IEC 61003-2

Edition 2.0 2016-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Industrial-process control systems – Instruments with analogue inputs and two or multi-position outputs –
Part 2: Guidance for inspection and routine testing

Systèmes de commande de processus industriels – Instruments avec entrées analogiques et sorties à deux ou plusieurs positions –
Partie 2: Conseils pour les inspections et les essais individuels de série

IEC 61003-2:2016-06(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 25.040.40

ISBN 978-2-8322-3389-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INDUSTRIAL-PROCESS CONTROL SYSTEMS – INSTRUMENTS WITH ANALOGUE INPUTS AND TWO OR MULTI-POSITION OUTPUTS –

Part 2: Guidance for inspection and routine testing

FOREWORD

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International Standard IEC 61003-2 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee TC 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

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

a) use of the term "two- or multi-position output" instead of "two- or multi-state instrument" (see Scope);
b) use of the term "differential gap" instead of "switching differential" (see Table 1 No 2);
c) use of the term "dielectric strength" instead of "isolation test" (see Table 1 No 5).

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

FDIS	Report on voting
65B/1039/FDIS	65B/1049/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.

This International Standard is to be used in conjunction with IEC 61003-1:2016. IEC 61298-2:2008 and IEC 61298-3:2008.

A list of all parts of the IEC 61003 series, published under the general title *Industrial-process control systems – Instruments with analogue inputs and two or multi-position outputs*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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
- amended.

INDUSTRIAL-PROCESS CONTROL SYSTEMS – INSTRUMENTS WITH ANALOGUE INPUTS AND TWO OR MULTI-POSITION OUTPUTS –

Part 2: Guidance for inspection and routine testing

1 Scope

This part of IEC 61003 gives guidelines for inspection and routine testing of electrical and pneumatic instruments with two- or multi-position output, for instance, for acceptance tests or after repair, and it is to be used in conjunction with IEC 61003-1:2016 IEC 61298-2:2008 and IEC 61298-3:2008.

This part of IEC 61003 is applicable to electrical and pneumatic industrial-process instruments, using measured values that are continuous signals. The set point value may be either a mechanical (position, force, etc.) or a standard signal. These instruments may be used as controllers or as switches for alarms and other similar purposes.

Quantitative criteria for acceptable performance should be established by agreement between manufacturer and user, and the report on the tests clarifies which tests were carried out. The requirements of this standard are effective when agreed by the manufacturer and the user.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61003-1:2016 *Industrial-process control systems – Instruments with analogue inputs and two- or multi-position outputs – Part 1: Methods for evaluating performance*

IEC 61298 (all parts), *Process measurement and control devices – General methods and procedures for evaluating performance*

IEC 61298-2:2008, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 2: Tests under reference conditions*

IEC 61298-3:2008, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 3: 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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61003-1, IEC 61298-2 and the following apply.

3.1
acceptance test
contractual test to prove to the customer that the item meets certain conditions of its specification

4 Sampling for test

Usually a routine test is applied to each instrument. If, agreed upon by the user and manufacturer, the tests can be performed on a sample lot.

When sampling is used, instruments to be tested may be chosen by the user's inspector.

5 Performance tests

5.1 General

Test items for routine test and acceptance test are specified in Table 1. The sequence of the tests shall be such that the results of a test are not affected by a previous test.

The following test conditions, test methods and test procedures are compatible with IEC 61003-1 and IEC 61298.

Table 1 – Test items

No.	Designation	Subclause of this standard	Subclause of IEC 61003-1:2016
1.	Inaccuracy of switching points	5.3	6.1.1.2
2.	Inaccuracy of differential gap		6.1.1.4
3.	Set point adjustable and measurable or indicated		6.1.3.1
	Set point adjustable but not indicated		6.1.3.2
	Set point not adjustable		6.1.3.3
4.	Indication of the measured value		6.3.2
5.	Dielectric strength [a]		6.3.4
6.	Characteristics of the multi-position output		7.2.1
7.	Determination of switching range		7.2.3
8.	Supply voltage variations	5.4	6.2.8
	Supply pressure variations		6.2.11

[a] For safety use only.

[b] Routine tests do not test frequency variations.

5.2 Test conditions

5.2.1 Ambient conditions

– Temperature from 15 °C to 25 °C;
– Relative humidity from 45 % to 75 %;
– Atmospheric pressure from 86 kPa to 106 kPa;
– Electromagnetic field value to be stated if relevant.

The maximum rate of change of ambient temperature permissible during any test shall be 1 °C in 10 min and less than 3 °C/h.

5.2.2 Supply conditions

Electrical supply:

– Rated voltage	±1 %;
– Rated frequency	±1 %;
– Harmonic distortion (a.c. supply)	less than 5 %;
– Ripple (d.c. supply)	less than 0,1 %.

Pneumatic supply:

– Rated pressure	±3 %;
– Supply air temperature	ambient temperature ±2 °C;
– Supply air humidity	dew point at least 10 °C below device's body temperature;
– Oil and dust content	oil: less than 1×10^{-6} by weight; dust: absence of particles greater than 3 μm.

5.3 Tests under reference conditions

5.3.1 General

All tests given in 6.1 and 6.3 of IEC 61003-1:2016 should be carried out. Multi-position output should supplement the tests given in Clause 7 of IEC 61003-1:2016. The detailed test procedures are given in IEC 61298-2.

5.3.2 Set point

5.3.2.1 Set point adjustable and measurable or indicated

The set point shall be tested at value of 10 %, 50 % and 90 % at least, the 50 % value being taken last. The measurement or indication accuracy shall be determined at five points approximately evenly spaced over the range.

5.3.2.2 Set point adjustable but not indicated

The set point shall be tested for at least three values, approximately evenly spaced over the effective range of adjustment.

5.3.2.3 Set point not adjustable

The set point shall be tested directly.

5.3.2.4 Multi-position output set point

Each position should be tested in accordance with 5.3.2.1, 5.3.2.2 and 5.3.2.3. IEC 61003-1:2016, 7.2.2 gives the test method of mutual influence of pairs of switching points.

5.4 Tests for the effects of influence quantities

5.4.1 General

When testing the effects of influence quantities, the set point shall be not less than one. For measurable or indicated instruments, indication of the measured value should be tested also. For set point adjustable instruments, the value of 50 % should be included.

The effects on switching points of influence quantities should be tested in accordance with 6.2 of IEC 61003-1:2016 and with IEC 61298-3.

5.4.2 Supply voltage variations

This test shall be performed on instruments with electrical power supply for internal operations.

For two-wire instruments, fix the load resistance at nominal value or a convenient value, and record this value.

Test the instruments with the power voltage set at the nominal value, maximum value and minimum value successively.

5.4.3 Supply pressure variations

This test shall be performed on instruments with pressure supply.

The testing supply pressure should be nominal value, +10 % of the nominal value or the manufacturer's limit, –15 % of the nominal value or the manufacturer's limit.

6 Test report and documentation

6.1 General

A test report of the evaluation shall be prepared in accordance with IEC 61298-4 after completing all tests.

All the original documentation, related to the tests, shall be stored by the test laboratory for at least two years, after the report is issued.

6.2 Test report and general observations

Table 2 gives an example of a summary of the test results information to be reported.

Table 2 – Test report and general observations

No.	Designation	Reference	Unit	Information to be reported
1.	Inaccuracy of switching points	IEC 61298-2:2008, 4.1.7	%	Values of points x_1 and x_2 and their average shall be reported. The differential gap ($x_1 - x_2$) shall be noted for each cycle. The greatest positive and negative deviations of any measured value of x_1 and x_2, of any cycle, from the set point w for increasing and decreasing inputs shall be reported as switching point inaccuracy.
2.	Inaccuracy of differential gap	IEC 61298-2:2008, 4.1.7.1	%	The difference between the average value of x_1 and the average value of x_2, shall be reported as X_{sd}. The greatest positive and negative deviations of any measured value of the differential gaps – calculated in each of the five cycles – from the X_{sd} value, shall be reported as differential gap inaccuracy.
3.	Set point adjustable and measurable or indicated	IEC 61298-2:2008, 4.1.7.1 and 4.1.7.6	%	The greatest positive and negative deviations of any measured value of x_m from the ideal set-point value for each cycle and for each set point shall be reported as inaccuracy of set point setting.
4.	Set point adjustable but not indicated	IEC 61298-2:2008, 4.1.7.1 and 4.1.7.6	%	Values of x_1, x_2 and X_{sd}, and their accuracy-related factors and values of x_m, shall be reported.
5.	Set point not adjustable	IEC 61298-2:2008, 4.1.7.1 and 4.1.7.6	%	Values of x_1, x_2 and X_{sd}, and their accuracy-related factors and values of x_m, shall be reported.
6.	Indication of the measured value		%	The changes in measured value indicated shall be recorded.
7.	Dielectric strength	IEC 61298-2:2008 6.3.3		Report any appreciable transient overvoltage that occurs during tests.
8.	Characteristics of the multi-position output		%	Each position shall report x_{i1}, x_{i2}, x_{mi}, x_{sdi}, x_{i1}- x_{i2}, x_{sri} and an appropriate, $x_{mi} - w$, (see IEC 61003-1:2016, Figure 2)
9.	Supply voltage variations	IEC 61298-3:2008, 12.1	%	The effect on switching points, measured during test, (and measured value) shall be reported.
10.	Supply pressure variations [a]	IEC 61298-3:2008, 12.8	%	The effect on switching points shall be reported [a].
[a] If the manufacturer's specified limits are less than the preferred test values, this fact shall be reported with the test result.				