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
- Earth-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

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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).

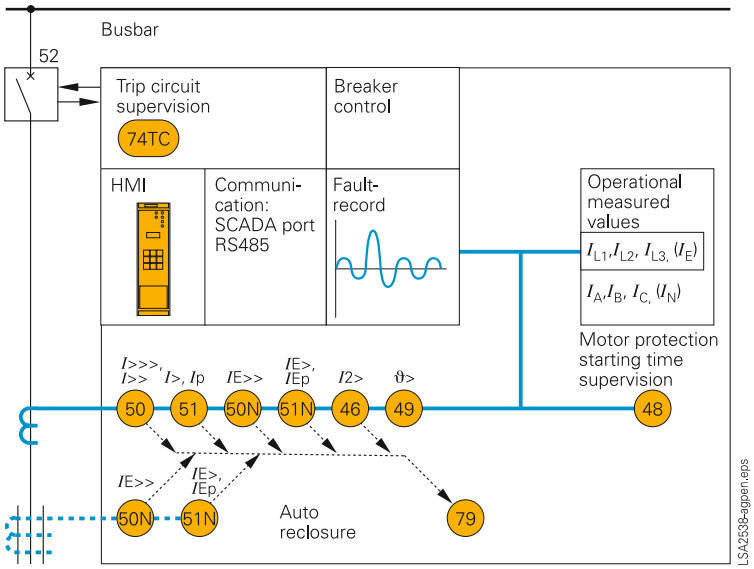

Fig. 5/20 Function diagram

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

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.

Fig. 5/21
Rear view of flush-mounting housing

Protection functions

Definite-time characteristics

The definite-time overcurrent function is based on phase-selective measurement of the three phase currents and/or earth 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 $I_{L3}(I_C)$.

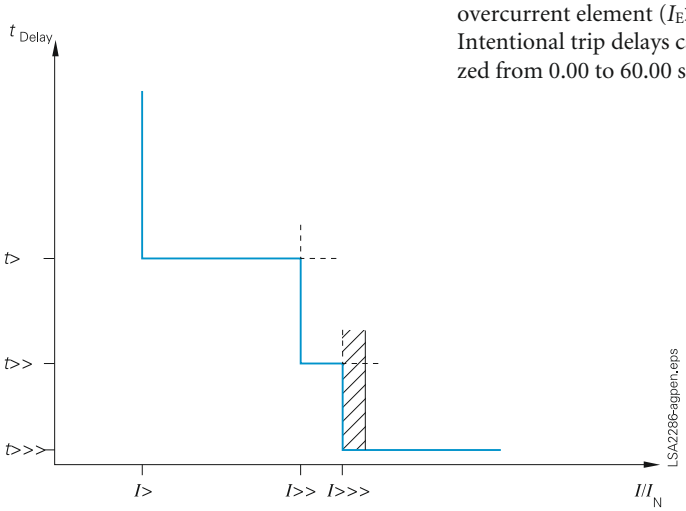

Fig. 5/22 Definite-time overcurrent characteristic

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.

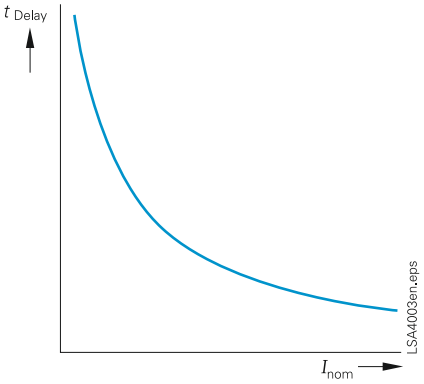

Fig. 5/23 Inverse-time overcurrent characteristic

Inverse-time characteristics

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

Available inverse-time characteristic

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

Protection functions

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_2 = 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).

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

t = Tripping time after beginning of the thermal overload

$\tau = 35.5 \cdot T_L$

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

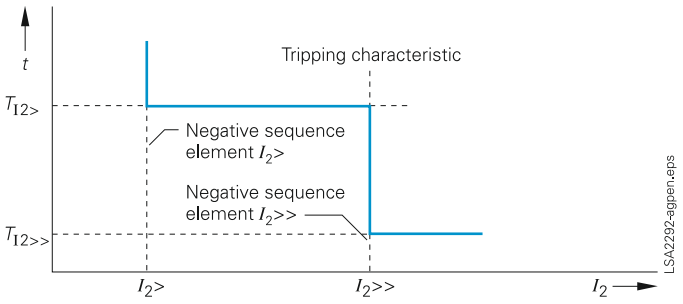

Fig. 5/24 Tripping characteristic of the negative-sequence protection function

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.

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_{12} = 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 autoreclosing of a feeder which has previously been disconnected by time-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”.

Protection functions

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.

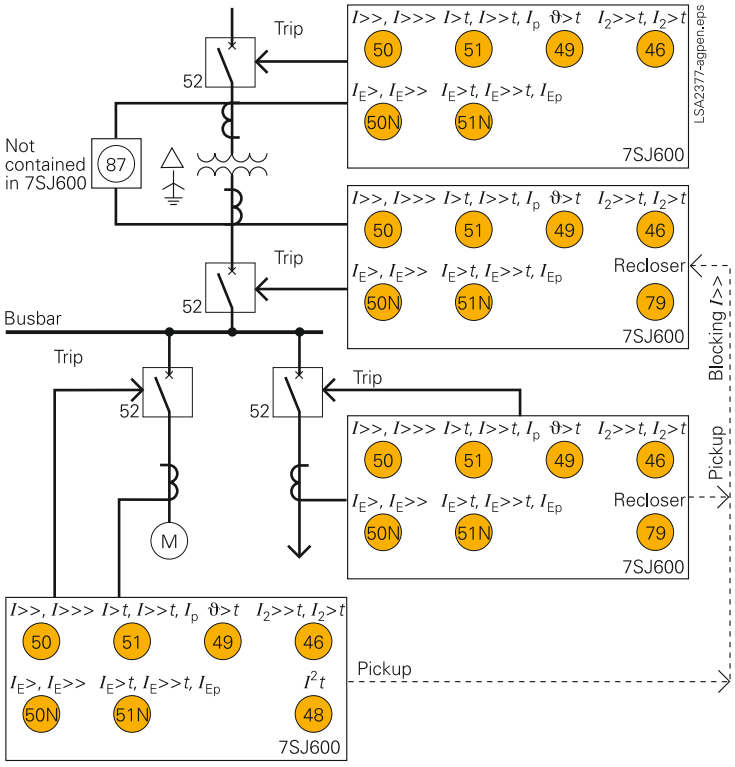

Fig. 5/25 Reverse interlocking

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 $\vartheta_s>$ (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.

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

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

Features

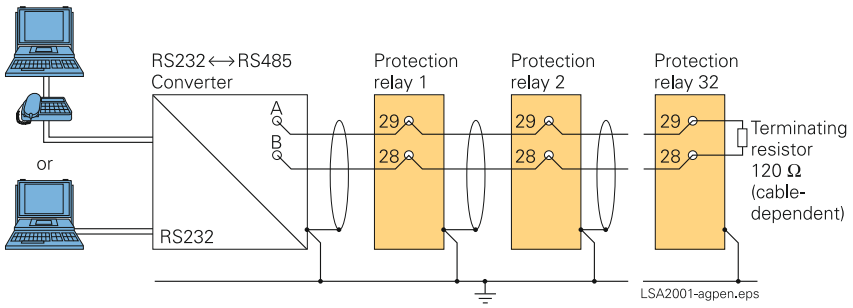

Fig. 5/26 Wiring communication
For convenient wiring of the RS485 bus, use bus cable system 7XV5103 (see part 15 of this catalog).

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

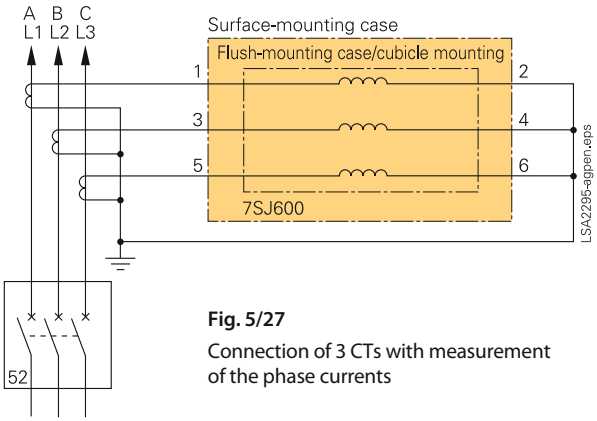

Fig. 5/27
Connection of 3 CTs with measurement of the phase currents

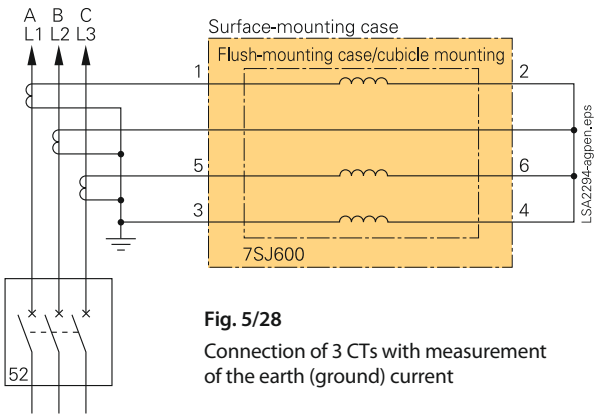

Fig. 5/28
Connection of 3 CTs with measurement of the earth (ground) current

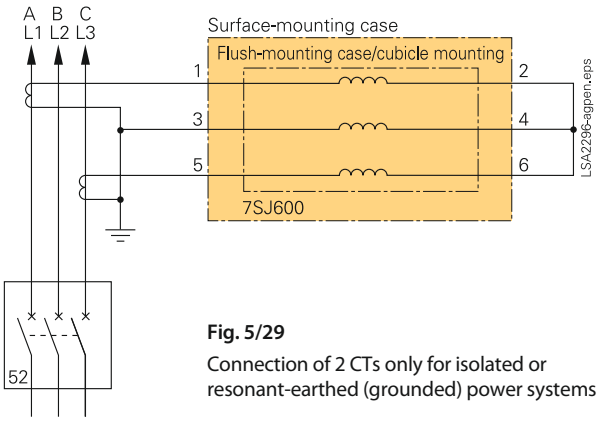

Fig. 5/29
Connection of 2 CTs only for isolated or resonant-earthed (grounded) power systems

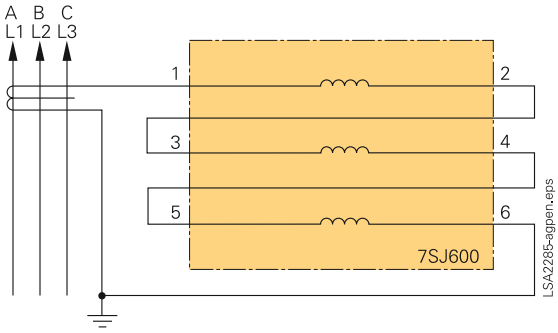

Fig. 5/30
Sensitive earth-fault protection (3 -times increased sensitivity)

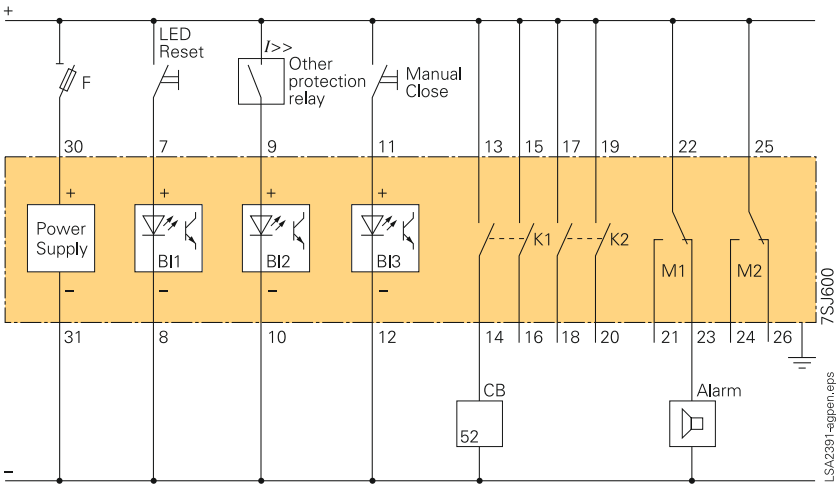

Fig. 5/31 Example of typical wiring

Technical data

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	< 0.1 VA
at I_N = 5 A	< 0.2 VA
Power supply via integrated DC/DC converter	
Rated auxiliary voltage V_{aux} / permissible variations	24, 48 V DC/± 20 % 60, 110/125 V DC/± 20 % 220, 250 V DC/± 20 % 115 V AC/–20 % +15 % 230 V AC/–20 % +15 %
Superimposed AC voltage, peak-to-peak	
at rated voltage	≤ 12 %
at limits of admissible voltage	≤ 6 %
Power consumption	
Quiescent	Approx. 2 W
Energized	Approx. 4 W
Bridging time during failure/ short-circuit of auxiliary voltage	≥ 50 ms at V_{aux} ≥ 110 V DC ≥ 20 ms at V_{aux} ≥ 24 V DC
Binary inputs	
Number	3 (marshallable)
Operating voltage	24 to 250 V DC
Current consumption, independent of operating voltage	Approx. 2.5 mA
Pickup threshold, reconnectable by solder bridges	
Rated aux. voltage	
24/48/60 V DC V_{pickup}	≥ 17 V DC
$V_{drop-out}$	< 8 V DC
110/125/220/250 V DC	
V_{pickup}	≥ 74 V DC
$V_{drop-out}$	< 45 V DC
Signal contacts	
Signal/alarm relays	2 (marshallable)
Contacts per relay	1 CO
Switching capacity	
Make	1000 W / VA
Break	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	1000 W / VA
Break	30 W / VA
Switching voltage	250 V
Permissible current	
Continuous	5 A
For 0.5 s	30 A
Design	
Housing 7XP20	Refer to part 15 for dimension drawings
Weight	
Flush mounting /cubicle mounting	Approx. 4 kg
Surface mounting	Approx. 4.5 kg
Degree of protection acc. to EN 60529	
Housing	IP51
Terminals	IP21

Serial interface	
Interface, serial; isolated	
Standard	RS485
Test voltage	2.8 kV DC 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	2.8 kV DC
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

Technical data

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 µs, 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 Ω

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	
<u>During operation</u>	
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
<u>During transport</u>	
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

Technical data

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 ∞
	earth $I_E>$	= 0.05 to 25 (steps 0.01), or ∞
	phase $I>>$	I/I_N = 0.1 to 25 (steps 0.1), or ∞
	earth $I_E>>$	= 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 $I>$, $I>>$, $I_E>$, $I_E>$		Approx. 35 ms
$I>>>$		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)
	earth 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 ∞
	earth $I_E>>$	= 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		8 % to 80 % of I_N
	$I_2>$ in steps of 1 %	8 % to 80 % of I_N
	$I_2>>$ in steps of 1 %	
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 ≤ f/f_N ≤ 1.02	≤ 2 % of I_N
range: 0.95 ≤ f/f_N ≤ 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

Technical data

Thermal overload protection with memory (ANSI 49) (total memory according to IEC 60255-8)

Setting ranges	
Factor k acc. to IEC 60255-8	0.40 to 2 (steps 0.01)
Thermal time constant τ_{th}	1 to 999.9 min (steps 0.1 min)
Thermal alarm stage $\Theta_{alarm}/\Theta_{trip}$	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}	Reset below Θ_{alarm}
Θ/Θ_{alarm}	Approx. 0.99
Tolerances	
Referring to k · I_N	± 5 % (class 5 % acc. to IEC 60255-8)
Referring to trip time	± 5 % ± 2 s (class 5 % acc. to IEC 60255-8)
Influence variables referred to k · I_N	
Auxiliary DC voltage in the range of 0.8 ≤ V_{aux} / V_{auxN} ≤ 1.2	≤ 1 %
Temperature, range: –5 °C ≤ Θ_{amb} ≤ +40 °C +23 °F ≤ Θ_{amb} ≤ +104 °F	≤ 0.5 % / 10 K
Frequency, range: 0.95 ≤ f/f_N ≤ 1.05	≤ 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	± 5 %
Referring to trip time	± 5 % ± 2 s
Influence variables	
Auxiliary DC voltage in the range of 0.8 ≤ V_{aux} / V_{auxN} ≤ 1.2	≤ 1 %
Temperature, range: –5 °C ≤ Θ_{amb} ≤ +40 °C +23 °F ≤ Θ_{amb} ≤ +104 °F	≤ 0.5 %/10 K
Frequency, range: 0.95 ≤ f/f_N ≤ 1.05	≤ 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	5 %
Delay time	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	Max. 8 fault records
Total storage time (fault detection or trip command = 0 ms)	Max. 5 s, incl. 35 power-fail safe selectable pre-trigger and post-fault time
Max. storage period per fault event T_{max}	0.30 to 5.00 s (steps 0.01 s)
Pre-trigger time T_{pre}	0.05 to 0.50 s (steps 0.01s)
Post-fault time T_{post}	0.05 to 0.50 s (steps 0.01 s)
Sampling rate	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	I_{L1}, I_{L2}, I_{L3}
Measuring range	0 % to 240 % I_N
Tolerance	3 % of rated value

Thermal overload values

Calculated temperature rise	Θ/Θ_{trip}
Measuring range	0 % to 300 %
Tolerance	5 % referred to Θ_{trip}

Fault event logging

Storage of indications of the last 8 faults

Time assignment

Resolution for operational indications	1 s
Resolution for fault event indications	1 ms
Max. time deviation	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 89/336/EEC) and electrical equipment designed for use within certain voltage limits (Council Directive 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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Selection and ordering data

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*
Terminal connection on top and bottom	*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

Mounting rail

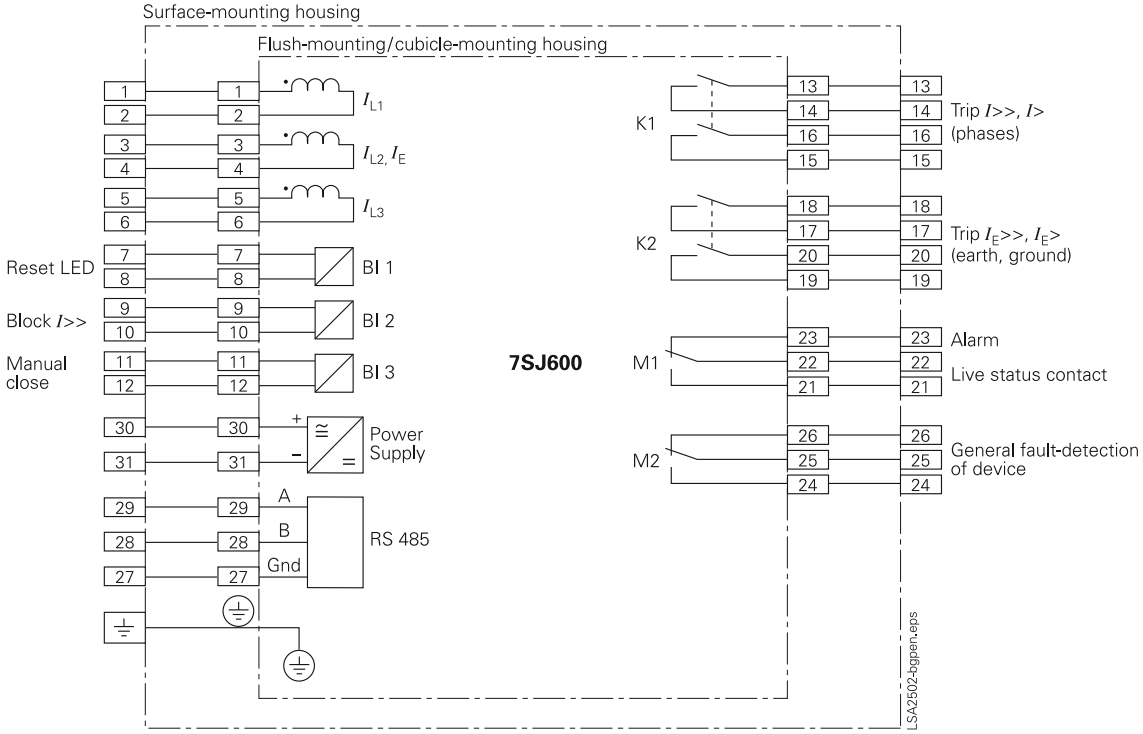
*Converter RS232 (V.24) - RS485**	
With communication cable for the 7SJ600 numerical overcurrent, motor and overload protection relay Length 1 m PC adapter	
With power supply unit 230 V AC	*7XV5700-0☐☐00*[4]
With power supply unit 110 V AC	*7XV5700-1☐☐00*[4]
Converter, full-duplex, fiber-optic cable RS485 with built-in power supply unit	
Auxiliary voltage 24 to 250 V DC and 110/230 V AC	*7XV5650-0BA00*
Mounting rail for 19" rack	*C73165-A63-C200-1*
Manual for 7SJ600	
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, 230 V AC	*7XV5700-0AA00*
Manual, English	*C53000-G1176-C106-7*

or visit www.siemens.com/siprotec

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.

Connection diagram



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Connection diagram according to IEC standard