

DESIGN GUIDE FOR ELECTRICAL ENERGY MEASUREMENTS IN FINLAND
Indirect metering in distribution networks (0,4 - 20kV)**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, e.g. grid operator before design work starts to ensure compatibility.

This guide includes recommendations from "Sähkön mittauksen periaatteita 2024" (Principles of Metering 2024) 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 is 5A. Secondary voltage 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 primary 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). Low voltage current transformer secondary circuits are not grounded.

Low-voltage current transformers must have double terminals on both poles, with one set left free for short-circuit loops (e.g., for wiring changes). If possible, the terminals must be safely accessible when the switchgear is energized.

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. (See table 1)

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.

No other devices may be connected to the current- and voltage measurement circuits besides the billing meter.

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Wiring and Terminal Blocks

Wires on the measuring circuits (voltage and current) must be 2.5mm² unless burden considerations dictate a wire with larger cross section. If required, auxiliary voltage, pulse, and other wires must have a cross-section of 1.5 mm². Wires connected to the meter are numbered with the meter terminal numbers.

To ease test and maintenance, measurement terminal blocks are installed on voltage- and current measurement circuits. The terminal blocks must be equipped with 4mm banana sockets, and have to be disconnectable. Voltage and current terminal blocks are separated with additional separator plate.

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. Terminals must be installed so they cannot close on their own.

The voltage measurement circuit must be protected with a dedicated set of fuses or 3x10A circuit breaker. No other devices may be connected to it.

Energy Meter

The grid operator supplies and install the required energy meter. An M2 meter rack must be reserved for the meter.

Sealing

The switchgear must allow for sealing of the unmetered section and the metering equipment.

CT nominal burden[VA]	2,5 mm ²		6 mm ²	
	min	max	min	max
1	1	2,5	2	6
1,5	1	3	3	9
2,5	2	6	4	15
3	2	7	5	18
4	3	10	7	25
5	4	13	9	30
7,5	6	20	15	45
10	8	27	20	60
15	11	40	30	80
20	15	55	40	120
25	20	65	60	150

Table 1. Nominal burden and maximum cable lengths(back and forth distance) for current transformers of 5A secondary by cross-section.

Attachments

Circuit diagrams for indirect measurements with and without voltage transformers

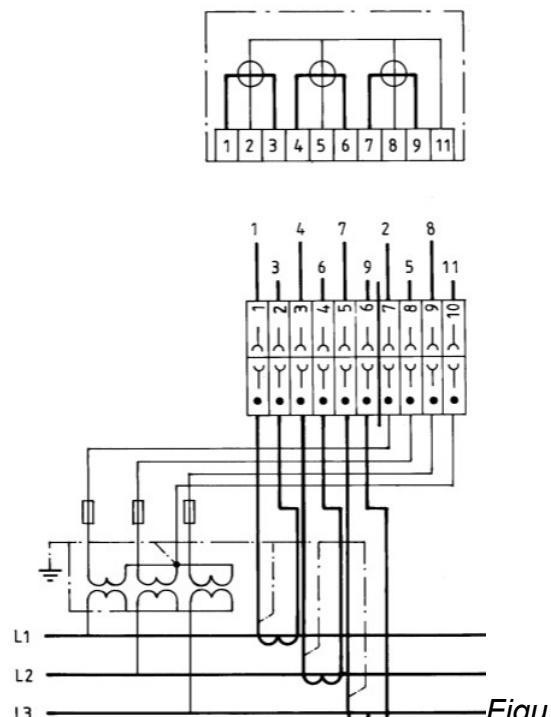
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Figure 1: Circuit diagram, measurement with voltage transformers

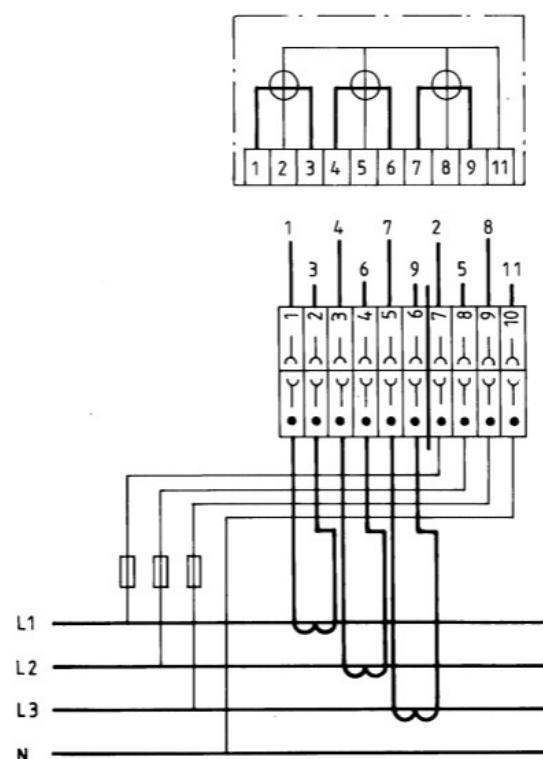


Figure 2: Circuit diagram, current transformer measurement