Model Implementation Conformance Statement for the IEC 61850 interface in SINEAX CAM

Version: 1.2

Creation Date: 17.12.2007
Release Date: 20.05.2009

Revision History

Author	Department	Changes	Version	Date
Alexander Zakharov	www.camillebauer.com	Initial	0.2	17.12.2007
Alexander Zakharov	www.camillebauer.com	Update LNodes added	0.4	09.01.2008
Alexander Zakharov	www.camillebauer.com	LNodes added	0.6	12.03.2008
Alexander Zakharov	www.camillebauer.com	Data objects added	0.8	21.12.2008
Alexander Zakharov	www.camillebauer.com	Array data objects and harmonics added	1.0	01.02.2009
Alexander Zakharov	www.camillebauer.com	Update version. Issue	1.1	09.03.2009
Alexander Zakharov	www.camillebauer.com	Based on the IEC 61850 MICS Template v0.1 The private extensions marked as "E"	1.2	20.05.2009

Distribution

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1. Introduction

This specification presents the top-level IEC 61850 data model that has been implemented. The definitions of all used Logical Nodes and their components are also included for completeness.
The reader is expected to be conversant with the terminology presented within the IEC 61850 part 7 series of specifications.

The Model Implementation Conformance Statement is conformant to the device associated ICD (Substation Configuration Language) file, according to part 6 of the IEC 61850 standards. This document specifies the modeling extensions compared to IEC 61850 edition 1.

The MICS is applicable for ***IEC 61850 interface in SINEAX CAM***, with firmware ***V.2.14***.
For the exact details on the standardized model please compare the ICD substation configuration file: ***CAM.V2.10.090519.icd*** version ***2*** revision ***10***.

Clause 2 contains the list of implemented logical nodes.
Clause 3 describes the data objects in the logical nodes.

2. Logical Nodes List

The ***IEC 61850 interface in SINEAX CAM*** implements an IEC 61850 server that contains 1 Logical Device. The Logical Device contains a data model built from instances of specific Logical Nodes and must consist of at least an instance of the LPHD Logical Node (which is responsible for providing physical information of ***IEC 61850 Interface***) and an instance of the LLN0 Logical Node.
The IEC 61850 data model is contained within the Logical Device detailed in the table below.

L: System Logical Nodes
LPHD (Physical device information)
LLN0 (Logical node zero)
P: Logical Nodes for control LN
GGIO (Generic process I/O)
M: Logical Nodes for metering and measurement
MHAI (Harmonics or interharmonics)
MHAN (Non phase related harmonics or interharmonics)
MMTR (Metering)
MMXN (Non phase related Measuremen)
MMXU (Measurement)
MSQI (Sequence and imbalance)
MSTA (Metering Statistics)

The IEC 61850 Logical Device data model consists of instances of Logical Nodes. The data model name for a Logical Node instance is constructed from the Logical Node name and an instance ID.

3. Logical Nodes

The following tables present a summary of the Logical Node templates used across the Logical Device within the overall IEC 61850 product data model.
The layout of the tables is conformant to the part 7 series of the IEC61850 standard specifications with the following exceptions:

- The "Trigger Options" field is not presented
- A remark “Y” means implemented in the ***IEC 61850 Interface SINEX CAM***.

The tables use the following conventional signs:

- M : Data is mandatory in the IEC-61850-7-4.
- O: Data is optional in the IEC-61850-7-4 and is used in the device.
- E: Data is an extension to the IEC-61850-7-4.

3.1 Common Logical Node

Common Logical Node class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see 7-2).		Y
Data				
Mandatory Logical Node Information (Shall be inherited by ALL LN but LPHD)				
Mod	INC	Mode	M	Y
Beh	INS	Behavior	M	Y
Health	INS	Health	M	Y
NamPlt	LPL	Name plate	M	Y
Data Sets (see IEC 61850-7-2)				
Inherited and specialized from Logical Node class (see IEC 61850-7-2).				
Control Blocks (see IEC 61850-7-2)				
Inherited and specialized from Logical Node class (see IEC 61850-7-2).				
Services (see IEC 61850-7-2)				
Inherited and specialized from Logical Node class (see IEC 61850-7-2).				

3.2 LPHD: Physical device information

LPHD class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see7-2).		
Data				
PhyName	DPL	Physical device name plate	M	Y
PhyHealth	INS	Physical device health	M	Y
Proxy	SPS	Indicates if this LN is a proxy	M	Y

3.3 LLN0: Logical node zero

LLNO class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		

Data		
Common Logical Node Information		
LN shall inherit all Mandatory Data from Common Logical Node Class.	M	Y

3.4 GGIO: Generic process I/O

GGIO class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see IEC61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	N
EEName	DPL	External equipment name plate	O	Y
Measured value				
AnIn	MV	Analogue input	O	Y
Status Information				
Ind	SPS	General indication (binary input)	O	Y
Private Extension				
Measured value				
HTWh	BCR	Net Real energy since last reset, high tariff	E	Y
HTVArh	BCR	Net Reactive energy since last reset, high tariff	E	Y
LTWh	BCR	Net Real energy since last reset, low tariff	E	Y
LTVArh	BCR	Net Reactive energy since last reset, low tariff	E	Y

3.5 MHAI: Harmonics or interharmonics

MHAI class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y
Measured value				
Hz	MV	Basic frequency	C	Y
HA	HWYE	Sequence of Harmonics current	O	Y
HPhV	HWYE	Sequence of Harmonics phase to ground voltages	O	Y
HPPV	HDEL	Sequence of Harmonics phase to phase voltages	O	Y
TddA	WYE	Current Total Demand Distortion per IEEE 519	O	Y
ThdPhV	WYE	Voltage Total Harmonic Distortion for phase to ground	O	Y
ThdPPV	DEL	Voltage Total Harmonic for phase to phase	O	Y
Private Extension				
Measured value				
TddMaxPhA	WYE	Maximum of current Total Demand Distortion per IEEE 519	E	Y
ThdMaxPhV	WYE	Maximum of voltage Total Harmonic Distortion for phase to ground	E	Y
ThdMaxPPV	DEL	Maximum of voltage Total Harmonic Distortion for phase to phase	E	Y
HMaxAa	HWYE	Maximum of sequence of Harmonics current Phase a	E	Y
HMaxAb	HWYE	Maximum of sequence of Harmonics current Phase b	E	Y
HMaxAc	HWYE	Maximum of sequence of Harmonics current Phase c	E	Y

HMaxPhVa	HWYE	Maximum of sequence of Harmonics phase a to ground voltage	E	Y
HMaxPhVb	HWYE	Maximum of sequence of Harmonics phase b to ground voltage	E	Y
HMaxPhVc	HWYE	Maximum of sequence of Harmonics phase c to ground voltage	E	Y
HMaxPPVab	HDEL	Maximum of sequence of Harmonics phase a to phase b voltage	E	Y
HMaxPPVbc	HDEL	Maximum of sequence of Harmonics phase b to phase c voltage	E	Y
HMaxPPVca	HDEL	Maximum of sequence of Harmonics phase c to phase a voltage	E	Y

3.6 MHAN: Non phase related harmonics or interharmonics

MHAN class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y
Measured value				
Hz	MV	Basic frequency	C	Y
HaAmp	HMV	Sequence of Harmonics for current	O	Y
HaVol	HMV	Sequence of Harmonics for voltages	O	Y
TddAmp	MV	Current Total Demand Distortion per IEEE 519 in [%]	O	Y
ThdVol	MV	Voltage Total Harmonic Distortion [%]	O	Y
Private Extension				
Measured value				
HaMaxAmp	HMV	Maximum of sequence of Harmonics for current [%]	E	Y
HaMaxVol	HMV	Maximum of sequence of Harmonics for voltage [%]	E	Y
TddMaxAmp	MV	Maximum of current Total Demand Distortion per IEEE 519 [%]	E	Y
ThdMaxVol	MV	Maximum of voltage Total Harmonic Distortion for phase to ground [%]	E	Y
HaMaxAmp	HMV	Maximum of sequence of Harmonics for current [%]	E	Y

3.7 MMTR: Metering

MMTR class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y
Measured value				
TotWh	BCR	Net Real energy since last reset	C	Y
TotVArh	BCR	Net Reactive energy since last reset	O	Y
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar)	O	Y
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar)	O	Y
DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away)	O	Y
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away)	O	Y

Private Extension				
Measured value				
IndVArh	BCR	Reactive energy, inductive load	E	Y
CapVArh	BCR	Reactive energy, capacitive load	E	Y

3.8 MMXN: Non phase related Measurement

MMXN class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y
Measured value				
Amp	MV	Current I (rms) not allocated to a phase	C	Y
Vol	MV	Voltage V (rms) not allocated to a phase	O	Y
Watt	MV	Power (P) not allocated to a phase	O	Y
VolAmpr	MV	Reactive Power (Q) not allocated to a phase	O	Y
VolAmp	MV	Apparent Power (S) not allocated to a phase	O	Y
PwrFact	MV	Power Factor not allocated to a phase	O	Y
Hz	MV	Frequency	O	Y
Private Extension				
Measured value				
QF	MV	Reactive power Factor not allocated to a phase	E	Y
LF	MV	LF factor not allocated to a phase	E	Y
IB	MV	bimetal current not allocated to a phase	E	Y
MaxTotW	MV	Maximum of total Active Power (Total P) since last reset	E	Y
MaxTotVAr	MV	Maximum of total Reactive Power (Total Q) since last reset	E	Y
MaxTotVA	MV	Maximum of total Apparent Power (Total S) since last reset	E	Y
MaxVol	MV	Maximum of voltage V not allocated to a phase since last reset	E	Y
MaxA	MV	Maximum of current I not allocated to a phase since last reset	E	Y
MaxHz	MV	Maximum frequency since last reset	E	Y
MinVol	MV	Minimum of voltage V not allocated to a phase since last reset	E	Y
MinHz	MV	Minimum frequency since last reset	E	Y
MinSupPFind	MV	Minimum power factor supply inductive load since last reset	E	Y
MinSupPFcap	MV	Minimum power factor supply capacitive load since last reset	E	Y
MinDmdPFind	MV	Minimum power factor demand inductive load since last reset	E	Y
MinDmdPFcap	MV	Minimum power factor demand capacitive load since last reset	E	Y

3.9 MMXU: Measurement

MMXU class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see IEC61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y

MMXU class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
Measured value				
TotW	MV	Total Active Power (Total P)	C	Y
TotVAr	MV	Total Reactive Power (Total Q)	O	Y
TotVA	MV	Total Apparent Power (Total S)	O	Y
TotPF	MV	Average Power factor (Total PF)	O	Y
Hz	MV	Frequency	O	Y
PPV	DEL	Phase to phase voltages (V12,V23,V31)	O	Y
PhV	WYE	Phase to ground voltages (V1N,V2N,V3N,VNE)	O	Y
A	WYE	Phase currents (I1, I2, I3, In)	O	Y
W	WYE	Phase active power (P1,P2,P3)	O	Y
VAr	WYE	Phase reactive power (QL1,QL2,QL3)	O	Y
VA	WYE	Phase apparent power (S1,S2,S3)	O	Y
PF	WYE	Phase power factor (PF1, PF2, PF3)	O	Y
Private Extension				
Measured value				
IB	WYE	Phase bimetal currents (IB1, IB2, IB3)	E	Y
TotQF	MV	Average reactive power factor (Total QF)	E	Y
QF	WYE	Phase reactive power factor (QF1, QF2, QF3)	E	Y
TotLF	MV	Average LF factor (Total LF)	E	Y
LF	WYE	Phase reactive power factor (LF1, LF2, LF3)	E	Y
Umean	MV	Mean values of voltages	E	Y
Imean	MV	Mean value of currents	E	Y
MaxTotW	MV	Maximum of total Active Power (Total P) since last reset	E	Y
MaxTotVAr	MV	Maximum of total Reactive Power (Total Q) since last reset	E	Y
MaxTotVA	MV	Maximum of total Apparent Power (Total S) since last reset	E	Y
MaxW	WYE	Maximum of active power (P1, P2, P3) since last reset	E	Y
MaxVAr	WYE	Maximum of reactive power (Q1, Q2, Q3) since last reset	E	Y
MaxVA	WYE	Maximum of apparent power (S1, S2, S3) since last reset	E	Y
MaxPPV	DEL	Maximum of phase to phase voltages V12, V23, V31 since last reset	E	Y
MaxPhV	WYE	Maximum of phase to ground voltages V1N,V2N,V3N,VNE since last reset	E	Y
MaxA	WYE	Maximum of phase currents I1, I2, I3, In since last reset	E	Y
MaxIB	WYE	Maximum of phase bimetal currents (IB1, IB2, IB3)	E	Y
MaxHz	MV	Maximum of frequency since last reset	E	Y
MinPPV	DEL	Minimum of phase to phase voltages V12, V23, V31 since last reset	E	Y
MinPhV	WYE	Minimum of phase to ground voltages V1N,V2N,V3N since last reset	E	Y
MinHz	MV	Minimum frequency since last reset	E	Y
MinSupPFind	MV	Minimum power factor supply inductive load since last reset	E	Y
MinSupPFcap	MV	Minimum power factor supply capacitive load since last reset	E	Y
MinDmdPFind	MV	Minimum power factor demand inductive load since last reset	E	Y
MinDmdPFcap	MV	Minimum power factor demand capacitive load since last reset	E	Y

3.10 MSQI: Sequence and imbalance

MSQI class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y

EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	Y
Measured value				
SeqA	SEQ	Absolute measured values of positive, negative and zero sequence current.	C	Y
SeqV	SEQ	Absolute measured values of positive, negative and zero sequence voltage.	C	Y
ImbA	WYE	Deviation from the average phase current. ImbA.phsX =| Ix − Iave | with Iave = (1/3) ×(IA + IB + IC)	O	Y
ImbNgA	MV	Current Imbalance Negative Sequence Method. ImbNgA = I2 / I1	O	Y
ImbNgV	MV	Voltage Imbalance Negative Sequence Method. ImbNgV = V2 / V1	O	Y
ImbPPV	DEL	Deviation from the average phase-to-phase voltage. ImbPPV.phsXY = |VXY – PPVave| with PPVave = (1/3) × (Vab + Vbc + Vca).	O	Y
ImbV	WYE	Deviation from the average phase-to-neutral voltage. ImbV.phsX = |VX – Vave | with Vave = (1/3) × (Van + Vbn + Vcn).	O	Y
ImbZroA	MV	Current Imbalance Zero Sequence Method. ImbZroA = I0 / I1	O	Y
ImbZroV	MV	Voltage Imbalance Zero Sequence Method. ImbZroV = V0 / V1	O	Y
MaxImbA	MV	Maximum deviation from the average current. Max(Idev_a,Idev_b,Idev_c)	O	Y
MaxImbPPV	MV	Maximum deviation from the average phase-to-phase voltage. MaxImbPPV = Max(PPVdev_a,PPVdev_b,PPVdev_c)	O	Y
MaxImbV	MV	Maximum deviation from the average phase-to-neutral voltage. MaxImbV = Max(Vdev_a,Vdev_b,Vdev_c)	O	Y

3.11 MSTA: Metering Statistics

MSTA class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
LNName		Shall be inherited from Logical-Node Class (see IEC61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	N
EEName	DPL	External equipment name plate	O	Y
Measured value				
AvAmps	MV	Average current system (single phase measurement only)	C	Y
MaxAmps	MV	Maximum current system (single phase measurement only)	O	Y
MinAmps	MV	Minimum current system (single phase measurement only)	O	Y
AvVolts	MV	Average voltage system (single phase measurement only)	O	Y
MaxVolts	MV	Maximum voltage system (single phase measurement only)	O	Y
MinVolts	MV	Minimum voltage system (single phase measurement only)	O	Y
AvVA	MV	Average apparent power	O	Y
MaxVA	MV	Maximum apparent power	O	Y
MinVA	MV	Minimum apparent power	O	Y
AvW	MV	Average real power	O	Y
MaxW	MV	Maximum real power	O	Y
MinW	MV	Minimum real power	O	Y
AvVAr	MV	Average reactive power	O	Y
MaxVAr	MV	Maximum reactive power	O	Y
MinVAr	MV	Minimum reactive power	O	Y
Private Extension				
Measured value				
AvA	WYE	Average phase currents (I1, I2, I3, In)	E	Y
MaxA	WYE	Maximum phase currents (I1, I2, I3, In)	E	Y
MinA	WYE	Minimum phase currents (I1, I2, I3, In)	E	Y

MSTA class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O / E**	**Remarks**
AvPPV	DEL	Average phase to phase voltages (V12, V23, V31)	E	Y
MaxPPV	DEL	Maximum phase to phase voltages (V12, V23, V31)	E	Y
MinPPV	DEL	Minimum phase to phase voltages (V12, V23, V31)	E	Y
AvPhV	WYE	Average phase to ground voltages (V1N,V2N,V3N,VNE)	E	Y
MaxPhV	WYE	Maximum phase to ground voltages (V1N,V2N,V3N,VNE)	E	Y
MinPhV	WYE	Minimum phase to ground voltages (V1N,V2N,V3N,VNE)	E	Y
AvVAPh	WYE	Average of apparent power (S1, S2, S3)	E	Y
MaxVAPh	WYE	Maximum of apparent power (S1, S2, S3)	E	Y
MinVAPh	WYE	Minimum of apparent power (S1, S2, S3)	E	Y
AvWPh	WYE	Average of active power (P1, P2, P3)	E	Y
MaxWPh	WYE	Maximum of active power (P1, P2, P3)	E	Y
MinWPh	WYE	Minimum of active power (P1, P2, P3)	E	Y
AvVArPh	WYE	Average of reactive power (Q1, Q2, Q3)	E	Y
MaxVArPh	WYE	Maximum of reactive power (Q1, Q2, Q3)	E	Y
MinVArPh	WYE	Minimum of reactive power (Q1, Q2, Q3)	E	Y

Note:
Detailed information about all implemented indications and commands can be viewed in the following documents:

- INTERNATIONAL STANDARD IEC 61850-7-4 “Communication networks and systems in substations –Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes
- INTERNATIONAL STANDARD IEC 61850-7-3 First edition 2003-05 “Communication networks and systems in substations - Part 7-3: Basic communication structure for substation and feeder equipment - Common data classes