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Title:
IEC 61175: Industrial systems, installation and equipment and industrial products, Designation of signals

(Titre) :
CEI 61175: Systèmes industriels, installations et appareils, et produits industriels, Désignations des signaux

Introductory note

This document has been prepared by TC3/MT17: Revision of IEC 61175.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Industrial systems, installation and equipment and industrial products, Designation of signals

FOREWORD

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International Standard IEC 61175 has been prepared by IEC technical committee TC3:

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

FDIS	Report on voting
XX/XX/FDIS	XX/XX/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 _____. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

The intention with this standard is to make rules for – and requirements to the designation of signals, furthermore to make recommendation about useful presentations of these.

Basic is the intention that a designation of a signal shall follow the signal in whole its lifetime, which means from the beginning of the design stage until the signal no more is needed.

Designation of a signal in according to this standard means that it has to be identified where it is “born” and where it is “used”, and also in between in interfaces where the signal is delivered from one system/media to another, but the identification itself has to be independent of the media for transferring the signal.

To comply with rules and procedures for different systems and media transferring signals, this standard describes how to handle special information in a system and/or in between systems as “additional information” if needed, but how to identify a signal inside a system is out of the scope of this standard.

Changing of the medium used for the transferring of signals because of physical rebuilding of an installation shall not cause changing of the identification of a specific signal which meaning stands. The kind of physical transportation of a signal has no influence on the identification of it, if not this physical transportation is a part the signal purpose.

Rebuilding of installations will probably lead to wishes to transfer more signals in the same physical medium. Every one of these additional signals has to be identified in accordance with their purpose and the rules stated in this standard.

Basic has the identification as mentioned before nothing to do with the physical transportation of a signal, therefore the lines in the figures in this standard are to be read as “signals” more than “connections”.

Industrial systems, installation and equipment and industrial products, Designation of signals

1 Scope

This standard is applicable for all types of signals within an industrial system, installation and equipment to establish the rules for the composition of designations and names that identify signals and signal connections. This includes the designation of the branches in nested power distribution.

This standard is not applicable for identification of wiring, terminals and other hardware for connections.

This standard establishes no rules for:

— the graphical/physical representation of a signal on devices, nor

— the representation of signals in documentation.

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 60027, *Letter symbols to be used in electrical technology*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60445, *Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system*

IEC 60447, *Man-machine interface (MMI) – Actuating principles*

IEC 60617-serie, *Graphical symbols for diagrams*

IEC 60747, *Semiconductor devices - Discrete devices*

IEC 61082-serie, *Preparation of documents used in electrotechnology*

IEC 61131-serie, *Programmable controllers*

IEC 61346-serie, *Industrial systems, installations and equipment and industrial products Structuring principles and reference designations*

IEC 61850-serie, *Communication networks and systems in substations*

ISO 31-1: 1978, *Quantities and units of space and time*

ISO 31-5: 1979, *Quantities and units of electricity and magnetism*

ISO/IEC 646: 1991, *Information technology ISO 7-bit coded character set for information processing interchange*

ISO 3511-1: 1977, *Process measurement control functions and instrumentation – Symbolic representation - Part 1: Basic requirements*

ISO/IEC 4873: 1991, *Information technology ISO 8-bit code for information interchange - Structure and rules for implementation*

ISO/IEC 8859-1: *Information technology - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No. 1*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1
signal designation
classification and unambiguous identification of a signal within a system

3.2
signal source
object in which the signal message is generated

Note - Example: Position indicator, measuring device

3.3
signal message
information represented by the signal

Note 1 - Example: Motor started, Activate valve, Temperature low

Note 2 - Messages may be sent in a communication network in form of telegrams. Such message may represent several signals (a Data object or set of PICOM's). This application of message shall be called Communication Message

3.4
signal connection (signal flow)
description of how the signal is transferred between the source and consumer/destination

Note - The connection can be identified as logical or physical, and can be realized in different connection medium. A complete signal connection chain may include different medium

3.5
signal connection medium
medium in which the information (signal message) is transferred from one point to an other

Note - The medium can be identified as logical or physical, and a complete signal connection chain may include different medium

Examples:

- Physical medium: Electric wire, Optic fibre

- Logical medium: Single data transfer, Communication bus or network

3.6
signal receiver/destination
end (destination) of the signal connection chain

Note - A reporting signal may have several Signal Receivers, while a commanding signal should have only one Signal Receiver

3.7
signal presentation
description of the message of a reporting signal in the signal receiver

Note 1 - Example: Digital display, Analogue indication, Lamp, Semaphore

Note 2 - The complete signal designation does not have to be used in the presentation (but it can be). It is recommended that the complete signal designation should be possible to find from the signal presentation

3.8
signal representation
activity, value, etc. that the signal entity represents

3.9
signal kind
super-type of the signal class defining direction of information in the signal connection

Note – Two signal kind are used:

- reporting signals and

- commanding signals

3.10
signal class
standardized class of the signal defining the main function of the signal

Note – Signal class is defined by a code in the signal designation

3.11
signal variant
identified section of the signal connection chain

Note – There will always be one variant

3.12
PICOM (Piece of Information for Communication)
dynamic aspect of a signal variant

Note 1 - PICOM - as defined in the approach of CIGRE WG 34.03 into data flows within Substations or in IEC 61850 - is specifically used in numerical (digital) communication systems to identify the signal information sent from data point to data point within the signal chain

Note 2 - The dynamic aspect is the transfer of information by sending messages or PICOMs from data point to data point(s)

3.13
data point
physical point in the signal information flow, where a message can be inspected and the current value of a signal can be accessed

3.14
data object
signal group comprised of one or more data items (signals)

Note – Data object is used to represent the specific elements of functionality of a device

3.15
version
identification of a specific edition/version of the information

Note – Example:

- Version 1 is the message for time 0

- Version 2 is the message for time 0 + 1 sec.

4 Basic rules

For applicable rules for the representation of signals in documentation see IEC 61082.

4.1 Structure of signal designation

A signal designation shall unambiguous identify and classify a signal among a set of points (terminal, junction, …) within a system (item, equipment, plant, …).

The structure of a signal designation is based on standardized and system related parts and their sub-parts for identification and classification, following each other in an organized and specified way. All parts may be represented for different purposes textually for human presentation or by codes for other purposes according to a documented principle.

The main parts of signal designation are:

OBJECT ; NAME : VARIANT (ADDITIONAL INFORMATION)

Where:

OBJECT is the designation of the item from which the signal comes or where it goes;

; is the prefix of NAME;

NAME is the designation and classification of the signal within the object;

: is the prefix of VARIANT;

VARIANT is the designation of the variant of the signal;

( ) is the identifier of an additional information;

(ADDITIONAL INFORMATION)

is the classification and description of the variant of the signal.

Subparts of these parts of signal designation are described in 4.1.1 – 4.1.4.

4.1.1 Object

The object identifying and describing the content of the information of the signal shall be represented by a reference designation in accordance with IEC 61346, or equal system.

4.1.2 Name

The name of the signal designates, classifies and describes the signal and the content of information of the signal generally. The name must include *Basic Signal Name* and may include *Nickname* and *Class* as described below.

The sub-parts of the name are:

CLASS _ NICK NAME _ BASIC SIGNAL NAME

where:

CLASS is the standardized class of the signal defining the main function of the signal. Subclasses is to be placed (found) in additional information;

NICKNAME is a short extension to the object or textual repetition of the object defining the related part of the system;

BASIC SIGNAL NAME is the standardized short description of the signal defining the kind of the signal.

4.1.3 Variant

The variant of the signal identifies a section of the way from the source to the destination. If only one variant is presented in the documentation of the signal it is not necessary to use variants number, but the variant prefix shall be used if additional information is described.

4.1.4 Additional information

The additional information of the signal shall describe the signal variant characteristics in a documented way.

Additional information of a signal variant can be:

- version, time stamp or level etc., and also
- system information e.g. protocol related parameters.

Note - To be used where necessary.

4.2 Recommended characters

Signal designations should be composed from standard character sets.

Different mnemonics, abbreviations, identifiers, suffixes, etc., within a name may be separated by a single space or by an underline (_) to increase readability. To maintain compatibility with computer processing, character sets should be restricted to those characters in the ISO/IEC 646 7-bit character set, basic code table, excluding control characters and national replacement characters.

If the computer and communication systems that are to be used are restricted to those that can process 8-bit character sets, ISO 8859-1 is recommended for supplementary characters.

The recommended characters include the following:

- capital letters A through Z;
- lower case letters a through z;
- digits 0 through 9;
- negation: see 5.3.2.1;
- spacing characters: underline (**_**) or space;
- name prefix: semicolon (**;**);
- variant prefix: colon (**:**);
- identifier of additional information: **( )**
- Boolean operators: raised dot (·) ;
- special characters: **! ‘‘ % & ‘ * , . / < = > - + ?**

5 The signal concept

The denomination “signal” stands in this standard for the complete concept of identification of information and transferring of the information from an object to an other. The signal is represented by a name that is related to the meaning of a signal message.

Important rules to remember:

- The signal message represents the information that shall be given to the receiver(s) of the signal.
- The message shall be described by the name of the signal.
- Each messages must be unambiguous identified by the signal designation.

Therefore - a mutual understanding of the signal message between the sender (signal source) and the receiver - is essential.

The signal designation indicates the meaning of information about the signal and not the transportation of the information. It means that signal name is related to the “thinking” and not to the physical construction. However, the logic (or physical) connection used to transfer the information may also need to be identified by a name. The name of the signal, identifying a signal variant, can be used also in this context.

The signal concept is a very wide conception including different kind of information and presentation of it, as well as different ways of distributing the information.

In one physical connection, other than a communication bus, where “multi-signal” transportation is the typical case, a number of different signals can be transported, e.g. in an electric wire connected to just one voltage or a connection for measuring purpose. Examples of such purposes are:

- The energizing (voltage goes from zero to nominal) indicates one signal and the de-energizing another signal.
- The energizing (voltage goes from zero to nominal) indicates one signal and the de-energizing another signal.
- For an analogue signal (i.e. continuously presentation of an analogue value) may a limit value be recognized and presented as a separate digital signal. Both the analogue and the digital signal, which information in this case describe a reporting signal, have the same signal source and may “share” the same wire up to the device that identifies the limit value and separates the signal representation.

These examples are related to the medium used for transportation of the signal information. The medium can be different for different sections of the signal transportation chain; subsequently may the way in which the signals are “grouped” together in sections of the chain differ.

5.1 Classification, kind of signals

Two kinds of signals can be recognized, **Reporting signal** and **Controlling signal**; the two kinds organize the signal due to the direction of the signal information. The signal classes are organized in one of these two kinds as described below.

5.1.1 Reporting signal kind

The message of a reporting signal transfers from the source to one or more destinations / receivers. The purpose of the signal is to inform or feed the consumer(s). The reference designation (IEC 61346) of the source is used to identify a reporting signal.

The receivers of a reporting signal is often a human person but may also be a mechanical or computerized system, etc.

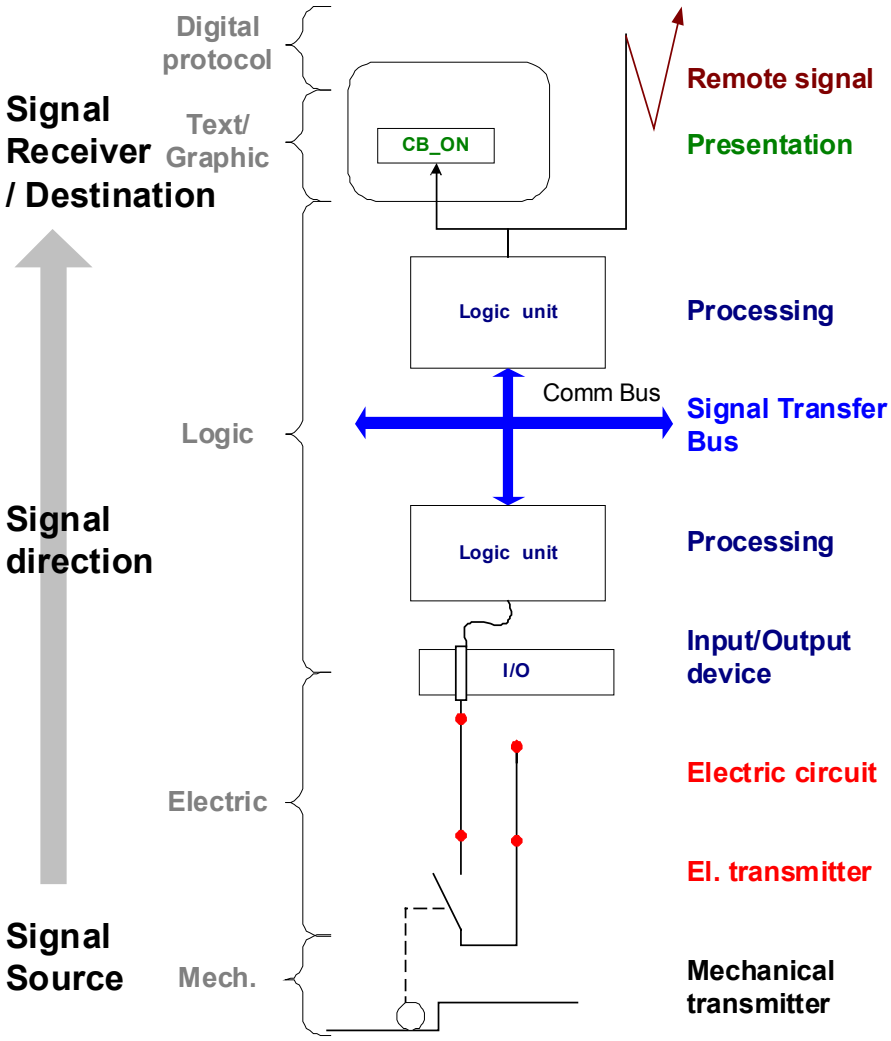


Figure 1 Typical signal connection in a plant, Reporting signal

The classes in Reporting signals are:

5.1.1.1 Indication signal (I)

The indication signals indicates just two statuses, the signal can be active or not active. The signal information is indicated by the active signal. When the signal is not active it just mean “No signal”. If information about two positions is needed two signals have to be defined, even if these two signals are indicated by one device and transmitted by one electric conductor.

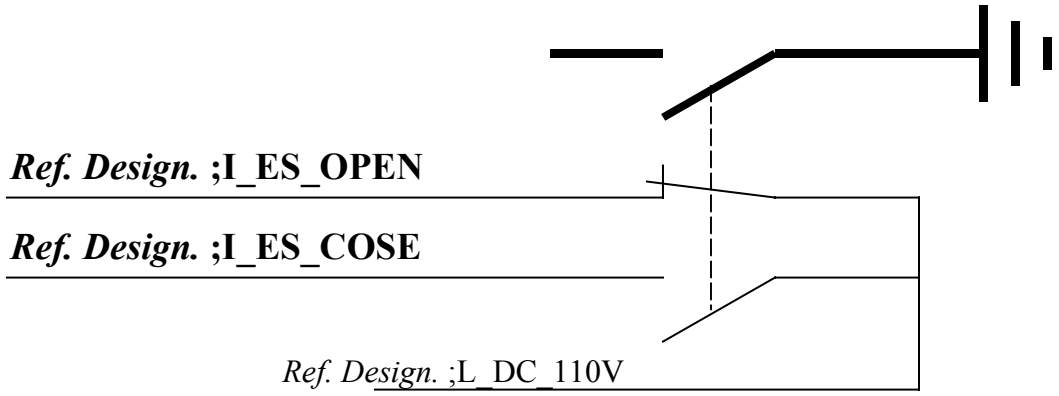


Figure 2 Example of an Indication signal

5.1.1.2 Alarm and Event signal (E)

Alarm and event signals act equal to the indication signals in order to give information about a status. Due to the treatment by the receiver system this signals should be recognized in there own class. Typically event signals are created of the signal source in case of changed status in the device, e.g. a process supervisory device. The purpose of these signals is to notify the receiver about a specific event when it happens, or via attached data to inform the receiver what had and/or when it had happened.

An alarm signal is an event signal specified by the receiver for specific treatment in the receiving system. The purpose of the alarm signal is to notify the (human) receiver about an abnormal situation in the supervised system.

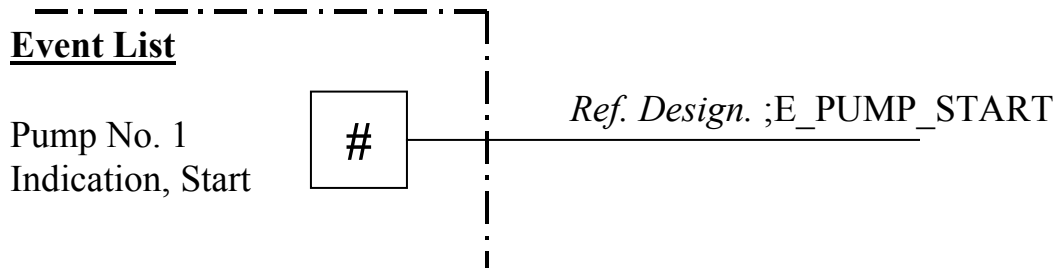


Figure 3 Example of an Event signal

Note 1 - The difference between the classes **Indication signals** and **Alarm & Event signals** is not obvious from the position of signal source. In case the purpose of the signal is not completely clear, when the object including the source are designed it is recommended that the class “Indication” be to be used.

Note 2 - It must be accepted that the classification will be change within the signal connection chain.

5.1.1.3 Measuring signals (M)

The measuring signals indicate more than one level or an analogue value. The signal itself can be an analogue signal or a number of level and/or time dependent discrete indications.

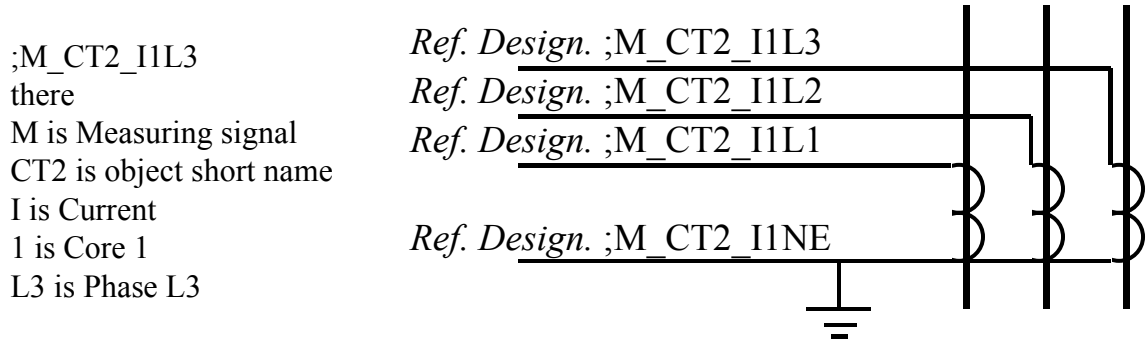


Figure 4 Example of Measuring signal

Analogue signals have a continuous range of possible physical values; the name for such signals should describe “the variable or function” represented by the signal.

The basic signal name for an analogue signal can be plain language or coded. If coded form are used it shall be formed in accordance with an applicable International Standard as limited by clause 2 of this standard.

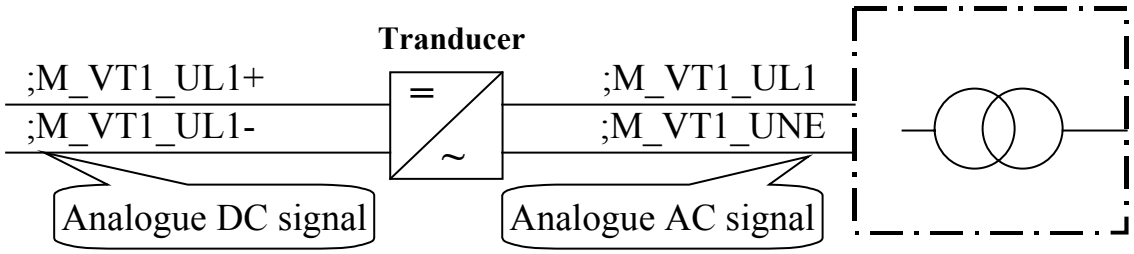


Figure 5 Example of en analogue signal

The measuring device that generates the measuring signal, the transportation medium and the presentation of a measuring signal, may use different forms of signal representation. An example is shown in figure 6. However, the information represented by the signal is in all cases the same and the same name should be used for all appearance of the specific signal. The differences are related to variants of the signal. The identification of the signal variant may include information about the form of representation. Specific attributes related to the form, e.g. time stamps of digital messages of analogue values should be added to the variant as “(additional information)”.

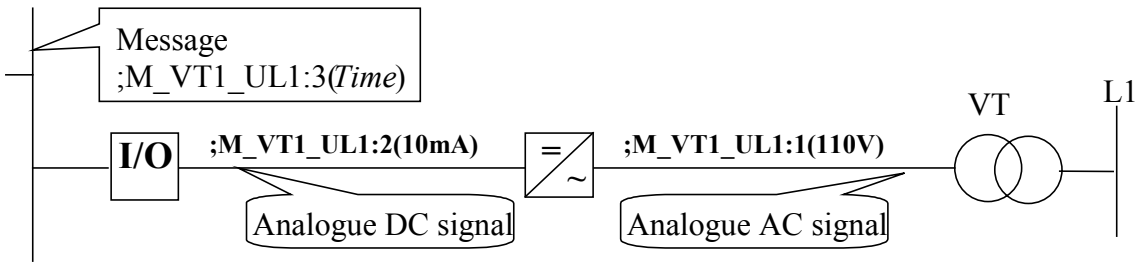


Figure 6 Example of additional information

All representation of the signal, including human representation, is related to variants of the signal. In case that a receiver of a measuring signal needs a part of a curve (analogue value) or a specific point (value) it shall be treated as “own” signals using the name of the previous signal together with the version designation and necessary additional information.

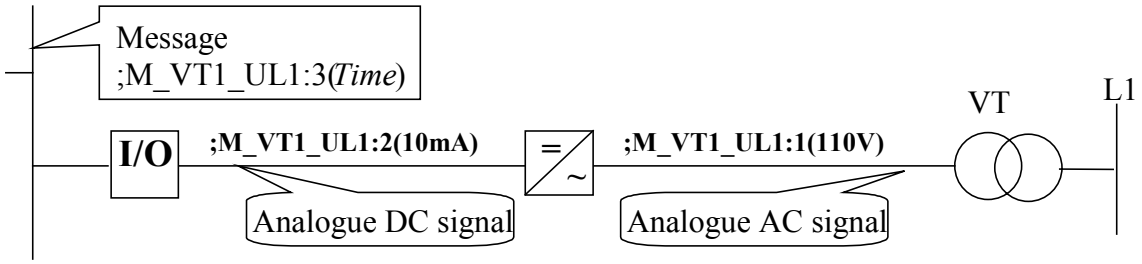


Figure 7 Part of an analogue signal

Note – Additional information belongs to a variant of the signal. Consequently the variant prefix shall be used before additional information, even if no variant is identified.

5.1.1.4 Constant level signal (L)

Constant level signal is a specific type of **Reporting signal**, with the purpose to feed the source with e.g. power, rater than bringing information to the source. However, the signal naming principle is the same as for other reporting signals.

Constant-level connections should be named according to the characteristics of the constant-level physical quantity they carry. This can be either a numerical value with a unit of measure or a commonly understood abbreviation that implies a nominal numerical value, and may also imply a tolerance or other additional properties. For example:

- A ground connection may be named 0V or GND or FE.
- A TTL supply voltage connection may be named +5V or V+ or VC.
- A power main connection may be named 50Hz 230V L1.

Mnemonics and abbreviations should be derived from letter symbols given in IEC 60747 or IEC 60445, if applicable. For convenience, IEC 60445 conductor markings are included in annex A, Table A.4.

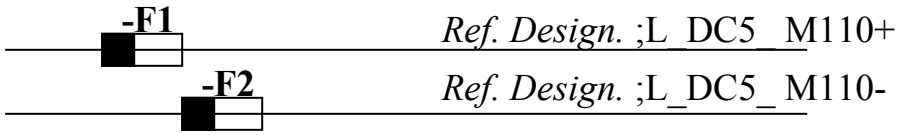


Figure 8 Example of Constant level signal

5.1.2 Controlling signal

The message of a controlling signal transfers from one or more sources to one destinations / consumer with the purpose to activate an operation or other activity. The reference designation of the destination object shall be used to identify a controlling signal.

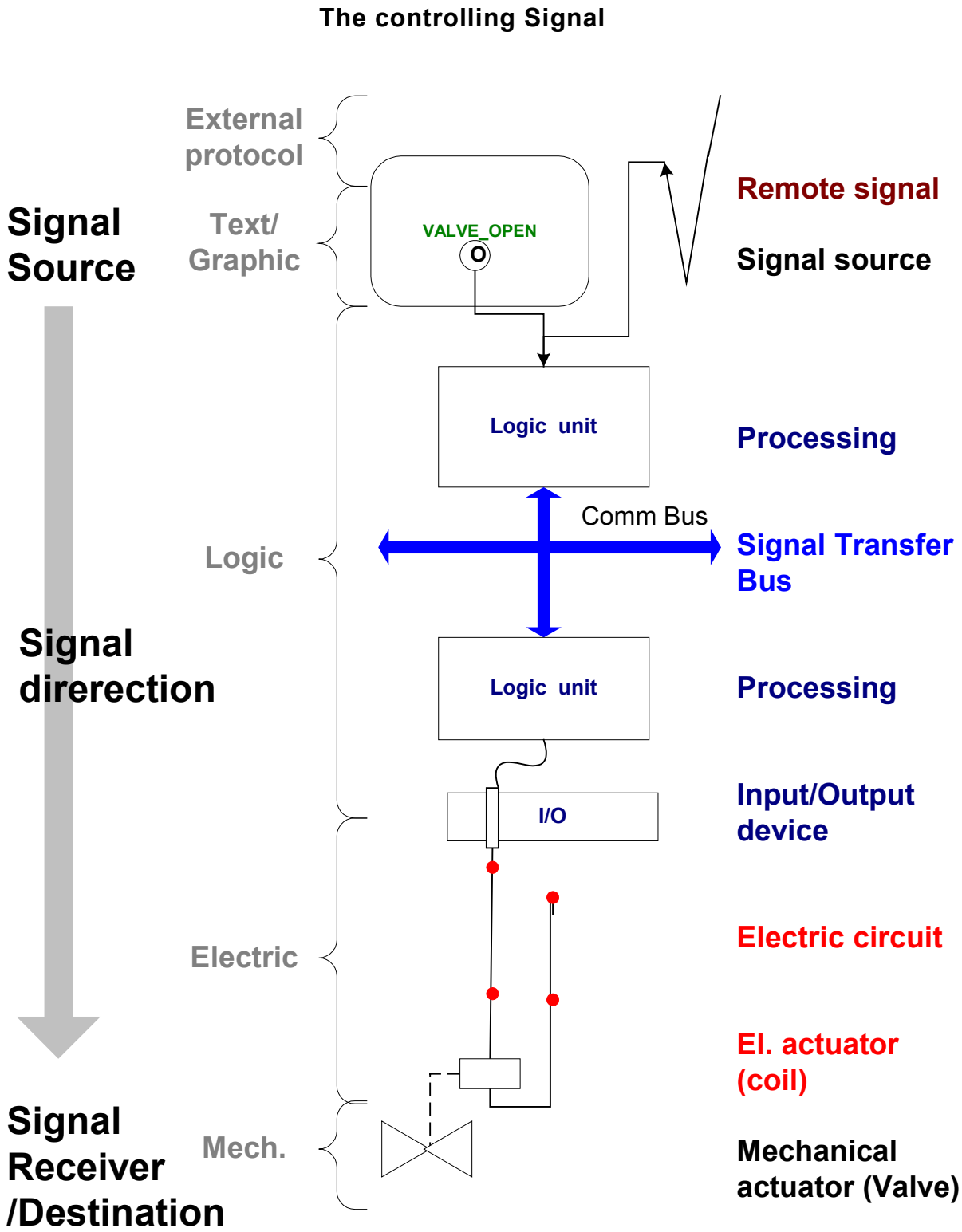


Figure 9 **Typical signal chain in a plant, Controlling signal**

The classes of controlling signals are:

5.1.2.1 Command signal (C)

The command signals shall be used for start or stop or equal [hold to run] activities in the controlled process.

The command signals indicates just two statuses, the signal can be active or not active. The task is activated by the active signal. When the signal is not active it just mean “No action”.

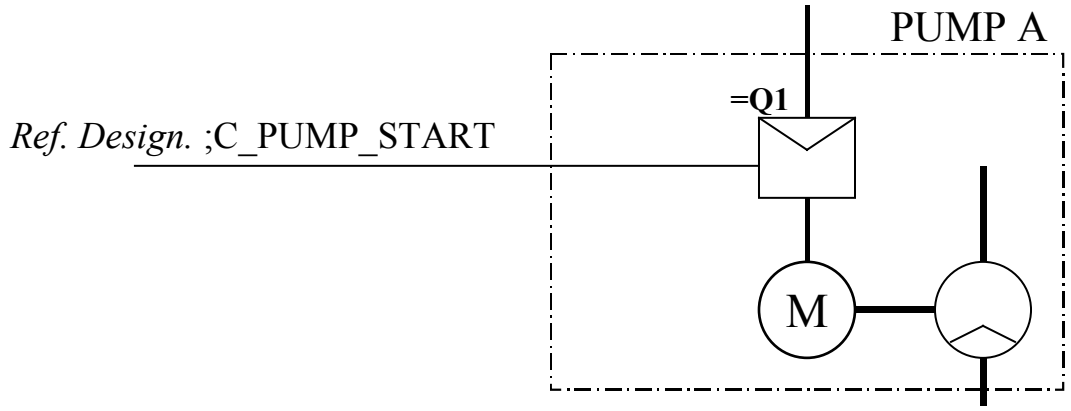


Figure 10 Example of Command signal

5.1.2.2 Setting value signal (S)

The setting value signal is a commanding signal including a value that influence the operation of the controlled process. The value may be analogue or numerical value in a range.

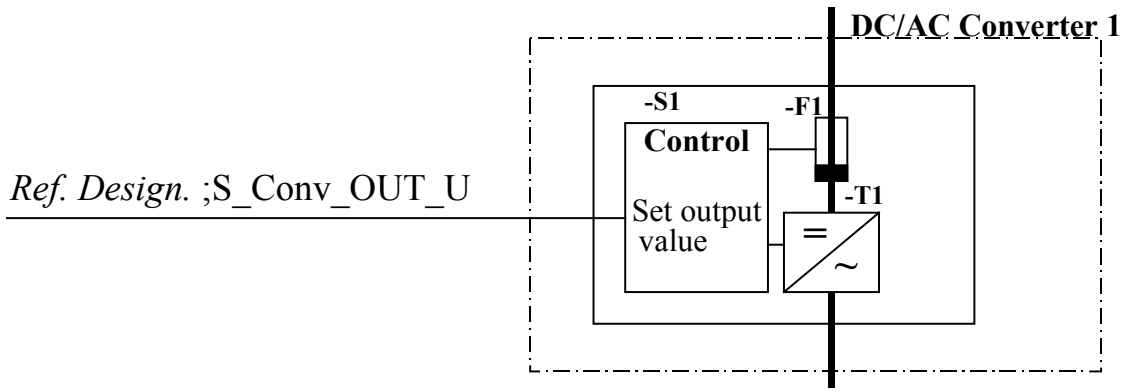


Figure 11 Example of signal for setting value

5.2 Signal Information Model

5.2.1 Identification attributes

The signal designation is the identification of the signal information. The signal designation includes Object identifier, Name, Variant and Additional information (see 4). The purpose of the name of the signal is also briefly to inform the user about the meaning of an actual message of the signal.

The Basic signal name (e.g. “started”) is a part of the section “Name”. This name is never enough to be the identifier of the signal through a complete plant. Therefore the name shall be linked to an object in the plant. An unambiguous identifier can be created by concatenate the **Object reference designation** of the related object to the “Name” (see 4.1).

It is not required that the complete signal chain, i.e. all Data Point of a signal, is covered by the “parent” object of the signal, but the signal source object (for Reporting signals) or the destination object (for Controlling signals) shall be a part of the “parent” object. The level of the object in a hierarchical structure is irrelevant as long as the name of the signal is unambiguous within the object it is linked to.

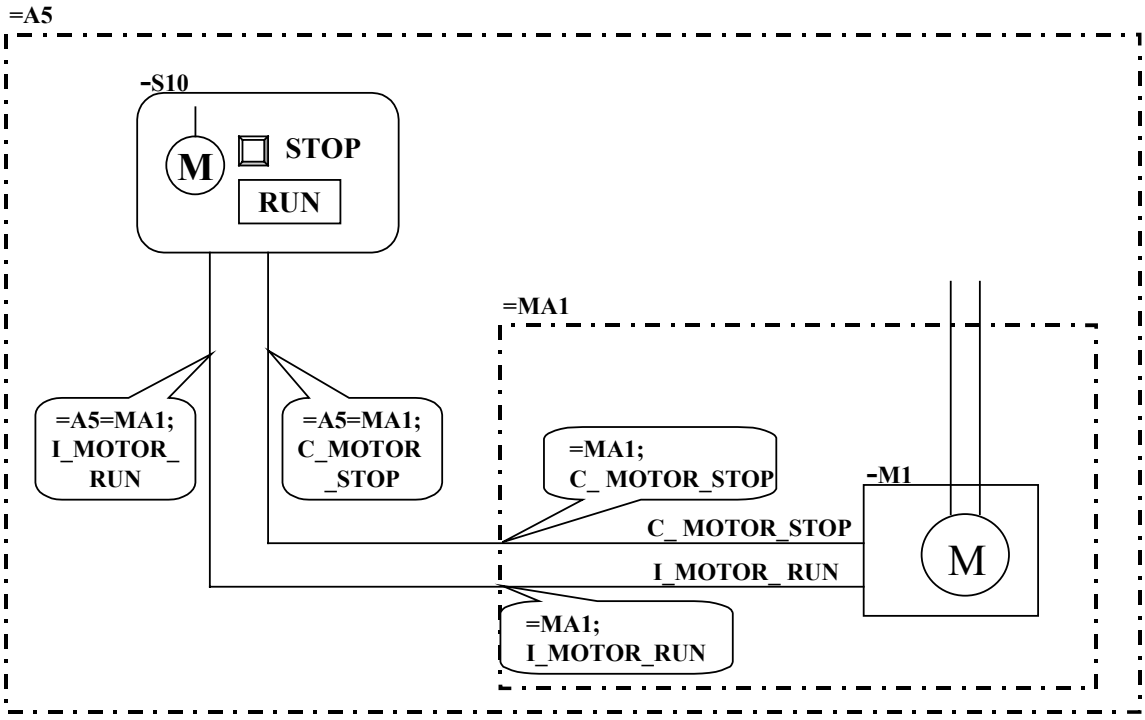


Figure 12 Use of signal designation within objects

Note - The name of the signal can be shown within an object without the Object reference designation. When a complete identification of the signal is required will the Object reference designation be concatenated to the “internal” Signal name.

5.2.1.1 Object identifier

For unambiguous identification of signals in a plant (industrial process) an object identifier shall be added to the name of the signal. The object identifier shall be an **Object reference designation** in accordance with IEC 61346. The Object reference designation is a structured code identifying the semantic relationship to an object (as the “owner” of the signal).

5.2.1.2 Signal classification code

Coded information may be added to the name for further specification of the signal or for bringing additional information to the user. Its recommended to use codes for classification of signals e.g. measuring (M), indication (I) and command (C) (see 5.1).

If other codes for further classification of signals will be used they shall be specified and documented.

5.2.1.3 Time or Version

Because a signal can be activated several times by the same signal source it may be necessary to identify each message (PICOM) separately. For unambiguous identification of a specific message, the time when the message was created may be added to the name of the signal; alternatively may a new version number be added, for each new message.

The “time stamp” or the version number of the signal shall be written in the additional information of the relevant variant(s). Consequently a measuring signal is considered as one signal regardless of how it is transferred, but the actual variant of the signal is depending on the signal transferring. If just a specific part/point of the analog curve is required by the user it is a new signal with its own name (using the name of the first signal by add version/time to the name).

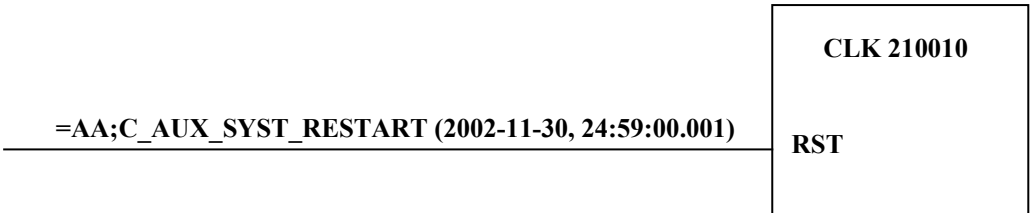


Figure 13 Example of signal designation with “time stamp”

Note - Time or version number is not applicable for analogue signals or constant level signals.

The feature of active and non-active signals is described in the dynamic aspect of a signal. Signals can be activated spontaneously by purpose or frequently. These signals can be sent to the signal receiver(s) via a predesigned signal connection chain or using one of several possible connections (see 5.3).

5.2.2 Attributes for specific signal types

5.2.2.1 Unit

The information presented by a signal type “measuring signal” is typically a value. In this case must the signal present the unit of the measured value. The unit can be given as a part of the Name or shown in property sheet (documentation) for the signal. Units according to the SI-system are preferred.

Note - Presentation of Unit is required for all type of signals that presents a value, examples can be constant level signal, digitized measuring signal or analogue measuring signal.

5.2.2.2 Value

Analog signals presents continuously updated information in form of a value. The name of the signal shall give the information about the meaning of - and the source for - the value, but shall not contain the value itself. The type of value, unit and limits (levels) may be given in the name or can be shown in a property sheet (documentation) for the signal.

An analogue value may be sampled and presented in digital form e.g. a message for each sample. In this case the signal is identified in the same way as the “real” analog signal.

5.3 Signal transferring (connection)

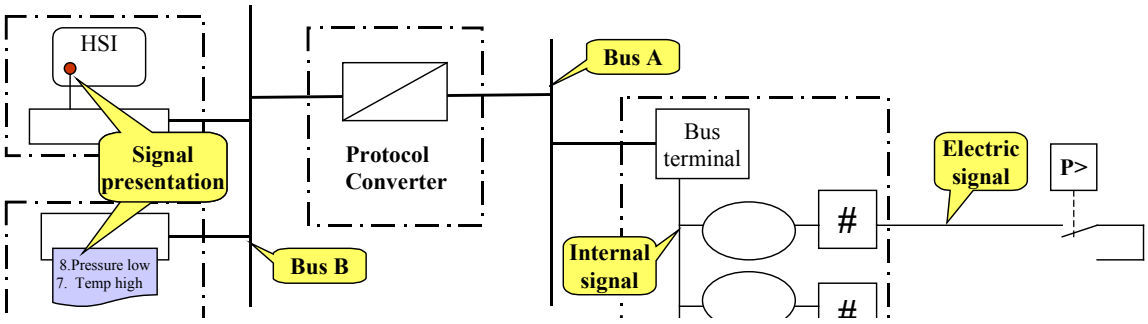
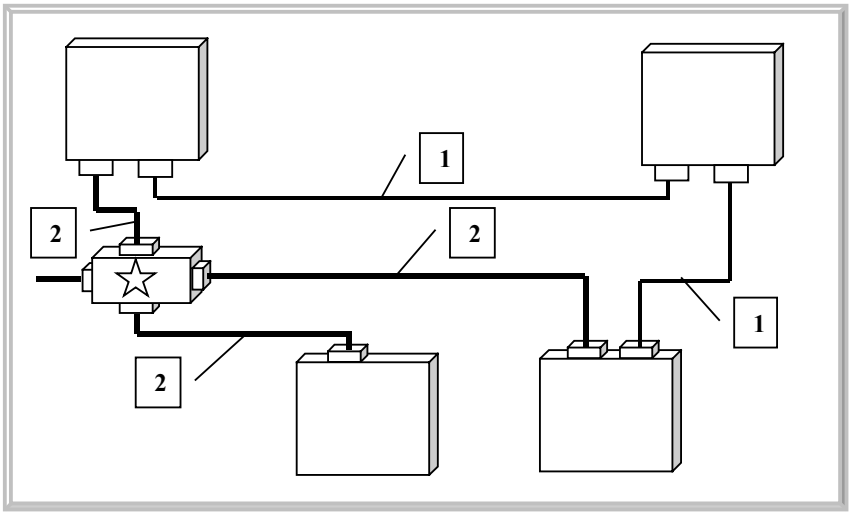


Figure 14 Typical signal flow (or signal connection chain)

The signal connection chain shows the physical and static (functional) aspect of the Signal transferring from source to destination. It describes the predefined way that a signal message will use for the transferring. The Signal transferring has also a dynamic aspect (functional) described as the action of sending the piece of information for communication (PICOM) though the signal connection chain.

A physical connection is the prerequisite for defining the static aspect of the Signal transferring. The physical connection is used to connect two or more physical devices and contain Data Points within the signal connection chain.

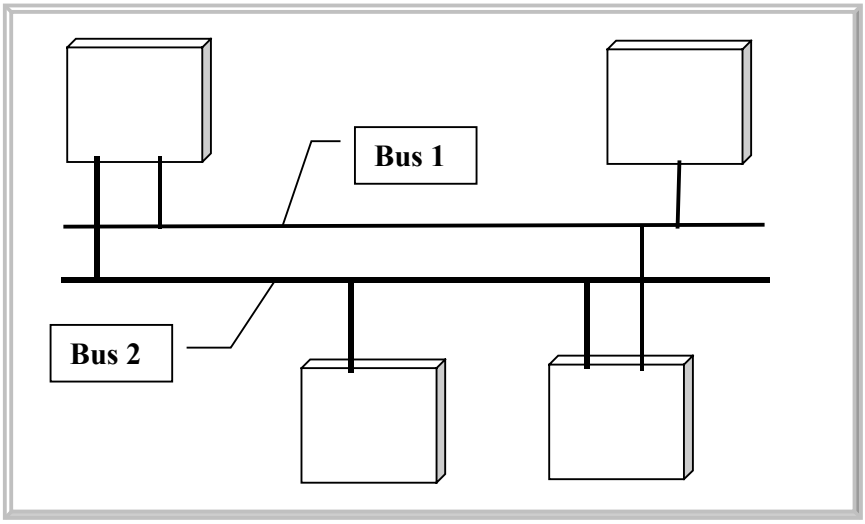
In some cases may the signal message have different possible connections to use for its transferring. In this case the static aspect will be defined as a number of options for the dynamic aspect.



Physical aspect: Communication via two busses.

1. Serial bus
2. Bus with star coupler.

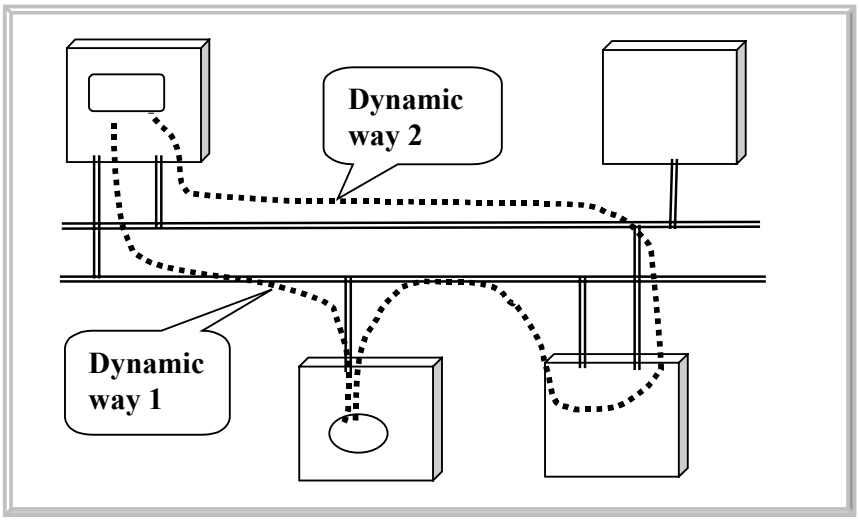
Figure 15a The Physical aspects of signal transferring



Functional Static aspect:

Communication via two busses.

Figure 15b The Static aspects of signal transferring



Functional Dynamic aspect:

Signal transfer via one of two possibilities

Figure 15c The Dynamic aspects of signal transferring

For transferring of signals in large nested network, e.g. Internet, make the description of the static aspect no sense. In such cases it can be sufficient to define the Data Points of connecting to the net, e.g. the server. The same is valid for radio or microwave signals in the air where no defined transmission way can be found.

5.3.1 Variants

Variants of signals (parent of the signal in the specific section/area of the signal transfer) are used in the transportation of a signal from one Data Point to another. Practically it may be necessary to identify different sections of the signal connection chain (static representation).

Reasons to use Signal Variant identification are such that:

- different medium or presentation forms are used in the signal connection chain, or
- each section of the chain should be unambiguous identified and documented for e.g. testing.

The Signal Variant identifier, e.g. a running number, shall be added after the Name. The signal variant has the prefix colon (:).

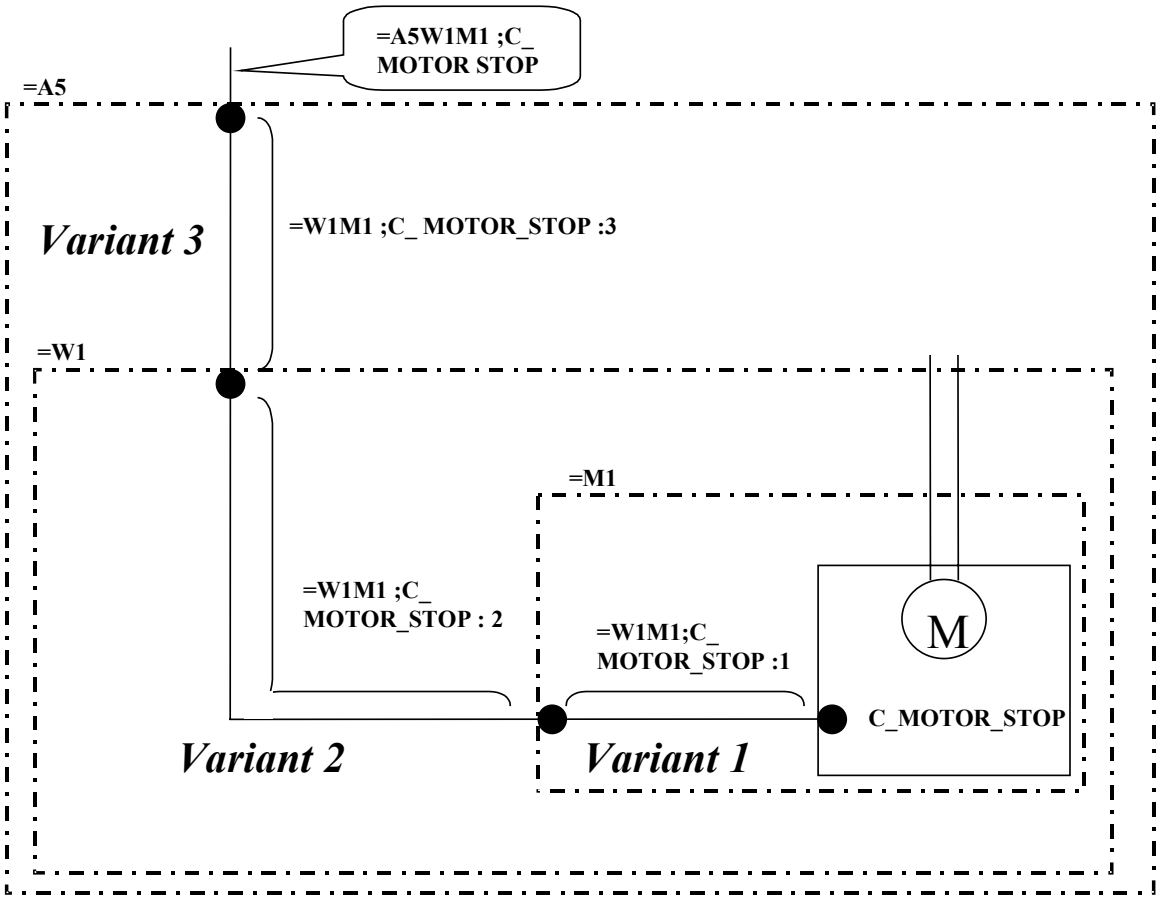


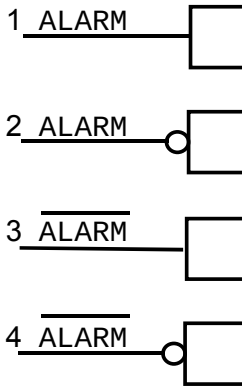
Figure 16 Signal variants in a Signal connection

5.3.2 Binary logic representation

A signal Variant may represent the signal information in Binary logic form; in Binary representation will the signal have only two “states”, which may be represented by two non-overlapping ranges of physical values. These two ranges are called “levels”.

For binary representation of signals may the basic signal name be an “abbreviation” of a statement or “expression” that can be evaluated to be “true” or “false” (or 1 or 0). For example, the name ALARM is an abbreviation of the statement “alarm is active”. The truth-value obtained from evaluating the statement or expression represented by the basic signal name is called the logic state - the ”signal state” - of the signal variant.

The true value of the statement represented by the basic signal name corresponds to the 1-state of the signal variant. The false value of the statement represented by the basic signal name corresponds to the 0-state of the signal variant. For example, the name ALARM means that “alarm is active” is true when the signal variant is in its 1-state and false when the signal variant is in its 0-state (see figure 17 row 1 and 2).



No. Input (or output)	System condition	Signal state (truth-value)	Relationship defined by presence or absence of negation symbol: External logic state	Relationship defined by presence or absence of negation symbol: Internal logic state
1 ALARM	alarm	true =1	1	1
	no alarm	false=0	0	0
2 ALARM	alarm	true =1	1	0
	no alarm	false=0	0	1
3 $\overline{\text{ALARM}}$	alarm	false=0	0	0
	no alarm	true =1	1	1
4 $\overline{\text{ALARM}}$	alarm	false=0	0	1
	no alarm	true =1	1	0

NOTES
1 The signal state being true always corresponds to the external logic state being 1.
2 The signal state being false always corresponds to the external logic state being 0.

Figure 17 Signal state of binary signals

5.3.2.1 Negated signal

A Signal Variant may represent the negated form of the previous signal. The negation is valid for binary representation of signals. However, sometimes an action should take place when a certain condition is not true.

The preferred methods of indicating negation in a name are as follows:

- Precede the appropriate portion of the name by the mathematical sign for logic negation. For example ¬RUN.

  Note 1 - This method is preferred.

  Note 2 - The tilde (~) may substitute the "¬ sign" on computer systems, which do not have the logic negation symbol as part of their character sets.

- Follow the appropriate portion of the name by ''-N''. For example RUN-N
- Place a negation bar ($\overline{\quad}$) over the portion of the name representing the expression to be negated. For example $\overline{\text{RUN}}$.

  Note 1 - This method is not recommended in text or graphical documents prepared by programs that cannot fix the negation bar to the text in a way so it follows the text.

  Note 2 - This method is typically used in expressions with Boolean algebra.

- Use another notation explained in the document or in supporting documentation.

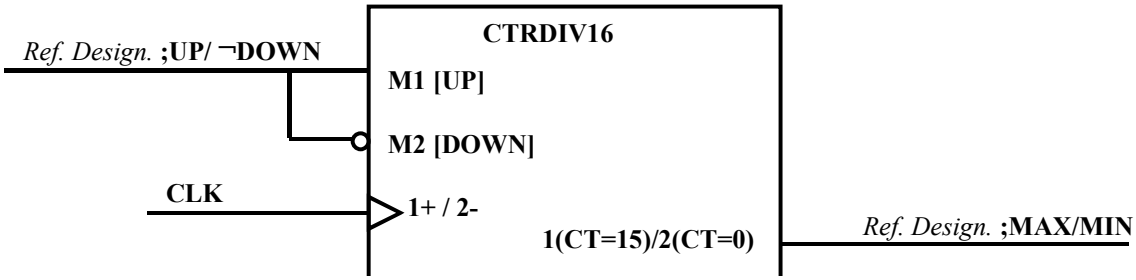


Figure 18 Example of negated signal

5.3.3 Numerical data communication and software programming

Signals transferred via communication busses are often packed in messages or telegrams as defined in a specific communication protocol. A protocol typical has specified signal identification tables and rules, which shall be followed.

Software programming, e.g. based on IEC 61131, also includes a number of restrictions regarded to the form of presenting variables in files. Even if such rules have to override the rules in this standard the basic principles for signal naming, e.g. setting of variable names, are applicable.

The prefix signs used in this standard are often used in communication protocols or software files in another meaning. In such cases the signal designation shall be written without using these prefixes in the context of this standard. The prefixes may in this case be replaced by underscore (_) or other accepted signs.

In communication protocols or other software handling may signal designation be defined and identified in different ways. The name as well as other data related to the signal can be defined as a variable of a Data Point or terminal. Signal data can also be packed into a Data Object, which represents a group of information (signals) intended for reporting or controlling of a specific object in the supervised process. This type of signal data should be identified as parameters given to a communication entity of an object. The basic definition given in this standard should be applicable also in these cases. However, the different parts of the signal designation may be written in different properties of the signal data entity.

5.4 Signal presentation

5.4.1 Human System Interface, HSI

Signals will be presented in the human interfaces (HSI) in many different forms, e.g. graphic symbol, annunciator, event list, bar graph, etc. When the signal is presented in textual form it is important that the signal identification is unambiguous to the human reader. Only documented and by the user understandable abbreviations shall be used. The signal designation (short form) used in circuit diagram or communication charts is not especially useful in this case, but the relationship shall be obvious.

Typical for the human presentation of the signal is that the signal is divided into individual blocks e.g.:

- The object reference designation is presented in a rubric for several signals;
- The object name and basic signal name is show in more describing textual form;
- The additional information is parameters for the presentation;

- The class or variants will not be visualized.

This standard does not make any further recommendations for representation of signals in human interfaces. See also IEC 60447 *Man-machine interface (MMI) – Actuating principles* and IEC 60417 *Graphical symbols for use on equipment*.

5.4.2 Documentation of signal properties

A complete signal designation includes different data, which represents properties to the signal. The properties may be presented in a property sheet of the signal.

For exchange of signal data the property sheet should be transferred into a standardized format, e.g. XML.

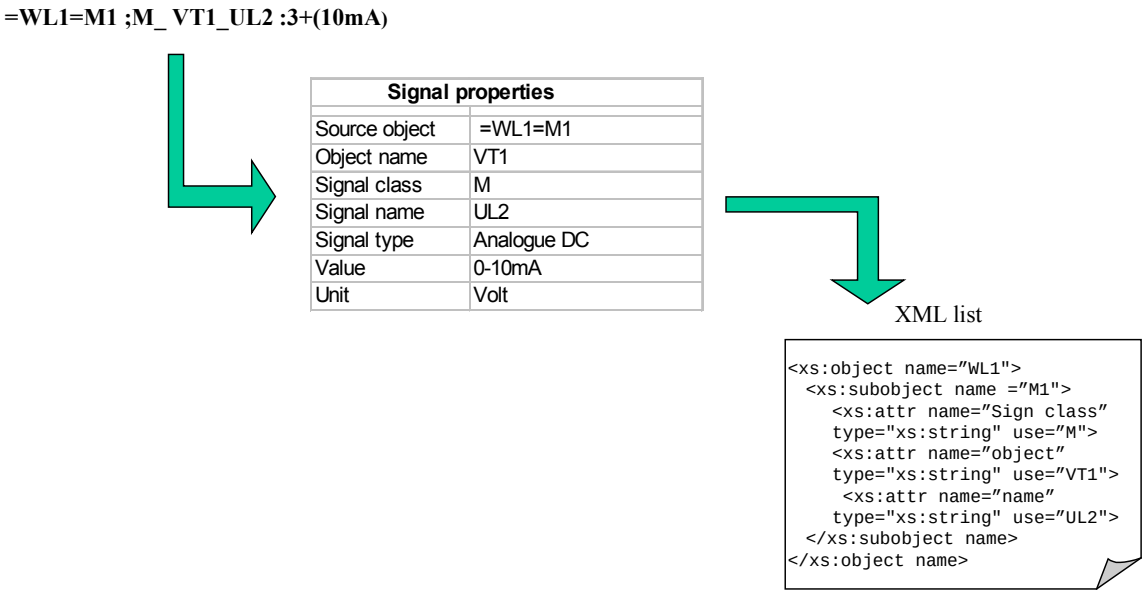


Figure 19 Signal designation presented in Signal properties and XML list

6 Application

6.1 Signal designation presented in signal properties

Examples of reporting signals documented in signal property sheets meeting, but not limited to, this standard, containing relevant and necessary information for a specific application. Variants are included.

6.1.1 Voltage measurement, reporting signal class (M)

OBJECT ; NAME : VARIANT (ADDITIONAL INFORMATION)

=EIPP1E1Q1 ; M_U1L1 : 3 (10mA)

Example shown is the Signal designation for Variant 3 in a voltage Measuring signal (see figure 20). In the following all part of the signal designation is explained including 5 Variants. The Variants are based on this standard, but not standardized. The documentation of the structure must exist, but is not presented here.

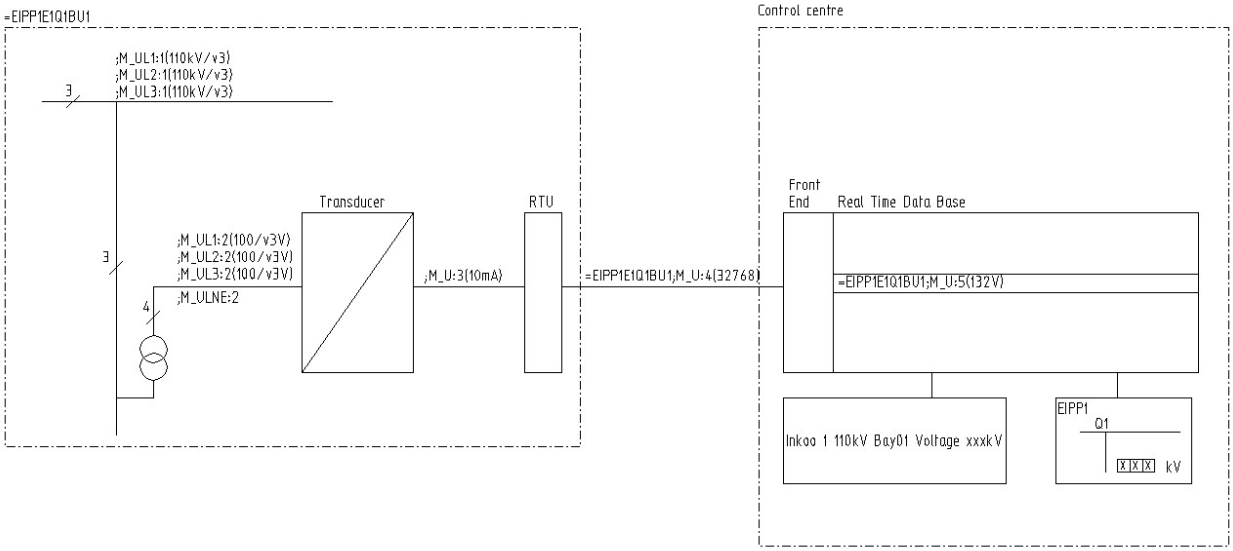


Figure 20 Voltage measurement, reporting signal class (M)

		Code	Textual
OBJECT			
1	(Plant)	=EIPP1	Power Plant, Station 1
2	(System)	E1	110kV system (switchgear)
3	(Sub-system)	Q1	Bay 1
NAME			
Class		M	Measurement
Nick name		-	NA
Basic signal name		U1L1	Voltage measuring, circuit 1, phase L1
COMMON ADDITIONAL INFORMATION			Not specified.
VARIANT		1	Primary
ADDITIONAL INFORMATION			
Range	Nominal	110/v3	information used in the drawing
	Measured	110/v3x1,2	
Unit		kV	kilovolt

VARIANT		2	Secondary and Auxiliary
ADDITIONAL INFORMATION			
Range	Nominal	100/v3	information used in the drawing
	Measured	100/v3x1,2	
Unit		V	Volt
VARIANT		3	Low
ADDITIONAL INFORMATION			
Range	Nominal	0…1…10mA	
	Max value	10 mA	information used in the drawing
	Measured	0…64…100%	
Unit		mA	milliampere
VARIANT		4	Tele control
ADDITIONAL INFORMATION			
Range	Nominal	0…20=0…32768	
	Max value	32768	information used in the drawing
	Measured	25%	
Unit		-	NA
VARIANT		5	Computer
ADDITIONAL INFORMATION			
Range	Nominal	32768=528	
	Max value	528x25%=132	information used in the drawing
	Measured	(0…64…100%)x25%	
Unit		kV	Kilovolt

6.1.2 Indication of status for a disconnector, reporting signal class (I)

OBJECT ; NAME : VARIANT (ADDITIONAL INFORMATION)

= EIPP1E1Q1 ; I_Disc_Open : 3 (48V)

Example shown is the Signal designation for Variant 3 in a Reporting signal from a disconnector (see figure 21). In the following all part of the signal designation is explained including 4 Variants. The Variants are based on this standard, but not standardized. The documentation of the structure must exist, but is not presented here.

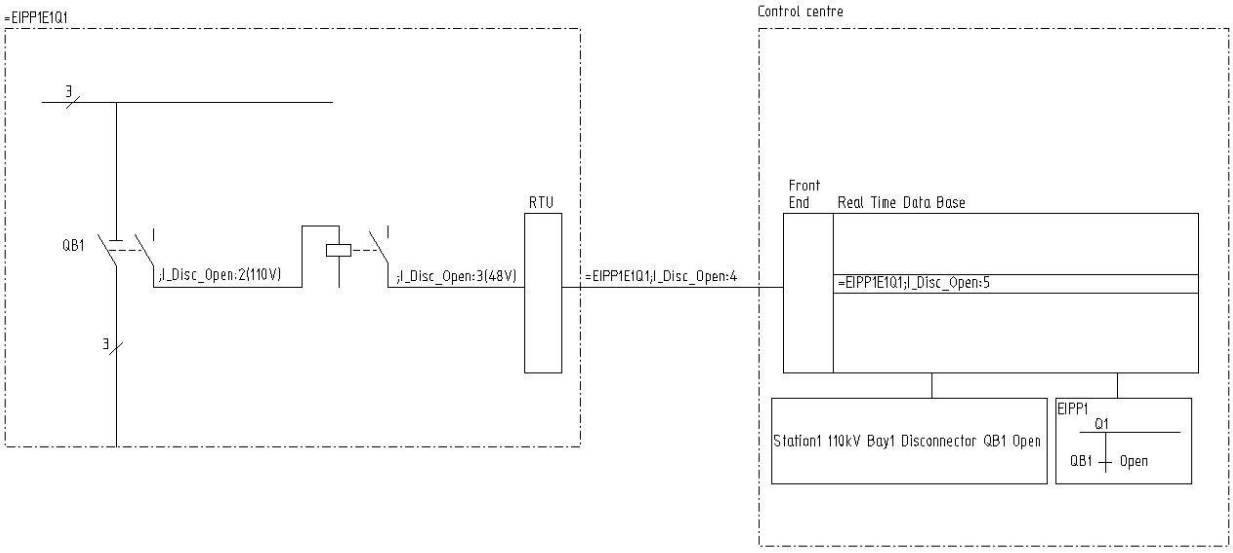


Figure 21 Indication of status for a disconnector, reporting signal class (I)

		Code	Textual
OBJECT			
1	(Plant)	=EIPP1	Power Plant, Station 1
2	(System)	E1	110kV system (switchgear)
3	(Sub-system)	Q1	Bay 1
4	(Device)	QB1	Disconnector
NAME			
Class		I	Indication
Nick name		Disc	Disconnector
Basic signal name		Open	Open
COMMON ADDITIONAL INFORMATION			Not specified
VARIANT		1	Primary
ADDITIONAL INFORMATION			

Type		AC	Alternating current
Level	Nominal	110	
	Maximum	123	
Unit		kV	kilovolt

VARIANT 2 Secondary and Auxiliary

ADDITIONAL INFORMATION

Type		DC	Direct current
Level	Nominal	110	
	Maximum	110x1,1	
Unit		V	Volt

VARIANT 3 Low

ADDITIONAL INFORMATION

Type		DC	Direct current
Level	Nominal	48	
	Maximum	48x1,1	
Unit		V	Volt

VARIANT 4 Telecontrol

ADDITIONAL INFORMATION NA

7 Conformance classes

Conformance to this standard is defined in three classes.

7.1 Conformance class 1

Conformance class 1 is defined as “using the Signal designation structure”:

- Designation of signals in documentation shall be composed of Object reference (even if IEC 61346 is not used);
- Name and if applicable Version and Additional information shall be in according to 4.1 of this standard;
- Prefixes of parts in the designation should preferably be used, but is not mandatory for Conformance class 1.

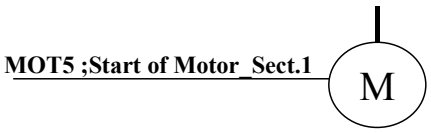


Figure 22 Example of signal designation corresponding to conformance class 1

7.2 Conformance class 2

Conformance class 2 is defined as “complying the rules for structuring and performing of signal designations according to this standard, and also including use of Object reference designations according to IEC 61346-1”:

- Parts as defined in 4.1 of this standard shall when applicable, compose designation of signals in documentation;
- Prefixes and recommended characters shall be used as well as structured object designations according to IEC 61346-1;
- Classification codes of objects according to IEC 61346-2 are recommended but not mandatory for class 2;
- Classification of signals shall be in accordance with 5.1 (additional classes are accepted).

Figure 23 Example of signal designation corresponding to conformance class 2

7.3 Conformance class 3

Conformance class 3 is defined as “full compliance with this standard and its annexes”:

- It is required to follow the rules in this standard as well as the general intention of it;
- Abbreviations and other recommendations listed in the annexes should be used. However, in case of minor deviations from the recommendations it shall be specified and well described for the user.

Figure 24 Example of signal designation corresponding to conformance class 3

(Informative)

Letter codes and mnemonics for use in signal names

A.1 Letter codes for variables

The letter codes listed in table A.1 are specified by ISO 3511-1 for use in symbols for instruments. They identify the variable measured by the instrument. They may also be used as the first character of a coded basic signal name for a measuring signal. In this case, they indicate the variable represented by the signal.

Table A.1 - Letter codes for variables

First letter	Variable
D	Density
E (Note 1)	All electrical variables
F	Flow rate
G	Gauging, position or length
K	Time or time programme
L	Level
M	Moisture or humidity
N (Note 2)	Users' choice
O (Note 2)	Users' choice
P	Pressure or vacuum
Q (Note 2)	Quality, for example analysis, concentration, conductivity
R	Nuclear radiation
S	Speed or frequency
T	Temperature
V	Viscosity
W	Weight or force
X (Note 2)	Unclassified variable
Y (Note 2)	Users' choice

Note 1 - In signal names, a letter from table A.2 should be used instead.

Note 2 - Explanatory note is required.

A.2 Special letter codes for electrical variables

The letter codes listed in table A.2 are derived from ISO 31-5 and IEC 60027. They may be used, in the same way as the letter codes for variables in ISO 3511-1, as the first character of a coded name for a measuring transducer output signal. These codes indicate the electrical variable represented by the signal.

A.2 – Special letter codes for electrical variables

First letter	Variable
F	Frequency
I	Current
P	Power
Q	Reactive power
R	Resistance
U [or V]	Voltage
Z	Impedance

A.3 Letter codes used as modifiers

The letter codes listed in table A.3 are specified by ISO 3511-1 for use in symbols for instruments. They indicate that the instrument measures some quantity other than the absolute level of the identified variable. They may also be used as the second character of a coded name for a measuring transducer output signal or equal.

Note - In this case, they indicate that the signal variant represents some quantity other than the absolute level of the variable identified by the first character of the coded name. The code will be used for a variant of the signal.

Table A.3 – Letter codes used as modifiers

Second letter	Modifier
D	Difference
F	Ratio
Q	Integrate or totalize
R	Residual (Not in ISO 3511-1)

A.4 Identification of terminations of certain designated conductors

The letter codes in table A.4 are specified in IEC 60445 for identifying the terminations of certain designated conductors. They may also be used as part of the signal designation for signals corresponding to those conductors.

Table A.4 – Identification of certain designated conductors

Marking		Conductor
L1		Phase 1 for a.c. supply
L2		Phase 2 for a.c. supply
L3		Phase 3 for a.c. supply
N		Neutral for a.c. supply
L+		Positive for d.c. supply
L -		Negative for d.c. supply
M		Mid-wire for d.c. supply
E		Earthing conductor
PE		Protective conductor
	PEN	Protective conductor (see definition in IEC 60050-195)
	PEM	Protective conductor (see definition in IEC 60050-195)
	PEL	Protective conductor (see definition in IEC 60050-195)
FE		Functional earthing conductor
FB		Functional equipotential bonding conductor

A.5 Mnemonics for use in descriptive signal messages

Tables A.5 are an effort to encourage uniformity in signal names. These tables necessarily cannot be exhaustive, but suggest mnemonic codes (mnemonics) for some of the more common terms used to construct signal names. These mnemonics may be combined to represent compound terms and phrases. If necessary, other meanings may be assigned to the mnemonics listed, and other mnemonics may be assigned to the meanings, if no ambiguity appears. Otherwise, within a related set of documents the same meaning should be assigned to specific mnemonic and the same mnemonic used for a specific meaning.

No set of rules can avoid the necessity for the designer to exercise good judgement and for the user to know how to interpret the significance of signal names. The examples given in the following tables represent typical usage in the English language.

Table A.5 - Mnemonics for use in descriptive signal messages

Mnemonic/Symbol	Meaning	Signification
A(uto)	Automatic	
Abn	Abnormal	
Acc	Accept; Accumulator	Accepter; accumulateur
Ack	Acknowledge	Accusé de réception
Acs	Access	
Act	Activate	Activation
Acu	Acoustic	
Add	Adder	Additionneur
Adr	Address	Adresse
Alm	Alarm	
Ali	Alarm inhibit	Inhibition d' alarme
Alu	Arithmetic logic unit	Unité logique arithmétique
An	Analogue	
AR	Address register	Registre d' adresses
Async	Asynchronous	Asynchrone
Attn	Attention	Attention
Auth	Authoration	
Aux	Auxiliary	
Bat	Battery	
BCD	Binary coded decimal	Décimal code binaire
BCtr	Bit counter	Compteur d' éléments binaires
Beh	Behaviour	
BG	Borrow generate	Retenue engendrée
BI	Borrow input	Entrée retenue
BIM	Binary input module	
Bin	Binary	Binaire
Bit	Bit	Bit
Blk	Block	Bloc
Blnk	Blank	Espace
BOM	Binary output module	
BP	Borrow propagate	Retenue propagée
B-P	By-pass	
Buf	Buffer;	Buffered Tampon; à tampon
Bus	Bus	Bus
Busy	Busy	Occupé
Byt	Byte	Multiplet

C	Command (Signal class code)	
Can	Cancel	
Cap	Capability	
Car	Carrier	
CB	Circuit breaker	
Cd	Code	
CD	Compact disc	
Cdsel	Code select	Sélection de code
CE	Chip enable	Validation de circuit
Cfg	Configure; configuration	
CG	Carry generate	Retenue engendrée
Ch	Channel	
Cha	Charger	
Chg	Change	
Chk	Check	Vérification; contrôle
CI	Carry input	Entrée retenue
Cl(ose)	Close	
CLA	Carry look-ahead	Anticipation de retenue
Clk	Clock	Horloge
Clr	Clear	Effacer
Cmd	Command	Commande; instruction; ordre
Cnt	Count	Comptage
Cntl	Control	Commande
CO	Carry output	Sortie retenue
Col	Column	Colonne
Comp	Compare	Comparaison
Corr	Corrected, Correction	Corrigé
CP	Carry propagate	Retenue propagée
CPU	Central processing unit	Unité centrale de traitement
CRC	Cyclic redundancy check	Contrôle de redondance cyclique
Cry	Carry	Retenue
CS	Chip select	Sélection puce
CT	Current transformer	
Ctr	Counter	Compteur
CTS	Clear to send	Prêt à envoyer
C(urr)	Current	Courant
Cyc	Cycle	Cycle
D	Data	Données
Dcd	Decode	Décoder
Dec	Decimal	Décimal
Decr	Decrease; Decrement	Diminution; amortissement
Dest	Destination	Destination
Det	Detect	Localiser
Dev	Device	Dispositif

Diff	Difference	Différence
Dir	Direction	
Dis	Disable	Neutraliser
Disc	Disconnector; Isolator	
Disk	Disk; Disc	Disquette; disque
Dist	Distance(protection)	
Dlt	Delete	
Dly	Delay	Retard
DMA	Direct memory access	Accès mémoire direct
Dmd	Demand	
DO	Data object	
DRAM	Dynamic RAM	Mémoire à accès aléatoire dynamiq.
Drv	Driver	Amplificateur
Dsch	Discharge	
Dscr	Discrepancy	
DSRDY	Data set ready	Poste de données prêt
DTRDY	Data terminal ready	Terminal de données prêt
Dur	Duration	
Dwn	Down	A rebours
E	Alarm&Event signal (Signal class code)	
El	Electrical	
Emg	Emergency	
En	Enable	Valider
Encd	Encode	Coder (en conversion de code)
End	End	Fin; Finir
EOF	End of file	Fin de fichier
EOL	End of line	Fin de ligne
EOT	End of tape	Fin de ruban;
EOT	End of transmission	Fin de transmission
Eq	Equal; Equalization	
Eqpt	Equipment	
Err	Error	Erreur
Ers	Erase	Oblitérer
Ety	Empty	Vide; Vider
Evt	Event	Evénement
EXOR	Exclusive OR	OU exclusif
Exc	Exceeded	
Excl	Exclusion; Excluded	
Ext	External	Externe
F(ail)	Failure; Fail	
Fact	Factor	
FF	Flip-flop	Bascule bistable
FIFO	First in, first out	Premier entré, premier sorti
FL	Flashing	
Fld	Field	Zone

Flg	Flag	Drapeau
Flt	Fault	Défaut
Flw	Flow	
FNC	Function	Fonction
FWD	Forward	
G	Gate	Porte
Gen	Generate	Générer
Gen	General	
Gnd	Ground; Earth	Terre
Gr	Group	
Grd	Guard	
H(and)	Hand; Manual	
H(igh)	High	
Halt	Halt	Arrêt ?????
Heal	Healthy	
Hex	Hexadecimal	Hexadécimal
Hld	Hold(ing)	Maintien
Horz	Horizontal	Horizontal
I	Indication signal (Signal class code)	
I/O	Input/output	Entrée/sortie
Id	Identification	Identification
IF, (Indf)	Indication fault/fail	
I-F, (Intfc)	Interface	
Imp	Impedance	
In	In; Input	Dans; entrée; d' entrée
Incr	Increase, Increment	Augmenter
Ind	Indication	
Inh	Inhibit	Interdire
Init	Initialisation	Initialisation
Ins	Insulation	
Int	Integer	
Intl	Internal	interne
Intrp	Interrupt	Interrompre; interruption
Irq	Interrupt request	Demande d' interruption
Kybd	Keyboard	Clavier
L	Constant level signal (Signal class code)	
L(ow)	Low	
L(oc)	Local	
LAN	Local area network	
Lch	Latch; Latched	Fermeture; verouillé
Ld	Load	Charger
LED	Light emitting diode	

Lft	Left	A gauche
L-O	Lock-out	
Loc	Location	Emplacement
LRC	Longitudinal redundancy check	Contrôle par redondance !!!!
LSB	Least significant bit	Bit le moins significatif
LSByt	Least significant byte	Multiplet le moins significatif
Lst	List	
Lt	Light	Voyant
LT(est)	Lamp test	
M	Measuring signal (Signal class code)	
Max	Maximum	Maximum
Mem	Memory	Mémoire
Min	Minimum	Minimum
Mod	Mode	
Mot	Motor	Moteur
MRD	Memory read	Lecture mémoire
MSB	Most significant bit	Bit de poids le plus élévé
MSByt	Most significant byte	Multiplet de poids le plus élévé
Msk	Mask	Masque
Mstr	Master	Principal; maî tre
Mtr	Motor	Moteur
Mux	Multiplex; Multiplexer	Multiplexer; multiplexeur
N(orm)	Normal	
N-O	Normal open	
N-C	Normal closed	
NAck	Negative acknowledge	Accusé de réception négatif
Nam	Name	
Neg	Negative	Négatif
No	No	Aucun; non
Nom	Nominal	
Num	Number	
O(pen)	Open	
O(ver)	Over	
Oct	Octal	Octal
Off	Off	Fermé
On	On	Ouvert
Out	Out; Output	Sortie; de sortie
Op	Operate; Operation	
Ovfl	Overflow	Dépassement (de capacité)
P(wr)	Power	
Par	Parity; Parallel	Parité
PC	Programme counter	Compteur du programme
PC	Personal computer	

PCI	Programme-controlled interrupt	Interruption commandée par progr. !!!!!
Pct	Percent	
PE	Parity error	Erreur de parité
Per	Periodic	
PF	Power Factor	
Pls	Puls	
Pos	Positive; Position	Positif; position
Prcs	Process; Processor	Processus; processeur
Pres	Pressure	
Prg	Progress	
Prgm	Program	Programme
Pim	Primary	
Proc	Process; Processor	Processus; processeur
Prot	Protection	
PU	Pull-up -access memory	Mémoire à accès aléatoire
Qty	Quantity	
R	Raise	
R(em)	Remote	
Rcd	Record; Recording	
Rch	Reach	
Rcirc	Recirculate	Recirculer
Rcl	Reclaim	
Rcvr	Receiver	Récepteur
Rd	Read	Lecture
Rdy, Ready	Ready	Prêt
Re	Retry; Reactivate	
React	Reactance; Reactive	
Rec	Reclose	
Red	Redaction	
Ref	Reference	Référence
Reg	Register Registre	
Reg	Regulated; Regulator	
Rej	Reject	Rejet
Rel	Release	
Req	Request	Demande
Res	Reset; Residual	Mise à zéro; remise à l’ état initial
Rest	Restricted	
Rev	Reverse	
RFD	Ready for data	Prêt pour données
Rfsh	Refresh	Rafraî chir
Rl	Relation	
Rms	Root mean square	
Rng	Range	Gamme (étendue)
ROM	Read-only memory	Mémoire à lecture seule
Rot	Rotation; Rotor	

Row	Row	Rangée
RQTS	Request to send (data)	Demande pour émettre (des données)
Rst	Restart; Restraint	Remise en marche
Rsv	Reserve	
Rt	Right	A droite
Rte	Rate	
RTL	Return to local	Retourner sur local
Rtn	Return	Retour
RTZ	Return to zero	Retour à zéro
Run	Run	Lancement
Rx	Receive	
S	Setting value signal (Signal class code)	
Sec	Secondary; Security	
Sel	Select	Sélectionner
Seq	Sequence, Sequential	
Set	Set; Setting	Positionnement; mise à "1"
SEV	Sum even	Nombre pair
Sft	Shift	Décalage
Slv	Slave	Esclave
SODD	Sum odd	Nombre impair
Spd	Speed	Vitesse
Sply	Supply	Alimentation
SRQ	Service request	Demande de service
Str, (Start)	Start	Mise en marche; début
Stat	Status	Etat
STDBY	Stand-by	De secours
Stk	Stack	Pile
Stop	Stop	Arrêt
Stor	Store	Mettre en mémoire; mémoire
Strb	Strobe	Activation par impulsion
Sup	Supervisory	
Supl	Supply	
Svc	Service	
Sw	Switch	Aiguillage; commutation
Sync	Synchronisation	Synchronisation
Sys	System	Système
T(est)	Test	
Term	Terminate; Terminal	Fin; terminal
Tg	Toggle	Déclencheur bistable
To	To; Top	
Tot	Total, Totally	
Trig	Trigger	Déclencheur; déclencher
Tr(ip)	Trip	
Trf	Transformator	
Tst	Test	Essai

Tx	Transmitt; Transmitted	
Typ	Type	
U(nder)	Under	
Un(it)	Unit	
Up	Up	En haut ; utilisable
Util	Utility	De service
Vac	Vacuum	
Val	Value	
Vert	Vertical	Vertical
Vid(eo)	Video	Vidéo
Virt	Virtual	Virtuel
Vld	Valid	Valable
Vlv	Valv	
VT	Voltage transformer	
WAN	Wide area network	
Wpl	Workplace	
Wr	Write	Ecriture
Wrd	Word	Mot
Wrm	Warm	
Xcvr	Transceiver	Emetteur-récepteur
Xmit	Transmission; Transmit	Transmission; transmettre
Xmt	Transmission; Transmit	Transmission; transmettre
Xmtr	Transmitter	Transmetteur
XOR	Exclusive OR	OU exclusif
Y(ES)	Yes	
Zer	Zero	
Zn	Zone	

(Normative)

Letter codes for use in signal designations

A.6 Signal kind letter codes classification

The following letter codes are specified in this standard and shall be used as introduction to the Name (part of signal designation) to identify the signal class.

Classification, including additional class, is related to the information of the signal and not to the appearance in a specific variant of the signal. If signal representation in a variant of the signal should be classified it may be identified by a code (subclass) in “Additional Information” (see 4.1).

Table B.1 - Letter codes for classification of Reporting Signal

Letter code	Signals classes
E	Alarm and Event signal
I	Indication signal
L	Constant level signal
M	Measuring signals
X(n)	Additional class, Reporting signal
	Note – Additional class is to be specified and documented for a specific application, and numbers are to be used if more then one additional class is requied.

Table B.2 - Letter codes for classification of Controlling Signal

Letter code	Signal classes
C	Command
S	Setting value
Y(n)	Additional class, Commanding signal
	Note – Additional class is to be specified and documented for a specific application, and numbers are to be used if more then one additional class is requied.