

Combined O/C and E/F Relay SPAJ 140 C

Multipurpose Relay for

- Applications where non-directional overcurrent and earth-fault protections are needed, e.g.
 - feeder protection
 - transformer protection
 - back-up protection
- Application areas, e.g.
 - power utilities
 - industries
 - marine and offshore installations

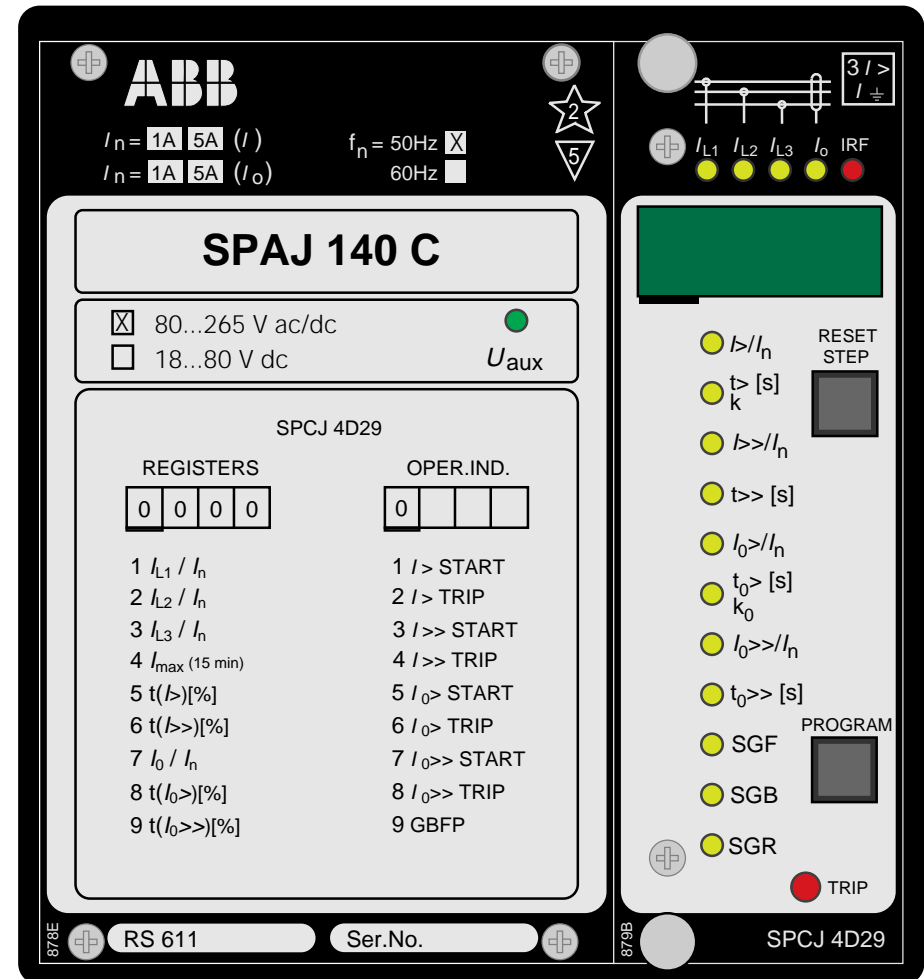


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Combined O/C and E/F Relay SPAJ 140 C

Protective Functions

- Three-phase, low-set phase overcurrent protection with definite time or inverse definite minimum time (IDMT) characteristic
- Three-phase, high-set phase overcurrent protection with instantaneous or definite time function
- Low-set, non-directional earth-fault protection with definite time or inverse definite minimum time (IDMT) characteristic
- High-set, non-directional earth-fault protection with instantaneous or definite time function
- Circuit-breaker failure protection

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Protective Functions

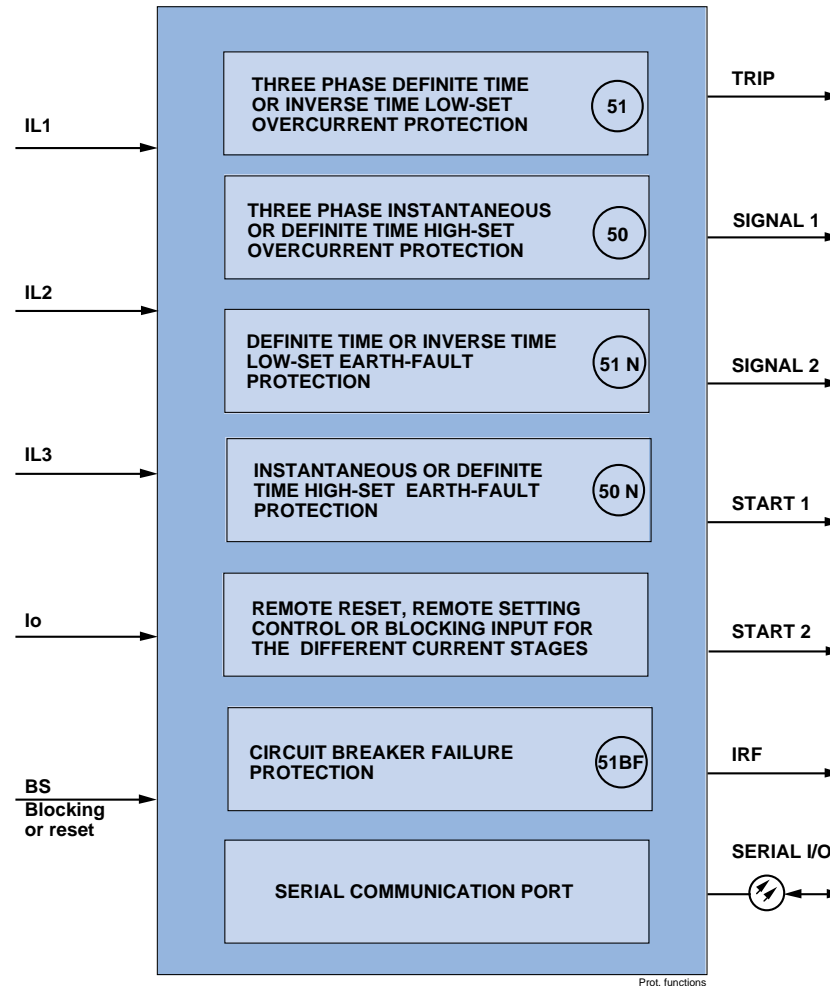


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Combined O/C and E/F Relay SPAJ 140 C

Features

- Wide and accurate numerical settings with perfect long-time stability
- Possibility for two sets of relay settings
- Local man-machine communication with push-buttons and a digital display
- High immunity to electrical and electromagnetic interference
- Rigid aluminium relay case with a degree of protection by enclosure to IP 54
- Extensive data communication capability over built-in serial port
- Enhanced system reliability and availability due to continuous hardware and software self-supervision

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Versions of the Earth-fault Protection

Relay versions	SPAJ 140 C	SPAJ 141 C	SPAJ 142 C
Measuring module	SPCJ 4 D 29	SPCJ 4 D 24	SPCJ 4 D 29
Rear module	SPTK 4E1	SPTK 4E2	SPTK 4E2
Start current of I _{>} stage, definite time	0.5 ... 5.0 x I _n	0.5 ... 5.0 x I _n	0.5 ... 5.0 x I _n
Start current of I _{>} stage, inverse time	0.5 ... 2.5 x I _n	0.5 ... 2.5 x I _n	0.5 ... 2.5 x I _n
Start current of I _{>>} stage	0.5 ... 40 x I _n and ∞	0.5 ... 40 x I _n and ∞	0.5 ... 40 x I _n and ∞
I _n of earth-fault unit	1 A / 5 A	0.2 A / 1 A	0.2 A / 1 A
Setting range of I _{o>}	0.1 ... 0.8 x I _n	0.01 ... 0.25 x I _n	0.1 ... 0.8 x I _n
Setting range of I _{o>>}	0.1 ... 10.0 x I _n	0.1 ... 10.0 x I _n	0.1 ... 10.0 x I _n
Lowest primary setting of I _{o>}	100 mA	2 mA	20 mA
Operation characteristic	Definite time IDMT	Definite time -	Definite time IDMT

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Block Diagram

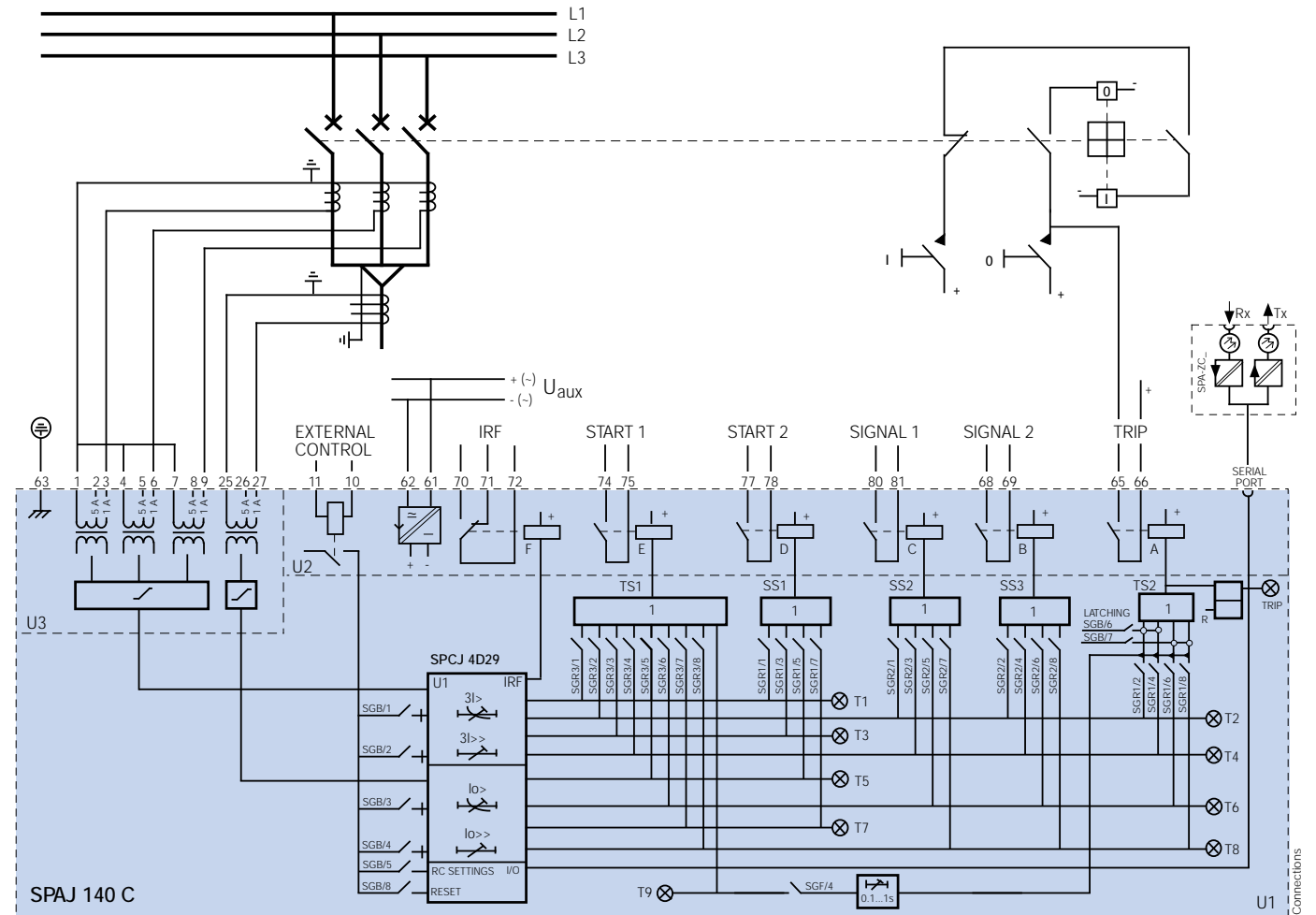


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Readouts and Operation Indicators

Indicators for readout of the measured phase currents, doubling as phase-fault indicators

Indicator for readout of the measured neutral current, doubling as earth-fault indicator

Indicator for signalling of internal relay faults

Digital display for readout of numerical parameters, i.e. settings, measured and recorded values including start and operation indications, auto-diagnostic fault messages, etc.

Indicator showing that the main trip relay of the protection relay has operated

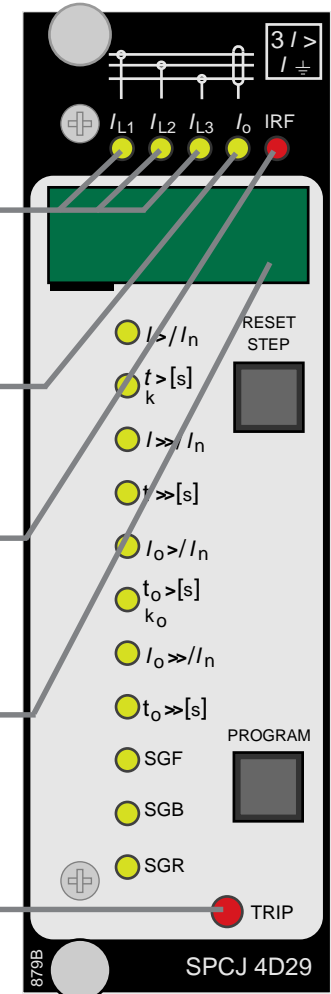


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Push-button Operations

Use the RESET/STEP push-button to:

- reset operation indicators
- step forward or backward in main menus or submenus
- set adjustable parameter values when in the setting mode

Use the PROGRAM push-button to:

- enter a submenu from the main menu
- enter the setting mode of an adjustable parameter
- control the cursor in the setting mode or to control the selected output in the test mode

Use both push-buttons **simultaneously** to:

- make a complete relay reset, i.e. erase recorded values and release latched output relays
- save a new setting value
- carry out an output relay test

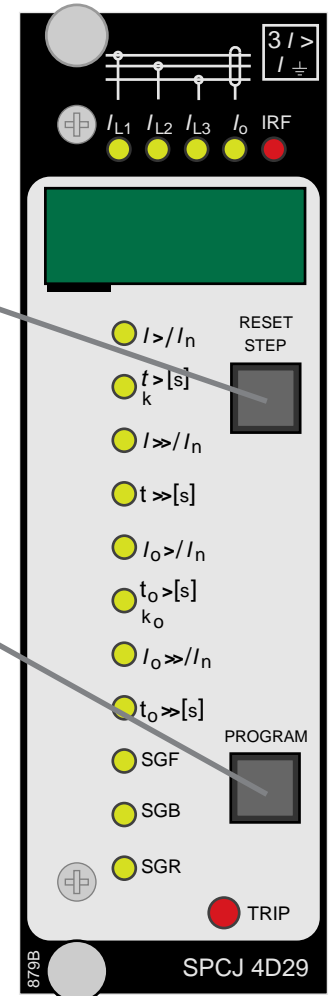
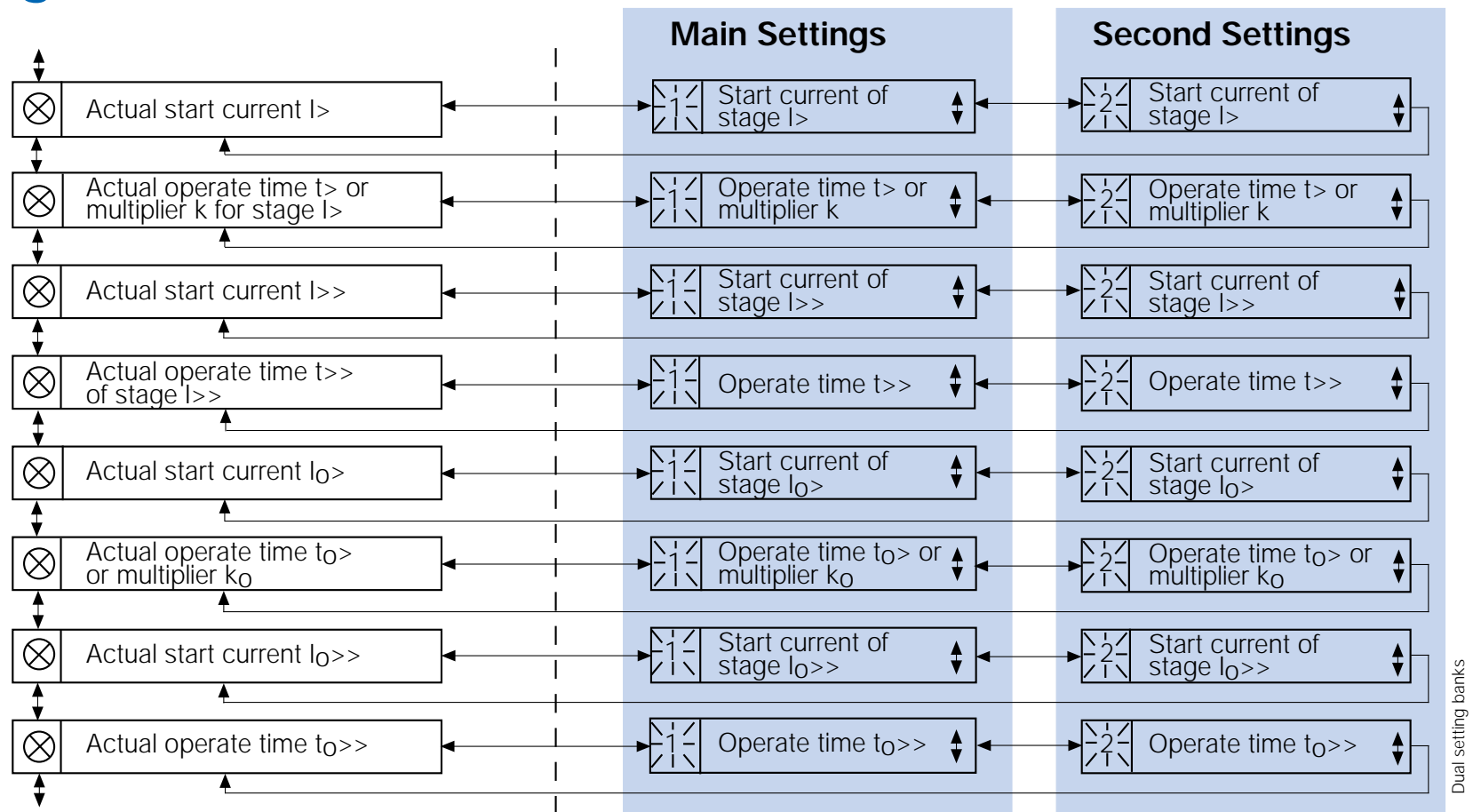


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Two Setting Banks



Combined O/C and E/F Relay SPAJ 140 C

Settings of the Overcurrent Unit

Low-set stage I>:

Start current I> at definite time	0.5 ... 5.0 x I _n
Start current I> at inverse time	0.5 ... 2.5 x I _n ^{*)}

Operate time t> at definite time	0.05 ... 300 s
Time multiplier k> at inverse time	0.05 ... 1.00

High-set stage I>>:

Start current I>>	0.5 ... 40 x I _n or infinite
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Operate time t>>	0.04 ... 300 s
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*) Any setting greater than 2.5 x I_n will be regarded as equal to 2.5 x I_n

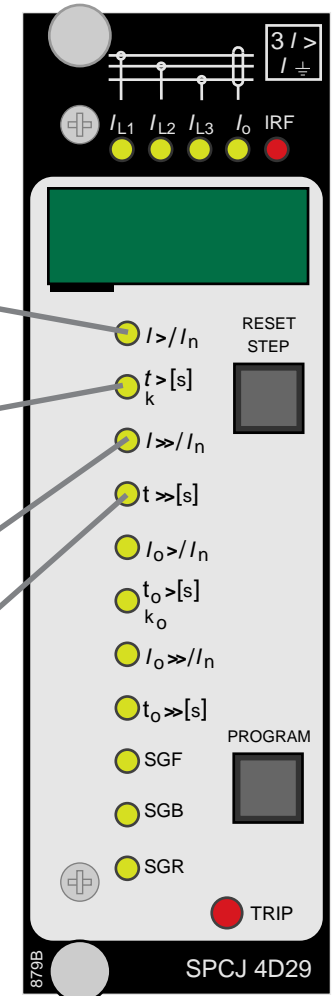


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Settings of the Earth-fault Unit

Low-set stage $I_{o>}$:

Start current $I_{o>}$, $0.1 \dots 0.8 \times I_n$

Operate time $t_{o>}$ for definite time $0.05 \dots 300 \text{ s}$
Time multiplier k at inverse time $0.05 \dots 1.00$

High-set stage $I_{o>>}$:

Start current $I_{o>>}$ $0.1 \dots 10 \times I_n$ or infinite

Operate time $t_{o>>}$ $0.05 \dots 300 \text{ s}$

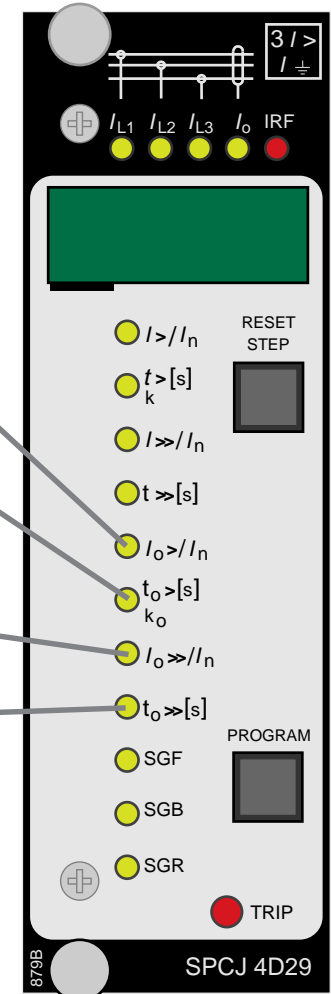


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Combined O/C and E/F Relay SPAJ 140 C

Switchgroup Settings

Switchgroups SGF1 and SGF2 for selection of operation characteristics and other functional parameters

Switchgroup SGB for routing of blocking signals and for selection of the latching function for the trip relay

Switchgroups SGR1, SGR2 and SGR3 for configuration of the output relays

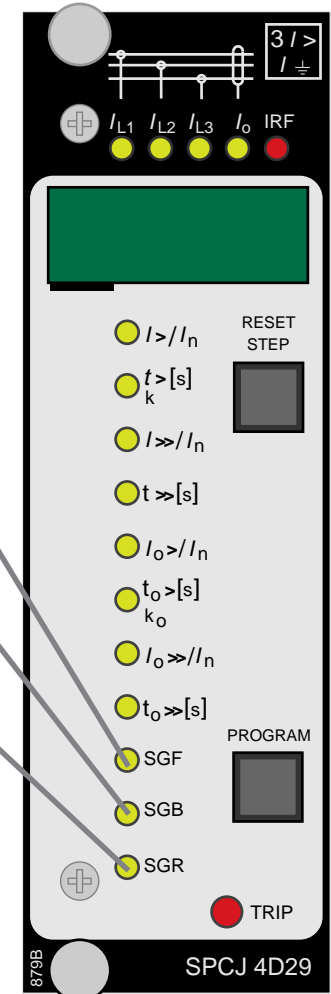


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Flexible Configuration of Output Signals

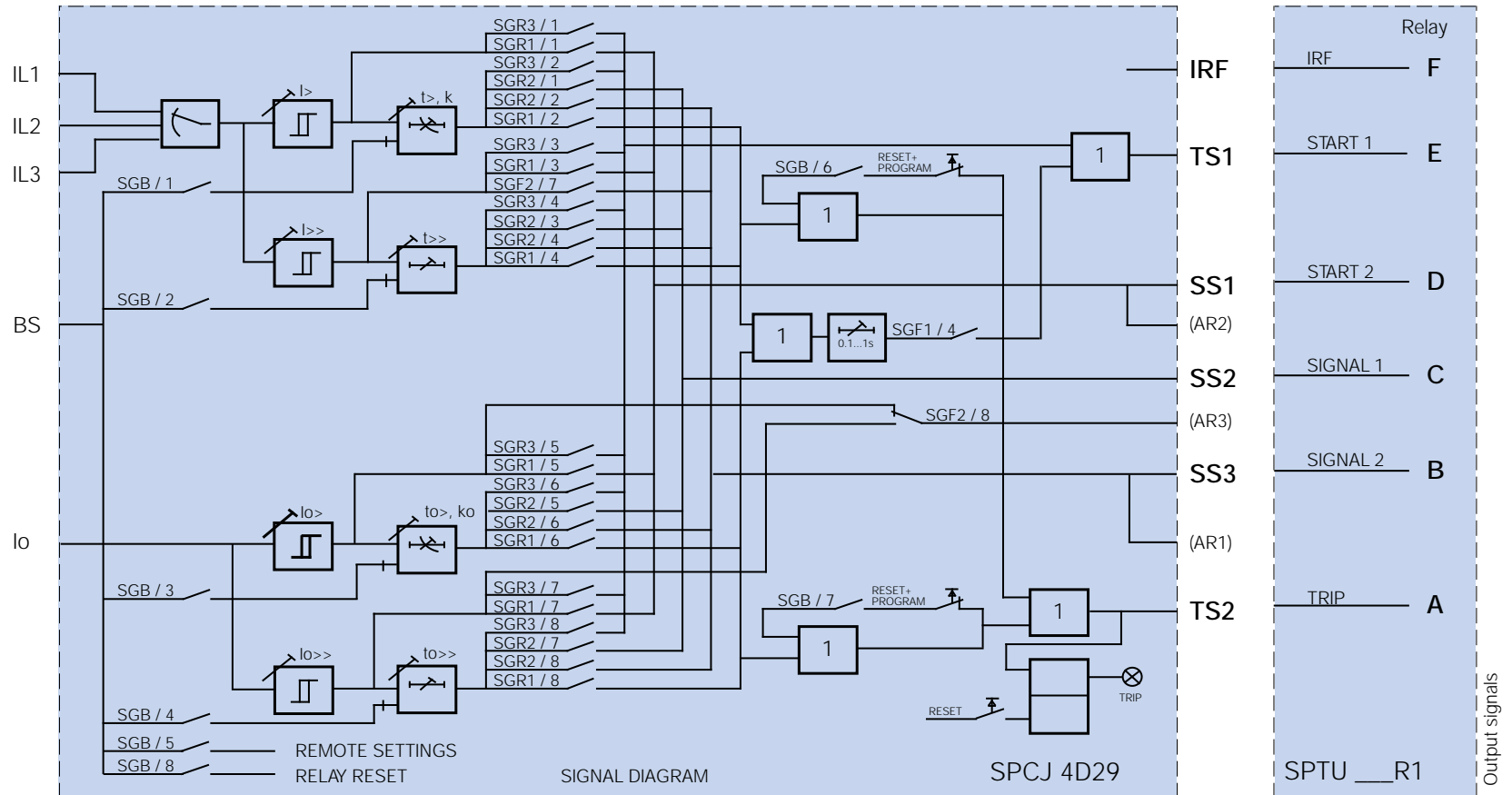



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Combined O/C and E/F Relay SPAJ 140 C

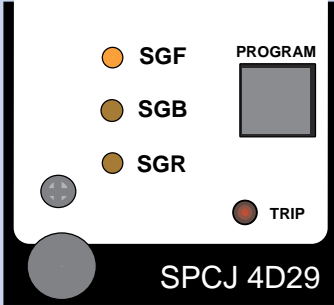
Settings of Switchgroup SGF 1



Main set



Second set



SPCJ 4D29

	0.05 ... 300 s Def. time	Extremely inverse	Very inverse	Normal inverse	Long-term inverse	RI characteristic	RXIDG characteristic	Not in use	Yes	No
SGF1	1	0	1	0	1	0	1	0	1	
	2	0	0	1	1	0	0	1	1	
	3	0	0	0	0	1	1	1	1	
4	Circuit breaker failure protection selected								1	0
5	Energizing will double the I _{>>} setting								1	0
SGF1	6	0	1	0	1	0	1	0	1	
	7	0	0	1	1	0	0	1	1	
	8	0	0	0	0	1	1	1	1	

Default programming	Setting
0	x 1 =
0	x 2 =
0	x 4 =
0	x 8 =
0	x 16 =
0	x 32 =
0	x 64 =
0	x 128 =
Checksum =	
(Default = 000)	

Combined O/C and E/F Relay SPAJ 140 C

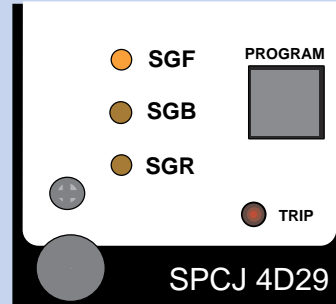
Settings of Switchgroup SGF 2

2000

Main set

4000

Second set



Yes	No
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Default programming

Setting

SGF2		Yes	No
1	Manual resetting of I> start indication	1	0
2	Manual resetting of I>> start indication	1	0
3	Manual resetting of I _o > start indication	1	0
4	Manual resetting of I _o >> start indication	1	0
5	I>> stage is blocked	1	0
6	I _o >> stage is blocked	1	0
7	I>> start signal to autoreclose output AR1	1	0
8	I _o > start signal to autoreclose output AR2		0
	I _o >> start signal autoreclose output AR3	1	

0	x 1 =
0	x 2 =
0	x 4 =
0	x 8 =
0	x 16 =
0	x 32 =
0	x 64 =
0	x 128 =

Checksum =
(Default = 000)

Combined O/C and E/F Relay SPAJ 140 C

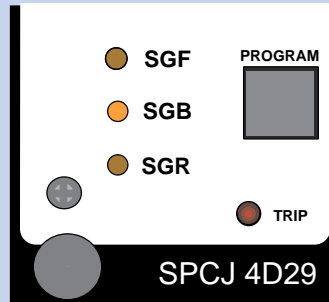
Settings of Switchgroup SGB



Main set



Second set



Yes	No
-----	----

Default programming

Setting

SGB

SGB	Description	Yes	No
1	BS input = I> stage blocking	1	0
2	BS input = I>> stage blocking	1	0
3	BS input = I _o > stage blocking	1	0
4	BS input = I _o >> stage blocking	1	0
5	BS input or command V150 activates the second setting	1	0
6	Overcurrent unit latches the relay A (signal TS2)	1	0
7	Earth-fault unit latches the relay A (signal TS2)	1	0
8	BS input resets latched output relay and recorded values	1	0

0	x 1 =
0	x 2 =
0	x 4 =
0	x 8 =
0	x 16 =
0	x 32 =
0	x 64 =
0	x 128 =

Checksum =
(Default = 000)

Combined O/C and E/F Relay SPAJ 140 C

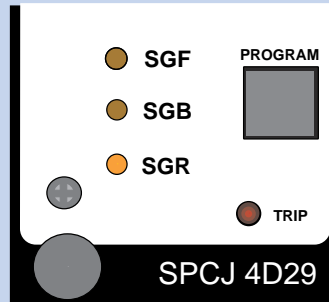
Settings of Switchgroup SGR 1



Main set



Second set



Yes	No
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SGR1			Yes	No
1	I>	start signal routed to relay D (signal SS1)	1	0
2	I>	start signal routed to relay A (signal TS2)	1	0
3	I>>	start signal routed to relay D (signal SS1)	1	0
4	I>>	start signal routed to relay A (signal TS2)	1	0
5	I _o >	start signal routed to relay D (signal SS1)	1	0
6	I _o >	start signal routed to relay A (signal TS2)	1	0
7	I _o >>	start signal routed to relay D (signal SS1)	1	0
8	I _o >>	start signal routed to relay A (signal TS2)	1	0

Default programming	Setting
1	x 1 =
1	x 2 =
0	x 4 =
1	x 8 =
0	x 16 =
1	x 32 =
0	x 64 =
1	x 128 =

Checksum =
(Default = 171)

Combined O/C and E/F Relay SPAJ 140 C

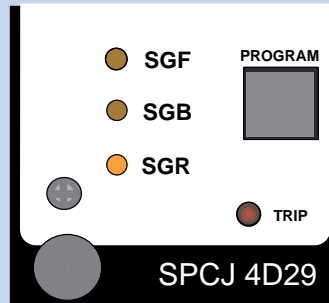
Settings of Switchgroup SGR 2

2 165

Main set

5 165

Second set



Yes	No
-----	----

SGR2

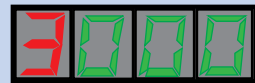
1	I> operate signal routed to relay C (signal SS2)	1	0
2	I> operate signal routed to relay B (signal SS3)	1	0
3	I>> operate signal routed to relay C (signal SS2)	1	0
4	I>> operate signal routed to relay B (signal SS3)	1	0
5	I _o > operate signal routed to relay C (signal SS2)	1	0
6	I _o > operate signal routed to relay B (signal SS3)	1	0
7	I _o >> operate signal routed to relay C (signal SS2)	1	0
8	I _o >> operate signal routed to relay B (signal SS3)	1	0

Default programming	Setting
1	x 1 =
0	x 2 =
1	x 4 =
0	x 8 =
0	x 16 =
1	x 32 =
0	x 64 =
1	x 128 =

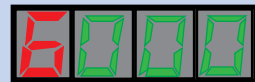
Checksum =
(Default = 165)

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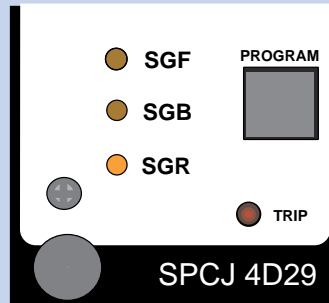
Settings of Switchgroup SGR 3



Main set



Second set



Yes	No
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SGR3

	1	2	3	4	5	6	7	8	Yes	No
	I>	I>	I>>	I>>	I _o >	I _o >	I _o >>	I _o >>	1	0
	operate signal routed to relay E (signal TS1)									
	operate signal routed to relay E (signal TS1)									
	operate signal routed to relay E (signal TS1)									
	operate signal routed to relay E (signal TS1)									
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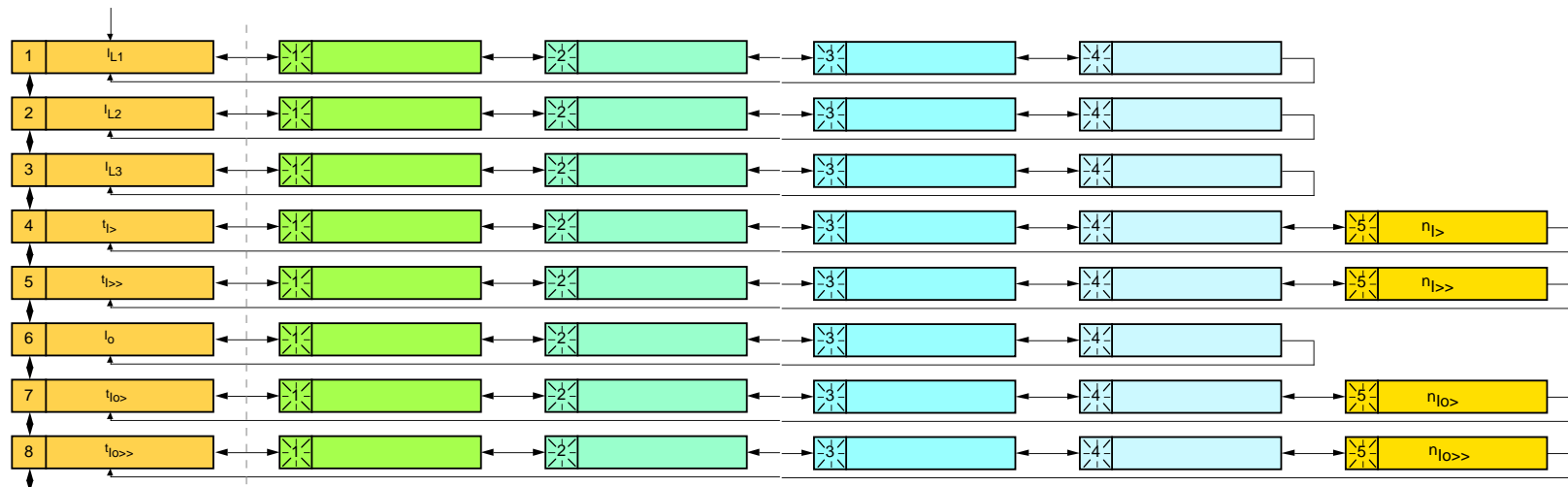
Default programming	Setting
0	x 1 =
0	x 2 =
0	x 4 =
0	x 8 =
0	x 16 =
0	x 32 =
0	x 64 =
0	x 128 =

Checksum =
(Default = 000)

Combined O/C and E/F Relay SPAJ 140 C

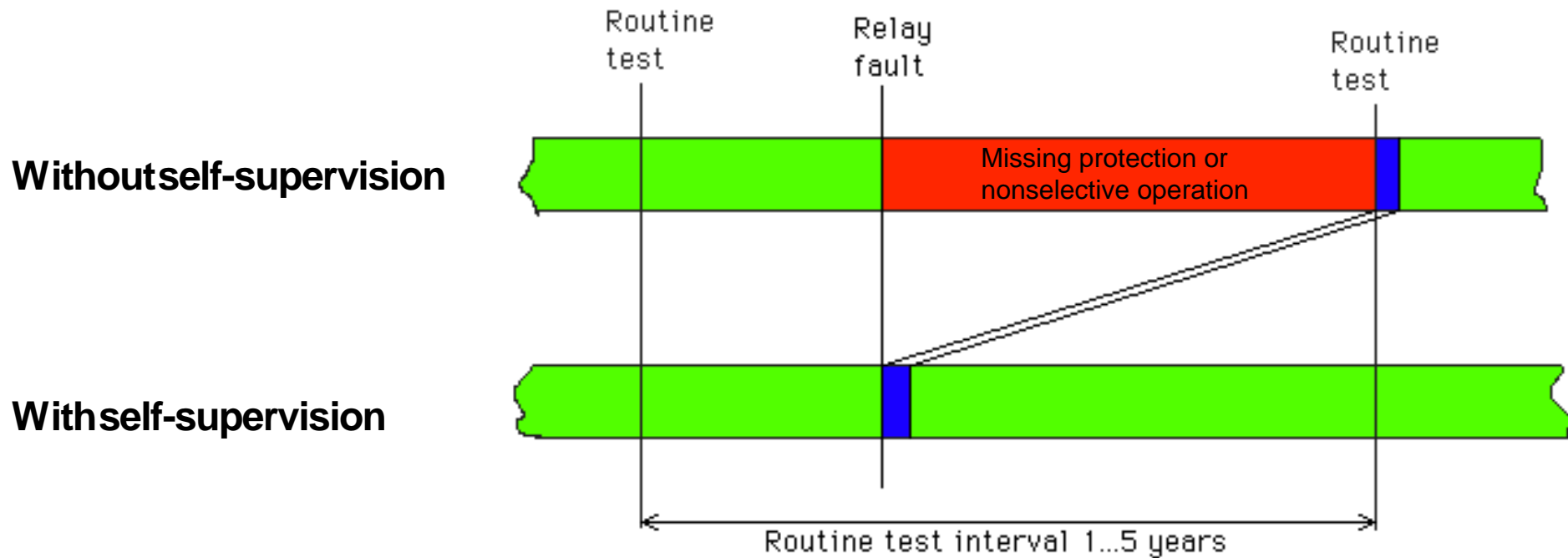
Comprehensive Post-fault Analysis

- The trip reason and phase conditions can be read on the front of the relay
- The latest five values of the measured values are stored in the memory
- The number of starts of all the protection stages available in the memory



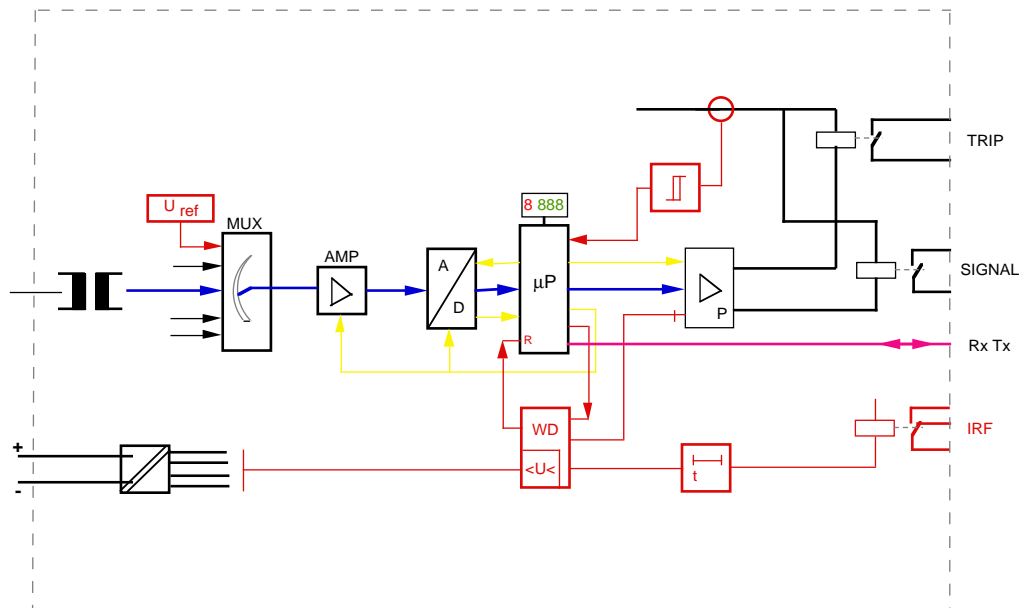
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Relay availability



Combined O/C and E/F Relay SPAJ 140 C

Continuous Self-supervision



Tested object	Check contents	Execution frequency
Memory circuits -RAM -ROM -EEPROM	Rotating "one" Check-sum Write and read of constant	One byte per 10ms
Microprocessor, Program execution	Watch-dog	Once every 5ms
A/D converter, MUX and amplifiers	Measuring of reference voltage	Once a minute and always before tripping
Settings	Checking for correct value	Once a minute
DC/DC converter	Measurement of supply voltages	Once a minute
Output amplifiers and trip relay coil	Feedback from output relays	Once a minute
Man-machine display	Visual inspection	On connection of supply voltage
Watch-dog	Auto-reset and IRF relay	Once every 5ms

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Serial Communication Features

The following parameters can be accessed via serial communication over the SPA bus:

- Actual measured values can be read
- Setting values for main and second sets and switchgroup settings can be read and, if necessary, changed using a security password
- Status information of output relays etc. can be read and written with password
- Recorded fault parameters can be read and erased
- Spontaneous reporting of selected events to an event recorder or a printer

Combined O/C and E/F Relay SPAJ 140 C

Insulation tests

**Dielectric test, inputs and outputs
between themselves and to the relay frame
as per IEC 255-5**

2kV

**Impulse test, inputs and outputs
between themselves and to the relay frame
as per IEC 255-5**

5kV, 1.2/50 μ s, 0.5J

**Insulation resistance, inputs and outputs
between themselves and to the relay frame**

>100Mohm, 500Vdc

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Disturbancetests

High frequency interference test, as per IEC 255-22-1, class III, 1 MHz, 400 bursts per sec

- common mode / differential mode

2.5 kV / 2.5 kV

Fast transient test as per IEC 255-22-4, class III and IEC 801-4, level IV

- power supply inputs

4 kV, 5/50 ns

- other inputs and outputs

2 kV, 5/50 ns

Electrostatic discharge test as per IEC 255-22-2 and IEC 801-2, class III, 150 pF

- air discharge / contact discharge

8 kV / 6 kV

Electromagnetic field test as per IEC 801-3, class III

10 V/m, 150 kHz...1000 MHz

Magnetic field as per IEC 521

400 A/m

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Mechanical tests

Seismic test as per ANSI/IEEE C37.98-1987

- operating basis earth-quake tests (OBE)

0.5...5.25g

- safe shutdown earth-quake tests (SSE)

0.5...7.5g

Vibration test

2...13.2Hz, ± 1.0 mm

13.2...100Hz, ± 0.7 g

Shock/bump test as per IEC 255-21-2

20g, 1000 bumps/direction

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Environmental conditions

Corrosion test as per Battelle-test, class G3

20 days

Specified ambient service temperature range

-10...+55 °C

Long term damp heat withstand according to IEC68-2-3

<95% at 40 °C for 56 days

Transport and storage temperature range

-40...+70 °C

Degree of protection by enclosure of the relay case as per IEC529 when panel mounted

IP54

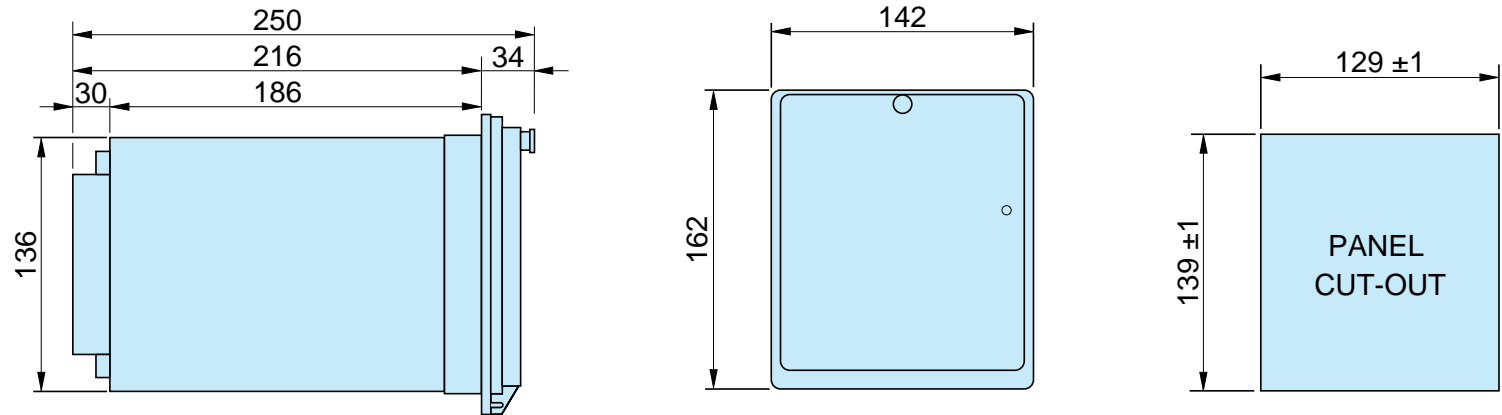
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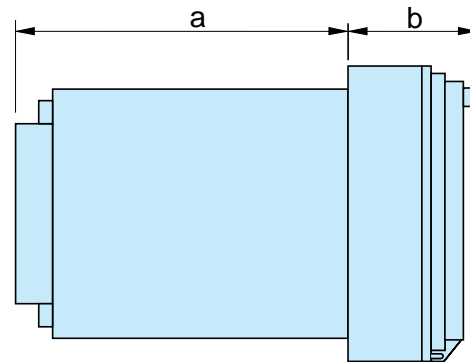
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Dimensions and Panel Cut-out

Flush mounting



Semi-flush mounting



RAISING FRAME	a	b
SPA-ZX 111	176	74
SPA-ZX 112	136	114
SPA-ZX 113	96	154

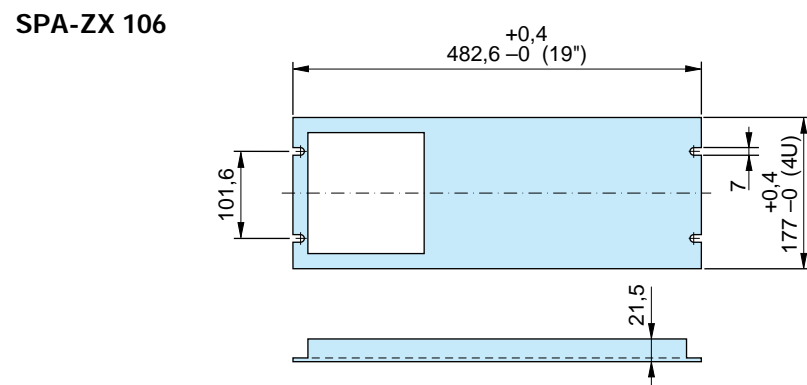
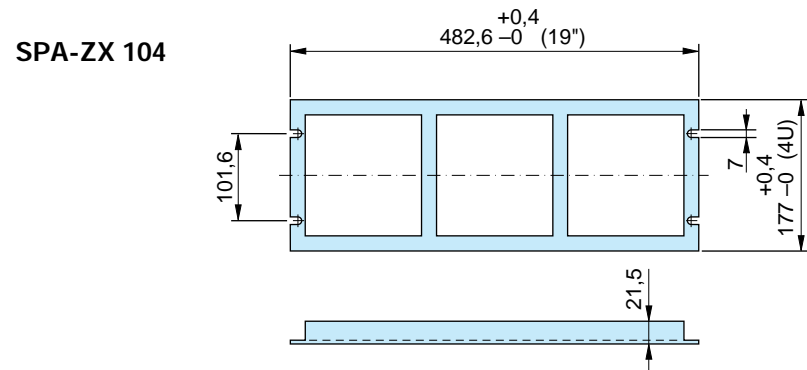
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Mounting Plates

Mounting in 19" cabinets



Surface mounting

SPA-ZX 110

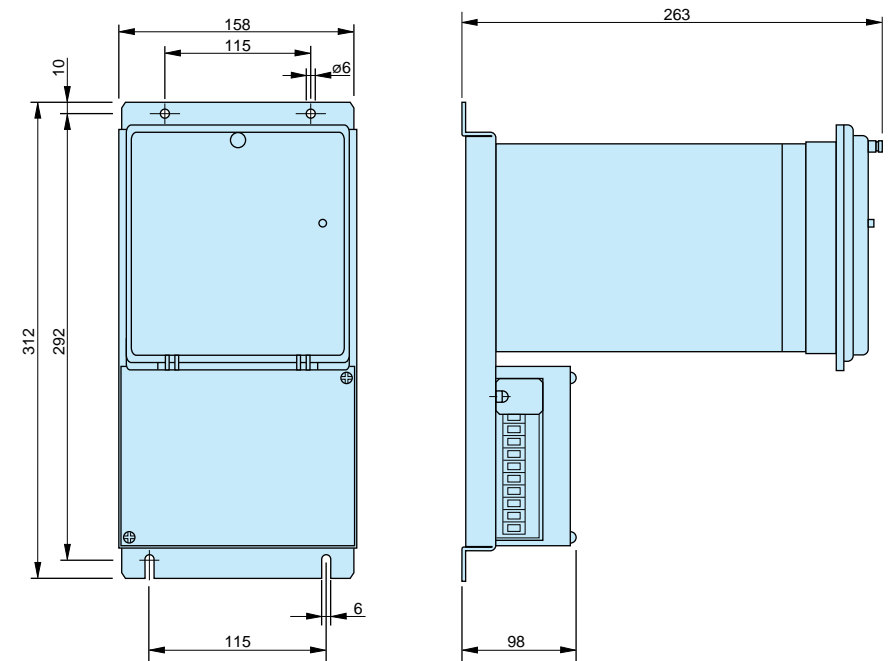


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