

Voltage transformer (VT)



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Henry Gras, Jean Mahseredjian, 2016-07-26 00:41:00

1 Introduction

The Voltage Transformer (VT) is available in 1-phase and 3-phase versions. It can be connected to any 1-phase or 3-phase circuit (wire) for measuring voltage. Its bundle output provides voltage measurements for control diagrams. Voltage “a” is available for the 1-phase version and voltages “a”, “b” and “c” are available for the 3-phase version.

The phase change occurs when a signal connected to a VT power pin is changed into a 3-phase signal or if a VT power pin is connected to a 3-phase signal.

The VT subcircuit contents (for both 1-phase and 3-phase versions) and internal design details can be viewed by entering into the subcircuit (Alt+double-click). The VT has a nonlinear magnetization branch. It is possible to specify initial (remanent) flux conditions.

2 Parameters

- Nominal frequency:** Frequency of application for this device (surrounding network frequency). Used when the inductance values are specified in Ohms and for the calculation of the flux points for the magnetization branch of the VT.
- Ratio:** ratio of the VT. Primary rated voltage and secondary rated voltage in V.
- Connection:** specifies the type of transformer connection for the 3-phase version.

- Winding 1 R:** resistance of the primary winding.
- Winding 1 X:** inductance of the primary winding.
- Winding 2 R:** resistance of the secondary winding.
- Winding 2 X:** inductance of the secondary winding.

- Standard:** standard burdens defined in IEEE C57.13 (ANSI). Data is listed in the following Section 3. Select the Standard dropdown menu to populate Z_{burden} and Power Factor. If the Standard dropdown menu is set to blank, then the user can enter the above parameters manually.
- Z_{burden} :** impedance magnitude of the burden, optionally populated automatically from Standard selection.
- Power Factor:** power factor of the burden, optionally populated automatically from Standard selection.
- Magnetization data:** excitation curve current-voltage at the secondary. When this information is completed and the user clicks on the OK button, the entered data is converted into current-flux points using the “L nonlinear data function” service. The current going through the magnetization resistance during the open-circuit test is accounted for in these computations.. An error message may appear on the EMTWorks Progress panel or Console, indicating that a conversion error occurred and in which case the user must revise entered data until the error is cleared.
- Magnetization resistance:** Resistance in parallel with the nonlinear inductance of the VT transformer.

The initial flux conditions are entered on the second data tab (IC):

- Initial flux (ϕ_0) phase A
- Initial flux (ϕ_0) phase B
- Initial flux (ϕ_0) phase C

For the open-delta connection:

- Initial flux (ϕ_0) phase A: for the winding between A and B
- Initial flux (ϕ_0) phase B: not considered
- Initial flux (ϕ_0) phase C: for the winding between B and C

3 Standard burdens

The following table presents data corresponding to the standard burdens.

Standards	Impedance Z_{burden} (VA)	Power Factor PF
W	12.5	0.1
X	25	0.7
Y	75	0.85
ZY	150	0.89
Z	200	0.85
ZZ	400	0.85
M	35	0.205

4 Pins

The VT device has one power pin “k” and a bundle control pin which contains the measurement(s) of voltage(s) at the secondary of the VT in Volts. The 1-phase bundle version contains the breakout “a”, whereas the 3-phase version contains the breakouts “a”, “b” and “c”.

5 Steady-state model

Steady-state representation based on subnetwork contents.

6 Initial conditions

Automatic initial conditions are found from the steady-state solution. Manual initial conditions can be provided for individual transformer phase unit fluxes.

7 Frequency Scan model

Steady-state representation based on subnetwork (power) contents for each frequency.

8 Time-domain model

Time-domain representation based on subnetwork contents.