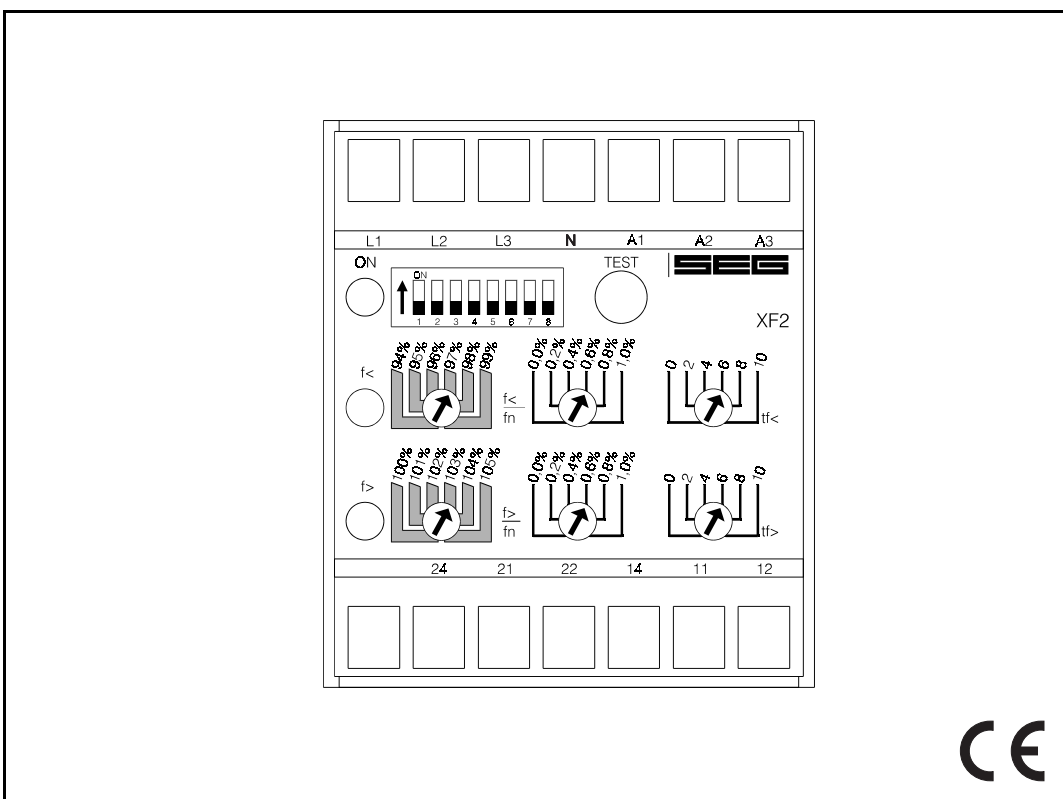


XF2-400 - Frequency Relay



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1. Applications and features

Unit *XF2-400* 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
- High reliability in operation by internal selfsupervision (watchdog)
- Extremely wide operating ranges of the supply voltage by universal wide range power supply
- Very fine graded setting ranges
- Data exchange with process management system by serial interface adapter *XRS1* which can be retrofitted
- RMS measurement
- Extremely short response times
- Compact design by *SMD*-technology

In addition to this relay *XF2-400* 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

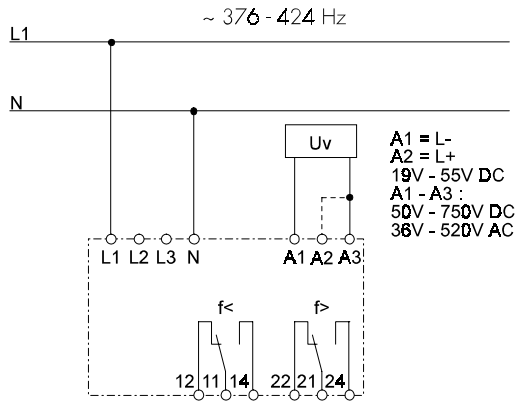


Fig. 2.1: Connection two-wire system

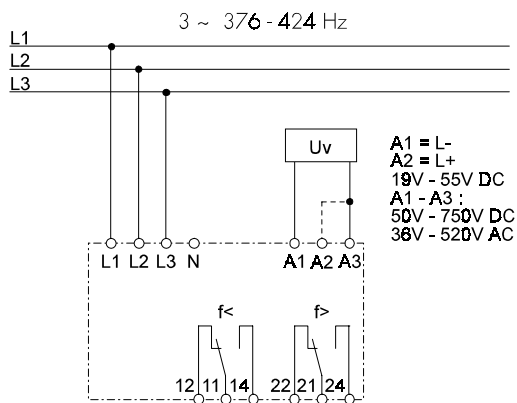


Fig. 2.2: Connection three-wire system

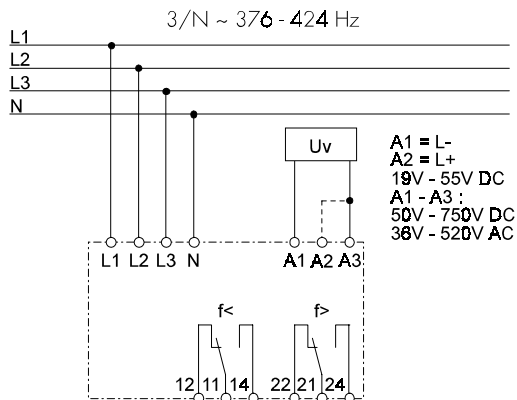


Fig. 2.3: Connection four-wire system

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 **XF2-400** 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 **XF2-400** 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 ($f = 100 - 480$ Hz).

Contact positions

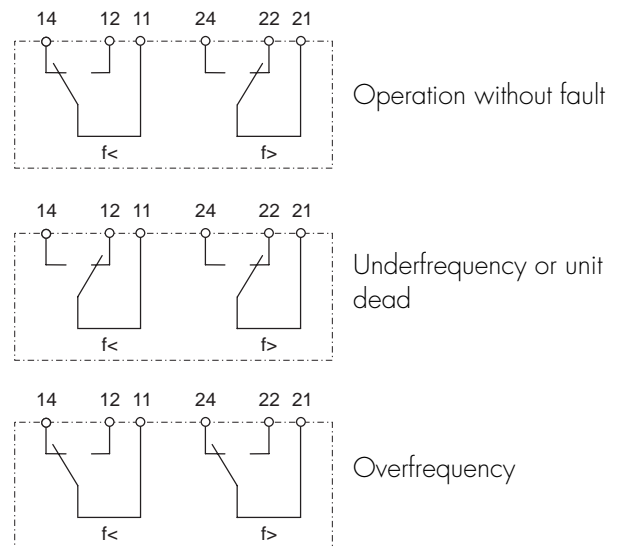


Fig. 2.4: Contact positions of the output relays

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 preadjustment, 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 **XF2-400** 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.

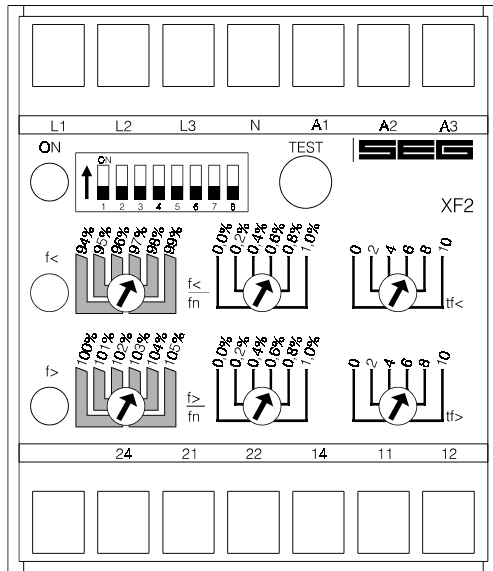


Fig. 4.1: Front plate

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.

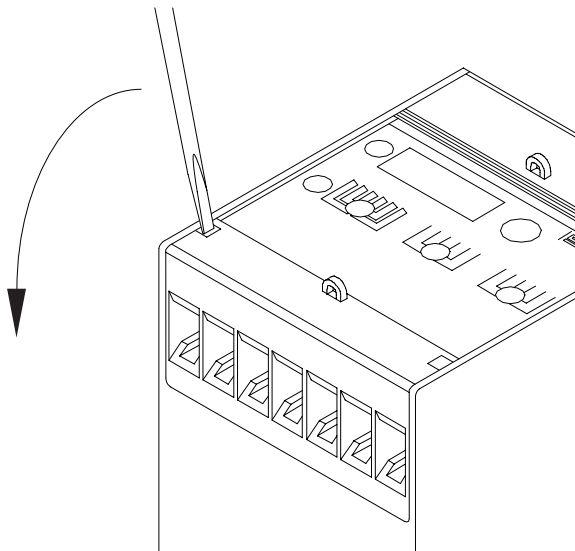


Fig. 4.2: How to open the transparent cover

LEDs

LED "ON" is used for display of the readiness for service (at applied auxiliary voltage U_v). 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.

Internal self supervision (watchdog)

To increase the operating safety a software watchdog is installed which checks over the internal hard- and software.

4.1 Setting of DIP-switches

The DIP-switch block on the front plate of unit **XF2-400** is used for the 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			
5	single-phase	three-phase	measurement of the frequency
6			
7*	0.25 %	0.5 %	switching hysteresis for $f>$ and $f<$
8*	$\times 0.1 \text{ s}$	$\times 1 \text{ s}$	time multiplier for $f</math>/f>$

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:

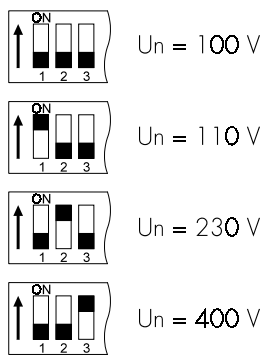


Fig. 4.3: Adjustment of rated voltage

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

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).

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 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).

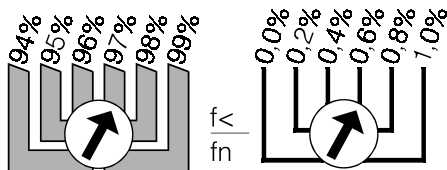


Fig. 4.4: Adjustment example

If the measuring voltage drops below 70 % U_n supervision 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 delay at over-/underfrequency 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

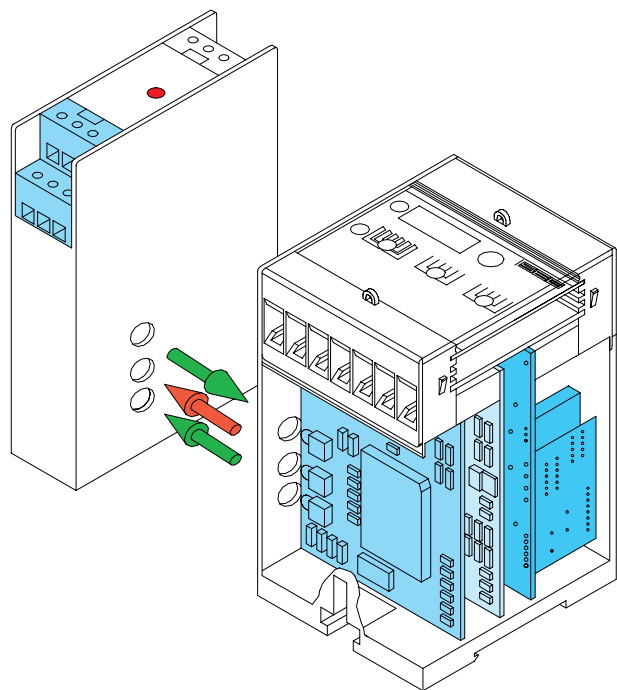


Fig. 4.5: Communication principle

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 *XF2-400* 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).

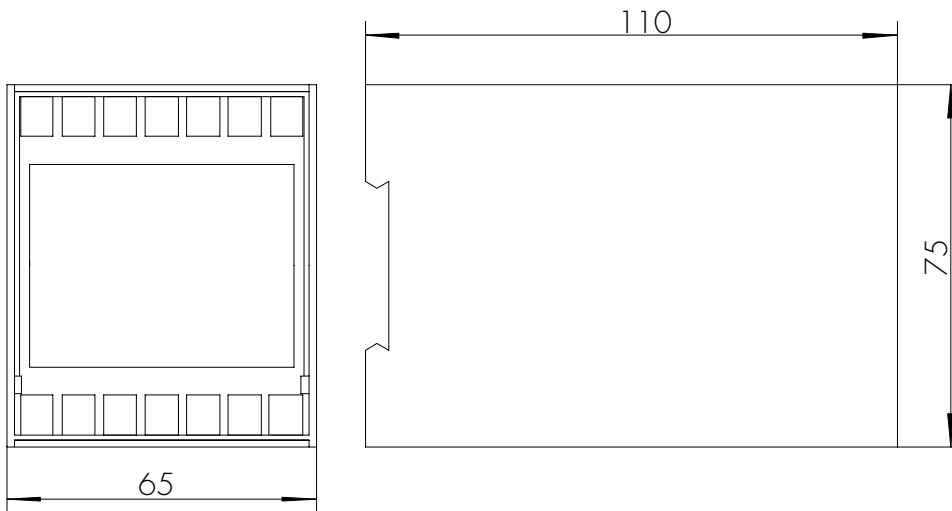


Fig.5.1: Dimensional drawings

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 para. 4).

5.2 Technical data

Connection possibilities:

System voltage	Setting Un	Connection	Setting	Connection	Setting	Connection	Setting
100 / 60 V	100 V	60 V single-phase	Y	100 V 3-phase	Δ	100/60 V four wire	Y
110 / 63 V	110 V	63 V single-phase	Y	110 V 3-phase	Δ	110/63 V four wire	Y
230 / 130 V	230 V	130 V single-phase	Y	230 V 3-phase	Δ	230/130 V four wire	Y
400 / 230 V	400 V	230 V single-phase	Y	400 V 3-phase	Δ	400/230 V four wire	Y
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: 400 Hz
 Frequency measuring range: 376 - 424 Hz (100 - 480 Hz at communication via serial interface)

Power consumption in the voltage circuit: 1 VA per phase at Un = 400 V

Thermal carrying capacity of voltage circuit: continuously 520 V AC

Auxiliary voltage

Rated auxiliary voltage Uv/ Power consumption: 36 - 520 V AC (f = 100 - 480 Hz) or 50 - 750 V DC / 4 W (terminals A1-A3)
 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: <20 ms
 Returning time from trip: 500 ms
 Minimum initialisation time after supply voltage has applied: 80 ms
 Minimum response time when supply voltage is available and measuring voltage has applied: 30 ms ±10 ms
 Minimum response time when supply voltage and measuring voltage is available: 20 - 30 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 ≤ 50 ms
 24 V DC inductive load I_{max.} = 5 A

Minimum load: 1 W / 1 VA at $U_{min} \geq 10$ 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 T303; IEC 0801 part 1-4, VDE 0160; IEC 255-4; BS 142
 Climat 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% for f
 Basic time delay accuracy: 0.5% or ± 20 ms
 Accuracy of the specific rated values: 0.05%
 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

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

Table 5.1: Setting ranges and graduation

Technical data subject to change without notice!

Setting-list XF2-400

Project: _____ SEG job.no.: _____

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

Relay functions: _____ Date: _____

Setting of parameters

Function		Unit	Default settings	Actual settings
f<	underfrequency	Hz	94 / Un = 100 V	
f>	overfrequency	Hz	100 / Un = 100 V	
tf>	time delay for f>	s	0	
tf<	time delay for f<	s	0	



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