IEC 61850-7-410

Edition 2.0 2015-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

IEC 61850-7-410:2012-10/AMD1:2015-11(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 33.200

ISBN 978-2-8322-2983-5

FOREWORD

This amendment has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

FDIS	Report on voting
57/1607/FDIS	57/1633/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

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

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- withdrawn,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

Generic change: the abbreviation "Trb" for Turbine is changed to "Tur", for consistency with other documents in the IEC 61850 series, where it appears in the following cases:

Table 1, Subclause 5.6.26, Table 14.

4 Abbreviated terms

Add the following terms to Table 1.

Term	Description	Term	Description
Boil	Boiler	Jnt	Joint
Cmpr	Compressor	LoPres	Low pressure
Cndct	Electrical conductivity [S]	Mft	Main fuel trip
Ctl	Control	Msk	Mask
Gdv	Guide vanes	Mtx	Matrix
HiPres	High pressure	Rh	Re-heat
Icp	Intercept	Rlf	Relief
Ign	Ignition	Src	Source
Iner	Inertia	Stm	Steam
Inlet	Inlet (to turbine)	Va	Variable
Ip	Intermediate pressure		

5.3 Summary of logical nodes to be used in hydropower plants

Replace the existing title of 5.3 with the following new title:

5.3 Summary of logical node groups to be used in power plants

Table 4 – Logical nodes for automatic functions

Add the following class at the end of Table 4:

LN Class	Description
ASEQ	Generic control action sequencer

Add, at the end of Subclause 5.3.2, the following new Subclause 5.3.11:

5.3.11 Group E – Thermal power plant specific logical nodes ("Enthalpy")

Table 16 – Logical nodes representing thermal power

LN Class	Description
EBCF	Block control function. This LN will represent one physical device that coordinates the control of the thermal pressure of the steam generator and the electrical power regulation of turbine / generator system.
EFCV	Fuel control valve. This LN will represent the physical device of fuel control valve related to the gas turbine in a thermal power plant.
EGTU	Gas turbine production unit. This LN represents the physical device of the GT and the generator combination in a thermal power plant. It is intended as an extended rating plate that allows settings of data. It also acts as a placeholder for the current operating conditions of the unit.
ESCV	Steam control valve. This LN will represent the physical device of inlet control valve of the steam turbine in a thermal power plant.
ESPD	Speed monitoring. This LN is derived from HSPD.
ESTU	Steam turbine production unit. This LN represents the physical device of the ST and the generator combination in a thermal power plant. It is intended as an extended rating plate that allows settings of data. It also acts as a placeholder for the current operating conditions of the unit.
EUNT	Thermal unit operating mode. The present status of the production unit.

Table 5 – Logical nodes representing functional blocks

Add the following new logical node classes to Table 5:

LN Class	Description
FDBF	Dead-band filter. This LN represents a settable filter for dead-band.
FMTX	Trip matrix. This LN represents a matrix for linking various trip functions to equipment that shall be tripped or controlled during a fault.

Add, after Subclause 5.3.3, the following new Subclause 5.3.12:

5.3.12 Group G – Logical nodes for general purposes

Table 17 – Logical nodes representing generic functions references

LN Class	Description
GUNT	Production unit operating mode. The present status of the production unit.

Table 6 – Hydropower specific logical nodes

Replace LN Class "HUNT" with LN Class "GUNT".

Replace LN Class "HSEQ" with LN Class "ASEQ".

Table 9 – Logical nodes for protections

Add the following class at the end of Table 9:

LN Class	Description
PTUR	Used for detection of under resistance, e.g. due to stator or rotor earth-faults.

Table 11 – Logical nodes for supervision and monitoring

Add the following class at the beginning of Table 11:

LN Class	Description
SECW	Supervision of electrical conductivity in water. This logical node represents a system for monitoring of electrical conductivity in water.

Add, after Subclause 5.3.9, the following new Subclause 5.3.13:

5.3.13 Group T – Transducers and instrument transformers

Table 18 – Logical nodes for transducers

LN Class	Description
TECW	Measurement of electrical conductivity in water. This logical node represents a generic device for measuring the conductivity in water.

Add, after Subclause 5.4, the following new Subclause 5.13:

5.13 Logical nodes for thermal power LN group E

5.13.1 LN: Block coordination function Name: EBCF

Logical node EBCF shall be used to coordinate the control of the thermal pressure of the steam generator and the electrical power regulation of turbine / generator system.

EBCF class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
GasTurUnt	SPS	Gas turbine generation unit {inst} contributing [True = contributing]		Omulti
StmTurUnt	SPS	Steam turbine generation unit {inst} contributing [True = contributing]		Omulti
BoilUnt	SPS	Boiler unit {inst} contributing [True = contributing]		Omulti
BlkOpSt	ENS	Status of the block. *Operational condition* / *Value* Undefined / 0 Coordinated / 1 Boiler Follow / 2 Steam Follow / 3 Gas Follow / 4		M
GasTurErr	MV	Gas turbine generation unit {inst} error.		Omulti
StmTurErr	MV	Steam turbine generation unit {inst} error.		Omulti
BoilErr	MV	Boiler unit {inst} error.		Omulti
JntCtlTag	TAG	Joint control maintenance tag affixed to the equipment		O
UntTag	TAG	Maintenance tag affixed to the unit {inst}		Omulti
CmdBlk	SPC	Block operation		O

GasTurMft	ACT	Gas turbine generation unit {inst} main fuel trip	T	Omulti
BoilMft	ACT	Boiler unit {inst} main fuel trip	T	Omulti

5.13.2 LN: Fuel Control Valve Name: EFCV

Logical Node EFCV shall be used to represent the physical device of fuel control valve related to the gas turbine in a thermal power plant. In case of individually controlled control valves, it is possible to instantiate the logical node for each control valve.

EFCV class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
PosCls	SPS	Control valve closed		M
PosOpn	SPS	Control valve fully open		M
Controls				
OpCntRs	INC	Resettable operation counter		O
PosSpt	APC	Position set-point		O
DithAct	SPC	Activate dither		O
Measured values				
PosPct	MV	High pressure control valve position as percent of full opening [%]		C
PosDegt	MV	High pressure control valve position in degrees [°]		C

Condition: either PosPct or PosDeg shall be used but not both.

5.13.3 LN Gas turbine unit Name: EGTU

Logical node EGTU shall be used to represent the physical device of a gas turbine in a thermal power plant. The logical node serves as an extended rating plate only, for any operational status and runtime information, the logical node EUNT shall be used. In case of more than one turbine is used to form a single engine, the logical node shall be instantiated for each.

EGTU class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
OpTmh	INS	Operation time [h]		O
RotDir	ENS	Rotational direction (Clockwise | Counter-clockwise | Unknown)		O
Settings				
TurTyp	ENG	Turbine type		M
SpdRtg	ASG	Turbine rated speed [s^{-1}]		M
TurInert	ASG	Turbine moment of inertia J [kgm^2]		O
TurTrsSpd	ASG	Maximum transient overspeed [s^{-1}]		O
TurRwySpd	ASG	Runaway speed [s^{-1}]		O
PwrRtgTur	ASG	Rated power in turbine mode [MW]		O
FlwRtgTur	ASG	Rated flow in turbine mode [kg/s]		O
MaxPres	ASG	Maximum pressure [Pa]		O
RtgMaxTmp	ASG	Rated maximum temperature [K]		O
VlvClsTmms	ING	Control valve rated closing time [ms]		O

5.13.4 LN: Steam Control Valve Name: ESCV

Logical Node ESCV shall be used to represent the physical device of inlet control valve related to the steam turbine in a thermal power plant. In case of individually controlled control valves, it is possible to instantiate the data objects for each control valve.

ESCV class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
PosCls	SPS	Control valve closed		M
PosOpn	SPS	Control valve fully open		O
SMLkdCls	SPS	Servomotor {inst} locked closed in position		Omulti
SMLkdMnt	SPS	Servomotor {inst} locked in maintenance position		Omulti
TripVlvOpn	SPS	Trip valve open		O
TripVlvCls	SPS	Trip valve closed		O
Controls				
OpCntRs	INC	Resetable operation counter		O
PosSpt	APC	Position set-point		O
DithAct	SPC	Activate dither		O
Measured values				
PosPct	MV	High pressure control valve position as percent of full opening [%]		C
PosDeg	MV	High pressure control valve position in degrees [°]		C

Condition: either PosPct or PosDeg shall be used but not both.

5.13.5 LN: Speed monitoring Name: ESPD

Logical node ESPD shall be used to represent a speed monitoring device for a thermal turbine. The logical node is normally located in a stand-alone logical device, separated from but monitoring the turbine governor. It will also act as a placeholder for various speed limits and set-points used by the start sequencer and other control functions.

ESPD class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
SpdSrc	INS	Speed sensor {inst} fault		Omulti
StndStl	SPS	Stand still detection		O
SpdBrk	SPS	Brake operation allowed {inst}		Omulti
SpdIgn	SPS	Ignition Speed Reached		O
SpdExt	SPS	Point of operation for field breaker		O
SpdSyn	SPS	Point of operation for synchronising		O
SpdOv	SPS	Over-speed detection {inst}		Omulti
SpdMOv	SPS	Mechanical over-speed detection {inst}		Omulti
DirRot	SPS	Direction of rotation		O
Settings				
SpdBrkSpt	ASG	Braking allowed setting {inst}		Omulti
SpdExtSpt	ASG	Field breaker operation setting		O
SpdSynSpt	ASG	Synchronisation setting		O
SpdStlSpt	ASG	Standstill detection limit setting		O
SpdIgnSpt	ASG	Ignition speed detection setting		O
SpdHysSpt	ASG	Hysteresis limit setting		O
SpdOvSpt	ASG	Over-speed detection setting {inst}		Omulti
Measured values				
Spd	MV	Rotational speed of the shaft [s^{-1}]		M

5.13.6 LN Steam turbine unit Name: ESTU

Logical node ESTU shall be used to represent the physical device of a steam turbine in a thermal power plant. The logical node serves as an extended rating plate only, for any operational status and runtime information, the logical node EUNT shall be used.

ESTU class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
OpTmh	INS	Operation time [h]		O

ESTU class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
RotDir	ENS	Rotational direction (Clockwise | Counter-clockwise | Unknown)		O
Settings				
TurTyp	ENG	Turbine type (steam, gas, oil)		M
SpdRtg	ASG	Turbine rated speed [s^{-1}]		M
TurInert	ASG	Turbine moment of inertia J [kgm^2]		O
TurTrsSpd	ASG	Maximum transient overspeed [s^{-1}]		O
TurRwySpd	ASG	Runaway speed [s^{-1}]		O
TurPwrRtg	ASG	Rated power in turbine mode [MW]		O
FlwRtgTurb	ASG	Rated flow in turbine mode [kg/s]		O
HiPresMax	ASG	High pressure inlet maximum pressure [Pa]		O
IpMax	ASG	Intermediate pressure inlet maximum pressure [Pa]		O
LoPresMax	ASG	Low pressure inlet maximum pressure [Pa]		O
HiPresVlv	ASG	High pressure control valve rated oil pressure [Pa]		O
HpVlvClsTms	ING	High pressure control valve rated closing time [s]		O
IpVlvPres	ASG	Intermediate pressure control valve rated oil pressure [Pa]		O
MidVlvClsTms	ING	Intermediate pressure control valve rated closing time [s]		O
LpVlvPres	ASG	Low pressure control valve rated oil pressure [Pa]		O
LpVlvClsTms	ING	Low pressure control valve rated closing time [s]		O
IcpVlvPres	ASG	Intercept valve rated oil pressure [Pa]		O
MainStmTmpRtg	ASG	Turbine rated main steam temperature		O
RhStmTmp	ASG	Re-heat steam temperature		O
IcpVlvTms	ING	Intercept valve rated closing time [s]		O

5.5 Functional logical nodes LN group F

Replace the existing title of 5.5 with the following new title:

5.5 Logical nodes for functional blocks LN group F

Add, before Subclause 5.5.2, the following new Subclauses 5.5.5 and 5.5.6:

5.5.5 LN: Deadband filter Name: FDBF

Logical Node FDBF shall be used to represent a dead band filter. The input value is compared by the limits Out+Db and Out-Db. Within these limits the output value “Out” is equal to the reference value. If one of the limits is exceeded, the output value “Out” is equal to the reference, +/- the deviation from the dead band. If “Ofs” is not used or used but equals zero, the output will be equal to the input, with the new output used as reference.

FDBF class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Settings				
Ofs	ASG	Offset value (to be used as + and – the input)		O

Db	ASG	Dead band value		M
Ref	ASG	Reference value		O
DbGain	ASG	Dead band gain setting		O
Measured values				
Out	MV	Output signal		M

5.5.6 LN: Trip Matrix Name: FMTX

Logical Node FMTX shall be used to represent the functional matrix for a power plant. It describes the relation between combinations of input values to associated output values. This matrix can be used to initiate sequences or trips.

FMTX class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 19		
Data Objects				
Status information				
MtxOut	SPS	Output {inst} from trip matrix		Mmulti
Settings				
MskIn	ASG	Mask {inst} for input values		Mmulti
MskOut	ASG	Mask {inst} for output values		Mmulti

Example:

Most signifi-cant bit		**Least signifi-cant bit**	**Most significant bit**	**Least significant bit**				
InRef03	**InRef02**	**InRef01**	**MtxOut02**	**MtxOut01**	**Data Object for masking input values**	**Value**	**Data Object for masking output values**	**Value**
0	0	0	0	0	MskIn1.St.Val	0	MskOut1.St.Val	0
0	0	1	1	0	MskIn2.St.Val	1	MskOut2.St.Val	2
0	1	0	1	0	MskIn3.St.Val	2	MskOut3.St.Val	2
0	1	1	1	1	MskIn4.St.Val	3	MskOut4.St.Val	3
1	0	0	1	0	MskIn5.St.Val	4	MskOut5.St.Val	2
1	0	1	0	1	MskIn6.St.Val	5	MskOut6.St.Val	1
1	1	0	0	1	MskIn7.St.Val	6	MskOut7.St.Val	1
1	1	1	1	1	MskIn8.St.Val	7	MskOut8.St.Val	3

This functional matrix example has three InRefs and two matrix outputs (MtxOut). Each input mask (for example MskIn1.St.Val) validates the truth statement with respect to the associated InRefs to an outgoing output mask (for example MskOut1.St.Val) that enables the MtxOut of the matrix FMTX.

5.6.27 LN: Hydropower unit **Name: HUNT**

Replace Subclause 5.6.27 by the following new Subclause 5.6.27:

5.6.27 Logical nodes for general purposes **LN group G**

5.6.27.1 LN: Large general production unit **Name: GUNT**

Logical node GUNT shall be used to represent the physical devices of a production unit, typically consisting of a turbine and generator combination including control and ancillary equipment. The logical node holds information about the present operating status of the unit; it shall also be used to receive commands to change the operational status. It is intended to replace the logical node HUNT, introduced in IEC 61850-7-410, to represent a hydro power unit.

GUNT class				
Data Object Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
Iner	INS	Inertia of the unit (sum of turbine and generator inertia) [kgm^2]		O
UntOpSt	ENS	Status of the unit (numbers above 20 are free for user specific requests)		M

Operational condition	*Value*
Blocked from operation (disabled)	1
Stopped (needs control sequence to start)	2
Starting (start-up in progress)	3
Auxiliaries started	4
Generator running (speed no load, not excited)	5
Generator energised (speed no load, excited)	6
Synchronised, normal conditions	7
Stopping (shut-down in progress)	8
Creeping (for hydro)	9
Ready for start (at stand-still)	10
Discharging (for hydro)	11
Cranking (air, motor, SFC) (for thermal)	12
Purging (for thermal)	13
Rotor barring (turning gear) (for thermal)	14

UntOpMod	ENS	Operating mode of the unit		M

Operational mode	*Value*
Generating mode	1
Synchronous condenser mode	2
Pumping mode (for pumped storage)	3
Launching mode (for back-to-back of another unit)	4
Discharge mode (for hydro)	5