Veris White Paper

CT Selection: Current Mode vs. Low Voltage

Introduction

In some power metering applications, the current flowing through a conductor is too high for direct connection to the meter. In these applications, current transformers (CTs) are placed around the conductor and wired to the meter. The CT reads the current in the conductor and transforms it into a signal that is proportional to the reading. This signal is then sent to the meter. In this way, the CT isolates and protects the meter.

The installer typically has two types of CTs to choose from: (a) current mode CT or (b) low voltage CT (LVCT).

Current Mode CTs

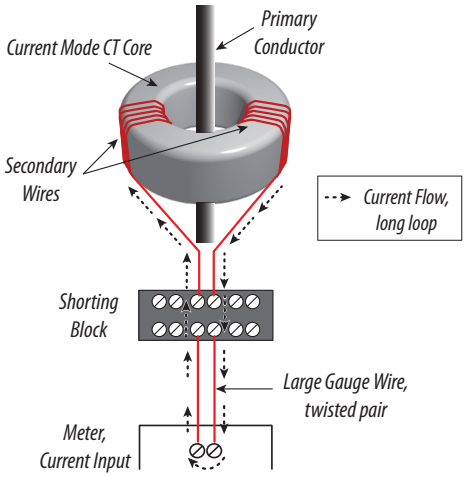
Current mode CTs can be rated to many different maximum currents. Current mode CTs are available with standard 1 Amp or 5 Amp maximum outputs.

Example: A CT is rated to a maximum current of 1000 Amps and placed around a conductor.

Amperage in the Conductor	Signal sent from CT to Meter	
	1 Amp max.	5 Amp max.
0 Amp	0 Amp	0 Amp
500 Amp	0.5 Amp	2.5 Amp
1000 Amp	1 Amp	5 Amp

When using current mode CTs, care must be taken. As long as current is flowing in the primary conductor, a proportional current signal continues to pass through the secondary CT wires. Do not disconnect the secondary wires from the load while current is flowing in the primary conductor, as the transformer secondary will attempt to continue driving current across the effectively infinite impedance up to its core saturation voltage. This produces a high voltage across the open secondary into the range of several kilovolts, causing arcing, compromising operator and equipment safety, or permanently affecting the accuracy of the transformer.

The installer must address this by including a shorting block between the CT and the meter. When the secondary CT wires must be disconnected from the meter, the installer must first insert a shorting jumper at the shorting block, keeping the loop in the secondary CT wires closed. This step allows the connections to the meter to be changed if needed. A shorting block reduces the risk of shock, but it adds time and cost for parts and labor.



With current mode CTs, the installer must also be aware of the burden capacity of the secondary wires. As the current output signal flows through the secondary wires to the meter, the burden capacity is what allows the CT to push the signal over the entire length of the loop. The burden capacity is based on the number of times the secondary wire is wrapped around the core. If using a CT that is rated for a high current (e.g. 1000 A), the greater number of windings increases the burden capacity, allowing the signal to travel more easily. However, for lower rated CTs (e.g. 50 A), number of windings is much lower, resulting in a lower burden capacity. The signal must work harder to travel through the loop, which lowers the CT's accuracy.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Follow safe electrical work practices. See NFPA 70E in the USA, or applicable local codes.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Read, understand and follow the instructions before installing this product.
- Turn off all power supplying equipment before working on or inside the equipment.
- Use a properly rated voltage sensing device to confirm power is off. DO NOT DEPEND ON THIS PRODUCT FOR VOLTAGE INDICATION
- SECONDARY LEADS/TERMINALS OF CURRENT OUTPUT (e.g. 5A) CTs MUST BE SHORTED, OR CONNECTED TO THE BURDEN AT ALL TIMES.
- Only install this product on insulated conductors.

Failure to follow these instructions will result in death or serious injury.

A qualified person is one who has skills and knowledge related to the construction and operation of this electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved. NEC2011 Article 100

No responsibility is assumed by Veris Industries for any consequences arising out of the use of this material.

The information provided herein is intended to supplement the knowledge required of an electrician trained in high voltage installations. There is no intent to foresee all possible variables in individual situations, nor to provide training needed to perform these tasks. The installer is ultimately responsible for ensuring that a particular installation remains safe and operable under the specific conditions encountered.

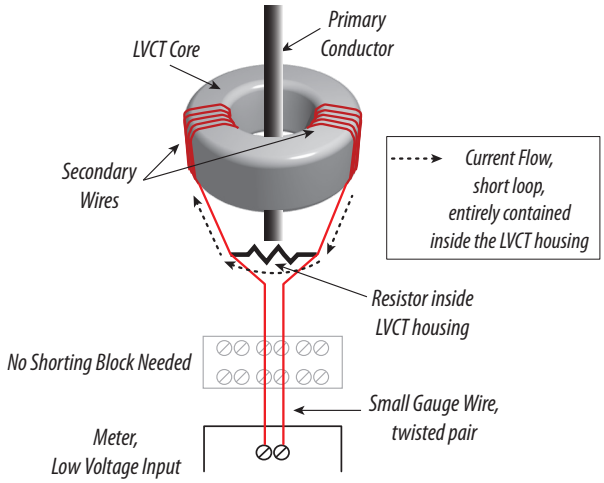
LVCTs

LVCTs are an alternative to current mode CTs. LVCTs contain an internal burden resistor, creating an internal loop through which the current flows. The low voltage signal to the meter is produced across this resistor. This design prevents current from flowing through the secondary wires to the meter, reducing the possibility of arcing. LVCTs are available with standard 1V or 0.333V maximum outputs.

Example: A CT is rated to a maximum current of 1000 Amps and placed around a conductor.

Amperage in the Conductor	Signal sent from CT to Meter	
	1 V max.	0.333 V max.
0 Amp	0 V	0 V
500 Amp	0.5 V	0.167 V
1000 Amp	1 V	0.333 V

No shorting blocks are needed to protect the user or the meter. The LVCTs can be wired to the meter directly, reducing installation time and cost.



Additionally, since the current flow loop is much shorter (contained within the LVCT housing), burden capacity is no longer an issue. The internal resistor and the number of secondary windings can be selected to generate a high accuracy signal at all current ratings.

Summary

The LVCT has many advantages over the current mode CT:

- Low voltage output instead of current output. This means less risk to installer and equipment.
- No shorting blocks, reducing installation time and cost.
- The LVCT is more accurate at very low currents.