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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Reference conditions and procedures for testing industrial and process measurement transmitters –
Part 1: General procedures for all types of transmitters

Conditions de référence et procédures pour l'essai des transmetteurs de mesure industrielle et de processus –
Partie 1: Procédures générales pour tous les types de transmetteurs

IEC 62828-1:2017-11(en-fr)

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Reference conditions and procedures for testing industrial and process measurement transmitters – Part 1: General procedures for all types of transmitters

Conditions de référence et procédures pour l'essai des transmetteurs de mesure industrielle et de processus – Partie 1: Procédures générales pour tous les types de transmetteurs

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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REFERENCE CONDITIONS AND PROCEDURES FOR TESTING INDUSTRIAL AND PROCESS MEASUREMENT TRANSMITTERS –

Part 1: General procedures for all types of transmitters

FOREWORD

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International Standard IEC 62828-1 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The IEC 62828 series cancels and replaces the IEC 60770 series and proposes revisions for the IEC 61298 series.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65B/1100/FDIS	65B/1107/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62828 series, published under the general title *Reference conditions and procedures for testing industrial and process measurement transmitters*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Most of the current IEC standards on industrial and process measurement transmitters are rather old and were developed having in mind devices based on analogue technologies. Today's digital industrial and process measurement transmitters are quite different from those analogue transmitters: they include more functions and newer interfaces, both towards the computing section (mostly digital electronic) and towards the measuring section (mostly mechanical). Even if some standards dealing with digital process measurement transmitters already exist, they are not sufficient, since some aspects of the performance are not covered by appropriate test methods.

In addition, existing IEC test standards for industrial and process measurement transmitters are spread over many documents, so that for manufacturers and users it is difficult, impractical and time-consuming to identify and select all the standards to be applied to a device measuring a specific process quantity (pressure, temperature, flow, level, etc.).

To help manufacturers and users, it was decided to review, complete and reorganize the relevant IEC standards and to create a more suitable, effective and comprehensive standard series that provides in a systematic way all the necessary specifications and tests required for different industrial and process measurement transmitters.

To solve the issues mentioned above and to provide an added value for the stakeholders, the new standard series on industrial and process measurement transmitters covers the following main aspects:

- Applicable normative references
- Specific terms and definitions
- Typical configurations and architectures for the various types of industrial and process measurement transmitters
- Hardware and software aspects
- Interfaces (to the process, to the operator, to the other measurement and control devices)
- Physical, mechanical and electrical requirements and relevant tests; clear definition of the test categories: type tests, acceptance tests and routine tests
- Performance (its specification, tests and verification)
- Environmental protection, hazardous areas application, functional safety, etc.
- Structure of the technical documentation.

To cover in a systematic way all the topics to be addressed, the standard series is organized in several parts. At the moment of the publication of this document, IEC 62828 consists of the following parts:

- *Part 1: General procedures for all types of transmitters*
- *Part 2: Specific procedures for pressure transmitters*
- *Part 3: Specific procedures for temperature transmitters*
- *Part 4: Specific procedures for level transmitters*
- *Part 5: Specific procedures for flow transmitters*

In preparing the IEC 62828 series many test procedures were taken, with the necessary improvements, from the IEC 61298 series. As the actual IEC 61298 series is applicable to all process measurement and control devices, when the IEC 62828 series is completed the IEC 61298 series will be revised to harmonise it with the IEC 62828 series, taking out from its scope the industrial and process measurement transmitters. During the time when 61298 scope is being updated, the new series IEC 62828 takes precedence for industrial and process measurement transmitters.

When the IEC 62828 series is published, the IEC 60770 series will be withdrawn.

REFERENCE CONDITIONS AND PROCEDURES FOR TESTING INDUSTRIAL AND PROCESS MEASUREMENT TRANSMITTERS –

Part 1: General procedures for all types of transmitters

1 Scope

This Part of IEC 62828 establishes a general framework for defining reference conditions and test procedures applicable to all types of industrial and process measurement transmitters (PMTs) used in measuring and control systems for industrial process and machinery. These reference test conditions are divided into “standard reference conditions”, which apply when determining the accuracy of measurement, and “ambient and process reference conditions”, which are used to assess the influence of external quantities on the measurement.

For the purpose of this document, an analogue PMT is a process measurement transmitter with an analogue current or voltage output, irrespective of the technology adopted and the complexity of the circuitry. All the other process measurement transmitters, with digital output only or with hybrid analogue and digital output (e.g. HART®), are considered to be digital PMTs.

For general test procedures, reference is made to IEC 62828-1, which is applicable to all types of industrial and process measurement transmitters.

Additional specific test procedures for given types of PMTs (pressure, temperature, level, flow) are covered by other parts of this series.

NOTE 1 In industrial and process applications, to indicate the process measurement transmitters it is common also to use the terms “industrial transmitters”, or “process transmitters”.

NOTE 2 For better clarity, when the complete definition “industrial and process measurement transmitter” makes the sentence too long in this document, the short term “transmitter” is used instead.

Proximity devices with analogue output are excluded from the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60079-10 (all parts): *Explosive atmospheres – Part 10: Classification of areas*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60654-1:1993, *Industrial-process measurement and control equipment – Operating conditions – Part 1: Climatic conditions*

IEC 60654-3:1983, *Operating conditions for industrial-process measurement and control equipment – Part 3: Mechanical influences*

IEC 60654-4:1987, *Operating conditions for industrial-process measurement and control equipment – Part 4: Corrosive and erosive influences*

IEC 60721-3-1, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61158 (all parts), *Industrial communication networks – Fieldbus specifications*

IEC 61298-1:2008, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 1: General considerations*

IEC 61298-4:2008, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 4: Evaluation report content*

IEC 61499 (all parts), *Function blocks*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry sector*

IEC 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61784-2, *Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3*

IEC 61784-5 (all parts), *Industrial communication networks – Profiles – Part 5: Installation of fieldbuses*

IEC 61804-2, *Function blocks (FB) for process control – Part 2: Specification of FB concept*

IEC 61918, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 61987-11:2016, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 11: List of properties (LOPs) of measuring equipment for electronic data exchange – Generic structures*

IEC 62061:2005, *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)*

IEC 62381:2012, *Automation systems in the process industry – Factory acceptance test (FAT), site acceptance test (SAT) and site integration test (SIT)*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms* (VIM:2007)

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/

- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1 Terms related to accuracy

3.1.1.1
accuracy (of a measuring instrument)
quality which characterizes the ability of a measuring instrument to provide an indicated value close to a true value of the measurand

Note 1 to entry: This term is used in the "true value" approach.

Note 2 to entry: Accuracy is all the better when the indicated value is closer to the corresponding true value.

[SOURCE: IEC 60050-311:2001, 311-06-08]

3.1.1.2
conformity
ability of a measuring instrument to provide an indication having a specified characteristic curve which can be linear, logarithmic, parabolic, etc.

3.1.1.3
dead band (dead zone)
finite range of values within which a variation of the input variable does not produce any measurable change in the output variable

Note 1 to entry: When this type of characteristic is intentional, it is sometimes called neutral zone.

Note 2 to entry: This entry was numbered 351-24-14 in IEC 60050-351:2006.

Note 3 to entry: This value is usually insignificant for the actual instruments.

[SOURCE: IEC 60050-351:2013, 351-45-15, modified: Note 3 added]

3.1.1.4
error
discrepancy between a computed, observed or measured value or condition, and the true, specified or theoretically correct value or condition

Note 1 to entry: An error within a system may be caused by failure of one or more of its components, or by activation of a systematic fault.

[SOURCE: IEC 60050-192:2015, 192-03-02]

3.1.1.5
hysteresis
phenomenon represented by a characteristic curve which has a branch, called ascending branch, for increasing values of the input variable, and a different branch, called descending branch, for decreasing values of the input variable

Note 1 to entry: The CDD code of this entry for Electronic Data Exchange is ABB661 and the hysteresis is defined as the difference between consecutive upscale and downscale outputs for any single test cycle at the same input test point.

[SOURCE: IEC 60050-351:2013, 351-45-16, modified: Note to entry added]

3.1.1.6
inaccuracy
maximum positive and negative deviation from the specified characteristic curve observed in testing a device under specified conditions and by a specified procedure

Note 1 to entry: Accuracy is defined in IEC 60050-300, definition 311-06-08.

[SOURCE: IEC 61298-1:2008]

3.1.1.7
linearity
ability of a measuring instrument to provide an indication having a linear relationship with a defined quantity other than an influence quantity

Note 1 to entry: The method of expression of lack of linearity is different for different kinds of instrument and is established in each particular instance.

[SOURCE: IEC 60050-311:2001, 311-06-05]

3.1.1.8
long term drift
drift in output monitored for 30 days at 90 % of span

[SOURCE: IEC 61987-1:2008, 3.22]

3.1.1.9
long term stability
drift of zero output signal in percent of full scale limit after a given period of normal operating conditions

Note 1 to entry: The long term stability can be evaluated over a different period of time, e.g. 6 months, 1, 2 or 5 years. Sometime manufacturers declare a life-time stability.

Note 2 to entry: Depending the type of PMT, the drift can be referred to an upper range limit (e.g. digital pressure PMTs), a fixed value (e.g. certain level PMTs), a full scale (e.g. some analogue PMTs), etc.

Note 3 to entry: The CDD code of this entry for Electronic Data Exchange is ABB551, modified (time period).

3.1.1.10
measured error
largest positive or negative value of errors of the average upscale or downscale values at each point of measurement

[SOURCE: IEC 61298-1:2008]

3.1.1.11
measuring range
range defined by two values of the measurand, or quantity to be supplied, within which the limits of uncertainty of the measuring instrument are specified

Note 1 to entry: An instrument can have several measuring ranges

[SOURCE: IEC 60050-311:2001, 311-03-12]

3.1.1.12
non-conformity
deviation from ideal behavior for devices that have a non-linear input/output relationship, determined from the curve plotted using the overall average of corresponding upscale and downscale errors

Note 1 to entry: Non-conformity can be calculated and expressed in one of three ways:

– independent: line positioned so as to minimize the maximum deviation;
– terminal-based: line positioned so as to coincide with the actual characteristic curve at the upper and lower range-values;
– zero-based: line positioned so as to coincide with the actual characteristic curve at the lower range-value.

Note 2 to entry: The corresponding properties are to be found in the CDD.

Note 3 to entry: in IEC 61298-2:2011 the non conformity is defined as the closeness with which a calibration curve approximates to a specified characteristic curve (which can be linear, logarithmic, parabolic, etc.).

Note 4 to entry: Non-conformity does not include hysteresis.

[SOURCE: IEC 61987-13:2016, modified: Note 3 and Note 4 added]

3.1.1.13
non-linearity
deviation from ideal behavior for devices that have a linear input/out relationship, determined from the curve plotted using the overall average of corresponding upscale and downscale errors

Note 1 to entry: Non-linearity can be calculated and expressed in one of three ways:

– independent: line positioned so as to minimize the maximum deviation;
– terminal-based: line positioned so as to coincide with the actual characteristic curve at the upper and lower range-values;
– zero-based: line positioned so as to coincide with the actual characteristic curve at the lower range-value.

Note 2 to entry: The corresponding properties can be found in the CDD.

Note 3 to entry: Linearity is defined in IEC 60050(300). definition 311-06-06.

Note 4 to entry: Non-linearity does not include hysteresis.

[SOURCE: IEC 61987-13:2016, modified: Notes added]