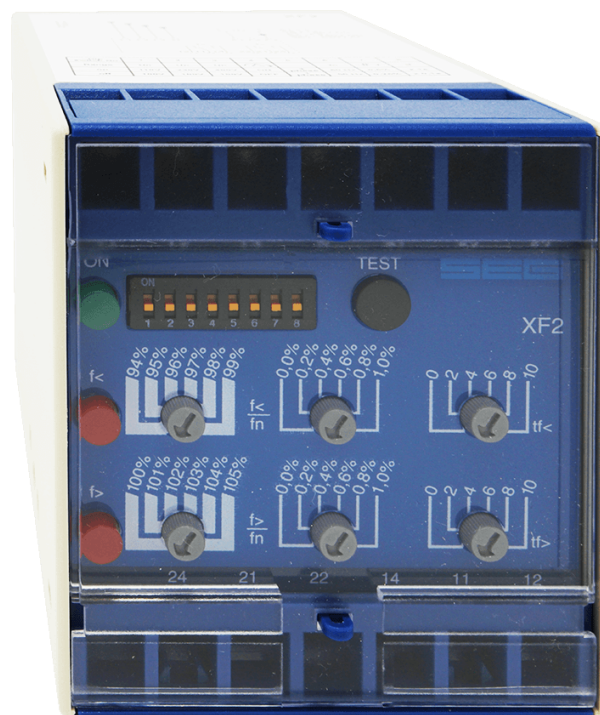


MANUAL

Professional Line | PROTECTION TECHNOLOGY
MADE SIMPLE

XF2 | FREQUENCY RELAY



FREQUENCY RELAY

Original document

English

Revision: D

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1. Applications and features

Unit XF2 of the PROFESSIONAL LINE is a digital measuring relay for the frequency supervision of single- and three-phase AC-voltages. It offers reliable protection against inadmissible over- and underfrequency.

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

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

In addition to this relay XF2 has the following special features:

- The tripping periods for overfrequency/underfrequency separately adjustable
- Different switching hysteresis for $f >$ and $f <$ adjustable
- Phase sequence supervision switchable

2. Design

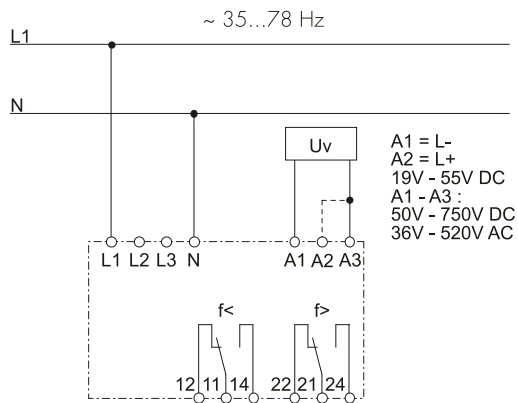


Figure 2.1: Connection two-wire system

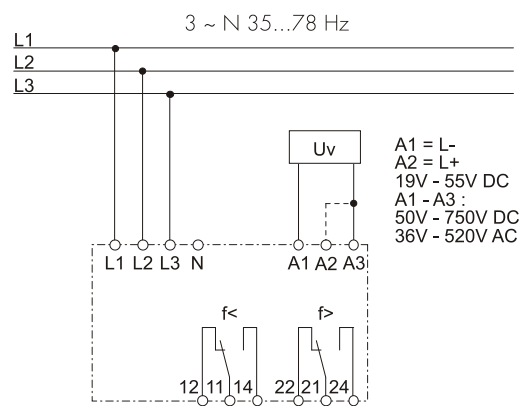


Figure 2.2: Connection three-wire system

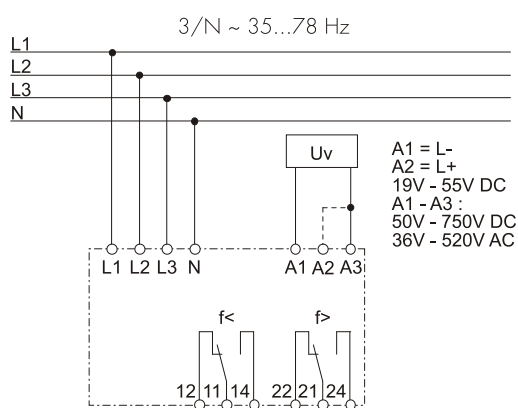


Figure 2.3: Connection four-wire system

Analog inputs

The analog input signals of AC voltages are connected to the protection device via terminals L1 - L3 and N.

Auxiliary voltage supply

Unit XF2 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 XF2 has an 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

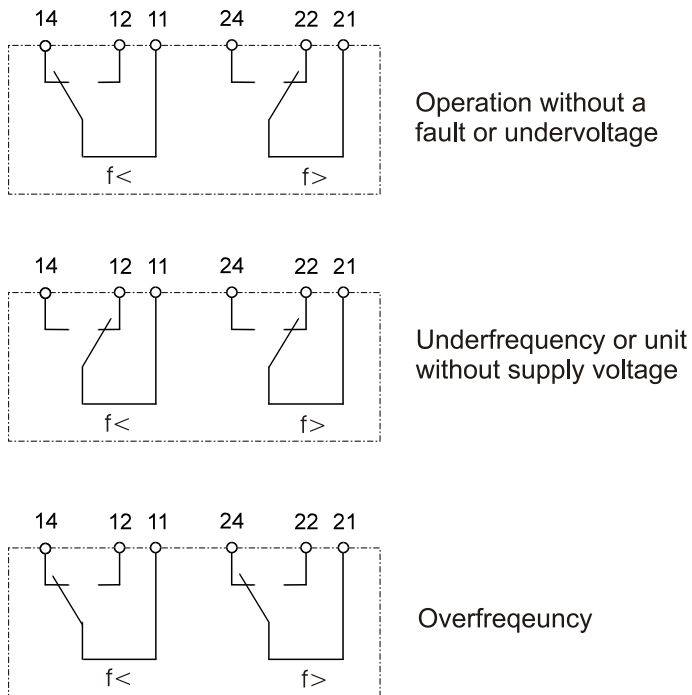


Figure 2.4: Contact positions of the output relays

3. Function

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.

Dependent on the pre-adjustment, supervision of the frequency is either 1-phase or 3-phase. 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.

Pickup of a supervision circuit is indicated by flashing of the corresponding LED. At tripping the flashing light changes to steady light. 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 panel of the XF2 as well as all display elements.

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

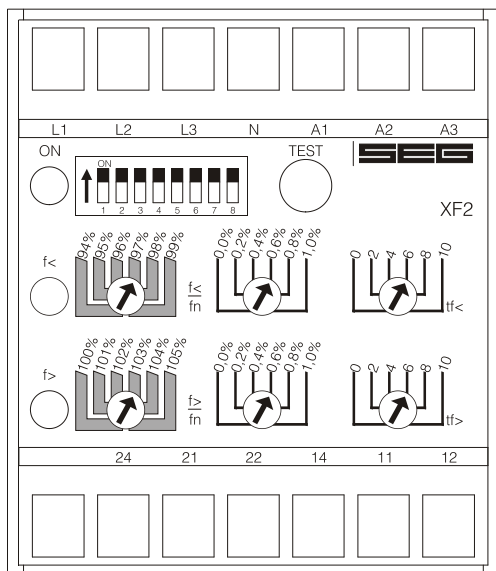


Figure 4.1: Front plate

For adjustment of the unit the transparent cover has to be opened as illustrated. Do not use force! The transparent cover has two inserts for labels.

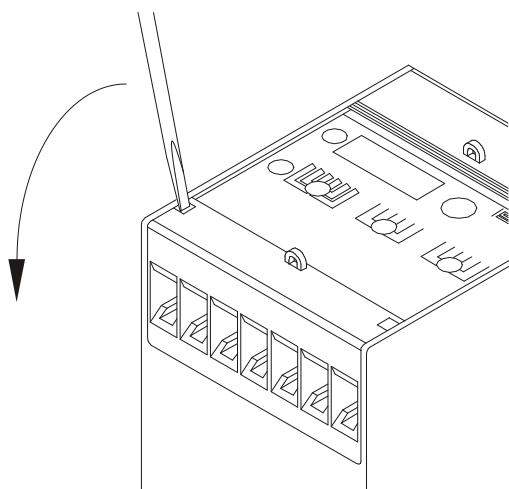


Figure 4.2: How to open the transparent cover

LEDs

LED "ON" is used for display of the readiness for service (at applied auxiliary voltage U_v) and besides this it flashes at wrong phase sequence (see table under para.4.1). LEDs $f_>$ and $f_<$ signal pickup (flashing) or tripping (steady light) of the corresponding function.

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 LEDs light up.

4.1 Setting of DIP-switches

The DIP-switch block on the front plate of unit XF2 is used for the adjustment of the nominal values and setting of function parameters:

DIP-switch	OFF	ON	Function
1*	Un = 100 V	Un = 110 V	setting of rated voltage
2*	Un = 100 V	Un = 230 V	
3*	Un = 100 V	Un = 400 V	
4*	inactive	active	phase sequence supervision
5*	single-phase	three-phase	measurement of the frequency
6*	50 Hz	60 Hz	rated frequency
7*	0.25 %	0.5 %	switching hysteresis for f> and f<
8*	x 0.1 s	x 1 s	Multiplier for tf< and tf>

Table 4.1: Function of DIP-switches

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

Rated voltage

The required rated voltage (phase-to-phase voltage) can be set with the aid of DIP-switches 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:

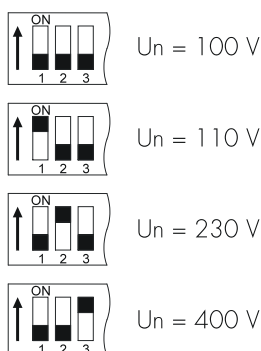


Figure 4.3: Adjustment of rated voltage

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 and 5 are 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 trippings, when connected to two-wire systems, the phase sequence supervision must not be activated.

Supervision of single- or three-phase AC-voltages

For the supervision of single-phase AC voltages DIP-switch 5 must be switched off (measuring of phase-to-neutral voltage).

The DIP-switch 5 must be put in "ON" position if the frequency supervision is to be three-phase (measuring of phase-to-phase voltage). A three-phase measurement leads to a faster tripping.

Rated frequency

With the aid of DIP-switch 6 unit XF2 can be set to $f_n=50$ Hz or $f_n=60$ Hz, depending upon the given mains conditions.

Switching hysteresis

The switching hysteresis of both tripping relays can be set to 0.25 or 0.5 % of the rated frequency with the aid of DIP-switch 7.

4.2 Setting of the tripping values

The PROFESSIONAL LINE units have the unique possibility of high accuracy fine adjustments. For this, two potentiometers are used. The coarse setting potentiometer can be set in discrete steps of 1 %. A second fine adjustment potentiometer is then used for continuously variable setting of the final 0 - 1 %. Adding of the two values results in the precise tripping value.

Underfrequency supervision

The tripping value can be set in the range from 94 -100 % f_n with the aid of the potentiometer illustrated on the following diagram.

Example:

A tripping value $f_{<}$ of 97,6 % f_n is to be set. The set value of the right potentiometer is just added to the value of the coarse setting potentiometer. (The arrow of the coarse setting potentiometer must be inside of the marked bar, otherwise no defined setting value).

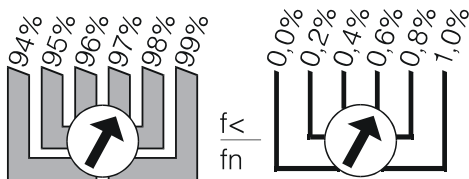


Figure 4.4: Adjustment example

If the measuring voltage drops below 70 % U_n super-vision of frequency is blocked.

Overfrequency supervision

The tripping value at overfrequency is adjustable in the range from 100 - 106 % f_n . The adjustment is made analogically to the overfrequency supervision.

Time delay

The time delays $t_{f<}$ and $t_{f>}$ can be adjusted continuously variable 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

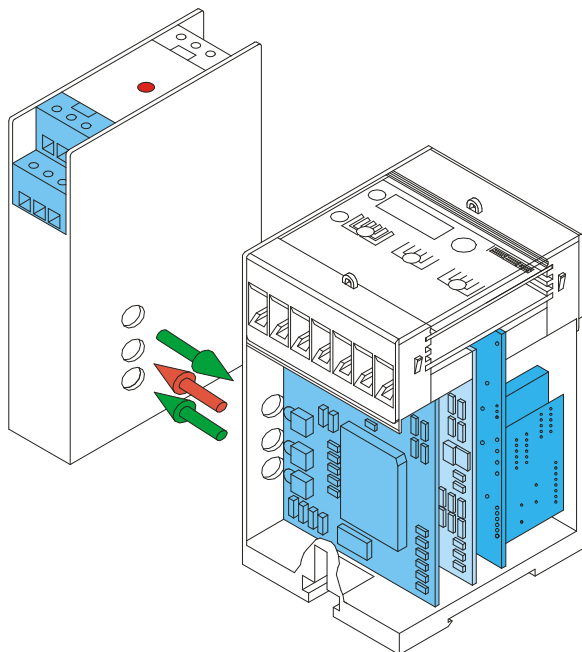


Figure 4.5: Communication principle

For communication of the units among each other and 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 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

Unit XF2 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 unit is protected with a sealable transparent cover (IP40).

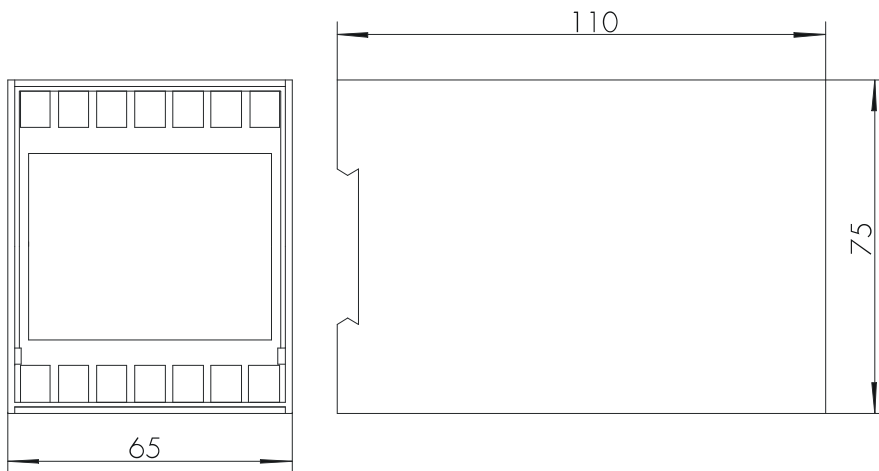


Figure 5.1: Dimensional drawings

Connection terminals

The connection 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 chapter 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 fn:	50 / 60 Hz
Frequency measuring range:	35 - 78 Hz (35 - 66 Hz at communication via serial interface)
Power consumption in the voltage circuit:	1 VA per phase at Un
Thermal carrying capacity of voltage circuit:	continuously 520 V AC

Auxiliary voltage

Auxiliary voltage range:	36 - 520 V AC (*) (f = 35 - 78 Hz) or 50 - 750 V DC / 4W (*) (terminals A1-A3)
	(*) max. 300 V AC / 424 V DC against ground (earth).
Power consumption:	19 - 55 V DC / 3 W (terminals A1 (L-) - 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 initialisation time after supply voltage has applied:	150 ms
Minimum response time when 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
	24 V DC inductive load I _{max.} = 0,1 A at L/R ≤ 50 ms
Minimum load:	inductive load I _{max.} = 5 A
Maximum rated current:	1 W / 1 VA at U _{min} ≥ 10 V
Maximum rated current:	5 A
Making current (16 ms):	20 A
Contact life span:	10 ⁵ operations at max. breaking capacity

System data

Design standard: VDE 0435, VDE 0843 Part 1-4, VDE 0871, EN 50178:1998

Climate condition:

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) test
acc. to IEC 0801, 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: 0.015%
Basic time delay accuracy: 0.5% or \pm 25 ms
Accuracy of the specific rated values: 0,1%
Temperature effect: 0.002% per K

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

Parameter	Setting range	Graduation
f<	94 - 100 % fn	continuously variable
f>	100 - 106 % fn	continuously variable
tf</tf>	0 - 1 / 0 - 10 s	continuously variable
Hysteresis for f< and f>	0.25; 0.5%	

Table 5.2: Setting ranges and graduation

Technical data subject to change without notice!

Setting-list XF2

Project: _____ SEG Electronics GmbH job.-no.: _____

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

Relay functions: _____ Date: _____

Setting of parameters

Function		Unit	Default settings	Actual settings
f<	Overfrequency low set element	% fn	94	
f>	Overfrequency high set element	% fn	100	
tf</tf>	Trip delay for tf</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	Frequency measuring	single phase	
6	Adjustment of the rated frequency	50 Hz	
7	Hysteresis for f< and f>	0.25 %	
8	Multiplier for tf< 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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