Monitoring Devices

Configuration Manual · 10/2010

SENTRON

Answers for infrastructure.

SIEMENS

Monitoring Devices

Introduction

Overview

Devices		Page	Field of application	Standards	Used in		
					Non-residential buildings	Residential buildings	Industry
Transfer switches							
	**SENTRON transfer control devices for ATSE**	7	The SENTRON ATC5300, equipped with two motor-driven circuit breakers, serves as a transfer system that automatically or manually switches between two power supply systems in low-voltage power distribution applications.	IEC 60947-6-1; DIN VDE 0660-114	✓	✓	✓
Monitoring devices for electrical values							
	**Residual current monitors, 5SV8**	13	To increase system availability and operating safety through continuous monitoring of residual current in electrical systems and alarms if a defined threshold is exceeded.	IEC 62020; EN 62020	✓	--	✓
	**Voltage relays, 5TT3**	19	Monitoring the voltage of emergency lighting in public buildings, short-time failures of 20 ms, for ensuring operational parameters for devices or system components or monitoring the neutral conductor for breaks.	IEC 60255; DIN VDE 0435-303; DIN VDE 0108; DIN VDE 0435; DIN VDE 0633	✓	--	✓
	**Current relays, 5TT6**	26	Monitoring of emergency and signal lighting and motors. All current relays can be short-time overloaded and connected either with direct measurement or through transformers.	IEC 60255; DIN VDE 0435-303	✓	--	✓
	**Priority switches, 5TT6**	31	For a reduction of the connection fee in accordance with German Federal Regulations on Tariffs when used in systems with electric storage heaters where the continuous-flow heaters are switched with priority.	IEC 60669 (VDE 0632); BTO § 6 Section 4	--	✓	--
	**Fuse monitors, 5TT3**	32	Monitoring of all types of low-voltage fuses. Can be used in asymmetric systems afflicted with harmonics and regenerative feedback motors.	IEC 60255; DIN VDE 0435	✓	--	✓

Devices		Page	Field of application	Standards	Used in		
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	**Phase and phase sequence monitors, 5TT3**	33	For the visual signaling of phase failures or phase sequences in three-phase systems. The phase sequence is arbitrary. The device is also suitable for 1, 2 or 3-phase operation.	IEC 60255; DIN VDE 0435	--	--	✓
	**Insulation monitors for industrial applications, 5TT3**	35	To increase system availability and operating safety through continuous monitoring of the isolation resistance in ungrounded direct voltage or alternating voltage networks.	IEC 60255; IEC 61557	--	--	✓
	**Monitoring of medical premises, 7LQ**	38	For the insulation monitoring of a medical IT system or the load current monitoring of an IT system transformer for a non-permissible temperature rise. Monitoring of the voltage supply with automatic switchover.	DIN EN 61557-8; IEC 61557-8; DIN VDE 0100-710; IEC 60364-7-710	✓	--	--
Monitoring devices for systems and devices							
	**GSM alarm modules, 5TT7**	57	Mobile monitoring and switching of plants worldwide by SMS for greater safety and convenience. Plants can be remotely switched and signals received.		✓	✓	✓
	**Fault signaling units, 5TT3**	60	Evaluation and display of fault alarms and alarm signals for monitoring industrial plants and control systems. With 4 inputs and connections for 39 expansion fault signaling units.	IEC 60255, DIN VDE 0435-303	✓	--	✓
	**EMERGENCY STOP modules, 5TT5**	62	For EMERGENCY-STOP switching in accordance with the EC Machine Directive 98/37/EC. Safe types of circuits for machines, plants or test stations in industrial, commercial and private enterprise applications.	According to the EC Machine Directive 98/37/EC, EN 954-1	✓	--	✓
	**Level relays, 5TT5**	65	Control of liquid levels in containers with 3 electrode connections for 1-step and 2-step level control. High immunity to interference of the measuring circuit isolated from the system.	IEC 60255, DIN VDE 0435	✓	--	✓

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	**Line circuit relays, 5TT5**	67	For disconnecting the voltage or field circuit of unused lines when loads are disabled.	IEC 60255, DIN VDE 0435	--	✓	--
	**Dusk switches, 7LQ2**	68	For demand-oriented switching of lighting installations for shop windows or paths in order to cut energy costs	EN 60730	✓	✓	--
	**Temperature controllers, 7LQ2**	70	For controlling and limiting temperatures. Three adjustable ranges from - 30 °C to + 100 °C. For PT 100 measuring element + 2 °C to + 400 °C.	EN 60730	✓	✓	✓
	**P.f. controllers, 5TT5**	72	For the monitoring of asynchronous motors for underload and no-load operation, e.g. fan monitoring in the case of V-belt breakage, filter blockages, pump monitoring in the event of valve closure or dry runs.	IEC 60255, IEC 61557	--	--	✓
	**Thermistor motor protection relays, 5TT5**	74	For the prevention of thermal motor overloads, e.g. due to high switching frequency, single-phasing, disabled cooling or excessive ambient temperatures. With detection of wire breaks in the sensor circuit.	IEC 60255, DIN VDE 0435	--	--	✓

Overview

SENTRON ATC5300 network switchover controls

Automatic system transfer with the SENTRON ATC5300

The SENTRON ATC5300, equipped with two motor-driven circuit breakers, serves as a transfer system that automatically or manually switches between two power supply systems in low-voltage power distribution applications.

In particular, the SENTRON ATC5300 is deployed everywhere where a power failure is especially critical, e.g. in hospitals, in conjunction with UPS systems, and for industrial processes.

Mode of operation

The SENTRON ATC5300 controls the transfer between the main and standby power supplies fully automatically, while talking into consideration the set limit values and delay times. It detects fluctuations occurring in the main power supply quickly and switches to the standby power supply. The control device only switches to the standby power supply after it has ensured that the standby supply is delivering the required power supply quality. The devices switches back to the main power supply taking into consideration the set parameters once the required power supply quality is available again. If the standby power supply and/or the main power supply is fed by a generator, the control device also offers a wide range of settings, such as a generator lead time, generator delay time, and generator start test at specified times.

The SENTRON ATC5300 can control air circuit breakers, compact molded case circuit breakers, switch disconnectors or contactors. The circuit breakers are controlled via the related motorized operating mechanisms.

Setting parameters and monitoring using SENTRON ATC SOFTWARE

In addition to operation and parameterization on-site, you can also monitor and set the parameters of the controller using the SENTRON ATC software. The software offers a high level of convenience and quick access to all device settings, e.g. complex settings which occur when connecting generators.

Measurement variables

The SENTRON ATC5300 records and monitors the following measurement variables:

Measured variables		Default setting	Limit value setting	Delay time	Can be deactivated
Rated system voltage U_n	V AC	100 ... 690	70 % ... 98 % (75 % ... 100 %) [1]	0.1 s ... 900 s	--
			102 % ...120 % (100...115 %) [1]	0.1 s ... 900 s	✓
Voltage asymmetry	%		1 % ... 20 %	0.1 s ... 900 s	✓
Phase failure	%		60 % ... 85 %	0.1 s ... 30 s	✓
Direction of rotation		Left, right	--	--	✓
Frequency	Hz	50/60	80 % ... 100 %	0.1 s ... 900 s	✓
			101 % ...120 %	0.1 s ... 900 s	✓
Battery voltage U_b	V DC	12/24/48	70 % ... 100 %[2]	0 ... 60 s	✓
			110 % ... 140 %[2]		✓

[1] Hysteresis value for enabling back-transfer

[2] Warning only, no switching

✓ yes

-- no

SENTRON transfer control devices for ATSE, 3KC

Field of application

Applications

The SENTRON ATC5300 can be used in the following applications:

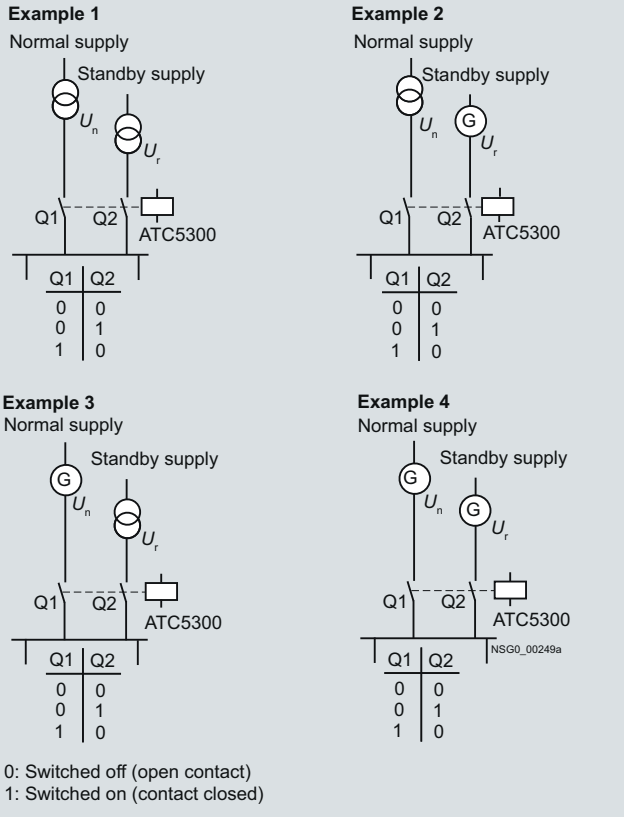
- Supplying power to UPS systems
- Hospital power supplies
- Public building, hotel and airport emergency power supplies
- Data center and communication system power supplies
- Supplying power to industrial processes that require a high level of operational continuity

Applications in low-voltage power supplies

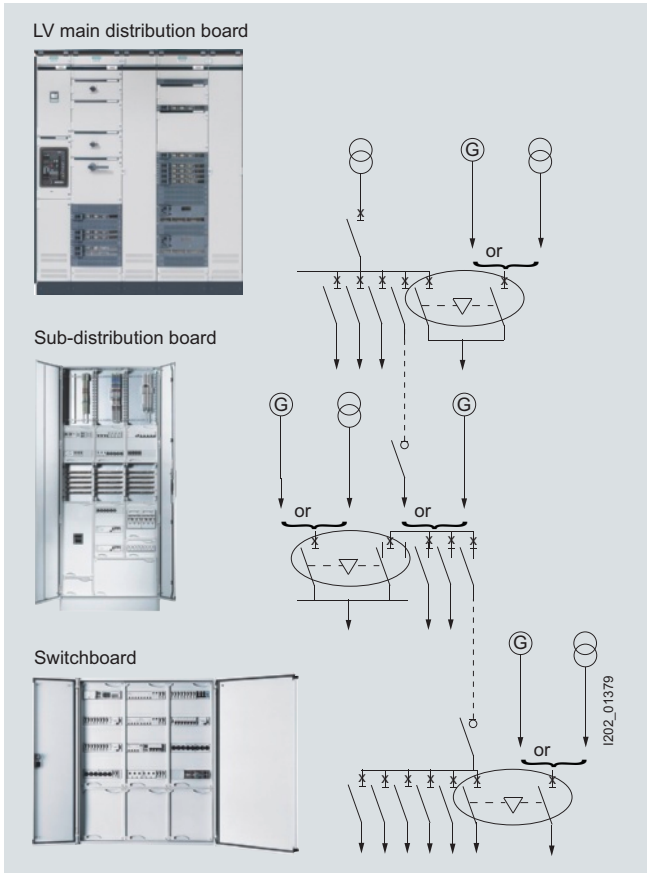
SENTRON ATC5300 is ideally suited for low-voltage power supplies thanks to its wide voltage range covering up to 690 V U_{L-L}.

Two separate power supplies are required to maintain a continuous power supply to loads in the event of a power failure. Loads can be supplied with power through the following configurations system to system, system to generator, or generator to generator. The SENTRON ATC5300 can be deployed throughout the entire range of low-voltage power distribution applications .

It can be integrated as a control panel instrument in low-voltage main distribution units, sub-distribution units, and distribution boards.



Examples of switching options with truth table



Applications in low-voltage power distribution

SENTRON transfer control devices for ATSE, 3KC

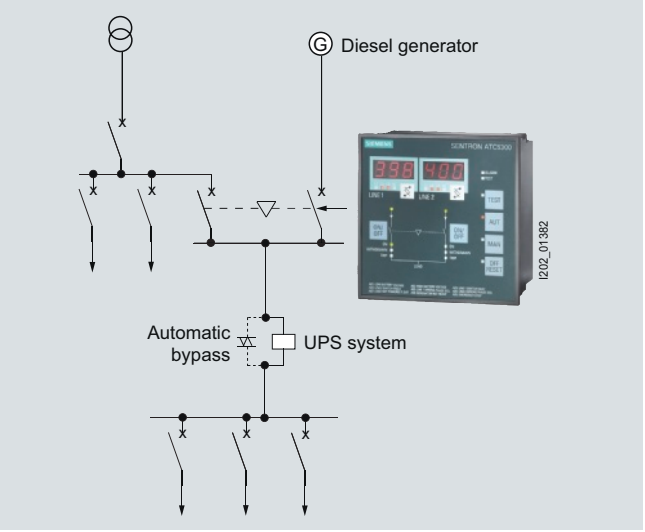
Supplying power to UPS systems

The SENTRON ATC5300 guarantees a high level of reliability and operational continuity. It can be used in all areas such as industry, infrastructure and buildings. Emergency power supplies are needed in public buildings, high-rise buildings, hospitals and other areas where people work.

UPS systems are essential for areas with high demands regarding supply safety, such as in hospitals and IT systems. Using the SENTRON ATC5300 in conjunction with USP systems ensures the maximum level of continuous power distribution. In case of a power failure, the end loads are immediately supplied by the USP system until the control device has successfully switched to the standby system.

Industries

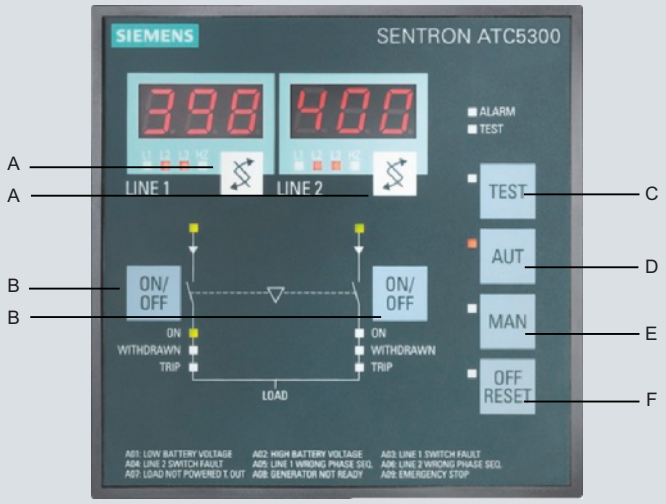
The SENTRON ATC5300 is used independently where a high level of supply safety is required.



Feeding UPS systems with SENTRON ATC5300

Design

Front and rear of the SENTRON ATC5300



A) Switchover between measured data (voltage, frequency), when in the parameter setting programming mode

B) Manual switchover

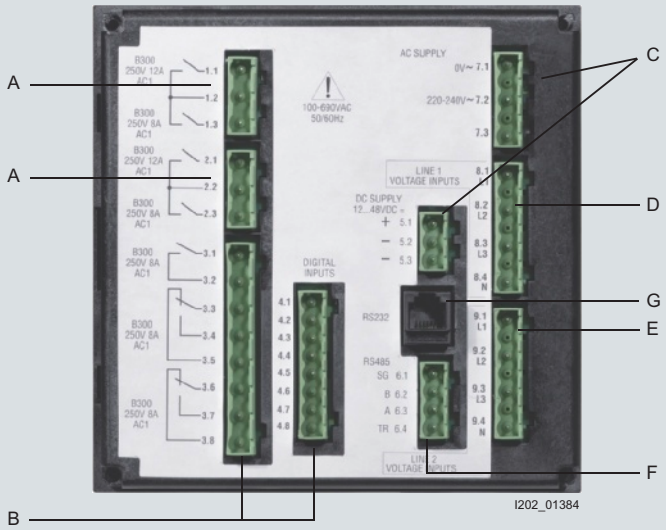
C) In Test mode, the generator start-up can be tested, without switching over to the standby power supply.

D) Automatic switchover to the standby power supply in case of fault

E) Manual switchover possible

F) Switch off, access for programming

Front



A) Output for controlling: motorized operating mechanisms, contactors 250 V AC 12 A

B) Programmable inputs and outputs, e.g. for electrical interlock, generator start signal, alarm output, etc.

C) Power supply: 220-240 V AC or 12-24-48 V DC

D) Measuring lead, main power supply

E) Measuring lead, standby power supply

F) RS485 communication (Modbus RTU)

G) RS232 communication (connection to PC with SENTRON SOFTWARE ATC)

Rear

SENTRON transfer control devices for ATSE, 3KC

Function

The control device is equipped four selectable modes:

- Automatic
- Manual
- Test
- Off

In Manual mode, the system can be switched manually on the SENTRON ATC5300. The test mode allows the generator to be started or tested in the system-generator configuration, without switching to the standby power supply. This ensures that the power flow to the load is not interrupted.

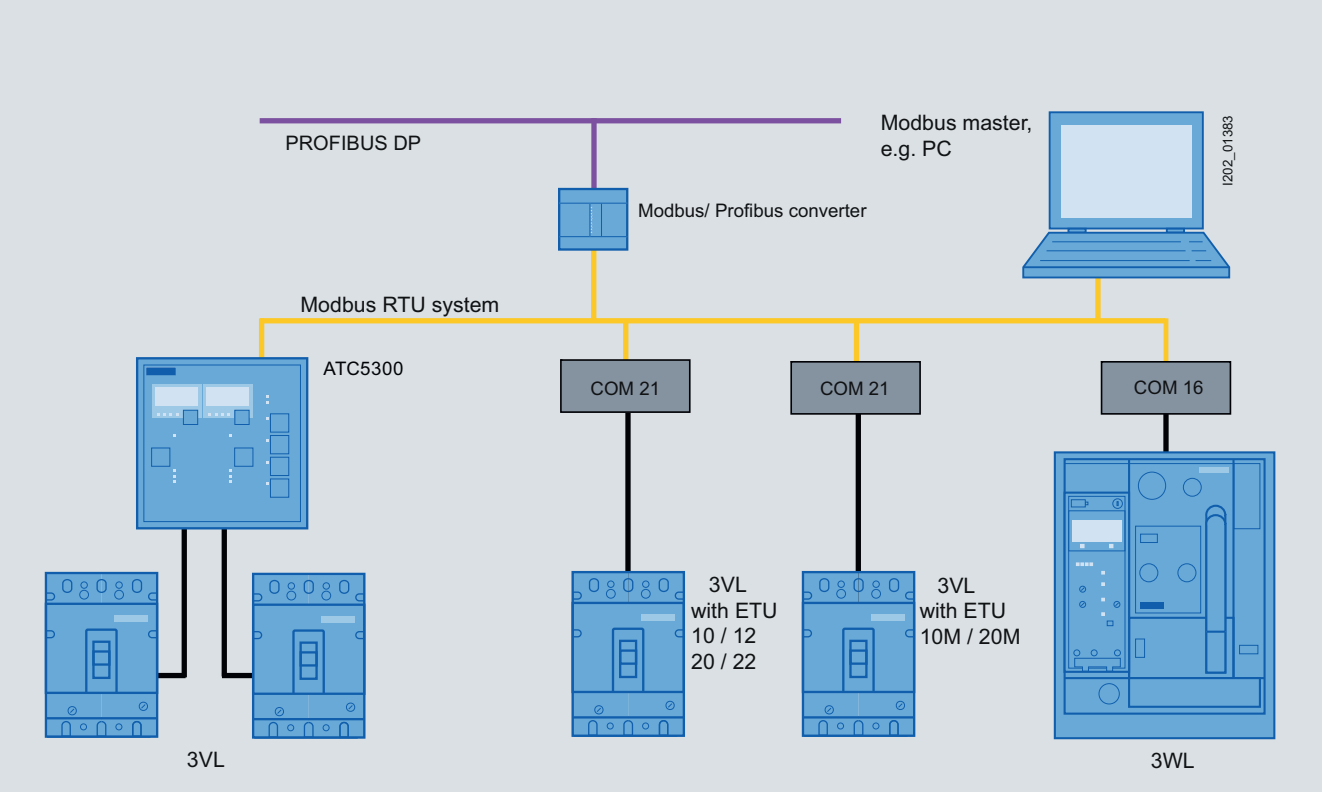
The control device is also equipped with programmable inputs and outputs. They enable the implementation of the following functions, among other things:

- Load shedding (unauthorized loads are disconnected from the system)
- Load shedding preparation (machines can be switched into safe mode)
- Generator start and stop signal
- Collective fault message (e.g. message to PLC, light)
- An external signal initiates the transfer to the standby system
- An external signal can communicate to the control device that switching is not permitted, even if the limit value is not maintained

The SENTRON ATC5300 can be connected to a higher-level power management system using the modbus interface (RTU or ASCII). Modbus enables the transfer of all data, parameter sets, and status messages of the device.

SENTRON ATC5300 in a modbus RTU system

The SENTRON ATC 5300 supports the MODBUS communication protocol (RTU or ASCII) through the RS485 interface.



Easy system integration through integrated MODBUS interface, e.g. for integrating into a power management system (ETU: Electronic Trip Unit)

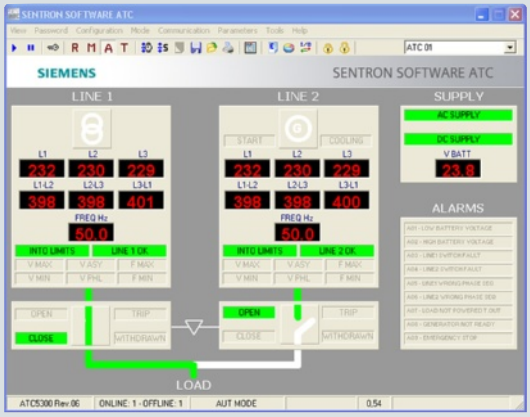
Programming

Setting parameters and monitoring using SENTRON ATC SOFTWARE

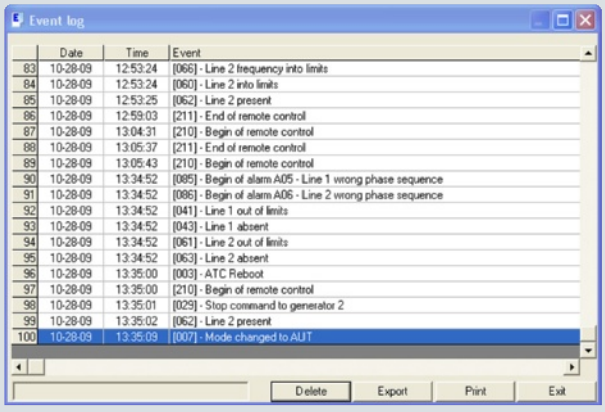
In addition to operation and setting parameters on-site, you can also monitor and set the parameters of the control device using the SENTRON ATC SOFTWARE. The software offers a high level of convenience and quick access to all device settings.

Various time settings required when connecting generators can be easily programmed using the software. If parameters for several devices must be set, the data sets can be very easily duplicated.

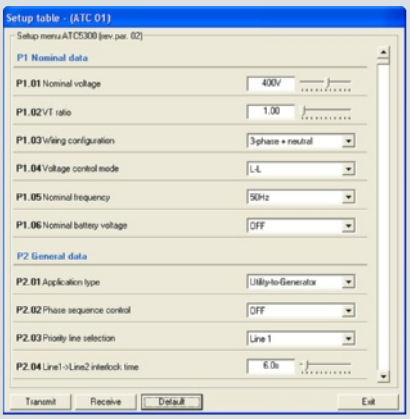
The SENTRON ATC5300 features an internal memory that logs the occurring events. The software can read out this data and compile it into statistics.



Main screen



Event display



Setup

Statistical analysis

SENTRON transfer control devices for ATSE, 3KC

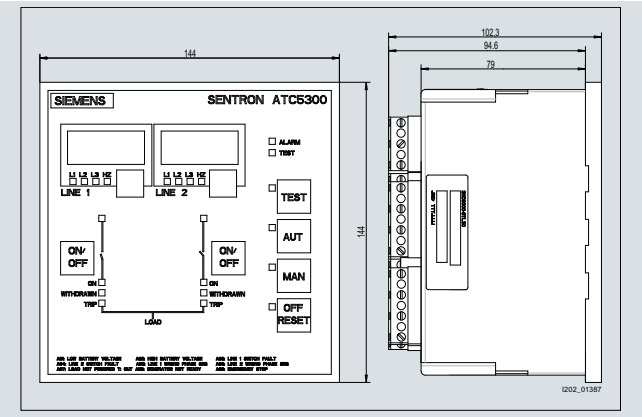
Technical specifications

		ATC5300
Auxiliary supply		
Rated voltage U_n		
• AC	V AC	220 ... 240
• DC	V DC	12 / 24 / 48
Operating range		
• AC	V AC	187 ... 264
• DC	V DC	9 ... 70
Frequency	Hz	45 ... 65
Max. power consumption at U_n = 240 V AC	VA	9
Max. power loss		
• At 240 V AC	W	6.3
• At 48 V DC	W	4.1
Max. current consumption		
• At 12 V DC	mA	300
• At 24 V DC	mA	180
• At 48 V DC	mA	90
Safety in the event of short interruptions	ms	50
Measuring inputs		
Max. rated voltage U_n		
• Phase-phase	V AC	690
• Phase-neutral	V AC	400
Phase-phase measuring range	V AC	80 ... 800
Frequency ranges	Hz	45 ... 65
Measuring method		RMS value (true RMS)
Measuring input impedance		
• Phase-phase	MΩ	>1.1
• Phase-neutral	MΩ	>0.5
Connection method		Single-phase, two-phase, or three-phase system
Measuring errors		±0.25%, Value range ±1 digit
Digital inputs		
Number of inputs		8, 6 of which are programmable
Type of input		Negative
Input current	mA	≤10
Input signal		
• Logic state "0"	V	≤1.5 (typical 2.9)
• Logic state "1"	V	≥ 5.3 (typical 4.3)
Input signal delay	ms	≥ 50
Relay outputs		
Number of outputs		7, 5 of which are programmable
Contact configuration		
• 2 relays with 1 NO contact		12 A, at 250 V AC (AC1)
• 3 relays with 1 NO contact		8 A, at 250 V AC (AC1)
• 2 relays with 1 CO contact		8 A, at 250 V AC (AC1)

		ATC5300
Reversing time of control device	s	1
Communication cables		
RS232 serial interface • With programmable baud rate • Connection through RJ6/6 connector	bit/s	1200 ... 38400
RS485 serial interface • Optically insulated • With programmable baud rate • Connection through plug-in terminals	bit/s	1200 ... 38400
Real-time clock		
Energy storage		Stored-energy capacitors
Operating time without feeding voltage	Days	Approx. 12 ... 15
Insulation voltage		
Rated insulation voltage U_i	V	690
Ambient conditions		
Operating temperature	°C	-20 … +60
Storage temperature	°C	-30 … +80
Relative humidity	%	<90
Max. pollution degree		3
Overvoltage category		3
Measuring category		CAT III
Connections		
Terminal type		Removable/pluggable
Cable cross-section	mm^2	0.2 ... 2.5 (24 ... 12 AWG)
Max. tightening torque	Nm	0.5 (4.5 lbf·in)
Enclosures		
Enclosure material		Thermoplast LEXAN 3412R
Version		Door installation
Degree of protection		IP41 front, IP20 rear
Weight	g	950
Certificates and conformity		
ATS/ATSE standard		Complies with the ATS/ATSE standard IEC 60947-6-1, in combination with 3VL or 3WL[1)]
Environment classification		3K6 acc. to IEC 60721-3-3
		3B2 acc. to IEC 60721-3-3
		3C3 acc. to IEC 60721-3-3
		3S2 acc. to IEC 60721-3-3
		3M6 acc. to IEC 60721-3-3
EMC		Acc. to IEC 60947-6-1

[1)] See device manual for further information.

Dimensional drawings



SENTRON ATC5300 control device: front view and view from the right

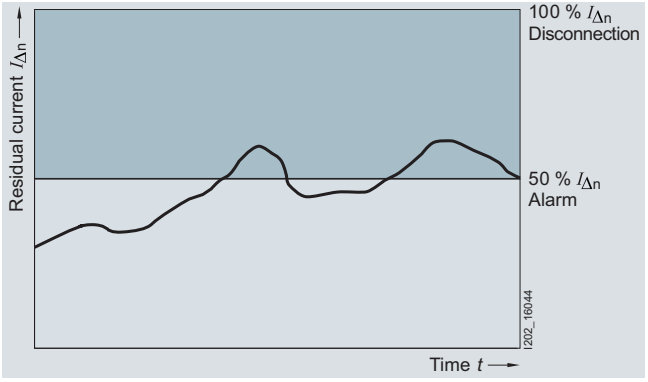
Overview

Plant safety and operating safety are becoming increasingly important alongside the protection of personnel. Shutdowns due to the unexpected tripping of protective devices cause high costs. It is possible to detect residual currents in the electrical installation before the protective device responds.

Residual current monitors (RCM) monitor residual current in electrical installations and issue a signal when the residual current exceeds a set value.

RCMs are used primarily in plants where a fault should result in a signal but not in disconnection. This enables plant operators to detect faults and eliminate their causes before the protective devices disconnect the installation, which increases plant and operating safety and cuts costs.

The summation current transformer detects all conductors required to conduct the current, i.e. including the neutral conductor where applicable. In a fault-free system, the magnetizing effects of the conductors through which current is flowing cancel each other out for the summation current transformer, i.e. the sum of all currents is zero. If a residual current is flowing due to an insulation fault, a residual magnetic field is left in the core of the transformer and produces a voltage. This voltage is evaluated using the electronics of the RCM. The switched contact can be used e.g. to operate an acoustic/optical signaling device, a higher-level control system or a circuit breaker.



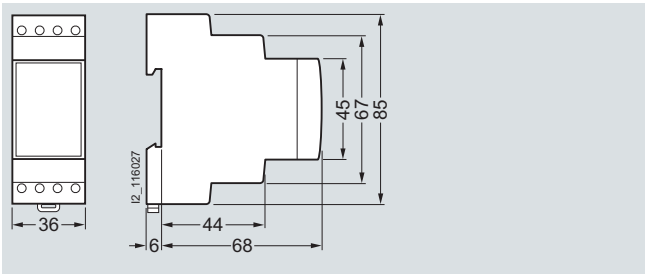
Technical specifications

		RCM analog	RCM digital	RCM digital, 4 channels
Standards		EN 62020, IEC 62020		
Rated operational voltage U_e	V AC	230		
• Frequency	Hz	50/60		
Rated residual current I_{Dn}				
• Type A	A	0.03 ... 3	0.03 ... 3	0.03 ... 3
• Type AC	A	3 ... 5	3 ... 30	3 ... 30
Response time t_v	s	0.02 ... 5	0.02 ... 10, INS, SEL[1)]	0.02 ... 10, INS, SEL[1)]
Relay contacts		1 × alarm	1 × alarm, 1 × tripping operation	1 × alarm, 4 × tripping operation
• Rated voltage	V AC	230	230	230
• Rated current	A	6	6	6
Summation current transformer	mm ∅	20 ... 210		
Test/Reset		Yes/Yes		
External tripping operation/external reset		--/Yes	Yes/Yes	Yes/Yes
Mounting width	MW	2	3	3
Degree of protection				
• Contacts		IP20		
• Front		IP41		
operating temperature	°C	-10 ... +50		

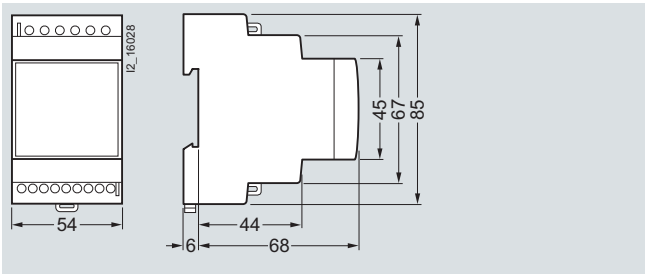
1) INS: instantaneous, SEL: selective.

Dimensional drawings

Residual current monitor

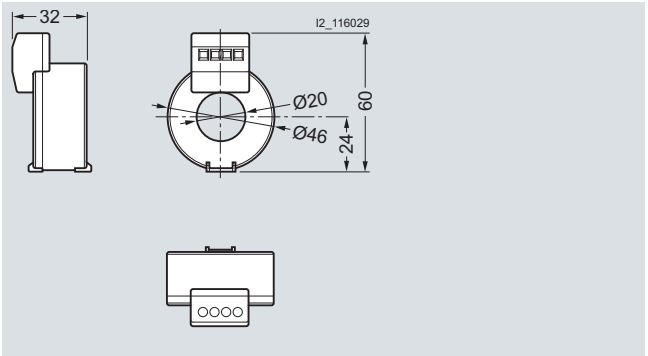


RCM analog, 5SV8 000-6KK

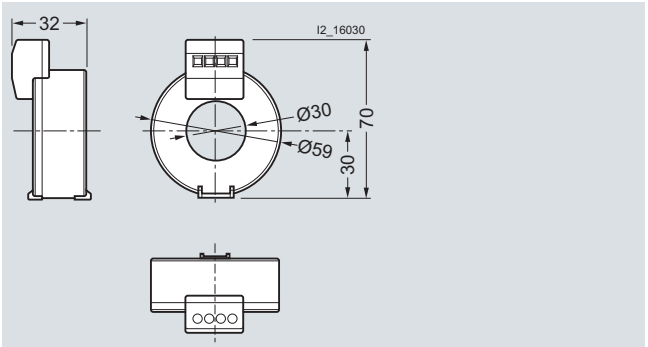


RCM digital, 5SV8 001-6KK, 5SV8 200-6KK

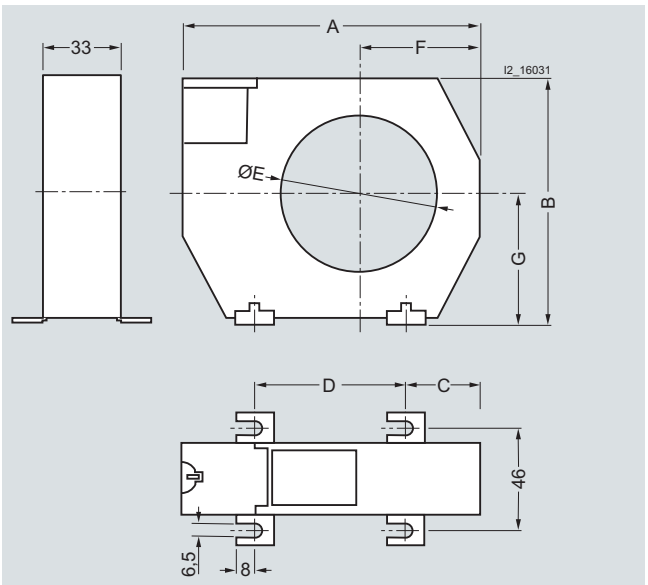
Summation current transformer



Summation current transformer, 5SV8 700-0KK



Summation current transformer, 5SV8 701-0KK

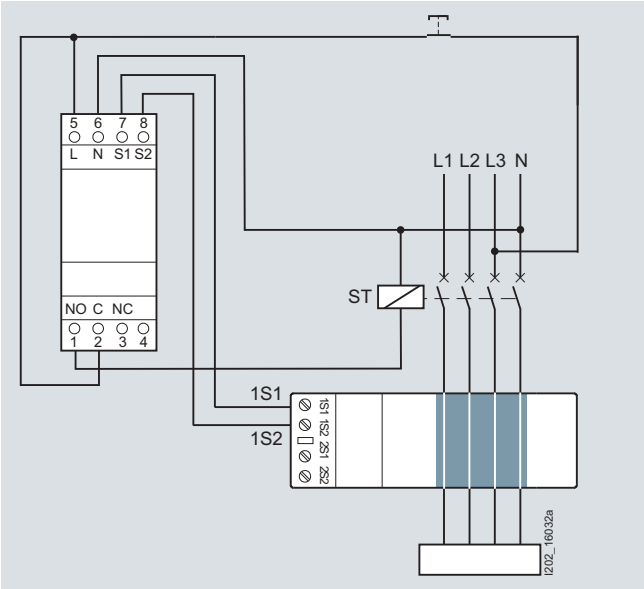


Summation current transformers, 5SV8 702-0KK, 5SV8 703-0KK, 5SV8 704-0KK, 5SV8 705-0KK, 5SV8 706-0KK

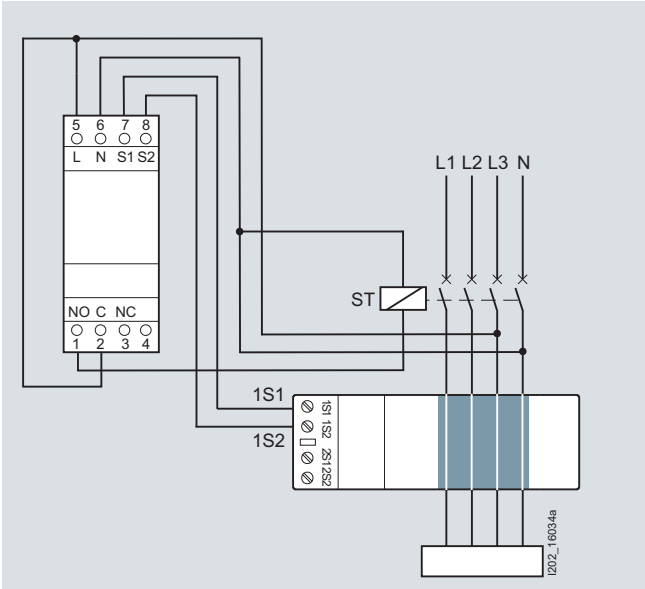
Type Dimensions	A	B	C	D	E	F	G
5SV8 702-0KK	100	79	26	49	35	35	43
5SV8 703-0KK	130	110	32	66	70	52	57
5SV8 704-0KK	170	146	38	94	105	72	73
5SV8 705-0KK	230	196	49	123	140	97	98
5SV8 706-0KK	299	284	69	161	210	141	142

Schematics

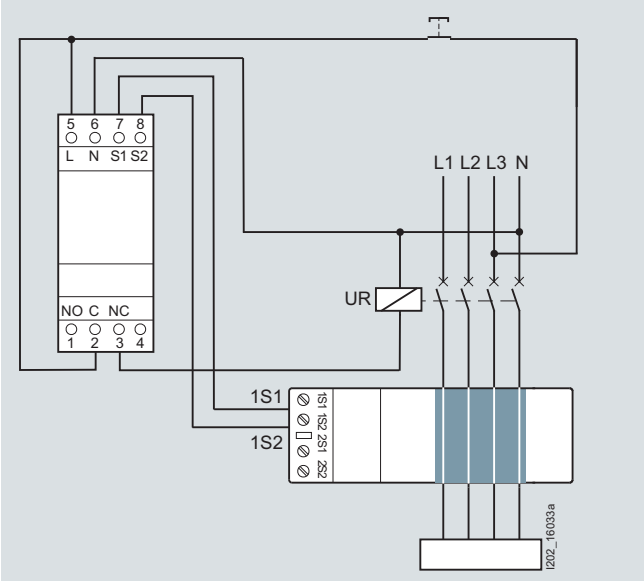
Residual current monitor



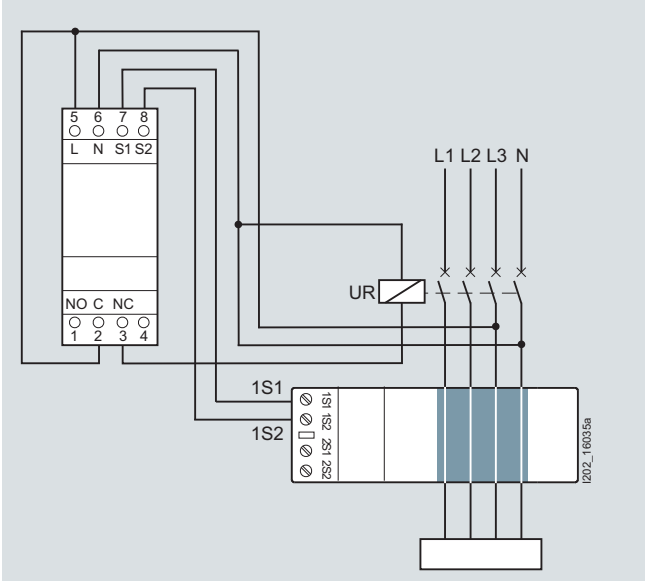
RCM analog, 5SV8 000-6KK, shunt trip (ST)



RCM analog, 5SV8 000-6KK, shunt trip (ST), self-acknowledging



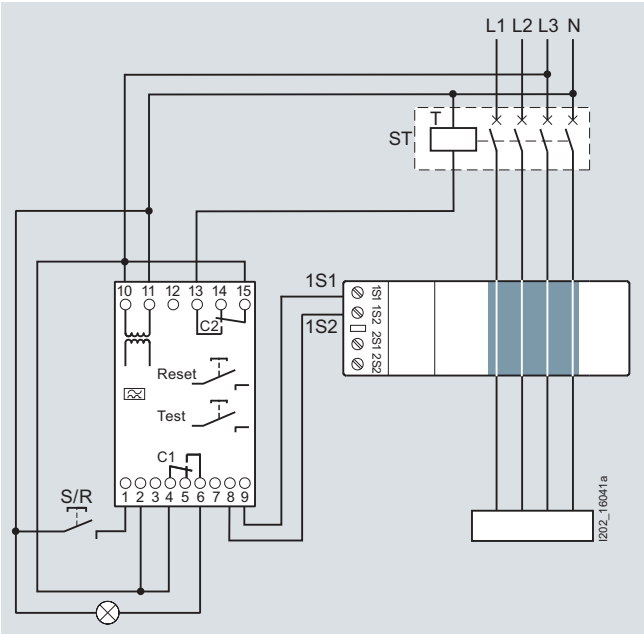
RCM analog, 5SV8 000-6KK, undervoltage release (UR)



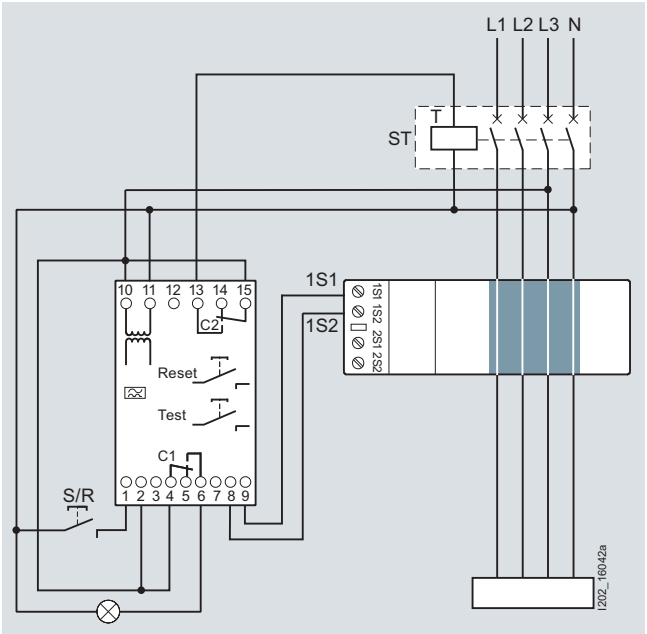
RCM analog, 5SV8 000-6KK, undervoltage release (UR), self-acknowledging

ST = shunt trip
UR = undervoltage release

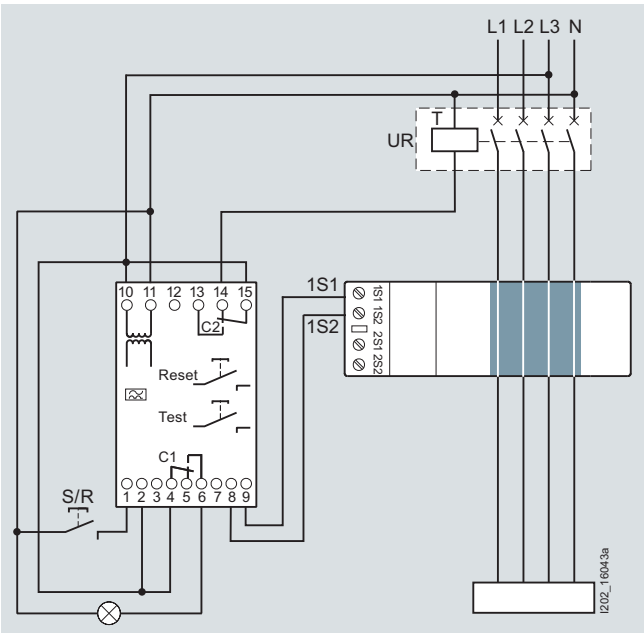
Residual current monitors, 5SV8



RCM digital, 5SV8 001-6KK, shunt trip (ST)

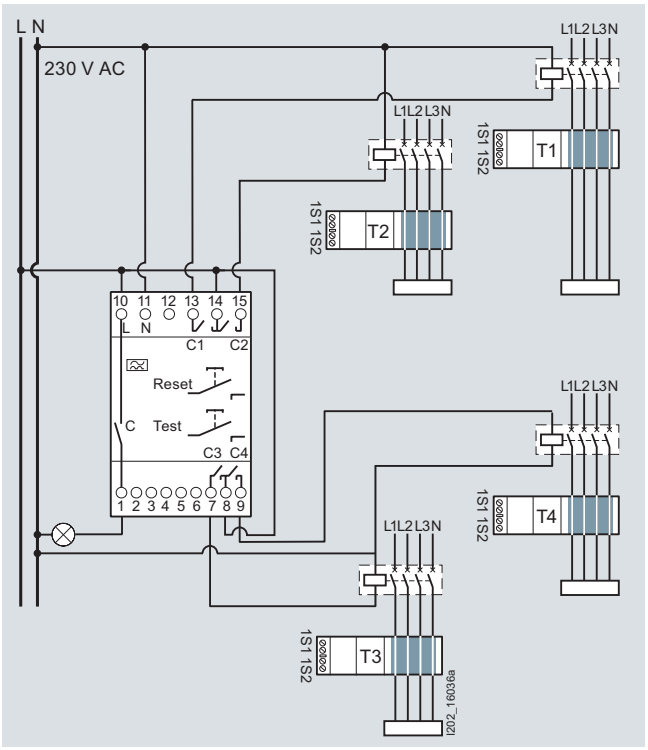


RCM digital, 5SV8 001-6KK, shunt trip (ST), self-acknowledging



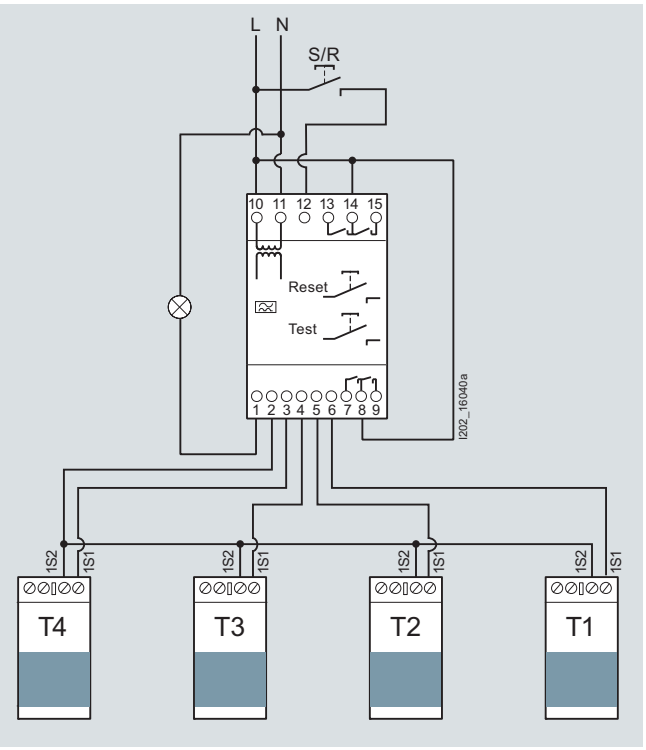
RCM digital, 5SV8 001-6KK, undervoltage release (UR)

ST = shunt trip
UR = undervoltage release



RCM digital, 4 channels, 5SV8 200-6KK, Shunt trip (unit)

ST = shunt trip



RCM digital, 4 channels, 5SV8 200-6KK

S/R = set/reset

More information

Switch positions

RCM digital, 5SV8 001-6KK:

Setting	Alarm "Standard"	Trip "Standard"	Alarm "+"	Trip "+"
Without power supply	4 — 5 / 6	15 — 14 / 13	4 — 5 / 6	15 — 14 / 13
With power supply	4 — 5 / 6	15 — 14 / 13	4 — 5 / 6	15 — 14 / 13
Over limit	4 — 5 / 6	15 — 14 / 13	4 — 5 / 6	15 — 14 / 13
CT disconnection	4 — 5 / 6	15 — 14 / 13	4 — 5 / 6	15 — 14 / 13

Residual current monitors, 5SV8

RCM digital, 4 channels, 5SV8 200-6KK:

Setting	Alarm "Standard"	Trip "Standard"	Trip "+"
Without power supply		C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9	C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9
With power supply		C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9	C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9
Over limit		C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9	C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9
CT disconnection		C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9	C1: 14 C1: 13 C2: 14 C2: 15 C3: 8 C3: 7 C4: 8 C4: 9

Overview

Voltage relays are used for device and plant protection, supplying safety light devices and the detection of N-conductor breaks and short-time voltage interruptions.

They are available as undervoltage, overvoltage and under/overvoltage relays. The devices are equipped with different functions, depending on their intended use, and comply with the pertinent regulations.

Technical specifications

			5TT3 400 5TT3 401 5TT3 402 5TT3 403	5TT3 404 5TT3 405	5TT3 406	5TT3 194	5TT3 195
Standards			IEC 60255; DIN VDE 0435-110, -303				
Rated control voltage U_c		V AC	230/400				400
Operating range (overload capability)		$\times U_c$	1.1			1.35	
Rated frequency		Hz	50/60				
Response values	ON-switching OFF-switching	$\times U_c$	0.9/0.95 0.7/0.85		4 % hysteresis 0.7 ... 0.95	 0.9 ... 1.3	
Minimum contact load		V; mA	10; 100				
Phase asymmetry	Setting accuracy	%	--	Approx. 5 ... 10		--	Approx. 5 ... 10
	Repeat accuracy	%	--	1		--	1
Phase failure detection	At L1 or L2 or L3	ms	100			--	
N-conductor monitoring			--	Yes		--	
Rated insulation voltage U_i	Between coil/contact	kV	4				
Contacts	µ contact (AC-11)	A	4				
Electrical isolation	Creepage distances and clearances Actuator/contact	 mm	 3	 5.5			
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 2.5	> 4			
Terminals	±screw (Pozidriv)		1				
Conductor cross-sections • Rigid, max. • Flexible, with end sleeve, min.		 mm^2 mm^2	 2 × 2.5 0.5				
Permissible ambient temperature		°C	-20 ... +60				
Resistance to climate	According to EN 60068-1		20/60/4				

			5TT3 196
Standards			IEC 60255; DIN VDE 0435
Rated control voltage U_c		V AC	24
Rated power dissipation P_v • Coil/drive • Contact[1] per pole		 VA VA	 0.6 0.8
Hysteresis		%	4
Response values × U_c • Undervoltage • Overvoltage	 Undervoltage Overvoltage		 0.82 1.18
Residual ripple tripping ΔU_c	Infinitely variable	%	0 ... 15
Overload capability	DC33 V DC35 V DC45 V	 ms ms	Continuous 500 10
Creepage distances and clearances		mm	4
Rated impulse withstand voltage U_{imp}	Input/output	kV	> 2.5
Minimum contact load		V/mA	24/300
Rated operational current I_e	AC -11 AC -1	A A	1 4
Contacts			µ contact
Electrical service life	In switching cycles at I_e		5×10^5
Terminals	+/-screw (Pozidriv)		1
Conductor cross-sections • Rigid, max. • Flexible, with end sleeve, min.		 mm^2 mm^2	 2 × 2.5 1 × 0.5
Permissible ambient temperature		°C	-20 ... +60
Resistance to climate	According to EN 60068-1		20/60/4

[1] For rated operational current.

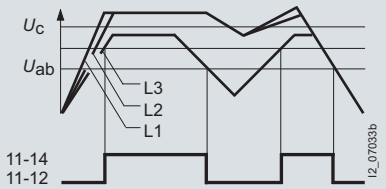
Voltage relays, 5TT3

			5TT3 407	5TT3 408	5TT3 410
Standards			IEC 60255; DIN VDE 0435-110		
Rated control voltage U_c		V AC	230/400		
Operating range (overload capability)		$\times U_c$	1.1	1.35	1.2
Rated frequency		Hz	50/60		
Back-up fuse	Terminals L1/L2/L3	A	2		
Response values	Overvoltage:				
	OFF-switching	$\times U_c$	--	0.9 ... 1.3	--
	ON-switching		--	4 % hysteresis	--
	Undervoltage:				
	OFF-switching	$\times U_c$	0.8	0.7 ... 1.1	--
	ON-switching		0.85	4 % hysteresis	--
Minimum contact load		V; mA	10; 100		
Phase asymmetry	Setting accuracy	%	Approx. 5 ... 10		
	Repeat accuracy	%	1		
Phase failure detection	At L1, L2 or L3	ms	≥ 20	100	--
OFF delay		s	--	0.1 ... 20	--
Automatic reclosing delay		s	0.2 ... 20	--	--
Rated insulation voltage U_i	Between coil/contact	kV	4		
Contacts	μ contact (AC-11)	A	3	1	4
Electrical isolation	Creepage distances and clearances				
	Contact/contact	mm	--	4	--
	Actuator/contact	mm	4		5.5
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 4		
Rated operational power P_s	AC operation:				
	230 V and p.f. = 1	VA	2000	--	--
	230 V and p.f. = 0.4	VA	1250	--	--
	DC operation:				
	U_e = 24 V and I_e = 6 A	W	max. 100	--	--
	U_e = 60 V and I_e = 1 A	W	max. 100	--	--
	U_e = 110 V and I_e = 0.6 A	W	max. 100	--	--
	U_e = 220 V and I_e = 0.5 A	W	max. 100	--	--
Terminals	±screw (Pozidriv)		1		
Conductor cross-sections					
• Rigid, max.		mm^2	2 × 2.5		
• Flexible, with end sleeve, min.		mm^2	0.5		
Permissible ambient temperature		°C	-20 ... +60		
Humidity class	Acc. to IEC 60068-2-30		F		

			Voltage relays	
			5TT3 411	5TT3 412
Rated control voltage U_c		V AC	230	230/400
Overload capability		$\times U_c$	1.15	1.1
Rated frequency		Hz	50/60	
Response values	ON-switching		2 % hysteresis	4 % hysteresis
	OFF-switching	$\times U_c$	0.9	0.9
Minimum contact load		V/mA	10/100	
Phase failure detection	At L1, L2 or L3	ms	--	100
N-conductor monitoring			--	Yes
Rated insulation voltage U_i	Between coil/contact	kV	4	
Contacts	AC 15 NO contacts		3	3
	AC 15 NC contacts		2	1
Electrical service life in switching cycles	AC15, 1 A, 230 V AC		5×10^5	
Rated impulse withstand voltage	Acc. to IEC 60664-1	kV	4	
Pollution degree			2	
Terminals	±screw (Pozidriv)		2	
Conductor cross-sections				
• Rigid		mm^2	2 × 2.5	
• Flexible, with end sleeve		mm^2	2 × 1.5	
Permissible ambient temperature		°C	-20 … +60	
Resistance to climate	Acc. to EN 60068-1		20/060/04	

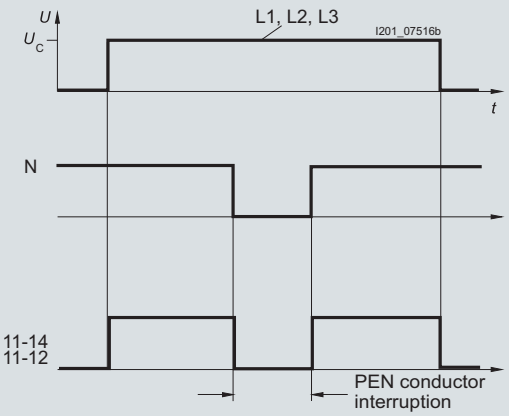
Characteristic curves

Timing interval of 5TT3 400 ... 5TT3 406 undervoltage relays

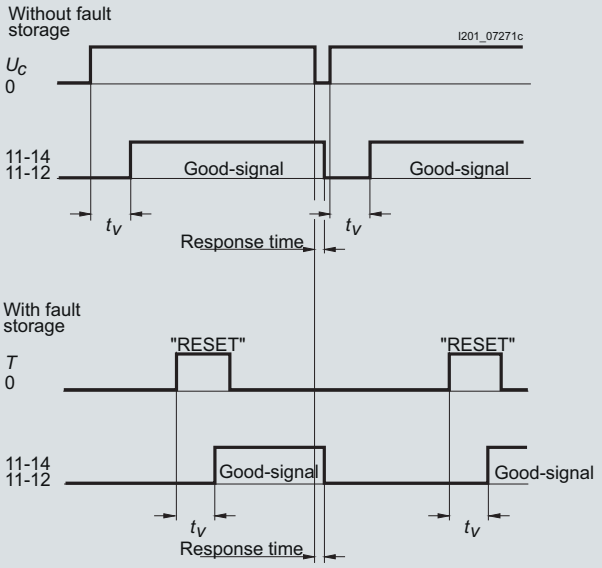


U_{ab}= Release value

Timing interval of 5TT3 410 N-conductor monitors



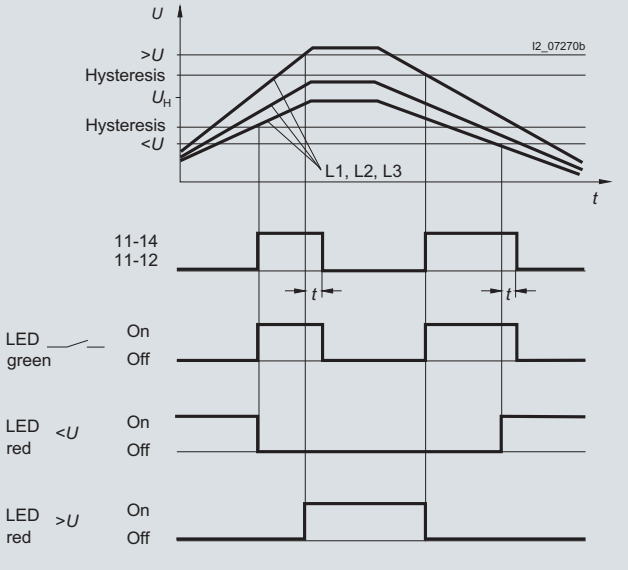
Timing interval of 5TT3 407 short-time relays



t_v: adjustable automatic reclosing delay 0.2 to 20 s

The undervoltage relay switches at a phase asymmetry of approx. 6 to 8 %, regardless of the response values for undervoltage. The above diagram shows the timing interval for undervoltage or asymmetry.

Timing interval of 5TT3 408 under/overvoltage relays



t: Adjustable OFF delay 0.1 to 20 s

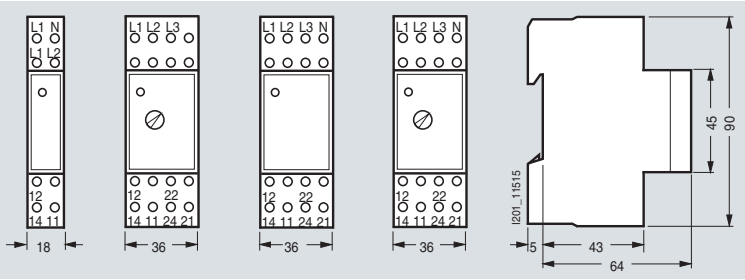
The undervoltage relay switches at a phase asymmetry of approx. 6 to 8 %, regardless of the response values for undervoltage. The above diagram shows the timing interval for undervoltage.

5TT3 411 and 5TT3 412 voltage relays

For characteristic curves of the 5TT3 411 and 5TT3 412 voltage relays see "Insulation monitors for medical premises" on page 38.

Dimensional drawings

5TT3 4, 5TT3 194 and 5TT3 195 voltage relays



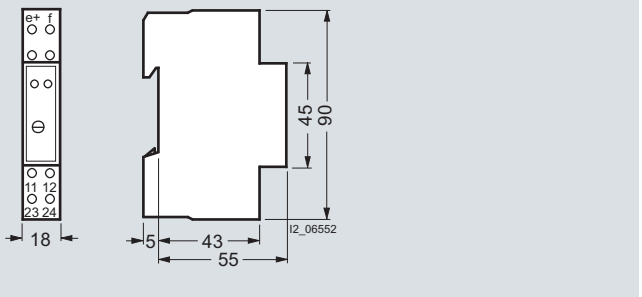
5TT3 400
5TT3 401

5TT3 402
5TT3 403

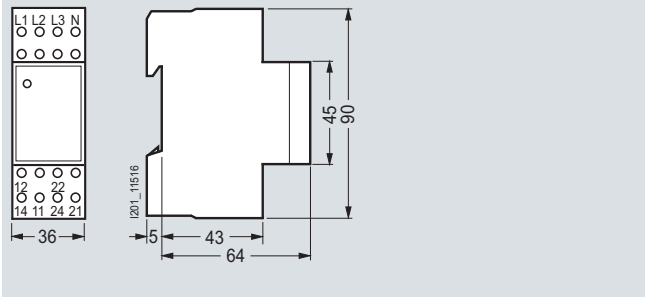
5TT3 404
5TT3 405
5TT3 407
5TT3 408

5TT3 194
5TT3 195
5TT3 406

5TT3 196 DC voltage controller



5TT3 410 N-conductor monitors

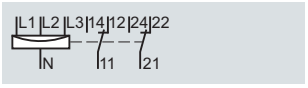


5TT3 411 and 5TT3 412 voltage relays

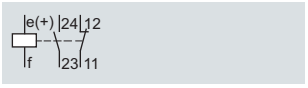
For dimensional drawings of the 5TT3 411 and 5TT3 412 voltage relays see "Insulation monitors for medical premises".

Schematics

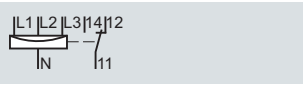
Diagrams



5TT3 194
5TT3 195
5TT3 402
5TT3 403
5TT3 404
5TT3 405
5TT3 406
5TT3 407
5TT3 408
5TT3 410



5TT3 196



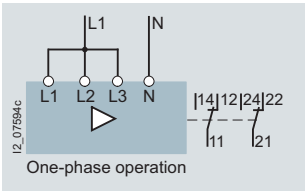
5TT3 400
5TT3 401

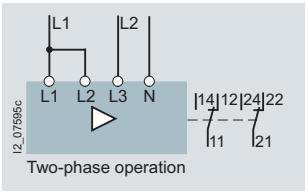
5TT3 411 and 5TT3 412 voltage relays

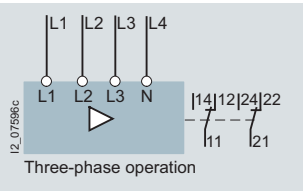
For schematics of the 5TT3 411 and 5TT3 412 voltage relays see "Insulation monitors for medical premises" on page 38.

Switching example for 5TT3 195, 5TT3 40 voltage relays.

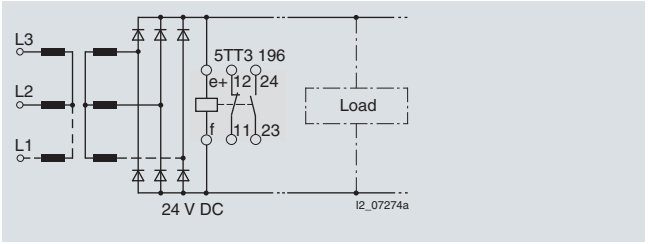
1, 2, 3-phase operation against N

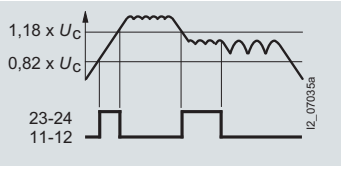






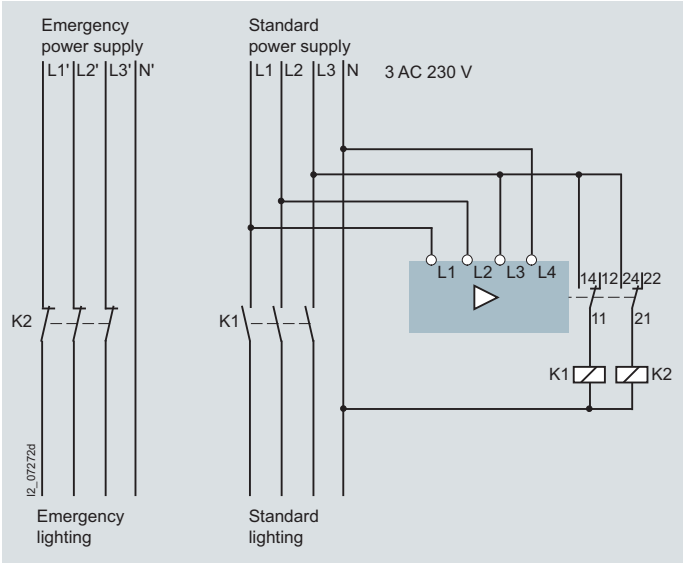
Typical circuit diagram: 5TT3 196 DC voltage controller





If 0.82 × U_c is fallen short of, or 1.18 × U_c exceeded, or if the residual ripple is too high, the 11/12 contacts closes and the 23/24 contact opens.

Circuit example for 5TT3 401, 5TT3 403, 5TT3 405 undervoltage relays

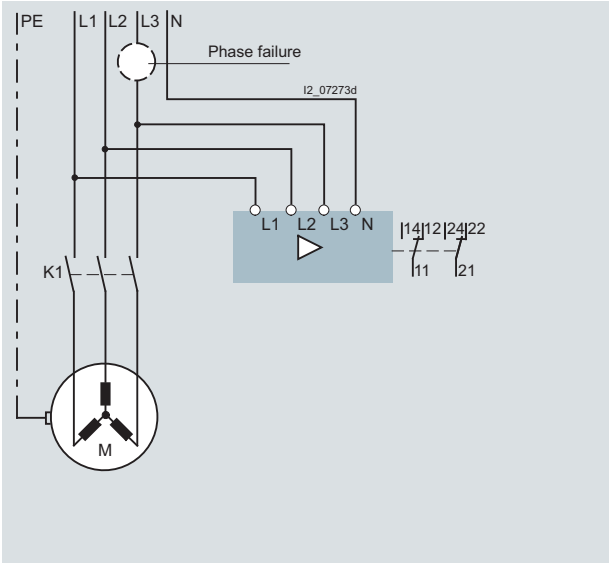


One application of undervoltage relays is the switching to a safe power supply after a fault.
Buildings are distinguished according to use, such as business premises, exhibition areas or guest houses. These are all covered generically as rooms/buildings where "people meet".

There is a fault if the voltage of the general power supply drops for 0.5 seconds > 15 % in relation to the rated voltage (i.e. 195 V at 230 V).

In this case the lighting must be switched to a safety power supply after 0.5 to 15 s depending on the type of use. A safety power supply may be: a battery system, a generating set or a quick-starting standby generating set.

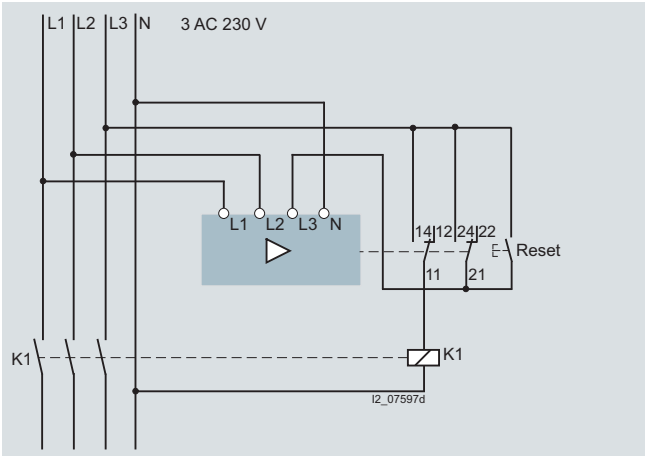
Switching example for 5TT3 404, 5TT3 405, 5TT3 406, 5TT3 408 undervoltage relays



These voltage relays can only be used for 3-phase operation. They monitor not only under and overvoltages in accordance with their description, but also reverse voltage, asymmetry and N-conductor breaks.

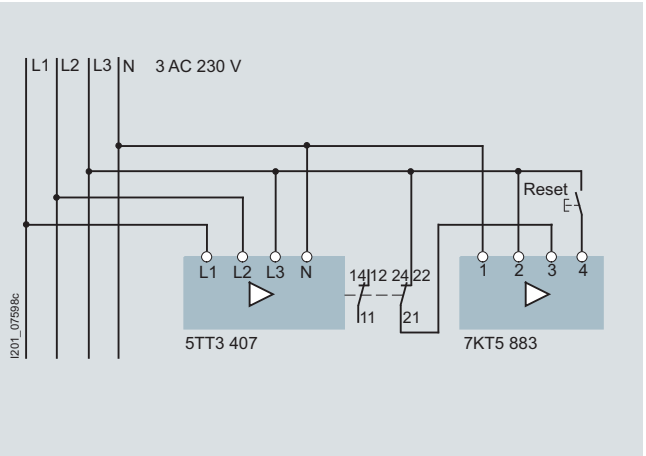
Voltage relays, 5TT3

Circuit example for 5TT3 407 short-time relays



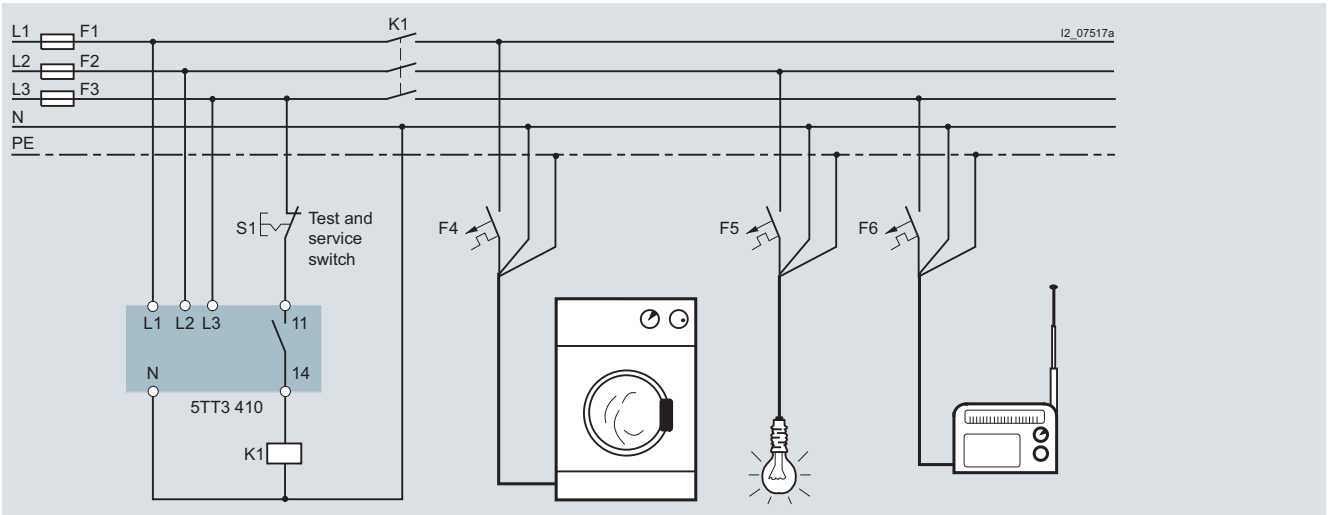
In the case of sensitive technical sequences, it is often not possible to tell whether this interrupt has interfered with the process sequence. The switch disconnects the power supply, which can then be switched back by using the reset pushbutton.

Circuit example for 5TT3 407 short-time relays



In simple cases, it may be sufficient that a short-time interruption is registered without the need to disconnect the power supply. In the case of a short-time interruption, this is counted by the pulse counter. The pulse counter can be reset if required.

Switching example of 5TT3 410 N-conductor monitors



More information

	5TT3 194	5TT3 195	5TT3 196	5TT3 400	5TT3 401	5TT3 402	5TT3 403	5TT3 404	5TT3 405	5TT3 406	5TT3 407	5TT3 408	5TT3 410	5TT3 411	5TT3 412
Overvoltage	✓	✓	✓	--	--	--	--	--	--	--	--	✓	--	✓	✓
Undervoltage	--	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	--	--	--
Monitoring of safety light devices	--	--	--	--	✓	--	--	--	✓	--	--	--	--	--	--
Monitoring of medical premises	--	--	--	--	--	--	--	--	--	--	--	--	--	✓	✓
Monitoring of N-conductor	--	--	--	--	--	--	--	--	--	--	--	--	✓	--	✓
Monitoring of short-time interruptions	--	--	--	--	--	--	--	--	--	--	✓	--	--	--	--
1, 2, 3-phase against N	✓	--	--	✓	✓	✓	✓	--	--	--	✓	--	--	✓	✓
3 phases against N	--	✓	--	--	--	--	--	✓	✓	✓	--	✓	--	--	--
Asymmetry detection	--	✓	--	--	--	--	--	✓	✓	✓	--	✓	✓	--	✓
N-conductor monitoring	--	--	--	--	--	--	--	✓	✓	✓	✓	✓	✓	--	✓
Reverse voltage detection	--	✓	--	--	--	--	--	✓	✓	✓	--	✓	--	--	✓
Short-time failure detection	--	--	--	--	--	--	--	--	--	--	✓	--	--	--	--
Phase failure detection	--	--	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	--	--	✓
Switching thresholds:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
0.7/0.9 × U_c, not adjustable	--	--	--	✓	--	✓	--	✓	--	--	--	--	--	--	--
0.8/0, 85 × U_c, not adjustable	--	--	--	--	--	--	--	--	--	--	✓	--	--	--	--
0.85/0.95 × U_c, not adjustable	--	--	--	--	✓	--	✓	--	✓	--	--	--	--	--	--
0.7 ... 0.95 × U_c, 5 % hysteresis, adjustable	--	--	--	--	--	--	--	--	--	✓	--	--	--	--	--
0.7 ... 1.1 × U_c, 4 % hysteresis, adjustable	--	--	--	--	--	--	--	--	--	--	--	✓	--	--	--
0.9 ... 1.3 × U_c, 4 % hysteresis, adjustable	✓	✓	--	--	--	--	--	--	--	--	--	✓	--	--	--
Adjustable time delay	--	--	--	--	--	--	--	--	--	--	--	✓	--	--	--
Contact: 1 CO	--	--	--	✓	✓	--	--	--	--	--	--	--	--	--	--
Contact: 2 CO	✓	✓	--	--	--	✓	✓	✓	✓	✓	✓	✓	✓	--	--
Contact: 1 changeover contact, 1 NO contact, 1 NC contact	--	--	--	--	--	--	--	--	--	--	--	--	--	--	✓
Contact: 1 NO contact, 1 NC contact	--	--	✓	--	--	--	--	--	--	--	--	--	--	--	--
Contact: 2 NO contacts, 2 NC contacts	--	--	--	--	--	--	--	--	--	--	--	--	--	✓	--

General voltage monitoring

For general device and plant protection, voltage relays with switching thresholds of 0.7 × U_c, i.e.161 V are used. If they have fixed, unchangeable switching thresholds, they switch back to normal operation at 0.85 × U_c, 195 V or at 0.9 × U_c, 207 V, depending on the version. If they have adjustable threshold values, they switch back to normal operation with 4 % hysteresis, 9 V.

1, 2 or 3 phases against N or 3 phases against N

All voltage relays require an N-conductor. Devices for 1, 2 or 3 phases against N can be used for 1-, 2-, or 3-phase operation. Devices for 3 phases against N require all three phases, whereby the sequence in which they are connected is irrelevant.

Asymmetry detection

If different voltages occur in a three-phase network, this is called phase asymmetry. Some voltage relays detect an asymmetry of approx. 6 to 8 % of the phase-to-neutral voltage, i.e. approx. 14 to 16 V and switch off. This type of operation is used for example to protect motors against a "skew".

N-conductor monitoring

An N-conductor break causes a skew, depending on the phase load. In extreme cases, this could cause 400 V to be applied to a phase and destroy the connected devices. Each voltage relay with asymmetry detection is tripped by an N-conductor break, if the phase displacement is at least 14 to 18 V.

The 5TT3 410 N-conductor monitor detects a phase displacement of 5 %, which is roughly 12 V. This provides earlier protection against overvoltage for connected devices. The N-conductor monitor does not react if the voltage drops or rises in all phases simultaneously; or if a phase is swapped with the N-conductor.

Reverse voltage detection

If a phase fails, the motors feed a reverse voltage to the missing phase. However, in this case, voltage relays with reverse voltage detection will disconnect because they are monitoring the phase angle.

Phase failure detection

If a phase fails completely, the voltage relays disconnect with a delay as specified in the technical specifications.

Short-time failure detection

Short-time failures upwards of 20 ms cannot be detected with conventional voltage relays. However, they can occur in the case of system transfers or lightning strikes and can lead to uncertainty for sensitive process sequences or measuring procedures. The 5TT3 407 short-time voltage relay has a reset function that allows a procedure to be permanently interrupted after a fault.

Back-up fuse

The voltage relays do not require a back-up fuse as device protection. However, they are often installed in junctions, i.e. in main supply systems with high fusing. In this case, the supply lead to the voltage relay must be short-circuit resistant. The back-up fuse only serves as line protection.

5TT3 411 and 5TT3 412 voltage relays

For control elements of the 5TT3 411 and 5TT3 412 voltage relays see "Insulation monitors for medical premises" on page 38.

Current relays, 5TT6

Overview

Current relays monitor single and three-phase systems for the flow of current, e.g. in emergency lighting installations, and the loading of motors. They are available as undercurrent, overcurrent and under/overcurrent relays.

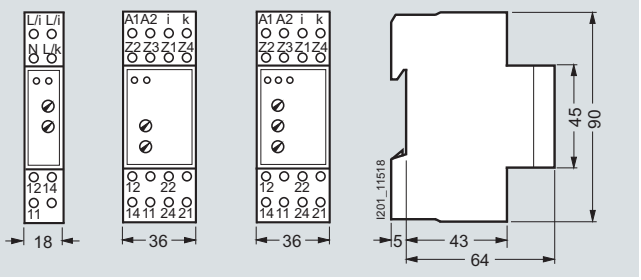
Technical specifications

			5TT6 111	5TT6 112
Standards			IEC 60255; DIN VDE 0435-303	
Rated control current I_c		A	1 ... 10	
Rated control voltage U_c		V AC	230	
Primary operating range **Overload capability, continuous** **Overload capability, short-time**	 at 50 °C ambient temperature max. 3 s	$\times U_c$ A A	0.9 ... 1.1 15 20	
Rated frequency		Hz	50/60	
Response values	ON-switching OFF-switching		Infinitely variable permanent, 4 % hysteresis	
Switching delay t_v	Infinitely adjustable	s	0.1 ... 20	
Response time	Non-adjustable	ms	Current corresponds to the rated operational power of the continuous-flow heater	
Minimum contact load		V; mA	10; 100	
Rated insulation voltage U_i	Between coil/contact	kV	2.5	
Contacts µ contact (AC-15)	 NO contacts NC contacts	 A A	 3 1	
Electrical isolation	Creepage distances and Actuator/contact	mm	3	
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 4	
Terminals	±screw (Pozidriv)		1	
Conductor cross-sections	Rigid Flexible, with end sleeve	max. mm^2 min. mm^2	2 × 2.5 1 × 0.5	
Permissible ambient temperature		°C	-20 ... +60	
Resistance to climate	According to EN 60068-1		20/60/4	

			5TT6 113	5TT6 114	5TT6 115	5TT6 120
Standards			IEC 60255; DIN VDE 0435-303			
Rated control current I_c		 A A A A	4 ranges 0.1 ... 1 0.5 ... 5 1 ... 10 1.5 ... 15			1 range 0.5 ... 5
Rated control voltage U_c		V AC	230			
Primary operating range **Overload capability, continuous** **Overload capability independent of measuring range**	 max. 3 s	$\times U_c$ A A	0.9 ... 1.1 20 30			15
Rated frequency		Hz	50/60			
Response values	ON-switching OFF-switching		Infinitely variable permanent, 4 % hysteresis			
Switching delay t_v	Infinitely adjustable	s	0.1 ... 20			
Response time	Non-adjustable	ms	See page 29			
Minimum contact load		V; mA	10; 100			
Rated insulation voltage U_i	Between coil/contact	kV	2.5			
Contacts µ contact (AC-15)	 NO contacts NC contacts	 A A	 5 1			
Electrical isolation	Creepage distances and Actuator/contact	mm	3			
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 4			
Terminals	±screw (Pozidriv)		1			
Conductor cross-sections	Rigid Flexible, with end sleeve	max. mm^2 min. mm^2	2 × 2.5 1 × 0.5			
Permissible ambient temperature		°C	-20 ... +60			
Resistance to climate	According to EN 60068-1		20/60/4			

Dimensional drawings

5TT6 11 current relays

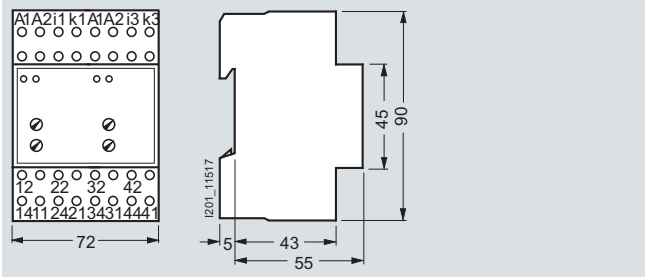


5TT6 111
5TT6 112

5TT6 113
5TT6 114

5TT6 115

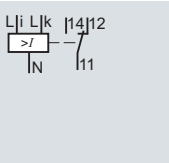
5TT6 120 current relays



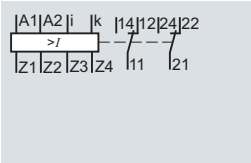
5TT6 120

Schematics

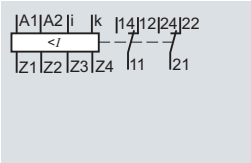
Diagram



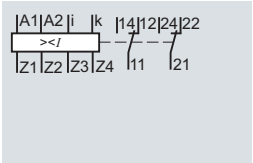
5TT6 111
5TT6 112



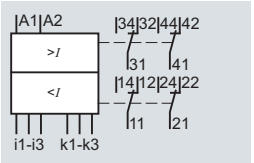
5TT6 113



5TT6 114

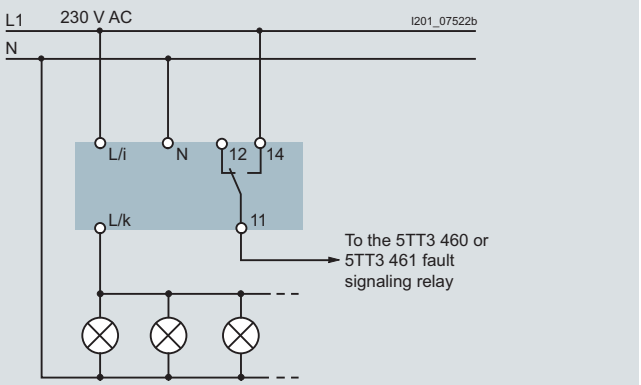


5TT6 115

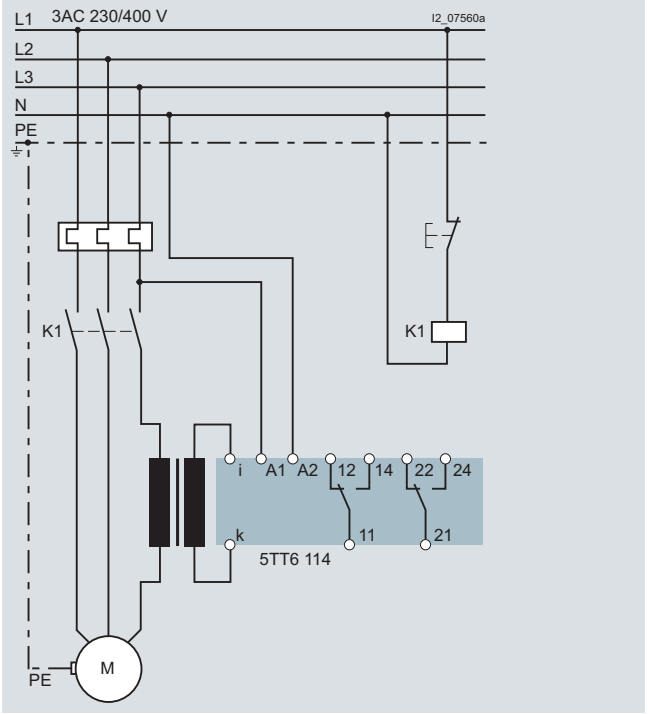


5TT6 120

Switching example for 5TT6 111 undervoltage monitoring

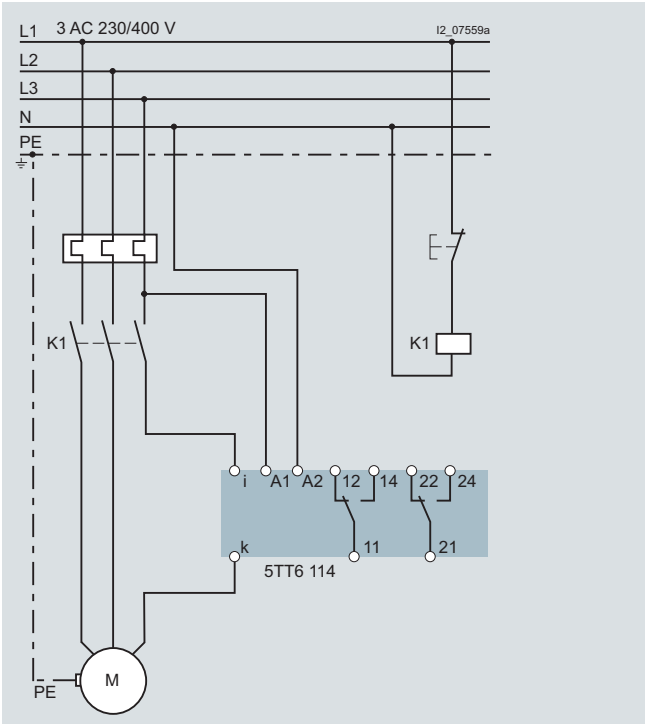


Switching example for 5TT6 114 overvoltage monitoring Measurement with transformer

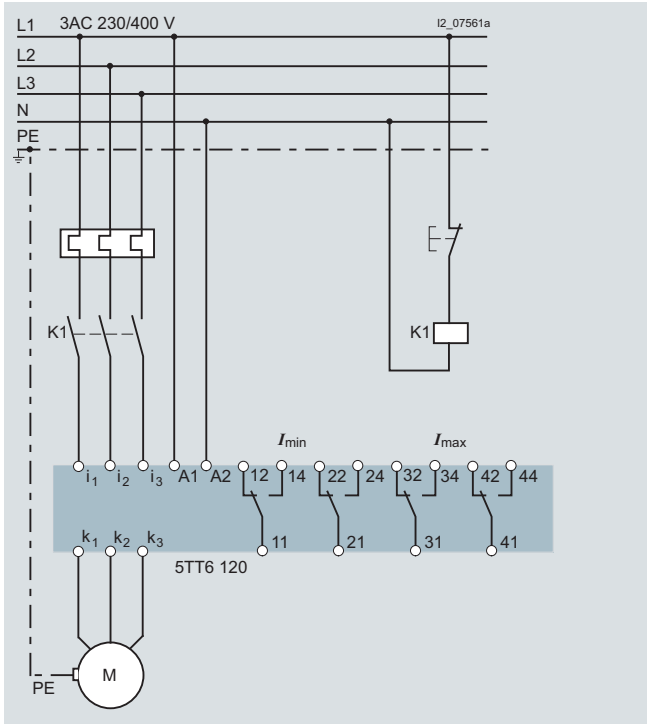


Current relays, 5TT6

Switching example for 5TT6 114 with direct measurement up to 15 A for overcurrent measurement



Switching example for 5TT6 120 with direct measurement up to 5 A for under/overcurrent measurement



More information

Direct measurement, transformer measurement

All current relays can be connected with direct measurement or through transformers.

N potential

Versions 5TT6 113 to 5TT6 120 can be connected with a separate N potential.

Response time

Current relays are not circuit-protective devices for lines. They switch with a delay in the ms range.

Overload capability

Independent of the set measuring range and set measured value, current relays can be permanently overloaded up to 15 A and 20 A; for 3 s; even up to 20 A and 30 A.

Device overview		5TT6 111	5TT6 112	5TT6 113	5TT6 114	5TT6 115	5TT6 120
Undercurrent		✓	--	✓	--	✓	✓
Overcurrent		--	✓	--	✓	✓	✓
Single-phase		✓	✓	✓	✓	✓	--
Three-phase		--	--	--	--	--	✓
Separate N potential		--	--	✓	✓	✓	✓
Measuring ranges:	**Jumper:**						
0.1 ... 1 A	Z1 – Z2	--	--	✓	✓	✓	--
0.5 ... 5 A	Z1 – Z3	--	--	✓	✓	✓	✓
1 ... 10 A	Z1 – Z4	✓	✓	✓	✓	✓	--
1.5 ... 15 A	Z1 – Z3 – Z4	--	--	✓	✓	✓	--
Can be programmed over jumpers		--	--	✓	✓	✓	--
Contacts	1 CO	✓	✓	--	--	--	--
	2 CO	--	--	✓	✓	✓	✓

Buildings/object-safe guiding lights

In the approach corridors of planes, high buildings must be fitted with position lighting. The same planning instructions apply to the monitoring of this type of lighting and runway lighting as the monitoring of emergency lighting.

Monitoring of emergency lighting with incandescent lamps

The function of emergency lighting according to DIN VDE 0108 must be checked at regular intervals. The operational current is continuously monitored using current relays. The lighting can either be integrated in the general lighting system or just supplied on demand with emergency current.

The current relay is set so that it switches on at the max. lamp current. If an incandescent lamp fails, a fault is signaled.

Monitoring of motors

If the warning is sent early enough, the fault can be eliminated before the motor starts to overheat and the circuit breaker switches the motor off.

Current relays reliably safeguard the monitoring of fault-free running motors and, in some cases are more suitable than a voltage relay, which is geared more towards motor protection.

Example: Screw conveyors

Hard objects in screw conveyors, e.g. in sewage treatment plants, can often jam the conveyor system. Appropriately set, the current relay signals over its contact(s) that a hazardous situation has occurred and threatens to block the motor.

Example: Stirrer

As with the conveyor processes, changes to the viscosity can lead to an overload of the motors.

Example: crane motor control system

The current monitoring of the main motor (hoisting motor) ensures that the electrical holding brake is not released until the main motor is in operation and the load is held.

Example: dust extraction

In the interests of work safety and to protect against massive dust development, it is essential to ensure that the dust extraction system is working perfectly before a saw or sanding machine is switched on.

Planning the monitoring of an incandescent lamp

Current relays have a hysteresis of approx. 4 %. The smallest lamp must not exceed the set measuring range by more than 8 %.

Example: 12 lamps à 100 W = 1200 W, which corresponds to a current of approx. 5.2 A. If a lamp fails, the current drops by 0.4 A. This 0.4 A corresponds to 8 % of the set measured value 5.2 A.

Response time

The response time of the fault signal is produced by the "Adjustable switching delay" (see the technical specifications) and an additional delay, which is determined from the actual current and the set value.

F	Pickup ms	Dropout ms
1	10	250
2	70	70
5	120	30
10	180	15
20	220	10
30	240	12

$$F = \frac{I_{act}}{I_{meas}}$$

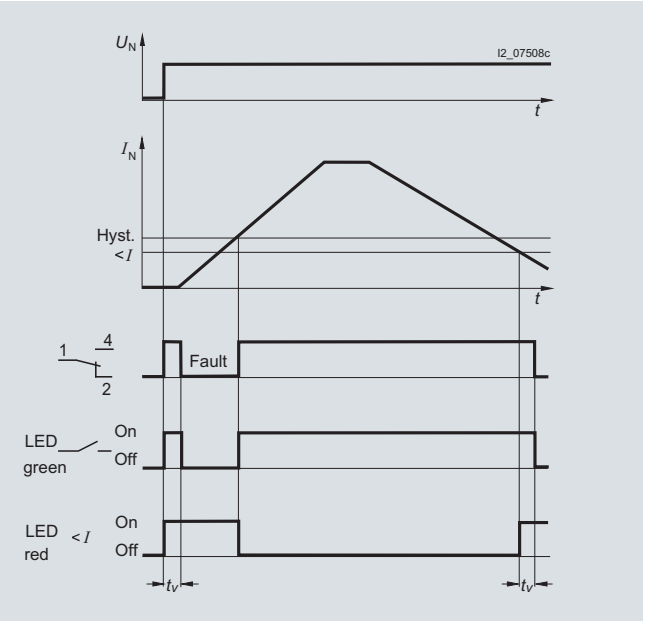
I_{act}: Actual current

I_{meas}: Set current threshold value to be measured

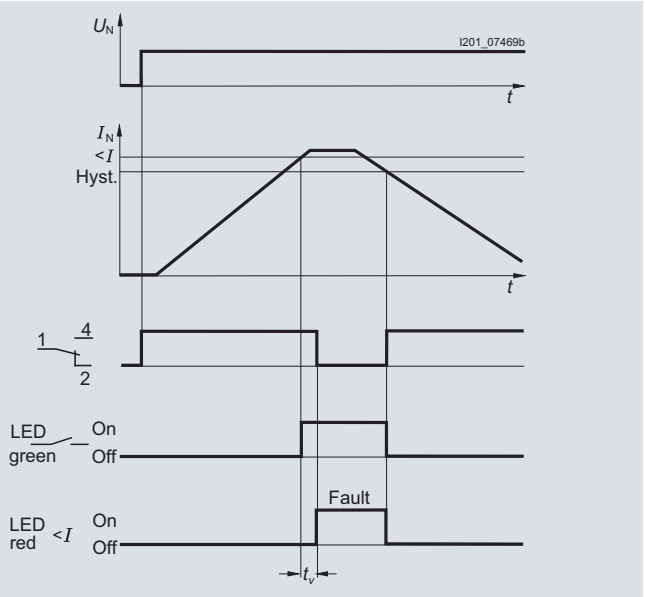
Pick-up: With an overcurrent relay, the contact 11 – 14 (21 – 24) to the fault signal closes when the actual current flowing is higher than the switching threshold. The relay picks up.

Drop-out: With an undercurrent relay, the contact 11 – 12 (21 – 22) to the fault signal closes when the actual current flowing is lower than the switching threshold. The relay drops out.

Function chart for 5TT6 1 undercurrent relay signal

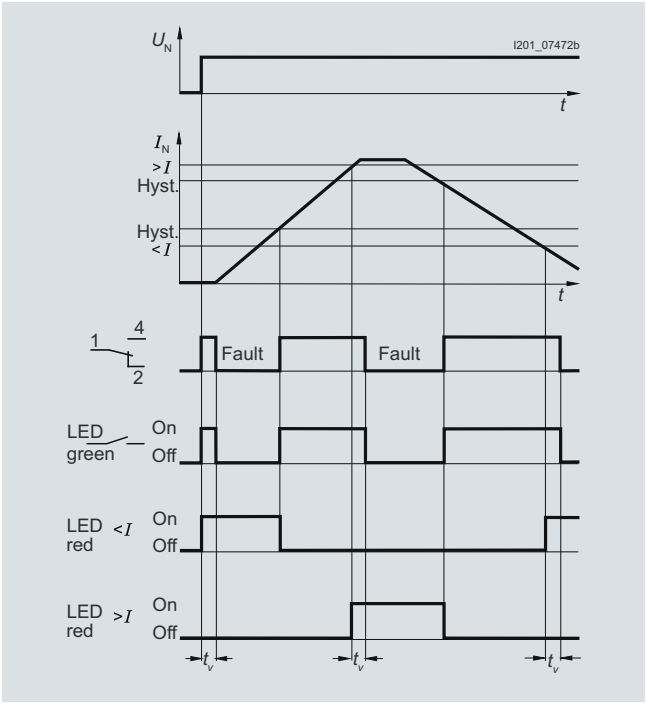


5TT6 1 overcurrent relay signal



Current relays, 5TT6

Function charts for 5TT6 115 under/overcurrent relay signal



Contrary to all other current relays, a fault signal is always output over the contact 11 – 14 (21 – 24). The red LEDs indicate whether the signal is for an undercurrent or an overcurrent.

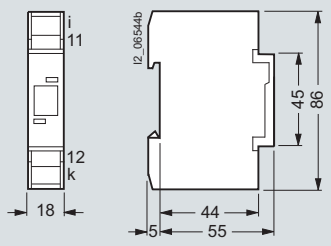
Overview

In the mixed operation of electric hot water and electric storage heaters, the priority switch interrupts the charging procedure of the storage heater if hot water is required during the low-tariff time, thus limiting the connected load in compliance with BTO § 6. The control circuit terminals must be sealable.

Technical specifications

				5TT6 101	5TT6 102	5TT6 103
Standards				EN 60669 (VDE 0632), BTO § 6 Section 4		
Rated control current I_c			A	40 (Current corresponds to the rated operational power of the continuous-flow heater).	54	6 ... 40
Rated frequency			Hz	50		
Response currents			A	13 (Continuous rise not permissible)	23	6
Rating For continuous-flow heaters	Up to Up to 3 ×	230 V AC 230 V AC	kW kW	9 27	12 36	1.5 ... 9 4.5 ... 27
Rated impulse withstand voltage U_{imp}			kV	> 2.5		
Rated operational voltage U_e			V AC	250		
Rated operational current I_e	At U_e=	230 V AC	A	1		
Terminals	±screw (Pozidriv)			1		
Conductor cross-sections • Coil	For conductor cross-sections up to		mm²	10		
• Contacts	For conductor cross-sections up to		mm²	2 × 2.5		
Permissible ambient temperature			°C	-20 ... +40		
Resistance to climate	Acc. to DIN 50016			FW 24		

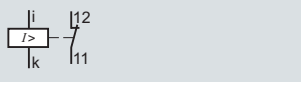
Dimensional drawings



5TT6 101, 5TT6 102, 5TT6 103

Schematics

Diagram



5TT6 101, 5TT6 102, 5TT6 103

Fuse monitors, 5TT3

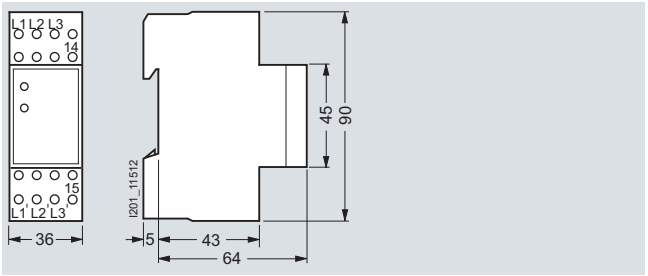
Overview

Fuse monitors serve to monitor all types and versions of melting fuses that cannot be equipped with a fault signal contact. This enables integration in fault signaling circuits or a central alarm in order to improve plant availability.

Technical specifications

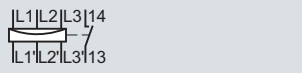
			5TT3 170
Standards			IEC 60255; DIN VDE 0435-110
Rated control voltage U_c		V	3 AC 380 ... 415
Primary operating range		× U_c	0.8 ... 1.1
Rated frequency		Hz	50 ... 400
Internal resistance of measuring paths		Ω/V	> 1000
Max. permissible rear feed		%	90
Response/release time		ms	< 50
Rated impulse withstand voltage U_{imp} Input/output		kV	> 4
Rated operational voltage U_e		V AC	250
Rated operational current I_e	AC -1	A	4
Electrical service life	AC -11	in switching cycles at 1 A	1.5×10^5
Terminals	±screw (Pozidriv)		1
Conductor cross-sections	Rigid, max. Flexible, with end sleeve, min.	mm^2 mm^2	2 × 2.5 1 × 0.5
Permissible ambient temperature		°C	-20 ... +45
Resistance to climate	According to EN 60068-1		20/45/4

Dimensional drawings



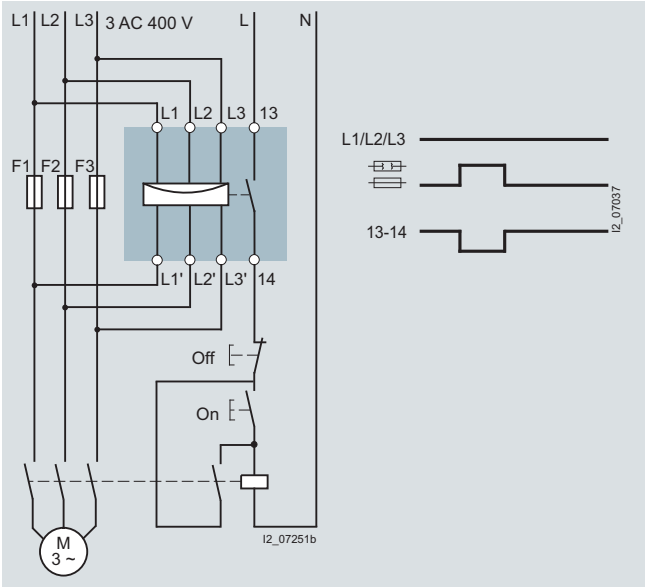
Schematics

Diagram



More information

Switching example, function chart



If the fuse fails, the motor is immediately disconnected (prevention of two-phase run). After changing the fuse, the motor can be restarted by pressing the "ON" button.
Unlike conventional motor circuit breakers, it is not possible to switch the motor on, if the fuse is faulty.

Note:
The internal resistance of the measuring paths of the fuse monitor is in the MΩ range so that the VDE regulations with regard to touch voltage are met in the event of faulty fuses (> 1000 Ω/V). To isolate the main switch, it must be switched off. The enclosed label should be affixed to the switchgear as a reminder.

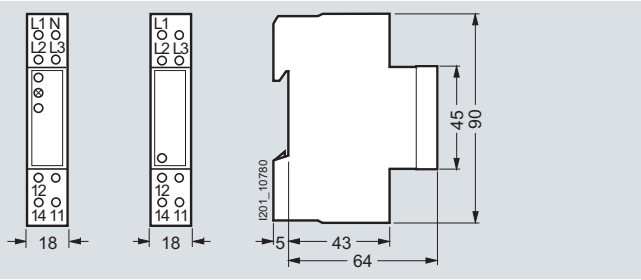
Overview

Phase monitors monitor the voltages in three-phase system and signal the power failure of one or more phases over a floating contact. Phase sequence monitors monitor the phase sequence in three-phase systems and signal any changes in the phase sequence – change of rotating field – over a floating changeover contact.

Technical specifications

			5TT3 421	5TT3 423
Standards			IEC 60255; DIN VDE 0435	
Rated control voltage U_c		V AC	230/400	400
Primary operating range		$\times U_c$	0.8 ... 1.1	
Rated frequency		Hz	50/60	
Rated power dissipation P_v	Electronics Contacts	VA VA	9 0.2	
Rated operational voltage U_e		V AC	250	
Rated operational current I_e		A	4	
Minimum contact load		V; mA	10; 100	
Rated insulation voltage U_i	Between coil/contact	kV	4	
Contacts	μ contact (AC-11)	A	3	
Electrical isolation	Creepage distances and clearances Actuator/contact	 mm	 4	
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 2.5	
Terminals	±screw (Pozidriv)		1	
Conductor cross-sections	Rigid, max. Flexible, with end sleeve, min.	mm^2 mm^2	2 × 2.5 –	
Degree of protection	Acc. to EN 60529		IP20, with connected conductors	
Safety class	Acc. to EN 61140/VDE 0140-1		II	
Permissible ambient temperature		°C	-20 ... +60	
Resistance to climate	Acc. to EN 60068-1		20/60/4	

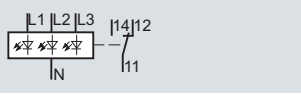
Dimensional drawings



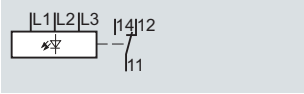
5TT3 421 5TT3 423

Schematics

Diagrams



5TT3 421



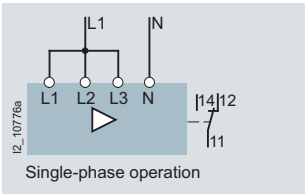
5TT3 423

More information

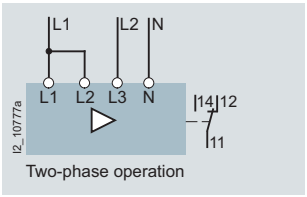
Switching examples

5TT3 421 phase monitors

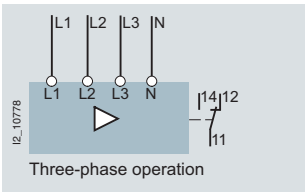
The phase monitor can be operated either in 1, 2 or 3-phase operation.



Single-phase operation



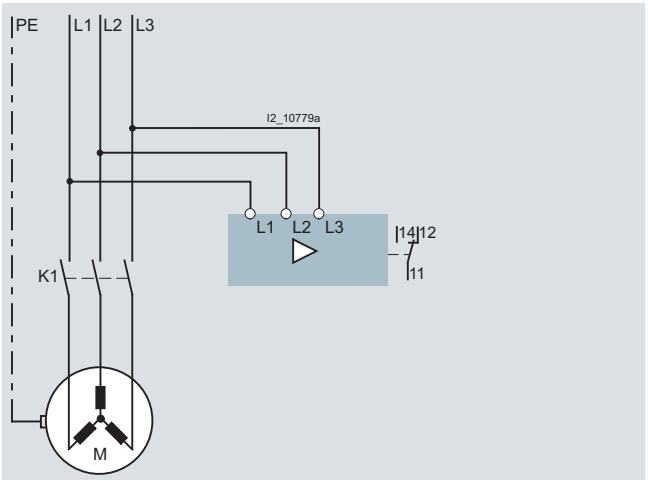
Two-phase operation



Three-phase operation

5TT3 423 phase sequence monitors

Phase sequence monitors must always be connected in three-phase.



Overview

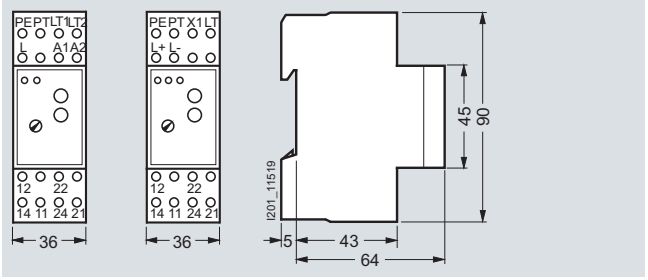
Insulation monitors are used for protection of persons and against fire in non-grounded systems (IT systems). The insulation resistance of the system being monitored is measured against ground.

These types of measurements are specified according to DIN/VDE 0100-410 – Erection of power installations up to 1000 V – Protection against electric shock.

Technical specifications

			5TT3 470	5TT3 471
Power supply U_c		V AC V DC	220 ... 240 --	-- --
Primary operating range	With AC supply For DC supply	$\times U_c$ V DC	0.8 ... 1.1 --	-- --
Frequency range for U_c		Hz	45 ... 400	--
Rated power dissipation P_v	 For DC supply	VA W	Approx. 2 --	-- Approx. 1
Rated impulse withstand voltage U_{imp}	Terminals A1 to A2 Terminals L to PU Terminals A1, A2 to L, PU Terminals against contacts	kV kV kV kV	< 4 < 4 < 4 < 6	< 4 < 4 < 3 < 6
Measuring circuit			For direct voltage and alternating voltage systems	For direct voltage systems
Measurement voltage range U_{meas}		V AC V DC	0 ... 500 --	-- 12 ... 280
Primary operating range		$\times U_{meas}$	0 ... 1.1	0.9 ... 1.1
Frequency range for U_{meas}		Hz	10 ... 1000	--
Alarm values	Measuring shunt R_{AL}	kΩ	5 ... 100	5 ... 200
Setting of alarm value	On absolute scale		Infinitely variable	Infinitely variable
Alternating current internal resistance	Internal testing resistor	kΩ	> 250	--
Direct current internal resistance	Internal testing resistor L+ and L- to PU	kΩ kΩ	> 250 --	-- 75 each
Measurement voltage U_{meas}	Internal	V DC	Approx. 15	--
Max. measurement current I_{meas}	Short circuit	mA	< 0.1	0.2 ... 4 depending on the voltage
Direct interference voltage	Max. permissible	V DC	500	--
Response delay	At R_{AL} 50 kΩ and 1 µF and ∞ up to 0.9 x R_{meas} and R_{meas} from ∞ to 0 Ω	 s s	 < 1.3 < 0.7	 0.8 0.4
Switching hysteresis	At R_{meas} 50 kΩ	%	15	10 ... 15
Contacts	µ contact		2 CO	2 CO
Rated operational voltage U_e		V AC	230	230
Rated operational current I_s	Thermal current limit I_{th} DC-13 at 24 V DC DC-13 at 250 V DC AC-15 AC-15 NO contacts AC-15 NC contacts	A A A A A A	4 -- -- -- 5 2	4 2 0.2 3 -- --
Terminals	±screw (Pozidriv)		2	2
Conductor cross-sections	Rigid, max. Flexible, with end sleeve, min.	mm^2 mm^2	2 × 2.5 1 × 0.50	
Permissible ambient temperature		°C	-20 ... +60	
Degree of protection	Terminals (acc. to EN 60529) Enclosure (acc. to EN 60529)		IP20 IP40	
Resistance to climate	Acc. to EN 60068-1		20/060/04	

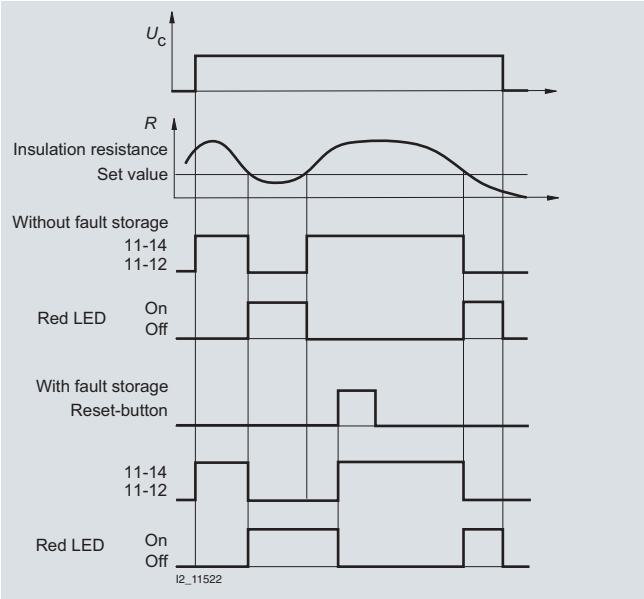
Dimensional drawings



5TT3 470 5TT3 471

More information

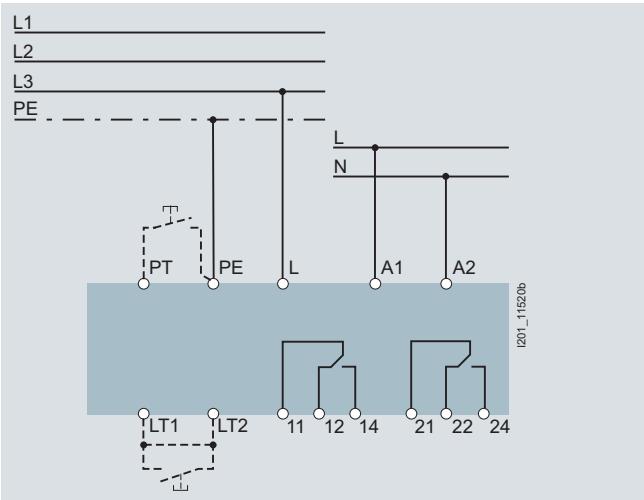
Function charts



5TT3 470, 5TT3 471

Switching examples

5TT3 470 for direct voltage and alternating voltage systems

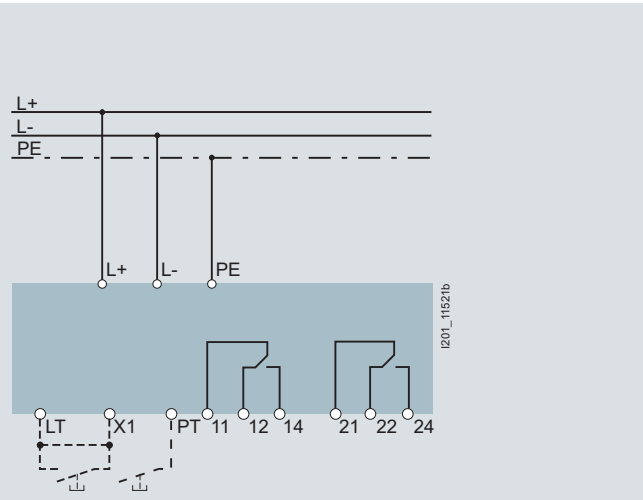


The power supply to terminals A1 – A2 can be taken from the system being monitored. However, in this case it is important to ensure compliance of the voltage range with the technical specifications.

With a jumper LT1 – LT2: a fault signal is not stored; the device is automatically released again if the insulation resistance improves.
Without a jumper LT1 – LT2: The error message is stored; pressing the Reset button or an external key at the terminals
LT1 - LT2 clears the fault signal.

Pressing the Test button or an external key at the terminals PT – PE simulates a fault.

5TT3 471 for direct voltage systems

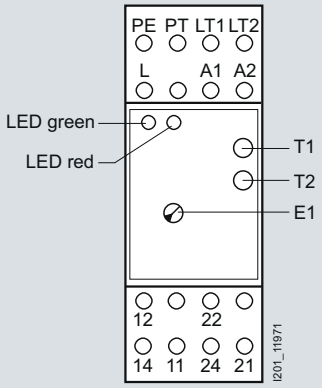


The measurement voltage to the terminals L+ and L- serves at the same time as the power supply.

With a jumper LT – X1: a fault signal is not stored; the device is automatically released again if the insulation resistance improves.
Without a jumper LT – X1: the error message is stored; pressing the Reset button or an external key at the terminals LT - X1 clears the fault signal.

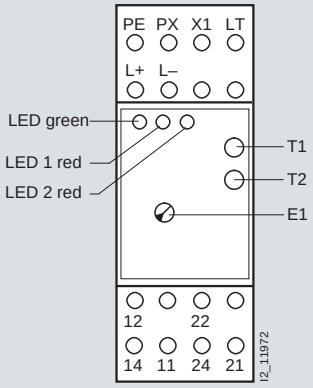
Pressing the Test button or an external key at the terminals PT – X1 simulates a fault.

Front views



LED green: status display (ON)
LED red: insulation fault (AL)
E1: alarm value adjuster (RAL)
T1: Test
T2: Reset

5TT3 470



LED green: status display (ON)
LED 1 red: insulation fault L– (RE–)
LED 2 red: insulation fault L+ (RE+)
E1: alarm value adjuster (RAL)
T1: Test
T2: Reset

5TT3 471

5TT3 470 for direct voltage and alternating voltage systems

Direct interference voltage

While direct interference voltages do not damage the devices they often interfere with conditions in the measuring circuit. In a system being monitored, only one insulation monitor should be connected. This must be taken into account if gateways are used.

System capacitances against protective ground C_E do not corrupt the insulation measurement as these are implemented with direct current. However, the response time may be extended in the event of an insulation fault, namely in the magnitude of the time constant R_E times C_E.
The power supply to the insulation monitors can be taken from a separate system or from the one being monitored. However, the above mentioned power supply range must be taken into account.

LEDs:
- Green LED lights up if power supply U_c is applied
- Red LED lights up in the event of an insulation fault.

5TT3 471 for direct voltage systems

Leakage capacitance

The line insulation monitor can be installed in systems with higher leakage capacitance against PE. In the case of high-resistance alarm values, a transient alarm signal may occur when switching on the system being monitored due to an existing ground leakage capacitance.
The values of the C_E capacitance given the following set values of R are approximately:
- R = 200 kΩ: C_E > 0.8 µF
- R = 50 kΩ: C_E > 2.0 µF
- R = 20 kΩ: C_E > 4.5 µF

In these applications, you should work without an alarm storage. Due to the measuring function with bridge circuit, the insulation monitor does not respond in the event of a simultaneous, exactly symmetric ground fault of L+ and L-. However, exactly symmetric ground faults are highly unlikely in practice.
LEDs:
- Green LED lights up if power supply U_c is applied
- Red LED 1 lights up for insulation fault L+ against PE
- Red LED 2 lights up for insulation fault L- against PE.

Insulation monitors for medical premises, 7LQ

Overview

In areas that conform to Group 2 of DIN VDE 0100-710, any interruption to the examination and/or treatment of patients would place those patients at risk.

Limit value monitoring

This is prevented through the use of changeover and monitoring units. These monitor the insulation resistance of the non-grounded IT system, the load current and the temperature of the transformer. If the limit value is exceeded, the insulation monitor gives out a warning signal.

Voltage monitoring

In addition, a special voltage relay monitors the voltage of the power supply and switches to a second power supply if it falls below the specified limit values.

Technical specifications

			Switchover device 7LQ3 361	7LQ3 362
Standards			IEC 60364-7-710; DIN VDE 0100-710	
Power supply U_v		V AC	230	230/400
Primary operating range		× U_v	0.9 … 1.1	
Supply frequency f_v		Hz	50 … 60	
Insulation coordination			IEC 60664-1	
Rated impulse withstand voltage		kV	4	
Pollution degree			3	
Power loss max. P_v		W	10.7	
Power section				
Contactors			Mechanically latched; mechanically and electrically locked	
Rated operational current acc. to DIN VDE 0100-710		A	51	32
Rated operational current AC-3		A	113	71
Short-circuit protection acc. to DIN VDE 0100-710:				
• Max. backup protection	gG	A	63	
Switchover time		s	0.1 ... 10	
Measuring circuit insulation monitoring				
Response value R_{resp}		kΩ	50	
Response deviation			DIN VDE 61557-8	
Response time t_{on} at R_{on} = 50 kΩ, C_e = 1 µF	R_F from ∞ to 0.5 × R_{to} R_F from ∞ to 0 kΩ	s s	< 1.3 < 0.7	
Hysteresis		%	15	
Measurement voltage U_m		V DC	Approx. 15	
Measurement current $I_{m\ max}$ (at R_F = 0 Ω)		µA	< 50	
Internal resistance DC R_i		kΩ	> 250	
Impedance Z_i at 50 Hz		kΩ	> 250	
Permissible direct interference voltage U_{fg}		V DC	< 300	
Test button			External/internal	
Measuring circuit load current monitoring				
Response value, adjustable with external transformer 50/5 A, Class 1		A	5 … 50	
Hysteresis		%	4	
Temperature influence		%/°C	≤ 0.05	
Time delay t_v, adjustable		s	0.1 … 20	
Measuring circuit temperature monitoring				
Response value		kΩ	3.2 … 3.8	
Release value		kΩ	1.5 … 1.8	
PTC thermistor	Acc. to DIN 44081/44082	Unit(s)	1 … 6 in series	
Measuring circuit, voltage monitoring				
Response values	ON-switching OFF-switching	 × U_c	2 % hysteresis 0.9	4 % hysteresis 0.9
Phase failure detection	At L1, L2 or L3	ms	--	100
N-conductor monitoring			--	Yes

			Switchover device 7LQ3 361	7LQ3 362
Connection				
Terminals				
• Load circuit	Feeder terminals Output terminals	mm^2	4 ... 16	
• Communication	Status signals Fault indications	mm^2	2.5	
Environmental conditions				
Permissible ambient temperature		°C	-20 ... 45	
Mounting position			Vertical	

			Insulation monitors 7LQ3 354	7LQ3 355
Standards			EN 61557-8	
Power supply U_v		V AC	230	
Primary operating range		× U_v	0.9 … 1.1	
Supply frequency f_v		Hz	50 … 60	
Power loss max. P_v		VA	Approx. 7	
Rated system voltage U_n (measuring circuit)		V AC	0 … 300	
Rated frequency f_n		Hz	10 … 1000	
EMC immunity to interference			IEC 61000-6-2	
EMC emitted interference			IEC 61000-6-3	
Insulation coordination			IEC 60664-1	
Rated impulse withstand voltage		kV	4	
Pollution degree			3	
Flammability class			UL 94V-0	
Measuring circuit insulation monitoring				
Response value R_{resp}		kΩ	50	50 ... 500
Response deviation			DIN VDE 61557-8	
Response time t_{on} at R_{on} = 50 kΩ, C_e = 1 µF	R_F from ∞ to 0.5 × R_{on} R_F from ∞ to 0 kΩ	s s	< 1.3 < 0.7	
Hysteresis		%	15	
Measurement voltage U_m		V DC	Approx. 15	
Measurement current $I_{m\ max}$ (at R_F = 0 Ω)		µA	< 50	
Internal resistance DC R_i		kΩ	> 250	
Impedance Z_i at 50 Hz		kΩ	> 250	
Permissible direct interference voltage U_{fg}		V DC	< 300	
Measuring circuit load current monitoring				
Response value, adjustable with external transformer 50/5 A, Class 1		A	5 … 50	
Hysteresis		%	4	
Temperature influence		%/°C	≤ 0.05	
Time delay t_v, adjustable		s	0.1 … 20	
Measuring circuit temperature monitoring				
Response value		kΩ	3.2 … 3.8	
Release value		kΩ	1.5 … 1.8	
PTC thermistor	Acc. to DIN 44081/44082	Unit(s)	1 … 6 in series	
Display and control elements				
Operating error	Acc. to IEC 61557-8			
LED display				
• Current and temperature monitoring			One red and one green LED	
• Ready-to-run			Green	
• Insulation fault			Red	
• Line breakage monitoring of the isolation measuring circuit			Red	
• Display of current insulation resistance			--	11-step LED chain
Pushbuttons			Test and Reset	

Insulation monitors for medical premises, 7LQ

			Insulation monitors 7LQ3 354	7LQ3 355
Output relay				
Contacts for	Overtemperature Overload Insulation fault		2 CO 2 CO 2 CO	
Mode of operation			Working current	
Contacts	AC 15 NO contacts AC 15 NC contacts	A AC/V AC A AC/V AC	3/230 1/230	
Electrical service life	AC15, 1 A, 230 V AC	Switching cycles	30000	
Thermal current		A AC	5	
Connection				
Terminals	±screw (Pozidriv)		2	
• Conductor cross-sections • Insulation fault	Rigid Flexible, with end sleeve	mm^2 mm^2	2 × 2.5 1 × 2.5	
Environmental conditions				
Permissible ambient temperature		°C	-20 … +60	
Resistance to climate	Acc. to EN 60068-1		20/060/04	
Degree of protection	Acc. to EN 60529		IP20, with connected conductors	
Mounting position			Any	
Vibration strain • Amplitude • Frequency	Acc. to IEC 60068-2-6	 mm Hz	 0.35 10 … 55	

			Test and signaling panels 7LQ3 356	7LQ3 357
Standards			DIN VDE 0100-710; IEC60364-7-710	
Rated voltage U_n		V AC/DC	24	
Rated impulse withstand voltage	Acc. to IEC 60664-1	kV	4	
Voltage range		AC DC	0.8 ... 1.1 x U_n 0.9 ... 1.2 x U_n	
Rated current per input		mA	0.25	
Rated consumption		VA	6	
Rated operating mode			Continuous operation	
Pollution degree	Acc. to IEC 60664-1		2	
Degree of protection • Enclosures • Terminals	 Acc. to IEC/EN 60529 Acc. to IEC/EN 60529		 IP40 IP20	
Flammability class			UL 94V-0	
Vibration strain • Amplitude • Frequency	Acc. to IEC/EN 60068-2-6	 mm Hz	 0.35 10 … 55	
Resistance to climate	Acc. to IEC/EN 60068-1		20/045/04	
Terminal marking			EN 50005	
Conductor connections				
• Solid		mm^2 mm^2	1 × 1.5 2 × 0.5	
• Strand		mm^2 mm^2	1 × 1 2 × 0.2	
• Strand with sleeve		mm^2	1 × 0.5	
Conductor mounting			Box terminals with wire protection	
Device dimensions		mm	80 × 160 × 57	82 × 150 × 57
Temperature range		°C	-20 ... +45	

			Current transformer Class 1 7LQ3 358
Standards			IEC/EN 60044-1, VDE 0414
Rated control voltage U_c		V AC	230
Rated frequency		Hz	50/60
Test voltage	50 Hz, 1 min	kV	3
Rated transmission ratio k_n		A	50/5
Primary rated current		A	50
Secondary rated current		A	5
Rated power		V/A	1.5
Class			1
Rated frequency		Hz	50 ... 60
Highest voltage at equipment / insulation level		kV	0.72/3
Overcurrent factor			FS5
• Thermal rated short-time current		$\times I_n$	60
• Thermal rated continuous current		$\times I_n$	1.2
Expanded current range		%	120
Permissible ambient temperature		°C	-20 … +60

			Test and signaling combination for insulation monitors 7LQ3 360
Standards			DIN VDE 0100-710; IEC60364-7-710
Rated voltage U_n		V AC	24
Voltage range		AC	0.8 ... 1.1 $\times U_n$
Connected load		W	0.5
Rated operating mode			Continuous operation
EMC			
• Static discharge	Acc. to IEC/EN 61000-4-2	kV	8 (air discharge)
• RF irradiation	Acc. to IEC/EN 61000-4-3	V/m	10
• Rapid transients	Acc. to IEC/EN 61000-4-4	kV	2
• Surge voltage (surge)	Acc. to IEC/EN 61000-4-5	kV	1
Degree of protection			IP30
Amplitude		mm	0.35
Frequency		Hz	10 ... 55
Temperature range		°C	-5 ... +55
Resistance to climate	Acc. to IEC/EN 60068-1		05/055/04
Terminal marking			EN 50005
Conductor connections			
• Solid		mm^2	1 × 4
• Strand with sleeve and plastic collar		mm^2	1 × 2.5
• Strand with sleeve and plastic collar	DIN 46228-1/-2/-3/-4	mm^2	2 × 1.5
• Strand with sleeve	DIN 46228-1/-2/-3	mm^2	2 × 2.5
Conductor mounting			Box terminals with wire protection
Device dimensions		mm	80 × 80 × 35

Insulation monitors for medical premises, 7LQ

			Voltage relays	
			5TT3 411	**5TT3 412**
Rated control voltage U_c		V AC	230	230/400
Overload capability		× U_c	1.15	1.1
Rated frequency		Hz	50/60	
Response values	ON-switching OFF-switching	 × U_c	2 % hysteresis 0.9	4 % hysteresis 0.9
Minimum contact load		V/mA	10/100	
Phase failure detection	At L1, L2 or L3	ms	--	100
N-conductor monitoring			--	Yes
Rated insulation voltage U_i	Between coil/contact	kV	4	
Contacts	AC 15 NO contacts AC 15 NC contacts		3 2	3 1
Electrical service life in switching cycles	AC15, 1 A, 230 V AC		5×10^5	
Rated impulse withstand voltage	Acc. to IEC 60664-1	kV	4	
Pollution degree			2	
Terminals	±screw (Pozidriv)		2	
Conductor cross-sections • Rigid • Flexible, with end sleeve		 mm^2 mm^2	 2 × 2.5 2 × 1.5	
Permissible ambient temperature		°C	-20 … +60	
Resistance to climate	Acc. to EN 60068-1		20/060/04	

			IT line transformer 4AT3/4AT4	
In the case of isolating transformers used to set up medical IT systems, overcurrent protective devices are only permissible as protection against short circuits. To protect the isolating transformers against overload they are fitted with monitoring devices that signal an excessive rise in temperature (e.g. 7LQ3 354 insulation monitors).				
Standards			EN 61558-2-15	
Safety class			I	
Static shield between primary and secondary winding			With insulated connection	
Thermistor transformer protection			Warning in the event of thermal overload[1)]	
Insulation monitoring			With center tap	
Short-circuit voltage u_z		%	≤ 3	
No-load supply current i_0 • Starting current (rush), max.		% x I_{1N}	≤ 3 8	
Rated ambient temperature t_a /Thermal Class			55 °C/H	

1) Tripping units must be ordered separately.

Accessories

SIRIUS 4AT isolating transformers

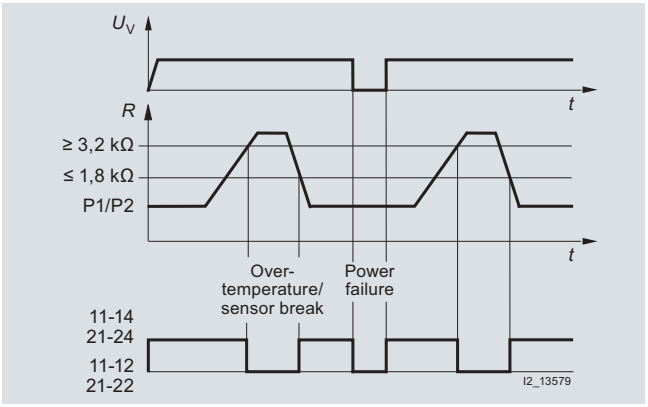
Further information about the isolation transformers SIRIUS 4AT can be found in the catalog IC 10 · 2011.

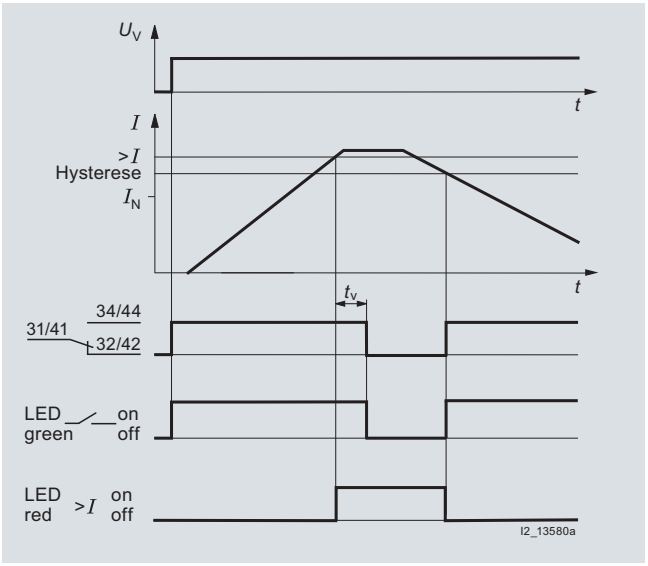
1) Delivery time depends on the number of units ordered, the specified delivery time applies to an order quantity of up to 5 units.

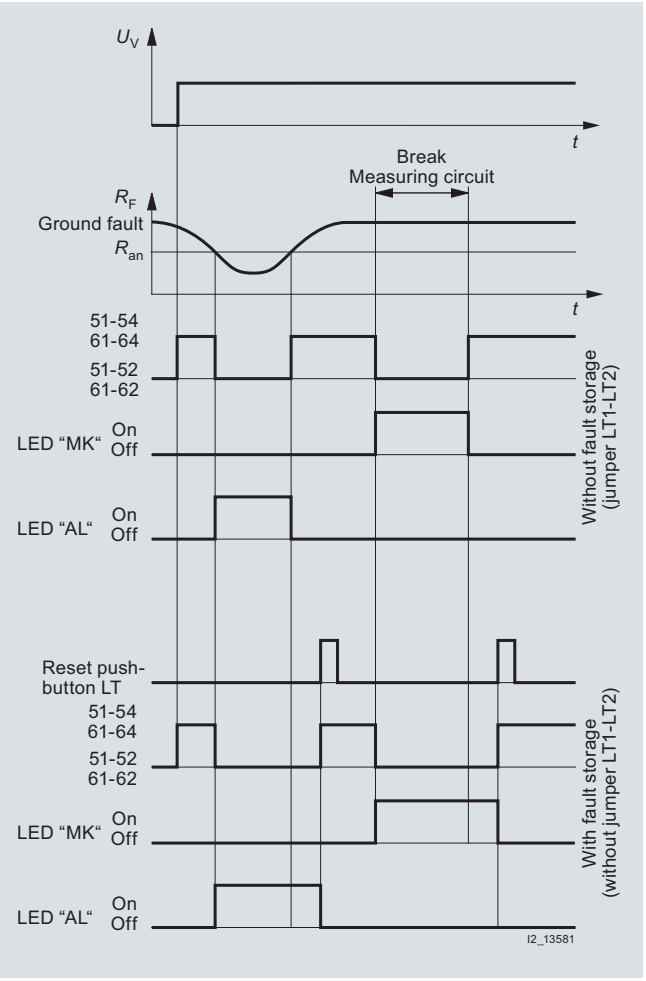
Characteristic curves

7LQ3 354 and 7LQ3 355 insulation monitors

The following diagrams show the function of the measuring circuits of the temperature monitors (top left), the load current monitors (bottom left) and the insulation monitors (right).

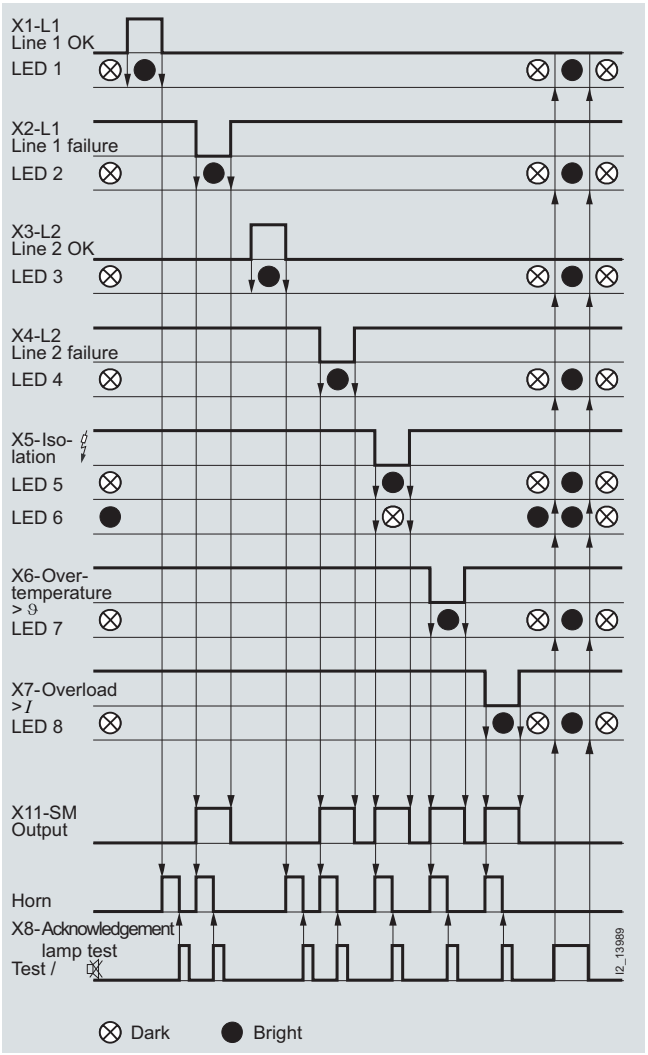






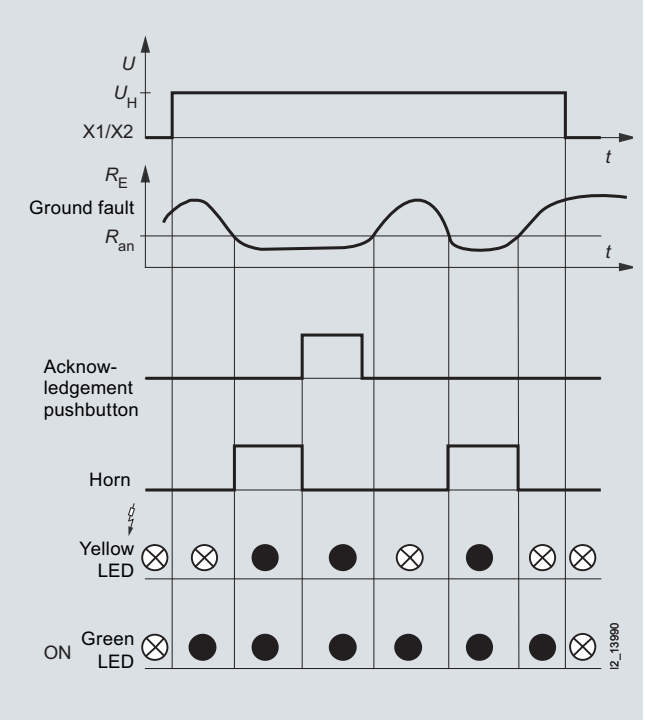
Insulation monitors for medical premises, 7LQ

Test and signaling panels



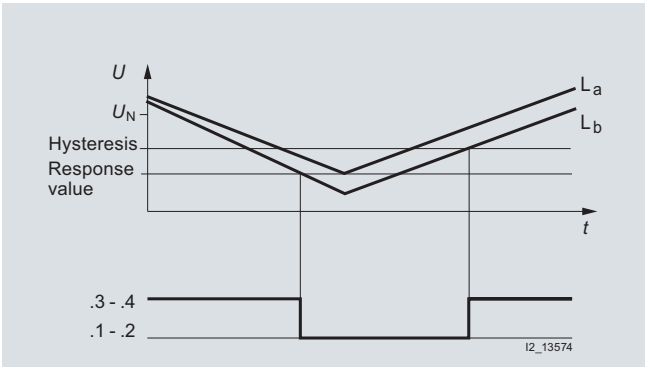
7LQ3 356, 7LQ3 357

Test and signaling combination for insulation monitors

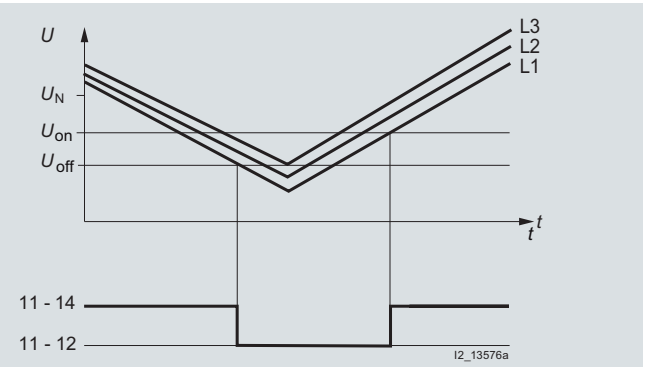


7LQ3 360

Voltage relays



5TT3 411

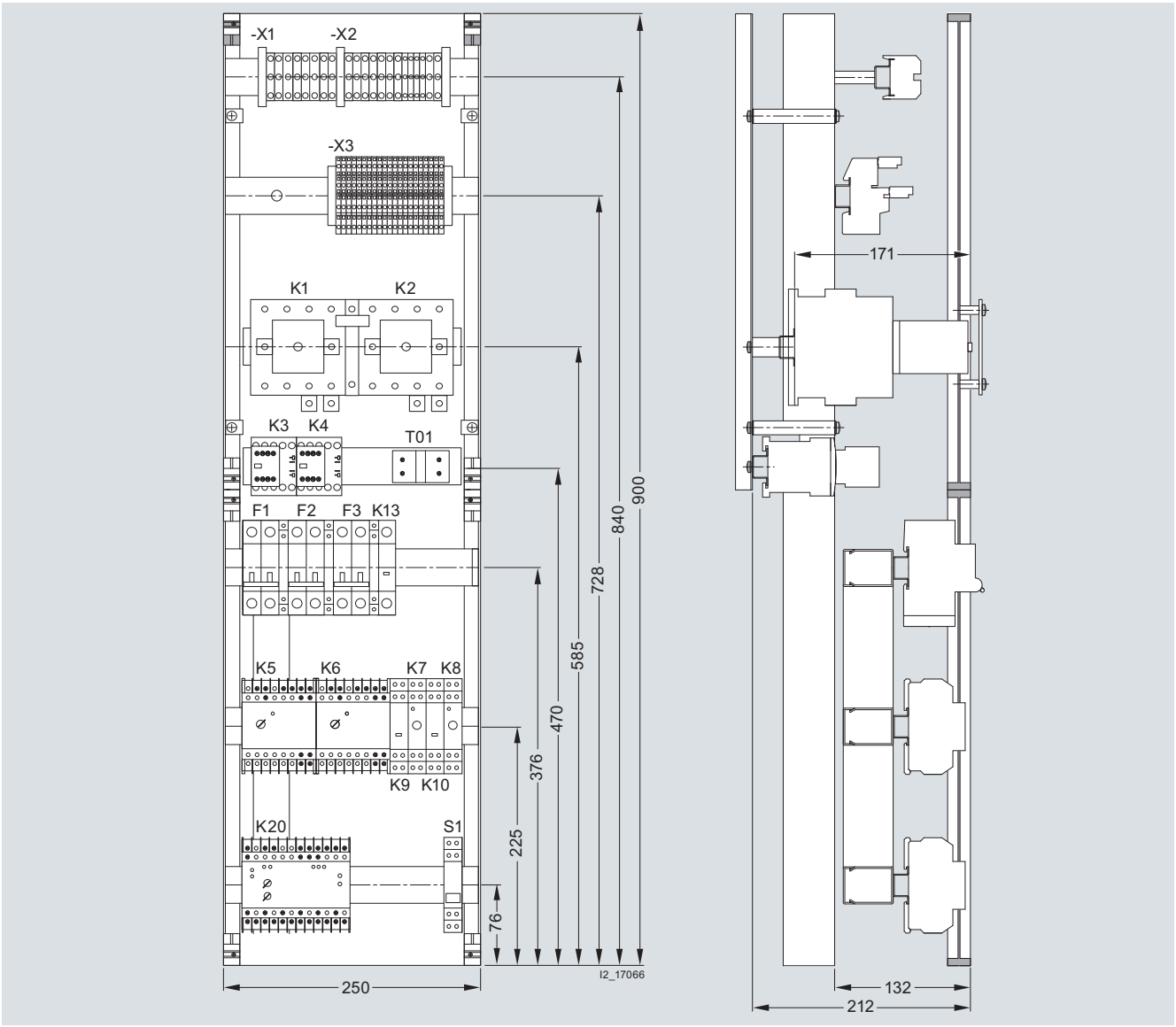


5TT3 412

The voltage relay switches at a phase asymmetry of approx. 6 % to 8 %, regardless of the response values for undervoltage. The above diagram also show the timing interval.

Dimensional drawings

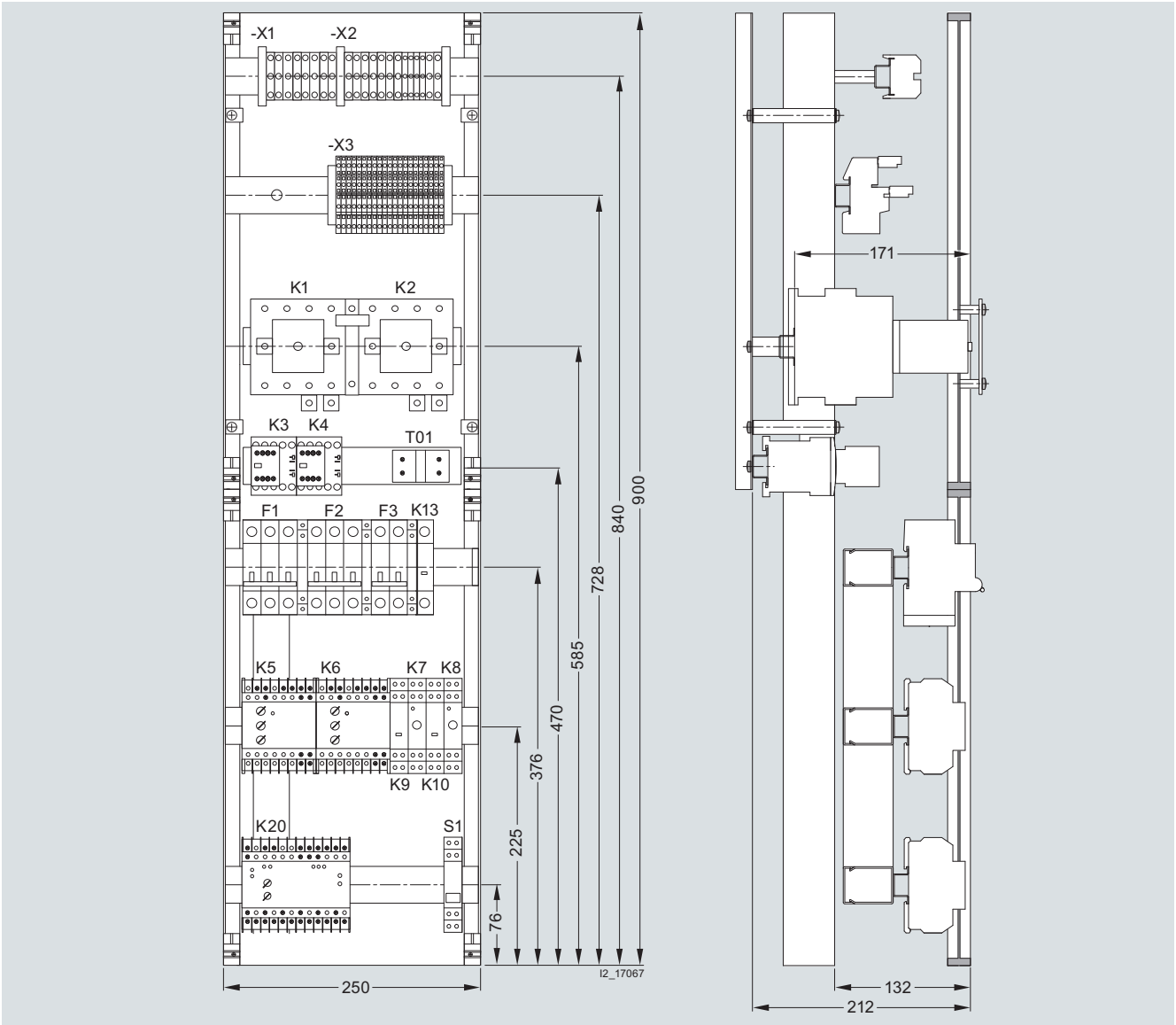
Switchover device



7LQ3 361

The 7LQ3 361 and 7LQ3 362 switchover devices are designed for mounting in series ALPHA 630 DIN floor-mounted distribution boards and ALPHA AS side-by-side switchgear cabinets with a cabinet depth of at least 320 mm.
More information about the distribution boards can be found in Catalog LV 10.2.
Contact your local Siemens representative for information on additional versions.

Insulation monitors for medical premises, 7LQ



7LQ3 362

The 7LQ3 361 and 7LQ3 362 switchover devices are designed for mounting in series ALPHA 630 DIN floor-mounted distribution boards and ALPHA AS side-by-side switchgear cabinets with a cabinet depth of at least 320 mm.
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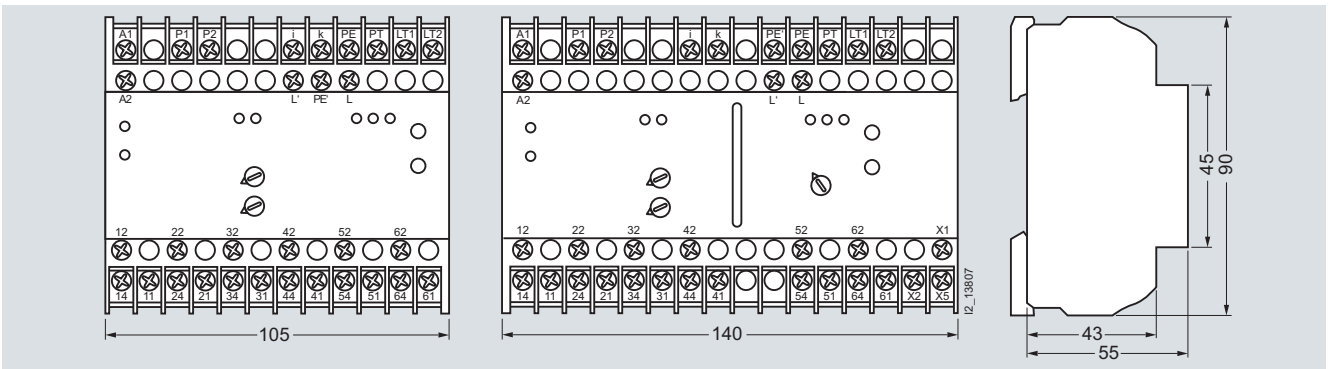
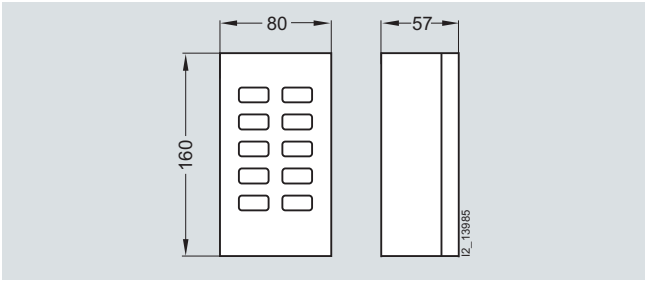
Contact your local Siemens representative for information on additional versions.

Insulation monitors

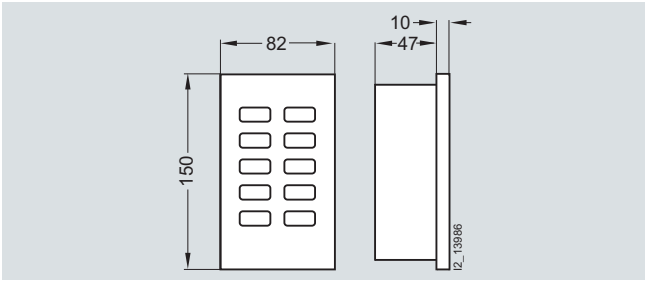


7LQ3 354 7LQ3 355

Test and signaling panels

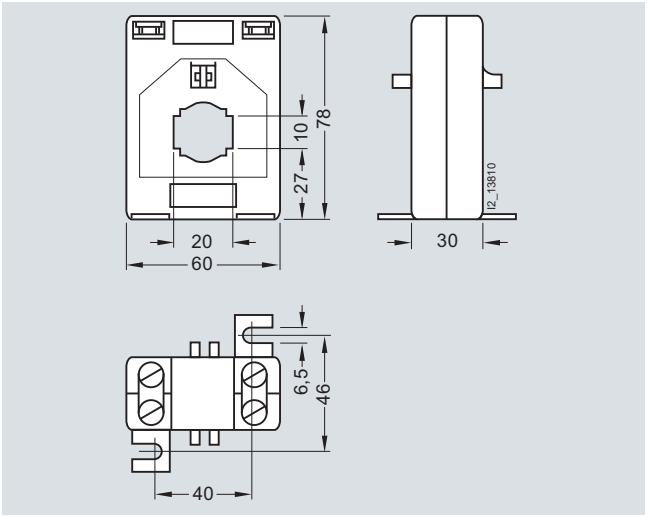


7LQ3 356



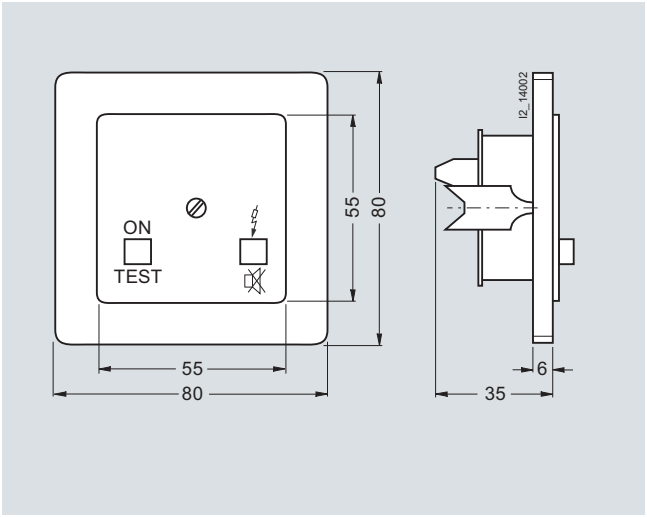
7LQ3 357

Current transformers



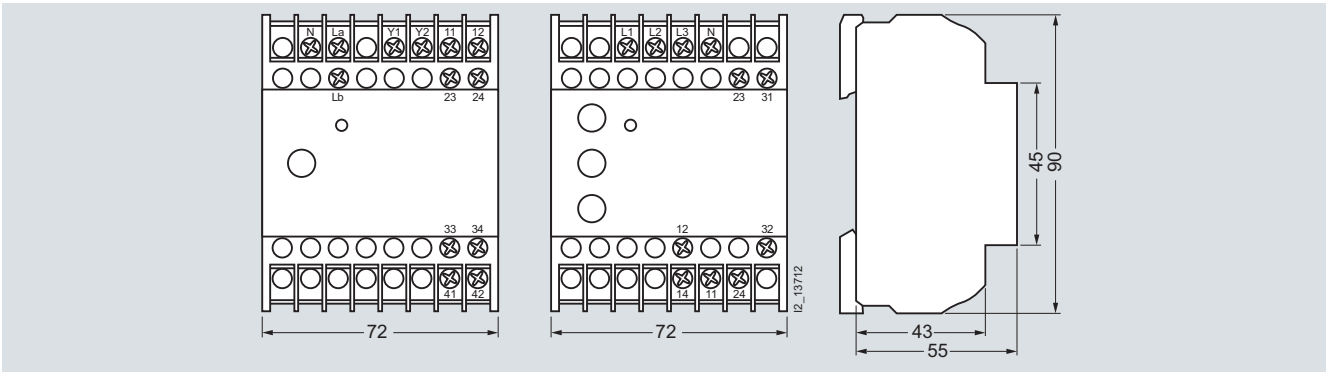
7LQ3 358

Test and signaling combination for insulation monitors



7LQ3 360

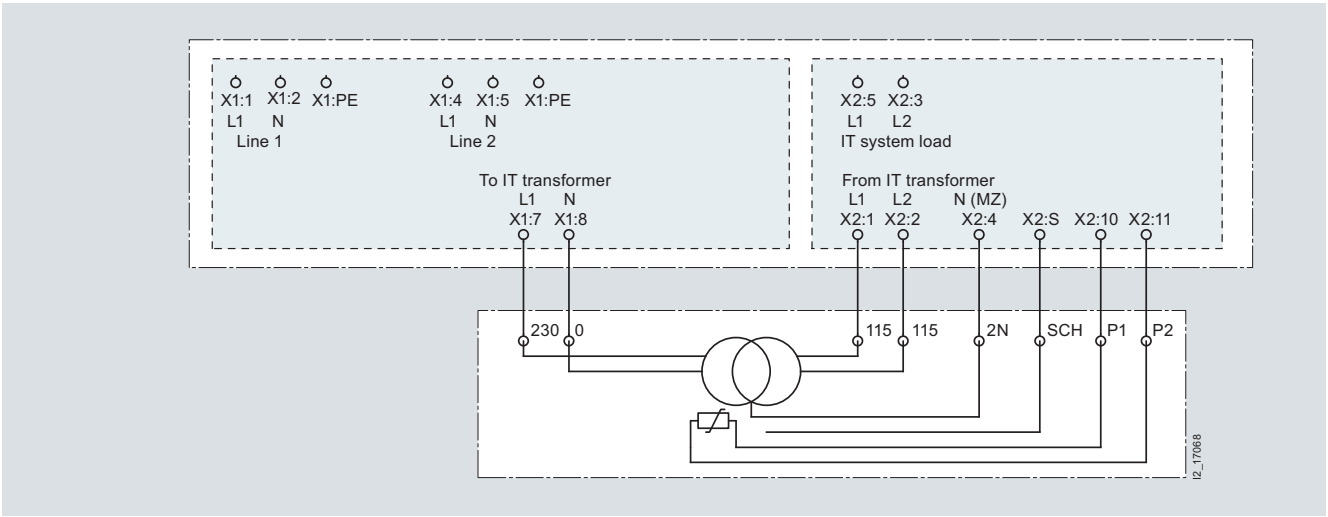
Voltage relays



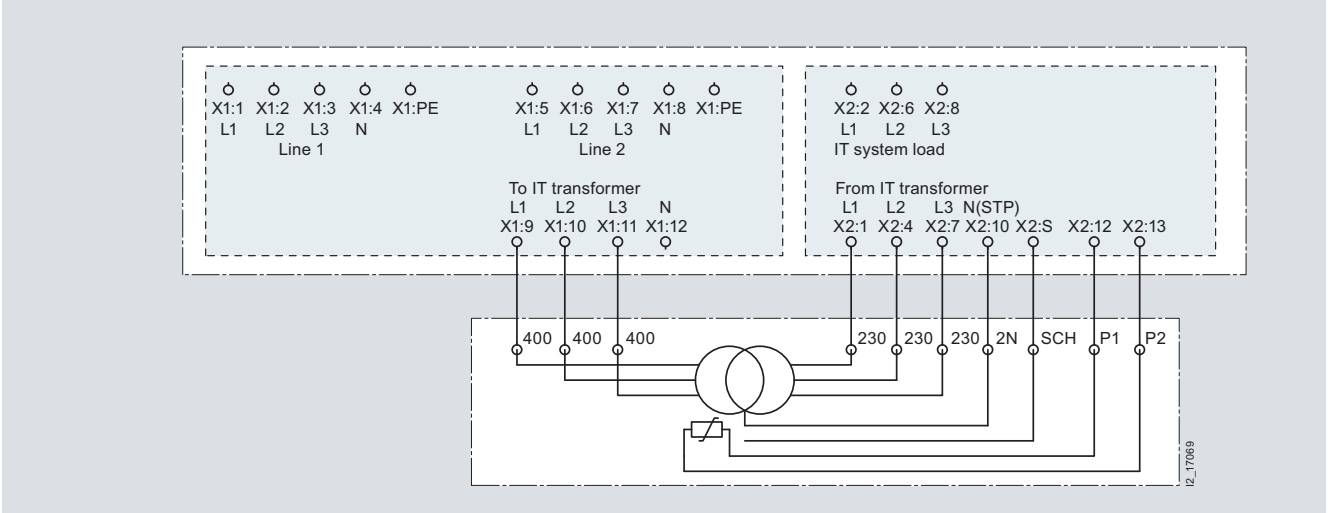
5TT3 411 5TT3 412

Schematics

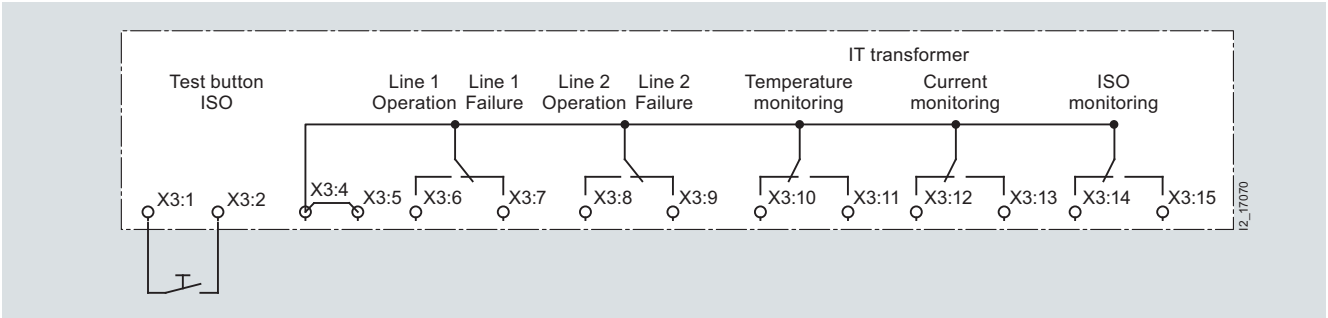
Switchover device



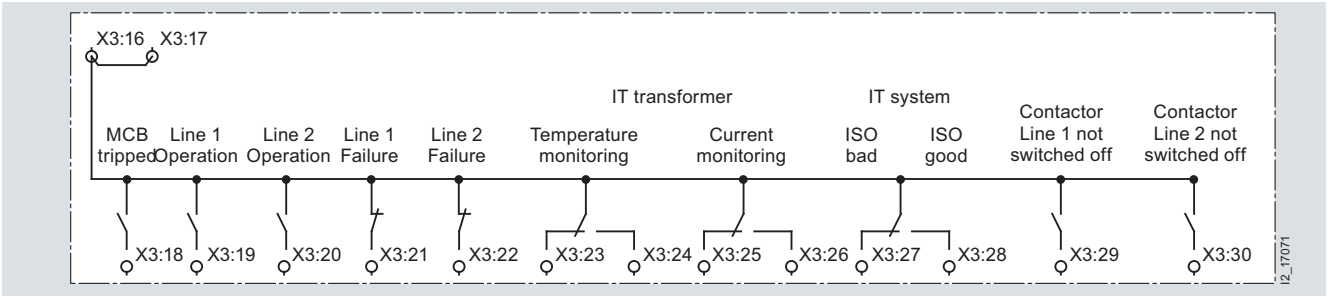
7LQ3 361



7LQ3 362

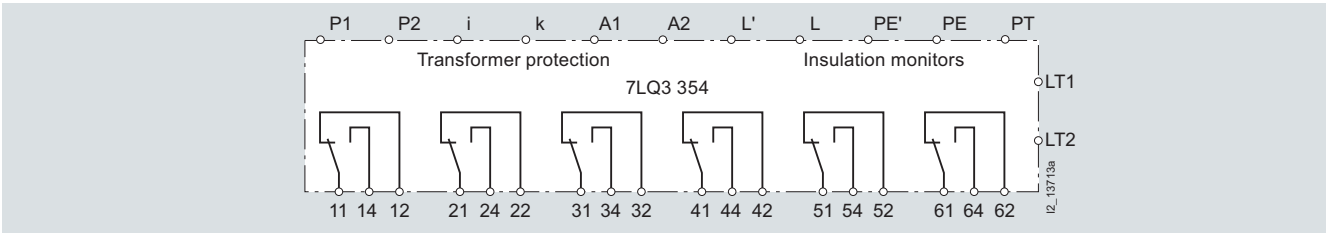


7LQ3 361 and 7LQ3 362 switchover device circuit diagram to test signaling device (e.g. 7LQ3 356 or 7LQ3 357 test and signaling panels)

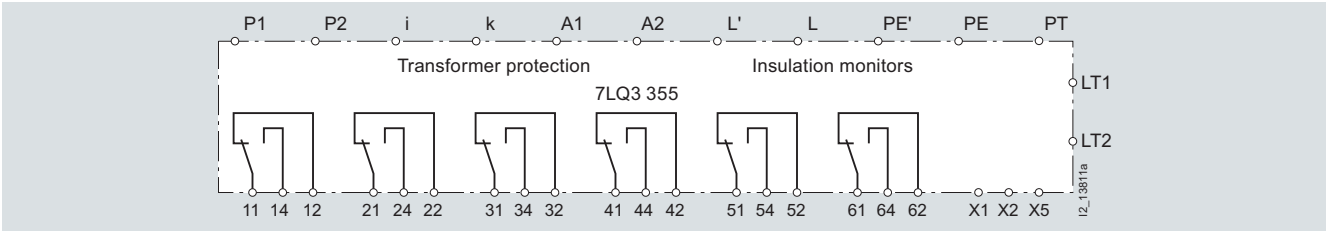


7LQ3 361 and 7LQ3 362 circuit diagram switchover device to the central building control system devices

Insulation monitors

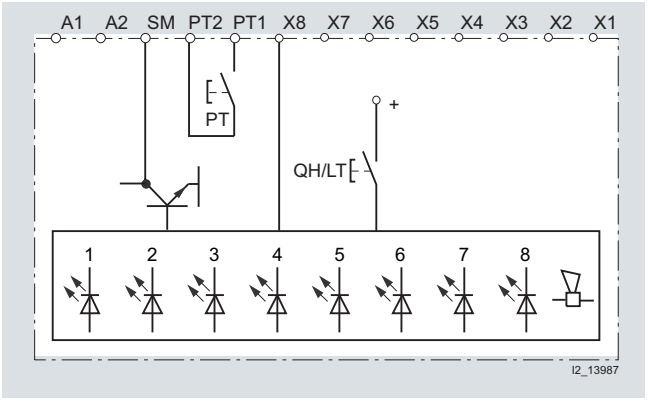


7LQ3 354



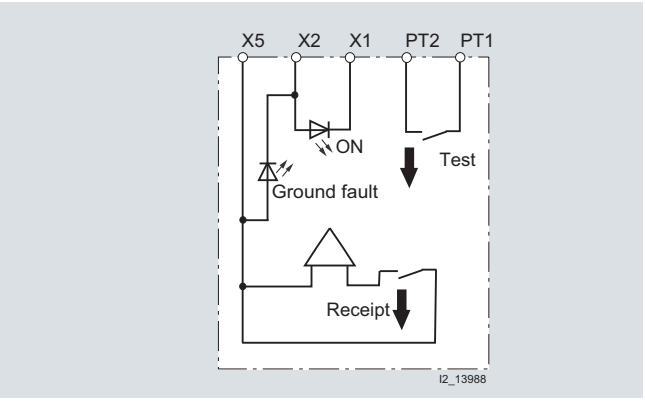
7LQ3 355

Test and signaling panels



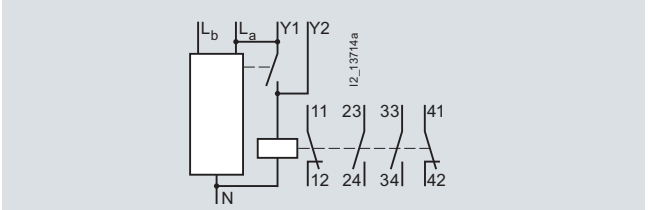
7LQ3 356, 7LQ3 357

Test and signaling combination for insulation monitors

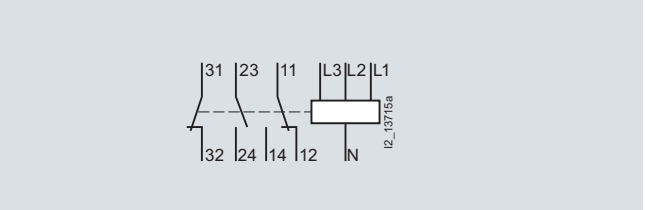


7LQ3 360

Voltage relays



5TT3 411



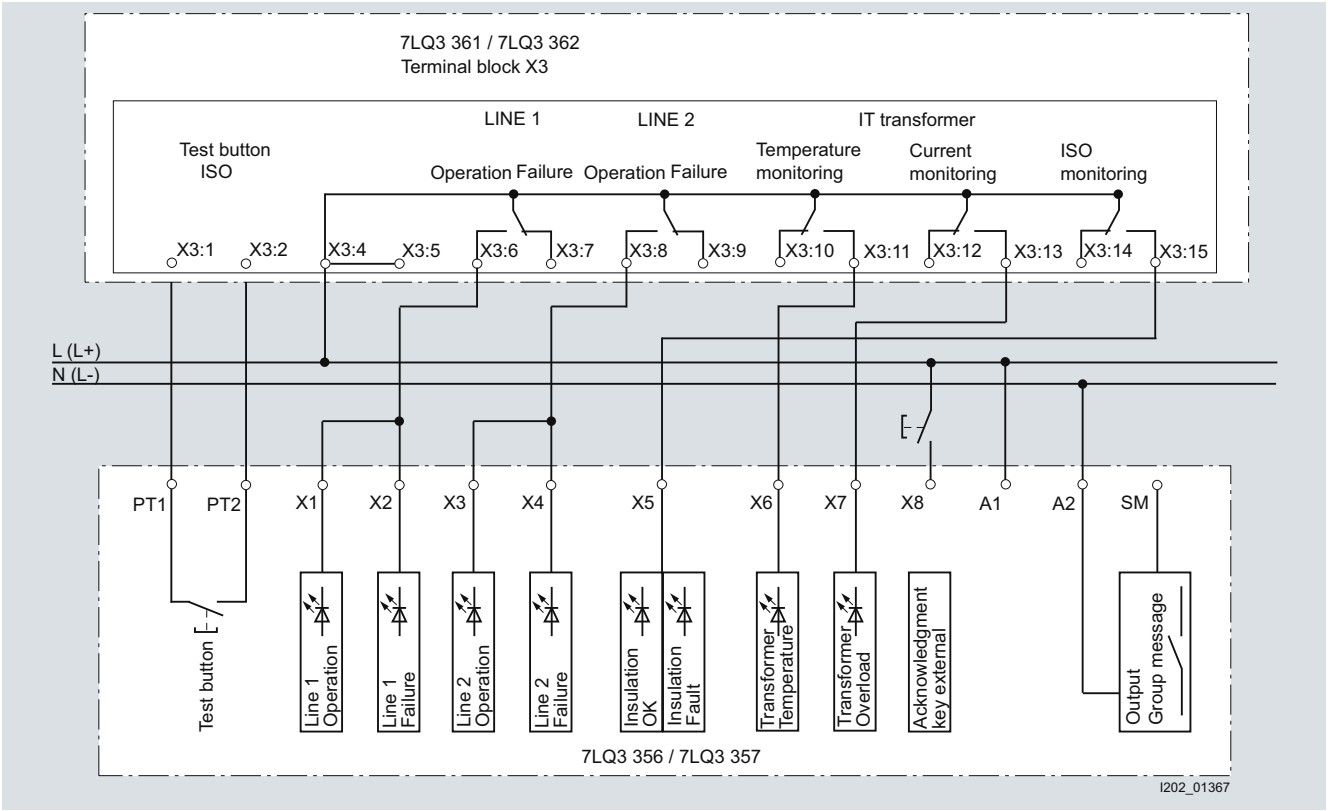
5TT3 412

Use L_a und L_b for monitoring 2 phases or 2-channel monitoring of 1 phase. If only L_a is used, L_b must be bridged with L_a.

More information

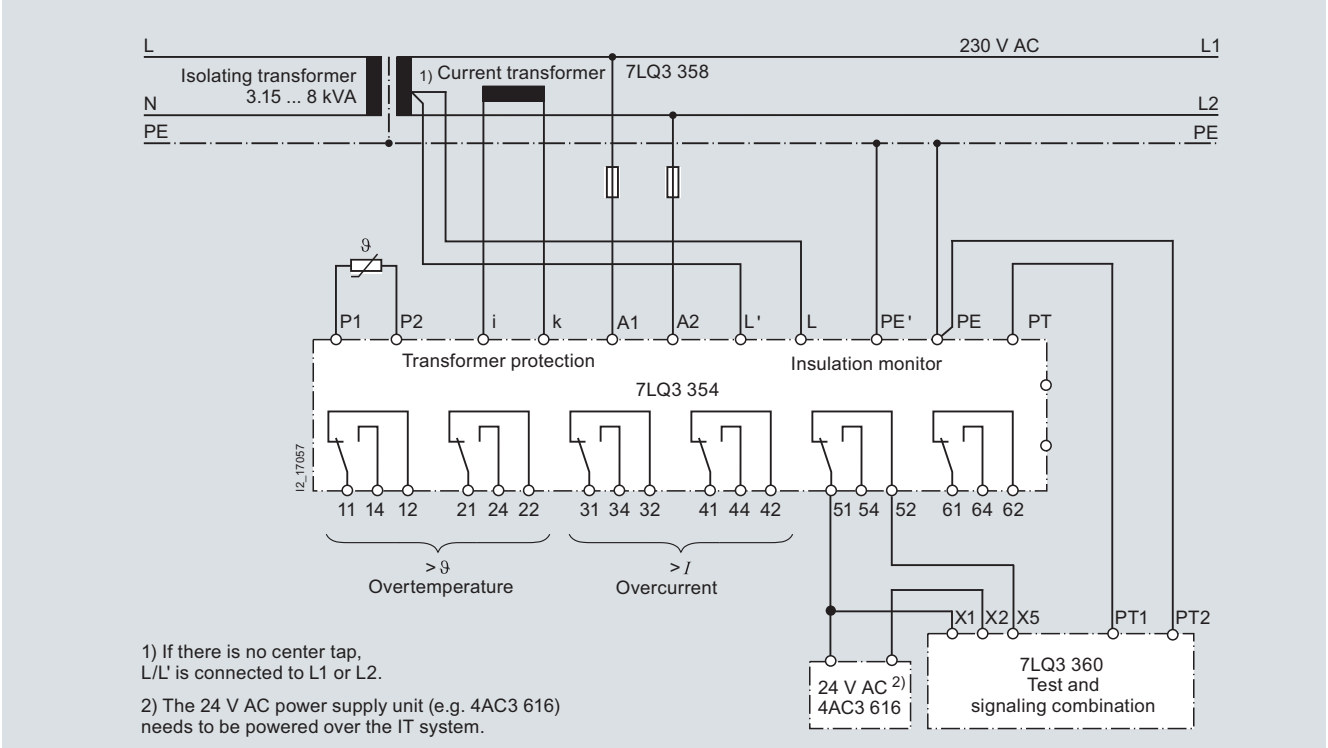
Circuit examples

Switchover device



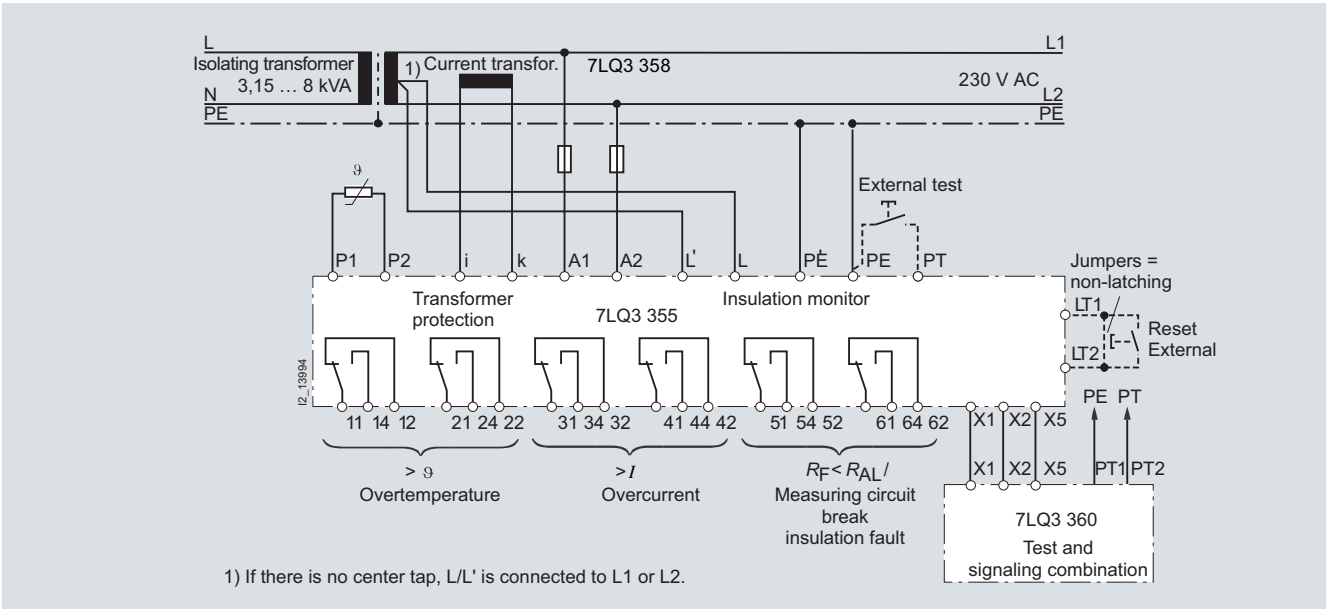
7LQ3 361, 7LQ3 362

Insulation monitors



7LQ3 354

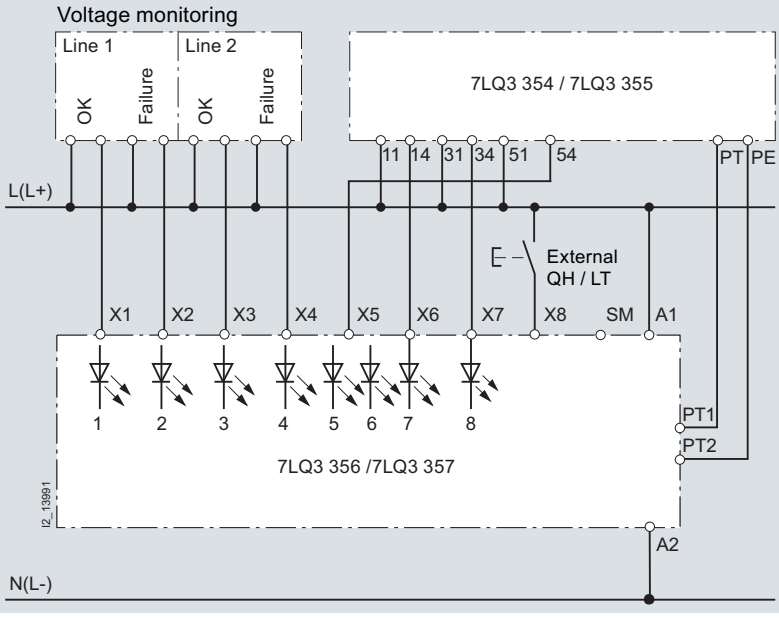
Insulation monitors



7LQ3 355

Up to four 7LQ3 360, 7XV9 306, 7XV9 304 or 7XV9 302 test and signaling combinations can be connected; compare with connection example and comparison of contact assignment between previous and current test and signaling combinations

Test and signaling panels

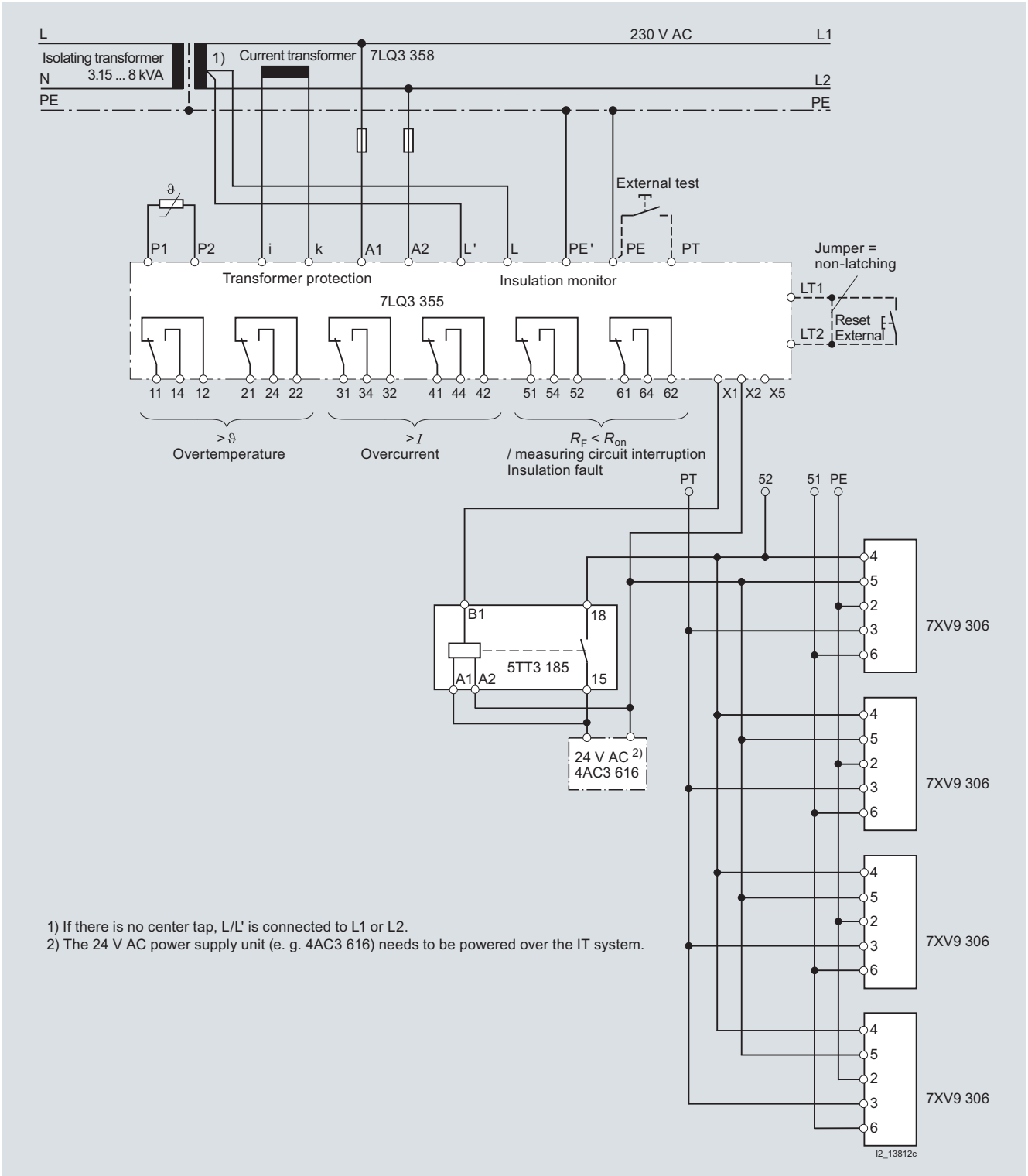


X1 ... X7	Fault signaling inputs
X8	Acknowledgement of horn/lamp test
SM	Central indication output
PT1, PT2	Test button for insulation monitors

7LQ3 356, 7LQ3 357

Insulation monitors for medical premises, 7LQ

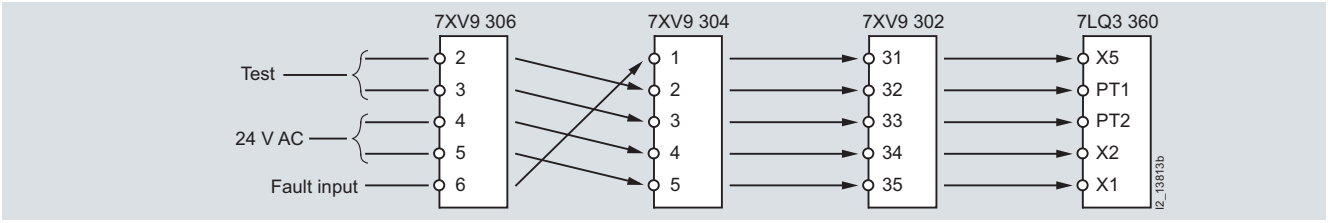
Circuit example: 7LQ3 355 insulation monitors with test and signaling combination 7XV9 306



7LQ3 355

Up to four test and signaling combinations (e.g. the test and signaling combination 7LQ3 360 and the previous 7XV9 306, 7XV9 304 or 7XV9 302 test and signaling combinations (now no longer available) can be connected.

An external 24 V AC (e.g. 4AC3 616) transformer is required to power the test and signaling combination.



Compare the contact assignment for the previous, no longer available test and signaling combinations 7XV9 306, 7XV9 304 and 7XV9 302 with the contact assignment for the current 7LQ3 360 test and signaling combination .

Monitoring of medical premises

Medical premises are all rooms used for the examination or treatment of persons or animals. Besides doctors' surgeries and clinics, these also include hydrotherapeutic and physical therapeutic treatment and massage rooms.

TÜV-certified changeover and monitoring units are used for a guaranteed power supply. The insulation monitors and voltage relays in the changeover and monitoring units need to comply with standard DIN VDE 0100-710 and IEC 60364-7-710 requirements.

Areas used for medicinal purposes were divided up into three groups in DIN VDE 0100-710, which was published in 2002.

For premises in groups 0 and 1, the standard requires, among other things, implementation of the system type TN-S and residual current protective devices (RCD) for protection against excessively high touch voltages.

The premises of group 2 are defined as follows:

- The system must not be disconnected in the event of a first short circuit to frame or to ground or if the general power supply fails.
- Repetition of treatment is unacceptable for patients or it is impossible to obtain results of examinations again.
- An irregularity (a fault) in the power supply can cause danger to life.
- A piece of equipment used for medical purposes, which is used occasionally for applications in accordance with DIN VDE 0100-710.2.7, should be assigned to group 2.

Typical locations in group 2 are anesthetic rooms, operating rooms and recovery rooms in hospitals, clinics or doctors' surgeries, as well as equipment used in veterinary medicine.

Standard DIN VDE 0100-710 makes the following stipulations:

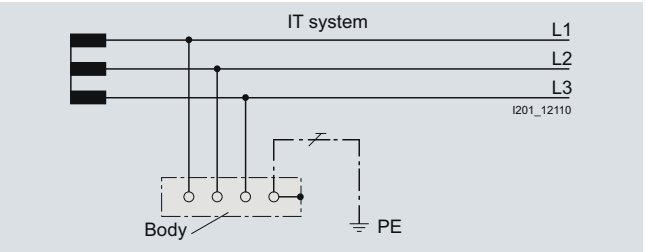
- Constant monitoring of the power supply on the preferred supply line and on the second supply line
- Automatic changeover to the second supply line within a defined time (< 0.5 s or < 15 s)
- Reliable operation even if a fault occurs (one-fault security).

The switchover device monitors the supply voltage on the preferred and second supply line for undervoltage and power failure. As soon as a voltage drop to a defined value is determined, the voltage relays operate and the switchover device automatically switches to the second supply line. As soon as the power is restored on the preferred supply line, the system switches back to it.

IT system

In the IT system designation, the first letter describes the grounding conditions of the power source. *I* stands for insulation of all live parts from the ground or the linking of a point to the ground over an impedance. The second letter designates the grounding conditions of the body of the electrical plant.

T means that the body is directly grounded, independently of any existing grounding of a point of the power source.



Medical IT systems

Standard DIN VDE 0100-710 makes the following stipulations for a medical IT system in group 2:

- The medical IT system must be used for socket outlet current circuits in the patient environment. This also applies for circuits supplying operating room lights.
- At least one IT system is required for each room group.
- Separate circuits must be provided for multiple socket outlets.
- First faults must not lead to disconnection of the system.

The IT system is powered by an isolating transformer or an independent power source (such as a battery). The special feature here is the fact that no active conductor is directly linked to the ground in this system. This has the advantage that only a small residual current can flow in the event of a insulation fault. This is essentially dictated by the leakage capacitances and is harmless to patients and staff. The upstream fuse does not respond so that the power supply, and therefore operation, is maintained, even in the event of a phase-to-ground fault. The high reliability of an IT system is ensured by continuous isolation monitoring. The insulation monitor detects isolation faults as they develop and signals in good time if a value falls below a limit value, before any further insulation faults can lead to an unexpected shutdown. The temperature of the transformer and the transformer load continue to be monitored constantly. Any exceeding of limit values is signaled immediately.

Insulation monitors for medical premises, 7LQ

Insulation monitoring

The 7LQ3 354 and 7LQ3 355 insulation monitors are used for the monitoring of the insulation resistances of non-grounded IT systems in medical premises. They also simultaneously monitor the load current and the temperature of the IT isolating transformer. The devices can monitor both three-phase and AC systems.

Temperature measurement: The temperature in the transformer development is recorded over PTC thermistor or NC contacts.

As well as an adjustable response value of 50 & 500 kΩ, the 7LQ3 355 insulation monitor also has an 11-step LED chain for displaying the current insulation resistance of the system. A range of different colored LEDs indicate the insulation resistance within the range of 20 kΩ … 1 MΩ. This allows insulation deteriorations to be detected even before an alarm is triggered. The device is also equipped with an additional relay for connection of a test and signaling combination. This allows the test and signaling combination 7LQ3 360 and the previous and no longer available test and signaling combinations 7XV9 306, 7XV9 304 and 7XV9 302 to be connected to the insulation monitor 7LQ3 355 (see also the graphic under "Connection example: 7LQ3 355 insulation monitors with 7XV9 306 test and signaling combination").

Load current sensing: The 7LQ3 358 current transformer detects the load current of a phase. Evaluation is carried out over the 7LQ3 354 and 7LQ3 355 insulation monitors.

Evaluation: If one of the values is outside the limit values, an alarm is triggered. The LED for the relevant fault lights up and the alarm relay switches. The information is made available over the changeover contacts and can be displayed on the 7LQ3 356 and 7LQ3 357 test and signaling panels.

Voltage monitoring

In the case of undervoltage, there is no guarantee that medical equipment will continue to function. Because of the risk this presents to patients, e.g. during operations, it is essential that a changeover unit switches to a second power supply in the event of an undervoltage in the preferred power supply.

The voltage relays switch when the voltage falls below 90 % of the rated voltage. The 5TT3 411 relays serve to monitor a 1-phase infeed. 3-phase infeeds can be monitored using 5TT3 412 relays. These relays also offer asymmetry, reverse voltage and phase failure detection.

TÜV-certified switchover device

The 7LQ3 361 and 7LQ3 362 switchover devices have been tested and certified by TÜV Rheinland. Switchover devices comply with DIN VDE 0100-710:2002-11 and IEC 60364-7-710:2002-11.

TÜVRheinland®
Genau. Richtig.

Industrie Service

ZERTIFIKAT

Die Umschalteinrichtungen der Firma Siemens AG
Siemensstraße 10
93055 Regensburg

der Typen

7LQ3362 (4-polige Umschaltung)
Zeichnungs- Nr.: 01- 07- UMT 710- 475S- UE vom 25.1.2007

7LQ3361 (2-polige Umschaltung)
Zeichnungs- Nr.: 01- 07- UMT 710- 275S- UE vom 25.1.2007

haben wir geprüft.

Die Übereinstimmung mit den Normen DIN VDE 0100, Teil 710
Pkt.710.537.6.2
und IEC 60364-7-710: 2002- 11
wird bestätigt.

Der Prüfbericht Nr. 074013 vom 13.01.2007 des Industrie Service ist Bestandteil des Zertifikates.

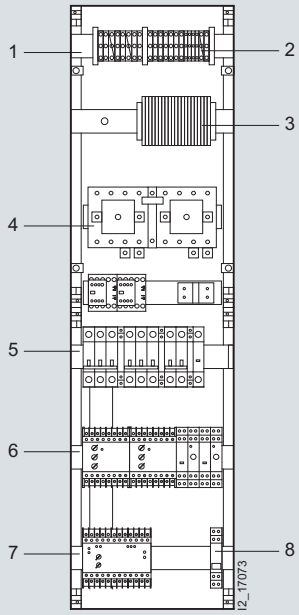
Erfurt den, 28.3.2008

Geschäftsfeld Elektro- und Gebäudetechnik

Dipl.-Ing. Jochen Ebenau

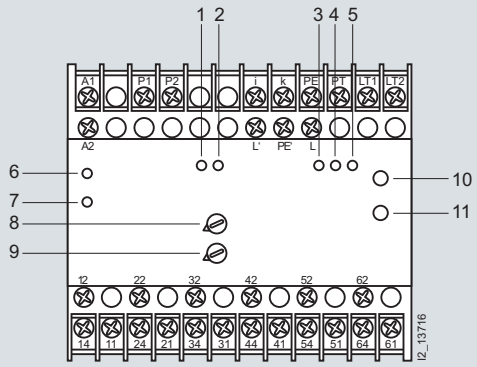
Rhineland TÜV certificate for 7LQ3 361 and 7LQ3 362 switchover devices

Components and control elements in 7LQ3 361 and 7LQ3 362 switchover devices



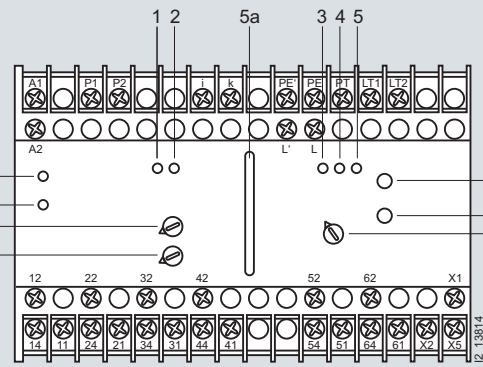
	Meaning
1	Terminal block X1
2	Terminal block X2
3	Terminal block X3
4	Mechanical latching
5	Miniature circuit breakers
6	Voltage relay test pushbuttons
7	Insulation monitors
8	Temperature monitoring test pushbuttons

Control elements for insulation monitors



7LQ3 354

	LED	Meaning
1	Current monitoring (green)	Lights up if the current is correct (Go-state)
2	Current monitoring ">*I*" (red)	Lights up in the case of overcurrent
3	Insulation monitoring "ON" (green)	Lights up when the power supply is switched on (ready-to-run)
4	Insulation monitoring "MK" (red)	Lights up if a line of the measuring circuit is interrupted (L, L', PE, PE')
5	Insulation monitoring "AL" (red)	Lights up in the case of an insulation fault, R_F<R_{on} (value has fallen below the response value)
5a	Line insulation monitoring "R_F" (location, yellow, green)	11-step LED chain to display the current resistance
6	Temperature monitoring (green)	Lights up when the power supply is switched on
7	Temperature monitoring (red)	Lights up in the event of overtemperature or an interruption in the sensor circuit

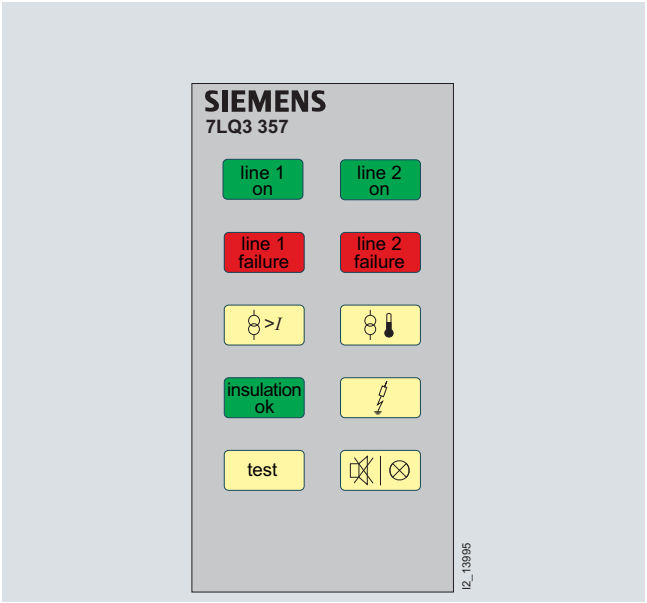


7LQ3 355

	Pushbutton/rotary regulator	Meaning
8	Rotary regulator response value ">*I*"	Setting of the response value for current monitoring
9	Rotary regulator delay time	Setting of delay time after which the CO contacts return to their normal position if the current value exceeds the set response value.
9a	Rotary regulator response value "R_{an} kΩ"	Setting of the response value for line insulation monitoring
10	"Test" button	Pressing the test button simulates an insulation deterioration in the measuring circuit (R_F approx. 40 kΩ), thus checking that the line insulation monitor is fully functional.
11	"Reset" button	Deletion of fault if the fault storage is activated

Insulation monitors for medical premises, 7LQ

Control elements of the test and signaling panels

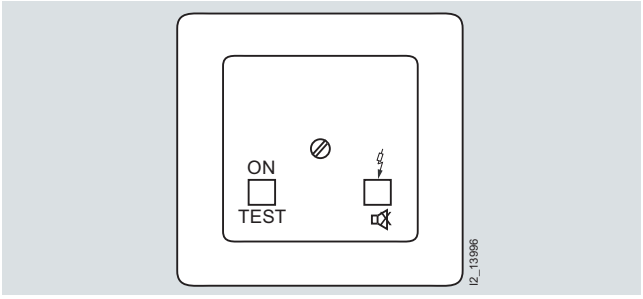


7LQ3 356, 7LQ3 357

	LED window displays	Meaning
	Line 1 On	Power supply is implemented over the preferred infeed
	Line 2 On + Line 1 Failure	Power supply is implemented over the second line as the preferred infeed has failed
	Line 1 On + Line 2 Failure	Power supply is implemented over the preferred infeed. However the second line is no longer available
	Line 2 On + Line 1 Failure + Line 2 Failure	Power supply is implemented over the second line as the preferred infeed is faulty. There is undervoltage on the second line
	Overload	Excessive power consumption of the IT system
	Overtemperature	The transformer of the IT system is overloaded
	Insulation is good	The transformer of the IT system is overloaded
	Insulation is defective	The insulation resistance of the IT system is too low
	Test	Pushbutton for testing the insulation monitoring devices
	Acknowledgement pushbutton/lamp test	Pushbutton for acknowledging the acoustic alarm signal/function test of the display elements

Note:
Customized reporting and signaling panels can be produced, for instance with an integrated intercom, for the changeover and monitoring units. For more information on this contact your local Siemens representative.

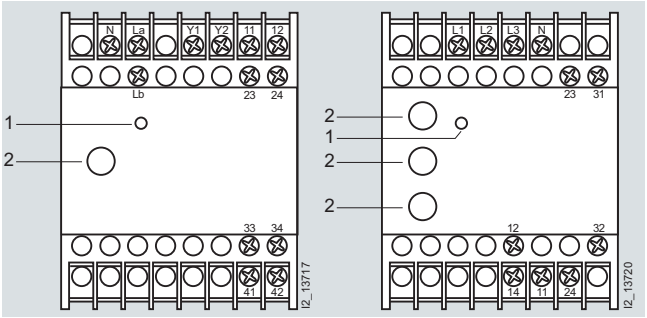
Control elements of the test and signaling combination



7LQ3 360

	LED/pushbutton	Meaning
ON	green LED	The LED lights up if the power supply is applied
Ground fault	Yellow LED	Insulation fault: the insulation resistance of the IT system is too low
	Test	Pushbutton for testing the insulation monitoring devices
	Acknowledgement pushbutton	Button for acknowledging the acoustic alarm signal

Control elements of voltage relay



5TT3 411 5TT3 412

	LED/pushbutton	Meaning
1	5TT3 411: yellow LED 5TT3 412: green LED	The LED lights up if the system is fault-free
2	Test button	Pressing the test button simulates an undervoltage. The 3-phase 5TT3 412 voltage relay has a test button for each phase.

Overview

The GSM alarm module (GSM = Global System for Mobile Communications) enables cost-effective remote control of industrial and private building management, e.g. of heating, air-conditioning and cooling systems. But it is also possible to safely control elevators and escalators and all kinds of production equipment, such as machines, automatic devices and conveyor belts. The GSM alarm module is particularly suitable for distant plants, such as monitoring the heating of summer houses or the pumps of a water treatment plant.

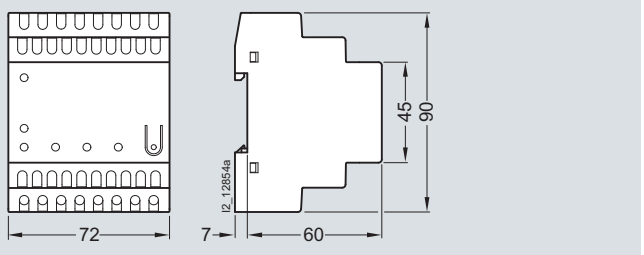
Using voltage relays, current relays, fuse monitors, miniature circuit breakers, residual current operated circuit breakers or surge arresters fitted with auxiliary switches or signal contacts, there are virtually no limits to the type of monitoring tasks that can be carried out. The use of remote controlled mechanisms with miniature circuit breakers and residual current operated circuit breakers also allows realization of a range of cost-effective and interesting solutions.

Note:
Since the availability of mobile networks cannot be guaranteed, GSM alarm modules should not be used for safety-relevant control functions.

Technical specifications

			5TT7 120-0
Rated power P_s		W	4.5
Digital inputs		V DC	24; 2-wire connection, isolated
Signal voltage "0" at the input		V DC	-2 ... 2
Signal voltage "1" at the input		V DC	8 ... 30
Maximum contact load	At p.f. = 1	V; A	250; 5
Maximum contact load		V; A	30; 5
Rated operational voltage U_e		V DC	10 ... 30
• Permissible residual ripple			
- At 10 V		%	< 1
- At 30 V		%	< 10
Vibration resistance	Acc. to EN 60068-2-34	g	1 at 10 ... 500 Hz
Shock resistance	Acc. to EN 60068-2-27	g	30 for 18 ms
Shock resistance	Acc. to EN 60068-2-29	g	25 for 6 ms
EMC	Acc. to EN 6100-6-2, EN 61000-6-3		Complied with
Frequency band			E-GSM 900 / GSM 1800
Power class			GSM 900:4 (2 CO) / GSM 1800:1 (1 CO)
GPRS class			Multislot Class 8, operation mode Class B, HSCSD, SAT
Connections			
• Terminals	±screw (Pozidriv)		1
• Conductor cross-sections of main current paths			
- Rigid, max.		mm^2	1.5 ... 4
- Flexible, with end sleeve, min.		mm^2	1 ... 2.5
Ambient temperature		°C	-20 ... +50
Storage temperature		°C	-20 ... +50
Humidity at 40 °C		%	0 ... 95

Dimensional drawings

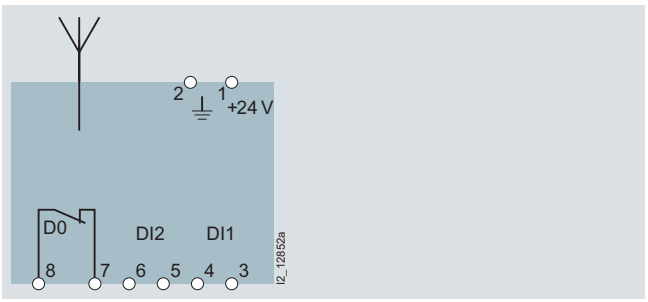


5TT7 120

GSM alarm modules, 5TT7

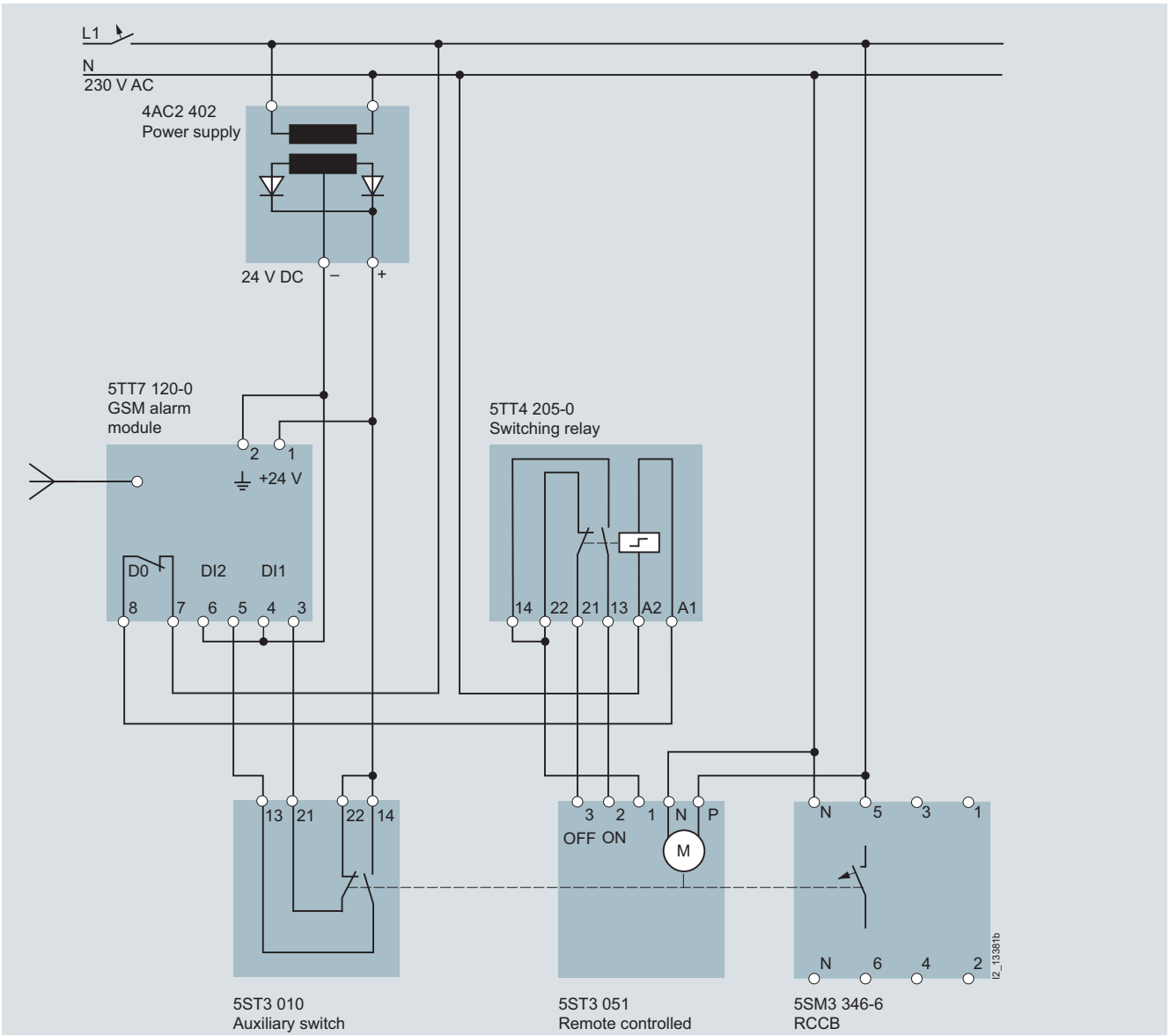
Schematics

Diagram



5TT7 120

Switching example



Switching a 5ST3 051 remote control

- The GSM alarm module sends an ON command.
- The switching relay switches and sends this command to the remote control, whereby the voltage at the remote control switches the relay from the OFF to the ON input over the changeover contact
- The auxiliary switch relays the ON position of the remote controlled mechanism to the input of the GSM alarm module. This sends the switching position ON per SMS.

More information

SIM card

An activated SIM card of a GSM network provider is used (e.g. T-Mobile D1, Vodafone D2, E-Plus, O2 – even prepaid cards). The card is prepared for use in the GSM alarm module in a conventional cell phone, by setting the PIN to "1234". The device can then be simply configured and put into service without any software tools or programming skills. The status of two digital inputs are monitored and in the event of any change, an SMS is sent. By sending an SMS from a cell phone to the GSM alarm module you can switch the output.

Administrator

One cell telephone number has administrator rights. This administrator number is used to specify the signaling and control texts, define time responses at outputs and inputs and register and store up to 5 further phone numbers in the device. An SMS alarm message is then also sent to these 5 phone numbers in the event of a fault.

Freecall function

The freecall function is an extremely interesting feature and – unlike the sending of SMS messages – is completely free. It can be used for the functions of the GSM alarm module. By simply selecting the device, this function can be used to switch the output, switch it over or call up the switching states of inputs and outputs. The GSM alarm module detects the phone number that is calling, checks the authorization and executes the desired function. To use this function, the anonymous call feature must be disabled on the phone being used.

Safety in the event of power failure

Any device power faillure is detected by the 5TT7 120-0 GSM alarm module. The device then sends an appropriate alarm SMS and switches itself off.

Status interrogation

A status SMS can be used to query the switching state of both inputs and the output. If required, the freecall function can also be used for this purpose.

Heartbeat function

The GSM alarm module automatically sends a status SMS at user-definable intervals.

User-definable device name

In the devices, users can define their own device names. This device name then prefixes each SMS. If more than one device is in use, the user can clearly see where the alarm has occurred.

Power-On SMS

If required, the GSM alarm module automatically sends a so-called Power-On SMS with device name and time delay after the system is switched on. A time delay can be set for the inputs. If there is a change in the device state, the alarm SMS is not sent until the set delay time has expired.

Time delay

The adjustable delay time serves to suppress the sending of multiple Alarm messages, e.g. in the case of chattering contacts. This time is started after an alarm SMS is sent. No further SMS is then sent within the set time interval.

Monoflop function

This allows a time to be set after which the output is automatically reset to zero.

Password protection

If the password protection is activated, the password must be entered in front of each SMS. This protects against unauthorized access.

Interrogation settings

All the settings of a device can be called up using a range of SMS interrogations.

Fault signaling units, 5TT3

Overview

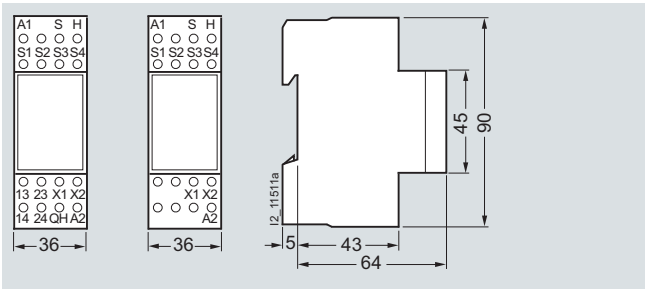
Fault signaling units are used in small plants where the installation of complex fault signaling systems would be too labor-intensive and too expensive. In the event of a fault, they enable fast fault localization of all monitoring devices and limit monitors from a central location. This increases plant availability. With the correct sensor configuration, they also provide the option of preventative maintenance.

- 4 fault signal inputs with LED
- 1 LED as centralized fault indicator
- One unit each for centralized fault indication and acoustic signaling
- With acknowledgment for acoustic indicators
- Open-/closed-circuit principle to the 4 inputs can be adjusted via jumpers X1 - X2
- A maximum of 39 5TT3 461 expansion fault signaling units can be connected to the 5TT3 460 centralized fault signaling unit
- The maximum possible cable length between 5TT3 460 centralized fault signaling units and 5TT3 461 expansion fault signaling units is approx. 100 m with a conductor cross-section of 1.5 mm^2.

Technical specifications

			5TT3 460	5TT3 461
Standards			IEC 60255; DIN VDE 0435-110, -303	
Rated control voltage U_c		V AC	230	
Primary operating range		× U_c	0.8 ... 1.1	
Rated frequency f_n		Hz	50/60	
Fault signaling inputs S1 ... S4		V AC	230	
Signal voltage		V	7 ... 10	
to terminals S and H				
Noise pulse duration		ms	≥ 100	
Acknowledgment pulse duration		ms	≥ 200	
Contacts				
• Rated operational voltage U_e		V AC	230	--
• Rated operational current I_e		A	5	--
• Minimum contact load		V; mA	10; 100	--
Connections				
• Terminals	±screw (Pozidriv)		PZ 1	
• Conductor cross-sections				
- Rigid, max.		mm^2	2 × 2.5	
- Flexible, with end sleeve, min.		mm^2	1 × 0.5	
Permissible ambient temperature		°C	-20 ... +60	
Humidity class	Acc. to IEC 60068-2-30		F	

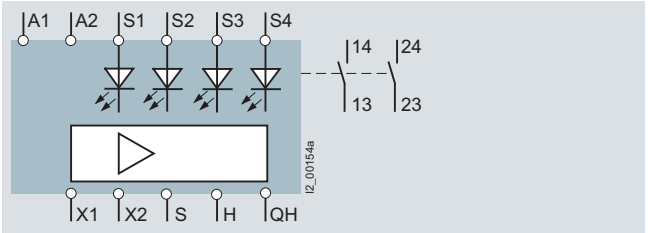
Dimensional drawings



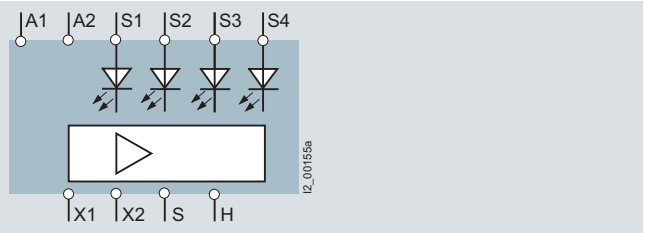
5TT3 460 5TT3 461

Schematics

Diagram

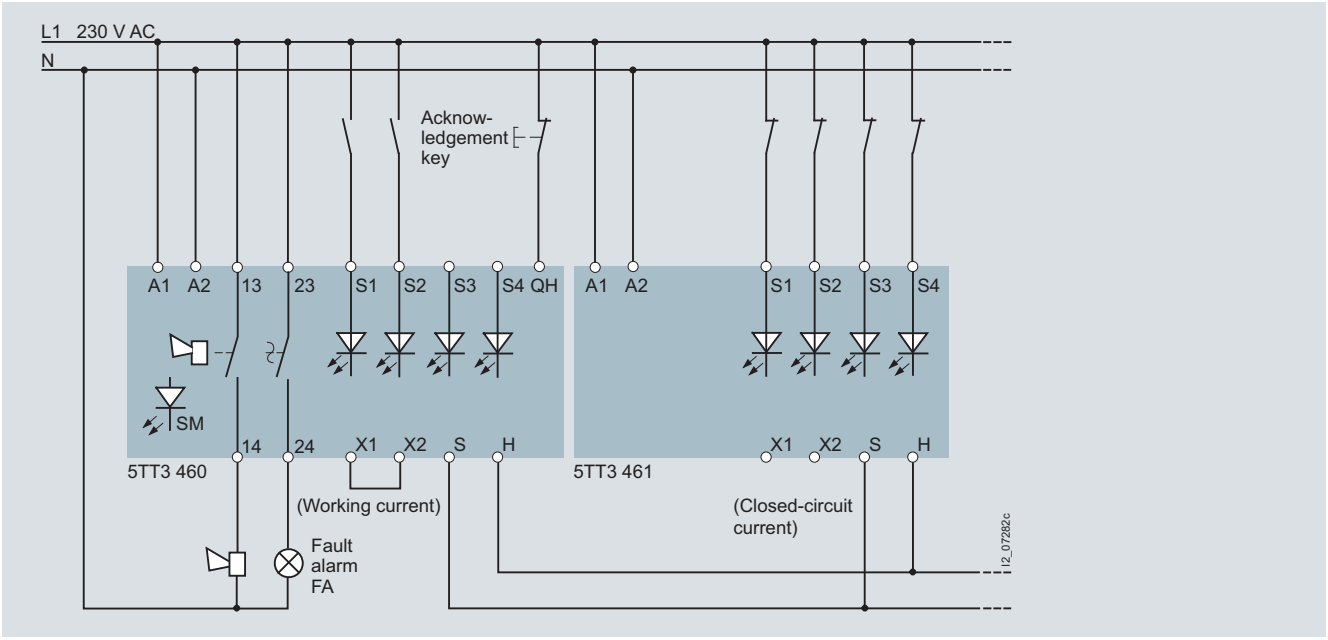


5TT3 460



5TT3 461

Switching example, function chart



If there is a fault, the SM fault indication contact closes and a centralized fault is indicated over an LED. The assigned LED remains lit until the fault is eliminated. Until the acknowledgment, momentary faults can be identified by the remaining centralized fault.

The terminals A1, S1 to S4 and QH must be operated in-phase. If no external acknowledgment key is connected, terminal QH must be applied to L1.

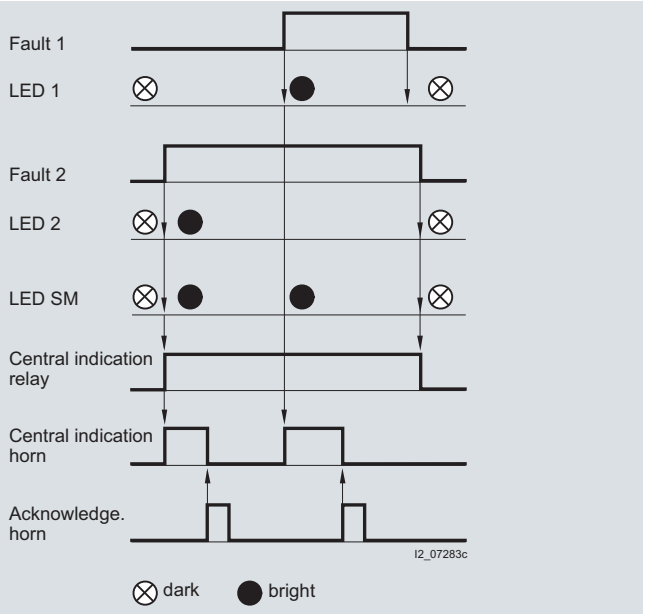
If jumper X1 – X2 is fitted, open-circuit protection (otherwise closed-circuit protection).

Contacts 13/14 and 23/24 close in the event of an incoming fault. The assigned LED and the SM centralized fault indication LED light up.

The alarm sensor (contact 13/14) is switched off using the acknowledgment key. The assigned LED and the centralized fault indication LED continue to light up and contact 23/24 remains closed until the fault is eliminated.

Cables S and H carry an extra-low voltage. In the case of long connections between different distribution boards a shielded cable must be laid parallel to the installed load lines.

As a light signal sensor for the group messages we recommend devices 5TE5 7 or 5TE5 8; as alarm sensor the devices 5TT3 450 to 5TT3 453.



EMERGENCY STOP modules, 5TT5

Overview

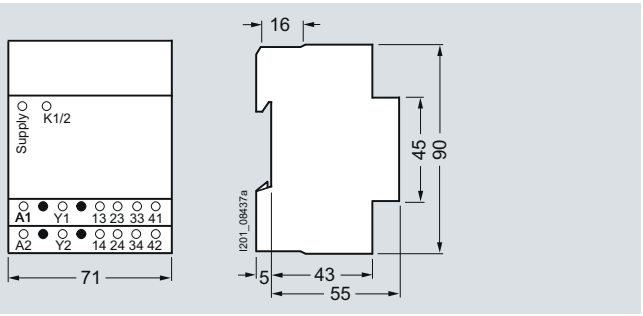
EMERGENCY STOP circuits are common safety measures in all laboratory equipment and industrial plants. The EMERGENCY STOP modules used here must meet the most rigorous demands with regard to functional reliability. Benchmark is the degree of self-monitoring. The Machine Directive 98/37/EC, valid from 31.02.1994, only specifies global safety standards. Details on how to implement individual safety demands are defined in standards, e.g. by the European Committee for Electrotechnical Standardization (CENELEC), which are based on international standards.

Technical specifications

				5TT5 200
Standards				**IEC 60204-1; EN 60204-1 (VDE 0113-1)**
Supply				
• Rated control voltage U_c			V AC	230
- Primary operating range			× U_c	0.8 ... 1.1
• Rated frequency f_n			Hz	50
• Rated power dissipation P_v	Coil/drive			3.5
	Contact per pole		VA	0.8
Control voltage	Terminal Y1		V AC/DC	24
Control current	Terminal Y1		mA DC	45
Recovery time			ms	500
Safety				
• Electrical isolation, creepage distances and clearances, actuator/contact			mm	3
• Rated impulse withstand voltage U_{imp} drive/contact			kV	> 4
Contacts				
• Contacts	NO contacts	AC-15	A	3
	NC contacts	AC-15	A	2
	NO contact/NC contact	AC-1	A	5
• Contact gap			mm	> 1
• Electrical service life	AC-15, 2 A, 230 V AC		Switching cycles	10^5
• Reliable switching frequency			Switching cycles/h	600
Vibration resistance				
Amplitude	Acc. to EN 60068-2-610	Up to 55 Hz	mm	0.35
Connections				
• Terminals	±screw (Pozidriv)			PZ 1
• Conductor cross-sections of main current paths				
- Rigid	Max.		mm^2	2 × 2.5
- Flexible, with end sleeve	Min.		mm^2	1 × 0.5
Permissible ambient temperature			°C	0 ... +50
Resistance to climate	Acc. to EN 60068-1			0/55/04

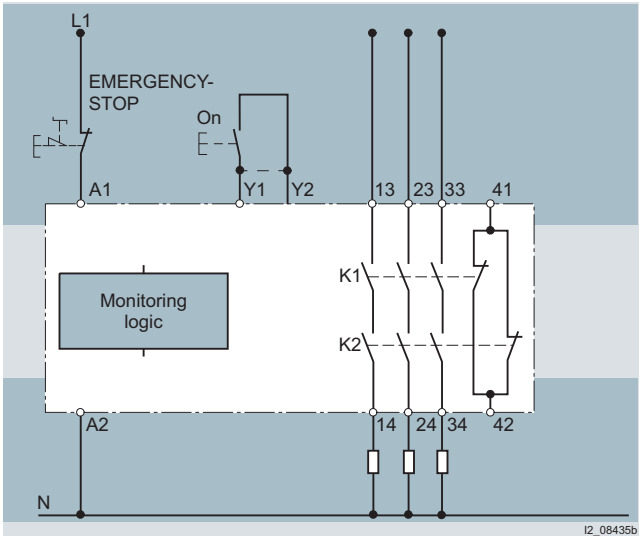
Dimensional drawings

5TT5 200 EMERGENCY-STOP modules



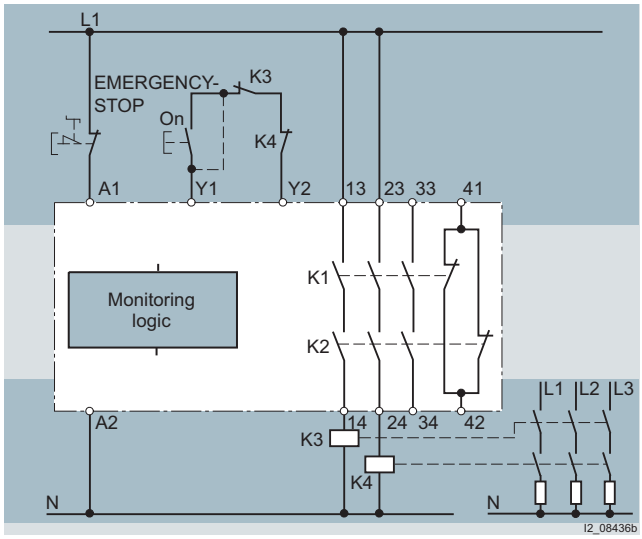
Schematics

Switching examples



Direct connection 230 V/400 V to 5 A

The monitoring logic checks internal relay contacts (not shown) to see whether both relays have been released prior to switching on. This ensures that no contacts are welded. The voltage level at terminal A1 is also monitored. The parallel NC contacts K1 and K2 (terminals 41 and 42) can be connected as required.



Connection of external contactors

External contactors may be used when they are equipped with positively driven contacts according to safety regulations ZH1/457 of the German Trade Association. Contactors with 3 NO contacts and 1 NC contact must be used, whereby the NC contacts must be integrated in the monitoring loop – terminals Y1/Y2. The parallel NC contacts K1 and K2 (terminals 41 and 42) can be connected as required.

More information

Category of safety-related parts of control systems according to CEN/TC 114 EN 954-1

Category	Summary of requirements	System behavior
B	The safety-related parts of machine control systems and/or their protective devices and their components must be state of the art and designed, selected, assembled and combined such that they can withstand the expected influences.	The occurrence of a fault can lead to the loss of the safety function. Some faults remain undetected.
1	The requirements of B must be fulfilled. Use of proven safety components and principles.	As described for category B, but with a higher level of safety-related reliability
2	The requirements of B must be fulfilled. Use of proven safety principles. The safety functions must be tested at suitable intervals using the machine control system. Note: What is considered suitable depends on the application and the type of machine.	The occurrence of a fault can lead to the loss of safety function between testing intervals. The fault is detected by the test.
3	The requirements of B must be fulfilled. Use of proven safety principles. The control systems must be designed so that: a) A single fault in the control system does not lead to the loss of the safety function(s) and b) Wherever possible, the single fault is detected by the appropriate means, which must be state-of-the-art.	If a single fault occurs, the safety function is always maintained. Some, but not all, faults are detected. An accumulation of undetected faults may lead to the loss of the safety function.
4	The requirements of B must be fulfilled. Use of proven safety principles. A control system must be designed so that: a) A single fault in the control system does not lead to the loss of the safety function(s) and b) whenever possible, a single fault is detected at or before the next request for the safety function or c) If b) is not possible, then an accumulation of faults does not lead to the loss of the safety function.	If faults occur, the safety function is always maintained. The faults are detected in time to prevent the loss of the safety function.

Scope

The scope of the EC Directive Machines is no longer restricted to industrial machinery, but now covers virtually all machines used in all areas of commercial and private trade and industry and applies to all

- Stationary
- Movable
- Hand-held
- Mobile
- Machine tools and processing machines

EMERGENCY STOP modules, 5TT5

- Prime movers and production machines
- Compressors
- Operating and packaging machines
- Machines in underground mining
- Earthmoving machines and harvesters
- Hoisting equipment
- Floor conveyors
- Machines for lifting persons
- Plants
- Interchangeable equipment, such as snow ploughs and mountable sweeping devices.

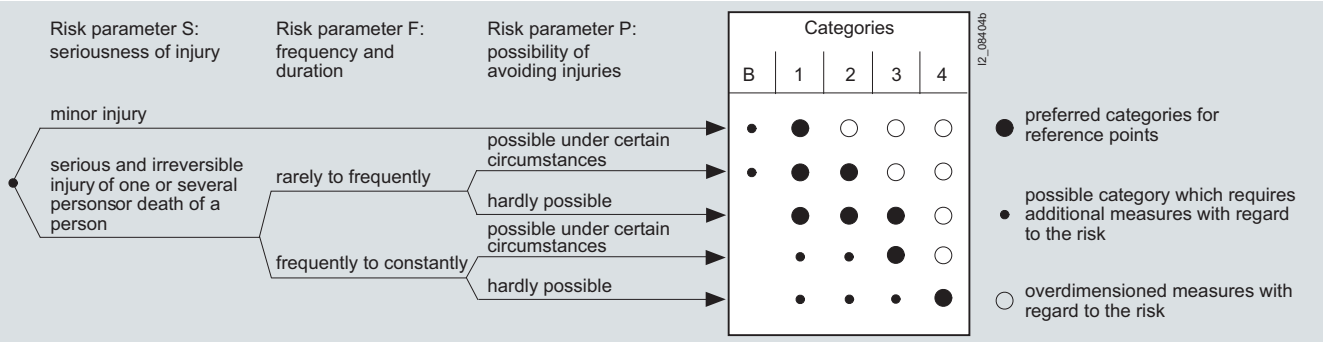
Risk analysis and selection of a suitable category

Engineers and operators assume responsibility for the correct risk assessment.

It is difficult to make a quantitative assessment of the risk, so that when selecting the category, the reasonable risk can be determined within a broad band width.

This becomes clear if you select "F2 - frequently to continuous" instead of "F1 - rarely to frequently", for the risk parameters "F - Frequency and duration" when drawing up a risk graph (see image).

The whole band width of safety categories may lie between the assessment of "often" and "frequently".



Key standards

- **EN 60204-1 (VDE 0113-1):1998**
  "Safety of machinery – Electrical equipment of machinery Part 1: General requirements"
- **EC Directive machinery 98/37/EC**
- **EN 292-1:1991**
  "Basic concepts, general principles for design
  Part 1: Basic terminology, methodology"
- **EN 292-2:1991 und EN 292-2/A1:1995**
  "Basic concepts, general principles for design
  Part 2: Technical principles and specifications"
- **EN 418:1992**
  "Safety of machinery – EMERGENCY STOP equipment, functional aspects, principles for design"
- **EN 954-1:1996**
  "Safety of machinery – Safety-related parts of control systems – Part 1: General principles"
- **EN 1088:1995**
  "Safety of machinery – Interlocking devices associated with guards – Principles for design and selection"

Overview

Level relays are used for the monitoring and control of conductive, non-combustible liquids and powders. They ensure overflow and dry run protection. Due to their sensor performance, the devices can also be used for general resistance monitoring.

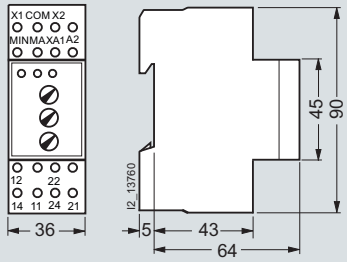
LED displays:
- Green LED: lights up when operational voltage is applied
- Yellow LED: lights up if MIN output relay is activated
- Red LED: lights up if MAX output relay is activated.

Technical specifications

			5TT3 435
Standards			IEC 60255; DIN VDE 0435-110
Supply			
• Rated control voltage U_c		V AC	230
- Primary operating range		$\times U_c$	0.8 ... 1.1
• Rated frequency f_n		Hz	50/60
Setting range of the liquid level		kΩ	2 ... 450
Switching point hysteresis of set value			
- At 450 kΩ		%	3
- At 2 kΩ		%	6
Voltage temperature influence	From set value	%	< 2
Max. cable length to the Electrodes at 100 µF/km	Set value kΩ		
	450	m	50
	100	m	200
	35	m	500
	10	m	1500
	5	m	3000
Electrode voltage	Max.	V AC	Approx. 10
Electrode current	Max.	mA AC	Approx. 1.5
Response delay	adjustable	s	0.2 ... 20
OFF-delay	adjustable	s	0.2 ... 20
Rated operational voltage U_e		V	250
Rated operational current I_e		A	5
Test voltage			
	Input/auxiliary circuit	kV	4
	Input/output circuit	kV	4
	Auxiliary/output circuit	kV	4
Connections			
• Terminals	±screw (Pozidriv)		PZ 2
• Conductor cross-sections			
- Rigid	Max.	mm^2	2 × 2.5
- Flexible, with end sleeve	Min.	mm^2	1 × 0.5
Permissible ambient temperature		°C	-20 ... +60
Resistance to climate	According to EN 60068-1		20/60/4

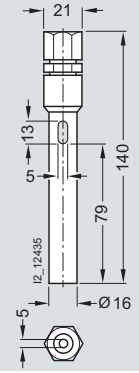
Dimensional drawings

5TT3 43 level relays



5TT3 435

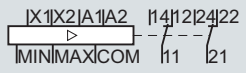
5TG8 223 immersion electrodes



5TG8 223

Schematics

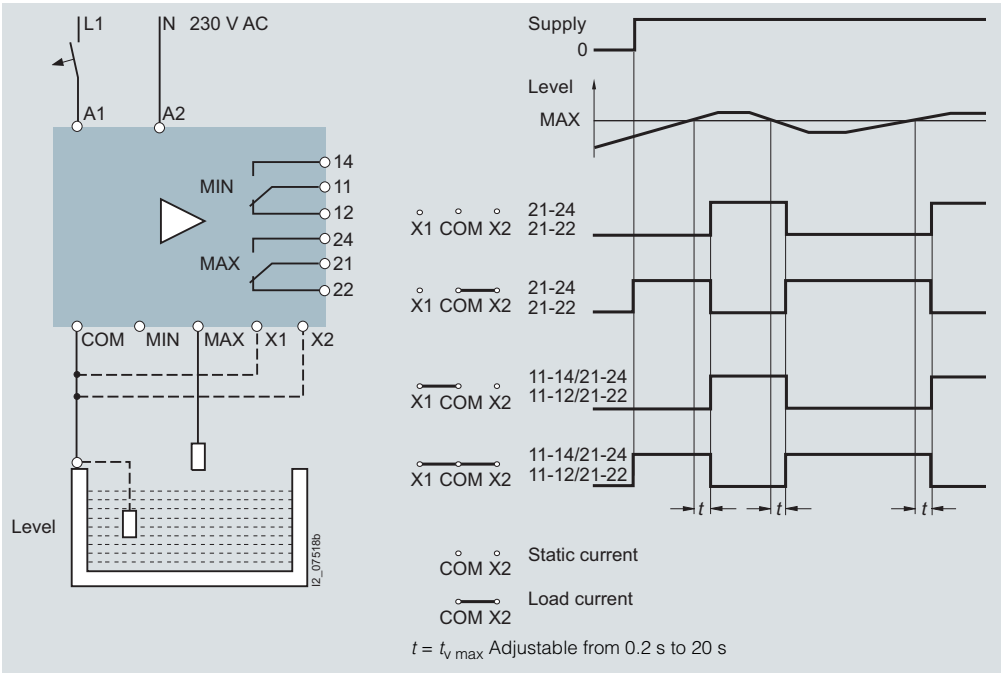
Diagram



Level relays, 5TT3

Switching example: 5TT3 435

One-step level control



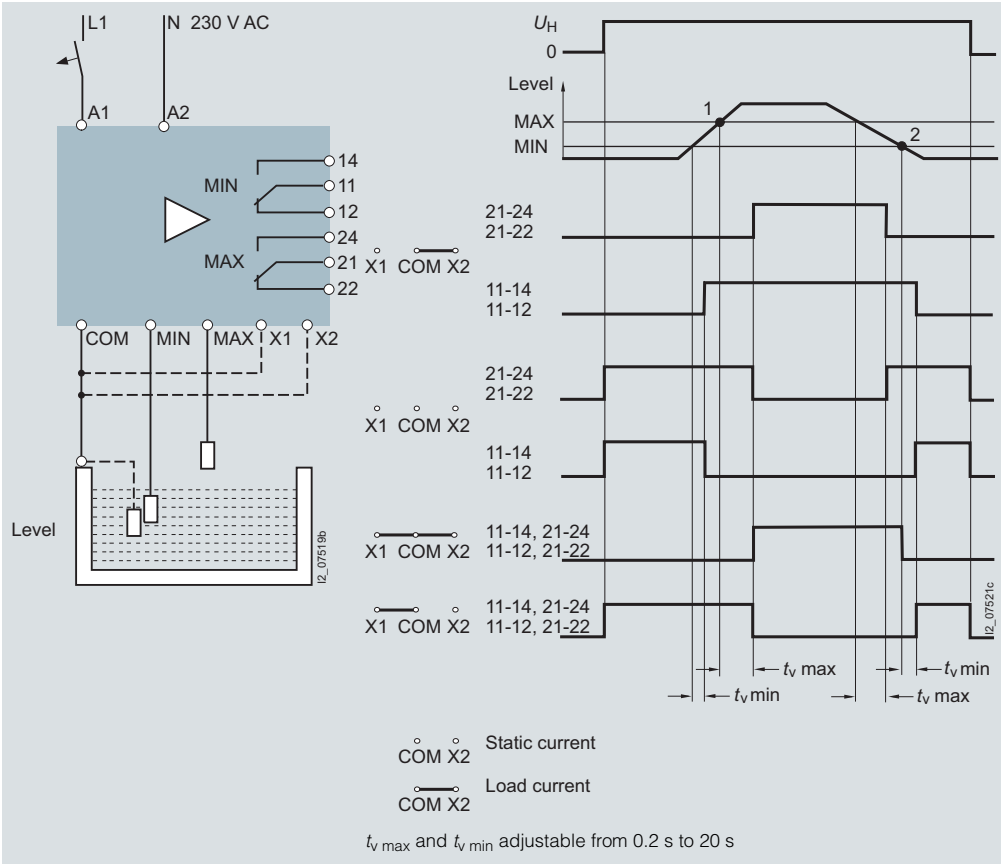
The one-step level control is particularly suitable for dry run or overrun protection with free inflow/outflow.

The COM reference electrode and the MAX electrode are required.

Without the jumper X1-COM only relay 21-22-24 switches.

With the jumper X1-COM both relays switch together.

Two-step level control



The 2-step level control keeps the liquid level between a minimum and a maximum level. Three electrodes are required: MIN, MAX and COM.

Without the jumper X1-COM, switching is as follows:

- If the MAX level is fallen below/exceeded, only relay 21-22-24.
- If the MIN level is fallen below/exceeded, only relay 11-12-14.

With the jumper X1–COM, both relays switch together if the value exceeds the MAX level or falls below the MIN level.

Overview

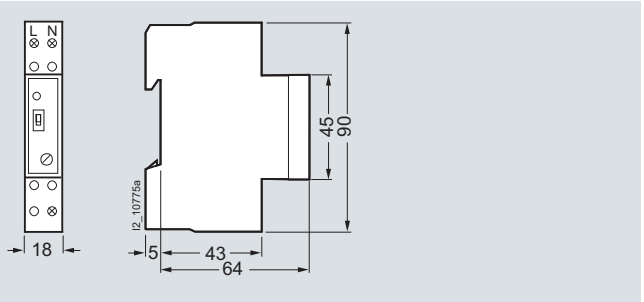
Line circuit relays are used to interrupt circuits and prevent electromagnetic fields in circuits where there are currently no active loads.
If the loads are disconnected, and the line circuit relay measures a usage of only 2 to 20 VA - adjustable - it disconnects the cable to the supply voltage and switches over to extra-low voltage. As soon as loads are reconnected, the line circuit relay detects the increase in usage and switches back to the supply voltage.
While the line circuit relay switches off any unnecessary system components, it is not a device for ensuring isolation in the sense of safe disconnection.

The line circuit relay is unable to detect consumers with electronic power supply units, e.g. electronically controlled vacuum cleaners. It is expedient to connect such equipment to a base load resistor (PTC resistor) so that the line circuit relay is reset to supply voltage.

Technical specifications

			5TT3 171
Standards			IEC 60255; DIN VDE 0435-110
Rated control voltage U_c		V AC	230
Primary operating range		$\times U_c$	0.85 ... 1.15
Rated frequency		Hz	50/60
Rated power dissipation P_v	Electronics Contacts	VA VA	5 2.6
Monitoring voltage		V	3
Response value	adjustable	VA	2 ... 20
Release value	% of the response value		70
Rated impulse withstand voltage U_{imp}	Input/output	kV	> 4
Rated operational voltage U_e		V AC	250
Rated operational current I_e	AC -1 AC-11	A A	16 3
Contacts			μ contact
Electrical service life	in switching cycles at 3 A	AC-11	5×10^5
Terminals	+/-screw (Pozidriv)		PZ 1
Conductor cross-sections • Rigid • Rigid, with end sleeve	 Max. Min.	 mm^2 mm^2	 2×2.5 1×0.5
Permissible ambient temperature		°C	-20 ... +45
Degree of protection	Acc. to IEC/EN 60529		IP20, with connected conductors
Safety class	Acc. to EN 61140/VDE 0140-1		II
Humidity class	According to IEC 60068-2-30		F

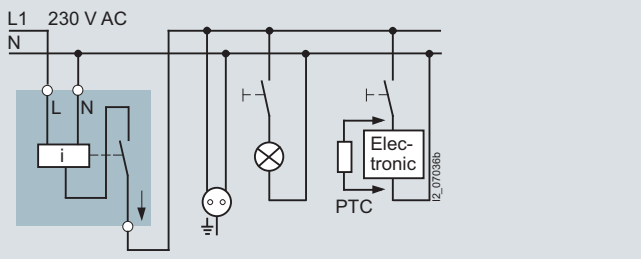
Dimensional drawings



5TT3 171

Schematics

Switching example



If the line circuit relay does not respond to a load, it must be connected with a 5TG8 222 base load resistor. Devices in active standby operation may impair the function of the line circuit relay.

Dusk switches, 7LQ2

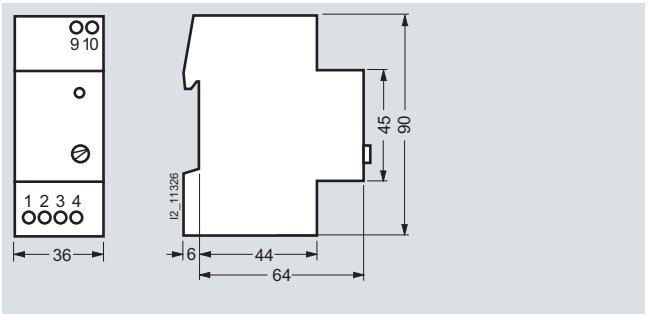
Overview

Dusk switches are used for the demand-oriented switching of lighting installations for shop windows or paths in order to cut operating costs.
A light sensor measures the level of daylight. Switching depends on the desired brightness. A time delay and the switching hysteresis prevent clock-pulse behavior.
The sensor must be mounted so that it is not influenced by the lighting feedback.

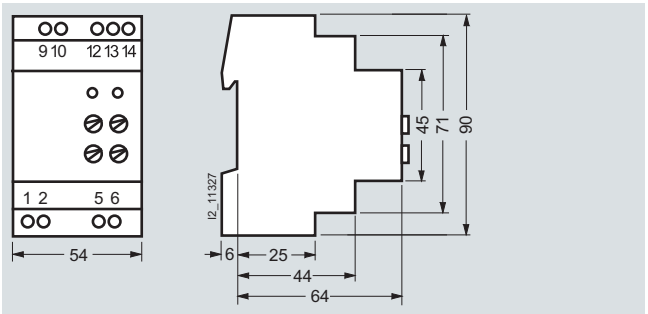
Technical specifications

			7LQ2 100	7LQ2 101	7LQ2 102	7LQ2 103	5TT3 303
Standards			EN 60730				
Rated control voltage U_c		V AC	230				
Primary operating range	At 50/60 Hz	$\times U_c$	0.8 ... 1.2				
Rated frequency f_n		Hz	45 ... 65				
Measuring ranges, setting ranges		Lux	2 ... 500	2 × 2 ... 500	2 ... 500	2 × 2 ... 500	2 ... 500
Time delay	Non-adjustable adjustable	s	75 ± 25 No	No 2 × 50 ... 100 ± 25	75 ± 25 No	No 2 × 50 ... 100 ± 25	50 No
Status indication, LED	Switching status indication Switching state OFF Switching state ON		Instantaneous Green Red				No No No
Incandescent lamp load		W	2000	2 × 2000	2000	2 × 2000	1200
Different phases	Actuator/contact permissible Contact/contact		Yes No	Yes	No	Yes	No No
Electrical isolation	Creepage distances and clearances Actuator/contact Contact/contact	 mm mm	 4 No	 4	 No	 4	 No No
Rated impulse withstand voltage U_{imp} 1.2/50 µs	Actuator/contact Contact/contact	kV kV	> 2.5 No	> 2.5	No	> 2.5	No No
Contacts	µ contact		1 NO	2 NO	1 NO	2 NO	1 NO
• Rated operational voltage U_e		V AC	250				
• Rated operational current I_s - At p.f. = 1 - At p.f. = 0.4		 A A	 16 4				 10 2
• Minimum contact load		V; mA	10; 100				
• Contact switching	Closes with approaching darkness	Terminals	3/4	5/6 and 9/10	3/4	5/6 and 9/10	No
Connections							
• Terminals	±screw (Pozidriv)		PZ 1				
• Conductor cross-sections - Rigid - Flexible, with end sleeve	 Min.	 mm^2 mm^2	 1.5 ... 6 0.75				 1.5 0.5
Environmental conditions							
• Permissible ambient temperature - Device - Light sensor		 °C °C	 -10 ... +55 -30 ... +70				 --
• Permissible humidity - Device - Light sensor		 % %	 < 80 < 98				 --
• Degree of protection - Device - Light sensor	Acc. to EN 60529		 IP20, with connected conductors IP55		 IP65		 IP54 No
• Safety class	Acc. to EN 61010		II				

Dimensional drawings

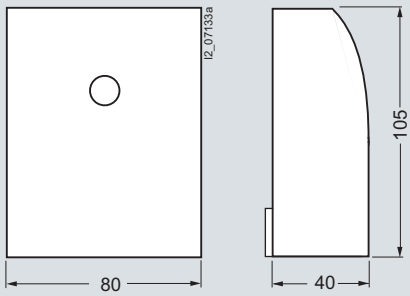


7LQ2 100
7LQ2 102

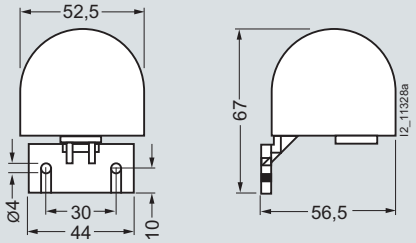


7LQ2 101
7LQ2 103

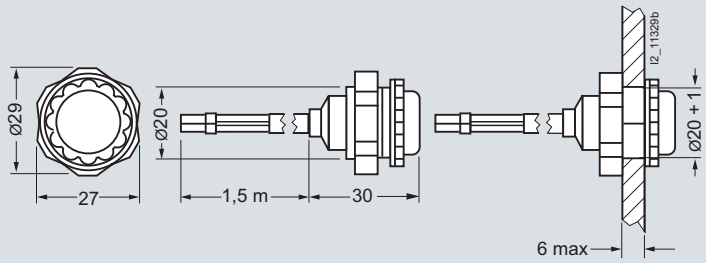
For surface mounting



5TT3 303

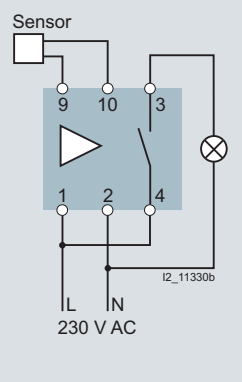


7LQ2 910

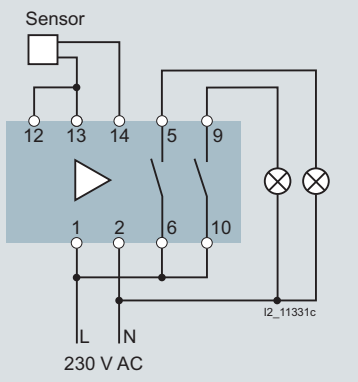


7LQ2 911

Schematics

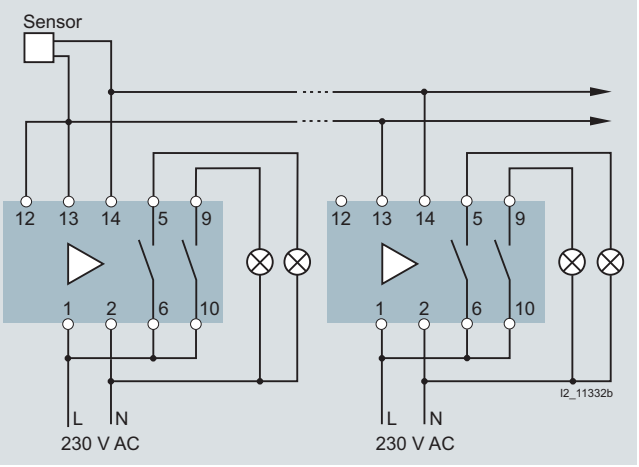


Dusk switches
7LQ2 100
7LQ2 102



Dusk switches
7LQ2 101
7LQ2 103

The cable length between the device and the light sensor must not exceed a maximum of 50 m. The conductor cross-section must be a minimum of 2 × 0.75 mm².



Up to 12 dusk switches with a single sensor
7LQ2 101
7LQ2 103

Up to 12 dusk switches can be operated with a single sensor

If the device measures a light level below the set value or if the device is no-voltage, the contacts are in the position shown.

- If the surrounding light level increases by approx. 30 % to 100 % above the set value, the light is switched off after the set delay time.
- If the surrounding light level falls below the set value, the light is switched on after the set delay time.

Temperature controllers, 7LQ2

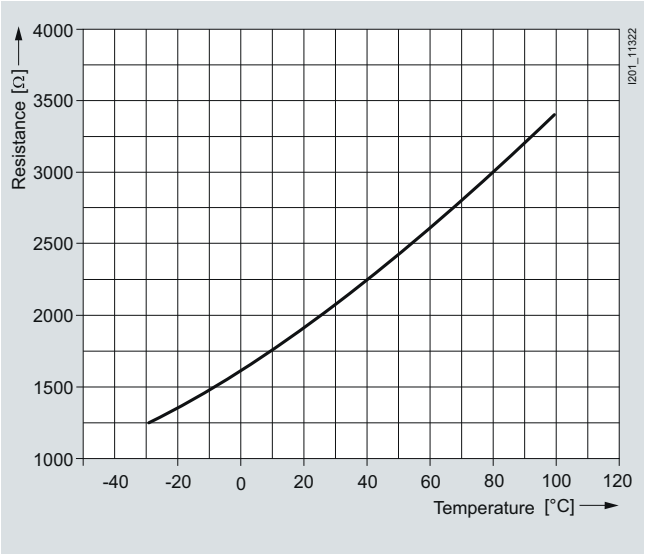
Overview

The temperature controllers are used for controlling or limiting temperatures in residential and non-residential buildings, as well as in industrial areas. They're used for heating registers, panel and hot air heating and direct floor heating, as a limiting thermostat for air-conditioning systems and cooling systems, switchgear cabinet cooling, etc. as well as for temperature control in humid and dusty rooms. Can also be used for inaccessible room temperature setting for rooms in public buildings, such as schools, dayrooms and comparable applications.

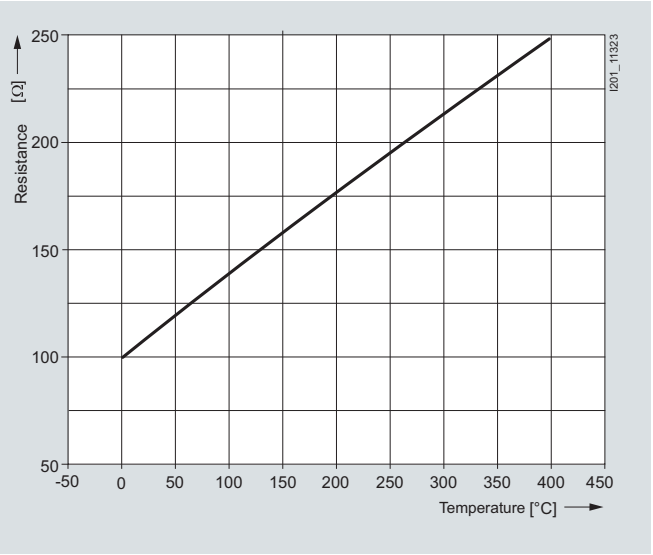
Technical specifications

			7LQ2 001	7LQ2 002	7LQ2 003	7LQ2 005
Standards			EN 60730			
Rated control voltage U_c		V AC	230			
Primary operating range	At 50/60 Hz	× U_c	0.8 ... 1.2			
Rated frequency f_n		Hz	45 ... 65			
Measuring ranges, setting ranges		°C	-30 ... +30	0 ... +60	+40 ... +100	2 ... +400
Switching hysteresis	adjustable	°C	1 ... 5			4 ... 20
Status indication, LED Switching status indication						
• Actuating voltage			Green			
• Switching state ON			Red			
• Break or short circuit of the sensor conductor			Red flashing			
Different phases	Actuator/contact permissible		Yes			
Electrical isolation	Creepage distances and clearances, actuator/contact	mm	4			
Rated impulse withstand voltage U_{imp} (1.2/50 µs)	Actuator/contact	kV	> 2.5			
Contacts	µ contact		1 CO			
• Rated operational voltage U_e		V AC	250			
• Rated operational current I_s						
- At p.f. = 1		A	16			
- At p.f. = 0.4		A	4			
• Minimum contact load		V; mA	10; 100			
• Contact switching	Closes with increasing temperature	Terminals	3/4			
Connections						
• Terminals	±screw (Pozidriv)		PZ 1			
• Conductor cross-sections						
- Rigid		mm^2	1.5 ... 6			
- Flexible, with end sleeve	Min.	mm^2	0.75			
Environmental conditions						
• Permissible ambient temperature						
- Device		°C	-10 ... +55			
- Temperature sensor		°C	-30 ... +105			--
• Permissible humidity						
- Device		%	≤ 80			
- Temperature sensor		%	≤ 98			--
• Degree of protection	Acc. to EN 60529					
- Device			IP20, with connected conductors			
- Temperature sensor			IP65			--
• Safety class	Acc. to EN 61010		II			

Characteristic curves

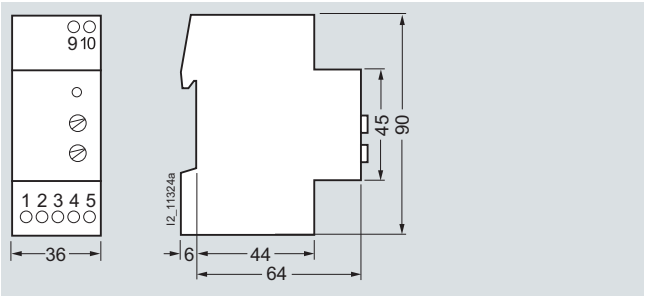


Resistor characteristic curves KTY 11-6

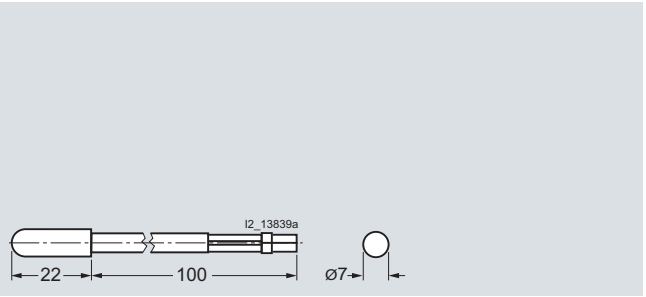


Resistor characteristic curves PT100 acc. to EN 60751

Dimensional drawings



7LQ2 0



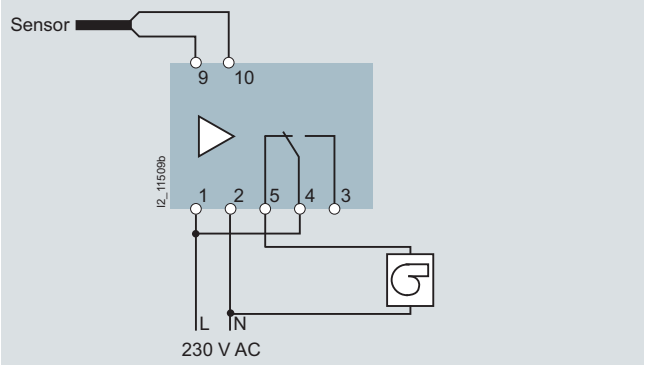
7LQ2 900

Schematics

Switching examples

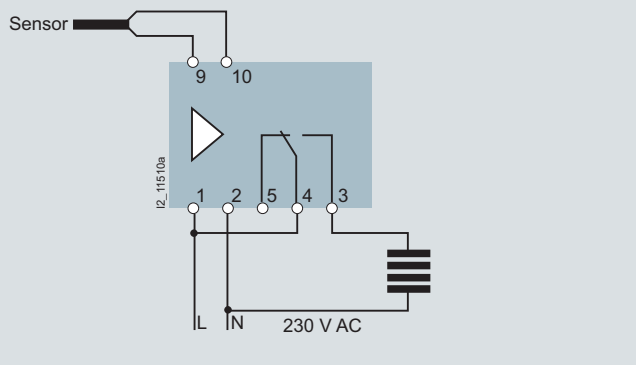
7LQ2 0 temperature controllers in cooling operation with adjustable functioning temperature difference

7LQ2 0



7LQ2 0 temperature controllers in cooling operation with adjustable functioning temperature difference

7LQ2 0



The cable length between the device and the temperature sensor must not exceed a maximum of 100 m. The conductor cross-section must be a minimum of 2 × 0.75 mm².

P.f. controllers, 5TT3

Overview

The p.f. controllers monitor the phase displacement between current and voltage. Because the phase displacement angle changes with the load of the motor, this measurement method is ideal for the monitoring of asynchronous motors for underload and no-load operation, independent of size. However, in some cases, the p.f. barely changes if the load of the motor changes, e.g. in the case of relatively minor load changes on large-scale motors or single-phase split-pole motors or collector motors.

The p.f. controller monitors single and three-phase asynchronous motors up to approx. 5 A (without current transformer) for underload and no-load operation. This is phase-sequence-independent and increases plant availability. Typical applications are fan monitoring in the case of V-belt breakage, pump monitoring in the event of valve closure or dry runs. A current transformer is used for higher rated currents.

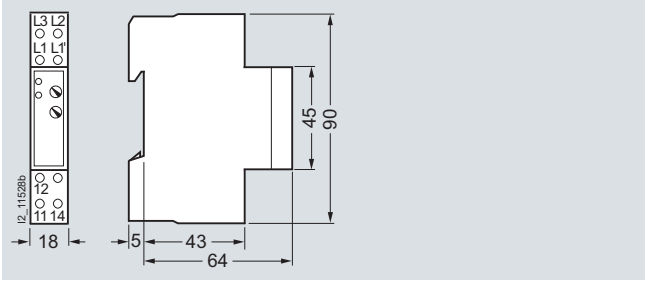
If the p.f. value set at the p.f. controller is fallen below for the duration of the set response delay, the output relay switches to the alarm state and the red LED lights up. If it exceeds the p.f. value, the output relay switches back without any significant delay.

- Adjustable p.f. response value from 0 to 0.97
- Current range up to 8 A
- LED display for operation and alarm
- Automatic resetting of alarm.

Technical specifications

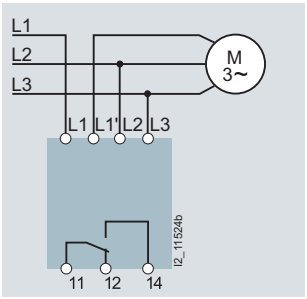
			5TT3 472
Standards			IEC/EN 60255, VDE 0435
Rated control voltage U_c		3 V AC	400
Primary operating range	With AC supply	× U_c	0.8 ... 1.1
Frequency range f_n		Hz	45 ... 65
Rated power dissipation P_v		VA	Approx. 11
Rated impulse withstand voltage U_{imp}	Against contacts	kV	< 4
Current measuring circuits			For AC systems
Current measuring range I_{meas}		A AC	0.4 ... 8
Short-time load carrying capacity	For 2 s For 0.5 s	A A	20 40
Current transformer, Class 3 or better	Secondary current	A	1 or 5
Setting range	adjustable	P.f.	0 ... 0.97
Response delay	adjustable	s	1 ... 100
Short-circuit strength	fuse 4 A gL	A	4
Contacts	µ contact		1 CO
• Rated operational voltage U_e		V AC	250
• Rated operational current I_e	Thermal current AC-15 NO contacts AC-15 NC contacts AC-13 at 24 V DC	A A A A	4 3 1 1
• Minimum contact load		V; mA	10; 100
Connections			
• Terminals	±screw (Pozidriv)		PZ 2
• Conductor cross-sections - Rigid - Flexible, with end sleeve	 Max. Min.	 mm^2 mm^2	 2 × 2.5 1 × 0.5
Permissible ambient temperature		°C	-20 ... +60
Resistance to climate	Acc. to EN 60068-1		20/60/4
Degree of protection	Acc. to EN 60529		IP20, with connected conductors

Dimensional drawings

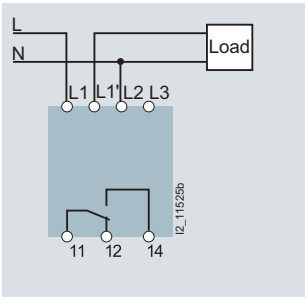


5TT3 472

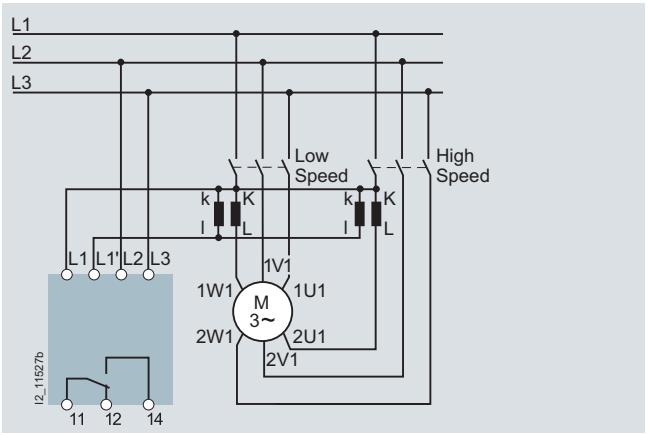
Schematics



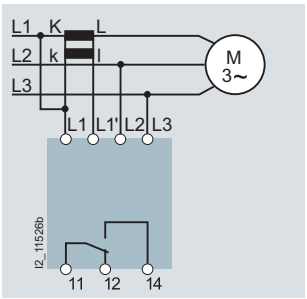
Connection of three-phase load



Connection of single-phase load



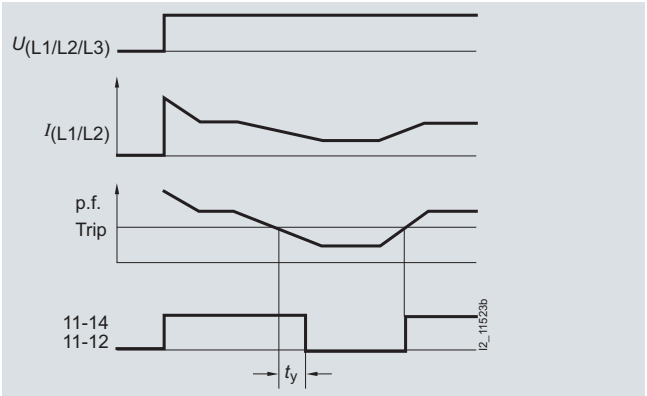
Connection of motors with separate windings



Connection of three-phase load with external current transformer, whereby the winding sense of the current transformer must be taken into account.

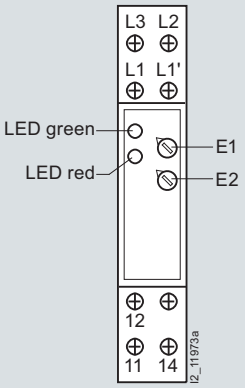
More information

Function charts



If the p.f. value set at the p.f. controller has fallen below for the duration of the set response delay, the output relay switches to the alarm state and the red LED lights up. Contact 11–14 closes and the red LED lights up.

Front view



LED green: Status display (*U*)
LED red: Underloading indicator (p.f. alarm)
E1: Response value
E2: Response delay t_y

Motor protection relays, 5TT3

Overview

Thermistor motor protection relays monitor the thermistors wound in motors. This helps prevent thermal motor overloads, e.g. due to high switching frequency, single-phasing, disabled cooling or excessive ambient temperatures. Up to 6 thermistors in series can be monitored. A conductor break in the sensor conductor will immediately trip the device. The device can also be used for monitoring wound quick-break switches - e.g. bimetal thermostats. This offers all-round motor protection.

- For the detection of
  - Temperature limits being exceeded
  - Wire breaks in sensor circuits
- 1 input for 1 to 6 thermistors
- With 2 LEDs green/red for ready-to-run and fault
- Response value: 3.2 to 3.8 kΩ
- Release value: 1.5 to 1.8 kΩ
- Max. cable length of sensor supply cable NYM 2 × 1.5 is 100 m
- Remote Reset: over A1/A2 (NC contact) or over X1/X2 (NO contact)

LED displays:

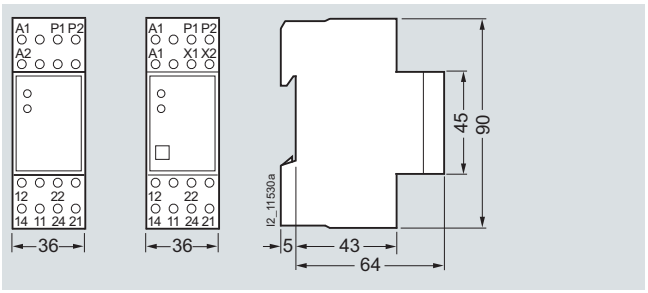
- Green LED: lights up when operational voltage is applied
- Red LED: lights up in the event of overtemperatures or an interruption in the sensor circuit.

Technical specifications

			5TT3 431 **5TT3 432**
Standards			IEC 60255; DIN VDE 0435-110
Rated control voltage U_c		V AC	230
Primary operating range		$\times U_c$	0.9 ... 1.1
Rated frequency		Hz	50/60
Response value		kΩ	3.2 ... 3.8
Release value		kΩ	1.5 ... 1.8
Minimum contact load		V; mA	10; 100
Rated insulation voltage U_i	Between coil/contact	kV	4
Rated impulse withstand voltage U_{imp}	Actuator/contact	kV	> 2.5
Contacts	μ contact (AC-11)	A	3
• Rated operational voltage U_e		V AC	230
• Rated operational current I_e		A	5
	Actuator/contact	mm	4
Connections			
• Terminals	±screw (Pozidriv)		PZ 1
• Conductor cross-sections			
- Rigid	Max.	mm^2	2 × 2.5
- Lexible, with end sleeve	Min.	mm^2	1 × 0.5
Permissible ambient temperature		°C	-20 ... +60
Resistance to climate	According to EN 60068-1		20/60/4

Dimensional drawings

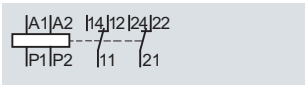
5TT3 43 thermistor motor protection relays



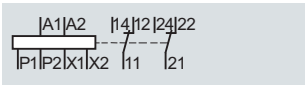
5TT3 431 5TT3 432

Schematics

Diagram

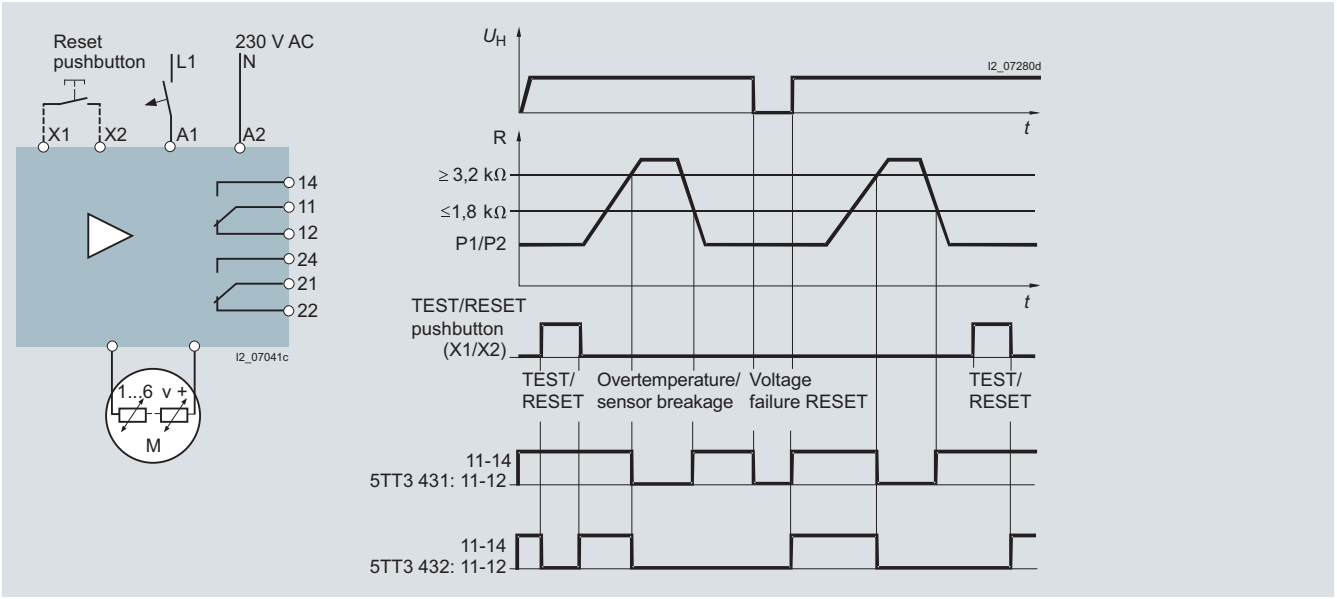


5TT3 431



5TT3 432

Circuit examples: 5TT3 431, 5TT3 432



If one of the thermistors (possible for up to 6) reaches the response temperature, the device switches.

5TT3 431 (without terminals X1/X2 and without Reset button) switches back on after cooling and after the value falls below that permanently set for the hysteresis. To switch on before this time, briefly disconnect the power supply.

5TT3 432 stores the fault and remains switched off until the Reset button is pressed.

Notes

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