# Instrument Transformer Testing Training Course for Protection and Metering

15 – 19 February 2027
Rome

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## Programme Summary

Instrument transformer testing is the subject of this one-week training course for substation test engineers, protection and metering engineers and commissioning leads, taught at applied level and ending in a transformer test record package for one substation bay. Protection and metering depend on current and voltage transformers that are rarely re-proved after installation. The programme moves from accuracy principles to ratio and polarity checks, burden and excitation curves, insulation tests and records, using prepared test data from a transmission substation and an industrial plant. Mars Training Centre UK delivers this programme on instrument transformer testing to mixed-organisation cohorts.

## The Business Case

Teams that test transformers against recorded criteria find wrong ratios, reversed polarity and saturating cores before protection or revenue metering relies on them. Where tests are limited to a quick continuity check, faults stay hidden until a relay misoperates or a meter reads wrongly. Without kept test records, later work repeats the same checks or misses drift. The programme works on the measures below.

- Protection Misoperation Risk: Falls when ratio, polarity and saturation margin are proved before energisation.
- Metering Accuracy: Improves when burden and accuracy class are verified against recorded limits.
- Commissioning Rework: Reduces when test records are complete and deviations are closed.

## Principles and Evidence Base

- IEC 61869: The international series on instrument transformers, applied in Session 1 to set the requirements each test is judged against.
- IEC 61869-2: The part of the series with additional requirements for current transformers, applied in Session 3 to review excitation and performance results.

## Intended Participants

- Substation test engineers who carry out and record transformer tests.
- Protection engineers who rely on current transformer performance for relay settings.
- Metering engineers who answer for accuracy at billing and control points.
- Commissioning leads who accept test results before energisation.

Typical settings include transmission and distribution utilities, power generation, oil and gas facilities and heavy industry.

## Learning Outcomes

1. Participants will be able to construct a test plan for current and voltage transformers matched to their protection or metering duty.
2. Participants will be able to evaluate ratio, polarity and wiring results against nameplate data.
3. Participants will be able to diagnose saturation and burden problems from excitation curves and burden measurements.
4. Participants will be able to prioritise failed or doubtful results by effect on protection and metering.
5. Participants will be able to justify the test records and accuracy evidence kept for one substation bay.

## Programme Structure

### Day 1: Instrument Transformer Testing Principles and Accuracy Classes

What do current and voltage transformers do, and what must a test prove?

- Current and Voltage Transformer Equivalent Circuit
- Accuracy Class and Rated Burden Table
- IEC 61869 Requirements Map
- Protection and Metering Core Comparison
- Test Plan and Safety Sheet

### Day 2: Ratio, Polarity and Secondary Wiring Checks

How are ratio, polarity and wiring proved before a transformer is put in service?

- Ratio Test Procedure
- Polarity Check Method
- Secondary Wiring Continuity Sheet
- Earthing Point Verification
- Nameplate and Tap Record

### Day 3: Burden, Excitation and Saturation Curves

How are burden and excitation measured, and what does the curve show?

- Burden Measurement Method
- Excitation Curve Test Sheet
- Knee Point Reading Table
- Saturation Margin Calculation
- IEC 61869-2 Performance Review

## Day 4: Insulation Tests, Equipment Use and Result Analysis

How are insulation and results judged, and which test equipment suits each check?

- Insulation Resistance Test Record
- Test Set Connection Diagram
- Voltage Transformer Winding Check
- Result Trend Comparison Table
- Failed Test Diagnosis Flowchart

## Day 5: Test Record Package for One Substation Bay

Do the earlier results join into a record package that protection and metering can rely on?

- Applying the Session 2 Ratio Records
- Testing the Session 3 Excitation Curves
- Checking the Session 4 Insulation Results
- Reviewing the Open Test Deviations
- Completing the Transformer Test Record Package

## Methodology

The programme is a data workshop built on prepared test data from a transmission substation and an industrial plant: nameplates, ratio and polarity sheets, excitation curves, burden readings and insulation records. Participants plan tests, plot and read curves, judge results against limits and defend their conclusions to peers acting as a commissioning review team.

- Suggested activity: Plotting an excitation curve and marking the knee point.
- Suggested activity: Checking a burden reading against the rated burden of a protection core.
- Suggested activity: Diagnosing a reversed polarity record from a wiring sheet and a test result.

## Capstone Output

Each participant completes a transformer test record package for one substation bay. It holds a test plan, ratio and polarity sheets, burden and excitation results, insulation records and a deviation log. At work it goes to the commissioning review team for acceptance and becomes the baseline for later retesting.

## Frequently Asked Questions

### Is instrument transformer testing training suitable for engineers new to substation work?

Yes. Instrument transformer testing is taught from prepared data and templates. You need basic knowledge of electrical circuits and measurement, but no earlier experience of a particular test set.

## Which standards does instrument transformer testing rest on in this training?

Instrument transformer testing here rests on the IEC 61869 series for instrument transformers, with IEC 61869-2 used for additional requirements on current transformers.

## How is the record package from instrument transformer testing training used at work?

You take the test record package to your commissioning review team for acceptance, keep its results as a baseline and compare later retests against them.

## How does instrument transformer testing differ from protection relay testing?

Instrument transformer testing proves the current and voltage sources that feed relays and meters, while protection relay testing proves that the relay itself operates as set.