

# INTERNATIONAL STANDARD

# IEC 61003-1

Second edition  
2004-01

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## Industrial-process control systems – Instruments with analogue inputs and two- or multi-state outputs –

### Part 1: Methods of evaluating performance

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## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions .....	7
4 General conditions for tests .....	8
4.1 Documentary information .....	8
4.2 Safety.....	8
4.3 Installation.....	8
4.4 Supply conditions.....	9
5 General testing procedures and precautions.....	9
5.1 Checking of calibration made prior to delivery .....	9
5.2 Set point.....	9
5.3 Switching differential.....	9
6 Test methods and procedures.....	9
6.1 Tests under reference conditions .....	9
6.2 Tests for the effects of influence quantities.....	12
6.3 Other tests .....	19
7 Multi-state instrument .....	21
7.1 Action.....	21
7.2 Tests.....	21
7.2.1 Characteristics of the multi-state instrument.....	21
7.2.2 Mutual influence of pairs of switching points.....	21
7.2.3 Determination of switching range .....	21
8 General observations.....	21
8.1 Protective finishes .....	21
8.2 Design features .....	22
8.3 Tools and equipment .....	22
9 Test report and summary of tests.....	23
10 Other considerations.....	27
10.1 Routine maintenance and adjustment .....	27
10.2 Repair .....	27
10.3 Partial evaluation.....	27

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL-PROCESS CONTROL SYSTEMS –  
INSTRUMENTS WITH ANALOGUE INPUTS AND  
TWO- OR MULTI-STATE OUTPUTS –****Part 1: Methods of evaluating performance**

## FOREWORD

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International Standard IEC 61003-1 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

This second edition cancels and replaces the first edition issued in 1991 and constitutes a technical revision. It takes into account the common standardized basis specified in the IEC 61298 series. Any test method or procedure specified and described herein is referred to the corresponding Clause of the IEC 61298 series. Any particular method or procedure not covered by the IEC 61298 series is developed and specified in this standard in accordance with the criteria stated in the IEC 61298 series, as far as they are applicable.

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

FDIS	Report on voting
65B/516/FDIS	65B/524/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.

The committee has decided that the contents of this publication will remain unchanged until 2012. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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WITHDRAWN

## INTRODUCTION

The methods of evaluation specified in this part of IEC 61003 are intended for use by manufacturers to determine the performance of their products and by users, or independent testing establishments, to verify the manufacturer's performance specifications.

The test conditions in this standard, for example the range of ambient temperatures and power supply, represent those, which commonly arise in use. Consequently, the values specified herein shall be used where the manufacturer specifies no other values.

The tests specified in this standard are not necessarily sufficient for instruments specifically designed for unusually arduous duties. Conversely, a restricted series of tests may be suitable for instruments designed to perform within a more limited range of conditions.

It will be appreciated that the closest communication should be maintained between the evaluating body and the manufacturer. Note shall be taken of the manufacturer's specifications for the instrument, when the test programme is being decided, and the manufacturer should be invited to comment on both the test programme and the results. His comments on the results should be included in any report produced by the testing organisation.

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

## Part 1: Methods of evaluating performance

### 1 Scope

This part of IEC 61003 is applicable to pneumatic and electric industrial-process instruments using measured values that are continuous signals in accordance with IEC 60382, or IEC 60381-1. The other input value (i.e. the set point value) may be either a mechanical (position, force, etc.) or a standard signal.

It should be noted that tests specified herein may be applied to instruments which have other continuous measured values, provided that due allowance is made for such differences.

These instruments may be used as controllers or as switches for alarm and other similar purposes.

Instruments with feedback are not covered by this standard.

Electronic security issues may impact only a few products covered by this document. Consequently this document does not address such security issues.

This standard is intended to specify uniform testing methods for performance evaluation of industrial-process instruments with analogue measured values and two- or multi-state outputs.

Considerations other than the performances are listed in Clause 10.

### 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 60050-351:1998, *International Electrotechnical Vocabulary (IEV) – Part 351 Automatic control*

IEC 60381-1:1982, *Analogue signals for process control systems – Part 1: Direct current signals*

IEC 60382:1991, *Analogue pneumatic signals for process control systems*

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

IEC 61298-1:1995, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 1: General considerations*

IEC 61298-2:1995, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 2: Tests under reference conditions*



IEC 61298-3:1998, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 3: Tests for the effects of influence quantities*

IEC 61298-4:1995, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 4: Evaluation report content*

IEC 61326:2002, *Electrical equipment for measurement, control and laboratory use – EMC requirements*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-351 and in IEC 61298-1, IEC 61298-2, IEC 61298-3, IEC 61298-4, together with the following definitions apply.

#### 3.1

##### **switching point $x_1$ , $x_2$**

measured value (with the input moving either upscale or downscale), at which the output ( $y$ ) changes from one state to another

#### 3.2

##### **two-state instrument**

action illustrated in Figure 1, where  $x$  is the value of the input variable and  $y$  is the value of the output signal.

The two-state instrument, having one pair of switching points  $x_1$  and  $x_2$  ( $x_2$  greater than  $x_1$ ) has the relationships:

$$y = y_1 \text{ for } x < x_1$$

$$y = y_2 \text{ for } x > x_2$$

For  $x_1 < x < x_2$ ,  $y$  may be either  $y_1$  or  $y_2$ .

It is  $y_1$  if the last switching point crossed by  $x$  was  $x_1$ .

It is  $y_2$  if the last switching point crossed by  $x$  was  $x_2$ .

#### 3.3

##### **multi-state instrument**

a multi-state instrument (see Clause 7 and Figure 4) has  $n$  possible output values and  $n-1$  pairs of switching points. Each pair of switching points may be investigated by the procedure given for the two-state instrument.

#### 3.4

##### **switching differential $X_{sd}$**

difference between the switching point  $x_2$  with the measured value moving upscale and the switching point  $x_1$  with the measured value moving downscale

#### 3.5

##### **instrument with no switching differential**

this is considered to be a special case where the switching differential approaches zero

#### 3.6

##### **mean switching point $x_m$**

the mean of the values of upscale and downscale switching points

**3.7****switching range  $X_{sr}$** 

in a multi-state instrument the range of measured values corresponding to the extreme switching points

**3.8****set point  $w$  (reference input variable)**

the point (value) at which it is desired that switching (at  $x_2$  or  $x_1$  as specified) should occur

**4 General conditions for tests**

For the purpose of this standard the general test conditions (e.g. environmental test conditions, supply conditions, load conditions, mounting position, externally induced vibrations, external mechanical constraints, delivery of the instrument) specified in IEC 61298-1, Clause 6 apply, together with the additional information below.

**4.1 Documentary information**

The manufacturer shall supply to the evaluating body information for installation, commissioning, operation, routine maintenance and repair of the instrument. A spare parts list, together with a recommendation of the spare parts to be held in stock, shall be supplied. The language of written information for installation should be the language of the local user.

All the relevant publications supplied by the manufacturer, automatically and on request, should be listed.

If they do not contain a clear description, with adequate diagrams, of the operation of the instrument, or if they do not contain an adequate spare parts and specifications list, the nature of the inadequacy should be noted.

Additionally, any certificates indicating the degree of intrinsic safety and flameproofing, etc. of electrically powered instruments should be listed. This information should give details of the certificate numbers and the degree of protection provided.

Procedures for installation, routine maintenance and adjustment, repairs and overhaul should be examined by the actual performance of the required operation. This should be performed in accordance with the manufacturer's instructions, so that an evaluation of the instructions can be carried out concurrently.

**4.2 Safety**

Electrically powered instruments should be examined to determine the degree to which their design protects them against accidental electric shock.

**4.3 Installation**

The instrument should be installed and set to work according to the manufacturer's instructions, taking account of the various applications which may be met in practice and which require different procedures.

The method of mounting specified by the manufacturer should be reported. Any restrictions on the use of the instrument caused by this method of mounting shall be noted with explanations.

Any other aspects that may seem relevant to the ease or difficulty of installation should be noted with explanations.

#### 4.4 Supply conditions

Tolerances on supply conditions for mains supplied equipment are given in 6.2.2 of IEC 61298-1. For instruments with self-contained power supplies (e.g. battery-powered) the tolerances are different and shall be agreed.

NOTE For pneumatic instrument care should be taken to ensure that pneumatic connections are leak tight.

### 5 General testing procedures and precautions

For the purpose of this standard, the general testing procedures and precautions, specified in Clause 7 of IEC 61298-1, shall be applied, together with the additional information below.

#### 5.1 Checking of calibration made prior to delivery

The input-output characteristic that shall be checked (see 7.6 of IEC 61298-1) is the values of the switching points  $x_1$  and  $x_2$  found during the calibration (if any) made prior to delivery.

#### 5.2 Set point

Except where otherwise specified, the set point shall be set to the midscale value or, where no scale is provided, to the middle of the effective range of adjustment.

#### 5.3 Switching differential

Except where otherwise specified, if the switching differential  $X_{sd}$  is adjustable, it shall be set to the midscale value or, where no scale is provided, to the middle of the effective range of adjustment.

### 6 Test methods and procedures

For the purpose of this standard, the tests general methods and procedures – if any – specified in IEC 61298-2 and IEC 61298-3 apply, together with the additional information stated below.

#### 6.1 Tests under reference conditions

Methods and procedures for each test are described in the last column of the following table.

In the others column are indicated:

- Clause N° and designation of test;
- Clause number of the reference where the general procedures are specified.