



SLOVENSKI STANDARD

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Oddajniki za uporabo v sistemih vodenja industrijskih procesov - 3. del: Metode vrednotenja lastnosti inteligentnih oddajnikov (IEC 60770-3:2006)

Transmitters for use in industrial-process control systems - Part 3: Methods for performance evaluation of intelligent transmitters

Messumformer für industrielle Prozessleittechnik - Teil 3: Verfahren zur Bewertung der Leistungsfähigkeit von intelligenten Messumformern

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Transmetteurs utilisés dans les (systèmes de conduite des) processus industriels - Partie 3: Méthodes pour l'évaluation des performances des transmetteurs intelligents

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

Transmetteurs utilisés dans les systèmes
de conduite des processus industriels
Partie 3: Méthodes pour l'évaluation des
performances des transmetteurs
intelligents
(CEI 60770-3:2006)

Messumformer für industrielle
Prozessleittechnik
Teil 3: Verfahren zur Bewertung der
Leistungsfähigkeit von intelligenten
Messumformern
(IEC 60770-3:2006)

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This European Standard was approved by CENELEC on 2006-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 65B/580/FDIS, future edition 1 of IEC 60770-3, prepared by SC 65B, Devices, of IEC TC 65, Industrial-process measurement and control, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60770-3 on 2006-05-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2007-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60770-3:2006 was approved by CENELEC as a European Standard without any modification.

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Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-300	- ¹⁾	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	- ¹⁾	Environmental testing - Part 2: Tests - Tests A: Cold	EN 60068-2-1	1993 ²⁾
IEC 60068-2-2	- ¹⁾	Basic environmental testing procedures - Part 2: Tests - Tests B: Dry heat	EN 60068-2-2 ³⁾	1993 ²⁾
IEC 60068-2-6	- ¹⁾	Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	1995 ²⁾
IEC 60068-2-31	- ¹⁾	Basic environmental testing procedures - Part 2: Tests - Test Ec: Drop and topple, primarily for equipment-type specimens	EN 60068-2-31 ⁴⁾	1993 ²⁾
IEC 60068-2-78	- ¹⁾	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001 ²⁾
IEC 60079	Series	Electrical apparatus for explosive gas atmospheres	EN 60079	Series
IEC 60381	Series	Analogue signals for process control systems	- ⁵⁾	-
IEC 60529 + A1	1989 1999	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May + A1	1991 1993 2000

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

³⁾ EN 60068-2-2 includes supplement A to IEC 60068-2-2.

⁴⁾ EN 60068-2-31 includes A1 to IEC 60068-2-31.

⁵⁾ IEC 60381-1:1982 is harmonized as HD 452.1 S1:1984.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60654	Series	Industrial-process measurement and control equipment - Operating conditions	EN 60654	Series
IEC 60721-3	Series	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities	EN 60721-3	Series
IEC 60770-1	1999	Transmitters for use in industrial-process control systems - Part 1: Methods for performance evaluation	EN 60770-1	1999
IEC 61010-1 + corr. May + corr. April	2001 2001 2003	Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements	EN 61010-1 + corr. June	2001 2002
IEC 61032 + corr. January	1997 2003	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	1998
IEC 61158	Series	Digital data communications for measurement and control - Fieldbus for use in industrial control systems	CLC/TR 61158-1 EN 61158-x	2004 ²⁾ Series
IEC 61298	Series	Process measurement and control devices - General methods and procedures for evaluating performance	EN 61298	Series
IEC 61326 + corr. July	2002	Electrical equipment for measurement, control and laboratory use - EMC requirements	EN 61326 ⁶⁾ A3	1997 2003
IEC 61499	Series	Function blocks	EN 61499	Series
IEC 61804	Series	Function blocks (FB) for process control	- ⁷⁾	-
CISPR 11	- ¹⁾	Industrial scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement	-	-

⁶⁾ IEC 61326:2002 is superseded by the IEC 61326-X series, which is harmonized as EN 61326-X.

⁷⁾ IEC 61804-2:2004 is harmonized as EN 61804-2:2004.

INTERNATIONAL STANDARD

IEC 60770-3

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Transmitters for use in industrial-process control systems –

Part 3: Methods for performance evaluation of intelligent transmitters

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TRANSMITTERS FOR USE IN INDUSTRIAL-PROCESS
CONTROL SYSTEMS –**

**Part 3: Methods for performance evaluation
of intelligent transmitters**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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The International Standard IEC 60770-3 has been prepared by subcommittee 65B, Devices, of IEC technical committee 65: Industrial-process measurement and control.

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

FDIS	Report on voting
65B/580/FDIS	65B/587/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.

IEC 60770 consists of the following parts, under the general title *Transmitters for use in industrial-process control systems*:

Part 1: Methods for performance evaluation

Part 2: Methods for inspection and routine testing

Part 3: Methods for performance evaluation of intelligent transmitters

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
- amended.

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

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INTRODUCTION

New transmitters for use in industrial process control systems are now equipped with micro-processors which utilise digital data processing and communication methods, auxiliary sensors and artificial intelligence. This makes them more complex than conventional analogue transmitters and gives them considerable added value.

An intelligent transmitter is an instrument that uses digital data processing and communication methods for performing its functions and for safeguarding and communicating data and information on its operation. It may be equipped with additional sensors and functionality which support the main function of the intelligent transmitter. The variety of added functionality can for instance enhance accuracy and rangeability, self-test capabilities, and alarm and condition monitoring. Therefore accuracy-related performance testing, although still a major tool for evaluation, is no longer sufficient to show the flexibility, capability and other features with respect to engineering, installation, maintainability, reliability and operability.

Because of the complexity of intelligent transmitters, a close collaboration should be maintained between the evaluating body and the manufacturer during the evaluation. Note should 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.

This part of IEC 60770 addresses, in its main body, structured and mandatory methods for a design review and performance testing of intelligent transmitters. Intelligent transmitters will, in many cases, also have the capacity to be integrated into digital communication (bus) systems, where they have to co-operate with a variety of devices. In this case, dependability, (inter)operability and real-time behaviour are important issues. The testing of these aspects depends largely on the internal structure and organisation of the intelligent transmitter and the architecture and size of the bus system. The Annexes A, B and C give a non-mandatory methodology and framework for designing specific evaluation procedures for dependability and throughput testing and function block testing in a specific case.

When a full evaluation, in accordance with this part of IEC 60770, is not required or possible, those tests which are required, should be performed and the results reported in accordance with the relevant parts of this standard. In such cases, the test report should state that it does not cover the full number of tests specified herein. Furthermore, the items omitted should be mentioned, in order to give the reader of the report a clear overview.

The structure of this part of IEC 60770 largely follows the framework of IEC 62098. For performance testing, the IEC 61298 series should also be consulted. A number of tests described there are still valid for intelligent transmitters. Further reading of the IEC 61069 series is recommended, as some notions in this part of IEC 60770 are based on concepts brought forward therein.

TRANSMITTERS FOR USE IN INDUSTRIAL-PROCESS CONTROL SYSTEMS –

Part 3: Methods for performance evaluation of intelligent transmitters

1 Scope and object

This part of IEC 60770 specifies the following methods.

- Methods for
 - reviewing the functionality and the degree of intelligence in intelligent transmitters;
 - testing the operational behaviour, as well as the static and dynamic performance of an intelligent transmitter.
- Methodologies for
 - determining the reliability and diagnostic features used to detect malfunctions;
 - determining the communication capabilities of the intelligent transmitters in a communication network.

The methods and methodologies are applicable to intelligent transmitters, which convert one or more physical, chemical or electrical quantities into digital signals for use in a communication network or into analogue electrical signals (as specified in the IEC 60381 series).

The methods and methodologies listed in this part of IEC 60770 are intended for use by:

- manufacturers to determine the performance of their products and
- users or independent testing laboratories to verify equipment performance specifications.

Manufacturers of intelligent transmitters are urged to apply this part of IEC 60770 at an early stage of development.

This standard is intended to provide guidance for designing evaluations of intelligent transmitters by providing:

- a checklist for reviewing the hardware and software design in a structured way;
- test methods for measuring and qualifying the performance, dependability and operability under various environmental and operational conditions;
- methods for reporting the data obtained.

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 – 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, *Environmental testing – Part 2: Tests. Tests A: Cold*

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

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-31, *Environmental testing. Part 2: Tests. Test Ec: Drop and topple, primarily for equipment-type specimens*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60079 (all parts), *Electrical apparatus for explosive gas atmospheres*

IEC 60381(all parts), *Analogue signals for process control systems*

IEC 60529:1989, *Degree of protection provided by enclosures (IP Code)*
Amendment 1 (1999)

IEC 60654 (all parts), *Operating conditions for industrial-process measurement and control equipment*

IEC 60721-3 (all parts), *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities*

IEC 60770-1:1999, *Transmitters for use in industrial-process control systems – Part 1: Methods for performance evaluation*

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 61158 (all parts), *Digital data communications for measurement and control – Fieldbus for use in industrial control systems*

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

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

IEC 61499 (all parts), *Function blocks*

IEC 61804 (all parts), *Function blocks (FB) for process control*

CISPR 11, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*

3 Terms and definitions

For the purposes of this part of IEC 60770, the definitions given in IEC 60770-1 and IEC 60050-300 as well as the following, apply.

3.1

intelligent transmitter

transmitter provided with means for bi-directional communication with external systems and human operators for sending measurement and status information and receiving and processing external commands

3.2**intelligent single variable transmitter**

transmitter that measures one single physical quantity

3.3**intelligent multi variable transmitter**

transmitter that measures two or more identical or different physical quantities

3.4**adjustment**

set of operations carried out on a measuring instrument in order that it provides given indications corresponding to given values of the measurand

NOTE 1 When the instrument is made to give a null indication corresponding to a null value of the measurand, the set of operation is called zero adjustment.

NOTE 2 Many manufacturers use the term calibration for adjustment of zero, span and linearity or conformity.

3.5**user adjustment**

adjustment, employing only the means at the disposal of the user, specified by the manufacturer

3.6**calibration**

set of operations which establishes by reference to standards the relationship which exists, under specified conditions, between an indication and a result of a measurement

NOTE The relationship between the indications and the results of measurement can be expressed, in principle, by a calibration diagram.

3.7**tuning**

process of adjusting the various instrument parameters, required for obtaining a stable and optimal measurement. This can range from "trial and error" to an automatic proprietary procedure provided by the manufacturer

3.8**base load**

minimum amount of software necessary to execute the essential function(s)

3.9**signal generator**

installation or device that provides the physical quantity to be measured by a transmitter. The output of the signal generator shall be accurate and traceable to international standards both under reference conditions and controlled operational conditions in the required range

3.10**configuring**

process of implementing the functionality required for a certain application

3.11**configurability**

extent to which an intelligent transmitter can be provided with functions to control various applications

3.12**set-up**

process of configuring, calibrating and tuning a transmitter for optimal measurement