IEC 62828-3

Edition 1.0 2018-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Reference conditions and procedures for testing industrial and process measurement transmitters –
Part 3: Specific procedures for temperature transmitters

Conditions de référence et procédures pour l'essai des transmetteurs de mesure industrielle et de processus –
Partie 3: Procédures spécifiques pour les transmetteurs de température

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

Part 3: Specific procedures for temperature transmitters

FOREWORD

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International Standard IEC 62828-3 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.

In IEC 61298, all parts related to PMT's will be deleted, leaving all the requirements regarding all devices but PMT's.

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

FDIS	Report on voting
65B/1110A/FDIS	65B/1114/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- withdrawn,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. Many industrial and process measurement transmitters are meanwhile evolved and are quite different from those analogue transmitters: they are often digital and 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 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 test report and 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, the IEC 62828 series 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 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 3: Specific procedures for temperature transmitters

1 Scope

This part of IEC 62828 establishes specific procedures for testing temperature transmitters used in measuring and control systems for industrial process and for machinery control systems.

When the process measurement transmitter features the temperature transmitter separated from the sensing element (RTD, TC, etc.), the standard applies only to the temperature transmitter without the sensing element. In case of device where the sensing element is fully integrated with the temperature transmitter, the standard applies to the complete device.

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

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

The sensing element itself (e.g. RTD, TC, etc.) as well as radiation thermometers 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 60584 (all parts), *Thermocouples*

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

3 Terms and definitions

3.1 Definitions regarding temperature

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

3.1.1
cold junction compensation
CJC
suitable automatic system to compensate the thermocouple EMF to 0 °C

3.1.2
International Temperature Scale of 1990
ITS 90
temperature scale adopted by the International Committee on Weights and Measures (CIPM) in 1989 for the purpose of practical measurements

Note 1 to entry: The quantities corresponding to thermodynamic temperature and Celsius temperature defined by this scale are denoted T_{90} and t_{90}, respectively, where $t_{90} = T_{90} - T_0$ with T_0 = 273,15 K.

Note 2 to entry: The units for T_{90} and t_{90} are the kelvin, symbol K, and the degree Celsius, symbol °C, respectively.

[SOURCE: IEC 60050-113:2011, 113-04-18]

3.1.3
resistance temperature detector
RTD
temperature sensor containing a sensing element made of platinum or other metals whose resistance changes with temperature

Note 1 to entry: Resistance thermometers are often called RTDs.

Note 2 to entry: A platinum resistance thermometer (PRT) is an RTD that has a sensing element made of platinum; other common RTDs are nickel resistance thermometers (NRT) and copper resistance thermometers (CRT), with the sensing element made of nickel or copper respectively.

[SOURCE: IEC 62465:2010, 3.20, modified – The notes have been added.]

3.1.4
thermocouple
TC
pair of conductors of dissimilar materials joined at one end and forming part of an arrangement using the thermoelectric effect for temperature measurement

Note 1 to entry: The production of an electromotive force (EMF) due to a temperature gradient along a conductor is called thermoelectric effect (or Seebeck effect).

[SOURCE: IEC 60584-1:2013, 2.3, modified – The abbreviation and notes have been added.]

4 General description of the device

The general description outlined in Clause 4 and Annex A of IEC 62828-1:2017 is applicable.

In Annex A of this document, some additional information is only given regarding the measuring section of a temperature industrial and process measurement transmitter (temperature PMT).

5 Reference test conditions

To verify the influence of external quantities on accuracy, as well as the mechanical and electrical conditions which a device can withstand and still work within specification, the corresponding clause of IEC 62828-1 applies, both for standard reference test conditions and for operating reference test conditions.

6 Test procedures

6.1 General

Clause 6 of IEC 62828-1:2017 applies, with the following additional requirements.

The general schematic test set-up for a typical temperature PMT is reported in Figure 1.

NOTE 1 Annex A provides information on the several typologies of typical temperature transmitters.

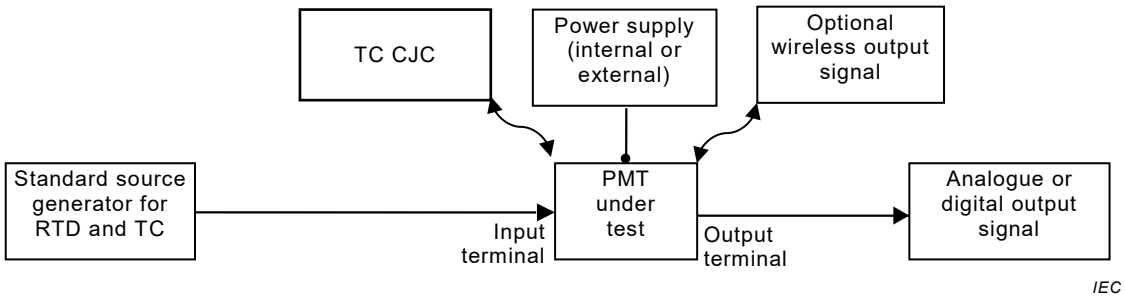


Figure 1 – Schematic example of test set-up for temperature measurement transmitters

NOTE 2 The test source generator for RTD is a decade resistance standard or a multifunction temperature calibrator.

NOTE 3 The test source generator for TC is a voltage generator or a multifunction temperature calibrator.

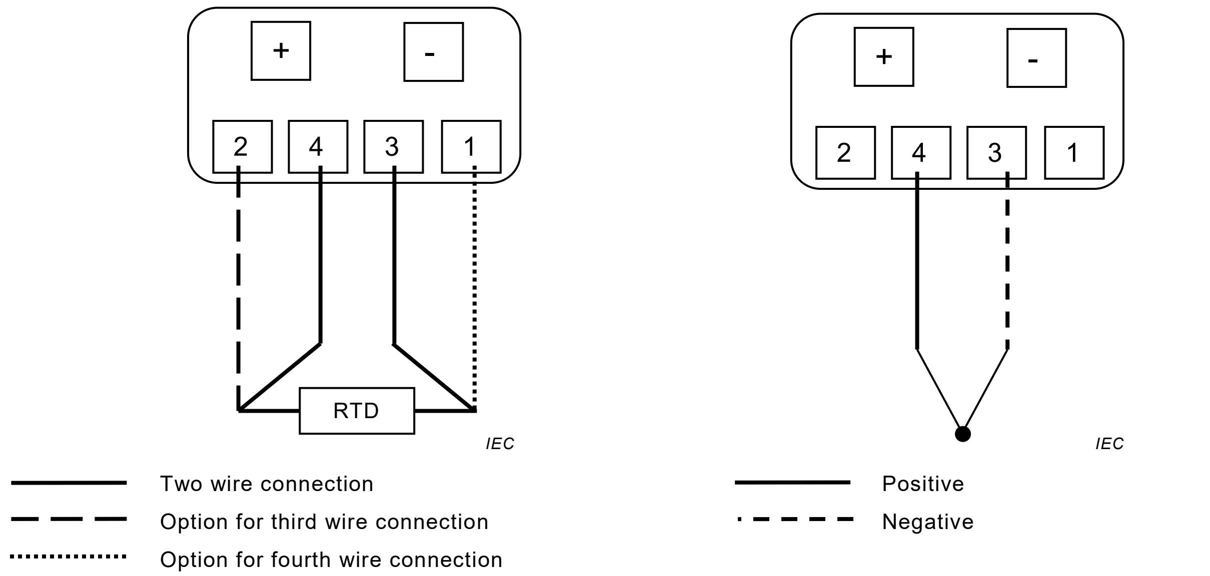
NOTE 4 To compensate the TC signal for the reference temperature of 0 °C, Cold Junction Compensation CJC may be used for TC transmitters.

NOTE 5 In case of temperature sensing element fully integrated into the temperature PMT, a reference temperature is used.

NOTE 6 The optional digital output signal is provided for smart and intelligent transmitters and is detected by handheld or PC communicator (configurator).

Figure 2 shows an example of terminal connections for a generic temperature PMT. In this figure, the supply and the output terminals (+, -) are on the upper side, and the input connections to the RTD or TC sensors (1, 2, 3, 4) are on the lower side.

For testing, the RTD and TC shall be replaced by the relevant test source generator.



a) **Connection example for RTD**

b) **Connection example for TC**

Figure 2 – Examples of terminals connection for RTD and TC

NOTE 7 The RTD can be simulated as a two, three or four-wire connection. For platinum RTD, more details are given in IEC 60751.

NOTE 8 The TC is simulated using specific extension or compensating cables. More details are given in IEC 60584-1 and IEC 60584-3.

For specifications and tolerances of temperature sensors used with temperature PMTs, see:

- IEC 60584 and IEC 62460 for TC sensors;
- IEC 60751 for RTD sensors.

6.2 Tests at standard and operating reference test conditions

6.2.1 General

For the majority of the tests, the corresponding clause of Part 1 applies, in particular see:

- Annex B in IEC 62828-1:2017 for the summary of the tests at standard reference conditions;
- Annex C in IEC 62828-1:2017 for the summary of the tests at operating reference conditions.

The tests are conducted on a test set-up similar to the one shown schematically in Figure 1.

The test source generator (in case of sensing element not integrated into the temperature PMT) or the reference temperature (in case of sensing element fully integrated into the temperature PMT) needed to stimulate the response of the device under test shall have characteristics and performances suitable to the tests required.

In addition to the error due to the sensing element, the process measurement transmitter shall not introduce an additional error greater than 50 % of the error relevant to the pertinent tolerance class of the sensing element.

The following specific tests for temperature transmitters shall be performed in addition.