

IEEE Guide for Common Format for Naming Intelligent Electronic Devices (COMDEV)

IEEE Power and Energy Society

Sponsored by the
Power System Relaying and Control Committee (PSRC)

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Sponsor

Power System Relaying and Control Committee (PSRC) of
the
IEEE Power and Energy Society

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Abstract: A common convention for naming physical and virtual intelligent electronic devices (IEDs) is provided in this guide. The various environments where device names are needed and how a common naming convention would be beneficial is discussed.

Keywords: channel name, device name, IED name, IEEE C37.248™, virtual device

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Introduction

This introduction is not part of IEEE Std C37.248™-2017, IEEE Guide for Common Format for Naming Intelligent Electronic Devices (COMDEV).

While configuring an IED, the user has to compose and enter a number of electronic names or designations that uniquely identify the IED and each channel within it. The same is also required when manually composing COMTRADE files for use in simulation and modeling applications. Current standards such as IEEE Std C37.111™, IEEE Std C37.118™, IEEE Std C37.232™, and IEC 61850 require such designations but define them as “unformatted fields,” which means it is up to the user to compose and specify these fields without having the benefit of a standard, recommended practice, or guide. Such fields may include, and are not limited to, company, substation and IED names, installed locations, channel names, phase identifiers, monitored circuits, voltage classes, and so forth.

The above-mentioned fields are essential for fault and disturbance analysis and are especially so for automated applications. For example, without knowing the voltage class it is difficult to determine whether the data are calibrated based on peak or based on rms. Also, without accurate and informative names, it is impossible for an automated application to associate voltage and current phases together to calculate a fault location or a missing phase. Users and utilities are often faced with the problem of having to invent their own naming conventions and they do so usually to suit their own purposes. Considering the large and growing number of users today, it is clear why there are too many types of naming conventions in circulation.

A common naming convention for specifying IED designations would help solve many of the problems that are associated with analysis, coordination, and automation. The common convention will, in turn, have a positive impact on maintenance, protection, operations, and on engineering applications. Developing a device name for use throughout the design documentation package is an important function of device names as well. This convention could be used on the single-line, panel layout, bill of material, etc. This naming convention could also benefit manufacturers of IEDs and software tools. To that extent, the main objective of this guide is to address and report on the issues related to specifying IED designations. The guide explains the need for having a common naming convention and provides a brief, high level survey of current practices. The guide also provides a common naming convention for naming IEDs. The convention references standard IEEE device names as listed in IEEE Std C37.2™.

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1. Overview

1.1 Scope

This guide provides a common convention for naming physical and virtual intelligent electronic devices (IEDs). It discusses the various environments where device names are needed and how a common naming convention would be beneficial.

1.2 Purpose

The purpose of this guide is to provide a convention for naming physical and virtual IEDs that provides consistency to the point that automated systems and persons unfamiliar with the particular electrical system could determine what entities the IEDs are monitoring or reporting.

1.3 Need for guide

Current standards such as IEC 60255-24/IEEE Std C37.111^{TM1}, Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE) for power systems; IEEE Std C37.118TM, IEEE Standard for Synchrophasor Measurements for Power Systems [B7]; IEEE Std C37.232TM, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME); IEC 81346 Reference Designation System, and IEC 61850 Communication Networks and Systems for Power Utility Automation [B3] require naming devices but define them as “unformatted fields,” which means it is up to the user to compose and specify these fields without having the benefit of a guide. Having consistent and understood device names are essential for fault and disturbance analysis and are especially so for automated applications. Users and utilities are often faced with the problem of having to invent their own naming conventions, and they do so usually to suit their own purposes. Considering the large and growing number of users today, it is clear that there are now too many types of naming conventions in circulation. A common naming convention for specifying IED designations would help solve many of the problems that are associated with analysis, coordination, and automation. The common convention will, in turn, have a positive impact on maintenance, protection, operations, and engineering applications.

¹Information on references can be found in [Clause 2](#).

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEC 61850-6, Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs.²

IEC 60255-24/IEEE Std C37.111™, Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE) for power systems.^{3,4}

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

IEEE Std C37.2™, IEEE Standard Electrical Power System Device Function Numbers, Acronyms, and Contact Designations.

IEEE Std C37.232™-2011, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME).

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The IEEE Standards Dictionary Online should be consulted for terms not defined in this clause.⁵

virtual device: A non-physical device whose data are composed from one or more physical or virtual devices.

3.2 Acronyms and abbreviations

CHP	combined heat and power
CIM	Common Information Model
DER	distributed energy resources
DFR	digital fault recorder
DNP3	Distributed Network Protocol
DR	disturbance recorders
IED	intelligent electronic devices
LD	logical device
LN	logical node
RTU	remote terminal unit

²IEC publications are available from the International Electrotechnical Commission (<http://www.iec.ch>) and the American National Standards Institute (<http://www.ansi.org/>).

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⁴IEEE publications are available from the Institute of Electrical and Electronics Engineers (<http://standards.ieee.org/>). ⁵IEEE Standards Dictionary Online is available at: <http://dictionary.ieee.org>.

UML	Unified Modeling Language
VSTR	visible string
XSD	XML Schema Definition

4. Current practices

4.1 Examples of IED naming practices

A digital fault recorder (DFR) is used to monitor many elements at a substation while a protective relay typically monitors only one element (line, transformer, bus, etc.). The name assigned to each of these IEDs may therefore be somewhat different.

The name of a protective relay may include information on the equipment it protects and monitors, while the name of a DFR generally indicates the substation and maybe some other high level entity, such as a voltage level or relay house. [Table 1](#) provides some examples of IED naming practices:

Table 1—Examples of IED names

IED type	IED name	Examples
Substation IEDs	Short unique (within substation) name	DFR#40
		DAU#150
Line Relays	Breaker Number(s) or Line Description + Function + Model	730-760 ZDA11
		SMITH 230KV ZD.S B11
Transformer Relays	Description + Function + Model	BK2 115-12KV HSOC C51
Breaker Relays	Breaker Number + Function + Model	03060 BF D51
Bus Relays	Description + Function + Model	NO2 12KV BUS E51
All IEDs (61850)	Code for sub, voltage, bay, type, device	NA138_6_M5_F60
		NA138_3_T1_G87
All IEDs	Manufacturer (or common name)+serial number	mti1004
		ben707

4.2 Examples of channel naming practices

Because a substation IED such as a DFR monitors many items, some reference to those items should be made in the channel naming. The information on the element for a protective relay is in the IED name and so is not needed in the channel name. [Table 2](#) provides some examples of channel naming practices:

Table 2—Examples of channel names

IED type	Channel names	Examples
Substation IEDs	Location (Protection) + Phase + Type	230KV P1/G POTENTIAL
		JACKSON 01 AMPS
		NO4 BANK HS P1 AMPS
Relays	Type Phase	IA
		VA

5. Uniqueness

Each IED should be uniquely identified so that it is not confused with any other IED.

6. Naming convention

6.1 General

The convention described here defines the fields identified to uniquely name an installed IED. This convention could be used to also name the IED channels (both analog and digital). Information from IEEE Std C37.2™-2008 (as summarized in [Annex B](#)), IEC 61850 [B3] and IEC 81346 [B5] (as summarized in [Annex C](#)), and IEEE Std C37.111™-2013 (as summarized in [Annex D](#)) were used in arriving at this proposed naming convention. The intent is to produce a humanly understood name with little effort from which relevant information can be extracted, both with as-low-as-possible chance of error.

6.2 Variability of format with applications

The convention for naming IEDs constitutes a wide array of devices and applications where the names are needed.

Theoretically, an IED can be composed of one channel (such as a temperature monitor) or can contain multiple channels (such as a numerical relay used for feeder or transformer protection). An IED can contain an unlimited number of channels (such as substation automation systems including data concentrators and gateway systems used to combine channels from multiple IEDs and form large composite records for a specific substation or even region). To that extent, the IED name may become far removed from the physical locations of its channels. The IED name may become as small as a single attribute or field (such as company name), which means the burden is then on the channel name to specify all of the remaining fields needed for the user to identify the actual system component that is being sensed or monitored.

For the example of a DFR, the relationship between the IED name and the channel name is dynamic; however, the combination “IED name + channel name” should always comprise a unique sequence that identifies the specific component being monitored.

Many of the applications where names are needed already allow for company name and station identifier. Some applications have identifiers for many of the other quantities that comprise the IED name. To avoid redundancy and preserve space in file names, the IED name can vary from application to application as long as it is understood that the quantities missing from the IED name are available in other places in the application. [Clause 7](#) addresses many of the applications where an IED name is used.

Although many quantities have been identified to name an IED, the instance of many of the quantities actually used together is rare.

6.3 Delimiter

To separate the various parameters for parsing, a delimiter is required. Underscore (_) is chosen as the delimiter in order to minimize conflicts with known applications.

6.4 Defined fields

The fields that are defined to uniquely identify a channel of a physical or virtual device (IED name + channel name) are:

Company Name _ Station Identifier _ IED Type _ Function Type _ Voltage Level _ Equipment Name _
Phase ID _ Input Type

where

Company (or Owner) Name is the identification of the company owning the IED.

Station (or Location) Identifier is the identification of the substation containing the IED or location of the IED if not located in a substation.

IED Type is the type of the IED (such as a numerical relay, DFR, data concentrator, or virtual device). It should be unique within the substation or protection scheme. For instance, if two A21 relays are used to protect a feeder, one IED Type could be A21A, the other A21B.

Function Type is the IEEE C37.2 function designation for the device and may also include additional information, such as first or second line protection (primary or backup). Refer to [Annex B](#) for details such as multi-function devices.

Voltage Level is the kV or a company's nomenclature for the voltage level(s) of the item(s) being monitored by the IED channels. For example, some companies use letters for voltage classes such as X, which represents 345kV. Where multiple voltage levels are represented such as for a transformer, a dash (-) should be used as the delimiter where permitted by the application.

Equipment Name is the item being protected or monitored by the IED or channel. This is typically a line, breaker, transformer, or generator name.

Phase ID is the identification of the phase(s) or control circuit being monitored. In many instances, this value is fixed by the manufacturer, and users have no control over this quantity. Where this field is user specified and is a phase quantity, example values are:

IA, IB, IC, IR, IG, VA, VB, VC, VAB, VBC, VCA (or VAC, VCB, VBA), V0, 3V0

Input Type or signal type for analog channels is formatted as follows:

P = Periodic, alternating input such as three phase currents and voltages

A = Aperiodic, direct input such as frequency, temperature, and trip coil current

6.5 Optional fields

Any other optional fields could be added at the end of the IED name:

User 1 _ User 2 _ User 3 and so on

Possible optional fields include Relay House, Relay Panel, Latitude, Longitude, and Time. Time does not make sense in a device/channel name; however, it is useful in certain instances, such as in a settings file name for the IED to allow for different versions of a settings file.

6.6 Limitations

The allowed characters and the size of the name of the IED plus channel depend on the application in which the name is used. The most limiting application listed here is IEC 61850 [\[B3\]](#), which limits the device name to ASCII characters, numbers, and special characters dollar sign (\$) and underscore (_). IEC 61850 names cannot begin with a number. The maximum number of characters allowed in IEC 61850 device names is 32 in edition 1 and 64 in edition 2. In order to meet these limits, abbreviations and mixed case letters (to avoid spaces) should be used.

6.7 Examples

The example in [Table 3](#) shows how three different IEDs that monitor the same phase current could be named.

Table 3—Example names of three different IEDs monitoring the same phase current

IED type	IED name	Channel name
Sensor	CoA_AlphaSub_CurrentSensor_77_115_AlphaBetaLine_IA_A	
Legacy Relay	CoA_AlphaSub_RE21_11_115_AlphaBetaLine	IA ^a
DFR	CoA_AlphaSub_DFR1_DFR	115_AlphaBetaLine_IA_A

^aChannel name in relays is defined by the manufacturer and user has no control over this.

7. Applications

Various applications require a device name. Depending on the application, some of the defined fields may be described elsewhere in the application; hence, to save space, those redundant fields should be omitted from the device name in that application. The order of the remaining fields is critical for automation purposes. If the application specifies an order different than what is described in [6.4](#), then the application order should be used; otherwise the order described in [6.4](#) should be used. Following are some of the more common applications with details on how this guide can be used in each.

7.1 Use in COMTRADE and COMNAME

COMTRADE is an IEC/IEEE dual logo standard for power system transient data (time sequence data) exchange. COMNAME (IEEE Std C37.232–2011) is an IEEE standard for naming time sequence data files, such as those produced by DFRs and power swing recorders. Owing to the structure defined by these standards, all of the information specified by COMDEV can be placed in the filename(s), while a subset of this information is also placed in the contents of the COMTRADE file/section.

Under COMNAME, filenames begin with six mandatory fields, which are delimited by commas. The fifth field is specifically reserved for the device identifier. According to the standard, “users can formulate their own code for the originating device (a unique name within the station). This variable-length field can contain letters, numbers, and some punctuation marks. Disallowed characters are defined in [Clause 2](#).” The disallowed characters consist of ? “ / \ < > * | : ; [] \$ % { }. Spaces are also discouraged as their use can cause problems when using most operating systems. The COMNAME standard places no particular limit on the length of this field; however, excessively long filenames can cause a number of problems. Many media have specific limitations on filename length. Even without any particular limitation, excessively long filenames are difficult to read in a directory listing. Accordingly, the COMNAME standard requires that “users shall try to limit in every possible way the total number of characters used in the filename,” and “it is therefore recommended for users of this convention always to strive to create filenames that are as short as possible and unique.” The first three fields in the COMNAME standard may use a maximum of 28 characters (including the delimiters following each field), while the remaining three fields (station identifier, device identifier, and company name) are each of variable length. To be compatible with COMNAME, the device name should therefore be as short as possible while still being capable of uniquely identifying the recording device.

COMNAME handles company name and substation name through separate fields. Therefore the station identifier name in COMNAME should consist of:

Station Identifier

The device identifier field should consist of as many of the following COMDEV fields as are required by the device:

IED Type _ Function Type _ Voltage Level _ Equipment Name _ Phase ID _ Input Type

Finally, the company name field should consist of:

Company Name

Station Identifier and Company Name are as defined in [6.4](#).

The first line of the COMTRADE CFG file or section for any data set contains a field for the station name and another field for the identification of the recording device. Each of these fields is limited to a maximum of 64 characters. The station name field in the first line in the COMTRADE CFG file/section should consist of:

Station Identifier

and the field for identification of the recording device should consist of as many of the following fields as are appropriate

IED Type _ Function Type _ Voltage Level _ Equipment Name _ Phase ID _ Input Type

where Station_Identifier is as described in [6.4](#).

7.2 Use in settings files

Utility or manufacturer databases may exist in a relational format where the Company Name, Station Identifier, IED Type, Equipment Name, and possibly some other quantities are identified in separate tables. In these instances, there is no need for the name of the IED in the database to contain all of the information set forth in this guide. However, when data are extracted from the database, the file name for transport should follow the convention presented here, with the information pulled from the various tables/locations.

Company, station, and possibly other information may exist in the substation computer. Enough information needs to exist in either the substation computer or the IED itself for the substation computer to construct the IED name for either a standalone file or for the file name as described in the COMNAME use described above.

When importing or exporting settings from the IED or databases, the name of the file used for transport should match the convention presented in this guide. In addition, to handle versions, it is suggested that date, and possibly time, fields be appended to the IED name.

7.3 Use in CIM

The IEC Common Information Model (CIM) is a set of meta-models for topological, asset, and business functions needed by the electric utility industry. In general, this document refers to Station Identifier, which in CIM would be the equivalent to a SubstationID or name. However, the scope of CIM goes beyond substations and includes distribution networks, plants, generation, and distributed energy resources (DER), and is being expanded to support microgrids. The proposed convention could be applicable to these other environments as well.

Within CIM, there is a concept of EquipmentContainer as shown in [Figure 1](#).

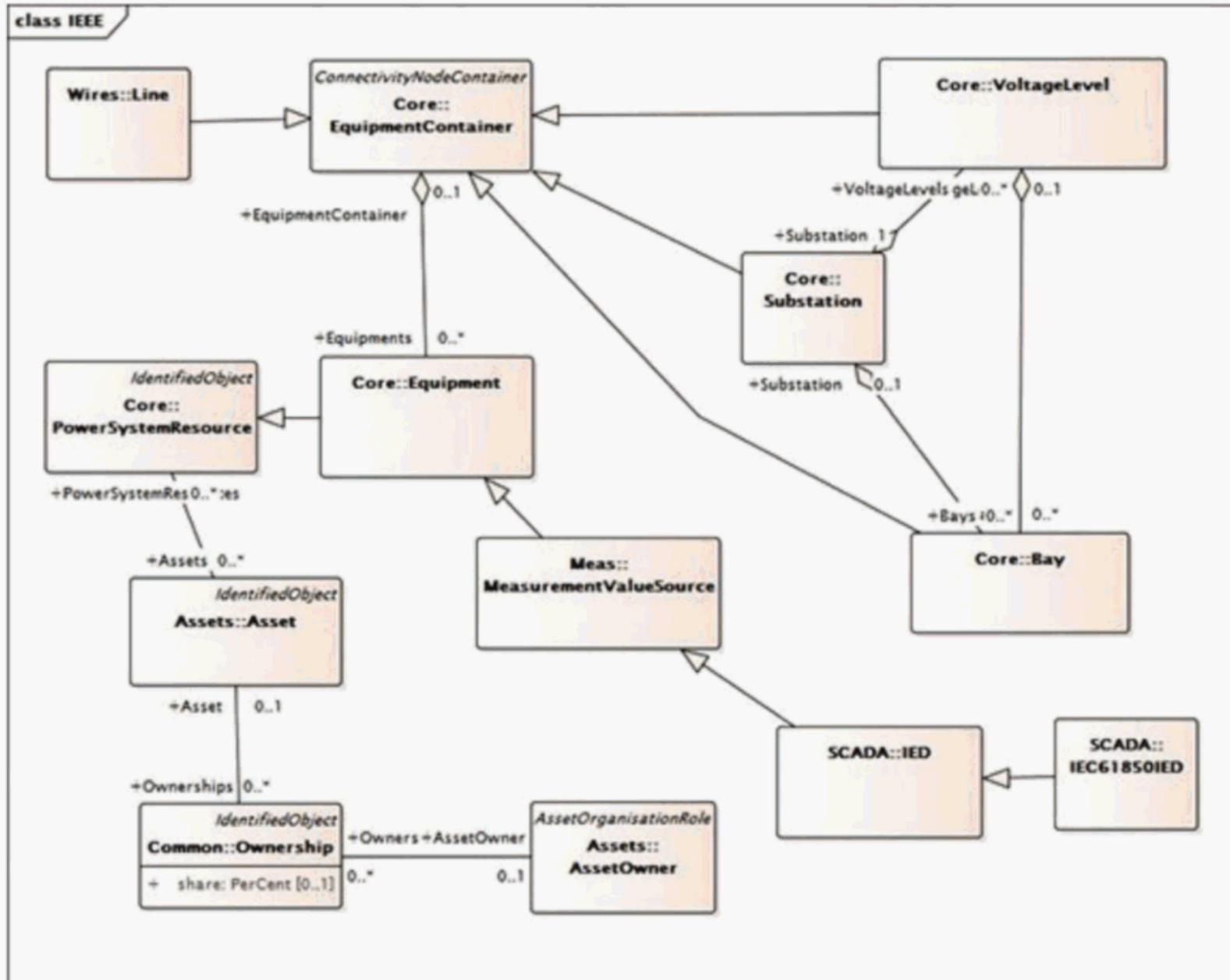


Figure 1—UML diagram

EquipmentContainers contain power system equipment and IEDs/RTUs. The Unified Modeling Language (UML) diagram shows that a Substation is a type of equipment container. However, at the same level as Substation, there are other EquipmentContainers of Line and different types of Plants (e.g., wind, combined heat and power (CHP), and microgrids). With the extension to support microgrids (still ongoing work), it is necessary to allow a Plant to contain other EquipmentContainers as a microgrid could contain substations, and other Plants. It is worthwhile to note, that IEC 61850 [B3] is also being expanded to have additional containers besides Substation.

Additionally, CIM's concept of ownership includes the concept that multiple entities could own/operate a resource (e.g., IED/RTU). However, for the purposes of this naming convention, only 100% ownership should be considered.

It is this potential of a hierarchy of EquipmentContainers, in addition to the extra equipment containers, that would require additional guidance for the use of the Station Identifier field. Within the context of CIM, it is recommended that the Station Identifier field be used to represent the identification of the Substation, Line, and Plant. Therefore, in the context of CIM, the Station Identifier would be recommended to be the name of the appropriate equipment container.

Thus, for CIM:

Station Identifier should be renamed to EquipmentContainerName

The field may also need a structure to represent the hierarchy of EquipmentContainers. The hierarchies that need representation are microgrids containing other Plants (e.g., PV Generation) and microgrids containing Substations. The hierarchy needs to be able to be parsed within the constraints of the proposed format. The hierarchy encoded within the EquipmentContainerName should be separated by "\$" (IEEE Std C37.118.2–2011 [B8]).

As an example, a Company (e.g., AssetOwner) could have multiple microgrids with one named MG1. MG1 could contain a substation "North". Therefore, the resulting EquipmentContainerName would be: MG1\$North.

7.4 Use in IEC 61850

The IEC 61850 standard utilizes a hierarchical approach and standard nomenclature for defining the majority of substation automation equipment, functions, and attributes. The substation automation functions include protection, control, monitoring, measurement, and disturbance recording functions.

The object identification in IEC 61850 [B3] for the purpose of information exchange consists of logical device (LD) name, logical node (LN) name, data name, and data attribute name. Data name, data attribute name, and parts of logical node name are defined by the standard. Logical device name and remaining parts of the logical node name are configurable parts.

For the configurable parts, IEC 61850-6 defines two types of naming conventions: product-related and function-related naming.

In product-related naming, the logical device name consists of the IED name and an additional configurable part differentiating the multiple logical devices within an IED (logical device instance or "LD Inst"). In that case, the IED name is user configurable; LD Inst may be defined fixed by the device manufacturer or can be user configurable as well.

In function-related naming, the logical device name is fully configurable by the user. But even with functional naming, an IED name is configured by the user; however, that name will not be used for object identification but may be visible in the name plate of the IED.

The logical node name consists of an LN prefix, the LN class name, and an LN Inst. LN class name is defined by the standard; LN Inst is defined by the device manufacturer, and LN Prefix may be defined by the device manufacturer or can be user configurable.

More details on the naming can be found in IEC 61850-6:2009, clause 8.5.3

For IEC 61850 naming, the IED name may not contain "\$". The name is restricted to a size of 64 characters and may not begin with a numeric. The XMLSchema Definition (XSD) character set is defined as:

```
<xs:pattern value = "[A-Z,a-z][0-9,A-Z,a-z,]*"/>
```

In addition, names according to IEC 61850-6 should follow the concepts in IEC 81346-1, which describes the rules for creating names out of hierarchical elements (see IEC 61850-6:2009, clause 6.1). However, in deviation from IEC 81346-1, the prefix sign shall be replaced with a "_".

Moreover, it has to be noted that the examples provided in [Clause 8](#) are based on typical North American naming convention and do not follow the use of IEC 81346-2 [B6] for the designation coding as recommended by IEC 61850-6.

An IED name in IEC 61850 [B3] would typically be a concatenation of the hierarchical elements starting at voltage level and going down in the hierarchy to the level where the IED is allocated. If multiple IEDs

are allocated at that same level, it may also include a function or IED Type identification. An example of a protection device main 1 in voltage level E1 and bay Q2 would be: E1Q2F1.

With regard to this guide, in the above example, Equipment Name would be the bay name and IED Type identification would be F1, so the IED name would be made out of the elements

Voltage Level - Equipment Name – Function Type

If in IEC 61850 communication needs to go beyond substation and product related naming is used, the IED name needs to be unique across multiple substations. In that case, the substation name may be added to the IED name, so the IED name would now be:

Station Identifier - Voltage Level - Equipment Name – IED Type

It has to be noted that within IEC 61850 [B3] it is possible that the naming of equipment is such that the equipment has a name unique within the context of a bay and then the bay has a name unique within the voltage level. As an example, a breaker may always be called QA1 within the bay and would become a unique name E1Q1QA1 if it is located on the bay Q1 of the voltage level E1. In that case, the Equipment Name according to IEC 61850 [B3] would be a concatenation of the bay name and the name of the breaker.

It has to be noted further that, according to IEC 81346-1, the hierarchical elements creating a name start with a character and end with a number; there is no sign needed as separation between the elements.

Besides being partly included in the IED name, elements specified in this standard can be found in IEC 61850 [B3] as follows:

Company Name: in the name plate of the IED (attribute “owner”)

Station Identifier: in the name plate of the IED (attribute “location”).

IED Type: the user supplied IED type name. Note that the model name from the vendor is also available in the name plate of the IED. This model name is not unique.

Function Type: through the available data model; e.g., if there is a LN of the class PDIS this would be function 21.

Voltage Level, Equipment Name, Phase ID: these would be visible through the SCL file (substation section).

Input Type: this is not explicitly available.

7.5 Use in channel names in DR

Disturbance recorders (DRs) typically monitor many power system items, possibly at different voltages. As such, the Voltage Level and Equipment Name cannot be defined in the IED name. This shortens the IED name for DRs to:

Company Name _ Station Identifier _ IED Type_ Function Type

The missing information is needed and should be included in the channel names. The convention described here can be used to name each channel. The channel name can then pick up where the IED name stopped:

Voltage Level _ Equipment Name _ Phase ID _ Input Type

7.6 Use in DNP3 (IEEE 1815)

DNP3 devices may publish device attributes, including the device location and name, in object group 0, variations 245 and 247. These are defined, respectively, as the user-assigned location name (g0v245) and the user-assigned device name (g0v247). For this purpose, characters in names are restricted to “visible characters suitable for print and display”.

Within the context of the present standard, the type field of the g0v245 object shall be 1 (Visible ASCII Characters Suitable for Print and Display or Visible STRing (VSTR)) and the contents are those parts of the device name that indicate the location – namely the station ID, followed by optional fields such as relay house, relay panel, latitude, longitude, and any applicable user-defined fields (only the station ID being mandatory).

Station ID

Similarly, within the contents of the present standard, the type field of the g0v247 object shall be 1 (VSTR) and the contents are:

Company Name _ IED Type _ Function Type _ Voltage Level _ Equipment Name _ Input Type _ Phase ID

followed by any user-defined fields that do not indicate the location of the device.

8. Illustrative examples

The titles used in the illustrative examples in the following subclauses are defined in 6.4. For the purposes of the examples in this section, the following optional user defined fields are used:

Relay House: relay house where IED or channel is located.

Relay Panel: relay panel where IED or channel is located.

Latitude and Longitude are in decimal format.

All dates and times listed follow International Standard ISO 8061 date and time format YYYY-MM-DD HH:MM:SS. The fewest number of characters would be (not using the seconds): YYYYMMDDHHMM, which would be 12 characters.

Because spaces are discouraged or not allowed in some applications, spaces have been removed in these examples.

8.1 Line relay

Table 4 shows examples of proposed IED naming convention derived from various fields of different standards used in a line relay. In other words, the interpretation and use of various fields of proposed IED naming convention for a line relay in different standards are shown.

8.2 Transformer relay

Table 5 shows examples of proposed IED naming convention derived from various fields of different standards used in a transformer relay. In other words, the interpretation and use of various fields of proposed IED naming convention for a transformer relay in different standards are shown.

8.3 Bus relay

Table 6 shows examples of proposed IED naming convention derived from various fields of different standards used in a bus relay. In other words, the interpretation and use of various fields of proposed IED naming convention for a bus relay in different standards are shown.

8.4 Second bus relay

Table 7 shows examples of proposed IED naming convention derived from various fields of different standards used in the second bus relay. In other words, the interpretation and use of various fields of proposed IED naming convention for the second bus relay in different standards are shown.

8.5 Generator relay

Table 8 shows examples of proposed IED naming convention derived from various fields of different standards used in a generator relay. In other words, the interpretation and use of various fields of proposed IED naming convention for a generator relay in different standards are shown.

8.6 Line recloser

Table 9 shows examples of proposed IED naming convention derived from various fields of different standards used in a line recloser. In other words, the interpretation and use of various fields of proposed IED naming convention for a line recloser in different standards are shown.

8.7 Second line recloser

Table 10 shows examples of proposed IED naming convention derived from various fields of different standards used in the second line recloser. In other words, the interpretation and use of various fields of proposed IED naming convention for the second line recloser in different standards are shown.

8.8 DFR

Table 11 shows examples of proposed IED naming convention derived from various fields of different standards used in a DFR. In other words, the interpretation and use of various fields of proposed IED naming convention for a DFR in different standards are shown.

8.9 Substation gateway

Table 12 shows examples of proposed IED naming convention derived from various fields of different standards used in a substation gateway. In other words, the interpretation and use of various fields of proposed IED naming convention for a substation gateway in different standards are shown.

Table 4—Line relay example

Fields										Optional fields			
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Thomas Edison	Walt Elmore	ABC-123	11	345	Line to station Bulb	All three phases of voltages and currents used	P	Tesla	4			May 15, 2015	4:02 p.m.
IEEE C37.232–2011 Device ID										19 characters			
Company Name in C37.232.Company Name, Station Identifier in C37.232.Station Identifier, optional fields not included since they have no bearing on analyzing event files.													
Settings File										78 characters			
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file.													
CIM Core:Equipment										25 characters			
ThomasEdison_WaltElmore_ABC-123_11_345_Bulb_313V_P_Tesla_4_2015-05-15_1602.txt													
Company Name in database name, Station Identifier in Core:Substation, Voltage Level in Core:VoltageLevel, Equipment Name in Wires:Line. Included optional fields since they could aid in locating relay.													
IEC 61850										29 characters			
WaltElmore_345_Bulb_ABC123_11													
Company Name (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR										Not applicable			
DNP3 (IEEE 1815)										18 characters			
g0v245													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).										56 characters			
g0v247													

Table 5—Transformer relay example

Fields										Optional fields			
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Michael Faraday	Plumb	XYZ4	11	138/69	Transformer North	All three phases of voltages and currents used	P	Building 1	30			May 15, 2015	8:20 a.m.
IEEE C37.232–2011 Device ID										31 characters			
<i>Company Name</i> in C37.232.Company Name, <i>Station Identifier</i> in C37.232.Station Identifier, optional fields not included since they have no bearing on analyzing event files.													
Settings File										92 characters			
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file.													
CIM Core:Equipment										27 characters			
<i>Company Name</i> in database name, <i>Station Identifier</i> in Core:Substation, <i>Voltage Level</i> in Core:VoltageLevel, <i>Equipment Name</i> in Wires:Plant. Included optional fields since they could aid in locating relay.													
IEC 61850 Product Related										34 characters			
<i>Company Name</i> (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR										Not applicable			
DNP3 (IEEE 1815)										18 characters			
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).										70 characters			

Table 6—Bus relay example

Fields							Optional fields						
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
IndiXYZ	NCAA	WX287	87-1	115	East Bus	3 phase current	P	Main	6			May 15, 2015	9:15 a.m.
IEEE C37.232-2011 Device ID												22 characters	
<i>Company Name</i> in C37.232.Company Name, <i>Station Identifier</i> in C37.232.Station Identifier, optional fields not included since they have no bearing on analyzing event files.													
Settings File												72 characters	
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file.													
CIM Core:Equipment												22 characters	
WX287_87-1_3I_P_Main_6													
<i>Company Name</i> in database name, <i>Station Identifier</i> in Core, <i>Voltage Level</i> in Core, <i>VoltageLevel</i> , <i>Equipment Name</i> in Wires:Plant. Included optional fields since they could aid in locating relay.													
IEC 61850 Product Related												26 characters	
NCAA_115_EastBus_WX287_871													
<i>Company Name</i> (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR													
Not applicable													
DNP3 (IEEE 1815)												11 characters	
g0v245 NCAA_Main_6													
g0v247												52 characters	
IndiXYZ_WX287_87-1_115_EastBus_3I_P_2015-05-15_09:15													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Table 7—Second bus relay example

Fields							Optional fields						
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
IndiXYZ	NCAA	WX287-2	87-2	115	East Bus	3 phase current	P	Main	6			May 16, 2015	10:12 a.m.
IEEE C37.232-2011 Device ID													
<i>Company Name</i> in C37.232.Company Name, <i>Station Identifier</i> in C37.232.Station Identifier, optional fields not included since they have no bearing on analyzing event files.													
Settings File													
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file.													
CIM Core:Equipment													
WX287-2_87-2_3I_P_Main_6													
<i>Company Name</i> in database name, <i>Station Identifier</i> in Core:Substation, <i>Voltage Level</i> in Core:VoltageLevel, <i>Equipment Name</i> in Wires:Plant. Included optional fields since they could aid in locating relay.													
IEC 61850													
Product Related NCAA_115_EastBus_WX2872_872													
<i>Company Name</i> (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR													
Not applicable													
DNP3 (IEEE 1815)													
g0v245 NCAA_Main_6													
g0v247 IndiXYZ_WX287-2_87-2_115_EastBus_3I_P_2015-05-15_10:12													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Table 8—Generator relay example

Fields										Optional fields			
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Ange	Phoenix	GEN987	11	18	Unit 1	All three phases of voltages and currents used	P	Gen Building 6	15			May 16, 2015	2:12 p.m.
IEEE C37.232–2011 Device ID													
Company Name in C37.232. Company Name, Station Identifier in C37.232. Station Identifier, optional fields not included since they have no bearing on analyzing event files.													
Settings File													
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file.													
CIM Core: Equipment													
GEN987_11_313V_P_GcnBuilding6_15													
Company Name in database name, Station Identifier in Core; Voltage Level in Core; VoltageLevel, Equipment Name in Wires:Plant. Included optional fields since they could aid in locating relay.													
IEC 61850													
Phoenix_18_Unit1_GEN987_11													
Company Name (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR													
Not applicable													
DNP3 (IEEE 1815)													
g0v245													
Phoenix_GenBuilding6_15													
g0v247													
Ange_GEN987_11_18_Unit1_313V_P_2015-05-16_14:12													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Table 9—Line recloser example

Fields										Optional fields			
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Thomas Edison	Walt Elmore	ZBG-5051 (pole top power circuit recloser)	50/51	12.47	Distribution line 1234	IABC	P	Pole	7439	33.73 N	118.02 W	May 16, 2015	4:12 p.m.
IEEE C37.232–2011 Device ID													
<i>Company Name</i> in C37.232. Company Name, <i>Station Identifier</i> in C37.232. Station Identifier which in this case would be Pole7439, optional fields not included since they have no bearing on analyzing event files.													
Settings File													
ThomasEdison_Pole7439_ZBG-5051_12.47_L1234_3I_P_33.73N_118.02W_2015-05-16_1612.txt													
Includes all fields. File extension would vary to fit format of settings file.													
CIM Core: Equipment													
ZBG-5051_5051_3I_P_33.73N_118.02W													
<i>Company Name</i> in database name, <i>Station Identifier</i> in Core: Substation, <i>Voltage Level</i> in Core: VoltageLevel, <i>Equipment Name</i> in Wires: Plant. Included optional fields since they could aid in locating relay.													
IEC 61850													
Pole7439_12_L1234_ZBG5051_5051													
<i>Company Name</i> (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR													
Not applicable													
DNP3 (IEEE 1815)													
g0v245													
WaltElmore_Pole_7439_33.73N_118.02W													
g0v247													
ThomasEdison_ZBG-5051_5051_12.47_L1234_3I_P_2015-05-16_16:12													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Table 10—Second line recloser example

Fields							Optional fields						
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Thomas Edison	Walt Elmore	ZBG-5051 (pole top power circuit recloser)	50/51	12.47	Distribution line 1234	IABC	P	Pole	8602	33.99N	118.31 W	May 17, 2015	3:22 p.m.
IEEE C37.232-2011 Device ID													
ZBG-5051_5051_12.47_L1234													
<i>Company Name</i> in C37.232. <i>Company Name</i> , <i>Station Identifier</i> in C37.232. <i>Station Identifier</i> which in this case would be Pole8602, optional fields not included since they have no bearing on analyzing event files.													
Settings File													
ThomasEdison_Pole8602_ZBG-5051_12.47_L1234_3I_P_33.99N_118.31W_2015-05-17_1522.txt													
Includes all fields. File extension would vary to fit format of settings file.													
CIM Core:Equipment													
ZBG-5051_5051_3I_P_33.99N_118.31W													
<i>Company Name</i> in database name, <i>Station Identifier</i> in Core: Substation, <i>Voltage Level</i> in Core: VoltageLevel, <i>Equipment Name</i> in Wires:Plant. Included optional fields since they could aid in locating relay.													
IEC 61850													
Pole8602_12_L1234_ZBG5051_5051													
<i>Company Name</i> (owner) is available in the nameplate of the IED. Order is defined by IEC 61850 .													
DR													
Not applicable													
DNP3 (IEEE 1815)													
g0v245													
WaltElmore_Pole_8602_33.99N_118.31W													
g0v247													
ThomasEdison_ZBG-5051_5051_12.47_L1234_3I_P_2015-05-17_15:22													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Table 11—DFR example

Fields										Optional fields				
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time	
Thomas Edison	Walt Elmore	ABC456	DFR	Multi. Ch1 = 115 Ch4 = 115	Multi. Ch1 = East Bus CCVT Ch4 = Line to Bulb	Multi. Ch1 = VA Ch4 = IA	Multi	Main	3			May 10, 2015	11:05 a.m.	
IEEE C37.232–2011 Device ID										ABC456_DFR				
Company Name in C37.232. Company Name, Station Identifier in C37.232. Station Identifier, optional fields not included since they have no bearing on analyzing event files. All other information should be available in the DFR configuration.														
Settings File										ThomasEdison_WaltElmore_ABC456_DFR_Main_3_2015-05-10_1105.txt				
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file. Since function type is DFR, remaining fields should be obtained from channel information. As such, any fields following DFR are user defined fields.										61 characters				
CIM Core:Equipment										ABC456_DFR_Main_3				
Company Name in database name, Station Identifier in Core:Substation, Voltage Level in Core:VoltageLevel, Equipment Name in Wires:Plant. Included optional fields since they could aid in locating relay. Since function type is DFR, remaining fields should be obtained from channel information. As such, any fields following DFR are user defined fields.										17 characters				
IEC 61850 Product Related										WaltElmore_ABC456_DFR				
Company Name (owner) is available in the nameplate of the IED. Since there is no normal hierarchy for DFRs, order reverts to that given in 6.4.										21 characters				
DR														
IED										ThomasEdison_WaltElmore_ABC456_DFR_Main_3				
Ch 1										41 characters				
Ch 4										16 characters				
With the combination of device name and channel name, all information is available.										24 characters				
DNP3 (IEEE 1815)														
g0v245										WaltElmore_Main_3				
g0v247										17 characters				
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name). As this DFR records faults for multiple channels, channel information is not included in the name (see 6.2).										ThomasEdison_ABC456_DFR_2015-05-10_11:05				
										40 characters				

Table 12—Substation gateway example

Fields										Optional fields			
Company Name	Station Identifier	IED Type (brand and model)	Function Type	Voltage Level	Equipment Name	Phase ID	Input Type	Relay House	Relay Panel	Latitude	Longitude	Date	Time
Nikola Tesla	Faraday	XYZ-17	Gateway		GW21			Main	1			Oct 28, 2015	12:17 p.m.
IEEE C37.232–2011 Device ID													
Company Name, Station Identifier in C37.232. Optional fields not included since they have no bearing on analyzing event files. All other information should be available in the Gateway configuration.													
Settings File													
NikolaTesla_Faraday_XYZ-17_Gateway_Main_1_2015-05-10_1105.txt													
Includes all fields except Latitude and Longitude. File extension would vary to fit format of settings file. Since function type is Gateway, remaining fields should be obtained from channel information.													
CIM Core:Equipment													
Gateway_XYZ-17_Main_1													
Company Name in database name, Station Identifier in Core:Substation, Voltage Level in Core:VoltageLevel, Equipment Name in Wires:Plant. Included optional fields since they could aid in locating relay. Since function type is Gateway, remaining fields should be obtained from channel information.													
IEC 61850 Product Related													
XYZ17_Gateway													
Company Name (owner) is available in the nameplate of the IED. Since there is no normal hierarchy for Gateways, order reverts to that given in 6.4.													
DR													
Not applicable													
DNP3 (IEEE 1815)													
g0v245 Faraday_Main_1													
g0v247 NikolaTesla_Gateway_XYZ-17_GW21_2015-10-28_12:17													
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name). As this Gateway records faults for multiple channels, channel information is not included in the name (see 6.2).													

Annex A

(informative)

Graphical representation

A.1 Overview

Figure A.1 shows an example power system, identifying different equipment normally used.

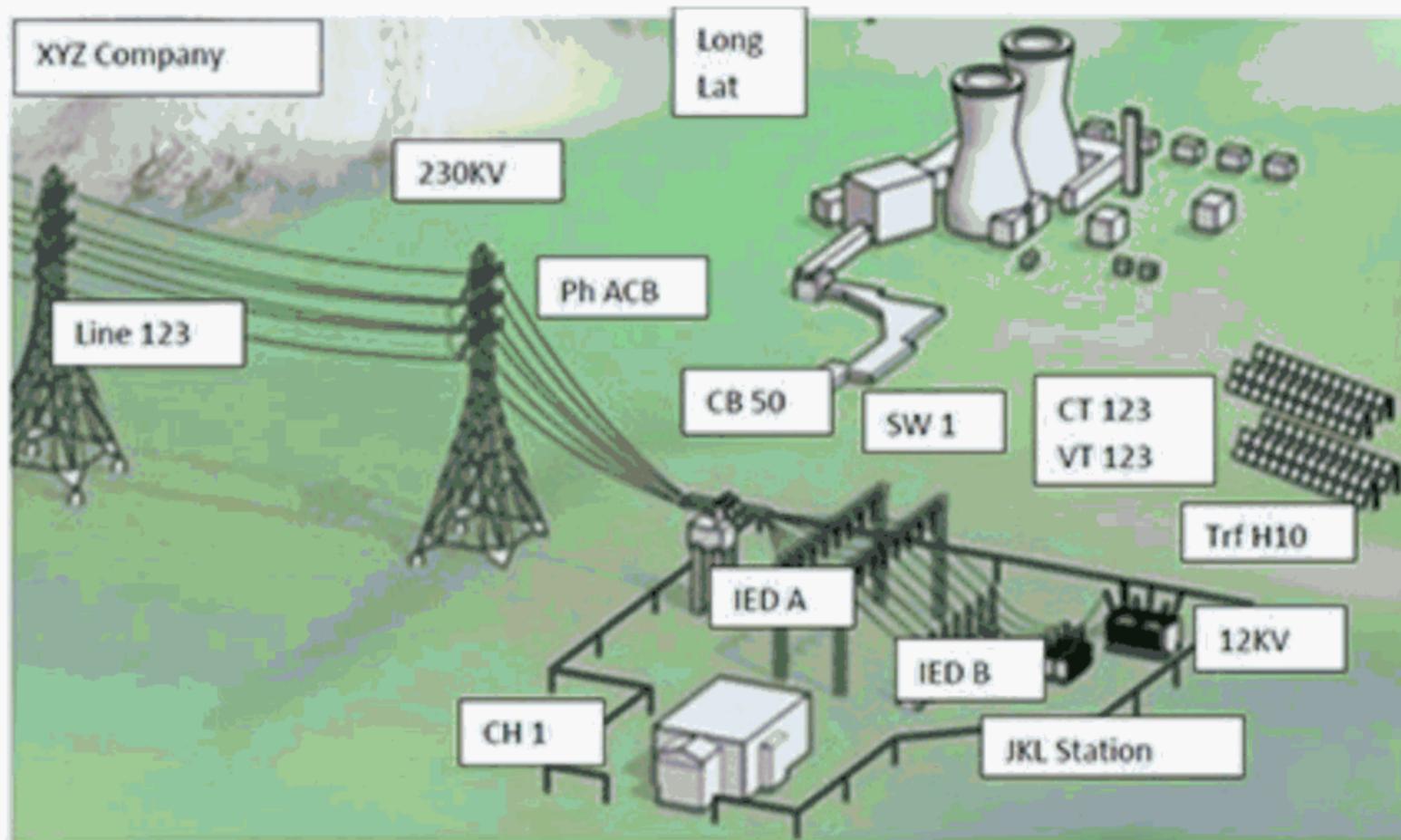


Figure A.1—Example power system

In the following tables, the correlation between different applications of the IED naming convention can be directly established. The first columns of each table are predefined fields and their order, the latter columns are optional user defined fields. In this example, relay house (4) and panel (CH1) are user defined fields.

The following examples use the tags in the graphic to illustrate usage:

COMTRADE (2 channel) –

CFG Row 1: JKL, DFR1, 2013

CFG Row 2: 2,1A,1D

CFG Row 3: 1,IR,,,Amps,0.0010,0.0,0.0,-3628000,3593000,240.0,1,P

CFG Row 4: 1,ZAG,,,0

CFG Row 5: 60.00

CFG Row 6: 1

CFG Row 7: 960.0000,176

CFG Row 8: 17/09/2014,14:02:27.259542

CFG Row 9: 17/09/2014,14:02:27.346000

CFG Row 10: ASCII

CFG Row 11: 1

CFG Row 12: -4,-4

CFG Row 13: 0,3

COMNAME – 150916,11450202456,+5h00,JKL,IEDA,XYZ.txt

COMDEV – XYZ_JKL_IEDA_87-1_230_Line 123_3I3V_P_4_CH1

A.2 COMTRADE

[Table A.1](#) shows the required and non-critical fields for the COMTRADE CFG file or section. The following abbreviations are applicable to [Table A.1](#):

A = Analog

Company Name and Station Identifier

ccbm = circuit component being monitored RMn = Range minimum for data values

Ch = Channel

RMx = Range maximum for data values

D = Digital

Sta ID = Station Identifier

dft = Data file type

SR = Sampling Rates

fdp = first data point

tp = Trigger point

Freq = Frequency

TQC = Time quality code

LSI = Leap second indicator

TS = Time skew

Mult = Multiplier

tsm = Time stamp multiplication factor

Num = Number

VTp = VT/CT primary factor

Ph = phase

VTs = VT/CT secondary factor

PS ID = Primary/secondary data identifier (nc) = (not critical)

Rec Dev ID = COMDEV name less

Annex B

(informative)

IEEE Std C37.2-2008 Standard Electrical Power System Device Function Numbers, Acronyms, and Contact Designations

The primary objective is to identify, by its name, an installed IED's location and the element of the power system to which it is connected. This is essential for effective post event analysis.

B.1 Single Function Devices

The fundamental IED naming approach (with its extensions) in IEEE Std C37.2 should be the prime candidate for this naming convention.

B.2 Multifunction Devices

Some IEDs that may be a source of data for post event analysis are multifunction devices. In IEEE Std C37.2 these are individually known as a Device 11 – multifunction device. That standard also uses the first suffix letter to define the power system element: L (line), B (bus), G (generator), T (transformer), etc. being monitored or controlled. An addition α -numeric suffix is used to define the specific power system element, and the final letter, if any (A, B, C, etc.) defines the IED's position in a redundant scheme. Thus, 11L1209A is a multifunction device controlling Line 1209 and is the A element in a redundant scheme.

If needed, IEEE Std C37.2-2008 includes addition suffix letters that may be used to describe the protective relay scheme implemented in the Device 11. These appear in 3.5.5 of the standard and now include:

BU: back up

DCB: directional comparison blocking

DCUB: directional comparison unblocking

DUTT: direct under-reaching transfer trip

POTT: permissive over-reaching transfer trip

PUTT: permissive under-reaching transfer trip

SOTF: switch on to fault

Annex A.4 of IEEE Std C37.2-2008 also includes the following example diagram showing how these notational methods have been used on an elementary diagram for Line 1209. The zone of protection covered by this multifunction device 11 is line 1209. The line is connected to a breaker-and-a-half substation via bus breaker 108 and mid breaker 118. This device is the System A multifunction device for line 1209. There is also a System B multifunction device 11 on line 1209 as well, and it would have its own list box. XXXX is reserved for the manufacturer's model number. An example of elementary diagram from IEEE Std C37.2-2008 is shown in [Figure B.1](#).

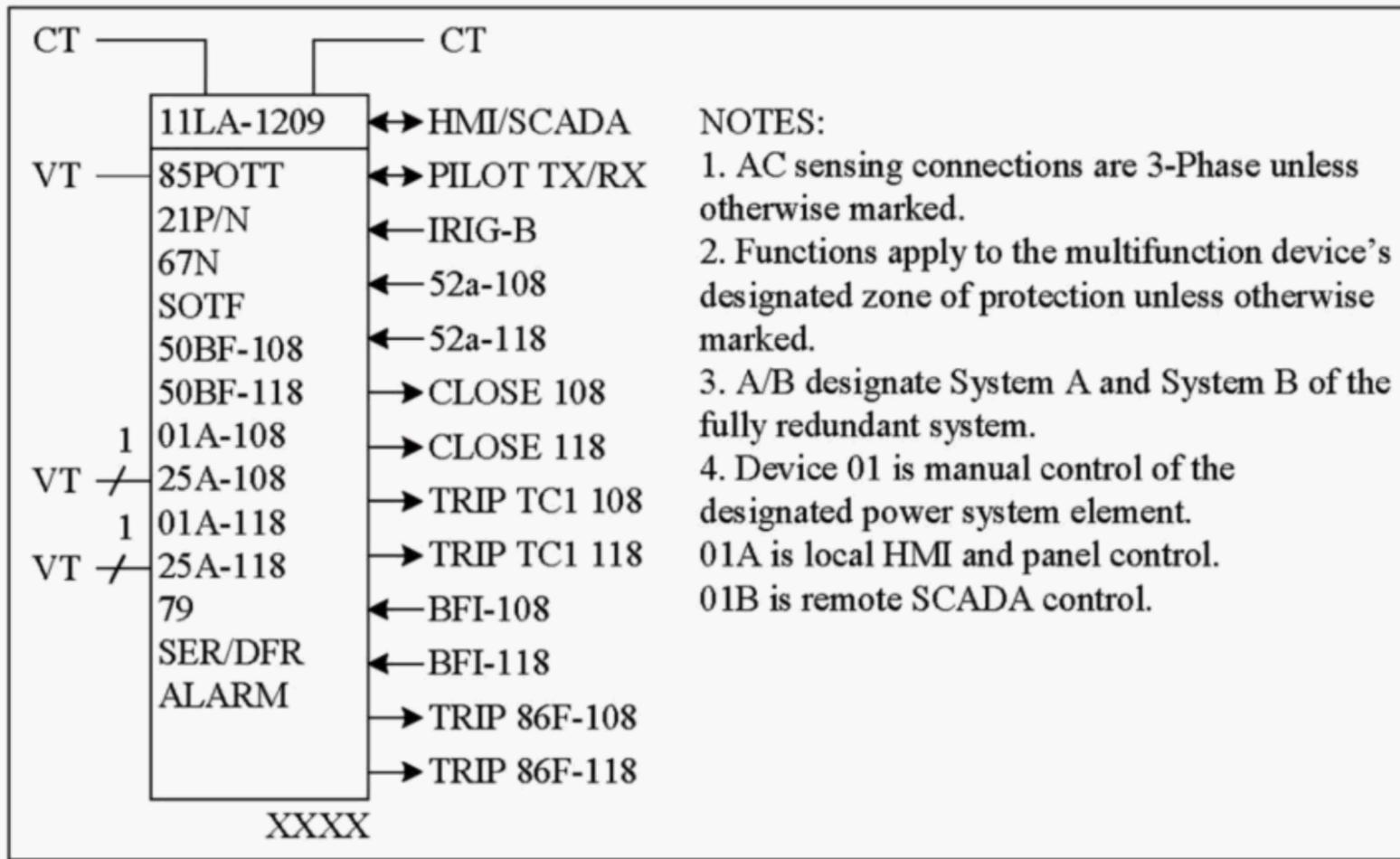


Figure B.1—Example of elementary diagram from IEEE Std C37.2-2008

Annex C

(informative)

IEC 61850, IEC 81346

C.1 IEC 61850 networks and systems for power utility automation

IEC 61850 [B3] has several options concerning how to name objects within the IED. The two main ones are product-related naming and function-related naming. The product-related naming uses the vendor pre-defined LDevice Inst and LN Prefix attributes. This concept allows the project engineer to freely choose the IED Name. This is described in Figure C.1.

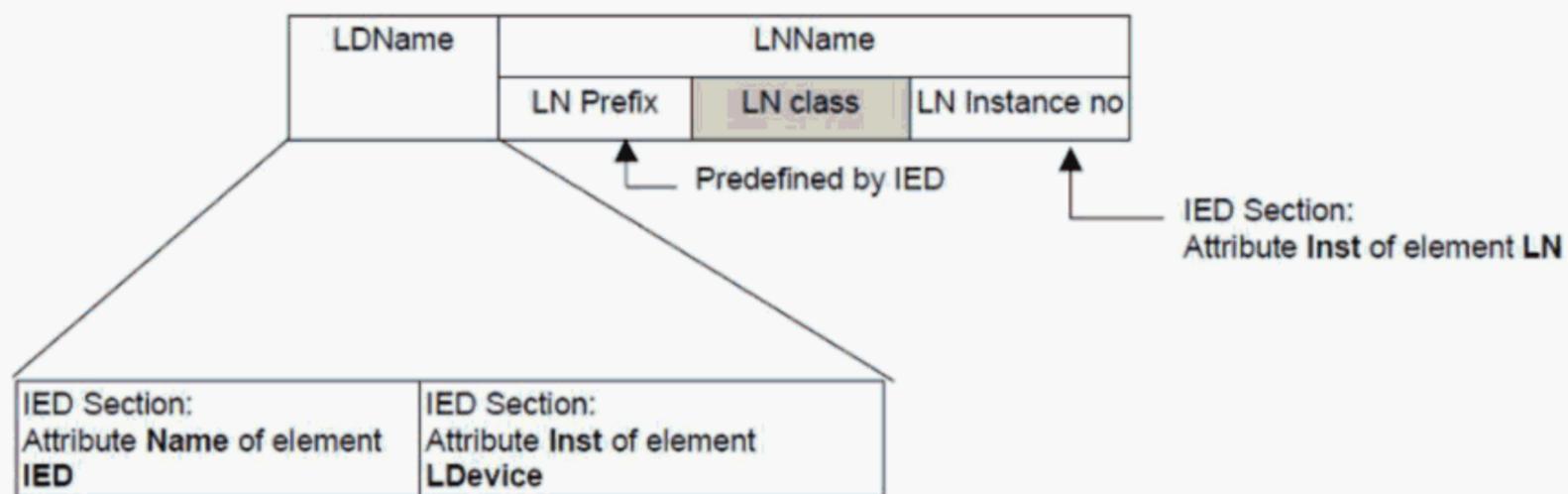


Figure C.1—Product-related naming from IEC 61850-6, Ed 2.0

The other option is function-related naming. In this concept the purpose is to name the IED and the LD according to its function. The IED name would in this case be created by concatenating the voltage level name, bay name, and the IED's function within the bay. This concept does guarantee that the IED name is unique within the substation. The option to allow the project engineer to modify LD Inst and LN Prefix shall be enabled by the tools from the IED vendor in order to allow function-related naming to be used. This is described in Figure C.2.

IEC 61850 [B3] does not define how to name voltage levels, bays, or IEDs. The standard refers to IEC 81346 [B5] (formerly IEC 61346) for naming of the different levels and objects within the substation.

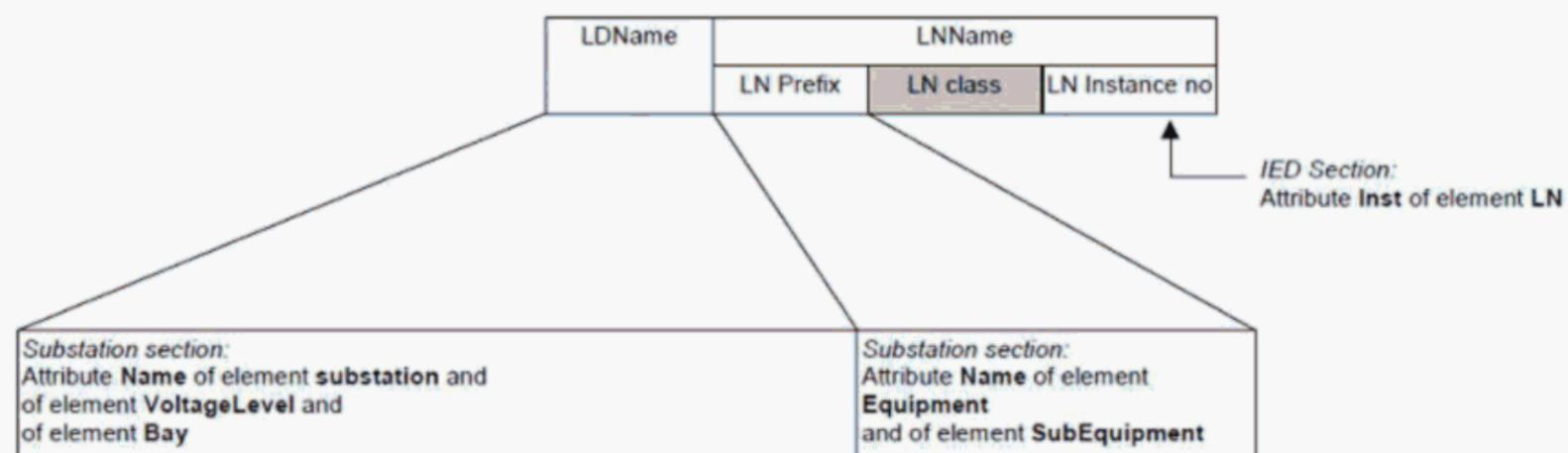


Figure C.2—Function-related naming from IEC 61850-6, Ed 2.0

Figure C.3 shows an example of an IED with LNs, which control a circuit breaker QA1 of bay Q1 at voltage level E1. The naming is chosen according to the IEC 81346 series. In this example, the IED as a product has the same higher-level product designation part according to the bay (-E1Q1) as the controlled circuit breaker QA1 has in its functional designation (= E1Q1QA1). Figure C.3 shows the resulting references within different structures, and the resulting LN reference for communication.

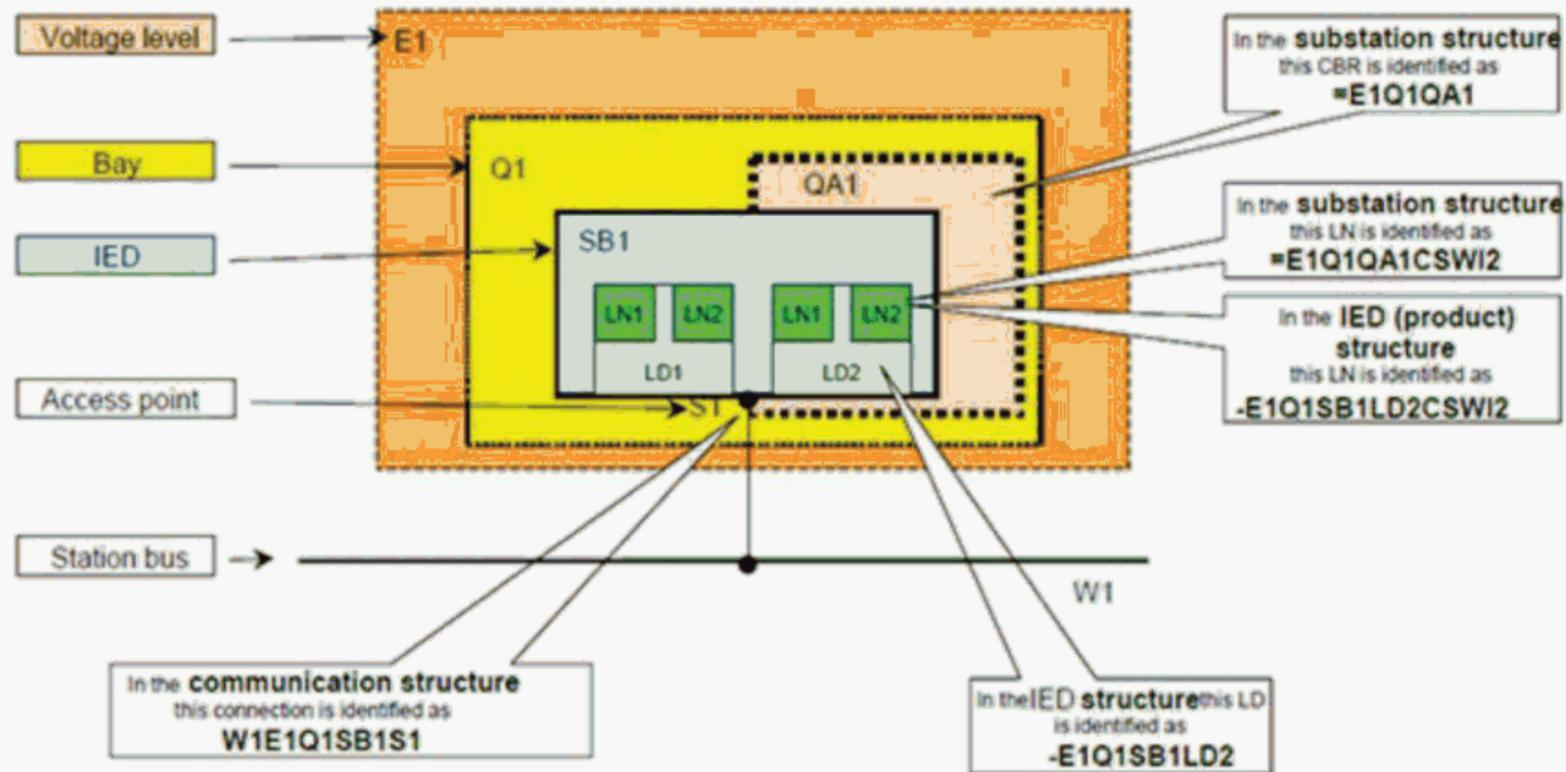


Figure C.3—Example of IED naming from IEC 61850-6, Ed 2.0

In IEC 61850 [B3], MMS is used for client-server communication.

MMS objects can be organized using the different scopes. The object names (with or without domain scope) can be compounded from the following character set:

A|a|B|b|C|c|D|d|E|e|F|f|G|g|H|h|I|i|J|j|K|k|L|l|M|m|N|n|O|o|P|p|Q|q|R|r|S|s|T|t|U|u|V|v|W|w|X|x|Y|y|Z|z|\$|_|0|1|2|3|4|5|6|7|8|9

The identifiers can contain 1 to 32 characters and they shall not start with a number.

C.2 IEC 81346, Industrial systems, installations and equipment and industrial products

IEC 81346 [B5] was published in 2009 and it replaced the former standard IEC 61346. IEC 81346 [B5] defines naming of objects in a structured way. There are several ways to address an object, the most important ones are the function-oriented, product-oriented, and location-oriented structures. As the names of the structures suggests, these are different ways to locate an object.

A function-oriented structure is based on the purpose of a system. A function-oriented structure shows the subdivision of the system into constituent objects with respect to the function aspect, without considering possible location and/or product aspects of these objects.

A product-oriented structure is based on the way a system is implemented, constructed, or delivered using intermediate or final components. A product-oriented structure shows the subdivision of the system into constituent objects with respect to the product aspect without considering possible function and/or location aspects of these objects.

A location-oriented structure is based on the spatial constituents or, if sufficient, the topographical layout of an object. A location-oriented structure shows the subdivision of the system into constituent objects with respect to the location aspect without considering possible product and/or function aspects of these objects.

When using one of the methods discussed above to name an object, in general the different elements building up the complete object address are from the same structure. There are also ways to cross over from one structure to another.

Annex D

(informative)

Summary of COMTRADE file format

D.1 IED names

The first line of the COMTRADE (2013) configuration file contains the IED name, which is formatted as follows:

Station Name, Recording Device ID, Revision Year

where:

Station Name is the name of the substation location where the IED is installed, length = 64 characters.

Recording Device ID is the identification number or name of the recording device, length = 64 characters.

Revision Year is the year of the standard revision, e.g., 1999, that identifies the COMTRADE version being used.

D.2 Analog channel names

The following fields contain the analog channel information. There is one line for each defined analog channel. The fields are:

An, ch_id, ph, ccbm, uu, a, b, skew, min, max, primary, secondary, PS

where:

An is the analog channel index number, length = 6 characters.

ch_id is the channel name or identifier, length = 64 characters.

ph is the channel phase identification, length = 2 characters.

ccbm is the circuit component being monitored, length = 64 characters.

uu is the channel unit (e.g., kV, V, kA, A), length = 32 characters.

a is the channel data multiplier, length = 32 characters.

b is the channel offset adder, length = 32 characters.

skew is the time skew (in μs) from start of sample period, length = 32 characters.

min is the lower limit of the data range for the channel, length = 13 characters.

max is the upper limit of the data range for the channel, length = 13 characters.

primary is the CT or PT primary ratio factor, length = 32 characters.

secondary is the CT or PT secondary ratio factor, length = 32 characters.

P or S is the data type in primary (P) or secondary (S), length = 1 character.

D.3 Digital channel names

The following fields contain the digital channel information. There is one line for each defined digital channel. The fields are:

Dn, ch_id, ph, ccbm, Y

where

Dn is the digital or status channel index number, length = 6 characters.

ch_id is the channel name or identifier, length = 64 characters.

ph is the channel phase identification, length = 2 characters.

ccbm is the circuit component being monitored, length = 64 characters.

Y is the normal state "in service" of the channel, length = 1 character (0 or 1).

Annex E

(informative)

Bibliography

Bibliographical references are resources that provide additional or helpful material but do not need to be understood or used to implement this standard. Reference to these resources is made for informational use only.

[B1] The Authoritative Dictionary of IEEE Standards Terms, ⁶

[B2] “Combining Digital Fault Records from Various Types of Devices (Virtual DFR),” Makki, et al, Fault and Disturbance Analysis Conference, May 2006.

[B3] IEC 61850, Communication Networks and Systems for Power Utility Automation. ⁷

[B4] IEC 61970-301, Energy management system application program interface (EMS-API) - Part 301: Common information model (CIM) base.

[B5] IEC 81346, Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations.

[B6] IEC 81346-2, Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 2: Classification of objects and codes for classes.

[B7] IEEE Std C37.118.1™-2011, IEEE Standard for Synchrophasor Measurements for Power Systems. ^{8,9}

[B8] IEEE Std C37.118.2™-2011, IEEE Standard for Synchrophasor Data Transfer for Power Systems.

[B9] IEEE Std C37.239™-2010, IEEE Standard for Common Format for Event Data Exchange (COMFEDE) for Power Systems.

⁶IEEE Standards Dictionary Online is available at: <http://ieeexplore.ieee.org/xpls/dictionary.jsp>.

⁷IEC publications are available from the International Electrotechnical Commission (<http://www.iec.ch>) and the American National Standards Institute (<http://www.ansi.org/>).

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