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2CD of IEC 61346-2: Structuring principles and reference designation, Part 2: Classification of objects and codes for classes

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The 2CD is planned to be officially circulated together with the 1CD of IEC 61346-3 in the end of 1997.

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Structuring principles and reference designation

Part 2: Classification of objects and codes for classes

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL SYSTEMS, INSTALLATIONS AND EQUIPMENT AND INDUSTRIAL PRODUCTS – STRUCTURING PRINCIPLES AND REFERENCE DESIGNATIONS –

Part 2: Classification of objects and codes for classes

Foreword

This draft of International Standard IEC 61346-2 has been prepared by subcommittee 3B: Documentation, of IEC technical committee 3: Documentation and graphical symbols, and ISO technical committee 10: Technical drawings, product definitions and related documentation.

IEC 61346 consists of the following parts under the general title: Structuring principles and reference designations:

- Part 1: Basic rules
- Part 2: Classification of objects and codes for classes
- Part 3: Application guidelines (under consideration)
- Part 4: Discussion of some concepts used in the reference designation system (technical report)

Introduction (to this draft)

IEC 61346-2 is based on the basic requirements published as 3B(Secretariat)123 within IEC and TC10 N575 within ISO, and the comments received and published as 3B(Secretariat)140. The revised basic requirements are presented in the informative annex A.

The first draft was distributed as 3B/195/CD within IEC and as TC10, N655 within ISO. Comments were received and distributed as 3B/213/CC.

Annex B (informative) illustrates, how objects may be classified according to their purpose related to a process.

Annex C shows an excerpt of the table from ISO / DIS 14617-6. In the first draft a new classification scheme was presented using to a great extent the same letter codes as in the ISO draft. This led to some confusion. The working group decided, to delete that table and refer to the ISO-document although it shows no classification scheme but qualifying symbols. This may lead to unsufficient covering of the needs in some fields of application. Especially electric variables are represented by one letter only. It was however seen that in most cases the variables will only be dealt with as technical attributes or also as part of the graphical symbol.

The aim of IEC 61346-2 is to establish classification schemes for objects which can be applied throughout all technical areas. Therefore existing letter codes, like those from the former IEC 750 (see IEC 61346-1, annex E), have been included unless they interfere with a generic approach. It was however tried to find a solution which will cause as few changes as possible.

INDUSTRIAL SYSTEMS, INSTALLATIONS AND EQUIPMENT AND INDUSTRIAL PRODUCTS – STRUCTURING PRINCIPLES AND REFERENCE DESIGNATIONS –

Part 2: Classification of objects and codes for classes

1 Scope

This part of IEC 61346 establishes object classes and associated letter codes for these classes. The letter codes are intended to be used in reference designations.

The classification schemes are applicable for objects in all technical areas and may be applied at any level in a hierarchical structure set up in accordance with IEC 61346-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61346. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61346 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 61346-1 : 1996,	Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules
ISO/DIS 14617-6,	Graphical symbols for diagrams – Part 6: Measurement and control functions

3 Definitions

For the purpose of this part of IEC 61346, the definitions given in part 1 apply.

4 Classification principle

The principle of classification of objects is based on viewing each object as being part of a process with input and output (see figure 1).

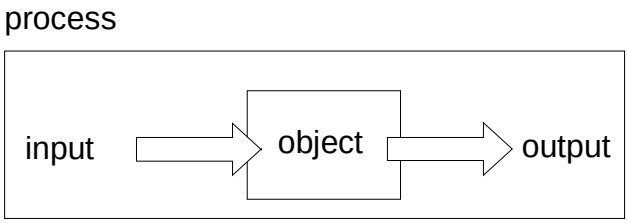


Figure 1 – The basic process concept

Each object being part of a process can be characterized by the purpose or task with respect to its input and output. This implies that it is of no importance how the object is built-up internally. Purpose and task are the main characteristics for establishing a classification scheme in this International Standard. (See also annex B.)

5 Classification of objects according to purpose or task

If at any level in any hierarchical structure an object is relevant from the view how this object interacts or is intended to interact with a flow, the purpose-related classification scheme and the letter codes presented in table 1 shall be used.

In principle it is possible to classify any object according to table 1. It is recommended to use it, wherever possible and appropriate.

In annex B, figure B.1 shows the classes of table 1 related to a generic process model.

Rules and guidelines on how to relate objects to that classification scheme are given in the following.

– The relevant object shall be viewed with regard to how it is functioning on the flow but without regarding how this function is implemented.

  Example:

  The desired purpose of an object is "heating". According to table 1 this object is clearly related to class E. It is not of importance, or simply not known in an early stage of a design process, how the required purpose is realized. This may be done by using a gas or oil burner or an electrical heater. In case of an electric heater, the heat is produced by an electric resistor. A resistor may in other cases be classified by its purpose "restricting a flow" according to class R. The purpose of the object in the process is however to produce heat, so class R should not be used.

– There may be cases, where more than one purpose is identified. In these cases, a main purpose shall be taken into account.

  Example:

  A flow rate recorder stores measured values for later use but at the same time delivers an output in visible form. In the case that the storing function is regarded as the main purpose, the object is related to class C of table 1. In case the main purpose is regarded to indicate measured values and recording is a secondary feature, the object is related to class P.

– There may be cases, where no main purpose can be identified. Only in these cases class A should be used.

Figure 2 illustrates the principle of assigning classes to objects in case of a measuring circuit.

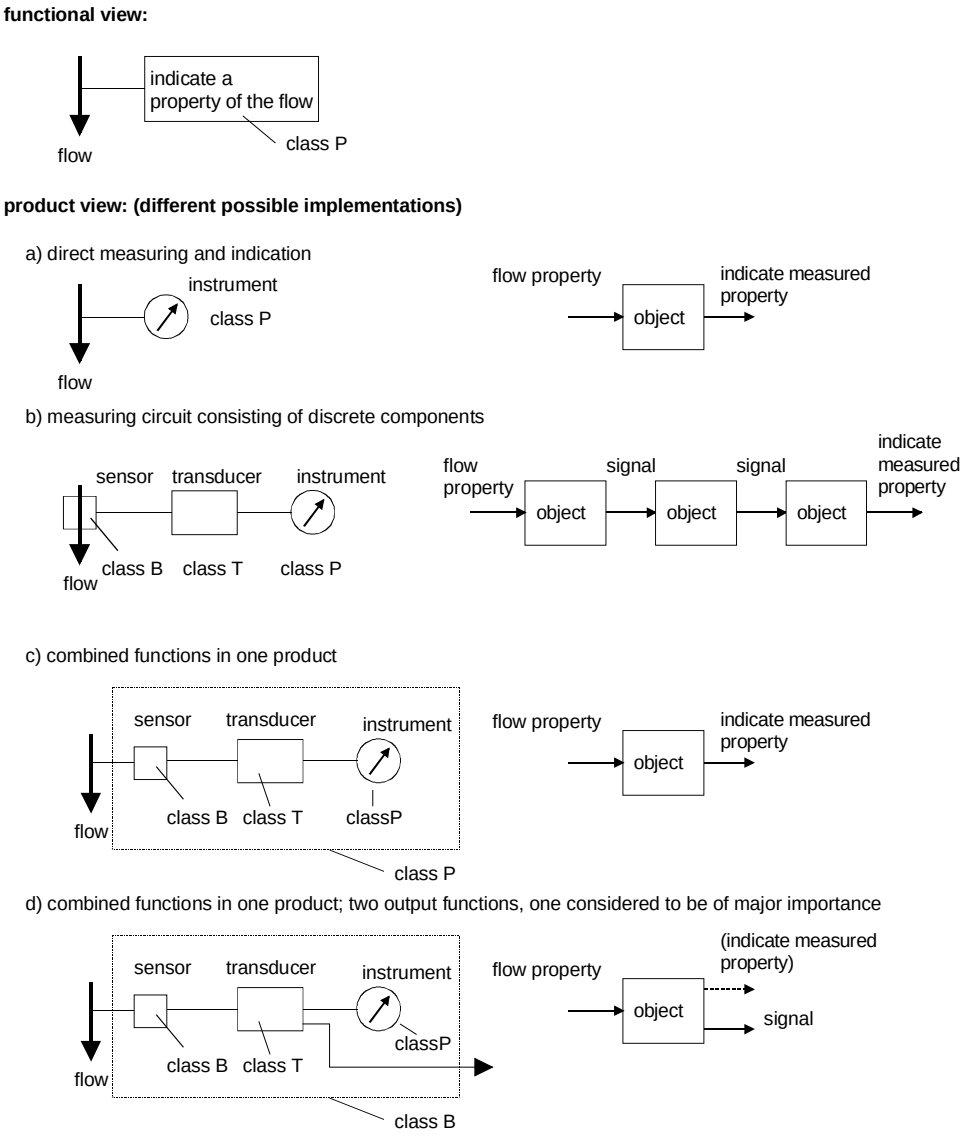


Figure 2 – Classification of objects in a measuring circuit

Table 1 – Classes of objects according to their purpose or task

Code	Object class definition	Examples for terms describing the purpose or task of objects	Examples for typical mechanical/fluid objects	Examples for typical electrical objects
A	Object serving two or more purposes Note - This class is only for objects for which no main function can be identified.			
B	Object for monitoring and detecting or determining events or conditions.	detecting measuring *) monitoring sensing weighing *) *) picking-up of values	orifice plate (for measuring) sensor	detector fire detector limit switch measuring element measuring shunt microphone movement detector photo cell pilot switch position switch proximity switch proximity sensor sensor smoke sensor tachogenerator temperature sensor video camera
C	Object for storing material, energy, or information	recording storing	barrel cistern container hot water accumulator steam accumulator tank vessel	buffer (store) capacitor event recorder *) memory tape recorder *) video recorder *) voltage recorder *) *) mainly storing function
D	Reserved for future standardization			
E	Object for generating heat, cold, and/or light or other radiation.	cooling heating lighting radiating transmitting	boiler furnace heater gas lamp heat exchanger nuclear reactor paraffin lamp radiator	antenna boiler fluorescent lamp freezer heater lamp *) lamp bulb laser luminaire maser radiator refrigerator *) see also H

Table 1 *(continued)*

Code	Object class definition	Examples for terms describing the purpose or task of objects	Examples for typical mechanical/fluid objects	Examples for typical electrical objects
F	Object for protecting directly or indirectly a flow, personnel or equipment from dangerous or unwanted conditions.	absorbing insulating guarding preventing protecting securing shielding	air bag buffer fence pipe-break valve rupture disk safety belt safety valve shield vacuum valve	Buchholtz relay cathodic protection anode earthing electrode Faraday cage fuse insulator protective relay miniature circuit breaker cable screen shield surge diverter thermal overload relay thermal overload release
G	Object for generating a flow of material, energy, or signals.	generating producing pumping transporting	pump blower conveyor (driven) fan lift manipulator vacuum pump ventilator	battery dry cell battery coil *) dynamo generator hand inductor power generator rotating generator signal generator solenoid *) wave generator *) see also M
H	Object for presenting signals or information *) in optical, audible or tactile (touchable) form. *) e.g. positions, levels, conditions, alarms, announcements Note - Objects for presenting measured values: see class P	alarming communicating displaying indicating informing presenting printing warning	acoustical signal device clock bell display unit indicating device printer sight glass	acoustical signal device clock bell display unit indicating device LED loudspeaker optical signal device printer signal lamp signal vibrator
J	Reserved for future standardization			
K	Object for processing (receiving, treating and providing) signals for discrete and/or continuous control of other objects.	closing *) continuous controlling delaying opening *) positioning postponing switching synchronising *) of information circuits	fluid feedback controller pilot valve valve positioner	all-or-nothing relay analogue integrated circuit automatic paralleling device binary integrated circuit contactor relay delay element delay line electronic valve electronic tube feedback controller measuring relay programmable controller synchronizing device time relay transistor
L	Reserved for future standardization			

Code	Object class definition	Examples for terms describing the purpose or task of objects	Examples for typical mechanical/fluid objects	Examples for typical electrical objects
M	Object supplying kinetic energy for actuating/driving other objects.	actuating driving	combustion engine fluid actuator fluid cylinder fluid motor heat engine mechanical actuator spring-loaded actuator turbine water turbine wind turbine	actuator actuating coil electric motor linear motor
N	Object for producing or reshaping material	crushing cutting forging forming fractionating grinding milling pulverising rolling turning	crusher drop forge mill turning lathe	
P	Object for presenting measured, metered, integrated, or calculated values.	counting measuring *) metering *) indicating function	balance clock flow meter gas meter indicator (mechanical) manometer glass gauge thermometer watermeter	ammeter clock continuous line recorder event counter Geiger counter recording voltmeter synchronoscope voltmeter wattmeter watt-hour meter
Q	Object for varying a flow of energy or material.	opening *) closing *) switching *) clutching *) of energy and material flow	brake control valve clutch door flap gate pressure control valve shut-off valve shutter sluice lock	circuit breaker contactor (for power) disconnector fuse switch *)

Table 1 *(concluded)*

Code	Object class	Examples for functions	Examples for typical mechanical/fluid objects	Examples for typical electrical objects
S	Object providing an interface for manual input of information into or selecting information from a system.	influencing manually controlling operating selecting	push button valve selector switch	keyboard light pen mouse push button switch selector switch set-point adjuster
T	Object for converting one form of energy or information into another form of the same kind of energy respectively information.	amplifying compressing converting expanding modulating transforming	fluid amplifier gear box measuring transducer measuring transmitter pressure intensifier torque converter	AC/DC converter amplifier demodulator frequency changer measuring transducer measuring transformer measuring transmitter modulator power transformer rectifier rectifier station signal converter signal transformer transducer
U	Object for keeping other objects in a defined position.	bearing carrying holding supporting	beam bearing block cable ladder cable tray console corbel foundation hanger insulator mounting plate mounting rack pylon roller bearing roll stand	---
V	Object for separating, combining, or mixing material, energy, or information.	filtering mixing separating stirring	centrifuge filter mixer rake separator sieve	filter induction stirrer
W	Object conducting, guiding or leading material, energy or information from one place to another.	conducting guiding leading	duct hose ladder mirror link (mechanical) roller table (not driven) pipe shaft	busbar cable conductor information bus optical fibre through bushingwaveguide
X	Object for establishing a static connection.	connecting *) coupling *) joining *) static	flange hook hose fitting pipeline fitting quick-release coupling terminal block	connector plug connector terminal terminal block terminal strip
Y	Reserved for future standardization			
Z	Reserved for future standardization			

6 Classification of infrastructur objects

The use of codes for classes according to table 1 is possible for each object in a hierarchical structure. For extensive installations like industrial complexes with plenty of different production facilities or for factories with several production lines and related auxiliary facilities it may however not be sufficiently differentiating, because most constituents will probably belong to the same class. For example in a chemical works each of the different factories will have the purpose to produce one or more chemical products. For this reason designations may be needed that allow the differentiation between the main constituents. In this context the main constituents are called infrastructure objects. They include installations and services regarded as the basic subdivisions (power stations, sewers, roads, factories, housing, etc.) of an area of interest. The classification scheme shown in table 2 provides a frame for setting up letter codes for infrastructur objects.

Some facilities can be identified that are common to most applications. These should be assigned letter codes according to classes A and U ... Z of table 2.

The classification of the main facilities of the process described is to a great extent branch-related and should therefore be treated in branch-related standards if required. Classes B to T of table 2 are reserved for this purpose. If no branch-related standard exists, classes B to T may be freely chosen and shall then be explained in the documentation.

Examples for some possible branch-related applications of classes B to T:

Note – The letter codes shown in the examples are not intended to prescribe any future branch-related standardization. They only illustrate the principle.

	oil refinery:
A	overall control system
B	catalytic cracking plant

	electric power distribution station:
A	overall control system
B	

	canteen:
A	overall control system
B	

Table 2 – Classes of infrastructur objects

Code	Object class definition	Examples
A	Objects for overall control	Supervisory control system
B **...** **T**	Reserved for branch-related class-definitions	see examples presented in the text of this clause
U	Objects for storage of material or goods	finished goods store fresh-water tank plant garbage store oil tank plant raw materials store
V	Objects for fulfilling auxiliary purposes besides the process (for example on a site, in a plant or building)	air conditioning system fire protection system gas-supply lighting installation water-supply sewage disposal plant
W	Objects for administrative or social purposes	canteen exhibition hall garage office recreation area
X	Objects for or related to transportation of material or goods	crane-system traffic light system railway signal system ship loading system
Y	Objects for communication and information tasks	computer network telephone system video surveillance system
Z	Objects for housing or enclosing technical systems or installations like areas and buildings	constructional facilities factory site fence railway line road wall

7 Sub-classes

For each class presented in table 1 or table 2, sub-classes may be defined with the purpose of a more detailed specification of the object. The definition of subclasses is free to the user. Subclasses can be used in manyfold ways, depending on the field of application and the purpose required. It should however be avoided to use subclasses for the coding of technical attributes as these information normally appears in the documentation, for example in a technical specification or in a parts list.

Subclasses may be dealt with in branch-related standards. Appropriate subclasses defined in other existing standards may also be applied if agreed. If for example measured oder initiating variables need to be specified for the purpose-related object-classes B, C, and P of table 1 (but not restricted to these) letter codes according to the table given in ISO 14617-6, subclause 7.3.1 may be applied. An excerpt of this table is shown for information in annex C.

Example: A temperature sensor may be assigned class BT if the designation according to class B alone is not sufficient for an intended purpose.

Note – It should be noted, that the letter codes in ISO 14617-6 document are intended to be used in connection with symbols for measurement and control functions. Although they do not represent a classification scheme in a very strict sense, there application may lead to sufficiently differentiating single-level reference designations in most cases.

8 Application of classes and sub-classes

The construction of reference designations is described in clause 5 of IEC 61346-1. Each node in a structure, except the top-node, may be assigned a letter code indicating the object-class. Letter codes for object classes related to a function-oriented or a product-oriented structure should preferably be chosen from table 1 or table 2. Further branch-related definitions shall be taken into account.

Letter codes to be used for location-oriented reference designations are dealt with in clause 6 of IEC 61346-1. Letter codes according to table 1 and table 2 may also be used if it is intended to indicate which kind of object is located or intended to be located at the designated place.

The following rules apply:

– If an object is subdivided into sub-objects, these sub-objects shall be assigned letter codes from one classification scheme only.

– If an object is associated with letter codes for sub-classes, these shall be chosen from one sub-classification scheme only.

Note – Subclasses do not define a new level in a structure, i.e., they do not describe a subdivision of the object. Class and subclass refer to the same object.

Following these rules results in unique reference designations. The use of the classification schemes related to levels in a structure should be explained in the documentation.

Note – It is normally impossible to recognize from the position of a letter code in a multi-level reference designation from which classification scheme a letter code originates and what the meaning is. This can only be seen if the structures and related classification schemes are documented.

Guidelines and examples are presented in part 3 of this standard.

Annex A

(informative)

Basic requirements for the definition of letter codes indicating the kinds of objects

The following basic requirements are based on the common IEC/ISO document 3B(Secretariat)123/TC10 N575 and the compilation of comments 3B(Secretariat)140.

1) Letter codes shall be based on a classification scheme.

2) A classification scheme is the set of definitions for the types of objects (for example a classification scheme for function types containing the definition of the different function types of objects).

3) A classification scheme shall support hierarchical classes of types of objects, i.e. subclasses and superclasses.

4) A letter code for a type of object shall be independent of the actual position of the instances of that type of object in a system.

5) Distinct classes shall be defined on each level of the classification scheme.

6) The definitions of the classes of one level within a classification scheme shall have a common basis (for example a classification scheme that on one level classifies objects according to colour shall not contain classes that classifies objects with regard to shape). The basis however may vary from one level to another.

7) A letter code should indicate the kind of object and not an aspect of this object.

8) A classification scheme shall allow for expansion due to future development and needs.

9) A classification scheme shall be usable within all technical areas without favour a specific area.

10) It shall be possible to use the letter codes consistently throughout all technical areas. The same type of object should preferably have only one letter code independent of the technical area where it is being used.

11) It should be possible to indicate in a letter code from which technical area the object originates, if this is wanted.

12) A classification scheme should reflect the practical application of letter codes.

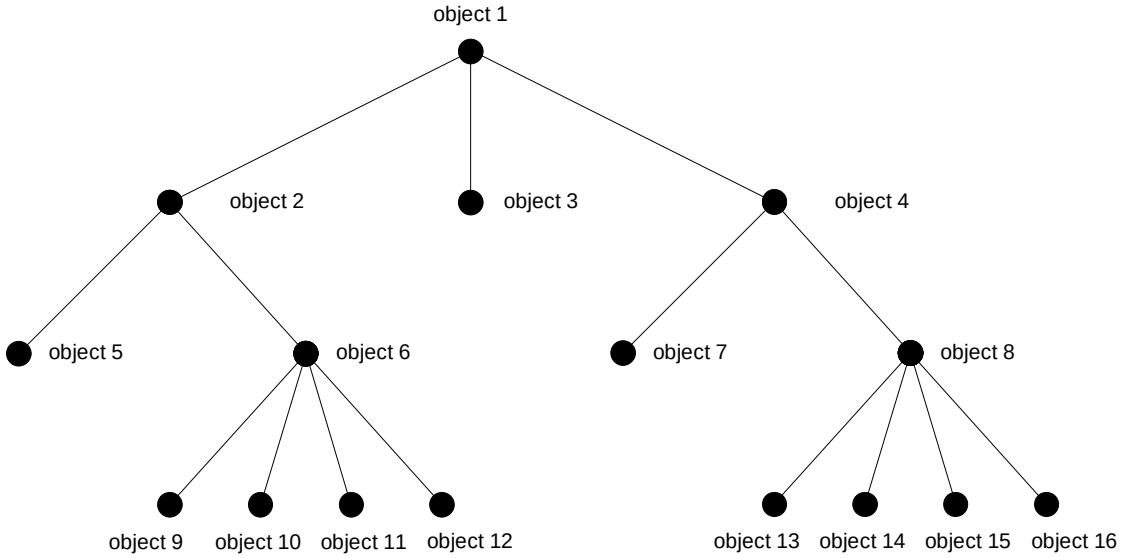
13) Letter codes should not be mnemonic, as this can not be implemented consistently throughout a classification scheme and for different languages.

14) Letter codes shall be formed using capital letters from the Latin alphabet, excluding I and O due to possible confusion with the digits 1 (one) and 0 (zero).

15) Different classification schemes shall be allowed and be applicable for the same type of object.

16) Objects may be classified for example according to function types, shapes, colours, or material. This means that the same type of object may be assigned different letter codes according to the different classification schemes.

17) Objects that are directly constituents of another object using the same aspect shall be assigned letter codes according to the same classification scheme. See figure A.1.



Object 2, 3, and 4 that are direct constituents of object 1
shall be assigned letter codes from the same classification scheme.

Object 5 and 6 that are direct constituents of object 2
shall be assigned letter codes from the same classification scheme.

Object 7 and 8 that are direct constituents of object 4
shall be assigned letter codes from the same classification scheme.

Object 9, 10, 11, and 12 that are direct constituents of object 6
shall be assigned letter codes from the same classification scheme.

Object 13, 14, 15, and 16 that are direct constituents of object 8
shall be assigned letter codes from the same classification scheme.

Figure A.1 - Constituent objects

18) If products from different manufacturers are combined into a new product, the constituents of this product may be assigned codes according to different classification schemes.

Annex B

(informative)

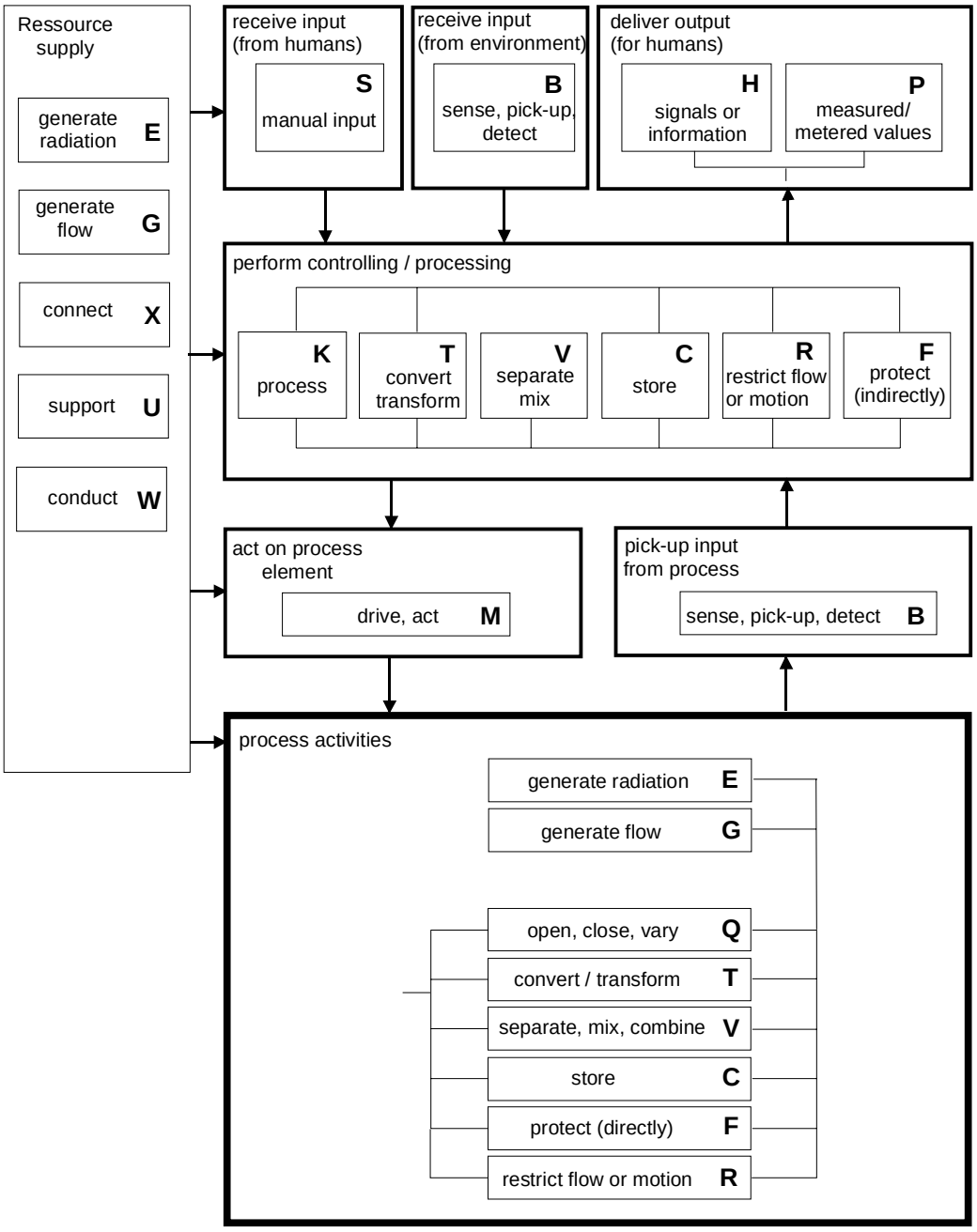
Figure B.1 shows classes of objects according to table 1 related to a process. It contains activities that are directly initiating or influencing the flow, and activities that are indirectly influencing the flow or monitoring its condition. Both are supported by activities or tasks that do not influence the flow, but are necessary resources, sometimes acting in a static way. Some of the latter are also valid for objects that are not related to any flow, for example pillars in a building.

The same class of objects appears at different places in this model. This is to be understood so that "real" objects may be assigned classes and letter codes without considering the position of the object in the process.

The model is independent of technology. Therefore it is possible to use it in all technical areas.

It is also independent of the size or importance of the regarded object and may be used as a means for classification of small objects as well as for big ones. It may be repeatedly used in all levels of a hierarchical structure.

It should however be noted that this model is only used as a basis for classifying objects. It is not intended to establish a model for a real process and process environment.


Ressource supply
generate radiation E
generate flow G
connect X
support U
conduct W
receive input (from humans)
S manual input
receive input (from environment)
B sense, pick-up, detect
deliver output (for humans)
H signals or information
P measured/ metered values
perform controlling / processing
K process
T convert transform
V separate mix
C store
R restrict flow or motion
F protect (indirectly)
act on process element
drive, act M
pick-up input from process
sense, pick-up, detect B
process activities
generate radiation E
generate flow G
open, close, vary Q
convert / transform T
separate, mix, combine V
store C
protect (directly) F
restrict flow or motion R

Annex C

(informative)

In this annex an excerpt of the table presented in ISO 14617-6, subclause 7.3.1 is shown for information. The letters shown there are used as addition to symbols for measurement and control functions. The original table contains a column with symbol numbers and columns with the titles "Modifiers" and "Function". These are omitted in this annex because they are irrelevant for the use in connection with reference designations.

It should be noted that letters I and O shall not be used in reference designation codes.

Sym-bol	Measured or initiating variable
A	
B	
C	
D	Density
E	Electric variable
F	Flow-rate
G	Gauge, position, length
H	Hand
I	
J	Power
K	Time
L	Level
M	Moisture, humidity
N	User’s choice
O	User’s choice
P	Pressure, vacuum
Q	Quality
R	Radiation
S	Speed, frequency
T	Temperature
U	Multi-variable
V	User’s choice
W	Weight, force
X	Unclassified
Y	User’s choice
Z	Number of events, quantity