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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Dispositifs de mesure et de commande de processus – Méthodes et procédures générales d'évaluation des performances – Partie 1: Généralités

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PROCESS MEASUREMENT AND CONTROL DEVICES – GENERAL METHODS AND PROCEDURES FOR EVALUATING PERFORMANCE –

Part 1: General considerations

FOREWORD

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International Standard IEC 61298-1 has been prepared by subcommittee 65B: Devices and process analysis, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 1995 and constitutes a technical revision.

This edition is a general revision with respect to the previous edition and does not include any significant changes (see Introduction).

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The text of this standard is based on the following documents:

FDIS	Report on voting
65B/685/FDIS	65B/693/RVD

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

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

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 publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This standard 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.

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

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

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PROCESS MEASUREMENT AND CONTROL DEVICES – GENERAL METHODS AND PROCEDURES FOR EVALUATING PERFORMANCE –

Part 1: General considerations

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 measurement and control devices. 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 standard should be used, together with any product specific standard specifying special tests.

This standard covers general principles which apply to the series.

2 Normative references

The following referenced documents are indispensable for the application 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) – Electrical and electronic measurements and measuring instruments (composed of Part 311, 312, 313 and 314)*

IEC 60050-351, *International Electrotechnical Vocabulary (IEV) – Part 351: Control technology*

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

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

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

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

3 Terms and definitions

For the purpose of this document, the following relevant terms and definitions, some of them based on IEC 60050(300) or IEC 60050(351), apply.

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.)
[IEV 351-21-01, modified]

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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]

3.3
range
range of values defined by the two extreme values, within which a variable can be measured within the specified accuracy
[IEV 351-27-11, modified]

3.4
span
algebraic difference between the values of the upper and lower limits of the measuring range
[IEV 311-03-13]

3.5
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 Accuracy is defined in IEC 60050-300, definition 311-06-08.

3.6
error
algebraic difference between the indicated value and a comparison value of the measured variable
[IEV 351-27-04, modified]

NOTE 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.

3.7
measured error
largest positive or negative value of errors of the average upscale or downscale values at each point of measurement

3.8
non-linearity
deviation from linearity

NOTE 1 Linearity is defined in IEC 60050(300), definition 311-06-05.

NOTE 2 Non-linearity does not include hysteresis.

3.9
non-repeatability
deviation from repeatability

NOTE Repeatability is defined in IEC 60050(300), definition 311-06-06.

3.10
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
[IEV 351-24-15, modified]

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3.11
dead band
finite range of values within which a variation of the input variable does not produce any measurable change in the output variable
[IEV 351-24-14, modified]

3.12
unexpected event
device breakdown, failure to work, anomaly, or inadvertent damage occurring during an evaluation, which requires correction by the device manufacturer

3.13
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

3.14
type tests
a test of one or more devices made to a certain design to show that the design meets certain specifications

NOTE The type tests are in principle applied only on a sample. Normally are not repeated on all the individual units of equipment made in series.

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 programme of tests, prepared in accordance with this standard, 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 standard, the tests listed may be too extensive, or insufficiently comprehensive for a particular requirement, and a modification of the test programme may 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 standard.

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

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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 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

To obtain comparable results from tests performed at different times and places, by different operators, on different devices of the same type, the test procedures and methods need to be well defined and reproducible. In particular, the following are required.

5.3.1 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.

5.3.2 Influence factors

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

5.3.3 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 not influenced by the previous tests.

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