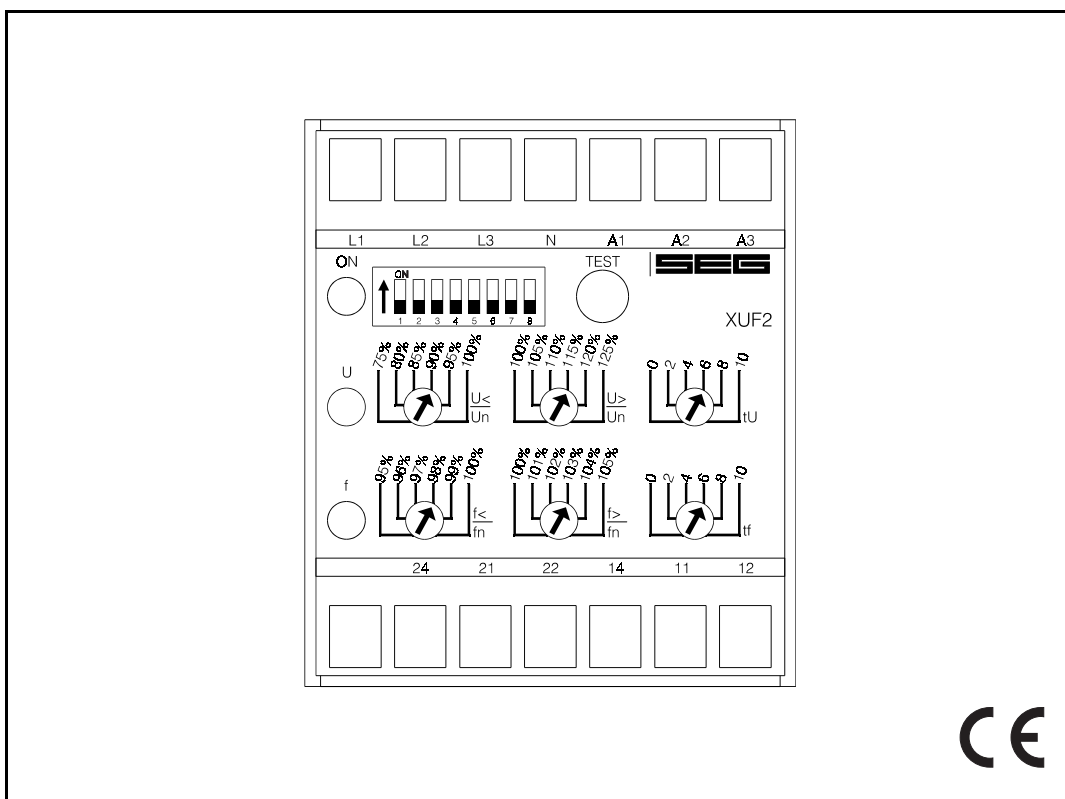


XUF2 - AC voltage and frequency relay



Contents

- 1. Applications and features**
- 2. Design**
- 3. Function**
 - 3.1 Voltage supervision
 - 3.2 Frequency supervision
- 4. Operation and settings**
 - 4.1 Setting of DIP-switches
 - 4.2 Setting of potentiometers
 - 4.3 Communication via serial interface adapter *XRS1*
- 5. Relay case and technical data**
 - 5.1 Relay case
 - 5.2 Technical data

1. Applications and features

Relay *XUF2* of the *PROFESSIONAL LINE* is a digital relay for voltage and frequency supervision of 1-phase or 3-phase systems and provides protection for electrical power generators and general equipment against inadmissible undervoltage or overvoltage as well as against frequency changes. Furthermore it is possible to supervise the phase sequence.

When compared to conventional protection equipment all relays of the *PROFESSIONAL LINE* reflect the superiority of digital protection technique with the following features:

- High measuring accuracy by digital processing
- Fault indication via LEDs
- Extremely wide operating ranges of the supply voltage by universal wide range power supply unit
- Very fine graded wide setting ranges
- Data exchange with process management system by serial interface adapter *XRS1* which can be retrofitted
- RMS measurement
- Extremely short response time
- Compact design by *SMD*-technology

In addition to this relay *XUF2* has the following special features:

- Different switching hysteresis for frequency adjustable
- Tripping times for supervision of voltage and frequency individually adjustable
- Measurement phase-to-neutral or phase-to-phase voltage possible
- Phase sequence supervision switchable

2. Design

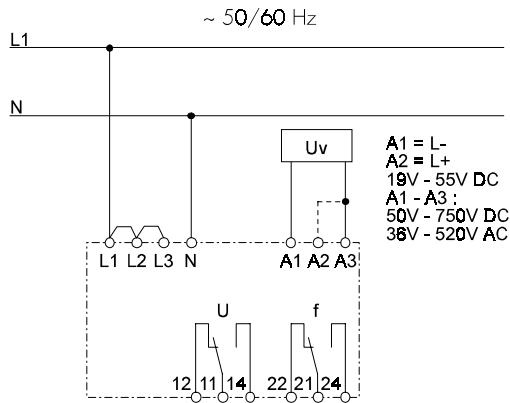


Fig. 2.1: Connection two wire system Y

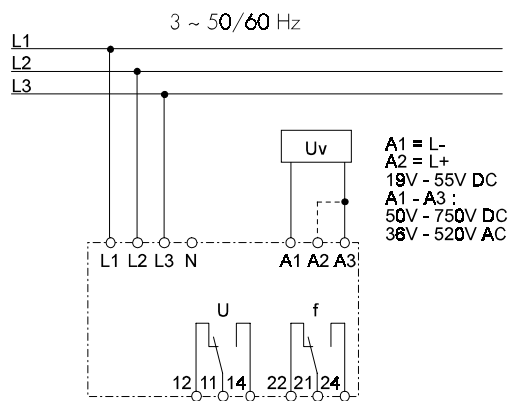


Fig. 2.2: Connection three wire system Δ

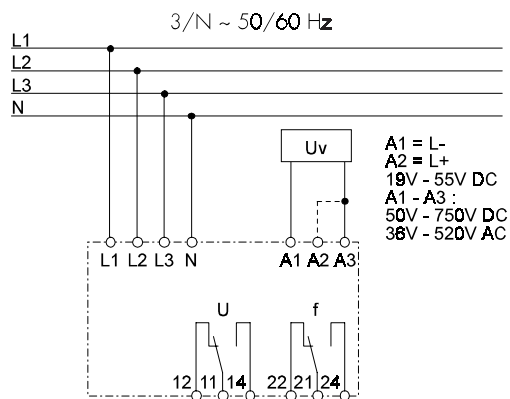


Fig. 2.3: Connection four wire system Y/Δ

Analog inputs

The analog voltage input signals are connected to the protection relay via terminals L1-L3 and N.

Auxiliary voltage supply

Unit *XUF2* can be supplied directly from the measuring quantity itself or by a secured auxiliary supply. Therefore a DC or AC voltage must be used.

Unit *XUF2* has integrated wide range power supply. Voltages in the range from 19 - 55 V DC can be applied at connection terminals A1(L-) and A2(L+). Terminals A1/A3 are to be used for voltages from 50 - 750 V DC or from 36 - 520 V AC.

Contact Positions

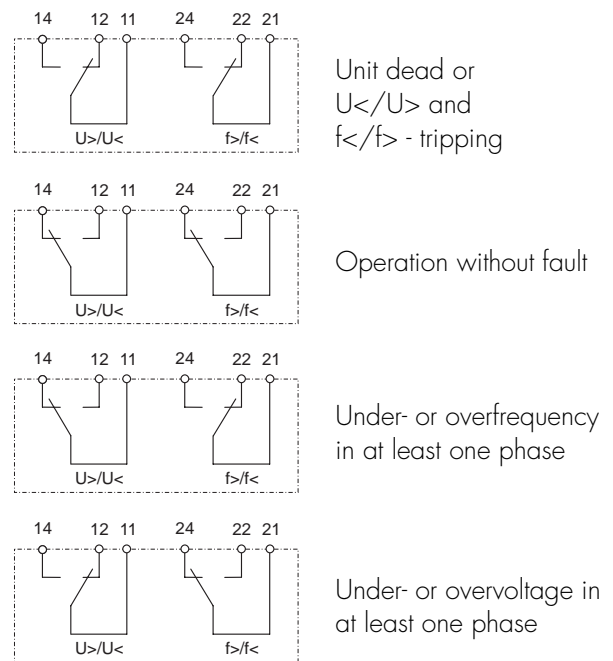


Fig. 2.4: Contact positions of the output relays

3. Function

3.1 Voltage supervision

The *XUF2* has an independent under- and overvoltage supervision. Either 1-phase or 3-phase of the voltage are measured. During 3-phase measuring the voltage is permanently compared with the set reference values.

For overvoltage supervision always the highest value is evaluated, for undervoltage supervision always the lowest value.

Tripping/pickup at undervoltage is indicated by flashing LED U, whereas at overvoltage LED U is steady lit.

3.2 Frequency supervision

For frequency supervision the cycle duration is evaluated and so measuring is virtually independent on harmonic influences. To avoid tripping during normal operation due to voltages transients and phase transients - a fixed measuring repetition is used. Each of the phases is individually monitored. Pickup or tripping only after the set reference value in at least one phase is exceeded or not reached. Tripping/pickup at underfrequency is indicated by flashing LED f, whereas at overfrequency LED f is steady lit. If the measuring voltage drops below 70 % U_n , supervision of the frequency is blocked.

4. Operation and settings

All operating elements needed for setting parameters are located on the front plate of the **XUF2** as well as all display elements.

Because of this all adjustments of the relay can be made or changed without disconnecting the unit from the DIN-rail.

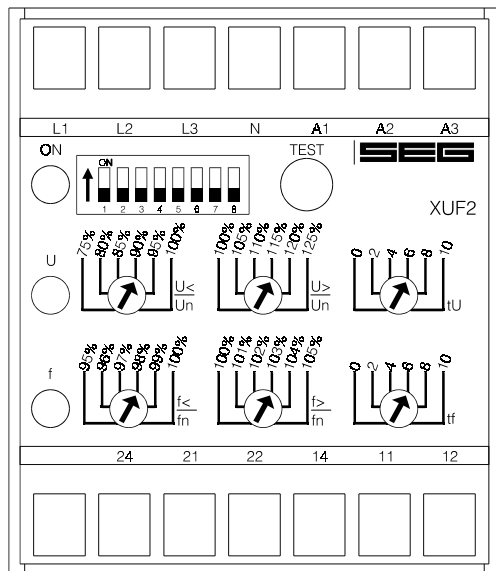


Fig. 4.1: Front plate

For adjustment of the relay please open the transparent cover as illustrated. Do not use force! The transparent cover has two inserts for labels.

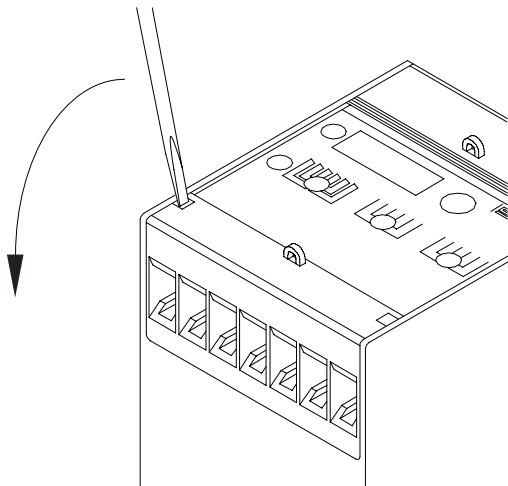


Fig. 4.2: How to open the transparent cover

LEDs

LED "ON" is used for display of the readiness for service (at applied auxiliary voltage U_v) and besides it flashes at wrong phase sequence. LED U indicates tripping/pickup due to undervoltage by a flashing light, at overvoltage this LED is steady lit. Underfrequency is indicated by flashing of LED f, at overfrequency LED f is steady lit.

Test push button

This push button is used for test tripping of the unit and when pressed for 5 s a check-up of the hardware takes place. Both output relays are tripped and all tripping LED's light up.

4.1 Setting of DIP-switches

The DIP-switch block on the front plate of unit *XUF2* is used for adjustment of the nominal values and setting of function parameters:

DIP-switch	OFF	ON	Function
1*	$U_n = 100 \text{ V}$	$U_n = 110 \text{ V}$	setting of rated voltage
2*	$U_n = 100 \text{ V}$	$U_n = 230 \text{ V}$	
3*	$U_n = 100 \text{ V}$	$U_n = 400 \text{ V}$	
4	inactive	active	phase sequence supervision
5	Y	Δ	measuring phase-to-neutral/phase-to-phase voltage
6	50 Hz	60 Hz	rated frequency
7	0.25 %	0.5 %	switching hysteresis of the frequency protection
8	x 0.1 s	x 1 s	multiplier for tU and tf

Table 4.1: Function of DIP-switches

* Only one of the DIP-switches 1 - 3 shall be in "ON" position at a time

Rated voltage

The required rated voltage (phase-to-phase voltage) can be set with the aid of DIP-switch 1 - 3 to 100, 110, 230 or 400 V AC. It has to be ensured that only one of the three DIP-switches is switched on.

The following DIP-switch configurations for adjustment of the rated voltage are allowed:

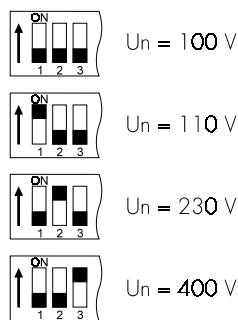


Fig. 4.3: Adjustment of rated voltage

Rated voltage chosen too low, does not cause destruction of the unit, but leads to wrong measuring results which may lead to false tripping.

Phase sequence supervision

When DIP-switch 4 is in position "ON", the phase sequence supervision is active. Wrong phase sequence is indicated with the flashing LED "ON" and all output relays will be tripped. A correct phase sequence is indicated with the steady lit LED "ON". The phase sequence supervision is only activated at $U_n > 70 \%$. To prevent tripping when connected to two-wire systems, the phase sequence supervision must be deactivated.

Measurement over phase-to-neutral voltage / phase-to-phase voltage

The phase-to-neutral (position "OFF") or phase-to-phase voltage (position "ON") can be adjusted by means of switching over the DIP-switch 5.

By measuring phase-to-neutral voltage a displacement of the neutral point will be detected.

If the phase-to-phase voltage is measured, a displacement of the neutral point will not be detected. Instead of it the values of the three phase-to-phase voltages in the phase triangle will be detected.

The kind of connection Y or Δ is dependent on the item to be protected, i.e. a three phase motor (without neutral) in a four wire system => select Δ .

Rated frequency

Dependent on the mains conditions, the *XUF2* can be switched over from rated frequency 50 Hz to 60 Hz by using DIP-switch 6.

Switching hysteresis of the frequency protection

Switching hysteresis of the frequency protection can be set to 0.25 % or 0.5 % of the tripping value by using DIP-switch 7.

Supervision of single-phase AC voltages

For supervision of single-phase AC voltages, terminals L1 - L3 must be short-circuited. DIP-switches 4 and 5 must be in position "OFF".

4.2 Setting of potentiometers

Undervoltage element

The undervoltage element can be adjusted in the range from 75 % to 100 % U_n by using potentiometer $U_{<}/U_n$. The switching hysteresis is fixed to 3 %.

Overvoltage element

The overvoltage element can be adjusted in the range from 100 % to 125 % U_n by using potentiometer $U_{>}/U_n$. The switching hysteresis is fixed to 3 %.

Underfrequency element

The underfrequency element can be adjusted in the range from 95 % to 100 % f_n by using potentiometer $f_{<}/f_n$. The frequency protection will be blocked if the measuring voltage drops below 70 % U_n .

Overfrequency element

The overfrequency element can be adjusted in the range from 100 % to 105 % f_n by using potentiometer $f_{>}/f_n$. The frequency protection will be blocked if the measuring voltage drops below 70 % U_n .

Time delays

Time delays t_f and t_U can be adjusted continuously variably in the range from 0 - 1 s (DIP-switch 8 = OFF) or 0 - 10 s (DIP-switch 8 = ON).

4.3 Communication via serial interface adapter XRS1

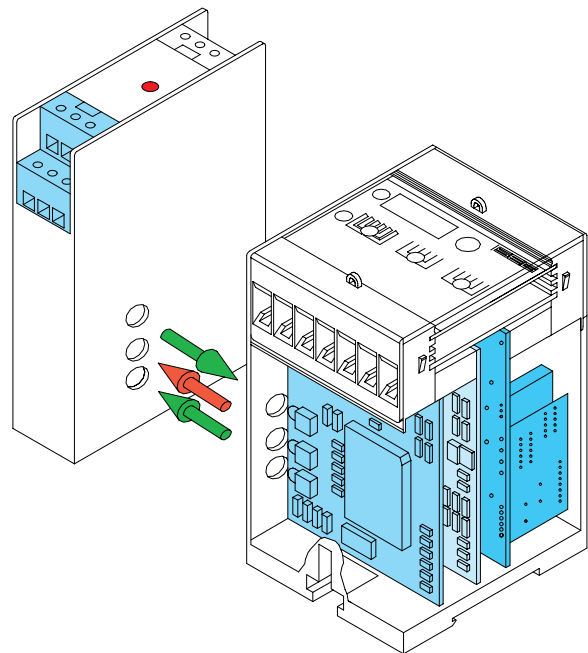


Fig. 4.4: Communication principle

For communication of the units with a superior management system, the interface adapter **XRS1** is available for data transmission, including operating software for our relays. This adapter can easily be retrofitted at the side of the relay. Screw terminals simplify its installation. Optical transmission of this adapter makes galvanic isolation of the relay possible. Aided by the software, actual measured values can be processed, relay parameters set and protection functions programmed at the output relays. Information about unit **XRS1** in detail can be taken from the description of this unit.

5. Relay case and technical data

5.1 Relay case

Relay *XUF2* is designed to be fastened onto a DIN-rail acc. to DIN EN 50022, the same as all units of the *PROFESSIONAL LINE*.

The front plate of the relay is protected with a sealable transparent cover (IP40).

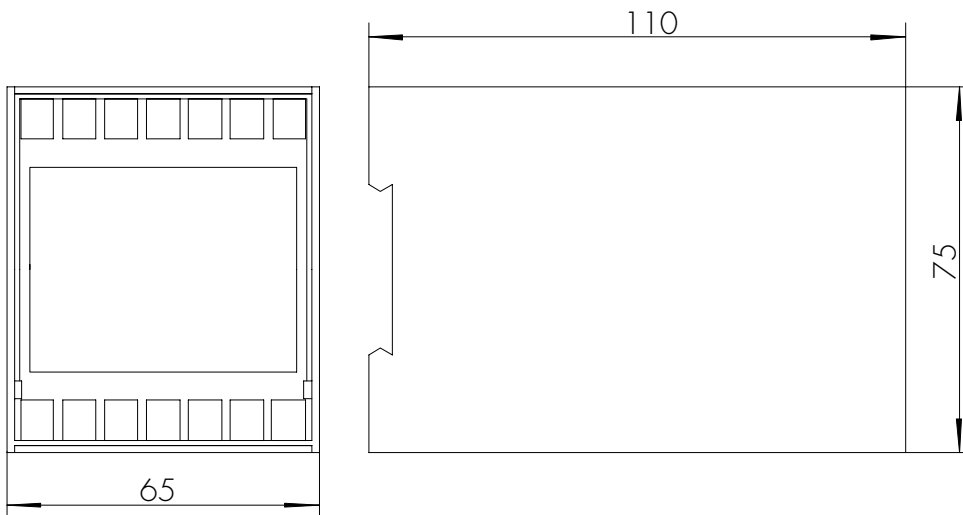


Fig. 5.1: Dimensional drawings

Connection terminals

The connection of up to a maximum of $2 \times 2.5 \text{ mm}^2$ cross-section conductors is possible. For this the transparent cover of the unit has to be removed (see para. 4).

5.2 Technical data

Connection possibilities:

System voltage	Setting Un	Connection	Setting	Connection	Setting	Connection	Setting
100 / 58 V	100 V	58 V single-phase	Y	100 V 3-phase	Δ	100/58 V four wire	Y/ Δ
110 / 63 V	110 V	63 V single-phase	Y	110 V 3-phase	Δ	110/63 V four wire	Y/ Δ
230 / 130 V	230 V	130 V single-phase	Y	230 V 3-phase	Δ	230/130 V four wire	Y/ Δ
400 / 230 V	400 V	230 V single-phase	Y	400 V 3-phase	Δ	400/230 V four wire	Y/ Δ
690 / 400 V		not possible		not possible		not possible	

Table 5.1: Connection possibilities

Measuring input circuits

Rated voltage Un:	100, 110, 230, 400 V AC (phase-to-phase voltage)
Rated frequency	50/60 Hz
Rated frequency range:	35 - 78 Hz (35 - 66 Hz at communication via serial interface)
Power consumption in voltage circuit:	1 VA per phase at Un
Thermal capacity of the voltage circuit:	continuously 520 V AC

Auxiliary voltage

Rated auxiliary voltage U_v /	36 - 520 V AC ($f = 35 - 78$ Hz) or 50 - 750 V DC / 4 W (terminals A1-A3)
Power consumption:	19 - 55 V DC / 3 W (terminals A1 (L-) and A2 (L+))

Common data

Dropout to pickup ratio:	depending on the adjusted hysteresis
Resetting time from pickup:	< 50 ms
Returning time from trip:	500 ms
Minimum initialization time after supply voltage has applied:	150 ms
Minimum response time when the supply voltage is available:	50 ms
Time lag error class index E:	± 20 ms

Output relay

Number of relays:	2
Contacts:	1 changeover contact for each trip relay
Maximum breaking capacity:	ohmic 1250 VA/AC resp. 120 W/DC inductive 500 VA/AC resp. 75 W/DC
Max. rated voltage:	250 V AC 220 V DC ohmic load $I_{max.} = 0,2$ A inductive load $I_{max.} = 0,1$ A at $L/R \leq 50$ ms
Minimum load:	24 V DC inductive load $I_{max.} = 5$ A
Maximum rated current:	1 W / 1 VA at $U_{min} \geq 10$ V
Making current (16 ms):	5 A
Contact life span:	20 A 10^5 operations at max. breaking capacity

System data

Design standard:	VDE 0435 T303; IEC 0801 part 1-4, VDE 0160; IEC 255-4; BS 142; VDE 0871
Temperature range at storage and operation:	- 25 °C to + 70 °C
Constant climate class F acc. to DIN 40040 and DIN IEC 68, T.2-3:	more than 56 days at 40 °C and 95 % relative humidity
High voltage test acc. to VDE 0435, part 303	
Voltage test:	2,5 kV (eff) / 50 Hz; 1 min
Surge voltage test:	5 kV; 1.2/50 μ s, 0.5 J
High frequency test:	2,5 kV / 1 MHz
Electrostatic discharge (ESD) acc. to IEC 0801, part 2:	8 kV
Radiated electromagnetic field test acc. to IEC 0801, part 3:	10 V/m

Electrical fast transient (burst) acc. to IEC 801, part 4:	4 kV/2.5 kHz, 15 ms	
Radio interference suppression test acc. to DIN 57871 and VDE 0871:	limit value class A	
Repeat accuracy:	1 %	
Basic time delay accuracy:	0.5 % or ± 25 ms	
Accuracy of the specificrated values:	for U: $U_n = 100\text{ V } 110\text{ V } / 230\text{ V } / 400\text{ V}$	1 % Uphase-to-neutral 1 % Uphase-to-phase
	for f: 0.1 %	
Temperature effect:	0.02 % per K for voltage measuring 0.002 % per K for frequency measuring	
Frequency effect:	for voltage measuring 45 - 66 Hz no tolerance 35 - 45 Hz and 66 - 78 Hz 1 %	
Mechanical test		
Shock:	class 1 acc. to DIN IEC 255-21-2	
Vibration:	class 1 acc. to DIN IEC 255-21-1	
Degree of protection:		
Front plate:	IP40 at closed front cover	
Weight:	approx. 0.5 kg	
Mounting position:	any	
Relay case material:	self-extinguishing	
GL-Approbation:	94656-94HH	

Parameter	Setting range	Graduation
U<	75 - 100 % U_n	continuously variable
U>	100 - 125 % U_n	continuously variable
f<	95 - 100 % f_n	continuously variable
f>	100 - 105 % f_n .	continuously variable
t_u/t_f	0 - 1 s / 0 - 10 s	continuously variable
Hysteresis for U> and U<	3 % fest	
Hysteresis for f> and f<	0.25 % or 0.5 %	

Table 5.2: Setting ranges and graduation

Technical data subject to change without notice!

Setting-list XUF2

Project: _____ SEG job.no.: _____

Function group: = _____ Location: + _____ Relay code: - _____

Relay functions: _____ Date: _____

Setting of parameters

Function		Unit	Default settings	Actual settings
U<	Undervoltage	% Un	75	
U>	Overvoltage	% Un	100	
f<	Underfrequency	% fn	95	
f>	Overfrequency	% fn	100	
tU	Trip delay for tU	s	0	
tf	Trip delay for tf	s	0	

DIP-switch	Function	Default settings	Actual settings
1 *		100 V	
2 *	Adjustment of rated voltage	100 V	
3 *		100 V	
4	Phase sequence supervision	inactive	
5	Measuring phase-to-neutral / phase-to-phase voltage	Y	
6	Adjustment of the rated frequency	50 Hz	
7	Hysteresis for f< and f>	0.25 %	
8	Multiplier for tU and tf	x 0.1 s	

*Only one of the DIP-switches 1 - 3 shall be in „ON“-position at the same time.



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