

INTERNATIONAL STANDARD



Preparation of documents used in electrotechnology – Part 1: Rules



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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IN ELECTROTECHNOLOGY –****Part 1: Rules****FOREWORD**

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International Standard IEC 61082-1 has been prepared by IEC technical committee 3: Information structures, documentation and graphical symbols.

It has the status of a horizontal standard in accordance with IEC Guide 108.

This third edition cancels and replaces the second edition published in 2006. This edition constitutes a technical revision and includes the following main technical changes:

- a) inclusion of presentation rules for wireless interconnections
- b) description of exceptional cases for the application of rules for positioning of reference designations in diagrams
- c) correction of errors and update of the normative references
- d) harmonization of definitions with respect to referenced publications.

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

FDIS	Report on voting
3/1189/FDIS	3/1196/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.

A list of all the parts in the IEC 61082 series, under the general title *Preparation of documents used in electrotechnology*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

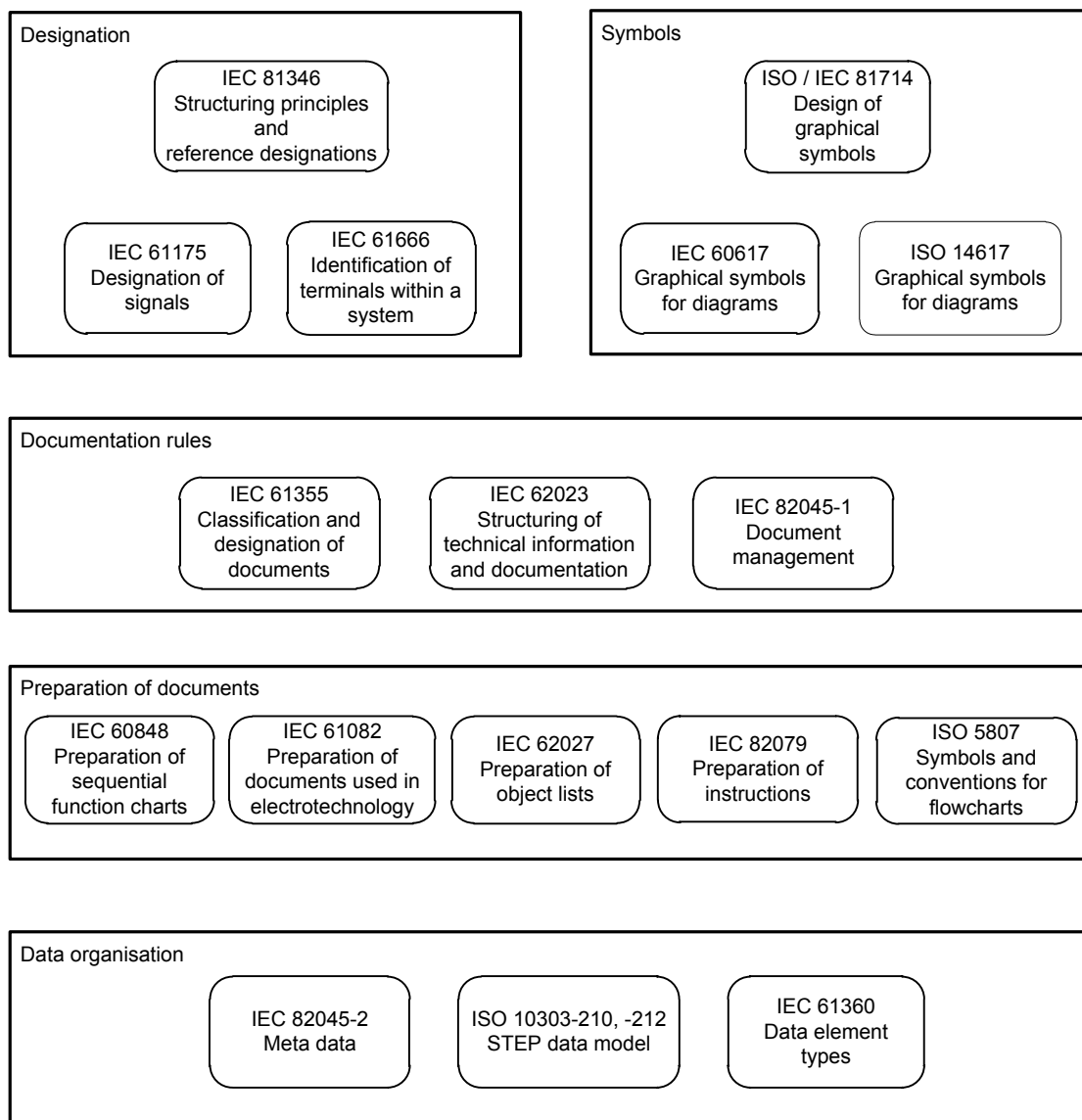
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INTRODUCTION

IEC 61082-1 deals with the presentation of information in documents. Part of this information is described in other International Standards. **Figure 1 – Overview of standards related to the presentation of information in documents** provides an overview on the interrelation between some of these standards.



IEC

Figure 1 – Overview of standards related to the presentation of information in documents

Examples in this part of IEC 61082 are intended to illustrate a given rule and are not necessarily representative of complete documents.

PREPARATION OF DOCUMENTS USED IN ELECTROTECHNOLOGY –

Part 1: Rules

1 Scope

This part of IEC 61082 ~~provides~~ **establishes** general rules and guidelines for the presentation of information in documents, and specific rules for diagrams, drawings and tables used in electrotechnology.

Excluded from this part of IEC 61082 are rules and guidelines for all kind of audio or video **or tactile** presentations.

This horizontal standard is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 108.

One of the responsibilities of a technical committee is, wherever applicable, to make use of horizontal standards in the preparation of its publications. The contents of this horizontal standard will not apply unless specifically referred to or included in the relevant publications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60375:~~2003~~, *Conventions concerning electric and magnetic circuits*

IEC 60757:~~1983~~, *Code for designation of colours*

IEC 60617:~~DB:—2001~~, *Graphical symbols for diagrams*. **Available from:**
<http://std.iec.ch/iec60617>

IEC 60848:~~2002~~, *GRAFCET specification language for sequential function charts*

IEC 61175:~~2005~~, *Industrial systems, installations and equipment and industrial products-
Designation of signals*

IEC 61286:~~2004~~, *Information technology – Coded graphic character set for use in the
preparation of documents used in electrotechnology and for information interchange*

IEC 61293:~~1994~~, *Marking of electrical equipment with ratings related to electrical supply –
Safety requirements*

~~IEC 61355:1997, Classification and designation of documents for plants, systems and
equipment~~

IEC 61355-1:2008, *Classification and designation of documents for plants, systems and equipment – Part 1: Rules and classification tables*

IEC 61666:~~1997~~, *Industrial systems, installations and equipment and industrial products – Identification of terminals within a system*

~~IEC 61804-1:2003, Function blocks (FB) for process and control – Part 1: Overview of system aspects~~

~~IEC 61804-2:2004, Function blocks (FB) for process and control – Part 2: Specification of FB concept and Electronic Device Description Language (EDDL)~~

IEC 62023:~~2000~~, *Structuring of technical information and documentation*

IEC 62027:~~2000~~, *Preparation of object lists, including parts lists*

~~IEC 62079:2001, Preparation of instructions – Structuring, content and presentation~~

IEC 62491, *Industrial systems, installations and equipment and industrial products – Labelling of cables and cores*

~~IEC 61346-1:1996~~ IEC 81346-1, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 81714-2:~~1998~~ 2006, *Design of graphical symbols for use in the technical documentation of products – Part 2: Specification for graphical symbols in a computer-sensible form including graphical symbols for a reference library, and requirements for their interchange*

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

IEC 82045-2:~~2004~~, *Document management – Part 2: Metadata elements and information reference model*

IEC 82079-1, *Preparation of instructions for use – Structuring, content and presentation – Part 1: General principles and detailed requirements*

~~ISO 31 (all parts), Quantities and units¹~~

ISO 128-22:~~1999~~, *Technical drawings – General principles of presentation – Part 22: Basic conventions and applications for leader lines and reference lines*

ISO 128-30:~~2004~~, *Technical drawings – General principles of presentation – Part 30: Basic conventions for views*

ISO 2594:~~1972~~, *Building drawings – Projection methods*

ISO 3098-5:~~1997~~, *Technical product documentation – Lettering – Part 5: CAD- lettering of the Latin alphabet, numerals and marks*

~~ISO 5807:1985, Information processing – Documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts~~

ISO 5455:~~1979~~, *Technical drawings – Scales*

¹ ~~Published as a compilation in ISO Standards Handbook, Quantities and units.~~

ISO 5456-2:1996, *Technical drawings – Projection methods – Part 2: Orthographic representations*

ISO 5457:1999, *Technical product documentation – Sizes and layout of technical drawing sheets*

~~ISO 10209-1:1992, *Technical product documentation – Vocabulary – Part 1: Terms relating to technical drawings: general and types of drawings*~~

~~ISO 10628:1997, *Flow diagrams for process plants – General rules*~~

~~ISO 14617 (all parts), *Graphical symbols for diagrams*~~

ISO 80000 (all parts), *Quantities and units*

ISO 81714-1:1999, *Design of graphical symbols for use in the technical documentation of products – Part 1: Basic rules*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

~~NOTE 1 In the definitions, terms that are defined elsewhere within this clause are shown in *italics*.~~

NOTE 0 provides further information on different document kinds.

3.1 Basic terms

~~3.1.1~~

~~data medium~~

~~material on which data can be recorded and from which data can be retrieved~~

~~[ISO/IEC 2382-1, definition 01.01.51]~~

3.1.1

document

fixed and structured amount of information intended for human perception that can be managed and interchanged as a unit between users and systems

Note 1 to entry: The term document is not restricted to its meaning in a legal sense.

Note 2 to entry: A document can be designated in accordance with the type of information and the form of presentation, for example overview diagram, connection table, function chart.

[SOURCE: ISO/IEC 8613-1:1994, 3.58, modified – Notes 1 and 2 to entry have been added.]

3.1.2

document kind

type of document defined with respect to its specified content of information and form of presentation

Note 1 to entry: Sometimes the term document type is used for the same concept.

[SOURCE: IEC 61355-1:2008, 3.56]

3.1.3

documentation

collection of documents related to a given subject

Note 1 to entry: This may include technical, commercial and/or other documents.

Note 2 to entry: The term subject may refer to objects in the sense of IEC 81346 or to other things to be addressed.

Note 3 to entry: A documentation can consist of documents, composite documents and document sets.

Note 4 to entry: The number and kinds of documents in a documentation can differ according to purpose.

[SOURCE: ~~IEC 62023, definition 3.2.2~~ IEC 61355-1:2008, 3.5]

3.1.4

database

collection of data organized according to a conceptual structure describing the characteristics of the data and the relationships among their corresponding entities, supporting one or more application areas

[SOURCE: ISO/IEC 2382-1:1993, 01.08.05]

3.1.5

hyperlink

active link from one place in a presentation to another place in the same presentation or in another presentation

Note 1 to entry: A hyperlink is only active when the presentation of the document is managed by a computer

Note 2 to entry: The hyperlink implies that a user can activate the link in order to get to the other point

3.1.6

object

entity treated in a process of ~~design, engineering, realization, operation, maintenance and demolition~~ development, implementation, usage and disposal

Note 1 to entry: The ~~entity~~ object may refer to a physical or non-physical "thing", ~~or to a set of information associated with it~~ i.e. anything that might exist, exists or did exist

Note 2 to entry: ~~Depending on its purpose, an object may be viewed in different ways called "aspects".~~ The object has information associated to it

[SOURCE: ~~IEC 61346-1~~ IEC 81346-1:2009, 3.1]

3.1.7

object designation

identifier of a specific object in a given context

Note 1 to entry: Examples of such designations are: reference designation, type number, serial number, name.

[SOURCE: IEC 61355-1:2008, 3.13]

3.1.8

reference designation

identifier of a specific object formed with respect to the system of which the object is a constituent, based on one or more aspects of that system

[SOURCE: ~~IEC 61346-1~~ IEC 81346-1:2009, 3.7.11]

3.1.9

single-level reference designation

reference designation assigned with respect to the object of which the specific object is a direct constituent

Note 1 to entry: A single-level reference designation does not include any reference designations of upper level or lower level objects.

[SOURCE: ~~IEC 61346-1~~ IEC 81346-1:2009, 3.812]

3.1.10

reference designation set

~~set of~~ collection of two or more reference designations assigned to an object of which at least one unambiguously identifies this object ~~of interest~~

~~NOTE—Other members of the set need not necessarily identify the object of interest but other objects of which it is a constituent.~~

[SOURCE: ~~IEC 61346-1~~ IEC 81346-1:2009, 3.4014]

3.1.11

product

intended or accomplished result of labour, or of a natural or ~~industrial~~ artificial process

[SOURCE: IEC 81346-1:2009, 3.6]

3.1.12

component

~~industrial product which serves a specific function or functions, which is not decomposable or physically divisible in the considered context and which is intended for use in a higher order assembled product~~

product used as a constituent in an assembled product, system or plant

[SOURCE: IEC 81346-1:2009, 3.7]

3.2 Terms related to the forms of presentation of information

3.2.1

drawing form

presentation of information using graphical means

3.2.2

pictorial form

presentation of information using images or geometrically absolute depictions irrespective of the actual perspective used

Note 1 to entry: Pictorial forms can be two- or three-dimensional.

3.2.3

textual form

presentation of information using words and numerals

~~3.3 Terms related to basic document kinds~~

3.2.4

drawing

presentation mainly using the drawing form by showing, usually to scale, the objects and their relative position to each other

~~NOTE—Plans, sections, cuts, sketches and views as defined in ISO 10209-1 are specific kinds of drawings.~~

3.2.5

diagram

presentation mainly using the drawing form and ~~in which graphical symbols are used to indicate the objects and their relationships~~ showing the functions of the objects composing a system and their interrelations using graphical symbols

~~[ISO 10209-1, definition 2.4, modified]~~

3.2.6**chart
graph**

presentation mainly using the drawing form expressing the relationship between two or more variable quantities, operations or states

[SOURCE: ISO 10209-1:1992, 2.1, modified – "usually within a coordinate system" has been deleted and "operations or states" has been added.]

3.2.7**table
list**

presentation in which the information is presented in columns and rows

Note 1 to entry: A list is a specific kind of a table.

Note 2 to entry: A presentation in a table cell can be of any form.

3.3 Terms related to specific document kinds**3.3.1****overview diagram**

diagram providing a comprehensive view of an object with a low degree of detailing

3.3.2**function diagram**

diagram providing information on the functional behaviour of an object

3.3.3**circuit diagram**

diagram providing information on the interaction of the components of electric circuits together with information on physical connections

3.3.4**connection diagram**

diagram providing information on the physical connections among components or units

3.3.5**equivalent-circuit diagram**

function diagram providing information on an electric and/or magnetic behaviour model of an object

3.3.6**logic-function diagram**

function diagram that predominantly uses symbols for binary logic elements

3.3.7**arrangement drawing**

drawing providing information on the relative or absolute location of objects

3.3.8**connection table**

table providing information on the physical connections among components or units

3.3.9**sequence chart**

chart providing information on the succession of operations or status of the units of a system

3.3.10

time sequence chart

sequence chart with the time axis plotted to scale

4 Documentation principles

4.1 General considerations

Technical documentation is essential for the planning, design, manufacture, installation, commissioning, use, maintenance and demolition of a product or a system.

The purpose of the documentation is to provide information in the most appropriate form. In addition it is an essential means to proof and guarantee that safety, environmental and quality requirements related to a product or a system are met.

Technical documentation represents as significant a part of a contract as the supply of equipment, and constitutes an essential element of the after-sales processes.

4.2 Structure of documentation

In ~~IEC 61346-1~~ IEC 81346-1 it is stated that information on products and systems can be organised in tree-like structures. The structures represent the way in which an object is subdivided into constituent objects, for example the process into smaller processes or a product into sub-products.

In accordance with IEC 61355-1, a document should describe and be clearly related to relevant objects. The relationship of a document to the object described is normally given by use of the object designation as part of a document designation.

NOTE The object designation can be either a reference designation (for occurrence related documents) or a type designation (for type related documents). For further information see Clause 0.

The use of structure leads to hierarchy in the presentation of information, see IEC 62023. This means that information is presented in subsequent levels, each showing a different degree of details. For example, documents related to the object represented by the top node in a structure consist of overall information of the complete system, while documents related to the other objects represented in the structure consist of more detailed information of the constituents, see also Clause 0.

The structuring principles also support design and manufacturing based on division of labour or subcontracting. The manufacturer of a component provides all information necessary for the understanding and use of his delivery without taking care of external matters. The documentation for such component or subsystem can then be integrated in any system on the appropriate level of that system structure.

4.3 Presentation of information

The presentation of information, in a document shall be unambiguous and aimed at practical use. This implies that the same information may be presented in different documents applying the same or a different document kind. The information shall be consistent throughout all places of presentation.

When information is stored in a database independent from any form of presentation, this information can be made accessible by distinct views in the moment it is needed and in the form most suitable for the intended purpose, provided adequate tools are available applying the rules of this International Standard (see Figure 2).

Document kinds represent possible and predefined forms of presentations (see IEC 61355-1 and Annex C).

When information is stored dependent on a form of presentation, i.e. as a document, the rules of this International Standard applies when the document is being prepared, see Figure 3. The document could be prepared by means of a CAX-system or directly on paper or equivalent.

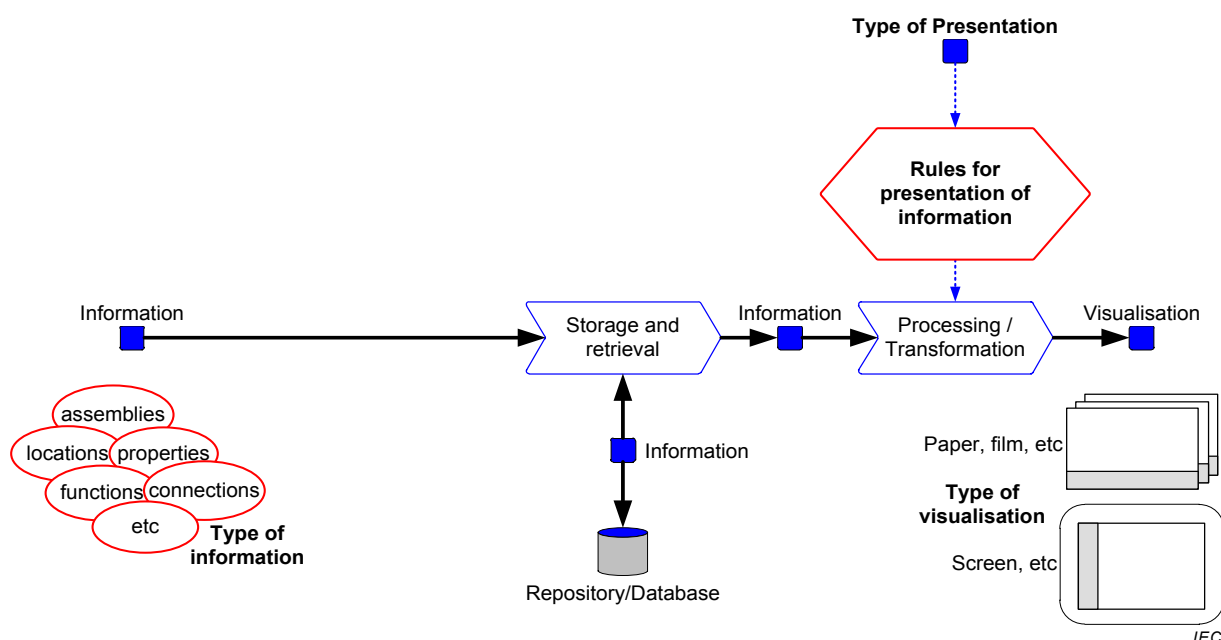


Figure 2 – Documents generated from information stored in a database

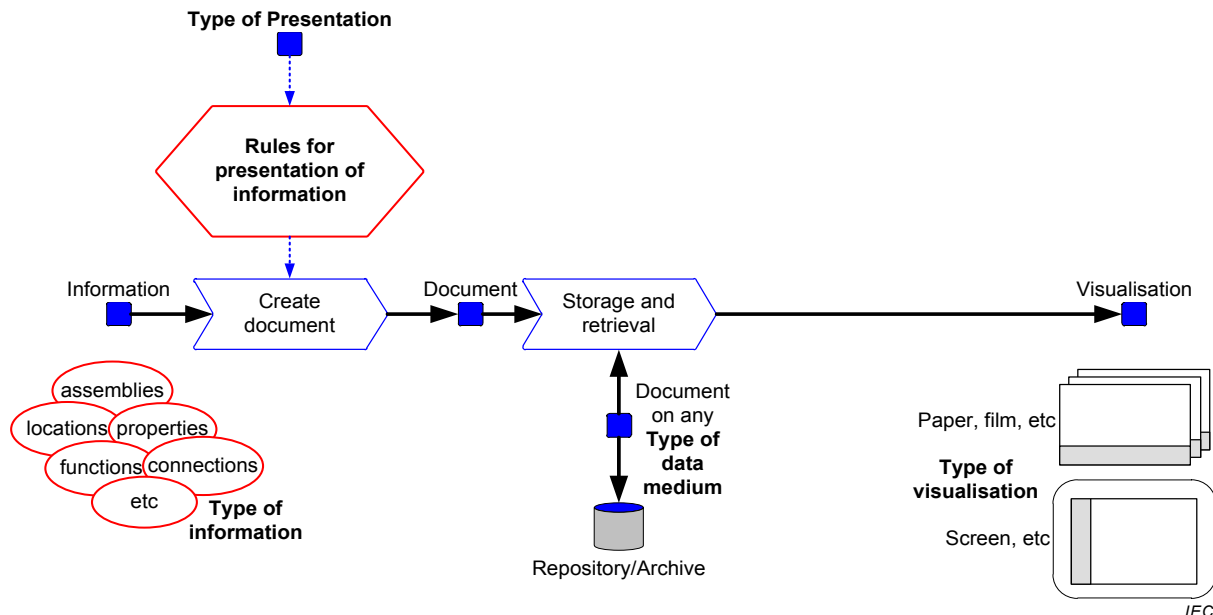


Figure 3 – Documents prepared and stored in a database

4.4 Document identification and designation

Each document shall be identified with at least one identifier, which shall be unambiguous within a given context. As a document may be unambiguously identified within several contexts, the valid context shall be explained in the document or in supporting documentation.

NOTE 1 The context in which a document identifier is valid could be indicated by stating:

- the organization responsible for that document identifier, e.g. the company preparing the document,

– the internationally recognized document or article numbering system, e.g. ISBN, ISSN, EAN, UPC.

In order to relate parts of the documentation to the described objects, a document may be designated in accordance with IEC 61355-1:2008, Clause 5.

NOTE 2 ~~IEC 61355 requires an object designation and document classification code (DCC) as part of the document designation.~~ In accordance with IEC 61355-1, a document designation consists of the parts “object designation” and “document classification code (DCC)”. An object designation as described in IEC 61355-1 is either a reference designation in accordance with ~~IEC 61346-1~~ IEC 81346-1 or any other unambiguous identifier.

If the object designation is not a reference designation, it shall be clearly distinguishable from any reference designation.

5 Rules for presentation of information

5.1 Legibility

Whenever information is presented to a user, the presentation shall be legible under the intended conditions of use. The legibility depends on:

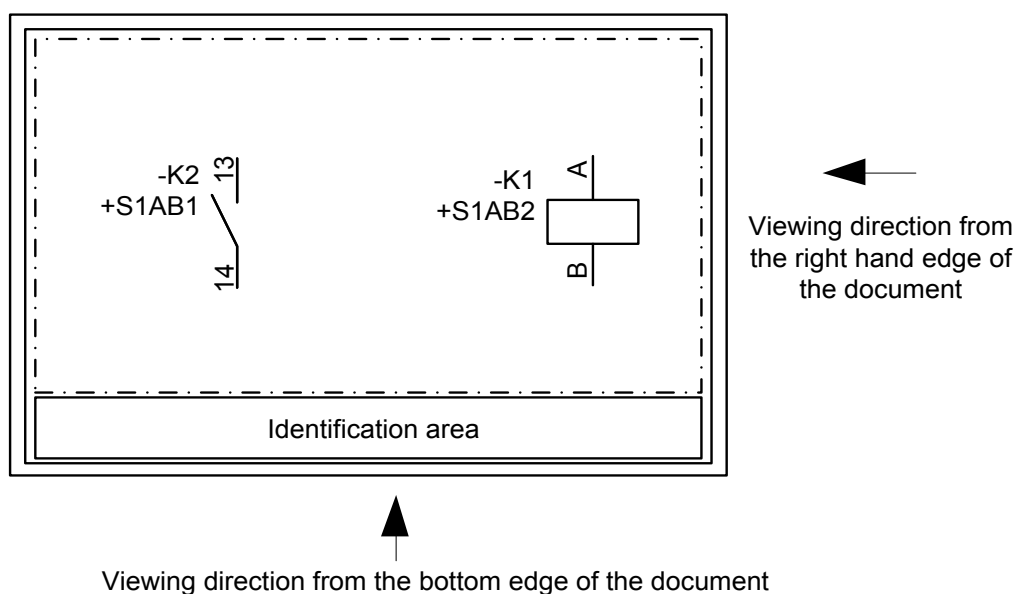
- the used forms of presentation and their combinations;
- the arrangement of symbols in relation to each other;
- how the presentation is split into different pages;
- the sizes of a page, see 0;
- the foreseen size modifications of a page;
- the use of simplification techniques, see 0, 0 and 0;
- the use of hyperlinks, see 0;
- the use of static or dynamic presentations;
- the used medium for information presentation, for example paper or screens.

The information can be presented by combinations of:

- symbols, see 0 and 0;
- lines, see 0, 0, 0 and 0;
- text and text strings, see 0, and 0;
- pictures, see 0;
- outlines of objects;
- colours, shading and patterns, see 0.

5.2 Text orientation

A text within a document shall be oriented horizontally or vertically and intended to be read from the bottom edge or from the right-hand edge, see Figure 4.



IEC

Figure 4 – Viewing directions of a document

5.3 Colours, shading and patterns

Colours should be used only as complementary information. Perception of different colours shall not be the only means for understanding presentations.

NOTE The uses of colours for specific purposes are given in ISO 3864-1, IEC 60204-1, and IEC 60073.

The meaning of the colours used shall be stated in the document or in supporting documentation.

Shadings and patterns may be used to differentiate various areas or surfaces. For documents on paper or equivalent media, the use of colours, shading and/or patterns should be usable for black and white printing.

5.4 Paper page sizes

The size of paper pages or equivalent shall conform to ISO 5457:1999, 3.1. Size A3 is recommended when mainly pictorial or diagram forms of presentation are used;

The elongated sizes defined in ISO 5457:1999, Clause 3 shall not be used.

5.5 Paper page reproduction

For documents on paper or equivalent media intended to be reproduced or microfilmed, centring marks complying with 4.3 of ISO 5457:1999 may be added to facilitate reproduction or microfilming.

5.6 Page identification

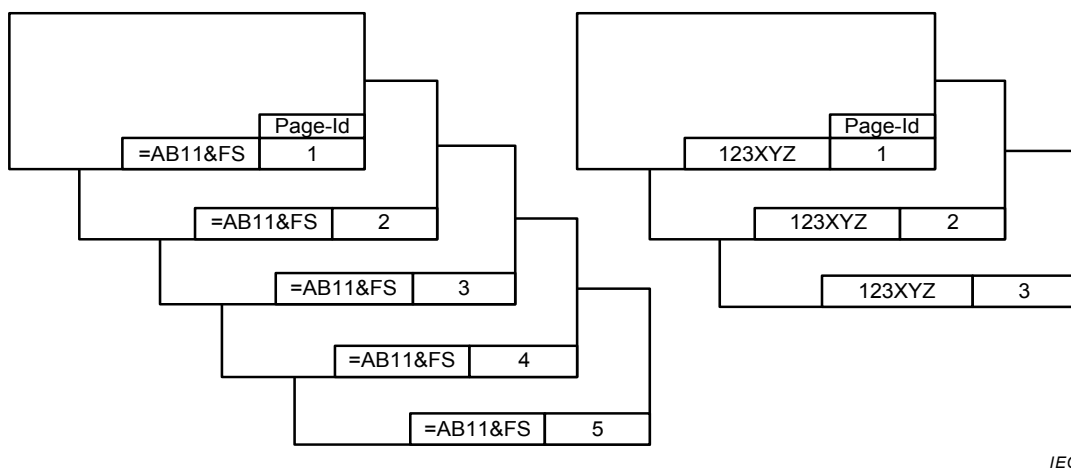
A document may consist of more than one page. In order to identify each page, for example for referencing purposes, a page identifier needs to be applied in addition to the document identifier. A single document page is identified by the combination of the document identifier and the page identifier. See Figure 5.

NOTE 1 The page counting number as described in IEC 61355-1, 7.2 can be used as such a page identifier which is related to a document designation code.

If a page of a document is associated with more than one document identifier, the page shall be given different page identifiers for the different document identifiers. See Figure 6.

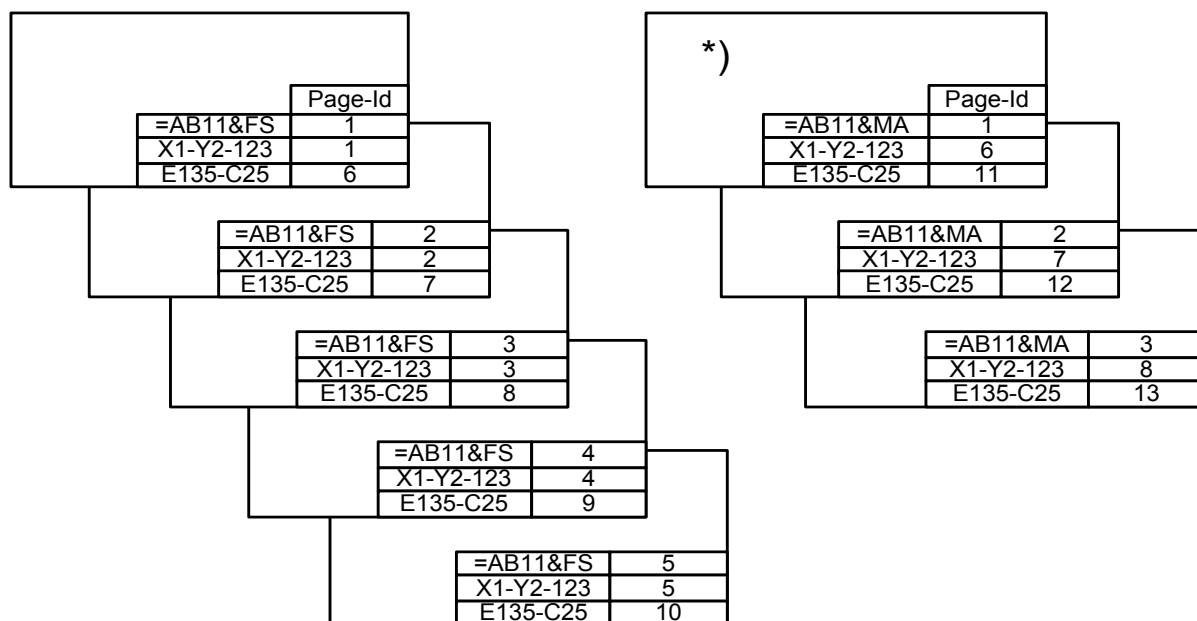
NOTE 2 The page identifier related to different document identifiers can look the same.

The page identifier shall be presented adjacent to the document identifier with which it is associated (example, see Clause 0).



IEC

Figure 5 – Examples of documents with document and page identifications



IEC

Explanation for page marked with *)

Document designation (IEC 61355)	=AB11&MA page 1
Document number of the supplier	X1-Y2-123 page 6
Document number of the customer	E135-C25 page 11

Figure 6 – Example of documents with multiple document identifiers

5.7 Page layout

5.7.1 General

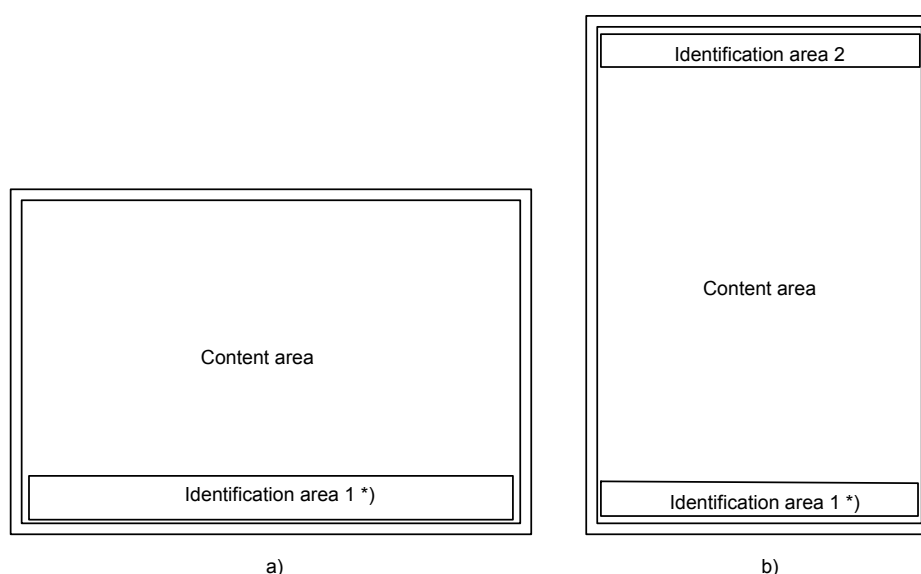
Pages may be portrait or landscape oriented.

A page is divided into:

- one or more identification areas (see 0); and
- one content area (see 0).

Each page of a document shall have at least one identification area clearly separated from the content area, for example by a frame.

Figure 7 shows examples of pages with one or more identification areas.



*) Mandatory for pages using the drawing form of presentation

IEC

a) a **landscape-oriented** page with one identification area

b) a **portrait-oriented** page with two identification areas

Figure 7 – Examples of pages with defined identification areas

5.7.2 Identification area

5.7.2.1 General

The information to be presented in the identification area should contain document metadata relevant for the reader. The metadata should comply with IEC 82045-2.

Clause 0 lists an extract of the collection of metadata of IEC 82045-2 that should be considered for inclusion.

5.7.2.2 Identification area for documents using the drawing form of presentation

One identification area shall be located at the bottom of the page. Additional identification areas may be located along the other sides of the page, see Figure 7.

Within the identification area located at the bottom, the information related to the identification and classification of the document, for example a title block in accordance with IEC 82045-2

shall be located in the ~~right~~ **rightmost part of the identification area**. Clause 0 shows an example of the layout of a title block.

Clause 0 shows examples of the location of the identification areas for different page sizes **and orientations**.

NOTE **Binder techniques and** possible punching holes should be considered when locating the **identification area and the** information within an identification area.

5.7.3 Content area

5.7.3.1 General

The information on the object of interest shall be shown within the content area.

5.7.3.2 Module

The unit M is used as the module for harmonising graphical presentation of objects, for example reference grids, location reference systems, drawing grids, and symbol sizes.

The unit M should for paper presentations or equivalent take one of the following values in millimetres:

1,8 (2,0) mm; 2,5 mm; 3,5 mm; 5 mm; 7 mm; 10 mm; 14 mm; 20 mm.

It is recommended not to use a module size less than 2,5 mm. If the module size 1,8 (2,0) mm is used, special care should be taken to ensure the legibility of the document.

NOTE IEC 81714-2 specifies that the minimum module size for the design of graphical symbols is 2,0 mm instead of 1,8 mm.

For further information concerning scaling, modification of the module size, see IEC 81714-2.

5.7.3.3 Drawing grid

For the purpose of positioning of symbols, lines and text, content areas and identification areas may be provided with a drawing grid of 1M. **This drawing grid is an auxiliary means when preparing the document and should not be visible or at least not disturb the reading of the content presented in the document version that is intended to be exchanged between parties.**

For the value of M see 0.

5.7.3.4 Reference grid

For reference purposes, see 0, documents presenting information in pictorial or diagram form on paper or equivalent should have a reference grid in accordance with ISO 5457 with a grid size of 10M, 16M or 20M.

NOTE 1 The division of the rows and columns does not need to be equal e.g. the rows could be 20M each and the columns 16M each.

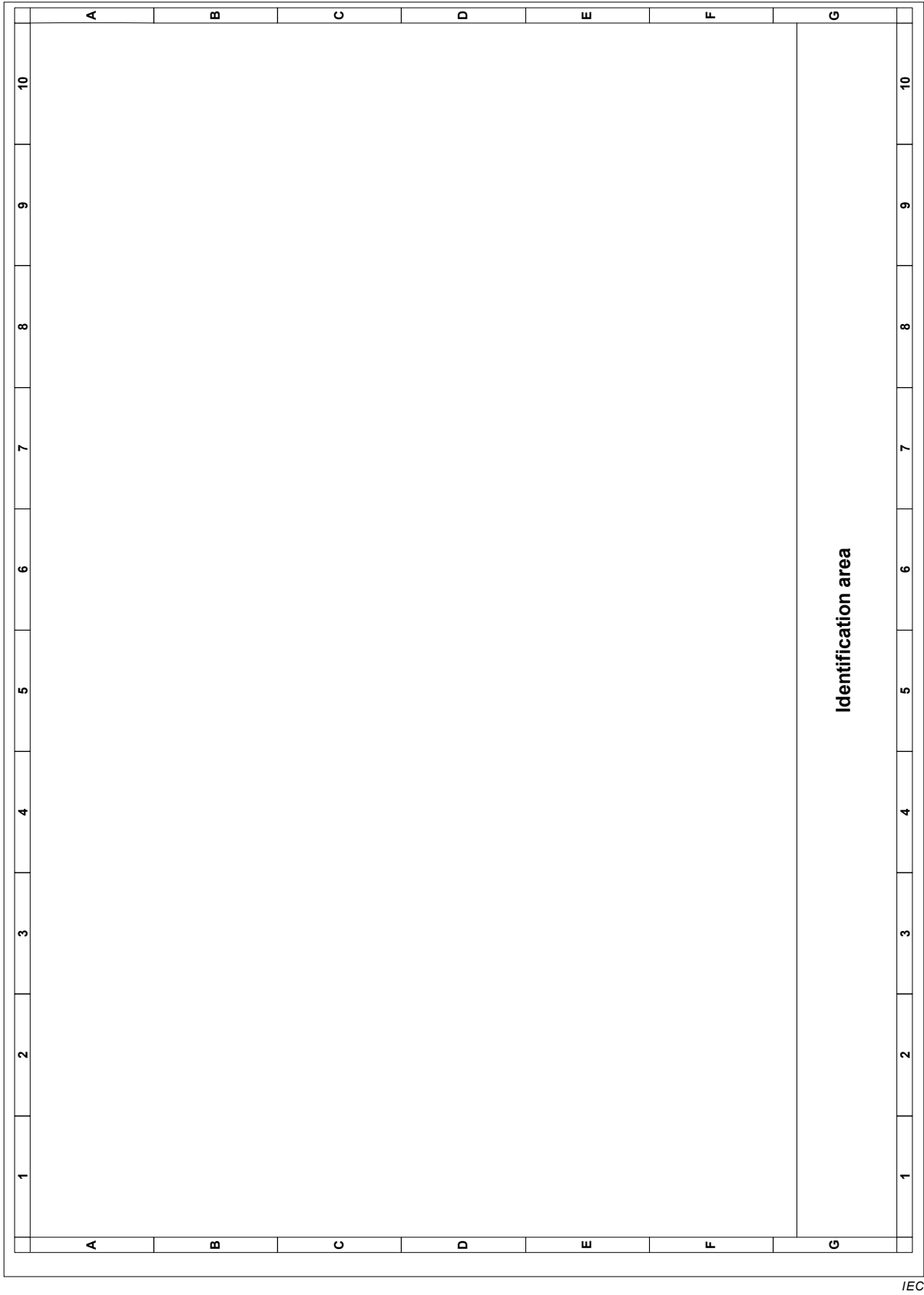
For the value of M see 0.

NOTE 2 For example if M is chosen to 2,5 mm, the reference grid will be 40 mm or 50 mm.

The grid numbering should start at the upper-left corner of the area of the page that is available for content area. **For grid numbering purposes capital Latin letters A, B, C, ... excluding I and O, or numbers starting from 0 or 1 shall be used.**

The rows of the grid should be identified by capital Latin letters ~~A, B, C, ... excluding I and O.~~ and the columns of the grid should be sequentially numbered ~~starting from 0 or 1,~~ (see Figure 8), *or vice versa.*

The grid numbering at one side of the page, for example at the shorter side, may be omitted if this is considered sufficient for referencing. It may also be considered sufficient to show the grid numbering at one side/two sides only and to omit its presentations at the opposite sides.



(Page A3 landscape, module size 2,5 mm, reference grid 16 M)

Figure 8 – Example of a reference grid

5.8 Cross-references

A cross-reference may refer to a document, to a page of a document or to a zone on a page. It shall be presented in the following sequence:

- Document
- Page
- Column, row or zone.

The document is identified in accordance with 4.4. If different document identifiers are presented on the document page and confusion is likely, it shall be clearly stated in the document or in supporting documentation which document identifier is used for cross-references.

A page is identified in accordance with 5.6 preceded by the character “SOLIDUS” (/).

A zone is identified by the sign “FULL STOP” (.) followed by the coordinates built in accordance with 5.7.3.4.

If confusion is likely, the cross-reference shall be included in square brackets [...] or brackets (...).

Examples:

=EA2=S1&FS/3.B2 : Reference to zone B2 on page 3 of a document of type FS (i.e. a circuit diagram) describing the object =EA2=S1

ZAB&FS/3.B2 : Reference to zone B2 on page 3 of a document of type FS (i.e. a circuit diagram) describing the object type ZAB.

XYZ123456/3.B2 : Reference to zone B2 on page 3 of document XYZ123456

XYZ123456/3 : Reference to page 3 of document XYZ123456

XYZ123456 : Reference to document XYZ123456

[XYZ123456] : Reference to document XYZ123456 (if XYZ123456 could be misinterpreted otherwise)

If the reference is in the same document, the reference to the document may be omitted.

Examples:

&FS/3.B2 : Reference to zone B2 on page 3 of a document of type FS (i.e. a circuit diagram) describing the same object

&FS : Reference to a set documents of type FS (i.e. circuit diagrams) of the same object

/3.B2 : Reference to zone B2 on page 3 of the same presentation

/2 : Reference to page 2

[/2] : Reference to page 2 (if /2 alone could be misinterpreted otherwise)

If the reference is in the same page, the reference to the document and page may be omitted. In this case, the row, column or zone identification shall be preceded by the character “SOLIDUS” /.

Examples:

/.B2 : Reference to zone B2 on the same page

/.2 : Reference to column 2 on the same page

Figure 9 shows examples of the application of cross-references.

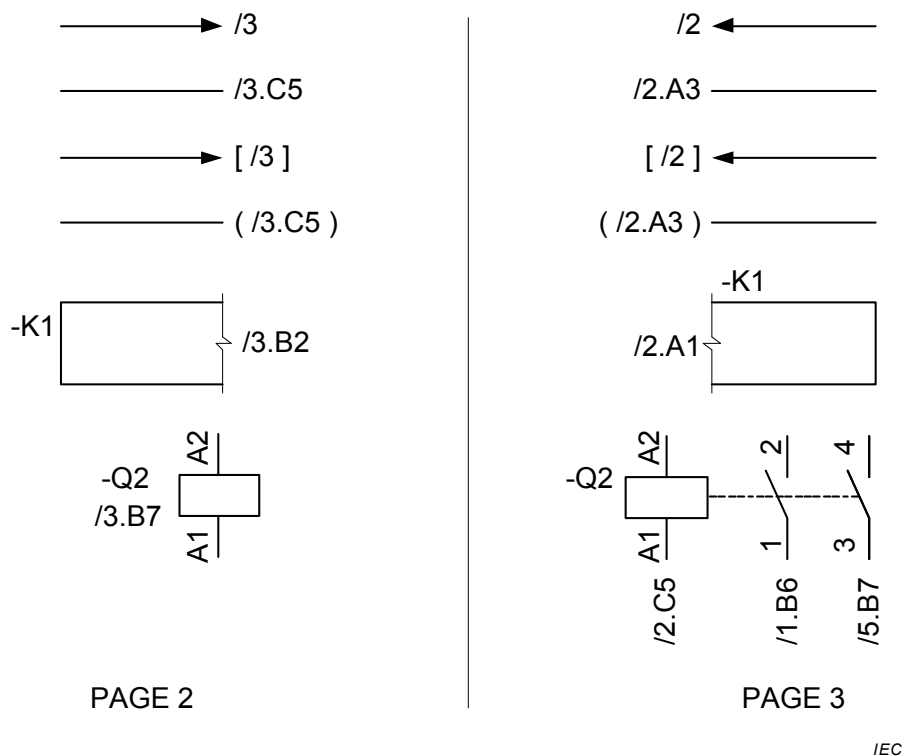


Figure 9 – Examples of the application of cross-references

5.9 Hyperlinks

Hyperlinks may be used as a means for improving the navigation between different sets of information, for example to positions in or to pages of a document, between documents or to external information sources.

The navigation shall not by itself be dependent on the functioning of hyperlinks.

Consequently, the basic navigation within a document needs to be possible, for example via content lists, indexes, explicit page or section references.

Hyperlinks may also be used for linking documents or document parts that constitute a document. However, special care should be taken when the document is under version control, see IEC 82045-1:2001, 4.5.

5.10 Line widths

For drawings the possible line widths are derived from: $0,1 \times (\sqrt{2})^n \times M$, with $n = 0, 1, 2, 3, \dots$

For the value of M see 5.7.3.2.

NOTE 1 EXAMPLE If M is chosen to 2,5 mm, the line width would be 0,25 mm, 0,35 mm, etc.

NOTE 1 For presentation on paper or equivalent media the possible line widths are 0,18 mm (0,2 mm), 0,25 mm, 0,35 mm, 0,5 mm, 0,7 mm and 1,0 mm.

If two or more lines of the same line type but with different widths are used, the ratio between these line widths shall be at least 2:1.

NOTE 2 ISO 6428 provides rules for micro copying of presentations that ~~may can~~ have influence on the choice of line widths.

5.11 Text fonts

For presentations in drawing form, the lettering type CB, vertical (V) of ISO 3098-5 should be used. Both tabular and proportional lettering in accordance with ISO 3098-5 may be used. In addition the following rules apply in this case:

- The character spacing factor should be zero, see E.2.7 of IEC 81714-2:2006. When tabular lettering is used the character aspect ratio should be 0,81 in accordance with 6.7.2 of IEC 81714-2:2006.
- The text height is derived from: $(\sqrt{2})^n \cdot M$, with $n = 0, 1, 2, 3, \dots$ For the value of M see 5.7.3.2.

NOTE 4 EXAMPLE If M is chosen to 2,5 mm, the text height would be 2,5 mm, 3,5 mm, etc.

NOTE For presentation on paper or equivalent media the possible ~~line widths text heights~~ are 1,8 mm, 2,5 mm, 3,5 mm, 5,0 mm, 7,0 mm and 10,0 mm.

- Sloped (inclined) lettering (also called *Italic*), type CB (S) of ISO 3098-5, may be used for letter symbols for quantities, see Figure 62 and Figures A.7, A.8, A.9.
- If another text font than one of the lettering types of ISO 3098-5 is used, the text font of characters shall be ~~in line with~~ scalable and distinct, similar to the stroke style presented in ISO 3098-5.
- For documents intended to be exchanged between CAx-systems the rules of IEC 81714-2 shall be considered.

5.12 Symbols

5.12.1 Choice of symbols

Symbols shall conform to relevant IEC, ISO or IEC/ISO standards, for example:

- IEC 60617 for electrical objects in diagrams and installation drawings
- ISO 14617 for non-electrical objects in diagrams
- ISO 5807 for basic flow charts

also taking ISO 81714-1 into consideration.

Symbols that depict functions may be used independent of technology, for example fibre optics may use symbols from IEC 60617. See Figure 10.

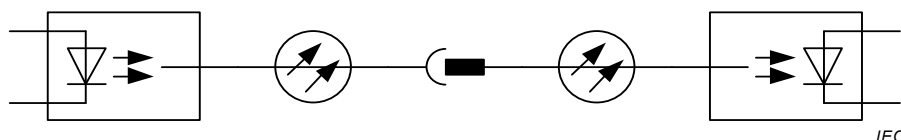


Figure 10 – Example of the use of symbols for fibre optics

Symbols to be used in CAx-applications shall in addition conform to IEC 81714-2.

When symbols have alternative forms, the forms appropriate to the purpose of the presented information shall be chosen.

When an appropriate symbol does not exist, either the general symbols S00059, S00060 or S00061 in IEC 60617 shall be applied, or a symbol may be constructed following the rules of IEC 60617 and ISO 81714-1, see also the normative Annex A.

A symbol may be replaced by one of the general symbols S00059, S00060 or S00061 in IEC 60617 with:

- the considered symbol inscribed as a qualifying symbol in the general symbol; or
- a describing text inscribed in the general symbol.

See also 5.12.2 and Figure 11.

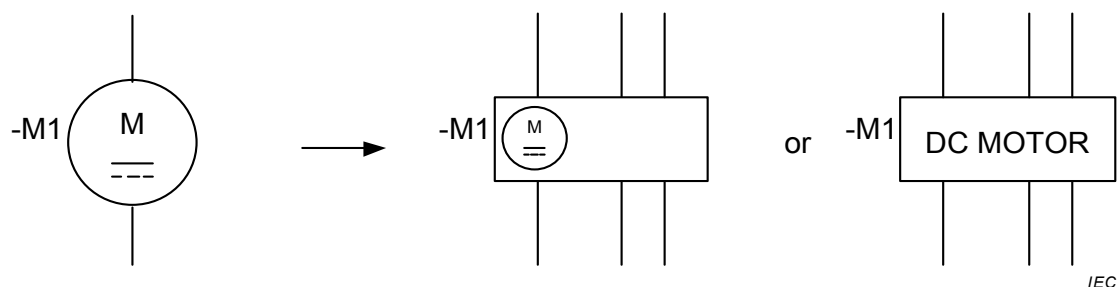


Figure 11 – Example of replacing a symbol with a general symbol

5.12.2 Symbol size

The meaning of a symbol is ~~defined~~ conveyed to the reader by its shape and by its content. The size and line thickness does not affect the meaning.

The symbols in IEC 60617 are shown on a grid pattern with a module M to specify symbol proportions. Symbols used in documentation should preferably retain the same size related to the module M.

A symbol may be enlarged, reduced or replaced by one of the general symbols S00059, S00060 or S00061 in IEC 60617 with qualifying symbol, in order to:

- increase the number of inputs or outputs;
- facilitate the inclusion of additional information;
- emphasise certain aspects;
- facilitate the use of a symbol as qualifying symbol or
- suit the scale of a drawing, plan or map.

When enlarged or reduced the general shape of the symbol shall be maintained, see also Figure 12.

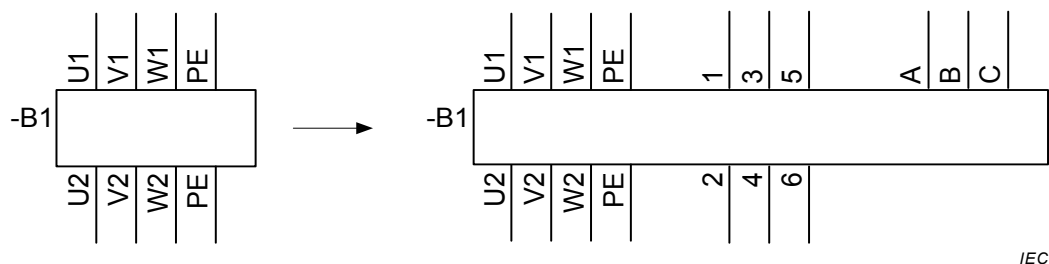


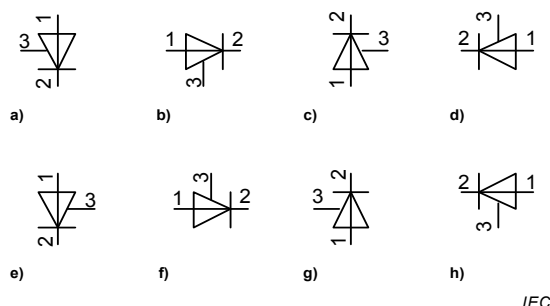
Figure 12 – Example of enlarging a symbol

5.12.3 Orientation of symbols

Symbols should be shown to support the chosen principal direction of flow in the diagram. When the orientation of a symbol to be placed in the diagram thereby deviates from the

orientation the symbol has in the symbol standards, the symbol taken from the symbol standard, may be turned or mirror-imaged if the meaning thereby will not be changed, see Figure 13. In some cases it may be necessary to redesign the symbol following the rules of ISO 81714-1.

Letters, graphs or input/output labels of symbols shall be oriented ~~horizontally or vertically and intended to be read~~ individually, separate from the orientation of the symbol, so that the final reading direction is from the bottom edge or from the right-hand edge of the page, see Figure 13.



NOTE—The symbol in position a) is as the symbol is shown in IEC 60617. The positions b), c) and d) are obtained by turning the symbol in step of 90° anti-clockwise. The positions e), f), g) and h) are obtained by mirroring the symbols in position a), b), c), and d) by the horizontal axis respectively.

Figure 13 – Turning and/or mirroring of symbol S00055 in IEC 60617

5.13 Scales

For information presented to scale, the scale should be chosen in accordance with ISO 5455.

A scale bar may be included for information purposes, and shall then be shown in the content area.

5.14 Pictorial presentation

Information in two-dimensional pictorial forms shall be presented in accordance with ISO 128-30 following the orthographic projection method in accordance with ISO 5456-2.

For information on buildings in two-dimensional forms, the rules in ISO 2594 apply.

5.15 Quantities, units, values and colour codes

Quantities, units and values should be represented by letter symbols in accordance with IEC 60027, IEC 80000 or other appropriate IEC standards for letter symbols. For items ~~outside the scope of IEC, ISO 31 not covered by IEC standards, ISO 80000~~ should be considered. Examples of the application of letter symbols are shown in Clauses A.3 and A.4.

Codes for designation of colours shall be in accordance with IEC 60757.

5.16 Presentation of ranges and set of elements

A range **representing an infinite number of values** shall be presented by using the “HORIZONTAL ELLIPSIS” character ... (three dots) between the lower and upper limits.

NOTE 1 The parenthesis shown in the following are not part of the character sequence.

EXAMPLE 1 The range 1 A to 5 A can be written: 1 A ... 5 A.

A set of elements, **i.e. an integer number of elements**, shall be presented using ...

- the character “COMMA” and “SPACE” (,) between each element of the set; or
- the characters “COMMA”, “SPACE”, “HORIZONTAL ELLIPSIS”, “COMMA” and “SPACE” (, ...,) between the lower and upper limits when the set consists of numbers and the increment is one; or
- the characters “COMMA”, “SPACE”, “HORIZONTAL ELLIPSIS”, “COMMA” and “SPACE” (, ...,) between the lower and upper limits when the set consists of consecutive ascending letters of the Latin alphabet;
- the characters “COMMA”, “SPACE” and “HORIZONTAL ELLIPSIS” (, ...) after the lower limit when the upper limit is undefined and the increment is one;
- the characters “HORIZONTAL ELLIPSIS”, “COMMA” and “SPACE” (...,) before the upper limit when the lower limit is undefined and the increment is one.

EXAMPLE 2:

- The numerical set of elements 1, 2, 3, 4, 5 and 6 can be written 1, ..., 6.
- The numerical set of unlimited elements starting from 25 can be written 25, ...
- The numerical set of unlimited elements ending with 25 can be written ..., 25
- The alphabetical set of elements C, D, E, F and G can be written C, ..., G
- The alphabetical set of elements a, b, c, d and e can be written a, ..., e

Combinations of upper–case and lower–case letters in a set of elements, for example A, ..., c shall not be used, due to their possible ambiguous interpretation.

NOTE 2 Upper–case letters I and O are not used, neither in reference designations in accordance with ~~IEC 61346-1~~ IEC 81346-1 nor in terminal designations in accordance with IEC 60445, ~~IEC 60446~~ and IEC 61666. This implies that in such cases the upper–case letter J follows the upper–case letter H, and the upper–case letter P follows the upper–case letter N.

If a set of numerical elements are prefixed or suffixed by the same letter the elements may be presented as for a numerical set of elements.

EXAMPLE 3

- The set of elements 1U, 2U, 3U, 4U can be written 1U, ..., 4U
- The set of elements R2, R3, R4, R5 can be written R2, ..., R5

If a set of alphabetical elements are prefixed or suffixed by the same number the elements may be presented as for an alphabetical set of elements.

EXAMPLE 4

- The set of elements 1U, 1V, 1W, 1X, 1Y, 1Z can be written 1U, ..., 1Z
- The set of elements R2, S2, T2, U2, V2 can be written R2, ..., V2

Elements of a non-consecutive order may be represented within a sequence. In this case, the representation of the different elements shall be separated by using the character “COMMA” (,) for example 1, 3, 6. If confusion is likely, the group shall be enclosed in parentheses, for example (1, 3, 6).

A group of elements may also be represented as a set of elements.

EXAMPLE 5 The set of elements 1, 8, 9, 10, 11, 12, 14, A, B, C and D can be written 1, 8, ..., 12, 14, A, ..., D

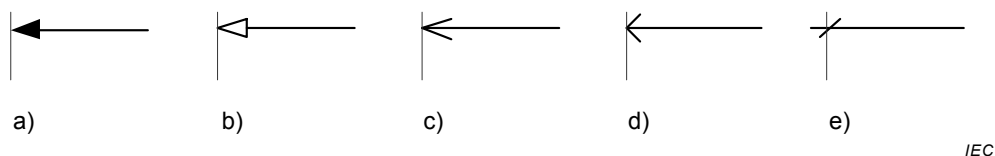
If computer-supported systems are used in presenting information the horizontal ellipsis shall be realised either as:

- a sequence of three characters “FULL STOP” .; or
- a single character “HORIZONTAL ELLIPSIS” ... as specified in IEC 61286.

NOTE 3 The rules of 5.16 have been derived from ISO 31-11.

5.17 Dimension lines

Dimension lines including their terminators and the indication of the origin shall be in accordance with ISO 129. Examples of terminators are shown in Figure 14. The choice of the arrowheads in Figure 14 a) to d) has no significant meaning, and only one type should be used within a document.

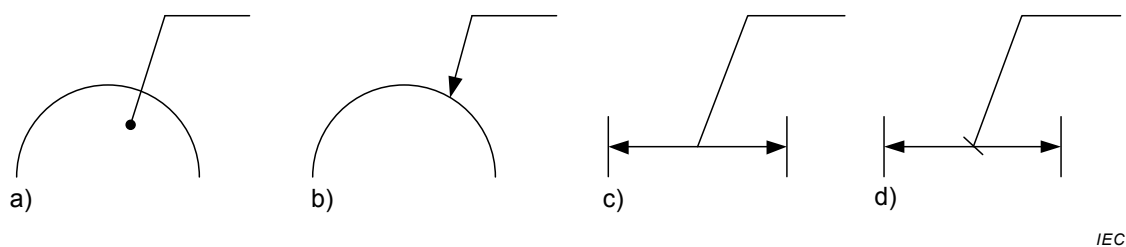


- a) Arrowhead, closed and filled 30°
- b) Arrowhead, closed 30°
- c) Arrowhead, open 30°
- d) Arrowhead, open 90°
- e) Oblique stroke

Figure 14 – Terminators of dimension lines (from ISO 129)

5.18 Leader lines and reference lines

Leader lines and reference lines shall be presented in accordance with ISO 128-22. Examples are shown in Figure 15.



- a) Leader line terminating in an object
- b) Leader line terminating on an object
- c) Leader line terminating on a line
- d) Leader line with a stroke terminating on a line

Figure 15 – Examples of leader lines (from ISO 128-22)

Leader lines ending on a connecting line shall be terminated with an oblique stroke at the connecting line, see Figure 16.

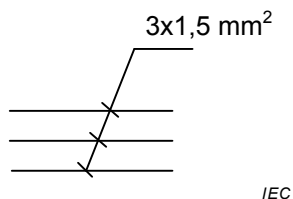


Figure 16 – Example of the use of leader lines to connecting lines

5.19 Explanatory notes and markings

An explanatory note should be used when the meaning cannot otherwise be conveyed. It should be placed adjacent to where it applies, or a reference should be made to a note placed elsewhere in the content area, see Figure 17. In the case of multi-page presentation of information, all notes of a general character should appear on the first page(s).

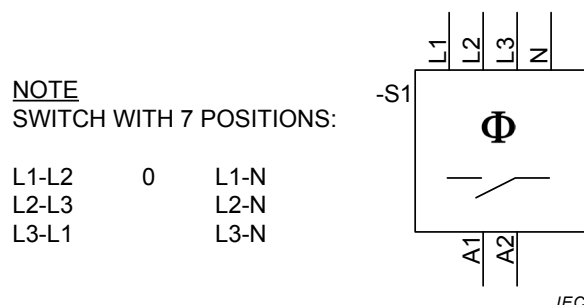


Figure 17 – Example of an explanatory note

If informative markings (for example graphical symbols in accordance with IEC 60417) for man-machine control functions appear on an equipment panel, these same markings should appear adjacent to the corresponding graphical symbol in the ~~underlying related~~ presentation of information ~~in documentation~~. If the reference direction of the current in a branch, the indication of magnetic flux direction, the reference polarity of voltage, and the correspondence between the voltage polarities of coupled electric circuits, is needed to be shown, the ~~principles of presentation methods shown in~~ IEC 60375 shall be applied.

5.20 ~~Reference designations~~ Designation of objects

5.20.1 General

~~For objects having a reference designation or a reference designation set in accordance with IEC 61346-1, at least one unambiguous reference designation shall be shown at each representation of the object.~~

For objects having an object designation this shall be consistently shown at each representation of the object.

~~The reference object~~ designation shall be readable from the bottom edge of the page. In diagrams, ~~object designations~~ should be located above or to the left of the object representation, see IEC 81714-2 for further details. ~~In other document kinds the object designation shall be clearly related to the object representation with the requirement not to interfere with other presentation elements shown in the document.~~

~~A reference~~ An object designation shall be presented on a single line (not split to several lines).

5.20.2 Reference designations

Reference designations in accordance with IEC 81346-1 are object designations for which the requirements provided in 5.20.1 apply.

~~For the presentation of objects having~~ a reference designation set in accordance with IEC 81346-1, the following applies (see Figure 18):

- the reference designation set may be presented on a single line or on successive lines;
- if the reference designations are presented on successive lines, each reference designation shall start on a separate line;

- if more than one reference designation is presented on the same line, and if not clearly separated for example as in a table, the character SOLIDUS (/) shall be used as separator sign between the different reference designations;
- the order of the presented reference designations in a reference designation set has no significant meaning;
- **At least one unambiguous reference designation out of the set shall consistently be shown at each representation of the object.**

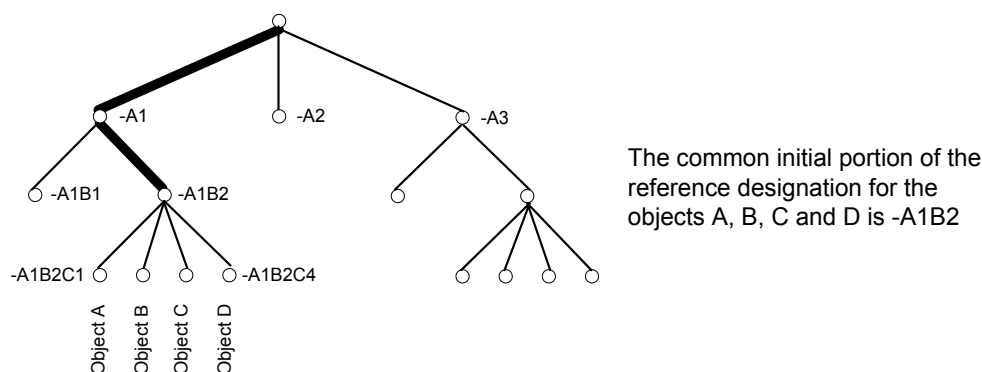
	Reference designations	Possible graphical presentations	
		All presented on the same line	Each presented on one line
Three reference designations in one reference designation set	=A1	=A1/-B2/+C3 	=A1 -B2 +C3 
	-B2		
	+C3		
One reference designation in one reference designation set	=D4-E5+F6	=D4-E5+F6 	=D4-E5+F6 
Two reference designations in one reference designation set	=G7-H8	=G7-H8/+J9 	=G7-H8 +J9 
	+J9		

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Figure 18 – Presentation of reference designations and sets of reference designations

5.20.3 Simplified presentation

A reference designation in accordance with ~~IEC 61346-1~~ IEC 81346-1 is the representation of a path in a tree-like structure. Different objects may therefore have a common initial portion because they are constituents of the same object, including at least one single-level reference designation, of their paths starting from the top of the structure tree, see Figure 19.



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Figure 19 – The common initial portion of reference designations

If all objects shown on a page of a document have a reference designation with a common initial portion, this portion may be presented once at a defined place, depending on the kind of document, in the content area of a document page and shall not be shown in any of the identification areas of the document. (See also 7.1.6)

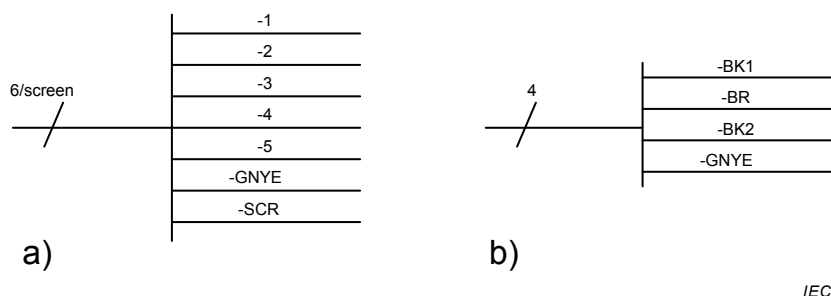
In a series of reference designations, a single level of the reference designations may be presented applying the rules for presentation of set of elements as specified in 5.16, with the indicated set of elements enclosed in parentheses. The complete single level reference designation shall be presented at both the lower and upper limit of the set of elements.

Examples:

- -A2C4F1, -A2C4F2, -A2C4F3 and -A2C4F4 being presented as -A2C4(-F1, ..., -F4)
- =B2-C1, =B2-D3, =B2-F5 being presented as =B2(-C1, -D3, -F5)
- =Q3=1=H1, =Q3=2=H1, =Q3=3=H1 and =Q3=4=H1 being presented as =Q3(=1, ..., =4)=H1

5.20.4 Cable core designations

Cable cores should be identified by their reference designation, for example core numbers or core colour codes, provided by the cable manufacturer, see Figure 20.



- a) Cable with numbers printed on the cores, one core marked with colour, and with a concentric lead
 b) Cable with colour-marked cores, two cores black

Figure 20 – Examples of cable core designations

If no core identifier is provided by the cable manufacturer, a reference designation for the core should be applied.

NOTE Cables per se are designated in accordance with 5.20.1 and 5.20.2

5.21 Terminal designations

Terminal designations shall be applied in accordance with IEC 61666.

5.22 Signal designations

Signal designations shall be applied in accordance with IEC 61175.

6 Document kinds

This International Standard provides rules for the presentation of four different basic document kinds for electrotechnology:

- Diagrams, see Clause 7;
- Drawings, see Clause 8;
- Tables (lists), see Clause 9.
- Charts and graphs, see Clause 10.

For each basic document kind, more specific rules are provided for specific document kinds to the extent that is necessary for the presentation of these.

Annex C provides a list of specific document kinds with indication of their minimum content and additional content of information to be provided.

For other specific document kinds, relevant IEC and ISO publications exist, for example:

- IEC 60848 for sequential function charts;
- IEC 61131-3 for graphical representations of programming languages for programmable controllers;
- IEC 62027 for parts lists;
- IEC-~~62079~~ 82079-1 for instructions for use;
- IEC/TS 61804-1 and IEC/PAS 61804-2 for the description of function blocks;
- ISO 5807 for flow charts for information processing;
- ISO-~~10628~~ 15519-1 for diagrams in process industry (e.g. process flow diagram, piping and instrumentation diagram).

7 Diagrams

7.1 General

7.1.1 Flow of energy, signal, etc.

If the direction of a flow, for example of a signal, is of importance and is not obvious, the corresponding connecting line shall be provided with arrowheads (symbol S00099 in IEC 60617 (2001-07)). See Figure 21.

NOTE The use of signal classification code as per IEC 61175 ~~may can~~ also provide information on the flow direction.

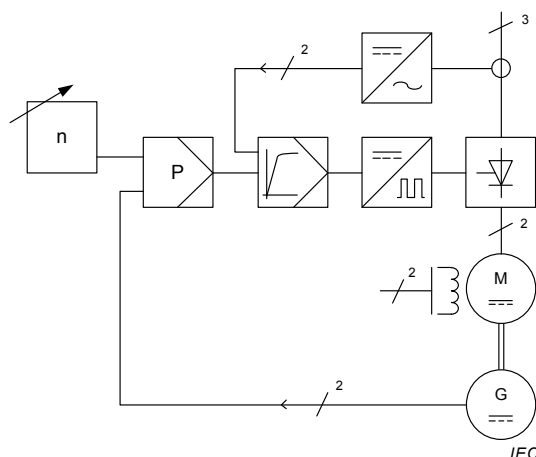


Figure 21 – Example of functional grouping and signal flow directions; a control system

Different flow paths, for example for information, control, energy, and material flow, shall be clearly distinguished and recognizable.

7.1.2 Symbols

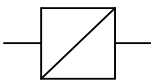
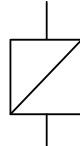
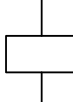
7.1.2.1 Choice of symbols

Symbols shall conform to IEC 60617. For objects outside the scope of IEC 60617, symbols of ISO 14617 should be considered.

NOTE When choosing a symbol representing a component with movable parts, the rule given in 7.4.4 applies.

7.1.2.2 Connect nodes

Symbols shall be provided with the appropriate number of connect nodes. The connect nodes shall be positioned on the 1M or 0,5M grid (see ISO 81714-1:2010, 6.11). For **standardized** symbols that are associated with connect nodes and/or terminal lines (e.g. as in IEC 60617) the position of the connect nodes and terminal lines may be changed as long as the meaning of the symbol is not changed. See Figure 22.

Symbol where different locations of connections do not affect the meaning		Symbols where the location of connections may affect the meaning (neglecting the proportions of the symbols)	
			
Symbol S00213 in IEC 60617 (2001-07), Converter, general symbol		Symbol S00555 in IEC 60617 (2001-07), Resistor	Symbol S00305 in IEC 60617 (2001-07), Operating device

IEC

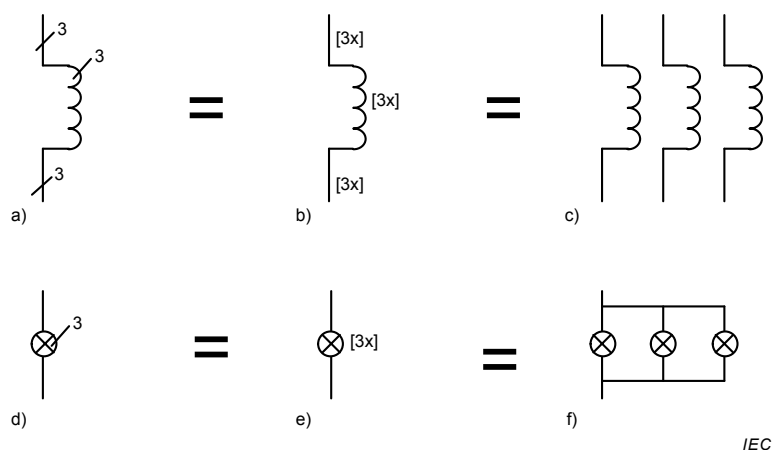
Figure 22 – Example of symbols and different location of connections

7.1.2.3 Simplified presentation

7.1.2.3.1 Identical symbols in a group

A number of identical symbols in a group may be represented by a single symbol, using one of the following methods:

- the single symbol should be provided with a short oblique stroke and a figure indicating the number of symbol elements represented by the single symbol (see Figure 23a) and Figure 23d)); or
- the represented number of symbols by the single symbol should be indicated by a figure followed by a multiplication sign within square brackets, for example [3×] (see Figure 23b) and Figure 23e)).



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- Three independent circuits using an oblique stroke
- Three independent circuits using the multiplication sign
- Three independent circuits, complete presentation
- One circuit with three objects using an oblique stroke
- One circuit with three objects using the multiplication sign
- One circuit with three objects, complete presentation

Figure 23 – Simplified presentation

7.1.2.3.2 Parallel connected objects

If identical objects are connected in parallel, they may be simplified presented following the rules in 7.1.2.3 and with the reference designations presented at the symbol shown following the rules for presentation of set of elements in 5.16, see Figure 24. The terminal designations shall be presented at the symbol shown.

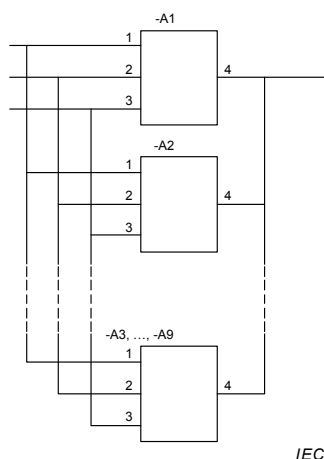


Figure 24 – Simplified presentation of parallel connected identical objects

7.1.2.3.3 Serial connected objects

If identical objects are connected in series and the internal connections among the objects are obvious, they may be simplified presented by showing the symbol for the first and the last symbol of the objects and with a dotted line in between. The reference designations of the objects shall be shown following the rules for presentation of set of elements in 5.16, see Figure 25. The terminal designations shall be presented at the symbols shown.

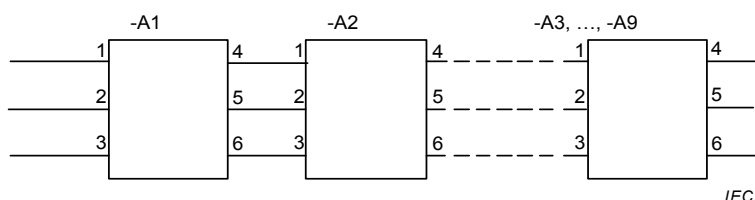


Figure 25 – Simplified presentation of serial connected identical objects

7.1.2.4 Presentation of cross-references related to detached presentations

Cross-references associated with a symbol applying detached representation (see 7.4.3.3) shall be shown adjacent to that symbol. They should be located above the symbol and to the right of the reference designation, when it is shown with mainly horizontal terminal lines or to the left of the symbol and below the reference designation when it is shown with mainly vertical terminal lines. For detailed rules related to symbols used in CAX-systems, see IEC 81714-2.

A cross-reference shall not be presented immediately above or to the left of the reference designations presented. See Figure 26.

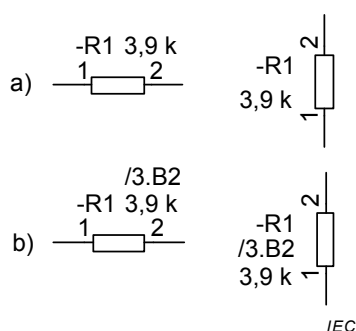


Figure 26 – Example of cross-references related to detached presentations

7.1.2.5 Presentation of technical data

Technical data associated with the object represented by a symbol shall, if presented, be shown adjacent to that symbol. They shall be located above the symbol when it is shown with mainly horizontal terminal lines or to the left of the symbol when it is shown with mainly vertical terminal lines.

The technical data shall be presented below or to the right of the reference designations presented. See Figure 27.



a) symbol with technical data

b) symbol with cross-reference and technical data

Figure 27 – Example for technical data associated with a symbol

If the meaning of the symbol will not be changed, technical data may also be shown inside the symbol outline. See Figure 28.

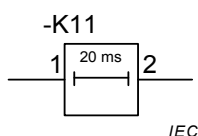


Figure 28 – Example of technical data shown inside a symbol

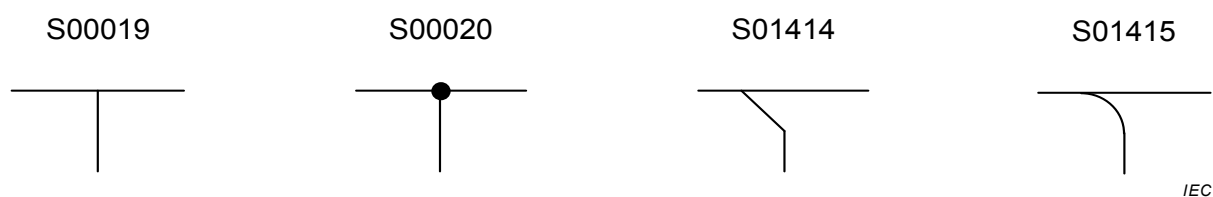
7.1.3 Connecting lines

7.1.3.1 Electrical or functional interconnections

Connecting lines shall be in accordance with symbol S00001 in IEC 60617 (2001-07).

NOTE Symbol S00001 is a continuous line.

When two lines are joined at a specific point, the junction shall be in accordance with symbols S00019, S00020, S01414 or S01415 in IEC 60617 (2001-07), see Figure 29.



NOTE-2 Symbols S00019 and S00020 provide information that the interconnections exist but not their location. Symbol S01414 indicates that there are two physical electrical interconnections being presented by one connecting line, indicating the direction of the electrical interconnection that enters two physical interconnections that are to be attached to the same terminal (not shown) on the left side. Symbol S01415 is used for graphical bundling indicating the direction of the bundle that enters.

Figure 29 – Symbols representing joining of connecting lines

The interconnection of crossing connecting lines shall be shown using the symbol S00022 in IEC 60617 (2001-07), see Figure 30.

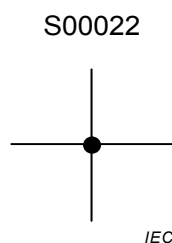


Figure 30 – Symbol representing the interconnection of crossing connecting lines

Figure 31 shows one example where the symbols S00019 and S00020 in IEC 60617 (2001-07) are applied.

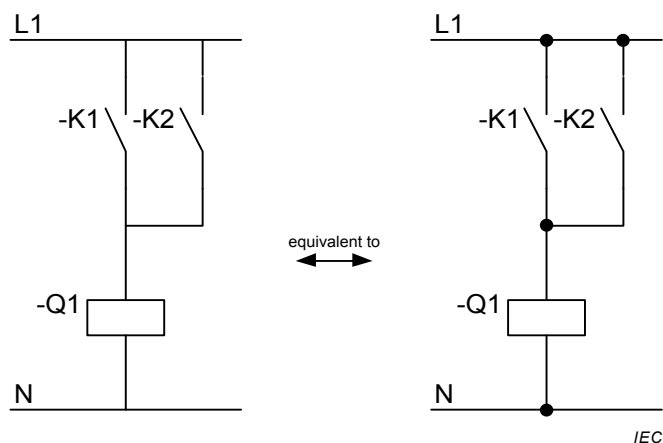


Figure 31 – Examples of the joining of connecting lines

Figure 32 shows an example with the application of symbol S01414 in IEC 60617 (2001-07). The circuit illustrates the same function as in Figure 31, but includes a visualisation of how the wiring shall be done.

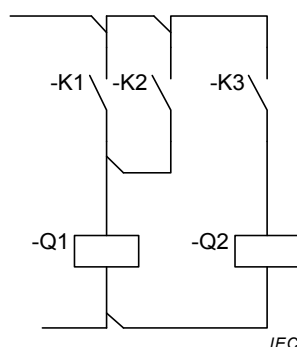


Figure 32 – Example of the joining of connecting lines with indication of where the physical wire goes

Figure 33 shows an example of the application of the symbol S01415 in IEC 60617 (2001-07), illustrating the direction of a bundle when two bundles are joined in a diagram.

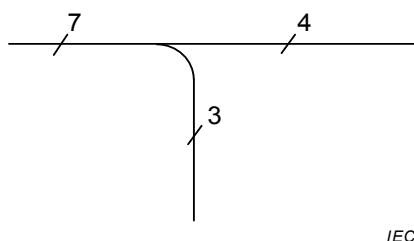


Figure 33 – Example of the joining of connecting lines where the connecting lines represent bundles of wires

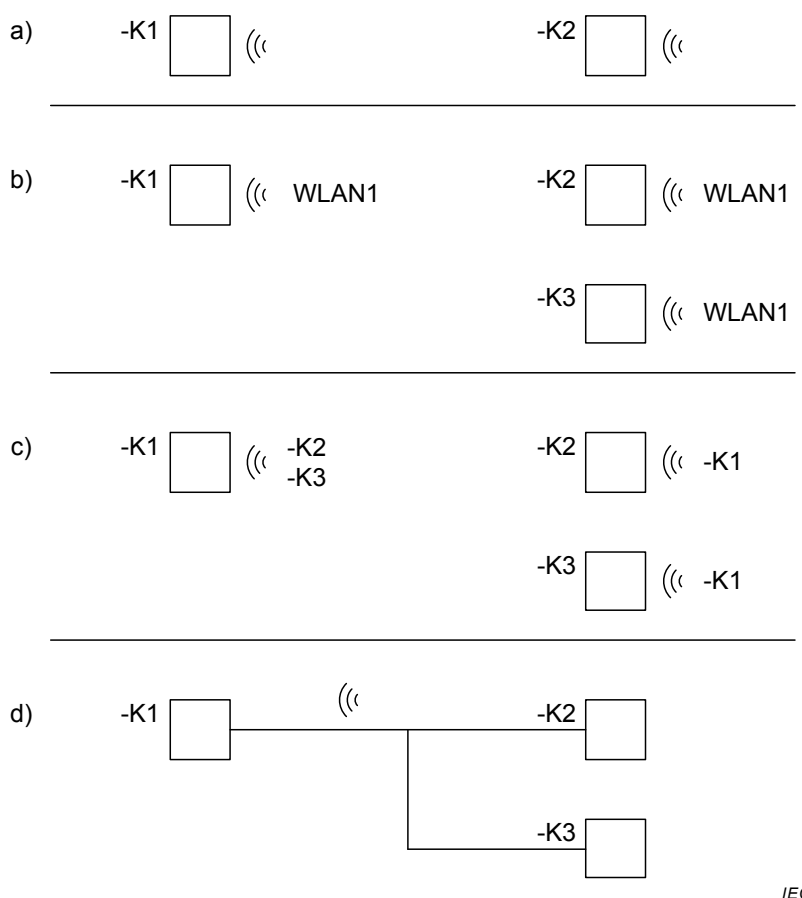
7.1.3.2 Fibre optical interconnections

Fibre optical interconnections shall be shown in accordance with symbol S01318 in IEC 60617 (2001-07), see Figure 10.

7.1.3.3 Wireless interconnections

Wireless interconnections shall be shown in accordance with symbol S01863 (see Figure 34) presented adjacent to the symbols representing the interconnected objects. The direction of waves shall, regardless of the actual information or wave flow direction, be presented as incoming to the object. Any cross-reference to objects that is communicated with or other descriptive indications related to the wireless network shall be presented at the small side of symbol S01318 in IEC 60617 (2001-07).

If required, symbol S00001 (continuous line) representing a connection together with symbol S01863 in IEC 60617 (2001-07) as qualifying symbol may be used to explicitly show the wireless interconnections.



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Key

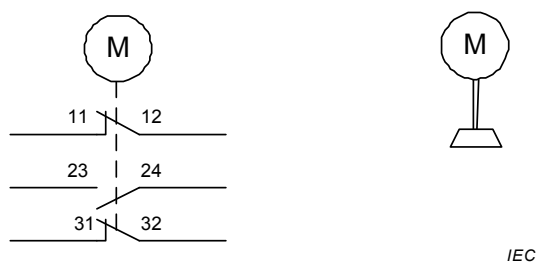
- a) Indicates that objects communicate via wireless interfaces
- b) Indicates that objects with wireless interfaces communicate via a network with the name WLAN1
- c) Reference designation at the wireless interface symbol indicate with which objects is communicated
- d) Wireless connections are explicitly presented by qualifying the symbol for a connection (continuous line) with that for a wireless connection

Figure 34 –Different presentation methods for wireless interconnections

Mechanical links

Mechanical links shall be shown in accordance with symbols S00144 or S00147 in IEC 60617 (2001-07), see Figure 35.

NOTE Symbol S00144 is a dashed line. Symbol S00147 is a double continuous line.



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Figure 35 – Example of presentations of mechanical links

7.1.3.4 Arrangement and orientation of connecting lines

Connecting lines shall be oriented horizontally or vertically except in those cases where oblique lines improve the legibility.

Connecting lines should not interfere with other symbols; see IEC 81714-2:2006, 6.11.2.

Bends and crossover of lines should be restricted to a minimum. To avoid bends and crossovers lines may be interrupted. In this case, and also when a line is interrupted on one page and continues on another, the ends of the interrupted line shall be mutually referenced, see 5.8. The ends of the interrupted line should be drawn so that they can easily be recognised, see Figure 36.

NOTE In circuit diagrams, bends and cross-overs can be avoided by regarding the layout principles in accordance with 7.4.2 and the use of detached representation in accordance with 7.4.3.3.

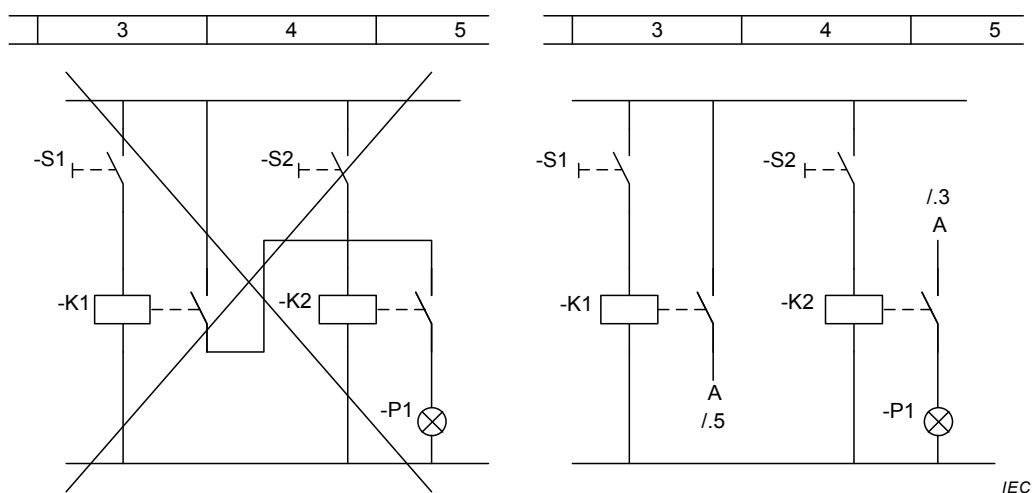


Figure 36 – Example for avoiding bends and cross-overs

The space between two parallel connecting lines shall be at least 1M.

The minimum distance between parallel connecting lines where text is to be shown in between, shall be twice the lettering height and not less than 2M, see Figure 37.

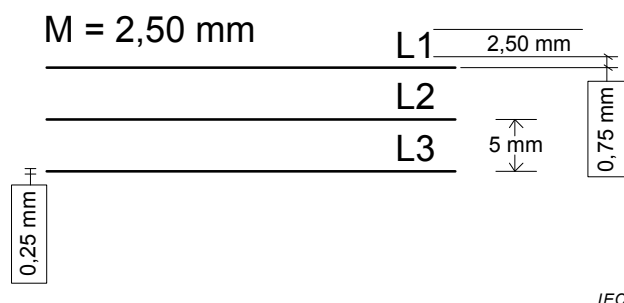


Figure 37 – Spacing of lines

7.1.3.5 Technical data related to connecting lines

Technical data associated with connecting lines:

- shall be clearly related to the associated connecting line;
- shall not touch or cross the connecting line;

- should be located adjacent to – above horizontal and to the left of vertical – connecting lines.

If it is not possible to show the technical data adjacent to the connecting line, it shall be shown elsewhere in the content area together with a leader line or a reference to the connecting line.

The technical data shall be clearly separated from any reference designations, signal designations ~~associated with~~ or terminal designations presented along the connecting line. See Figure 38.

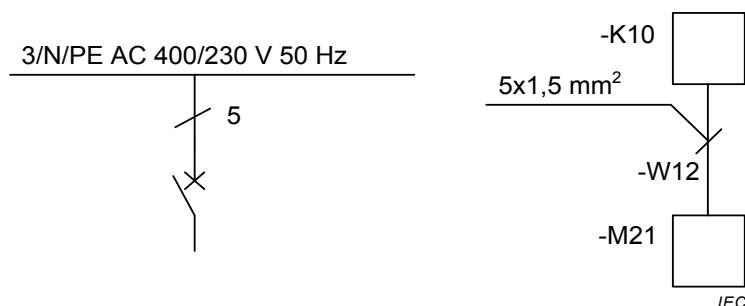


Figure 38 – Examples for technical data associated with connecting lines

Waveforms may be included and should be shown in the way that they normally appear on an oscilloscope screen, detailed as far as necessary for the application.

Electrical ratings of a.c. and d.c. circuits shall be presented in accordance with the examples shown in IEC 61293, preferably in the abbreviated form.

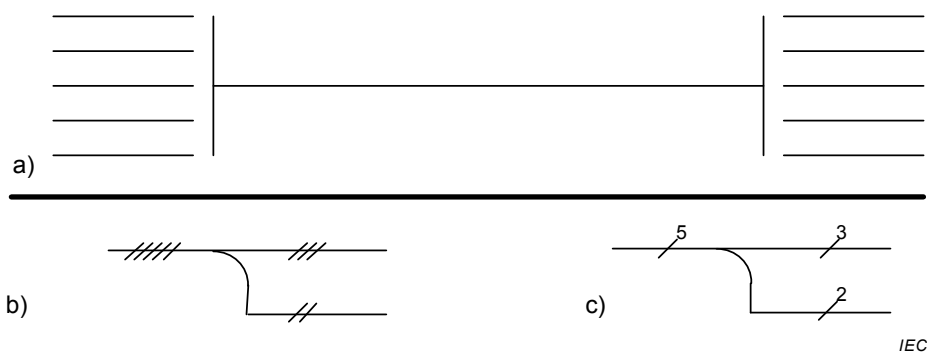
EXAMPLE

- DC 110 V: Direct voltage 110 V
- 3 AC 400 V: Three phase, three wire system 400 V
- 3/N/PE AC 400/230 V 50 Hz: Three-phase, five-wire system with N and PE 400/230 V

7.1.3.6 Simplified presentation

Multiple parallel connecting lines may be represented by one line (i.e. bundle) using one of the following methods:

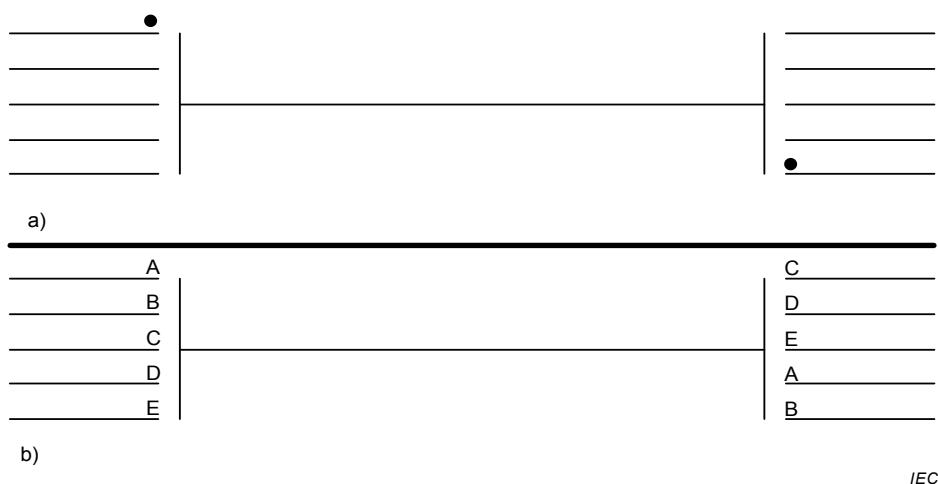
- the parallel lines are interrupted and a cross-line after a short space represents the bundle (See Figure 39.a);
- the number of parallel connecting lines represented by the bundle shall be indicated either by adding as many oblique strokes as the number of connections (see symbol S00002 in IEC 60617 (2001-07) and Figure 39.b), or by adding one stroke followed by the figure for the number of connections (see symbol S00003 in IEC 60617 (2001-07) and Figure 39c).



- a) Using a cross-line and a space
 b) Indication by a number of strokes
 c) Indication by numbers

Figure 39 – Presentation of bundles

The sequential order of the parallel lines at both ends of the bundle should be unambiguously indicated, see Figure 40.



- a) Using a dot to indicate the first connection
 b) Indicating the individual connections

Figure 40 – Indication of sequence within bundles

7.1.4 Representation of binary logic circuits

7.1.4.1 Logic conventions and logic polarity indication

7.1.4.1.1 General

The relationship between logic states and the nominal values (logic levels) of the physical quantities used to represent these states shall be indicated by using one of the following methods in a diagram:

- Single logic convention (relative notation);
- Direct logic polarity convention (absolute notation).

Figure 41 illustrates the terms "states" and "levels", where:

- "Internal logic state" describes a logic state assumed to exist inside a symbol outline at an input or output.

- “External logic state” describes a logic state assumed to exist outside a symbol outline:
 - on an input connecting line prior to any external qualifying symbol at that input; or
 - on an output connecting line beyond any external qualifying symbol at that output.
- “Logic level” describes the physical quality assumed to represent a logic state of a binary variable:
 - IEC 60617 uses the symbols “0” and “1” to identify the two logic states of a binary variable. These states are referred to as 0-state and 1-state.
 - A binary variable may be equated to any physical quantity for which two distinct ranges can be defines. In IEC 60617-DB these distinct ranges are referred to as logic levels and are denoted “H” and “L”. “H” is used to denote the logic level with the more positive algebraic value, and “L” is used to denote the logic level with the less positive algebraic level.

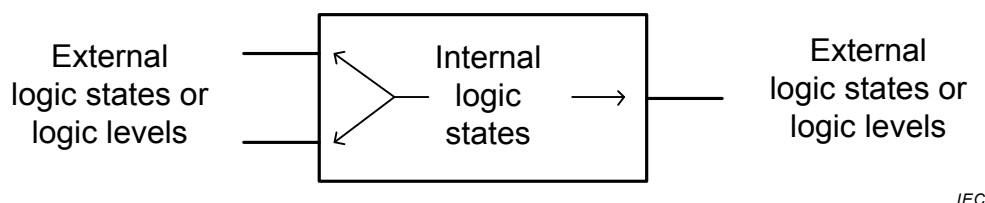


Figure 41 – Illustration of the terms “states” and “levels”

7.1.4.2 Single logic convention

Single logic convention implies that the correspondence between a given external logic state and logic level is the same at all inputs and outputs in the diagram or a portion of a diagram.

The symbol for logic negation (symbols S01466 and S01467 in IEC 60617) shall be used at an input or output terminal to indicate that the internal and external states are the complements of one another for that terminal.

a) Positive logic convention:

The more positive value of the physical quantity (H-level) corresponds to the external 1-state. The less positive value (L-level) corresponds to the external 0-state. If necessary, the positive logic convention may be indicated as:

POSITIVE LOGIC 

b) Negative logic convention:

The less positive value of the physical quantity (L-level) corresponds to the external 1-state. The more positive value (H-level) corresponds to the external 0-state. The use of negative logic convention shall be indicated in the diagram or in supporting documentation as:

NEGATIVE LOGIC 

Figure 42 shows an example of a diagram using positive logic convention.

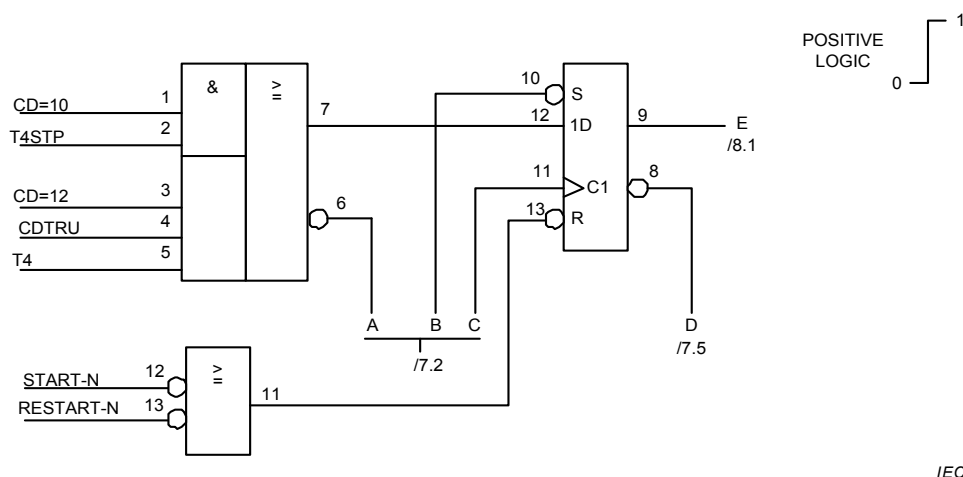


Figure 42 – Detail of a circuit diagram using positive logic convention

7.1.4.3 Direct logic polarity convention

Direct logic polarity convention implies that the relationship between the internal logic state and the (external) logic level of each input of every binary logic element shall be indicated directly by means of the presence or absence of the logic polarity symbol (symbols S01468 through S01471 in IEC 60617 (2001-07)).

The logic polarity symbol shall be used at an input or output terminal to indicate that the (external) low level corresponds to the internal 1-state for that terminal.

NOTE The absence of the logic polarity symbol signifies that the (external) high level corresponds to the internal 1-state for that terminal.

The relationship between the (external) logic level and a signal state shall only be defined by the signal designation in accordance with IEC 61175.

Figure 43 shows an example of a diagram using direct polarity convention.

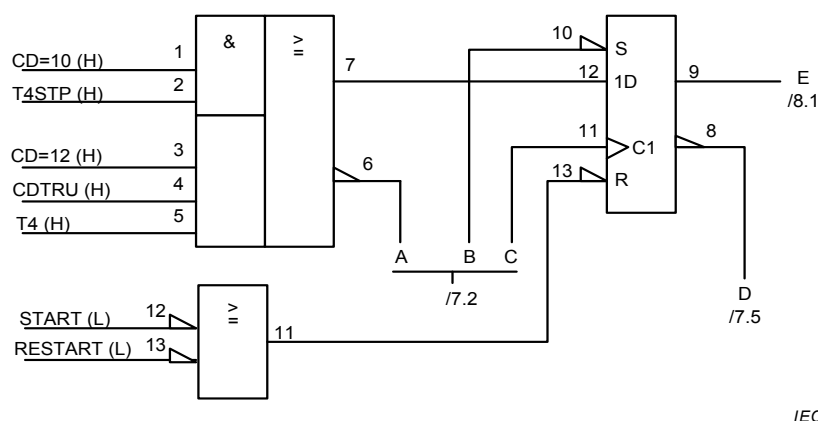


Figure 43 – Detail of a circuit diagram using direct logic polarity convention

For diagrams prepared with direct logic polarity convention, but showing no logic polarity symbols, a statement indicating that direct logic polarity convention is applied shall be placed in the diagram or in supporting documentation.

7.1.5 Boundary frames

A boundary frame shall consist of horizontal and vertical lines using the symbol S00064 in IEC 60617 (2001-07).

NOTE Symbol S00064 is a dashed dotted line. The resulting boundary frame is not a defined symbol itself.

A boundary frame shall represent an object. Objects shown inside the boundary frame shall be constituents of this object and may be represented in a simplified form, provided a reference to a more detailed document is given, see Figure 44.

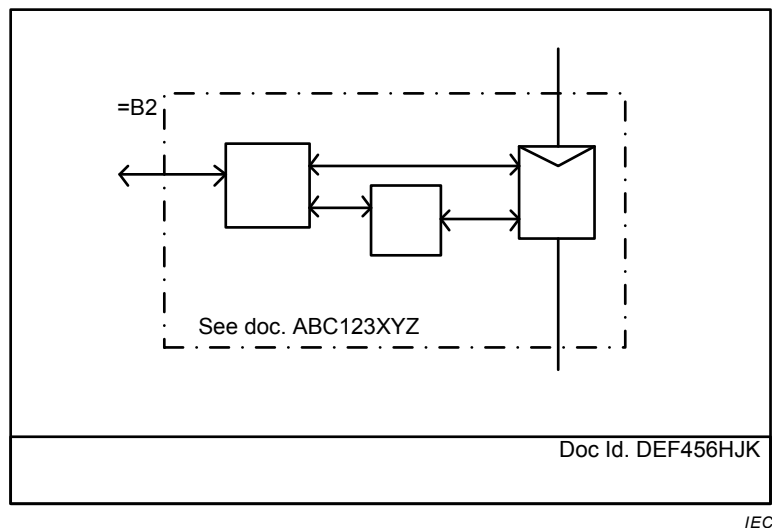


Figure 44 – Boundary frame with a reference to another document

The boundary frame shall be associated with the reference designations of the object it represents.

7.1.6 Presentation of reference designations

7.1.6.1 Symbols

Reference designations associated with a symbol shall be located to the left of the symbol when it is shown with mainly vertical terminal lines, see Figure 45a), or above the symbol when it is shown with mainly horizontal terminal lines, see Figure 45b).

NOTE For symbols to be used in CAX-applications more precise rules for the positioning of various text fields in accordance with IEC 81714-2 apply (see also 5.12.1). For example, reference designations or reference designation sets are to be placed in a defined distance above an imagined horizontal centre line or any horizontal terminal line (and also in a defined distance from the symbol outline) when it is shown with mainly vertical terminal lines as indicated in Figure 45a). For symbols with mainly horizontal terminal lines the position of reference designations is to the left of an imagined vertical centre line as indicated Figure 45b).

For reference designations associated with a symbol representing a connection and for boundary frames other rules apply, see 7.1.6.2 and 7.1.6.3.