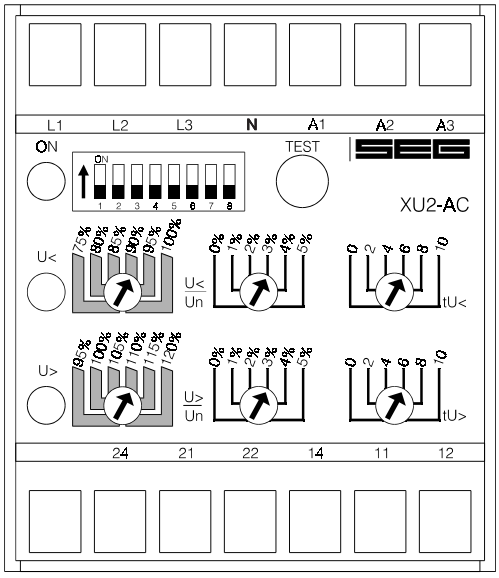
XU2-AC-400 - AC voltage relay



Inhalt

1. Applications and features

The voltage relay, type *XU2-AC-400*, of the *PROFESSIONAL LINE*, is a digital measuring relay for the supervision of two, three and four wire systems. It protects electrical power generators, consumers or general equipment against inadmissible overvoltage or undervoltage and can be used for low voltage and for medium voltage systems.

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 retrofitted
- RMS - measurement
- Extremely short response time
- Compact design by SMD-technology

In addition to this relay *XU2-AC-400* has the following special features:
- Different switching hysteresis adjustable
- The tripping periods for overvoltage/undervoltage supervision separately adjustable
- Measurement phase-to-neutral or phase-to-phase voltage possible

2. Design

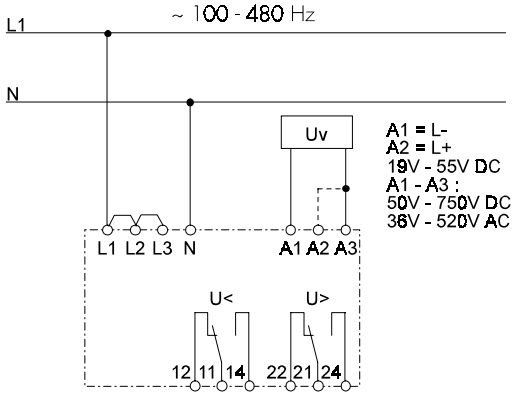


Fig. 2.1: Connecting two-wire system
DIP-switch setting Y

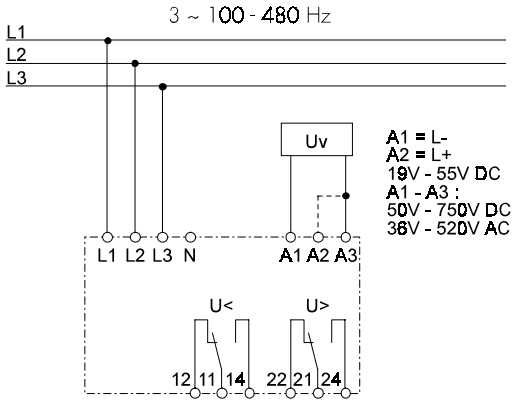


Fig. 2.2: Connection three-wire system
DIP-switch setting Δ

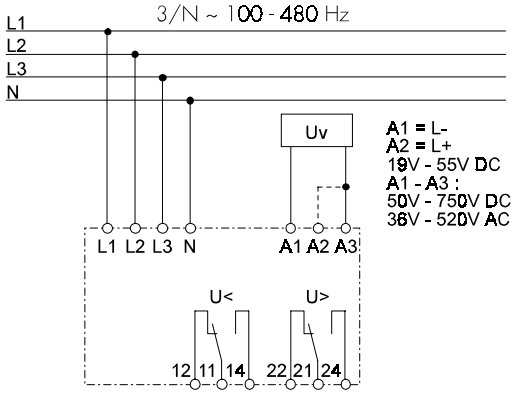


Fig. 2.3: Connection four-wire system
DIP-switch setting Y or Δ

Analog inputs

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

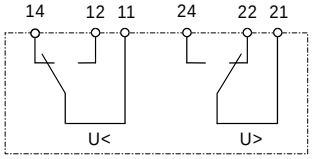
Auxiliary voltage supply

Unit *XU2-AC-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.

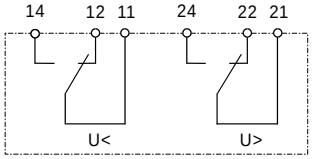
Unit *XU2-AC-400* has integrated wide range power supply. Voltages in the range from 19 - 55 V DC can be applied at connection terminals A1(L-) and A2(L+).

Terminals A1/A3 are to be used for voltages from 50 - 750 V DC or from 36 - 520 V AC (f = 100 - 480 Hz).

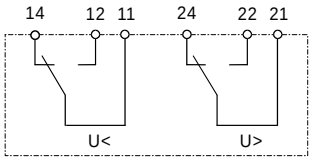
Contact positions



Operation without fault



Undervoltage in at least one phase or dead condition



Overvoltage in at least one phase

Fig. 2.4: Contact positions of the output relays

3. Function

Unit *XU2-AC-400* has an independent overvoltage (U>) and undervoltage supervision (U<) with separate adjustable pickup values and tripping periods. The noise signals caused by inductive and capacitive coupling are supressed by an analog RC-filter circuit.

The analog voltage signals are fed to the A/D-converter of the microprocessor and transformed to digital signals through sample-and-hold circuits. The analog signals are sampled with a sampling frequency of 2.66 x fn during 3 periods, a sampling rate of 0.9375 ms for every measuring quantity (at 400 Hz).

The voltages are compared with the set reference values. For three-phase overvoltage supervision the highest voltage in each phase is evaluated, for undervoltage supervision the lowest in each phase.

Pickup of a supervision circuit U> or U< is indicated by flashing of the corresponding LED, after tripping it is steady lit.

4. Operation and settings

All operating elements needed for setting parameters are located on the front plate of the *XU2-AC-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.

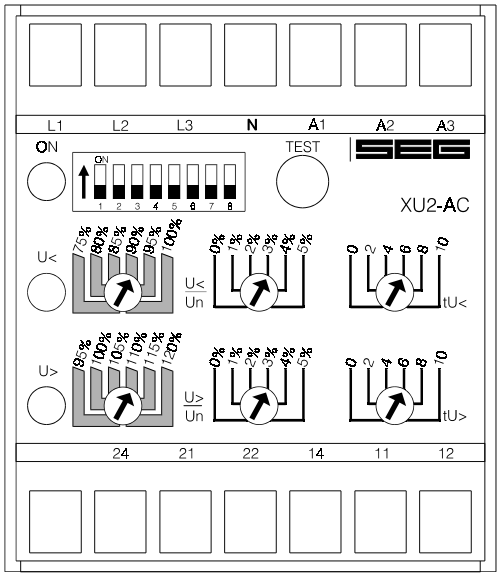


Fig. 4.1: Front plate

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.

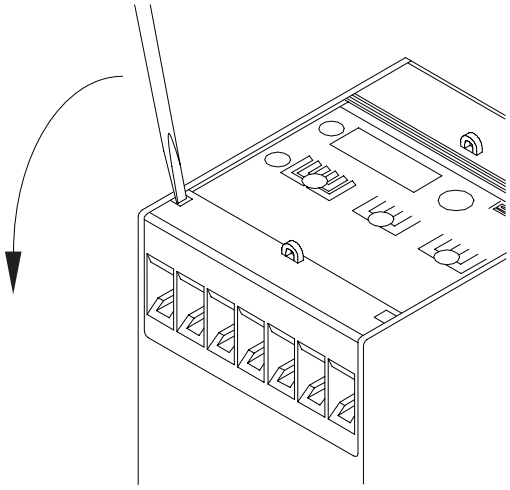


Fig. 4.2: How to open the transparent cover

LEDs

LED "ON" is used for display of the readiness for service (at applied auxiliary voltage Uv). LEDs U> and U< signal pickup (flashing) or tripping (steady light) of the respective 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 the *XU2-AC-400* 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			
5	Y	Δ	measuring phase-to-neutral/phase-to-phase voltage
6*	3 %	6 %	setting of switching hysteresis
7*	3 %	10 %	
8	x 0.1 s	x 1 s	Time multiplier for tU</tU>

Table 4.1: Function of DIP-switches

* Only one of the DIP-switches 1 - 3 and 6 - 7 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-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:

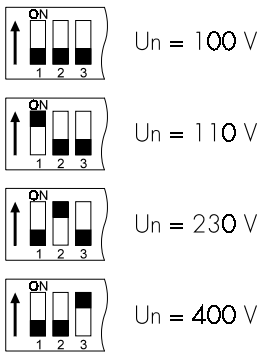


Fig. 4.3: Adjustment of rated voltage

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

Supervision of single-phase AC-voltages

For the supervision of single-phase AC-voltages terminals L1-L3 must be short-circuited. DIP-switch 5 must be in position "OFF".

Measurement phase-to-neutral/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.
Note:
By measuring phase-to-neutral voltage a displacement of the neutral point will be detected.
If the phase-to-phase voltage is measured, a dispacement 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.

Switching hysteresis

The switching hysteresis of both tripping relays can be adjusted with the aid of DIP switches 6 - 7 to 3, 6 or 10 % of the tripping values. As for the rated voltage, it has to be ensured that only one of the two DIP-switches is switched on.
The following adjustments of the switching hysteresis for U> and U< are possible:

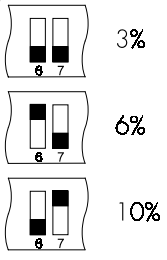


Fig. 4.4: Adjustment of the switching hysteresis

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 course setting potentiometer can be set in descrete steps of 5 %. A second fine adjustment potentiometer is then used for continuously variable setting of the final 0 - 5 %. Adding of the two values results in the precise tripping value.

Undervoltage element

The undervoltage element can be set in the range from 75 to 105 % Un with the aid of the potentiometer illustrated on the following drawing.

Example:

A tripping value U< for 93 % Un 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 the marked bar, otherwise no defined setting value).

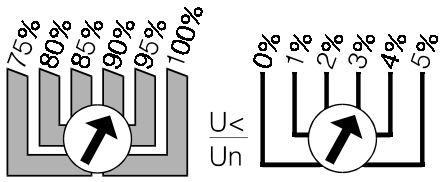


Fig. 4.5: Adjustment example

Overvoltage tripping element

The overvoltage tripping element is adjustable in the range from 95 - 125 % Un. The adjustment is carried out in a similar way to the undervoltage adjustment.

Time delays

The time delays for over-/undervoltage, tU< or tU> can be adjusted infinitely 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

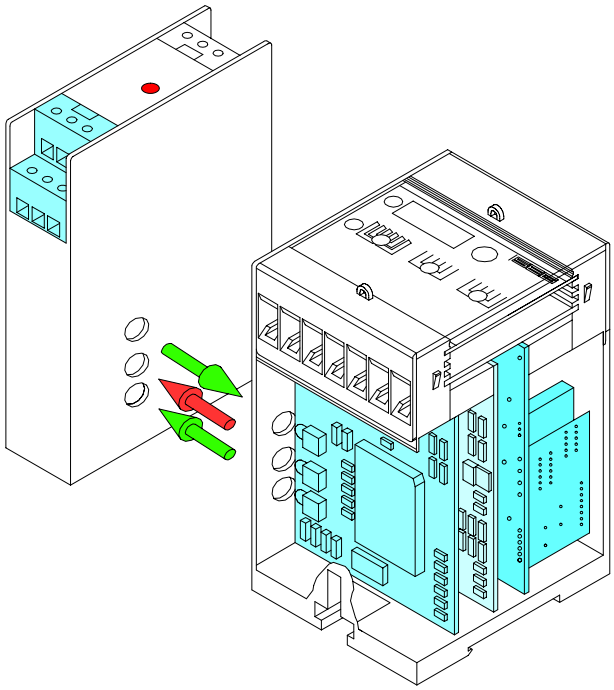


Fig. 4.6: Communication principle

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 outputrelays. 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 *XU2-AC-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).

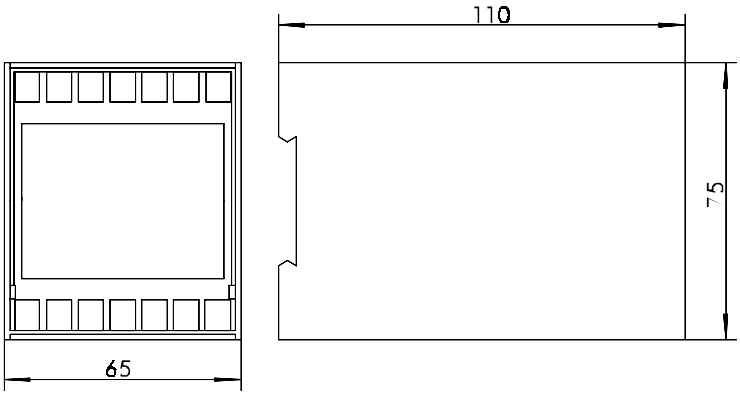


Fig. 5.1: Dimensional drawings

Connections terminals

The connection of up to a maximum of 2 x 2.5 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 data

Rated voltage Un:	100, 110, 230, 400 V AC (phase-to-phase voltage)
Rated frequency range:	100 - 480 Hz
Power consumption in voltage circuit:	1 VA per phase at Un = 400 V
Thermal capacity of the voltage circuit:	continuously 520 V AC

Auxiliary voltage

Rated auxiliary voltage Uv/	36 - 520 V AC (100 - 480 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:	<20 ms
Returning time from trip:	500 ms
Minimum initialization time after supply voltage has applied:	90 ms
Minimum response time when the supply voltage is available and measuring voltage has applied:	60 ms ±10 ms
Minimum response time when the supply voltage and measuring voltage is available:	30 ms ±10 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 µs, 0.5 J
High frequency test:	2.5 kV / 1 MHz
Electrostatic discharge (ESD) acc. to IEC0801 part 2:	8 kV
Radiated electromagnetic field test acc. to IEC 0801 part 3:	10 V/m
Electrical fast transient (burst) acc. to IEC 0801 part 4:	4 kV/2.5 kHz, 15 ms
Radio interference suppression test as per DIN 57871 and VDE 0871:	limit value class A
Repeat accuracy:	1 %
Basic time delay accuracy.	0.5 % or ±20 ms
Accuracy of the specific rated values:	Un = 100 V / 110V / 230 V / 400 V 1 % $U_{phase\text{-}to\text{-}neutral}$ 1 % $U_{phase\text{-}to\text{-}phase}$
Temperature effect:	0.02 % per K
Frequency effect:	320 - 480 Hz no tolerance 100 - 320 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 panel:	IP40 at closed front cover
Weight:	approx. 0.5 kg
Mounting position:	any

Parameter	Setting range	Graduation
U<	75 - 105 % Un	continuously variable
U>	95 - 125 % Un	continuously variable
tU</tU>	0 - 1 s / 0 - 10 s	continuously variable
Hysteresis for U> and U<	3, 6, 10 %	

Table 5.2: Setting ranges and graduation

Technical data subject to change without notice!

Setting-list *XU2-AC-400*

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 / Un = 100 V	
U>	Overvoltage	% Un	95 / Un = 100 V	
tU</tU>	Time delay for U< / U>	s	0	

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