WOODWARD

XUF2 – AC voltage and frequency relay

(April 2010)

Manual XUF2 (Revision A)

Contents

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 in-admissible 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 volt-age 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

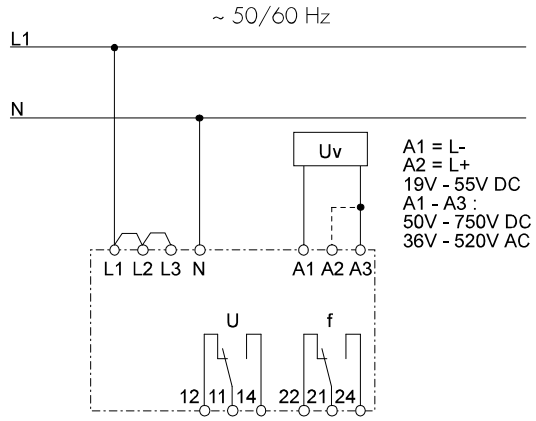

Figure 2.1: Connection two wire system Y

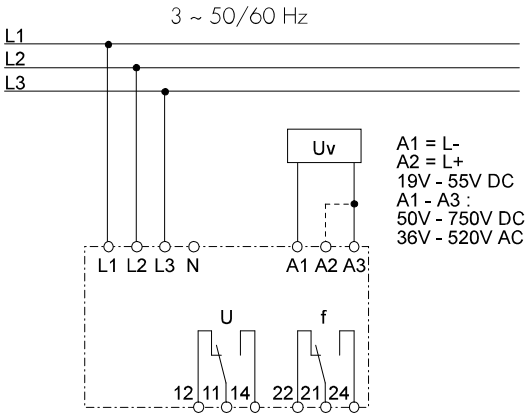

Figure 2.2: Connection three wire system ☐

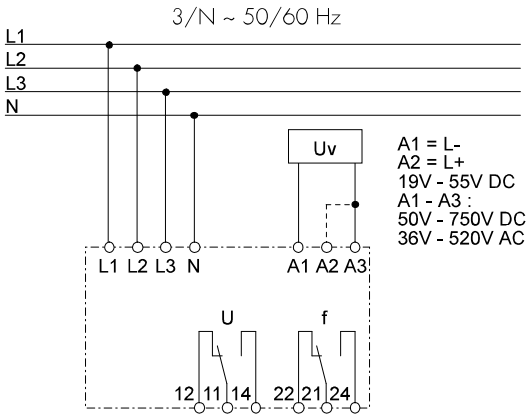

Figure 2.3: Connection four wire system Y/☐

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

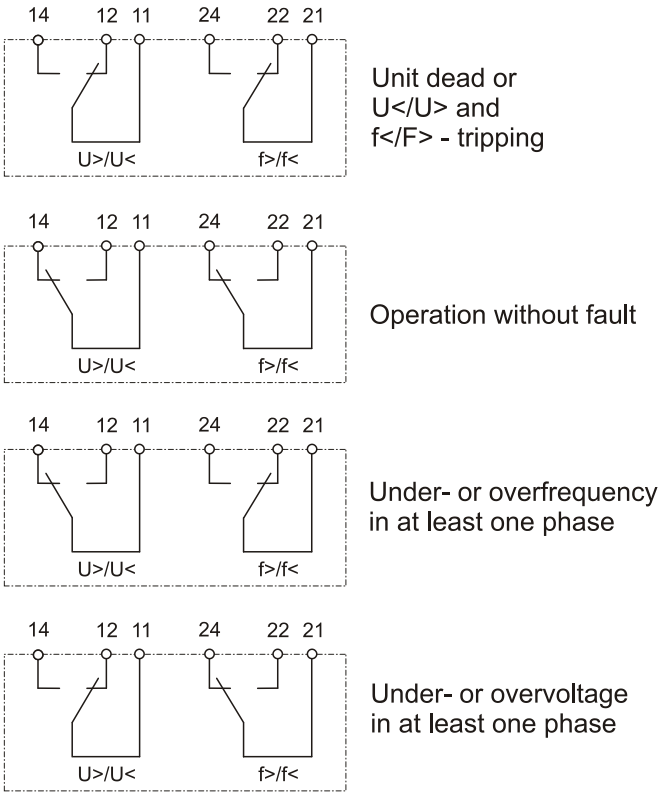

Figure 2.4: Contact positions of the output relays

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 % Un, 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.

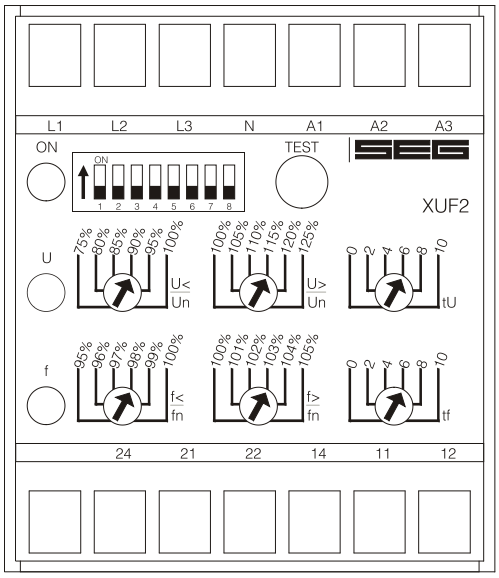

Figure 4.1: Front plate

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

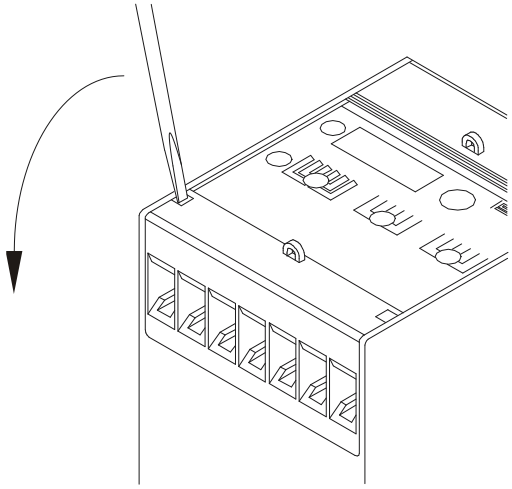

Figure 4.2: How to open the transparent cover

LEDs
LED "ON" is used for display of the readiness for service (at applied auxiliary voltage Uv) 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*	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	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:

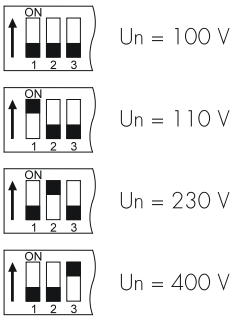

Figure 4.3: Adjustment of rated voltage

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 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 Un > 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.
The kind of connection Y or Δ is dependent on the item to be protected, i.e. a three phase motor (without neu-tral) 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 % Un by using potentiometer U</Un. The switching hysteresis is fixed to 3 %.

Overvoltage element
The overvoltage element can be adjusted in the range from 100 % to 125 % Un by using potentiometer U>/Un. The switching hysteresis is fixed to 3 %.

Underfrequency element
The underfrequency element can be adjusted in the range from 95 % to 100 % fn by using potentiometer f</fn. The frequency protection will be blocked if the measuring voltage drops below 70 % Un.

Overfrequency element
The overfrequency element can be adjusted in the range from 100 % to 105 % fn by using potentiometer f>/fn. The frequency protection will be blocked if the measuring voltage drops below 70 % Un.

Time delays
Time delays tf and tU 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

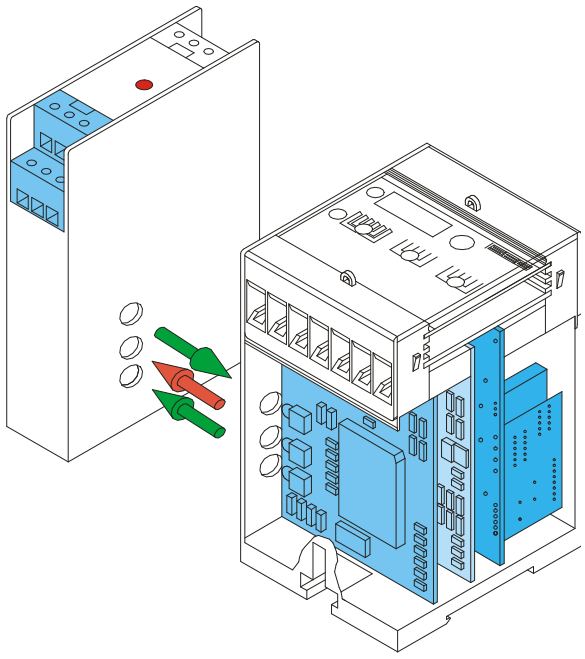

Figure 4.4: Communication principle

For communication of the units with a superior management system, the interface adapter XRS1 is avail-able 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 PRO-FESSIONAL LINE.
The front plate of the relay is protected with a sealable transparent cover (IP40).

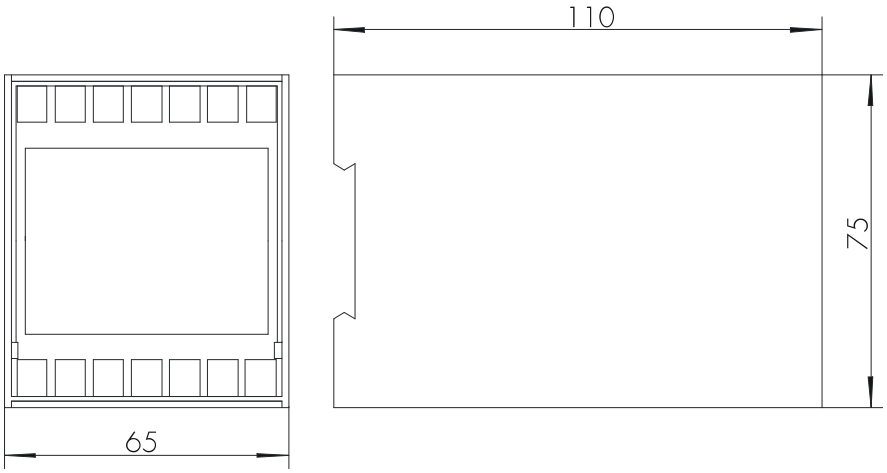

Figure 5.1: Dimensional drawings

Connection terminals
The connection of up to a maximum of 2 x 2.5 mm2 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	Set-ting	Connection	Set-ting	Connection	Set-ting
100/58 V	100 V	58 V single-phase	Y	100 V 3-phase	Δ	100/58 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	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 Uv/	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 Imax. = 0,2 A inductive load Imax. = 0.1 A at L/R ≤ 50 ms
24 V DC	inductive load Imax. = 5 A
Minimum load:	1 W / 1 VA at Umin ≥ 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; 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 □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 specificated values: for U: Un = 100 V 110 V / 230 V / 400 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 % Un	continuously variable
U>	100 - 125 % Un	continuously variable
f<	95 - 100 % fn	continuously variable
f>	100 - 105 % fn.	continuously variable
tu/tf	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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