# DKTVA-OX-EP

**LINE DIFFERENTIAL PROTECTION EXTENSION WITH FIBRE OPTIC CONNECTION FOR DKTVA-EP**


## *Field of application*

The **DKTVA-EP** factory configuration of the **EuroProt** complex protection device serves the distance protection, earth fault protection and automatic reclosing function of the medium voltage lines. The **DKTVA-OX-EP** version contains line differential protection extension as well. This document contains the technical description of this extension.

The other functions of the configuration are described in the **DKTVA-EP** information sheet.

The line differential protection extension of the **DKTVA-OX-EP** version is a three-phase line differential protection, which needs fibre optic cable connection between the line ends. It can be applied as the selective and high-speed protection function of medium voltage lines to clear internal faults. If it is applied, the distance protection function of the factory configuration serves as backup protection if the fibre optic connection fails to communicate the needed information.

## *Main characteristics of the line differential protection function*

The line differential protection function – as the operating principle indicates – needs cooperation of two devices located at the line ends. To assure the same sampling moment, one of the devices is appointed to "master", this device generates the sampling commands for the other end as well, where the other device, the "slave" receives it. The software is not fully identical in the two devices. This is indicated by the scripts on the devices: „MASTER” or „SLAVE”.

The main characteristics of the line differential protection function integrated in the **DKTVA-OX-EP** complex devices are as follows:

- three-phase line differential protection,
  - operating with sampled current momentary values,
  - needs fibre optic connection (OX),
  - the healthy state of the communication channel is continuously supervised, if error is detected, the operation is disabled and an error signal is generated,
  - generates a three-phase trip command,
  - the trip command can be dependent of the operation of the undervoltage function,
  - to assure synchronous sampling one of the devices is the *master*, this generates a synchronising signal for the *slave* device,
  - the tripping characteristics have three line sections, with wide setting range,
  - the percentage characteristics are based on the average of the absolute values of the sampled currents,
  - operating time is about 25...35 ms,
  - the fault reporting signals the faulty phase as well.

## *The fibre optic communication channel (The OX hardware module)*

The line differential protection communicates with the far line end device via high security fibre optic channel. The preferred solution for this channel is the fibre optic cable integrated to the ground wire of the line, but other configurations can be the solution as well: earth cable, cable mounted on the towers, etc. The healthy state of the fibre optic channel is continuously monitored by the self-check function of the device.

The (C)OX fibre optic driver module converts, transmits and receives the communication signals.

Technical specification of this module:

- The fibre optic driver is a laser diode (1300 nm)
- The receiver is an IGaAs detector
- The fibre optic modulation frequency is 10 MHz
- The data transmission speed is 1,2 Mbbaud

## *The operating characteristics of the line differential protection*

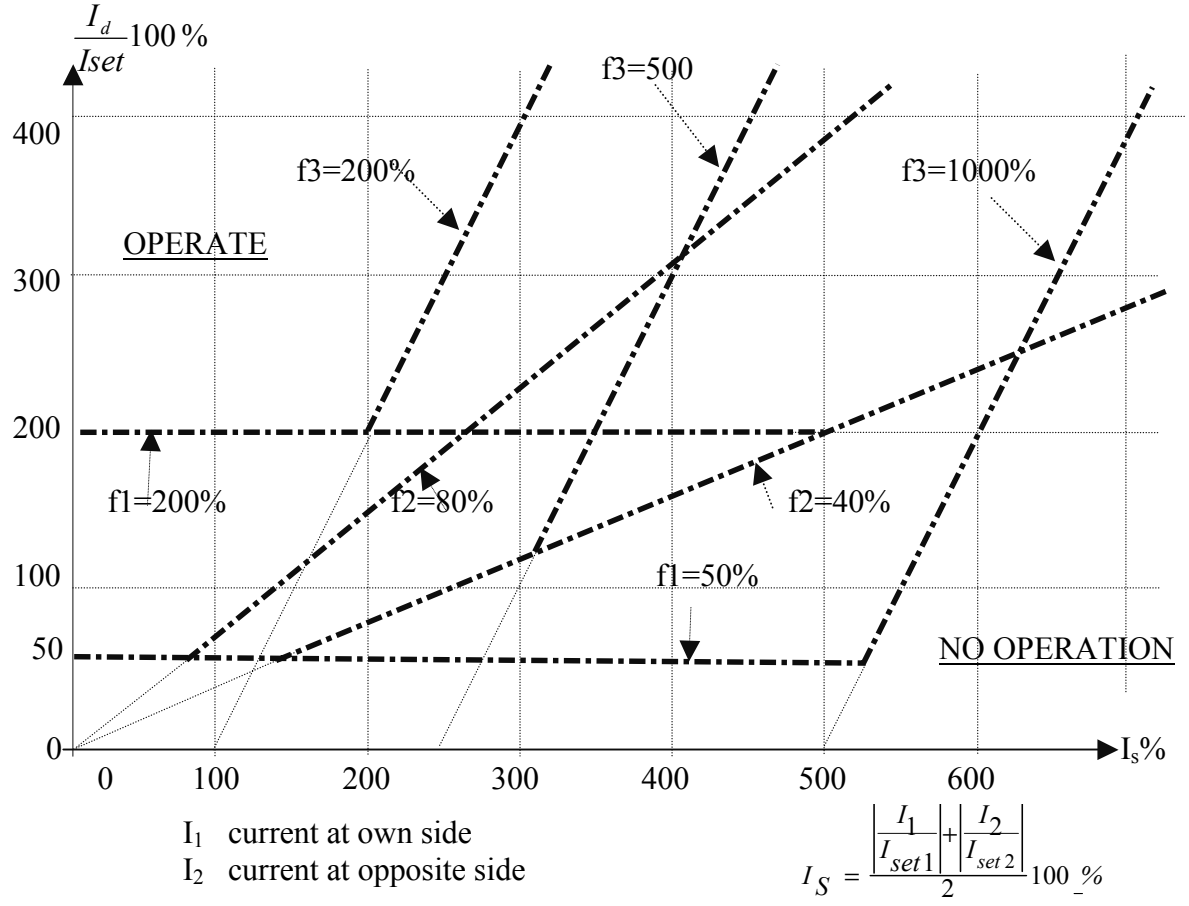


*Fig. 1. The tripping characteristics of DKTVA-EP/OX line differential protection*

The tripping characteristics of the ***DKTVA-OX-EP*** line differential protection is shown on Fig.1. If in case of internal fault the point defined with the following formulas

$$\frac{I_d}{Iset}100\% \qquad I_S = \frac{\left|\frac{I_1}{I_{set1}}\right| + \left|\frac{I_2}{I_{set2}}\right|}{2} 100\_\%$$

is above the characteristic lines, then the protection operates, if the point is below them, no trip command is generated.

## *Technical data*

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|---|
| 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** |

## *Setting ranges*

| Parameter | Range |
|---|---|
| Current setting at the own line end related to the CT rated current | 20 to 270, steps 2 [%] |
| Current setting at the opposite line end related to the CT rated current | 20 to 270, steps 2 [%] |
| Setting of the horizontal section of the characteristics | 50 to 200, steps 2 [%] |
| Slope setting of the second line section | 40 to 80, steps 2 [%] |
| Intersection of the third section with the vertical axis | 200 to 2000, steps 10 [%] |
| Setting voltage of the voltage condition | 10 to 100, steps 2 [%] |
| Disabling time delay | 0 to 64000, steps 10 [ms] |
| | |

## *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 [DKTVA-OX-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]