DEFL-EP
EARTH-FAULT LOCATOR

The DEFL-EP type numerical earth-fault locator is member of the EuroProt product family, produced by PROTECTA Co. Ltd. To locate the faulty feeder the DRL-EP type numerical controller is needed as well, which controls the arc suppression coil and the fault current rising resistor. This information sheet describes the special information of DEFL-EP factory configuration. The general user's manual for the **EuroProt** devices is the document „EPCP-2004 EuroProt complex protection, hardware and software manual", which provides all common information to the members of the **EuroProt** complex protection series.

Field of application

The ***DEFL-EP*** type factory configuration has been developed for medium voltage compensated networks lo locate the faulty feeder among 10 outgoing feeders, having small or large impedance earth-fault. The device measures the current and the conductivity of each feeder, and detects if the conductivity increases by an amount above the setting. Using the "classical" watt-metric method the small impedance earth fault is calculated. The ***DEFL-EP*** device co-operates with the DRL2-EP type controller, the mean function of which are tuning the Petersen coil and control the earth-fault current rising resistor, connected parallel to the Petersen coil. Tuning the Petersen coil is performed by changing the air gap, when moving the iron core. The method of the algorithm is based on current injection, and it determines the optimal coil position and drives the movement in a single step. The means for injection are located in an additional relay case DRLi-EP, which is sized identically to DRL2-EP.

The ***DEFL-EP*** exploits the injected current of the DRL2-EP controller for calculation of the zero sequence data of the individual feeders.

Main characteristics

The main characteristics of the earth fault locator are as follows**:**

- Microprocessor-based modular device,
- High sensitivity,
- Man-machine interface with integrated LCD and with external PC,
- The man-machine interface (2x16 character LCD and six push-buttons) supports with simple menu-system parameter setting (programming), checking, reading of logged events, messages,
- The external PC supports parameter setting (programming), checking, reading of logged events, messages, registered disturbances, and programming the PROTLOG logic equations,
- On-line screen on external PC supporting commissioning and checking,
- 22 fix connected NO contacts, 1 contacts to be programmed with PROTLOG equation, and 1 NC contact for signalling state of the device,
- Connections for external communication, RS 232 interface on the front plate, fibre optic connectors on the rear side,
- Automatic self-check functions,
- Fully numerical signal processing,
- Displaying evaluated events,
- Digital event sequence recording with 1 ms time resolution for up to 300 events,
- 8 optically coupled inputs, 2 of them are fix assigned, 6 can be used freely by the user,
- Real-time clock with battery supported RAM, which can be synchronised via fibre optic connection from an external PC or through an optically coupled input.

Method of operation

The two main functions of the ***DEFL-EP*** factory configuration are selection and disconnection of the feeder of the medium voltage compensated network with earth fault of small impedance, and selection the feeder with earth-fault of large impedance.

The earth-fault locator as third device operating parallel to the arc suppression coil controller (DRL2-EP) and the injector (DRLi-EP) is designed to supervise the conductivity of the compensated medium voltage network, and in co-operation with the controller it selects the faulty feeder. The fault locator exploits the injected measuring current of the controller.

The device measures with numerical Fourier analysis the zero sequence voltage of the network, the phase voltages and the zero sequence currents of each feeder. The algorithm stores the natural asymmetry voltage in the healthy state of the network, and in case of high impedance earth-fault the fault location is identified based on the measured small changes.

The zero sequence impedance of the individual feeders is calculated based on the measured signals during current injection of the Petersen coil controller. This method assures that even in case of high natural network asymmetry and small changes in conductivity the selection of the feeder with earth-fault is reliable.

In case of small impedance earth-fault this method cannot be applied. So for higher zero sequence voltages and zero sequence currents the measurement is performed with “traditional” method (zero sequence power direction measurement).

The device can detect intermittent faults as well. The delay of this function is extended with hysteresis. The time counter does not reset at once, but the timer drops only after time delay following the extinction of the earth fault. This method assures that in case of re-igniting, but short duration arcing the time needed to the trip command can be integrated.

The integrated event log store the digital event and the measured analogue values with time stamp.

Technical data

General technical specification see in **EuroProt system information sheet**
Type tests see in **EuroProt system information sheet**
Design and sizes see in **EuroProt system information sheet**

Rated secondary current, I_n	1A or 5 A,
Rated secondary voltage (line-to-line), U_n	100 V or 200 V
Rated secondary zero sequence voltage	100 V
Overload capacity, V.T. circuits, thermal continuous	$2xU_n/\sqrt{3}$
Overload capacity, C.T. circuits, thermal continuous 1 s	$4xI_n$ $100xI_n$ (if I_n = 1 A) $50xI_n$ (if I_n = 5 A)
Overload capacity, dynamic	$100xI_n$
Injected current, I_{inj} (a DRL2 controls)	± 2 A
Measuring range of the neutral point voltage (U_0)	0,03...150 V
Frequency range	45...55 Hz
Digital outputs (contact) type amount rated operating voltage continuous current rating making capacity DC breaking capacity at 220 V DC, for resistive load L/R = 40 ms load	 Potential-free 24 pcs 250 V 8 A 16 A 0,25 A 0,14 A
- Digital inputs (optically coupled inputs), rated voltage amount self consumption	 110 or 220 V DC 8 db + 1 db clk.synch. 1 mA

Size

The layout of the ***DEFL-EP*** complex digital device is similar to that of the arc suppression coil controller and injector with the same sizes.

Options

- Interface to a SCADA system (see the **EuroProt** system information sheet)
- Need of output contacts with 4 A DC breaking capability
- Additional digital input modules (in the modularity of 8 pcs)
- Graphic LCD

Ordering information

- Type of protection [DEFL-EP]
- Rated C.T. current [1 A, 5 A]
- Rated V.T. voltage [100 V, 200 V]
- Design type [19 inch cabinet frame mounted device, panel mounted device with flash mounted form, panel mounted device with raised-hinged form]
- Auxiliary DC voltage [220 V, 110 V, or other]
- Options.