Summary Paper of IEEE Std. C37.248-2018
Guide for Common Format for Naming Intelligent Electronic Devices (COMDEV)

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Members (H23)

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Abstract

IEEE PSRC WG H23 (PC37.248) has produced a Guide (COMDEV) for a common naming convention for specifying IED designations that 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. 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. The convention could also benefit manufacturers of IEDs and software tools.

The main objective of COMDEV 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 guide contains examples of different type devices in various applications.

Background

While configuring an IED or manually composing COMTRADE files for use in simulation and modeling applications, the user has to compose and enter a number of electronic names or designations that uniquely identify the IED and each channel within it. Current standards 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 company, substation and IED names, installed locations, channel names, phase identifiers, monitored circuits, voltage classes, and so forth.

Keywords

IED Name, Channel Name, Device Name, Virtual Device

Introduction

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 Institute of Electrical and Electronics Engineers (IEEE) and International Electrotechnical Commission (IEC) standards such as IEEE C37.111, IEEE C37.118, IEEE 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 wave amplitude or root-mean-square (RMS). 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 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. 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 C37.2.

The Standard Practice adopted in C37.248-2018

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

Virtual Device

A virtual device is a non-physical device whose data are composed from one or more physical or virtual devices. For example, if the voltage record from one physical device is combined with the current record from another physical device then the result is a new record from a virtual device which must be named in compliance with this standard. Virtual records are invaluable for testing relay performance and for feeding advanced analytics such as fault location modeling and simulation applications.

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 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.

Defined Fields

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 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 of the guide 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 (e.g., X for 345 kV). Where multiple voltage levels are represented such as for 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 is the type of signal provided by the device for a given analog channel and is very useful for automated analysis. It 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

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 which allows for different versions of a settings file.

Applications

The guide describes how the naming convention could be used in the following applications:

- Common Format for Transient Data Exchange for Power Systems (COMTRADE) -- IEC 60255-24/IEEE C37.111 and Common Format for Naming Time Sequence Data Files (COMNAME) -- IEEE C37.232

- settings files
- Common Information Model (CIM) -- IEC 61970
- IEC Standard Networks and Systems for Power Utility Automation -- IEC 61850
- disturbance recorders
- Distributed Network Protocol (DNP3) -- IEEE 1815

Examples

The guide gives examples of many IED types used in each of the applications mentioned above. Table 1 shows the IED naming convention derived from various fields of the different applications used in one IED type - a line relay.

Table 1 – 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**	**Lat.**	**Long**	**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 PM
IEEE C37.232-2011 Device ID			ABC-123_11_345_Bulb								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			ThomasEdison_WaltElmore_ABC-123_11_345_Bulb_3I3V_P_Tesla_4_2015-05-15_1602.txt								78 characters		
Includes all fields except latitude and longitude. File extension would vary to fit format of settings file.													
CIM Core:Equipment			ABC-123_11_3I3V_P_Tesla_4								25 characters		
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		**Product Related**	WaltElmore_345_Bulb_ABC123_11								29 characters		
Company Name (owner) is available in the nameplate of the IED. Order is defined by IEC 61850.													
DR			Not applicable										
DNP3 (IEEE 1815)		**g0v245**	WaltElmore_Tesla_4								18 characters		
		g0v247	ThomasEdison_ABC-123_11_345_ Bulb_3I3V_P_2015-05-15_16:02								56 characters		
Location data is included in g0v245 (user-specified location data); all other data is included in g0v247 (user-specified device name).													

Conclusion

This paper describes the naming of intelligent electronic devices based on IEEE C37.248 guide. The proposed approach is simple and flexible. The guide shows with example the mapping process from the proposed guide to various related standards where naming of IEDs and channels have been described. It is expected that the adoption of this standard will simplify the device identification along with recording channels associated with those devices.

Bibliography

This listing of books, articles & standards is provided as sources for additional information:

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

IEC 60255-24/IEEE C37.111 Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE) for power systems

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

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

IEC 61850-6-1, Communication networks and systems for power utilities – Part 6: Configuration description language for communication in electrical substations related to IEDs

IEC Standard 61850, IEC Standard Networks and Systems for Power Utility Automation

IEC Standard 81346, IEC Standard Industrial systems, installations and equipment and industrial products

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

IEEE 1815, IEEE Standard for Electric Power Systems Communications - Distributed Network Protocol (DNP3)

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

IEEE Standard C37.239-2010, IEEE Standard for Common Format for Event Data Exchange (COMFEDE) for Power Systems

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

IEEE C37.118.1-2011, IEEE Standard for Synchrophasor Measurements for Power Systems

IEEE C37.118.2-2011, IEEE Standard for Synchrophasor Data Transfer for Power Systems

Biographical Summaries

Rick Cornelison, protection engineer for over 40 years with Alabama Power Company / Southern Company. Currently employed by Power Grid Engineering. Former member of the CAPE Advisory Committee. Former member of the IEEE PSRC Main Committee and H Subcommittee.

Amir Makki has worked at Softstuf since 1991. He has BS and MS degrees in Electrical Engineering from Tennessee Tech University, and pursued his Ph.D. studies in Software Engineering at Temple University. His main interest is fault and disturbance data analysis. He is a senior member of IEEE and an active member of the IEEE Protection Systems Relay Committee.

Jim Hackett had over 30 year of experience in various positions at Ontario Hydro and Hydro One. He has been with Mehta Tech, Inc. for the last 15 years. He is a member of the IEEE PSRC Main Committee and its C, H and I Subcommittees and also a member of TRUC, NASPI (PSVTT) and ICAP (SCASC).