

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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**Transmitters for use in industrial-process control systems –  
Part 1: Methods for performance evaluation**

**Transmetteurs utilisés dans les systèmes de conduite des processus  
industriels –  
Partie 1: Méthodes d'évaluation des performances**



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**TRANSMITTERS FOR USE IN INDUSTRIAL-PROCESS  
CONTROL SYSTEMS –****Part 1: Methods for performance evaluation**

## FOREWORD

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International Standard IEC 60770-1 has been prepared by subcommittee 65B: Devices & process analysis, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 1999. This edition constitutes a technical revision.

The significant technical change with respect to the previous edition is as follows:

- 4.3 Load conditions: For pneumatic transmitters, load details have been added.

This standard should be read in conjunction with IEC 61298-1, IEC 61298-2, IEC 61298-3 and IEC 61298-4.

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

CDV	Report on voting
65B/656/CDV	65B/720/CDV

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 IEC 60770 series, published under the general title *Transmitters for use in industrial-process control systems*, 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 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- withdrawn,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
- amended.

# TRANSMITTERS FOR USE IN INDUSTRIAL-PROCESS CONTROL SYSTEMS –

## Part 1: Methods for performance evaluation

### 1 Scope and object

This part of IEC 60770 is applicable to transmitters which have either a standard analogue electric current output signal or a standard pneumatic output analogue signal in accordance with IEC 60381-1 or IEC 60382. The tests detailed herein may be applied to transmitters which have other output signals, provided that due allowance is made for such differences.

For the evaluation of the intelligent transmitters see IEC 60770-3.

For certain types of transmitters where the sensor is an integral part, other specific IEC or ISO standards may need to be consulted (e.g. for chemical analysers, flowmeters, etc.)

This standard is intended to specify uniform methods of test for the evaluation of the performance of transmitters with pneumatic or electric output signals.

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

The test conditions defined 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 should be used where no other values are specified by the manufacturer.

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

When a full evaluation in accordance with this standard is not required, those tests which are required shall be performed and the results reported in accordance with those parts of the standard which are relevant.

### 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 60050-300:2001, *International Electrotechnical Vocabulary – 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*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:1974, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-31:2008, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

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

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

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

IEC 60770-3:2006, *Transmitters for use in industrial-process control systems – Part 3: Methods for performance evaluation of intelligent transmitters*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2008, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-10:2001, *Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-12:2006, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-16:2002, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

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

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61298-1:2008, *Process measurement and control devices – General methods and procedures for evaluating performance – Part 1: General considerations*

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 61298-4:2008, *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 part of IEC 60770, definitions given in IEC 60050-300 and in IEC 61298-1 are applicable.

### 4 General conditions for tests

#### 4.1 Overview

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, constancy of the operating conditions and settings, input variable quality, delivery of the transmitter, etc.) specified in IEC 61298-1 apply, together with the additional information below.

NOTE It is desirable that the closest communication should be maintained between the manufacturer and the evaluating body. The manufacturer's specifications for the instrument should be taken into account when the test programme is being decided, and the manufacturer should be invited to comment on both the test programmes and the results.

#### 4.2 Supply conditions

For the two-wire transmitters, the normal supply voltage might be 24 V d.c. For pneumatic transmitters, the normal pressure supply might be 140 kPa (1,4 bar).

Tolerances on supply conditions, as given in IEC 61298-1, are not applicable to transmitters with self-contained power supplies (e.g. battery-powered). The tolerance for battery-powered equipment shall be agreed.

#### 4.3 Load conditions

The value of the load to be used shall be agreed. A load of 250  $\Omega$  is a commonly used value for electrical transmitters. For pneumatic transmitters, unless otherwise specified, a test load consisting of an 8 m long rigid pipe with a 4 mm internal diameter, followed by a 20 cm<sup>3</sup> capacity (or more), shall be used. Care should be taken to ensure that pneumatic connections are leak-tight.

#### 4.4 Input variable quality

For transmitters that are to be evaluated with an integral sensor, the conditions and requirements for maintaining the quantities to be measured (physical/chemical) shall be properly stated (e.g. for flow transmitters, the fluid through the measuring device shall be that specified by the manufacturer; the temperature of the fluid shall be maintained within  $\pm 2$  °C of the value specified in order to ensure the correct values of density and viscosity).

### 5 Analysis and classification of transmitter performance

In determining the test programme and test values to be used in the evaluation, the physical and functional design of transmitter should be taken into account.

Guidance on this process can be found in Annex A.