

Overview

Quick, accurate, and safe current measurements can be made on medium and high-voltage systems at the secondary of instrument current transformers (CT's) using the TPI A254 Low-Current Clamp-On Adapter. The low-range accuracy (down to 10 milliamps) of the adapter permits measurements on the 5-amp secondary of CT's without placing the meter in series with the current transformer secondary, and without being in close proximity to the high-voltage side of the current transformer.

WARNING! This procedure is intended for use by qualified individuals only. Work must be performed in accordance with OSHA 29 CFR 1910.269.

When making AC current measurements, the TPI A254 Adapter can be used with the TPI 122, 126, 133, 153, 163, and 183 Digital Multimeters, the TPI 440 Scopemeter, and the TPI 460 Dual-Channel Oscilloscope. See additional Application Notes for specific instructions on the TPI 183, 440, and 460.

Applications

It is often necessary to make recordings of equipment operation, particularly of medium voltage motor starting, in order to determine the motor actual locked-rotor-amps (LRA), full-load-amps (FLA), acceleration time, and power factor. This data is often required to verify proper protective relay settings, for inclusion in commissioning reports, and to establish an operating baseline for future system troubleshooting.

The TPI 440 Scopemeter, and 460 Oscilloscope both have the ability to store data and waveforms. Optional software is available to permit downloading the stored information to a computer and then printed to obtain a permanent hard-copy record.

The TPI A254 Adapter



The A254 is capable of current measurements on either AC or DC systems. For this application only the AC mode is utilized.

The adapter's low-range accuracy is due in part to the small clamp-on opening diameter which insures good coupling but is large enough for metering, protective relaying, and other instrument wiring.

As with all TPI current adapters, the clamp-on converts current to a proportional millivoltage (mV). The adapter is plugged into the voltage input of the multimeter, 440 Scopemeter, or 460 Oscilloscope and the instrument display is read as current.

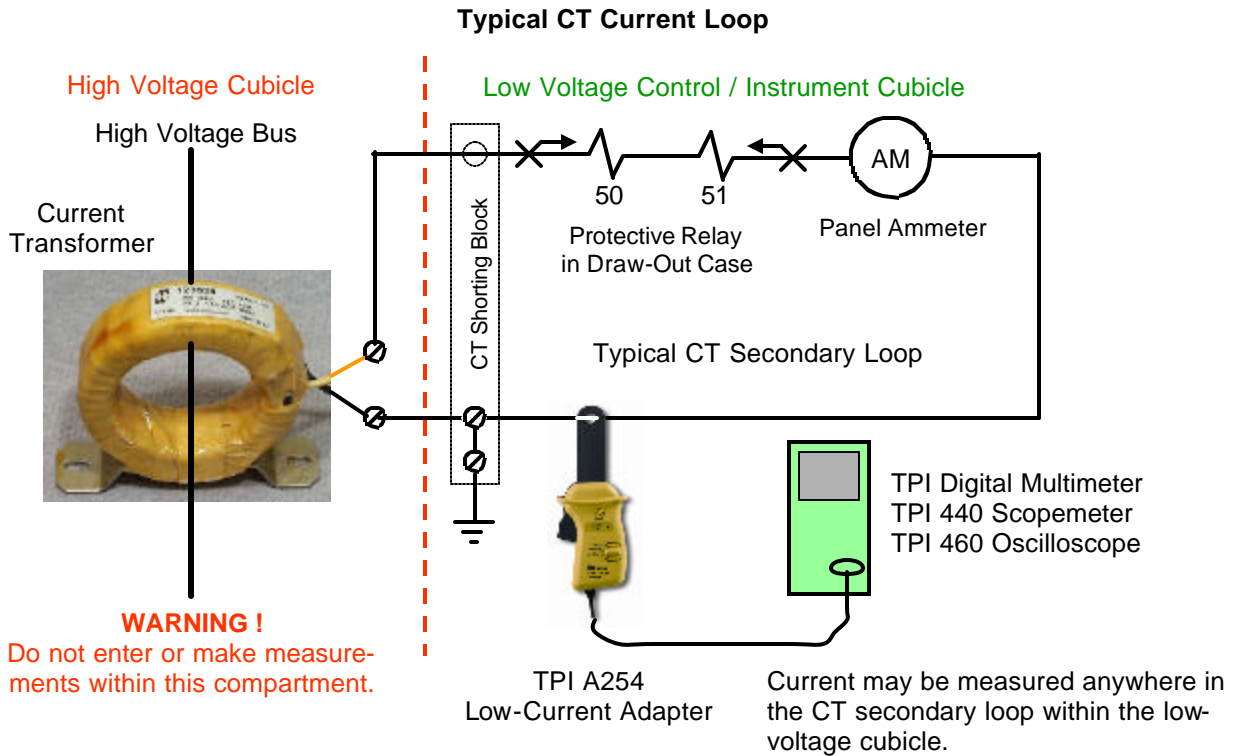
There are two switch-selectable ranges on the A254: 0-10 mV/amp and 0-100 mV/amp.

The A254 adapter is accurate down to 10 milliamps but it has a maximum rating of 60 amps so the instrument will not be over-ranged during measurements made on the secondary of the CT which, in the case of a motor start trending, may momentarily go to six-times (or more) of the full-load current of the motor. (Maximum permissible adapter current of 60 amps would be 12 times the CT 5 amp secondary.)

WARNING! - Current Transformer Safety

- This procedure is for measurement *only* on the secondary circuit of current transformers and may *not* be used within the high voltage equipment cubicle.
- The secondary of a current transformer must never be open-circuited. It must have a burden connected or be short-circuited. An open circuited CT can develop a dangerously high secondary voltage.

For more information on Current Transformers and CT safety see *The Industrial Electrician's Notebook* Article 0016: Current Transformers - Part 1.



Typical Measurement Calculation

Assume for this example the Current Transformer (CT) Ratio is 800/5.

Assume that with the A254 Low-Current Adapter switch placed in the 100 mV/A position, the meter reads 246 millivolts.

The CT secondary current would be $246 / 100 = 2.46$ amps.

The CT primary current would be $2.46 \times 160 = 393.6$ amps. (Note $800/5 = 160/1$.)

Determining the CT Ratio

The Current Transformer ratio can be determined using the System One-Line Diagram, or if an analog panel meter is used, the full-scale value of the ammeter will indicate the CT primary current.

The CT ratio can also be determined from the Current Transformer nameplate, or may be painted in large numbers on the CT. Do not open or enter the high-voltage compartment without following proper de-energizing, lockout/tagout, and grounding procedures as per OSHA 29 CFR 1910.269.

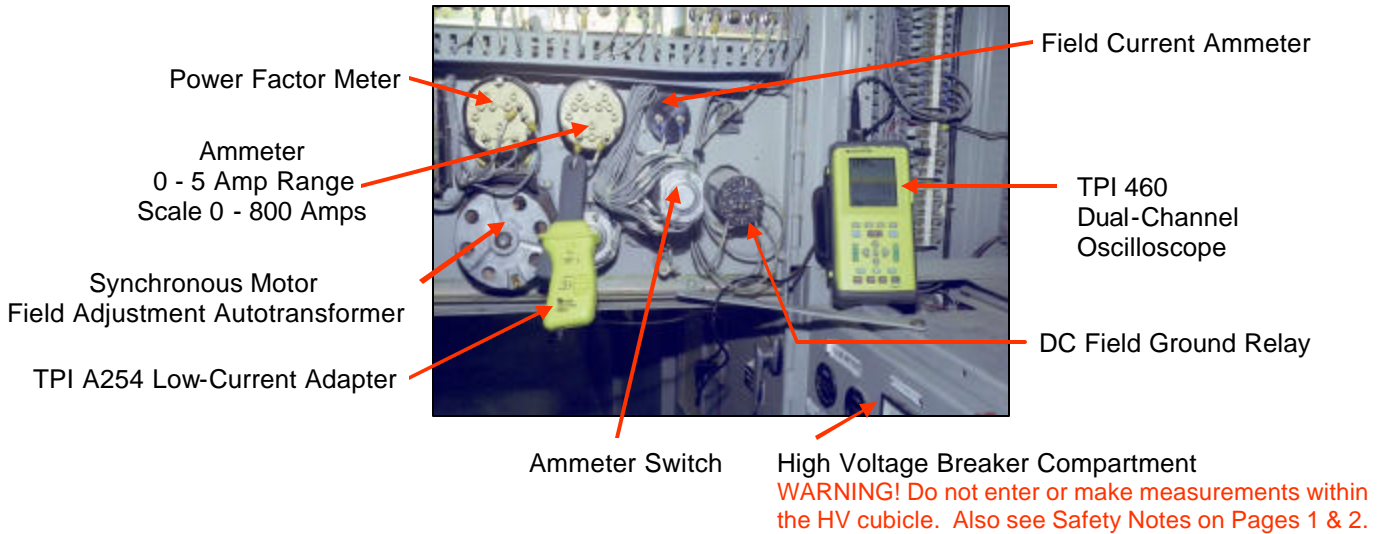
WARNING! - Current Transformer Safety

- This procedure is for measurement *only* on the secondary circuit of current transformers and may not be used within the high voltage equipment cubicle.
- The secondary of a current transformer must never be open-circuited. It must have a burden connected or be short-circuited. An open circuited CT can develop a dangerously high secondary voltage.

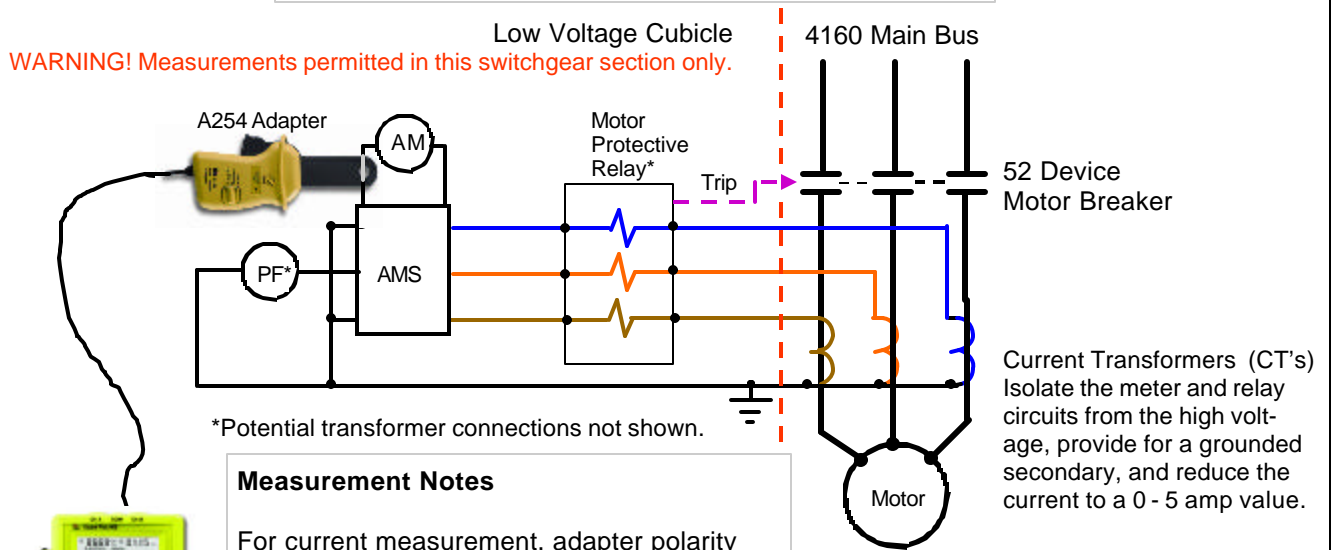
For more information on Current Transformers and CT safety see *The Industrial Electrician's Notebook* Article 0016: Current Transformers - Part 1.

4500 H.P. Medium Voltage Synchronous Motor

4160 Volt Motor Control Center - Field Excitation / Relay Cubicle - Showing back of Door
Current measurement using the TPI A254 Low-Current Adapter and TPI 460 Oscilloscope.



Schematic Diagram of Measurement Set-up



Measurement Notes

For current measurement, adapter polarity (placement around conductor) is not critical.

Convenience usually dictates the point at which the current measurement is made. Any phase CT secondary would be acceptable.

When using the 460 Oscilloscope, a direct amperage reading can be obtained using Channel B.

Legend

- AM - Panel Ammeter
- AMS - Ammeter Switch
- PF - Power Factor Meter



460 O'Scope