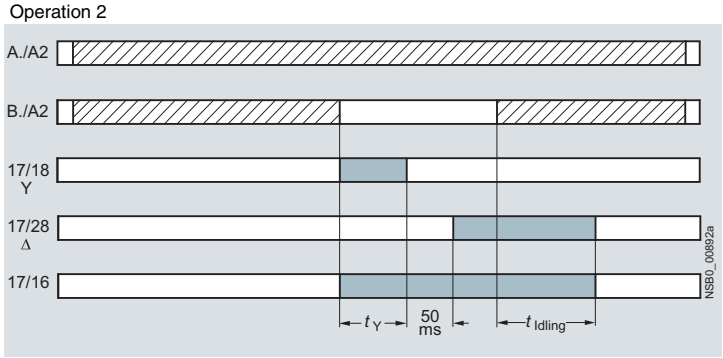
Timing relay energized
Contact closed
Contact open

t_Y = Star time 1 ... 20 s
t_{Idling} = Idling time (overtravel time) 30 ... 600 s

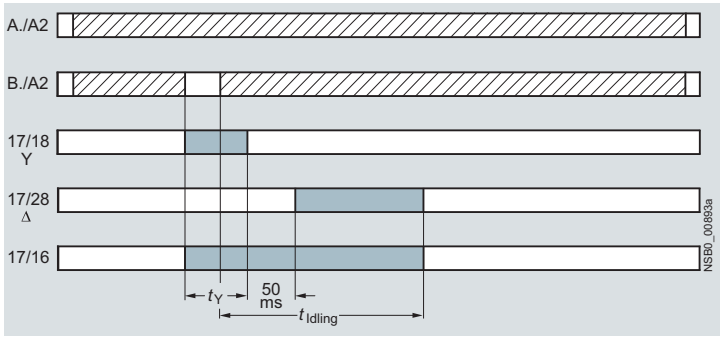
Operation 1



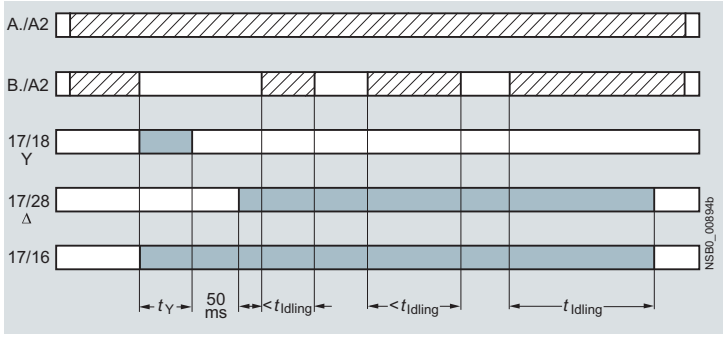
Operation 2



Operation 3



Operation 4



Operation 1:
Start contact B./A2 is open when supply voltage A./A2 is applied.

The supply voltage is applied to A./A2 and there is no control signal on B./A2. This starts the Y/Δ timing. The idling time (coasting time) is started by applying a control signal to B./A2. When the set time t_{Idling} (30 ... 600 s) has elapsed, the output relays (17/16 and 17/28) are reset. If the control signal on B./A2 is switched off (minimum OFF period 270 ms), a new timing is started.

Comments:

Observe response time (dead time) of 400 ms on energizing supply voltage until contacts 17/18 and 17/16 close.

Operation 2:
Start contact B./A2 is closed when supply voltage A./A2 is applied.

If the control signal B./A2 is already present when the supply voltage A./A2 is applied, **no** timing is started. The timing is only started when the control signal B./A2 is switched off.

Operation 3:
Start contact B./A2 closes while star time is running.

If the control signal B./A2 is applied again during the star time, the idling time starts and the timing is terminated normally.

Operation 4:
Start contact B./A2 opens while delta time is running and is applied again.

If the control signal on B./A2 is applied and switched off again during the delta time, although the idling time has not yet elapsed, the idling time (coasting time) is reset to zero. If the control signal is re-applied to B./A2, the idling time is restarted.

Application example based on standard operation (operation 1): For example, use of 3RP15 60 for compressor control

Frequent starting of compressors strains the network, the machine, and the increased costs for the operator. The new timing relay prevents frequent starting at times when there is high demand for compressed air. A special control circuit prevents the compressor from being switched off immediately when the required air pressure in the tank has been reached. Instead, the valve in the intake tube is closed and the compressor runs in "Idling" mode for a specific time which can be set from 30 ... 600 s.

If the pressure falls within this time, the motor does not have to be restarted again, but can return to nominal load operation from no-load operation.

If the pressure does not fall within this idling time, the motor is switched off.

The pressure switch controls the timing via B./A2.

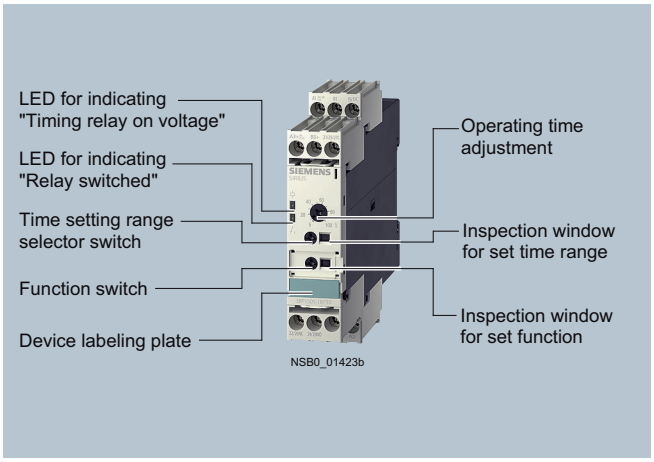
The supply voltage is applied to A./A2 and the start contact B./A2 is open, i.e. there is no control signal on B./A2 when the supply voltage is applied. The pressure switch signals "too little pressure in system" and starts the timing by way of terminal B./A2. The compressor is started, enters Y/Δ operation, and fills the pressure tank.

When the pressure switch signals "sufficient pressure", the control signal B./A2 is applied, the idling time (overtravel time) is started, and the compressor enters no-load operation for the set period of time from 30 ... 600 s. The compressor is then switched off. The compressor is only restarted if the pressure switch responds again (low pressure).

Note:
The following applies to all operations: The pressure switch controls the timing via B./A2.

3RP15 timing relays in industrial enclosure, 22.5 mm

Overview

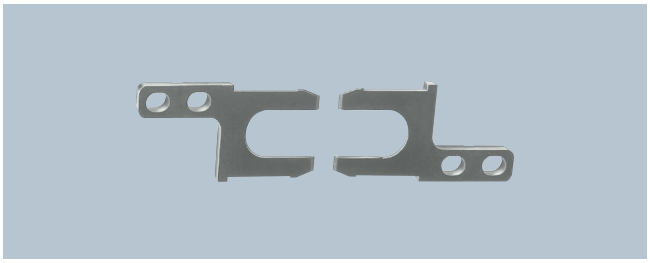


Standards

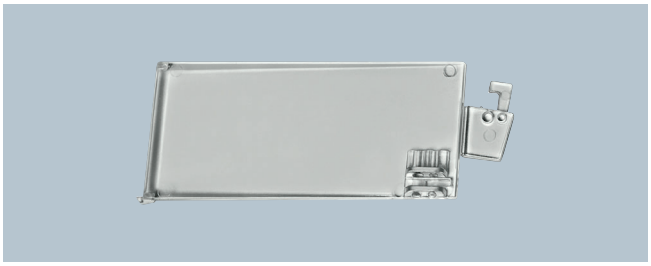
The timing relays comply with:

- IEC 60947-5-1 (VDE 0660 Part 200) "Low-voltage switchgear and controlgear – Electromechanical control circuit devices"
- IEC 61812-1 (VDE 0435 Part 2021) "Specified time relays for industrial use"
- EN 60721-3-3 "Environmental conditions"
- IEC 61000-6-2 and IEC 61000-6-4 "Electromagnetic compatibility"

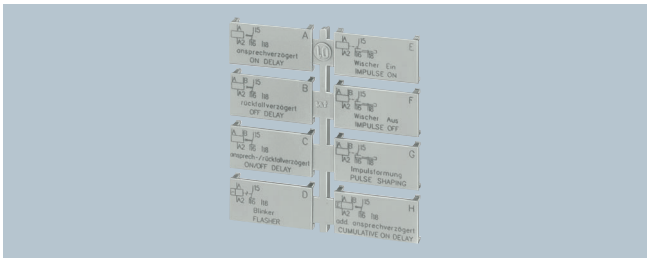
Accessories



Push-in lugs for screw fixing



Sealable cover



Label set for marking the multifunction relay

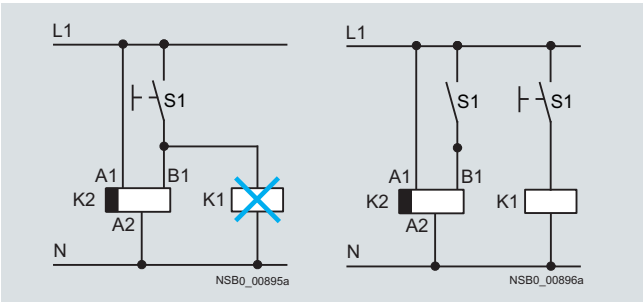
Function

- Changes to the time setting ranges and the functions must be carried out in the de-energized state.
- Start input B1 or B3 must only be triggered when the control supply voltage is applied.
- The same potential must be applied to A1 and B1 or A3 and B3. With two-voltage version, only one voltage range must be connected.
- The activation of loads parallel to the start input is not permissible when using AC control supply voltage (see diagrams).
- Surge suppression is integrated in the timing relay. This prevents the generation of voltage peaks on the control supply voltage when the relay is switched on and off. No additional damping measures are necessary.
- 3RP15 05-.R must not be operated next to heat sources > 60 °C.
- For 3RP15 40-..W31:
  For correct operation, observe minimum ON period at 24 to 40 V AC/DC: 400 ms and at 40 to 240 V AC/DC: 200 ms.
  The timing relay has only one LED which indicates that the control supply voltage is connected. The switch position of the relay is not indicated.
  Setting of output contacts in as-supplied state not defined (bistable relay). Application of the control supply voltage once results in contact changeover to the correct setting.

Timing relay with multifunction

The functions can be adjusted by means of rotary switches. Insert labels can be used to adjust different functions of the 3RP15 05 timing relay clearly and unmistakably.
The corresponding labels can be ordered as an accessory. The same potential must be applied to terminals A. and B.

Parallel load on start input



Technical specifications

Type			3RP15 05 3RP15 31 3RP15 32 3RP15 33	3RP15 11 3RP15 12 3RP15 13 3RP15 25 3RP15 55	3RP15 40	3RP15 60	3RP15 74 3RP15 76	3RP15 27
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III		V AC	300; 500 for 3RP15 05-1BT10					
Operating range at excitation[1]			0.85 ... 1.1 x U_s with AC/DC, 50/60 Hz 0.8 ... 1.25 x U_s at 24 V DC 0.95 ... 1.05 times the rated frequency					
Rated power		W	2					1
Power consumption at 230 V AC, 50 Hz		VA	6		2[2]	6		1
Rated operational current I_e								
• AC-140, DC-13		A	--					0.01 … 0.6
• AC-15 at 24 ... 400 V, 50 Hz		A	3[3]					--
• DC-13 at 24 V		A	1					--
• DC-13 at 125 V		A	0.2					--
• DC-13 at 250 V		A	0.1					--
Conventional thermal current I_{th}		A	5					--
DIAZED protection[4] gL/gG operational class		A	4					--
Switching frequency								
• When loaded with I_e 230 V AC		1/h	2500					5000
• When loaded with 3RT10 16 contactor, 230 V AC		1/h	5000					
Recovery time		ms	150	--	--	300	150	50
Minimum ON period		ms	35[5]	--	200[6]	--		
Residual current With non-conducting output		mA	--					5
Voltage drop With conducting output		VA	--					3.5
Short-time loading capacity		A	--					10 (up to 10 ms)
Setting accuracy With reference to upper limit of scale		%	Typical ± 5					
Repeat accuracy		%	≤ ±1					
Mechanical endurance	Operating cycles		30 x 10^6					100 x 10^6
Permissible ambient temperature	During operation	°C	-25 … +60					
	During storage	°C	-40 … +85					
Degree of protection acc. to IEC 60529			IP40 cover, IP20 terminals					
Connection type			**Screw terminals**					
• Terminal screw			M 3 (standard screwdriver, 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)					
Mounting position			Any					
Shock resistance acc. to IEC 60068-2-27 for half-sine shock type		g/ms	15/11					
Vibration resistance acc. to IEC 60068-2-6			10 ... 55 Hz: 0.35 mm					
Electromagnetic compatibility (EMC)			IEC 61812-1/IEC 61000-6-2/IEC 61000-6-4					

1) If nothing else is stated.

2) Inrush current after 100 ms <1 A. Observe for actuation with semiconductor output and internal current limit.

3) For 3RP15 05-.R: NC contact -> I_e = 1 A.

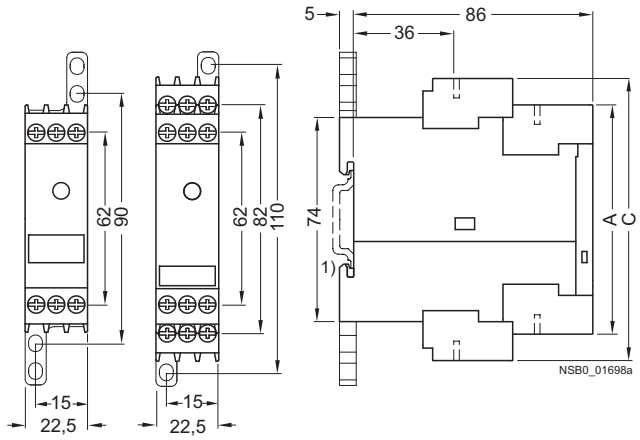
4) I_k ≥ 1 kA, weld-free according to IEC 60947-5-1.

5) Minimum ON period with 3RP15 05-.BW30, 150 ms, until instantaneous contact has switched.

6) For correct operation, observe minimum ON period. With 3RP15 40-..W31 at U_s 24 ... 40 V AC/DC: 400 ms, 40 ... 240 V AC/DC: 200 ms.

3RP15 timing relays in industrial enclosure, 22.5 mm

Dimensional drawings



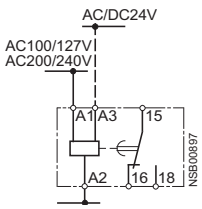
Type	3RP15 1 3RP15 25-.A 3RP15 27 3RP15 40-A 3RP15 55 3RP15 7	3RP15 05 3RP15 25-.B 3RP15 3 3RP15 40-.B 3RP15 60
	A	C
Removable terminal		
Screw-type terminal	83	102
Spring-loaded terminal	84	103

1) For standard mounting rail according to EN 60715.

Schematics

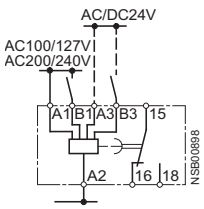
3RP15 internal circuit diagrams (terminal designation to DIN 46199, Part 5)

3RP15 05-.A
3RP15 1.
3RP15 25-.A



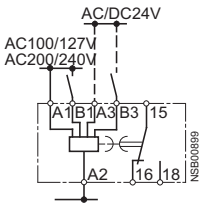
With ON-delay

3RP15 05-.A
3RP15 3.-.A



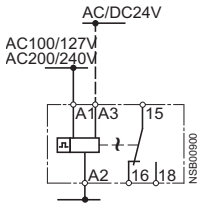
OFF-delay
with auxiliary voltage

3RP15 05-.A



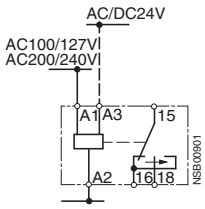
ON-delay and OFF-delay
with auxiliary voltage

3RP15 05-.A



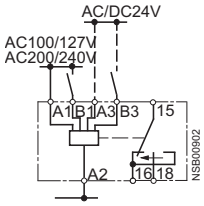
Flashing

3RP15 05-.A



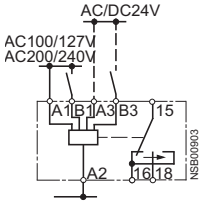
Passing make contact

3RP15 05-.A



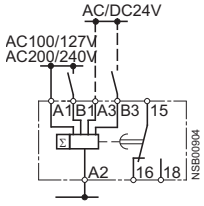
Passing break contact
with auxiliary voltage

3RP15 05-.A



Pulse-forming
with auxiliary voltage

3RP15 05-.A

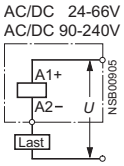


Additive ON-delay
with auxiliary voltage

3RP15 timing relays in industrial enclosure, 22.5 mm

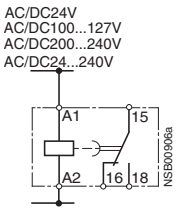
3RP15 27

U = 24 ... 66 V AC/DC
90 ... 240 V AC/DC



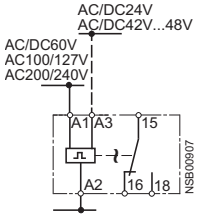
ON-delay,
two-wire version

3RP15 40-.A



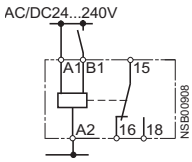
OFF-delay
without auxiliary voltage

3RP15 55



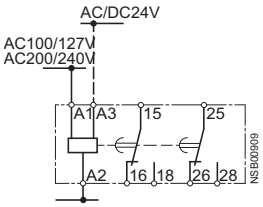
Clock-pulse relay

3RP15 05-.AW30



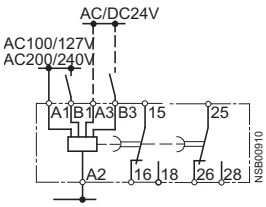
Multifunction relay
(same functions as 3RP15 05-1A)

3RP15 05-.B, 3RP15 25-1B



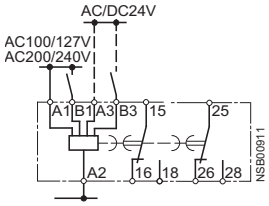
ON-delay, 3RP15 25-1B
also for 42 ... 48/60 V AC/DC
(see page 50 3RP15 25-1BR30)

3RP15 05-.B



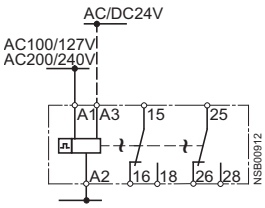
OFF-delay with auxiliary voltage

3RP15 05-.B



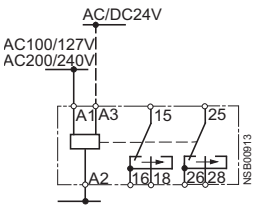
ON-delay and OFF-delay
with auxiliary voltage

3RP15 05-.B



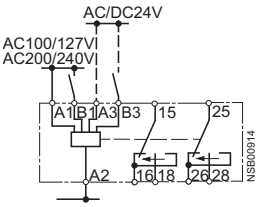
Flashing

3RP15 05-.B



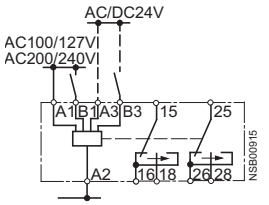
Passing make contact

3RP15 05-.B



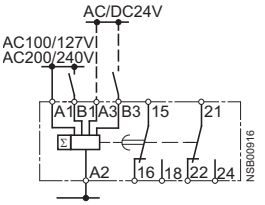
Passing break contact
with auxiliary voltage

3RP15 05-.B



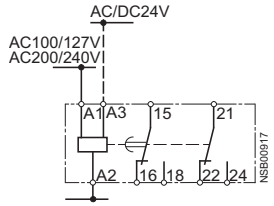
Pulse-forming with auxiliary voltage

3RP15 05-.B



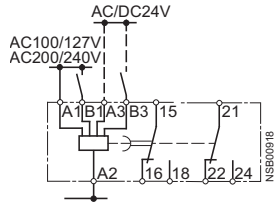
Additive ON-delay with
auxiliary voltage and instantaneous
contact

3RP15 05-.B



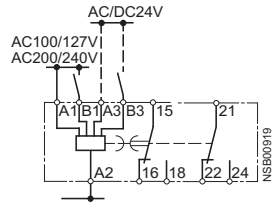
ON-delay and instantaneous
contact

3RP15 05-.B



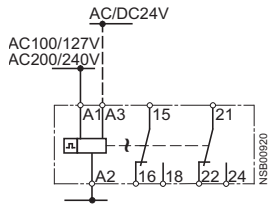
OFF-delay with auxiliary voltage
and instantaneous contact

3RP15 05-.B



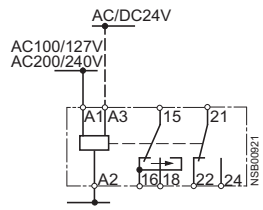
ON-delay and OFF-delay with aux-
iliary voltage and instantaneous
contact

3RP15 05-.B



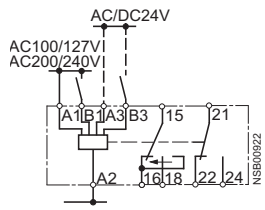
Flashing and instantaneous contact

3RP15 05-.B



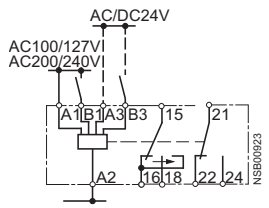
Passing make contact
and instantaneous contact

3RP15 05-.B



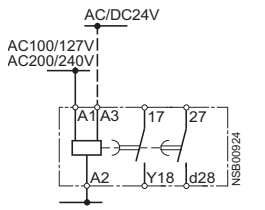
Passing break contact with auxil-
iary voltage and instantaneous
contact

3RP15 05-.B



Pulse-forming with auxiliary voltage
and instantaneous contact

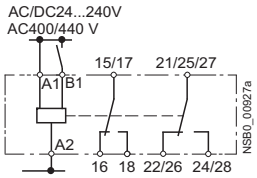
3RP15 05-.B



Wye-delta function

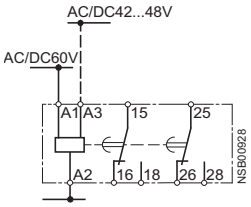
3RP15 timing relays in industrial enclosure, 22.5 mm

3RP15 05-.BW30/-1BT20/-.RW30



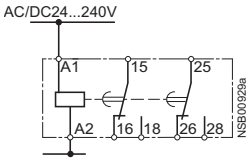
Multifunction relay
(for functions see function table)

3RP15 25-. BR30



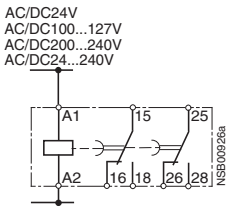
With ON-delay

3RP15 25-. BW30



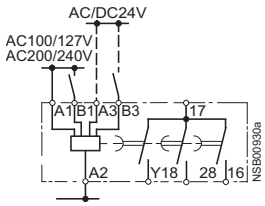
With ON-delay

3RP15 40-.B



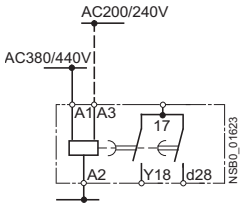
OFF-delay without auxiliary voltage

3RP15 60-. S



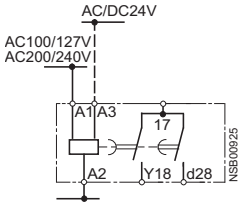
Wye-delta timing relay with overtravel function (idling)

3RP15 7.-.M20



Wye-delta timing relay

3RP15 74, 3RP15 76



Wye-delta timing relay

Position of the terminals

3RP15 05-.A

A1	B1	15
A3	B3	
for 1 changeover contact		
16	18	A2

NSB00996

3RP15 05-.AA40

A1	B1	15
A1		
for 2 changeover contact		
16	18	A2

NSB0_01605

3RP15 05-.AW

A1	B1	15
for 1 changeover contact		
16	18	A2

NSB01007

3RP15 05-.BP/-.BQ

A1	B1	15/17
A3	B3	21/25/27
for 2 changeover contacts		
22/26	24/28	
16	18	A2

NSB01008

3RP15 05-.BW

A1	B1	15/17
		21/25/27
for 2 changeover contacts		
22/26	24/28	
16	18	A2

NSB00999

3RP15 05-1BT

A1	B1	15/17
		21/25/27
for 2 changeover contacts		
22/26	24/28	
16	18	A2

NSB00999

3RP15 05-.RW

A1	B1	15
		25
for 2 changeover contacts		
26	28	
16	18	A2

NSB01000

3RP15 1.

A1	A3	15
for 1 changeover contact		
16	18	A2

NSB01001

3RP15 25-1A. or **-1B.** 1)

A1	A3	15
for 1 changeover contact		
16	18	A2

NSB01002

A1		15
A3		25
for 2 changeover contacts		
26	28	
16	18	A2

3RP15 27

A1		
for 1 NO contact		
		A2

NSB01003

3RP15 3.

A1	B1	15
A3	B3	
for 1 changeover contact		
16	18	A2

NSB00996

3RP15 40

A1		15
for 1 changeover contact		
16	18	A2

NSB0_01004a

A1		15
A1		25
for 2 changeover contacts		
26	28	A2
16	18	A2

3RP15 55

A1	A3	15
for 1 changeover contact		
16	18	A2

NSB01001

3RP15 60

A1	B1	17
A3	B3	
for 1 NO contact		
16		
18	28	A2

NSB01005

3RP15 7.

A1	A3	17
for 1 NO contact		
18	28	A2

NSB01006

Note: All the diagrams show the view onto the terminals.

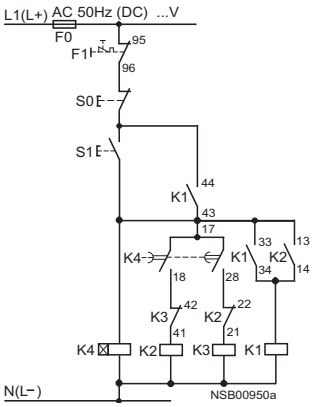
1) Depending on the version.

3RP15 circuit diagrams

Control circuits (example circuits)
with 3RP15 74 and 3RP15 76 wye-delta timing relays

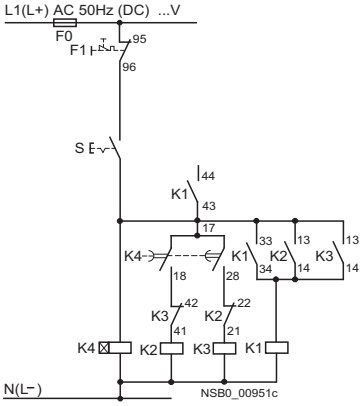
For momentary-contact operation

Size S00 to S3

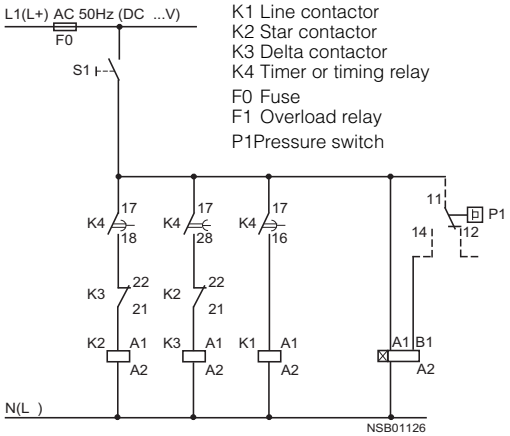


For maintained-contact operation

Size S00 to S3



Control circuit (example circuit)
with 3RP15 60 wye-delta timing relays



Legend:

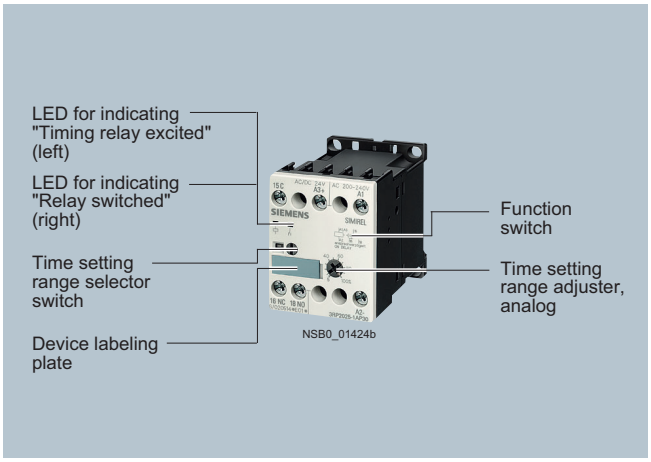
S0 Button "OFF"
S1 Button "ON"
S Maintained-contact button
K1 Line contactor
K2 Star contactor
K3 Delta contactor
K4 Timer or timing relay
F0 Fuse
F1 Overload relay
P1Pressure switch

Note:

The contact element 17/18 is only closed in the wye stage; the contact element is open in the delta stage as well as in the de-energized state.

3RP20 timing relays, 45 mm

Overview

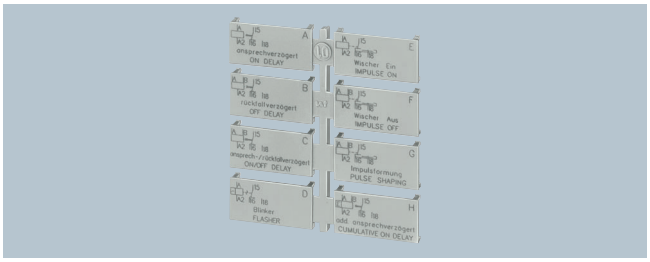


Standards

The timing relays comply with:

- IEC 60947-5-1 (VDE 0660 Part 200) "Low-voltage switchgear and controlgear – Electromechanical control circuit devices"
- IEC 61812-1 (VDE 0435 Part 2021) "Specified time relays for industrial use"
- EN 60721-3-3 "Environmental conditions"
- IEC 61000-6-2 and IEC 61000-6-4 "Electromagnetic compatibility"
- EN 61140 "Protective separation"

Accessories



Label set for marking the multifunction relay

Function

- Changes to the time setting ranges and the functions must be carried out in the de-energized state.
- Start input B1 or B3 must only be triggered when the control supply voltage is applied.
- The same potential must be applied to A1 and B1 or A3 and B3. With two-voltage version, only one voltage range must be connected.
- The activation of loads parallel to the start input is not permissible when using AC control supply (see diagrams).
- Surge suppression is integrated in the timing relay. This prevents the generation of voltage peaks on the control supply voltage when the relay is switched on and off. No additional damping measures are necessary.

Timing relay with multifunction

The functions can be adjusted by means of rotary switches. Insert labels can be used to adjust different functions of the 3RP20 05 timing relay clearly and unmistakably.
The corresponding labels can be ordered as an accessory. The same potential must be applied to terminals A. and B.

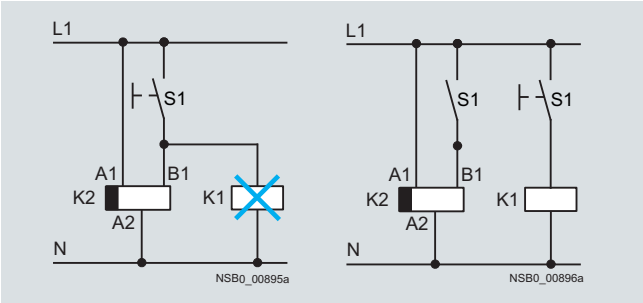
3RP20 05 with one changeover contact

Corresponds to the functions of 3RP15 05-.A.

3RP20 05 with two changeover contacts

Corresponds to the functions of 3RP15 05-.B.

Parallel load on start input



Technical specifications

Type			3RP20 05 3RP20 25
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III		V AC	300
Operating range at excitation[1]			0.85 ... 1.1 x U_s at AC/DC; 0.8 ... 1.25 x U_s at 24 V DC; 0.95 ... 1.05 times rated frequency
Rated power Power consumption at 230 V AC, 50 Hz		W VA	1 4
Rated operational current I_e • AC-15 at 24 ... 400 V, 50 Hz • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V		 A A A A	 3 1 0.2 0.1
Conventional thermal current I_{th}		A	5
DIAZED protection[2] gL/gG operational class		A	4
Switching frequency • When loaded with I_e 230 V AC • When loaded with 3RT10 16 contactor, 230 V AC		 1/h 1/h	 2500 5000
Recovery time		ms	150
Minimum ON period		ms	35
Setting accuracy With reference to upper limit of scale		%	Typical ±5
Repeat accuracy		%	≤ ±1
Mechanical endurance	Operating cycles		30 x 10^6
Permissible ambient temperature	During operation During storage	°C °C	-25 … +60 -40 … +85
Degree of protection acc. to IEC 60529			IP40 cover, IP20 terminals
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	M 3 (standard screwdriver, size 2 and Pozidriv 2) 1 x (0.5 ... 4)/2 x (0.5 ... 2.5)[3] 1 x (0.5 ... 2.5)/2 x (0.5 ... 1.5)[3] 2 x (20 ... 14)[3] 0.8 … 1.2
Connection type			**Spring-type terminals**
• Solid • Finely stranded, with end sleeves • 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)
Mounting position			Any
Shock resistance acc. to IEC 60068 for half-sine shock type		g/ms	15/11
Vibration resistance acc. to IEC 60068-2-6			10 ... 55 Hz: 0.35 mm
Electromagnetic compatibility (EMC)			IEC 61812-1/IEC 61000-6-2/IEC 61000-6-4

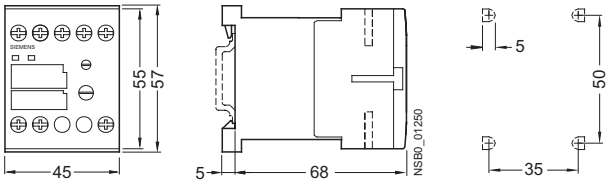
1) If nothing else is stated.

2) $I_k \geq 1$ kA, weld-free according to IEC 60947-5-1.

3) If two different conductor cross-sections are connected to one clamping point, both cross-sections must lie in the range specified. If identical cross-sections are used, this restriction does not apply.

3RP20 timing relays, 45 mm

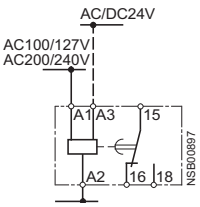
Dimensional drawings



Schematics

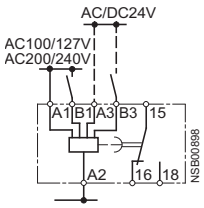
3RP20 internal circuit diagrams
(terminal designation to DIN 46199, Part 5)

3RP20 05
3RP20 25



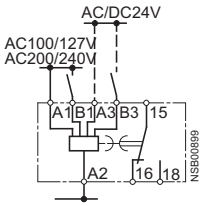
With ON-delay

3RP20 05



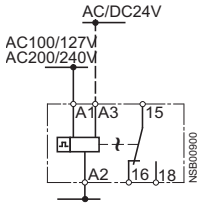
OFF-delay
with auxiliary voltage

3RP20 05



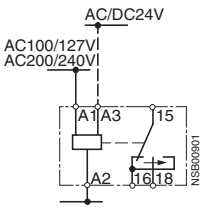
ON-delay and OFF-delay
with auxiliary voltage

3RP20 05



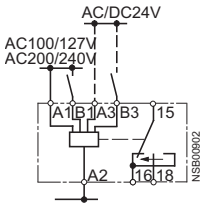
Flashing

3RP20 05



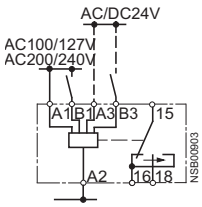
Passing make contact

3RP20 05



Passing break contact
with auxiliary voltage

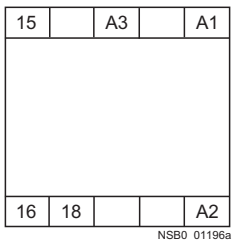
3RP20 05



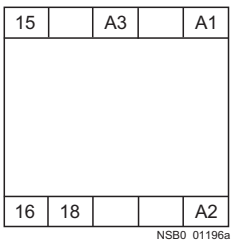
Pulse-forming
with auxiliary voltage

Position of the terminals

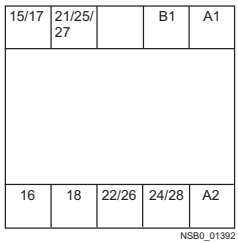
3RP20 05-.A



3RP20 25-.A



3RP20 05-.BW30



Note:

All the diagrams show the view onto the terminals.

Technical specifications

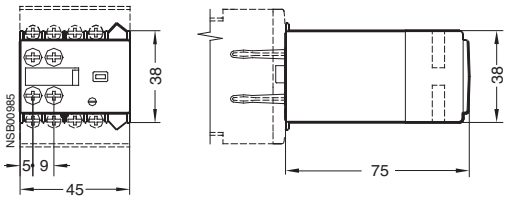
According to IEC 61812-1 (VDE 0435 Part 2021)

Contactors	Type		Solid-state time-delay blocks with semiconductor output		Solid-state time-delay auxiliary switch blocks			
			3RT19 .6-2C	3RT19 .6-2D	3RT19 .6-2L	3RT19 .6-2E	3RT19 .6-2F	3RT19 .6-2G
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III acc. to IEC 60664		V AC	300					
Operating range of excitation			0.8 ... 1.1 x U_s, 0.95 ... 1.05 times rated frequency		0.85 ... 1.1 x U_s, 0.95 ... 1.05 times rated frequency			
Rated power Power consumption at 230 V AC, 50 Hz		W VA	1 1		2 4			
Rated operational currents I_e								
• AC-140, DC-13		A A	0.3 for 3RT19 16 0.5 for 3RT19 26		-- --			
• AC-15 at 24 ... 400 V, 50 Hz		A	--		3			
• DC-13 at 24 V		A	--		1			
• DC-13 at 125 V		A	--		0.2			
• DC-13 at 250 V		A	--		0.1			
DIAZED protection gL/gG operational class		A	--		4			
Switching frequency for load								
• With I_e 230 V AC		1/h	2500					
• With 3RT10 16 contactor, 230 V AC		1/h	2500		5000			
Recovery time		ms	50		150			
Minimum ON period		ms	35		35 (OFF-delay with auxiliary voltage)	200 (with OFF-delay)		
Residual current	Max.	mA	5		--			
Voltage drop With conducting output	Max.	VA	3.5		--			
Short-time loading capacity	Up to 10 ms	A	10		--			
Setting accuracy With reference to upper limit of scale		%	typ. ±15					
Repeat accuracy		%	typ. ≤ ±1					
Mechanical endurance Operating cycles			100 x 10^6		10 x 10^6			
Permissible ambient temperature								
• During operation		°C	-25 ... +60					
• During storage		°C	-40 ... +80					
Degree of protection acc. to IEC 60947-5-1, Appendix C			IP40 Cover IP20 Terminals					
Connection type			**Screw terminals**					
• Terminal screw			M 3 (standard screwdriver, 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					
Mounting position			Any					
Shock resistance Half-sine acc. to IEC 60068-2-27		*g*/ms	15/11					
Vibration resistance acc. to IEC 60068-2-6			10 ... 55 Hz: 0.35 mm					
Electromagnetic compatibility (EMC)			IEC 61812-1/IEC 61000-6-2/IEC 61000-6-4					
Overvoltage protection			Varistor integrated in timing relay		--			

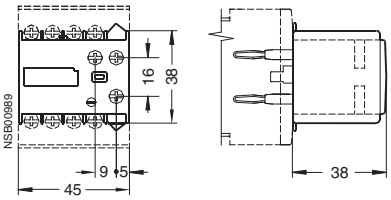
3RT19 16, 3RT19 26 timing relays for mounting onto contactors

Dimensional drawings

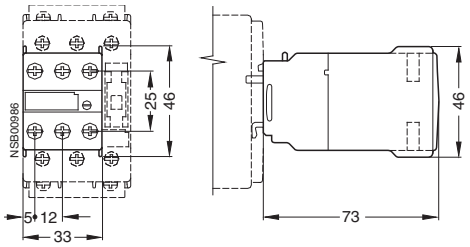
3RT19 16-2E, -2F, -2G, -2L
solid-state, time-delay auxiliary switch blocks
For size S00 contactors and contactor relays



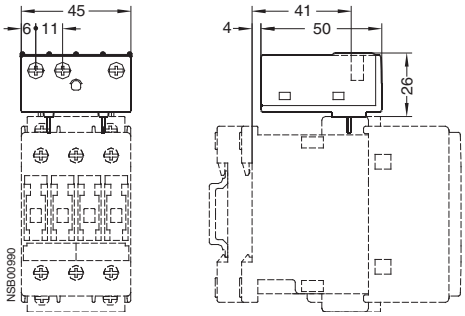
3RT19 16-2D
solid-state time-delay blocks, with OFF-delay
For mounting onto the front of size S00 contactors



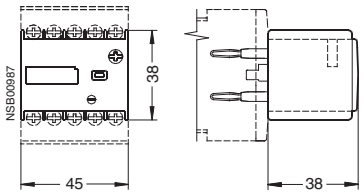
3RT19 26-2E, -2F, -2G
For size S0 to S3 contactors and contactor relays



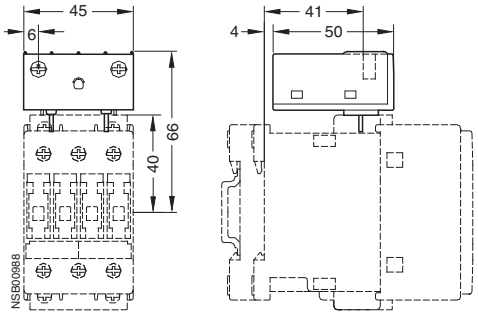
3RT19 26-2D
Mountable on top or bottom of the contactors for size S0 to S3



3RT19 16-2C
solid-state time-delay blocks, with ON-delay
For mounting onto the front of size S00 contactors



3RT19 26-2C
Mountable on top or bottom of the contactors for size S0 to S3



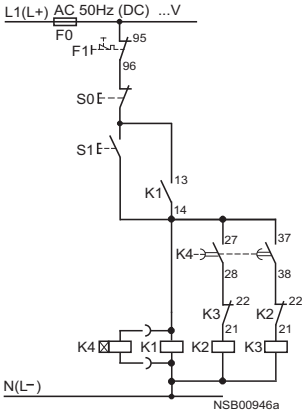
Schematics

3RT19 circuit diagrams

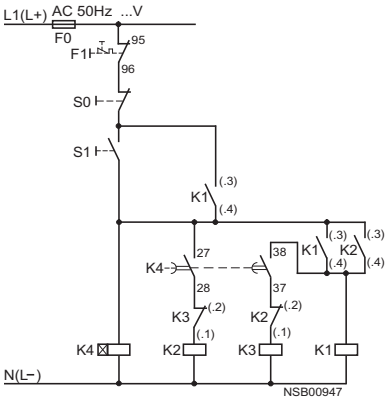
Control circuits (example circuits)
with delayed 3RT19 .6-2G wye-delta auxiliary switch block

For momentary-contact operation

Size S00

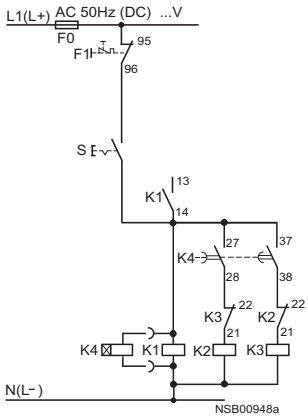


Sizes S0 to S3

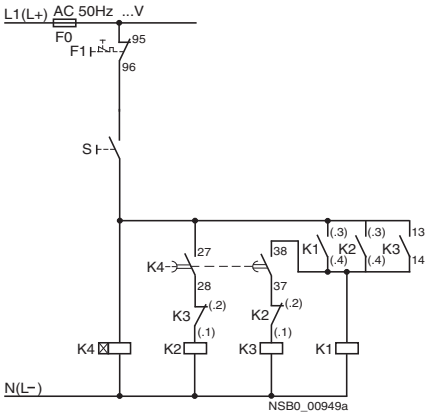


For maintained-contact operation

Size S00



Sizes S0 to S3



Legend:

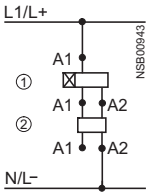
S0	"OFF" button
S1	"ON" button
S	Maintained-contact switch
K1	Line contactor
K2	Star contactor
K3	Delta contactor
K4	Timer or timing relay
F0	Fuse
F1	Overload relay

Note:
The 27/28 contact element for the solid-state time-delay auxiliary switch block with wye-delta function is only closed on the wye stage; the contact element is open in the delta stage as well as in the de-energized state.

3RT19 16, 3RT19 26 timing relays for mounting onto contactors

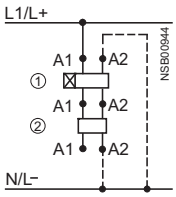
Solid-state timing relay blocks
For size S00 to S3 3RT10 contactors and 3RH11 contactor relays

3RT19 16-2C



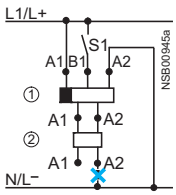
With ON-delay

3RT19 26-2C



With ON-delay

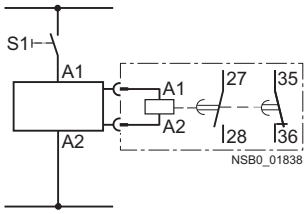
3RT19 16-2D/3RT19 26-2D



OFF-delay
(with auxiliary voltage)

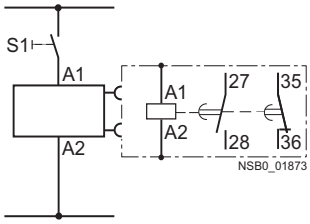
① Timing relay block
② Contactor
--- Can be connected
✖**Do not connect!**

3RT19 16-2E



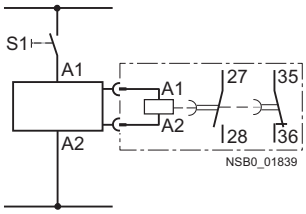
With ON-delay

3RT19 26-2E



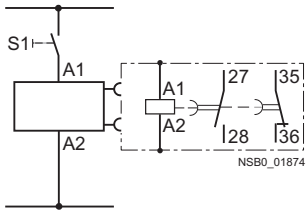
With ON-delay

3RT19 16-2F



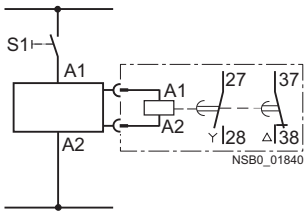
With OFF-delay
(without auxiliary voltage)

3RT19 26-2F



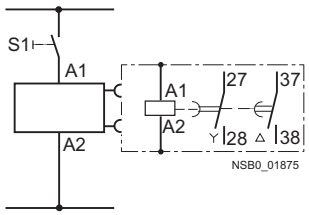
With OFF-delay
(without auxiliary voltage)

3RT19 16-2G



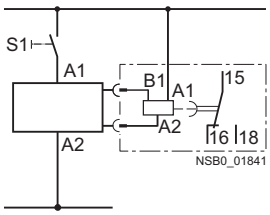
Wye-delta function

3RT19 26-2G



Wye-delta function

3RT19 16-2L



OFF-delay
(with auxiliary voltage)

Overview

Solid-state line monitoring relays provide maximum protection for mobile machines and plants or for unstable networks. Network and voltage faults can be detected early and rectified before far greater damage ensues.
Depending on the version, the relays monitor phase sequence, phase failure with and without N conductor monitoring, phase unbalance, undervoltage or overvoltage.
Phase unbalance is evaluated as the difference between the greatest and the smallest phase voltage relative to the greatest phase voltage. Undervoltage or overvoltage exists when at least one phase voltage deviates by 20 % from the set rated system voltage or the directly set limit values are overshot or undershot. The rms value of the voltage is measured.
With the 3UG46 17 or 3UG46 18 relay, a wrong direction of rotation can also be corrected automatically.

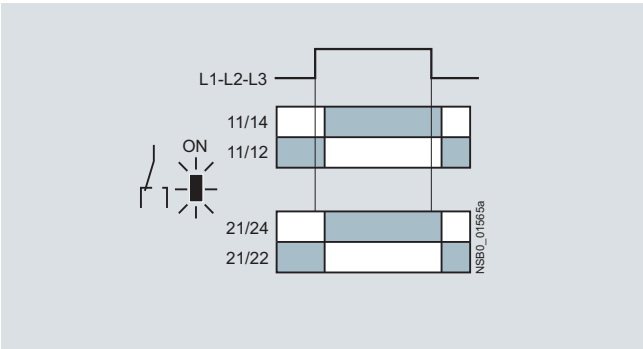
Function

3UG45 11 monitoring relays

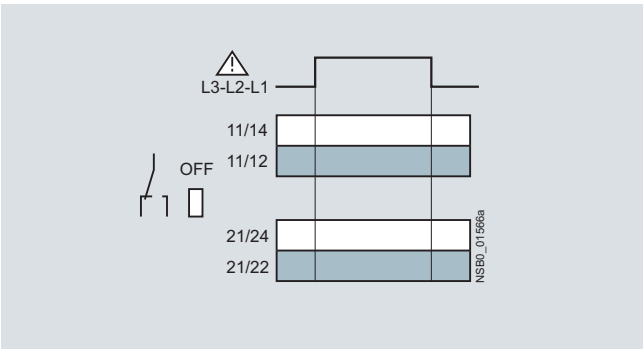
The 3UG45 11 phase sequenced relay monitors the phase sequence in a three-phase network. No adjustments are required for operation. The device has an internal power supply and works using the closed-circuit principle. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up after the delay time has elapsed and the LED is lit. If the phase sequence is wrong, the output relay remains in its rest position.

Note: When one phase fails, connected loads (motor windings, lamps, transformers, coils, etc.) create a feedback voltage at the terminal of the failed phase due to the network coupling. Because the 3UG45 11 relays are not resistant to voltage feedback, such a phase failure is not detected. Should this be required, then the 3UG45 12 monitoring relay must be used.

Correct phase sequence



Wrong phase sequence

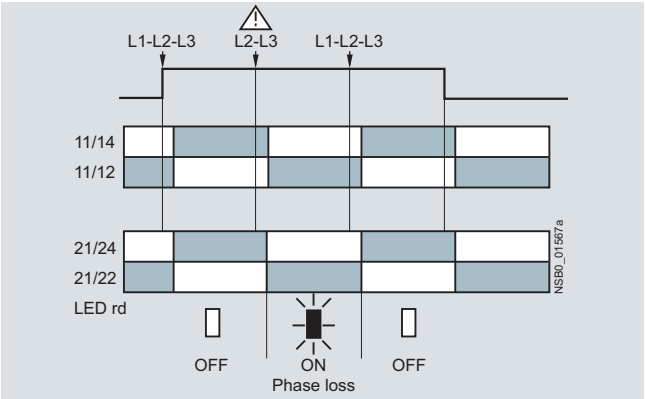


3UG45 12 monitoring relays

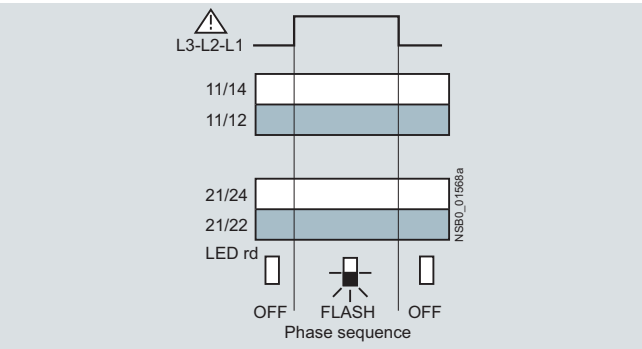
The 3UG45 12 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure and phase unbalance of 10 %. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 90 %. The device has an internal power supply and works using the closed-circuit principle. No adjustments are required. When the mains voltage is switched on, the green LED is lit. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up. If the phase sequence is wrong, the red LED flashes and the output relay remains in its rest position. If a phase fails, the red LED is permanently lit and the output relay drops.

Note: The red LED is a fault diagnostic indicator and does not show the current relay status. The 3UG45 12 monitoring relay is suitable for line frequencies of 50/60 Hz.

Phase failure



Wrong phase sequence



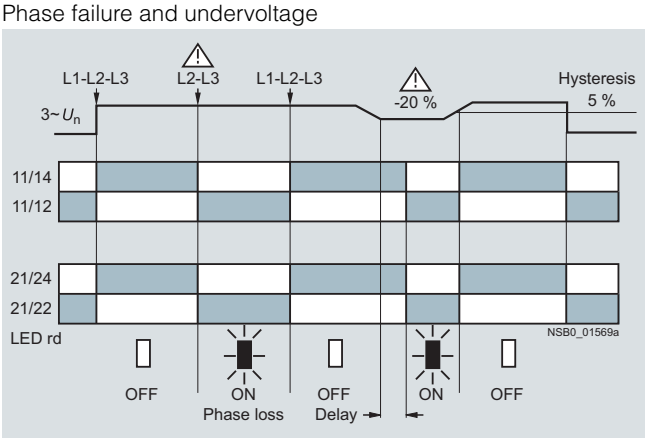
Line monitoring

3UG45 13 monitoring relays

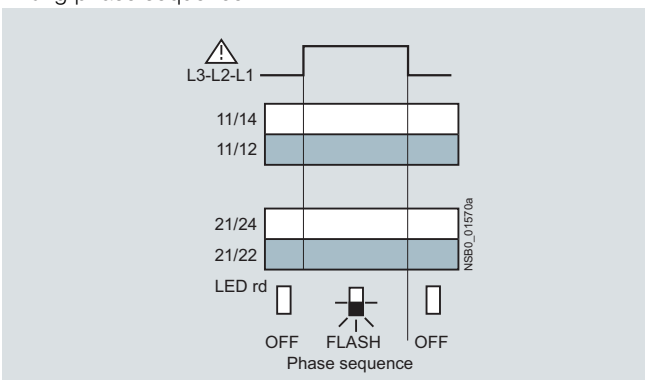
The 3UG45 13 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure, phase unbalance and undervoltage of 20 %. The device has an internal power supply and works using the closed-circuit principle. The hysteresis is 5 %. The integrated response delay time is adjustable from 0 ... 20 s and responds to undervoltage. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback up to 80 % through the load. When the mains voltage is switched on, the green LED is lit. If the phase sequence at the terminals L1-L2-L3 is correct, the output relay picks up. If the phase sequence is wrong, the red LED flashes and the output relay remains in its rest position. If a phase fails, the red LED is permanently lit and the output relay drops.

Note:
The red LED is a fault diagnostic indicator and does not show the current relay status. The 3UG45 13 monitoring relay is suitable for line frequencies of 50/60 Hz.

Phase failure and undervoltage



Wrong phase sequence



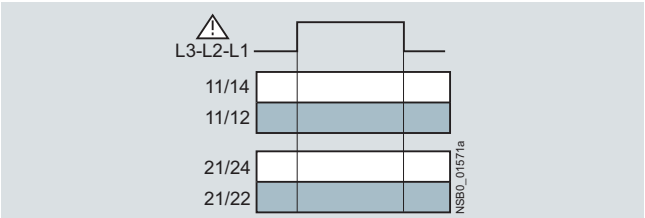
3UG46 14 monitoring relays

The 3UG46 14 line monitoring relay has a wide voltage range and an internal power supply. The device is equipped with a display and is parameterized using three buttons. It monitors three-phase networks with regard to phase unbalance from 5 ... 20 %, phase failure, undervoltage and phase sequence. The hysteresis is adjustable from 1 ... 20 V. In addition the device has a response delay and ON-delay from 0 ... 20 s in each case. The integrated response delay time responds to phase unbalance and undervoltage. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback up to 80 % through the load.

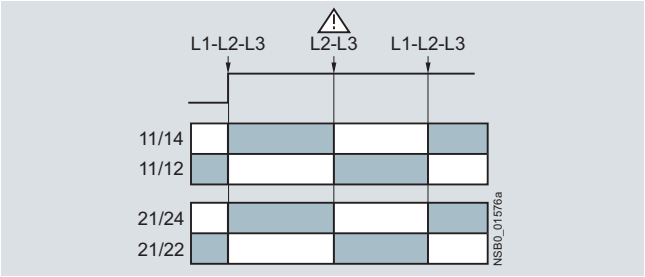
The 3UG46 14 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET.

With the closed-circuit principle selected

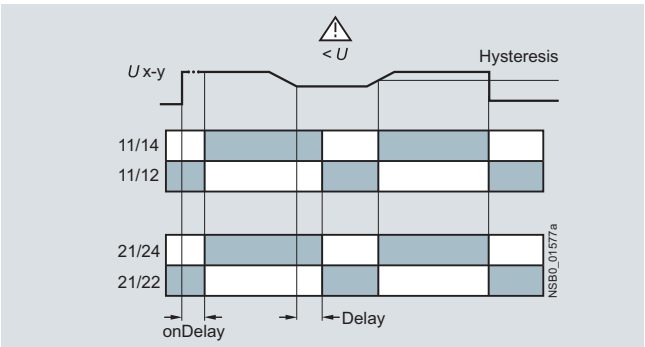
Wrong phase sequence



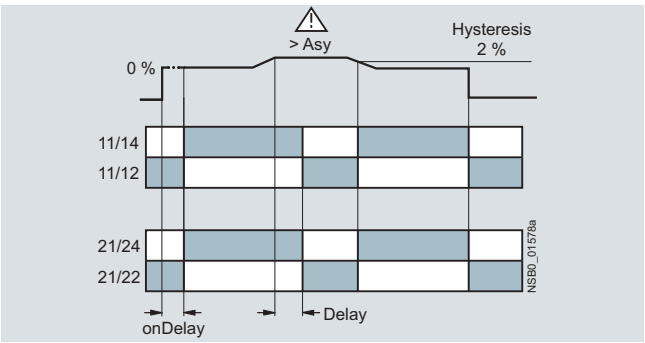
Phase failure



Undervoltage



Unbalance



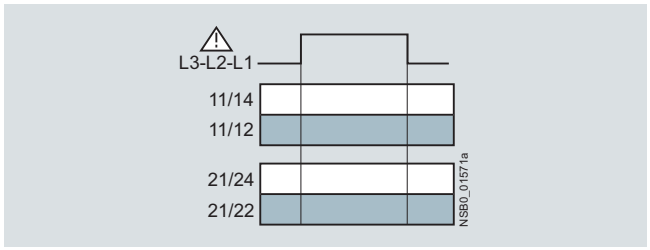
3UG46 15/3UG46 16 monitoring relays

The 3UG46 15/3UG46 16 line monitoring relay has a wide voltage range and an internal power supply. The device is equipped with a display and is parameterized using three buttons. The 3UG46 15 device monitors three-phase networks with regard to phase failure, undervoltage, overvoltage and phase sequence. The 3UG46 16 monitoring relay monitors the neutral conductor as well. The hysteresis is adjustable from 1 ... 20 V. In addition the device has two separately adjustable delay times for overvoltage and undervoltage from 0 .. 20 s in each case. If the direction is incorrect, the device switches off immediately. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 80 %.

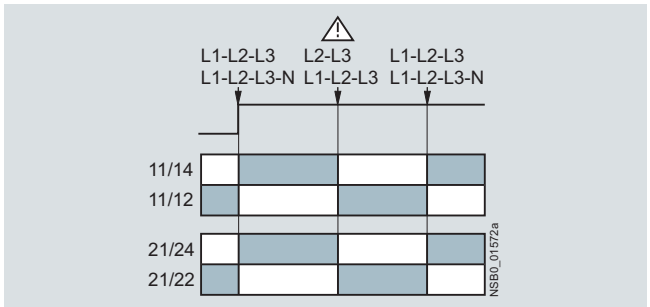
The 3UG46 15/ 3UG46 16 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET.

With the closed-circuit principle selected

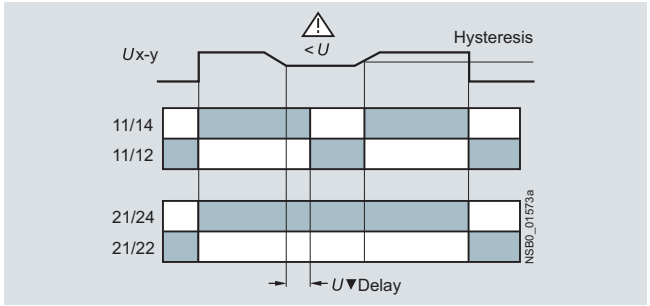
Wrong phase sequence



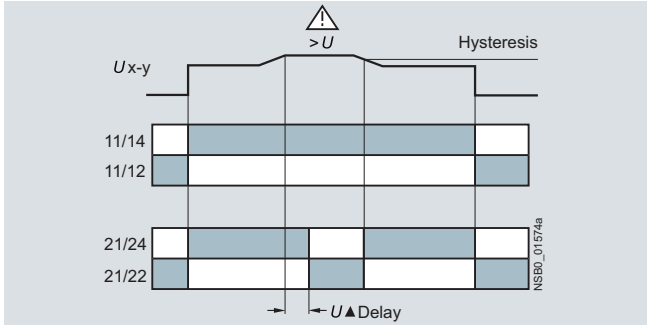
Phase failure



Undervoltage



Overvoltage

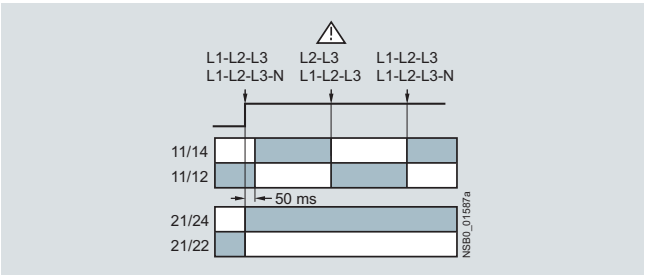


3UG46 17/3UG46 18 monitoring relays

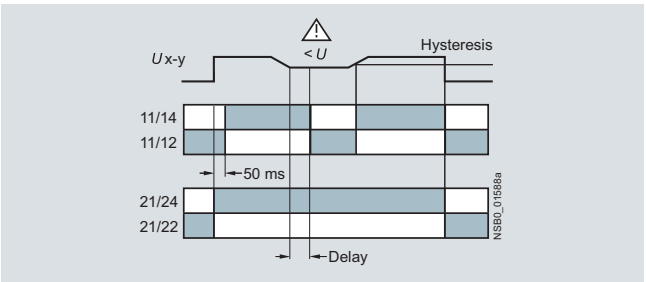
The 3UG46 17/ 3UG46 18 line monitoring relay has an internal power supply and can automatically correct a wrong direction of rotation. Thanks to a special measuring method, a phase failure is reliably detected in spite of the wide voltage range from 160 ... 690 V AC and feedback through the load of up to 80 %. The device is equipped with a display and is parameterized using three buttons. The 3UG46 17 line monitoring relay monitors three-phase networks with regard to phase sequence, phase failure, phase unbalance, undervoltage and overvoltage. The 3UG46 18 monitoring relay monitors the neutral conductor as well. The hysteresis is adjustable from 1 ... 20 V. In addition the device has delay times from 0 ... 20 s in each case for overvoltage, undervoltage, phase failure and phase unbalance. The 3UG46 17/ 3UG46 18 monitoring relay can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET. The one changeover contact is used for warning or disconnection in the event of power system faults (voltage, unbalance), the other responds only to a wrong phase sequence. In conjunction with a contactor reversing assembly it is thus possible to change the direction automatically.

With the closed-circuit principle selected

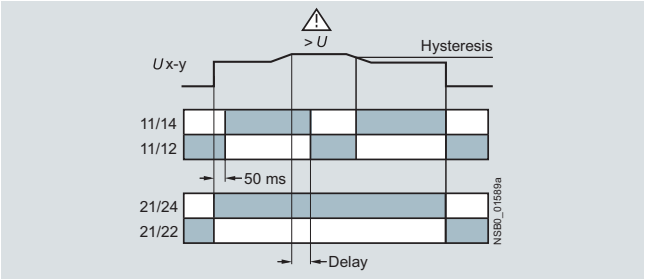
Phase failure



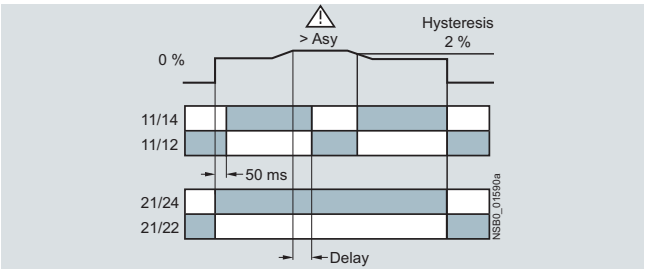
Undervoltage



Overvoltage



Unbalance



Line monitoring

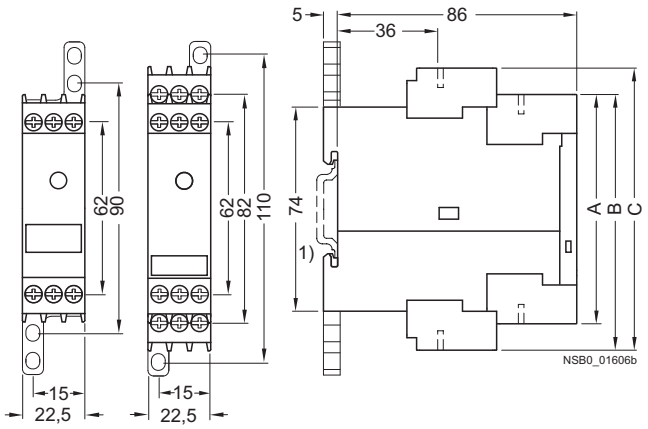
Technical specifications

Type		3UG45 11-..N20	3UG45 11-..P20	3UG45 11-..Q20	3UG45 12	3UG45 13	3UG46 14	3UG46 15 3UG46 17	3UG46 16 3UG46 18
General data									
Rated control supply voltage U_s Absolute limit values	V	160 … 260	320 … 500	420 … 690	160 … 690				90 … 400
Rated frequency	Hz	50/60							
Rated power, typical • At AC 230 V • At AC 400 V • At AC 460 V	 W/VA W/VA W/VA	 2/4 -- --	 -- 2/8 --	 -- -- 2/8	 2/2.5 2/3.5 2/4				
Width	mm	22.5							
RESET		Auto-RESET					Automatic/manual		
Principle of operation		Closed-circuit					Closed-circuit, open-circuit (3UG46 17/3UG46 18: closed-circuit)		
Availability time after application of U_s	ms	200			1.000				
Response time once a switching threshold is reached	ms	Max. 450							
Unbalance	%	--			10	20	0; 5 ... 20	3UG46 15/3UG46 16: Through threshold values 3UG46 17/3UG46 18: 0; 5 ... 20	
Adjustable tripping delay time	s	--				0.1 ... 20			
Adjustable ON-delay time	s	--					0.1 … 20	--	
Mains buffering time, minimum	ms	10			30				
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III acc. to IEC 60664	V	690							
Rated impulse withstand voltage	kV	6							
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 … +60 -40 … +85							
EMC tests[1)]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4							
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals							
Mounting position		Any							
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*							
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11							
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	M 3 (standard screwdriver, 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-type terminals**							
• Solid • Finely stranded, with end sleeves • 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)							
Measuring circuit									
Measuring range AC 50/60 Hz rms value	V	160 ... 260	320 ... 500	420 ... 690	160 ... 690				
Setting range	V					200...690	160...690		90...400
Measuring accuracy	%	--				±5			
Repeat accuracy At constant parameters	%	--				±1			
Setting accuracy		--				±10 % referred to setting	±1 V		
Accuracy of digital display		--					±1 digit		
Deviations for temperature fluctuations	%/°C	--				±0.1			
Hysteresis for voltage	V	--				5 % from setting	1 ... 20 V		
Hysteresis for unbalance	%	--					(setting - 2)	3UG46 17/3UG46 18: (setting - 2)	
Deviation for frequency fluctuation	%	--				±1			

[1)] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

		3UG45 11-..N20	3UG45 11-..P20	3UG45 11-..Q20	3UG45 12	3UG45 13	3UG46 14	3UG46 15 3UG46 17	3UG46 16 3UG46 18
Control circuit									
Load capacity of the output relay									
• Conventional thermal current I_{th}	A	5							
Rated operational current I_e at									
• AC-15 at 24 ... 400 V	A	3							
• DC-13 at 24 V	A	1							
• DC-13 at 125 V	A	0.2							
• DC-13 at 250 V	A	0.1							
Minimum contact load at 17 V DC	mA	5							
Output relay with DIAZED fuse gL/gG operational class	A	4							
Electrical endurance AC-15, 3 A, Million operating cycles		0.1							
Mechanical endurance Million operating cycles		10							

Dimensional drawings



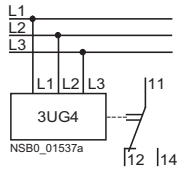
Type	3UG45 11-.A 3UG45 12-.A	3UG45 11-.B 3UG45 12-.B 3UG45 13 3UG46 14 3UG46 15 3UG46 17	3UG46 16 3UG46 18
	A	B	C
Removable terminal			
Screw-type terminal	83	92	102
Spring-loaded terminal	84	94	103

1) For standard mounting rail according to EN 60715.

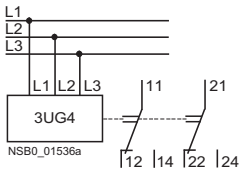
Line monitoring

Schematics

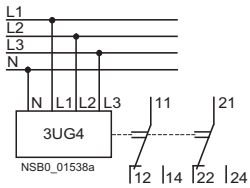
3UG45 11-.A
3UG45 12-.A



3UG45 11-.B
3UG45 12-.B
3UG45 13
3UG46 14
3UG46 15
3UG46 17



3UG46 16
3UG46 18

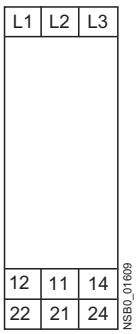


Note: It is not necessary to protect the measuring circuit for device protection. The protective device for line protection depends on the cross-section used.

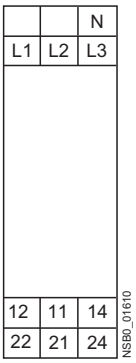
Position of the terminals

3UG45 11-.A
3UG45 12-.A

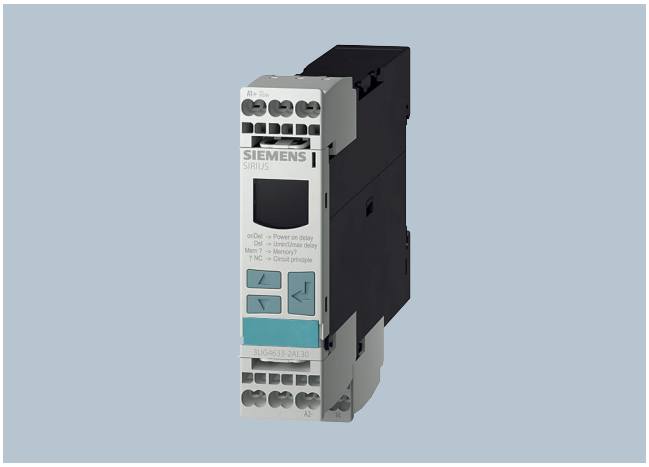
3UG45 11-.B
3UG45 12-.B
3UG45 13
3UG46 14
3UG46 15
3UG46 17



3UG46 16
3UG46 18



Overview



The relays monitor single-phase AC voltages (rms value) and DC voltages against the set threshold value for overshoot and undershoot. The devices differ with regard to their power supply (internal or external).

Function

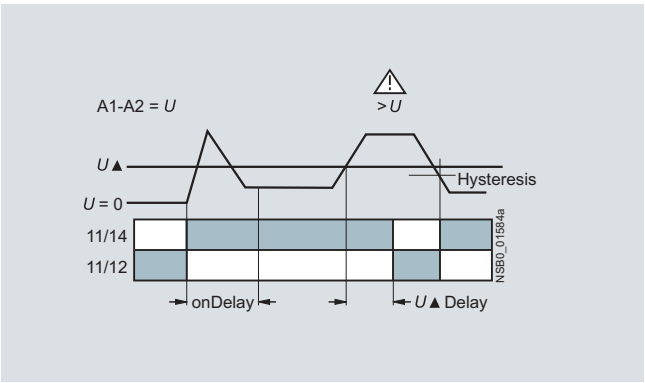
3UG46 33 monitoring relays

The 3UG46 33 voltage monitoring relay has an internal power supply and performs overshoot, undershoot or window monitoring of the voltage depending on how it is parameterized. The device is equipped with a display and is parameterized using three buttons.
The operating and measuring range extends from 17 ... 275 V AC/DC. The threshold values for overshoot or undershoot can be freely configured within this range. If one of these threshold values is reached, the output relay responds according to the set principle of operation as soon as the tripping delay time has elapsed. This delay time U_{Del} can be set from 0.1 ... 20 s like the ON-delay time on_{Del}.

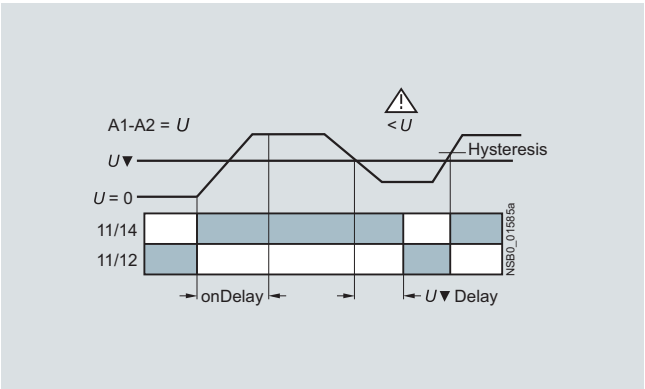
The hysteresis is adjustable from 0.1 ... 150 V. The device can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET. One output changeover contact is available as signaling contact.

With the closed-circuit principle selected

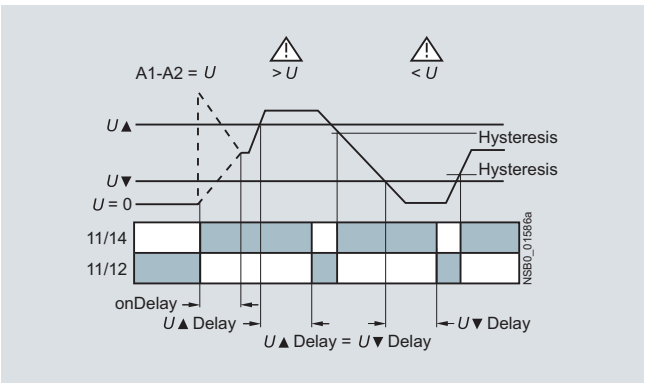
Overvoltage



Undervoltage



Window monitoring



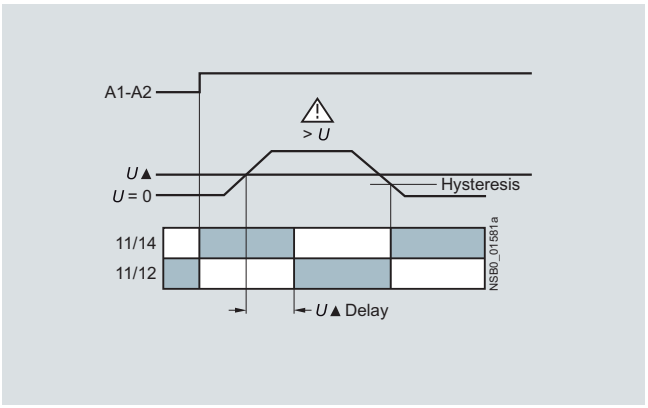
Voltage monitoring

3UG46 31/3UG46 32 monitoring relays

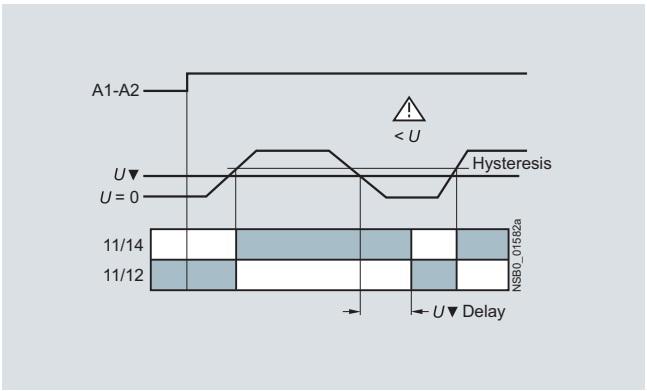
The 3UG46 31/3UG46 32 voltage monitoring relay is supplied with an auxiliary voltage of 24 V AC/DC or 24 ... 240 V AC/DC and performs overshoot, undershoot or window monitoring of the voltage depending on how it is parameterized. The device is equipped with a display and is parameterized using three buttons.
The measuring range extends from 0.1 V ... 60 V or 10 ... 600 V AC/DC. The threshold values for overshoot or undershoot can be freely configured within this range. If one of these threshold values is reached, the output relay responds according to the set principle of operation as soon as the delay time has elapsed. This delay time U_{Del} can be set from 0.1 ... 20 s.
The hysteresis can be set from 0.1 ... 30 V or 0.1 ... 300 V. The device can be operated on the basis of either the open-circuit or closed-circuit principle and with manual or auto RESET. One output changeover contact is available as signaling contact.

With the closed-circuit principle selected

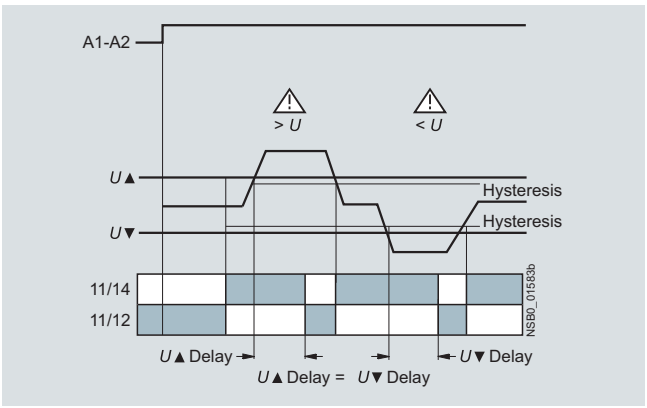
Overvoltage



Undervoltage



Window monitoring



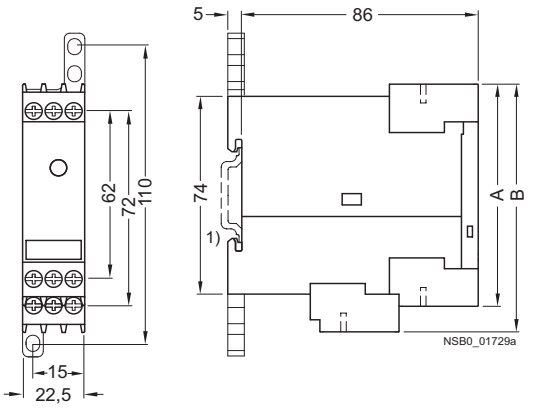
Technical specifications

		3UG46 31-.AA	3UG46 31-.AW	3UG46 32-.AA	3UG46 32-.AW	3UG46 33
General data						
Rated control supply voltage U_s	V	24 AC/DC	24...240 AC/DC	24 AC/DC	24...240 AC/DC	17 ... 275[1] AC/DC
Rated frequency for AC	Hz	50/60				40 ... 500
Operating range	V	20.4 ... 27.6	20.4 ... 264	20.4 ... 27.6	20.4 ... 264	17...275
Rated power in W/VA	VA	2/4				
Width	mm	22.5				
RESET		Automatic/manual				
Availability time after application of U_s	ms	1000				
Response time once a switching threshold is reached	ms	Max. 450				
Adjustable tripping delay time	s	0.1 … 20				
Adjustable ON-delay time	s	--				0.1 ... 20
Mains buffering time, minimum	ms	10				
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III acc. to IEC 60664	V	690				
Rated impulse withstand voltage U_{imp}	kV	6				
Protective separation acc. to IEC 60947-1, Annex N	V	300				
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 … +60 -40 … +85				
EMC tests[2]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4				
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals				
Mounting position		Any				
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*				
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11				
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	M 3 (standard screwdriver, 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-type terminals**				
• Solid • Finely stranded, with end sleeves • 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)				
Measuring circuit						
Permissible measuring range single-phase AC/DC voltage	V	0.1 … 68		10 … 650		17 … 275
Setting range single-phase voltage	V	0.1 ... 60		10 ... 600		17 ... 275
Measuring frequency AC/DC	Hz	40 ... 500				40 ... 500
Measuring accuracy	%	5				
Repeat accuracy at constant parameters	%	1				
Accuracy of digital display		±1 digit				
Deviations for temperature fluctuations	%/°C	±0.1				
Hysteresis for single-phase voltage	V	0.1 ... 30		0.1 ... 300		0.1 ... 150
Control circuit						
Load capacity of the output relay • Conventional thermal current I_{th}	 A	 5				
Rated operational current I_e • AC-15 at 24 ... 400 V • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V	 A A A A	 3 1 0.2 0.1				
Minimum contact load at 17 V DC	mA	5				
Output relay with DIAZED fuse gL/gG operational class	A	4				
Electrical endurance AC-15, 3 A, million operating cycles		0.1				
Mechanical endurance million operating cycles		10				

1) Absolute limit values.
2) Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

Voltage monitoring

Dimensional drawings

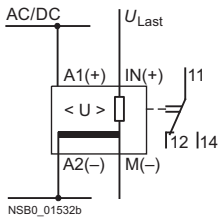


Type	3UG46 31 3UG46 32 3UG46 33	
	A	B
Removable terminal		
Screw-type terminal	83	92
Spring-loaded terminal	84	94

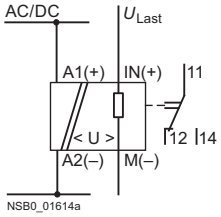
1) For standard mounting rail according to EN 60715.

Schematics

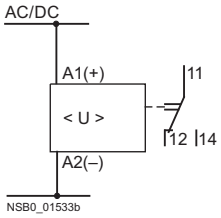
3UG46 31-.AA30
3UG46 32-.AA30



3UG46 31-.AW30
3UG46 32-.AW30



3UG46 33

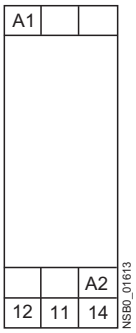


Note: It is not necessary to protect the measuring circuit for device protection. The protective device for line protection depends on the cross-section used.

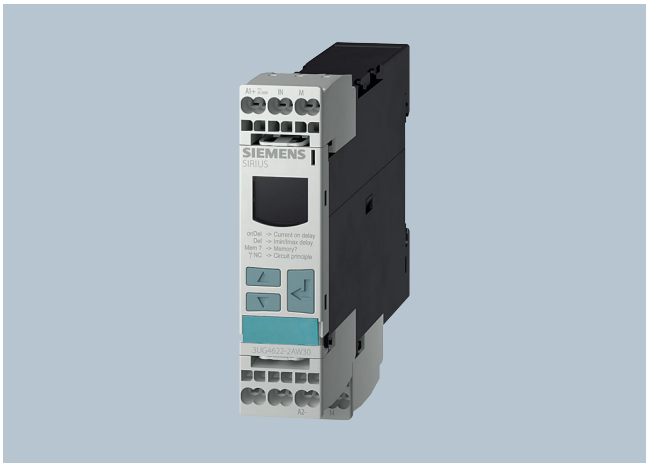
Position of the terminals

3UG46 31
3UG46 32

3UG46 33



Overview



The relays monitor single-phase AC currents (rms value) and DC currents against the set threshold value for overshoot and undershoot. They differ with regard to their measuring ranges and supply voltage types.

Function

3UG46 21/3UG46 22 monitoring relays

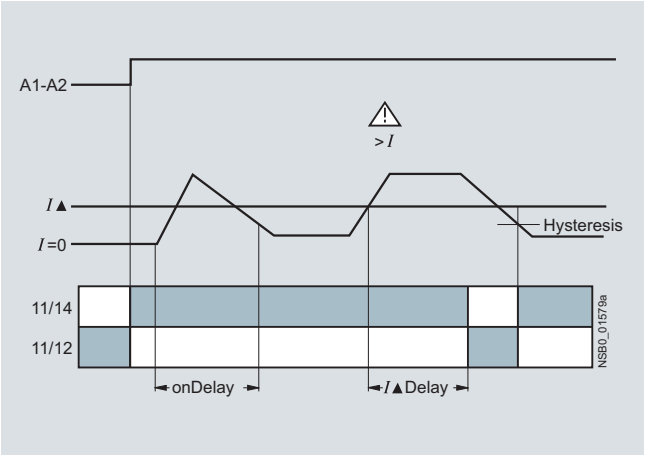
The 3UG46 21/3UG46 22 current monitoring relay is supplied with an auxiliary voltage of 24 V AC/DC or 24 ... 240 V AC/DC and performs overshoot, undershoot or window monitoring of the current depending on how it is parameterized. The device is equipped with a display and is parameterized using three buttons.

The measuring range extends from 3 ... 500 mA or 0.05 ... 10 A. The rms value of the current is measured. The threshold values for overshoot or undershoot can be freely configured within this range. If one of these threshold values is reached, the output relay responds according to the set principle of operation as soon as the tripping delay time I_{Del} has elapsed. This time and the ON-delay time on_{Del} are adjustable from 0.1 ... 20 s.

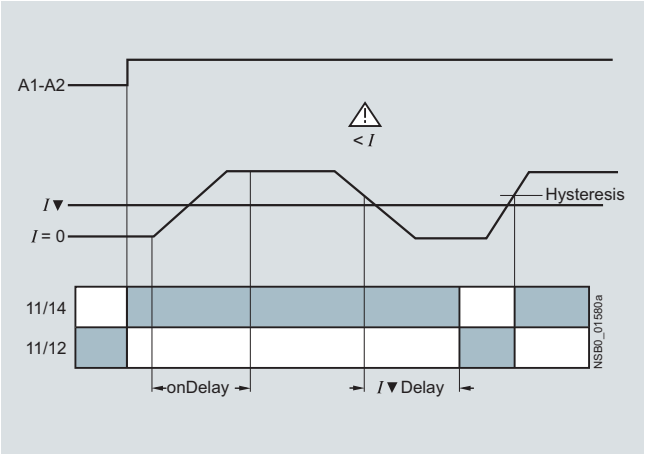
The hysteresis is adjustable from 0.1 ... 250 mA or 0.01 ... 5 A. The device can be operated with manual or auto RESET and on the basis of either the open-circuit or closed-circuit principle. Following options are available: Response of the output relay when the supply voltage U_s = ON is applied or not until the lower measurement range limit of the measuring current (I > 3 mA/ 50 mA) is reached. One output changeover contact is available as signaling contact.

With the closed-circuit principle selected upon application of the supply voltage

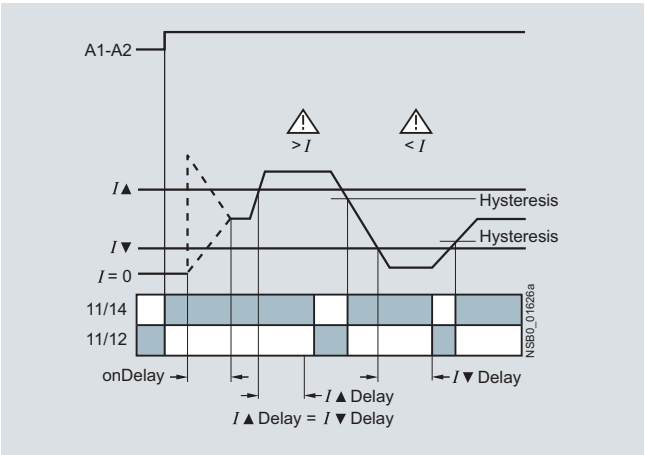
Current overshoot



Current undershoot



Window monitoring



Technical specifications

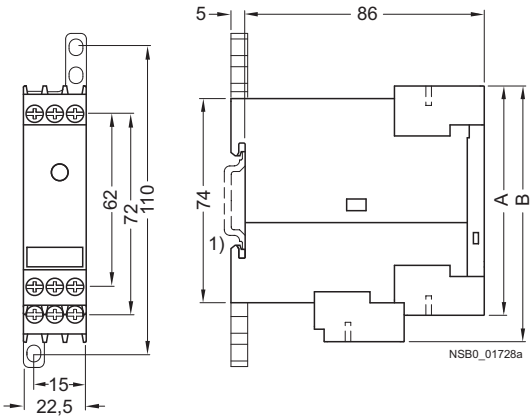
		3UG46 21-.AA	3UG46 21-.AW	3UG46 22-.AA	3UG46 22-.AW
General data					
Rated control supply voltage U_s	V	24	24 … 240	24	24 … 240
Rated frequency	Hz	50/60			
Operating range	V	20.4 ... 26.4	20.4 ... 264	20.4 ... 26.4	20.4 ... 264
Rated power	W/VA	2/4			
Width	mm	22.5			
RESET		Automatic/manual			
Availability time after application of U_s	ms	1000			
Response time once a switching threshold is reached	ms	Max. 450			
Adjustable tripping delay time/ON-delay time	s	0.1 … 20			
Mains buffering time, minimum	ms	10			
Rated insulation voltage U_i Degree of pollution 3; overvoltage category III acc. to IEC 60664	V	690			
Rated impulse withstand voltage U_{imp}	kV	6			
Protective separation acc. to IEC 60947-1, Annex N	V	300			
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 … +60 -40 … +85			
EMC tests[1]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4			
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals			
Mounting position		Any			
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*			
Shock resistance acc. to IEC 60068-2-27 for half-sine shock type	g/ms	15/11			
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	M 3 (standard screwdriver, 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-type terminals**			
• Solid • Finely stranded, with end sleeves • 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)			
Measuring circuit					
Measuring range for single-phase AC/DC current	A	0.003 … 0.6		0.05 … 15	
Setting range for single-phase current	A	0.003 ... 0.5		0.05 ... 10	
Load supply voltage	V	24	Max. 300[2] Max. 500[3]	24	Max. 300[2] Max. 500[3]
Measuring accuracy	%	5			
Repeat accuracy at constant parameters	%	1			
Accuracy of digital display		±1 digit			
Deviations for temperature fluctuations	%/°C	±0.1			
Hysteresis for single-phase current		0.1 ... 250 mA		0.01 ... 5 A	
Permissible overcurrent, continuous	A	0.6		15	
Permissible overcurrent, < 1 s	A	5		50	
Protection against destruction, DIAZED gL/gG	A	2		16	
Measuring circuit internal resistance, shunt	mΩ	500		5	
Control circuit					
Load capacity of the output relay • Conventional thermal current I_{th}	 A	 5			
Rated operational current I_e • AC-15 at 24 ... 400 V • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V	 A A A A	 3 1 0.2 0.1			
Minimum contact load at 17 V DC	mA	5			
Output relay with DIAZED fuse gL/gG	A	4			
Electrical endurance AC-15, 3 A, million operating cycles		0.1			
Endurance with contactor relay million operating cycles		10			

[1] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

[2] With protective separation.

[3] With simple separation.

Dimensional drawings



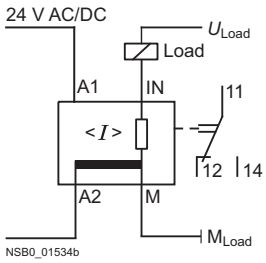
Type	3UG46 21 3UG46 22 A	B
Removable terminal		
Screw-type terminal	83	92
Spring-loaded terminal	84	94

1) For standard mounting rail according to EN 60715.

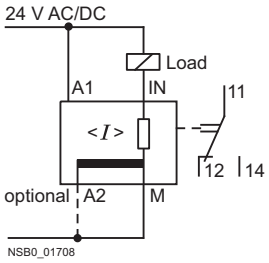
Schematics

3UG46 21-.AA30
3UG46 22-.AA30

Operation with separate control circuit and load circuit

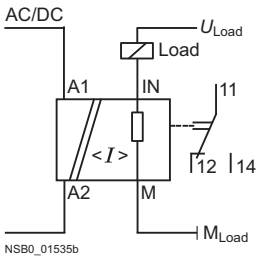


Operation with joint control circuit and load circuit

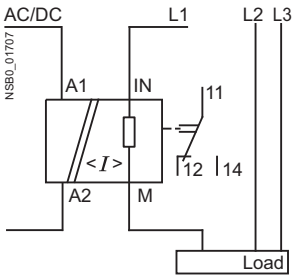


3UG46 21-.AW30
3UG46 22-.AW30

Single-phase operation

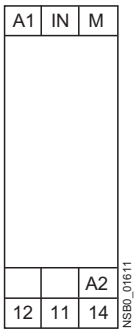


3-phase operation



Position of the terminals

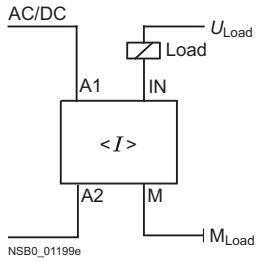
3UG46 21
3UG46 22

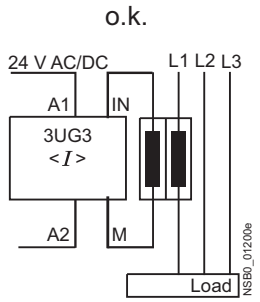


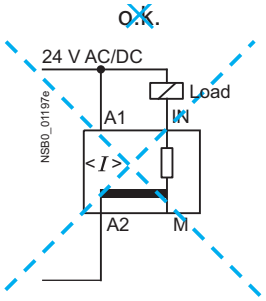
Current monitoring

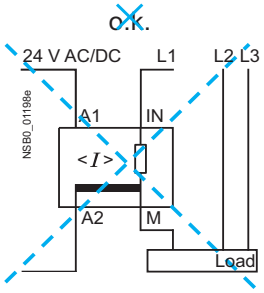
Wiring diagram for 24 V AC/DC (only 3UG46 2.-.AA30)

From the following circuit diagrams it is clear that loads in measuring circuits have to be in the current flow upstream from the monitoring relay. Otherwise, the monitoring relay could be destroyed and the short-circuit current could cause damage to the plant.









Configuring note:

A2 and M are electrically connected internally!

For applications in which the load to be monitored and the monitoring relay are supplied from the same power supply, there is no need for connection A2!

The load current must always flow through M or the monitoring relay may be destroyed!

Overview

The 3UG46 41 power factor and active current monitoring device enables the load monitoring of motors.

Whereas power factor monitoring is used above all for monitoring no-load operation, the active current monitoring option can be used to observe and evaluate the load factor over the entire torque range.

Function

3UG46 41 monitoring relays

The 3UG46 41 monitoring relay is self-powered and serves the single-phase monitoring of the power factor or performs overshoot, undershoot or window monitoring of the active current depending on how it is parameterized.

The load to be monitored is connected in front of the IN terminal. The load current flows over the IN and Ly/N terminals. The setting range for the power factor is 0.1 ... 0.99 and for the active current I_{res} 0.2 ... 10 A.

If the supply voltage is switched on and no load current is flowing, the display indicates I < 0.2 and a symbol for overshoot, undershoot or window monitoring.

If the motor is now switched on and the current exceeds 0.2 A, the set ON-delay time begins. During this time, an undershooting or overshooting of the set limit values will not lead to a relay response of the changeover contact.

If the operational flowing active current and/or the power factor value falls below or exceeds the respective set threshold value, the spike delay begins. When this time has expired, the relay changes its switch position. The relevant measured variables for overshooting and undershooting in the display flashes. If the monitoring of active current undershooting is deactivated (I_{res}▼= OFF) and the load current drops below the lower measurement range threshold (0.2 A), then the CO contacts remain unchanged. If a threshold value is set for the monitoring of active current undershooting, then undershooting of the measurement range threshold (0.2 A) will result in a response of the CO contacts.

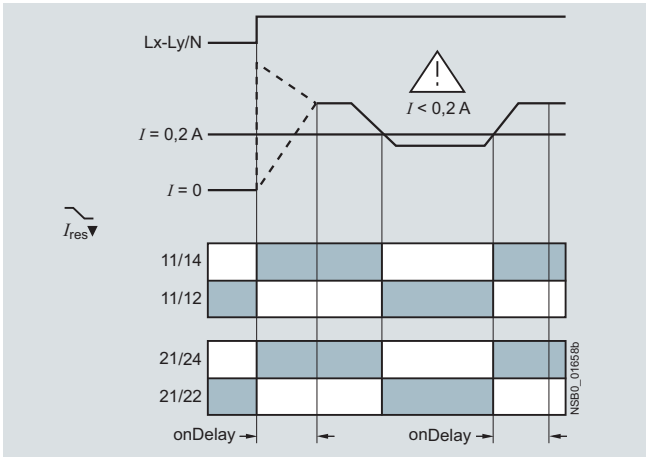
The relay operates either according to the open-circuit or closed-circuit principle.

If the device is set to Auto-RESET (Memory = No), depending on the set principle of operation, the switching relay returns to its initial state and the flashing ends when the hysteresis threshold is reached.

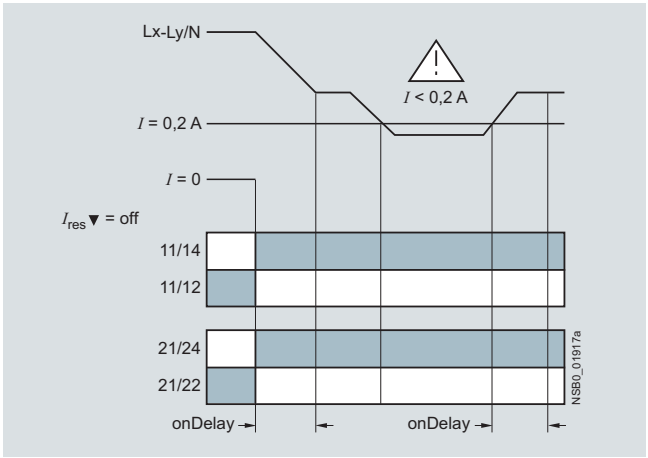
If manual reset is selected in the menu (Memory = Yes), the switching relay remains in its current switching state and the current measured value and the symbol for undershooting and overshooting continues to flash, even when the measured variable reaches a permissible value again. This stored fault status can be reset by pressing the UP▲ and DOWN▼ key simultaneously for 2 seconds, or by switching the supply voltage off and back on again.

With the closed-circuit principle selected

Behavior upon undershooting of the measurement range limit with activated monitoring of I_{res}▼

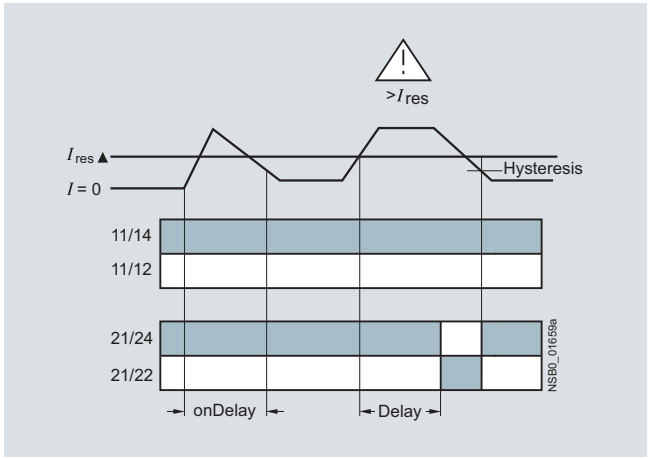


Behavior upon undershooting of the measurement range limit with deactivated monitoring of active current undershooting

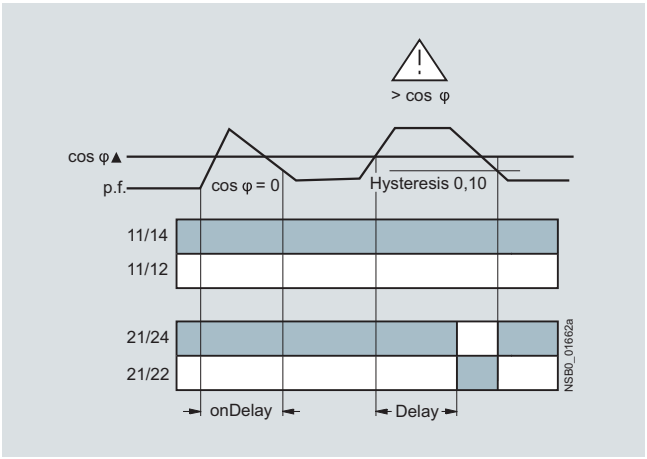


Power factor and active current monitoring

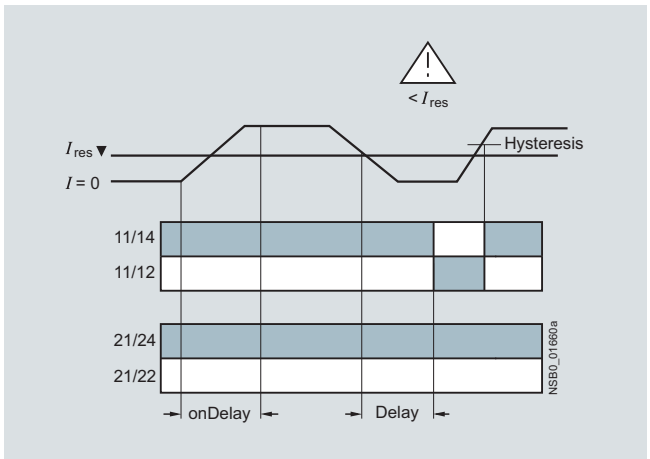
Overshooting of active current



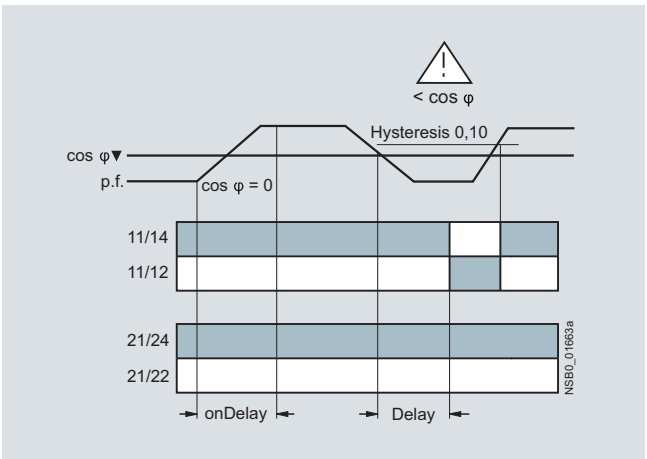
Overshooting of power factor



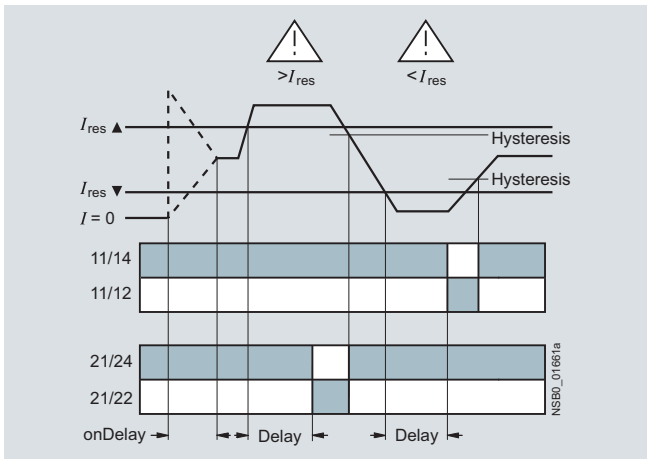
Undershooting of active current



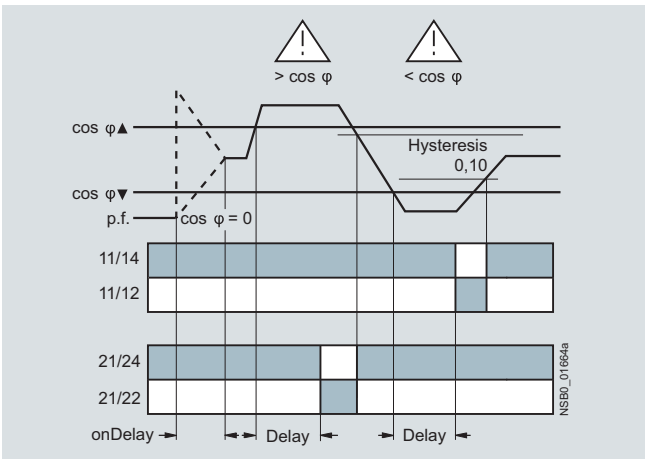
Undershooting of power factor



Window monitoring of active current



Window monitoring of power factor



Legend

cos φ: p. f.

Technical specifications

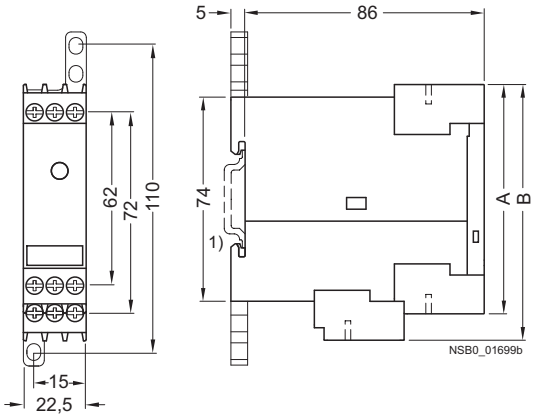
Type		3UG46 41
General data		
Rated control supply voltage U_s Absolute limit values	V	90 … 690
Rated frequency	Hz	50/60
Rated power, typical • At 200 V AC • At 400 V AC • At 460 V AC	 VA VA VA	 2.0 2.7 3.1
Width	mm	22.5
RESET		Automatic/manual
Principle of operation		Closed-circuit principle, open-circuit principle
Availability time after application of U_s	ms	1000
Response time once a switching threshold is reached	ms	Max. 450
Adjustable tripping delay time	s	0.1 ... 20
Adjustable ON-delay time	s	0 ... 99
Mains buffering time, minimum	ms	10
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III acc. to IEC 60664	V	690
Rated impulse withstand voltage	kV	6
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 … +60 -40 … +85
EMC tests[1]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals
Mounting position		Any
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11
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	M 3 (standard screwdriver, 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-type terminals**
• Solid • Finely stranded, with end sleeves • 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)
Measuring circuit		
Measurable active current I_{res}	A	0.2 ... 10
Max. permissible load current	A	10
Peak current < 1 s	A	50
Adjustable response value **Phase displacement angle**		0.1 ... 0.99
DIAZED protection, gL/gG operational class	A	16
Measuring accuracy	%	10
Repeat accuracy at constant parameters	%	1
Accuracy of digital display		± 1 digit
Deviations for temperature fluctuations	%/°C	±0.1
Hysteresis Phase angle		0.10
Hysteresis Active current monitoring	A	0.1 ... 2.0

[1] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

Power factor and active current monitoring

Type		3UG46 41
Control circuit		
Number of CO contacts for auxiliary contacts		2
Load capacity of the output relay • Conventional thermal current I_{th}	A	5
Rated operational current I_e at • AC-15 at 24 ... 400 V • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V	 A A A A	 3 1 0.2 0.1
Minimum contact load at 17 V DC	mA	5
Output relay with DIAZED fuse gL/gG operational class	A	4
Electrical endurance AC-15	Million operating cycles	0.1
Mechanical endurance	Million operating cycles	10

Dimensional drawings

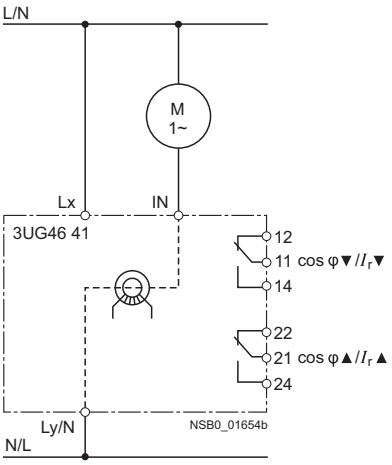


Type	3UG46 41	
	A	B
Removable terminal		
Screw-type terminal	83	92
Spring-loaded terminal	84	94

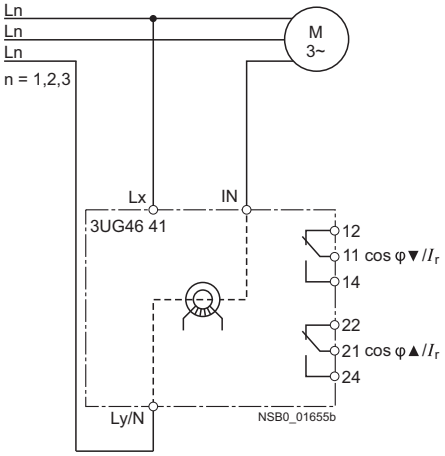
1) For standard mounting rail according to EN 60715.

Schematics

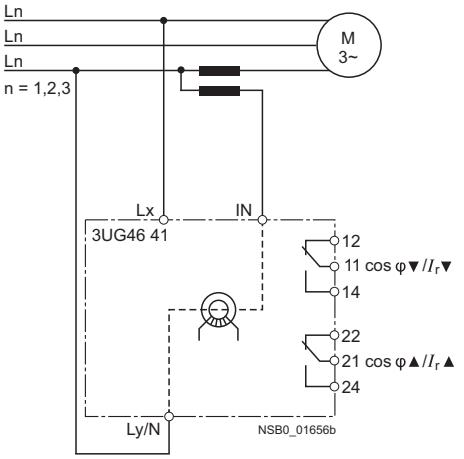
Single-phase motors



3-phase motors



3-phase motors with transformers for currents > 10 A



Legend

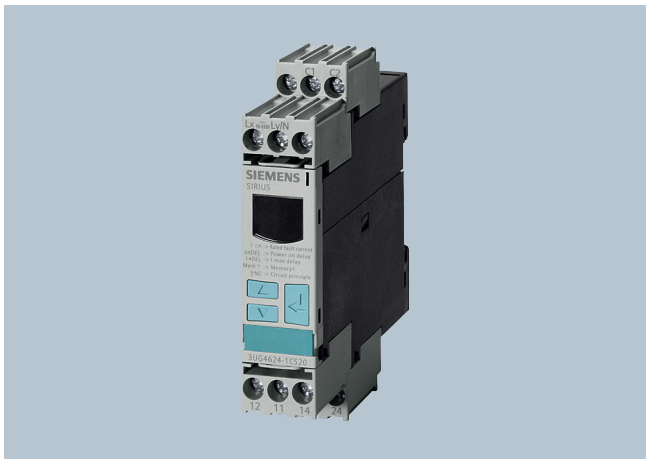
cos φ: p. f.

Position of the terminals

3UG46 41

Residual current monitoring: Residual-current monitoring relays

Overview



The 3UG46 24 residual current monitoring relay is used together with the 3UL22 summation current transformer for plant monitoring.

Function

3UG46 24 monitoring relays

The main conductor and any neutral conductor to which a load is connected, are routed through the opening of the annular strip-wound core of a summation current transformer. A secondary winding is placed around this annular strip-wound core to which the monitoring relay is connected.

If operation of a plant is fault-free, the sum of the inflowing and outward currents equals zero. In this case, no voltage is induced in the secondary winding of the summation current transformer.

However, if an insulation fault occurs downstream of the residual current operated circuit breaker, the sum of the inflowing currents is greater than that of the outward currents.

The differential current - the residual current - induces a secondary current in the secondary winding of the transformer. This current is evaluated in the monitoring relay and is used on the one hand to display the actual residual current and on the other, to switch the relay if the set warning or tripping threshold is overshot.

If the measured residual current exceeds the set warning value, the associated changeover contact instantly changes the switching state and an indication appears on the display. If the measured residual current exceeds the set tripping value, the set delay time begins and the associated relay symbol flashes. On expiry of this time, the associated changeover contact changes the switching state.

ON-delay time for motor start

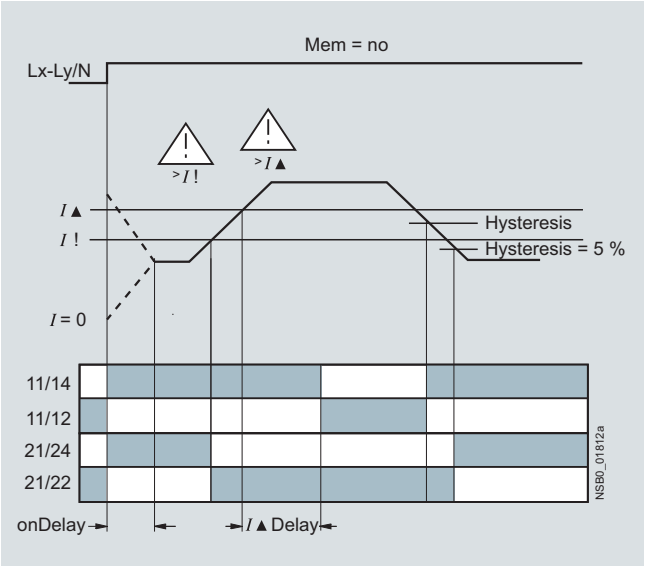
To be able to start a motor, once the auxiliary voltage has been applied for an adjustable ON-delay time, and depending on whether the open-circuit or closed-circuit principle is selected, the output relay switches to the GO state.

The changeover contacts do not react if the set threshold value is overshot during this period.

With the closed-circuit principle selected

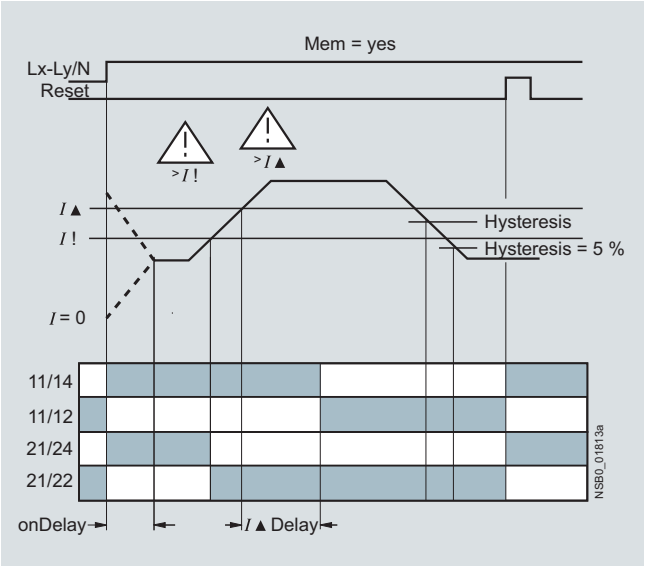
Residual current monitoring with Auto-RESET (Memory = no)

If the device is set to Auto-RESET (Memory = No), the relay switches for the tripping value once the value falls below the set hysteresis threshold and the display stops flashing. The associated relay changes its switching state if the value falls below the fixed hysteresis value of 5 % of the warning value. Any overshoots are therefore not stored.



Residual current monitoring with Manual-RESET (Memory = yes)

If Manual-RESET is selected in the menu, the output relay remains in its current switching state and the current measured value and the symbol for overshooting continues to flash, even when the measured residual current returns to a permissible value. This stored fault status can be reset by pressing the UP▲ and DOWN▼ key simultaneously for > 2 seconds, or by switching the supply voltage off and back on again.



Note:

The neutral conductor must not be grounded downstream of the summation current transformer as this may impair the function of the residual current monitoring device.

Residual current monitoring: Residual-current monitoring relays

Technical specifications

Type		3UG46 24
General data		
Rated control supply voltage U_s Absolute limit values	V	90 … 690
Rated frequency	Hz	50/60
Rated power, typical • At 90 V AC • At 230 V AC • At 400 V AC • At 460 V AC • At 690 V AC	 VA VA VA VA VA	 2.8 2.4 3.1 3.2 4.7
Width	mm	22.5
RESET		Automatic/manual
Principle of operation		Closed-circuit principle, open-circuit principle
Availability time after application of U_s	ms	1000
Response time once a switching threshold is reached	ms	Max. 300
Adjustable delay time	s	0.1... 20
Mains buffering time, minimum	ms	10
Rated insulation voltage U_i Degree of pollution 3 Overvoltage category III acc. to IEC 60664	V	690
Rated impulse withstand voltage	kV	6
Permissible ambient temperature • During operation • During storage	 °C °C	 -25 … +60 -40 … +85
EMC tests[1]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals
Mounting position		Any
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11
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-type terminals**
• Solid • Finely stranded, with end sleeves • 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)
Measuring circuit		
Measurable residual current I_{res}	A	10 ... 120 % $I_{\Delta n}$ ($I_{\Delta n}$: rated residual current of the transformer)
Adjustable response value • Residual current • Warning	 	 10 ... 100 % $I_{\Delta n}$ 10 ... 100 % $I_{\Delta n}$
Measuring accuracy[3]	%	±5
Repeat accuracy at constant parameters	%	±1
Accuracy of digital display		± 1 digit
Deviations for temperature changes	%/°C	±0.1
Hysteresis for residual current		LSB[2] up to 50 % $I_{\Delta n}$
Hysteresis for warning threshold	A	5 % $I_{\Delta n}$

[1] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must take suitable precautions.

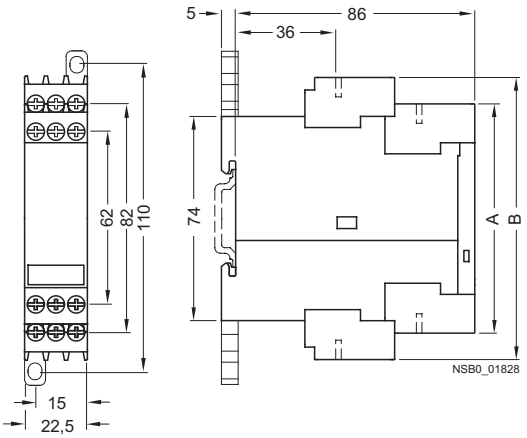
[2] LSB: Smallest adjustable value, transformer-dependent, ≤ 1 % of $I_{\Delta n}$.

[3] The measuring accuracy of the evaluation system has higher tolerances when combined with the 3UL2 current transformer.

Type		3UG46 24
Control circuit		
Number of CO contacts for auxiliary contacts		2
Load capacity of the output relay Conventional thermal current I_{th}	A	5
Rated operational current I_e at • AC-15 at 24 ... 400 V • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V	 A A A A	 3 1 0.2 0.1
Minimum contact load at 17 V DC	mA	5
Output relay with DIAZED fuse gL/gG operational class	A	4
Electrical endurance AC-15	Million operating cycles	0.1
Mechanical endurance	Million operating cycles	10

Dimensional drawings

3UG46 24



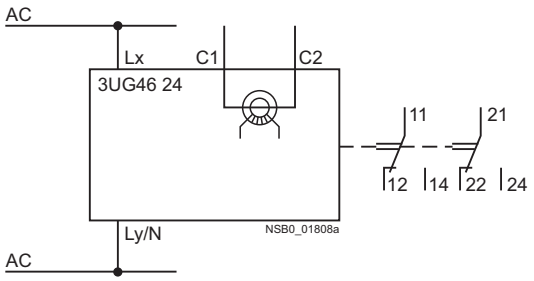
Type	3UG46 24	
	A	B
Removable terminal		
Screw-type terminal	83	102
Spring-loaded terminal	84	103

1) For standard mounting rail according to EN 60715.

Residual current monitoring: Residual-current monitoring relays

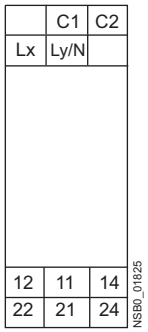
Schematics

3UG46 24

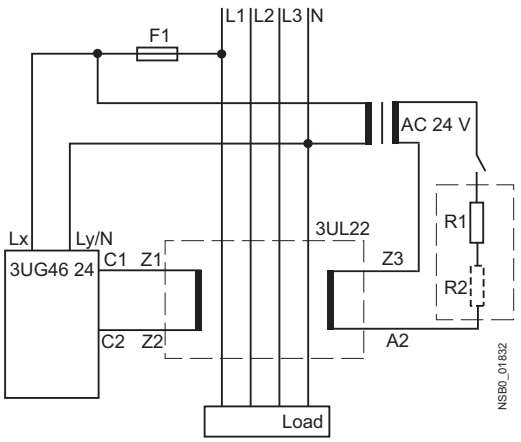


Note: It is not necessary to protect the measuring circuit for device protection. The protective device for line protection depends on the cross-section used.

Position of the terminals

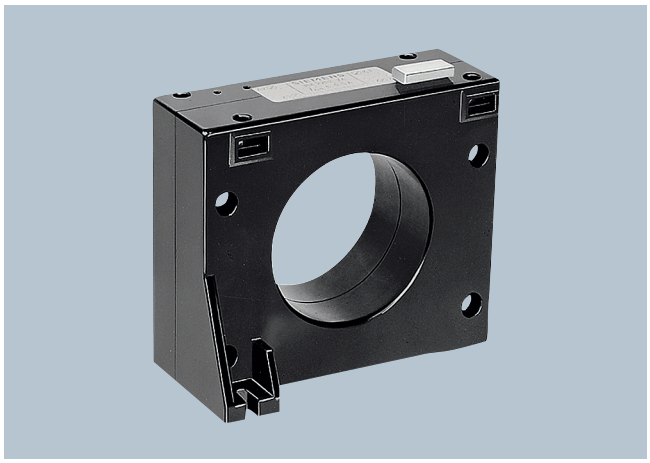


Circuit example



Type	$I_{\Delta n}$	R1	R2
3UL22 0.-1A	0,3 A	220 Ω ≥ 3 W	--
3UL22 0.-2A	0,5 A		
3UL22 0.-3A	1 A		
3UL22 0.-1B	6 A	22 Ω ≥ 6 W	22 Ω ≥ 6 W
3UL22 0.-2B	10 A		
3UL22 0.-3B	16 A		
3UL22 0.-4B	25 A		
3UL22 0.-5B	40 A		

Overview



The 3UL22 summation current transformers detect fault currents in machines and plants. Together with the 3UG46 24 residual current monitoring relay or the SIMOCODE 3UF motor management and control device they enable residual-current and ground-fault monitoring.

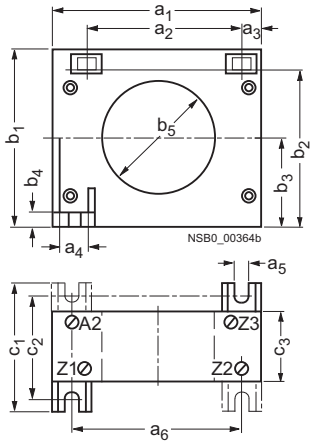
Technical specifications

Summation current transformers

Type		3UL22 01	3UL22 02	3UL22 03
Rated insulation voltage U_i	AC 50/60 Hz	690 V		1000 V
Rated residual current $I_{\Delta n}$ Without response delay	A	0.3 ... 1	0.3 ... 40	0.3 ... 40
Permissible ambient temperature	°C	-20 ... +70		
Feed-through openings	mm	40	65	120
For Protodur cables Can be fed through	Max. mm²	4 x 95	4 x 240	8 x 300

Dimensional drawings

3UL22 summation current transformer



Type	a_1	a_2	a_3	a_4	a_5	a_6	b_1	b_2	b_3	b_4	b_5	c_1	c_2	c_3
3UL22 01	100	75	10	15	for M4	80	85	72.5	42.5	7.5	40	65	50	40
3UL22 02	125	95	10	15	for M4	100	110	97.5	55	7.5	65	70	60	45
3UL22 03	200	165	20	20	for M4	170	200	100	100	10	120	85	70	55

Insulation monitoring
For ungrounded AC networks

Overview

Relay for monitoring the insulation resistance between the ungrounded single or three-phase AC supply and a protective conductor

- Measuring principle with superimposed DC voltage
- Two selectable measuring ranges of 1 ... 110 kΩ
- Stepless setting within the measuring range
- Selectable:
  - Auto reset function with fixed hysteresis or
  - Storage of the tripping operation
- Test function with test button and terminal connections on the front
- Switching output: 1 CO contact
- Insulation fault indication with a red LED
- Supply voltage indication with a green LED
- Electro-magnetically compatible according to IEC 61000-6-2 and IEC 61000-6-4

Function

The monitoring relay measures the insulation resistance between the ungrounded AC supply and an associated protective conductor.

A superposed DC measuring voltage is used to perform the measurement.

The monitoring relay is divided into two ranges for an insulation resistance range from 1 ... 100 kΩ. A range switch on the front can be used to switch over between a 1 ... 11 kΩ range and a 10 ... 110 kΩ range. Within the selected range, the monitoring relay can be steplessly adapted to the respective insulation conditions.

If the insulation resistance undershoots the set response value, the output relay is excited and the red LED (fault indication) is lit.

If the insulation resistance exceeds 1.6 times (corresponding to 60 % hysteresis) the set response value, the output relay will return to the rest position.

Test functions

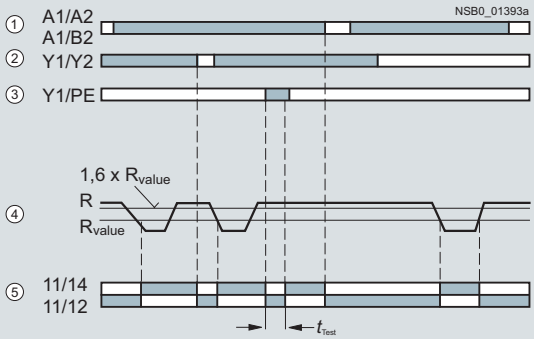
The "Test" button on the front can be used to simulate a ground fault. If the "Test" button is pressed for at least 300 ms, the output relay is energized and the fault LED lights up. An external test button, which is connected to PE, can also be connected to terminal Y1. The function is activated by closing (> 300 ms).

Fault storage and RESET

If terminals Y1 and Y2 are jumpered, the monitoring relay is set to fault storage mode. If the set insulation resistance is undershot, the output relay is excited and remains tripped even after the insulation resistance rises above 1.6 times the set value again. Fault storage can be reset by briefly pressing the RESET button, briefly jumpering (< 300 ms) the Y1 and PE/ground terminals or by switching off and on the supply voltage.

Note:

The monitoring relay is designed for AC voltage systems. Series-connected rectifiers must be electrically isolated from the measuring relay.



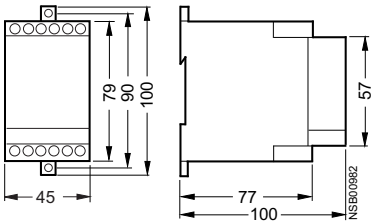
① = Supply voltage
A1-B2/A1-A2 for 115V/230V AC
A1-A2 for 24 … 240V AC/DC
② = Remote connection-Save-Reset
③ = Button on the front Test/Reset
④ = Insulation resistance R of the network
⑤ = Normally open contact

t_{Test} = > approx. 300 ms

Technical specifications

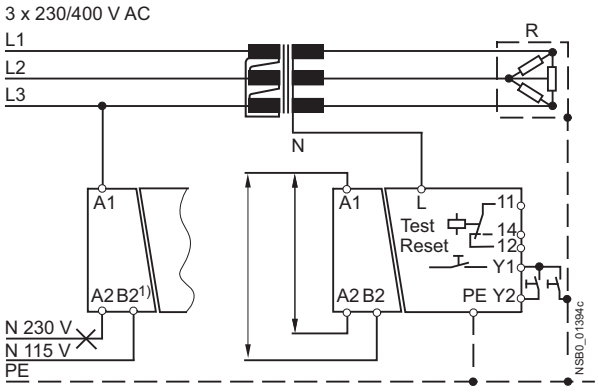
			3UG30 81
Control circuit			
Operating range of the control supply voltage			-15 %... +10 %
Rated power	24 ... 240 V AC/DC	VA/W	8/2
	110 ... 130 V AC/DC	VA	3
	220 ... 240 V AC/DC	VA	3
Frequency of the rated control supply voltage		Hz	50 ... 60
Measuring circuit L/PE			
• Response value		kΩ	1...110
• Min. internal resistance for AC		kΩ	100
• Min. internal resistance for DC		kΩ	100
• Measurement DC voltage		V	30
• Max. AC insulation voltage (L/PE)		V	415
• Reset/test function terminals (max. 10 m)			Y1-Y2
• Delay time in case of response		s	1
Output relay			1 CO contact, open-circuit principle
General data			
Rated insulation voltage U_i	Between supply, measurement, and output circuit	V	250 acc. to IEC 60947-1
Overvoltage category	Acc. to EN 60664-1		III
Degree of pollution	Acc. to IEC 60664-1		3
Impulse withstand voltage U_{imp}	Acc. to VDE 0435, Part 303	kV	4
Degree of protection	Acc. to IEC 60529		IP50 enclosure IP20 terminals
Shock resistance	Acc. to IEC 60068-2-27	*g*/ms	10
Vibration resistance	Acc. to IEC 60068-2-6		10 ... 55 Hz: 0.35 mm
Permissible ambient temperature			
• During operation		°C	-25 ... 65
• During storage		°C	-40 ... 85
Mounting position			Any
Conductor cross-section	Solid	mm^2	2 x 0.75 ... 2.5
	Finely stranded with end sleeve	mm^2	2 x 0.75 ... 2.5

Dimensional drawings



Schematics

Circuit diagram for networks up to 400 V AC



A1-A2 for 24...240 V AC/DC

A1-B2 for 115 V AC or
A1-B2 for 230 V AC

1) Only 3UG3081-1AK20.

Insulation monitoring
For ungrounded DC networks

Overview

Relay for monitoring the insulation resistance between ungrounded pure DC networks and a protective conductor

- Measuring principle for residual current measurement
- Response value can be adjusted steplessly from 10 ... 110 kΩ
- Selectable
  - Auto reset function with hysteresis or
  - Storage of the tripping operation
- Front selector switch for open-circuit and closed-circuit principle for the output relay
- Test function with test buttons on the front for L+ and L- and over terminal connections
- Switching output: 1 CO contact
- Insulation fault indicator for L+ and L- through two red LEDs
- Supply voltage indication with a green LED
- Electro-magnetically compatible according to IEC 61000-6-2 and IEC 61000-6-4

Function

The monitoring relay measures the insulation resistance between the positive and negative supply voltage in an ungrounded DC voltage network and a corresponding protective conductor.

The measurement is based on the DC residual current measurement principle. The response value can be adjusted steplessly in the range from 10 ... 110 kΩ and thus can be adapted to the corresponding conditions. If the insulation resistance falls below the set response value, the output relay triggers (depending on the setting of the open/closed-circuit principle selector switch) and a fault LED lights up.

A ground fault is evaluated separately for L+ and L- and indicated by means of a corresponding LED.

Note:

Due to the measurement principle, a symmetrical ground fault on terminals L+ and L- cannot be evaluated.

Test function

A ground fault can be simulated using the Test L+ and Test L- buttons on the front. If the test button is pressed for at least 1 s, the status of the output relay changes and the corresponding fault LED lights up.

An external test button can be connected to terminals Y1-Y3 for L+ and terminals Y4-Y3 for L-. The function is triggered by means of a NO contact.

Fault storage and RESET

If terminals Y2 and Y3 are linked, the monitoring relay is set to fault storage mode.

If the insulation resistance falls below the set value, the output relay triggers (depending on the setting of the open/closed circuit selector switch), and stays in this state even if the insulation resistance rises again above the hysteresis value (typical: 2 times the set value). This fault storage can be deleted by pressing and releasing the L+ RESET button, opening the Y2-Y3 connection or by switching off the supply voltage.

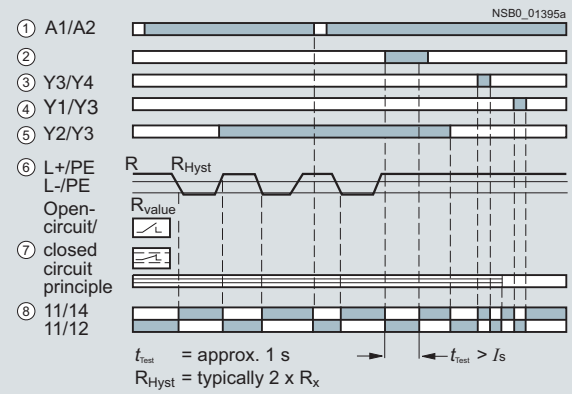
Open/closed-circuit principle selector switch

The principle of operation of the output relay can be adjusted by means of a selector switch on the front panel.

If the relay is to respond in the event of a fault (contact symbol open), the open-circuit principle must be selected. If the relay however is to trigger in the event of a fault (contact symbol closed), the closed-circuit principle must be selected.

Note:

The position of the selector switch has no effect upon the fault LEDs. The LEDs always light up if the insulation resistance on L+ or L– falls below the set value.

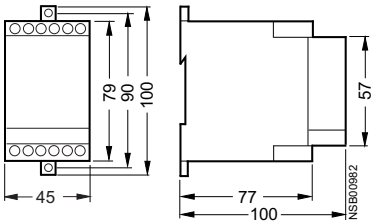


① = Supply voltage
② = Button on front – Reset L+ and L-/Test L+
③ = Button on front – Test L – Test remote connection – Test L
④ = Test remote connection – Test L+
⑤ = Test remote connection – Store, reset
⑥ = Insulation resistance R of supply set response value R
⑦ = Switch on front Open-circuit/closed-circuit principle
⑧ = Selector switch

Technical specifications

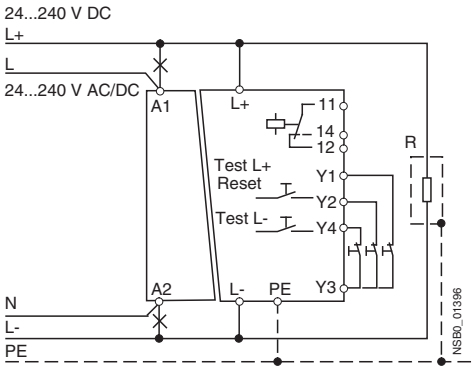
			3UG30 82
Control circuit			
Operating range of the control supply voltage			-15 %... +10 %
Rated power	24 ... 240 V AC/DC	VA/W	8/2
Frequency of the rated control supply voltage		Hz	50 ... 60
Measuring circuit			
• Response value		kΩ	10 ... 110
• Min. internal resistance for DC		kΩ	57
• Measurement DC voltage		V	24 ... 240
• Max. DC insulation voltage (L+/PE/ground, L-/PE/ground)		V	300
• Reset/test function terminals (max. 10 m)			Y1/Y3, Y4/Y3
• Delay time in case of response		s	1
Output relay			1 changeover contact, open-circuit or closed-circuit principle
General data			
Rated insulation voltage U_i **Insulation resistance**	Between supply, measurement, and output circuit	V	250
Overvoltage category	Acc. to IEC 60664		III
Degree of pollution	Acc. to IEC 60664		3
Impulse withstand voltage U_{imp}	Acc. to VDE 0435, Part 303	kV	4
Degree of protection	Acc. to IEC 60529		IP50 enclosure IP20 terminals
Shock resistance	Acc. to IEC 60068-2-27	*g*/ms	10
Vibration resistance	Acc. to IEC 60068-2-6		10 ... 55 Hz: 0.35 mm
Permissible ambient temperature • During operation • During storage		 °C °C	 -25 ... + 65 -40 ... + 85
Mounting position			Any
Conductor cross-section	Solid	mm^2	2 x 0.75 ... 2.5
	Finely stranded with end sleeve	mm^2	2 x 0.75 ... 2.5

Dimensional drawings



Schematics

Circuit diagram for 24 ... 240 V DC



Level monitoring: Level monitoring relays

Overview

The 3UG45 01 level monitoring relay is used together with 2- or 3-pole sensors to monitor the levels of conductive liquids.

Function

3UG45 01 monitoring relays

The principle of operation of the 3UG45 01 level monitoring relay is based on measuring the electrical resistance of the liquid between two immersion sensors and a reference terminal. If the measured value is lower than the sensitivity set at the front, the output relay changes its switching state. In order to exclude electrolytic phenomena in the liquid, the sensors are supplied with alternating current.

Two-point control

The output relay changes its switching state as soon as the liquid level reaches the maximum sensor, while the minimum sensor is submerged. The relay returns to its original switching state as soon as the minimum sensor no longer has contact with the liquid.

Single-point control

If only one level is being controlled, the terminals for Min and Max on the monitoring relay are bridged. The output relay changes its switching state as soon as the liquid level is reached and returns to its original switching state once the sensor no longer has contact with the liquid.

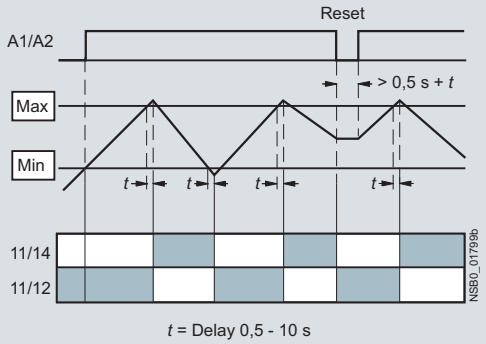
In order to prevent premature tripping of the switching function caused by wave motion or frothing, even though the set level has not been reached, it is possible to delay this function by 0.5 ... 10 s.

For safe resetting, the supply voltage must be interrupted for at least the set delay time of +0.5 s.

Note:

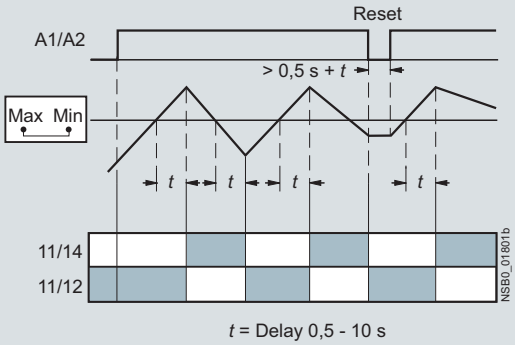
It is also possible to connect other resistance sensors to the Min and Max terminals in the range 2 ... 200 kW, e. g. photoresistors, temperature sensors, encoders based on resistance etc. The monitoring relay can therefore also be used for other applications apart from monitoring the levels of liquids.

OVER, two-point control



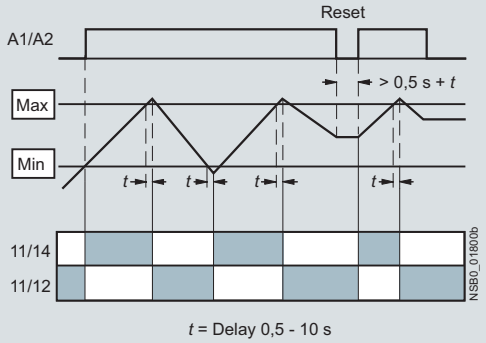
t = Delay 0,5 - 10 s

OVER, single-point control



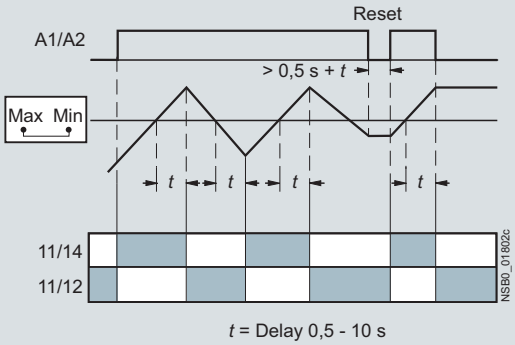
t = Delay 0,5 - 10 s

UNDER, two-point control



t = Delay 0,5 - 10 s

UNDER, single-point control



t = Delay 0,5 - 10 s

Technical specifications

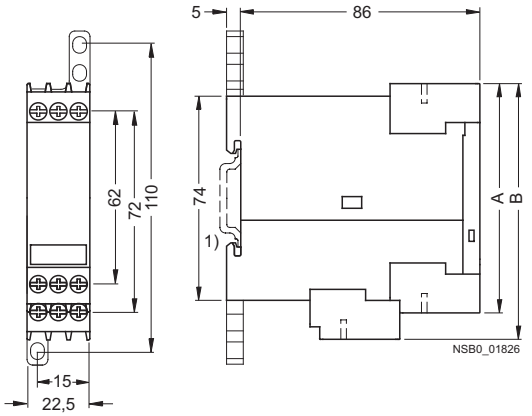
Type		3UG45 01-1AA30, 3UG45 01-2AA30	3UG45 01-1AW30, 3UG45 01-2AW30
General data			
Rated control supply voltage U_s	V AC/DC	24	24 … 240
Rated frequency	Hz	50/60	
Operating range	V	20.4 ... 26.4	20.4 ... 264
Rated power, max.			
• At 24 V AC	VA	2	2
• At 240 V AC	VA	--	4
Width	mm	22.5	
Availability time after application of U_s	ms	500	
Response time once a switching threshold is reached	ms	Max. 300	
Adjustable delay time	s	0.5 ... 10	
Inlet or outlet monitoring function		UNDER/OVER selector switch at the front	
Mains buffering time, minimum	ms	200	
Rated insulation voltage U_i Degree of pollution 3, Overvoltage category III acc. to IEC 60664	V	300	
Rated impulse withstand voltage	kV	4	
Permissible ambient temperature			
• During operation	°C	-25 … +60	
• During storage	°C	-40 … +80	
EMC tests[1]		IEC 60947-5-1/IEC 61000-6-2/IEC 61000-6-4	
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals	
Mounting position		Any	
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*	
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11	
Connection type		**Screw terminals**	
• Terminal screw		M3 (for standard screwdriver, 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 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)	
Measuring circuit			
Electrode current, max. (typ. 70 Hz)	mA	1	
Electrode voltage, max. (typ. 70 Hz)	V	15	
Sensor feeder cable	m	Max. 100	
Conductor capacity of sensor cable[2]	nF	Max. 10	
Adjustable sensitivity			
• Resistance	kΩ	2 ... 200	
Measuring accuracy	%	±20	
Repeat accuracy at constant parameters	%	±1	
Deviations for temperature fluctuations	%/°C	±1	
Control circuit			
Number of CO contacts for auxiliary contacts		1	
Load capacity of the output relay Conventional thermal current I_{th}	A	5	
Rated operational current I_e at			
• AC-15 at 24 ... 400 V	A	3	
• DC-13 at 24 V	A	1	
• DC-13 at 125 V	A	0.2	
• DC-13 at 250 V	A	0.1	
Minimum contact load at 17 V DC	mA	5	
Output relay with DIAZED fuse gL/gG operational class	A	4	
Electrical endurance AC-15, 3 A, million operating cycles		0.1	
Mechanical endurance million operating cycles		10	

[1] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

[2] The sensor cable does not necessarily have to be shielded, but we do not recommend installing this cable parallel to the power supply lines. It is also possible to use a shielded cable, whereby the shield has to be connected to the M terminal.

Dimensional drawings

3UG45 01

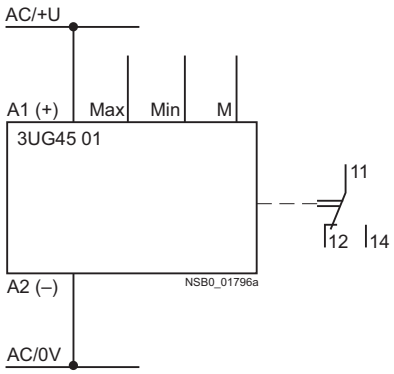


Type	3UG45 01	
	A	B
Removable terminals		
Screw terminals	83	92
Spring-loaded terminals	84	94

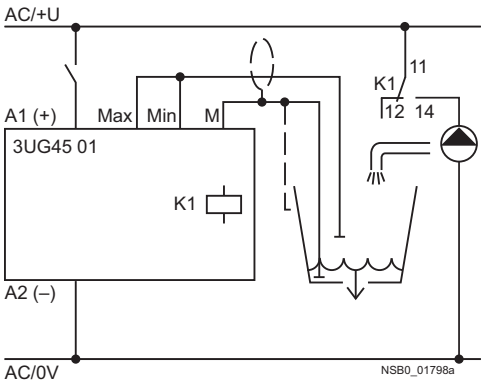
1) For standard mounting rail according to EN 60715.

Schematics

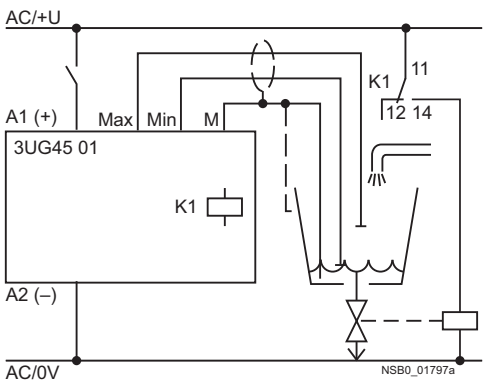
3UG45 01



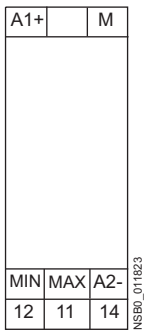
Single-point control with inlet monitoring



Two-point control with outlet monitoring



Position of the terminals



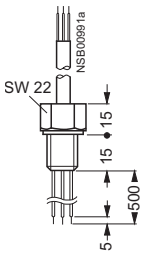
Level monitoring: Level monitoring sensors

Technical specifications

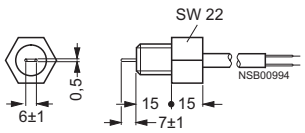
Type			3UG32 07-3A three-pole	3UG32 07-2A two-pole	3UG32 07-2B two-pole	3UG32 07-1B single-pole	3UG32 07-1C single-pole
Length		mm	500	500	--	--	--
Insulation	Teflon insulation (PTFE)		Yes	Yes	Yes	--	Yes
Installation			Vertical	Vertical	Lateral	Lateral	Lateral
Screw-in gland width A/F			22				
Thread		inch	R 3/8				
Connecting cable		mm^2	3 x 0.5, 2 m long				
Operating temperature		°C	90				
Operating pressure		bar	10				
Assignment							
Cable/Electrode	• Cable brown		Center electrode	Not assignable	Gland	Gland	Gland
	• Cable white		Not assignable	Not assignable	Not assignable	Electrode	Electrode
	• Cable green		Not assignable	--	Not assignable	--	--

Dimensional drawings

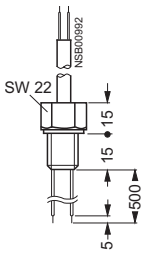
3UG32 07-3A
three-pole wire electrode



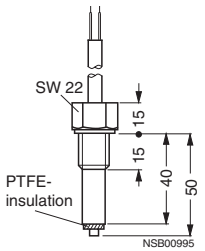
3UG32 07-1B
single-pole bow electrode



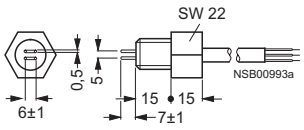
3UG32 07-2A
two-pole wire electrode



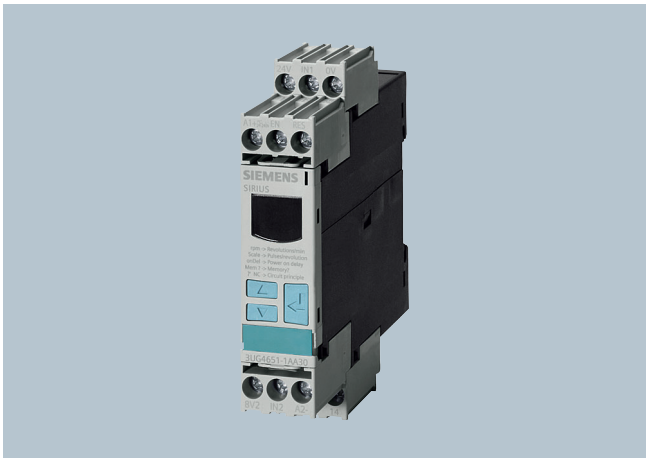
3UG32 07-1C
single-pole electrode, rugged version



3UG32 07-2B
two-pole bow electrode



Overview



The 3UG46 51 monitoring relay is used together with a sensor to monitor motor drives for overspeed and/or underspeed.

Furthermore, this relay is ideal for all functions where a continuous pulse signal needs to be monitored (e. g. belt travel monitoring, completeness monitoring, passing monitoring, clock-time monitoring).

Function

3UG46 51 monitoring relays

The speed monitoring relay operates according to the principle of period duration measurement.

In the monitoring relay, the time between two successive rising edges of the pulse encoder is measured and compared to the minimum and/or maximum permissible period duration calculated from the set limit values for the speed.

Thus, the period duration measurement recognizes any deviation in speed after just two pulses, even at very low speeds or in the case of extended pulse gaps.

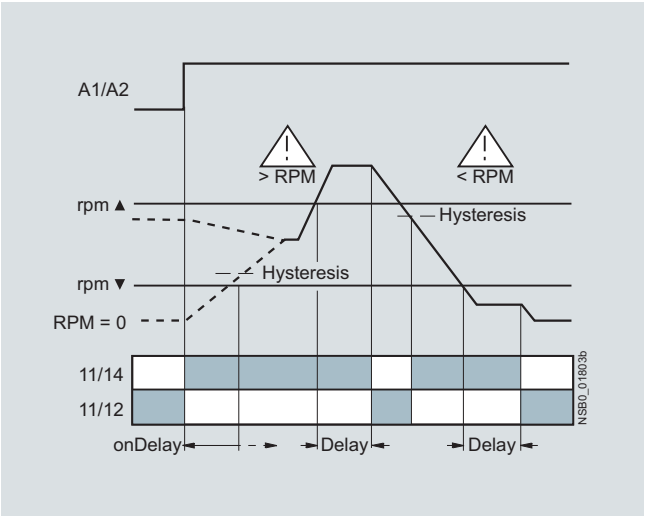
By using up to ten pulse encoders evenly distributed around the circumference, it is possible to shorten the period duration, and in turn the response time. By taking into account the number of sensors in the monitoring relay, the speed continues to be indicated in rpm.

ON-delay time for motor start

To be able to start an motor drive, and depending on whether the open-circuit or closed-circuit principle is selected, the output relay switches to the GO state during the ON-delay time, even if the speed is still below the set value.

With the closed-circuit principle selected

Window monitoring without enable input



The ON-delay time is started by either switching on the auxiliary voltage or, if the auxiliary voltage is already applied, by actuating the respective NC contact (e. g. auxiliary contact).

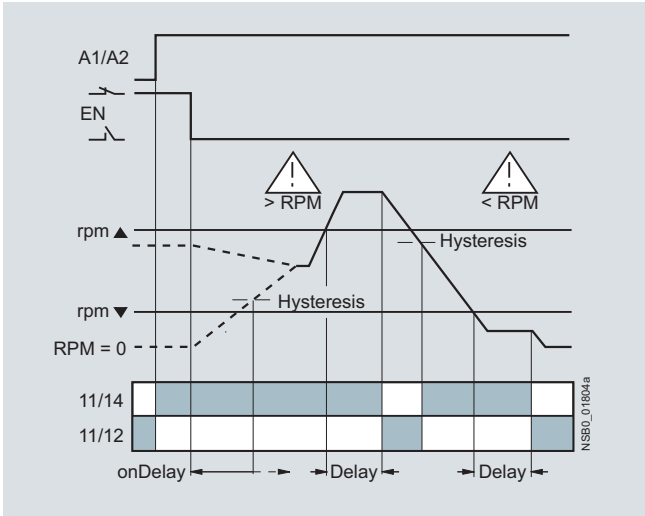
Speed monitoring with Auto-RESET (Memory = no)

If the device is set to Auto-RESET, the output relay switches to the GO state, once the adjustable hysteresis threshold is reached in the range of 0.1 ... 99.9 rpm and the flashing stops. Any overshoots or undershoots are therefore not stored.

Speed monitoring with Manual-RESET (Memory = yes)

If Manual-RESET is selected in the menu, the output relay remains in its current switching state and the current measured value and the symbol for overshooting/undershooting continues to flash, even when the speed returns to a permissible value. This stored fault status can be reset by pressing the UP▲ and DOWN▼ buttons simultaneously for > 2 seconds, by connecting the RESET device terminal to 24 V DC or by switching the supply voltage off and back on again.

Window monitoring with enable input



Speed monitoring

Technical specifications

Type		3UG46 51-1AA30, 3UG46 51-2AA30	3UG46 51-1AW30, 3UG46 51-2AW30
General data			
Rated control supply voltage U_s	V AC/DC	24	24 … 240
Rated frequency	Hz	50/60	
Operating range	V	20.4 ... 26.4	20.4 ... 264
Rated power, max.			
• At 24 V AC	VA	2.5	4
• At 240 V AC	VA	--	9
Width	mm	22.5	
RESET		Automatic/manual	
Availability time after application of U_s	ms	500	
Response time once a switching threshold is reached	ms	Max. 300	
Adjustable tripping delay time	s	0.1 ... 99.9	
Adjustable ON-delay time	s	1 ... 900	
Principle of operation		Closed-circuit principle, open-circuit principle	
NC/NO contact behavior		Adjustable	
Mains buffering time, minimum	ms	10	
Rated insulation voltage U_i Degree of pollution 3, Overvoltage category III acc. to IEC 60664	V	300	
Rated impulse withstand voltage	kV	4	
Permissible ambient temperature			
• During operation	°C	-25 … +60[1]	
• During storage	°C	-40 … +80	
EMC tests[2]		IEC 60947-5-1, IEC 61000-6-2, IEC 61000-6-4	
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals	
Mounting position		Any	
Vibration resistance acc. to IEC 60068-2-6		1 ... 6 Hz: 15 mm; 6 ... 500 Hz: 2 *g*	
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11	
Connection type		**Screw terminals**	
• Terminal screw		M3 (for standard screwdriver, 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)	
Measuring circuit			
Sensor supply			
• For three-wire sensor (24 V/0 V)	mA	Max. 50	
• For 2-wire NAMUR sensor (8V2)	mA	Max. 8.2	
Signal input			
• IN1	kΩ	16, three-wire sensor, pnp operation	
• IN2	kΩ	1, floating contact, 2-wire NAMUR sensor	
Voltage level			
• For level 1 at IN1	V	4.5 ... 30	
• For level 0 at IN1	V	0 ... 1	
Current level			
• For level 1 at IN2	mA	> 2.1	
• For level 0 at IN2	mA	< 1.2	
Minimum pulse duration of signal	ms	5	
Minimum interval between 2 pulses	ms	5	
Adjustable response value rpm	rpm	0.1 ... 2200	
Hysteresis	rpm	OFF and 0.1 ... 99.9	
Scale		1 ... 10	
Measuring accuracy	%	±10	
Repeat accuracy at constant parameters	%	±1	
Accuracy of digital display		±1 digit	

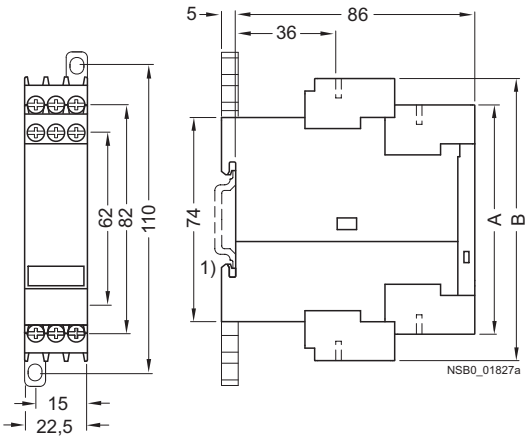
[1] At a distance of > 1 cm to adjacent devices; if butt-mounted: +50 °C.

[2] Important: This is a Class A product. In the household environment this device may cause radio interference. In this case the user must introduce suitable measures.

Type		3UG46 51-1AA30, 3UG46 51-2AA30	3UG46 51-1AW30, 3UG46 51-2AW30
Control circuit			
Number of CO contacts for auxiliary contacts		1	
Load capacity of the output relay Conventional thermal current I_{th}	A	5	
Rated operational current I_e at • AC-15 at 24 ... 400 V AC/DC • DC-13 at 24 V • DC-13 at 125 V • DC-13 at 250 V	 A A A A	 3 1 0.2 0.1	
Minimum contact load at 17 V DC	mA	5	
Output relay with DIAZED fuse gL/gG operational class	A	4	
Electrical endurance AC-15	Million operating cycles	0.1	
Mechanical endurance	Million operating cycles	10	

Dimensional drawings

3UG46 51



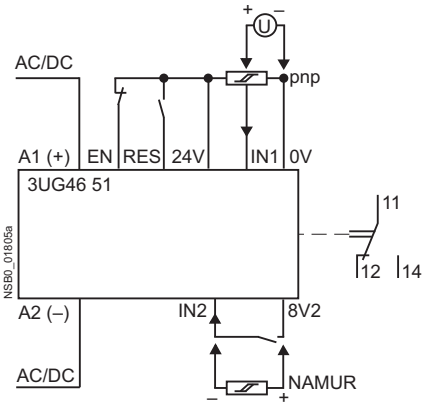
Type	3UG46 51	
	A	B
Removable terminal		
Screw-type terminal	83	102
Spring-loaded terminal	84	103

1) For standard mounting rail according to EN 60715.

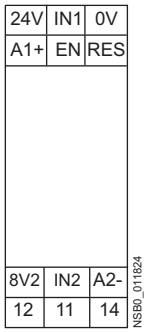
Speed monitoring

Schematics

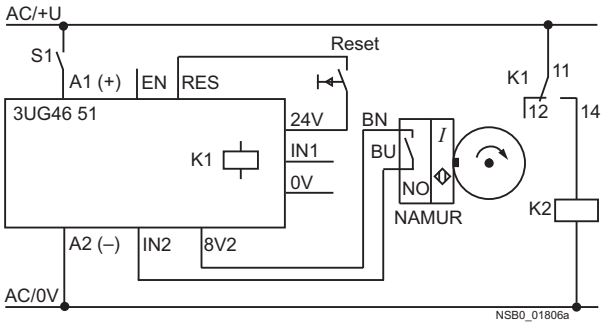
3UG46 51



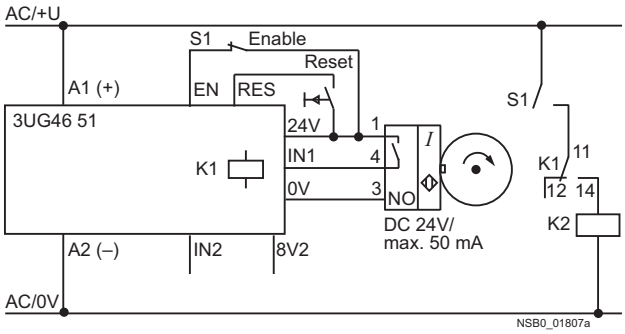
Position of the terminals



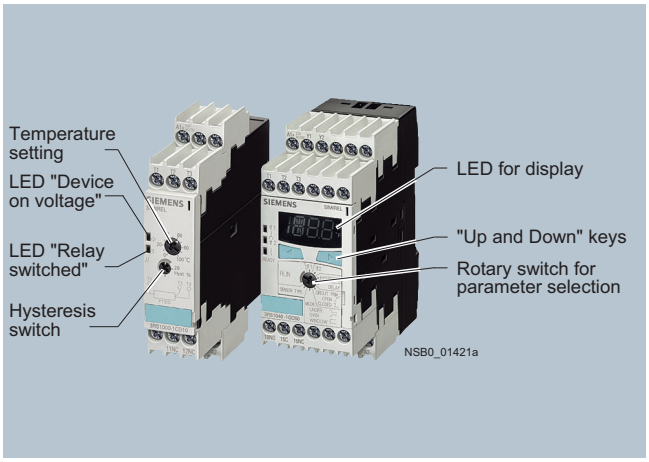
Circuit example without enable input



Circuit example with enable input



Overview



The 3RS10/3RS11 temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is detected 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

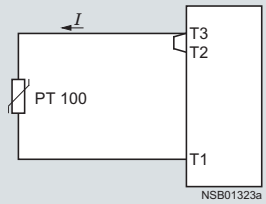
The temperature monitoring relays comply with:

- IEC 60947-5-1 "Low-voltage switchgear and controlgear – Electromechanical control circuit devices"
- IEC 60721-3-3 "Environmental conditions"
- 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

Two-wire measurement

When two-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

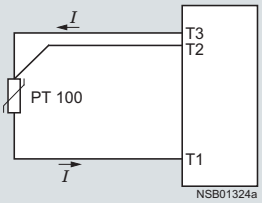
The errors that are generated by the wiring comprise approximately 2.5 Kelvin/Ω. If the resistance of the cable is not known and cannot be measured, the wiring errors can also be estimated using the following table.

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

Three-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

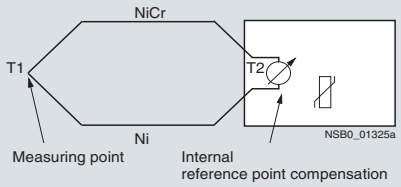
Based on the thermo-electrical effect, a differential temperature measurement will be performed between the measuring point and the signal evaluation unit.

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

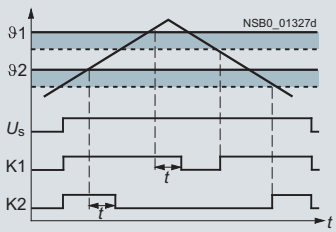
Function

Once the temperature has reached the set threshold value $\vartheta 1$, the output relay K1 changes its switching state as soon as the set time t has elapsed (K2 responds in the same manner to $\vartheta 2$). 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.

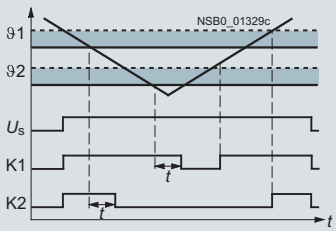
Temperature overshoot

Closed-circuit principle



Temperature undershoot

Closed-circuit principle

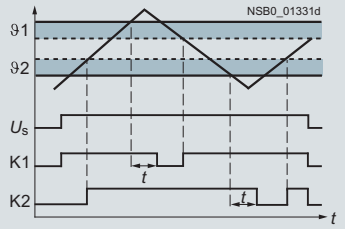


Window monitoring (digital units only)

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.

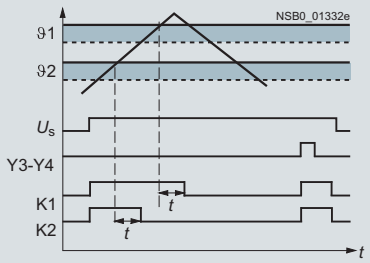
Closed-circuit principle



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

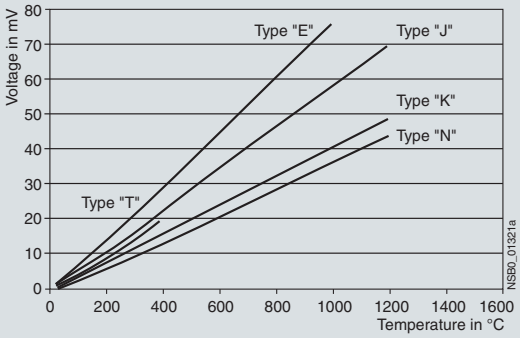
Once the temperature has reached the set threshold value ϑ1, the output relay K1 changes its switching state as soon as the set time t has elapsed (K2 responds in the same manner to ϑ2). The relays only return to the original state when the temperature falls below the set hysteresis value and when terminals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

Closed-circuit principle

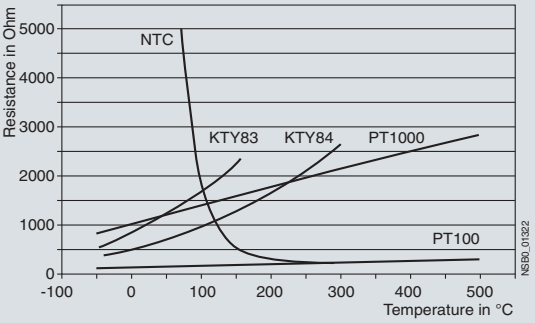


Characteristic curves

For thermoelements



For resistance sensors



The short-circuit and open-circuit detection as well as the measuring range is limited, depending on the sensor type.

Measuring range in °C for thermoelements

Sensor type	Short-circuit	Open circuit	3RS11 40 Measuring range in °C	3RS11 42 Measuring range in °C
J	--	✔	-99 ... +999	-99 ... +1200
K	--	✔	-99 ... +999	-99 ... +1350
T	--	✔	-99 ... +400	-99 ... +400
E	--	✔	-99 ... +999	-99 ... +999
N	--	✔	-99 ... +999	-99 ... +999
S	--	✔	--	0 ... 1750
R	--	✔	--	0 ... 1750
B	--	✔	--	400 ... 1800

Measuring range in °C for resistance sensors

Sensor type	Short-circuit	Open circuit	3RS10 40/ 3RS10 41 Measuring range in °C	3RS10 42 Measuring range in °C
PT100	✔	✔	–50 ... +500	–50 ... +750
PT1000	✔	✔	–50 ... +500	–50 ... +500
KTY 83-110	✔	✔	–50 ... +175	–50 ... +175
KTY 84	✔	✔	–40 ... +300	–40 ... +300
NTC[1])	✔	--	80 ... 160	80 ... 160

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

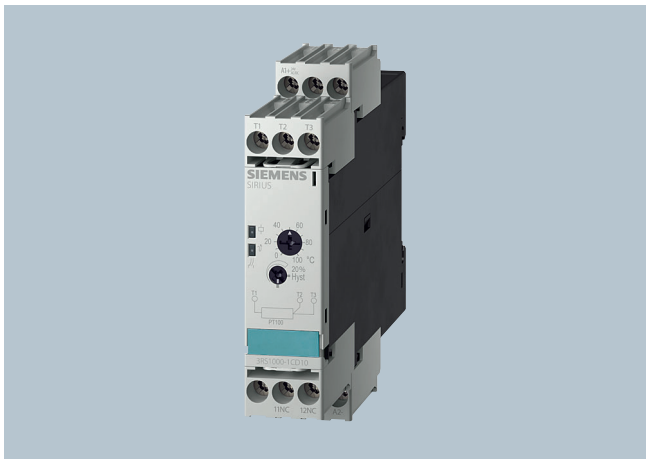
✔ = Detection possible

-- = Detection not possible

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 detected 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.

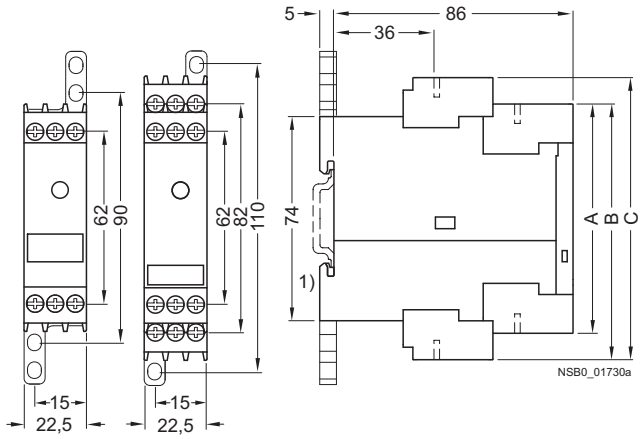
Technical specifications

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							
• DC-13 at 125 V	A	0,2							
• DC-13 at 250 V	A	0.1							
DIAZED fuse									
• gL/gG operational class	A	4							
Short-circuit current (at 250 V)	kA	1							
Electrical endurance AC-15, 3 A, million operating cycles		0,1							
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 % of 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							
• **Three-wire conductor connection** [1]		Yes		-		Yes		-	
Enclosures									
Environmental influences									
Permissible ambient temperature	°C	-25 ... +60							
Permissible storage temperature	°C	-40 ... +80							
Degree of protection acc. to IEC 60529		IP40 Cover IP20 Terminals							
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-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)							
Mounting position		Any							
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm							
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11							

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

Relays, analogically adjustable, for 1 sensor

Dimensional drawings



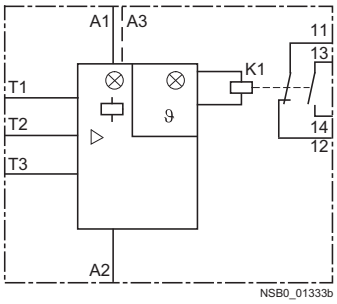
Type	3RS10 00	3RS10 10	3RS11 0 3RS11 1 3RS1. 2 3RS1. 3
	A	B	C
Removable terminal			
Screw-type terminal	83	92	102
Spring-loaded terminal	84	94	103

1) For standard mounting rail according to EN 60715

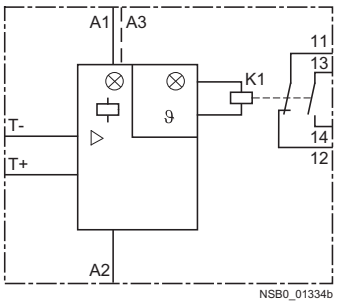
Schematics

Connection examples

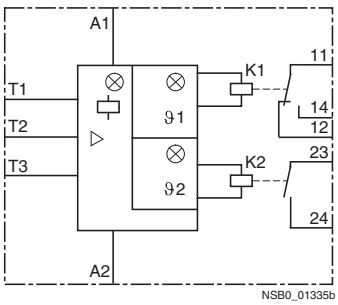
3RS10 00, 3RS10 10



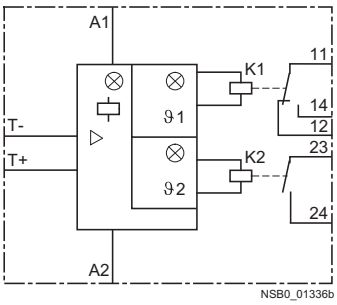
3RS11 00, 3RS11 01



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

⏚ = 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

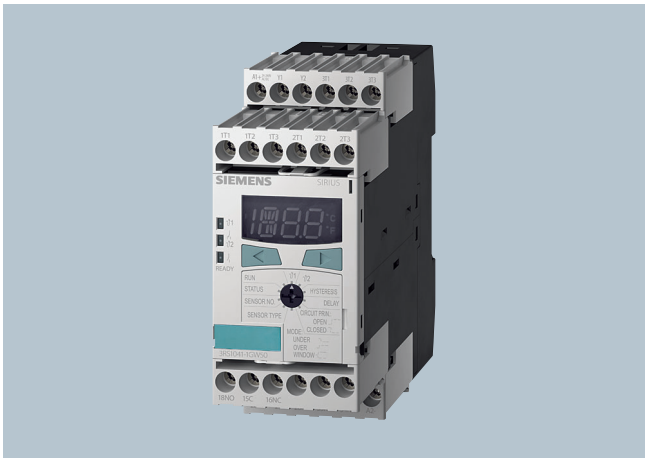
Caution!

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

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 detected 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

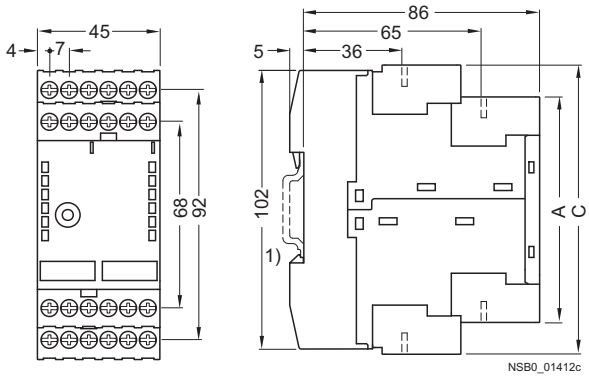
Type		3RS10 40/3RS10 42/3RS20 40	3RS11 40/3RS21 40	3RS11 42
General data				
Width	mm	45		
Operating range	V	0.85 ... 1.1 x U_s		
Rated power	W/VA	< 4/7		
Auxiliary circuit				
Contacts		1 CO + 1 CO + 1 NO		
Rated operational currents I_e				
• AC-15 at 230 V, 50 Hz	A	3		
• DC-13 at 24 V	A	1		
• DC-13 at 125 V	A	0.2		
• DC-13 at 250 V	A	0.1		
DIAZED protection gL/gG operational class	A	4		
Electrical endurance AC-15, 3 A, million operating cycles		0.1		
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	mA	Typically 1	--	--
• PT1000/KTY83/KTY84/NTC	mA	Typically 0.2	--	--
Open-circuit detection		Yes[1]	Yes	Yes
Short-circuit detection		Yes	No	No
Three-wire conductor connection		Yes[2]	--	--
Enclosures				
Environmental influences				
• Permissible ambient temperature	°C	-25 ... +60		
• Permissible storage temperature	°C	-40 ... +80		
Degree of protection acc. to IEC 60529		IP40 Cover IP20 Terminals		
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-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)		
Mounting position		Any		
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm		
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11		

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

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

Relays, digitally adjustable, for 1 sensor

Dimensional drawings



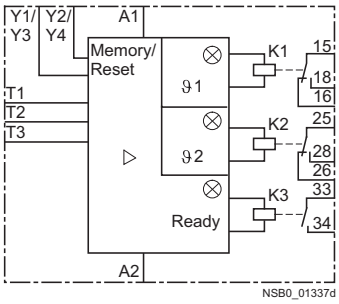
Type	3RS10, 3RS11, 3RS20, 3RS21 digital	
	A	C
Removable terminal		
Screw-type terminal	83	106
Spring-loaded terminal	84	108

1) For standard mounting rail according to EN 60715.

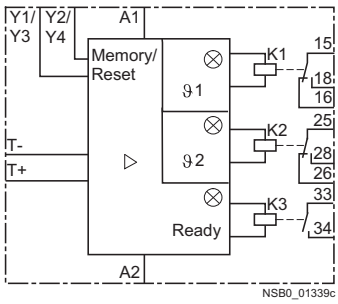
Schematics

Circuit 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

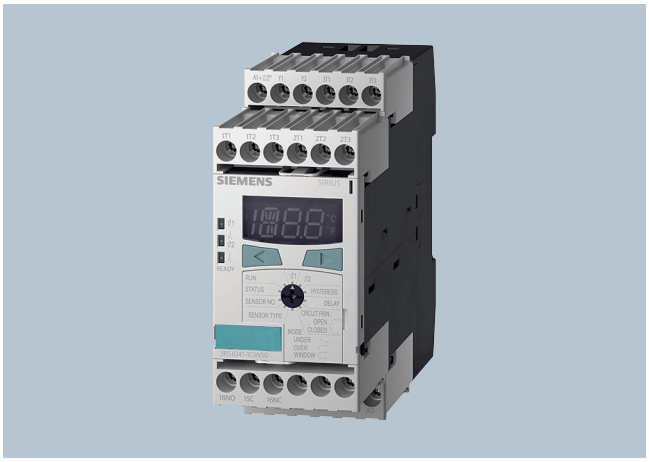
T+/T- = Sensor connection for thermoelements

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.

Overview



The 3RS10 41 temperature monitoring relays can be used for measuring temperatures in solid, liquid and gas media. The temperature is detected 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.

Relays, digitally adjustable for up to 3 sensors

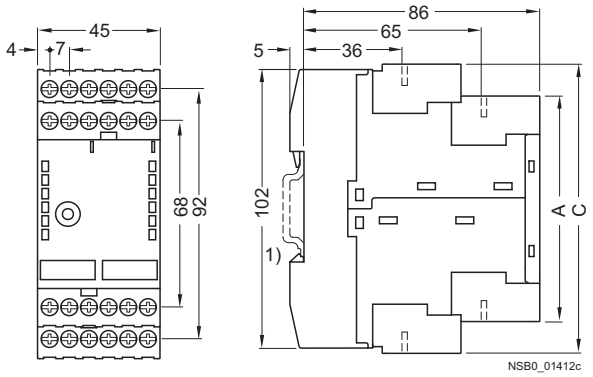
Technical specifications

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
• DC-13 at 125 V	A	0.2
• DC-13 at 250 V	A	0.1
DIAZED fuse		
• gL/gG operational class	A	4
Electrical endurance AC-15, 3 A, million operating cycles		0.1
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
Three-wire conductor connection		Yes[2]
Enclosures		
Environmental influences		
• Permissible ambient temperature	°C	-25 ... +60
• Permissible storage temperature	°C	-40 ... 80
Degree of protection acc. to IEC 60529		IP40 Cover IP20 Terminals
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-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)
Mounting position		Any
Vibration resistance acc. to IEC 60068-2-6		5 ... 26 Hz: 0.75 mm
Shock resistance acc. to IEC 60068-2-27	g/ms	15/11

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

2) Two-wire connection of resistance sensors with wire bridge between T2 and T3.

Dimensional drawings

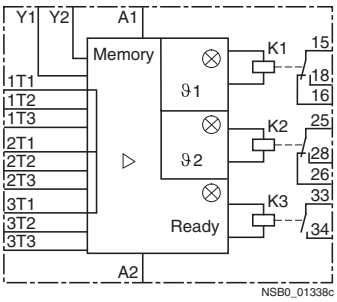


Type	3RS10, 3RS11, 3RS20, 3RS21 digital	
	A	C
Removable terminal		
Screw-type terminal	83	106
Spring-loaded terminal	84	108

1) For standard mounting rail according to EN 60715.

Schematics

Circuit 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

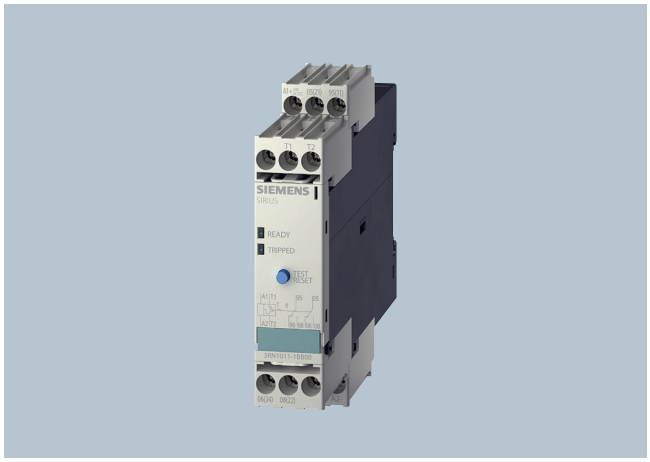
Caution!

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

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

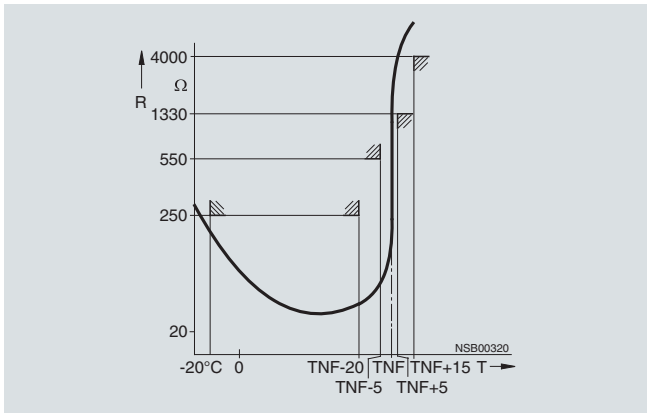
The terminals of the auxiliary contacts are designated in accordance with EN 50005.

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

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

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

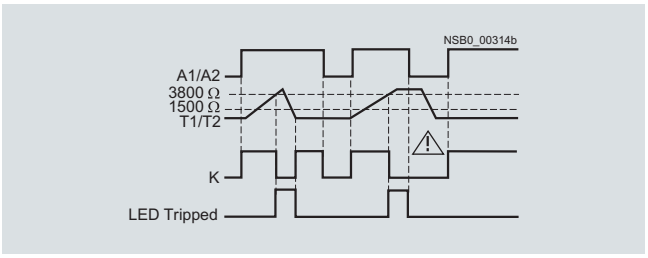
Behavior	Monostable 3RN10 00 3RN10 10 3RN10 11	Non-volatile, monostable 3RN10 12 3RN10 13-....0 3RN10 22 3RN10 62	Bistable 3RN10 13-...01
In case of failure of the control voltage	Device trips	Device trips	No change in switching state of the auxiliary contacts
In case of return of the control voltage 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.

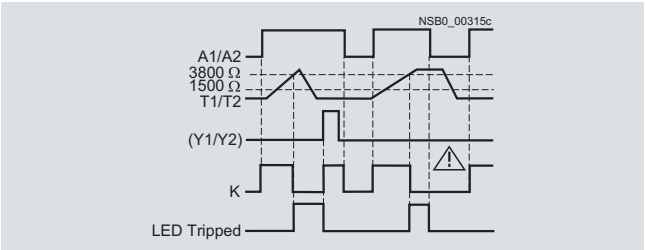
Function diagrams

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

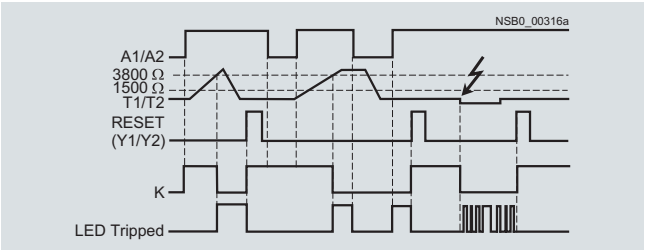


[1] For versions with 2 CO and short-circuit detection in the sensor circuit see function diagram 3RN10 13.

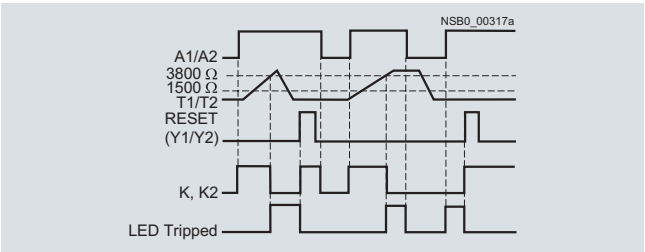
3RN10 11[1)]



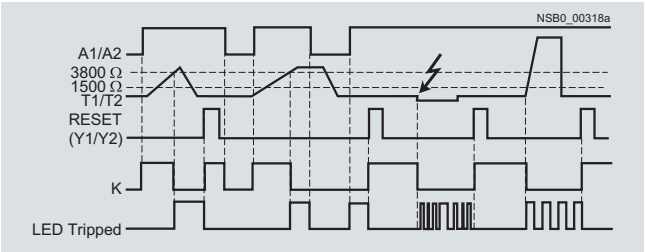
3RN10 13-...01



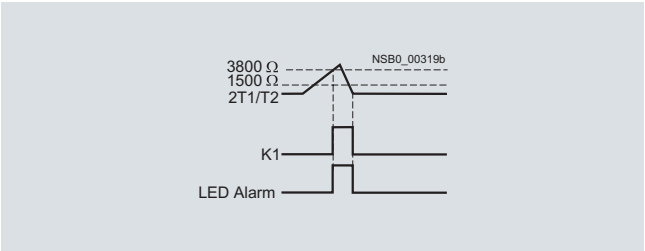
3RN10 12[1)]**/3RN10 22/3RN10 62**



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		Yes2)	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				Yes3)	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 $R_F \leq 1.5$ kΩ	mW	≤ 5						
Voltage in sensor circuit at $R_F \leq 1.5$ kΩ	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)	kΩ	≤ 1.5						
Response value	kΩ	3.4 ... 3.8						
Return value	kΩ	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).

3RN1 Thermistor Motor Protection

For PTC sensors

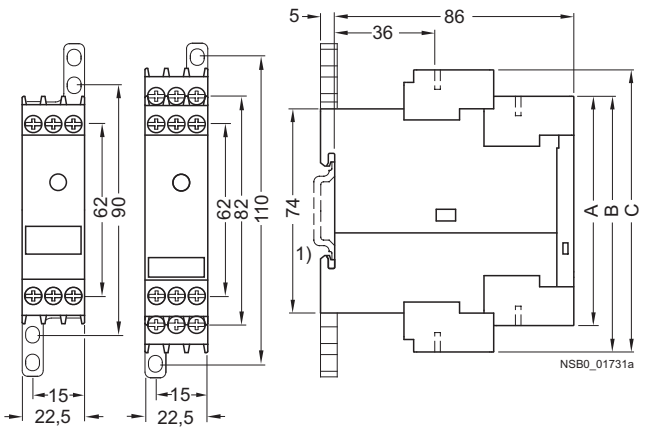
Type		Compact units	Standard devices			Multi-function units	Warning + tripping	Multiple motor protection
		3RN10 00	3RN10 10	3RN10 11	3RN10 12	3RN10 13	3RN10 22	3RN10 62
Control circuit								
Rated control supply voltage U_s		1)						
Operating range								
• 110/230 V AC		0.85 ... 1.1 x U_s						
• 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								
• AC/DC	W	< 2						
Max. mains buffering time	ms	50						
Auxiliary circuit								
Conventional thermal current I_{th}	A	5						
Rated operational current I_e								
• 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								
• 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.

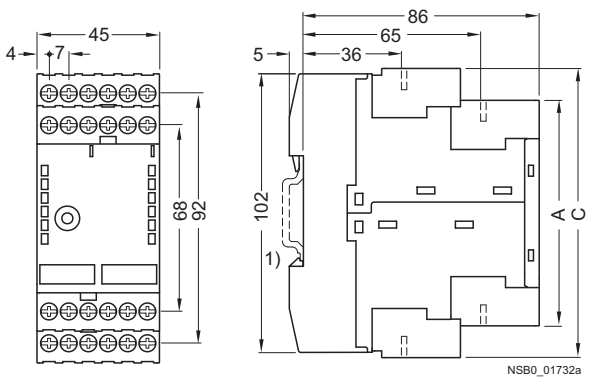
2) I_n > 1 kA weld-free according to EN 60947-5-1.

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

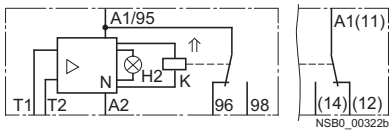
1) For standard mounting rail according to EN 60715.

Schematics

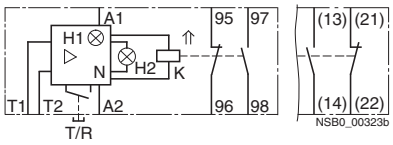
Circuit diagrams

Illustrated with control voltage applied | **Illustrated with control voltage not applied**

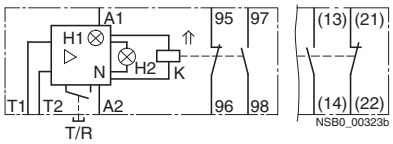
3RN10 00, 1 CO



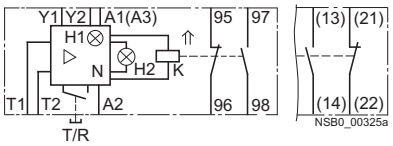
3RN10 10, 1 NO + 1 NC



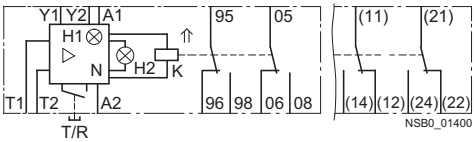
3RN10 11[1], 1 NO + 1 NC



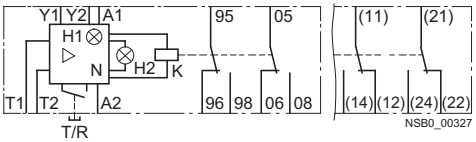
3RN10 12[1], 1 NO + 1 NC



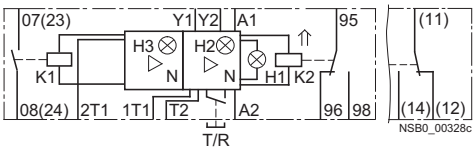
3RN10 13-...0 (monostable)



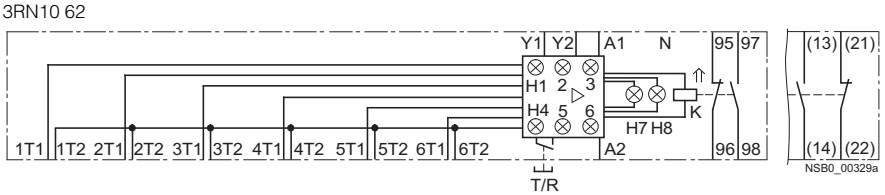
3RN10 13-...1 (bistable)



3RN10 22

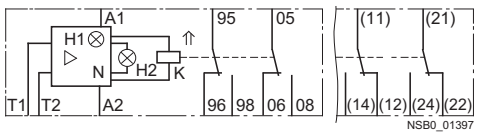


3RN10 62

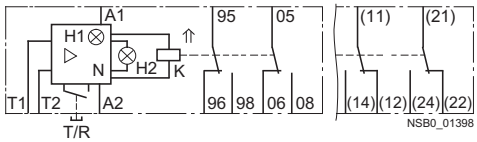


Illustrated with control voltage applied | **Illustrated with control voltage not applied**

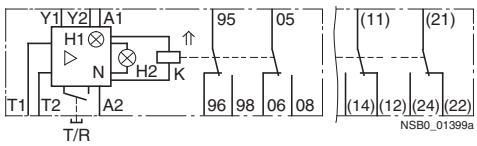
3RN10 10, 2 COs



3RN10 11, 2 COs



3RN10 12, 2 COs



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
2T1 and T2	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 to 6T1, 6T2	Connections of the 1st sensor loop / Connections of the 6th sensor loop

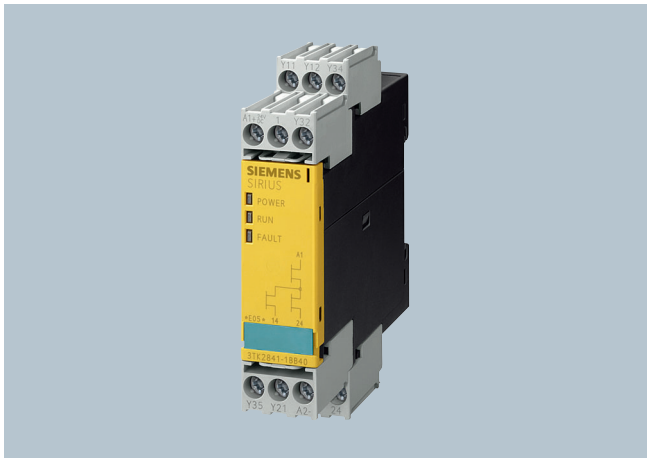
⚠ *Important!*

Close unconnected sensor circuits.

[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.

General data

Overview



SIRIUS safety relays are the key modules of a consistent and cost-effective safety chain. Be it EMERGENCY-STOP disconnection, protective door monitoring or the protection of presses or punches – with SIRIUS safety relays every safety application can be implemented to optimum effect in terms of engineering and price.

SIRIUS safety relays provide numerous safety-related functions:
- Monitoring the safety functions of sensors
- Monitoring the sensor cables
- Monitoring the correct operation of the safety relay
- Monitoring the actuators (contactors) in the shutdown circuit
- Safety-oriented disconnection when dangers arise
- Standstill monitoring of actuators

Depending on the device version, SIRIUS safety relays meet the highest requirements (category 4) according to EN954-1 and reach the highest Safety Integrity Level (SIL 3) according to IEC61508.

Function

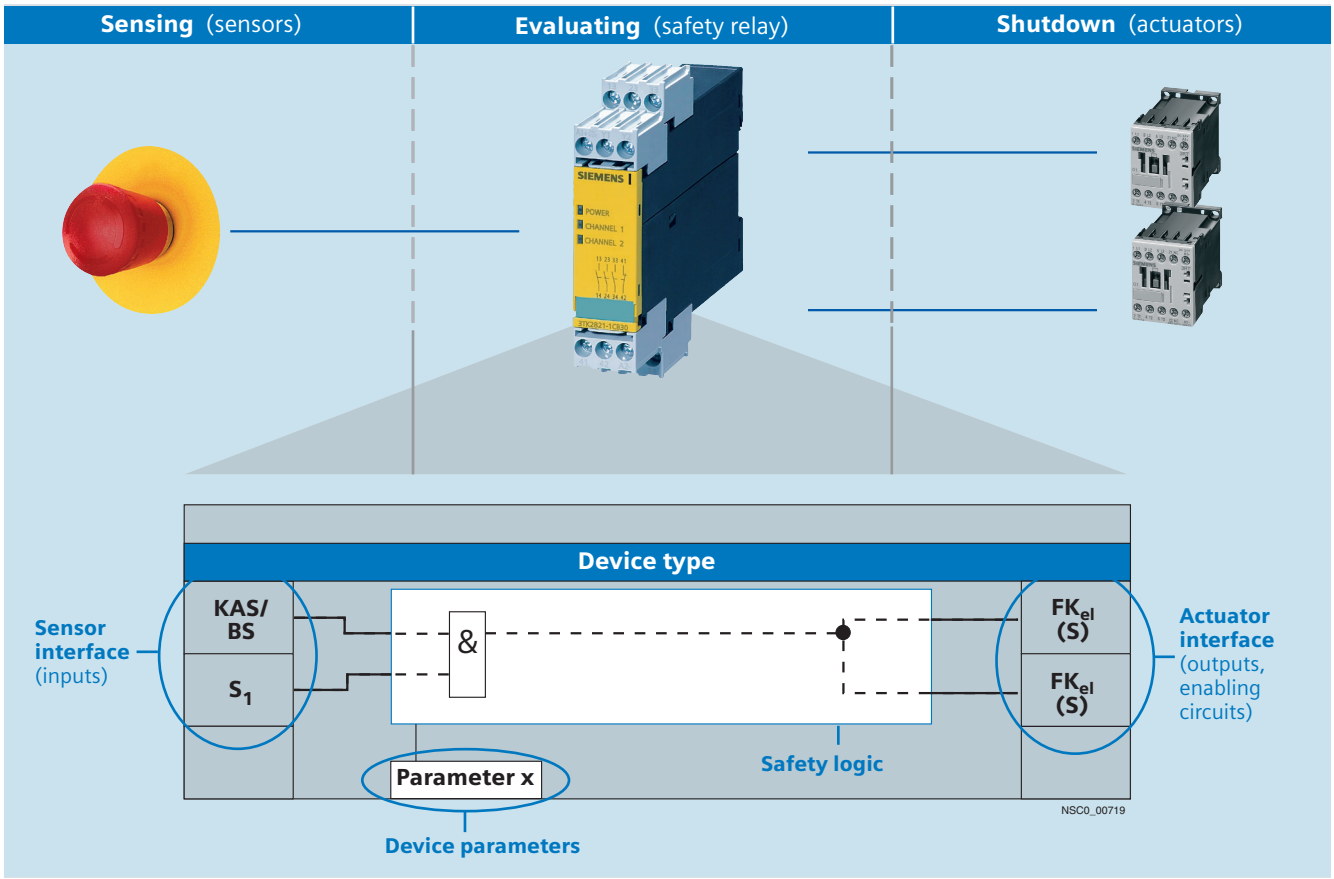
SIRIUS safety relays and the safety chain

A safety chain normally comprises the following functions: sensing, evaluating and shutdown.

Sensing
The detection of a safety requirement, e. g. when an EMERGENCY-STOP is actuated or someone enters a hazardous area which is protected by sensors such as light arrays or laser scanners.

Evaluating
The evaluation of a safety requirement and the reliable initiation of a reaction, e. g. shutting down the enabling circuits.

Shutdown
The shutting down of hazards, e. g. a power supply, using the downstream contactors.
SIRIUS safety relays are active in the evaluating and shutdown links of this safety chain.



The inputs of the device (number and type) are portrayed in the sensor interface. The safety logistics is shown at the center. The mode of operation of the device and the way the inputs act on the outputs are explained with the help of this safety logistics. The type and number of enabling circuits or signaling outputs are shown in the actuator interface, and the setting options (parameters) of the device are shown at the lower edge of the graphic.

Notes on the function diagrams on pages 118 to 143

In the interest of simplicity, the function diagrams show only the inputs and outputs which are required to explain the safety function. The power supply inputs and the sensors and actuators which can be connected to the interfaces are disregarded because they are not relevant for illustrating the function.

The legends explain the meaning of the symbols.

With electronic enabling circuits

Design

The solid-state safety relays can be used in EMERGENCY-STOP devices to EN 418 and in safety circuits to EN 60204-1 (11.98), for example, for moving covers and protective doors. Depending on the device type and the external circuit, the maximum category that can be achieved is Category 4 of EN 954-1 or SIL 3 according to IEC 61508.

Mounting

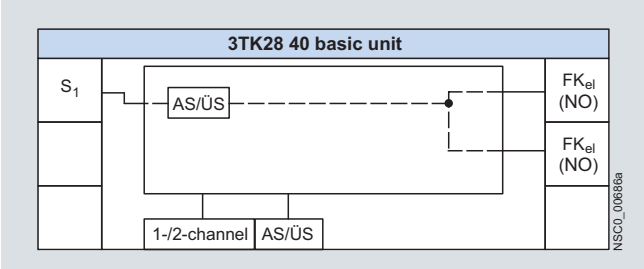
For snap-on mounting on 35 mm standard mounting rail according to EN 60715. Screw fixing is also possible for the devices by means of 2 additional 3RP19 03 push-in lugs.

Function

Basic units

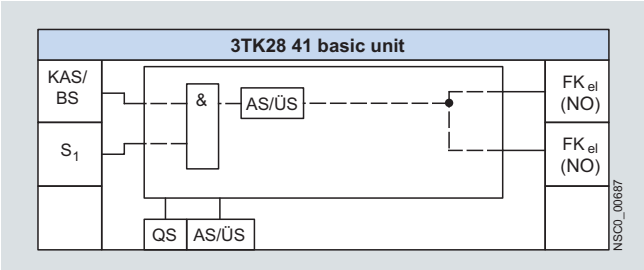
3TK28 40

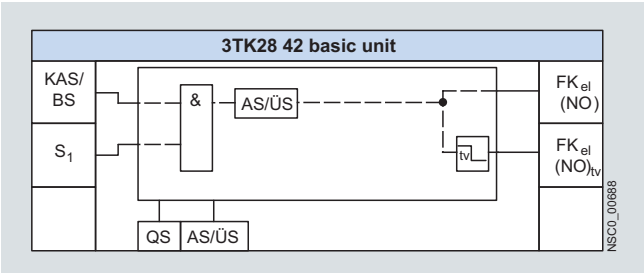
The 3TK28 40 has one sensor input S1 and two solid-state enabling circuits. If the signal is no longer applied to the sensor input, the enabling circuits are disconnected immediately.



3TK28 41 and 3TK28 42

The 3TK28 41 and 3TK28 42 each has one sensor input S1 and one cascading input KAS/BS as well as two solid-state enabling circuits (2 x instantaneous or 1 x instantaneous and 1 x with delay). If the signal is no longer applied to either of the two inputs, the enabling circuits are isolated immediately or according to the set delay time. Autostart or monitored start can be selected in the parameterization.





Legend

Sensor interface

KAS/BS: Cascading input or normal switching duty. Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control. The safety function is on a higher level.

S_x: Sensor input

Safety logic

AS/ÜS: Automatic or monitored start depending on the parameterization

tv: Time delay, OFF-delay

Parameters

AS/ÜS: Automatic or monitored start depending on the parameterization

QS: With or without crossover monitoring

1-/2-channel: One-channel / two-channel sensor connection

Actuator interface

FK_{el}: Enabling circuit, solid-state (non-floating)

NO: NO contact

NO_{tv}: NO contact, time-delayed

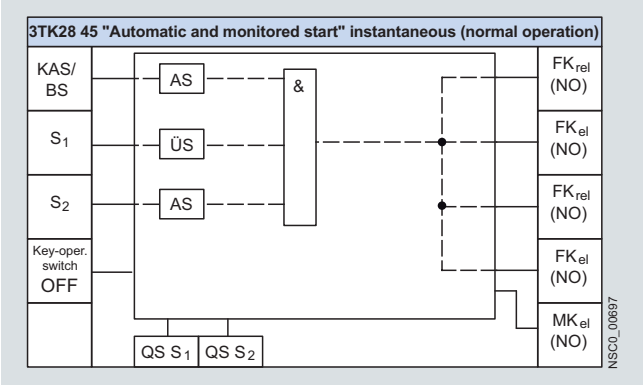
Multi-function units

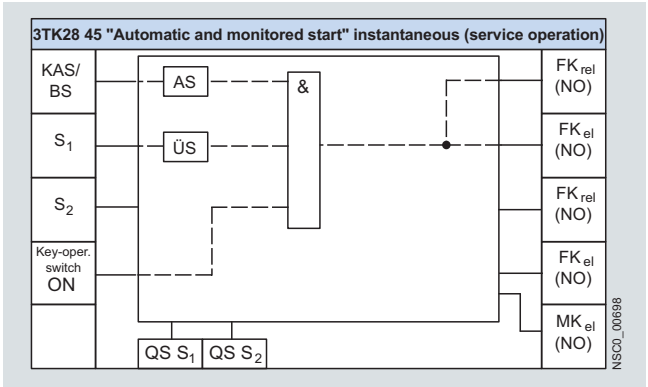
3TK28 45-.HB.. "Monitored start and autostart"

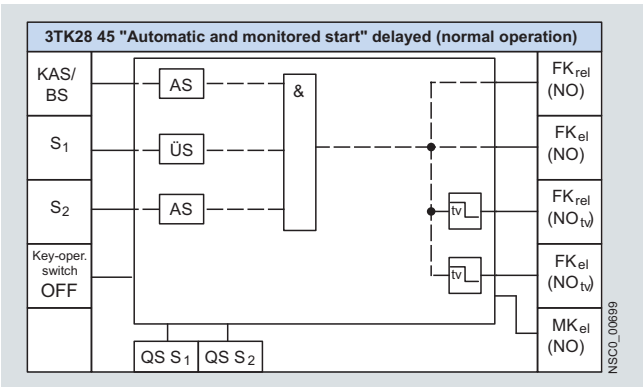
The 3TK28 45-.HB.. has two sensor inputs (S_1 with monitored start, S_2 with autostart), a cascading input (KAS/BS with autostart) and a changeover input (key-operated switch). On the output side are two relay enabling circuits, two solid-state enabling circuits and a solid-state signaling output.

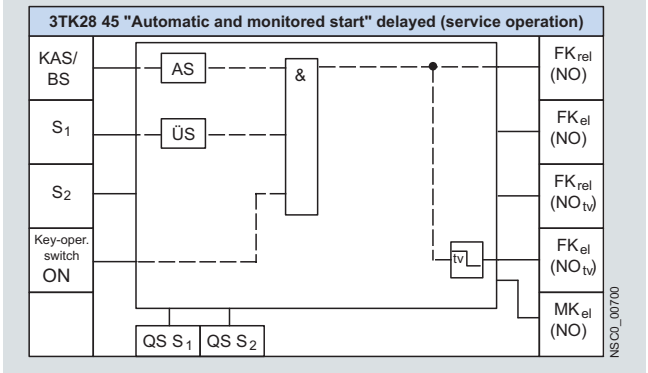
Normal operation
In normal operation (key-operated switch "OFF"), all enabling circuits are activated. All inputs are "AND"-interconnected and act simultaneously on all enabling circuits, some time-delayed.

Service operation
In service operation (key-operated switch "ON"), only two of the four enabling circuits are activated. In this case the sensor input S_2 (e. g. protective door) has no function. The hazard area can be entered because the hazardous movement is switched off by means of the two inactive enabling circuits. The sensor input S_1 and the cascading input KAS/BS still act on the active enabling circuits.









Legend

Sensor interface

KAS/BS: Cascading input or normal switching duty.
Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control.
The safety function is on a higher level.

S_x: Sensor input

Key-operated switch: Bridging of the sensor connected to S_2 (normal/service operation)

Safety logic

AS: Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).

ÜS: Monitored start. Device does not start until after the enabling conditions are fulfilled and a start signal is issued.

tv: Time delay, OFF-delay

Parameters

QS: With or without crossover monitoring

Actuator interface

FK_{el}: Enabling circuit, solid-state (non-floating)
FK_{rel}: Enabling circuit, relay contact (floating)
MK_{el}: Signaling circuit, solid-state (non-floating)
NO: NO contact
NO_{tv}: NO contact, time-delayed

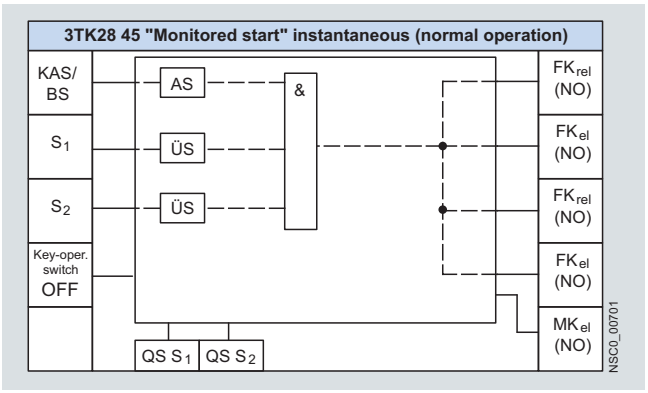
With electronic enabling circuits

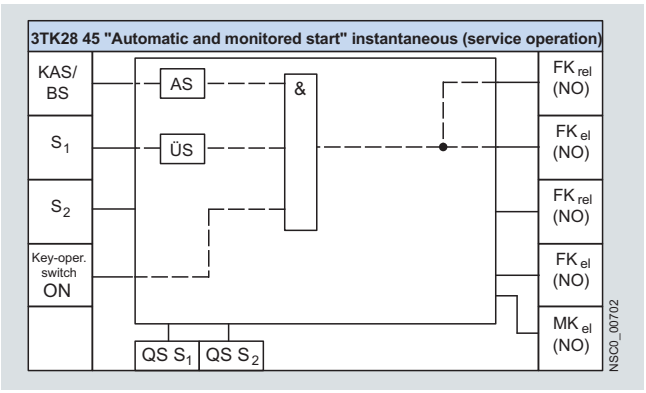
3TK28 45-.DB.. "Monitored start"

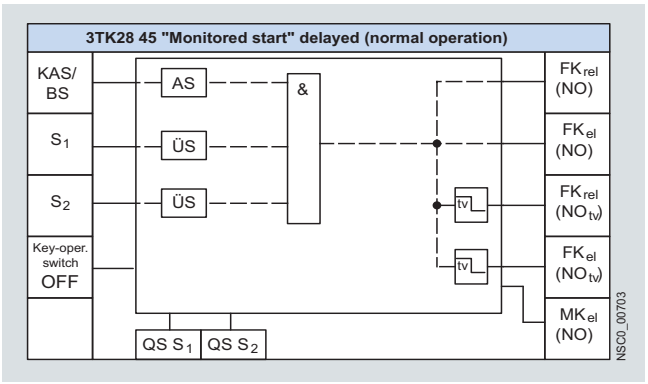
The 3TK28 45-.DB.. has two sensor inputs (S_1, S_2 with monitored start), a cascading input (KAS/BS with autostart) and a changeover input (key-operated switch). On the output side are two relay enabling circuits, two solid-state enabling circuits and a solid-state signaling output.

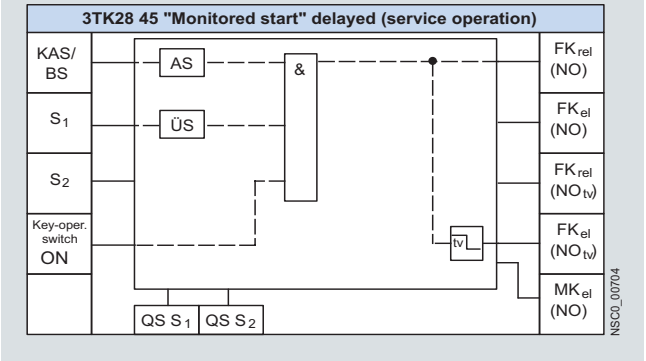
Normal operation
In normal operation (key-operated switch "OFF"), all enabling circuits are activated. All inputs are "AND"-interconnected and act simultaneously on all enabling circuits, some time-delayed.

Service operation
In service operation (key-operated switch "ON"), only two of the four enabling circuits are activated. In this case the sensor input S_2 (e. g. protective door) has no function. The hazard area can be entered because the hazardous movement is switched off by means of the two inactive enabling circuits. The sensor input S_1 and the cascading input KAS/BS still act on the active enabling circuits.









Legend

Sensor interface

KAS/BS: Cascading input or normal switching duty. Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control. The safety function is on a higher level.

S_x: Sensor input

Key-operated switch: Bridging of the sensor connected to S_2 (normal/service operation)

Safety logic

AS: Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).

ÜS: Monitored start. Device does not start until after the enabling conditions are fulfilled and a start signal is issued.

tv: Time delay, OFF-delay

Parameters

QS: With or without crossover monitoring

Actuator interface

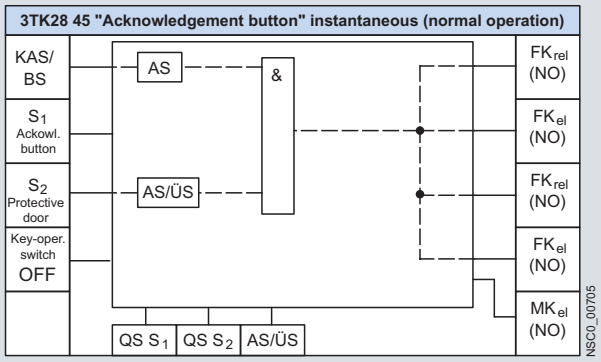
FK_{el}: Enabling circuit, solid-state (non-floating)
FK_{rel}: Enabling circuit, relay contact (floating)
MK_{el}: Signaling circuit, solid-state (non-floating)
NO: NO contact
NO_{tv}: NO contact, time-delayed

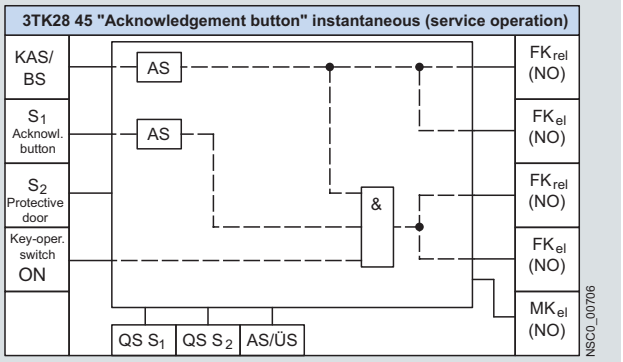
3TK28 45-.EB.. "OK button"

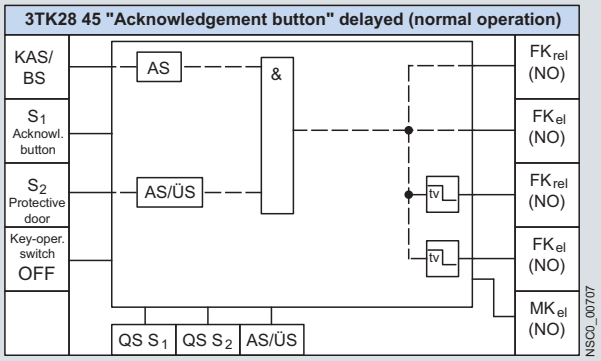
The 3TK28 45-.EB.. has two sensor inputs (S_1 OK button with autostart, S_2 protective door with selectable monitored start or automatic start), a cascading input (KAS/BS with autostart) and a changeover input (key-operated switch). On the output side are two relay enabling circuits, two solid-state enabling circuits and a solid-state signaling output.

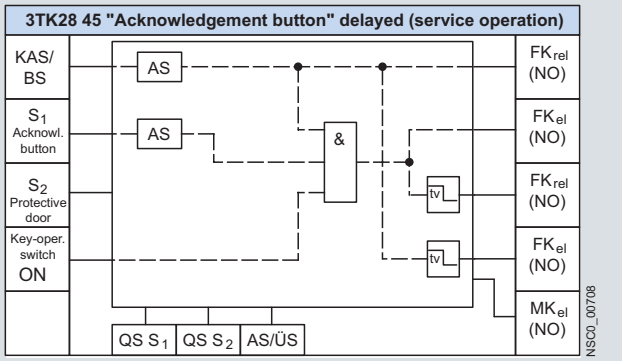
Normal operation
In normal operation (key-operated switch "OFF"), all enabling circuits are activated. The cascading input KAS/BS and the protective door input S_2 are "AND"-interconnected and act simultaneously on all enabling circuits, some time-delayed. The input S_1 for the OK button has no function here. Opening the protective door or a missing signal at the cascading input KAS/BS will deactivate all enabling circuits.

Service operation
In service operation (key-operated switch "ON"), only two of the four enabling circuits are activated. In this case the sensor input S_2 (e. g. protective door) has no function. The hazard area can be entered because the hazardous movement is switched off by means of the two inactive enabling circuits. Using the OK button at sensor input S_1, the hazardous movement can be started in spite of an open protective door.









Legend

Sensor interface

KAS/BS: Cascading input or normal switching duty.
Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control.
The safety function is on a higher level.

S_x: Sensor input

Key-operated switch: Bridging of the sensor connected to S_2 (normal/service operation)

Safety logic

AS: Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).

AS/ÜS: Automatic or monitored start depending on the parameterization

tv: Time delay, OFF-delay

Parameters

QS: With or without crossover monitoring
AS/ÜS: Automatic or monitored start depending on the parameterization

Actuator interface

FK_{el}: Enabling circuit, solid-state (non-floating)
FK_{rel}: Enabling circuit, relay contact (floating)
MK_{el}: Signaling circuit, solid-state (non-floating)
NO: NO contact

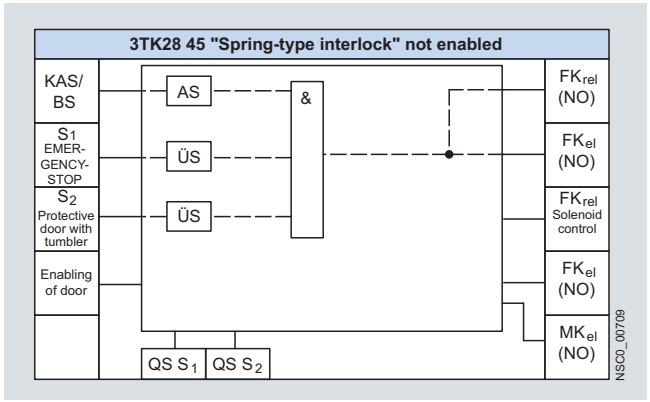
With electronic enabling circuits

3TK28 45-.FB.. "Spring-type interlocking"

The 3TK28 45-.FB.. has two sensor inputs (S_1: EMERGENCY-STOP with monitored start, S_2: protective door with interlock and monitored start), a cascading input (KAS/BS with autostart) and a door-enabling input. On the output side are a relay enabling circuit, two solid-state enabling circuits, a relay solenoid control output and a solid-state signaling output.

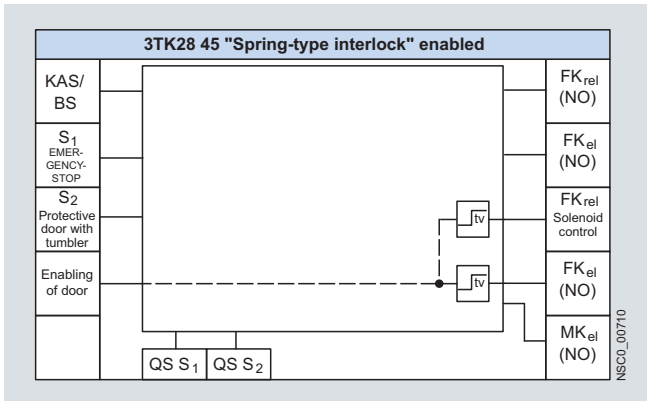
Not enabled

If the protective door is not enabled, it cannot be opened. If the signal is no longer applied to the inputs S_1 or KAS/BS, the enabling circuit is deactivated.



Enabled

With a signal at the door enabling input, the solenoid control output and the second solid-state enabling circuit are activated after the delay time has elapsed. The protective door is thus enabled.

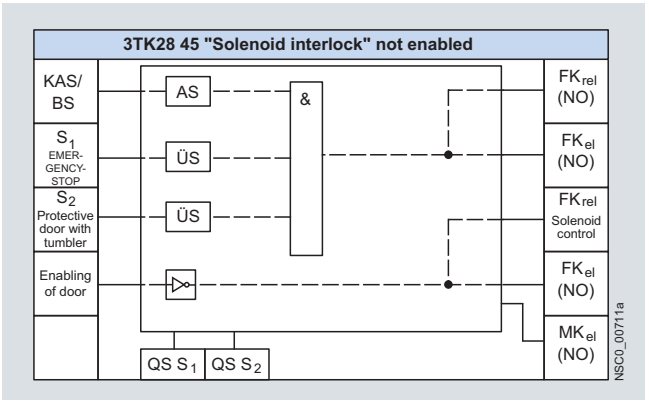


3TK28 45-.GB.. "Solenoid interlocking"

The 3TK28 45-.GB.. has two sensor inputs (S_1: EMERGENCY-STOP with monitored start, S_2: protective door with interlock and monitored start), a cascading input (KAS/BS with autostart) and a door-enabling input. On the output side are a relay enabling circuit, two solid-state enabling circuits, a relay solenoid control output and a solid-state signaling output.

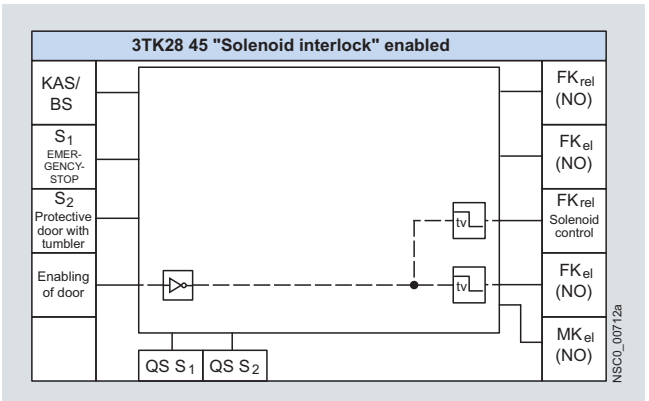
Not enabled

If the protective door is not enabled, it cannot be opened. If the signal is no longer applied to the inputs S_1 or KAS/BS, the enabling circuit is deactivated.



Enabled

With a signal at the door enabling input, the solenoid control output and the second solid-state enabling circuit are deactivated after the delay time has elapsed. The protective door is thus enabled.



Legend

Sensor interface

KAS/BS: Cascading input or normal switching duty.
Normal switching duty: Connection of a PLC output for example.
The enabling circuits and hence the connected loads can then be operated by the machine control.
The safety function is on a higher level.

S_x: Sensor input

Door enabling: Isolating the lock on the protective door

Safety logic

AS: Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).

ÜS: Monitored start. Device does not start until after the enabling conditions are fulfilled and a start signal is issued.

tv Time delay, OFF-delay

tv Time delay, ON-delay

Parameters

QS: With or without crossover monitoring

Actuator interface

FK_{el}: Enabling circuit, solid-state (non-floating)
FK_{rel}: Enabling circuit, relay contact (floating)
MK_{el}: Signaling circuit, solid-state (non-floating)
NO: NO contact

Technical specifications

Type		3TK28 40	3TK28 41	3TK28 42	3TK28 45-..B40	3TK28 45-..B41 3TK28 45-..B42 3TK28 45-..B44
General data						
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508	EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508 EN 50156-1		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508	
Test certificates		TÜV, UL, CSA				
Safety-oriented output contacts • Instantaneous FK_{rel} • Time-delayed $FK_{rel\ (tv)}$		 -- --			 2 --	 1 1
Safety-oriented semiconductor outputs • Instantaneous FK_{el} • Time-delay $FK_{el\ (tv)}$		 2 --		 1 1	 2 --	 1 1
Signaling contacts MK_{rel}		--				
Semiconductor signaling outputs MK_{rel}		--			1	
Sensor inputs S		1			2	
Cascading inputs KAS/BS		--	1			
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals				
Shock resistance sine wave	*g*/ms	8/10 and 15/5				
Permissible mounting positions		Any				
Touch protection acc. to EN 61140 or EN 60900		Finger-safe				
Height	mm	102: Screw terminals; 104: Spring-type terminals				
Width	mm	22.5			45	
Depth	mm	86			120	
Weight	kg	0.180			0.400	
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	M 3 (standard screwdriver, 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 (24 ... 16) 0.8 ... 1.2				
Connection type		**Spring-type terminals**				
• Solid • Finely stranded, with end sleeves acc. to DIN 46228 • Finely stranded	mm^2 mm^2 mm^2	2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5)				
Electrical specifications						
Rated control supply voltage U_s	V	24 DC				
Operating range DC operation	V	0.9 ... 1.15 × U_s			0.85 ... 1.15 × U_s	
Rated insulation voltage U_i • For control circuit • For outputs	 V V	 50 50			 50 50/300	
Rated impulse withstand voltage U_{imp} • For control circuit • For outputs	 V V	 500 500			 500 500/4000	
Rated power at U_s	W	1.5	1.3		2.5	
Frequency ranges	Hz	--				
Rated operational current I_e (relay outputs) at • AC-15 at 115 V • AC-15 at 230 V • DC-13 at 24 V • DC-13 at 115 V • DC-13 at 230 V	 A A A A A	 -- -- -- -- --			 -- 3 1 -- 0.1	
Rated operational current I_e (semiconductor outputs) at • DC-13 at 24 V	 A	 0.5	 1.5		 1	
Electrical endurance	Operating cycles	Unlimited				
Mechanical endurance	Operating cycles	--			10^5	
Switching frequency *z*	1/h	2000				

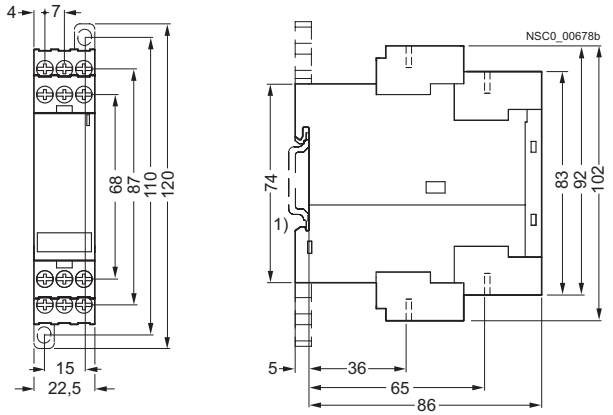
With electronic enabling circuits

Technical specifications

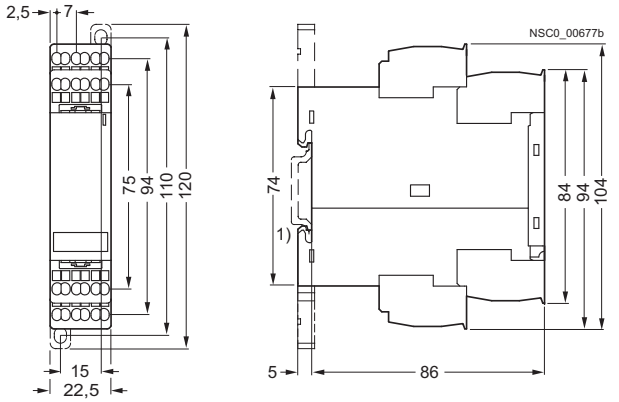
Type		3TK28 40	3TK28 41	3TK28 42	3TK28 45-..B40	3TK28 45-..B41 3TK28 45-..B42 3TK28 45-..B44
Electrical specifications (continued)						
Conventional thermal current I_{th}		--				
Conventional thermal current I_{th}						
• 1 contact	A	--				
• 2 contacts	A	--				
• 3 contacts	A	--				
• 4 contacts	A	--				
Fusing for output contacts						
Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE, gL/gG operational class						
• gL/gG		Not required				
• Quick		Not required				
Maximum line resistance	Ω	250	1000			
Cable length from terminal to terminal With Cu 1.5 mm^2 and 150 nF/km	m	2000			1000	
Times						
Bridging of voltage dips, supply voltage (only internal, no outputs) (only internal, no outputs)	ms	25				
Make-time t_E						
• For automatic start typ.	ms	80	60		60	
• For automatic start max.	ms	100	100		100	
• For automatic start after mains failure typ.	ms	350	6000		--	
• For automatic start after mains failure max.	ms	500	7000		--	
• For monitored start typ.	ms	60	60		60	
• For monitored start max.	ms	100	100		100	
Release time t_R						
• For sensor typ.	ms	20	45	--	45	--
• For sensor max.	ms	30	60	0.05 ... 300 Adjustable	--	0.05 ... 300 Adjustable
• For mains failure typ.	ms	0	0	0	25	25
• For mains failure max.	ms	0	0	0	30	30
Recovery time t_W						
• After sensor	ms	120	400		400	
• After mains failure	s	0.5	Max. 7		Max. 8	
Minimum command duration t_B						
• Sensor input	ms	5	45			
• ON button input	ms	60	200 ... 5000			
• Cascading input	ms	5	45			
Simultaneity t_G	ms	∞				
Temperatures						
Permissible ambient temperature						
• During operation	°C	–25 ... +60				
• During storage	°C	–40 ... +80				
Safety specifications						
Safety integrity level SIL CL acc. to IEC 61508		2	3			
Performance level PL acc. to ISO 13849-1		d	e			
Safety category CAT acc. to EN 954-1		3	4			
Type acc. to EN 574		--				
Probability of a dangerous failure						
• Per hour (PFH_D)	1/h	1.10×10^{-8}	5.40×10^{-11}		6.90×10^{-9}	
• On demand (PFD)		--	--		--	
Proof-test interval T1	a	10			20	
Environmental data						
EMC		EN 60947-5-1, EN 61000-6-2, EN 61000-6-4	IEC 60947-5-1, IEC 60000-4-3, IEC 60000-4-5, IEC 60000-4-6			
Vibrations acc. to EN 60068-2-6						
• Frequency	Hz	5 ... 500				
• Amplitude	mm	0.075				
Climatic withstand capability		EN 60068-2-78				
Clearances in air and creepage distances		EN 60947-1				

Dimensional drawings

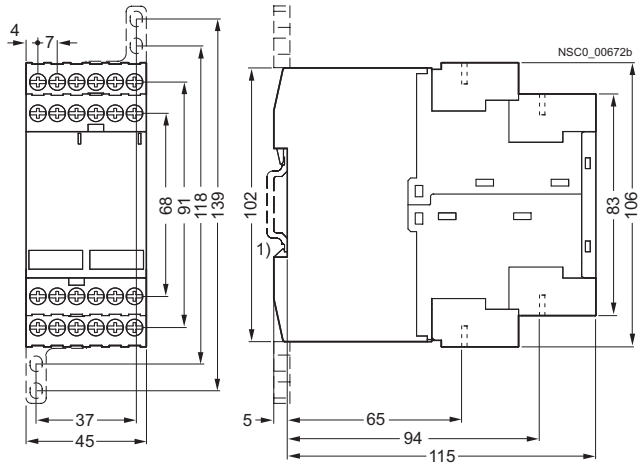
3TK28 40 to 3TK28 42 with screw terminals



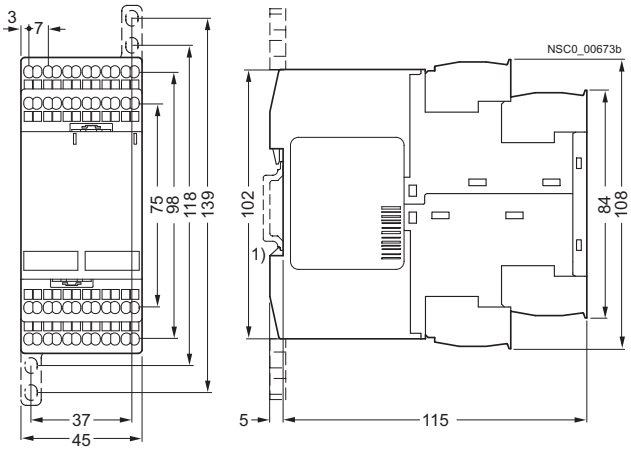
3TK28 40 to 3TK28 42 with spring-type terminals



3TK28 45 with screw terminals



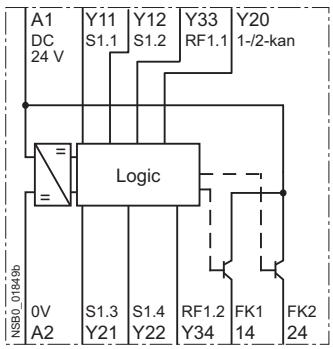
3TK28 45 with spring-type terminals



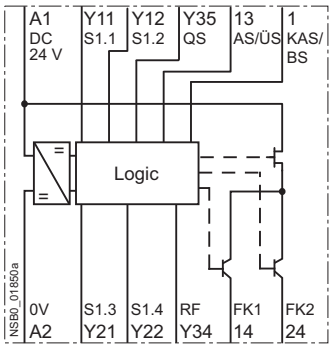
1) For standard mounting rail TH 35 according to EN 60715.

Schematics

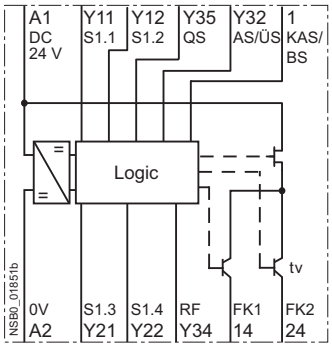
3TK28 40



3TK28 41



3TK28 42

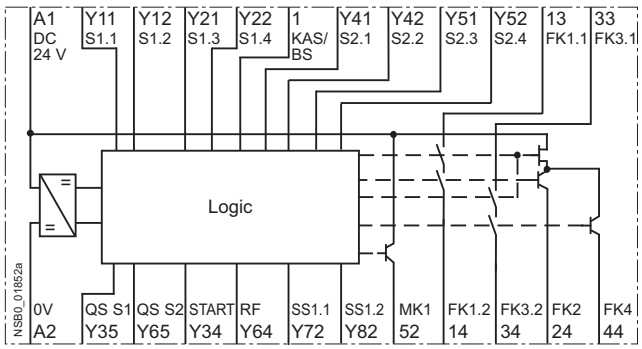


Legend

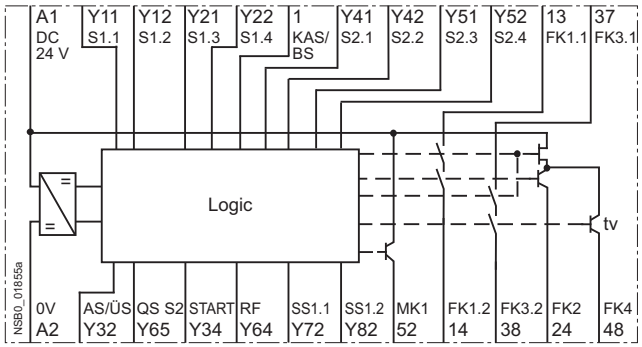
$FK_{x.x}$:	Enabling circuits
$S_{x.x}$:	Sensor terminals (test connectors)
$RF_{x.x}$:	Feedback circuit terminals
1-/2-kan:	Parameter terminal switchover, one/two-channel
QS:	Parameter terminal with crossover monitoring (ON/OFF)
AS/ÜS:	Parameter terminal switchover, automatic/monitored start
KAS/BS:	Terminal, cascading input/normal switching
tv:	Time-delayed outputs

With electronic enabling circuits

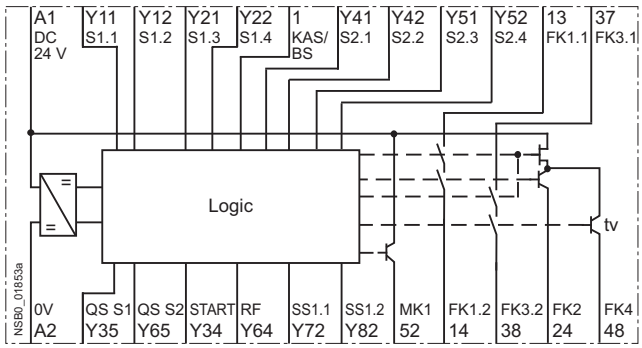
3TK28 45-.HB40, -.DB40



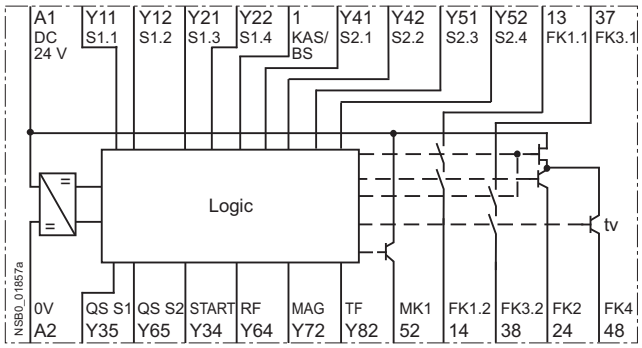
3TK28 45-.EB41, -.EB42, -.EB44



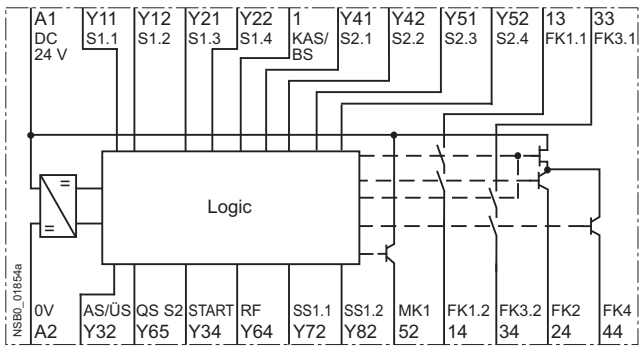
3TK28 45-.HB41, -.HB42, -.HB44, -.DB41, -.DB42, -.DB44



3TK28 45-.FB41, -.FB42, -.FB44, -.GB41, -.GB42, -.GB44



3TK28 45-.EB40



Legend

$FK_{x.x}$:	Enabling circuits
$S_{x.x}$:	Sensor terminals (test connectors)
$RF_{x.x}$:	Feedback circuit terminals
$MK_{x.x}$:	Indicating circuit terminals
START:	Start signal terminal
QS:	Parameter terminal with crossover monitoring (ON/OFF)
AS/ÜS:	Parameter terminal switchover, automatic/monitored start
KAS/BS:	Terminal, cascading input/normal switching
$SS_{x.x}$:	Key-operated switch terminals
MAG:	Magnetic monitoring
TF:	Door enabling
tv:	Time-delayed outputs

Design

The 3TK28 21 to 3TK28 28, 3TK28 30 and 3TK28 34 safety relays operate with internal contactor relays with positively-driven contacts The contacts of the controls comply with the requirement for positively-driven operation laid down in ZH 1/457, Edition 2, 1978. NO and NC contacts are not allowed to be closed at the same time.

In a redundant circuit, operation of the internal controls is monitored. If a safety relay fails, it will always switch to the de-energized and consequently safe state. The fault is detected and the safety relay can no longer be switched on.

This product series is characterized by its space-saving width (22.5 mm or 45 mm). The usual BIA, BG and SUVA approvals and test certificates have been awarded.

Enabling contacts (FK)

Safety related operation must be performed by safe output contacts, known as enabling contacts. Enabling contacts are always NO contacts and switch without delay.

Signaling contacts (MK)

NC contacts are used as signaling contacts but they are not permitted to perform functions with relevance for safety. An enabling contact can also be used as a signaling contact.
A signaling contact cannot, however, be used as an enabling contact.

Delayed enabling contacts

Machine drives that overrun for a long time must be externally braked in the event of danger. For this purpose, the energy infeed for electrical braking can be maintained (Stop Category 1 according to EN 60204-1).

The basic units have off-delay enabling contacts in addition to instantaneous enabling contacts. Delay times of between 0.5 ... 30 s are available with the different versions. A 3RP19 02 sealable cover can be fitted to protect against unauthorized adjustment of the set delay time.

Expansion units

If the enabling contacts of the basic unit are inadequate, expansion units can be used. An expansion unit has 4 enabling contacts.

Expansion units are not allowed to be operated separately in safety-related switching circuits; they must be combined with a basic unit. One enabling contact of the basic unit is required for connecting an expansion unit. The category of a control system with expansion unit corresponds to that of the basic unit.

Mounting

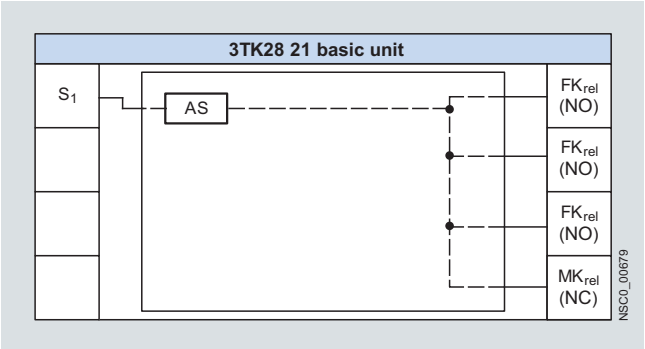
The equipment is designed for snap-on mounting on a TH 35 standard mounting rail according to EN 60715. Screw fixing is also possible for the devices by means of 2 additional 3RP19 03 push-in lugs.

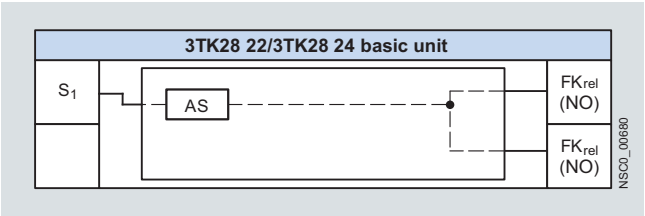
Function

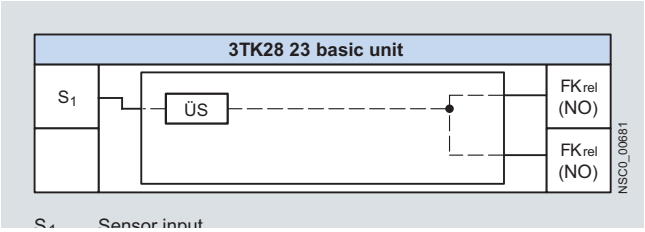
Basic units

3TK28 21 to 3TK28 24

The devices 3TK28 21 to 3TK28 24 each have one sensor input and a varying number of relay enabling circuits and signaling outputs. If the signal is no longer applied to the sensor input, the enabling circuits are disconnected immediately or according to the set delay timed.







Legend

Sensor interface

S_x:	Sensor input

Safety logic

AS:	Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).
ÜS:	Monitored start. Device does not start until after the enabling conditions are fulfilled and a start signal is issued.

Actuator interface

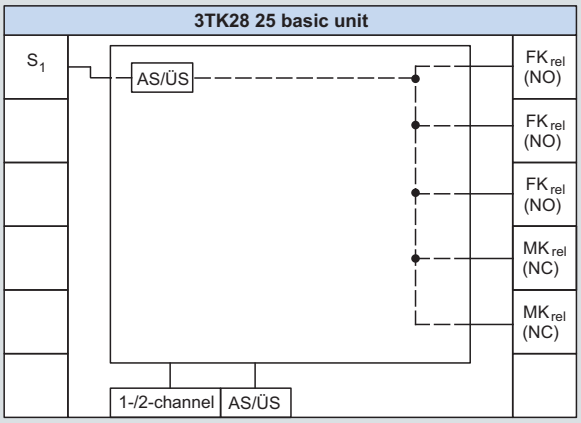
FK_{rel}:	Enabling circuit, relay contact (floating)
MK_{rel}:	Signaling circuit, relay contact (non-floating)
NC:	NC contact
NO:	NO contact

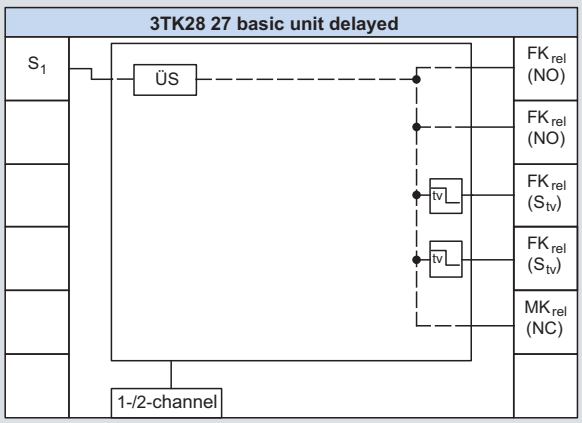
With relay enabling circuits

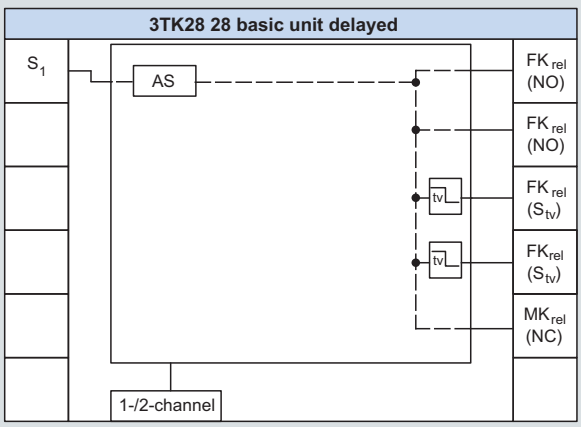
Basic units

3TK28 25, 3TK28 27 and 3TK28 28

The devices 3TK28 25, 3TK28 27 and 3TK28 28 each have one sensor input and a varying number of contactor relay enabling circuits and signaling outputs. If the signal is no longer applied to the sensor input, the enabling circuits are disconnected immediately or according to the set delay timed.





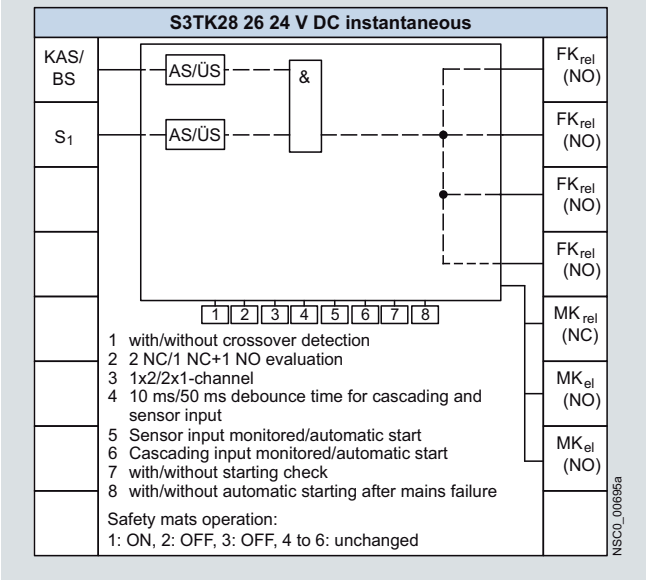


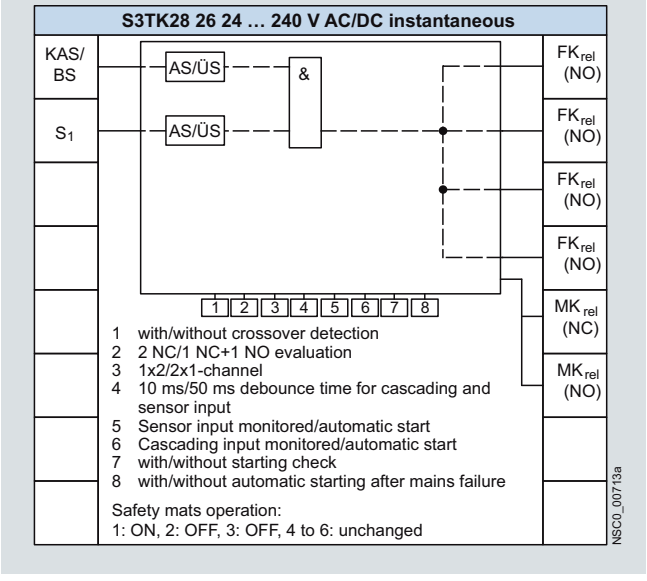
Basic units

3TK28 26

The 3TK28 26 safety relay combines several functions in one unit. The sensor input S_1 and the cascading input KAS are suitable for connecting sensors with contacts, non-contact sensors (electronic sensors), safety mats and NC/NO magnetically operated switches.

DIP switches mounted on the front can be used to adapt the functions of the device to the functions required.

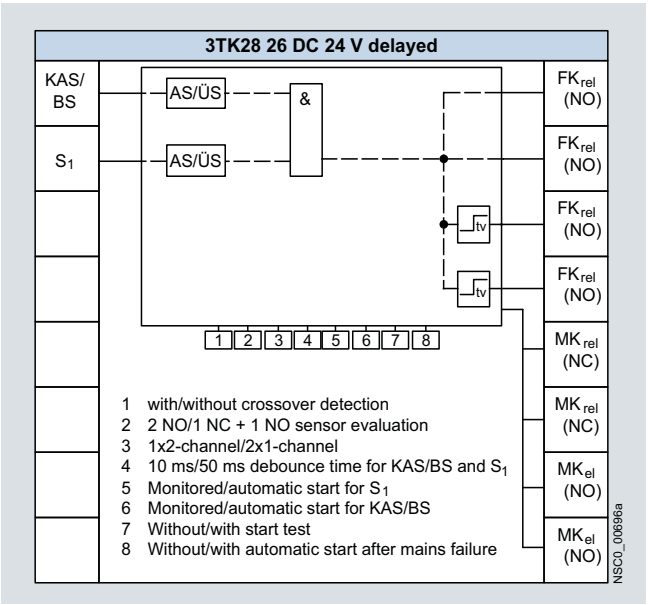


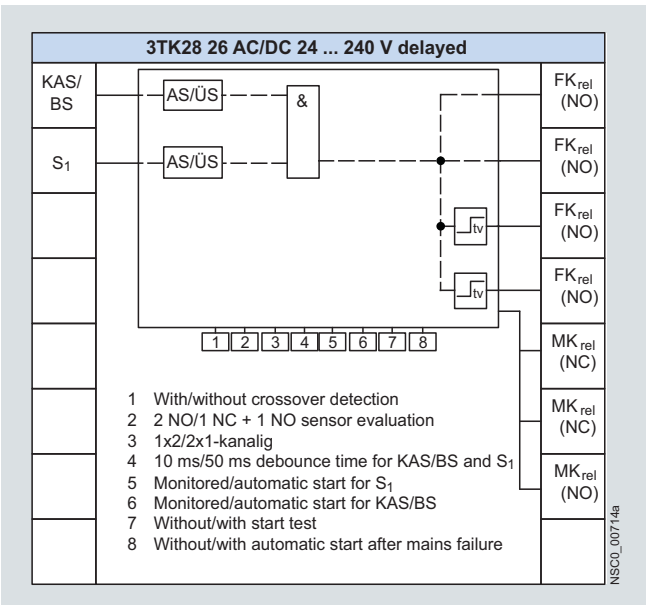


For legend see page 129.

Basic units

3TK28 26 (continued)



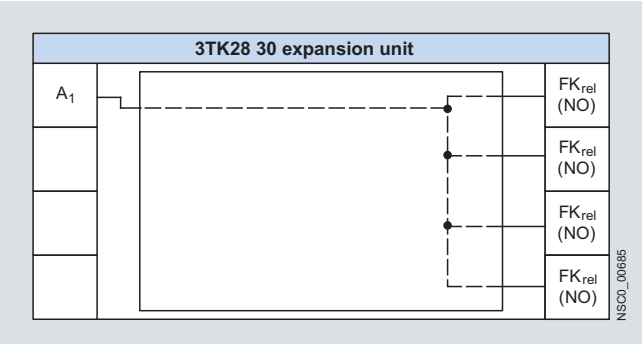


Expansion units

3TK28 30

3TK28 30 is a safe contact extension for 3TK28 basic devices. Using this device, depending on the wiring of the downstream basic device, applications with SIL 3 (according to IEC 62061) or PL e (according to ISO 13849-1) can be implemented.

The 3TK28 30 is activated through the power supply input A1. On the output side are four contactor relay enabling circuits. If the signal is no longer applied to the input, the enabling circuits are isolated immediately.



Legend

Sensor interface

S_x:	Sensor input
A1:	Power supply input as sensor input or cascading input
KAS/BS:	Cascading input or normal switching duty. Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control. The safety function is on a higher level.

Safety logic

AS:	Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).
AS/ÜS:	Automatic or monitored start depending on the parameterization
ÜS:	Monitored start. Device does not start until after the enabling conditions are fulfilled and a start signal is issued.
	Time delay, OFF-delay
	Time delay, ON-delay

Parameters

1 to 8:	See drawing
1-/2-channel:	One-channel / two-channel sensor connection
AS/ÜS:	Automatic or monitored start depending on the parameterization

Actuator interface

FK_{rel}:	Enabling circuit, relay contact (floating)
MK_{el}:	Signaling circuit, solid-state (non-floating)
MK_{rel}:	Signaling circuit, relay contact (non-floating)
NC:	NC contact
NO:	NO contact
S_{tv}:	NO contact, time-delayed

With relay enabling circuits

Technical specifications

Type		3TK28 21	3TK28 22	3TK28 23	3TK28 24-..B0.0	3TK28 24-.A.20	3TK28 25
General data							
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508					
Test certificates		BG, SUVA, UL, CSA					
Safety-oriented output contacts							
• Instantaneous FK_{rel}		3	2				3
• Time-delayed $FK_{rel\ (tv)}$		--	--				--
Safety-oriented semiconductor outputs							
• Instantaneous FK_{el}		--					
• Time-delay $FK_{el\ (tv)}$		--					
Signaling contacts MK_{rel}		1	--				2
Semiconductor signaling outputs MK_{rel}		--					
Sensor inputs S		1					
Cascading inputs KAS/BS		--					
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals					
Shock resistance sine wave	*g*/ms	8/10					
Permissible mounting positions		Any					
Touch protection acc. to EN 61140 or EN 60900		Finger-safe					
Height	mm	102: screw terminals; 104: spring-type terminals					
Width	mm	22.5					
Depth	mm	115					
Weight	kg	0.240					0.460
Connection type		**Screw terminals**					
• Terminal screw		M 3 (standard screwdriver, 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 (24 ... 16)					
• 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 acc. to DIN 46228	mm^2	2 x (0.25 ... 1.5)					
• Finely stranded	mm^2	2 x (0.25 ... 1.5)					
• Stripped length	mm	10					
Electrical specifications							
Rated control supply voltage U_s	V	24 AC/DC				115/230 AC	24/115/230 AC, 24 DC
Operating range							
• AC operation	V	0.85 ... 1.1 × U_s				0.85 ... 1.1 × U_s	0.85 ... 1.1 × U_s
• DC operation	V	0.85 ... 1.2 × U_s				--	0.85 ... 1.1 × U_s
Measurement voltage	V	--					
Response value U_{resp}	mV	--					
Rated insulation voltage U_i							
• For control circuit	V	--					
• For outputs	V	300					
Rated impulse withstand voltage U_{imp}							
• For control circuit	V	--					
• For outputs	V	4000					
Rated power	W	1.5					3
Frequency ranges	Hz	50/60					
Rated operational current I_e (relay outputs) at							
• AC-15 at 115 V	A	5					6
• AC-15 at 230 V	A	5					6
• DC-13 at 24 V	A	5					6
• DC-13 at 115 V	A	0.2					0.2
• DC-13 at 230 V	A	0.1					0.1
Rated operational current I_e (semiconductor outputs) at							
• DC-13 at 24 V	A	--					
• DC-13 at 230 V	A	--					

Type		3TK28 21	3TK28 22	3TK28 23	3TK28 24-..B0.0	3TK28 24-.A.20	3TK28 25
Electrical specifications (continued)							
Electrical endurance	Operating cycles	10^5					
Mechanical endurance	Operating cycles	10^7					
Switching frequency *z*	1/h	1000					
Conventional thermal current I_{th}	A	5					6
Conventional thermal current I_{th}							
• 1 contact	A	--					
• 2 contacts	A	--					
• 3 contacts	A	--					
• 4 contacts	A	--					
Fusing for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE, gL/gG operational class							
• gL/gG	A	6	6		6		6
• Quick	A	10; Signaling circuit: 6	10		10; Signaling circuit: 6		10
Maximum line resistance	Ω	30					
Cable length from terminal to terminal With Cu 1.5 mm² and 150 nF/km	m	1000					
Times							
Bridging of voltage dips, supply voltage (only internal, no outputs)	ms	60	30	80	60		100
Make-time t_E							
• For automatic start typ.	ms	--	--	--	--	--	--
• For automatic start max.	ms	AC: 300, DC: 200	125	--	AC: 300, DC: 200	300	150
• For automatic start after mains failure typ.	ms	--	--	--	--	--	--
• For automatic start after mains failure max.	ms	--	--	--	--	--	--
• For monitored start typ.	ms	--	--	--	--	--	--
• For monitored start max.	ms	--	--	30	--	--	25
Release time t_R							
• For sensor typ.	ms	--	--	--	--		--
• For sensor max.	ms	200	20	20	200		25
• For mains failure typ.	ms	--	--	--	--		--
• For mains failure max.	ms	200	100	150	200		350
Recovery time t_W							
• After sensor	ms	Min. 200		Min. 400	Min. 200		Min. 200
• After mains failure	s	Min. 200		Min. 600	Min. 200		Min. 500
Minimum command duration t_B							
• Sensor input	ms	Min. 200	Min. 25	Min. 25	Min. 200	Min. 300	Min. 25
• ON button	s	Min. 150	Min. 40	Min. 25	Min. 150	Min. 300	Min. 25
• Cascading input	s	--	--	--	--	--	--
Simultaneity t_G	ms	∞					
Temperatures							
Permissible ambient temperature							
• During operation	°C	–25 ... +60					
• During storage	°C	–40 ... +80					
Safety specifications							
Safety integrity level SIL CL acc. to IEC 61508		1	3		1		3
Performance level PL acc. to ISO 13849-1		c	e		c		e
Safety category CAT acc. to EN 954-1		3	4		3		4
Type acc. to EN 574		--					
Probability of a dangerous failure							
• Per hour (PFH_D)	1/h	1.10×10^{-9}	1.30×10^{-9}	1.30×10^{-9}	8.70×10^{-10}	8.70×10^{-10}	1.50×10^{-9}
• On demand (PFD)		9.90×10^{-7}	1.10×10^{-6}	1.20×10^{-6}	7.70×10^{-7}	7.70×10^{-7}	1.30×10^{-6}
Proof-test interval T1	a	20					
Environmental data							
EMC		EN 60947-5-1					
Vibrations acc. to EN 60068-2-6							
• Frequency	Hz	5 .. 500					
• Amplitude	mm	0.075					
Climatic withstand capability		EN 60068-2-1, EN 60068-2-2, EN 60068-2-14, EN 60068-2-30					
Clearances in air and creepage distances		EN 60947-1					

With relay enabling circuits

Type		3TK28 26-.BB40	3TK28 26-.CW30	3TK28 26-.BB41 3TK28 26-.BB42 3TK28 26-.BB44	3TK28 26-.CW31 3TK28 26-.CW32 3TK28 26-.CW44	3TK28 27
General data						
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508				
Test certificates		TÜV, UL, CSA				BG, SUVA, UL, CSA
Safety-oriented output contacts • Instantaneous FK_{rel} • Time-delayed $FK_{rel\ (tv)}$		4 --		2 2		
Safety-oriented semiconductor outputs • Instantaneous FK_{el} • Time-delay $FK_{el\ (tv)}$		-- --				
Signaling contacts MK_{rel}		1	2		3	1
Semiconductor signaling outputs MK_{rel}		2	--	2	--	
Sensor inputs S		1				
Cascading inputs KAS/BS		1				--
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals				
Shock resistance sine wave	*g*/ms	8/10				
Permissible mounting positions		Any				
Touch protection acc. to EN 61140 or EN 60900		Finger-safe				
Height	mm	106: screw terminals; 108: spring-type terminals				
Width	mm	45				
Depth	mm	116				115
Weight	kg	0.350				0.580
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	M 3 (standard screwdriver, 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 (24 ... 16) 0.8 ... 1.2				
Connection type		**Spring-type terminals**				
• Solid • Finely stranded, with end sleeves acc. to DIN 46228 • Finely stranded • Stripped length	mm^2 mm^2 mm^2 mm	2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 10				
Electrical specifications						
Rated control supply voltage U_s	V	24 DC	24 ... 240 AC/DC	24 DC	24 ... 240 AC/DC	24 DC, 24/115/230 AC
Operating rangec • AC operation • DC operation	V	-- 0.85 ... 1.2 × U_s	0.9 ... 1.1 × U_s 0.9 ... 1.1 × U_s	-- 0.85 ... 1.2 × U_s	0.9 ... 1.1 × U_s 0.9 ... 1.1 × U_s	0.85 ... 1.1 × U_s 0.85 ... 1.1 × U_s
Measurement voltage	V	--				
Response value U_{resp}	mV	--				
Rated insulation voltage U_i • For control circuit • For outputs	 V V	 -- 300				
Rated impulse withstand voltage U_{imp} • For control circuit • For outputs	 V V	 -- 4000				
Rated power	W	3				
Frequency ranges	Hz	50/60				
Rated operational current I_e (relay outputs) at • AC-15 at 115 V • AC-15 at 230 V • DC-13 at 24 V • DC-13 at 115 V • DC-13 at 230 V	 A A A A A	 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 33/34, 43/44: 4 51/52: 2 0.2 0.1	 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 63/64: 1 13/14, 23/24, 33/34, 43/44: 4 51/52: 2, 63/64: 1 0.2 0.1	 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 47/48, 57/58: 4 31/32, 61/62: 3 13/14, 23/24, 47/48, 57/58: 4 31/32, 61/62: 2 0.2 0.1	 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 33/34, 43/44: 4 51/52: 3 13/14, 23/24, 47/48, 57/58: 4 31/32, 61/62: 2 73/74: 1 0.2 0.1	 -- 13/14, 23/24, 47/48, 57/58: 4 31/32, 61/62: 3 73/74: 1 13/14, 23/24: 5 47/48, 57/58: 2 0.2 0.1
Rated operational current I_e (semiconductor outputs) at • DC-13 at 24 V • DC-13 at 230 V	 A A	 64, 75: 0.5 --	 -- --	 74, 84: 0.5 --	 -- --	 -- --

Type		3TK28 26-.BB40	3TK28 26-.CW30	3TK28 26-.BB41 3TK28 26-.BB42 3TK28 26-.BB44	3TK28 26-.CW31 3TK28 26-.CW32 3TK28 26-.CW44	3TK28 27
Electrical specifications (continued)						
Electrical endurance	Oper. cycles	--				10^5
Mechanical endurance	Oper. cycles	10^7				
Switching frequency z	1/h	2000				1000
Conventional thermal current I_{th}	A	Summation current max. 12				5
Conventional thermal current I_{th}						
• 1 contact	A	4				
• 2 contacts	A	4				
• 3 contacts	A	4				
• 4 contacts	A	3				
Fusing for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE, gL/gG operational class						
• gL/gG	A	4				6 (control voltage: 2)
• Quick	A	6				10
Maximum line resistance	Ω	1000				30
Cable length from terminal to terminal With Cu 1.5 mm^2 and 150 nF/km	m	2000				1000
Times						
Bridging of voltage dips, supply voltage (only internal, no outputs)	ms	Min. 10				30
Make-time t_E						
• For automatic start typ.	ms	50 + debounce time				--
• For automatic start max.	ms	50 + debounce time				--
• For automatic start after mains failure typ.	ms	Approx. 8000 starting time				Approx. 8000 starting time
• For automatic start after mains failure max.	ms	Approx. 8000 starting time				Approx. 8000 starting time
• For monitored start typ.	ms	50 + debounce time				--
• For monitored start max.	ms	50 + debounce time				80
Release time t_R						
• For sensor typ.	ms	50 + deb. time	50 + deb. time	--	--	--
• For sensor max.	ms	--	--	50+ deb. time	50+ deb. time	≤ 30 adjustable
• For mains failure typ.	ms	75	--	75	--	--
• For mains failure max.	ms	125	300	125	320	100
Recovery time t_W						
• After sensor	ms	Min. 250		Min. 250	Min. 250	After time has elapsed
• After mains failure	s	Min. 200		Min. 600	Min. 200	Min. 200
Minimum command duration t_B						
• Sensor input	ms	30				Min. 25
• ON button	s	0.2 ... 5				Min. 25
• Cascading input	s	--				--
Simultaneity t_G	ms	∞				
Temperatures						
Permissible ambient temperature						
• During operation	°C	–25 ... +60				
• During storage	°C	–40 ... +80				
Safety specifications						
Safety integrity level SIL CL acc. to IEC 61508		3				Stop cat. 0: 3 Stop cat. 1: 2
Performance level PL acc. to ISO 13849-1		e				Stop cat. 0: e Stop cat. 1: d
Safety category CAT acc. to EN 954-1		4				Stop cat. 0: 4 Stop cat. 1: 3
Type acc. to EN 574		--				
Probability of a dangerous failure						
• Per hour (PFH_D)	1/h	7.80×10^{-9}				2.70×10^{-9}
• On demand (PFD)		1.50×10^{-5}				2.40×10^{-6}
Proof-test interval T1	a	20				
Environmental data						
EMC		EN 60947-5-1				
Vibrations acc. to EN 60068-2-6						
• Frequency	Hz	5 .. 500				
• Amplitude	mm	0.075				
Climatic withstand capability		EN 60068-2-1, EN 60068-2-2, EN 60068-2-14, EN 60068-2-30				
Clearances in air and creepage distances		EN 60947-1				

[1] Time-delayed enabling circuit: ≤ 300 ms adjustable.

With relay enabling circuits

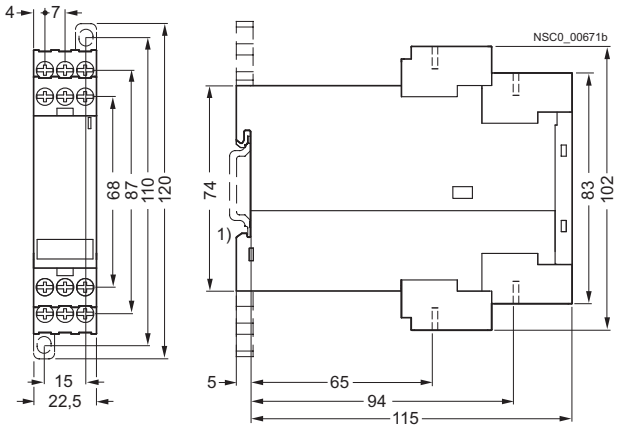
Type		3TK28 28	3TK28 30	3TK28 34	3TK28 35
General data					
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508, EN 574	
Test certificates		BG, SUVA, UL, CSA, TÜV			
Safety-oriented output contacts					
• Instantaneous FK_{rel}		2	4	2	4
• Time-delayed $FK_{rel\ (tv)}$		2	--	--	--
Safety-oriented semiconductor outputs					
• Instantaneous FK_{el}		--			
• Time-delay $FK_{el\ (tv)}$		--			
Signaling contacts MK_{rel}		1		2	--
Semiconductor signaling outputs MK_{rel}		--			
Sensor inputs S		1	--	1	
Cascading inputs KAS/BS		--			
Degree of protection acc. to IEC 60529					
• Enclosure		IP40	IP20		
• Terminals		IP20	IP20		
Shock resistance sine wave	*g*/ms	8/10			
Permissible mounting positions		Any			
Touch protection acc. to EN 61140 or EN 60900		Finger-safe			
Height	mm	106 (3TK28 30: 102): screw terminals; 108 (3TK28 30: 104): spring-type terminals			
Width	mm	45	22.5	45	
Depth	mm	115			
Weight	kg	0.580	0.260	0.450	0.500
Connection type		**Screw terminals**			
• Terminal screw		M 3 (standard screwdriver, 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 (24 ... 16)			
• 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 acc. to DIN 46228	mm^2	2 x (0.25 ... 1.5)			
• Finely stranded	mm^2	2 x (0.25 ... 1.5)			
• Stripped length	mm	10			
Electrical specifications					
Rated control supply voltage U_s	V	24 DC, 24/115/230 AC			
Operating range					
• AC operation	V	0.85 ... 1.1 × U_s	0.85 ... 1.1 × U_s	0.85 ... 1.1 × U_s	
• DC operation	V	0.85 ... 1.1 × U_s	0.85 ... 1.2 × U_s	0.85 ... 1.1 × U_s	
Measurement voltage	V	--			
Response value U_{resp}	mV	--			
Rated insulation voltage U_i					
• For control circuit	V	--			
• For outputs	V	300			
Rated impulse withstand voltage U_{imp}					
• For control circuit	V	--			
• For outputs	V	4000			
Rated power	W	3	2	3	
Frequency ranges	Hz	50/60			
Rated operational current I_e (relay outputs) at					
• AC-15 at 115 V	A	--	--	--	--
• AC-15 at 230 V	A	13/14, 23/24: 5 47/48, 57/58: 3	5	5	23/24, 33/34, 41/42: 5 13/14: 3
• DC-13 at 24 V	A	13/14, 23/24: 5 47/48, 57/58: 2	5	6	23/24, 33/34, 41/42: 5 13/14: 2
• DC-13 at 115 V	A	0.2	0.2	0.2	0.2
• DC-13 at 230 V	A	0.1	0.1	0.1	0.1
Rated operational current I_e (semiconductor outputs) at					
• DC-13 at 24 V	A	--			
• DC-13 at 230 V	A	--			

Type		3TK28 28	3TK28 30	3TK28 34	3TK28 35
Electrical specifications (continued)					
Electrical endurance	Oper. cycles	10^5			
Mechanical endurance	Oper. cycles	10^7			
Switching frequency *z*	1/h	1000			
Conventional thermal current I_{th}	A	5		6	5
Conventional thermal current I_{th}					
• 1 contact	A	--			
• 2 contacts	A	--			
• 3 contacts	A	--			
• 4 contacts	A	--			
Fusing for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE, gL/gG operational class					
• gL/gG	A	6, control voltage: 2	6	6, control voltage: 2	
• Quick	A	10	10	10	
Maximum line resistance	Ω	30		--	
Cable length from terminal to terminal With Cu 1.5 mm^2 and 150 nF/km	m	1000	3TK28 30-.CB30:1000 3TK28 30-.AJ20: 300 3TK28 30-.AL20: 80	1000	--
Times					
Bridging of voltage dips, supply voltage (only internal, no outputs)	ms	30	3TK28 30-.CB30:10 3TK28 30-.A.20: 35	40	
Make-time t_E					
• For automatic start typ.	ms	--	--	--	--
• For automatic start max.	ms	80	3TK28 30-.CB30: 30 3TK28 30-.A.20: 200	100	50
• For automatic start after mains failure typ.	ms	--	--	--	--
• For automatic start after mains failure max.	ms	--	3TK28 30-.CB30: 30 3TK28 30-.A.20: 200	--	--
• For monitored start typ.	ms	--	--	--	--
• For monitored start max.	ms	--	--	--	--
Release time t_R					
• For sensor typ.	ms	--	--	--	--
• For sensor max.	ms	Up to 30 adjustable	--	20	50
• For mains failure typ.	ms	--	--	--	--
• For mains failure max.	ms	100	3TK28 30-.CB20: 25 3TK28 30-.A.20: 80	--	--
Recovery time t_W					
• After sensor	ms	After time has elapsed	--	Min. 250	Min. 250
• After mains failure	s	Min. 1	3TK28 30-.CB20: 50 3TK28 30-.A.20: 120	--	--
Minimum command duration t_B					
• Sensor input	ms	Min. 25	--		
• ON button	s	Min. 25	--		
• Cascading input	s	--	--		
Simultaneity t_G	ms	∞			
Temperatures					
Permissible ambient temperature					
• During operation	°C	–25 ... +60			
• During storage	°C	–40 ... +80			
Safety specifications					
Safety integrity level SIL CL acc. to IEC 61508		Stop cat. 0: 3 Stop cat. 1: 2	3	--	3
Performance level PL acc. to ISO 13849-1		Stop cat. 0: e Stop cat. 1: d	--	e	--
Safety category CAT acc. to EN 954-1		Stop cat. 0: 4 Stop cat. 1: 3	As basic unit	4	As basic unit
Type acc. to EN 574		--	--	III C	As basic unit
Probability of a dangerous failure					
• Per hour (PFH_D)	1/h	2.70×10^{-9}	3×10^{-8}	1.40×10^{-9}	3×10^{-8}
• On demand (PFD)		2.40×10^{-6}	--		
Proof-test interval T1	a	20			
Environmental data					
EMC		EN 60947-5-1			
Vibrations acc. to EN 60068-2-6					
• Frequency	Hz	5 .. 500			
• Amplitude	mm	0.075			
Climatic withstand capability		EN 60068-2-1, EN 60068-2-2, EN 60068-2-14, EN 60068-2-30			
Clearances in air and creepage distances		EN 60947-1			

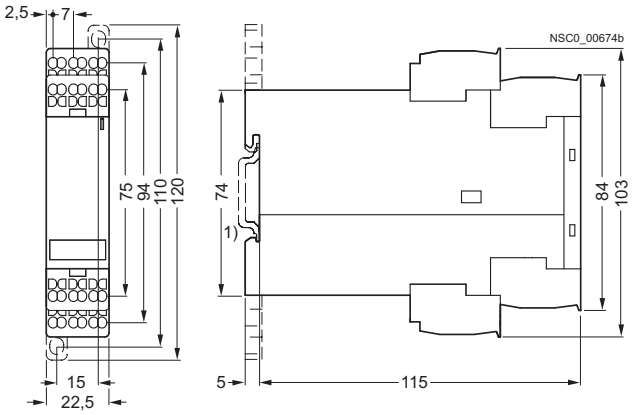
With relay enabling circuits

Dimensional drawings

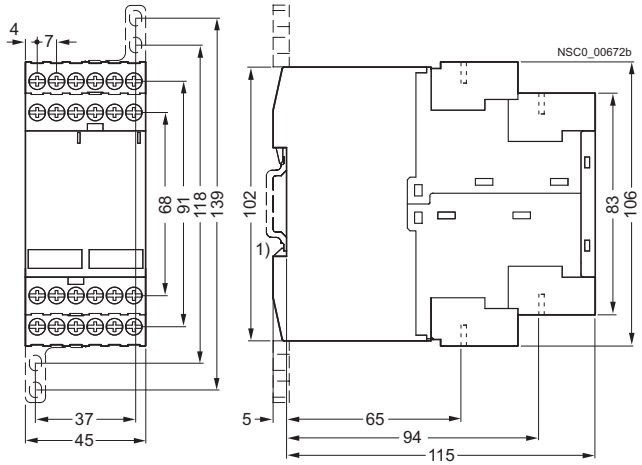
3TK28 21 to 3TK28 24, 3TK28 30 with screw terminals



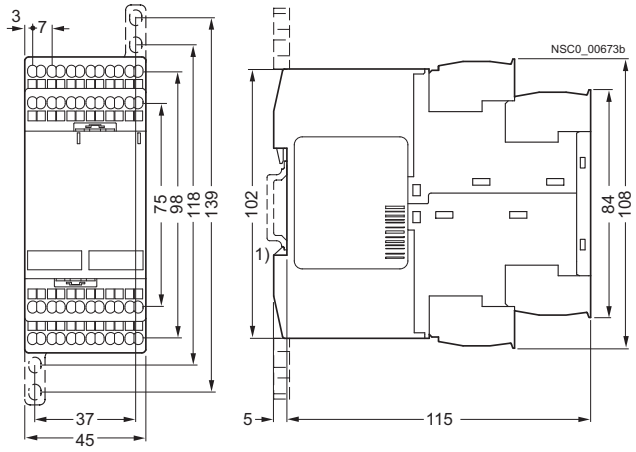
3TK28 21 to 3TK28 24, 3TK28 30 with spring-type terminals



3TK28 25 up to 3TK28 28, 3TK28 34, 3TK28 35 with screw terminals



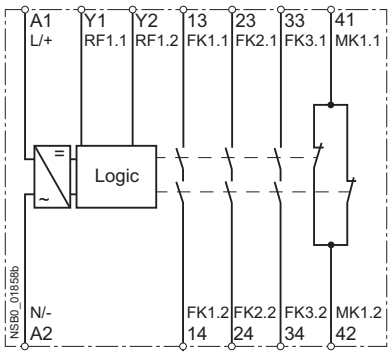
3TK28 25 to 3TK28 28, 3TK28 34, 3TK28 35 with spring-type terminals



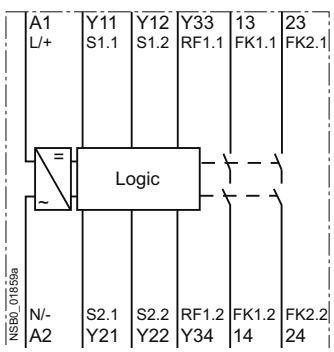
[1] For standard mounting rail TH 35 according to EN 60715.

Schematics

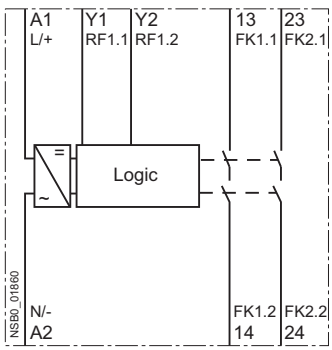
3TK28 21



3TK28 22, 3TK28 23



3TK28 24

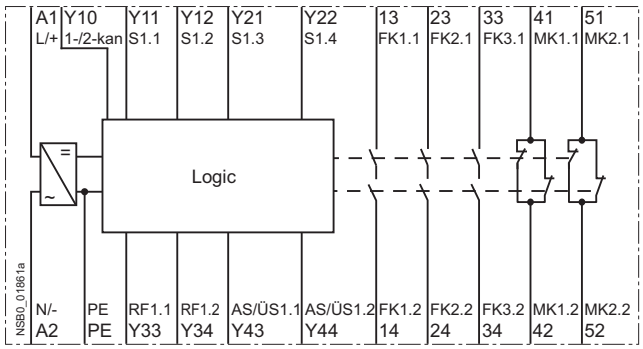


Legend

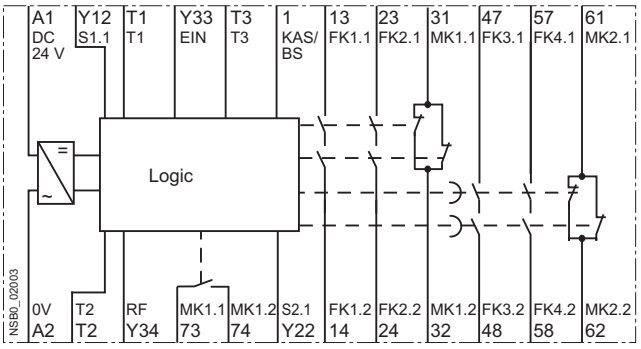
$FK_{x.x}$:	Enabling circuits
$S_{x.x}$:	Sensor terminals (test connectors)
$RF_{x.x}$:	Feedback circuit terminals
$MK_{x.x}$:	Indicating circuit terminals

Schematics

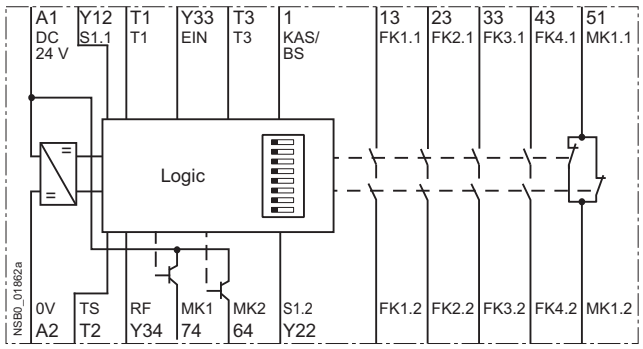
3TK28 25



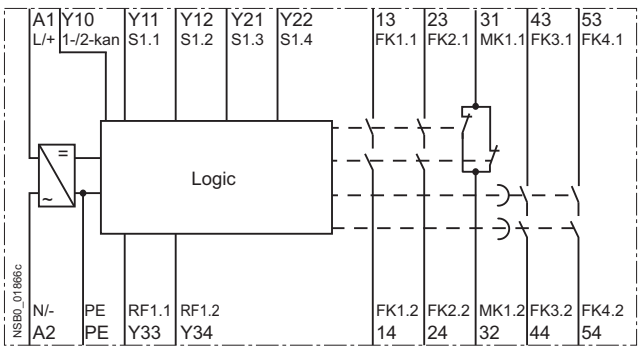
3TK28 26-.CW31/-.CW32/-.CW34



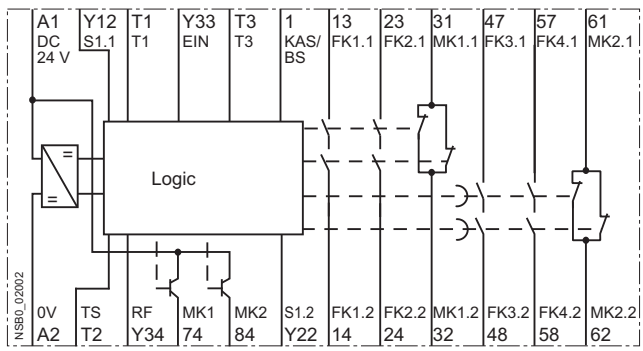
3TK28 26-.BB40



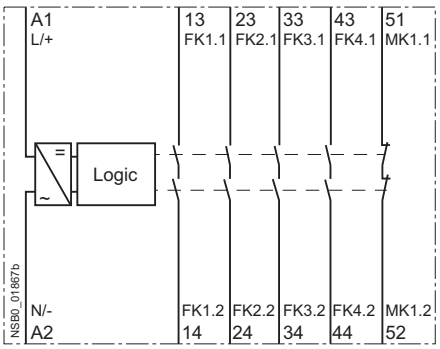
3TK28 27, 3TK28 28



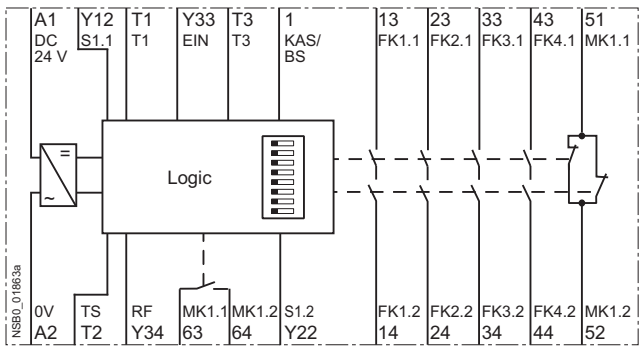
3TK28 26-.BB41/-.BB42/-.BB44



3TK28 30



3TK28 26-.CW30



Legend

$FK_{x.x}$:	Enabling circuits
$S_{x.x}$:	Sensor terminals (test connectors)
$RF_{x.x}$:	Feedback circuit terminals
$MK_{x.x}$:	Indicating circuit terminals
PE:	PE/ground conductor terminal
Tx:	Test signal terminal
EIN:	Start signal terminal
1-/2-kan:	Parameter terminal switchover, one/two-channel
AS/ÜS:	Parameter terminal switchover, automatic/monitored start
KAS/BS:	Terminal, cascading input/normal switching
tv:	Time-delayed outputs

With contactor relay enabling circuits

Design

The solid-state safety relays can be used in EMERGENCY-STOP devices according to EN 418 and in safety circuits according to EN 60204-1 (11.98), for example, for moving covers and protective doors. Depending on the device type and the external circuit, the maximum category that can be achieved is Category 4 of EN 954-1 or SIL 3 according to IEC 61508.

With these devices, solid-state safety relays are connected with contactor relays. The combination is supplied as a complete unit, fully wired up and tested, for snapping onto a standard mounting rail. This unit combines the advantages of a solid-state safety relay and those of contactor relays with positively-driven contacts in a single device. It has been certified by the appropriate authorities as a complete unit.

Basic units, Category 3

The 3TK28 50, 3TK28 51 and 3TK28 52 solid-state safety relays have two contactor relays snapped onto the safety solid-state unit as floating switching blocks. Three LEDs indicate the operating state and the function. During operation, all internal circuit elements are monitored cyclically for faults. Up to Category 3 according to EN 954-1 is achieved, depending on the external circuit.

Basic units, Category 4

The 3TK28 53 solid-state safety relay has two contactor relays snapped onto the safety solid-state units as floating switching blocks, as well as a safe solid-state output, a safe input for cascading and one input for normal switching duty. Three LEDs indicate the operating state and the function.

During start-up, the device runs through a self-test in which the internal electronics are checked for correct functioning. During operation, all internal circuit elements are monitored cyclically for faults.

Expansion units, namely 3TK28 30, 3TK28 56, 3TK28 57, 3RA7 11 to 3RA7 14, as well as external actuators or loads can be connected using the safe solid-state output (terminal 2). Cascading with the 3TK28 41, 3TK28 42, 3TK28 45 and 3TK28 53 safety relays as well as with the 3RA7 11 load feeder is also possible using the safe solid-state output (terminal 2).

Mounting

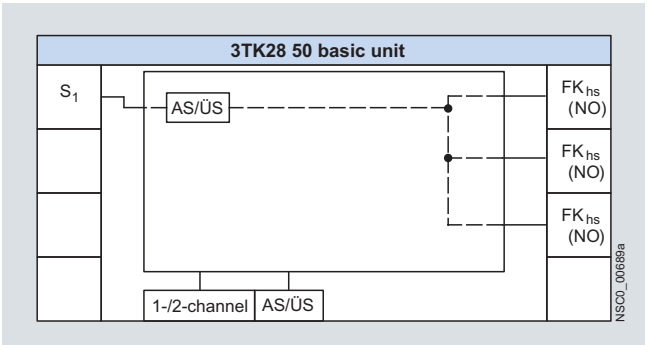
For snap-on mounting on TH 35 standard mounting rail according to EN 60715. Screw fixing is also possible for the devices by means of 2 additional 3RP19 03 push-in lugs.

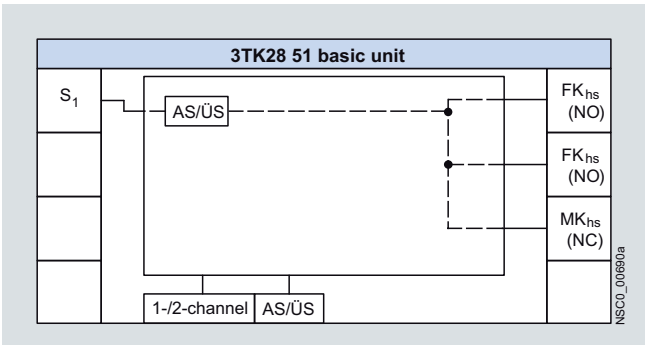
Function

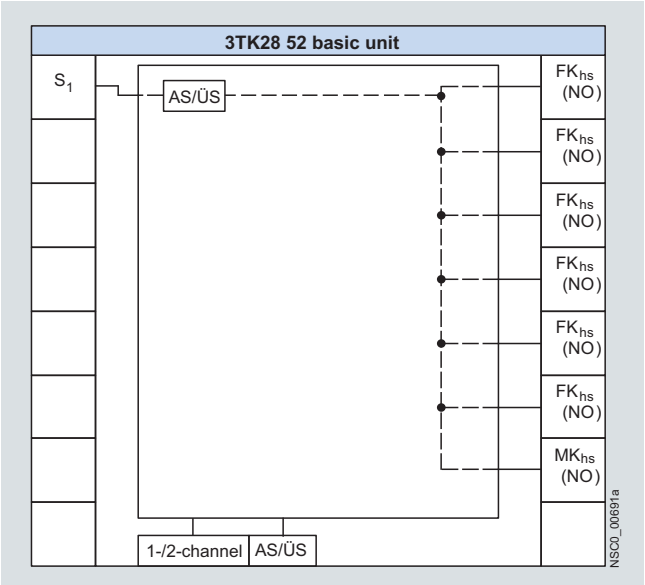
Basic units

3TK28 50 to 3TK28 52

The devices 3TK28 50 to 3TK28 52 each have one sensor input and a varying number of contactor relay enabling circuits and signaling outputs. If the signal is no longer applied to the sensor input, the enabling circuits are disconnected immediately.







Legend

Sensor interface

S_x: Sensor input

Safety logic

AS/ÜS: Automatic or monitored start depending on the parameterization

Parameters

1-/2-channel: One-channel / two-channel sensor connection
AS/ÜS: Automatic or monitored start depending on the parameterization

Actuator interface

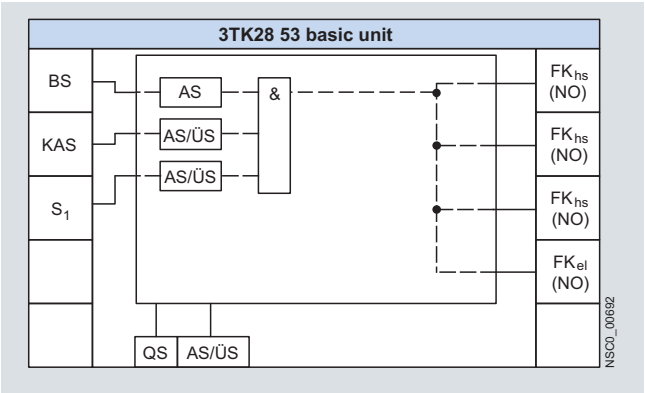
FK_{hs}: Enabling circuit, contactor relay (floating)
MK_{hs}: Signaling circuit, contactor relay (floating)
NO: NO contact
NC: NC contact

With contactor relay enabling circuits

Basic units

3TK28 53

The 3TK28 53 has one sensor input and one input for normal switching duty and one cascading input. On the output side is a varying number of solid-state enabling circuits or contactor relay enabling circuits. If the signal is no longer applied to one of the inputs, the enabling circuits are isolated immediately. Autostart or monitored start can be selected in the parameterization.



Legend

Sensor interface

S_x: Sensor input
KAS/BS: Cascading input or normal switching duty.
Normal switching duty: Connection of a PLC output for example. The enabling circuits and hence the connected loads can then be operated by the machine control.
The safety function is on a higher level.

Safety logic

AS: Automatic start. Device starts automatically once the enabling conditions are fulfilled. If a START button is integrated in the feedback circuit, a manual start is also possible (up to Category 3 according to EN 954-1).
AS/ÜS: Automatic or monitored start depending on the parameterization

Parameters

QS: With or without crossover monitoring
AS/ÜS: Automatic or monitored start depending on the parameterization

tv Time delay, OFF-delay

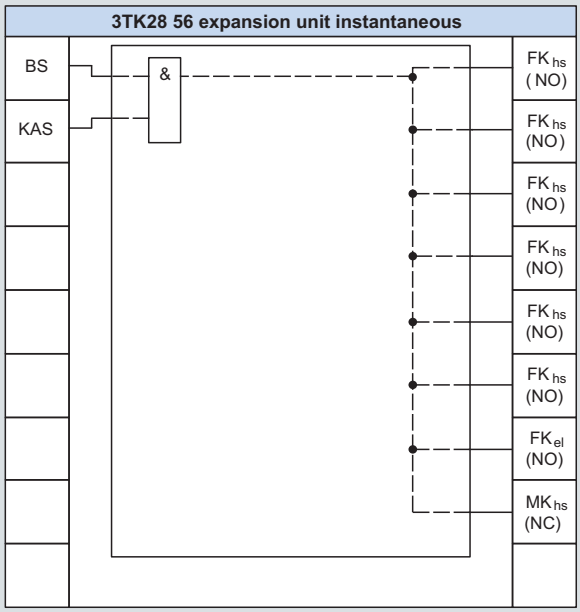
Actuator interface

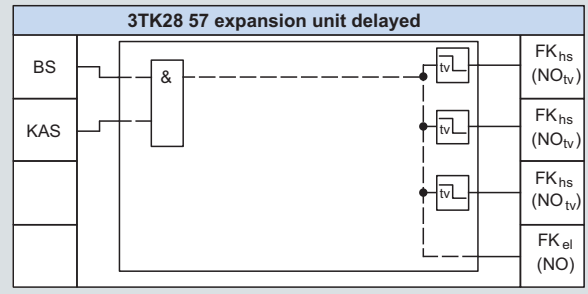
FK_{el}: Enabling circuit, solid-state (non-floating)
FK_{hs}: Enabling circuit, contactor relay (floating)
MK_{hs}: Signaling circuit, contactor relay (floating)
NO: NO contact
NO_{tv}: NO contact, time-delayed
NC: NC contact

Expansion units

3TK28 56 and 3TK28 57

The 3TK28 56 and 3TK28 57 devices each have one one input for normal switching duty and one cascading input. On the output side is a varying number number of solid-state enabling circuits or contactor relay enabling circuits and signaling outputs. If the signal is no longer applied to one of the inputs, the enabling circuits are isolated immediately or according to the set delay time.





With contactor relay enabling circuits

Technical specifications

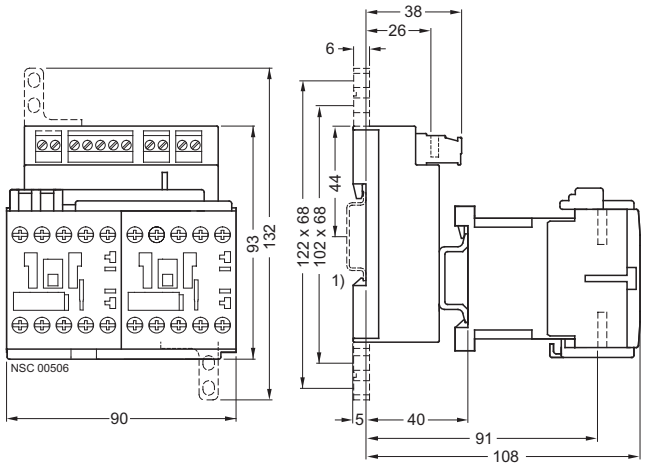
Type		3TK28 50	3TK28 51	3TK28 52	3TK28 53	3TK28 53-0AB1	3TK28 56	3TK28 57
General data								
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508						
Test certificates		TÜV, UL, CSA						
Safety-oriented output contacts								
• Instantaneous FK_{rel}		3	2	6	3	6		3
• Time-delayed $FK_{rel\ (tv)}$		--	--	--	--	--		--
Safety-oriented semiconductor outputs								
• Instantaneous FK_{el}		--			1			
• Time-delay $FK_{el\ (tv)}$		--			--			
Signaling contacts MK_{rel}		--	1		--	1		--
Semiconductor signaling outputs MK_{rel}		--						
Sensor inputs S		1					--	
Cascading inputs KAS/BS		--			2			
Degree of protection acc. to IEC 60529		IP20 Enclosure IP20 Terminals						
Shock resistance sine wave	*g*/ms	5/11					8/10 and 15/5	
Permissible mounting positions		Any						
Touch protection acc. to EN 61140 or EN 60900		Finger-safe						
Height	mm	89						
Width	mm	90						
Depth	mm	112		150	112		150	112
Weight	kg	0.850			0.750			
Connection type		**Screw terminals**						
• Terminal screw		M 3 (standard screwdriver, size 2 and Pozidriv 2)						
• Solid	mm^2	1 x (0.2 ... 2.5)/2 x (0.2 ... 1.0)						
• Finely stranded with end sleeve	mm^2	1 x (0.25 ... 2.5)/2 x (0.25 ... 1.5)						
• AWG cables, solid or stranded	AWG	2 x (24 ... 12)						
• Tightening torque	Nm	0.8 … 1.2						
Connection type		**Spring-type terminals**						
• Solid	mm^2	2 x (0.2 ... 2.5)						
• Finely stranded, with end sleeves acc. to DIN 46228	mm^2	2 x (0.25 ... 2.5)						
• Finely stranded	mm^2	2 x (0.25 ... 2.5)						
• Stripped length	mm	10						
Electrical specifications								
Rated control supply voltage U_s	V	24 DC, 24/115/230 AC			24 DC			
Measurement voltage	V	--						
Response value U_{resp}	V	--						
Operating range								
• AC operation	V	0.9 ... 1.15 × U_s			--			
• DC operation	V	0.85 ... 1.1 × U_s			0.85 ... 1.1 × U_s			
Rated insulation voltage U_i								
• For control circuit	V	50						
• For outputs	V	690						
Rated impulse withstand voltage U_{imp}								
• For control circuit	V	500						
• For outputs	V	6000						
Rated power at U_s	W	8.5						
Frequency ranges	Hz	50/60			--			
Rated operational current I_e (relay outputs) at								
• AC-15 at 115 V	A	6		6	6			6
• AC-15 at 230 V	A	6		6	6			6
• DC-13 at 24 V	A	10		10, Auxiliary switch blocks: 6	10			10, Auxiliary switch blocks: 6
• DC-13 at 110 V	A	3		3	3			3
• DC-13 at 220 V	A	1		1	1			1
Rated operational current I_e (semiconductor outputs) at								
• DC-15 at 24 V	A	--						

Type		3TK28 50	3TK28 51	3TK28 52	3TK28 53	3TK28 53-0AB1	3TK28 56	3TK28 57
Electrical specifications (continued)								
Electrical endurance	Operating cycles	See "3RH1 Characteristic Curves"						
Mechanical endurance	Operating cycles	3 x 10^7						
Switching frequency *z*		10^3						
Conventional thermal current I_{th}	A	10						
Conventional thermal current I_{th}								
• 1 contact	A	--						
• 2 contacts	A	--						
• 3 contacts	A	--						
• 4 contacts	A	--						
Fusing for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE								
• gL/gG	A	10						
• Quick	A	--						
Maximum line resistance	Ω	250			500			
Cable length from terminal to terminal With Cu 1.5 mm^2 and 150 nF/km	m	2000						
Times								
Bridging of voltage dips, supply voltage (only internal, no outputs)	ms	5						
Make-time t_E								
• For automatic start typ.	ms	100			60		--	
• For automatic start max.	ms	200			100		--	
• For automatic start after mains failure typ.	ms	350			6000		6000	
• For automatic start after mains failure max.	ms	500			7000		7000	
• For monitored start typ.	ms	60			60		--	
• For monitored start max.	ms	100			100		--	
Release time t_R								
• For sensor typ.	ms	30			50			--
• For sensor max.	ms	50			60			300 adjustable
• For mains failure typ.	ms	100			120			120
• For mains failure max.	ms	120			120			120
Recovery time t_W								
• After sensor	ms	20			500			
• After mains failure	s	0.02			7			
Minimum command duration t_B								
• Sensor input	ms	20			45		--	
• ON button	s	20			0.2 ... 5		--	
• Cascading input	ms	20			45		45	
Simultaneity t_G	ms	∞						
Temperatures								
Permissible ambient temperature								
• During operation	°C	–25 ... +60						
• During storage	°C	–40 ... +80						
Safety specifications								
Safety integrity level SIL CL acc. to IEC 61508		2			3		--	
Performance level PL acc. to ISO 13849-1		d			e		--	
Safety category CAT acc. to EN 954-1		3			4		As basic unit	
Type acc. to EN 574		--						
Probability of a dangerous failure								
• Per hour (PFH_D)	1/h	1.20 x 10^{-8}	1.10 x 10^{-8}				9.8 x 10^{-11}	
• On demand (PFD)	--	--						
Proof-test interval T1	a	10						
Environmental data								
EMC		IEC 60947-5-1, IEC 60000-4-3, IEC 60000-4-5, IEC 60000-4-6						
Vibrations acc. to EN 60068-2-6								
• Frequency	Hz	5 ... 500						
• Amplitude	mm	0.075						
Climatic withstand capability		EN 60068-2-78						
Clearances in air and creepage distances		EN 60947-1						

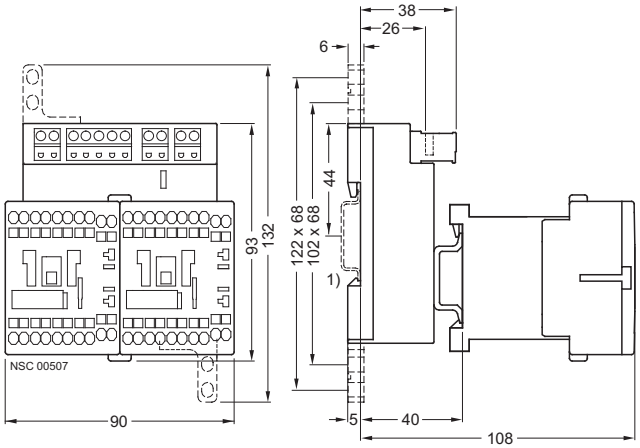
With contactor relay enabling circuits

Dimensional drawings

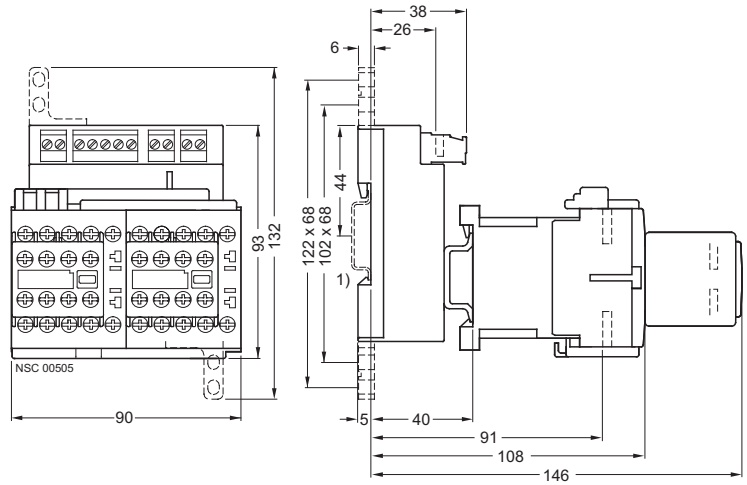
3TK28 50, 3TK28 51, 3TK28 53, 3TK28 57 with screw terminals



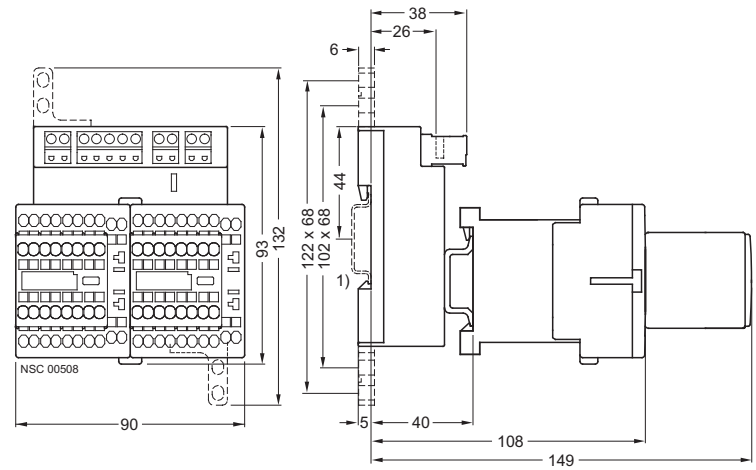
3TK28 50, 3TK28 51, 3TK28 53, 3TK28 57 with spring-type terminals



3TK28 52, 3TK28 56 with screw terminals



3TK28 52, 3TK28 56 with spring-type terminals



[1] For standard mounting rail TH 35 according to EN 60715.

Design

The 3TK28 10 safety relays with special functions operate with internal contactor relays with positively-driven contacts.

In a redundant circuit, operation of the internal controls is monitored. If a safety relay fails, it will always switch to the de-energized and consequently safe state. The fault is detected and the safety relay can no longer be switched on.

Enabling contacts (FK)

Safety related operation must be performed by safe output contacts, known as enabling contacts. Enabling contacts are always NO contacts and switch without delay.

Signaling contacts (MK)

NC contacts are used as signaling contacts but they are not permitted to perform functions with relevance for safety. An enabling contact can also be used as a signaling contact. A signaling contact cannot, however, be used as an enabling contact.

Expansion units

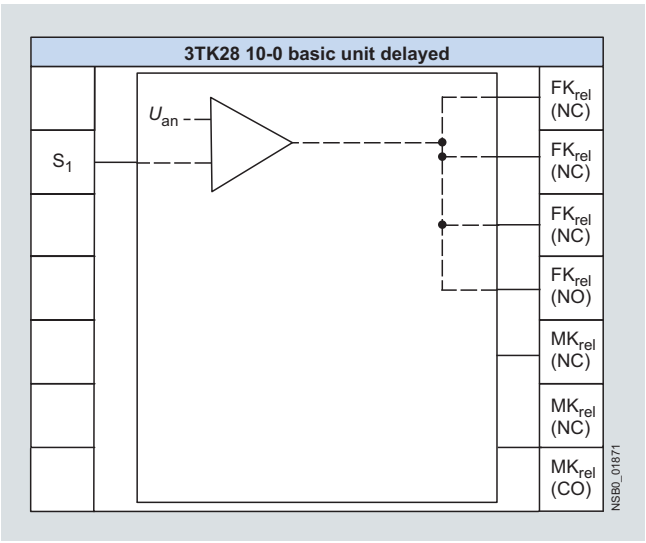
If the enabling contacts of the basic unit are inadequate, expansion units can be used. An expansion unit has 4 enabling contacts. Expansion units are not allowed to be operated separately in safety-related switching circuits; they must be combined with a basic unit. One enabling contact of the basic unit is required for connecting an expansion unit. The category of a control system with expansion unit corresponds to that of the basic unit.

Function

3TK28 10-0 standstill monitor

The 3TK2810-0 safe standstill monitor measures a voltage of the decelerating motor, which is induced by residual magnetism, at 3 terminals of the stator winding. When the induction voltage approximates to 0, the monitor interprets this to mean that the motor has stopped and the output relay is activated. To be able to adapt the monitor to different motors and applications, it is possible to adjust the voltage threshold U_{an} below which the 3TK2810-0 detects a stoppage. Also adjustable is the length of time over which U_{an} must be undershot in order for a stoppage to be detected and the output circuit enabled (downtime t_s).

The device also detects wire breaks between the measuring inputs L1/L2/L3. If a wire break is detected, the output relay will adopt the safe position (the same as with a running motor).



Legend

Sensor interface

S_x: Sensor input

Actuator interface

FK_{rel}: Enabling circuit, relay contact (floating)
MK_{el}: Signaling circuit, solid-state output (non-floating)
MK_{rel}: Signaling circuit, relay contact (floating)
NO: NO contact
NC: NC contact
CO: Changeover contact

With special functions

Technical specifications

Type		3TK28 10
General data		
Standards		EN 60204-1, EN ISO 12100, EN 954-1, IEC 61508
Test certificates		TÜV, UL, CSA
Safety-oriented output contacts • Instantaneous FK_{rel} • Time-delayed $FK_{rel\ (tv)}$		 4 --
Safety-oriented semiconductor outputs • Instantaneous FK_{el} • Time-delay $FK_{el\ (tv)}$		 -- --
Signaling contacts MK_{rel}		1
Semiconductor signaling outputs MK_{rel}		2
Sensor inputs S		1
Cascading inputs KAS/BS		--
Degree of protection acc. to IEC 60529		IP40 Enclosure IP20 Terminals
Shock resistance sine wave	*g*/ms	8/10
Mounting positions		Any
Touch protection acc. to EN 61140 or EN 60900		Finger-safe
Height	mm	106: screw terminals; 108: spring-type terminals
Width	mm	45
Depth	mm	116
Weight	kg	0.500
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	M 3 (standard screwdriver, 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 (24 ... 16) 0.8 … 1.2
Connection type		**Spring-type terminals**
• Solid • Finely stranded, with end sleeves acc. to DIN 46228 • Finely stranded	mm^2 mm^2 mm^2	2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5) 2 x (0.25 ... 1.5)
Electrical specifications		
Rated control supply voltage U_s	V	24 DC, 230/400 AC
Operating range • AC operation • DC operation	 V V	 0.8 ... 1.1 × U_s 0.9 ... 1.15 × U_s
Measurement voltage	mV	Max. 690
Response value U_{resp}	V	20 ... 400 adjustable
Rated insulation voltage U_i • For control circuit • For outputs	 V V	 300 690
Rated impulse withstand voltage U_{imp} • For control circuit • For outputs	 V V	 6/4 6
Rated power at U_s	W	3
Frequency ranges	Hz	50/60
Rated operational current I_e (relay outputs) at • AC-15 at 115 V • AC-15 at 230 V • DC-13 at 24 V • DC-13 at 115 V • DC-13 at 230 V	 A A A A A	 -- 3 (NO contacts); 2 (NC contacts) 2 -- --
Rated operational current I_e (semiconductor outputs) at • DC-13 at 115 V • DC-13 at 230 V	 A A	 0.1 --
Electrical endurance	Operating cycles	2×10^5
Mechanical endurance	Operating cycles	5×10^7
Switching frequency *z*	1/h	1200

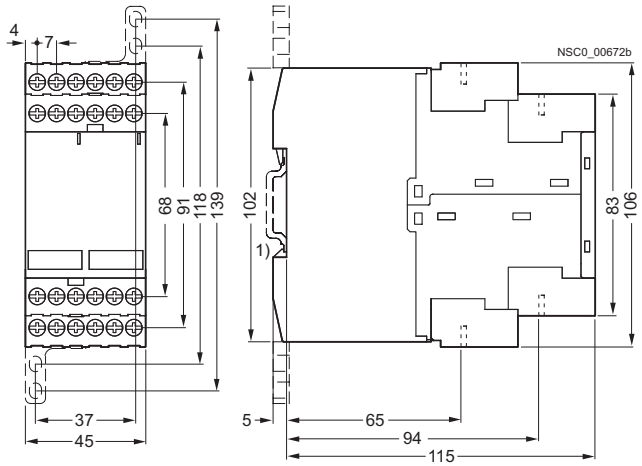
Technical specifications

Type		3TK28 10
Electrical specifications (continued)		
Conventional thermal current I_{th}	A	5, summation current max. 8
Conventional thermal current I_{th}		
• 1 contact	A	5
• 2 contacts	A	5
• 3 contacts	A	5
• 4 contacts	A	--
Fusing for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE, gL/gG operational class		
• gL/gG		--
• Quick	A	5
Maximum line resistance	Ω	--
Cable length from terminal to terminal With Cu 1.5 mm^2 and 150 nF/km	m	--
Times		
Release time t_R		
• For sensor typ.	s	--
• For sensor max.	s	6 adjustable
• For mains failure typ.	s	--
• For mains failure max.	s	--
Simultaneity t_G	ms	∞
Temperatures		
Permissible ambient temperature		
• During operation	°C	–25 ... +60
• During storage	°C	–40 ... +75
Safety specifications		
Safety integrity level SIL CL acc. to IEC 61508		3
Performance level PL acc. to ISO 13849-1		e
Safety category CAT acc. to EN 954-1		4
Probability of a dangerous failure		
• Per hour (PFH_D)	1/h	1.49×10^{-9}
• On demand (PFD)		--
Proof-test interval T1	a	20

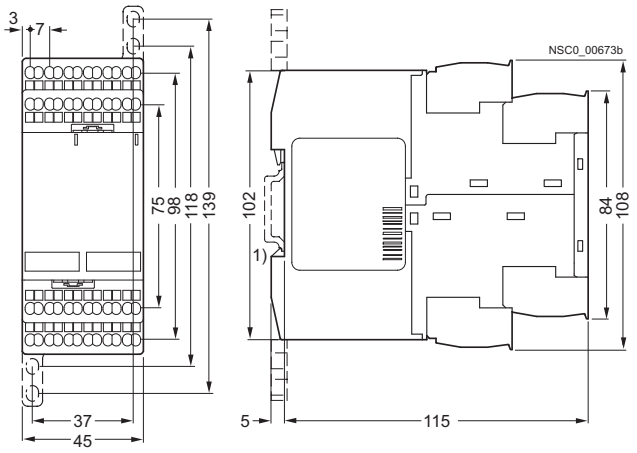
With special functions

Dimensional drawings

3TK28 10
with screw terminals



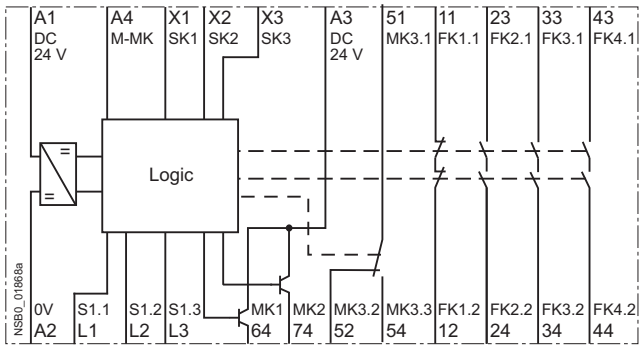
3TK28 10
with spring-type terminals



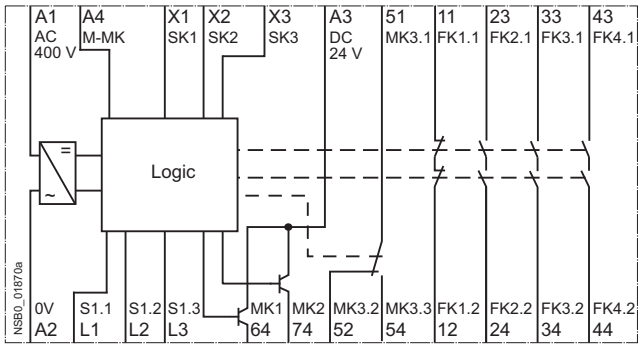
[1] For standard mounting rail TH 35 according to EN 60715.

Schematics

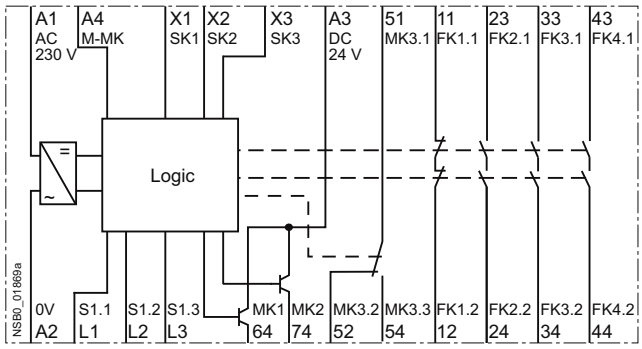
3TK28 10-0BA0.



3TK28 10-0JA0.



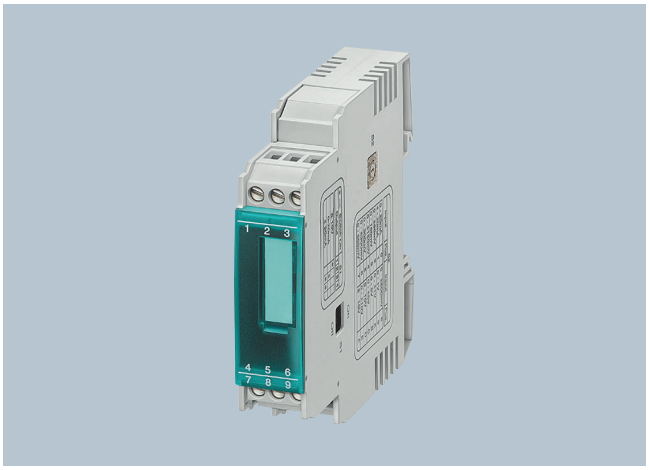
3TK28 10-0GA0.



Legend

$FK_{x.x}$:	Enabling circuits
$MK_{x.x}$:	Indicating circuit terminals
M-MK:	Ground signaling circuits
$S_{x.x}$:	Sensor terminals (test connectors)
SK_x:	Control terminals

Overview



Interface converters perform the coupling function for analog signals on both the input side and the output side. They are indispensable when processing analog values with electronic controls. Under harsh industrial conditions in particular, it is often necessary to transmit analog signals over long distances. This means that electrical separation is essential due to the different supply systems. The resistance of the wiring causes voltage differences and losses which must be prevented.

Electromagnetic faults and overvoltages can affect the signals on the input side in particular or even destroy the analog modules. All terminals of the 3RS17 interface converters are safe up to a voltage of 30 V DC and protected against interchangeing poles. Short-circuit protection is an especially important function for the outputs.

The devices are EMC-tested according to

- IEC 61000-6-2 (Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environments)
- IEC 61000-6-4 (Electromagnetic compatibility (EMC) - Generic standards - Emission standard for industrial environments)

The analog signals comply with

- IEC 60381-1, -2 (Analogue signals for process control systems)

Function

Active interface converters

Active interface converters provide maximum flexibility for the application by the use of an external supply voltage. Configuration with active interface converters is extremely easy because input and output resistances and voltage drops are compensated by the auxiliary supply. They support electrical separation as well as conversion from one signal type to another or reinforcement. The load of the measured value transmitter is negligible.

Passive interface converters

Passive interface converters do not require an external supply voltage. This advantage can only be used by current signals that are converted 1:1. Reinforcement or conversion is not possible. The converters are used for complete electrical separation of current signals and to protect the inputs and outputs. Passive isolators do not operate reaction-free, any load on the output produces an equal load on the input. When the passive converter is to be used, the output performance of the sensor and the input resistance of the analog input must be analyzed. This technique is being increasingly implemented in the case of pure current signals.

Calculation guide for passive converters

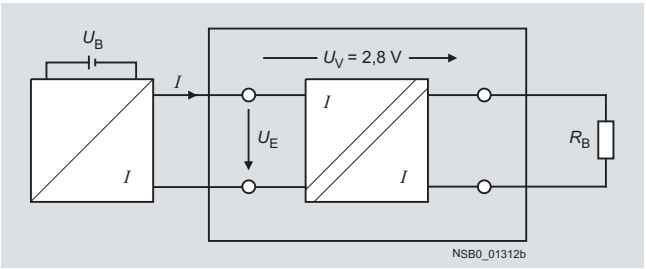
Important: Please note the following when using passive separators:

The current-driving voltage of the measuring transducer U_E must be sufficient to drive the maximum current of 20 mA over the passive separator with a voltage loss of U_V = 2.8 V and the load R_B.

This means that:

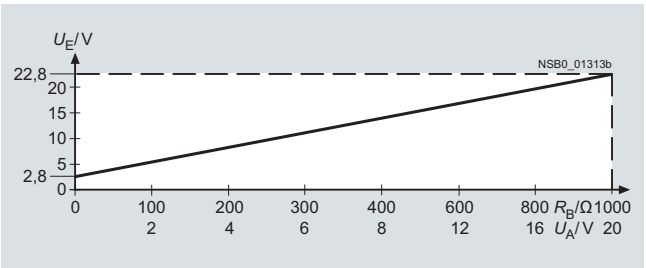
$U_B \geq U_E = 2.8\ V + 20\ mA \times R_B$

Distribution of the voltages in the case of passive separators



Input voltage depending on the load at I_a = 20 mA

The following graphic shows the input voltage U_E as a function of the load R_B taking into account the voltage loss U_V. If the load is known, the y-axis shows the minimum voltage that has to be supplied by the current source in order to drive the maximum current of 20 mA over the passive isolator and load.



3RS17 interface converters

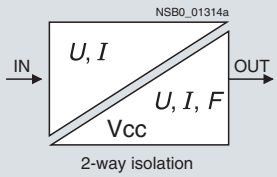
Current carrying capacity of the outputs

A maximum output load is specified for current signals. This resistance value specifies how large the input resistance of the next device connected in series can be as a result of the power of the converter.

For voltage signals, the maximum current that can be drawn from the output is the decisive factor.

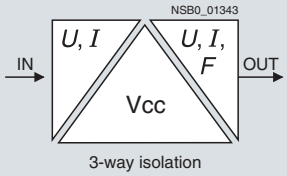
2-way separation

In the case of 2-way separation, the input is electrically separated from the output. The "zero potential" of the supply voltage is the same as the reference potential for the analog output signal.



3-way separation

For the 3-way separation, each circuit is electrically separated from the other circuits, i. e. input, output, and supply voltage do not have a potential link.



Technical specifications

Type 3RS17			24 V AC/DC	24 ... 240 V AC/DC
General data				
Supply voltage operating range	DC AC		0.7 ... 1.25x U_n 0.8 ... 1.2 x U_n	0.7 ... 1.1 x U_n 0.8 ... 1.1 x U_n
Rated power		W	Typically 0.3	Typically 0.75
Electrical separation of input/output			Active disc.: 1500 V, 50 Hz, 1 min; Passive disc.: 500 V, 50 Hz, 1 min	4000 V, 50 Hz, 1 min
Rated insulation voltage U_i Degree of pollution 2 Overvoltage category III acc. to IEC 60664		V	50	300
Ambient temperature	During operation During storage	°C °C	-25 ... +60 -40 ... +85	
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 1 x (0.5 ... 2.5) 1 x (0.5 ... 1.5) 1 x (20 ... 14)/1 x (20 ... 16) 0.5 … 0.8	
Connection type			**Spring-type terminals**	
• Solid • Finely stranded, with end sleeves • Finely stranded • AWG cables, solid or stranded		mm^2 mm^2 mm^2 AWG	1 x (0.5 ... 2.5) 1 x (0.5 ... 2.5) 1 x (0.2 ... 1.5) 1 x (20 ... 16)	
Mounting position			Any	
Vibration resistance acc. to IEC 60068-2-6			10 ... 55 Hz: 0.35 mm	
Shock resistance acc. to IEC 60068-2-27		*g*/ms	15/11	
Input				
Impedance	Voltage inputs Current inputs, active	kΩ Ω	330 100	
Input voltage max.	Voltage inputs Current inputs, active	V V	30 AC/DC 30 AC/DC	
Operating current	Current inputs, passive	µA	100/250 (6.2 mm width)	
Voltage drop	Current inputs, passive	V	2.7 at 20 mA	
Output				
Internal resistance	Voltage output, 0 ... 10 V AC/DC	Ω	55	
Output load	Current 0/4 ... 20 mA active, max. Current 0 ... 20 mA passive, max. Frequency, min.	Ω Ω Ω	400 1000 at 20 mA 2400	
Output voltage	Frequency	V	20.9	
Output current	Voltage output, 0 ... 10 V, max. Frequency, max.	mA mA	21; note the terminating resistance (> 500 Ω)! 10	
Short-circuit current	Voltage output, 0 ... 10 V AC/DC Current output, 0 ... 20 mA, passive Frequency	mA mA mA	40 Corresponds to the input current 15	
Protection of the outputs			Short-circuit resistant	
Max. overvoltage at output		V	30	
Accuracy				
Total error at 23 °C	Active disconnector (frequency) Active disconnector (U, I)	% %	0.1 0.1[1)]	
Linearity error	Active disconnector (U, I) Active disconnector (frequency)	% %	0.02 0.02	
Deviation due to ambient temperature	Active disconnector (frequency) Active disconnector (U, I) Passive disconnector		0 ... 50 Hz: 7.5 mHz/K; 0 ... 100 Hz: 15 mHz/K; 0 ... 1 kHz: 0.15 Hz/K; 0 ... 10 kHz: 1.5 Hz/K 0 ... 10 V: 1.5 mV/K; 0/4 ... 20 mA: 3 µA/K With load < 600 Ω: <100 ppm/K of measured value With load ≥ 600 Ω: < 175 ppm/K of measured value	
Transmission error	Passive disconnector	%	0.1	
Measured value load error		%/Ω	0.06/100	
Limit frequency at 3 dB	Active disconnector (frequency) Active disconnector (U, I) Passive disconnector	Hz Hz Hz	30 30 50	
Rise time (10 ... 90 %)	Active disconnector (frequency) Active disconnector (U, I)	 ms	10 + 1 period 10	
Settling time at 1 % accuracy	Active disconnector (frequency) Active disconnector (U, I)	 ms	30 + 1 period 30	
Residual ripple	Active disconnector (U, I) Passive disconnector	mV_{eff} mV_{eff}	< 5 < 8	

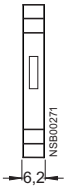
The accuracy refers to the upper limit of effective range if not otherwise stated.

1) For 3RS17 06: 0.1 % for selected output 4... 20 mA;
0.3 % for selected output 0 ... 20 mA;
0.3 % for selected output 0 ... 10 V and from an input voltage > 50 mV.
For an input voltage < 50 mV an offset of max. 20 ms is effective at the output.

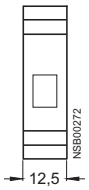
3RS17 interface converters

Dimensional drawings

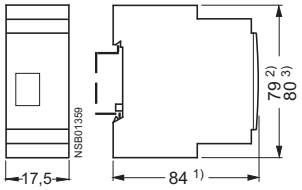
6.2 mm design



12.5 mm design



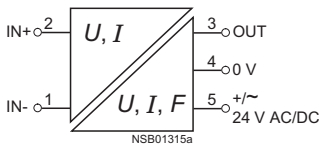
17.5 mm design



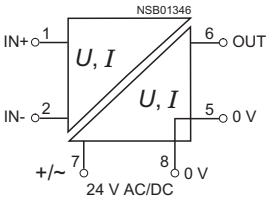
1) Depth for 3RS17 25 is approx. 90 mm.
2) Dimensions for screw terminal.
3) Dimensions for spring-type terminal.

Schematics

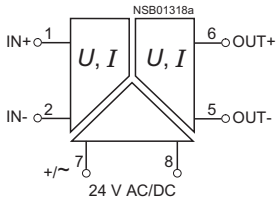
3RS17 00-..D..
3RS17 02-..D..
3RS17 03-..D. .
3RS17 05-..D..



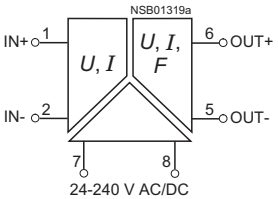
3RS17 06- . FD00



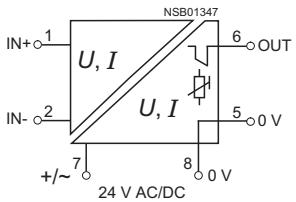
3RS17 06-.FE00



3RS17 0.-..W00



3RS17 25-.FD00



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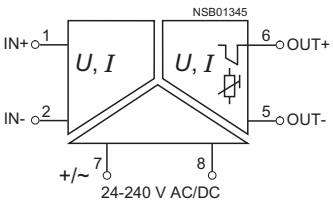
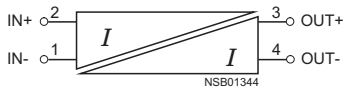
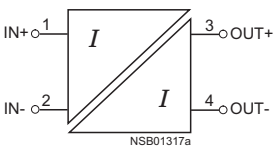


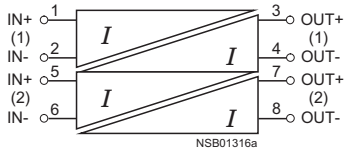
3RS17 20-.ET00



3RS17 21-.ET00



3RS17 22-.ET00



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