SPAF 140 and SPAF 340
Frequency relays

Frequency Relays
Type SPAF 140 and SPAF 340

Features

- Overfrequency and underfrequency relay with four frequency stages
- Operation based on either the positive or the negative rate of change of frequency (df/dt). Can be used independently or in combination with a set frequency value.
- Each frequency stage can be given two separate time delays; outputs for connection to various output relays.
- Selectable undervoltage blocking level
- Selectable rated frequency of the relay
- The protection stages can be blocked separately via external blocking inputs
- SPAF 140 includes four binary blocking inputs plus three relay outputs, two of which heavy-duty type, to be configured by the customer
- SPAF 340 includes five binary blocking inputs and eight output relays for customer needs. Four output relays can be used for circuit breaker control.
- Flexible configuration of blocking inputs, protection stages and output relays through programmable switch matrices
- Recovery function with adjustable time delay for the start of network restoration
- Serial communication enabling connection to remote control systems, parametrization via a PC, and reading of registers and measured values
- High system reliability due to continuous self-supervision
- High immunity to electrical and electromagnetical interference; robust aluminium case for IP 54 installation.
- CE marking according to the EC directive for EMC.

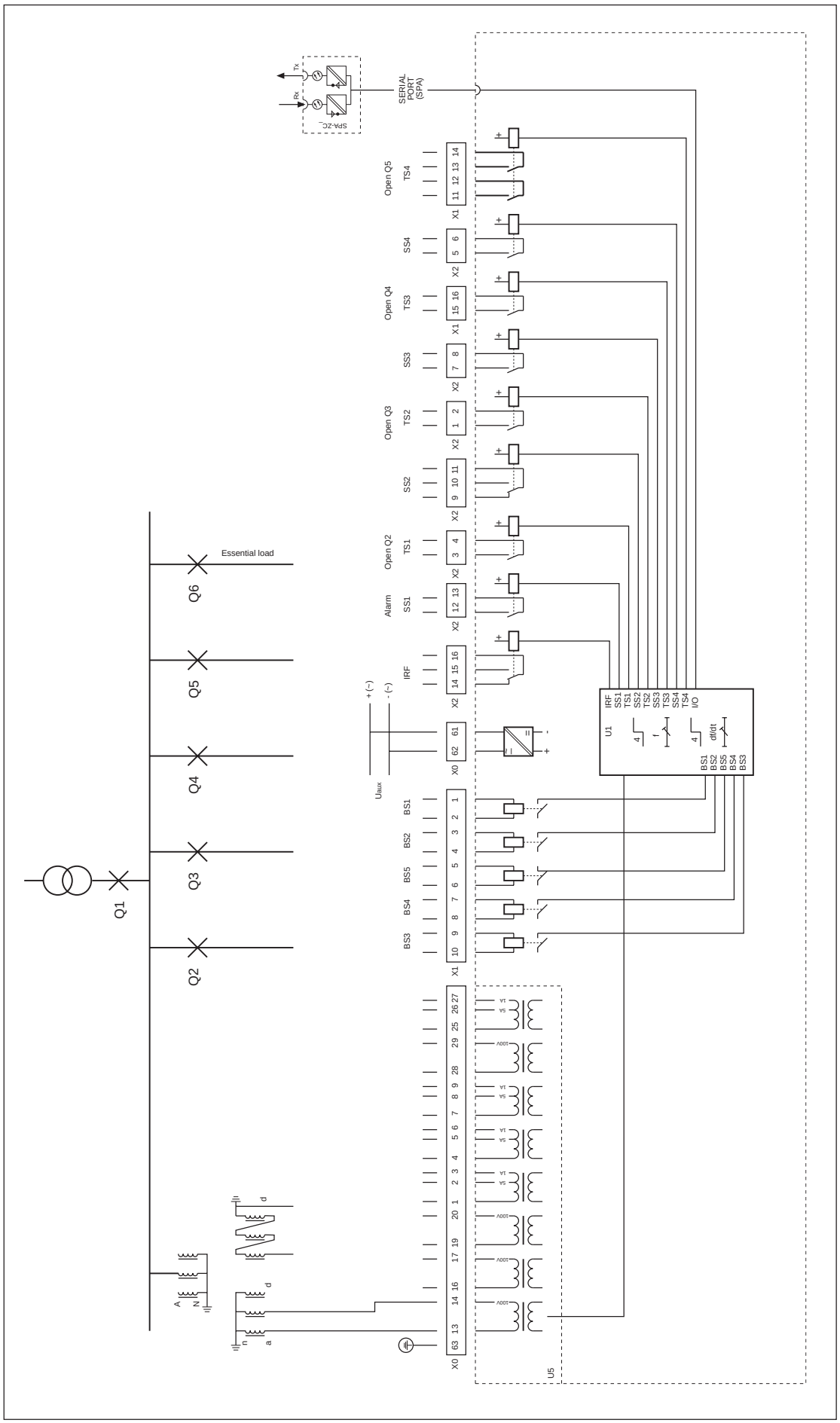
Application

The frequency relay SPAF 140 is designed to be used for protecting generators and other AC equipment against overfrequency and underfrequency. The operation of the relay can be based on set frequency values, on the rate of change of frequency, or on a combination of these two. In generator protection applications the relay protects the generator and the prime mover against hazardous overspeeding and/or underspeeding. The relay can also be used for the protection of large synchronous motors in networks where automatic network restoration is used. The relay isolates the motor from the network in the event of an outage, averting dangerous unsynchronized connection.

The frequency relay SPAF 340 is specially adapted for load shedding in situations where power consumption exceeds power capacity in the network. In such a situation of unbalance, the network frequency starts declining. The SPAF 340 relay can control four circuit breakers, allowing four feeders to be disconnected from the network, one by one. Should the power deficiency still persist, the relay disconnects the plant for island operation. The operation of the relay can be based on set frequency values (f<), on the rate of decrease of frequency (negative df/dt), or on both criteria (f< and df/dt). In addition, output of each stage can be obtained via two separate time circuits and so eight different frequency/time combinations are available. Should the network frequency drop rapidly, this feature allows fast disconnection of different loads.

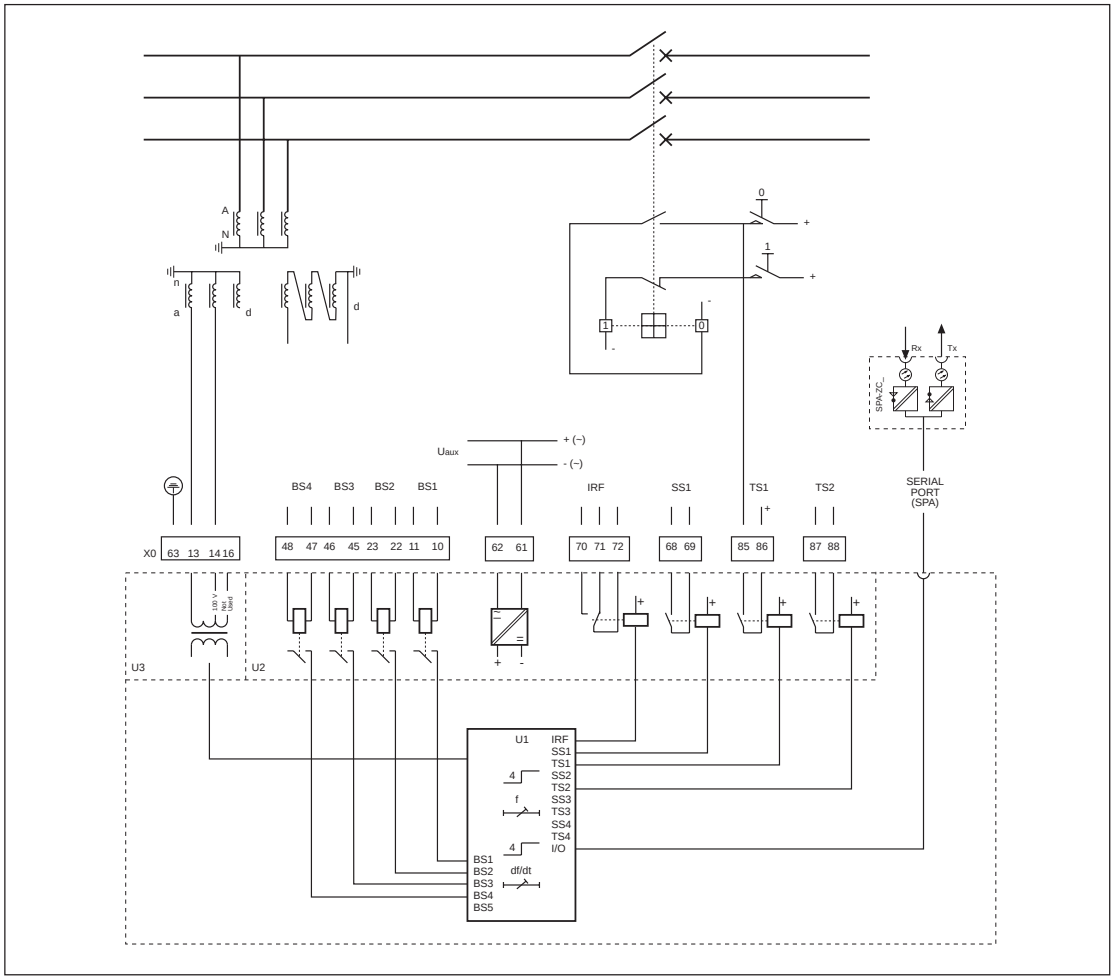
The frequency relays type SPAF 140 and SPAF 340 are members of the SPACOM product family and part of the PYRAMID® concept.

Connection Diagram



Simplified block diagram and connection diagram for the frequency relay SPAF 340 C3 in load shedding application

Connection Diagram



Simplified block diagram and connection diagram for the frequency relay SPAF 140 C

Technical Data

Energizing inputs

Voltage inputs			
Rated voltage U_n		100 V, 110 V,115 V or 120 V	
Continuous voltage withstand		200 V	
Rated burden of voltage input at U_n		<0.5 VA	
Rated frequency f_n, programmable		30 ... 65 Hz	
Current inputs*			
Rated current I_n	0.2 A	1 A	5 A
Thermal current withstand			
- continuously	1.5 A	4 A	20 A
- for 10 s	5 A	25 A	100 A
- for 1 s	20 A	100 A	500 A
Dynamic current withstand			
- half-wave value	50 A	250 A	1250 A
Input impedance	<750 mΩ	<100 mΩ	<20 mΩ

Output contacts

Trip contacts	
Rated voltage	250 V ac/dc
Continuous current carrying capacity	5 A
Make and carry for 0.5 s	30 A
Make and carry for 3 s	15 A
Breaking capacity for dc when the control circuit time constant L/R _40 ms at the control voltage levels	
- 48 V dc	5 A
- 110 V dc	3 A
- 220 V dc	1 A
Contact material	$AgCdO_2$
Signalling contacts	
Rated voltage	250 V ac/dc
Continuous current carrying capacity	5 A
Make and carry for 0.5 s	10 A
Make and carry for 3 s	8 A
Breaking capacity for dc when the control circuit time constant L/R _40 ms at the control voltage levels	
- 48 V dc	1 A
- 110 V dc	0.25 A
- 220 V dc	0.15 A
Contact material	$AgCdO_2$

External control inputs

Operative control voltage range	18...250 V dc or 80...250 V ac
Current drain of activated control input	2...20 mA

Auxiliary power supply *)

Power module SPGU 240A1	
- rated voltages	U_n = 110/120/230/ 240 V ac U_n = 110/125/220 V dc
- operative voltage range	80...265 V ac/dc
Power module SPGU 48B2	
- rated voltages	U_n = 24/48/60 V dc
- operative voltage range	18...80 V dc
Power consumption, quiescent/operation conditions	~10 W/~15 W

Power supply and output relay module **)

Supply and output relay module SPTU 240R4	
- rated voltages	U_n = 110/120/230/ 240 V ac U_n = 110/125/220 V dc
- operative voltage range	80...265 V ac/dc
Supply and output relay module SPTU 48R4	
- rated voltages	U_n = 24/48/60 V dc
- operative voltage range	18...80 V dc
Power consumption, quiescent/operation conditions	~4 W/~6 W

Data communication

Transmission mode	Fibre-optic serial bus
Coding	ASCII
Data transfer rate, selectable	4800 or 9600 Bd
Electrical/optical bus connection module powered from the host relay	
- for plastic core cables	SPA-ZC 21BB
- for glass fibre cables	SPA-ZC 21MM
Electrical/optical bus connection module powered from the host relay or from an external power source	
- for plastic core cables	SPA-ZC 17BB
- for glass fibre cables	SPA-ZC 17MM

Test voltages

Dielectric test voltage according to IEC 255-5	2.0 kV, 50 Hz, 1 min
Impulse test voltage according to IEC 255-5	5 kV, 1.2/50 µs, 0.5 J
Insulation resistance according to IEC 255-5	>100 MΩ, 500 V dc

Disturbance tests

High-frequency (1MHz) disturbance test according to IEC 255-22-1, class III	
- common mode	2.5 kV
- differential mode	1.0 kV
Fast transients according to IEC 255-22-4, class III and IEC 801-4, level 4	
- power supply inputs	4 kV, 5/50 ns
- other inputs	2 kV, 5/50 ns
Electrostatic discharge test according to IEC 255-22-2 and IEC 801-2, class III	
- air discharge	8 kV
- contact discharge	6 kV

Environmental conditions

Service temperature range	-10...+55°C
Transport and storage temperature range according to IEC 68-2-8	-40...+70°C
Damp heat test, cyclic (12 h + 12 h) according to IEC 68-2-30	+25°C/+55°C RH = 93%, 6 cycles
Degree of protection by enclosure of flush mounting relay case	IP 54
Weight of fully equipped relay including flush mounting relay case *)	~6 kg
Weight of fully equipped relay including flush mounting relay case **)	~3,5 kg

*) Concerning only SPAF 340 C3
**) Concerning only SPAF 140 C

RELAY MODULE DATA

Combined frequency and rate of change of frequency module SPCF 1D15

Four protection stages, which include over- and underfrequency function, rate of change of frequency function and two timer functions.

f function

Rated frequency	30.00 ... 65.00 Hz
Setting range	25.00 ... 70.00 Hz
Measuring range	20.00 ... 75.00 Hz
Frequency measuring time	3 ... 20 periods (programmable)
Drop-off hysteresis	20 mHz
Operation accuracy	
- for SPAF 140 C	±20 mHz
- for SPAF 340 C3	±10 mHz
Minimum measuring voltage	0.25 x U_n

df/dt function

Setting range	0.2 ... ±10.0 Hz/s (step 0.1 Hz/s)
Operation accuracy	±150 mHz/s
Minimum measuring voltage	0.25 x U_n

Timer function

Operation time delay setting range *)	0.10 ... 120.00 s
- the minimum time is depending on the frequency measuring time	
Operation time accuracy	±1% or ±30 ms

Undervoltage blocking

Setting range	0.30 ... 0.90 x U_n
Measuring range	0.0 ... 1.4 x U_n
Operation accuracy	±3% of the set value (in the range 25…70 Hz)

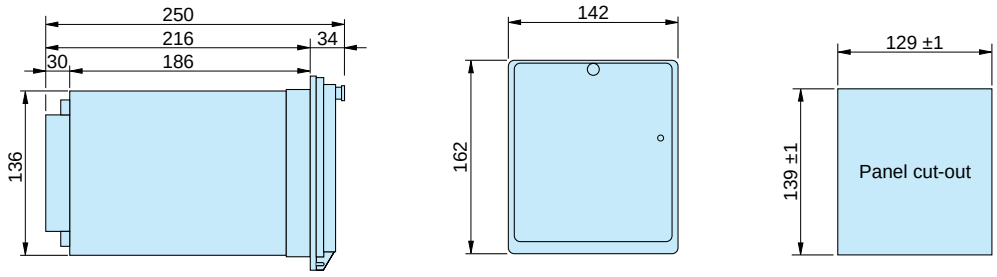
Recovery function

Setting range for frequency difference from the nominal frequency	0.1 ... 10.0 Hz
Time delay setting range	1 s ... 120 min 59 s
Operation time accuracy	±1% or ±30 ms

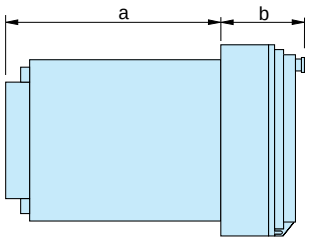
*) The minimum operation time depends on the rated frequency and the number of cycles to be used in the frequency measurement.

Mounting and Dimensions for SPAF 140 C

Flush mounting relay case (dimensions in millimetres)



Semi-flush mounting



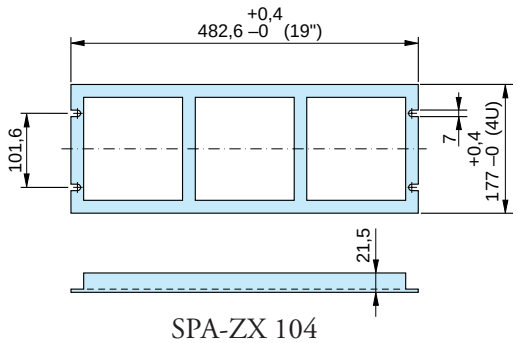
Raising frame	a	b
SPA-ZX 111	176	74
SPA-ZX 112	136	114
SPA-ZX 113	96	154

Mounting in 19 inch cabinets and frames

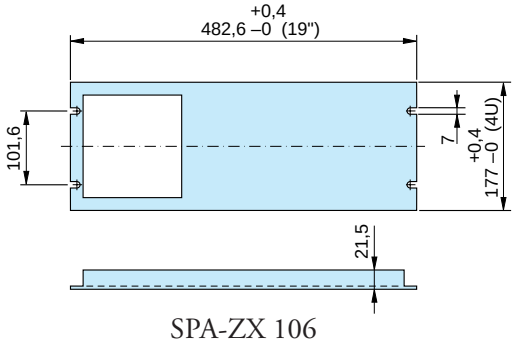
An ancillary mounting plate, height 4U (~177 mm), is recommended to be used when the protection relays are to be mounted in 19 inch frames or cabinets. The ancillary mounting plate type SPA-ZX 104 accommodates three relays, type SPA-ZX 105 two relays and type SPA-ZX 106 one relay.

Projecting mounting

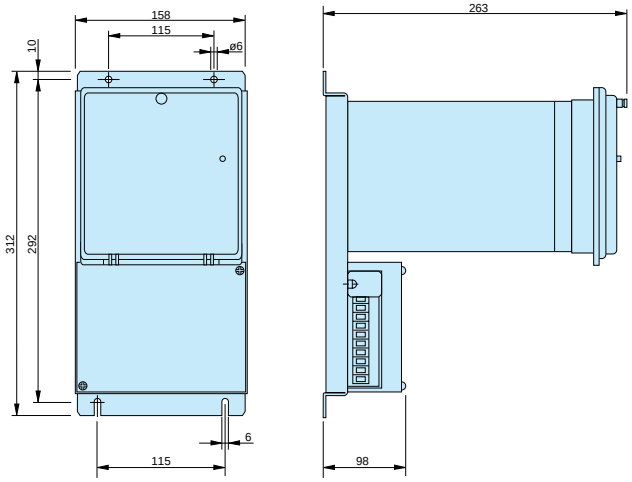
When projecting mounting is preferred a relay case type SPA-ZX 110 is used. The relay case for projecting mounting is provided with front connectors.



SPA-ZX 104



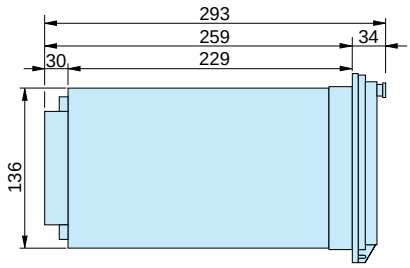
SPA-ZX 106

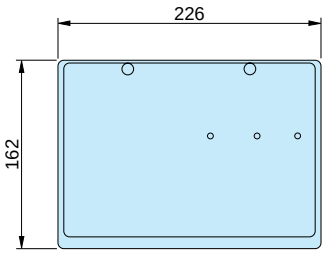


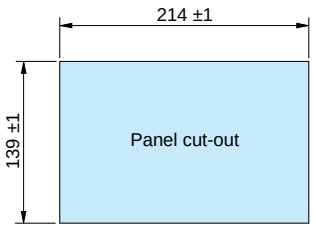
Mounting and Dimensions for SPAF 340 C3

Flush mounting relay case

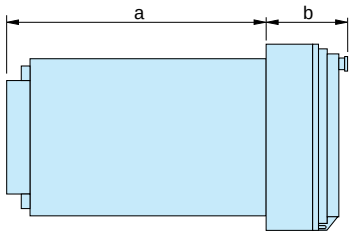
(dimensions in millimetres)







Semi-flush mounting



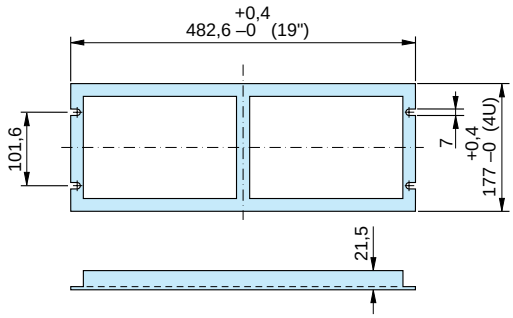
Raising frame	a	b
SPA-ZX 301	219	74
SPA-ZX 302	179	114
SPA-ZX 303	139	154

Mounting in 19 inch cabinets and frames

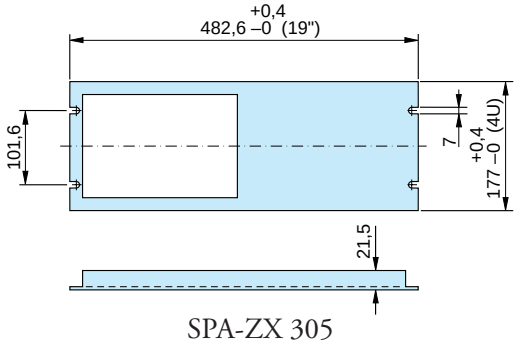
An ancillary mounting plate, height 4U (~177 mm), is recommended to be used when the protection relays are to be mounted in 19 inch frames or cabinets. The ancillary mounting plate type SPA-ZX 304 accommodates two size 300 relays and type SPA-ZX 305 one size 300 relay.

Projecting mounting

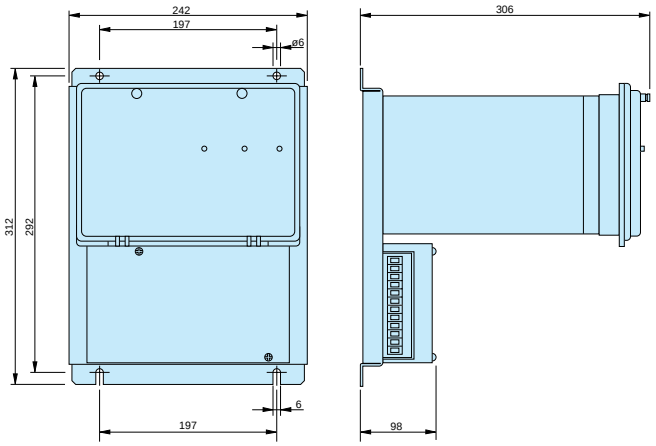
When projecting mounting is preferred a relay case type SPA-ZX 317 is used. The relay case for projecting mounting is provided with front connectors.



SPA-ZX 304



SPA-ZX 305



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