ezPAC™

Substation Automation Unit
SA310/SA320/SA330

IEC 61850 Communications Protocol

Reference Guide

BG0472 Rev. A3

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REVISION HISTORY

A1	Nov 2009	Initial release
A2	July 2010	Changed dataset names. Added aiGGIO and sbsLGOS logical nodes. Added process measurement limits for measured values. Added IEC 61850 configuration via PAS
A3	Feb 2013	Applicable to F/W 20.1X.07 or higher: Added bay controller configuration, monitoring and control nodes. Added IEC 61850 IED properties setup. Applicable to F/W 20.1X.10 or higher: Added configurable measurement units, datasets and RCBs, and generating CID files.

Table of Contents

1 General

The SA300 is provided with an embedded IEC 61850 server compliant with the IEC 61850 set of standards.

This document contains the IEC 61850 conformance statements that give the summary of the device data object model, protocol implementations and communication capabilities of the SA300.

For detailed information on operating the SA300 and communication settings refer to the SA300 Operation Manual.

IMPORTANT

In the SA300N with F/W V20.1X.07 and higher, control commands addressed to the CSWI switch controller nodes and to the boGGIO general binary output nodes will be rejected until the internal BOOLEAN variable REMOTE MODE is set to TRUE via a setpoint logic equation. See Controls in Section 5.3 for details.

2 ACSI (Abstract Communication Service Interface) Conformance Statement

This chapter contains the ACSI conformance statement as defined in Annex A of IEC 61850-7-2 that specifies the device communication features mapped to an SCSM (Specific Communication Service Mapping).

2.1 ACSI basic conformance statement

Services		Client / Subscriber	Server / Publisher	Value / Comments
Client-server roles				
B11	Server side (of TWO-PARTY-APPLICATION-ASSOCIATION)		● c1	
B12	Client side of (TWO-PARTY-APPLICATION-ASSOCIATION)			
SCSMs supported				
B21	SCSM: IEC 61850-8-1 used		●	
B22	SCSM: IEC 61850-9-1 used			
B23	SCSM: IEC 61850-9-2 used			
B24	SCSM: other			
Generic substation event model (GSE)				
B31	Publisher side		●	
B32	Subscriber side	●		
Transmission of sampled value model (SVC)				
B41	Publisher side			
B42	Subscriber side			

c1– declared support for LOGICAL-DEVICE model
● – supported

2.2 ACSI models conformance statement

Services		Client / Subscriber	Server / Publisher	Value / Comments
If Server side (B11) supported				
M1	Logical device		● c2	
M2	Logical node		● c3	
M3	Data		● c4	
M4	Data set		● c5	
M5	Substitution		●	
M6	Setting group control			
	Reporting			
M7	Buffered report control		●	
M7-1	sequence-number		●	
M7-2	report-time-stamp		●	
M7-3	reason-for-inclusion		●	
M7-4	data-set-name		●	
M7-5	data-reference		●	
M7-6	buffer-overflow		●	
M7-7	entryID		●	
M7-8	BufTm		●	
M7-9	IntgPd		●	
M7-10	GI		●	
M8	Unbuffered report control		●	
M8-1	sequence-number		●	
M8-2	report-time-stamp		●	
M8-3	reason-for-inclusion		●	
M8-4	data-set-name		●	

Services		Client / Subscriber	Server / Publisher	Value / Comments
M8-5	data-reference		●	
M8-6	BufTm		●	
M8-7	IntgPd		●	
M8-8	GI		●	
	Logging			
M9	Log control			
M9-1	IntgPd			
M10	Log			
M11	Control		●	
If GSE (B31/B32) is supported				
	GOOSE			
M12-1	entryID			
M12-2	DataRefInc			
M13	**GSSE**			
If SVC (B41/B42) is supported				
M14	Multicast SVC			
M15	Unicast SVC			
M16	Time		●	Time source with required accuracy shall be available
M17	File Transfer		●	

c2 – declared support for LOGICAL-NODE model
c3 – declared support for DATA model
c4 – declared support for DATA-SET, Report, or Time model
c5 – declared support for Report model
● – supported

2.3 ACSI service conformance statement

AA – APPLICATION-ASSOCIATION; TP – TWO- PARTY; MC – Multicast

Services		AA: TP/MC	Client / Subscriber	Server / Publisher	Comments
Server (Clause 6)					
S1	ServerDirectory	TP		●	
Application association (Clause 7)					
S2	Associate			●	
S3	Abort			●	
S4	Release			●	
Logical device (Clause 8)					
S5	LogicalDeviceDirectory	TP		●	
Logical node (Clause 9)					
S6	LogicalNodeDirectory	TP		●	
S7	GetAllDataValues	TP		●	
Data (Clause 10)					
S8	GetDataValues	TP		●	
S9	SetDataValues	TP			
S10	GetDataDirectory	TP		●	
S11	GetDataDefinition	TP		●	
Data set (Clause 11)					
S12	GetDataSetValues	TP		●	
S13	SetDataSetValues	TP		●	
S14	CreateDataSet	TP		●	
S15	DeleteDataSet	TP		●	
S16	GetDataSetDirectory	TP		●	
Substitution (Clause 12)					
S17	SetDataValues	TP		●	Applied to

Services		AA: TP/MC	Client/ Subscriber	Server/ Publisher	Comments
Setting group control (Clause 13)					
S18	SelectActiveSG	TP			
S19	SelectEditSG	TP			
S20	SetSGValues	TP			
S21	ConfirmEditSGValues	TP			
S22	GetSGValues	TP			
S23	GetSGCBValues	TP			
Reporting (Clause 14)					
Buffered report control block (BRCB)					
S24	Report	TP		●	
S24-1	data-change (dchg)			●	
S24-2	qchg-change (qchg)			●	
S24-3	data-update (dupd)			●	
S25	GetBRCBValues	TP		●	
S26	SetBRCBValues	TP		●	
Unbuffered report control block (URCB)					
S27	Report	TP		●	
S27-1	data-change (dchg)			●	
S27-2	qchg-change (qchg)			●	
S27-3	data-update (dupd)			●	
S28	GetURCBValues	TP		●	
S29	SetURCBValues	TP		●	
Logging (Clause 14)					
Log control block					
S30	GetLCBValues	TP			
S31	SetLCBValues	TP			
Log					
S32	QueryLogByTime	TP			
S33	QueryLogAfter	TP			
S34	GetLogStatusValues	TP			
Generic substation event model (GSE) (Clause 15)					
GOOSE-CONTROL-BLOCK					
S35	SendGOOSEMessage	MC		●	
S36	GetGoReference	TP			
S37	GetGOOSEElementNumber	TP			
S38	GetGoCBValues	TP		●	
S39	SetGoCBValues	TP		●	
GSSE-CONTROL-BLOCK					
S40	SendGSSEMessage	MC			
S41	GetGsReference	TP			
S42	GetGSSEElementNumber	TP			
S43	GetGsCBValues	TP			
S44	SetGsCBValues	TP			
Transmission of sampled value model (SVC) (Clause 16)					
Multicast SVC					
S45	SendMSVMessage	MC			
S46	GetMSVCBValues	TP			
S47	SetMSVCBValues	TP			
Unicast SVC					
S48	SendUSVMessage	TP			
S49	GetUSVCBValues	TP			
S50	SetUSVCBValues	TP			
Control (Clause 17)					
S51	Select	TP		●	For boGGIO class nodes
S52	SelectWithValue	TP			
S53	Cancel	TP		●	For boGGIO class nodes

Services		AA: TP/MC	Client/ Subscriber	Server/ Publisher	Comments
S54	Operate	TP		●	
S55	Command-Termination	TP		●	For CSWI class nodes
S56	TimeActivated-Operate	TP			
File transfer (Clause 20)					
S57	GetFile	TP		●	
S58	SetFile	TP			
S59	DeleteFile	TP			
S60	GetFileAttributeValues	TP		●	
Time (Clause 18)					
T1	Time resolution of internal clock (nearest value of 2**-n in seconds)			n=10 (T1)	
T2	Time accuracy of internal clock			n=10 (T1)	
T3	Supported TimeStamp resolution (nearest value of 2**-n in seconds)			n=10 (T1)	
● – supported					

3 MICS - Model Implementation Conformance Statement

This chapter contains the MICS conformance statement as required by IEC 61850-10. It lists data object model elements supported by the SA300 and provides definitions of the logical nodes, common data classes and data attribute types as defined in IEC 61850-7-3 and IEC 61850-7-4.

3.1 Model conformance

The model conformance of the SA300 is described by its ICD file.

3.2 Common data attributes classes

The following tables indicate which fields are supported in each Common Data Attribute Class. Not listed fields are either optional (O) or conditional (C) and are not supported by the SA300. Mandatory fields (M) are always present.

Quality

Attribute name	Attribute type	Value/Range	M/O/C	Comments
validity	CODED ENUM	good | invalid	M	Supported
detailQual	PACKED LIST		M	Supported
overflow	BOOLEAN	FALSE	M	Defaulted
outOfRange	BOOLEAN	TRUE | FALSE	M	Supported
badReference	BOOLEAN	TRUE | FALSE	M	Supported
oscillatory	BOOLEAN	FALSE	M	Defaulted
failure	BOOLEAN	TRUE | FALSE	M	Supported
oldData	BOOLEAN	FALSE	M	Defaulted
inconsistent	BOOLEAN	FALSE	M	Defaulted
inaccurate	BOOLEAN	FALSE	M	Defaulted
source	CODED ENUM	process	M	Defaulted
test	BOOLEAN	FALSE	M	Defaulted
operatorBlocked	BOOLEAN	FALSE	M	Defaulted

Analog value

Attribute name	Attribute type	Value/Range	M/O/C	Comments
i	INT32	integer value	C	
f	FLOAT32	floating point value	C	

Only one of the attributes may be present for a given instance of DATA.

Configuration of analogue value

Common data attribute class is not supported.

Range configuration

Common data attribute class is not supported.

Step position with transient indication

Common data attribute class is not supported.

Pulse configuration

Attribute Name	Attribute Type	Value/Range	M/O/C	Comments
cmdQual	ENUMERATED	pulse | persistent	M	For boGGIO pulse output, a relay must be set to pulse mode via the device Relay Setup
onDur	INT32U		M	boGGIO class nodes: default = 2000 ms CSWI class nodes: default = 0
offDur	INT32U		M	Not supported
numPls	INT32U	1	M	Read only

Originator

Attribute Name	Attribute Type	Value/Range	M/O/C	Comments
orCat	ENUMERATED	not-supported | bay-control | station-control | remote-control | automatic-bay | automatic-station | automatic-remote | maintenance | process	M	
orIdent	OCTET STRING64		M	

Unit definition

Attribute Name	Attribute Type	Value/Range	M/O/C	Comments
SIUnit	ENUMERATED	See IEC61850-7-3, Tables A.1 to A.4 in Annex A	M	
multiplier	ENUMERATED	See IEC61850-7-3, Table A.5 in Annex A	O	

The default value of the multiplier is 0 and the multiplier value is 1: 10**0 = 1.

Vector

Attribute Name	Attribute Type	Value/Range	M/O/C	Comments
mag	AnalogueValue		M	Only one of the attributes of the AnalogueValue may be present for a given instance of DATA.
ang	AnalogueValue		O	ang attribute is used for data objects of the phzrMMXU LN only (see below)

Point definition

Common data attribute class is not supported.

CtlModels definition

Attribute Value	Comments
status-only	Not controllable SPS, DPS and INS
direct-with-normal-security	Controllable SPC. Supported by boGGIO and evfGGIO class nodes.
sbo-with-normal-security	Controllable SPC. Supported by boGGIO and evfGGIO class nodes.
direct-with-enhanced-security	Controllable DPC. Supported by CSWI class nodes.
sbo-with-enhanced-security	Not supported

SboClasses definition

Attribute Value	Comments
operate-once	
operate-many	Not supported

PackedInd32 definition

Attribute name	Attribute type	Value/Range	M/O/C	Comments
PackedInd32	PACKED LIST		M	
Ind1	BOOLEAN	TRUE | FALSE	M	
Ind2	BOOLEAN	TRUE | FALSE	M	
Ind3	BOOLEAN	TRUE | FALSE	M	
Ind4	BOOLEAN	TRUE | FALSE	M	
Ind5	BOOLEAN	TRUE | FALSE	M	
Ind6	BOOLEAN	TRUE | FALSE	M	
Ind7	BOOLEAN	TRUE | FALSE	M	
Ind8	BOOLEAN	TRUE | FALSE	M	
Ind9	BOOLEAN	TRUE | FALSE	M	
Ind10	BOOLEAN	TRUE | FALSE	M	
Ind11	BOOLEAN	TRUE | FALSE	M	
Ind12	BOOLEAN	TRUE | FALSE	M	
Ind13	BOOLEAN	TRUE | FALSE	M	
Ind14	BOOLEAN	TRUE | FALSE	M	
Ind15	BOOLEAN	TRUE | FALSE	M	
Ind16	BOOLEAN	TRUE | FALSE	M	
Ind17	BOOLEAN	TRUE | FALSE	M	
Ind18	BOOLEAN	TRUE | FALSE	M	
Ind19	BOOLEAN	TRUE | FALSE	M	
Ind20	BOOLEAN	TRUE | FALSE	M	
Ind21	BOOLEAN	TRUE | FALSE	M	
Ind22	BOOLEAN	TRUE | FALSE	M	
Ind23	BOOLEAN	TRUE | FALSE	M	
Ind24	BOOLEAN	TRUE | FALSE	M	
Ind25	BOOLEAN	TRUE | FALSE	M	
Ind26	BOOLEAN	TRUE | FALSE	M	
Ind27	BOOLEAN	TRUE | FALSE	M	
Ind28	BOOLEAN	TRUE | FALSE	M	
Ind29	BOOLEAN	TRUE | FALSE	M	
Ind30	BOOLEAN	TRUE | FALSE	M	
Ind31	BOOLEAN	TRUE | FALSE	M	
Ind32	BOOLEAN	TRUE | FALSE	M	

NOTE: not supported by F/W V20.1X.07 or higher.

3.3 Common data classes

The following tables indicate mandatory, conditional and optional attributes of each Common Data Class (CDC) that are supported by the SA300. Mandatory attributes (M) are always present.

Single point status (SPS)

Attribute Name	Attribute Type	FC	M/O/C	Comments
stVal	BOOLEAN	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
d	VISIBLE STRING64	DC	O	
subEna	BOOLEAN	SV	PICS_SUBST	Supported by CTRL/CILO nodes[1]
subVal	CODED ENUM	SV	PICS_SUBST	Supported by CTRL/CILO nodes[1]
subQ	Quality	SV	PICS_SUBST	Supported by CTRL/CILO nodes

[1] Indicate the switch interlocking bypass status for EnaCls and EnaOpn attributes in CTRL/CILO nodes: TRUE when interlocking bypass is enabled, FALSE when bypass is disabled.

Double point status (DPS)

Attribute Name	Attribute Type	FC	M/O/C	Comments
stVal	CODED ENUM	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	

Packed 32-bit status (PackBitSt32)

Attribute Name	Attribute Type	FC	M/O/C	Comments
st32Val	PackedInd32	ST	M	
d	VISIBLE STRING64	DC	O	

NOTE: not supported by F/W V20.1X.07 or higher.

Integer status (INS)

Attribute Name	Attribute Type	FC	M/O/C	Comments
stVal	INT32	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
d	VISIBLE STRING64	DC	O	

Protection activation information (ACT)

Common data class is not supported.

Directional protection activation information (ACD)

Common data class is not supported.

Security violation counting (SEC)

Common data class is not supported.

Binary counter reading (BCR)

Attribute Name	Attribute Type	FC	M/O/C	Comments
actVal	INT32	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
units	Unit	CF	O	
pulsQty	FLOAT32	CF	M	
d	VISIBLE STRING64	DC	O	

Measured value (MV)

Attribute Name	Attribute Type	FC	M/O/C	Comments
mag	AnalogueValue	MX	M	Only one of the attributes (i or f) of the AnalogueValue may be present for a given instance of DATA
q	Quality	MX	M	
t	TimeStamp	MX	M	
units	Unit	CF	O	
db	INT32U	CF	O	
d	VISIBLE STRING64	DC	O	

Complex measured value (CMV)

Attribute Name	Attribute Type	FC	M/O/C	Comments
cVal	Vector	MX	M	
q	Quality	MX	M	

Attribute Name	Attribute Type	FC	M/O/C	Comments
t	TimeStamp	MX	M	
units	Unit	CF	O	
db	INT32U	CF	O	
d	VISIBLE STRING64	DC	O	

Sampled value (SAV)

Common data class is not supported.

WYE

Attribute Name	Attribute Type	FC	M/O/C	Comments
phsA	CMV		C	
phsB	CMV		C	
phsC	CMV		C	
neut	CMV		C	Signed with (*) where available

Delta (DEL)

Attribute Name	Attribute Type	FC	M/O/C	Comments
phsAB	CMV		C	
phsBC	CMV		C	
phsCA	CMV		C	

Sequence (SEQ)

Attribute Name	Attribute Type	FC	M/O/C	Comments
c1	CMV		M	
c2	CMV		M	
c3	CMV		M	
seqT	ENUMERATED	MX	M	pos-neg-zero | dir-quad-zero

Harmonic value (HMV)

Common data class is not supported.

Harmonic value for WYE (HWYE)

Attribute Name	Attribute Type	FC	M/O/C	Comments
q	Quality	MX	M	
t	TimeStamp	MX	M	
phsAHar	ARRAY[0..numHar] OF Vector	MX	M	
phsBHar	ARRAY[0..numHar] OF Vector	MX	O	
phsCHar	ARRAY[0..numHar] OF Vector	MX	O	
numHar	INT16U	CF	M	numHar = 63 (no subharmonics)
numCyc	INT16U	CF	M	numCyc = 1
units	Unit	CF	O	
evalTm	INT16U	CF	M	evalTm = nominal period
frequency	FLOAT32	CF	M	frequency = nominal frequency
d	VISIBLE STRING64	DC	O	

Harmonic value for DEL (HDEL)

Attribute Name	Attribute Type	FC	M/O/C	Comments
q	Quality	MX	M	
t	TimeStamp	MX	M	
phsABHar	ARRAY[0..numHar] OF Vector	MX	M	

Attribute Name	Attribute Type	FC	M/O/C	Comments
phsBCHar	ARRAY[0..numHar] OF Vector	MX	O	
phsCAHar	ARRAY[0..numHar] OF Vector	MX	O	
numHar	INT16U	CF	M	numHar = 63 (no subharmonics)
numCyc	INT16U	CF	M	numCyc = 1
units	Unit	CF	O	
evalTm	INT16U	CF	M	evalTm = nominal period
frequency	FLOAT32	CF	M	frequency = nominal frequency
d	VISIBLE STRING64	DC	O	

Controllable single point (SPC)

Applied to boGGIO and evfGGIO class nodes.

Attribute Name	Attribute Type	FC	M/O/C	Comments
ctlVal	BOOLEAN	CO	C	See notes below for relay operation explanation
stVal	BOOLEAN	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
d	VISIBLE STRING64	DC	O	
pulseConfig	PulseConfig	CF	O	
ctlModel	CtlModels	CF	M	

Relay output operation depends on the configurable cmdQual attribute value (see pulseConfig) and the relay operation mode configured in the device via the Relay Setup as described in the following table.

cmdQual	Relay operation mode	Relay output operation
pulse	Pulse/KYZ	Pulse output. ctlVal = 1 – generates a pulse (normal/KYZ) with a duration defined by the onDur attribute; ctlVal = 0 – no effect
pulse	Latched/unlatched	No effect
persistent	Pulse/KYZ	Pulse output. ctlVal = 1 – generates a pulse (normal/KYZ) with a duration defined by the pulse width pre-configured in the device setup; ctlVal = 0 – no effect
persistent	Latched/unlatched	Latched output. ctlVal = 1 – switch on, ctlVal = 0 – switch off

Controllable double point (DPC)

Applied to CSWI class nodes.

Attribute Name	Attribute Type	FC	M/O/C	Comments
ctlVal	BOOLEAN	CO	C	
stVal	CODED ENUM	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	
subEna	BOOLEAN	SV	PICS_SUBST	
subVal	CODED ENUM	SV	PICS_SUBST	
subQ	Quality	SV	PICS_SUBST	
pulseConfig	PulseConfig	CF	O	
ctlModel	CtlModels	CF	M	
d	VISIBLE STRING64	DC	O	

Controllable integer status (INC)

Attribute Name	Attribute Type	FC	M/O/C	Comments
ctlVal	INT32	CO	C	
stVal	INT32	ST	M	
q	Quality	ST	M	
t	TimeStamp	ST	M	

Attribute Name	Attribute Type	FC	M/O/C	Comments
d	VISIBLE STRING64	DC	O	

Binary controlled step position information (BSC)

Common data class is not supported.

Binary controlled step position information (ISC)

Common data class is not supported.

Controllable analog set point information (APC)

Common data class is not supported.

Single point setting (SPG)

Common data class is not supported.

Integer status setting (ING)

Common data class is not supported.

Analog setting (ASG)

Common data class is not supported.

Setting curve (CURVE)

Common data class is not supported.

Device name plate (DPL)

Attribute Name	Attribute Type	FC	M/O/C	Comments
vendor	VISIBLE STRING255	DC	M	
model	VISIBLE STRING255	DC	O	
location	VISIBLE STRING255	DC	O	

Logical node name plate (LPL)

Attribute Name	Attribute Type	FC	M/O/C	Comments
vendor	VISIBLE STRING255	DC	M	
swRev	VISIBLE STRING255	DC	M	
d	VISIBLE STRING255	DC	M	
confgRev	VISIBLE STRING255	DC	C	LLN0 only
ldNs	VISIBLE STRING255	DC	C	LLN0 only

Curve shape description (CSD)

Common data class is not supported.

3.4 Logical devices and logical nodes

The SA300 IEC 61850 server provides a single logical device MET1.

The SA300N IEC 61850 server (F/W version 20.1X.07 and higher) provides two logical devices CTRL and MET1 described in the following table. The domain name of a logical device can incorporate a configurable IED name (see Section 6.2) that will precede a logical device name.

Logical device	Description
CTRL	Bay control elements – breaker and switch control
MET1	Metering, measurements and general digital input and output elements

Logical devices contain logical nodes LPHD and LLN0 dedicated to the SA300 unit, and a set of functional logical nodes for functions supported by the SA300. Logical node names are fixed.

The following tables describe attributes of logical nodes. Not listed attributes are either optional (O), or conditional (C) and are not supported by the SA300. Mandatory (M) attributes are always present.

The SA300 also uses extension (E) attributes for some logical nodes.

3.4.1 System logical nodes

Physical device information LPHD

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	LPHD1		M	
PhyNam	DPL	Physical device name plate		M	
PhyHealth	INS	Physical device health		M	
Proxy	SPS	Indicates if this LN is a proxy		M	Defaulted to FALSE

Logical node zero LLN0

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	LLN0		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	

GOOSE subscription status CTRL/sbsLGOS1-sbsLGOS20

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	sbsLGOS1...sbsGOS20		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
SbsSt	SPS	Status of the subscription		M	TRUE = active FALSE = not active
LastStNum	INS	Last state number received		O	
ConfRevNum	INS	Expected configuration revision number		O	

3.4.2 Logical nodes for control

Switch controllers CTRL/CSWI1- CSWI16

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	CSWI1...CSWI16		M	A configurable prefix can be added to a LNName via the device Bay Control Setup
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Loc	SPS	Local control behavior		O	
Controls					
Pos	DPC	Switch, general		M	

Switch control interlocking status CTRL/CILO1-CILO16

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	CILO1...CILO16		M	A configurable prefix can be added to a LNName via the device Bay Control Setup
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
EnaOpn	SPS	Enable Open		M	
EnaCls	SPS	Enable Close		M	

Relay control interlocking status MET1/blkCILO1-blkCILO8

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	blkCILO1...blkCILO8		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
EnaOpn1...EnaOpn8	SPS	Enable Open: Relay outputs RO1-RO8 (blkCILO1) Relay outputs RO9-RO16 (blkCILO2) Relay outputs RO17-RO24 (blkCILO3) Relay outputs RO25-RO32 (blkCILO4) Relay outputs RO33-RO40 (blkCILO5) Relay outputs RO41-RO48 (blkCILO6) Relay outputs RO49-RO56 (blkCILO7) Relay outputs RO57-RO64 (blkCILO8)		M	Blocking operation is configurable via the Relay setup. A relay can only be unblocked via a control setpoint.
EnaCls1...EnaCls8	SPS	Enable Close: Relay outputs RO1-RO8 (blkCILO1) Relay outputs RO9-RO16 (blkCILO2) Relay outputs RO17-RO24 (blkCILO3) Relay outputs RO25-RO32 (blkCILO4) Relay outputs RO33-RO40 (blkCILO5) Relay outputs RO41-RO48 (blkCILO6)		M	Blocking operation is configurable via the Relay setup. A relay can only be unblocked via a control setpoint.

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
		Relay outputs RO49-RO56 (blkCILO7) Relay outputs RO57-RO64 (blkCILO8)			

3.4.3 Logical nodes for switchgear

Circuit breakers CTRL/XCBR1- XCBR2

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	XCBR1...XCBR2		M	A configurable prefix can be added to a LNName via the device Bay Control Setup
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Loc	SPS	Local control behavior		M	
OpCnt	INS	Operation counter		M	
AlmFlt	SPS	Breaker fault trip alarm		E	
Controls					
Pos	DPC	Switch position		M	ST only
BlkOpn	SPC	Block opening		M	ST only
BlkCls	SPC	Block closing		M	ST only

Circuit switches CTRL/XSWI1- XSWI14

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	XSWI1...XSWI14		M	A configurable prefix can be added to a LNName via the device Bay Control Setup
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Loc	SPS	Local control behavior		M	
OpCnt	INS	Operation counter		M	
SwTyp	INS	Switch type		M	
Controls					
Pos	DPC	Switch position		M	ST only
BlkOpn	SPC	Block opening		M	ST only
BlkCls	SPC	Block closing		M	ST only

3.4.4 Logical nodes for protection related functions

Disturbance recorders MET1/drRDRE1-drRDRE8

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	drRDRE1...drRDRE8		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
Status Information					
RcdMade	SPS	Recording made		M	Set to TRUE when at least one disturbance waveform is available for a read.
FltNum	INS	Fault number		M	Indicates the last waveform series number available in a disturbance recorder.

3.4.5 Logical nodes for generic reference

External (GOOSE) indication status CTRL/extGGIO1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	extGGIO1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Ind1...Ind128	SPS	General indication		O	

Digital inputs MET1/biGGIO1-biGGIO8

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	biGGIO1...biGGIO8		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Ind1...Ind16	SPS	General indication: Digital inputs DI1-DI16 (biGGIO1) Digital inputs DI17-DI33 (biGGIO2) Digital inputs DI34-DI48 (biGGIO3) Digital inputs DI49-DI64 (biGGIO4) Digital inputs DI65-DI80 (biGGIO5) Digital inputs DI81-DI96 (biGGIO6) Digital inputs DI97-DI112 (biGGIO5) Digital inputs DI113-DI128 (biGGIO6)		O	TRUE = closed FALSE = open

Relay outputs MET1/boGGIO1-boGGIO8

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	boGGIO1...boGGIO8		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Loc	SPS	Local operation		O	
Controls					
SPCSO1...SPCSO8	SPC	Single point controllable status output:		O	

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
		Relay outputs RO1-RO8 (boGGIO1) Relay outputs RO9-RO16 (boGGIO2) Relay outputs RO17-RO24 (boGGIO3) Relay outputs RO25-RO32 (boGGIO4) Relay outputs RO33-RO40 (boGGIO5) Relay outputs RO41-RO48 (boGGIO6) Relay outputs RO49-RO56 (boGGIO7) Relay outputs RO57-RO64 (boGGIO8)			

Event flags MET1/evfGGIO1 – evfGGIO2

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	evfGGIO1, evfGGIO2		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Loc	SPS	Local operation		O	
Controls					
SPCSO1...SPCSO32	SPC	Single point controllable status output: Event flags FLG1-FLG32 (evfGGIO1) Event flags FLG33-FLG64 (evfGGIO2)		O	

Setpoint status MET1/spGGIO1- spGGIO2

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	spGGIO1, spGGIO2		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Status Information					
Ind1...Ind32	SPS	General indication: Setpoint SP1-SP32 (spGGIO1) Setpoint SP33-SP64 (spGGIO2)		O	TRUE = setpoint operated FALSE = setpoint released

Analog inputs MET1/aiGGIO1-aiGGIO2

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	aiGGIO1, aiGGIO2		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured Values					
AnIn1...AnIn8	MV	Scaled analog inputs: Analog inputs AI1-AI8 (aiGGIO1) Analog inputs AI9-AI16 (aiGGIO2)		O	

3.4.6 Logical nodes for metering and measurement

Energy counters MET1 / engMMTR1

Attribute name	Attribute type	Explanation / Value	T	M / O / C / E	Comments
LNName	Object name	engMMTR1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
TotVAh	BCR	Apparent energy		O	Total
TotWh	BCR	Net real energy		O	Net
TotVArh	BCR	Net reactive energy		O	Net
SupWh	BCR	Real energy supply		O	Exported
SupVArh	BCR	Reactive energy supply		O	Exported
DmdWh	BCR	Real energy demand		O	Imported
DmdVArh	BCR	Reactive energy demand		O	Imported

Harmonic demands MET1 / demMHAI1

Attribute name	Attribute type	Explanation / Value	T	M / O / C / E	Comments
LNName	Object name	demMHAI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
ThdPhV	WYE	Voltage THD demand for phase to ground		O	In 4LN3, 3LN3 and 3BLN3 wiring modes
ThdPPV	DEL	Voltage THD demand for phase to phase		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes
ThdA	WYE	Current THD demand		O	
TddA	WYE	Current TDD demand per IEEE 519		O	
ThdAuxV	MV	Voltage THD demand for auxiliary voltage input V4		E	
ThdAuxA	MV	Current THD demand for auxiliary current input I4		E	
TddAuxA	MV	Current TDD demand for auxiliary current input I4		E	

Sequence of harmonics MET1 / hrmMHAI1

Attribute name	Attribute type	Explanation / Value	T	M / O / C / E	Comments
LNName	Object name	hrmMHAI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
HA	HWYE	Sequence of harmonics current		O	
HPhV	HWYE	Sequence of harmonics phase to ground voltages		O	In 4LN3, 3LN3 and 3BLN3 wiring modes

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
HPPV	HDEL	Sequence of harmonics phase to phase voltages		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes

Total harmonics MET1/ocvMHAI1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	ocvMHAI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
ThdPhV	WYE	Voltage THD for phase to ground		O	In 4LN3, 3LN3 and 3BLN3 wiring modes
ThdPPV	DEL	Voltage THD for phase to phase		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes
ThdA	WYE	Current THD		O	
HKf	WYE	K-Factor		O	
TddA	WYE	Current TDD per IEEE 519		O	

3-second total harmonics MET1/osvMHAI1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	osvMHAI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
ThdPhV	WYE	Voltage THD for phase to ground		O	In 4LN3, 3LN3 and 3BLN3 wiring modes
ThdPPV	DEL	Voltage THD for phase to phase		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes
ThdA	WYE	Current THD		O	
HKf	WYE	K-Factor		O	
TddA	WYE	Current TDD per IEEE 519		O	

Present demands MET1/demMMXU1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	demMMXU1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
PhV	WYE	Phase to ground voltage demands		O	In 4LN3, 3LN3 and 3BLN3 wiring modes
PPV	DEL	Phase to phase voltage demands		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
A	WYE	Phase and neutral current demands		O	(*) See WYE
TotkWImp	MV	Total active power imported block demand		E	
TotkWExp	MV	Total active power exported block demand		E	
TotkVarImp	MV	Total reactive power imported block demand		E	
TotkVarExp	MV	Total reactive power exported block demand		E	
TotVA	MV	Total apparent power demand		O	
AuxV	CMV	Auxiliary voltage V4 demand		E	
AuxA	CMV	Auxiliary current I4 demand		E	

Sliding power demands MET1/demMMXU2

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	demMMXU2		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
TotkWImp	MV	Total active power imported sliding window demand		E	
TotkWExp	MV	Total active power exported sliding window demand		E	
TotkVarImp	MV	Total reactive power imported sliding window demand		E	
TotkVarExp	MV	Total reactive power exported sliding window demand		E	
TotVA	MV	Total apparent power sliding window demand		O	

Accumulated power demands MET1/demMMXU3

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	demMMXU3		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
TotkWImp	MV	Total active power imported accumulated demand		E	
TotkWExp	MV	Total active power exported accumulated demand		E	
TotkVarImp	MV	Total reactive power imported accumulated demand		E	
TotkVarExp	MV	Total reactive power exported accumulated demand		E	
TotVA	MV	Total apparent power accumulated demand		O	

Predicted power demands MET1/demMMXU4

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	demMMXU4		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
TotkWImp	MV	Total active power imported predicted demand		E	
TotkWExp	MV	Total active power exported predicted demand		E	
TotkVarImp	MV	Total reactive power imported predicted demand		E	
TotkVarExp	MV	Total reactive power exported predicted demand		E	
TotVA	MV	Total apparent power predicted demand		O	

Half-cycle measurements MET1/hcvMMXU1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	hcvMMXU1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
PhV	WYE	Phase to ground voltages		O	
PPV	DEL	Phase to phase voltages		O	
A	WYE	Phase and neutral currents		O	(*) See WYE
AuxV	CMV	Auxiliary voltage V4		E	
AuxA	CMV	Auxiliary current I4		E	
DCVolt	MV	DC voltage		E	
ExtA	WYE	Phase and neutral currents, extended inputs I1x-I3x		E	(*) See WYE
ExtAuxA	CMV	Auxiliary current, extended input I4x		E	

One-second measurements MET1/osvMMXU1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	osvMMXU1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
PhV	WYE	Phase to ground voltages		O	
PPV	DEL	Phase to phase voltages		O	
A	WYE	Phase and neutral currents		O	(*) See WYE
W	WYE	Phase active power		O	
VAr	WYE	Phase reactive power		O	
VA	WYE	Phase apparent power		O	

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
PF	WYE	Phase power factor		O	
TotW	MV	Total active power		O	
TotVAr	MV	Total reactive power		O	
TotVA	MV	Total apparent power		O	
TotPF	MV	Total power factor		O	
TotPFLag	MV	Total power factor lag		E	
TotPFLead	MV	Total power factor lead		E	
TotkWImp	MV	Total active power imported		E	
TotkWExp	MV	Total active power exported		E	
TotkVarImp	MV	Total reactive power imported		E	
TotkVarExp	MV	Total reactive power exported		E	
AuxV	CMV	Auxiliary voltage V4		E	
AuxA	CMV	Auxiliary current I4		E	
Hz	MV	Frequency		O	
DCVolt	MV	DC voltage		E	
AvPhV	MV	Average voltage phase to ground		E	
AvPPV	MV	Average voltage phase to phase		E	
AvA	MV	Average current		E	
ExtA	WYE	Phase currents, extended inputs I1x-I3x		E	(*) See WYE
ExtAuxA	CMV	Auxiliary current, extended input I4x		E	
AvExtA	MV	Average current, extended inputs I1x-I3x		E	

Phasors MET1/phsrMMXU1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	phsrMMXU1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
PhV	WYE	Phase to ground voltages (magnitude and angle)		O	In 4LN3, 3LN3 and 3BLN3 wiring modes
PPV	DEL	Phase to phase voltages (magnitude and angle)		O	In 4LL3, 3LL3, 3BLL3, 3DIR2, 3OP2 and 3OP3 wiring modes
A	WYE	Phase currents (magnitude and angle)		O	
AuxV	CMV	Auxiliary voltage V4 (magnitude and angle)		E	
AuxA	CMV	Auxiliary current I4 (magnitude and angle)		E	

Half-cycle sequence and imbalance MET1/hcvMSQI1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	hcvMSQI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
Measured values					
SeqV	SEQ	Zero sequence voltage		C	
SeqA	SEQ	Zero sequence current		C	
SeqExtA	SEQ	Zero sequence current, extended inputs Ix		E	
ImbNgV	MV	Imbalance negative sequence voltage		O	
ImbNgA	MV	Imbalance negative sequence current		O	
ImbNgExtA	MV	Imbalance negative sequence current, extended inputs Ix		E	

One-cycle imbalance MET1/ocvMSQI1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	ocvMSQI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
ImbNgV	MV	Imbalance negative sequence voltage		O	
ImbNgA	MV	Imbalance negative sequence current		O	

Sequence components MET1/seqMSQI1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	seqMSQI1		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	
NamePlt	LPL	Name plate		M	
Measured values					
SeqV	SEQ	Positive, negative and zero sequence voltage		O	
ImbNgV	MV	Imbalance negative sequence voltage		O	
ImbZroV	MV	Imbalance zero sequence voltage		O	
SeqA	SEQ	Positive, negative and zero sequence current		O	
ImbNgA	MV	Imbalance negative sequence current		O	
ImbZroA	MV	Imbalance zero sequence current		O	

Minimum/maximum on any phase MET1/ocvMSTA1, MET1/osvMSTA1

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
LNName	Object name	ocvMSTA1 (one-cycle values), osvMSTA1 (one-second values)		M	
Common Logical Node Information					
Mod	INC	Mode		M	
Beh	INS	Behavior		M	
Health	INS	Health		M	

Attribute name	Attribute type	Explanation/Value	T	M/O/C/E	Comments
NamePlt	LPL	Name plate		M	
Measured values					
MinVolts	MV	Minimum voltage		O	
MinPPV	MV	Minimum voltage phase to phase		E	
MinAmps	MV	Minimum current		O	
MinW	MV	Minimum phase real power		O	
MinVAr	MV	Minimum phase reactive power		O	
MinVA	MV	Minimum phase apparent power		O	
MinPFLag	MV	Minimum phase PF lag		E	
MinPFLead	MV	Minimum phase PF lead		E	
MinThdPhV	MV	Minimum voltage THD phase to ground		E	
MinThdA	MV	Minimum current THD		E	
MinHKf	MV	Minimum K-Factor		E	
MinTddA	MV	Minimum current TDD		E	
MinIntThdPhV	MV	Minimum interharmonic voltage THD		E	
MinIntThdA	MV	Minimum interharmonic current THD		E	
MaxVolts	MV	Maximum voltage		O	
MaxPPV	MV	Maximum voltage phase to phase		E	
MaxAmps	MV	Maximum current		O	
MaxW	MV	Maximum phase real power		O	
MaxVAr	MV	Maximum phase reactive power		O	
MaxVA	MV	Maximum phase apparent power		O	
MaxPFLag	MV	Maximum phase PF lag		E	
MaxPFLead	MV	Maximum phase PF lead		E	
MaxThdPhV	MV	Maximum voltage THD phase to ground		E	
MaxThdA	MV	Maximum current THD		E	
MaxHKf	MV	Maximum K-Factor		E	
MaxTddA	MV	Maximum current TDD		E	
MaxIntThdPhV	MV	Maximum interharmonic voltage THD		E	
MaxIntThdA	MV	Maximum interharmonic current THD		E	

4 PICS – Protocol Implementation Conformance Statement

This chapter contains the PICS conformance statement as defined by IEC 61850-8-1 that specifies mapping to MMS and to ISO/IEC 8802-3.

4.1 Profile conformance

A-Profile support

Profile	Profile description type	Client / Subscriber	Server / Publisher	Comments
A1	Client/server		Yes	
A2	GOOSE/GSE Management		Yes	SendGOOSEMessage only
A3	GSSE			
A4	Time sync	Yes		SNTP (RFC 2030, RFC 4330)

T-Profile support

Profile	Profile description type	Client / Subscriber	Server / Publisher	Comments
T1	TCP/IP profile		Yes	
T2	OSI T profile			
T3	GOOSE/GSE profile	Yes	Yes	
T4	GSSE T profile			
T5	Time sync profile	Yes		

4.2 MMS conformance

MMS service supported CBB (server)	M/O/C/I	Supported
status	M	Yes
getNameList	C	Yes
identify	M	Yes
rename	O	
read	C	Yes
write	C	Yes
getVariableAccessAttributes	C	Yes
defineNamedVariable	O	
defineScatteredAccess	I	
getScatteredAccessAttributes	I	
deleteVariableAccess	O	
defineNamedVariableList	O	
getNamedVariableListAttributes	C	
deleteNamedVariableList	C	
defineNamedTypet	I	
getNamedTypeAttributes	I	
deleteNamedType	I	
input	I	
output	I	
takeControl	I	
relinquishControl	I	
defineSemaphore	I	
deleteSemaphore	I	
reportPoolSemaphoreStatus	I	
reportSemaphoreStatus	I	
initiateDownloadSequence	I	
downloadSegment	I	
terminateDownloadSequence	I	

MMS service supported CBB (server)	M/O/C/I	Supported
initiateUploadSequence	I	
uploadSegment	I	
terminateUploadSequence	I	
requestDomainDownload	I	
requestDomainUpload	I	
loadDomainContent	I	
storeDomainContent	I	
deleteDomain	I	
getDomainAttributes	C	Yes
createProgramInvocation	I	
deleteProgramInvocation	I	
start	I	
stop	I	
resume	I	
reset	I	
kill	I	
getProgramInvocationAttributes	I	
obtainFile	C	
defineEventCondition	I	
deleteEventCondition	I	
getEventConditionAttributes	I	
reportEventConditionStatus	I	
alterEventConditionMonitoring	I	
triggerEvent	I	
defineEventAction	I	
deleteEventAction	I	
alterEventEnrollment	I	
reportEventEnrollmentStatus	I	
getEventEnrollmentAttributes	I	
acknowledgeEventNotification	I	
getAlarmSummary	I	
getAlarmEnrollmentSummary	I	
readJournal	C	
writeJournal	O	
initializeJournal	C	
reportJournalStatus	I	
createJournal	I	
deleteJournal	I	
fileOpen	C	Yes
fileRead	C	Yes
fileClose	C	Yes
fileRename	I	
fileDelete	C	
fileDirectory	C	Yes
unsolicitedStatus	I	
informationReport	C	Yes
eventNotification	I	
attachToEventCondition	I	
attachToSemaphore	I	
conclude	M	Yes
cancel	M	Yes
getDataExchangeAttributes	NP	
exchangeData	NP	
defineAccessControlList	NP	
getAccessControlListAttributes	NP	
reportAccessControlledObjects	NP	

MMS service supported CBB (server)	M/O/C/I	Supported
deleteAccessControlList	NP	
alterAccessControl	NP	
reconfigureProgramInvocation	NP	

M: mandatory support
O: optional support
C: conditional support
I: out of scope
NP: not present (MMS minor version 1 compatibility)

4.3 GOOSE conformance statement (GOOSE Services)

Service	Subscriber	Publisher	Value/comments
SendGOOSEMessage		Yes	
GetGoReference			
GetGOOSEElementNumber			
GetGoCBValues	Yes	Yes	
SetGoCBValues	Yes	Yes	GoEna, DstAddress.addr, DstAddress.APPID ConfRev - subscriber only
GSENotSupported			
GOOSE Control Block (GoCB)	Yes	Yes	

4.4 GSSE conformance statement (GSSE Services)

Service	Subscriber	Publisher	Value/comments
SendGSSEMessage			
GetGsReference			
GetGSSEDataOffset			
GetGsCBValues			
SetGsCBValues			
GSENotSupported			
GSSE Control Block (GsCB)			

4.5 SCL services (SCL conformance)

Service	M/O/C	Supported
SCL.1 SCL file implementation available (offline)	M	
SCL.2 SCL file available from implementation online	O	
SCL.3 SCL implementation reconfiguration supported online	O	

5 PIXIT - Protocol Implementation Extra Information for Testing

This chapter describes device specific implementation of the protocol and communication capabilities of the SA300.

5.1 Device configuration

The device configuration except of the listed items cannot be modified and is listed for information only.

5.2 ACSI models

Association model

Item	Value/Comments
Maximum simultaneous client associations	4
TCP Keepalive	120-600 s, configurable
Authentication	Not supported
Association parameters	
TSEL	0001, fixed value
SSEL	0001, fixed value
PSEL	00000001, fixed value
AP-Title	Not required, ignored if present
AE-Qualifier	Not required, ignored if present
Maximum MMS PDU size	16000
Typical startup time after a power supply interrupt	5 s

Server model

Item	Value/Comments
Quality bits for analog values (MX)	
Validity	Good
OutofRange	Not supported
Failure	Not supported
Inconsistent	Not supported
Source	Process
Other quality bits and values	Not supported
Quality bits for status values (ST)	
Validity	Good
BadReference	Not supported
Failure	Not supported
Inconsistent	Not supported
Inaccurate	Not supported
Source	Process
Other quality bits and values	Not supported
Maximum number of data values in Get/SetDataValues requests	Limited only by the MMS PDU size

Setting group model

Item	Value/Comments
Number of setting groups	Not supported

Dataset model

Item	Value/Comments
Predefined Datasets in ICD file	Measurand data: MET1/LLN0$DSet01Mx MET1/LLN0$DSet02Mx MET1/LLN0$DSet03Mx MET1/LLN0$DSet04St MET1/LLN0$DSet05Mx Status data: MET1/LLN0$DSet01StInd MET1/LLN0$DSet02StInd MET1/LLN0$DSet03StInd MET1/LLN0$DSet04StInd MET1/LLN0$DSet04StSPCSO MET1/LLN0$DSet05StSPCSO MET1/LLN0$DSet06StSPCSO MET1/LLN0$DSet07StSPCSO MET1/LLN0$DSet08StInd MET1/LLN0$DSet09StInd MET1/LLN0$DSet09StFltNum GOOSE publisher data set: CTRL/LLN0$DSetGOOSE1
Maximum number of data elements in one Dataset	64
Maximum number of persistent Datasets	17 predefined + 16 deletable

Predefined Dataset members

Data Set name	Members
MET1/LLN0$DSet01Mx	MET1/LLN0$osvMMXU1$MX$AvPhV MET1/LLN0$osvMMXU1MXAvPPV MET1/LLN0$osvMMXU1$MX$AvA MET1/LLN0$osvMMXU1MXTotW MET1/LLN0$osvMMXU1$MX$TotVAr MET1/LLN0$osvMMXU1MXTotVA MET1/LLN0$osvMMXU1$MX$TotPF MET1/LLN0$osvMMXU1MXHz MET1/LLN0$osvMMXU1$MX$DCVolt
MET1/LLN0$DSet02Mx	MET1/LLN0$osvMMXU1$MXPhVphsA MET1/LLN0$osvMMXU1$MXPhVphsB MET1/LLN0$osvMMXU1$MXPhVphsC MET1/LLN0$osvMMXU1$MXPPVphsAB MET1/LLN0$osvMMXU1$MXPPVphsBC MET1/LLN0$osvMMXU1$MXPPVphsCA MET1/LLN0$osvMMXU1$MXAphsA MET1/LLN0$osvMMXU1$MXAphsB MET1/LLN0$osvMMXU1$MXAphsC MET1/LLN0$osvMMXU1$MXAneut
MET1/LLN0$DSet03Mx	MET1/LLN0$osvMMXU1$MXWphsA MET1/LLN0$osvMMXU1$MXWphsB MET1/LLN0$osvMMXU1$MXWphsC MET1/LLN0$osvMMXU1$MXVArphsA MET1/LLN0$osvMMXU1$MXVArphsB MET1/LLN0$osvMMXU1$MXVArphsC MET1/LLN0$osvMMXU1$MXVAphsA MET1/LLN0$osvMMXU1$MXVAphsB MET1/LLN0$osvMMXU1$MXVAphsC MET1/LLN0$osvMMXU1$MXPFphsA MET1/LLN0$osvMMXU1$MXPFphsB MET1/LLN0$osvMMXU1$MXPFphsC
MET1/LLN0$DSet04St	MET1/LLN0$engMMTR1$ST$SupWh MET1/LLN0$engMMTR1STDmdWh MET1/LLN0$engMMTR1$ST$SupVArh MET1/LLN0$engMMTR1STDmdVArh
MET1/LLN0$DSet05Mx	MET1/LLN0$osvMMXU1$MX$AuxA MET1/LLN0$osvMMXU1MXAuxV MET1/LLN0$osvMMXU1$MX$ExtA$phsA

Data Set name	Members
	MET1/LLN0$osvMMXU1$MX$ExtA$phsB MET1/LLN0$osvMMXU1$MX$ExtA$phsC MET1/LLN0$osvMMXU1$MX$ExtAuxA MET1/LLN0$osvMMXU1MXAvExtA
MET1/LLN0$DSet01StInd	MET1/LLN0$biGGIO1$ST$Ind1 MET1/LLN0$biGGIO1STInd2 ... MET1/LLN0$biGGIO1$ST$Ind16 MET1/LLN0$biGGIO2STInd1 MET1/LLN0$biGGIO2$ST$Ind2 ... MET1/LLN0$biGGIO2STInd16
MET1/LLN0$DSet02StInd	MET1/LLN0$biGGIO3$ST$Ind1 MET1/LLN0$biGGIO3STInd2 ... MET1/LLN0$biGGIO3$ST$Ind16 MET1/LLN0$biGGIO4STInd1 MET1/LLN0$biGGIO4$ST$Ind2 ... MET1/LLN0$biGGIO4STInd16
MET1/LLN0$DSet03StInd	MET1/LLN0$biGGIO5$ST$Ind1 MET1/LLN0$biGGIO5STInd2 ... MET1/LLN0$biGGIO5$ST$Ind16 MET1/LLN0$biGGIO6STInd1 MET1/LLN0$biGGIO6$ST$Ind2 ... MET1/LLN0$biGGIO6STInd16
MET1/LLN0$DSet04StInd	MET1/LLN0$biGGIO7$ST$Ind1 MET1/LLN0$biGGIO7STInd2 ... MET1/LLN0$biGGIO7$ST$Ind16 MET1/LLN0$biGGIO8STInd1 MET1/LLN0$biGGIO8$ST$Ind2 ... MET1/LLN0$biGGIO8STInd16
MET1/LLN0$DSet04StSPCSO	MET1/LLN0$boGGIO1$ST$SPCSO1 MET1/LLN0$boGGIO1STSPCSO2 ... MET1/LLN0$boGGIO1$ST$SPCSO8 MET1/LLN0$boGGIO2STSPCSO1 MET1/LLN0$boGGIO2$ST$SPCSO2 ... MET1/LLN0$boGGIO2STSPCSO8
MET1/LLN0$DSet05StSPCSO	MET1/LLN0$boGGIO3$ST$SPCSO1 MET1/LLN0$boGGIO3STSPCSO2 ... MET1/LLN0$boGGIO3$ST$SPCSO8 MET1/LLN0$boGGIO4STSPCSO1 MET1/LLN0$boGGIO4$ST$SPCSO2 ... MET1/LLN0$boGGIO4STSPCSO8
MET1/LLN0$DSet06StSPCSO	MET1/LLN0$boGGIO5$ST$SPCSO1 MET1/LLN0$boGGIO5STSPCSO2 ... MET1/LLN0$boGGIO5$ST$SPCSO8 MET1/LLN0$boGGIO6STSPCSO1 MET1/LLN0$boGGIO6$ST$SPCSO2 ... MET1/LLN0$boGGIO6STSPCSO8
MET1/LLN0$DSet07StSPCSO	MET1/LLN0$boGGIO7$ST$SPCSO1 MET1/LLN0$boGGIO7STSPCSO2 ... MET1/LLN0$boGGIO7$ST$SPCSO8 MET1/LLN0$boGGIO8STSPCSO1 MET1/LLN0$boGGIO8$ST$SPCSO2 ...

Data Set name	Members
	MET1/LLN0$boGGIO8$ST$SPCSO8
MET1/LLN0$DSet08StInd	MET1/LLN0$spGGIO1$ST$Ind1 MET1/LLN0$spGGIO1STInd2 ... MET1/LLN0$spGGIO1$ST$Ind32
MET1/LLN0$DSet09StInd	MET1/LLN0$spGGIO2$ST$Ind1 MET1/LLN0$spGGIO2STInd2 ... MET1/LLN0$spGGIO2$ST$Ind32
MET1/LLN0$DSet09StFltNum	MET1/LLN0$drRDRE1$ST$FltNum MET1/LLN0$drRDRE2STFltNum ... MET1/LLN0$drRDRE8$ST$FltNum
MET1/LLN0$DSetGOOSE1 (SA300)	MET1/LLN0$spGGIO1$ST$StsStr$st32Val
CTRL/LLN0$DSetGOOSE1 (SA300N F/W 20.1X.07 and higher)	CTRL/QA1XCBR1STPos$stVal CTRL/QA1XCBR1$STPosq CTRL/QA2XCBR2STPos$stVal CTRL/QA2XCBR2$STPosq CTRL/QB1XSWI1STPos$stVal CTRL/QB1XSWI1$STPosq CTRL/QB2XSWI2STPos$stVal CTRL/QB2XSWI2$STPosq CTRL/QB3XSWI3STPos$stVal CTRL/QB3XSWI3$STPosq CTRL/QB4XSWI4STPos$stVal CTRL/QB4XSWI4$STPosq CTRL/QB5XSWI5STPos$stVal CTRL/QB5XSWI5$STPosq CTRL/QB6XSWI6STPos$stVal CTRL/QB6XSWI6$STPosq CTRL/QE1XSWI7STPos$stVal CTRL/QE1XSWI7$STPosq CTRL/QE2XSWI8STPos$stVal CTRL/QE2XSWI8$STPosq CTRL/QE3XSWI9STPos$stVal CTRL/QE3XSWI9$STPosq CTRL/QE4XSWI10STPos$stVal CTRL/QE4XSWI10$STPosq CTRL/QE5XSWI11STPos$stVal CTRL/QE5XSWI11$STPosq CTRL/QE6XSWI12STPos$stVal CTRL/QE6XSWI12$STPosq CTRL/QE71XSWI13STPos$stVal CTRL/QE7XSWI13$STPosq CTRL/QE8XSWI14STPos$stVal CTRL/QE8XSWI14$STPosq MET1/osvMMXU1MXPhV$phsA$cVal MET1/osvMMXU1MXPhV$phsA$q MET1/osvMMXU1MXPhV$phsB$cVal MET1/osvMMXU1MXPhV$phsB$q MET1/osvMMXU1MXPhV$phsC$cVal MET1/osvMMXU1MXPhV$phsC$q

Reporting model

Item	Value/Comments
Predefined RCBs in the ICD file (See Section 6.2 on configuring the number of RCB instances)	Number of RCB instances = 1 (non-indexed RCBs) 16 URCBs: CTRL/LLN0RPURep01 CTRL/LLN0RPURep02 CTRL/LLN0RPURep03 CTRL/LLN0RPURep04 CTRL/LLN0RPURep05 CTRL/LLN0RPURep06 CTRL/LLN0RPURep07 CTRL/LLN0RPURep08 MET1/LLN0RPURep01 MET1/LLN0RPURep02

Item	Value/Comments
	MET1/LLN0RPURep03 MET1/LLN0RPURep04 MET1/LLN0RPURep05 MET1/LLN0RPURep06 MET1/LLN0RPURep07 MET1/LLN0RPURep08 16 BRCBs: CTRL/LLN0BRBRep01 CTRL/LLN0BRBRep02 CTRL/LLN0BRBRep03 CTRL/LLN0BRBRep04 CTRL/LLN0BRBRep05 CTRL/LLN0BRBRep06 CTRL/LLN0BRBRep07 CTRL/LLN0BRBRep08 MET1/LLN0BRBRep01 MET1/LLN0BRBRep02 MET1/LLN0BRBRep03 MET1/LLN0BRBRep04 MET1/LLN0BRBRep05 MET1/LLN0BRBRep06 MET1/LLN0BRBRep07 MET1/LLN0BRBRep08 Number of RCB instances = 1 (indexed RCBs, RptEnabled max=1) 16 URCBs: CTRL/LLN0RPURepA01 CTRL/LLN0RPURepB01 CTRL/LLN0RPURepC01 CTRL/LLN0RPURepD01 CTRL/LLN0RPURepE01 CTRL/LLN0RPURepF01 CTRL/LLN0RPURepG01 CTRL/LLN0RPURepH01 MET1/LLN0RPURepA01 MET1/LLN0RPURepB01 MET1/LLN0RPURepC01 MET1/LLN0RPURepD01 MET1/LLN0RPURepE01 MET1/LLN0RPURepF01 MET1/LLN0RPURepG01 MET1/LLN0RPURepH01 16 BRCBs: CTRL/LLN0BRBRepA01 CTRL/LLN0BRBRepB01 CTRL/LLN0BRBRepC01 CTRL/LLN0BRBRepD01 CTRL/LLN0BRBRepE01 CTRL/LLN0BRBRepF01 CTRL/LLN0BRBRepG01 CTRL/LLN0BRBRepH01 MET1/LLN0BRBRepA01 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepC01 MET1/LLN0BRBRepD01 MET1/LLN0BRBRepE01 MET1/LLN0BRBRepF01 MET1/LLN0BRBRepG01 MET1/LLN0BRBRepH01 Number of RCB instances = 2 (indexed RCBs, RptEnabled max=2) 8 URCBs x 2 clients: CTRL/LLN0RPURepA01 CTRL/LLN0RPURepA02 CTRL/LLN0RPURepB01 CTRL/LLN0RPURepB02 CTRL/LLN0RPURepC01 CTRL/LLN0RPURepC02 CTRL/LLN0RPURepD01

Item	Value/Comments
	CTRL/LLN0RPURepD02 MET1/LLN0RPURepA01 MET1/LLN0RPURepA02 MET1/LLN0RPURepB01 MET1/LLN0RPURepB02 MET1/LLN0RPURepC01 MET1/LLN0RPURepC02 MET1/LLN0RPURepD01 MET1/LLN0RPURepD02 8 BRCBs x 2 clients: CTRL/LLN0BRBRepA01 CTRL/LLN0BRBRepA02 CTRL/LLN0BRBRepB01 CTRL/LLN0BRBRepB02 CTRL/LLN0BRBRepC01 CTRL/LLN0BRBRepC02 CTRL/LLN0BRBRepD01 CTRL/LLN0BRBRepD02 MET1/LLN0BRBRepA01 MET1/LLN0BRBRepA02 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepB02 MET1/LLN0BRBRepC01 MET1/LLN0BRBRepC02 MET1/LLN0BRBRepD01 MET1/LLN0BRBRepD02 Number of RCB instances = 4 (indexed RCBs, RptEnabled max=4) 4 URCBs x 4 clients: CTRL/LLN0RPURepA01 CTRL/LLN0RPURepA02 CTRL/LLN0RPURepA03 CTRL/LLN0RPURepA04 CTRL/LLN0RPURepB01 CTRL/LLN0RPURepB02 CTRL/LLN0RPURepB03 CTRL/LLN0RPURepB04 MET1/LLN0RPURepA01 MET1/LLN0RPURepA02 MET1/LLN0RPURepA03 MET1/LLN0RPURepA04 MET1/LLN0RPURepB01 MET1/LLN0RPURepB02 MET1/LLN0RPURepB03 MET1/LLN0RPURepB04 4 BRCBs x 4 clients: CTRL/LLN0BRBRepA01 CTRL/LLN0BRBRepA02 CTRL/LLN0BRBRepA03 CTRL/LLN0BRBRepA04 CTRL/LLN0BRBRepB01 CTRL/LLN0BRBRepB02 CTRL/LLN0BRBRepB03 CTRL/LLN0BRBRepB04 MET1/LLN0BRBRepA01 MET1/LLN0BRBRepA02 MET1/LLN0BRBRepA03 MET1/LLN0BRBRepA04 MET1/LLN0BRBRepB01 MET1/LLN0BRBRepB02 MET1/LLN0BRBRepB03 MET1/LLN0BRBRepB04
Support of trigger conditions	
Integrity	Supported
Data change	Supported
Data update	Can be set, but there is no process data to report for this condition
Quality change	Can be set, but there is no process data to report for this condition
General interrogation	Supported

Item	Value/Comments
Support of optional fields	
Sequence number	Supported, default = TRUE
Report time-stamp	Supported, default = TRUE
Reason for inclusion	Supported, default = TRUE
Dataset name	Supported, default = TRUE
Data reference	Supported, default = TRUE
Buffer overflow	Supported, default = FALSE
EntryID	Supported, default = FALSE
Conf-rev	Supported, default = FALSE
Segmentation	Not supported
Sending of segmented reports	Not supported
EntryID	Only the first 4 octets are used. Remaining octets must be 0.
Buffer size	5000 octets for each BRCB

Report Control Blocks predefined attribute values

RptID	Datset	OptFlds	BufTm	TrgOps
CTRL/LLN0RPURep01	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep02	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep03	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep04	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep05	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep06	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep07	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0RPURep08	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep01	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep02	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep03	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep04	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep05	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep06	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep07	Not defined	0x7C, 0x00	0	0x60
CTRL/LLN0BRBRep08	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0RPURep01	MET1/LLN0$DSet01Mx	0x7C, 0x00	0	0x60
MET1/LLN0RPURep02	MET1/LLN0$DSet02Mx	0x7C, 0x00	0	0x60
MET1/LLN0RPURep03	MET1/LLN0$DSet03Mx	0x7C, 0x00	0	0x60
MET1/LLN0RPURep04	MET1/LLN0$DSet05Mx	0x7C, 0x00	0	0x60
MET1/LLN0RPURep05	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0RPURep06	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0RPURep07	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0RPURep08	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep01	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep02	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep03	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep04	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep05	Not defined	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep06	MET1/LLN0$DSet08StInd	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep07	MET1/LLN0$DSet09StFltNum	0x7C, 0x00	0	0x60
MET1/LLN0BRBRep08	Not defined	0x7C, 0x00	0	0x60

Report service information

Any predefined RCB attribute value may be written when RptEna is FALSE. Only existing data sets (see Dataset model table) may be used for DatSet attribute changing. Internal events, caused by data-change and quality-change trigger options only, result in immediate sending of reports or buffering events for transmission (limited by a buffer size of 1000 bytes per report).

Control model

Item	Value/Comments
Control models supported	
Status only	Supported
Direct with normal security	Supported for GGIO class nodes
Direct with enhanced security	Supported for CSWI class nodes
SBO with normal security	Supported for GGIO class nodes
SBO with enhanced security	Not supported
Time activated operate (operTm)	Not supported
Test mode	Not supported
Check conditions	Not supported
Operate many	Not supported
Pulse configuration	Not supported
Service error types: instance-not-available access-violation parameter-value-inappropriate instance-locked-by-another-client failed-due-to-server-constraint generic-error	 Not supported Supported Not supported Not supported Not supported Not supported

GOOSE Publisher model

Item	Value/Comments
Maximum number of supported GOOSE data sets	1 (fixed)
Maximum data change detection delay	8 ms @ 60Hz/10 ms @ 50Hz
Initial retransmission interval	8 ms @ 60Hz/10 ms @ 50Hz for the first 5 messages
Maximum retransmission interval	Configurable from 0.5 s to 60 s
Publisher retransmission strategy	Geometric with a time multiplier of 2 after the 5th message
Declared message timeAllowedToLive time	Twice the message retransmission interval + 10 ms

GOOSE Subscriber model

Item	Value/Comments
Maximum number of GOOSE subscriptions	4 for SA300, 20 for SA300N
Maximum number of GOOSE data set items	4 for SA300, 16 for SA300N per subscription
Supported types of GOOSE data set items	Bstring32, Bstring16, Bstring8, FLOAT32, INT32, INT16, INT8, BOOLEAN, Dbpos
Mapping external GOOSE data set objects to internal variables	SA300: External indication: - 16 variables of Bstring32 (ExtInd1/1:32 – ExtInd16/1:32) External measured values: - 16 variables of INT32 (ExtiVal1 – ExtiVal16) - 16 variable of FLOAT32 (ExtfVal1 – ExtfVal16) SA300N: External indication: - 128 variables of BOOLEAN (ExtInd1... ExtInd128) External measured values: - 32 variables of INT32 (ExtiVal1 – ExtiVal32) - 32 variable of FLOAT32 (ExtfVal1 – ExtfVal32)
Filters used to identify subscribed GOOSE messages	Destination MAC address, ETHERTYPE, APPID.
Subscriber behavior in case of mismatching GOOSE header parameters (confRev, numDatSetEntries)	All expected data objects are invalidated and zeroed.
Subscriber behavior in case of missing a GOOSE message within the timeAllowedToLive time	All expected data objects are invalidated and zeroed.

Time and time synchronization model

Item	Value/Comments
Time synchronization sources	SNTP, IRIG-B
Time quality bits	
LeapSecondsKnown	Supported
ClockFailure	Supported
ClockNotSynchronized	Supported
Meaning of ClockFailure bit	The bit is set when the device clock is reset as a result of losing backup battery power. The bit is cleared when the device clock is updated from any external time source or via communications.
Meaning of ClockNotSynchronized bit	The bit is set in the event of using unsynchronized internal clock for time stamping in the following cases: a) if none of the external time sources is selected for time synchronization b) if no valid time synchronization message arrives in 10 minutes after the expected time from either a SNTP server, or from the IRIG-B time code input
Number of SNTP servers supported	2
SNTP polling interval	Programmable, 60 to 86400 seconds
Allowable SNTP server response time	10 seconds
Number of SNTP connection retries for each server	Up to 3 retries in 1 minute intervals
Failed SNTP server reconnection time	10 minutes

File transfer model

Item	Value/Comments
Maximum length of names (incl. path)	64
Separator for file and directories path	'\'
Maximum number of directory entries	10 per recorder (the last 10 events recorded, starting from the newest record)
Structure of directories	COMTRADE\filename
Filename structure	drRDRE<1...8>$<fault number>$<trigger event ID>.cfg drRDRE<1...8>$<fault number>$<trigger event ID>.dat

5.3 Impact of the device settings

Logical device mode

Logical device mode given by LLN0.Mod is always ON.

Controls

The Loc attribute in logical nodes containing controls indicates the complementary status of the internal BOOLEAN variable REMOTE MODE defaulted to FALSE. It is controlled via a setpoint logic equation that should normally check the status of an external Local/Remote switch. Control commands addressed to the CSWI switch controller nodes and to the boGGIO general binary output nodes will be rejected with AddCause=2 Blocked-by-switching-hierarchy until REMOTE MODE is set to TRUE via a logic equation.

The SA300 can provide additional protection for control nodes based on client IP addresses by enabling control commands for specific clients and disabling or conditional blocking via logic equations for others. Commands received from a blocked client port are rejected with AddCause=2 Blocked-by-switching-hierarchy.

Measurement units

Voltage, current and power units are selectable (see Section 6.2 for details).

Measurement type	Units (precision)	
	PT = 1	PT > 1
Current	A/kA (0.01 A)	A/kA (0.01 A)
Voltage AC	V/kV (0.1 V)	V/kV (1 V)
Voltage DC	V (0.01 V)	V (0.01 V)
Power	kW, kVA, kvar or MW, Mvar, MVA (0.001 kW/kVA/kvar)	kW, kVA, kvar or MW, Mvar, MVA (1 kW/kVA/kvar)
Energy	1 kWh, kVAh, kvarh	1 kWh, kVAh, kvarh

Process Measurement Limits

Measurement type	Measurement limits		
	Condition	min	max
Current (standard inputs)		0	Current Scale × CT Ratio [1, 2] (Imax)
Auxiliary current I4 (standard input)		0	Current Scale × I4 CT Ratio [1, 2]
Current (extended inputs)		0	30 × CTx Primary current
Auxiliary current I4x (extended input)		0	30 × I4x CTx Primary current
Voltage AC		0	Voltage Scale × PT Ratio [3] (Vmax)
Auxiliary voltage V4		0	Voltage Scale × V4 PT Ratio [3]
Voltage DC		0	9999.00
Power signed (kW, kvar)		-Vmax × Imax × 2/1000	Vmax × Imax × 2/1000 [4]
Power unsigned (kVA, kW import/export, kvar import/export) and power demands		0	Vmax × Imax × 2/1000 [4]
Power factor signed		-1.000	1.000
Power factor unsigned (lag, lead)		0	1.000
Analog inputs	+/-1mA	-AI full scale × 2	AI full scale × 2
	0-20mA	AI zero scale	AI full scale
	4-20mA	AI zero scale	AI full scale
	0-1mA	AI zero scale	AI full scale
	0-50mA	AI zero scale	AI full scale × 2
	+/-10V	-AI full scale	AI full scale
Unbalance		0	300.0
THD		0	999.9
TDD		0	999.9
K-Factor		1.0	999.9
Harmonics		0	100.00

NOTES:

1. CT Ratio = CT primary current/CT secondary current.
2. The default Current Scale is 4 × CT secondary current for devices with a 400% overload (ANSI) or 2 × CT secondary current for devices with a 200% overload (IEC). It can be changed via the Device Options setup in PAS.
3. The default Voltage Scale is 828V. It can be changed via the Device Options setup in PAS.
4. If PT Ratio = 1.0 and Pmax is greater than 9,999 kW, then it is truncated to 9,999 kW.

Deadbands

The db value represents the percentage of difference between max and min process measurement limits indicated in the table above. The default db (deadband) attribute values in functional constraint CF are defined in the ICD file. They can be changed to provide reasonable conditions for generating reportable events.

Textual descriptions

The default d (textual description of the data) attribute values in functional constraint DC are defined in the device. They can be changed for descriptions of measured/metered and status data.

6 Configuring IEC 61850

The PAS software supplied with the SA300 provides a configuration tool for customizing your device and generating a configured IED description (CID) file for use with IEC 61850 client applications. See the SA300 Operation Manual for more information on installation and operating PAS on your computer.

To reset the IEC 61850 settings to the factory defaults:

1. Select Administration->Master Reset from the Monitor menu.
2. Click the “Reset IEC 61850 Configuration” button, and then confirm the command.

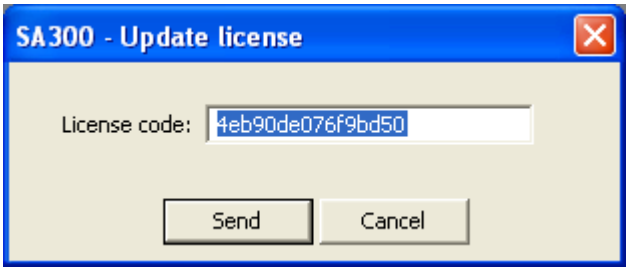
6.1 Licensing IEC 61850

A valid license key must be provided in the SA300 for IEC 61850 communications. The device is normally shipped with a temporary license, which is valid for a 30-day operation and then can be extended for an additional month.

A permanent license can be obtained from your local distributor for an additional fee. A device serial number must be provided in the license request. The device may also be shipped with the permanent license in the event of a pre-paid fee.

To program a license key in you device:

1. Select Administration->Update License from the Monitor menu.



2. Type in the license code and click Send.

6.2 Configuring IED Properties

The IEC 61850 configurator allows you to configure the IED name, device location, measurement units and communication options, and arrange a set of report control blocks for multi-client installations

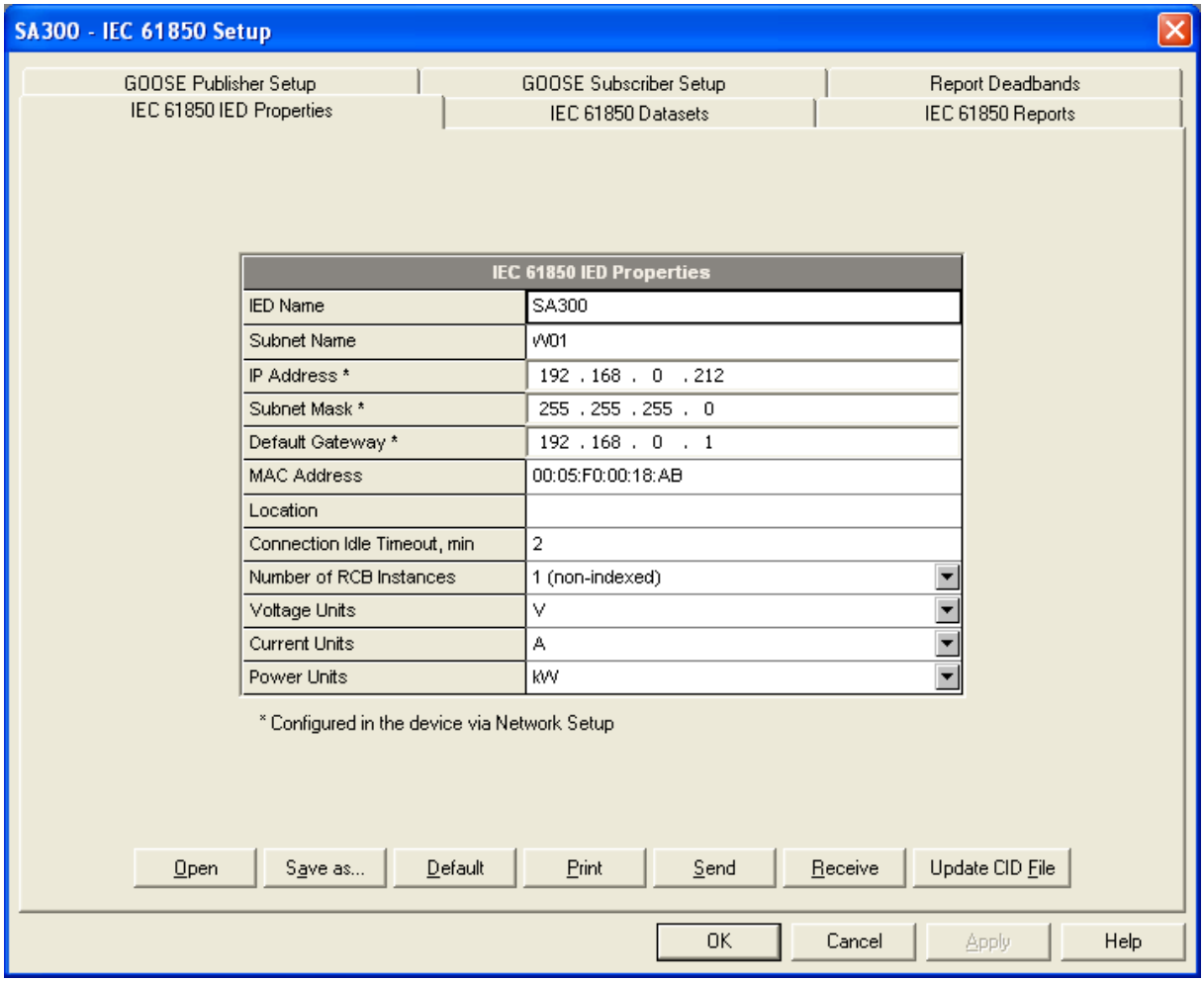
To configure the IED properties in your device:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the IEC 61850 IED Properties tab.
2. Configure IED options for your application as required.

   NOTES

   - The configured IED name accompanies logical device names in object references.
   - The device location also identifies the substation location in COMTRADE configuration files as the station_name attribute.
   - Attributes marked with the asterisk cannot be changed in the device via this setup but you can define and store them to the device database when working offline to use for updating a device CID file.
   - The number of RCB instances defines how pre-defined RCBs are arranged in the device for use in multi-client applications. The RCBs are automatically pre-configured in the device in the way indicated in Section “Reporting model”. The RCB names and report IDs are set to defaults as the number of RCB instances changes. If you intend to change the default setting, set it first before configuring report control blocks.

3. Send your setup to the device and save it to the device database.



6.3 Configuring Datasets

To review or configure the IEC 61850 datasets:

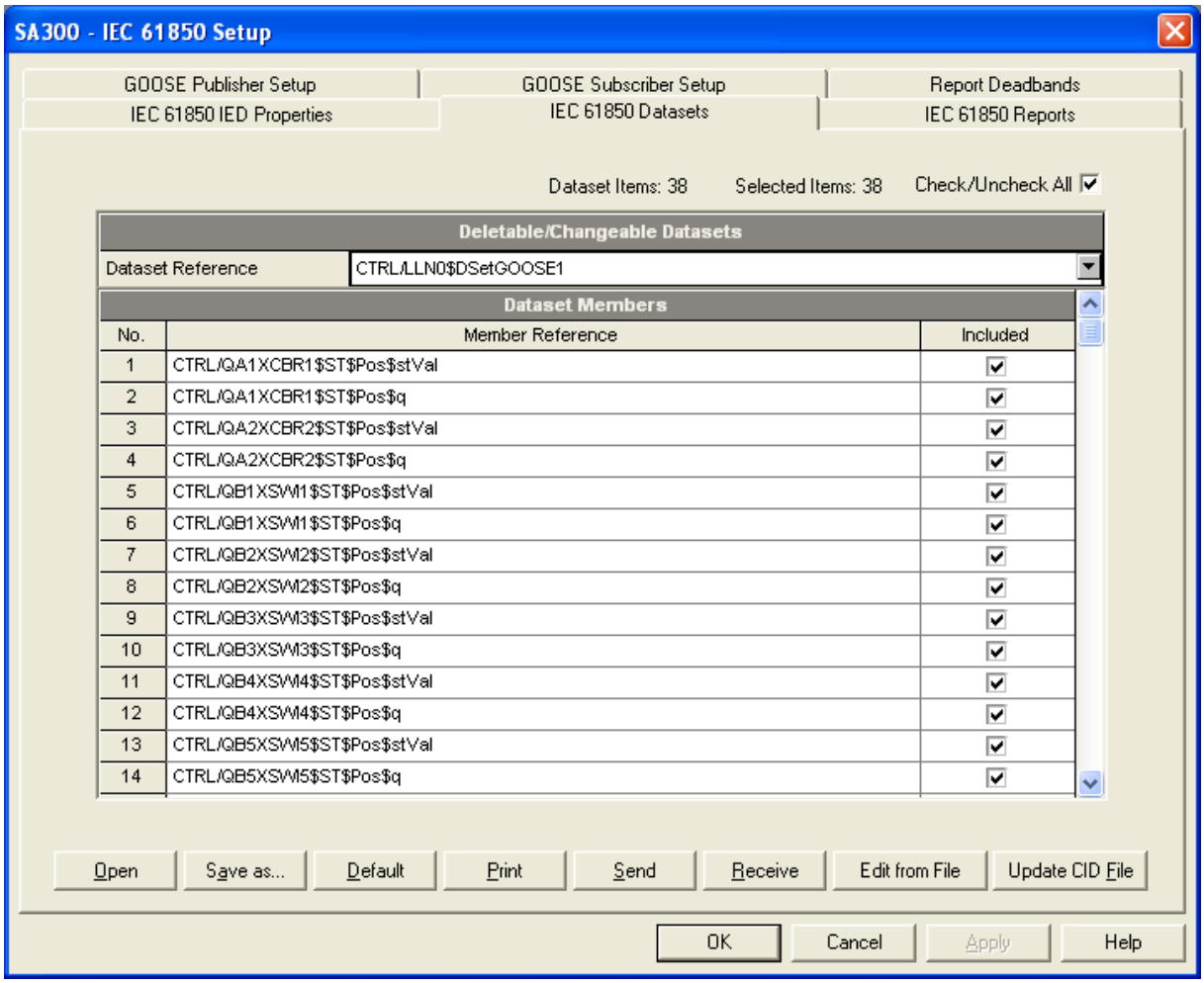
1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the IEC 61850 Datasets tab.
2. Select a dataset you wish to view or configure in the “Dataset Reference” box. Select “New Dataset” to create a new dataset.
3. To delete dataset members, uncheck the appropriate “Included” boxes. Uncheck all dataset members to delete the entire dataset.
4. To add or change dataset members, click “Edit from file”, locate the SA300N.icd template file or a CID file you generated for your device, and click Open.

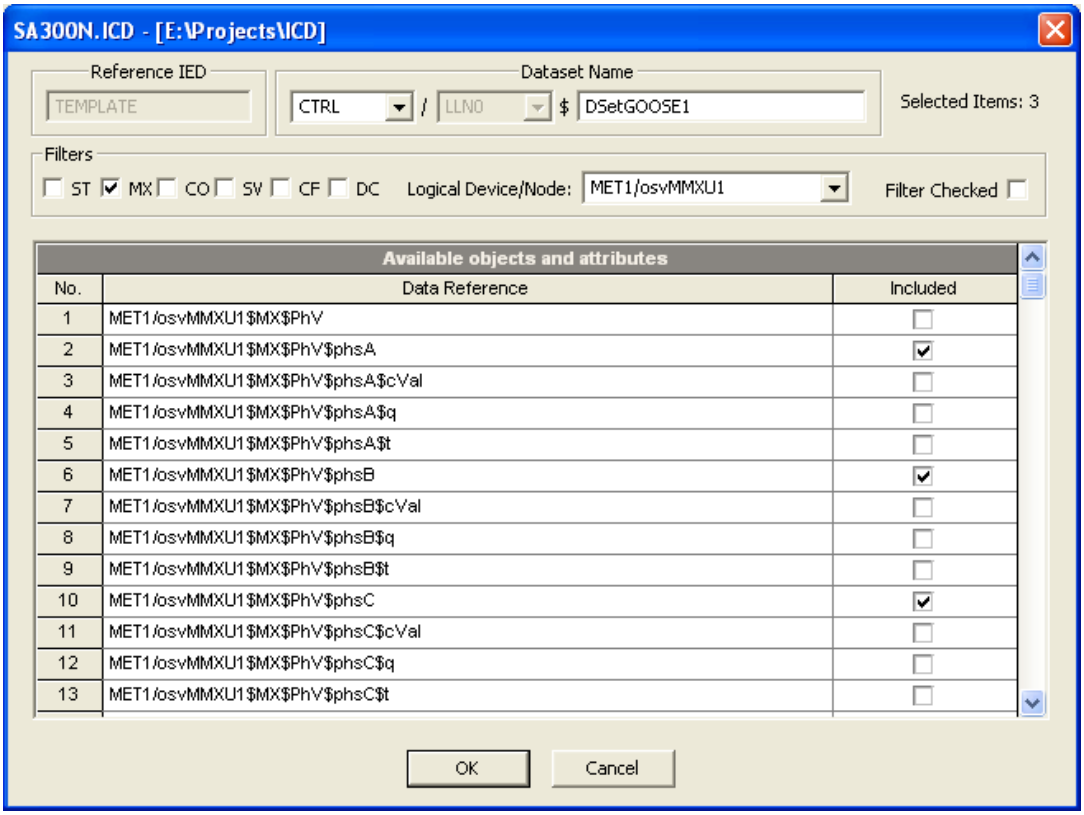
   A full list of the available data objects and data attributed is displayed, where included dataset members are checked.

   To create a new dataset, select a logical device where the dataset will be located and type a dataset name in the “Dataset Name” box.

   Check the “Included” boxes for items you wish to be members of the dataset and click OK.

   To make easy selection of items across the list, use filters - functional constraints or/and a selected logical device/logical node. Click “Filter checked” to see and revise a list of the selected items.
5. Send your new setup to the device and save it to the device database.

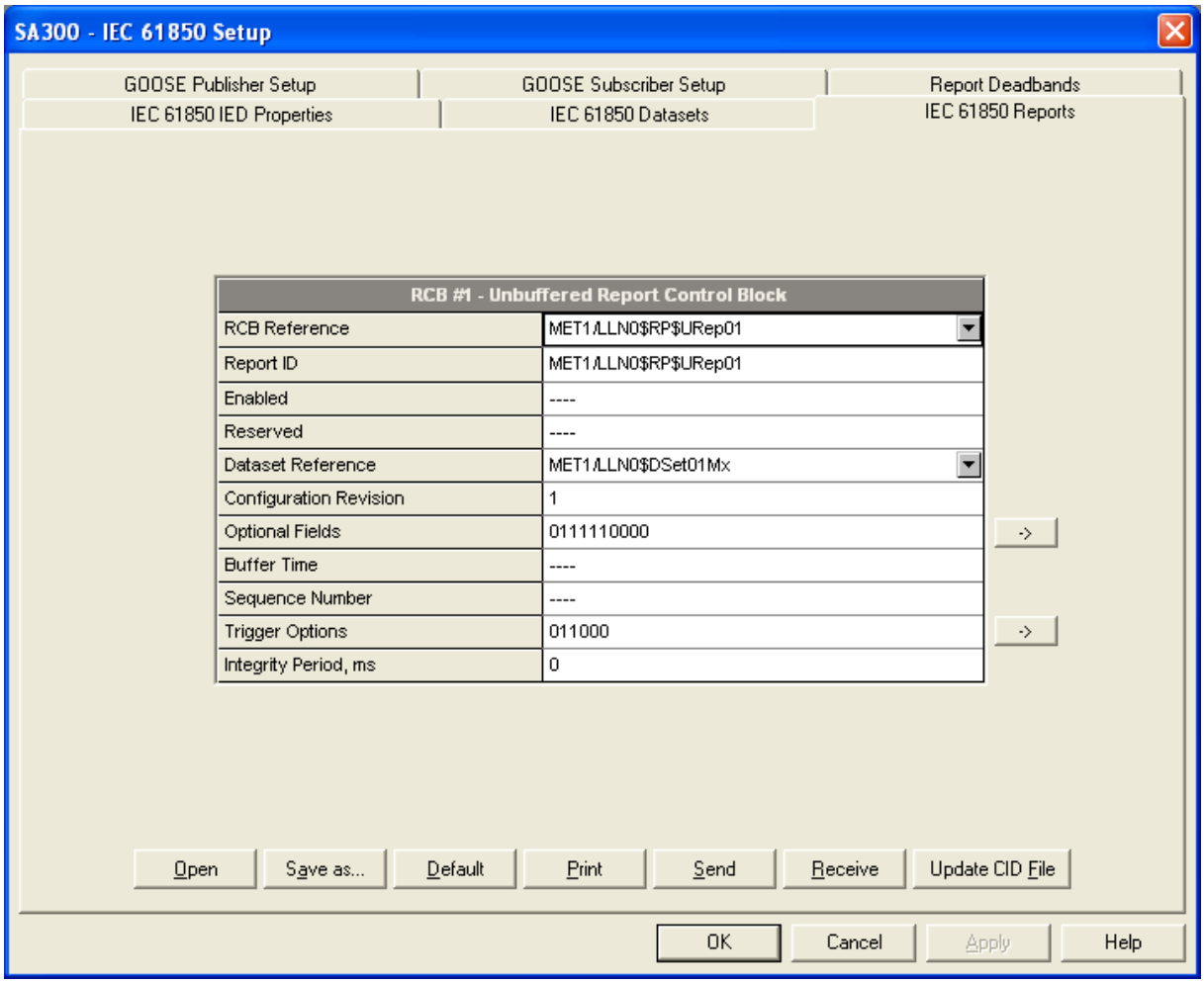

SA300 - IEC 61850 Setup
GOOSE Publisher Setup
GOOSE Subscriber Setup
Report Deadbands
IEC 61850 IED Properties
IEC 61850 Datasets
IEC 61850 Reports
Dataset Items: 38
Selected Items: 38
Check/Uncheck All
Deletable/Changeable Datasets
Dataset Reference
CTRL/LLN0$DSetGOOSE1
Dataset Members
No.
Member Reference
Included
1 CTRL/QA1XCBR1STPos$stVal
2 CTRL/QA1XCBR1STPos$q
3 CTRL/QA2XCBR2STPos$stVal
4 CTRL/QA2XCBR2STPos$q
5 CTRL/QB1XSWI1STPos$stVal
6 CTRL/QB1XSWI1STPos$q
7 CTRL/QB2XSWI2STPos$stVal
8 CTRL/QB2XSWI2STPos$q
9 CTRL/QB3XSWI3STPos$stVal
10 CTRL/QB3XSWI3STPos$q
11 CTRL/QB4XSWI4STPos$stVal
12 CTRL/QB4XSWI4STPos$q
13 CTRL/QB5XSWI5STPos$stVal
14 CTRL/QB5XSWI5STPos$q
Open
Save as...
Default
Print
Send
Receive
Edit from File
Update CID File
OK
Cancel
Apply
Help


SA300N.ICD - [E:\Projects\ICD]
Reference IED
TEMPLATE
Dataset Name
CTRL
LLN0
$
DSetGOOSE1
Selected Items: 3
Filters
ST
MX
CO
SV
CF
DC
Logical Device/Node:
MET1/osvMMXU1
Filter Checked
Available objects and attributes
No.
Data Reference
Included
1 MET1/osvMMXU1MXPhV
2 MET1/osvMMXU1MXPhV$phsA
3 MET1/osvMMXU1MXPhV$phsA$cVal
4 MET1/osvMMXU1MXPhV$phsA$q
5 MET1/osvMMXU1MXPhV$phsA$t
6 MET1/osvMMXU1MXPhV$phsB
7 MET1/osvMMXU1MXPhV$phsB$cVal
8 MET1/osvMMXU1MXPhV$phsB$q
9 MET1/osvMMXU1MXPhV$phsB$t
10 MET1/osvMMXU1MXPhV$phsC
11 MET1/osvMMXU1MXPhV$phsC$cVal
12 MET1/osvMMXU1MXPhV$phsC$q
13 MET1/osvMMXU1MXPhV$phsC$t
OK
Cancel

6.4 Configuring Report Control Blocks

To configure Report Control Blocks in your device:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the IEC 61850 Reports tab.



2. Select an RCB you wish to view or configure in the “RCB Reference” box.
3. Configure the RCB attributes as required for your application. The following items can be configured:
   - Report ID
   - Dataset reference (can be selected from the available datasets list)
   - Optional fields
   - Trigger options
   - Integrity period for periodic reports with the integrity trigger option selected

   To change the Optional fields or Trigger options, click the arrow button at the right to the item, check the appropriate options and click OK.

   NOTE

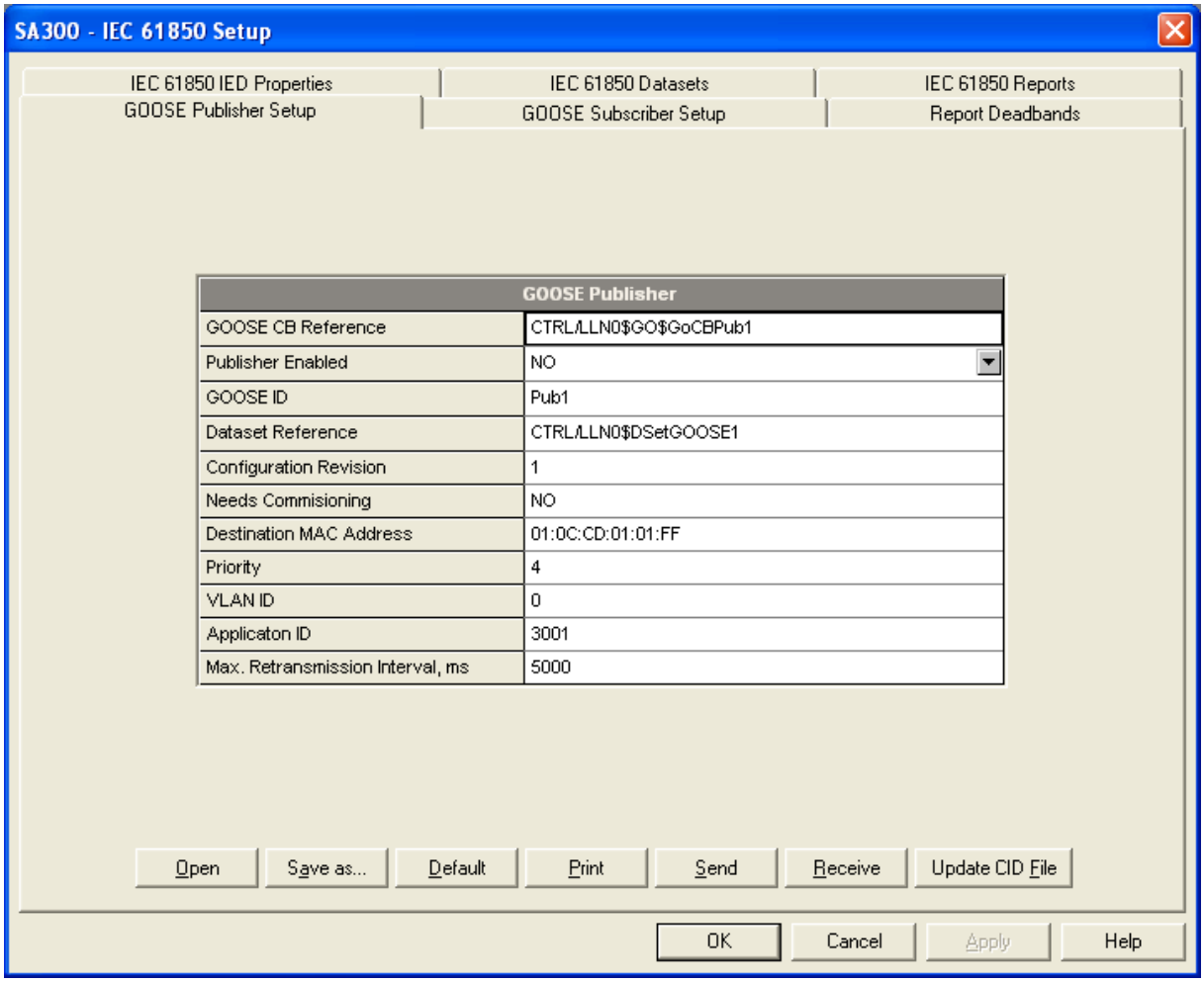
   Configure your new and customized datasets and update them in the device, or save to the device database if you work offline, before configuring reports; otherwise you may get an incomplete dataset list.
4. Send your new setup to the device and save it to the device database.

6.5 Configuring the GOOSE Publisher

The SA300 GOOSE publisher provides the dedicated dataset CTRL/LLN0$DSetGOOSE1 for GOOSE communications. The default dataset variables list can be modified via the IEC 61850 Datasets setup (see Section 6.3).

To configure the GOOSE publisher:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the GOOSE Publisher Setup tab.
2. Configure the destination MAC address, application ID and the maximum message retransmission interval as required for your application. Other setup attributes are not changeable and are indicated for information only.
3. Select Yes in the Publisher Enabled box to enable publisher operation.
4. Send your setup to the device.



6.6 Configuring the GOOSE Subscriber

The SA300 can be subscribed to messages sent by any GOOSE network device including both SA300 and non-SATEC devices.

The GOOSE subscriber supports up to 20 subscriptions with up to 16 data elements in each subscription. The location of the subscribed elements in GOOSE data sets and mapping to the SA300 internal variables are configurable. The subscription elements are selected from a publishing device's ICD/CID file.

The SA300 provides a set of internal variables for mapping external GOOSE data:

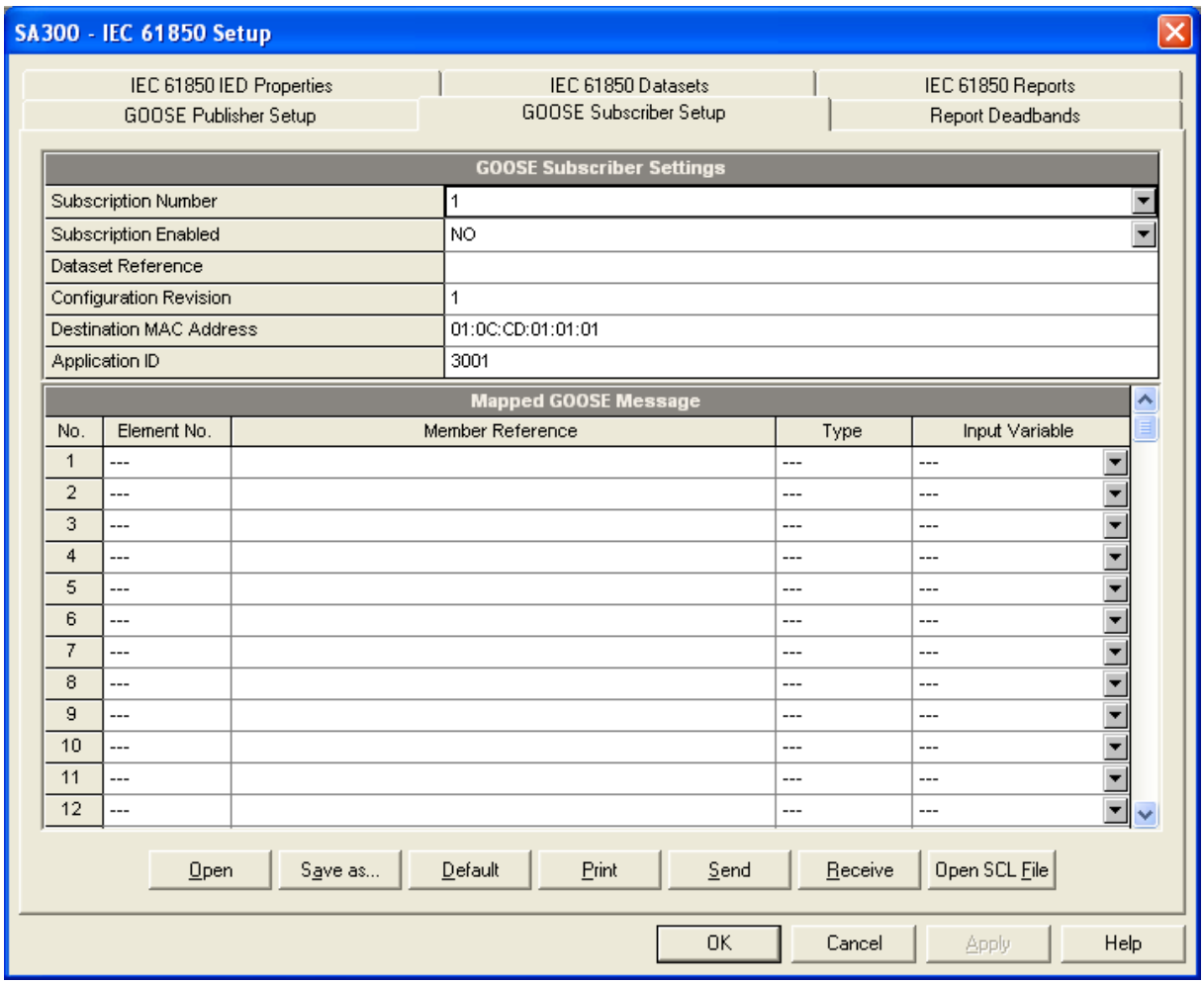
- a 128-bit binary string composed of 128 binary variables ExtInd1…ExtInd128 of type BOOLEAN called external indication and intended for mapping single-point BOOLEAN and integer elements and double-point Dbpos data;
- 32 variables ExtiVal1…ExtiVal32 of type INT32 for mapping signed and unsigned integer numbers of any size;
- 32 variables ExtfVal1…ExtfVal32 of type FLOAT32 for mapping single-precision floating point numbers.

When the subscriber receives GOOSE message updates, the subscribed data is copied to the internal variables that can be monitored and recorded in the device like any other measured value. When the subscriber does not receive updates, or the declared message live time has expired, or the data set differs from the subscriber setup, the internal variables are zeroed and the non-active status is indicated in the subscription status.

The subscription status can be monitored from an IEC 61850 client via the GOOSE subscriber logical nodes CTRL/sbsLGOS1-CTRL/sbsLGOS20, or from a Modbus client application via the GOOSE subscriber status register (see the SA300 Modbus Reference Guide for the register location).

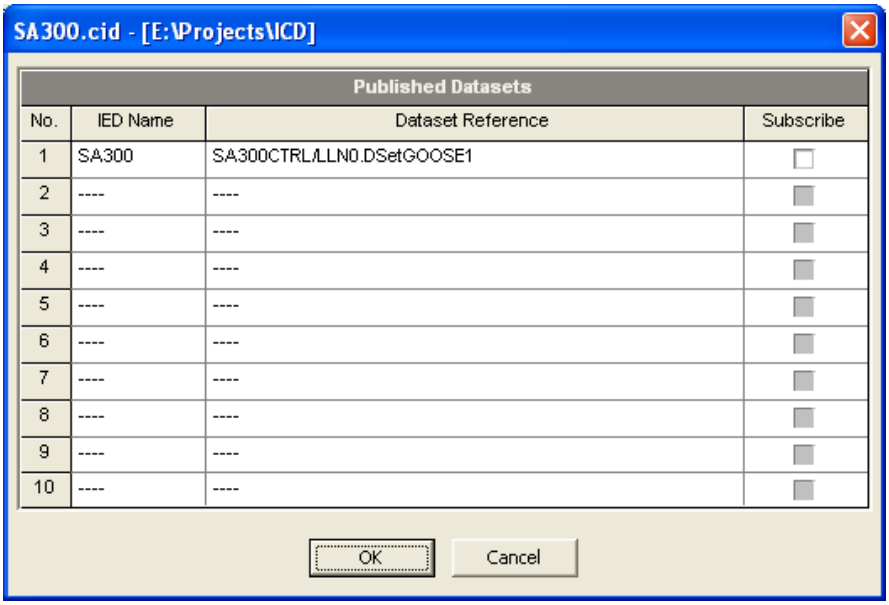
To configure the GOOSE subscriber:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the GOOSE Subscriber Setup tab.

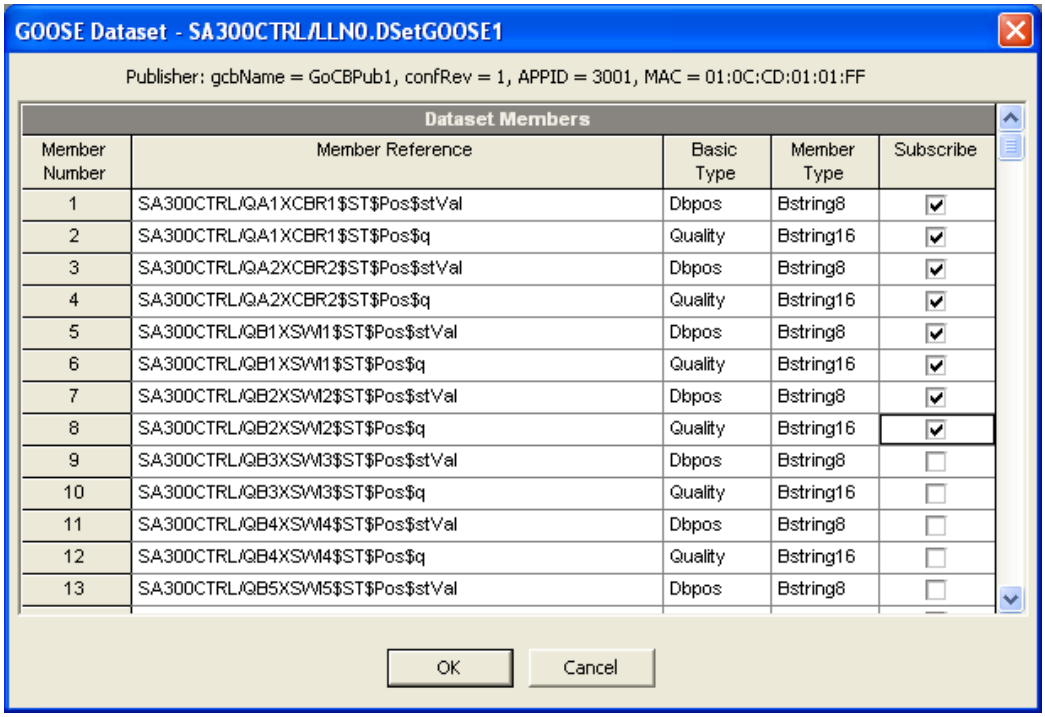


2. In the Subscription Number box, select the subscription you wish to configure.
3. Click the “Open SCL File” button and open an ICD or CID file for the publishing device you wish to subscribe to. PAS shows you a list of all datasets linked to GOOSE publisher

control blocks that are found in the ICD/CID file. Check the Subscribe box for the dataset you wish to subscribe to.

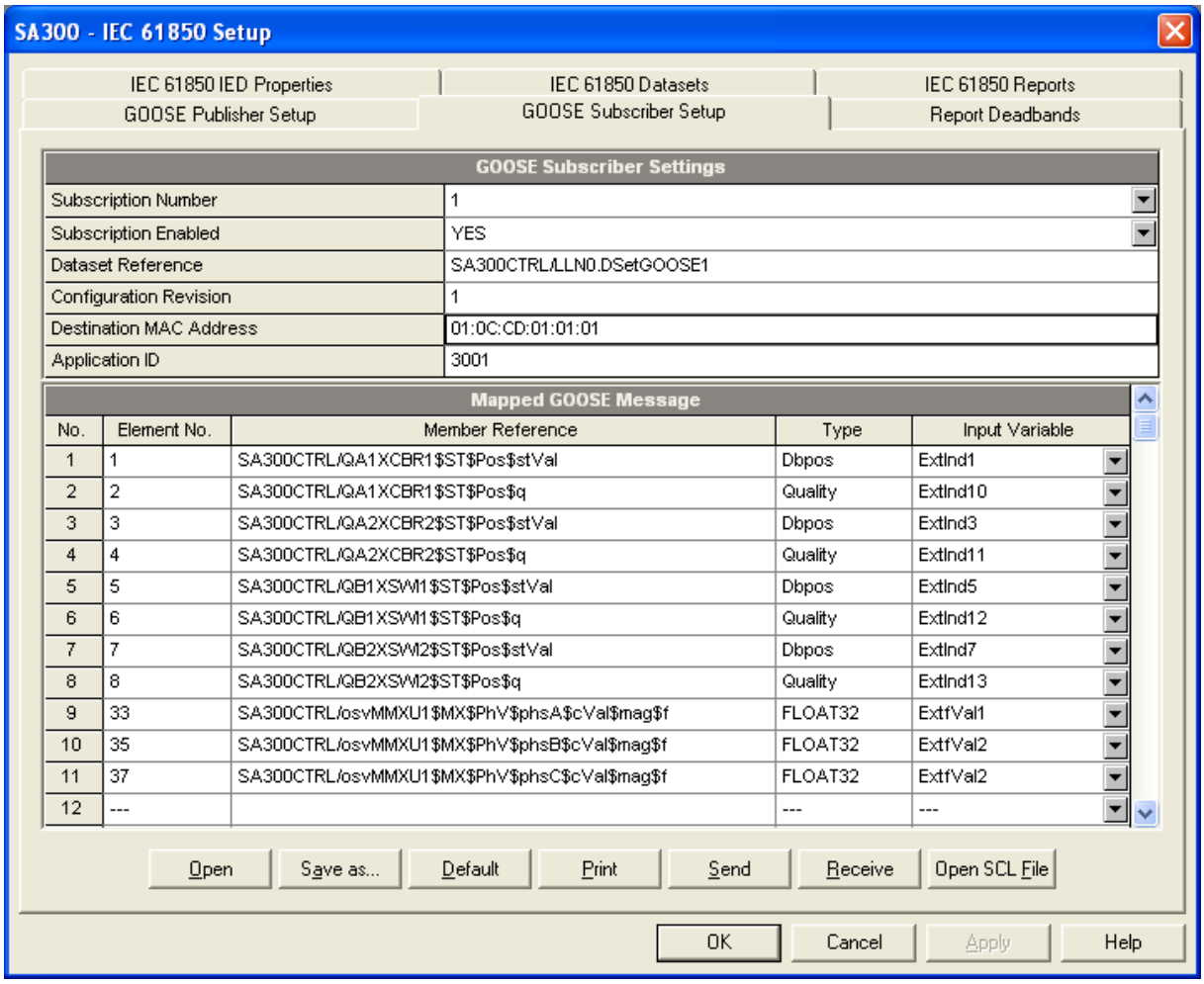


4. The publisher attributes and a list of dataset members for the selected dataset are displayed as shown in the picture below. PAS also indicates a basic IEC 61850 data element type and a physical MMS type for dataset members. Check the Subscribe boxes for elements you want to subscribe to, and then click OK.



You are allowed to select no more than 16 elements. Elements with incompatible data types are not allowed for selection.

The publisher attributes of the selected dataset and the selected data elements are copied to the current subscription.



Select compatible input variables to which dataset elements will be mapped in the device. See the table below for allowable mapping options depending on the basic variable type.

Basic Data Type	MMS Data Type	Compatible Input Variables
BitString32	Bstring32	ExtInd, ExtiVal
Dbpos	Bstring8	ExtInd, ExtiVal
Enum	INT8	ExtInd, ExtiVal
INT32	INT32	ExtInd, ExtiVal
INT32U	INT32U	ExtInd, ExtiVal
INT16	INT16	ExtInd, ExtiVal
INT16U	INT16U	ExtInd, ExtiVal
INT8	INT8	ExtInd, ExtiVal
INT8U	INT8U	ExtInd, ExtiVal
BOOLEAN	BOOLEAN	ExtInd, ExtiVal
FLOAT32	FLOAT32	ExtfVal

NOTES:

- Mapping integer data to a BOOLEAN ExtInd variable results in copying a least-significant bit of the dataset member only.
- Mapping double-point data of type Dbpos to a BOOLEAN ExtInd variable causes a high-order bit of the dataset member to be copied to the following BOOLEAN ExtInd variable.

5. Check the application ID, configuration revision and destination MAC address to meet the GOOSE publisher attributes.
6. Select Yes in the Subscription Enabled box to activate the subscription.

7. Repeat the setup for other subscriptions you wish to configure, and then send your setup to the device and save to the device database. Notice that dataset member names are not stored in the device and will not be displayed when reading the setup from the device unless you saved the setup in the device database on your PC.

6.7 Configuring Report Deadbands

Deadbands for reporting measured analog values can be configured at once via PAS without the need to setup individual deadbands for every data element. If required, you can then change deadbands for individual variables via your IEC 61850 application.

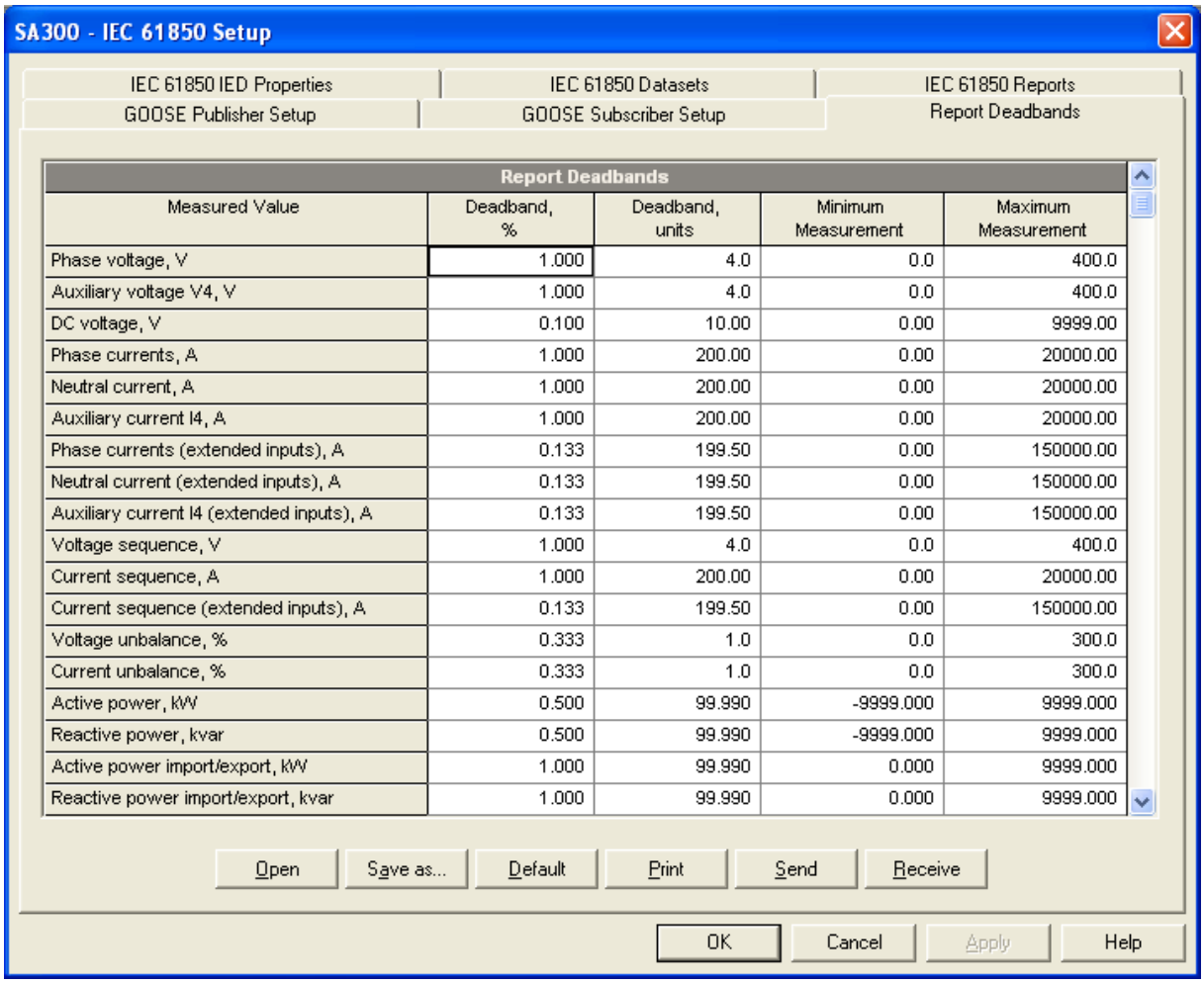
Downloading new report deadbands to the device changes deadbands for all analog data of the same type in all logical nodes, so it is recommended to do that before you make your individual deadband adjustments.

NOTE

The process measurement scales for most analog values depend on your external PT and CT settings and on the voltage and current scales defined in the device. Configure them in your device and save to the device site database before changing report deadbands. See Basic Setup and Device Options Setup in the SA300 Operation Manual on how to configure these parameters in the device. See Programming Analog Inputs in the SA300 Operation Manual on how to setup the measurement scales for analog inputs.

To configure the deadbands for measured analog values:

1. Select IEC 61850 Setup from the Meter Setup menu, and then click on the Report Deadbands tab.



Report Deadbands				
Measured Value	Deadband, %	Deadband, units	Minimum Measurement	Maximum Measurement
Phase voltage, V	1.000	4.0	0.0	400.0
Auxiliary voltage V4, V	1.000	4.0	0.0	400.0
DC voltage, V	0.100	10.00	0.00	9999.00
Phase currents, A	1.000	200.00	0.00	20000.00
Neutral current, A	1.000	200.00	0.00	20000.00
Auxiliary current I4, A	1.000	200.00	0.00	20000.00
Phase currents (extended inputs), A	0.133	199.50	0.00	150000.00
Neutral current (extended inputs), A	0.133	199.50	0.00	150000.00
Auxiliary current I4 (extended inputs), A	0.133	199.50	0.00	150000.00
Voltage sequence, V	1.000	4.0	0.0	400.0
Current sequence, A	1.000	200.00	0.00	20000.00
Current sequence (extended inputs), A	0.133	199.50	0.00	150000.00
Voltage unbalance, %	0.333	1.0	0.0	300.0
Current unbalance, %	0.333	1.0	0.0	300.0
Active power, kW	0.500	99.990	-9999.000	9999.000
Reactive power, kvar	0.500	99.990	-9999.000	9999.000
Active power import/export, kW	1.000	99.990	0.000	9999.000
Reactive power import/export, kvar	1.000	99.990	0.000	9999.000

For your convenience, PAS shows the deadbands both in percent and in engineering units, and also indicates the minimum and maximum process measurements from which the percent deadband is taken.

2. Adjust the default percent deadbands to the desired values as required for your application. The allowable range is 0.001% to 50.000%. Press Enter or click with the left mouse button elsewhere on the dialog window to update the engineering deadbands.
3. Send your setup to the device.

The following table shows the default factory-set deadbands for all measured analog values.

Measured Value	Default Deadband, %
Phase voltage	1.000
Auxiliary voltage V4	1.000
DC voltage	0.100
Phase currents	1.000
Neutral current	1.000
Auxiliary current I4	1.000
Phase currents (extended inputs)	0.133
Neutral current (extended inputs)	0.133
Auxiliary current I4 (extended inputs)	0.133
Voltage sequence	1.000
Current sequence	1.000
Current sequence (extended inputs)	0.133
Voltage unbalance	0.333
Current unbalance	0.333
Active power	0.500
Reactive power	0.500
Active power import/export	1.000
Reactive power import/export	1.000
Apparent power	1.000
Active power demand	1.000
Reactive power demand	1.000
Apparent power demand	1.000
Power factor	5.000
Power factor lag/lead	10.000
Frequency	0.100
Voltage THD	0.100
Current THD	0.500
Voltage interharmonic THD	0.100
Current interharmonic THD	0.500
Current TDD	1.000
Current K-factor	0.100
Analog input #1	1.000
Analog input #2	1.000
Analog input #3	1.000
Analog input #4	1.000
Analog input #5	1.000
Analog input #6	1.000
Analog input #7	1.000
Analog input #8	1.000
Analog input #9	1.000
Analog input #10	1.000
Analog input #11	1.000
Analog input #12	1.000
Analog input #13	1.000
Analog input #14	1.000
Analog input #15	1.000
Analog input #16	1.000

6.8 Generating a CID File

Generating a new or updating a preconfigured CID file for your device is done separately for each configuration setup. The following order is recommended but not mandatory:

- IED properties
- Datasets
- Report control blocks
- GOOSE publisher setup

To create or update a device CID file:

1. Click the "Update CID file" button on the setup tab.
2. Locate a source ICD or CID file for your device you wish to update and click Open. Use the SA300N.icd file provided with your device as a primary template file to create a new CID file, and then use the new file as a source to update remaining settings.
3. Select the folder and the name of the target CID file where to store your new configuration description and click Open. It may be the same CID file you used as the source.
4. Repeat this procedure for other configuration setups you wish to update.

NOTES

- In the event an RCB reference is used as the Report ID (the default setting for non-indexed RCBs), update the RCBs in a CID file after changing the IED name even if no changes to RCBs have been made to keep consistency with your device.
- Breaker/switch nodes prefixes are configured in a CID file as they are defined in the device database while updating the IED properties. If you change the default breaker/switch prefixes in your device via the Bay Control setup, save the setup to the device database, and then update the IED properties in a CID file even if no other properties have been changed.