



XU1-E – Earth fault voltage relay

(August 1996)

Manual XU1-E (Revision New)

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1. Applications and features

The XU1-E of the PROFESSIONAL LINE is a digital relay for earth fault detection in isolated and resistively earthed medium voltage systems. Digital filters ensure a suppression of harmonics. The relay can be connected to the open e-n winding of the voltage transformer.

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
- Adjustment of rated data
- Compact design by SMD-technology

In addition to this relay XU1-E has the following special features:

- Different switching hysteresis adjustable
- Adjustable trip delay

2. Design

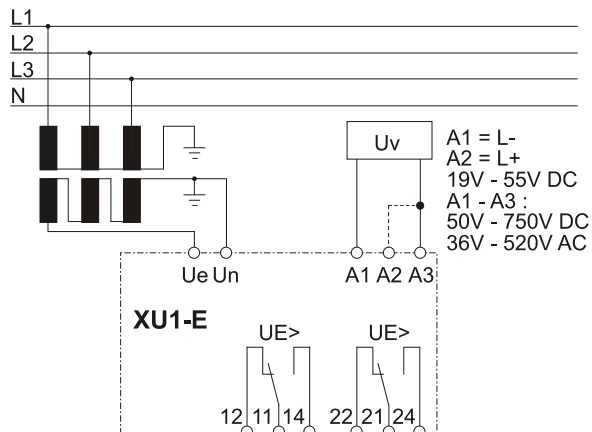


Figure 2.1: Connection diagram

Analog inputs

The analog input signals of earth fault voltage are connected to the protection device via terminals Ue and Un.

Auxiliary voltage supply

Unit XU1-E can be supplied directly from the measuring voltage itself or by a secured auxiliary supply.

Unit XU1-E 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

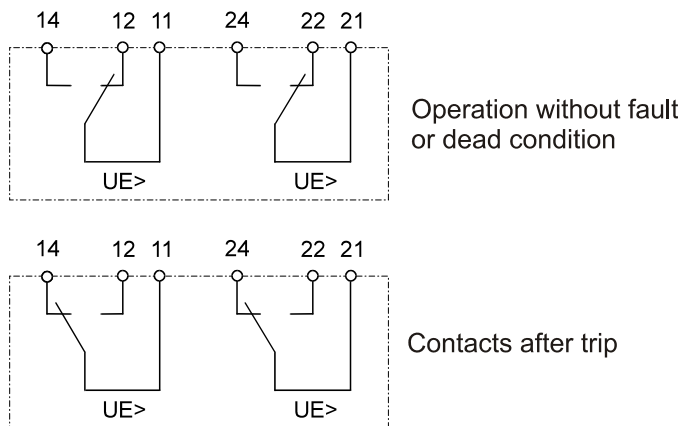


Figure 2.2: Contact positions of the output relays

3. Function

Unit XU1-E has a single step earth fault voltage supervision. The noise signals caused by inductive and capacitive coupling are suppressed 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. The analog signals are sampled with a sampling frequency of $16 \times f_n$, namely, a sampling rate of 1.25 ms (1,04 ms) for every measuring quantity at 50 Hz (60 Hz).

The earth fault voltage is compared with the set reference value. Pickup of the supervision circuit is indicated by flashing of the LED UE>, 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 XU1-E 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.

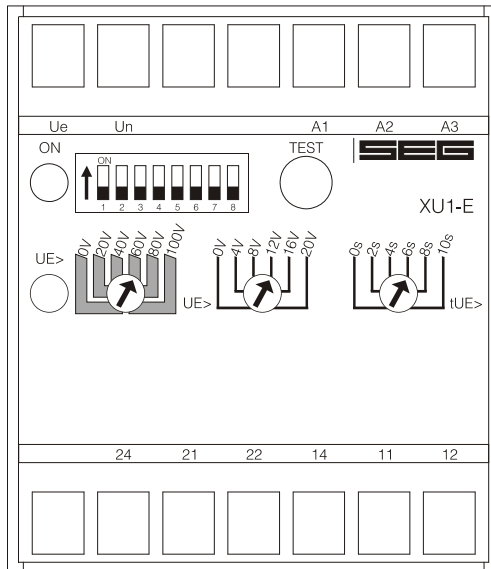


Figure 4.1: Front plate

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.

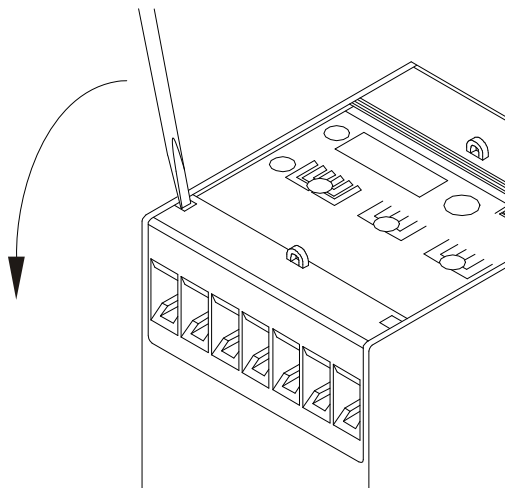


Figure 4.2: How to open the transparent cover

LEDs

LED "ON" is used for display of the readiness for service (at applied auxiliary voltage U_v). LED UE> signals pickup (flashing) or tripping (steady light).

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 the XU1-E is used for adjustment of the rated values and setting of function parameters:

DIP-switch	OFF	ON	Function
1			
2			
3			
4			
5	x 1	x 10	Time multiplier for tUE>
6	50 Hz	60 Hz	Rated frequency
7*	1 %	2 %	Switching hysteresis
8*	1 %	5 %	

Table 4.1: Function of DIP-switches

* Only one of the DIP-switches 7 - 8 shall be in "ON" position at the same time.

Rated frequency

With the aid of DIP-switch 6 the rated frequency can be set to 50 or 60 Hz, depending upon the given mains characteristics.

Switching hysteresis

The switching hysteresis can be adjusted with the aid of DIP switches 7 - 8 to 1, 2 or 5% of the tripping value. It has to be ensured that only one of the two DIP-switches is switched on. The smallest switching hysteresis is limited to 0.5 V

Multiplier for tUE>

If DIP-switch 5 is in position "ON", the scale reading of time delay tUE> is multiplied by 10. In position "OFF" the actual scale reading applies.

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 20 V.

A second fine adjustment potentiometer is then used for continuously variable setting of the final 0 - 20 V. Adding of the two values results in the precise tripping value.

Earth fault voltage element

The earth fault voltage element can be set in the range from 1 to 120 V with the aid of the potentiometer illustrated on the following drawing.

Example

A tripping value $UE>$ of 72 V 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).

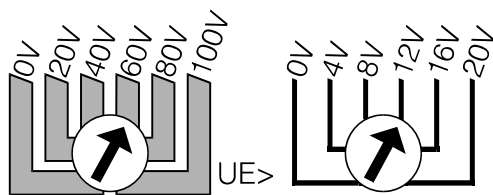


Figure 4.3: Adjustment example

The smallest adjustment $UE>$ is 1 V.

Time delay

The time delay can be adjusted infinitely variably in the range from 0 - 10 s or 0 - 100 s.

4.3 Communication via serial interface adapter XRS1

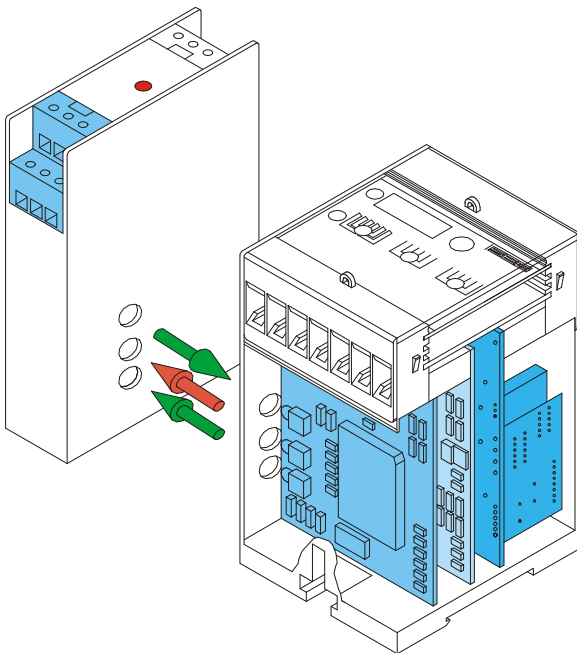


Figure 4.4: Communication principle

For communication of the units with a superior management system, the interface adapter XRS1 is 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

Unit XU1-E 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).

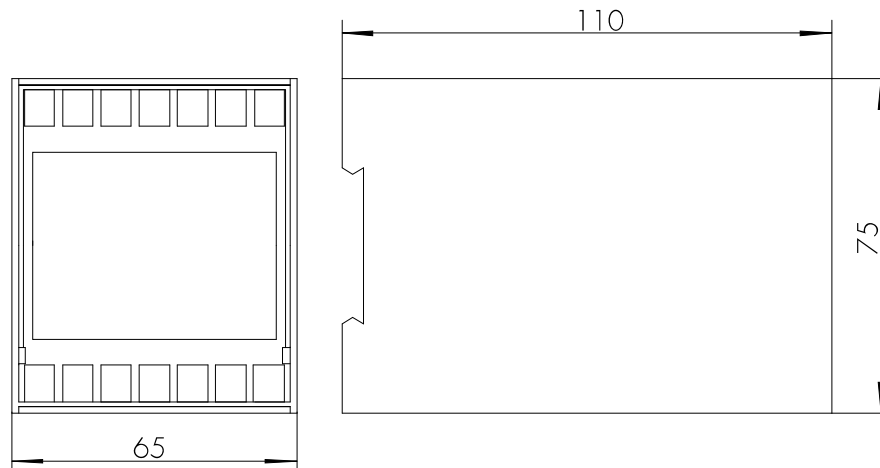


Figure 5.1: Dimensional drawings

Connections 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 chapter 4).

5.2 Technical data

Measuring input circuits

Rated data

Rated frequency:	50 / 60 Hz
Power consumption in voltage circuit:	1 VA per phase at U_n
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:	200 ms
Minimum initialization time after supply voltage has applied:	120 ms
Minimum response time when the supply voltage is available:	70 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
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; VDE 0871
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Temperature range at storage and operation:	-25 °C to +70 °C
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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
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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 IEC0801 part 2:	8 kV
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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
Min. limit value UE>:	1 V
Min. Hysteresis:	0,5 V
Repeat accuracy:	1 %
Basic time delay accuracy:	0.5 % or ± 25 ms
Accuracy of the specific rated values:	1 % at nominal frequency
Temperature effect:	0.02% per K
Frequency effect:	1 % per 1 Hz deviation of nominal frequency

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. 0.7 kg
Mounting position:	any
Relay case material:	self-extinguishing
Relay case material:	self-extinguishing

Parameter	Setting ranges	Graduation
UE>	1 - 120 V	continuously variable
tUE>	0 - 10 s / 0 -100 s	continuously variable
Hysteresis U</U>	1, 2, 5 %	

Table 5.1: Setting ranges and graduation

Technical data subject to change without notice!

Setting-list XU1-E

Project: _____ SEG job.-no.: _____

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

Relay functions: _____ Date: _____

Setting of parameters

Function		Unit	Default settings	Actual settings
UE>	Earth fault voltage tripping	V	1	
tUE>	Trip delay for UE>	s	0	

DIP-switch	Function	Default settings	Actual settings
1			
2			
3			
4			
5	Multiplier for tUE>	x 1	
6	Adjustment of the rated frequency	50 Hz	
7*	Hysteresis	1 %	
8*		1 %	

*Only one of the DIP-switches 7 - 8 shall be in „ON“-position at the same time.