SIPROTEC 7SJ600 numerical overcurrent, motor and overload protection relay

Fig. 5/19 SIPROTEC 7SJ600 numerical overcurrent, motor and overload protection relay

Description

The SIPROTEC 7SJ600 is a numerical overcurrent relay which, in addition to its primary use in radial distribution networks and motor protection, can also be employed as backup for feeder, transformer and generator differential protection.

The SIPROTEC 7SJ600 provides definite-time and inverse-time overcurrent protection along with overload and negative-sequence protection for a very comprehensive relay package. In this way, equipment such as motors can be protected against asymmetric and excessive loading. Asymmetric short-circuits with currents that can be smaller than the largest possible load currents or phase interruptions are reliably detected.

Function overview

Feeder protection

- Overcurrent-time protection
- Ground-fault protection
- Overload protection
- Negative-sequence protection
- Cold load pickup
- Auto-reclosure
- Trip circuit supervision

Motor protection

- Starting time supervision
- Locked rotor

Control functions

- Commands for control of a circuit-breaker
- Control via keyboard, DIGSI 4 or SCADA system

Measuring functions

- Operational measured values I

Monitoring functions

- Fault event logging with time stamp (buffered)
- 8 oscillographic fault records
- Continuous self-monitoring

Communication

- Via personal computer and DIGSI 3 or DIGSI 4 (≥ 4.3)
- Via RS232 – RS485 converter
- Via modem
- IEC 60870-5-103 protocol, 2 kV-isolated
- RS485 interface

Hardware

- 3 current transformers
- 3 binary inputs
- 3 output relays
- 1 live status contact

Application

Wide range of applications

The SIPROTEC 7SJ600 is a numerical overcurrent relay which, in addition to its primary use in radial distribution networks and motor protection, can also be employed as backup for feeder, transformer and generator differential protection.

The SIPROTEC 7SJ600 provides definite-time and inverse-time overcurrent protection along with overload and negative-sequence protection for a very comprehensive relay package. In this way, equipment such as motors can be protected against asymmetric and excessive loading. Asymmetric short-circuits with currents that can be smaller than the largest possible load currents or phase interruptions are reliably detected.

The integrated control function allows simple control of a circuit-breaker or disconnector (electrically operated/motorized switch) via the integrated HMI, DIGSI 3 or DIGSI 4 (≥ 4.3) or SCADA (IEC 60870-5-103 protocol).

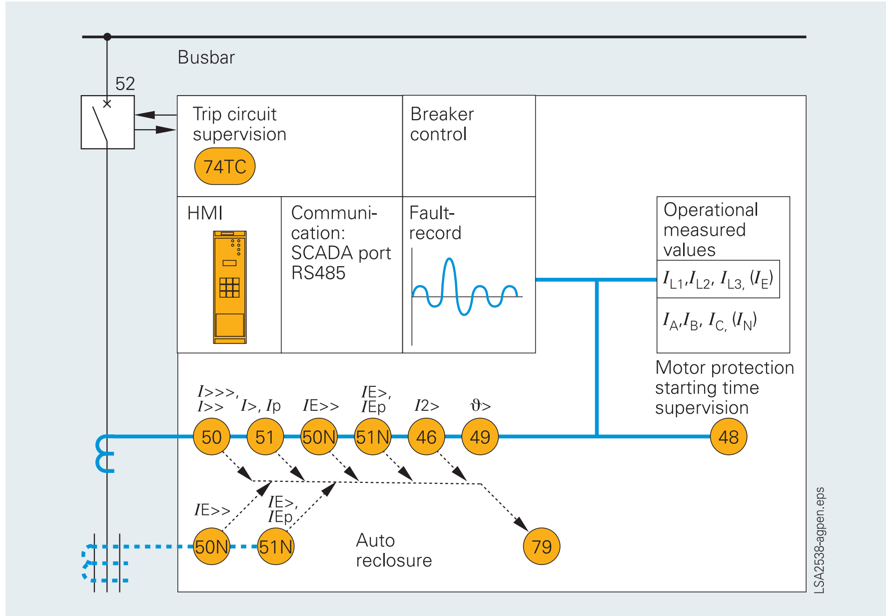

Fig. 5/20 Typical application

ANSI	IEC	Protection functions
50, 50N	I>, I>>, I>>> I_E>, I_E>>	Instantaneous overcurrent protection
50, 51N	I_p, I_{Ep}	Inverse overcurrent protection (phase/neutral)
79		Auto-reclosure
46	I_2	Phase-balance current protection (negative-sequence protection)
49	ϑ>	Thermal overload protection
48		Starting time supervision
74TC		Trip circuit supervision breaker control

Fig. 5/21 SIPROTEC 7SJ600 numerical overcurrent, motor and overload protection relay

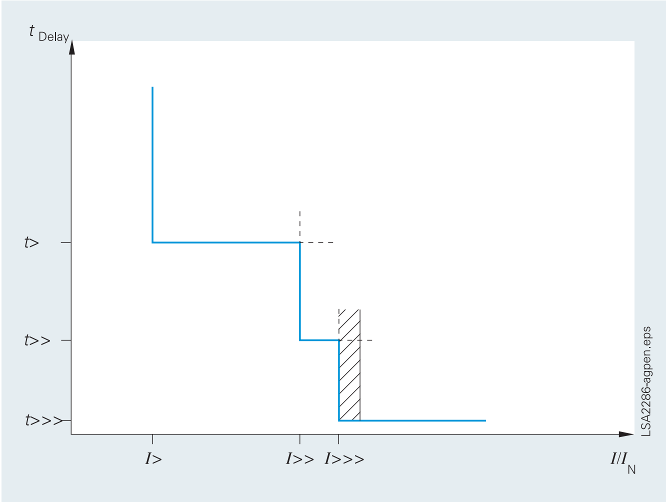

Fig. 5/22 Definite-time overcurrent characteristic

Construction

The relay contains all the components needed for

- Acquisition and evaluation of measured values
- Operation and display
- Output of signals and trip commands
- Input and evaluation of binary signals
- SCADA interface (RS485)
- Power supply.

The rated CT currents applied to the SIPROTEC 7SJ600 can be 1 or 5 A. This is selectable via a jumper inside the relay.

Two different housings are available. The flush-mounting/ cubicle-mounting version has terminals accessible from the rear. The surface-mounting version has terminals accessible from the front.

Protection functions

Definite-time characteristics

The definite-time overcurrent function is based on phase-selective measurement of the three phase currents and/or ground current.

Optionally, the earth (ground) current I_E (Gnd) is calculated or measured from the three line currents $I_{L1}(I_A)$, $I_{L2}(I_B)$ and $I_{L3}(I_C)$.

The definite-time overcurrent protection for the 3 phase currents has a low-set overcurrent element (*I*>), a high-set overcurrent element (*I*>>) and a high-set instantaneous-tripping element (*I*>>>). Intentional trip delays can be parameterized from 0.00 to 60.00 seconds for the low-set and high-set overcurrent elements. The instantaneous zone *I*>>> trips without any intentional delay. The definite-time overcurrent protection for the earth (ground) current has a low-set overcurrent element (I_E>) and a high-set overcurrent element (I_E>>). Intentional trip delays can be parameterized from 0.00 to 60.00 seconds.

Inverse-time characteristics

In addition, invese-time overcurrent protection characteristics (IDMTL) can be activated.

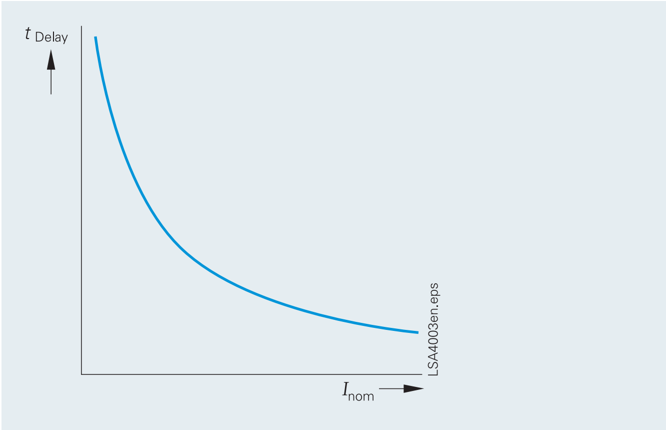

Fig. 5/23 Inverse-time overcurrent characteristic

Available inverse-time characteristics		
Characteristics acc. to	*ANSI/IEEE*	*IEC 60255-3*
Inverse	•	•
Short inverse	•	
Long inverse	•	•
Moderately inverse	•	
Very inverse	•	•
Extremely inverse	•	•
Definite inverse	•	
I squared *T*	•	

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Thermal overload protection (ANSI 49)

The thermal overload protection function provides tripping or alarming based on a thermal model calculated from phase currents.

Thermal overload protection without preload

For thermal overload protection without consideration of the preload current, the following tripping characteristic applies only when

$I \geq 1.1 \cdot I_L$

For different thermal time constants T_L, the tripping time t is calculated in accordance with the following equation:

$$t = \frac{35}{\left(\frac{I}{I_L}\right)^2 - 1} \cdot T_L$$

I = Load current
I_L = Pickup current
T_L = Time multiplier

The reset threshold is above $1.03125 \cdot I/I_N$

Thermal overload protection with preload

The thermal overload protection with consideration of preload current constantly updates the thermal model calculation regardless of the magnitude of the phase currents. The tripping time t is calculated in accordance with the following tripping characteristic (complete memory in accordance with IEC 60255-8).

$$t = t \cdot \ln \frac{\left(\frac{I}{k \cdot I_N}\right)^2 - \left(\frac{I_{pre}}{k \cdot I_N}\right)^2}{\left(\frac{I}{k \cdot I_N}\right)^2 - 1}$$

t = Tripping time after beginning of the thermal overload
τ = $35.5 \cdot T_L$
I_{pre} = Pre-load current
T_L =Time multiplier
I = Load current
k = k factor (in accordance with IEC 60255-8)
ln = Natural logarithm
I_N = Rated (nominal) current

Negative-sequence protection (I_2>>, I_2>/ANSI 46 Unbalanced-load protection)

The negative-sequence protection (see Fig. 5/24) detects a phase failure or load unbalance due to network asymmetry. Interruptions, short-circuits or crossed connections to the current transformers are detected.

Furthermore, low level single-phase and two-phase short-circuits (such as faults beyond a transformer) as well as phase interruptions can be detected.

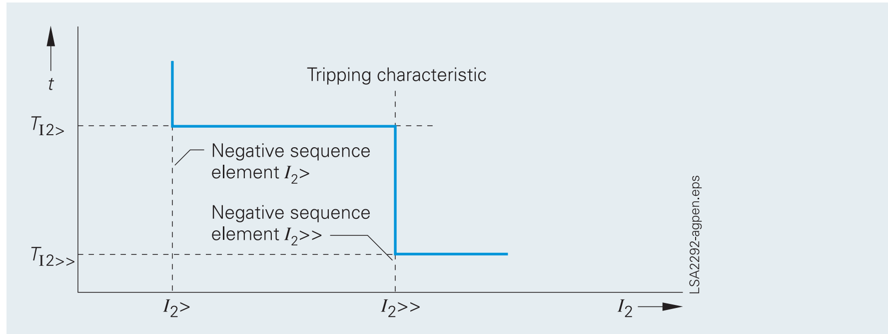

Fig. 5/24 Tripping characteristic of the negative-sequence protection function

This function is especially useful for motors since negative sequence currents cause impermissible overheating of the rotor.

In order to detect the unbalanced load, the ratio of negative phase-sequence current to rated current is evaluated.

I_2 = Negative-sequence current
T_{I2} = Tripping time

Transformer protection

The high-set element permits current coordination where the overcurrent element functions as a backup for the lower-level protection relays, and the overload function protects the transformer from thermal overload. Low-current single-phase faults on the low voltage side that result in negative phase-sequence current on the high-voltage side can be detected with the negative-sequence protection.

Cold load pickup

By means of a binary input which can be wired from a manual close contact, it is possible to switch the overcurrent pickup settings to less sensitive settings for a programmable duration of time. After the set time has expired, the pickup settings automatically return to their original setting. This can compensate for initial inrush when energizing a circuit without compromising the sensitivity of the overcurrent elements during steady state conditions.

3-pole multishot auto-reclosure (AR, ANSI 79)

Auto-reclosure (AR) enables 3-phase auto-reclosing of a feeder which has previously been disconnected by overcurrent protection.

Trip circuit supervision (ANSI 74TC)

One or two binary inputs can be used for the trip circuit monitoring.

Control

The relay permits circuit-breakers to be opened and closed without command feedback. The circuit-breaker/disconnector may be controlled by DIGSI, or by the integrated HMI, or by the LSA/SCADA equipment connected to the interface.

For further details please refer to part 2 “Overview”.

Switch-onto-fault protection

If switched onto a fault, instantaneous tripping can be effected. If the internal control function is used (local or via serial interface), the manual closing function is available without any additional wiring. If the control switch is connected to a circuit-breaker bypassing the internal control function, manual detection using a binary input is implemented.

Busbar protection (Reverse interlocking)

Binary inputs can be used to block any of the six current stages. Parameters are assigned to decide whether the input circuit is to operate in open-circuit or closed-circuit mode. In this case, reverse interlocking provides high-speed busbar protection in radial or ring power systems that are opened at one point. The reverse interlocking principle is used, for example, in medium-voltage power systems and in switchgear for power plants, where a high-voltage system transformer feeds a busbar section with several medium-voltage outgoing feeders.

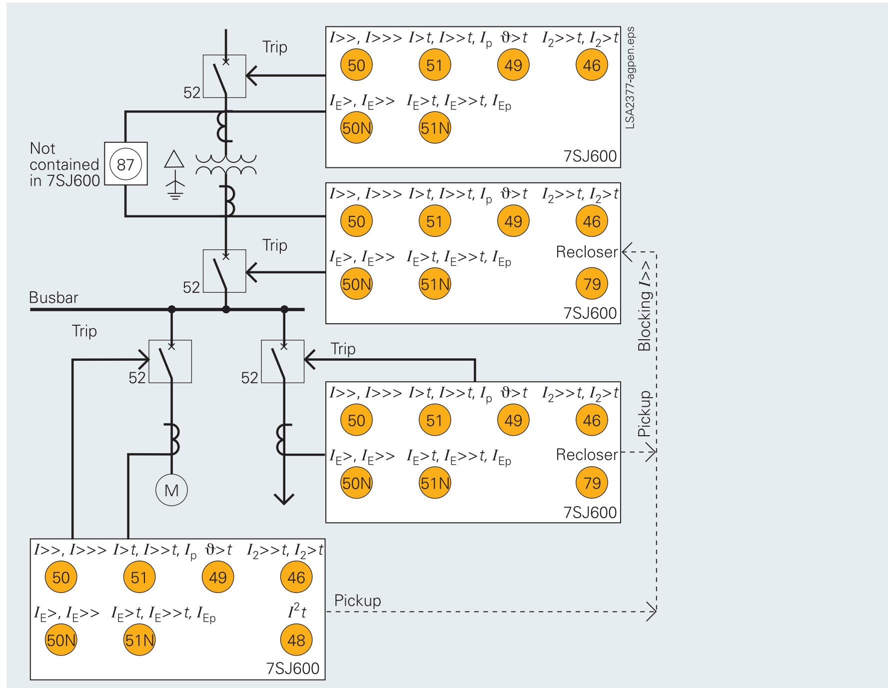

Fig. 5/25 Reverse interlocking

Motor protection

For short-circuit protection, e.g. elements I>> (50) and I_E (50N) are available. The stator is protected against thermal overload by ϑ_s> (49), the rotor by I_2> (46), starting time supervision (48).

Motor starting time supervision (ANSI 48)

The start-up monitor protects the motor against excessively long starting. This can occur, for example, if the rotor is blocked, if excessive voltage drops occur when the motor is switched on or if excessive load torques occur. The tripping time depends on the current.

$$t_{TRIP} = \left(\frac{I_{start}}{I_{rms}}\right)^2 \cdot t_{startmax}$$

for $I_{rms} > I_{start}$, reset ratio $\frac{I_N}{I_{start}}$

approx. 0.94

t_{TRIP} = Tripping time

I_{start} = Start-up current of the motor

$t_{start\ max}$ = Maximum permissible starting time

I_{rms} = Actual current flowing

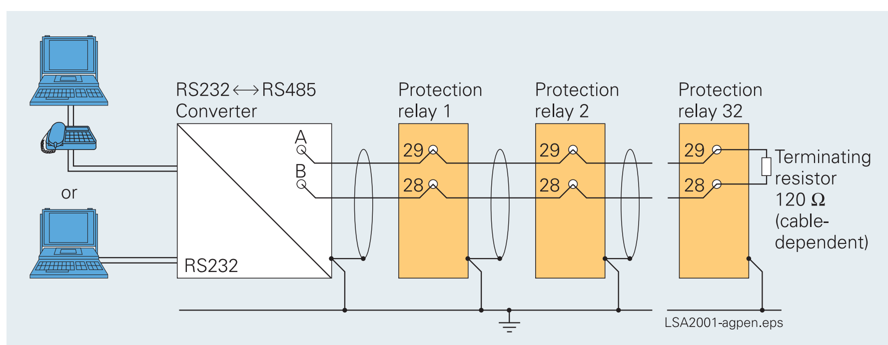

Fig. 5/26 Wiring communication
For convenient wiring of the RS485 bus, use bus cable system 7XV5103 (see part 14 of this catalog).

Features

Serial data transmission

A PC can be connected to ease setup of the relay using the Windows-based program DIGSI which runs under MS-Windows.

It can also be used to evaluate up to 8 oscillographic fault records, 8 fault logs and 1 event log containing up to 30 operational indications. The SIPROTEC 7SJ600 transmits a subset of data via IEC 60870-5-103 protocol:

- General fault detection
- General trip
- Phase current I_{L2}
- User-defined message
- Breaker control
- Oscillographic fault recording

Connection diagrams

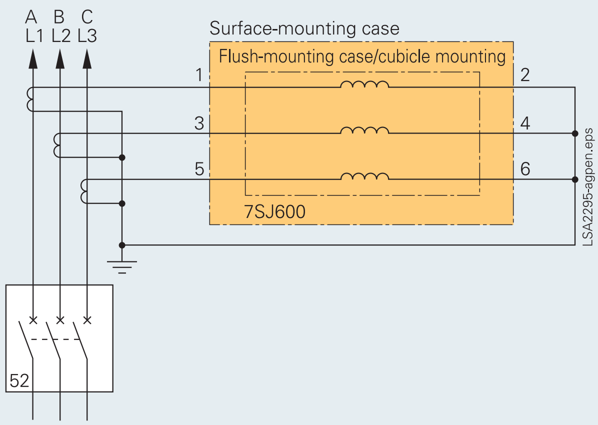

Fig. 5/27 Connection of 3 CTs with measurement of the phase currents

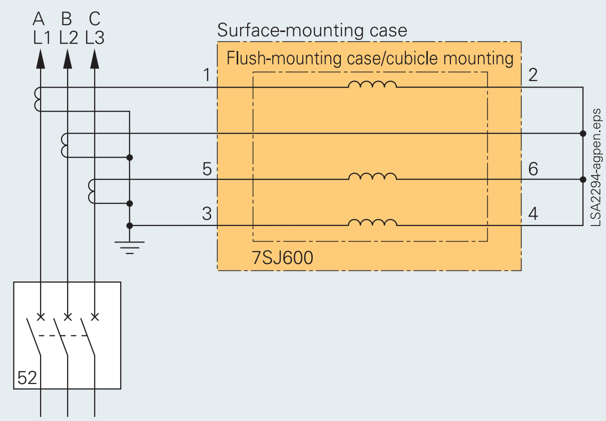

Fig. 5/28 Connection of 3 CTs with measurement of the earth (ground) current

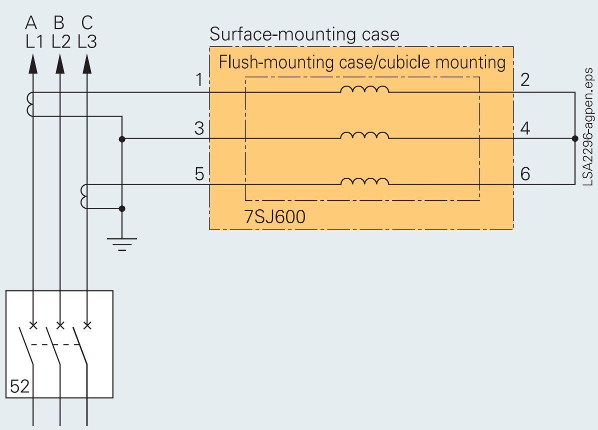

Fig. 5/29 Connection of 2 CTs only for isolated or resonant-earthed (grounded) power systems

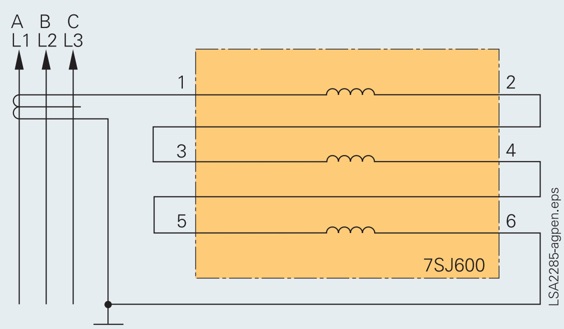

Fig. 5/30 Sensitive ground-fault protection (3-times increased sensitivity)

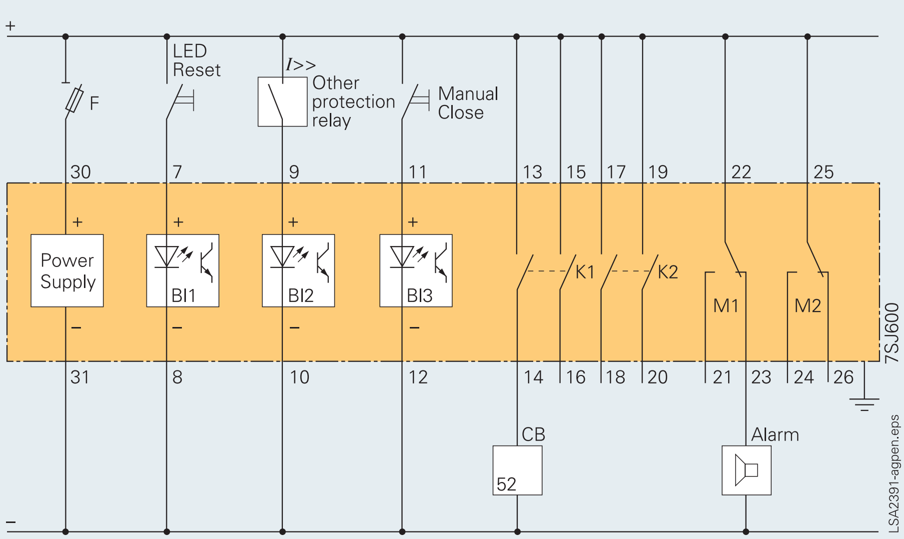

Fig. 5/31 Example of typical wiring

General unit data	
CT circuits	
Rated current I_N	1 or 5 A
Rated frequency f_N	50/60 Hz (selectable)
Overload capability current path Thermal (r.m.s.)	 100 x I_N for ≤ 1 s 30 x I_N for ≤ 10 s 4 x I_N continuous
Dynamic (pulse current)	250 x I_N one half cycle
Power consumption Current input at I_N = 1 A at I_N = 5 A	 < 0.1 VA < 0.2 VA
Power supply via integrated DC/DC converter	
Rated auxiliary voltage V_{aux} / permissible variations	DC 24, 48 V/± 20 % DC 60, 110/125 V/± 20 % DC 220, 250 V/± 20 % AC 115 V/–20 % +15 % AC 230 V/–20 % +15 %
Superimposed AC voltage, peak-to-peak at rated voltage at limits of admissible voltage	 ≥ 12 % ≥ 6 %
Power consumption Quiescent Energized	 Approx. 2 W Approx. 4 W
Bridging time during failure/ short-circuit of auxiliary voltage	≤ 50 ms at V_{aux} ≤ DC 110 V ≤ 20 ms at V_{aux} ≤ DC 24 V
Binary inputs	
Number	3 (marshallable)
Operating voltage	DC 24 to 250 V
Current consumption, independent of operating voltage	Approx. 2.5 mA
Pickup threshold, reconnectable by solder bridges Rated aux. voltage DC 24/48/60 V V_{pickup} $V_{drop\text{-}out}$	 ≥ DC 17 V < DC 8 V
DC 110/125/220/250 V V_{pickup} $V_{drop\text{-}out}$	 ≥ DC 74 V < DC 45 V
Signal contacts	
Signal/alarm relays	2 (marshallable)
Contacts per relay	1 CO
Switching capacity Make Break	 1000 W / VA 30 W / VA
Switching voltage	250 V
Permissible current	5 A

Heavy-duty (command) contacts	
Trip relays, number	2 (marshallable)
Contacts per relay	2 NO
Switching capacity Make Break	 1000 W / VA 30 W / VA
Switching voltage	250 V
Permissible current Continuous For 0.5 s	 5 A 30 A
Design	
Housing 7XP20	Refer to part 14 for dimension drawings
Weight Flush mounting /cubicle mounting Surface mounting	 Approx. 4 kg Approx. 4.5 kg
Degree of protection acc. to EN 60529 Housing Terminals	 IP51 IP21

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Serial interface	
Interface, serial; isolated	
Standard	RS485
Test voltage	DC 2.8 kV for 1 min
Connection	Data cable at housing terminals, two data wires, one frame reference, for connection of a personal computer or similar; core pairs with individual and common screening, screen must be earthed (grounded), communication possible via modem
Transmission speed	As delivered 9600 baud min. 1200 baud, max. 19200 baud

Electrical tests	
Specifications	
Standards	IEC 60255-5; ANSI/IEEE C37.90.0
Insulation test	
Standards	IEC 60255-5, ANSI/IEEE C37.90.0
High-voltage test (routine test) Except DC voltage supply input and RS485	 2 kV (r.m.s.), 50 Hz
Only DC voltage supply input and RS485	DC 2.8 kV
High-voltage test (type test) Between open contacts of trip relays	1.5 kV (r.m.s.), 50 Hz
Between open contacts of alarm relays	1 kV (r.m.s.), 50 Hz
Impulse voltage test (type test) all circuits, class III	5 kV (peak), 1.2/50 µs, 0.5 J, 3 positive and 3 negative impulses at intervals of 5 s

EMC tests for interference immunity; type tests	
Standards	IEC 60255-6; IEC 60255-22 (product standard) EN 50082-2 (generic standard), DIN VDE 0435 Part 303
High-frequency test IEC 60255-22-1, class III	2.5 kV (peak), 1 MHz, τ = 15 ms, 400 surges/s, duration 2 s
Electrostatic discharge IEC 60255-22-2, class III and IEC 61000-4-2, class III	4 kV/6 kV contact discharge, 8 kV air discharge, both polarities, 150 pF, R_i=330 Ω
Irradiation with radio-frequency field	
Non-modulated, IEC 60255-22-3 (report) class III	10 V/m, 27 to 500 MHz
Amplitude modulated, IEC 61000-4-3, class III	10 V/m, 80 to 1000 MHz, 80 % AM, 1 kHz
Pulse modulated, IEC 61000-4-3, class III	10 V/m, 900 MHz, repetition frequency, 200 Hz, duty cycle 50 %
Fast transient interference/bursts IEC 60255-22-4 and IEC 61000-4-4, class III	2 kV, 5/50 ns, 5 kHz, burst length 15 ms, repetition rate 300 ms, both polarities, R_i = 50 Ω, duration 1 min
Conducted disturbances induced by radio-frequency fields, amplitude modulated IEC 601000-4-6, class III	10 V, 150 kHz to 80 MHz, 80 % AM, 1 kHz
Power frequency magnetic field IEC 61000-4-8, class IV IEC 60255-6	30 A/m continuous, 50 Hz 300 A/m for 3 s, 50 Hz 0.5 mT; 50 Hz
Oscillatory surge withstand capability ANSI/IEEE C37.90.1 (common mode)	2.5 to 3 kV (peak), 1 MHz to 1.5 MHz, decaying oscillation, 50 shots per s, duration 2 s, R_i = 150 Ω to 200 Ω
Fast transient surge withstand capability ANSI/IEEE C37.90.1 (commom mode)	4 to 5 kV, 10/150 ns, 50 surges per s, both polarities, duration 2 s, R_i = 80 Ω
Radiated electromagnetic interference, ANSI/IEEE C37.90.2	10 to 20 V/m, 25 to 1000 MHz, amplitude and pulse-modulated
High-frequency test Document 17C (SEC) 102	2.5 kV (peak, alternating polarity), 100 kHz, 1 MHz, 10 MHz and 50 MHz, decaying oscillation, R_i = 50 W
EMC tests for interference emission; type tests	
Standard	EN 50081-* (generic standard)
Conducted interference voltage, aux. voltage CISPR 22, EN 55022, DIN VDE 0878 Part 22, limit value class B	150 kHz to 30 MHz
Interference field strength CISPR 11, EN 55011, DIN VDE 0875 Part 11, limit value class A	30 to 1000 MHz

Mechanical stress tests	
Vibration, shock and seismic vibration	
During operation	
Standards	Acc. to IEC 60255-2-1 and IEC 60068-2
Vibration IEC 60255-21-1, class1 IEC 60068-2-6	Sinusoidal 10 to 60 Hz: ± 0.035 mm amplitude, 60 to 150 Hz: 0.5 *g* acceleration Sweep rate 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60255-21-2, class 1	Half-sine, acceleration 5 *g*, duration 11 ms, 3 shocks in each direction of 3 orthogonal axes
Seismic vibration IEC 60255-21-3, class 1, IEC 60068-3-3	Sinusoidal 1 to 8 Hz: ± 3.5 mm amplitude (horizontal axis) 1 to 8 Hz: ± 1.5 mm amplitude (vertical axis) 8 to 35 Hz: 1 *g* acceleration (horizontal axis) 8 to 35 Hz: 0.5 *g* acceleration (vertical axis) Sweep rate 1 octave/min 1 cycle in 3 orthogonal axes
During transport	
Vibration IEC 60255-21-1, class 2 IEC 60068-2-6	Sinusoidal 5 to 8 Hz: ± 7.5 mm amplitude; 8 to 150 Hz: 2 *g* acceleration Sweep rate 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60255-21-2, class 1 IEC 60068-2-27	Half-sine, acceleration 15 *g*, duration 11 ms, 3 shocks in each direction of 3 orthogonal axes
Continuous shock IEC 60255-21-2, class 1 IEC 60068-2-29	Half-sine, acceleration 10 *g* duration 16 ms, 1000 shocks in each direction of 3 orthogonal axes

Climatic stress tests	
Temperatures	
Recommended temperature during operation	 −5 °C to +55 °C / +23 °F to +131 °F > 55 °C decreased display contrast
Permissible temperature during operation during storage during transport (Storage and transport with standard works packaging)	 −20 °C to +70 °C / −4 °F to +158 °F −25 °C to +55 °C / −13 °F to +131 °F −25 °C to +70 °C / −13 °F to +158 °F
Humidity	
	Mean value per year ≤ 75 % relative humidity, on 30 days per year 95 % relative humidity, condensation not permissible

Functions	
Definite-time overcurrent protection (ANSI 50, 50N)	
Setting range/steps	
Overcurrent pickup phase I	I/I_N = 0.1 to 25 (steps 0.1), or ∞
ground I_E>	= 0.05 to 25 (steps 0.01), or ∞
phase I>>	I/I_N = 0.1 to 25 (steps 0.1), or ∞
ground I_E>>	= 0.05 to 25 (steps 0.01), or ∞
phase I>>>	I/I_N = 0.3 to 12.5 (steps 0.1), or ∞
Delay times T for I>, I_E>, I>> and I_E>>	0 s to 60 s (steps 0.01 s)
The set times are pure delay times	
Pickup times I>, I>>, I_E>, I_E>>	
At 2 x setting value, without meas. repetition	Approx. 35 ms
At 2 x setting value, with meas. repetition	Approx. 50 ms
Pickup times for I>>> at 2 x setting value	Approx. 20 ms
Reset times I>, I>>, I_E>, I_E> I>>>	Approx. 35 ms Approx. 65 ms
Reset ratios	Approx. 0.95
Overshot time	Approx. 25 ms
Tolerances	
Pickup values I>, I>>, I>>>, I_E>, I_E>>	5 % of setting value
Delay times T	1 % of setting value or 10 ms
Influencing variables	
Auxiliary voltage, range: $0.8 \le V_{aux}/V_{auxN} \le 1.2$	≤ 1 %
Temperature, range: $0\ °C \le \Theta_{amb} \le 40\ °C$	≤ 0.5 %/10 K
Frequency, range: $0.98 \le f/f_N \le 1.02$	≤ 1.5 %
Frequency, range: $0.95 \le f/f_N \le 1.05$	≤ 2.5 %
Harmonics	
Up to 10 % of 3rd harmonic	≤ 1 %
Up to 10 % of 5th harmonic	≤ 1 %
Inverse-time overcurrent protection (ANSI 51/51N)	
Setting range/steps	
Overcurrent pickup phase I_p	I/I_N = 0.1 to 4 (steps 0.1)
ground I_{Ep}	= 0.05 to 4 (steps 0.01)
Time multiplier for I_p, I_{Ep} T_p	(IEC charac.) 0.05 to 3.2 s (steps 0.01 s) (ANSI charac.) 0.5 to 15 s (steps 0.1 s)
Overcurrent pickup phase I>>	I/I_N = 0.1 to 25 (steps 0.1), or ∞
phase I>>>	= 0.3 to 12.5 (steps 0.1), or ∞
ground I_E>>	= 0.05 to 25 (steps 0.01), or ∞
Delay time T for I>>, I_E>>	0 s to 60 s (steps 0.01 s)
Tripping time characteristics acc. to IEC	
Pickup threshold	Approx. 1.1 x I_p
Drop-out threshold	Approx. 1.03 x I_p
Drop-out time	Approx. 35 ms
Tripping time characteristics acc. to ANSI / IEEE	
Pickup threshold	Approx. 1.06 x I_p
Drop-out threshold, alternatively: disk emulation	Approx. 1.03 x I_p

Tolerances			
Pickup values	5 %		
Delay time for $2 \le I/I_p \le 20$ and $0.5 \le I/I_N \le 24$	5 % of theoretical value ± 2 % current tolerance, at least 30 ms		
Influencing variables			
Auxiliary voltage, range: $0.8 \le V_{aux}/V_{auxN} \le 1.2$	≤ 1 %		
Temperature, range: $-5\ °C \le \Theta_{amb} \le 40\ °C$ $+23\ °F \le \Theta_{amb} \le 104\ °F$	≤ 0.5 %/10 K		
Frequency, range: $0.95 \le f/f_N \le 1.05$	≤ 8 % referred to theoretical time value		
Negative-sequence overcurrent protection (ANSI 46)			
Setting range/steps			
Tripping stage			
I_2> in steps of 1 %	8 % to 80 % of I_N		
I_2>> in steps of 1 %	8 % to 80 % of I_N		
Time delays $T(I_2>)$, $T(I_2>>)$ in steps of 0.01s	0.00 s to 60.00 s		
Lower function limit	At least one phase current ≥ 0.1 x I_N		
Pickup times	At f_N =	50 Hz	60 Hz
Tripping stage I_2>, tripping stage I_2>>	Approx.	60 ms	75 ms
But with currents I/I_N >1.5 (overcurrent case) or negative-sequence current < (set value +0.1 x I_N)	Approx.	200 ms	310 ms
Reset times	At f_N =	50 Hz	60 Hz
Tripping stage I_2>, tripping stage I_2>>	Approx.	35 ms	42 ms
Reset ratios			
Tripping stage I_2>, tripping stage I_2>>	Approx. 0.95 to 0.01 x I_N		
Tolerances			
Pickup values I_2>, I_2>>			
with current $I/I_N \le 1.5$	± 1 % of I_N ± 5 % of set value		
with current $I/I_N > 1.5$	± 5 % of I_N ± 5 % of set value		
Stage delay times	± 1 % or 10 ms		
Influence variables			
Auxiliary DC voltage, range: $0.8 \le V_{aux}/V_{auxN} \le 1.2$	≤ 1 %		
Temperature, range: $-5\ °C \le \Theta_{amb} \le +40\ °C$ $+23\ °F \le \Theta_{amb} \le +104\ °F$	≤ 0.5 %/10 K		
Frequency, range: $0.98 \le f/f_N \le 1.02$	≤ 2 % of I_N		
range: $0.95 \le f/f_N \le 1.05$	≤ 5 % of I_N		
Auto-reclosure (option) (ANSI 79)			
Number of possible shots	1 up to 9		
Auto-reclose modes	3-pole		
Dead times for 1st to 3rd shot	0.05 s to 1800 s (steps 0.01 s)		
for 4th and any further shot	0.05 s to 1800 s (steps 0.01 s)		
Reclaim time after successful AR	0.05 s to 320 s (steps 0.01 s)		
Lock-out time after unsuccessful AR	0.05 s to 320 s (steps 0.01 s)		
Reclaim time after manual close	0.50 s to 320 s (steps 0.01 s)		
Duration of RECLOSE command	0.01s to 60 s (steps 0.01 s)		
Control			
Number of devices	1		
Evaluation of breaker control	None		

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Thermal overload protection with memory (ANSI 49) (total memory according to IEC 60255-8)	
Setting ranges Factor k acc. to IEC 60255-8 Thermal time constant τ_{th} Thermal alarm stage $\Theta_{alarm}/\Theta_{trip}$	 0.40 to 2 (steps 0.01) 1 to 999.9 min (steps 0.1 min) 50 to 99 % referred to trip temperature rise (steps 1 %)
Prolongation factor at motor stand-still k_{τ}	1 to 10 (steps 0.01)
Reset ratios Θ/Θ_{trip} Θ/Θ_{alarm}	 Reset below Θ_{alarm} Approx. 0.99
Tolerances Referring to k · I_N Referring to trip time	 ± 5 % (class 5 % acc. to IEC 60255-8) ± 5 % ± 2 s (class 5 % acc. to IEC 60255-8)
Influence variables referred to k · I_N Auxiliary DC voltage in the rangeof $0.8 \le V_{aux}/V_{auxN} \le 1.2$	 ≤ 1%
Temperature, range: $-5\ °C \le \Theta_{amb} \le +40\ °C$ $+23\ °F \le \Theta_{amb} \le +104\ °F$ Frequency, range: $0.95 \le f/fN \le 1.05$	 ≤ 0.5 % / 10 K ≤ 1%
Without pickup value I_L/I_N	0.4 to 4 (steps 0.1)
Memory time multiplier T_L (= t_6 -time)	1 to 120 s (steps 0,1 s)
Reset ratio I/I_L	Approx. 0.94
Tolerances Referring to pickup threshold 1.1· I_L Referring to trip time	 ±5% ±5% ± 2 s
Influence variables Auxiliary DC voltage in the range of $0.8 \le V_{aux}/V_{auxN} \le 1.2$ Temperature, range: $-5\ °C \le \Theta_{amb} \le +40\ °C$ $+23\ °F \le \Theta_{amb} \le +104\ °F$ Frequency, range: $0.95 \le f/f_N \le 1.05$	 ≤1% ≤ 0.5%/10 K ≤1%

Starting time supervision (motor protection)	
Setting ranges Permissible starting current I_{Start}/I_N	 0.4 to 20 (steps 0.1)
Permissible starting time t_{Start}	1 to 360 s (steps 0.1 s)
Tripping characteristic	$t = \left(\frac{I_{Start}}{I_{rms}}\right)^2 \cdot t$ for $I_{rms} > I_{Start}$
Reset ratio I_{rms}/I_{Start}	Approx. 0.94
Tolerances Pickup value Delay time	 5% 5 % of setting value or 330 ms

Fault recording	
Measured values	I_{L1}, I_{L2}, I_{L3}
Start signal	Trip, start release, binary input
Fault storage Total storage time (fault detection or trip command = 0 ms)	Max. 8 fault records Max. 5 s, incl. 35 power-fail safe selectable pre-trigger and post-fault time
Max. storage period per fault event T_{max} Pre-trigger time T_{pre} Post-fault time T_{post} Sampling rate	0.30 to 5.00 s (steps 0.01 s) 0.05 to 0.50 s (steps 0.01s) 0.05 to 0.50 s (steps 0.01 s) 1 instantaneous value per ms at 50 Hz 1 instantaneous value per 0.83 ms at 60 Hz

Additional functions	
Operational measured values	
Operating currents Measuring range Tolerance	I_{L1}, I_{L2}, I_{L3} 0 % to 240 % I_N 3 % of rated value
Thermal overload values	
Calculated temperature rise Measuring range Tolerance	Θ/Θ_{trip} 0 % to 300 % 5 % referred to Θ_{trip}
Fault event logging	
Storage of indications of the last 8 faults	
Time assignment	
Resolution for operational indications Resolution for fault event indications Max. time deviation	 1 s 1ms 0.01 %
Trip circuit supervision	
With one or two binary inputs	
Circuit-breaker trip test	
With live trip or trip/reclose cycle (version with auto-reclosure)	

CE conformity

This product is in conformity with the Directives of the European Communities on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EG previous 89/336/EEC) and electrical equipment designed for use within certain voltage limits (Council Directive 2006/95/EG previous 73/23/EEC).

This unit conforms to the international standard IEC 60255, and the German standard DIN 57435/Part 303 (corresponding to VDE 0435/ Part 303).

The unit has been developed and manufactured for application in an industrial environment according to the EMC standards.

This conformity is the result of a test that was performed by Siemens AG in accordance with Article 10 of the Council Directive complying with the generic standards EN 50081-2 and EN 50082-2 for the EMC Directive and standard EN 60255-6 for the "low-voltage Directive".

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Description	Order No.
7SJ600 numerical overcurrent, motor and overload protection relay Binary input voltage 24 to 250 V DC with isolated RS485 port	7SJ600□-□□A□0-□D□□
Rated current at 50/60 Hz	
1 A 1)	1
5 A 1)	5
Rated auxiliary voltage	
24, 48 V DC	2
60, 110, 125 V DC 2)	4
220, 250 V DC, 115 V AC 2)	5
230 V AC 3)	6
Unit design	
For panel surface mounting, terminals on the side B	B
Terminal connection on top and bottom D	D
For panel flush mounting / cubicle mounting	E
Languages	
English, German, Spanish, French, Russian	0
Auto-reclosure (option)	
Without	0
With	1
Control	
Without	A
With	B
U_L-Listing	
Without U_L-listing	0
With U_L-listing	1

Accessories	Description	Order No.
	Converter RS232 (V.24) - RS485*	
	With communication cable for the 7SJ600 numerical overcurrent, motor and overload protection relay Length 1 m PC adapter	
	With power supply unit AC 230 V	7XV5700- 0□□00 4)
	With power supply unit AC 110 V	7XV5700- 1□□00 4)
	Converter, full-duplex, fiber-optic cable RS485 with built-in power supply unit	
	Auxiliary voltage 24 to DC 250 V and AC 110/230 V	7XV5650- 0BA00
	Mounting rail for 19" rack	C73165-A63-C200-1
	Manual for 7SJ600	
	German	C53000-G1100-C106-9
	English	C53000-G1176-C106-7
	Spanish	C53000-G1178-C106-1
	French	C53000-G1177-C106-3
	Sample order	
	7SJ600, 1 A, 60 – 125 V, flush mounting, ARC	7SJ6001-4EA00-1DA0
	Converter V.24 -RS485, AC 230 V	7XV5700-0AA00
	Manual, English	C53000-G1176-C106-7
	or visit www.siemens.com/siprotec	

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Mounting rail

1) Rated current can be selected by means of jumpers.

2) Transition between the two auxiliary voltage ranges can be selected by means of jumpers.

3) Only when position 16 is not "**1**" (with U_L-listing).

4) Possible versions see part 13.

* RS485 bus system up to 115 kbaud RS485 bus cable and adaptor 7XV5103-□AA□□; see part 13.

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Connection diagram

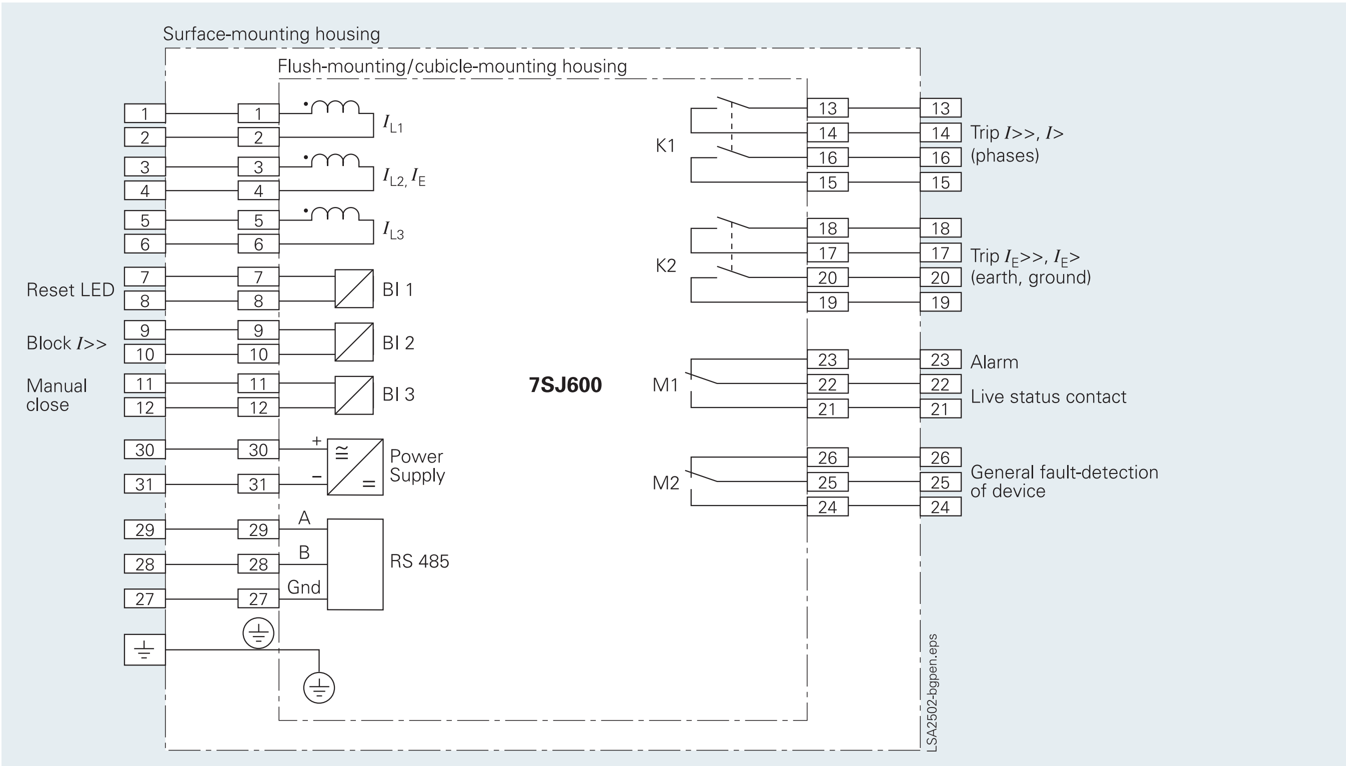

Fig. 5/32 Connection diagram according to IEC standard