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INTERNATIONAL STANDARD

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Industrial-process measurement and control – Data structures and elements in process equipment catalogues –
Part 12: Lists of properties (LOPs) for flow measuring equipment for electronic data exchange

Mesure et commande dans les processus industriels – Éléments et structures de données dans les catalogues d'équipements de processus –
Partie 12: Listes de propriétés (LDP) pour les équipements de mesure de débit pour l'échange électronique de données

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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FOREWORD

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

FDIS	Report on voting
65E/490/FDIS	65E/494/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 in 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- withdrawn,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.

INTRODUCTION

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 both within their own companies and 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. IEC 61987-10 also provides the data model for assembling the LOPs.

IEC 61987-11 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 quantity 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.

IEC 61987-12 concerns flow measuring equipment. It provides one operating LOP for all types of flow transmitter which can be used, for example, as a request for various sorts of quotation. The DLOPs provided in this standard for a range of flow transmitter types can be used in very different ways: in the computer systems of equipment manufacturers and suppliers; in CAE and similar systems of EPC contractors and other engineering companies; and especially in the various plant maintenance systems used by plant owners. The OLOP and the DLOPs provided correspond to the guidelines specified in IEC 61987-10 and IEC 61987-11.

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

Part 12: Lists of properties (LOPs) for flow measuring equipment for electronic data exchange

1 Scope

This part of IEC 61987 provides an

- operating list of properties (OLOP) for the description of the operating parameters and the collection of requirements for a flow measuring equipment and
- device lists of properties (DLOP) for the description of a number of flow measuring equipment types.

The structures of the OLOP and the DLOP correspond to the general structures defined in IEC 61987-11 and agree with the fundamentals for the construction of LOPs defined in IEC 61987-10.

Aspects other than the OLOP, needed in different electronic data exchange processes described in IEC 61987-10, will be published in IEC 61987-92[1].

Libraries of properties and of blocks used in the LOPs in this standard are listed in Annex C and Annex D.

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 61360 (all parts), *Standard data elements types with associated classification scheme for electric components*

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

IEC 61987-11:2012, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 11: Lists of Properties (LOP) of measuring equipment for electronic data exchange – Generic structures*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 61987-10 and IEC 61987-11 apply.

[1] Under consideration

4 General

4.1 Overview

The LOPs provided by this document are intended for use in electronic data exchange processes performed between any two computer systems. The computer systems can both belong to the same company or they can belong to different companies as described in Annex C of IEC 61987-10:2009.

The OLOP for the family of flow measuring equipment is to be found in Annex A while the DLOPs of the individual flow device types are to be found in Annex B.

Structural elements such as LOP type, block and property defined in this standard are available in electronic form in the “Automation equipment” domain of the IEC Common Data Dictionary (CDD).

4.2 Depiction of OLOPs and DLOPs

4.2.1 General

The properties of the OLOPs and DLOPs used in this part of IEC 61987 have been created in conformance to the requirements of the IEC 61360 series. As such, the structural elements, properties and attributes to be found in the IEC Common Data Dictionary are normative.

4.2.2 Structural roles

The entities within a list of properties can have one of a number of structural roles.

a) **Property**
A property exists as a property only.

b) **Ref. property + Block**
A reference property connects a block to the superordinate block or LOP in which it is embedded.

Properties and sub-blocks listed below a block name and placed one position to the right are elements of the block. A block ends when another block name appears in the same column as the block name or in any other column to its left.

The reference property has the same preferred name as the block to which it refers. All attributes of these properties are available in the IEC Common Data Dictionary (CDD).

c) **Cardinality property**
A cardinality property is connected to the block which immediately follows it. The value of the property (0 … n) in a transaction file determines the number of times the associated block shall be repeated. It is identified by the identifier in the column “Property identifier”.

The preferred name of a cardinality property is “Number of <xxxx>“, where <xxxx> is derived from name of the block with which it is associated.

In the transaction file (see examples in 4.3), it can be seen that a block has been repeated twice:

– the cardinality property directly before the block has a value greater than 1,

– the name of the repeated block is extended by “_” followed by the repetition number.

Example:

If the block “Signal function” is repeated 3 times, the following construction occurs in the transaction file:

“number of signal function” has the value “3”	- cardinality property
“Signal function_1”	- first repeated block
…	
“Signal function_2”	- second repeated block
…	

“Signal function_3” - third repeated block

…

d) **Ref. property + Block**
This role is similar to b) but the block concerned can be repeated according to value of the cardinality property which precedes it.

e) **Polymorphic control property**
A polymorphic control property provides the means of introducing complete blocks of properties describing different realizations of a particular device function, for instance inputs and outputs. The property has a value list containing the designations of the blocks that may be introduced. When in a transaction file a polymorphic control property is assigned a value, the corresponding block follows (see examples in Tables 2 and 3).

A polymorphic control property is identified in the IEC Common Data Dictionary by the identifier in the column “Property identifier”. The preferred name of a polymorphic property is “<xxxx> type“, where <xxxx> is normally the derived from name of the block with which it is associated.

f) **Ref. property + Polymorphic block**
This role is similar to b) but the block concerned is created by polymorphism.

g) **Polymorphic control property with the fixed value: “<Block name from value list>”**

This property appears directly behind the polymorphic block property. It is the same property as the polymorphic control property for the block, but with the fixed value used to create the block (see IEC 61987-10).

4.2.3 Marking of polymorphic areas

To help identify the possible polymorphic blocks in a list of properties in a printable version of this standard, a number with grey background has been added to the rightmost column of the DLOP to indicate the properties associated with the block. It should be noted that in transaction file, only the polymorphic block selected from value list of the polymorphic control property would appear in the superordinate block.

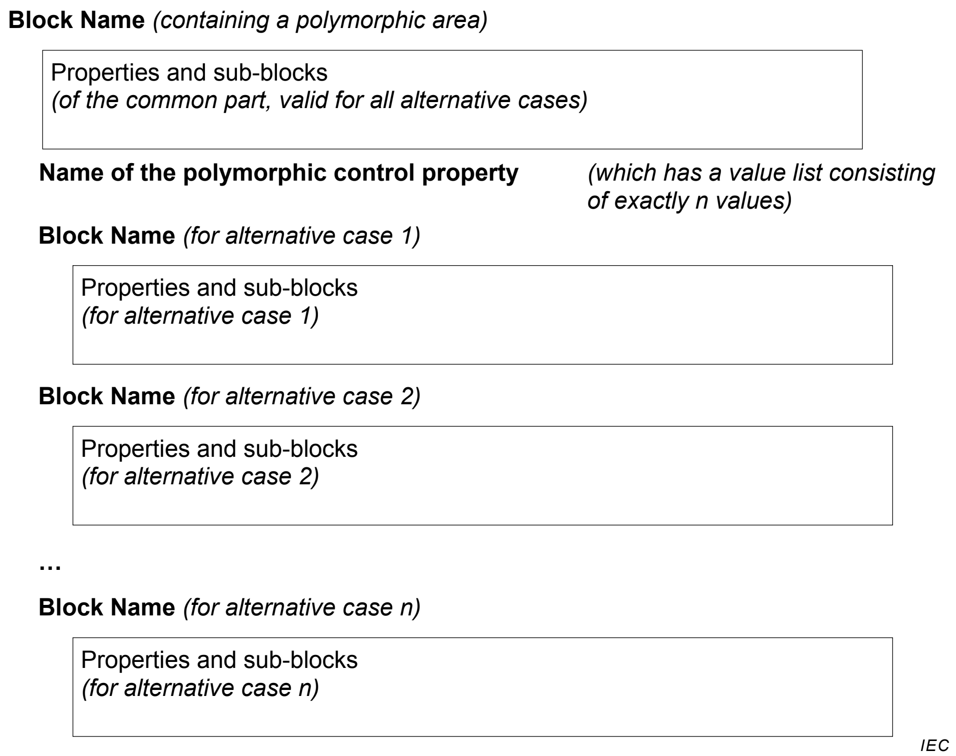

Figure 1 – Structure of a polymorphic area

Every polymorphic area corresponds to a block, the structure of which is shown in Figure 1. A polymorphic area begins with the name of this block containing this area.

The block name can be optionally followed by any number of additional properties or sub-blocks, provided that they are valid for all alternative sub-blocks that can be generated by the polymorphism.

The polymorphic control property follows, by means of which one of the alternative blocks can be selected. The alternative sub-blocks with their properties and sub-blocks are now listed one after the other.

The polymorphic area ends with the last property of the last sub-block that can be selected using the value list of the polymorphic control property.

In order to facilitate the analysis of the LOPs the following non-normative numerical marking system has been used. A polymorphic area can have one or more subordinate, polymorphic areas embedded in it. Table 1 shows the structure of the polymorphic areas implemented in the DLOPs of Annex B. In Table 1, each individual polymorphic area has been assigned a unique number. The areas have been numbered in the sequence which they occur in the LOP, not according to their level in the structure. The number of an embedded area has therefore a marking number greater than the marking number of area in which it is embedded.

For example, the majority of the content of the "Output" block is generated from the polymorphic area marked with the number 8, which starts at "Type of output" and can include any of the specializations which also are marked with the number 8. Each specialization also includes in this case a further polymorphic area, "Assigned variable" which is marked by its own number (>8).

Table 1 – Example of structure of polymorphic areas

Block name	Marking number of 1st level polymorphic area	Marking number of nested polymorphic area (2nd level)
Input		
Measured variable		
Type of measured variable	1	
Auxiliary input		
Type of auxiliary input	2	
Analog current input	2	
Assigned variable	2	3
Analog voltage input	2	
Assigned variable	2	4
Frequency input	2	
Assigned variable	2	5
Pulse input	2	
Assigned variable	2	6
Manufacturer-specific input	2	
Assigned variable	2	7
Output		
Type of output	8	
Analog current output	8	
Assigned variable	8	9
Analog voltage output	8	
Assigned variable	8	10
Frequency output	8	
Assigned variable	8	11
Pulse output	8	
Assigned variable	8	12
Manufacturer-specific	8	
Assigned variable	8	13
Pneumatic/hydraulic output	8	
Assigned variable	8	14
Performance		
Performance variable		
Type of performance variable	15	
Mechanical and electrical construction		
Structural design		
Structural design of a thermal mass flow transmitter	16	

In the OLOP for flow measuring equipment, there is only one polymorphic area. It appears in the block “Phase”.

In order to make clear how the structural elements such as block, cardinality and polymorphism can be implemented using the LOPs of this standard some examples are provided in 4.3.

4.3 Examples of DLOP block usage

4.3.1 Block “Input”

A Coriolis mass flowmeter with DN25 process connections has three input variables: mass flow, density and temperature. An additional binary voltage input can be configured to operate a totalizer reset or to start/stop batching. The Input block in the DLOP is configured as shown in Table 2 (… indicates a property or properties that have not been used; grey shading indicates polymorphism).

Table 2 – Example for the “Input” block

Name of LOP type, block or property[2]	Assigned value	Unit
…		
Input		
Number of measured variables	3	
Measured variable_1		
…		
Type of measured variable		
measured variable type	Mass flow measurement	
Mass flow measurement		
measured variable type	Mass flow measurement	
measuring principle	Coriolis mass flow for liquids	
Measuring range for mass flow		
lower range-limit of mass flow	0	kg/h
upper range-limit of mass flow	18 000	kg/h
base density	1 000	kg/m3
…		
Measured variable_2		
…		
measured variable type	Density measurement	
Density measurement		
measured variable type	Density measurement	
measuring principle		
Measuring range for density		
lower range-limit of density	310	kg/m3
upper range-limit of density	8 000	kg/m3
…		
Measured variable_3		
…		

2 In the CDD, block names start with a capital letter, property names with a lower case letter

Name of LOP type, block or property[2]	Assigned value	Unit
measured variable type	Temperature measurement	
Temperature measurement		
measured variable type	Temperature measurement	
type of temperature measurement	Temperature	
measuring principle		
Measuring range for temperature		
lower range-limit of temperature	0	°C
upper range-limit of temperature	150	°C
number of auxiliary inputs	1	
Auxiliary input		
…		
connected variable	Status input	
function of input/output	Switch	
Type of auxiliary input		
auxiliary input type	Binary input	
Binary input		
auxiliary input type	Binary input	
reference standard		
number of signal functions	2	
Signal function _1		
purpose of signal	Totalizer reset	
state for "low" signal	None	
state for " high" signal	Reset totalizer	
…		
Signal function_2		
purpose of signal	Batching start/stop	
state for "low" signal	Stop batching	
state for " high" signal	Start batching	
…		
…		
minimum signal level for signal "0"	0	V
maximum signal level for signal "0"	0	V
minimum signal level for signal "1"	3	V
maximum signal level for signal "1"	30	V
…		
electrical data for passive behaviour		
…		
number of galvanic isolations	1	
Galvanic isolation		
galvanic isolation from inputs	5 000	V
…		

4.3.2 Block "Output"

A Coriolis mass flowmeter has three outputs: a current output, a pulse/frequency output and a relay output, comprising an NC and an NO relay. The process variable assigned to the outputs at the factory is mass flow, the default flow mass range being the measuring range. The Output block in the DLOP is configured as shown in Table 3 (only the parameters used are shown; grey shading indicates polymorphism).

Table 3 – Example for the "Output" block

Name of LOP type, block or property[3]	Assigned value	Unit
…		
number of outputs	3	
Output_1		
…		
displayed variable	Mass flow	
function of input/output	Representation of measured value	
Type of output		
output type	Analog current output	
Analog current output		
output type	Analog current output	
Assigned variable		
assigned variable type	Assigned mass flow range	
Assigned mass flow range		
assigned variable type	Assigned mass flow range	
lower range-value of mass flow	0	kg/h
upper range-value of mass flow	18 000	kg/h
Analog current output parameters		
type of current output	Configurable 0/4…20 mA	
power source behaviour	Active, passive	
set power source behaviour	Passive	
lower range end-value of current output	4	mA
upper range end-value of current output	20	mA
lower current limit of the proportional range	3,8	mA
upper current limit of the proportional range	20,5	
Current signal on alarm		
current for lower signal on alarm	3,5	mA
current for upper signal on alarm	22	mA
configurability of signal on alarm	MIN, MAX, HOLD, User value	
set signal on alarm	MIN	
superimposed digital communication	HART	
current signal resolution	0,5	µA
Electrical data for passive behaviour		
rated voltage	24	V
minimum voltage	18	VDC

3 In the CDD, block names start with a capital letter, property names with a lower case letter