

RESEARCH AND STANDARDISATION

RESPONSE FORM for Standardisation groups

Opportunity for standardisation to contribute to the *European Partnership on Metrology EPM* under Horizon Europe

Objective: to collect standardization needs and suggestions to develop research projects in testing and measurements for the upcoming European Partnership on Metrology (EPM) calls in 2021

In the frame of the cooperation agreement between CEN-CENELEC and EURAMET, CEN and CENELEC have been invited by the EURAMET Management to put forward their **testing and measurement needs in research** for consideration by metrology institutes for future calls under EPM.

Relevant technical groups (sector fora, advisory boards, coordination groups, TCs, WGs...) **are invited to contribute with**

- a short introduction or an overview paper of their unaddressed standardization needs for testing and measurement, and
- a contact person (secretary, chair, convenor, liaison officer, etc.) whom proposers for the Potential Research Topics can contact,

by using this Response Form and send it at STAIR EMPIR, Mr Ortwin Costenoble: empir@nen.nl

Deadline for the consultation: **11 December 2020.**

Source of the identified need (identification of TC, WG, etc, incl. title)	<input type="checkbox"/> CEN/TC 0/WG 0 / <input type="checkbox"/> CLC/TC 0/WG 0 <input type="checkbox"/> ISO/TC 0/SC 0 / WG 0 / <input checked="" type="checkbox"/> IEC/TC 38/SC 0 / WG 0 <input type="checkbox"/> Other, namely <i>Identification, Title</i>
European entity responsible for submission of the need	<i>CEN/CLC TC 38 Instrument Transformers</i>
Person that can be contacted for more detail	<i>Filippo Frugoni filippo@frugoni.it +39 049 5384606 Italy</i>
Title:	<i>Characterization of Instrument Transformers for AC and DC grids up to 36 kV and up to 150 kHz</i>
Unaddressed need	<i>Traceable measurement methods and instrumentation for accurate characterization of Instrument Transformers used to measure disturbances up to 150kHz in Medium Voltage AC and DC grids</i>
Further explanation of need (TC business plan, road map, formal decision, work item, etc.)	<i>Further explanation on the need, why it shall be filled and why specifically related to standard Estimated time frame that need shall be fulfilled</i> <i>Measurement needs Measurement of voltage and current for high frequency (above 9 kHz, IEC) applications is becoming more important.</i>

In fact, due to the advances in the power electronics technology, switching devices are increasingly present in our daily life and, therefore, in the electrical grid, ranging from a few watt to more than 100 MW. At the same time, moreover, switching devices tend to have increasing power and increasing switching frequency. This trend, thus, asks for improved performance, in terms of accuracy and wide frequency range for voltage and current measuring instruments. Unavoidably, the same requirements apply to Instrument Transformers, as they are the first element of every voltage and current measuring chain, in almost all applications.

A non exhaustive list of high frequency applications, up to 150 kHz, that require the measurement of voltage and current is the following:

- a. Interferences between emissions of devices (including high power converters) and power line communication, with consequent possible failure of vital grid operations;*
- b. Propagation between devices: emissions of one device that couple with another device causing malfunctions in the control systems (with possible complete failure of a device) and reduced components life;*
- c. Accurate measurement of the performance of the power converters (DC/DC, AC/DC, AC/AC) to improve efficiency, electromagnetic emissions, compatibility and help the designers to guarantee the ecodesign paradigm;*
- d. Accurate modeling of the various grid components (cables, transformers, generators, loads) in the high frequency range, to give the operators an accurate mean to forecast accurately the grid behaviour in all the possible operating conditions and to take the appropriate actions.*
- e. Accurate measurements of disturbances present in AC and DC grids, up to 150 kHz, to provide the Technical Committees working, e.g.: in the standardization of grid operation, compatibility levels planning, Power Quality measurements, etc. reliable information for the correct identification of the characteristics of the disturbances.*

Past projects and open metrological Issues

The traceable characterization of Instrument Transformers, with reference to AC and DC grids applications and up to 150 kHz, currently represents an open metrological issue for the NMIs. Some of the metrological issues related to this topic are constituted by: 1) the generation of realistic AC and DC voltage and current waveforms, up to thousands volt and ampere, with the presence of disturbances typical of Medium Voltage grids and frequencies up to 150 kHz; 2) the development of traceable voltage and current reference

measurement devices, up to thousands volt and ampere and from 0 Hz to 150 kHz.

This is also demonstrated by the fact that some NMIs are currently involved in EMPIR research projects whose objectives, among the others, have very small overlaps with the proposed topic.

For instance: 19NRM05 IT4PQ is focused on Instrument Transformers for Medium Voltage AC grids and up to 9 kHz; EMPIR 18NRM05 SupraEMI is marginally investigating on the characterization of voltage and current sensors for Low Voltage AC grids, up to some hundreds of volt and from 2 kHz to 150 kHz; EMPIR JRP-n01 DC Grids, will be focused on instrument transformers for Low Voltage DC grids, up to 1000 V and 800 A and ripple on DC signals up to a frequency of 150 kHz.

Currently available relevant standards

As regards IEC TC38, three standards are relevant to this topic.

IEC 61869 parts 14 and 15 deal with Instrument Transformers for DC grids with rated voltage over 1.5 kV. They recognize that Instrument Transformers for DC grids have to measure also AC components; they also recognize that power converters inject frequency components into DC grids, even up to 20 kHz. However, these two standards do not give accuracy specifications at frequencies different from 0 Hz (i.e. at DC) nor indications on measurement methods, test procedures, instrumentation and uncertainty evaluation related to Instrument Transformer characterization.

IEC 61869 part 6 deals with Low Power Instrument Transformers, giving accuracy specifications up to 20 kHz. However, also here, no indications on measurement methods, test procedures, instrumentation and uncertainty evaluation, related to Instrument Transformer characterization, are given.

The IEC 61007, by IEC TC51, deals with measuring methods and test procedures regarding transformers and inductors for use in electronic and telecommunication equipment. It is specific for magnetic devices, for various type of applications, including thus also inductive Instrument Transformers, but not applicable to whatever type of Instrument Transformers. Moreover, it does not give: accuracy specifications, frequency ranges, indications on the reference instrumentation.

It can be concluded that, currently, no standard fully covers the topic at hand. A specific standard, covering the topic at hand, will constitute a reference document for all the entities (grid operators, Instrument Transformers manufacturers, power quality instruments manufacturers, power converters manufacturers, big electricity consumers, etc.) that now and in the future will need to perform AC and DC voltage and current measurements up to 150 kHz. Standardizing the procedures for the accuracy assessment of these kind of Instrument Transformers, the market will be normalized and

	<p><i>different products will be directly comparable since they will refer to the same standard.</i></p> <p><i>Interested NMIs</i> <i>The NMIs currently interested in the topics are: INRIM, PTB, VSL, METAS, FFII-LCOE.</i></p> <p><i>Estimated time frame</i> <i>All the complete documentation necessary for the preparation of the Standard will be available in 4-5 years after the kick-off of the project activity</i></p>
Proof of need by the TC/SC	<p><i>Indication by the standardization group of its support to use the effective research result is strongly recommended. Indicate a decision or attach minutes that underline that support</i></p> <p><i>The draft minute of CAG meeting of 09/12/2020 is attached.</i></p>
Enclosures	<p><input checked="" type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p>

*See more information or a link to the webinar at

[EMPIR website](#)

[CEN/CENELEC website "Standards and metrology"](#)