engineering center energoservice

Remote terminal unit ENCS-3

IEC 61850 Conformance Statement

ENCS IEC61850 CS. Rev. 04.2024

Contents

1   Introduction

The purpose of this document is to provide the IEC 61850 Edition 2.0 conformance details for the IEC 61850 implementation in the series of ENCS-3 remote terminal units manufactured by "Engineering Center "Energoservice".

This device offers the following major features:

1. Peer to peer communications via GOOSE message;
2. Abstract Communications Service Interface models including:

- Association model

- Server model

- Data set model

- Reporting model

- GOOSE publish model

- GOOSE subscribe model

- Control model

- Time and time synchronization model

Support

If you've got questions regarding the ENCS-3, please, contact our Technical Support:

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2 PICS details

Protocol Implementation Conformance Statement for the IEC 61850 interface in ENCS-3.

2.1 General

The following ACSI conformance statements are used to provide an overview and details about ENCS-3, with firmware 1.4.7:

- ACSI basic conformance statement;
- ACSI models conformance statement;
- ACSI service conformance statement.

The statements specify the communication features mapped to IEC 61850-8-1 Edition 2.0.

Conformance of the IEC 61850 implementation in ENCS-3 devices:

Supported models and services	"Y"
Unsupported	"N" or empty
Not applicable to Server/publisher	"−"

2.2 ACSI basic conformance statement

The basic conformance statement is defined in Table 2.1

Table 2.1 – Basic conformance statement

		Client/ subscriber	Server/ publisher	Value/ comments
Client-server roles				
B11	**Server** side (of TWO-PARTY APPLICATION-ASSOCIATION)	–	Y	
B12	**Client** side of (TWO-PARTY APPLICATION-ASSOCIATION)	N	–	
SCSMs supported				
B21	SCSM: IEC 61850-8-1 used		Y	
B22	SCSM: IEC 61850-9-1 used			deprecated
B23	SCSM: IEC 61850-9-2 used			
B24	SCSM: other			
Generic substation event model (GSE)				
B31	**Publisher** side	–	Y	
B32	**Subscriber** side	Y	–	
Transmission of sampled value model (SVC)				
B41	**Publisher** side	–	N	
B42	**Subscriber** side	N	–	

2.3   ACSI models conformance statement

The ACSI models conformance statement is defined in Table 2.2.

Table 2.2 – ACSI models conformance statement

		Client/ subscriber	Server/ publisher	Value/ comments
If Server side (B11) supported				
M1	**Logical device**		Y	
M2	**Logical node**		Y	
M3	**Data**		Y	
M4	**Data set**		Y	
M5	**Substitution**		N	
M6	**Setting group control**		N	
	Reporting			
M7	**Buffered report control**		Y	
M7-1	sequence-number		Y	
M7-2	report-time-stamp		Y	
M7-3	reason-for-inclusion		Y	
M7-4	data-set-name		Y	
M7-5	data-reference		Y	
M7-6	buffer-overflow		Y	
M7-7	entryID		Y	
M7-8	BufTm		Y	BufTm=0
M7-9	IntgPd		Y	
M7-10	GI		Y	
M7-11	conf-revision		Y	
M8	**Unbuffered report control**		Y	
M8-1	sequence-number		Y	
M8-2	report-time-stamp		Y	
M8-3	reason-for-inclusion		Y	
M8-4	data-set-name		Y	
M8-5	data-reference		Y	
M8-6	BufTm		Y	BufTm = 0
M8-7	IntgPd		Y	
M8-8	GI		Y	
M8-9	conf_revision		Y	
	Logging			
M9	**Log control**		N	
M9-1	IntgPd		N	
M10	**Log**		N	
M11	**Control**		Y	
If GSE (B31/B32) is supported				
M12	**GOOSE**	Y	Y	
M13	**GSSE**			deprecated
If SVC (B41/B42) is supported				
M14	Multicast SVC	N	N	
M15	Unicast SVC	N	N	

		Client/ subscriber	Server/ publisher	Value/ comments
For all IEDs				
M16	**Time**	N	Y	Time source with required accuracy shall be available.
M17	**File Transfer**	N	N	

2.4 ACSI service conformance statement

The ACSI service conformance statement is defined in Table 2.3 (depending on the statements in Table 2.1).

Table 2.3 – ACSI service Conformance statement

	Services	AA: TP/MC	Client/ subscriber	Server/ publisher	Comments
Server (Clause 7)					
S1	Server Directory	TP	N	Y	
Application association (Clause 8)					
S2	Associate		N	Y	
S3	Abort		N	Y	
S4	Release		N	Y	
Logical device (Clause 9)					
S5	LogicalDeviceDirectory	TP	N	Y	
Logical node (Clause 10)					
S6	GetLogicalNodeDirectory	TP	N	Y	
S7	GetAllDataValues	TP	N	Y	
Data (Clause 11)					
S8	GetDataValues	TP	N	Y	
S9	SetDataValues	TP	N	N	
S10	GetDataDirectory	TP	N	Y	
S11	GetDataDefinition	TP	N	Y	
Data set (Clause 12)					
S12	GetDataSetValues	TP	N	Y	
S13	SetDataSetValues	TP	N	N	
S14	CreateDataSet	TP	N	Y	
S15	DeleteDataSet	TP	N	Y	
S16	GetDataSetDirectory	TP	N	Y	
Setting group control (Clause 16)					
S18	SelectActiveSG	TP	N	N	

	Services	AA: TP/MC	Client/ subscriber	Server/ publisher	Comments
S19	SelectEditSG	TP	N	N	
S20	SetSGValues	TP	N	N	
S21	ConfirmEditSGValues	TP	N	N	
S22	GetSGValues	TP	N	N	
S23	GetSGCBValues	TP	N	N	

Reporting (Clause 17)					
Buffered report control block (BRCB)					
S24	Report	TP	N	Y	
S24-1	data-change (dchg)		N	Y	
S24-2	qchg-change (qchg)		N	Y	
S24-3	data-update (dupd)		N	N	
S25	GetBRCBValues	TP	N	Y	
S26	SetBRCBValues	TP	N	Y	
Unbuffered report control block (URCB)					
S27	Report	TP	N	Y	
S27-1	data-change (dchg)		N	Y	
S27-2	qchg-change (qchg)		N	Y	
S27-3	data-update (dupd)		N	N	
S28	GetURCBValues	TP	N	Y	
S29	SetURCBValues	TP	N	Y	

Logging (Clause 17)					
Log control block					
S30	GetLCBValues	TP	N	N	
S31	SetLCBValues	TP	N	N	
Log					
S32	QueryLogByTime	TP	N	N	
S33	QueryLogAfter	TP	N	N	
S34	GetLogStatusValues	TP	N	N	

Generic substation event model (GSE)					
GOOSE (Clause 18)					
S35	SendGOOSEMessage	MC	N	Y	IED supports GOOSE publish & subscription
S36	GetGoReference	TP	N	N	
S37	GetGOOSEElementNumber	TP	N	N	
S38	GetGoCBValues	TP	N	Y	
S39	SetGoCBValues	TP	N	Y	
GSSE (Annex C)					
S40	SendGSSEMessage	MC	N	N	
S41	GetGsReference	TP	N	N	
S42	GetGSSEElementNumber	TP	N	N	

	Services	AA: TP/MC	Client/ subscriber	Server/ publisher	Comments
S43	GetGsCBValues	TP	N	N	
S44	SetGsCBValues	TP	N	N	

Transmission of sampled value model (SVC) (Clause 19)					
Multicast SVC					
S45	SendMSVMessage	MC	N	N	
S46	GetMSVCBValues	TP	N	N	
S47	SetMSVCBValues	TP	N	N	
Unicast SVC					
S48	SendUSVMessage	TP	N	N	
S49	GetUSVCBValues	TP	N	N	
S50	SetUSVCBValues	TP	N	N	

Control (Clause 20)					
S51	Select	TP	N	Y	
S52	SelectWithValue	TP	N	Y	
S53	Cancel	TP	N	Y	
S54	Operate	TP	N	Y	
S55	CommandTermination	TP	N	Y	
S56	TimeActivated-Operate	TP	N	N	

File transfer (Clause 23)					
S57	GetFile	TP	N	N	
S58	SetFile	TP	N	N	
S59	DeleteFile	TP	N	N	
S60	GetFileAttributeValues	TP	N	N	

Time (5.5)					
T1	Time resolution of internal clock	TP		20 (1 µs)	Nearest negative power of 2 in seconds
T2	Time accuracy of internal clock	TP		1 ms	T1
T3	Supported TimeStamp resolution	TP		10 (1 ms)	Nearest value of 2**-n in seconds according to 6.1.2.9.3.2

3   TICS details

Tissues Conformance Statement for the IEC 61850 interface in ENCS-3 with firmware version 1.4.7.

3.1   Mandatory Edition 2 Tissues

Below tables give an overview of the applicable mandatory Tissues.

Items in *italic* are brief interpretations provided by the UCA International Users Group to aid in interpretation and is not normative.

Part 6 Tissue	Description	Implemented Y/na
658	Tracking related features *EntryID and CST missing, these are checked by schema*	na
663	FCDA element cannot be a "functionally constrained logical node" *doName now mandatory in FCDA element, SCT: refuse to make empty doName? ICT: Refuse SCD*	Y
668	Autotransformer modeling *Autotransformer model in substation section has changed*	na
687	SGCB ResvTms *SettingControl has added attribute resvTms see also TISSUE 845*	na
719	ConfDataSet - maxAttributes definition is confusing *maxAttributes now means max count of FCDA in dataset*	Y
721	Log element name *LN0/Log now has optional attribute "name"*	na
768	bType VisString65 is missing *VisString65 added as SCL BasicType*	na
779	object references *"@" as first character in object references now allowed*	Y
788	SICS S56 from optional to mandatory *SICS S56="Interpret IED capabilities and prohibit unsupported usage"*	na
789	ConfLdName as services applies to both server and client *Many changes made to Services section*	na
804	valKind and IED versus System configuration *valImport missing/false DAI means ICT shall ignore value in SCD and SCT shall not change from ICD/IID value. Instance section inherits from DA/BDA element.*	Y
806	Max length of log name inconsistent between -6 and -7-2 *LogControl.logName and Log.name restricted to 32 chars*	na
807	Need a way to indicate if "Owner" present in RCB *Services/ReportSettings@owner added*	Y
823	ValKind for structured data attributes *valKind is prohibited on structured attributes*	Y
824	Short addresses on structured data attributes *sAddr is now allowed for structured attributes*	na
825	Floating point value *Server shall support with exponential notation*	Y
845	SGCB ResvTms *Services/SettingGroups/SGEdit added attribute resvTms* *Services/SettingGroups/ConfSG added attribute resvTms* *See also TISSUE 687*	na
853	SBO and ProtNs *DA[@name=SBO] element shall have ProtNS element*	Y

855	Recursive SubFunction *Substation section extension must be tolerated*	na
856	VoltageLevel frequency and phases *Substation section extension must be tolerated*	na
857	Function/SubFunction for ConductingEquipment *Substation section extension must be tolerated*	na
886	Missing 8-1 P-types *"tP_IP_UDP_PORT" and "tP_IP_TCP_PORT" added*	Y
901	tServices as AP or as IED element *Rules for contents of AP/Server/Services are now defined*	Y
936	SupSubscription parameter usage is difficult *SupSubscription "max" replaced by "maxGo" and "maxSv"*	Y
1147	tServices - FileHandling not consistent with -7-2 *Services/FileHandling now means only support for GetFile and* *GetFileAttributeValues and NOT SetFile/DeleteFile*	na
1185	Valkind value Conf for EX FC data *valKind=Conf is allowed for dataNs*	Y
1284	SCSM mapping may require a communication section in an ICD file *Server IEDs supporting client/server associations to 61850-8-1 shall* *include a section*	Y
1328	Limitation on the size of data type templates identifiers *Identifer now limited to 255 characters*	Y
1395	Client LN attributes *ReportControl/RptEnabled/ClientLN@ldInst shall be "LD0" for pure* *clients (without any Logical Devices)*	na
1402	ExtRef during engineering *an ExtRef.intAddr attribute value unequal to empty string (prescribed or* *filled by the IED tool) is the flag indicating that the ExtRef shall not be* *deleted by the system tool. The system tool can however remove the link* *to the source IED* *<<applicable for SCL tool test>>*	na
1415	SICS-S110 IID import mandatory for Edition2 *only the import of data model modifications and CF value changes is* *mandatory for system tool* *<<applicable for SCL tool test>>*	na
1419	Support of ldName on other IEDs *SICS I212 is now mandatory*	Y
1444	Need to support fixed and SCT controlled Datasets *Services/xxxSetttings@datSet=fix now means "data set pointed by* *Control Block cannot be altered from ICD/IID value* *<<applicable for SCL tool test>>*	na
1445	ConfReportControl and a fixed ReportSettings *Control block capabilities must be consistent* *<<applicable for SCL tool test>>*	na
1450	originalSclXxx computation rules *Ed2 ICD/IID files specifying SCL@version=2007 SHALL include* *originalSCLVersion=2007 and originalSCLRevision as attributes of the* *<IED> element*	Y
1485	Need to supercede Tissue 1398 to clarify SCT behavior *Same as TISSUE 1450 <<applicable for SCL tool test>>*	na

Part 7-1 Tissue	Description	Implemented Y/na
828	Data model namespace revision IEC 61850-7-4:2007[A] *Both 2007 and 2007A are allowed for namespace name*	Y

948	Enumeration (string) values format *Enums are limited to 127 characters from Basic-Latin and Latin-1 character sets*	Y
1151	simulated GOOSE disappears after 1st appearance when LPHD.Sim = TRUE *New LGOS state machine defined, but TISSUE is not IntOp2, therefore TISSUE is optional if LGOS is used*	na
1396	The use and configuration flow of LGOS and LSVS is unclear *If Services/SupSubscription@maxGo > 1 then at least 1 LGOS must exist. Same for maxSv/LSVS.* *If maxGo > count(LGOS) then SCT can create additional LGOS. Same for maxSv/LSVS*	na
1447	Restriction on ENUMtypes in SCL *If a ENUM DA limits write or configuration to a subset, then that subset must be declared*	Y
1457	Multiple DOI nodes with the same name *LN can have no more than one DOI with same name*	Y
1468	Re-use DO from other LN *allow standard or private dataNs*	na
1491	CmdBlk blocks itself? *The data CmdBlk shall have no effect on the controllable data Mod or CmdBlk*	na
1495	GetVariableAccessAttributes error code *Return MMS error access/object-non-existent if the object does not exist*	Y

Part 7-2 Tissue	Description	Implemented Y/na
728	BRCB: could PurgeBuf be set when RptEna=TRUE? *PurgeBuf while RptEna=true is prohibited*	Y
778	AddCause values – add value not-supported *Align 7-2 with 8-1 (nothing new to 8-1)*	Y
780	What are unsupported trigger option at a control block? *All control blocks must support all trigger options*	Y
783	TimOper Resp- ; add Authorization check *Clarifies Time-Operated Controls*	na
786	AddCause values 26 and 27 are switched *Annex B.2 has wrong AddCause values*	Y
820	Mandatory ACSI services (use for PICS template) *Model entries M18 (Application Association), M19 (GCB), M20 (SVCB) are new. Services S17 (Substitution) and S61 (GetServerDirectory) are new. Services S1, S3, S4, S5, S6, S8, S16, S18, S23, S36, S37, S41, S42 are changed.*	Y
858	typo in enumeration ServiceType *Tracking serviceType now has GetLogicalNodeDirectory*	Y
861	dchg of ConfRev attribute *Clarifies (tracking) BTS.confRev is AFTER BRCB change*	na
1050	GTS Phycomaddr definition in SCL *(Tracking) GTS needs a special structure for SCL*	na
1071	Length of DO name *Private DO name length shall be <=12 including instance*	Y
1127	Missing owner attribute in BTS and UTS *NSD files for 61850-7-3 show owner in (tracking) BTS/UTS*	na
1202	GI not optional *GI support is mandatory for both URCB and BRCB*	Y
1232	EntryID needs clarification *Segments of a report shall have same identifiers*	na

1242	NTS definition *NTS.resv have been added*	na
1307	Segmented report with Buffer overflow *Segments of a report shall have identical buf-overflow value*	na
1428	MTS and NTS should use svOptFlds *MTS.optFlds and NTS.optFlds now have bType=SvOptFlds*	na
1630	Attributes in CDC=LTS do not match 8-1 definition *Order of attributes in LTS changed to: logEna, logRef, datSet,* *oldEntrTm, newEntrTm, oldEnt, newEnt, trgOps, intgPd*	na

Part 7-3 Tissue	Description	Implemented Y/na
697	persistent command / PulseConfig *PulseConfig adds enum "persistent-feedback"* *DPC.cmdQual=="persistent" is conditionally allowe*	na
698	Wrong case is BAC.dB attribute *attribute renamed from "dB" to "db"*	na
711	blkEna freeze data update while setting its quality to operaterBlocked *Mode=Blocked shall not cause q.operatorBlocked*	na
722	Units for 'h' and 'min' not in UnitKind enumeration. *New unit enums 84=hours, 85=minutes*	na
919	Presence Condition for sVC *svC may be valKind=Conf in ICD file*	na
925	Presence of i or f attribute - Problem with writing *New constructed attribute class "AnalogueValueCtl"*	na
926	Presence Conditions within RangeConfig *All or none of hhLim+hLim+lLim+llLim shall be present*	na
954	Data attributes with FC=CF should have trgOp=dchg *Some INS and HST and CSG attributes missing dchg*	na
1078	CMV.t update if rangeAng changed *Add rangeAng to "reasons-to-update-timestamp-of-CMV"*	na
1565	db = 0 behaviour *db=0 not longer suppresses reporting*	Y
1578	dataAttribute NameSpace content *Attributes with FC=EX must be initialized in ICD/IID file*	Y

Part 7-4 Tissue	Description	Implemented Y/na
671	mistake in definition of Mod & Beh *Beh=on, q=test should be "Processed as valid"*	Y
674	CDC of ZRRC.LocSta is wrong *ZRRC LocSta should be CDC=SPC*	na
676	Same data object name used with different CDC *LCCH.Fer renamed to FerCh, LCCH.RedFer to RedFerCh*	na
677	MotStr is used with different CDC in PMMS and SOPM LN classes *Rename SOPM.MotStr to MotStrNum*	na
679	MotStr is used with different CDC in PMMS and SOPM LN classes *Rename SOPM.MotStr to MotStrNum*	na
680	Remove CycTrMod Enum *Enum is no longer used, use TrMod instead*	na
681	Enum PIDAlg *Typographical error, invalid XML syntax*	na
682	Enum QVVR.IntrDetMth	na

	IntrDetMth enum values text have changed	
683	Enum QVVR.IntrDetMth *IntrDetMth enum values text have changed*	na
685	Enum ParTraMod *ParTraMod enum values text have changed*	na
686	New annex H - enums types in XML *Many changes have been made to enumeration names*	Y
694	Data object CmdBlk *CmdBlk semantics have changed*	na
696	LSVS.St (Status of subscription) *LSVS.St is now mandatory*	na
712	interpretation of quality operatorBlocked *Mode and Behavior semantics have changed*	Y
713	DO Naming of time constants in FFIL *Many DO names in FFIL have changed*	na
714	Enums for ShOpCap and SwOpCap *Type for YPSH.ShOpCap and XSWI.SwOpCap have changed*	Y
715	RBDR.ChNum1 *RBDR.ChNum1 changes from optional to conditional*	na
716	TAXD text for condition *TAXD.SmRte condition for inclusion has changed*	na
724	ANCR.Auto *ANCR.Auto changes from mandatory to optional*	na
725	Loc in LN A-group *Loc changes to optional, LocKey/LocSta conditions change*	na
734	LLN0.OpTmh vs. LPHD.OpTmh *LLN0.OpTmh deleted, LPHD.OpTmH added as conditional*	na
736	PFSign *MMXU.PFSign enum's 1 = IEC and 2 = EEI*	na
742	GAPC.Str, GAPC.Op and GAPC.StrVal *Objects have instance indicator removed (ex, Str1 to Str)*	na
743	CCGR.PmpCtl and CCGR.FanCtl *Object have instance indicator added (ex:PmpCtl to PmpCtl1)*	na
744	LN STMP, EEHealth and EEName *Removed STMP.EEHealth and STMP.EEName*	na
772	LPHD.PwrUp/PwrDn should be transient *These objects are now transient*	na
773	Loc, LocKey and LocSta YPSH and YLTC *Add Loc, LocKey and LocSta in YLTC and YPSH (optional)*	na
774	ITCI.LocKey *Add ITCI.LocKey as optional*	na
776	LPHD.OutOv/InOv and LCCH.OutOv/InOv *Clarified: stays true until buffer space again available*	na
800	Misspelling in CSYN *CSYN.VInvTmms renamed to CSYN.VIntvTmms*	na
802	CCGR and Harmonized control authority *Add Loc, LocKSta to every controllable LN (e.g. FSPT)*	na
808	Presence condition of ZMoT.DExt and new DOs *Change ZMOT.DExt to optional; add TotThmSt and MotSt*	na
831	Setting of ConfRevNum in LGOS *Add RxConfRevNum to LGOS and LSVS*	na
838	Testing in Beh=Blocked *Change sematic of Beh=Blocked to allow controls to be acknowledged even when LN is blocked*	Y
844	MFLK.PhPiMax, MFLK.PhPiLoFil, MFLK.PhPiRoot DEL->WYE *Change these NFLK objects from cdc=DEL to cdc=WYE*	na

877	QVUB -settings should be optional *Change QVUB.UnbDetMth and QVUB.StrVal to optional*	na
908	ARIS.StrSeq – transient *Change ARIS.StrSeq to transient*	na
909	Remove ANCR.ColOpR and ColOpL *Replace ANCR.ColOpR and ANCR.ColOpL with ANCR.ColChg. Add YEFN.ColChg*	na
912	Clarification of PwrRtg/VARtg *Change many DOs in YPTR, and ZGEN, see name space 2007A2.nsd for final result*	na
920	Resetable Counter is NOT resetable *Change GGIO.CntRs to CntVal; Same for FCNT*	na
932	Rename AVCO.SptVol to AVCO.VolSpt	na
933	Presence of LCCH.RedFerCh and RedRxCnt *Change the presence condition of LCCH.RedChLiv*	na
939	Change CDC for ANCR.FixCol *Change ANCR.FixCol from APC to ASG*	na
991	LGOS: GoCBRef (as well as LSVS.SvCBRanre ef) should be mandatory *LGOS.GoCBRef and LSVS.SvCBRef are now both mandatory*	Y
1007	PTRC as fault indicator - Update of description required *PTRC.Tr and Op and Str conditional (at least 1 of group)*	na
1044	TapChg in AVCO *AVCO.TapChg is now optional*	na
1077	Rename DOnames within LTIM *LTIM.TmChgDayTm, changed to TmChgDay;* *LTIM.TmChgStdTm changed to TmChgStd*	na
1256	New DO for LTIM to set time "manually" *Add LTIM.TmSet*	na
1331	Mod, Beh and Health with q=TEST, client can't receive their states *Mod while in Blocked will always be processed*	Y
1426	Add two DO for leap seconds in LTIM *LTIM.Leap added,*	na
1456	Annex A and Mod/Beh/Health *Mod.stVal writes always igore test bits in controls*	Y
1568	ISAF.AlmReset ->transient *Change ISAF.AmlReset to transient*	na

Part 8-1 Tissue	Description	Implemented Y/na
770	GoID type mitmatch 18.1.1 and 18.1.2.5.2 *GoID string length is now 129*	Y
784	Tracking of control (CTS) *Tracking CTS has been added*	na
817	Fixed-length GOOSE float encoding *GOOSE float is encoded Tag-0x87, length=5, first octet=8*	Y
827	Mandatory ACSI services (Part of 7-2 TISSUE resolution) *Change Table 111 (ServicesSupported): Add initiate, abort, and release.* *Change conditions for defineNamedVariables.*	Y
834	File dir name length 64 *Filename length changed from 32 to 64*	na
951	Encoding of Owner attribute *xRCB.owner is encoded as 4 octets(IPv4) or 16 octets(IPv6)*	na
1040	More associate error codes *3 additional associate error codes added*	na
1178	Select Response+ is non-null value	na

	Response to SBO read should be	
1324	The response- for DeleteNamedVariableList is not defined *numDeleted=0; error=service/object-constraint-conflict*	Y
1345	Fixed-length GOOSE ASN.1 length encoding *GOOSE publisher shall always encode minimum size legth field*	na
1441	Optonal fields in buffered reports *Writing BRCB.optFld shall not cause a purgeBuf operation*	Y
1442	Journal variableTag for ReasonCode *Example in the standard is incorrect*	na
1453	Purge buffer on write to BRCB *PurgeBuf only occurs if different value is written*	Y
1454	Reports can be transmitted before write(RptEna=true) is confirmed	Y
1500	the response for DeleteNamedVariableList with a non-existent LN is not specified *CreateDataSet/DefineNamedVariableList specifying a nonexisting LD/LN shall fail with access/object-non-existent*	Y

Compare the TISSUE database for more details: http://iec61850.tissue-db.com/

4 MICS details

Model Implementation Conformance Statement for the IEC 61850 interface in ENCS-3 with firmware version 1.4.7.

4.1 General

This MICS document specifies the modelling extensions compared to IEC 61850 edition 2. For the exact details on the standardized model please compare the ICD substation configuration file: "encs.icd", version 2.0.0.

- Clause 4.2 contains the list of implemented logical nodes.

4.2 Logical Nodes List

The following table contains the list of logical nodes implemented in the ENCS-3:

L: System Logical Nodes
LLN0 (Logical node zero)
LPHD (Physical device information)
P: Logical nodes for protection functions
PTOC (Time overcurrent)
PTRC (Protection trip conditioning)
R: Logical nodes for protection related functions
RBRF (Breaker failure)
C: Logical nodes for control
CILO (Interlocking)
CSWI (Switch controller)
G: Logical Nodes for generic references
GGIO (Generic process I/O)
M: Logical Nodes for metering and measurement
MMTR (Metering)
MMXN (Non-phase-related Measurement)
MMXU (Measurement)
MSQI (Sequence and Imbalance)
X: Logical Nodes for switchgear
XCBR (Circuit breaker)
XSWI (Switch)
T: Logical nodes for instrument transformers and sensors
TCTR (Current transformer)
TVTR (Voltage transformer)
Z: Logical nodes for further power system equipment
ZAXN (Auxiliary network)
ZBAT (Battery)

5 PIXIT details

Protocol Implementation Extra Information for Testing (PIXIT) of the IEC 61850 interface in ENCS-3 with firmware version 1.4.7.

5.1 General

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, TICS documents or SCL file.

Each table specifies the PIXIT for each applicable ACSI service model as structured in IEC 61850-10. The "Ed" column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2. A hyphen ("-") in the Ed column indicates the PIXIT entry is not applicable for any version.

Accepted abbreviations in the following tables:

Supported	"Y"
Unsupported	"N" or empty
Not available	"NA"

5.2 Documentation

ID	ED	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	Value is present in the datamodel

5.3 Association model

ID	ED	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	15
As2	1, 2	TCP_KEEPALIVE value	2 to 65535 s, default 10
As3	1, 2	Lost connection detection time	TCP_KEEPALIVE + 8 seconds
As4	–	Authentication is not supported yet	
As5	1, 2	What association parameters are necessary for successful association: Called/Calling values:	Transport selector Y Session selector Y Presentation selector Y AP Title N AE Qualifier N
As6	1, 2	If association parameters are necessary for association, describe the correct values: Called/Calling values:	Association parameters are configurable, default values are: Transport selector 0001 Session selector 0001 Presentation selector 00000001 AP Title 1,1,999,1,1 AE Qualifier 12
As7	1, 2	What is the maximum and minimum	Max 51200

		MMS PDU size	Min 16384
As8	1, 2	What is the maximum start up time after a power supply interrupt	60 s
As9	1, 2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N

5.4   Server model

ID	ED	Description	Value / Clarification
Sr1	1, 2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, N Questionable Detail Quality: N Overflow N OutofRange N BadReference N Oscillatory Y Failure N OldData N Inconsistent N Inaccurate Miscellaneous: N Source Y Test N OperatorBlocked
Sr2	1, 2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, N Questionable Detail Quality: N BadReference N Oscillatory Y Failure N OldData N Inconsistent N Inaccurate Miscellaneous: N Source Y Test N OperatorBlocked
Sr3	–	What is the maximum number of data values in one GetDataValues request	Deprecated
Sr4	–	What is the maximum number of data values in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported	On Y Blocked Y Test Y Test/Blocked Y Off Y

5.5 Data set model

ID	ED	Description	Value / Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	128
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	64 (Max number of all data sets is 64)
Ds3	1	How many non-persistent data sets can be created by one or more clients	64 (Max number of all data sets is 64)

5.6 Substitution model

ID	ED	Description	Value / Clarification
Sb1	1	Are substituted values stored in volatile memory?	NA

5.7 Setting group control model

ID	ED	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device	NA
Sg2	1.2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	NA
Sg3	1	Can multiple clients edit the same setting group	NA
Sg4	1	What happens if the association is lost while editing a setting group	NA
Sg5	1	Is EditSG value 0 allowed	NA
Sg6	2	When ResvTms is not present how long is an edit setting group locked	NA

5.8 Reporting model

ID	ED	Description	Value / Clarification	
Rp1	1	The supported trigger conditions are (compare PICS)	integrity	Y
			data change	Y
			quality change	Y
			data update	NA
			general interrogation	Y
Rp2	1	The supported optional fields are	sequence-number	Y
			report-time-stamp	Y
			reason-for-inclusion	Y
			data-set-name	Y
			data-reference	Y
			buffer-overflow	Y
			entryID	Y
			conf-rev	Y
			segmentation	N
Rp3	1, 2	Can the server send segmented reports	N	

ID	ED	Description	Value / Clarification
Rp4	1, 2	Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 $17.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2:2003 $14.2.1)	Each URCB is visible to all clients
Rp6	–	What is the format of EntryID	Integer
Rp7	1, 2	What is the buffer size for each BRCB or how many reports can be buffered	10 kilobytes for each BRCB.
Rp8	–	Pre-configured RCB attributes that can be changed online when RptEna = FALSE (see also the ICD report settings)	Deprecated
Rp9	1	May the reported data set contain: - structured data objects? - data attributes?	Y Y
Rp10	1, 2	What is the scan cycle for binary events? Is this fixed, configurable	1 millisecond Fixed
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart	Restored from original configuration
Rp13	1, 2	Does the server accept any client to configure/enable a BRCB with ResvTms=-1? What fields are used to do the identification?	NA N AP-Title N AE-Qualifier
Rp14	1, 2	When BRCB.ResvTms is exposed, what is the default value for BRCB.ResvTms if client does not write (must be > 0) When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0)	NA 60 seconds
Rp15	2	Is data model db=0 supported	Y

5.9 Logging model

ID	ED	Description	Value / Clarification
Lg1	1, 2	What is the default value of LogEna (Compare IEC 61850-8-1 §17.3.3.2.1, the default value should be FALSE)	NA
Lg2	-	What is the format of EntryID	NA
Lg3	1, 2	Are there multiple Log Control Blocks that specify the Journaling of the same MMS NamedVariable and TrgOps and the Event Condition (Compare IEC 61850-8-1 §17.3.3.3.2)	NA
Lg4	-	Pre-configured LCB attributes that cannot be changed online	NA
Lg5	1	Which TrgOps are supported for logging (note Ed2 and up requires support for all TrgOps)	NA

5.10 GOOSE publish model

ID	ED	Description	Value / Clarification
Gp1	1, 2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	Y
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect	NdsCom=T DUT keeps GoEna=F
Gp3	1, 2	Published FCD supported common data classes are	Any from Model
Gp4	1, 2	What is the maximum value of TAL (maxTime) Is it fixed or configurable	Configured by ENCS Configurator software
Gp5	1, 2	What is the fastest retransmission time	Configured by ENCS Configurator software
Gp6	–	Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated See PICS – SetGoCBValues
Gp7	1, 2	What is the initial GOOSE sqNum after restart	sqNum = 0
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD)? - timestamp data attributes?	 Y Y
Gp9	1, 2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	N

5.11 GOOSE subscribe model

ID	ED	Description	Value / Clarification
Gs1	1, 2	What elements of a subscribed GOOSE header are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: • the VLAN tag may be removed by an Ethernet switch and shall not be checked • the simulation flag shall always be checked (Ed2)	Y* source MAC address Y destination MAC address Y APPID Y gocbRef Y timeAllowedtoLive Y datSet Y goID Y* T Y stNum N sqNum Y simulation / test Y confRev Y ndsCom Y numDatSetEntries N out-of-order dataset members * - configured, default N Note: GOOSE with TAL = 0ms is ignored
Gs2	1, 2	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	message does not arrive prior to TAL
Gs3	1, 2	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	After TAL set Quality of GOOSE data as invalid
Gs4	1, 2	What is the behaviour when a subscribed GOOSE message is out-of-order	Data is still accepted in case of stNum change
Gs5	1, 2	What is the behaviour when a subscribed GOOSE message is duplicated	message is ignored

Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Configured
Gs7	1	May the GOOSE data set contain: - structured data objects (FCD)? - timestamp data attributes?	Y Y
Gs8	1, 2	Subscribed FCD supported common data classes / data types are	SPS, DPC, Boolean, Quality, Timestamp, INT32, Float
Gs9	1	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode	Y
Gs10	1, 2	Max number of dataset members	128
Gs11	1	Is Fixed-length encoded GOOSE supported	Y Note: Ed2 Am1 requires support
Gs12	2	Is IEC 62351-6 security supported	N

5.12 GOOSE performance

ID	ED	Description		Value / Clarification
Gf1	1, 2	Performance class		P2/P3
Gf2	1, 2	GOOSE ping-pong processing method		Event driven based
Gf3	1, 2	Application logic scan cycle(ms)	Max.	Boolean 1 milisecond
			Min.	Boolean 30 microsecond
Gf4	1, 2	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)		128

5.13 Control model

ID	ED	Description	Value / Clarification
Ct1	1	What control models are supported (compare ICD file enums for Ed2)	Y status-only Y direct-with-normal-security Y sbo-with-normal-security Y direct-with-enhanced-security Y sbo-with-enhanced-security
Ct2	1, 2	Is the control model fixed, configurable and/or online changeable?	Configurable
Ct3	–	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	–	Is "operate-many" supported (compare sboClass)?	Deprecated, see sboClass in datamodel (ICD)
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)	N
Ct6	–	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Deprecated
Ct7	–	Is pulse configuration supported	Deprecated
Ct8	1	What is the behaviour of the DUT when the check conditions are set	N synchrocheck Y interlock-check DUT uses the check value to perform the check

		Is this behaviour fixed, configurable, online changeable?	fixed
Ct9	1, 2	What additional cause diagnosis are supported	N Unknown N Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode Y Blocked-by-process Y Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution Y Blocked-by-health N 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 1 specific values: Y Parameter-change-in- execution (Ed1 semantics) Edition 2 specific values: Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client N Parameter-change-in- execution (Ed2 semantics)
Ct10	1, 2	How to force a "test-not-ok" respond with SelectWithValue request?	invalid orCat value
Ct11	1, 2	How to force a "test-not-ok" respond with Select request?	Send Select request twice
Ct12	1, 2	How to force a "test-not-ok" respond with Operate request?	invalid orCat value
Ct13	1, 2	Which origin categories are supported / accepted	Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process
Ct14	1, 2	What happens if the orCat value is not supported or invalid	DOns: Error SBOns: Error DOes: Error SBOes: Error

Ct15	1, 2	Does the IED accept a SelectWithValue/Operate with the same ctlVal as the current status value? Is this behaviour configurable	DOns: N SBOns: N DOes: N SBOes: N Configurable N
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	DOns: N SBOns: N DOes: N SBOes: N
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)	SBOns: N SBOes: N
Ct18	1	Deprecated	
Ct19	–	Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)	Deprecated
Ct20	1, 2	Does the IED support local / remote operation?	Y
Ct21	1, 2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOns: N DOns: N
Ct22	1, 2	How to force a "parameter-change-in-execution"	NA
Ct23	1, 2	How many SBOns/SBOes control objects can be selected at the same time?	SBOns: n = multiple SBOes: n = multiple
Ct24	1, 2	Can a controllable object be forced to keep its old state e.g. Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y
Ct25	1, 2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1, 2	Name an enhanced security control point (if any) with a finite operate timeout Specify the operate timeout (in milliseconds)	All DOes and SBOes Configurable
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct28		Deprecated, kept as placeholder	

5.14   Time synchronization model

ID	ED	Description	Value / Clarification
Tm1	1	What quality bits are supported (may be set by the IED)	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	1, 2	Describe the behaviour when all time server(s) cease to respond What is the time server lost detection time	Assert CNS after lost detection time Configurable
Tm3	1, 2	How long does it take to take over the new time from time server	17 s
Tm4	1, 2	When is the time quality bit "Clock failure"	Set when DUTs RTC is failure

		set?	Cannot be tested
Tm5	1, 2	When is the time quality bit "Clock not synchronized" set?	When connection to all time servers is lost
Tm6	–	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated
Tm7	1	Does the device support time zone and daylight saving?	Support only time zone
Tm8	1, 2	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3 N Mode is equal to SERVER Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 or 4 N other (describe)
Tm9	1, 2	Do the COMTRADE files have local time or UTC time and is this configurable	NA

5.15   File transfer model

ID	ED	Description	Value / Clarification
Ft1	1	What is the structure of files and directories Where are the COMTRADE files stored Are COMTRADE files zipped and what files are included in each zip file	NA
Ft2	1, 2	Directory names are separated from the file name by	NA
Ft3	1	The maximum file name size including path (recommended 64 chars)	NA
Ft4	1, 2	Are directory/file name case sensitive	NA
Ft5	1, 2	Maximum file size for SetFile	NA
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	NA
Ft7	1	Is the wild card supported in the MMS fileDirectory request	NA
Ft8	1, 2	Is it allowed that 2 clients get a file at the same time	NA
Ft9	1, 2	Which files can be deleted	NA

5.16   Service tracking model

ID	ED	Description	Value / Clarification
Tr1	2	Which ACSI services are tracked by LTRK.GenTrk	NA