

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Processus industriels – Instruments avec entrées analogiques et sorties à deux ou plusieurs états –
Partie 2: Guide pour les inspections et les essais individuels de série**



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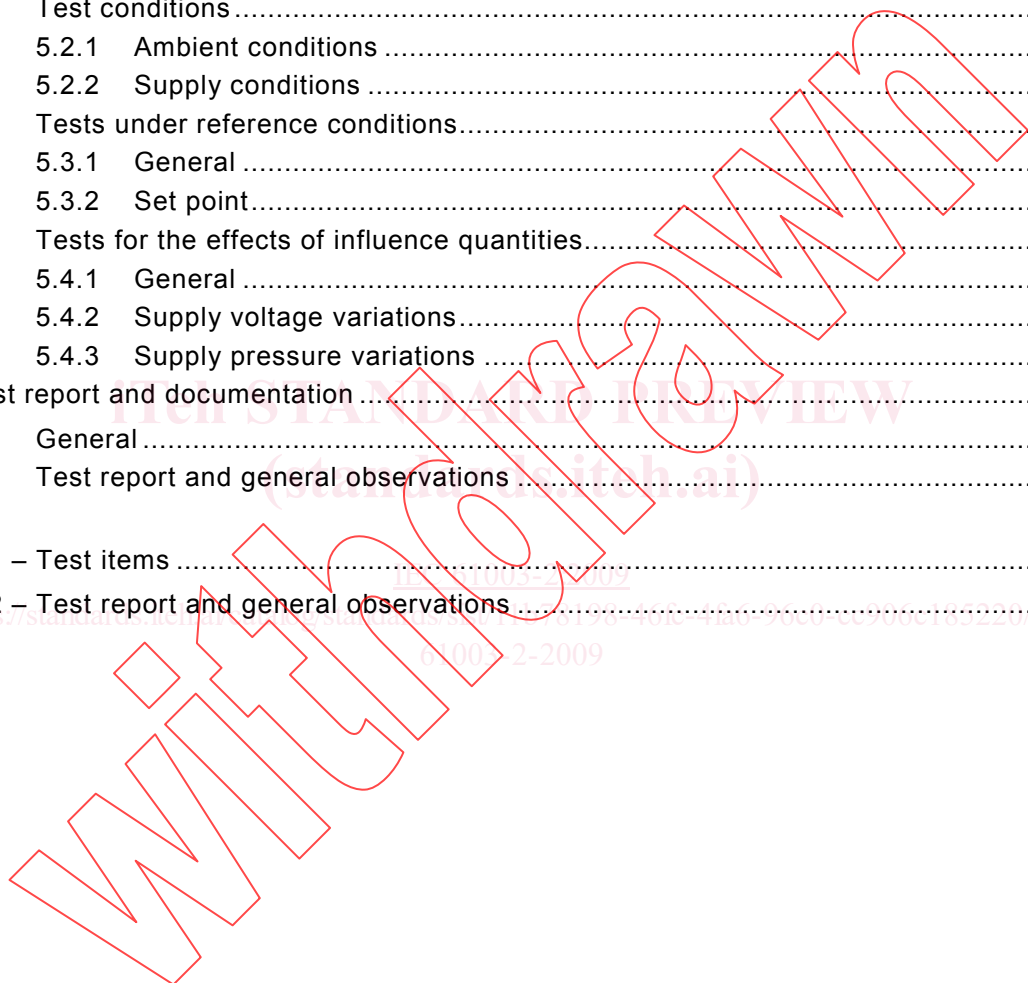
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL-PROCESS CONTROL SYSTEMS –
INSTRUMENTS WITH ANALOGUE INPUTS AND TWO
OR MULTI-STATE 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: Devices and process analysis, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

CDV	Report on voting
65B/703/CDV	65B/723/RVC

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 61003 series, published under the general title: *Industrial-process control systems – Instruments with analogue inputs and two or multi-state outputs*, 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

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- replaced by a revised edition; or
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INDUSTRIAL-PROCESS CONTROL SYSTEMS – INSTRUMENTS WITH ANALOGUE INPUTS AND TWO OR MULTI-STATE 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-state output, for instance, for acceptance tests or after repair. For a full evaluation, IEC 61003-1 is used. Whenever possible any test carried out is to be in accordance with IEC 61298 series.

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 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 60410, *Sampling plans and procedures for inspection by attributes*

IEC 61003-1:2004, *Industrial-process control systems – Instruments with analogue inputs and two- or multi-state outputs – Part 1: Methods of evaluating performance*

IEC 61010-1:2001, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*

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 (all parts) and the following apply.

3.1 acceptance test

test which intends to prove to the user that the instrument complies with certain conditions of its requirements as they appear in the contract

3.2 routine test

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

4 Sampling for test

If, by agreement between user and manufacturer, tests are to be performed on a sample lot, it is recommended that a sampling method such as that presented in IEC 60410 be selected.

NOTE Usually a routine test is applied to each instrument.

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	Clause of this standard	(Sub)clause of IEC 61003-1
1.	Inaccuracy of switching points	5.3	6.1.1.1
2.	Inaccuracy of switching differential		6.1.1.3
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.	Isolation test ^a		6.3.4
6.	Characteristics of the multi-state instrument	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.

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 should be carried out. Multi-state instruments should supplement the tests given in Clause 7 of IEC 61003-1. 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-state instrument set point

Each state should be tested in accordance with 5.3.2.1, 5.3.2.2 and 5.3.2.3. Subclause 7.2.2 of IEC 61003-1 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 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, 4.1.7	%	<p>Values of points x_1 and x_2 and their average shall be reported.</p> <p>The switching differential ($x_1 - x_2$) shall be noted for each cycle.</p> <p>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.</p>
2.	Inaccuracy of switching differential	IEC 61298-2, 4.1.7.1	%	<p>The difference between the average value of x_1 and the average value of x_2, shall be reported as X_{sd}.</p> <p>The greatest positive and negative deviations of any measured value of the switching differentials – calculated in each of the five cycles – from the X_{sd} value, shall be reported as switching differential inaccuracy.</p>
3.	Set point adjustable and measurable or indicated	IEC 61298-2, 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, 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, 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.	Isolation test	IEC 61010-1, 6.8 ^a and Annex F		Report any appreciable transient overvoltage that occurs during tests.
8.	Characteristics of the multi-state instrument		%	Each state 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, Figure 4)
9.	Supply voltage variations	IEC 61298-3, 12.1	%	The effect on switching points, measured during test, (and measured value) shall be reported.
10.	Supply pressure variations ^b	IEC 61298-3, 12.8	%	The effect on switching points shall be reported ^b .

^a IEC 61010-1 6.8 procedure for dielectric strength tests combines with IEC 61003-1 6.3.4 isolation test, and describe the test method.

^b If the manufacturer's specified limits are less than the preferred test values, this fact shall be reported with the test result.