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INTERNATIONAL STANDARD

REDLINE VERSION

**Process measurement and control devices - General methods and procedures
for evaluating performance -
Part 1: General considerations**

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Process measurement and control devices -
General methods and procedures for evaluating performance -
Part 1: General considerations**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61298-1:2008. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61298-1 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Process measurement transmitters (PMT) have been removed from the scope of this standard.

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

| Draft | Report on voting |
|---------------|------------------|
| 65B/1304/FDIS | 65B/1329/RVD |

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 61298 series, under the general title *Process measurement and control devices - General methods and procedures for evaluating performance*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document is ~~not intended as a substitute for existing standards, but is rather~~ intended as a reference document for any future standards developed within the IEC or other standards organizations, concerning the evaluation of process instrumentation. ~~Any revision of existing standards should take this standard into account,~~ except process measurement transmitters (PMT) which are standardized by the IEC 62828 series.

This common standardized basis ~~should~~ can be utilized for the preparation of future relevant standards, as follows:

- any test method or procedure, already treated in this document, ~~should~~ will be specified and described in the new standard by referring to the corresponding clause of this document. Consequently new editions of this document are revised without any change in numbering and scope of each clause;
- any particular method or procedure, not covered by this document, ~~should~~ will be developed and specified in the new standard in accordance with the criteria, as far as they are applicable, stated in this document;
- any conceptual or significant deviation from the content of this document ~~should~~ will clearly be identified and justified if introduced in a new standard.

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1 Scope

This part of IEC 61298 specifies general methods and procedures for conducting tests and reporting on the functional and performance characteristics of process instrumentation except process measurement ~~and control devices~~ transmitters (PMT) which are standardized by the IEC 62828 series. ~~The methods and procedures specified in this standard are applicable to any type of process measurement and control device.~~ The tests are applicable to any such devices characterized by their own specific input and output variables, and by the specific relationship (transfer function) between the inputs and outputs and include analogue and digital devices. For devices that require special tests, this document ~~should~~ can be used together with any product specific standard specifying special tests.

This document covers general principles which apply to the IEC 61298 series.

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 60050-300, *International Electrotechnical Vocabulary (IEV) - Part 300: Electrical and electronic measurements and measuring instruments - Part 311: General terms relating to measurements - Part 312: General terms relating to electrical measurements - Part 313: Types of electrical measuring instruments - Part 314: Specific terms according to the type of instrument*, available at <https://www.electropedia.org/>

IEC 60050-351, *International Electrotechnical Vocabulary (IEV) - Part 351: Control technology*, available at <https://www.electropedia.org/>

~~IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*~~

IEC 61298-2, *Process measurement and control devices - General methods and procedures for evaluating performance - Part 2: Tests under reference conditions*

IEC 61298-3, *Process measurement and control devices - General methods and procedures for evaluating performance - Part 2: Tests for the effects of influence quantities*

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

~~ISO 31 (all parts), *Quantities and units*~~

ISO/IEC 80000 (all parts), *Quantities and units*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC 60050-351 and the following apply.

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

variable

quantity or condition whose value is subject to change and can usually be measured (e.g. temperature, flow rate, speed, signal, etc.)

[SOURCE: ~~IEV 351-21-04~~ IEC 60050-351:2013, 351-41-01, modified – The first preferred term, “variable quantity”, has been removed, the definition has been amended and the 3 notes to entry have been removed.]

3.2

signal

~~physical quantity, one or more parameters of which carry information about one or more variables which the signal represents~~
~~[IEV 351-21-51, modified]~~

3.2

range

range of values defined by the two extreme values, within which a variable can be measured within the specified accuracy

[SOURCE: ~~IEV 351-27-14~~ IEC 60050-311:2001, 311-03-14, modified – The definition has been amended and the note to entry has been removed.]

3.3

span

algebraic difference between the values of the upper and lower limits of the measuring range

[SOURCE: IEC 60050-311:2001, 311-03-13]

3.4

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 60050-300:2001, 311-06-08.

3.5

error

algebraic difference between the indicated value and a comparison value of the measured variable

Note 1 to entry: The error is positive when the indicated value is greater than the comparison value. The error is generally expressed as a percentage of the relevant ideal span.

[SOURCE: ~~IEV 351-27-04~~ IEC 60050-192:2024, 192-03-02, modified – The definition has been amended, Note 1 to entry has been amended and Note 2 to entry has been removed.]

3.6**measured error**

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

3.7**non-linearity**

deviation from linearity

Note 1 to entry: Linearity is defined in IEC 60050-300:2001, 311-06-05.

Note 2 to entry: Non-linearity does not include hysteresis.

3.8**non-repeatability**

deviation from repeatability

Note 1 to entry: Repeatability is defined in IEC 60050-300:2001, 311-06-06.

3.9**hysteresis**

property of a device or instrument whereby it gives different output values in relation to its input values depending on the directional sequence in which the input values have been applied

[SOURCE: ~~IEV 351-24-15~~ IEC 60050-351:2013, 351-45-16, modified – The definition has been amended and the note to entry has been removed.]

3.10**dead band**

finite range of values within which a variation of the input variable does not produce any measurable change in the output variable

[SOURCE: ~~IEV 351-24-14~~ IEC 60050-351:2013, 351-45-15, modified – The definition has been amended and the note to entry has been removed.]

3.11**unexpected event**

device breakdown, failure to work, anomaly, or inadvertent damage occurring during an evaluation, which ~~requires~~ needs correction by the device manufacturer

3.12**test procedure**

statement of the tests to be carried out, and the conditions for each test, agreed between the manufacturer, the test laboratory, and the purchaser/user before the evaluation starts

3.13**type test**

test of one or more devices made to a certain design to show that the design meets certain specifications

Note 1 to entry: The type tests are in principle applied only on a sample. Normally, they are not repeated on all the individual units of equipment made in series.

3.14**performance evaluation**

complete test to establish the performance of a device under any likely operating conditions to permit comparison with the manufacturer's published or stated performance specification for the device, or the user's requirements

3.15**routine test**

simplified test to which each individual instrument is subjected during or after manufacture to ascertain whether it complies with certain criteria

3.16**sample test**

simplified test to check specific characteristics of a device

3.17**signal**

physical quantity, one or more parameters of which carry information about one or more variables which the signal represents

[SOURCE: IEC 60050-351:2013, 351-41-17, modified – The definition has been amended.]

4 Test categories

The tests specified can be considered under two categories:

a) Complete tests

These cover performance evaluations or type tests to establish the performance of a device under any likely operating conditions; to permit comparison with the manufacturer's published or stated performance specification for the device, or the user's requirements.

b) Simplified tests

These cover a selection of the complete tests to check specific characteristics of a device (e.g., routine tests of all devices before delivery, or tests on a random sample of devices).

Where the full range of tests is not carried out, this shall be stated in all reports on the testing, and the reasons given (e.g., economy, lack of relevance to the particular application, or failure of the device). Deviations from the test procedures specified shall also be reported.

The program of tests, prepared in accordance with this document, shall be agreed between the test house, the initiator/purchaser, and where appropriate, the device supplier or manufacturer, before tests are commenced. Because of the generic nature of this document, the tests listed ~~may~~ can be too extensive, or insufficiently comprehensive for a particular requirement, and a modification of the test program ~~may~~ can be agreed.

The criteria for accepting test results (e.g., expected or limiting values), and for judgement of the quality and acceptance of the device under test, are strictly related to the subsequent use of the test results, and are outside the scope of this document.

5 General criteria**5.1 Realistic operating conditions**

Ideally, instruments should be evaluated under each of the conditions which they are likely to meet in service. Unfortunately, it is not practical to evaluate performance under all possible combinations of operating conditions. A standard test procedure is therefore specified which is practical under laboratory conditions, which will provide sufficient data on which a prediction of field performance can be made. Use of a small number of standard conditions covering the range will simplify testing and enable tests on different devices to be more readily compared.

5.2 Economic aspects

The test procedures, and the number of test points and measurement cycles, shall be chosen so as to obtain the best compromise between objectives and relevance of the results on the one hand, and costs and technical difficulties of the test on the other. Standard procedures ~~should~~ shall be used, but if tests are omitted or curtailed for economic or other reasons, this shall be stated in the test report.

5.3 Replication of the tests and comparability of the results

5.3.1 General

To obtain comparable results from tests performed at different times and places, by different operators, on different devices of the same type, it is important that the test procedures and methods ~~need to be~~ are well defined and reproducible. In particular, the elements described in 5.3.2 to 5.5 are required.

5.3.2 Standardization of test methods

The test methods to be followed during the evaluation shall be decided before the start and shall conform with standardized test methods wherever possible. Deviation from standard methods shall be reported.

5.3.3 Influence factors

During the test, all the factors which ~~might~~ can influence the behavior of the Device Under Test (DUT) shall be checked and maintained as constant as possible (with the exception of the specific condition being tested).

5.3.4 Documentation of the test methods

The test report shall clearly indicate the standards or standard referred to during the evaluation and state the test conditions and any deviation from the specified conditions which has occurred during the evaluation (a format for a full report of an evaluation is presented in IEC 61298-4).

5.4 Processing the results

Due to economic aspects (see 5.2), the number of measurements during a test is often reduced to the minimum, and therefore it is statistically insignificant. Processing of the results to obtain meaningful information from the evaluation, therefore, cannot be performed following statistical methods, but it shall be performed following conventional methods.

Consequently, in view of the general nature of the parameters characterizing the DUT (e.g. inaccuracy, hysteresis, non-repeatability, dead band, etc.) the calculations are based on maximum values (positive and negative) of the difference between the measured value and conventional true values, with the exception of a few quantities, for which use is made of averaged values (e.g. measured error, non-linearity).

5.5 Independence of the results of a test from the effects of other tests

~~Special care shall be exercised to ensure that~~ The results of a test ~~are~~ shall not be influenced by the previous tests.

6 General conditions for tests and samples

6.1 Environmental test conditions

6.1.1 General

The test shall be performed under these ambient test conditions.