

CENELEC/TC or SC 38	Secretariat Italy	Date 2021-10-08
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TC or SC title: Instrument transformers

A Background

Instrument transformers have been used since the beginning of the 20th Century, in order to transmit an information signal, proportional or related to a voltage or a current to measuring instruments, meters and protective or control devices.

The relevant Technical Committee has been established at IEC level since the middle of 20th Century but the corresponding CENELEC Technical Committee was set up only at the close end of the past Century, with the designation of CLC TC38X and the following scope:

“To prepare European Standards for electronic, electromagnetic and capacitive equipment intended to adapt voltage and current for supplying instruments and protective devices”

Taking into account the evolution of the technology and of the need of the users, in June 2011 the scope has been changed in the following way: “To prepare European Standards (using whenever possible IEC Standards) in the field of AC and/or DC current and/or voltage instrument transformers, including their subparts like (but not limited to) sensing devices, signal treatment, data conversion and analogue or digital interfacing” and TC38X changed its name to TC38 since then.

This change takes into account both the appearance of instrument transformers relying on transduction principles, different from the traditional inductive one, and providing at the secondary output a low power signal, unable to operate electromechanical equipment but well suited for electronic and digital protection relays and measuring instruments. Moreover, the sensing device can be made available separately from signal treatment and data conversion equipment: the Stand Alone Merging Unit (SAMU) has been therefore conceived, in order to collect signals coming from all kind of instrument transformers, inductive and low power, and to provide a digital output compliant with IEC 61850.

B Business Environment

B.1 General

Instrument transformers are essential equipment in the operation, monitoring and protection of generating plants, transmission and distribution systems. Instrument Transformers, which are covered by International Standards issued by TC38, are widely used at all voltage levels, ranging from Low Voltage up to EHV.

The importance of the Standards produced by TC 38 is due to the fact that control, protection and measuring systems are supplied through instrument transformers.

With respect to the corresponding IEC Technical Committee, working at EU level grants a very strong added value given by the enforcement provided by EU Directives, with particular reference to the following two Directives:

- Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (commonly referred as “LV Directive”).
- Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (commonly referred as “EMC Directive”).

EU common deviations are avoided as far as possible by implementing the relevant EU needs directly in the approval process of Standards, in the framework of the Frankfurt Agreement.

B.2 Market demand

Market

The main market and application of TC 38 Standards is the functional chain in which instrument transformers are integrated with switchgear, meters and/or protection relays. These are used by manufacturers and users in conjunction with other Standards from other IEC and CENELEC Technical Committees.

Users of TC 38 Standards

TC 38 Standards are used by Utilities and Contractors for the specification of new installations (e.g. substations and power plants) as well as renewal or refurbishment of old plant and equipment. Manufacturers of instrument transformers also use TC 38 Standards. The specifications and performances of various kinds of relays, meters and controls are also referring to TC 38 Standards.

Participation in TC 38 work

The Technical Committee in developing the range of Standards relies mainly on the participation of European Experts to IEC working groups, in the framework of the Frankfurt agreement between CENELEC and IEC, in order to achieve the maximum efficiency. Participation in these WGs is mainly by members coming from manufacturers of instrument transformers and, to a lesser degree, from consultants, test laboratories, universities and utility companies. A larger representation from manufacturers of relays and meters would be desirable.

B.3 Trends in technology

Instrument transformers have been traditionally based for a very long time on magnetic induction principle. At higher voltages, a capacitive divider is usually coupled to an inductive voltage transformer in order to obtain Capacitive Voltage Transformers (CVTs), having a simpler and less expensive design with respect to a purely inductive voltage having the same ratings. Apart from some minor issue tied to their intrinsic nonlinearity due to both saturation and hysteresis, inductive instrument transformers are usually very stable with time.

Since the beginning of this century, a new generation of instrument transformers relying on different transduction principles is presented to the market, under the designation of "Low Power Instrument Transformers". The availability of the new series of Standards (EN 61869) is aimed at fostering the wide-scale diffusion and availability of instrument transformers based on these new trends in technology. As with the development of Capacitive Voltage Transformers (CVTs), the introduction of new products in the marketplace results in larger number of manufacturers with less expensive products. Now the market is facing a similar situation with the new technologies like electronic instrument transformers, low-power instrument transformers and digital communication.

Similar situation exists with instrument transformers embedded in other equipment, for which a clear standardization is required.

The advent of new manufacturers and new products is welcomed by the market because of the possible associated cost reduction: this creates a need for clear standardization to avoid loss of quality of service and incompatibility among equipment from different manufacturers.

B.4 Market trends

The introduction of new technology instrument transformers (e.g. low power sensors in Medium Voltage and electronic instrument transformers with digital interface in the Very High Voltage field, AC and/or DC) will be fostered by the introduction of Digital Substation Systems and by the wider use of IEC 61850.

This requires a close collaboration with the concerned Technical Committees covering the subscribing functions, in particular TC57 (utility communication), TC13 (metering), and TC95 (protection).

This will cause a possible change in the competition among Manufacturers, due to the possible introduction of new players due to the new technology. This may affect also average price levels.

One important tendency in the Very High Voltage networks is the introduction of DC High Voltage lines. Suitable Standards for the equipment to be used in such networks have been provided by TC 38 within IEC 61869 series.

It can also be observed that a growing number of protection applications use Travelling Waves. This holds for fault locators, fast AC protections and protections for the future DC grids. This also makes Travelling Wave based protections relevant for the Global Energy Interconnection (GEI). This aspect should be taken into account in the standards for Instrument Transformers, which convey the information of Travelling Waves from the primary side to the aforementioned functions.

Another tendency gaining an increasing interest is tied to power quality measurement and also this aspect is progressively considered in TC 38 Standards.

Finally, a market growing more and more is related to LV applications, which will be covered by a specific, dedicated series of Standards.

B.5 Ecological environment

Ecological issues are not generally a major concern for Instrument Transformers, since the lifetime of equipment is very long and, in addition, many materials used are recyclable or environmentally friendly.

However, some problems would be faced concerning: Disposal of oil, SF6 and other organic materials and the risk of explosion when fire occurs inside the instrument transformers.

Globally, it is expected that the use of Low Power Instrument Transformers (LPIT) will facilitate the management of environmental issues related to Instrument Transformers.

B.6 Involvement of societal stakeholders

The use of instrument transformers considered up to now by CENELEC TC 38 Standards has only an indirect impact on the final consumers, since it is mainly limited to industrial applications, in order to provide to secondary equipment signals proportional to the high voltage and current ones. This impact is mainly tied to the overall accuracy of High Voltage metering, to the consequent balance and transparency of the electricity market, to the stability and security of the supply.

Instrument transformers considered up to now by CENELEC TC 38 Standards are conceived in order to operate in an environment which is not accessible to public, but to informed or trained workers only. Safety is addressed both by intrinsic, standardized requirements and tests and by external factors, such as installation place and procedures.

No societal stakeholder has been therefore officially involved up to now in CENELEC TC 38 activities, nor have requests been forwarded to the Technical Committee at this proposal. CENELEC TC 38 is in any case at disposal of societal stakeholders to directly involve them or to take into account their specific needs, if any.

B.7 Involvement of SMEs

The products standardized by TC 38 have been traditionally manufactured both by multinational Corporations and by Small and Medium Enterprises, due to both technical and economic reasons.

At present, no CENELEC TC 38 Standard has been purposely issued for Small and Medium Enterprises. However, a series of Standards about instrument transformers for Low Voltage application is now under development; moreover, Standards about some kind of low power instrument transformers intended to be used in medium voltage application (Low power current or voltage instrument transformers, LPCT or LPVT) are now available. These Standards are more focused on specific technologies used and may therefore be simpler and more suitable for the needs of SMEs than the previous applicable Standards belonging to EN 60044 Series.

C System approach aspects

The instrument transformers are the interface between the High Voltage generation, transmission and distribution systems and the secondary measuring, control and protection equipment: they play a crucial role in providing relevant information to the secondary equipment connected. Since the beginning of the century, the possibility of interfacing Instrument Transformers via digital outputs has been developed. In relation with the deployment of IEC 61850 process bus based substation automation systems, this feature is now gaining in importance.

A system approach will be therefore more and more desirable in order to ensure proper interfacing and interoperability between instrument transformers and the secondary equipment connected. An optimal coordination between the requirements for the whole functional measuring and protection chains is required, with particular reference to the accuracy of the measurements themselves and to the possibility of improving it more and more and to further aspects related to the development of the Smart Grid.

For this reason, formal liaisons have been established with the following CENELEC TCs:

- TC 8X - System aspects of electrical energy supply;
- TC 13 - Equipment for electrical energy measurement and load control;
- TC 57 - Power systems management and associated information exchange;
- TC 85X - Measuring equipment for electrical and electromagnetic quantities;
- TC 95X - Measuring relays and protection equipment.

D Objectives and strategies (3 to 5 years)

To keep TC 38 EN Standards up to date, anticipating changes in market requirements, technology and environment, without sacrificing the necessary stability to achieve quality and interoperability. The CLC/TC 38 Standards are developed in close collaboration with IEC/TC 38. In particular, CLC/TC 38 is committed to avoid any conflicts between IEC and CENELEC Standards by conveying European positions directly into the IEC Standard. Deviations to IEC Standards are only considered if they are required for harmonisation with European Directives. At this proposal, particular care will be given to the harmonization of the relevant CLC/TC 38 Standards to the Low Voltage (LV), with a priority and to Electromagnetic Compatibility (EMC) Directives: in order to facilitate this process and to prepare the relevant Annexes of the EN versions of the Standards, specific Working Groups have been set up at CENELEC level. Safety is another concern of CLC/TC 38: a Standard relevant to Low Voltage applications is planned to be published in a parallel procedure with IEC but also the opportunity of covering High Voltage applications by means of a specific Standard will be considered.

These goals will be achieved by partnering with industry players and promoting the use of EN Standards.

E Action plan

At present, the following Standards have been published in the 61869 Series:

Reference	Date	Title
EN 61869-1:2009	2009-09-04	Instrument transformers - Part 1: General requirements
EN 61869-2:2012	2012-11-16	Instrument transformers - Part 2: Additional requirements for current transformers
EN 61869-3:2011	2011-10-21	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
EN 61869-4:2014	2014-06-06	Instrument transformers - Part 4: Additional requirements for combined transformers
EN 61869-4:2014/AC:2014	2014-08-27	Instrument transformers - Part 4: Additional requirements for combined transformers
EN 61869-5:2011	2011-10-21	Instrument transformers - Part 5: Additional requirements for capacitor voltage transformers
EN 61869-5:2011/AC:2015	2015-08-28	Instrument transformers - Part 5: Additional requirements for capacitor voltage transformers
EN 61869-6:2016	2016-12-23	Instrument transformers - Part 6: Additional general requirements for low-power instrument transformers
EN IEC 61869-9:2019	2019-07-05	Instrument transformers - Part 9: Digital interface for instrument transformers
EN IEC 61869-10:2018	2018-03-16	Instrument transformers - Part 10: Additional requirements for low-power passive current transformers
EN IEC 61869-11:2018	2018-03-16	Instrument transformers - Part 11: Additional requirements for low-power passive voltage transformers
EN IEC 61869-13:2021	2021-07-16	Instrument Transformers - Part 13: Standalone Merging Unit
EN IEC 61869-14:2019	2019-07-05	Instrument transformers - Part 14: Additional requirements for current transformers for DC applications
EN IEC 61869-15:2019	2019-07-05	Instrument transformers - Part 15: Additional requirements for voltage transformers for DC applications

The following Standards have been published in the 62869 Series:

Reference	Date	Title
EN 62689-1:2016	2016-12-16	Current and voltage sensors or detectors, to be used for fault passage indication purposes - Part 1: General principles and requirements
EN 62689-2:2017	2017-09-22	Current and voltage sensors or detectors, to be used for fault passage indication purposes - Part 2: System aspects

And, finally, the following Standards are still in force, waiting for a replacement in EN 61869 Series

Reference	Date	Title
EN 60044-7:2000	2000-01-24	Instrument transformers - Part 7: Electronic voltage transformers
EN 60044-8:2002	2002-09-10	Instrument transformers - Part 8: Electronic current transformers

In the next years, the following new Standards for instrument transformers are planned to be published by IEC and CENELEC in the framework of the Frankfurt Agreement:

Reference	Title
EN IEC 61869-1	Instrument transformers - Part 1: General requirements (new revision including the present parts 1 and 6)
EN IEC 61869-7	Instrument transformers - Part 7: Electronic voltage transformers
EN IEC 61869-8	Instrument transformers - Part 8: Electronic current transformers
EN IEC 61869-16	Instrument transformers - Part 16: TEDS (Transducer Electronic Data Sheet) for Instrument Transformers
EN IEC 61869-20	Safety requirements of Instrument Transformers for High Voltage applications
EN IEC 61869-99	Instrument transformers: Glossary
EN IEC 61869-201	Instrument transformers - Part 201: General requirements for low voltage applications
EN IEC 61869-202	Instrument Transformers – Part 202: Additional requirements for Current Instrument Transformers for Low Voltage applications
EN IEC 61869-220	Instrument transformers - Part 220: Safety requirements for Instrument Transformers for low voltage applications
EN IEC 63253	Station Service Voltage Transformers (SSVT)

In the next years, the following new Common Modifications are planned to be published by CENELEC in order to achieve the harmonisation of EN IEC 61869-13:2021 to both LV and EMC Directives:

Reference	Title
EN IEC 61869-13:2021/prAA	Instrument transformers - Part 13: Stand-alone merging unit (SAMU) (PR=74703)

F Useful links to CENELEC web site

https://standards.cenelec.eu/dyn/www/f?p=305:7:0::::FSP_ORG_ID:1258251

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