IEC 62828-4

Edition 1.0 2020-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Reference conditions and procedures for testing industrial and process measurement transmitters – Part 4: Specific procedures for level transmitters

Conditions de reference et procedures pour l'essai des transmetteurs de mesure industriels et de processus – Partie 4: Procédures spécifiques pour les transmetteurs de niveau

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Part 4: Specific procedures for level transmitters

Conditions de reference et procedures pour l'essai des transmetteurs de mesure industriels et de processus –
Partie 4: Procédures spécifiques pour les transmetteurs de niveau

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

Part 4: Specific procedures for level transmitters

FOREWORD

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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/1178/FDIS	65B/1182/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.

This International Standard is to be used in conjunction with IEC 62828-1:2017.

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- withdrawn,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 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) and towards the measuring section (mostly mechanical). Even if some standards dealing with digital transmitters already exist, they are not sufficient, since some aspects of the performance are not covered by appropriate test methods.

In addition, the existing IEC test standards for industrial and process measurement transmitters are spread over many documents, so that for manufacturers and users it was 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, level, flow, etc.).

To help the manufacturers and users, it was decided to review, complete and reorganize the existing IEC standards on the industrial and process measurement transmitters and to create a more suitable, effective and comprehensive standard series that provides, in a systematic way, all the needed specifications and tests for the 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 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;
- performances (their 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 time of publication of this document IEC 62828 consists of the following parts:

- IEC 62828-1: *General procedures for all types of transmitters*
- IEC 62828-2: *Specific procedures for pressure transmitters*
- IEC 62828-3: *Specific procedures for temperature transmitters*
- IEC 62828-4: *Specific procedures for level transmitters*
- IEC 62828-5: *Specific procedures for flow transmitters*

In preparing the IEC 62828 series (all parts), many test procedures were taken, with the necessary improvements, from the IEC 61298 series. As the IEC 61298 series is currently applicable to all process measurement and control devices, when the IEC 62828 series is completed, the IEC 61298 series will be revised to harmonize it with the IEC 62828 series, taking out from its scope the industrial and process measurement transmitters. During the time when the scope of the IEC 61298 series is being updated, the new IEC 62828 series 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 4: Specific procedures for level transmitters

1 Scope

This part of IEC 62828 establishes specific procedures for testing level transmitters used in measuring and control systems for industrial process and machinery control systems. For general test procedures, reference is to be made to IEC 62828-1:2017, applicable to all types of transmitters.

Throughout this document, the term "industrial transmitters" covers all types of transmitters used in measuring and control systems for industrial processes and for machinery.

The requirements of this document are applicable to all level measurement principles.

Detailed description of transmitters is given for two main principles for improved clarity.

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 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-64:2008, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 61326-2-3:2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning*

IEC 62828-1:2017, *Reference conditions and procedures for testing industrial and process measurement transmitters – Part 1: General procedures for all types of transmitters*

IEC 62828-2:2017, *Reference conditions and procedures for testing industrial and process measurement transmitters – Part 2: Specific procedures for pressure transmitters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62828-1 and the following 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 Basic definitions

3.1.1
warm-up time
duration between the instant when the power supply is energized and the instant when the instrument can be used, as specified by the manufacturer

SEE: Figure 1.

[SOURCE: Identifier ABB026 in the IEC common data dictionary.]

3.1.2
settling time
time interval between the step change of an input signal and the instant when the resulting variation of the output of the signal does not deviate more than 1 % from its final steady state value

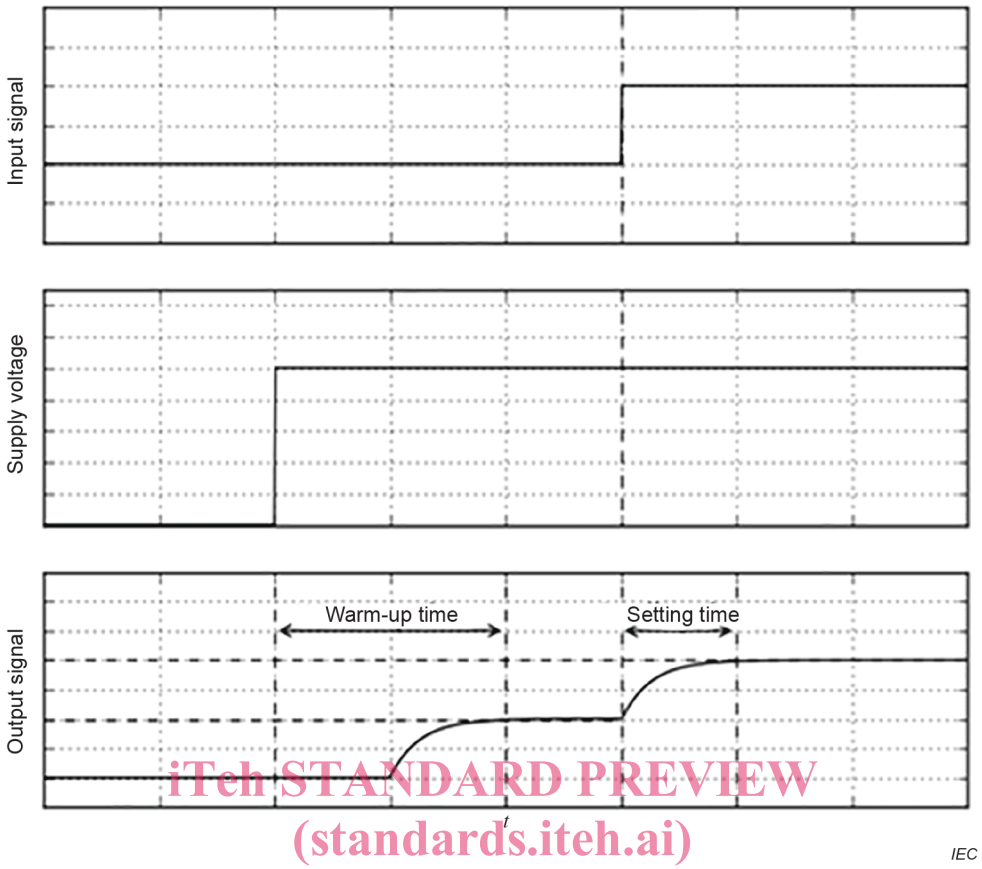
SEE: Figure 1.

[SOURCE: Identifier ABA999 in the IEC common data dictionary.]

3.1.3
output signal
analogue or digital representation of the measurand produced by a transducer

Note 1 to entry: A transmitter is a transducer with standardized output, see IEC 60050-351:2013, 351-56-29.

[SOURCE: IEC 60050-314:2001, 314-04-06, modified – Note 1 to entry has been added.]



Key

t time

Figure 1 – Principle diagram of time values and their meanings

3.1.4
true value (of a quantity)
value consistent with the definition of a given particular quantity

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

Note 2 to entry: This is a value that would be obtained by a perfect measurement.

Note 3 to entry: True values are by nature indeterminate.

Note 4 to entry: The indefinite article "a", rather than the definite article "the", is used in conjunction with "true value" because there can be many values consistent with the definition of a given particular quantity.

[SOURCE: IEC 60050-311:2001, 311-01-04]

3.1.5
conventional true value (of a quantity)
value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose

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

Note 2 to entry: The "conventional true value" is sometimes called "assigned value", "best estimate of the value", "conventional value" or "reference value". The term "reference value", in this sense, should not be confused with "reference value" in the sense used in 311-07-01.

Note 3 to entry: Frequently, a large number of results of measurement of a quantity are used to establish a conventional true value.

Note 4 to entry: Traditional definitions, based on the true value approach, treated the conventional true value as a value approximating to a true value of the quantity such that the difference could be neglected for the purposes for which that value was used.

[SOURCE: IEC 60050-311:2001, 311-01-06]

3.1.6
zero point for pressure-based level measurement
level at which the medium to be measured is not in contact with the sensing element of the pressure transmitter.

Note 1 to entry: For an installed pressure-based level transmitter, this means an empty, non-pressurized tank

Note 2 to entry: It represents the lowest possible measurement value which doesn't have to be necessarily the start of the measuring range as this can be adjusted depending on the application and installation.

Note 3 to entry: Reliable measurements will only be possible with a fully wetted diaphragm.

3.1.7
geometric zero point
vertical centre position of the lower nozzle or flange for side mounting that shall be considered for mechanical drawings and mounting instructions

Note 1 to entry: The geometric zero point for installation can be different from the zero point for measurement.

SEE: Figure 2 a).

3.2 Level transmitter definitions

3.2.1
level transmitter
transmitter that outputs a signal representative of a level

[SOURCE: Identifier ABA803 in the IEC common data dictionary.]

3.2.2 Pressure-based level transmitter definitions

3.2.2.1
pressure-based level transmitter
level transmitter that uses the pressure exerted by a head of liquid to measure level

Note 1 to entry: Pressure-based level transmitters are often called hydrostatic level transmitters.

[SOURCE: Identifier ABA812 in the IEC common data dictionary.]

3.2.2.2
pressure level transmitter (principle 1)
pressure (hydrostatic) level transmitter that uses gauge pressure to measure level

[SOURCE: Identifier ABA814 in the IEC common data dictionary, modified – "(principle 1)" added to the term.]

3.2.2.3
differential pressure level transmitter (principle 2)
differential pressure level transmitter (principle 3)
pressure (hydrostatic) level transmitter that uses differential pressure to measure level

[SOURCE: Identifier ABA813 in the IEC common data dictionary, modified – "(principle 2)" and "(principle 3)" added to the terms.]

3.2.3
displacer level transmitter
level transmitter that uses the buoyancy of a submerged displacement element to measure level

[SOURCE: Identifier ABA804 in the IEC common data dictionary.]

3.2.4 Float level transmitter definitions

3.2.4.1
float level transmitter
level transmitter that uses a float or a follower to measure level

[SOURCE: Identifier ABA809 in the IEC common data dictionary.]

3.2.4.2
magnetostrictive level transmitter
float level transmitter that uses the magnetostrictive effect to determine the position of the float

[SOURCE: Identifier ABA810 in the IEC common data dictionary.]

3.2.4.3
magnet level transmitters
float level transmitter that uses a magnet and resistors to determine the position of the float

[SOURCE: Identifier ABA811 in the IEC common data dictionary.]

3.2.5
ultrasonic (or sonic) level transmitter
wave level transmitter that uses the travelling time of an ultrasonic (or sonic) beam to measure level

[SOURCE: Identifier ABA829 in the IEC common data dictionary.]

3.2.6 Microwave/Radar level transmitter definitions

3.2.6.1
free-space radar level transmitter
level transmitter that emits a radar beam by an antenna to measure level by using the time of flight

3.2.6.2
guided-wave radar level transmitter
level transmitter that emits a high frequency signal guided by a probe to measure level by using the time of flight

3.2.7 Optical based level transmitter definitions

3.2.7.1
optical-based level transmitter
level transmitter that uses the transmission, reflection or refraction of light by the process material to measure level

[SOURCE: Identifier ABA820 in the IEC common data dictionary.]

3.2.7.2
optical refraction level transmitter
optical level transmitter that uses the difference between the refractive index of the process fluid and the material of the sensing element to measure level

[SOURCE: Identifier ABA821 in the IEC common data dictionary.]

3.2.7.3
laser level transmitter
wave level transmitter that uses the time of flight of a laser beam to measure level

[SOURCE: Identifier ABA828 in the IEC common data dictionary, modified – In the definition, "travelling time" replaced with "time of flight".]

3.2.8
nuclear level transmitter
level transmitter that uses the absorption of gamma radiation by process material to measure level

Note 1 to entry: A nuclear level transmitter is also known as a radiometric or radiation level transmitter.

[SOURCE: Identifier ABA819 in the IEC common data dictionary.]

3.2.9 Capacitance and admittance level transmitter definitions

3.2.9.1
capacitance level transmitter
electrical-based level transmitter that uses dielectric properties of a process material to measure level

[SOURCE: Identifier ABA806 in the IEC common data dictionary.]

3.2.9.2
admittance level transmitter

electrical-based level transmitter that uses the admittance of a process material to measure level

[SOURCE: Identifier ABA807 in the IEC common data dictionary.]

3.2.10 Mechanical level transmitter definitions

3.2.10.1
mechanical level transmitter
level transmitter that uses mechanical means to measure level

[SOURCE: Identifier ABA816 in the IEC common data dictionary.]

3.2.10.2
plumb bob level transmitter
level transmitter that uses a wire or tape with a body as sensing element to measure level

[SOURCE: Identifier ABA817 in the IEC common data dictionary.]

3.2.10.3
servo level transmitter
level transmitter that uses a float and a wire fed by a servo motor to measure level

[SOURCE: Identifier ABA818 in the IEC common data dictionary.]