

**25.7.2025****DESIGN GUIDE FOR ELECTRICAL ENERGY MEASUREMENTS IN FINLAND****110/20 kV substation****General**

This guide is intended for electrical designers and contractors for planning and delivery of electrical energy metering installations. This guide contains the minimum requirements for energy metering.

Since delivery and installation of the meters is done by the party responsible for the metering, the design work needs to be approved by them. eg. grid operator before design work starts to ensure compatibility.

This guide includes recommendations from "Sähkön mittauksen periaatteita 2024" (Principles of Metering 2014) and SFS-3381 standard.

**Instrument Transformers**

Instrument Transformers (voltage and current) are installed in each of the phases, aron-connection is not permitted. Secondary current of the current transformer is 1A or 5A. Secondary voltage of voltage transformer is 100V. Current transformers must have an accuracy class of 0.2s and voltage transformers 0.2

Current transformers are selected so that the measured current is between 5-120% of nominal. Current transformer secondary circuits are each wired with their own return leads (common return wire is not recommended)

To maintain the accuracy class of the current transformers, the secondary circuit is designed so that the burden on the secondary is 25-100% of the rated burden on CT. If required, additional load resistors are used to reach the minimum burden of at least 25%. The burden of static energy meters is so small that it can usually be ignored in burden calculations.

Instrument transformers must be installed so that their nameplates are visible when the switchgear is energized. Alternatively, a copy of the nameplates can be attached to the switchgear cover.

Test reports for each individual instrument transformer must be available.

**Wiring and Terminal Blocks**

Wires on the measuring circuits (voltage and current) must be 2.5mm<sup>2</sup> unless burden or voltage loss considerations dictate a wire with larger cross section. To ease test and maintenance, measurement terminal blocks are installed next to the meter and

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measuring transformers. The terminal blocks must be equipped with 4mm banana sockets, and have to be disconnectable.

The short-circuit bridge on the terminal block should be screw operated, spring loaded bridge is not recommended. For wire connections screw or spring-loaded contacts are accepted.

Auxiliary wires on the meter are typically 1.5 mm<sup>2</sup>. Chaining auxiliary wires through the meters is not recommended.

Wires connected to the meter are numbered with the meter terminal or terminal block numbers.

Measurement voltage circuit is equipped with its own dedicated circuit breaker. A suitable breaker is for example 3x6A or 3x10A. No other devices besides the electric meter is allowed to be connected to the measurement voltage circuit, to avoid disturbances to the metering. Maximum permitted voltage loss on the measuring voltage circuit is 0.05%

## **Energy Meter**

Meters are provided by the party responsible for the metering.

Wireless GSM-modems are the most typical way of reading the metered data. If cell reception is poor in the meter installation area (for example inside substations with steel walls), a 25mm hole outside is provided near the metering cabinet for installation of an outside antenna. If the meter is installed underground, a 25mm conduit is suitable for the antenna wiring to surface.

Auxiliary voltage for the meter is 100-230V AC or DC. Auxiliary voltage is required, so that it is possible to read the meters even when the measuring voltage is out. Auxiliary voltage also reduces current draw on the voltage measurement circuits, reducing voltage loss.

## **Attachments**

Example circuit diagrams for Landis & Gyr E650 and EMH LZQJ-XC meters.



