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Industrial-process measurement and control – Data structures and elements in process equipment catalogues –
Part 11: List of Properties (LOP) of measuring equipment for electronic data exchange – Generic structures

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International Standard IEC 61987-11 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65:Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65E/245/FDIS	65E/270/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.

A list of all parts of the IEC 61987 series, published under the general title*, Industrial-process measurement and control – Data structures and elements in process equipment catalogues*, 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- withdrawn,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.

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

INTRODUCTION

0.1 General

The exchange of product data between companies, business systems, engineering tools, data systems within companies and, in the future, control systems (electrical, measuring and control technology) can run smoothly only when both the information to be exchanged and the use of this information has been clearly defined.

Prior to this standard, requirements on process control devices and systems were specified by customers in various ways when suppliers or manufacturers were asked to quote for suitable equipment. The suppliers in their turn described the devices according to their own documentation schemes, often using different terms, structures and media (paper, databases, CDs, e-catalogues, etc.). The situation was similar in the planning and development process, with device information frequently being duplicated in a number of different information technology (IT) systems.

Any method that is capable of recording all existing information only once during the planning and ordering process and making it available for further processing, gives all parties involved an opportunity to concentrate on the essentials. A precondition for this is the standardization of both the descriptions of the objects and the exchange of information.

This standard series proposes a method for standardization which will help both suppliers and users of measuring equipment to optimize workflows within their own companies as well as in their exchanges with other companies. Depending on their role in the process, engineering firms may be considered here to be either users or suppliers.

The method specifies measuring equipment by means of blocks of properties. These blocks are compiled into lists of properties (LOPs), each of which describes a specific equipment (device) type. This standard series covers both properties that may be used in an inquiry or a proposal and detailed properties required for integration of the equipment in computer systems for other tasks.

IEC 61987-10 defines structure elements for constructing lists of properties for electrical and process control equipment in order to facilitate automatic data exchange between any two computer systems in any possible workflow, for example engineering, maintenance or purchasing workflow and to allow both the customers and the suppliers of the equipment to optimize their processes and workflows. Part 10 also provides the data model for assembling the LOPs.

This part of the IEC 61987 series specifies the generic structure for operating and device lists of properties (OLOPs and DLOPs). It lays down the framework for further parts of IEC 61987 in which complete LOPs for device types measuring a given physical variable and using a particular measuring principle will be specified. The generic structure may also serve as a basis for the specification of LOPs for other industrial-process control instrument types such as control valves and signal processing equipment.

0.2 Content of the lists of properties (LOPs)

The LOPs specified in this standard describe at generic level:

- the operating conditions of the measuring equipment,
- the ambient conditions at the measuring point,
- the performance of the measuring equipment,
- the metrological, mechanical and electrical features of the measuring equipment,

- the compliance of the measuring instrument to specific industrial requirements.

The LOPs mirror constructive reality but do not represent an instrument model.

0.3 Measuring equipment configuration

The generic LOPs have been so constructed that they take account of integral equipment and separately mounted equipment.

0.4 Device type dictionary

Annex A of this part describes a characterisation of measuring equipment based on the STEP library, ISO 10303. This is a tree of relationships between different device types. Starting at the root “automation equipment”, it first characterizes measuring equipment according to type, then according to process variable measured and finally according to the measuring method employed. This structure will be used in the IEC Component Data Dictionary (CDD) “Automation equipment” Domain.

For the purpose of this standard the following types of measuring equipment have been identified and defined in Clause 3: sight indicator, gauge, transmitter, switch and measuring assembly.

It should be noted that in the real world, there is not such a clear demarcation between types of measuring equipment. In commercial literature indicators are often called gauges, although the products offer no quantitative measurement. Similarly, direct indicating displays are often equipped with electrical trip switches which allow a gauge to act as a switch. Finally, “transmitter” is by no means a universal term and in particular for flow measurement many manufacturers call this kind of equipment “meter”.

0.5 Composite devices

A structural scheme is given, defining how to build up LOPs for devices consisting of several components or assembled from different parts, that is, composite devices and measuring assemblies.

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

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1 Scope

This part of IEC 61987 provides

- a characterisation of industrial process measuring equipment (device type dictionary) for integration in the Component Data Dictionary (CDD), and
- generic structures for Operating Lists of Properties (OLOPs) and Device Lists of Properties (DLOPs) of measuring equipment in conformance with IEC 61987-10.

The generic structures for the OLOPs and DLOPs contain the most important blocks for process measuring equipment. Blocks pertaining to a specific equipment type will be described in the corresponding part of the IEC 61987 series (for example IEC 61987-12, flow transmitters). Similarly, equipment properties are not dealt with in this part of the series For instance, the OLOPs and DLOPs for flow transmitters with blocks and properties will be found in future in IEC 61987-12.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61069-5, *Industrial-process measurement and control – Evaluation of system properties for the purpose of system assessment – Part 5: Assessment of system dependability*

IEC 61508-6, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

IEC 61987 (all parts), *Industrial-process measurement and control – Data structures and elements in process equipment catalogues*

IEC 61987-1:2006, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 1: Measuring equipment with analog and digital output*

IEC 61987-10:2009 *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 10: Lists of Properties (LOPs) for Industrial-Process Measurement and Control for Electronic Data Exchange – Fundamentals*

IEC 62424, *Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools*

3 Terms and definitions

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

3.1 Terms and definitions concerning measuring instruments

3.1.1
composite device with main component
device composed of various devices, whereby one is designated the main component

Note 1 to entry: These devices might be supplied as a whole or the parts comprising the assembly of the composite device might be supplied individually.

EXAMPLE A control valve which consists of the valve itself (main component), an actuator and a positioner.

3.1.2
gauge
measuring instrument intended to measure and indicate directly a measured value without auxiliary energy supply

Note 1 to entry: In process engineering a gauge is often called an indicator.

Note 2 to entry: A gauge equipped with electrical contacts in order to transmit one or more measured values to external equipment is still considered to be a gauge within the scope of this standard.

3.1.3
instrument component
entity within an instrument that plays a specific role and which can be handled separately if necessary

EXAMPLES Thermowell within a temperature assembly, remote seal for a pressure transmitter.

3.1.4
integral transmitter
transmitter mounted as an integral part of an assembly containing the sensing element

3.1.5
measuring assembly
measuring instrument comprising several required and/or optional components which together function as a gauge, transmitter or switch

Note 1 to entry: The components can often be ordered separately and as such require their own DLOPs.

Note 2 to entry: A measuring assembly may also be called a composite device.

3.1.6
measuring instrument
artefact intended to detect an aspect of a material to record, transform or display such an aspect or to perform a combination of these activities

3.1.7
PCE identifier
tag name
identifier assigned by the user to uniquely define the instrument or a component thereof

Note 1 to entry: PCE = Process Control Engineering.

3.1.8
sensing element
instrument component that is the primary element of a measuring chain and which may convert the input variable into a signal suitable for use by other instruments in that chain

Note 1 to entry: It is intended to respond to a physical stimulus and to produce a corresponding resulting signal.

3.1.9
separate transmitter
transmitter mounted at a location removed (locally or remotely) from an assembly containing the sensing element but connected to it by signal line

Note 1 to entry: A head-mounted transmitter is a separate transmitter mounted in a connection head.

3.1.10
sight indicator
measuring instrument that provides a means of visually inspecting a process regime and provides only a qualitative indication

Note 1 to entry: IEC 60770-1 defines “indicator” as an instrument intended to visually indicate a physical quantity.

3.1.11
switch
measuring instrument, the output of which is a binary signal

[SOURCE: IEC 60770-1:2010, A.2 d), modified]

3.1.12
transmitter
instrument intended to transmit a standardized signal that represents the measured variable, which may or may not include an integral sensing element

Note 1 to entry: A transmitter may also be equipped with the means to indicate a measured value.

Note 2 to entry: In process engineering a transmitter is often called a meter, for example flowmeter.

Note 3 to entry: A transmitter may also be a component of a composite device or measuring assembly.

3.2 Terms and definitions concerning relationships

3.2.1
aspect
specific way of selecting information on or describing a system or an object of a system

[SOURCE: IEC 61346-1:1996, 3.3][1]

EXAMPLE Such a way may be
– information about how to describe an object (device) – the describing aspect,
– information about the surrounding conditions in which a device operates – the operating aspect.

3.2.2
classification
non-transitive relationship indicating that the classified item is a member of the classifier class

[based on ISO 15926-2:2003]

EXAMPLE 1 The relationship that indicates that ‘London’ is a member of the class known as 'capital city' is known as “classification”.

[1] This standard was withdrawn in 2009 and replaced by IEC/ISO 81346-1:2009 which has a more general definition for aspect (3.3), namely “specified way of viewing an object”.

EXAMPLE 2 'pump' **is_classified_as** 'equipment type'.

Note 1 to entry: A subtype of relationship is transitive if when A is related to B, and B is related to C in the same way, then A is necessarily related to C in that way. "Specialization" and "composition" are examples of transitive subtypes of relationship. However, because classification is not transitive does not mean that A cannot be related to C in the same way, only that it does not necessarily follow from A being related to B and B being related to C.

Note 2 to entry: In this document the classification relationship is denoted as: **is_classified_as.**

3.2.3
has_part
time-dependent transitive, reflexive, anti-symmetric relation identifying that an item has another item as its part

EXAMPLE 1 Centrifugal pump **has_part** impeller during mounting.

Note 1 to entry: has_part is the inverse relation to is_part_of.

3.2.4
is_aspect_of
time-independent, anti-symmetric relation identifying that the LOP model of an aspect of a device and the LOP model of the device are in relationship to each other, reflecting the relationship between the device and its aspects

EXAMPLE The OLOP of a gauge **is_aspect_of** the DLOP of the gauge.

Note 1 to entry: IEC 61987-10 defines aspect as specific way of selecting information on or describing a system or an object of a system.

3.2.5
is_part_of
time-dependent transitive, reflexive, anti-symmetric relation identifying that an item is part of another item

EXAMPLE Impeller **is_part_of** centrifugal pump during mounting.

Note 1 to entry: C is_part_of C' if and only if: given any c that instantiates C at a time t, there is some c' such that c' instantiates C' at time t, and c is_part_of c' at t.

Note 2 to entry: is_part_of is time-dependent. An item may be part of another item but will be disconnected later during repair. In contrast the specialization and classification relation are time independent.

Note 3 to entry: The part of relation may be used on level of devices and on level of individual components. However, only device level is in the scope of this standard since the standard does not deal with individuals.

3.2.6
specialization
transitive, anti-symmetric relation indicating that all knowledge provided for the generic item is mandatory valid for the specialized item

EXAMPLE 'Centrifugal pump' **is_a** 'pump'. All knowledge provided for 'pump' is mandatory valid for 'centrifugal pump'. If an individual is denoted as 'centrifugal pump', it is consequently also a 'pump' and all properties and other information provided for 'pump' apply.

Note 1 to entry: If A is a specialization of B and B is a specialization of C, then A is necessarily a specialization of C.

Note 2 to entry: In this part of standard the classification relationship is denoted as: is_a.

Note 3 to entry: If the generic item is a LOP then C is_a C' if and only if: given any c that instantiates C, c instantiates C'

4 General

4.1 Characterization scheme

IEC 61987-1 describes a general classification scheme for industrial process measuring equipment based on measured variables. Industrial process measuring equipment may be further subdivided into sight indicators, gauges, transmitters, switches and measuring assemblies. See definitions in Clause 3. Figure 1 explains schematically how the characterisation has been created. The entire characterisation is provided in Table A.1.

It should be noted that in creating the LOPs for a device, an instrument component may be part of a sight indicator, gauge, transmitter or switch or alternatively, a sight indicator, gauge, transmitter or switch may be part of a measuring assembly or composite device (see 7.1). For clarity this is not shown in Figure 1.

The enhanced characterization scheme is used for the IEC Component Data Dictionary (CDD). The area of measuring instruments belongs to the domain of "automation equipment" in the CDD.

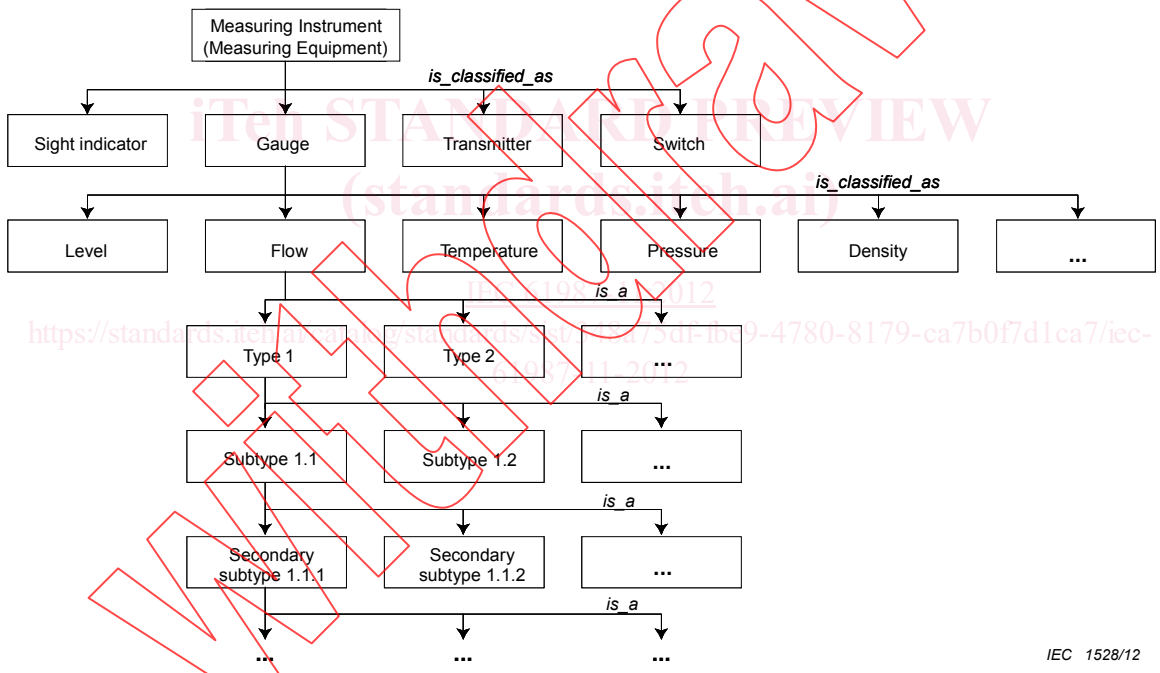

Figure 1 – Characterisation of measuring equipment

4.2 Aspects

In addition to properties describing the characterization of the device itself in the Device List of Properties (DLOP) a device has several different aspects describing all other issues related to it. Thus, for example, from the operating point of view, an operating list of properties (OLOP) and a device list of properties are linked.

A.1 of IEC 61987-10:2009 describes a model which uses reference properties to express the relationships between the various aspects of a device. This entails the embedding of these properties in both the OLOP and DLOP. An alternative model which conforms to but enhances that in A.1 of IEC 61987-10:2009, removes the reference properties from the OLOP and DLOP as shown in Figure 2. These are now only required for describing the blocks and for building composite devices.