FACULTY OF ENGINEERING & TECHNOLOGY

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INSTRUMENT TRANSFORMER

Introduction

Instrument Transformers are used in AC system for measurement of electrical quantities i.e. voltage, current, power, energy, power factor, frequency. Instrument transformers are also used with protective relays for protection of power system. Basic function of Instrument transformers is to step down the AC System voltage and current. The voltage and current level of power system is very high. It is very difficult and costly to design the measuring instruments for measurement of such high level voltage and current. Generally measuring instruments are designed for 5 A and 110 V. The measurement of such very large electrical quantities can be made possible by using the Instrument transformers with these small rating measuring instruments. Therefore these instrument transformers are very popular in modern power system.

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Types of Instrument Transformers

1. Current Transformer (C.T.)
2. Potential Transformer (P.T.)

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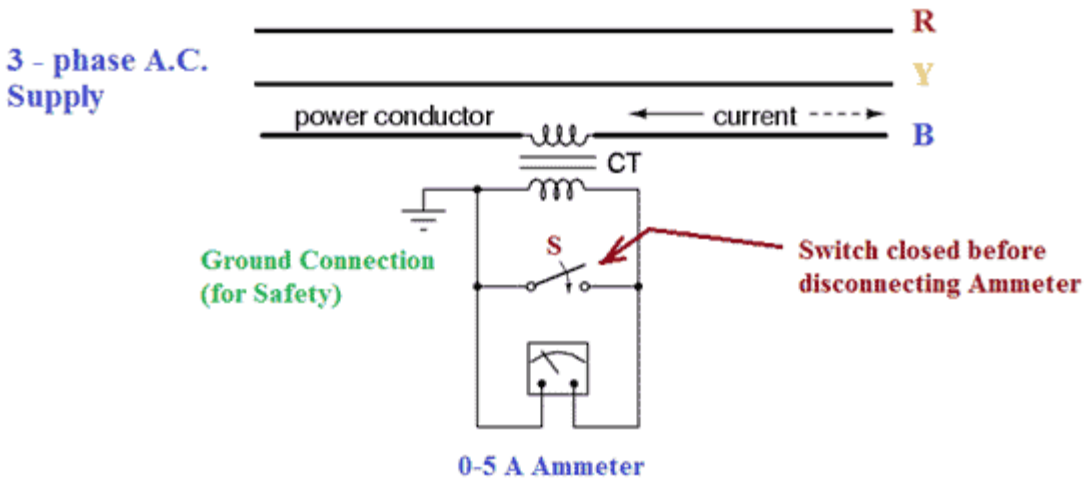
1. Current Transformer (C.T.)

Current transformer is used to step down the current of power system to a lower level to make it feasible to be measured by small rating Ammeter (i.e. 5A ammeter). A typical connection diagram of a current transformer is shown in figure below.



Current Transformer (C.T.)

Primary of C.T. is having very few turns. Sometimes bar primary is also used. Primary is connected in series with the power circuit. Therefore, sometimes it also called series transformer. The secondary is having large no. of turns. Secondary is connected directly to an ammeter. As the ammeter is having very small resistance. Hence, the secondary of current transformer operates almost in short circuited condition. One terminal of secondary is earthed to avoid the large voltage on secondary with respect to earth. Which in turns reduce the chances of insulation breakdown and also protect the operator against high voltage? More ever before disconnecting the ammeter, secondary is short circuited through a switch 'S' as shown in figure above to avoid the high voltage build up across the secondary.

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Accuracy

The accuracy of a CT is affected by a number of factors including:

- Burden
- Burden class/saturation class
- Rating factor
- Load
- External electromagnetic fields
- Temperature
- Physical configuration
- The selected tap, for multi-ratio CTs
- Phase change
- Capacitive coupling between primary and secondary
- Resistance of primary and secondary
- Core magnetizing current

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Use

- Current transformers are used extensively for measuring current and monitoring the operation of the power grid. Along with voltage leads, revenue-grade CTs drive the electrical utility's watt-hour meter on many larger commercial and industrial supplies.
- High-voltage current transformers are mounted on porcelain or polymer insulators to isolate them from ground. Some CT configurations slip around the bushing of a high-voltage transformer or circuit breaker, which automatically centers the conductor inside the CT window.
- Current transformers can be mounted on the low voltage or high voltage leads of a power transformer. Sometimes a section of a bus bar can be removed to replace a current transformer.
- Often, multiple CTs are installed as a "stack" for various uses. For example, protection devices and revenue metering may use separate CTs to provide isolation between metering and protection circuits and allows current transformers with different characteristics (accuracy, overload performance) to be used for the devices.