Application Paper **AP158007EN** Effective November 2019

Current transformers for low-voltage AutoVAR applications

Introduction

Current transformers (CT) are used in low-voltage applications as sensing devices for protective relays and meters. They work on the principal of electromagnetic coupling; a current flowing through the conductor they surround induces a proportional isolated low-level signal (either 1 A or 5 A) that can be measured by an electromechanical or electronic device.

CTs may be shown in several formats as indicated in **Figure 1**. The dots, X's or boxes are used to denote the instantaneous polarity orientation of the CT. The polarity marks on the conductor generally face toward the source of the current flow.

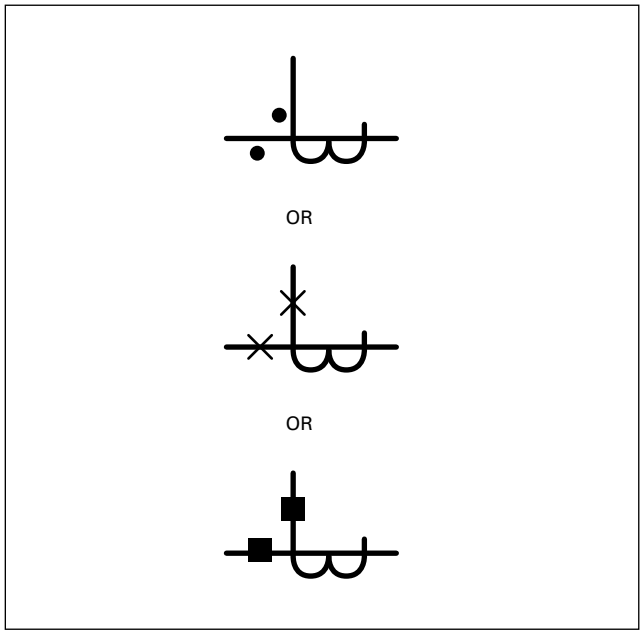

Figure 1. CT symbols

CT selection criteria

CT current rating is determined by the main service entrance current rating. If exact rating is not available, select the next higher appropriate rating.

If only transformer ratings are known, use the following formula to calculate the maximum current:

$$\text{Current for CT rating} = \frac{\text{Transformer kVA} \times 1000}{1.732 \times \text{line voltage}}$$

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Table 1. Terminal connections for appropriate CT current rating

TX2		TX4		TX5	
CT secondary terminals	**CT ampere rating**	**CT secondary terminals**	**CT ampere rating**	**CT secondary terminals**	**CT ampere rating**
X1–X5	3000	X1–X5	4000	X1–X5	5000
X1–X4	2500	X2–X5	3500	X1–X4	4000
X1–X3	2200	X1–X4	3000	X2–X5	3500
X2–X5	2000	X2–X4	2500	X3–X5	3000
X2–X4	1500	X1–X3	2000	X2–X4	2500
X2–X3	1200	X2–X3	1500	X3–X4	2000
X1–X2	1000	X3–X4	1000	X1–X2	1500
X3–X5	800	X1–X2	500	X4–X5	1000
X4–X5	500	—	—	X2–X3	500
X3–X4	300	—	—	—	—

Note: The CT secondary rating for all the taps is 5 A. To calculate the CT ratio, use the CT primary ampere rating and divide by 5 to get the CT ratio. TX2 example: For X1–X5, the CT ratio is 600 (=3000/5). TX4 example: For X1–X5, the CT ratio is 800 (=4000/5). TX5 example: For X1–X5 on the TX2, the CT ratio is 600 (=3000/5).

TX series CTs

TX series CTs are metering class, with accuracy of 1% at 25 VA burden for TX2, TX4, and TXSUM-2 and accuracy of 1% at 30 VA for TX5, TX2, TX4, and TX5 are split-core multi-ratio multi-tap CTs, indoor rated with 600 V insulated core. Split-core CTs are designed specifically for existing primary conductors so that the installer will not have to break the circuit.

TXSUM-2 is a summation CT, indoor rated, with two 5 A nominal inputs and one 5 A nominal output. The TXSUM-2 is typically used in applications where the nominal CT secondary current can exceed 5 A. If a 5 A nominal input CT signal is provided to one input of the summing CT, the resulting output CT signal will be nominal 2.5 A. Adding a second will increase the output to 5 A.

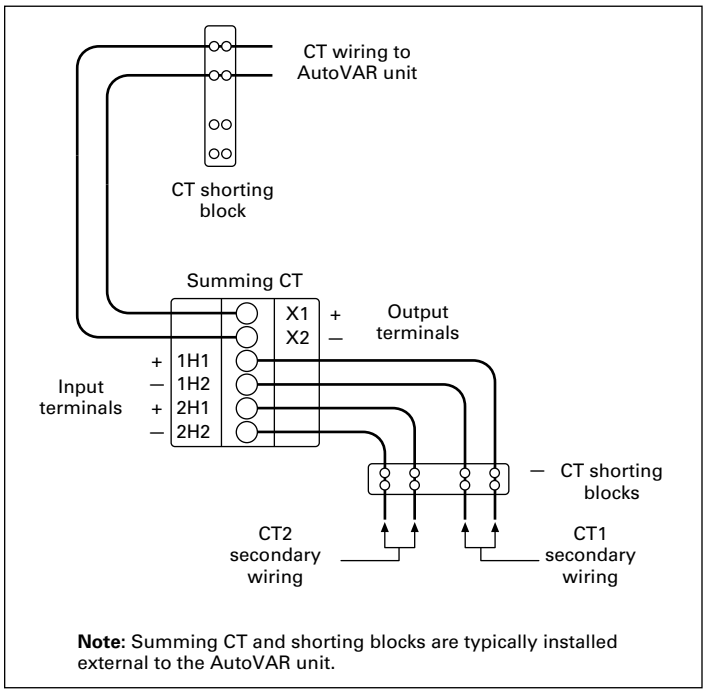
Installation instructions and troubleshooting

CT installation is critical for proper operation of automatic PFC. Typically, an outage is required to install the CT in the main switchgear or switchboard.

- The CT is to be installed on "A-phase" of the main service entrance, in to correct orientation, and wired to the appropriate terminal block, TB1- terminals 1 and 2 for Eaton's LV AutoVAR units. It is important to ensure that the CT fits around all bus bars or it will not function properly. Please read and understand the installation manual for the equipment connected to the CT before installing the CT
- The CT should always be installed upstream of the loads and the equipment it is feeding
- The CT shall not be installed on the feeder of the equipment it is controlling
- The CT polarity must be observed accurately for proper functioning of the equipment—H1 should always face the source (utility) side

Shorting terminal blocks

Properly installed CTs are wired to shorting terminal blocks. These are used to establish a complete path for the CT secondary current prior to equipment installation or to isolate the CT during maintenance. CT shorting blocks should be connected as shown in **Figure 2**. CT shorting block screws or pins are used to maintain continuity in the secondary circuit to prevent any potential from occurring across positive and negative terminals. The shorting block screws or pins should be stored in a secure location near shorting block when not in use.



Note: Summing CT and shorting blocks are typically installed external to the AutoVAR unit.

Figure 2. TX SUM-2 summing CT

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