

LV current transformer for billing measurement?

Welcome dear friends, of protection, control and electrical engineering. Today we will look at a topic in the field of low voltage current transformers for billing purposes. *Enjoy reading, let's go!*

Introduction

In the industrial environment, current sensors with a voltage output or Rogowski coils are increasingly used. Handling is often somewhat easier than with inductive current transformers. For example, with passive current sensors there is no dangerous open circuit voltage to consider and Rogowski coils can be quickly placed around any conductor shape. To date, however, these current sensors have not been approved for clearing measurements, even though the accuracy of these sensors is consistent with the accuracy classes approved for clearing measurements (cl. 0.1 to cl. 0.5).

From a technical point of view, the attitude of the authorities is understandable. For example, current sensors with voltage output contain a resistor in the secondary circuit. This resistance is subject to a certain aging and temperature dependence. Rogowski coils also sometimes have resistors for adjustment purposes, or even the potentiometer, which is considered unreliable.

Inductive current transformers consist only of an iron core, a secondary winding and, in some embodiments, a primary winding. This conventional design has proven to be very reliable. For this reason, the declaration of conformity for current transformers issued by the manufacturer in Germany is also valid indefinitely. Regular replacement, as is the case with MID-certified energy meters, for example, is not necessary. The standard output signals of 1 or 5 A also have a higher immunity to electromagnetic interference than small voltage signals, especially over longer distances.

The Problem

Nevertheless, there is a danger: If the connecting cables in low-voltage or medium-voltage measuring cabinets are very short, underloading often occurs. The burden power specified on the rating plate must be considered between 25 and 100 percent. This is the only way to guarantee the specified class accuracy. If the connected operating load lies outside this range, the class accuracy is no longer guaranteed by the manufacturer. For this reason, additional burdens are sometimes used in some modernized measuring fields to achieve the required quarter-burden power.

The common energy meters have quite small measuring resistors or small current transformers with shunts in the current input paths.

Table 1: Possible rating burdens for current transformers according to PTB and IEC 61869-2

Rated power [VA] S_r	Tested accuracy range [VA]	Test points
1 PTB	1-1	1/1 S_r
1,5 PTB	1-1,5	1 VA + 1/1 S_r
2 PTB	1-2	1/2 S_r + 1/1 S_r
2,5 PTB	1,25-2,5	1/2 S_r + 1/1 S_r
2,5 IEC	1-2,5	1 VA + 1/1 S_r
5 PTB/IEC	1,25-5	1/4 S_r + 1/1 S_r
10 PTB/IEC	2,5-10	1/4 S_r + 1/1 S_r
15 PTB/IEC	3,75-15	1/4 S_r + 1/1 S_r
30 PTB/IEC	7,5-30	1/4 S_r + 1/1 S_r

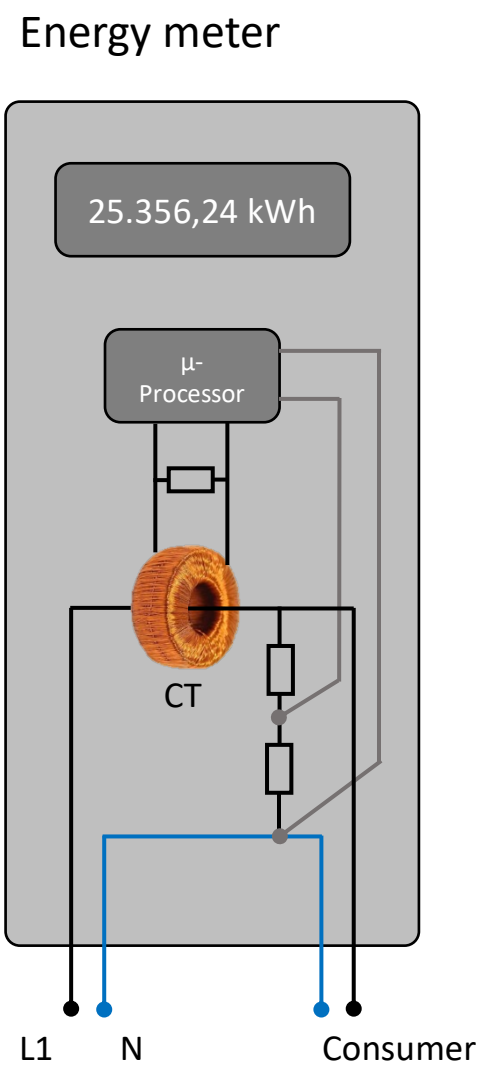

Figure 1: Schematic structure of an energy meter (single-phase)

Even with a nominal secondary current of 5 A, the load is often in the mVA range. If the connection of the current transformers is carried out with low-resistance copper cables due to specifications of the municipal utility, underloads may also occur in some constellations.

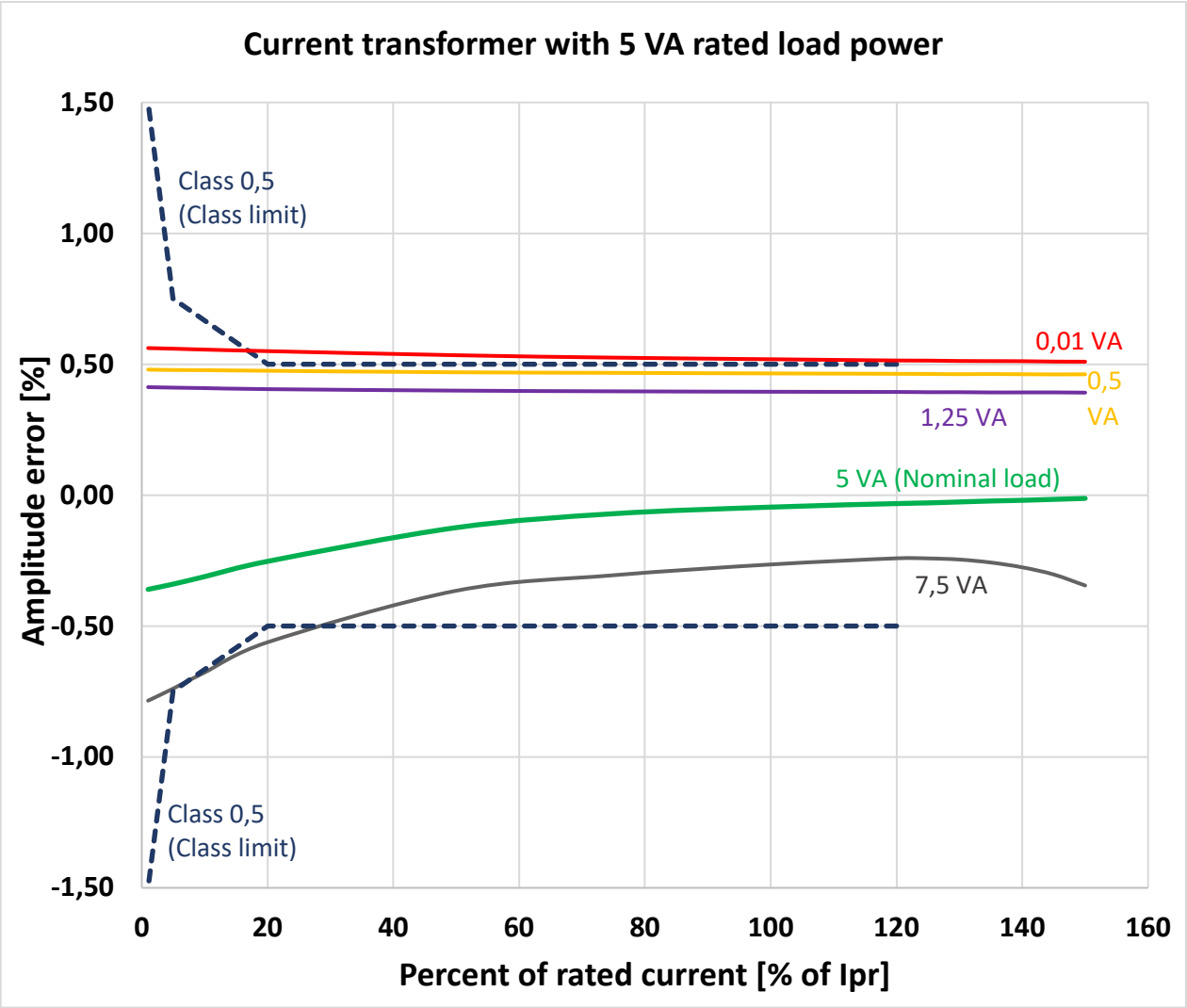

Figure 2: Billing current transformer with 5 VA and accuracy class 0.5

An underload is present at less than 1.25 VA (25 % of the rated load power 5 VA). Here we see that at 0.01 VA the class 0.5 is left. In principle, more can be billed for a smaller burden than for a larger burden or even an overburden, which occurs at 7.5 VA in Figure 2.

Conclusion

The situation described here must be considered for both network planning and operation.
Professional remedy is offered by a Dutch quality supplier of instrument transformers. The **ELEQ** company always specifies a load range starting at 0 VA for its billing transformers. This ensures that customer-side underloading in the field can be ruled out. Further loads such as additional burdens or connection cables with a higher resistance can thus be avoided. This is practical, safe, and also environmentally friendly. At least from this point of view, nothing stands in the way of saving the climate!

Figure 3: ELEQ measuring transformer ERM series

Burden	Model	Ratio	Class Ext. 120%	Accuracy class reached for burden	Article number
1 VA	ERM60-E2A	100/5A	0,5S	0 .. 1 VA	4M2140D
1 VA	ERM60-E2A	100/1A	0,5S	0 .. 1 VA	4M2170D
1 VA	ERM60-E3A	150/5A	0,2S	0 .. 1 VA	4M2450D
2 VA	ERM60-E3A	200/5A	0,2S	0 .. 2 VA	4M2451D
2,5 VA	ERM60-E3A	250/5A	0,2S	0 .. 2,5 VA	4M2452D
1 VA	ERM60-E3A	150/1A	0,2S	0 .. 1 VA	4M2480D
2 VA	ERM60-E3A	200/1A	0,2S	0 .. 2 VA	4M2481D
2,5 VA	ERM60-E3A	250/1A	0,2S	0 .. 2,5 VA	4M2482D
2,5 VA	ERM70-E4A	300/5A	0,2S	0 .. 2,5 VA	4M3453D
5 VA	ERM70-E4A	400/5A	0,2S	0 .. 5 VA	4M3454D
5 VA	ERM70-E4A	500/5A	0,2S	0 .. 5 VA	4M3455D
2,5 VA	ERM70-E4A	300/1A	0,2S	0 .. 2,5 VA	4M3483D
5 VA	ERM70-E4A	400/1A	0,2S	0 .. 5 VA	4M3484D
5 VA	ERM70-E4A	500/1A	0,2S	0 .. 5 VA	4M3485D
5 VA	ERM70-E4B	600/5A	0,2S	0 .. 5 VA	4M3556D
5 VA	ERM70-E4B	750/5A	0,2S	0 .. 5 VA	4M3557D
5 VA	ERM70-E4B	600/1A	0,2S	0 .. 5 VA	4M3586D
5 VA	ERM70-E4B	750/1A	0,2S	0 .. 5 VA	4M3587D
5 VA	ERM85-E6A	1000/5A	0,2S	0 .. 5 VA	4M8758D
5 VA	ERM85-E6A	1000/1A	0,2S	0 .. 5 VA	4M8788D

Figure 4: ELEQ ERM series with class & load indication

Warm wishes,

Your EEA-TEAM