Model Implementation Conformance Statement (MICS)

for the IEC 61850 Edition 2 server interface in SEL-451-5, SEL-487E-3, SEL-487E-4, SEL-421-4, SEL-421-5, SEL-487V-0, SEL-487V-1, SEL-487B-1

Version 1

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

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INDEX

page

1. Introduction

This model implementation conformance statement is applicable for:
SEL-451-5 with firmware version R328,
SEL-487E-3 with firmware R322,
SEL-487E-4 with firmware R322,
SEL-421-4 with firmware R331,
SEL-421-5 with firmware R331,
SEL-487V-0 with firmware R110,
SEL-487V-1 with firmware R110 and
SEL-487B-1 with firmware R318.

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:
“0451 009 R328.ICD”, version R406,
“0487E 009 R322.ICD”, version R406,
“0421 009 R331.ICD”, version R406,
“0487V 009 R110.ICD”, version R202, and
“0487B 009 R318.ICD”, version R404.

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) [(2) (3) (4) (5)]
G: Logical Nodes for generic references
GGIO (Generic process I/O) [(1)]
M: Logical Nodes for metering and measurement
MMXN (Non-phase-related measurement) [(3) (6)]
MMXU (Measurement) [(1)]
MDST (Demand and Peak Demand metering statistics) [(2) (4)]
MSQI (Sequence and imbalance) [(1)]
MTHR (Derived Metering) [(5)]
P: Logical Nodes for protection functions
PDIF (Differential) [(3) (4) (5) (6)]
PDIS (Distance) [(4)]
PDOP (Directional overpower) [(5)]
PDUP (Directional underpower) [(5)]
PHAR (Harmonic restraint) [(3)]
PHIZ (Ground detector) [(2)]
PIOC (Instantaneous overcurrent) [(2) (3) (5)]

PSCH (Protection scheme) [2] [4]
PTOC (Time overcurrent) [2] [3] [4] [5]
PTOF (Over frequency) [5]
PTOV (Overvoltage) [2] [3] [5]
PTRC (Protection trip conditioning) [1]
PTTR (Thermal overload) [2] [3] [4]
PTUF (Underfrequency) [5]
PTUV (Undervoltage) [2] [3] [4] [5]
PVPH (Volts per Hz) [3]
R: Logical nodes for protection related functions
RBRF (Breaker Failure) [1]
RDIR (Directional element) [2] [4]
RDRE (Disturbance recorder function) [1]
RFLO (Fault Locator) [2] [4]
RPSB (Power swing detection/blocking) [3] [4]
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 all SEL-4XX relays.

(2) Supported by SEL-451-5.

(3) Supported by SEL-487E-3 and SEL-487E-4.

(4) Supported by SEL-421-4 and SEL-421-5.

(5) Supported by SEL-487V-0 and SEL-487V-1.

(6) Supported by SEL-487B-1.

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 MDST1 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.	M	
Data Objects				
Common Logical Node Information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
A	WYE	Current	E	
W	WYE	Real power	E	
VAr	WYE	Reactive power	E	
VA	WYE	Apparent power	E	
SeqA	SEQ	Sequence currents	E	
TotW	MV	Total real power	E	
TotVAr	MV	Total reactive power	E	
TotVA	MV	Total apparent power	E	

SupWh	BCR	Real energy supply (default direction: energy flow towards busbar)	E	
DmdWh	BCR	Real energy demand (default direction: energy flow from busbar)	E	

3.1.2 MDST2 Peak 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.	M	
Data Objects				
Common Logical Node Information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Measured and metered values				
A	WYE	Current	E	
W	WYE	Real power	E	
VAr	WYE	Reactive power	E	
VA	WYE	Apparent power	E	
SeqA	SEQ	Sequence currents	E	
TotW	MV	Total real power	E	
TotVAr	MV	Total reactive power	E	
TotVA	MV	Total apparent power	E	

3.1.3 MTHR Derived 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.		
Data objects				
Common logical node information				
Beh	ENS	Behavior	M	
NamPlt	LPL	Name plate	O	
Status information				
Tmp01	MV	Temperature	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 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	

Status information				
Ind1	SPS	General indication (binary input)	O	
Measured and metered values				
AnIn1	MV	Analog Input	O	
Ra1	MV	Remote analog	E	
Rao1	MV	Remote analog output	E	
Controls				
SPCSO1	SPC	Single point controllable status Output	O	

3.2.2 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	Behavior	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	

3.2.3 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	Behavior	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	O	
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	

3.2.4 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	Behavior	M	
NamPlt	LPL	Name plate	O	Ed. 2 Amd. 1
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	
TmSrcTyp	ENS	Type of the clock source	E	Ed. 2 Amd. 1
TmSyn	ENS	Actual time synchronization applied	O	
TmSynLkd	ENS	Locked status of clock synchronization	E	Ed. 2 Amd. 1
Measured and metered values				
TmTosPer	MV	Duration, in milliseconds, between two consecutive top-of-second points on the synchronized time	E	

3.2.5 RDRE Disturbance Recorder Function

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	
Status Information				
RcdMade	SPS	Recording made	M	
FltNum	INS	Fault number	M	
FltTyp	ENS	Fault type	E	
FltCaus	ENS	Fault cause	E	

3.2.6 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	
Status information				
FltTyp	ENS	Fault Type	E	
FltCaus	ENS	Fault Cause	E	
Measured and metered values				
FltZ	CMV	Fault impedance	M	
FltDiskm	MV	Fault distance	M	
A	WYE	Fault current	E	
Anseq	CMV	Fault current Sequence Value	E	

3.2.7 SCBR Circuit Breaker Supervision

SCBR 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				
ColOpn	SPS	Open command for trip coil	M	
AbrAlm	SPS	Contact abrasion alarm	O	
MechTmAlm	SPS	Mechanical slow operation alarm	E	
OpTmAlm	SPS	Switch operating time exceeded	O	
Measured and metered values				
AccAbr	MV	Cumulated abrasion	O	

3.2.8 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	
TukRackPos (1)	SPS	Circuit breaker rack/truck position	E	
TukTestPos (1)	SPS	Circuit breaker rack/truck test position	E	
Controls				
Pos	DPC	Switch position	M	
BlkOpn	SPC	Block opening	M	
BlkCls	SPC	Block closing	M	

(1) Data Object supported by SEL-451-5.

3.2.9 XSWI Circuit Switch

XSWI 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	
SwTyp	ENS	Switch type	M	
SwOpCap	ENS	Switch operating capability	O	
SwBayCtlEn (1)	SPS	Disconnect switch front-panel control enable status	E	
Controls				
Pos	DPC	Switch position	M	
BlkOpn	SPC	Block opening	M	
BlkCls	SPC	Block closing	M	

(1) Data Object supported by SEL-451-5.

3.2.10 ZBAT Battery

ZBAT 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				
Vol	MV	Battery Voltage	M	
Status information				
BatWrn	SPS	DC Channel Warning	E	
BatFail	SPS	DC Channel Failed	E	
BatGndFlt	SPS	DC Channel Ground Fault detected	E	
BatDvAlm	SPS	DC Channel Excess Ripples detected	E	

4. Enum types Extensions

4.1. New Enum types

New enum types are listed in this clause.

4.1.1 ClockSourceKind (1)

Value	Description	Remarks
1	Unkown	Ed. 2 Amd.1
2	SNTP	Ed. 2 Amd.1
3	PTP	Ed. 2 Amd.1
4	IRIG-B	Ed. 2 Amd.1
5	Substation Internal	Ed. 2 Amd.1

(1) Supported by all SEL-4XX relays.

4.1.2 ClockSyncKind (1)

Value	Description	Remarks
0	InternalClock	Ed. 2 Amd.1
1	LocalAreaClock	Ed. 2 Amd.1
2	GlobalAreaClock	Ed. 2 Amd.1

(1) Supported by all SEL-4XX relays.

4.1.3 ClockSyncLockingKind (1)

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

(1) Supported by all SEL-4XX relays.

4.1.4 FltTypeKind_SEL

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

(1) Supported by all SEL-4XX relays, excluded SEL-487V-0 and SEL-487V-1.

(2) Supported by SEL-451-5, SEL-421-4 and SEL-421-5.

4.1.5 FltTypeKind_SEL (1)

Value	Description	Remarks
0	No fault type identified or present	
1	87 Phase Differential A Phase Top Section	
2	87 Phase Differential A Phase Bottom Section	
3	87 Phase Differential B Phase Top Section	
4	87 Phase Differential B Phase Bottom Section	
5	87 Phase Differential C Phase Top Section	
6	87 Phase Differential C Phase Bottom Section	
7	87 Phase Differential	

8	87 Ground Differential Element 1 Phase A Left Section	
9	87 Ground Differential Element 1 Phase A Right Section	
10	87 Ground Differential Element 1 Phase B Left Section	
11	87 Ground Differential Element 1 Phase B Right Section	
12	87 Ground Differential Element 1 Phase C Left Section	
13	87 Ground Differential Element 1 Phase C Right Section	
14	87 Ground Differential Element 1	
15	87 Ground Differential Element 2 Phase A Left Section	
16	87 Ground Differential Element 2 Phase A Right Section	
17	87 Ground Differential Element 2 Phase B Left Section	
18	87 Ground Differential Element 2 Phase B Right Section	
19	87 Ground Differential Element 2 Phase C Left Section	
20	87 Ground Differential Element 2 Phase C Right Section	
21	87 Ground Differential Element 2	
22	87 Ground Differential Element 3 Phase A Left Section	
23	87 Ground Differential Element 3 Phase A Right Section	
24	87 Ground Differential Element 3 Phase B Left Section	
25	87 Ground Differential Element 3 Phase B Right Section	

26	87 Ground Differential Element 3 Phase C Left Section	
27	87 Ground Differential Element 3 Phase C Right Section	
28	87 Ground Differential Element 3	
29	60 Phase Unbalance A Phase Left Section	
30	60 Phase Unbalance A Phase Right Section	
31	60 Phase Unbalance B Phase Left Section	
32	60 Phase Unbalance B Phase Right Section	
33	60 Phase Unbalance C Phase Left Section	
34	60 Phase Unbalance C Phase Right Section	
35	60 Phase Unbalance	
36	60 Neutral Unbalance Element 1 Phase A Left Section	
37	60 Neutral Unbalance Element 1 Phase A Right Section	
38	60 Neutral Unbalance Element 1 Phase B Left Section	
39	60 Neutral Unbalance Element 1 Phase B Right Section	
40	60 Neutral Unbalance Element 1 Phase C Left Section	
41	60 Neutral Unbalance Element 1 Phase C Right Section	
42	60 Neutral Unbalance Element 1	
43	60 Neutral Unbalance Element 2 Phase A Left Section	
44	60 Neutral Unbalance Element 2 Phase A Right Section	
45	60 Neutral Unbalance Element 2 Phase B Left Section	
46	60 Neutral Unbalance Element 2 Phase B Right Section	

47	60 Neutral Unbalance Element 2 Phase C Left Section	
48	60 Neutral Unbalance Element 2 Phase C Right Section	
49	60 Neutral Unbalance Element 2	
50	60 Neutral Unbalance Element 3 Phase A Left Section	
51	60 Neutral Unbalance Element 3 Phase A Right Section	
52	60 Neutral Unbalance Element 3 Phase B Left Section	
53	60 Neutral Unbalance Element 3 Phase B Right Section	
54	60 Neutral Unbalance Element 3 Phase C Left Section	
55	60 Neutral Unbalance Element 3 Phase C Right Section	
56	60 Neutral Unbalance Element 3	

(1) Supported by SEL-487V-0 and SEL-487V-1.

4.1.6 FltCauseKind_SEL

Value	Description	Remarks
0	No fault summary (1)	
1	Trigger (1)	
2	Trip (1)	
3	Event Report (1)	
4	Differential Trip (2)	
5	Breaker Failure Trip (2)	

(1) Supported by all SEL-4XX relays.

(2) Supported by SEL-487E-3, SEL-487E-4, SEL-487V-0, SEL-487V-1 and SEL-487B-1.

4.1.7 GOOSEErrSt (1)

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	

(1) Supported by all SEL-4XX relays.

4.1.8 NetMod (1)

Value	Description	Remarks
1	Fixed	
2	Failover	
3	Switched	
4	PRP	
5	IsolateIP	
3	Event Report	

(1) Supported by all SEL-4XX relays.

4.1.9 ServiceNameKind_SEL (1)

Value	Description	Remarks
16	SelectActiveSG	
24	SetBRCBValues	
26	SetURCBValues	
44	SelectWithValue	

45	Cancel	
46	Operate	
47	CommandTermination	
54	InternalChange	

(1) Supported by all SEL-4XX relays.

4.1.10 ServiceStatusKind_SEL (1)

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	

(1) Supported by all SEL-4XX relays.

4.1.11 CtlModelKind_SEL (1)

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

(1) Supported by all SEL-4XX relays.