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Part 1: Measuring equipment with analogue and digital output

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

Part 1: Measuring equipment with analogue and digital output

FOREWORD

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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- withdrawn,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

NOTE The rated operating condition generally specifies intervals of values for the quantity being measured and for any influence quantity.

[VIM 5.5]

3.39
reference conditions
condition of use prescribed for evaluating the performance of a measuring system or for comparison of measurement results

NOTE Reference conditions generally specify intervals of values for any influence quantity.

[VIM 5.7]

3.40
reliability
ability of an item to perform a required function under given conditions for a given time interval

[IEC 61069-5, 3.2]

3.41
response time (thermal)
time a thermometer takes to respond at a specified percentage to a step change in temperature

NOTE To specify response time it is necessary to declare

a) the percentage of response (usually 50 % or 90 %);

b) the test medium and the flow conditions (usually water with 0,4 m/s and air with 3 m/s).

[IEC 60751, 4.3.3]

3.42
rise time
for a step response, time interval between the instant when the output signal reaches a small specified percentage of the difference between the final and the initial steady- state vales and the instant when it reaches for the first time a large specified percentage of the same steady-state difference

NOTE Conventional values are 5 % to 95 % or 10 % to 90 %.

[IEC 61298-2, 3.17, modified]

3.43
security
assurance provided by a system that any incorrect input or unauthorized access is denied

[IEC 61069-5, 3.6]

3.44
settling time
duration of the time interval between the instant of a step change in one of the input variables and the instant when the output variable does not deviate by more than a specified tolerance (e.g. 5 %) from the difference between its final and initial steady-state values

NOTE 1 Conventional values for tolerance are ±2 % and ±5 %.

NOTE 2 For non-linear behaviour, both magnitude and position of the input variable should be specified.

[IEV 351-14-43]

3.45
shock
sudden non-periodic motion caused by a blow, impact, collision, concussion or violent shake or jar

NOTE There are two methods to measure shock:

a) the first is to specify a value of acceleration or deceleration together with its duration;

b) the second is to specify a height of free fall on to a specified flat surface.

3.46
signal
physical quantity, one or more parameters of which carry information about one or more variables which the signal represents

NOTE These parameters are called "information parameters".

[IEV 351-12-16]

3.47
span
algebraic difference between the values of the upper and lower limits of the measuring range [= VIM 5.2]

[IEV 311-03-13]

3.48
standardized signal
signal, the lower and upper range-values of which are standardized

Examples: 4 mA d.c. – 20 mA d.c.; 20 kPa – 100 kPa

3.49
start-up drift
drift in output monitored over a period of 4 h after power is switched on

[IEC 61298-2, 7.1]

3.50
storage and transportation conditions
specified conditions to which a device may be subject between the time of construction and the time of operation (see 3.20 and 3.21)

NOTE During storage and transportation, the device is inoperative and appropriately protected and/or packed to meet the specified condition limits so that the device will not be damaged or suffer a degradation of performance.

3.51
storage temperature
ambient temperature to which a device may be subject between the time of construction and the time of operation (see 3.1and 3.18)

3.52
type of protection
specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere by such apparatus

[IEV 426-01-02]

3.53
variation (due to an influence quantity)
difference between the indications of a measuring system for the same value of the quantity being measured when an influence quantity assumes, successively, two different values

[VIM 4.19]

3.54
vibration
periodic motion, reciprocating, rotary or both, usually with a well-defined fundamental frequency

NOTE A typical example is the vibration of rotating machinery.

3.55
warm-up time
duration between the instant after which the power supply is energized and the instant when the measuring instrument may be used, as specified by the manufacturer

[IEV 311-03-18]

3.56
zero adjustment
means provided in an instrument to cause a parallel shift in the input-output curve

[IEC 60770-1, 3.1]

4 Metadocuments

4.1 General

A metadocument is a document that describes how other documents for a particular purpose, in this case for the exchange of product catalogue data, are to be created and structured.

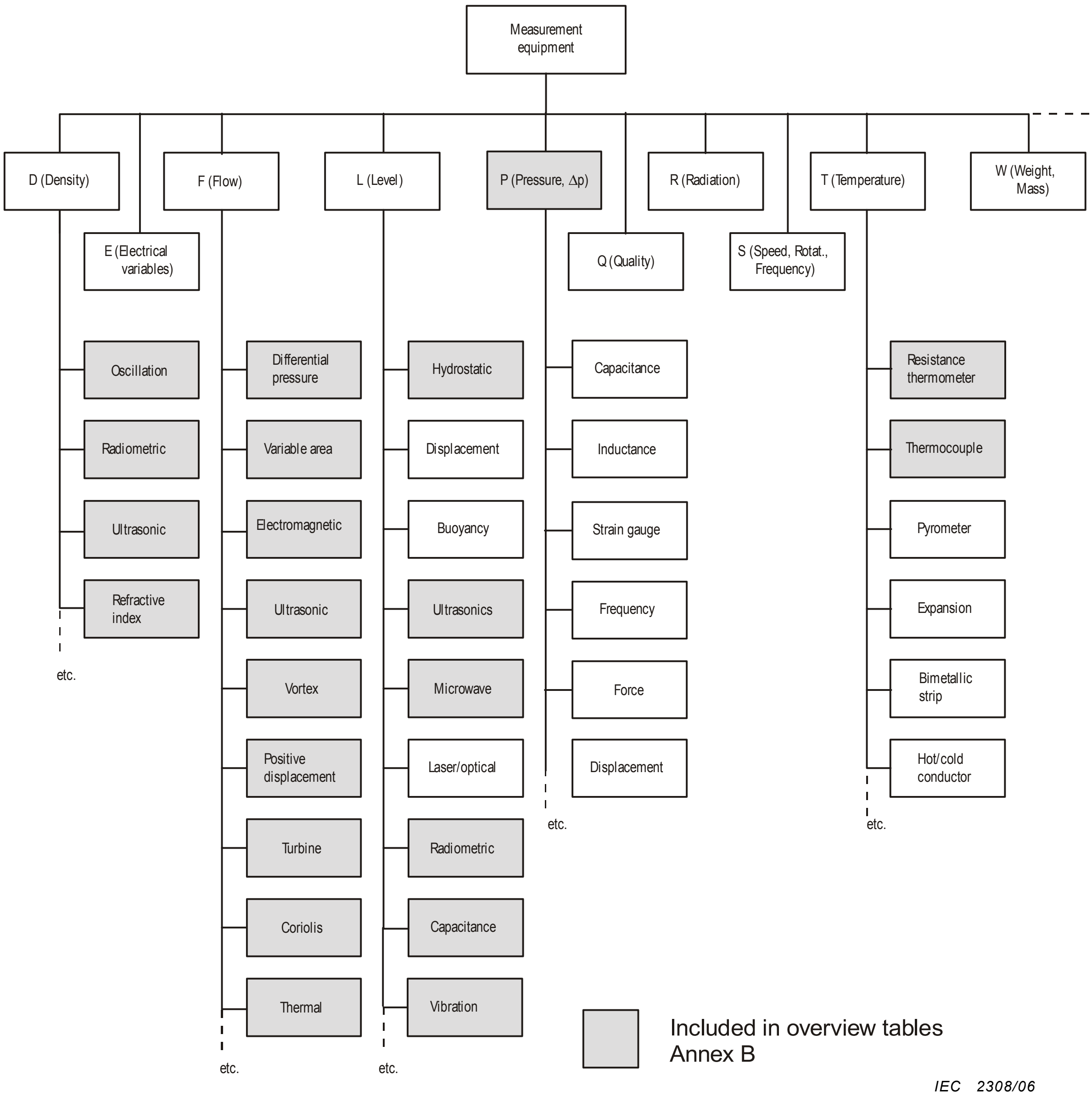
Metadocuments in this standard describe the non-proprietary structures (chapters) and product features (textual descriptions, tables, diagrams, photographs, or single properties) of a class of process measuring equipment. They serve as specimen and procedural instructions for the production of process 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 features common to all equipment at this hierarchical level. Metadocuments at lower hierarchical levels inherit the structure and features from the metadocuments at levels above them.

Figure 1 shows the classification scheme for process measuring equipment used in this standard. It is based on the table of letter codes for identification of instrument functions to be found in ISO 3511-1. Process measuring equipment may be further subdivided into continuous measuring equipment, the measurement value of which is expressed as a quantitative value through analogue or digital output, and limit detecting equipment, the measurement value of which is expressed as a binary-state signal. The metadocument defined in Clause 5 defines the common structures and features that are to be found at this level in the hierarchy.

Each piece of equipment is designed to measure one or more process variables, for example, level, pressure, flow, or temperature. To fully define the technical data of say, a flowmeter, additional features, for example, inlet and outlet run, shall be added to those 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 sensing the differential pressure produced across a primary element, a variable area flowmeter, an electromagnetic flowmeter, etc. Depending on the measuring method used, additional features can again be added to the structure to adequately characterize the equipment. Such additional features have already been defined for the measurement methods shaded grey in Figure 1 (see Annex B).



NOTE Letter codes D, F, L, etc. identifying the measuring equipment function are taken from ISO 3511-1.

Figure 1 – Classification scheme for process measuring equipment

4.2 Metadocument chapters and features

The metadocument shall 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

This standard shall be used by the equipment manufacturer, in that he takes the metadocuments and organizes the technical data for his measuring equipment under the structure and features defined for each chapter. The document may also contain photographs, drawings and tables.

NOTE 1 For the preparation of metadocument data, see also IEC 82045; for the preparation of diagrams, tables and lists, see also IEC 61082.

Features common to all process measuring equipment are compiled in Clause 5 of this standard. At the start of each subclause, for example 5.1, it is stated what information is expected to be entered at that point in the metadocument. The information itself is then entered under the appropriate feature. Where necessary, the vendor/manufacturer is free to specify additional, non-standard features at each point in the structure.

If no feature is specified for a part of the structure, the vendor/manufacturer is free to present his information as he likes under the structure heading, for example, by the use of non-standard features.

NOTE 2 The nomenclature adopted in the metadocument defined in Clause 5 is based on terms and concepts drawn from international standards.

NOTE 3 Clause 5 also includes so-called synonymous names. A synoymous name is a related designation or concept. It is intended for electronic searches only and should not be substituted for the preferred term.

NOTE 4 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.

The metadocument of the measuring equipment for particular measured variables is summarized in Table A.1.

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 standard but are included in Annex B for completeness.

4.2.1 Composite measuring equipment

Process measuring equipment may comprise one or more modules combined in different ways: for example, for temperature, it may comprise a sensing element (thermocouple or RTD) and a temperature transmitter. Such modular measuring equipment can be described using the features 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 shall always be described under Chapter 3 of the metadocument (function and system design).

4.2.2 Measuring equipment with fieldbus interface

Where measuring equipment offers digital communication by means of a fieldbus protocol, the corresponding features are to be described in Chapter 5 (output).

4.3 Nomenclature

The nomenclature adopted in the metadocument defined in Clause 5 is based on terms and concepts drawn from international standards.

The metadocument also includes so-called synonymous names. A synonymous name is a related designation or concept. It is intended for electronic searches only and should not be substituted for the preferred term.

Each term in the metadocument 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.

5 Metadocument for process measuring equipment

5.1 Identification

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

5.1.1 Document identification

Type, code number and version and, if appropriate, the revision number of the document.

5.1.2 Date of issue

Date of issue of the document in the form: year, month and, if appropriate, day.

NOTE The manufacturer is encouraged to supplement this information with a ”valid until” date.

5.1.3 Product type

Type of product, for example capacitance level transmitter, differential pressure transmitter, Pt100 resistance thermometer, variable area flowmeter (see also Figure 1).

5.1.4 Product name

Product name, under which the measuring equipment is marketed.

NOTE There is no conformity among manufacturers regarding the naming of their products. The name may comprise a product name, a product model number or a combination of both. If necessary, the manufacturer should add a separate feature for the product model number.

5.1.5 Manufacturer

Name of the manufacturer of the measurement equipment, optionally with address.

NOTE For OEM products, the vendor’s name should be entered here.

5.2 Application

The application, 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 method, 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 to measure a physical quantity in order to determine the value of a measured variable.

5.3.2 Equipment architecture

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

Synonymous name: modularity.

5.3.3 Communication and data processing

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

5.3.4 Dependability

Information on the dependability of the equipment as defined in IEC 61069. The scheme according to IEC 61069-5 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 recognized standards or regulatory guidelines regarding access authorization 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

Variable(s) measured by the equipment.

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

5.4.2 Measuring range

Range of values of the measured variable 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 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 the type of instrument.

NOTE 2 For some measurement methods, additional information on the physical starting point of the measuring range should be specified, for example, for ultrasonic level measurement.

NOTE 3 The accuracies specified in 5.6 should also apply after any permitted adjustments to the measuring range have been made; otherwise, the associated accuracies should 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 the 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

Type and characterizing 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 shall also be specified.

Examples:

4 mA – 20 mA analogue signal, configurable as binary signal 8/16 mA.

Digital signal as floating point number according to IEC 60559.

5.5.2 Signal on alarm

Value(s) or status assumed by the output signal when there is a fault in the process measuring equipment.

5.5.3 Load

For analogue outputs, 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 for example the accuracy and dynamic behaviour of the measurement equipment under operating and reference conditions shall be made here.

For measurement equipment with a span setting and analogue output, the performance characteristics concerning accuracy shall be expressed in relation to the span. If one value only is stated, it shall be applicable to all permitted span settings.

For digital output equipment, characteristics shall be expressed in relation to the reading or upper range-limit.

NOTE 1 For reference conditions, refer to IEC 61298-1.

NOTE 2 For details on performance testing and presentation of the results, see in particular IEC 61298 (all parts) and IEC 60770-1 as well as the test standards quoted in the normative references.

5.6.1 Maximum measured error

Maximum measured error, as determined for example by the method described in IEC 61298-2.

5.6.2 Hysteresis

Hysteresis, as determined, for example, by the method described in IEC 61298-2.

5.6.3 Non-repeatability

Non-repeatability, as determined, for example, by the method described in IEC 61298-2. Non-repeatability is synonymous with repeatability error.

NOTE 1 According to IEC 61298-2, the accuracy of the equipment is adequately expressed by the three quantities specified in 5.6.1, 5.6.2 and 5.6.3. If desired, the manufacturer may also express accuracy in terms of inaccuracy and hysteresis, or non-linearity/non-conformity, hysteresis and dead band. These alternatives are not included at this level of the structure.

NOTE 2 Standardized accuracy classes also exist for some types of process measuring equipment. These should be specified at a lower hierarchical level.

5.6.4 Start-up drift

Start-up drift as determined by, for example, the method described in IEC 61298-2.

5.6.5 Long-term drift

Long-term drift as determined by, for example, the method described in IEC 61298-2.

5.6.6 Influence of ambient temperature

Effect of temperature changes on the output signal as determined by, for example, the method described in IEC 61298-3.

NOTE IEC 61298-3 expresses the influence as the average error over the entire ambient temperature range. It may also be expressed as a percentage of span over a given temperature span.

5.6.7 Influence of medium temperature

The effect of changes in medium temperature on the output signal determined and expressed in a similar manner to the influence of ambient temperature (see 5.6.6).

Where appropriate, for equipment not in direct contact with the process medium, this information can be given in the form of a derating curve of ambient temperature versus process temperature.

5.6.8 Settling time

Settling time, as determined by for example the method described in IEC 61298-2.

Synonymous names: rise time; response time

5.7 Operating conditions

The conditions under which the measuring equipment can be operated within its specified accuracy limits and without permanent impairment of its operating characteristics shall be specified here. A distinction is made between normal operating conditions, operating limits and storage and transport conditions (see Annex C).

5.7.1 Installation

Installation conditions, in particular any special precautions necessary to obtain the specified performance of the measuring equipment, shall be specified here.

5.7.1.1 Climate class

General indication of the climatic conditions, to which the measuring equipment can be subjected during operation (including shutdown); for example, expressed by a location or climate class according to IEC 60654-1.

5.7.1.2 Installation instructions

Brief instructions and, if appropriate, warnings on the mounting of measuring equipment, so as to obtain the best performance from it. These might include orientation, cable length, inlet and outlet run (for flow), emitting angle (microwave and ultrasonics), etc.

5.7.1.3 Start-up conditions

Conditions to be upheld at the measuring point to ensure correct start-up of the measurement equipment. If special precautions shouldl be taken to avoid, for example, pressure or thermal overload, these should be stated.

5.7.1.4 Warm-up time

Time required after energizing the measuring equipment before its performance characteristics apply.

NOTE Although many modern instruments warm up in a matter of seconds, some systems take considerably longer, for example, radiometric level and density measurement or temperature measurement (where the warm-up time is dependent upon the response time of the complete temperature measuring device including the inset and thermowell).

5.7.2 Environment

The environmental conditions under which the measuring equipment can be stored and operated within its specified accuracy limits and without permanent impairment of its operating characteristics shall be specified here.

5.7.2.1 Ambient temperature range

The range of ambient temperatures, within which the measuring equipment is designed to operate within the specified accuracy limits.

Synonymous names: normal operating temperature, operating temperature, nominal temperature range, working temperature.

5.7.2.2 Ambient temperature limits

Extreme values of ambient temperature, to which the measuring equipment may be subjected during operation without permanent impairment of operating characteristics.

Synonymous names: limiting temperature range.

5.7.2.3 Storage temperature

Range of ambient temperatures within which the measuring equipment may be safely transported and stored.

Synonymous names: transportation temperature.

5.7.2.4 Relative humidity

Range of relative humidities within which the measuring equipment is designed to operate within the specified accuracy limits.

5.7.2.5 Immunity to temperature change

Ability of the measuring equipment to withstand given changes in ambient temperature.

NOTE IEC 60068-2-14 describes tests to simulate both sudden changes (Test Na) and gradual changes (Nb) in ambient temperature. The test(s) used, together with the conditions, should be presented in accordance with this standard.

Synonymous name: thermal cycling; temperature cycling, resistance to thermal shock

5.7.2.6 Shock resistance

Ability of the measuring equipment to withstand sudden mechanical loading without permanent impairment of operating characteristics, such that as described in IEC 61298-3.

5.7.2.7 Vibration resistance

Ability of the measuring equipment to withstand sinusoidal vibrations without permanent impairment of operating characteristics such as those described in IEC 61298-3.

5.7.2.8 Electromagnetic compatibility

Electromagnetic compatibility of the measuring equipment expressed as either the results of the individual tests, for example, those of the IEC 61000-4 series or conformance to a particular standard, for example, IEC 61326, which incorporates these tests.

Synonymous names: electromagnetic interference, electromagnetic immunity, RFI.

5.7.3 Process

The allowable process conditions under which the measurement equipment can be operated within its specified accuracy limits and/or without permanent impairment of its operating characteristics shall be specified here.

NOTE For the purposes of this standard, the term wetted-part refers not only to parts directly in contact with the process medium, but also to those parts of non-contact measuring equipment that intrude into the process vessel.

5.7.3.1 Process temperature range

Permissible range of temperatures for the wetted parts if the measuring equipment is to operate within the specified accuracy limits.

5.7.3.2 Process temperature limits

Extreme values of temperature, to which the wetted-parts of the measuring equipment may be subjected without permanent impairment of operating characteristics.

NOTE If higher temperatures are allowed for short periods, for example, for cleaning in process, then these, together with the permissible length of time, should be stated.

5.7.3.3 Process pressure range

Permissible range of pressures for the wetted parts, if the measuring equipment is to operate within specified accuracy limits.

5.7.3.4 Process pressure limits

Extreme values of pressure, to which the wetted parts of the measuring equipment may be subjected without permanent impairment of operating characteristics.

NOTE For temperature measurement, this is not a fixed value. The maximum pressure is dependent, for example, on the immersion depth of the thermometer, the process temperature, the viscosity of the medium and the flowrate. Guidelines for water and air are sufficient.

5.8 Mechanical construction

The mechanical construction of the measuring equipment shall be specified here. Details shall be given of all parts of direct relevance to its use, for example, process connections, seals, wetted parts, electrical connections, special cases (special materials, special versions) and accessories.

5.8.1 Design

Design of the measuring equipment with respect to the manner in which it is installed at the measuring point. For example, head transmitter or rail-mounted transmitter or 19" plug-in card; compact transmitter or separated transmitter, etc.

5.8.2 Dimensions

Principal dimensions of the measuring equipment.

NOTE 1 The dimensions should be expressed at least as "length x breadth x height" and, where appropriate, be supported by a dimensional drawing.

NOTE 2 The clearances required for the mounting of the instrument should also be indicated.

NOTE 3 Where several equipment versions are available, dimensions and weight may be presented together or under 5.8.5, process connection, as appropriate. A note to this effect should then be entered in 5.8.2 and 5.8.3.

5.8.3 Weight

Weight of the measuring equipment or its component parts.

5.8.4 Material

Materials used in the construction of the equipment, in particular for parts which come into contact with the process or the environment.

5.8.5 Electrical connection

Information regarding the provisions for the electrical connection(s) of the measuring equipment.

NOTE In addition to the degree and type of protection afforded by the device enclosure, this might include, for example, type of terminal, type of cable, cable cross-section, cable gland, galvanic isolation, etc. for both signal and power circuits.

5.8.5.1 Degree of protection

The degree of ingress protection of the enclosure expressed as an IP rating to IEC 60529 or other internationally recognized enclosure classification.

Synonymous names: ingress protection; enclosure classification

5.8.5.2 Type of protection

The type of protection offered by the enclosure against the ignition of a surrounding explosive atmosphere, for example EEx ia, Ex d.

5.8.6 Process connection

Where appropriate, the type of process connection(s) used by the measuring equipment, indicating nominal diameters, rated pressures and standards. See also Note 3 in 5.8.2.

5.9 Operability

Details of the design, operating concept, structure and functionality of the human interface shall be specified here. The operating elements, displays, foreign system interfaces (when allowing human operation), testing and configuration elements, for example, solder bridges, DIP-switches, re-ranging elements, handheld terminals, auxiliary stations shall be described here.

NOTE The operability of a device can be assessed and documented as described in IEC 61069-6 (1998).

5.10 Power supply

The permanent or temporary power to be supplied to the measurement equipment in order to maintain its function, which cannot be taken from the input signal, together with the permissible tolerances for the power supply, shall be specified here.

Examples:

Electrical power supply:

Voltage
Frequency
Harmonic distortion level (for a.c. supply)
Residual ripple (for d.c. supply)

Power consumption

Pneumatic power supply:

Pressure
Oil and dust content
Dew point of air supply

Air consumption

Hydraulic power supply

5.11 Certificates and approvals

Certificates, approvals and other formal documentation concerning the measurement equipment shall be specified here, for example, legal requirements, regulations, technical guidelines, approvals and test certificates.

Examples are electrical area classification, marine approvals, sanitary approvals, CE mark, etc.

5.12 Ordering information

The information required for the procurement of the measurement equipment shall be specified here. Normally, the information is summarized in the form of an ordering table. Details of the equipment type, software and firmware version as well as the order number should be given.

5.13 Documentation

A bibliography of documentation relevant to the measuring equipment shall be specified here, for example, operating manuals, specifications of components and auxiliary equipment, etc.

Annex A
(normative)

Classification of features as a function of measuring equipment

Table A.1 shows how the document structure defined in Clause 5 for measuring equipment in general applies to equipment designed to measure a particular process variable.

A shaded cell indicates that the feature defined for measuring equipment also applies to the measurement principle concerned.

A hatched cell indicates that the feature defined for measuring equipment is dependent upon output or equipment construction.

Table A.1 – Classification and documentation structure of measuring equipment.

	Measuring equipment	Flow	Level	Pressure	Temperature	Density
1 Identification						
Document identification						
Date of issue						
Product type						
Product name						
Vendor/Manufacturer						
2 Application						
3 Function and system design						
Measuring principle						
Equipment architecture						
Communication and data processing						
Dependability						
Reliability						
Maintainability						
Integrity						
Security						
4 Input						
Measured variable						
Measuring range						
5 Output						
Output signal						
Signal on alarm						
Load						
6 Performance characteristics						
Maximum measured error						
Hysteresis						
Non-repeatability						
Start-up drift						
Long-term drift						
Influence of ambient temperature						
Influence of medium temperature						
Settling time						

	Measuring equipment	Flow	Level	Pressure	Temperature	Density
7 Operating conditions						
7.1 Installation						
Climate class						
Installation instructions						
Start-up conditions						
Warm-up time						
7.2 Environment						
Ambient temperature range						
Ambient temperature limits						
Storage temperature						
Relative humidity						
Immunity to temperature change						
Shock resistance						
Vibration resistance						
Electromagnetic compatibility						
7.3 Process						
Process temperature range						
Process temperature limits						
Process pressure range						
Process pressure limits						
8 Mechanical construction						
Design						
Dimensions (length x breadth x height)						
Weight						
Material						
Electrical connection						
Degree of protection						
Type of protection						
Process connection						
9 Operability						
10 Power supply						
11 Certificates and approvals						
12 Ordering information						
13 Documentation						

For analogue signals only
Depending on equipment construction

Annex B
(informative)

Classification of features as a function of measurement principle

B.1 Additional features proposed for flow measurement principles

B.1.1 Overview

Table B.1 indicates the additional features for flow measurement devices. Each measurement principle considered to date is assigned to a column. The document structure and features are assigned to the rows.

Properties inherited from the process equipment level are indicated by a shaded cell in the column “Flow equipment”. This property applies to all flow measurement principles.

Properties that have not been inherited are indicated by a white cell in the column “Flow equipment”. The measurement principles to which they apply are indicated by a shaded cell in the appropriate measurement principle column.

Hatched cells indicate a dependency that is explained at the bottom of the table.

The table is followed by a list of features that have been added to those inherited from the measuring equipment level together with instructions on what to enter at this point.

Table B.1 – Classification and documentation structure of flow measuring equipment

	Inherited features for all flow equipment	Variable area	Electromagnetic	Ultrasonic	Vortex	Turbine	Coriolis	Thermal	Positive displacement	Differential pressure
1 Identification										
Document identification	■									
Date of issue	■									
Product type	■									
Product name	■									
Vendor/Manufacturer	■									
2 Application	■									
3 Function and system design										
Measuring principle	■									
Equipment architecture	■									
Communication and data processing	■									
Dependability	■									
Reliability	■									
Maintainability	■									
Integrity	■									
Security	■									
4 Input										
Measured variable	■									
Measuring range	■									
5 Output										
Output signal	■									
Signal on alarm	■									
Load	▨									
Signal resolution					■	■			■	
Low-flow cut-off		■	■	■		■	■	■	■	■
6 Performance characteristics										
Maximum measured error	■									
Hysteresis	■									
Non-repeatability	■									
Start-up drift	■									
Long-term drift	■									
Influence of ambient temperature	■									
Influence of medium temperature	■									
Influence of Reynolds number					■	■	■	■		
Influence of medium pressure			■							■
Settling time	■									

	Inherited features for all flow equipment	Variable area	Electromagnetic	Ultrasonic	Vortex	Turbine	Coriolis	Thermal	Positive displacement	Differential pressure
7 Operating conditions										
7.1 Installation										
Climate class	■									
Installation instructions	■									
Start-up conditions	■									
Warm-up time	■									
Inlet and outlet run		■	■	■	■	■	■	■	■	■
Cable length		■	■	■	■	■	■	■	■	■
7.2 Environment										
Ambient temperature range	■									
Ambient temperature limits	■									
Storage temperature	■									
Relative humidity	■									
Immunity to temperature change	■									
Shock resistance	■									
Vibration resistance	■									
Electromagnetic compatibility	■									
7.3 Process										
Process temperature range	■									
Process temperature limits	■									
Process pressure range	■									
Process pressure limits	■									
State of aggregation		■								
Density		■								
Viscosity		■								
Conductivity			■							
Reynolds number				■	■					
Gas content			■	■			■			
Limiting flow					■	■			■	■
Pressure loss		■	■	■	■	■	■	■	■	■
Downstream pressure		■			■	■	■			
8 Mechanical construction										
Design	■									
Dimensions (length x breadth x height)	■									
Weight	■									
Material	■									
Electrical connection	■									
Degree of protection	■									
Type of protection	■									
Field coil isolation class			■							
Process connection	■									
9 Operability	■									
10 Power supply	■									
11 Certificates and approvals	■									
12 Ordering information	■									
13 Documentation	■									

For analogue signals only

B.1.2 Output

B.1.2.1 Signal resolution

Resolution of the output signal.

B.1.2.2 Low flow cut-off

Section of the measurement range, starting at the lower range value, where the output signal will be equal to the lower range value (zero).

B.1.3 Performance characteristics

B.1.3.1 Influence of Reynolds number

Change in the lower range value (zero) and/or span caused by a change in the Reynolds number of the flow.

B.1.3.2 Rise time

Rise time for 10 % to 90 % as defined in IEC 61298-2.

B.1.3.3 Influence of medium pressure

Change in lower range value (zero) and/or span caused by a change in the static pressure of the fluid.

B.1.4 Installation

B.1.4.1 Inlet and outlet run

Portion of the conduit upstream and downstream of the primary, whose axis is straight and in which the cross-sectional area and shape are constant.

B.1.4.2 Cable length

Maximum length of the electrical cable between the primary and secondary device.

B.1.5 Process

B.1.5.1 State of aggregation

Permissible state of aggregation of the fluid (for example, liquid, gas, steam).

B.1.5.2 Density

Range of the density of the medium, within which a device will operate within specified accuracy limits.

B.1.5.3 Viscosity

Range of the viscosity of the medium, within which a device will operate within specified accuracy limits.

B.1.5.4 Conductivity

Minimum conductivity of the medium, above which a device will operate within specified accuracy limits.

B.1.5.5 Reynolds number

Range of the Reynolds number of the flow, within which a device will operate within specified accuracy limits.

B.1.5.6 Gas content

Maximum gas content of a liquid, below which a device will operate within specified accuracy limits.

B.1.5.7 Limiting flow

Maximum flowrate of the flowmeter, below which no damage to the primary device is to be expected**.**

B.1.5.8 Pressure loss

Irrecoverable pressure loss caused by the presence of a primary device in the conduit

B.1.5.9 Downstream pressure

Minimum downstream static pressure, above which no damage to the primary device must be expected (cavitation).

B.1.6 Mechanical construction

B.1.6.1 Field coil isolation class

Isolation class of the field coils of the primary device.

B.2 Additional features proposed for level measurement principles

B.2.1 Overview

Table B.2 indicates the additional features for flow measurement devices. Each measurement principle considered to date is assigned to a column. The document structure and features are assigned to the rows.

Properties inherited from the process equipment level are indicated by a shaded cell in the column "Level equipment". This property applies to all level measurement principles.

Properties that have not been inherited are indicated by a white cell in the column "Level equipment". The measurement principles to which they apply are indicated by a shaded cell in the appropriate measurement principle column.

Hatched cells indicate a dependency that is explained at the bottom of the table.

The table is followed by a list of features that have been added to those inherited from the measuring equipment level together with instructions on what to enter at this point.

Table B.2 – Classification and documentation structure of level measuring equipment

		Inherited features for all level equipment	Hydrostatic	Ultrasonic	Microwave/radar	Capacitance	Radiometric	Vibration
1	**Identification**							
	Document identification							
	Date of issue							
	Product type							
	Product name							
	Vendor/Manufacturer							
2	**Application**							
3	**Function and system design**							
	Measuring principle							
	Equipment architecture							
	Communication and data processing							
	Dependability							
	Reliability							
	Maintainability							
	Integrity							
	Security							
4	**Input**							
	Measured variable							
	Measuring range							
	Blocking distance							
	Operating frequency							
5	**Output**							
	Output signal							
	Signal on alarm							
	Load							
	Signal resolution							
6	**Performance characteristics**							
	Maximum measured error							
	Hysteresis							
	Non-repeatability							
	Start-up drift							
	Long-term drift							
	Influence of ambient temperature							
	Influence of medium temperature							
	Settling time							

	Inherited features for all level equipment	Hydrostatic	Ultrasonic	Microwave/radar	Capacitance	Radiometric	Vibration
7 Operating conditions							
7.1 Installation							
Climate class	■						
Installation instructions	■						
Start-up conditions	■						
Warm-up time	■						
Emission angle			■	■		■	
7.2 Environment							
Ambient temperature range	■						
Ambient temperature limits	■						
Storage temperature	■						
Relative humidity	■						
Immunity to temperature change	■						
Shock resistance	■						
Vibration resistance	■						
Electromagnetic compatibility	■						
7.3 Process							
Process temperature range	■						
Process temperature limits	■						
Thermal shock resistance		■					
Process pressure range	■						
Process pressure limits	■						
Viscosity			▨				■
Conductivity				▨			
Dielectric constant				■	■		
8 Mechanical construction							
Design	■						
Dimensions (length x breadth x height)	■						
Weight	■						
Material	■						
Electrical connection	■						
Degree of protection	■						
Type of protection	■						
Field coil isolation class			■				
Process connection	■						
9 Operability	■						
10 Power supply	■						
11 Certificates and approvals	■						
12 Ordering information	■						
13 Documentation	■						

For analogue signals only
▨ **Depending on mode of operation**

B.2.2 Input

B.2.3 Blocking distance

Distance immediately below an ultrasonic or radar sensor, within which measurements are technically impossible.

B.2.3.1 Operating frequency

Frequency at which the measuring equipment operates.

B.2.4 Output

B.2.4.1 Signal resolution

Resolution of the output signal.

B.2.5 Performance characteristics

B.2.5.1 Influence of medium pressure

Change in the lower range value (zero) and/or span caused by a change in the static pressure of the fluid.

B.2.6 Installation

B.2.6.1 Emitting angle

Solid angle at which radiation is emitted from the source of radiation.

B.2.7 Process

B.2.7.1 Thermal shock resistance

Ability of the measuring equipment to withstand an abrupt change in process medium temperature.

NOTE Test Nc of IEC 60068-2-14 simulates sudden changes in process medium temperature. The test conditions should be presented in accordance with this standard.

B.2.7.2 Viscosity

Range of the viscosity of the medium, within which a device will operate within specified accuracy limits.

B.2.7.3 Conductivity

Minimum conductivity of the medium, above which a device will operate within specified accuracy limits.

B.2.7.4 Dielectric constant

Range of the dielectric constant of the medium, within which a device will operate within specified accuracy limits.

B.3 Additional features proposed for pressure measurement principles

B.3.1 Overview

Table B.3 indicates the additional features for flow measurement devices. Each measurement principle considered to date is assigned to a column. The document structure and features are assigned to the rows.

Properties inherited from the process equipment level are indicated by a shaded cell in the column “Pressure equipment”. This property applies to all pressure measurement principles.

Properties that have not been inherited are indicated by a white cell in the column “Pressure equipment”. The measurement principles to which they apply are indicated by a shaded cell in the appropriate measurement principle column.

Hatched cells indicate a dependency that is explained at the bottom of the table.

The table is followed by a list of features that have been added to those inherited from the measuring equipment level together with instructions on what to enter at this point.

Table B.3 – Classification and documentation structure of pressure measuring equipment

		Inherited features for all pressure equipment	Relative/absolute	Differential
1	**Identification**			
	Document identification	■		
	Date of issue	■		
	Product type	■		
	Product name	■		
	Vendor/Manufacturer	■		
2	**Application**	■		
3	**Function and system design**			
	Measuring principle	■		
	Measurement type		■	■
	Equipment architecture	■		
	Communication and data processing	■		
	Dependability	■		
	Reliability	■		
	Maintainability	■		
	Integrity	■		
	Security	■		
4	**Input**			
	Measured variable	■		
	Measuring range	■		
	Maximum span		■	■
	Turndown ratio		■	■
5	**Output**			
	Output signal	■		
	Signal on alarm	■		
	Signal on overload		■	■
	Load	▧		
	Output damping	■		
6	**Performance characteristics**			
	Maximum measured error	■		
	Accuracy		■	■
	Dead time		■	■
	Rise time		■	■
	Step response time		■	■
	Time constant		■	■
	Hysteresis	■		
	Non-repeatability	■		
	Start-up drift	■		
	Long-term drift	■		
	Influence of ambient temperature	■		
	Influence of medium temperature	■	▨	▨
	Influence of medium pressure			■
	Influence of mounting position		■	■
	Influence of supply voltage		■	■
	Influence of load		▧	▧
	Settling time	■		

	Inherited features for all pressure equipment	Relative/absolute	Differential
7 Operating conditions			
7.1 Installation			
Climate class			
Installation instructions			
Start-up conditions			
Warm-up time			
Emission angle			
7.2 Environment			
Ambient temperature range			
Ambient temperature limits			
Storage temperature			
Relative humidity			
Immunity to temperature change			
Shock resistance			
Vibration resistance			
Electromagnetic compatibility			
7.3 Process			
Process temperature range			
Process temperature limits			
Thermal shock resistance			
Process pressure range			
Static pressure range			
Process pressure limits			
Static pressure limits			
Overpressure limits			
8 Mechanical construction			
Design			
Proof pressure			
Burst pressure			
Dimensions (length x breadth x height)			
Weight			
Material			
Sensor fill fluid			
Diaphragm material			
Electrical connection			
Degree of protection			
Type of protection			
Process connection			
9 Operability			
10 Power supply			
11 Certificates and approvals			
12 Ordering information			
13 Documentation			

For analogue signals only
Depending on process connection

B.3.2 Function and system design

B.3.2.1 Measurement type

Type of measurement performed by the measuring equipment, defined as differential, gauge (relative) and absolute.

B.3.3 Input

B.3.3.1 Maximum span

Maximum span of the transmitter, specified as a value with associated unit.

NOTE The maximum span defines the maximum calibration range, whereby the calibration range is defined by a lower range-value (LRV) and upper range-value (URV). Neither of the two values URV and LRV may exceed the lower range-limit (LRL) and/or upper range-limit (URV) specified by the measuring range.

In this case, the maximum span might be considered as the normal value and other possible larger spans might be allowed but as extended values (see examples). The maximum span could be used to define the reference calibration range.

Examples

– Differential pressure transmitter

Max. span: 1 000 kPa
Reference range: 0 bar to 1 000 kPa
Extended span: 2 000 kPa (range ±1 000 kPa)

– Gauge pressure transmitter

Max. span: 1 000 kPa
Reference range: 0 bar to 1 000 kPa
Extended span: 1 100 kPa (range: –100 kPa to 1 000 kPa)
with the lower range limit at 15 Pa abs

– Absolute pressure transmitter

Max. span: 1 000 kPa abs
Reference range: 0 kPa abs to 900 kPa abs
Extended range: not applicable
with the lower range limit at 0,1 Pa abs

B.3.3.2 Turndown ratio

Turndown is the ratio of the max span to the calibrated span.

The turndown (TD) can be specified as

- reference value;
- normal range;
- extended value range(s).

If no other limitation is implied, the TD values define all permitted calibrations of the transmitter, always considering that for any range the URV and LRV shall not exceed URL and/or LRL.

The TD may be adjusted continuously or in discrete steps. In this case, the step changes should be specified.

Example:	Differential pressure transmitter
Reference TD:	1
Normal range:	1 to 10
Extended range:	0,5 to 1; 10 to 30

B.3.4 Output

B.3.4.1 Signal on overload (overrange)

Value assumed by the output signal when the input pressure exceeds the upper and lower range-limits of the transmitter.

B.3.4.2 Output damping

Range of time parameters, in seconds, which can be set to influence the output response to a sudden change in input value (63,2 % of final steady-state value).

B.3.5 Performance characteristics

B.3.5.1 Accuracy (inaccuracy)

Inaccuracy as defined in IEC 61298-2, i.e. including the errors of non-linearity, non-repeatability and hysteresis.

NOTE If the accuracy is stated in this manner, then ”see accuracy“ can be entered under ”Max. measured error“

B.3.5.2 Dead time

Dead time as defined in IEC 61298-2.

B.3.5.3 Rise time

Rise time for 10 % to 90 % as defined in IEC 61298-2.

B.3.5.4 Step response time

Step response time as defined in IEC 61298-2.

B.3.5.5 Time constant

Time constant as defined in IEC 61298-2.

B.3.5.6 Influence of medium pressure

Change in lower range value (zero) and/or span caused by a change of the static pressure of the fluid.

B.3.5.7 Influence of mounting position

Effect of change in mounting position on the measurement as defined for example in IEC 61298-3.

B.3.5.8 Influence of supply voltage

Effect of a change in supply voltage on the measurement as defined for example in IEC 61298-3.

B.3.5.9 Influence of load

For devices with analogue output signal, effect of a change in output load on the measurement as defined for example in IEC 61298-3.

B.3.6 Operating conditions/process

B.3.6.1 Static pressure range

Range of static pressures, within which a differential pressure transmitter is designed to operate within its specified accuracy limits.

B.3.6.2 Static pressure limits

Extreme values of static pressure to which a differential pressure transmitter may be subjected, without permanent impairment of operating characteristics.

B.3.6.3 Overpressure limits

Peak pressure to which a pressure transmitter may be subjected, without permanent impairment of operating characteristics.

B.3.7 Mechanical construction

B.3.7.1 Proof pressure

Design pressure applied to the transmitter to verify structural integrity. No deformation or leakage is permitted at this pressure and the transmitter should function normally subsequent to this test. The exact testing conditions should be stated.

B.3.7.2 Burst pressure

Design test pressure that allows for permanent deformation and leakage, but parts should remain assembled.

B.3.7.3 Sensor fill fluid

Fill fluid used to transmit the process pressure, working on the diaphragm, to the measuring sensor.

B.3.7.4 Diaphragm material

Material of the separation element, between the process fluid and fill fluid.

B.4 Additional features proposed for temperature measurement principles

B.4.1 Overview

Table B.4 indicates the additional features for flow measurement devices. Each measurement principle considered to date is assigned to a column. The document structure and features are assigned to the rows.

Properties inherited from the process equipment level are indicated by a shaded cell in the column “Flow equipment”. This property applies to all temperature measurement principles.

Properties that have not been inherited are indicated by a white cell in the column “Temperature equipment”. The measurement principles to which they apply are indicated by a shaded cell in the appropriate measurement principle column.

Hatched cells indicate a dependency that is explained at the bottom of the table.

The table is followed by a list of features that have been added to those inherited from the measuring equipment level together with instructions on what to enter at this point.

Table B.4 – Classification and documentation structure of temperature measuring equipment

	Inherited features for all temperature equipment	RTD	Thermocouple
1 Identification			
Document identification			
Date of issue			
Product type			
Product name			
Vendor/Manufacturer			
2 Application			
3 Function and system design			
Measuring principle			
Equipment architecture			
Communication and data processing			
Dependability			
Reliability			
Maintainability			
Integrity			
Security			
4 Input			
Measured variable			
Measuring range			
Sensor type			
Sensor connection			
Insulation resistance			
5 Output			
Output signal			
Signal on alarm			
Load			
Linearisation			
6 Performance characteristics			
Maximum measured error			
Hysteresis			
Non-repeatability			
Start-up drift			
Long-term drift			
Influence of ambient temperature			
Influence of medium temperature			
Settling time			
Rise time			
Thermal response time			

	Inherited features for all temperature equipment	RTD	Thermocouple
7 Operating conditions			
7.1 Installation			
Climate class			
Installation instructions			
Start-up conditions			
Warm-up time			
Emission angle			
7.2 Environment			
Ambient temperature range			
Ambient temperature limits			
Storage temperature			
Relative humidity			
Immunity to temperature change			
Shock resistance			
Vibration resistance			
Electromagnetic compatibility			
7.3 Process			
Process temperature range			
Process temperature limits			
Process pressure range			
Process pressure limits			
8 Mechanical construction			
Design			
Dimensions (length x breadth x height)			
Weight			
Material			
Electrical connection			
Degree of protection			
Type of protection			
Process connection			
9 Operability			
10 Power supply			
11 Certificates and approvals			
12 Ordering information			
13 Documentation			

For analogue signals only

B.4.2 Input

B.4.2.1 Sensor type

Type of resistance temperature detector according to IEC 60751 or thermocouple according to IEC 60584.

B.4.2.2 Sensor connection

Type of sensor connection, for example 2-wire, 3-wire or 4-wire for RTD or jack-plug, etc. for thermocouple.

B.4.2.3 Insulation resistance

Resistance value measured between all parts of the electric circuit and the sheath at ambient or elevated temperatures and with a specified measuring voltage.

B.4.3 Output

B.4.3.1 Linearization

Means used to linearize the input of a resistance temperature detector or thermocouple to obtain a linear temperature (or temperature-proportional electrical) output.

B.4.4 Performance characteristics

B.4.4.1 Rise time

Rise time for 10 % to 90 % as defined in IEC 61298-2.

B.4.4.2 Thermal response time

Thermal response time, $t_{05,}$ in flowing water with a flowrate of 0,4 m/s and in flowing air with a flowrate of 3 m/s.

B.5 Additional features proposed for density measurement principles

B.5.1 Overview

Table B.5 indicates the additional features for density measurement devices. Each measurement principle considered to date is assigned to a column. The document structure and features are assigned to the rows.

Properties inherited from the process equipment level are indicated by a shaded cell in the column “Density equipment”. This property applies to all density measurement principles.

Properties that have not been inherited are indicated by a white cell in the column “Density equipment”. The measurement principles to which they apply are indicated by a shaded cell in the appropriate measurement principle column.

Hatched cells indicate a dependency that is explained at the bottom of the table.

The table is followed by a list of features that have been added to those inherited from the measuring equipment level together with instructions on what to enter at this point.

Table B.5 – Classification and documentation structure of temperature measuring equipment

	Inherited features for all density equipment	Oscillation	Radiometric	Ultrasonic	Refractive index
1 Identification					
Document identification					
Date of issue					
Product type					
Product name					
Vendor/Manufacturer					
2 Application					
3 Function and system design					
Measuring principle					
Equipment architecture					
Communication and data processing					
Dependability					
Reliability					
Maintainability					
Integrity					
Security					
4 Input					
Measured variable					
Measuring range					
5 Output					
Output signal					
Signal on alarm					
Load					
6 Performance characteristics					
Maximum measured error					
Hysteresis					
Non-repeatability					
Start-up drift					
Long-term drift					
Influence of ambient temperature					
Influence of medium temperature					
Influence of medium pressure					
Settling time					

	Inherited features for all density equipment	Oscillation	Radiometric	Ultrasonic	Refractive index
7 Operating conditions					
7.1 Installation					
Climate class					
Installation instructions					
Start-up conditions					
Warm-up time					
Cable length					
7.2 Environment					
Ambient temperature range					
Ambient temperature limits					
Storage temperature					
Relative humidity					
Immunity to temperature change					
Shock resistance					
Vibration resistance					
Electromagnetic compatibility					
7.3 Process					
Process temperature range					
Process temperature limits					
Process pressure range					
Process pressure limits					
State of aggregation					
Density					
Viscocity					
Gas content					
8 Mechanical construction					
Design					
Dimensions (length x breadth x height)					
Weight					
Material					
Electrical connection					
Degree of protection					
Type of protection					
Process connection					
9 Operability					
10 Power supply					
11 Certificates and approvals					
12 Ordering information					
13 Documentation					

For analogue signals only

B.5.2 Performance characteristics

B.5.2.1 Influence of medium pressure

Change in lower range value (zero) and/or span caused by a change of the static pressure of the fluid.

B.5.3 Installation conditions

B.5.3.1 Cable length

The maximal length of the electrical cable between the primary and secondary device.

B.5.4 Process conditions

B.5.4.1 State of aggregation

Permissible state of aggregation of the fluid (for example liquid, gas, steam).

B.5.4.2 Density

Range of the density of the medium, within which a device will operate within specified accuracy limits

B.5.4.3 Viscosity

The range of the viscosity of the medium, within which a device will operate within specified accuracy limits.

B.5.4.4 Gas content

Maximum gas content of a liquid, below which a device will operate within specified accuracy limits.

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VIM International Vocabulary of Basic and General Terms in Metrology

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