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Communication networks and systems for power utility automation – Part 7-410: Basic communication structure – Hydroelectric power plants – Communication for monitoring and control

Réseaux et systèmes de communication pour l'automatisation des systèmes électriques – Partie 7-410: Structure de communication de base – Centrales hydroélectriques – Communication pour le contrôle-commande

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-410: Basic communication structure – Hydroelectric power plants – Communication for monitoring and control

FOREWORD

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IEC 61850-7-410 edition 2.1 contains the second edition (2012-10) [documents 57/1274/FDIS and 57/1289/RVD] and its amendment 1 (2015-11) [documents 57/1607/FDIS and 57/1633/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61850-7-410 has been prepared by technical committee 57: Power systems management and associated information exchange.

This edition includes the following significant technical changes with respect to the previous edition:

a) The logical nodes in IEC 61850-7-410:2007 that were not specific to hydropower plants have been transferred to IEC 61850-7-4:2010 and have been removed from this edition of IEC 61850-7-410.
b) The definitions of logical nodes in this edition of IEC 61850-7-410 have been updated using the format introduced in IEC 61850-7-4:2010.
c) Most of the modelling examples and background information that was included in IEC 61850-7-410:2007 has been transferred to IEC/TR 61850-7-510.
d) However, this edition of IEC 61850-7-410 includes additional general-purpose logical nodes that were not included in IEC 61850-7-4:2010, but are required in order to represent the complete control and monitoring system of a hydropower plant.

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

A list of all the parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-410: Basic communication structure – Hydroelectric power plants – Communication for monitoring and control

1 Scope

This part of IEC 61850 specifies the additional common data classes, logical nodes and data objects required for the use of IEC 61850 in a hydropower plant.

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/TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-7-1, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 61850-7-3:2010, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure for substations and feeder equipment – Common data classes*

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 61850-2 apply.

4 Abbreviated terms

The terms listed in Table 1 are used to build concatenated Data Object Names in this document. IEC 61850-7-410 inherits all the abbreviated terms described in Clause 4 of IEC 61850-7-4:2010.

NOTE Data Object Names in the logical nodes representing PSS filter functions follow names in IEEE 421.5 as closely as possible. These names are not included in Table 1.

Table 1 – Abbreviated terms

Term	Description	Term	Description
Act	Action, activity, active, activate[a]	Lkg	Leakage
Atr	Actuator	Lo	Low, lower (position)[a]
BG	Before Gain	LoPress	Low pressure
Brg	Bearing	Lub	Lubrication
Boil	Boiler	Man	Manual (- operation selected)
Brk	Brake	Mft	Main fuel trip
Bt	Heartbeat	Mnt	Maintenance
BtB	Back-to-Back	Msk	Mask
Cam	Cam, e.g. rotating non-circular disk	Mtx	Matrix
Cap	Capacity, capability[a]	Ndl	Needle (used in Pelton turbines)
Cbr	Calibration	Nhd	Net head
Cff	Coefficient	Nrm	Normal
Cm	Centimetres	Nxt	Next
Cmpl	Completed, completion, complete	Off	Device disengaged (= off)
Cmpr	Compressor	On	Device applied (= on)
Cnd	Condenser, synchronous compensator	Operate	Operate order to any device
Cndtc	Electrical conductivity [S]	Opn	Open, opened, openinga
Crl	Correlation	Pe	Electric power
Crp	Creeping, slow movement	Pmp	Pump
Ctl	Control	Polytr	Polytropic
Cwb	Crowbar	Prec	Precondition, initial status
De	Remove	Prt	Priority
Deg	Degrees, for angle indication in °	Psk	Penstock
Dfl	Deflector (used in Pelton turbines)	Pss	PSS, power system stabiliser function
Dia	Diaphragm	Qu	Queue
Dith	Dither	Rb	Runner blade
Dn	Down, below, downstream, lowest	Reg	Regulation
Drtb	Draft tube	Req	Requested
Droop	Droop	Rh	Re-heat
Dtc	Detection	Rlf	Relief
Dvc	Device	Rng	Range
Dw	Delta Omega	Rpt	Repeat, repetition
Ena	Enable, allow operation[a]	Rtg	Rating, rated
Fa	“Fire all” sequence (to thyristors)	Rwy	Runaway, e.g. in runaway speed
Fbc	Field breaker configuration	Saf	Safety
Fir	Fire	Sft	Soft (as in soft start)
Flm	Flame	Shft	Shaft
Flsh	Flashing (e.g. field flashing)	Sld	Solidity
Flt	Fault	SM	Servo, servo-motor
Flw	Flow, flowing	SNL	Speed-no-load, connected but not generating
Fst	Fast	Spir	Spiral
Gdv	Guide vanes	Src	Source
Grd	Gradient	Srv	Service
Gte	Gate, dam gate	Stl	Still, not moving
Hd	Head	Stm	Steam
HiPres	High pressure	Stnd	Stand, standing
Hwt	Headwater, water level at intake	Syn	Synchronous, synchronism
Hys	Hysteresis	Tp	Test Point
I	Intermediate	Trg	Trigger
Icp	Intercept	~~Trb~~Tur	Turbine
Ign	Ignition	Twt	Tailwater, water level at outlet
Iner	Inertia	Unt	Unit, production unit
Inlet	Inlet (to turbine)	Up	Up, above, upstream, upper
Ip	Intermediate pressure	Va	Variable
Jnt	Joint	Vsi	Voltage stabilizer input
Lft	Lifting, lift	Vst	Voltage stabilizer terminal (output)
Lkd	Locked		

[a] Extended description of IEC 61850-7-4

5 Logical node classes

5.1 Logical node groups

Logical nodes are grouped together with nodes of similar or related functions having the same first letter. Table 2 shows presently assigned letters, letters marked “reserved” may be used in future extensions to the standard series. Names of logical nodes shall start with the letter of the group to which the LN belongs. E.g. most of the logical nodes, defined in this document, are specific for hydropower use and thus have names that start with the letter H.

Table 2 – List of logical node groups

A	Automatic control functions
B	Reserved
C	Control functions
D	Functions specific to distributed energy resources (DER)
E	Reserved
F	Logical nodes representing functional blocks
G	Generic references
H	Functions specific to hydropower plants
I	Interface and archiving functions
J	Reserved
K	Kinetic energy, mechanical devices and equipment
L	Physical devices and common logical nodes
M	Metering and measurement
N	Reserved
O	Reserved
P	Electrical protections
Q	Power quality
R	Protection related functions
S	Supervision and monitoring
T	Sensors and transmitters (including instrument transformers)
U	Reserved
V	Reserved
W	Functions specific to wind power plants
X	Switchgear
Y	Power transformers
Z	Power system equipment

5.2 Interpretation of logical node tables

The interpretation of the headings for the logical node tables is presented in Table 3.

Table 3 – Interpretation of logical node tables

Data Object Name	Function of the Data Object
Common Data Class	Common Data Class that defines the structure of the Data Object. See IEC 61850-7-3.
Explanation	Short explanation of the data and how it is used.
T	Transient Data – the status of data with this designation is momentary and shall be logged or reported to provide evidence of their momentary state. Some T may be only valid on a modelling level. The TRANSIENT property of DATA only applies to BOOLEAN process data attributes (FC=ST) of that DATA. Transient DATA is identical to normal DATA, except that for the process state change from TRUE to FALSE no event may be generated for reporting and for logging.
M/O	This column defines whether data, data sets, control blocks or services are mandatory (M) or optional (O) for the instantiation of a specific logical node. In some cases a data object can be instantiated; this is marked by “multi”, i.e. Omulti or Mmulti. Instantiation shall be made by numbers 01 to 99, added directly after the data object name. The part of the data object that is instatiated is marked by {inst} in the data object explanation The attributes for data that are instantiated may also be mandatory or optional based on the CDC (Attribute Type) definition in IEC 61850-7-3. Where the letter C is used for “conditional”, at least one of the items of data labelled with C shall be used from each category where C occurs.

All data object names are listed alphabetically in Clause 8. Despite some overlapping, the data in the logical node classes are grouped for the convenience of the reader into some of the following categories.

Common logical node information
Common logical node information is information independent of the dedicated function represented by the LN class. Mandatory data (M) are common to all LN classes; optional data (O) are valid for a reasonable subset of LN classes.

Status information
Status information is data which shows either the status of the process or of the function allocated to the LN class. This information is produced locally and cannot be changed remotely unless substitution is applicable. Data such as “start” or “trip” are listed in this category. Most of these data are mandatory. The data can only be read and not set from an external source.

Settings
Settings are data which are needed for the function to operate. Since many settings are dependent on the implementation of the function, only a commonly agreed minimum is standardised. They may be changed remotely, but normally not very often. The setting can not always be read back; whether it is possible or not depends on the data class used for the setting.

Measured values
Measured values are analogue data measured from the process or calculated in the functions such as currents, voltages, power, etc. This information is produced locally and cannot be changed remotely unless substitution is applicable.

Controls
Controls are data which are changed by commands such as switchgear state (ON/OFF), tap changer position or reset-able counters. They are typically changed remotely, and are changed during operation much more than settings. Data objects under controls cannot be read back.