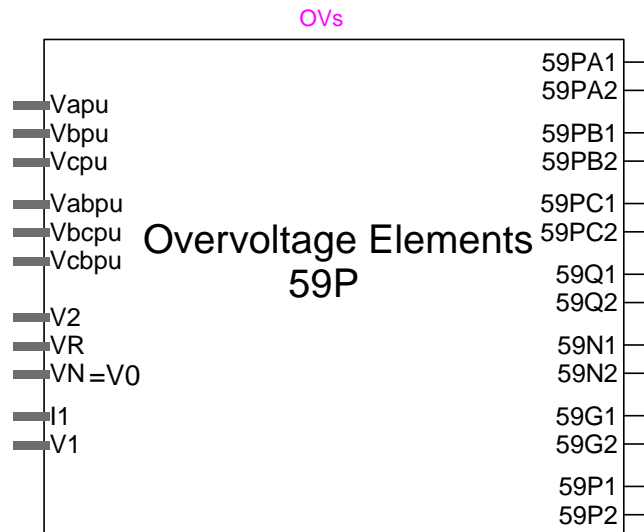


Protection: Overvoltage functions



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1 Introduction

This function follows the ANSI standard 59 – phase overvoltage and the IEC standard PTOV. It monitors the phase-to-phase or phase-to-ground voltage, the measured ground voltage (VR), the neutral voltage (V0), the negative sequence or a compensated voltage. The latter one is to prevent overvoltages due to Ferranti effect. The positive sequence current is used for the calculation of the compensation voltage.

Two levels of settings are available.

Different types of tripping curves are available depending on the manufacturer selection.

2 Input data: Overvoltage tab

Two levels are available. The input data is:

- ❑ **Input:** (for the phase elements only) Phase-to-phase or phase-to-ground. Choice of the voltage to be monitored.
 - V_{pkp} : Pickup voltage in pu. Once this value reached, the timer starts. Does not apply for 'Build your own' selection of **Type of curve** (see below).
- ❑ **Type of curve:** Select the type of curve (see Section 2.2)
- ❑ **Pickup delay or Time dial:** this input is related to the **Type of curve** selection:
 - Definite time: this input is a **Pickup delay**

- Build your own: this input is a coefficient multiplying the time-points
- **Reset delay:** Minimum value of voltage for this element to be active.

2.1 Compensated

Two levels are available.

- $Z_{c_{mag}}$: Magnitude of impedance (ohms at secondary). Z_c should be set as half of the positive sequence series impedance of the line. A more accurate setting of Z_c can be calculated if the positive sequence charging current I_c and the voltages at the local and remote line ends (resulting from an open breaker) are available:

$$Z_c = \frac{V_{local} - V_{remote}}{I_c}$$

- $Z_{c_{ang}}$: Angle of the impedance (degrees).
- $I_{l_{max}}$: Maximum positive sequence current. Above this value, the element is enabled.
- $V_{c_{pkp}}$: Pickup voltage in pu. Once this value is reached, the timer starts.

For the compensated element, the voltage at the remote end of the line is calculated as follows in pu:

$$V_{remote} = \frac{V_1 - Z_{c_{mag}} \left| \frac{Z_{c_{ang}}}{I_1} \right|}{V_{rated}} \quad (1)$$

- **Type of curve:** Select the type of curve (see Section 2.2)
- **Pickup delay or Time dial:** this input is related to the **Type of curve** selection:
 - Definite time: this input is a **Pickup delay**
 - Build your own: this input is a coefficient multiplying the time-points
- **Reset delay:** Minimum value of voltage for the element to be active.

2.2 Type of curve options

Here is how the tripping time is calculated according to the **Type of curve**. For the definition of Tap see the **Pickup delay or Time dial** input explanations above.

- “Definite time”

$$\text{trippingtime} = \text{Tap} \quad (2)$$

- “Build your own”

With this choice, the user specifies the number of points required to build the curve and enters the points of the voltages with the associated tripping times.

3 Flags available in the tripping function and the output bundle of the relay

- 59_PA_*i*: Over voltage on phase A (level *i*)
- 59_PB_*i*: Over voltage on phase B (level *i*)
- 59_PC_*i*: Over voltage on phase C (level *i*)
- 59_G_*i*: Ground over voltage (level *i*)
- 59_N_*i*: Neutral over voltage (level *i*)
- 59_Q_*i*: Negative-sequence over voltage (level *i*)
- 59_COMP_*i*: Compensated over voltage (level *i*)

4 Scopes

The following scopes are available in the subcircuit: *RelayName/Control/Console*

- 59_P_*i*: Over voltage detection of the 3 phases for the level *i*
- 59_G_*i*: Ground over voltage detection (level *i*)
- 59_N_*i*: Neutral over voltage detection (level *i*)
- 59_Q_*i*: Negative-sequence over voltage detection (level *i*)

- 59_COMP_/: Compensated over voltage detection (level i)

5 Modifications

The protection functions are updated automatically. For example, for memory usage and computational speed considerations, if an entire element is disabled, the subcircuits associated to its functions are replaced by empty subcircuits with the same inputs and outputs. The outputs will be forced to zero or one. When enabled, the subcircuits can take different architectures considering the user choices. Some elements can be excluded if not enabled in the mask.

The updates are performed immediately after entering the parameters and clicking the OK button. The user should wait for the completion of tasks.

If the user wants to modify the subcircuit manually (for example, when adding new scopes), using in the GUI, and avoid the automatic updates of contents, the attribute DeviceVersion has to be set to "none" as shown below. To access to this attribute, right click on the desired device, then go to Attributes and select DeviceVersion (see Figure below).

To allow the automatic updates again, just remove the "none" string.

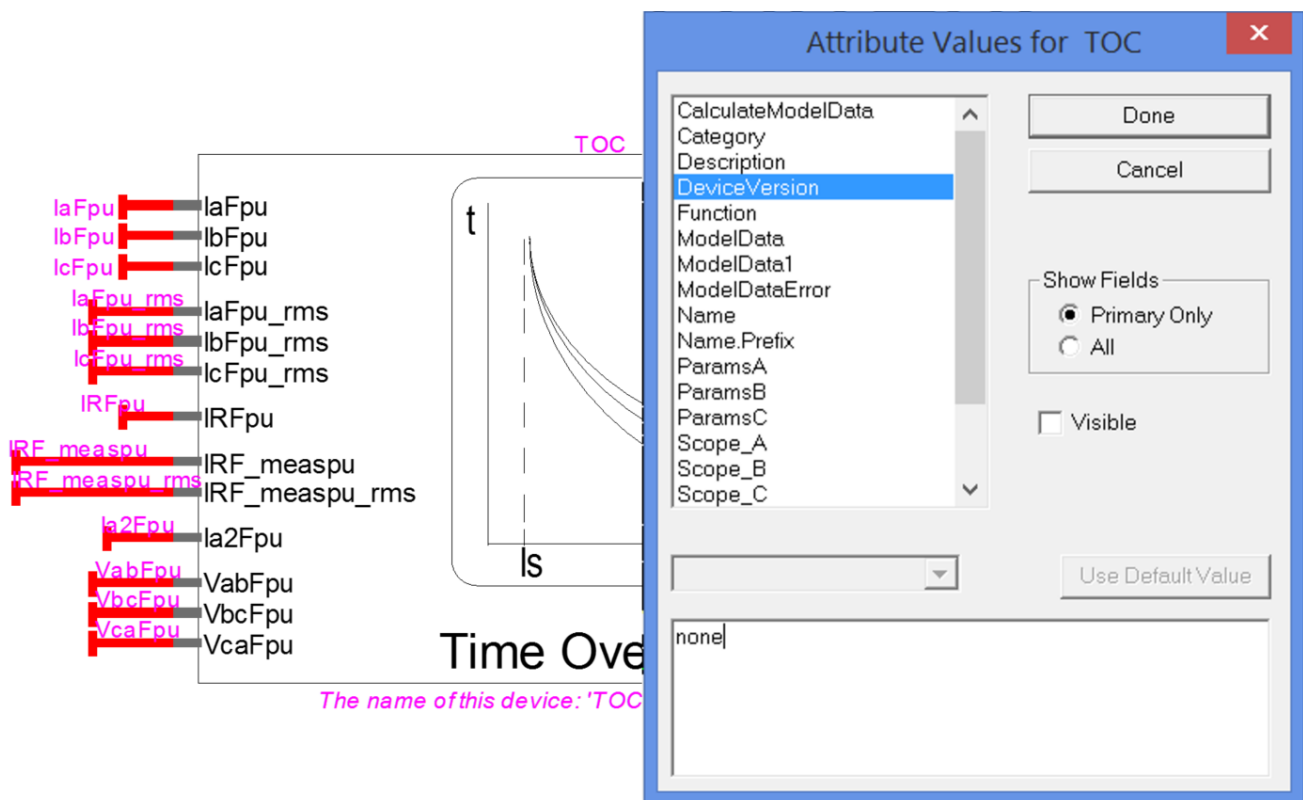


Figure 5-1 How to set the DeviceVersion attribute of the TOC element to allow modifications.

6 References:

- [1] D60 Line Distance Protection System, chapter 5.6 p5-159, UR Series Instruction Manual, DE Digital Energy, D60 Revision 7.1x