IEC/PAS 61987-1

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2002-08

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

Part 1: Measuring equipment with analogue and digital output

PUBLICLY AVAILABLE SPECIFICATION

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

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

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:
Draft PAS	**Report on voting**
65B/454/PAS	65B/457/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

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5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

The text of this PAS is based on a projected standard under development by SC65B/WG10.

Annexes A and D form an integral part of this PAS. Annexes B, C, and E are for information only.

This PAS shall remain valid for no longer than 3 years starting from 2002-09. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

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 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 data sets and elements themselves. There is little agreement between manufacturers on what information a technical data sheet should contain, how it should be structured, or how the results, e.g. 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 document aims to solve these problems by defining data structures, and their content for industrial process measuring and control equipment. It builds upon the assumption that, for a given class of measuring equipment, e.g., pressure measuring equipment, temperature measuring equipment or electromagnetic flow-measuring equipment, a set of non-proprietary structures and data elements (terms) can be specified.

Part 1 of the document 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 data elements that are common to measuring equipment with binary output.) Similarly the informative Annex B has been prepared with a view to future standardisation.

The document 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 account of the data structures and elements defined in Clause 5 of this document or work towards a harmonisation.

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.

Where possible, existing terms from international standards have been used to name the data elements within the structures. In accordance with ISO 10 241, Annex C of the document contains an alphabetical list of terms, definitions and sources.

SGML (Standard Generalised Mark-Up Language) to ISO 8879 provides one possible standardised means of exchanging structured document data free of layout information. To this end, Annex D contains a Document Type Description and Metadocument of Clause 5 of the document. Since the drafting of this document, XML, a simplified subset of SGML, has been developed for Internet applications. As a result it is well supported and provides a viable alternative to SGML.

The present document conforms with STEP: Standard for the Exchange of Product Model Data. The data model of the STEP application protocol 212, 221 and 231 (Electrotechnical Design and Installation; Functional Data and 2D Representation and Process Design: Specs of Major Equipment) is described in ISO 10 303.212, .221 and .231 respectively and can reproduce the data field of the DTD as per this document. This includes, e.g. product structure data, dimensional data, electrical connection data, and product properties such as measuring range or power supply. The STEP application protocols 212, 221 and 231 define

the objects and their inter-relationships only. Descriptive attributes as described in the document can be assigned to an object as aggregative property lists.

In defining data elements to fill the proposed data structure for process equipment catalogues, the present document is also relevant to IEC 61360 (Data Element Type Definition). It was considered beyond the scope of the document, however, to classify the said elements according to this scheme, since the main objective lies in the structured presentation of data. In practice a number of elements have already been defined and appear in commercial databases structured according to the present document.

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 document defines data structures and elements for industrial process measurement and control equipment with analogue or digital output. It applies to the production of catalogues of process measuring equipment supplied by the manufacturer of the product.

The document shall also serve 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, e.g., for other measuring equipment and actuators.

2 Normative references

This document contains provisions from other publications which are indicated by dated and undated references. These normative references are cited at the pertinent positions in the text and the appropriate publications are listed below. In the case of dated references, subsequent changes to or revisions of these publications belong to this document only if they have been integrated by changes to or revision of the present document. In the case of undated references, the latest edition of the cited publication is valid.

ISO 704:2000, *Terminology work – Principle and methods*

ISO 8879:1986 + A1: 1988, *Information Processing – Text and office systems – Standard Generalized Markup language (SGML)*

ISO 10241:1992, *Preparation and Presentation of Publications with Terminological Determinations; Standards*

ISO 10303-1:1994, *Industrial Automation Systems and Integration – Product Data Representation and Exchange – Part 1: Overview and fundamental principles*

ISO 10303-212, *Product Data Representation and Exchange – Part 212: Electrotechnical design and installation.*

ISO 10303-221, *Product Data Representation and Exchange – Part 221: Functional data and 2D representation.*

ISO 10303-231, *Product Data Representation and Exchange – Part 231: Process design/specs of major equipment.*

IEC 60050(351):1998, *International Electrotechnical Vocabulary – Chapter 351: Automatic control*

IEC 60068 (all parts), *Environmental testing standards*

IEC 60529:1989, *Degree of Protection provided by Enclosures (IP Code)*

IEC 60654 (all parts) *Industrial-process measurement and control equipment; Operating conditions*

IEC 60751 (1983), *Industrial platinum resistance thermometer sensors*

IEC 60770-1:1998, *Methods of evaluating the performance of transmitters for use in industrial-process control systems*

IEC 61000 (all parts), *Electromagnetic compatibility (EMC)*

IEC 61069-5 (all parts), *Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment*

IEC 61082 (all parts), *Preparation of documents used in electrotechnology*

IEC 61298 Parts 1 to 4, *Process measurement and control devices: General methods and procedures for evaluating performance*

IEC 61326-1:2000, Ed. 1.2 Consolidated Edition, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

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

IEC 61508 (all parts): *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 82045-1 (2001): *Document management – Part 1: Principles and methods*

3 Terms and definitions

The nomenclature adopted in the data structure defined in Clause 5 is based on terms and concepts drawn from international standards. In order to facilitate the use of the document, an alphabetical list of terms with definitions and normative references is to be found in the informative Annex C.

Clause 5 also includes so-called search terms. A search term is a related designation or concept, but is not necessarily a synonym. It is intended for electronic searches only, and must not be substituted for the preferred term. Search terms are not included in Annex C.

Each term in Clause 5 is accompanied by an explanation of what is to be entered in the data element. These explanations are informative only, and do not constitute normative definitions.

4 Metadocuments

4.1 General

Metadocuments describe the non-proprietary structures and data elements (terms) of a class of process measuring equipment. They serve as specimen and procedural instructions for the production of process equipment catalogues by the equipment manufacturer.

Metadocuments form a document hierarchy corresponding to the hierarchical classification of the process measuring equipment. A metadocument can exist at each level of the hierarchy which describes structures and data elements (terms) common to all equipment at this hierarchical level. Metadocuments at lower hierarchical levels inherit the structure and data elements (terms) from the metadocuments at levels above them.

Figure 1 shows the classification scheme for process measuring equipment on which this document is based. Process measuring equipment may be subdivided into continuous measuring equipment (with analogue and digital output) and limit detecting equipment (with binary output). The metadocument defined in Clause 5 defines the common structures and data elements (terms) that are to be found at this level in the hierarchy.

Each piece of equipment is designed to measure one or more process variables, e.g. level, pressure, flow or temperature. To fully define the technical data of say, a flowmeter, additional data elements, e.g. inlet and outlet run, must be added to data structure inherited from the level above.

The methods used to measure a particular process variable form a further level in the hierarchy. Thus flow may be measured by a differential pressure transmitter, a variable area flowmeter, an electromagnetic flowmeter etc.. Depending on the measuring method used, additional elements must again be added to the structure to adequately characterise the equipment. Such additional elements have already been defined for the measurement methods shaded grey in Figure 1.

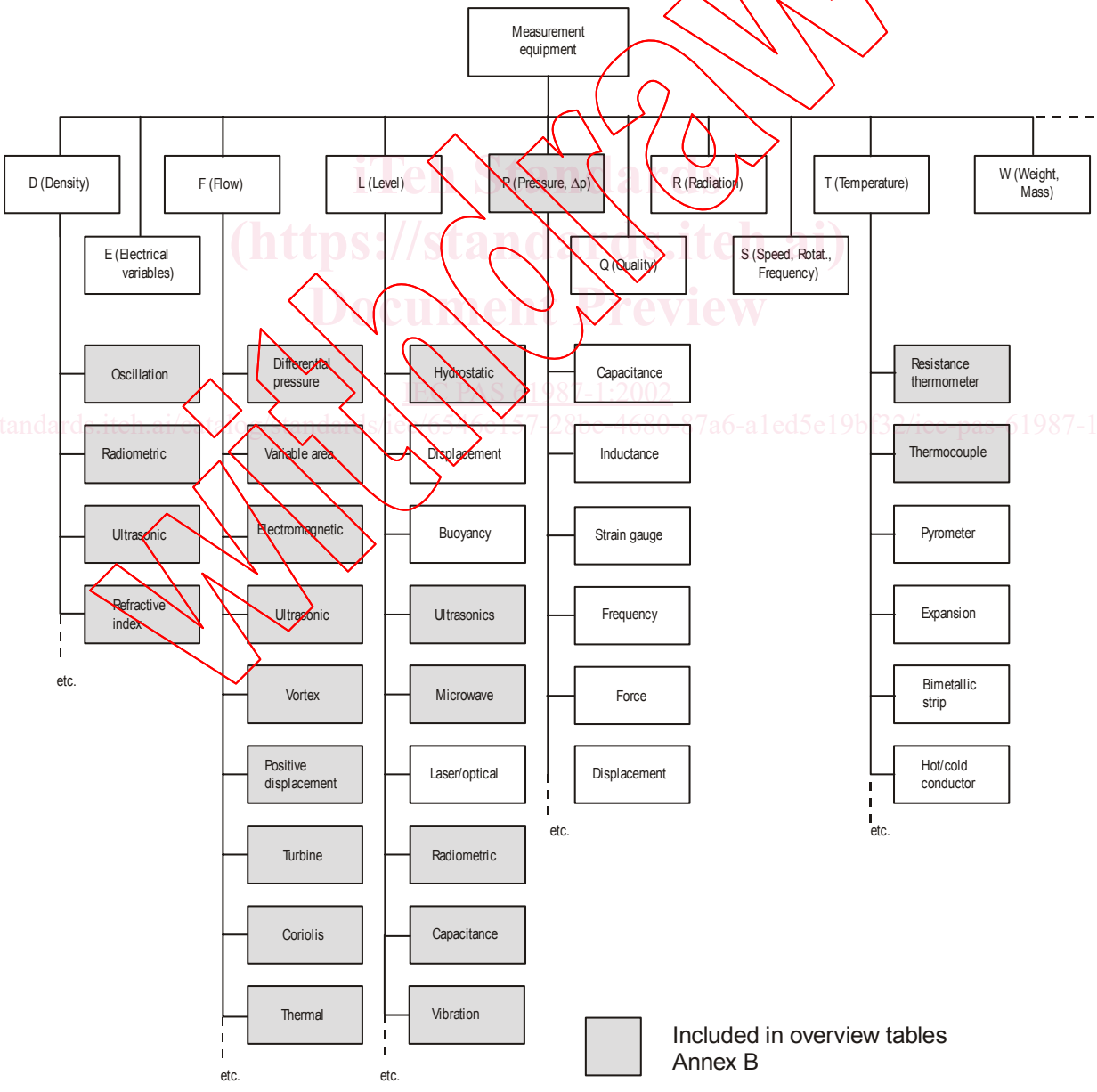

Figure 1 – Classification scheme for process measuring equipment

4.2 Determination of structure and elements

The chapters of the metadocument are to be structured for all process measuring equipment as follows:

1	Identification
2	Application
3	Function and System Design
4	Input
5	Output
6	Performance Characteristics
7	Operating Conditions
7.1	Installation
7.2	Environment
7.3	Process
8	Mechanical Construction
9	Operability
10	Power Supply
11	Certificates and Approvals
12	Ordering Information
13	Documentation

Fig. 2 – Chapter structure of the metadocument for process measuring equipment

Process measuring equipment may comprise one or more modules combined in different ways: e.g. for temperature it may comprise a sensor (thermocouple or resistance thermometer) and a temperature transmitter. Such modular measuring equipment can be described using the data structure for the corresponding equipment class, either for the equipment as a whole or for each separate module, according to the manufacturer's preference. The equipment architecture and the way in which the modules work together is always to be described under Chapter 3 of the metadocument, Function and System Design.

Data structures and elements (terms) common to all process measuring equipment are compiled in Clause 5 of this document. Document Type Definitions (DTD) necessary for electronic data exchange by SGML and computer supported processing of equipment documentation are to be found in Annex D.

The metadocument of the measuring equipment for particular measured variables is summarised in Table 1, Annex A. Annex B contains tables for the measurement methods which have so far been considered. The tables indicate general specifications to be made in all documents and particular specifications to be made for the different types of measurement equipment, i.e. for flow, level, pressure, temperature and density. Terms and definitions for specific measuring equipment and measurement methods are not the subject of this document, but are included in informative Annex B for completeness.

This document shall be used by the equipment manufacturer, in that he takes the metadocuments and organises the technical data for his measuring equipment under the structure and data elements (terms) defined for each chapter. The document may also contain photographs and drawings.

5 Metadocument for process measuring equipment

NOTE 1 At the start of each clause, e.g. 5.1, it is stated what information is expected to be entered at that point in the structure. The information itself is then entered under the appropriate data element. Where necessary, the vendor/manufacturer is free to specify additional, non-standard data elements at each point in the structure.

NOTE 2 For the preparation of metadata, see also IEC 82045, for the preparation of diagrams, tables and lists, see also IEC 61082.

NOTE 3 If no data element is specified for a part of the structure, the vendor/manufacturer is free to present his information as he likes under the structure heading, e.g. by the use of non-standard data elements.

NOTE 4 For SGML documents, information must be entered in each data element. If a data element does not
NOTE 5 Non-standard data elements within an SGML document cannot be searched for by name, but can be found indirectly under the structure heading.

5.1
identification
The information necessary for unambiguous identification of the measurement equipment shall be specified here. This information may be supplemented by illustrations, e.g. drawings or photographs.

5.1.1
document identification
The type, code number, and if appropriate, the revision number of the document.

5.1.2
date of issue
The date of issue of the document.

NOTE The vendor/manufacturer is encouraged to supplement this information with a "valid until" date.

5.1.3
product type
The type of product, e.g. capacitance level transmitter, differential pressure transmitter, Pt100 resistance thermometer, variable area flowmeter.

5.1.4
product name
The product name under which the measuring equipment is marketed and, where appropriate, its model number.

5.1.5
vendor/manufacturer
The name of the vendor/manufacturer responsible for the measurement equipment, optionally with address.

5.2
application
The applications for which the measurement equipment is designed, together with the reasons for its use shall be specified here.

5.3
function and system design
The means by which the physical quantity is acquired, processed and output as a signal by the measurement equipment shall be specified here. The measuring principle and the components comprising the measurement equipment shall be specified. Terms such as those

listed in IEC 60770-1 Annex A (transmitter, meter, indicator, switch, transducer and sensor) should be used. If appropriate, the signal processing including any diagnostic functions shall be described.

5.3.1
measuring principle
The principle used and the physical quantity measured in order to determine the measured variable.

5.3.2
equipment architecture
The components, devices, assemblies or systems used to perform the measuring activity.

Search terms: modularity

5.3.3
communication and data processing
The components, hardware and software for communication with external systems and execution of complex functions.

5.3.4
climate class
The climatic conditions, i.e. ambient temperature, pressure and humidity, to which the measuring equipment can be subjected during operation (including shutdown), transport and storage (over land or sea), e,g, as specified in IEC 60654-1.

5.3.4
dependability
Information on the dependability of the equipment as defined in IEC 61508. The scheme as per IEC 61069, Part 5 should be followed.

5.3.4.1
reliability
Where appropriate, the mean time between faults (MTBF), fault tolerance, internal redundancy etc. shall be entered here.

5.3.4.2
maintainability
Where appropriate, any special tools, the smallest replaceable units, any consumables required for the correct operation and maintenance of the equipment shall be entered here.

5.3.4.3
integrity
Where appropriate, any mechanism which ensures the integrity of the equipment output on the discovery of a fault shall be described here.

5.3.4.4
security
Where appropriate, any measures or conformance to recognised standards or regulatory guidelines regarding access authorisation to and protection of device data shall be entered here.

5.4
input
Information on the measured variable shall be entered here, i.e., the physical, physicochemical or chemical quantity, the size of which is to be acquired and indicated by the measurement.

5.4.1
measured variable
The variable(s) measured by the equipment.

For multi-sensor instruments, the various main measuring sensors and/or the auxiliary sensors, supporting the main sensor(s) shall be defined.

5.4.2
measuring range
The measuring range that the equipment has been designed to measure.

The measuring range is defined by a lower and an upper range-limit. Within this range, measurements are made within the accuracies specified in Clause 5.6.

In addition, depending upon the physical quantity being measured, adjustment ranges for the lower and upper range-limits or a turndown ratio may also be specified. These may be expressed as a percentage of the maximum span, as absolute values or as a ratio.

NOTE 1 The way in which the measuring range is expressed is a matter of convention and may differ according to the physical quantity measured and type of instrument.

NOTE 2 For some measurements, additional information on the physical starting point of the measuring range must be specified, e.g. for ultrasonic level measurement.

NOTE 3 The accuracies specified in Clause 5.6 must also apply after any permitted adjustments to the measuring range have been made, or the associated accuracies must be stated.

5.5
output
The information signal (output) after the processing of measured variable(s) shall be specified here. For analogue and digital equipment, the size of output signal indicates unequivocally the size of the measured variable.

Where the process measuring equipment has more than one output, all shall be described.

5.5.1
output signal
The type and characterising quantities of the output signal.

The output signal might be electrical, mechanical, hydraulic, pneumatic, optical, digital etc. It may be variable over a specified range or assume specific values only. If the output is configurable, the possible operating modes should be described.

If the output of a device, element or system is a foreign system interface, then the physical layer, transmission rate, transmission protocol and primary information parameters should also be specified.

EXAMPLE 1 — 4 mA - 20 mA analogue signal, configurable as binary signal 8/16 mA.

EXAMPLE 2 — Digital signal as floating point number to IEC 60754.

5.5.2
signal on alarm
The value(s) or status assumed by the output signal when there is a fault in the process measuring equipment.

5.5.3
load
The electrical, optical, pneumatic, hydraulic or mechanical load presented to the output of a device, element or system by the external devices connected to it.

5.6
performance characteristics
Specifications regarding e.g. the accuracy and dynamic behaviour of the measurement equipment under operating and reference conditions shall be made here.