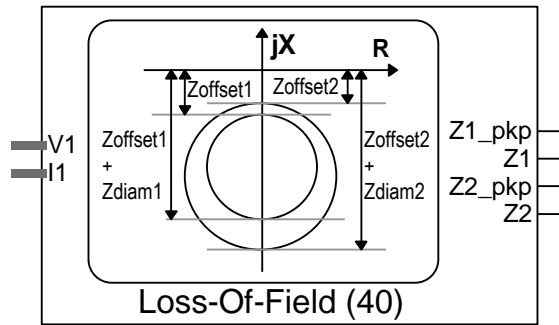


Protection: Loss-of-Field



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1 Introduction

This function follows the ANSI standard 40.

The loss-of-field is based on 2 zones. When the generator loses its field, the positive sequence impedance seen from the stator goes into the loss-of-field protection zones shown in Figure 1-1.

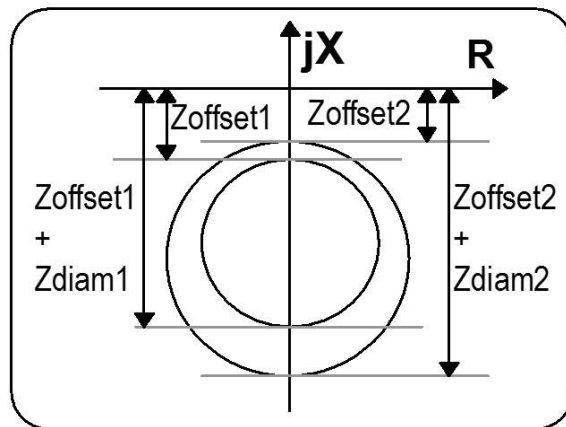


Figure 1-1 R-X impedance plane with the protective zones of the loss-of-field function.

2 Input data: Loss-of-Field tab

- Enable LOF:** enable the loss-of-field function. If unchecked, the functions are disabled and replaced in the by an empty subcircuit whose outputs are zeros.

- ❑ V_{1min} : Minimum value of positive-sequence voltage to enable this element.
- ❑ I_{1min} : Minimum value of positive-sequence current to enable this element.
- ❑ **Zone 1 diameter**: Zdiam1 in Figure 1-1. Diameter of Zone 1 in ohms.
- ❑ **Zone 1 offset**: Zoffset1 in Figure 1-1. Offset of the circle of Zone 1 in ohms.
- ❑ **Zone 1 delay**: Tripping delay for the Zone 1 in seconds. This is temporization before tripping.
- ❑ **Zone 2 diameter**: Zdiam1 on the Figure 1-1. Diameter of zone 2 in ohm.
- ❑ **Zone 2 offset**: Zoffset1 on the Figure 1-1. Offset of the circle of zone 2 in ohm.
- ❑ **Zone 2 delay**: Tripping delay for the zone 2 in seconds. The locus has to stay this amount of time before the tripping request.

2.1 Typical settings

The Typical settings option populates the diameters, offsets and delays of the Zones according to the following machine parameters.

- ❑ S_{NOM} : Rated power in MVA
- ❑ V_{NOM} : Nominal voltage in kVRMSLL.
- ❑ X_d : d-axis admittance in pu.
- ❑ X'_d : d-axis transient admittance in pu.

The offsets of all circles are then equal to:

$$\text{offset} = \frac{X'_d}{2} \quad (1)$$

The diameter of circle for Zone 1 is:

$$\text{diameter} = 0.7X_d \quad (2)$$

The diameter of circle for Zone 2 is:

$$\text{diameter} = X_d \quad (3)$$

Delay 1 is set to 0 and delay 2 to 0.5 s.

3 Flags available in the output bundle of the relay

- ❑ Z1pkp_LOF: Positive sequence impedance in the zone 1
- ❑ Z1_LOF: Positive sequence impedance in the zone 1 for at least the length of delay 1
- ❑ Z2pkp_LOF: Positive sequence impedance in the zone 2
- ❑ Z2_LOF: Positive sequence impedance in the zone 2 for at least the length of delay 2

4 Flags available in the tripping function

Same as the ones in the output bundle defined in Section 3.

5 Scopes

Same as the ones in the output bundle defined in Section 3. In addition there are selections for

- ❑ Locus zones: see Section 6.

6 Impedance locus drawing

- ❑ **Locus Zi Loss-of-field**: Cartesian coordinates of the positive sequence impedance and the circle of zone i .
- ❑ **Expansion time**: time in seconds for the locus to reach its maximum value. When the locus does not move in the R-X graph, its size increases until a maximum. The aim is to help the user to differentiate a transient position of the locus with a quasi-steady state one. The size of the locus gives an idea on the time the locus stays at a given position.

6.1 Showing the locus graphs

See the documentation of the “R-X graph plotter” device shown in Figure 6-1.



Figure 6-1 “R-X graph plotter” device.

7 Modifications

The protection functions are updated automatically. For example, for memory usage and computational speed considerations, if the entire element is disabled, the subcircuits associated to these functions are replaced by some with the same inputs and outputs, but empty. 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 done right after entering the parameters, after the mask has been closed.

If the user wants to modify the subcircuit manually, directly in the GUI, and avoid the automatic updates, the attribute *DeviceVersion* has to be set to *none*. To access to this attribute, right click on the function device in the relay subcircuit (inside the device *Control*), then go to *Attributes.../DeviceVersion* (see Figure 7-1).

To allow the automatic updates again, just delete *none*.

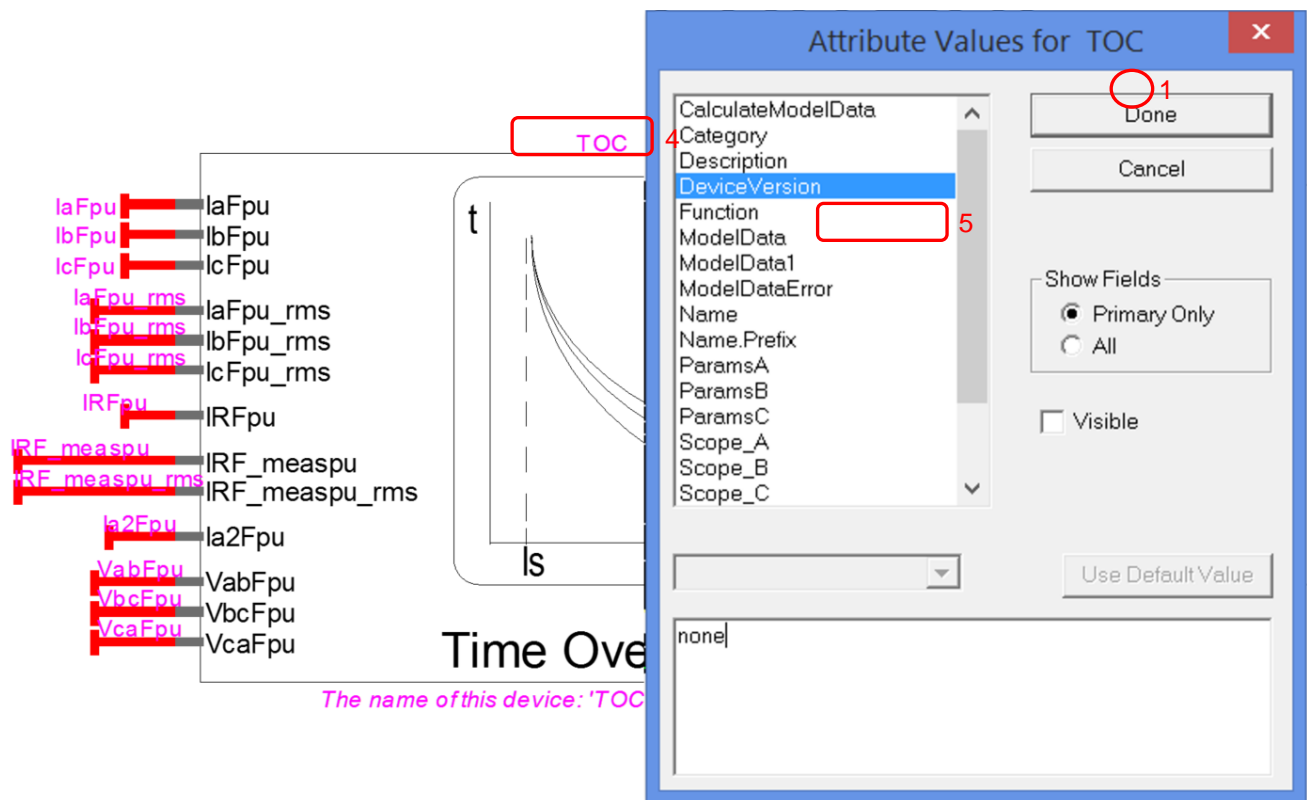


Figure 7-1 How to set the DeviceVersion attribute of the TOC element to allow modifications.