# INTERNATIONAL STANDARD

# IEC 61987-1

First edition
2006-12

## Industrial-process measurement and control – Data structures and elements in process equipment catalogues –

## Part 1: Measuring equipment with analogue and digital output



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## Part 1: Measuring equipment with analogue and digital output

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International Standard IEC 61987-1 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

This standard cancels and replaces IEC/PAS 61987-1 published in 2002. This first edition constitutes a technical revision.

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

| FDIS | Report on voting |
|---|---|
| 65B/599/FDIS | 65B/602/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 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- withdrawn,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 edition of this standard may be issued at a later date.

# INTRODUCTION

In recent years, industry has become alert to the fact that a great deal of time and effort is wasted in the transposition of measuring equipment data from one form to another. The technical data of an instrument, for example, may exist at the manufacturer's facilty as two separate data sets for paper and electronic presentation: the end-user requires much the same data for works standards, engineering data bases or commercial data bases. In most cases, however, the data cannot be automatically re-used because each application has its own particular data storage format.

A second problem that belies the re-use of technical data is the content of the product descriptions themselves. There is little agreement between manufacturers on what information a technical data sheet should contain, how it should be arranged or how the results, for example, of particular performance tests should be presented. When transferring this information into a data base, an end-user will always find gaps and proprietary interpretations that make the task more difficult.

This standard aims at solving these problems by defining a generic structure and its content for industrial-process measuring and control equipment. It builds upon the assumption that, for a given class of measuring equipment, for example, pressure measuring equipment, temperature measuring equipment or electromagnetic flow-measuring equipment, a set of non-proprietary structures and product features can be specified. The resulting documents cannot only be exchanged electronically, they can also be presented to humans in an easily understandable form.



This standard is applicable to electronic catalogues of process measuring equipment with analogue and digital output. Further parts with similar classification structures will be produced for measuring equipment with binary output and interface equipment in the future. (The structure already contains a great many product features that are common to measuring equipment with binary output.) Similarly, Annex B has been prepared with a view to future standardization.



This standard is not intended as a replacement for existing standards, but rather as a guiding document for all future standards which are concerned with the specifications of process measuring equipment. Every revision of an existing standard should take into account the structures and product features defined in Clause 5 of this standard or work towards a harmonization.

Annex A contains a tabular overview of the classification and catalogue structure of process measuring equipment. Annex B contains tables with a further sub-classification for specific measured variables.

Wherever possible, existing terms from international standards have been used to name the product features within the structures. In accordance with ISO 10241, Clause 3 of this standard contains a list of terms, definitions and sources.

Documents created according to the standard are structured. A possible means of exchanging structured information free of layout information is given by Standard Generalized Mark-Up Language (SGML) described in ISO 8879 or Extensible Mark-Up Language (XML), which is derived from it.

This standard could also provide the basis for arranging properties (data element types) that conform to IEC 61360 or ISO 13584. This would require that the features which, in this standard, can be textual units, graphical and tabular representations, etc., be broken down into properties (data element types) conforming to the said standards. For example, a range would be expressed as a lower range-limit (LRL) and upper range-limit (URL) with unit of measure; dimensions (L × B × H) as three separate elements, length, breadth and height with unit of measure; or a derating curve as an appropriate series of data element pairs.

This standard conforms to ISO 15926-1 and ISO 15926-2 with respect to the data model and associated reference data library (ISO 15926-4), for example, as used for the limited classification structure. At the same time, it is also aligned to the Standard for the Exchange of Product Model Data (STEP). The data model and definitions of ISO 10303-21 uses the ISO 15926-4 TS reference data library as “library”. The current standard can reproduce the data fields according to this standard, including, for example, product structure data, dimensional data, electrical connection data and product properties such as measuring range or power supply.

# INDUSTRIAL-PROCESS MEASUREMENT AND CONTROL – DATA STRUCTURES AND ELEMENTS IN PROCESS EQUIPMENT CATALOGUES –

## Part 1: Measuring equipment with analogue and digital output

## 1 Scope

This part of IEC 61987 defines a generic structure in which product features of industrial-process measurement and control equipment with analogue or digital output should be arranged, in order to facilitate the understanding of product descriptions when they are transferred from one party to another. It applies to the production of catalogues of process measuring equipment supplied by the manufacturer of the product and helps the user to formulate his requirements.

This standard also serves as a reference document for all future standards which are concerned with process measuring equipment catalogues. In addition, it is intended as a guide for the production of further standards on process equipment documentation for similar systems, for example, for other measuring equipment and actuators.



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



IEC 60559:1989, *Binary floating-point arithmetic for microprocessor systems*

IEC 60654-1:1993, *Industrial-process measurement and control equipment – Operating conditions – Part 1: Climatic conditions*

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

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques*

IEC 61069 (all parts), *Industrial-process measurement and control – Evaluation of system properties for the purpose of system assessment*

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

ISO 3511-1:1977, *Process measurement control functions and instrumentation – Symbolic representation – Part 1: Basic requirements*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**ambient conditions**
**environmental conditions**
characteristics of the environment which may affect performance of the device or system

NOTE Examples of ambient conditions are pressure, temperature, humidity, vibration, radiation.

[IEV 151-16-03]

**3.2**
**ambient temperature**
temperature measured at a representative point within the local environment, including adjacent heat generating equipment, in which the measurement and control equipment will normally operate, be stored or transported (see 3.1)

**3.3**
**ambient temperature limits**
extreme values of ambient temperature to which a device may be subjected without permanent impairment of operating characteristics (see 3.18 and 3.19)

NOTE The performance characteristics may be exceeded in the range between the limits of normal operation and the operating temperature limits.

**3.4**
**ambient temperature range**
range of ambient temperatures within which a device is designed to operate within specified accuracy limits (see 3.29 and 3.31)



**3.5**
**analogue signal**
signal whose information parameter may assume any value within a given continuous range

[IEV 351-12-18]



**3.6**
**binary signal**
digital signal whose information parameter may assume one out of two discrete values

[IEV 351-12-20]

**3.7**
**climate class**
climatic conditions, i.e. ambient temperature, pressure and humidity, to which the measurement equipment can be subjected during operation (including shutdown), transport and storage (over land or sea)

[IEC 60654-1, Clause 4]

**3.7.1**
**class A: air-conditioned location**
location in which both air temperature and humidity are controlled within specific limits

**3.7.2**
**class B: heated and/or cooled enclosed location**
location where only air temperature is controlled within specific limits

**3.7.3**
**class C: sheltered location**
location where neither air temperature nor humidity are controlled. The equipment is protected against direct exposure to sunlight, rain or other precipitation and full wind pressure

**3.7.4**
**class D: outdoor location**
location where neither air temperature nor humidity are controlled. The equipment is exposed to outdoor atmospheric condition such as direct sunlight, rain, hail, sleet, snow, icing, wind and blown sand

**3.8**
**degree of protection**
extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or ingress of water and verified by standardized test methods

[IEC 60529, 3.3]

**3.9**
**dependability**
extent to which a system can be relied upon to perform exclusively and correctly a task under given conditions at a given instant of time or over a given time interval, assuming that the required external sources are provided

[IEC 61069-5, 3.1]

**3.10**
**digital signal**
signal, the information parameter of which may assume one out of a set of discrete values

[IEV 351-12-19]



**3.11**
**drift**
change in the indication of a measuring system, generally slow, continuous, not necessarily in the same direction and not related to a change in the quantity being measured

[IEV 311-06-13, modified]



**3.12**
**electromagnetic compatibility**
ability of measuring equipment or a measuring system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[IEV 161-01-07, modified]

**3.13**
**environmental influence**
change in the output of an instrument caused solely by the departure of one of the specified environmental conditions from its reference value, all other conditions being held constant (see 3.16 and 3.52)

**3.14**
**hysteresis**
property of a device or instrument whereby it gives different output values in relation to its input values depending on the directional sequence in which the input values have been applied

[IEC 61298-2, 3.13]

**3.15**
**influence of ambient temperature**
change in zero (lower range-value) and/or span caused by a change in ambient temperature from the reference temperature up to the limits of the ambient temperature range quoted in the performance specifications (see 3.16)

**3.16**
**influence quantity**
quantity that is not the subject of the measurement and whose change affects the relationship between the indication and the result of the measurement [≈ VIM 2.7]

NOTE 1 This term is used in the “uncertainty” approach.

NOTE 2 Influence quantities can originate from the measured system, the measuring equipment or the environment.

NOTE 3 As the calibration diagram depends on the influence quantities, in order to assign the result of a measurement it is necessary to know whether the relevant influence quantities lie within the specified range.
[IEV 311-06-01]

**3.17**
**integrity**
assurance provided by a system that the tasks will be performed correctly unless notice is given of any state of the system, which could lead to the contrary

[IEC 61069-5, 3.5]



**3.18**
**limiting condition**
extreme condition that a measuring system is required to withstand without damage and without degradation of specified metrological characteristics when it is subsequently operated under its rated operating conditions.

NOTE 1 Limiting conditions for storage, transport or operation can differ.

NOTE 2 Limiting conditions can include limiting values of the quantity being measured and of any influence quantity.



[VIM 5.6]

**3.19**
**limiting values for operation**
extreme values which an influence quantity can assume during operation without damaging the measuring instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

NOTE The limiting values can depend on the duration of their application.

[IEV 311-07-06]

**3.20**
**limiting values for storage**
extreme values which an influence quantity can assume during storage without damaging the measuring instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

NOTE The limiting values can depend on the duration of their application.

[IEV 311-07-07]

**3.21**
**limiting values for transport**
extreme values which an influence quantity can assume during transport without damaging the measuring instrument so that it no longer meets its performance requirements when it is subsequently operated under reference conditions

NOTE The limiting values can depend on the duration of their application.

[IEV 311-07-08]

**3.22**
**long-term drift**
drift in output monitored for 30 days at 90 % of span

[IEC 61298-2, 7.2]

**3.23**
**maintainability**
ability of an item under given conditions of use, to be retained in, or restored to, a state in which it can perform a required function, when maintenance is performed under given conditions and and using stated procedures and resources

[IEC 61069-5, 3.3]

**3.24**
**maximum measured error**
largest positive or negative value of error of the upscale or downscale value at each point of measurement

[IEC 60770-2, 3.7]



**3.25**
**measurand**
particular quantity subject to measurement [VIM 2.6]

[IEV 311-01-03]

**3.26**
**measuring range**
range of values defined by the two extreme values within which a variable can be measured within the specified accuracy



NOTE The extreme values are usually termed the upper range-limit and the lower range-limit.

[IEV 351-12-35]

**3.27**
**measurement principle, measuring principle**
phenomenon serving as the basis of a measurement.

NOTE The measurement principle can be a physical, chemical, or biological phenomenon.

[VIM 2.3]

**3.28**
**non-repeatability (repeatability error)**
algebraic difference between the extreme values obtained by a number of consecutive measurements of the output over a short period of time for the same value of the input under the same operating conditions, approaching from the same direction, for full range traverses.

NOTE It is usually expressed in percentage of span and does not include hysteresis and drift.

[IEC 61298-2, 3.12, modified]

**3.29**
**nominal range of use**
specified range of values which an influence quantity can assume without causing a variation exceeding specified limits

[IEV 311-07-05]

**3.30**
**normal operating conditions**
range of operating conditions within which a device is designed to operate within specified performance limits (see 3.31)

**3.31**
**operating conditions**
conditions to which a device is subjected, not including the variables handled by the device

NOTE Examples of operating conditions include ambient pressure, ambient temperature, electromagnetic fields, gravitational force, inclination, power supply variation (voltage, frequency, harmonics), radiation, shock, and vibration. Both static and dynamic variations in these conditions should be considered (see IEC 60654).

[IEV 351-18-33, modified] (see also [IEV 151-16-01])

**3.32**
**operating limits**
range of operating conditions to which a device may be subject without permanent impairment of operating characteristics (see 3.18)

NOTE 1 In general, performance characteristics are not stated for the region between the limits of normal operation conditions and the operating limits.

NOTE 2 Upon returning within the limits of normal operating conditions, a device may require adjustments that restore normal performance.

NOTE 3 The limiting conditions for storage, transport and operation may be different.



**3.33**
**output variable**
recordable variable of a system, influenced only by the system and its input variables

[IEV 351-12-04]



**3.34**
**performance**
characteristics defining the ability of a measuring instrument to achieve the intended functions

[IEV 311-06-11]

**3.35**
**power source**
primary source, usually a.c. mains, from which the system's energy is derived

**3.36**
**power supply device**
separate unit which can convert, rectify, regulate or otherwise modify the form of energy from the power source to provide suitable energy for a system or elements of a system for measurement and control

**3.37**
**rangeability**
ratio of the maximum span to the minimum span to which an instrument can be adjusted within the specified accuracy rating.

Example: If the span of a device is adjustable from 10 to 90, its rangeability is 90/10 = 9

**3.38**
**rated operating condition**
condition to be fulfilled during measurement in order that a measuring system performs as designed