Model Implementation Conformance Statement (MICS)

for the IEC 61850 Edition 2 server interface in SEL-751 and SEL-787L

Version 1

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Based upon

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Testing Sub Committee

MICS template for Server Test Procedures First edition and Edition 2 servers

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1. Introduction

This model implementation conformance statement is applicable for:
SEL-751 with firmware R401 and
SEL-787L with firmware R401.

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:
“0751 009 R401.ICD”, version R401 and
“0787L 009.ICD”, version R100.

Clause 2 contains the list of implemented logical nodes.
Clause 3 describes the new and extended logical nodes (if any).
Clause 4 describes the new and extended enum types (if any).

2. Logical Nodes List

The following table contains the list of logical nodes implemented in the device:

L: System Logical Nodes
LPHD (Physical device information) [1]
LLN0 (Logical node zero) [1]
LCCH (Physical communication channel supervision) [1]
LGOS (GOOSE subscription) [1]
LTIM (Time management) [1]
LTMS (Time master supervision) [1]
LTRK (Service tracking) [1]
C: Logical Nodes for control
CSWI (Switch controller) [1]
CILO (Interlocking) [1]
G: Logical Nodes for generic references
GGIO (Generic process I/O) [1]
M: Logical Nodes for metering and measurement
MMDF (Differential) [2]
MMXU (Measurement) [1]
MSQI (Sequence and imbalance) [1]
MSTA (Metering statistics) [1]
MDST (Demand Metering Statistics) [1]
MTHE (Thermal Elements and RTD) [1]
MTHR (Thermal Metering) [1]
P: Logical Nodes for protection functions
PDIF (Differential) [2]
PDOP (Directional overpower) [1]
PDUP (Directional underpower) [1]
PFRC (Rate of change of frequency) [1]
PHIZ (Ground detector) [1]
PIOC (Instantaneous overcurrent) [1]

POPF (Over power factor) [1]
PTOC (Time overcurrent) [1]
PTOF (Overfrequency) [1]
PTOV (Overvoltage) [1]
PTRC (Protection trip conditioning) [1]
PTUV (Undervoltage) [1]
PAFD (Arc Flash Detection) [1]
R: Logical nodes for protection related functions
RBRF (Breaker Failure) [1]
RDIR (Directional element) [1]
RDRE (Disturbance recorder function) [1]
RFLO (Fault Locator) [1]
RSYN (Synchronism-check) [1]
S: Logical nodes for supervision and monitoring
SCBR (Circuit breaker supervision) [1]
X: Logical nodes for switchgear
XCBR (Circuit breaker) [1]
XSWI (Circuit switch) [1]
Z: Logical Nodes for further power system equipment
ZBAT (Battery) [1]

(1) Supported by SEL-751 and SEL-787L relays.

(2) Supported by SEL-787L.

3. Logical Node Extensions

The following table use

- M: Data is mandatory in the IEC 61850-7-4 Ed.2.
- O: Data is optional in the IEC 61850-7-4 Ed.2 and is used in the device.
- C: Data is conditional in the IEC 61850-7-4 Ed.2 and is used in the device.
- E: Data is an extension to the IEC 61850-7-4 Ed.2.

3.1. New Logical Nodes

Newly created logical nodes are listed in this clause, with lnNs attribute in the Name plate.

3.1.1 MMDF Differential

MMDF class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
OpA	WYE	Differential Currents	E	
OpAnseq	CMV	Negative Sequence Current	E	
ResA	WYE	Restraint Currents	E	
ResAnseq	CMV	Negative Sequence Restraint Current	E	
Local	WYE	Local Current	E	
LocAnseq	CMV	Local Negative Sequence Current	E	
LocApseq	CMV	Local Positive Sequence Current	E	
Remote	WYE	Remote Terminal Current	E	

RAnseq	CMV	Remote Terminal Negative Sequence Current	E	
RApseq	CMV	Remote Terminal Positive Sequence Current	E	

3.1.2 MDST Demand Metering Statistics

MDST class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
DmdA	WYE	Phase Demand Currents	E	
DmdAnseq	MV	Negative-Sequence Demand Current	E	
PkDmdA	WYE	Peak Demand Currents	E	
PkDmdAnseq	MV	Negative-Sequence Peak Demand Current	E	
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar)	E	
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar)	E	

DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away)	E	
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away)	E	

3.1.3 MTHE Thermal Elements

MTHE class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common logical node information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
Thrl1	MV	Operating quantity thermal level memory	E	
Thieq1	MV	Operating quantity equivalent current	E	
Thtcu1	MV	Thermal capacity used	E	
Thtrip1	MV	Time before thermal element trips	E	
Thrls1	MV	Time before thermal element releases	E	

3.1.4 MTHR RTD Thermal Metering

MTHR class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common logical node information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
MaxWdgTmp	MV	Maximum Winding RTD temperature	E	
MaxBrgTmp	MV	Maximum Bearing RTD temperature	E	
MaxAmbTmp	MV	Maximum Ambient RTD Temperature	E	
MaxOthTmp	MV	Maximum Other RTD Temperature	E	
Tmp1	MV	RTD Temperature	E	

3.1.5 PAFD Arc Flash Detection

PAFD class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				

Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Status information				
Str	ACD	Start	E	
Op	ACT	Operate	E	

3.2. Extended Logical Nodes

The following logical nodes have been extended with extra data. All extra data has been highlighted in the tables and marked as “E” (Extended).
NOTE: If the extended data object is already used in other logic nodes in IEC 61850-7-4 Ed.2, dataNs is not mandatory, but it’s still recommended.

3.2.1 LCCH Physical communication channel supervision

LCCH class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Status information				
ChLiv	SPS	Physical channel status	M	
RedChLiv	SPS	Physical channel status of redundant channel	C	
FerCh	INS	Frame error rate on this channel	O	
RedFerCh	INS	Frame error rate on redundant channel	O	
Measured and metered values				

RxCnt	BCR	Number of received messages	O	
RedRxCnt	BCR	Number of received messages on redundant channel	O	
TxCnt	BCR	Number of sent messages	O	
Controls				
RsStat	SPC	Reset device statistics	E	
Settings				
NetMod	ENG	Network Mode	E	

3.2.2 LGOS GOOSE Subscription

LGOS class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Status information				
NdsCom	SPS	Subscription needs commissioning	O	
St	SPS	Status of the subscription	M	
SimSt	SPS	Status showing really that Sim messages are received and accepted	O	
LastStNum	INS	Last state number received	O	
LastSqNum	INS	Last sequence number received	E	
LastTal	INS	Last time-allowed-to-live received	E	
ConfRevNum	INS	Expected configuration revision number	O	

RxConfRevNum	INS	Configuration revision number of the received messages	O	
ErrSt	ENS	Current error status of the subscription	E	
OosCnt	INS	Number of out-of-sequence (OOS) errors	E	
TalCnt	INS	Number of time-allowed-to-live violations	E	
DecErrCnt	INS	Number of messages that failed decoding	E	
BufOvflCnt	INS	Number of messages lost due to buffer overflow	E	
MsgLosCnt	INS	Number of messages lost due to OOS errors (estimated)	E	
MaxMsgLos	INS	Max. number of sequential messages lost due to OOS error (estimated)	E	
InvQualCnt	INS	Number of mapped incoming GOOSE data with invalid quality	E	
Measured and metered values				
TotDwnTm	MV	Total downtime in seconds	E	
MaxDwnTm	MV	Maximum continuous downtime in seconds	E	
Controls				
RsStat	SPC	Reset/clear statistics	E	
Settings				
GoCBRef	ORG	Reference to the subscribed GOOSE control block	M	
DatSet	ORG	Configured dataset reference	E	
GoID	VSG	Configured GOOSE ID	E	
Addr	VSG	Configured multicast MAC address	E	
VlanID	ING	Configured VLAN ID	E	
VlanPri	ING	Configured VLAD priority	E	
AppID	ING	Configured APPID	E	

3.2.3 LTMS Time master supervision

LTMS class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Status information				
TmAcc	INS	Number of significant bits in fraction of second in the time accuracy part of the time stamp	O	
TmSrc	VSS	Current time source identity	M	
SelTmSrcTyp	ENS	Type of the clock source	E	
SelTmSyn	ENS	Actual time synchronization applied	E	
SelTmSynLkd	ENS	Locked status of clock synchronization	E	
Measured and metered values				
SelTmTosPer	MV	Duration, in milliseconds, between two consecutive top-of-second points on the synchronized time	E	

3.2.4 GGIO Generic Process I/O

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and		

		LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Status information				
Ind1	SPS	General indication (binary input)	O	
Measured and metered values				
AnIn1	MV	Analog Input	O	
Ra1	MV	Remote analog	E	
Controls				
SPCSO1	SPC	Single point controllable status Output	O	

3.2.5 MMXU Measurement

LGOS class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Status information				
TotW	MV	Total active power (total P)	O	
TotVAr	MV	Total reactive power (total Q)	O	
TotVA	MV	Total apparent power (total S)	O	

TotPF	MV	Average power factor (total PF)	O	
Hz	MV	Frequency	O	
PPV	DEL	Phase to phase voltages (VL1, VL2, …)	O	
PhV	WYE	Phase to ground voltages (VL1ER, …)	O	
A	WYE	Phase currents (ILA, ILB, ILC)	O	
W	WYE	Phase active power (P)	O	
VAr	WYE	Phase reactive power (Q)	O	
VA	WYE	Phase apparent power (S)	O	
PF	WYE	Phase power factor	O	
VSyn	CMV	Synchronism-check voltage	E	
Fs	MV	Synchronism-check frequency	E	

3.2.6 MSTA Metering statistics

MSTA class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behaviour	M	
NamPlt	LPL	Name plate	O	
Metered values				
AvAmps	MV	Average current	O	
MaxA	MV	Maximum current	E	
MinA	MV	Minimum current	E	
AvVolts	MV	Average voltage	O	
MaxPhV	WYE	Maximum phase voltage	E	

MinPhV	WYE	Minimum phase voltage	E	
MaxP2PV	DEL	Maximum Phase to Phase Voltages	E	
MinP2PV	DEL	Minimum Phase to Phase Voltages	E	
MaxVs	MV	Maximum synchronism check voltage	E	
MinVs	MV	Minimum synchronism check voltage	E	
MaxVA	MV	Maximum apparent power	O	
MinVA	MV	Minimum apparent power	O	
MaxW	MV	Maximum active power	O	
MinW	MV	Minimum active power	O	
MaxVAr	MV	Maximum reactive power	O	
MinVAr	MV	Minimum reactive power	O	

3.2.7 PDIF Differential

PDIF class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common Logical Node Information				
Beh	ENS	Behavior	M	
Status Information				
Op	ACT	Operate	M	
Dnseq	SPS	Negative Sequence	E	

3.2.8 RFLO Fault locator

RFLO class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				
Beh	ENS	Behavior	M	
Measured and metered values				
FltZ	CMV	Fault impedance	M	
FltDiskm	MV	Fault distance	O	
FltA	WYE	Fault currents	E	

3.2.9 XCBR Circuit Breaker

XCBR class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.		
Data objects				
Common logical node information				

Beh	ENS	Behavior	M	
Status information				
Loc	SPS	Local control behavior	M	
OpCnt	INS	Operation counter	M	
CBOpCap	ENS	Circuit breaker operating capability	O	
OpCntEx	INS	Operation counter—external	E	
Controls				
Pos	DPC	Switch position	M	
BlkOpn	SPC	Block opening	M	
BlkCls	SPC	Block closing	M	

4. Enum Types Extensions

4.1. New Enum types

New enum types are listed in this clause.

4.1.1 CtlModelKind_SEL

Value	Description	Remarks
0	status-only	
1	direct-with-normal-security	
3	direct-with-enhanced-security	
4	sbo-with-enhanced-security	

4.1.2 GOOSEErrSt

Value	Description	Remarks
0	OK	
1	Device Disabled	
2	ConfRev Mismatch	
3	Needs Commissioning	
4	Message Corrupted	
5	TTL Expired	
6	Out of Sequence	
7	Invalid Data Quality	

4.1.3 NetMod

Value	Description	Remarks
1	Fixed	
2	Failover	

3	Switched	
4	PRP	
5	IsolateIP	

4.1.4 ClockSourceKind_SEL

Value	Description	Remarks
1	Unkown	
2	SNTP	
3	PTP	
4	IRIG-B	
5	Substation internal	

4.1.5 ClockSyncKind_SEL

Value	Description	Remarks
1	InternalClock	
2	LocalAreaClock	
3	GlobalAreaClock	

4.1.6 ClockSyncLockingKind_SEL

Value	Description	Remarks
1	Locked	
2	Unlocked10s	
3	Unlocked100s	
4	Unlocked1000s	
5	UnlockedMoreThan1000s	

4.1.7 FltTypeKind_SEL

Value	Description	Remarks
0	Undefined	
1	AG	
2	BG	
3	CG	
4	AB	
5	BC	
6	CA	
7	ABG	
8	BCG	
9	CAG	
10	ABC	

4.1.8 FltCauseKind_SEL

Value	Description	Remarks
0	No fault summary	
1	Trigger	
2	Trip	
3	Event Report	

4.1.9 ServiceNameKind_SEL

Value	Description	Remarks
16	SelectActiveSG	
24	SetBRCBValues	
26	SetURCBValues	

44	SelectWithValue	
45	Cancel	
46	Operate	
47	CommandTermination	
54	InternalChange	

4.1.10 ServiceStatusKind_SEL

Value	Description	Remarks
0	no-error	
1	instance-not-available	
3	access-violation	
5	parameter-value-inappropriate	
6	parameter-value-inconsistent	
7	class-not-supported	
8	instance-locked-by-other-client	
10	type-conflict	
11	failed-due-to-communications-constraint	
12	failed-due-to-server-constraint	