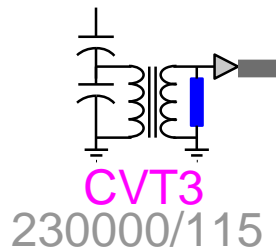


Capacitive Voltage transformer (CVT)



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1 Introduction

The Capacitive Voltage Transformer (CVT) 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 CVT power pin is changed into a 3-phase signal or if a CVT power pin is connected to a 3-phase signal.

The CVT 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 CVT has a nonlinear magnetization branch. It is possible to specify initial (remanent) flux conditions.

Stray capacitance and ferroresonance suppression circuit can be optionally included.

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 CVT.
- ❑ **Ratio:** Primary rated voltage and secondary rated voltage in V. This ration includes the capacitive voltage divider and the ideal transformer.

- ❑ **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.

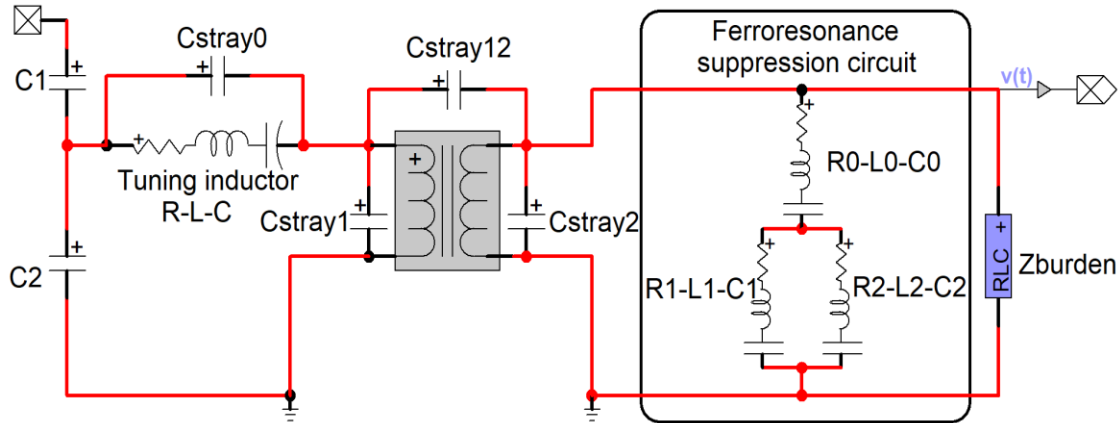


Figure 1: CVT subcircuit

- ❑ **C1:** First (top) capacitance of the capacitive divider.
- ❑ **C2:** Second (bottom) capacitance of the capacitive divider.

Tuning inductor parameter

- ❑ **R:** Resistance of tuning inductor.
- ❑ **L:** inductance of tuning inductor.
- ❑ **C:** Capacitance of tuning inductor.

Stray capacitance

Stray capacitance must be included when fast transients are studied. For example, they must be precisely modeled when the propagation of travelling waves from the CVT primary to the secondary has to be simulated.

- ❑ **Cstray 0:** Tuning inductor stray capacitance (see Figure 1)
- ❑ **Cstray 1:** Winding 1-to-ground stray capacitance of the CVT transformer (see Figure 1)
- ❑ **Cstray 2:** Winding 2-to-ground stray capacitance of the CVT transformer (see Figure 1)
- ❑ **Cstray 12:** Winding 1-to-winding 2 stray capacitance of the CVT transformer (see Figure 1)

Ferroresonance suppression circuit

- ❑ **RLC (0-1-2):** RLC parameters of each branch (see Figure 1)
- ❑ **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 of the voltage transformer behind the capacitor bridge. 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 EMTPWorks 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 CVT transformer.

The initial flux conditions (magnetization branch nonlinear inductance, transformer secondary side) 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

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 CVT device has one power pin “k” and a bundle control pin which contains the measurement(s) of voltage(s) at the secondary of the CVT 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.