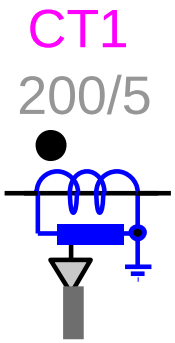
Current Transformer (CT)



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1 Introduction

The Current Transformer (CT) is available in 1-phase and 3-phase Wye-connected versions. It is inserted in series with any 1-phase or 3-phase circuit for measuring current. Its bundle output provides current measurements for control diagrams. Current “a” is available for the 1-phase version and currents “a”, “b” and “c” are available for the 3-phase version.

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

An application example for a relay model is shown in Figure 1-1.

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

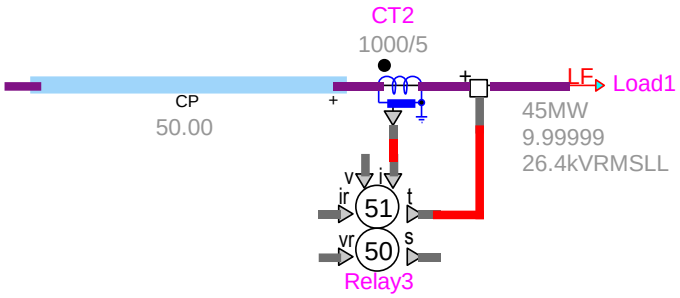

Figure 1-1: Example, 3-phase CT in a network

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 CT.
- **Ratio**: ratio of the CT. Primary rated current and secondary rated current in A.
  If the CT is of Multiratio type, this is the currently selected operating tap.

- **Winding 1 R**: resistance of the primary winding
- **Winding 1 X**: inductance of the primary winding
- **Winding 2 R**: resistance of the secondary winding. A typical value can be loaded by clicking on the button “Load typical R”. This value depends on Class, Ratio and Secondary voltage inputs.
- **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}, Power Factor and “Secondary voltage” inputs accordingly. If the Standard dropdown menu is set to blank, then the user can enter the above parameters manually.
- **Z_{burden}**: burden impedance magnitude, optionally populated automatically from Standard selection.
- **Power Factor:** power factor of the burden, optionally populated automatically from Standard selection.

- **Standard and Class:** Specify the selected Standard and Class.
- **Secondary voltage**: secondary voltage of the CT, optionally populated automatically from Standard selection in the “Burden data” section.
- **Rated power**: used for IEC standard (IEC 185), VA.
- **Precision**: used for IEC standard (IEC 185).
- **Precision limit factor K_p**: use for IEC standard (IEC 185).
- **Multiratio CT**: If the CT is of multiratio type, this box has to be checked and the Maximum ratio must be entered.
- **Maximum ratio**: for Multiratio CT option.
- Load typical Excitation Curve: this button is used to load typical Excitation Curve data from the given Class selection and Ratio data. The loaded curve respects specified precision limits.

- **Excitation Curve**: 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 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 CT 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

3 Standard burdens

The following table presents data corresponding to the standard burdens.

Standards	Impedance Z_{burden} (Ohm)	Power Factor PF	Secondary voltage (V RMS)
B-0.1	0.1	0.9	10
B-0.2	0.2	0.9	20
B-0.5	0.5	0.9	50
B-0.9	0.9	0.9	90
B-1.8	1.8	0.9	180
B-1	1	0.5	100
B-2	2	0.5	200
B-4	4	0.5	400
B-8	8	0.5	800

4 Pins

The CT device has two power pins “k” and “m” and a bundle control pin which contains the measurement(s) of current(s) at the secondary of the CT in Amperes. 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.