



## Directional Earth-Fault Protector ERER 3

### Application

The ERER 3 directional earth fault relay is used to selectively detect earth faults in medium-high and high-voltage systems. In isolated neutral systems the device selectively detects sustained earth faults; in resonant earthed systems it detects sustained and momentary earth faults. In radially operated systems the ERER 3 device can be used both to indicate and to switch off earth faults.

The ERER 3 reports the earth fault by an additional signal relay also without a successful direction decision.

Since hardware version 2 a direction decision at larger fault resistances is possible.

### Function

The criteria used by the earth fault detection systems are the residual current  $I_0$  ( $I_E$ ) and the displacement voltage  $U_{NE}$ .

The ERER 3 records the transients at the beginning of the earth fault and evaluates its first half-wave.

As the input values of the residual current and the displacement voltage are preset able, the detection of earth faults will to some extent depend on the earth fault power.

The direction decision is determined by the comparison of the polarities of the first half-wave of current and voltage, whereby the adjusted threshold values of residual current and displacement voltage have to be exceeded. The result of polarity comparison is stored and after the preset delay time  $t_{UNE}$  (fault-recognizing time) both the LED-display and signalling relays are released if the earth fault is still existing at that point. A criterion of the existence of the earth fault is the existence of a displacement voltage greater than the set value  $U_{NE}$ . The same polarity of residual current and displacement voltage indicate a fault in forward direction; different polarity gives the reverse direction.

If during an earth fault the current amplitude remains below the threshold while the displacement voltage exceeds the threshold (e.g. fault is far away), a yellow LED and the relay " $U_{NE}$ " are on after the time  $t_{UNE}$  signalling an earth fault only.

If the earth fault duration is shorter than the preset delay time  $t_{UNE}$ , the polarity storages for current and voltage signals and the timer will be reset. There will be no signal or tripping operation.

Every starting of the ERER 3 will drive a visual display. The display remains stored until it is acknowledged by pressing the Reset/Test key or by a remote reset. When an earth fault has occurred, the directional earth fault relay will be blocked until the fault is extinguished. This is designed to selectively detect the first low end in the event of double earth faults in the system.

The appearance of a new earth fault causes a resetting as well; therefore always the last value is displayed.

Normally the signalling relays for the direction decision are active as long as an earth fault exists. The relay releases when the earth fault is gone. With a wire bridge between the terminals marked "S" the direction signal relays are latched in the same way as the LED.

The signal relay " $U_{NE}$ " for the earth fault becomes after expiry of the delay time  $t_{UNE}$  actively and remains lively as long as there is the earth fault.

To the prevention of new starts when intermittent earth faults occur the general reset is delayed after the release of  $U_{NE}$  for ca. 0.5 s respectively 1.6 s in modified models of the ERER 3. So the 1<sup>st</sup> detected direction is stored. This off-delay of  $U_{NE}$  start bridges the fault-free time between to intermittent earth faults.

An adaptation to system conditions is possible by setting of displacement voltage  $U_{NE}$ , residual current  $I_E$  and fault-recognizing time delay  $t_{UNE}$ .

Different auxiliary voltage models of ERER 3 are available, in which a control circuit monitors the operating range and in case of a fault it signals it. Both the green LED and the signal relay " $U_H$ " go inactive.

For a remote reset of ERER 3 connect a d.c. voltage to terminals "R+" and "R-".

### Construction

The ERER 3 device is housed in plastic casing for rail and panel mounting.

Terminals are in front of the casing and are covered by an additional cover frame.

For safeguarding of setting knobs a crystal clear cover permits sealing.

On the device' front following elements are accommodated:

- Control knob of residual current  $I_E$
- Control knob of displacement voltage  $U_{NE}$
- Control knob of fault-recognizing time delay  $t_{UNE}$
- Green LED for state of readiness ( $U_H$ )
- Yellow LED for an earth fault without a successful direction decision
- Green LED for forward direction
- Red LED for reverse direction

The use of a cable-type current transformer is not forcing necessary, when 3 identical protective current transformers exist which are connected in Holmgreen or total current wiring.

A residual voltage transformer [da-dn winding (former: e-n)] 100 V / 3 is necessary also.

The following relay outputs are available:

- Internal auxiliary voltage is correct " $U_H$ ",
- " $\rightarrow$ " Earth fault forward,



- “ $\overline{I}$ ” Earth fault reverse and
- “ $U_{NE>}$ ” displacement voltage has exceeded setting value (earth fault).

The connection has to be taken from the connection circuit diagram. Since the phase-to-phase voltages are uninfluenced in the earth fault case at the voltage transformer, the ERER 3 can be supplied also from the voltage transformers.

**Specifications**

The protection relay satisfies the requirements of the product standards EN 60255-6 (IEC 60255-6); DIN 57435, part 303.

**Mechanical construction**

- plastic casing for panel mounting
- fastening 35 mm mounting rail or 2 screws M4
- weight ca. 1 kg
- degree of protection casing IP 40
- terminals IP 20
- connecting area 1 x 0.5 ... 2.5 mm<sup>2</sup>

**Insulation coordination**

- overvoltage category III
- impulse voltage withstand level 5 kV
- pollution degree 3

**Permissible ambient conditions**

- operating temperature -10°C...+55°C
- storage temperature -25°C...+55°C
- transport temperature -25°C...+70°C
- rel. humidity annual mean <75%
- for 30 days 95% at <40°C
- moisture condensation and ice formation not permitted

**Mechanical strength**

- resistance to earthquakes (IEC 60255-21-3)

- nominal frequency range 1...35 Hz
- cut-off frequency 8...9 Hz
- horizontal 3.5 mm; 10 m/s<sup>2</sup>
- vertical 1.5 mm; 5 m/s<sup>2</sup>
- vibration strain (IEC 60255-21-1) Fc: 10...150 Hz; 0.075 mm; 1g
- repeated impact strain (IEC 60255-21-2) Ea: 11 ms, 15 g; Eb: 16 ms, 10 g

**Measuring input circuits**

- nominal frequency 50/60 Hz
- current path rated current I<sub>n</sub> ≤ 5 A
- load capability permanent 20 A
- 1 s 300 A
- limiting dynamic value (10 ms) 500 A
- power consumption at I<sub>n</sub> < 0.08 VA
- voltage path rated voltage U<sub>n</sub> 100/110 V
- load capability ≤ 175 V
- power consumption at U<sub>n</sub> ≤ 0.8 VA

**Remote reset input (optocoupler)**

- input rated voltage (U<sub>i</sub>) PI-No. 1739 276 x0x 110...250 V DC
- PI-No. 1739 276 x1x 24...60 V DC
- Low-level PI-No. 1739 276 x0x < 40 V
- PI-No. 1739 276 x1x < 8 V
- power consumption PI-No. 1739 276 x0x ca.1.25·10<sup>-5</sup>·(U<sub>i</sub>)<sup>2</sup> W
- PI-No. 1739 276 x1x ca.1.55·10<sup>-4</sup>·(U<sub>i</sub>)<sup>2</sup> W

**Auxiliary power supply**

- rated operating range U<sub>H</sub> PI-No. 1739 276 x0x 110...275 V DC, 100...230 V AC, 50/60 Hz
- PI-No. 1739 276 x1x 24...60 V DC
- working range DC: 0.8...1.2·U<sub>H</sub>
- AC: 0.8...1.15·U<sub>H</sub>
- max. ripple at d.c. 12 %

- power consumption d.c.: < 3 W
- stored energy time in case of auxiliary power failure, based on nominal voltage ≥ 50 ms

**Output relays**

- Relays for U<sub>H</sub> o.k. 1 change over
- for U<sub>NE></sub> 1 normally open
- for forward direction 1 change over
- for reverse direction 1 change over
- switching voltage 300 V DC, 250 V AC
- switching current at ≤ 30 V DC, L/R=0 ms 8 A
- at 220 V DC, L/R = 0 ms < 0.3 A
- at 220 V DC, L/R = 20 ms < 0.1 A
- switching capacity <2000 VA, 50...220 W (voltage-dependent)
- limiting continuous current 4 A
- current for 0.5 s 30 A

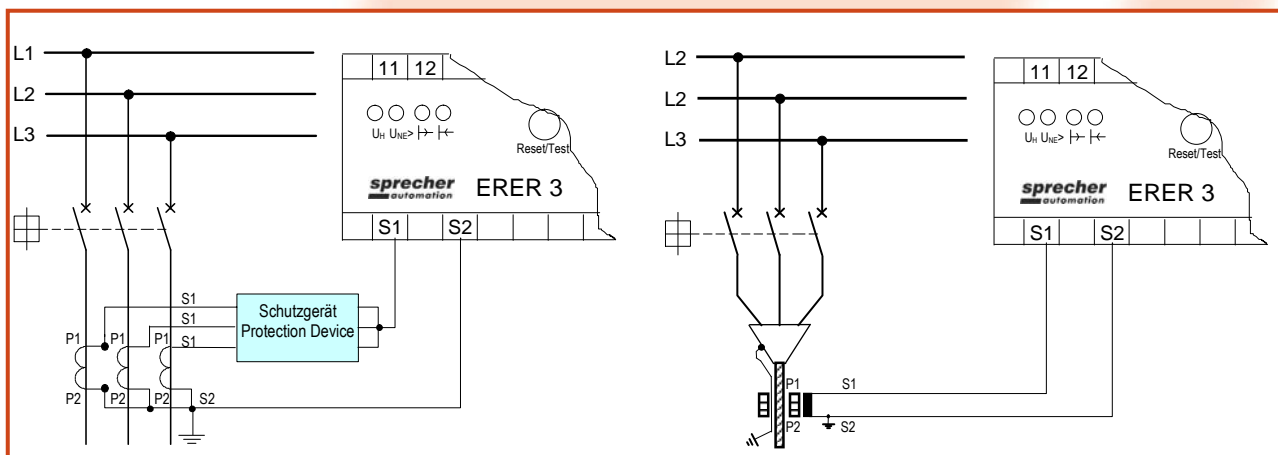
**Setting values**

- I<sub>E></sub> 30 / 100 / 200 / 300 mA
- U<sub>NE></sub> 6 / 8 / 10 / 12 / 18 / 24 / 30 / 36 V
- t<sub>UNE></sub> 0.065 s; 0.25...3.75 s in steps of 0.25 s
- fundamental error 10 %
- for U<sub>NE></sub> setting 6 V and 8 V 15 %

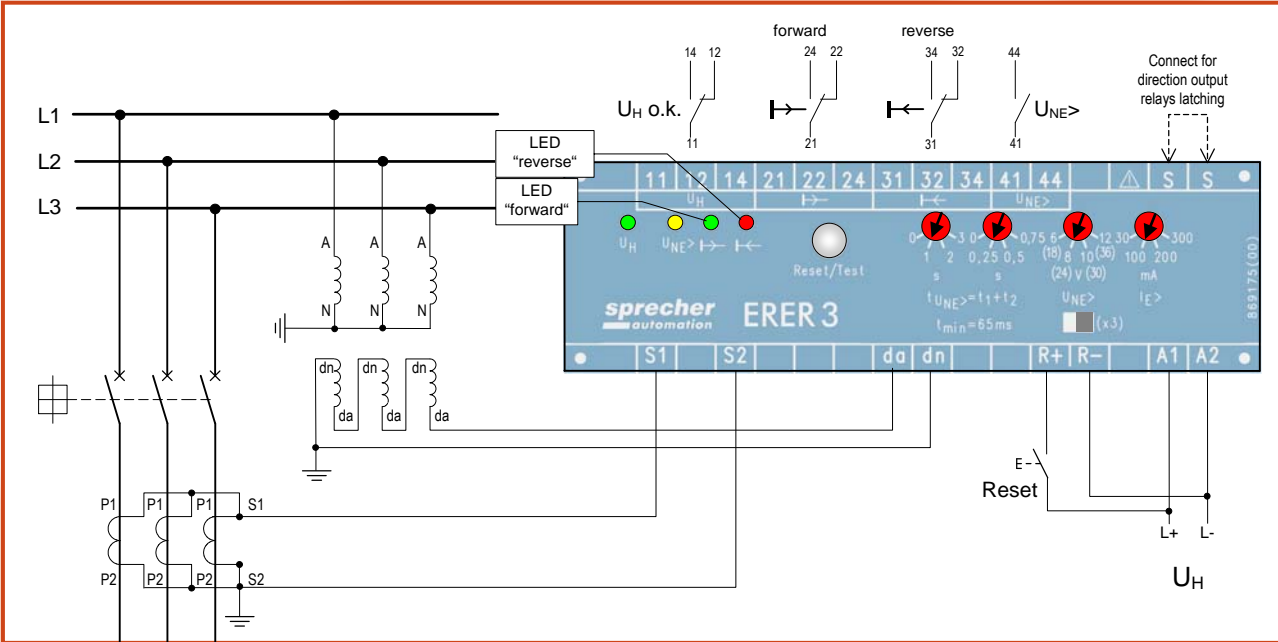
**Order data:**

|   |                            |
|---|----------------------------|
|   | PI-No. 1739 276 <b>xx0</b> |
| 8 <sup>th</sup> digit: off-delay time for U <sub>NE&gt;</sub> | ↑                          |
| 22 ms (Standard)  | 0                          |
| 0.5 s   | 1                          |
| 1.6 s   | 2                          |
| 9 <sup>th</sup> digit: auxiliary voltage U <sub>H</sub>       |                            |
| 110...275 V DC, 100...230 V AC                                | 0                          |
| 24...60 V DC  | 1                          |

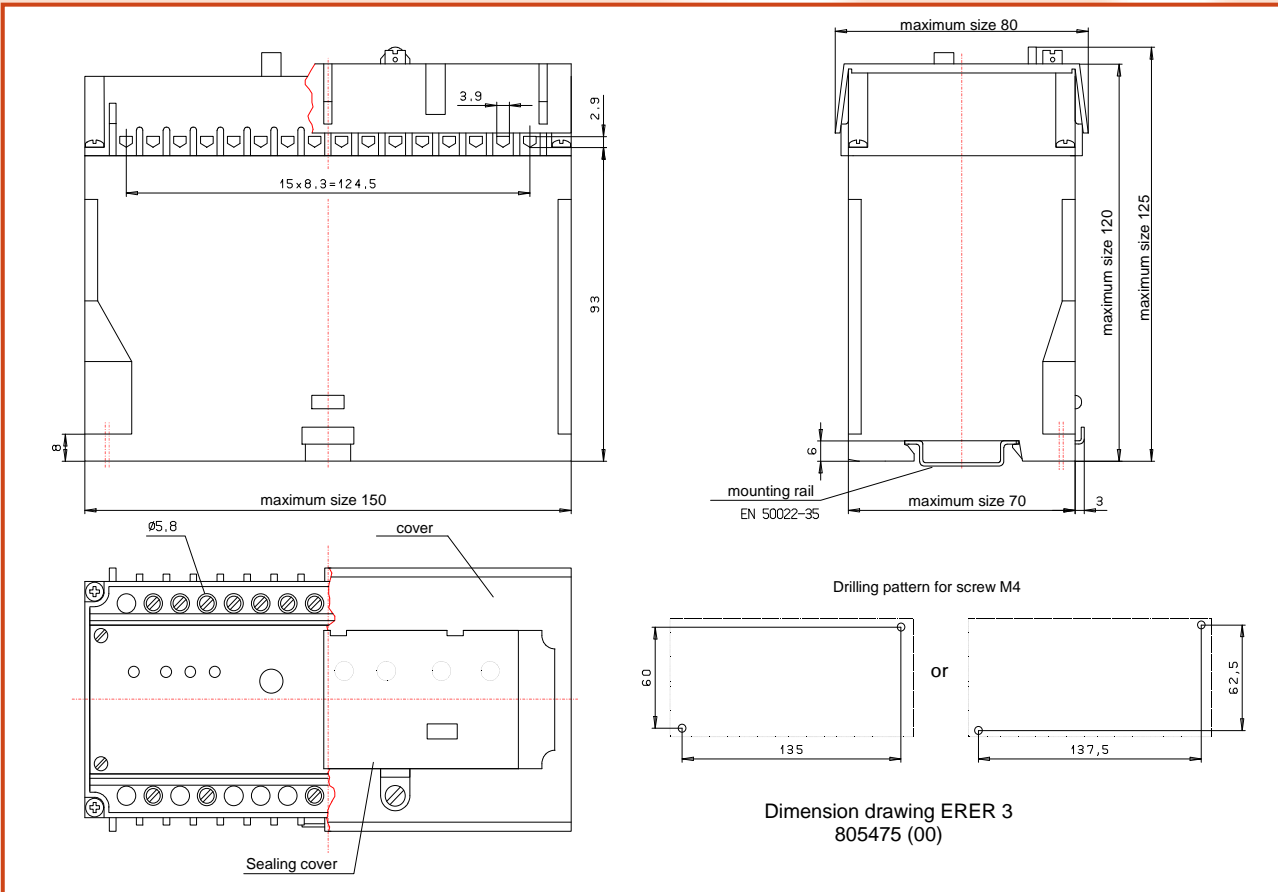
Other variants on request.



Variants of current path connection for ERER 3



Terminal assignment of ERER 3, connection example shows Holmgreen - connection in current path and voltage transformers with earth-fault windings 100 V / 3



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