GE

Grid Solutions

IEC 61850 Client (DCA) for MCP

Conformance Statement

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Contents

1. Protocol Implementation Conformance Statement (PICS) 5

1.1 GENERAL 5
1.2 ACSI Basic Conformance Statement 5
1.3 ACSI Models Conformance Statement 6
1.4 ACSI Service Conformance Statement 8

2. Model Implementation Conformance Statement (MICS) 12

2.1 Introduction 12
2.2 SUPPORTED COMMON DATA CLASSES 12
2.2.1 Common data class specifications for status information 12
2.2.2 Common data class specifications for measurement information 13
2.2.3 Common data class specifications for controls 13
2.2.4 Common data class specifications for status settings 13
2.2.5 Common data class specifications for analogue settings 14
2.2.6 Common data class specifications for description information 14
2.2.7 Common data class specifications for tracking 14

3. Protocol Implementation eXtra Information for Testing (PIXIT) 15

3.1 Introduction 15
3.2 PIXIT for Configuration 15
3.3 PIXIT for Association model 15
3.4 PIXIT for Server model 16
3.5 PIXIT for Data set model 19
3.6 PIXIT for Substitution model 21
3.7 PIXIT for Setting group control model 21
3.8 PIXIT for Reporting model 21
3.9 PIXIT for Logging model 24
3.10 PIXIT for GOOSE control block model 25
3.11 PIXIT for Control model 25
3.12 PIXIT for Time and time synchronization model 26
3.13 PIXIT for File transfer model 27
3.14 PIXIT for Service Tracking Model 28

4. TISSUES Implementation Conformance Statement (TICS) 29

4.1 Introduction 29
4.2 Mandatory Edition 2 Tissues 29

4.2.1 Part 6 Tissue List 29
4.2.2 Part 7-1 Tissue List 30
4.2.3 Part 7-2 Tissue List 30
4.2.4 Part 7-3 Tissue List 30
4.2.5 Part 7-4 Tissue List 31
4.2.6 Part 8-1 Tissue List 32

5. G500 Client ICD File 33

1. Protocol Implementation Conformance Statement (PICS)

1.1 GENERAL

The Multifunction Controller Platform (MCP) is a family of individual branded product names, with G500 being one of them.

The following ACSI conformance statements are used to provide an overview and details about G500 with firmware version 2.10:

- ACSI basic conformance statement
- ACSI models conformance statement
- ACSI service conformance statement

The tables in this document are identical to those given in IEC® 61850-7-2, except for the Value/comments column. This column shows the compliance of the MCP IEC 61850 Client to the ACSI.

1.2 ACSI Basic Conformance Statement

The basic conformance statement is defined as below:

Table 1.1: ACSI Basic Conformance Statement

		Client/ Subscriber	Server/ Publisher	Value/ Comments
DCA-server roles				
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)	–	N	
B12	**Client** side of (TWO-PARTY-APPLICATION-ASSOCIATION)	Y	–	
SCSMs supported				
B21	**SCSM**: IEC 61850-8-1 used	Y		
B22	**SCSM**: IEC 61850-9-1 used	–		**Deprecated in Ed2**
B23	**SCSM**: IEC 61850-9-2 used	N		
B24	**SCSM**: other	N		

		Client/ Subscriber	Server/ Publisher	Value/ Comments
Generic substation event model (GSE)				
B31	**Publisher** side	–		
B32	**Subscriber** side	N	–	
Transmission of sampled value model (SVC)				
B41	**Publisher** side	–		
B42	**Subscriber** side	N	–	
– = Not Applicable Y = Supported N or Empty = Not Supported				

1.3 ACSI Models Conformance Statement

The ACSI models conformance statement shall be as defined below:

Table 1.2: ACSI Models Conformance Statement

		Client/ Subscriber	Server/ Publisher	Value/ Comments
If Server side (B11) or DCA side (B12) supported				
M1	**Logical device**	Y		
M2	**Logical node**	Y		
M3	**Data**	Y		
M4	**Data set**	Y		
M5	**Substitution**			
M6	**Setting group control**			
Reporting				
M7	**Buffered report control**	Y		
M7-1	sequence-number	Y		
M7-2	report-time-stamp	Y		
M7-3	reason-for-inclusion	Y		
M7-4	data-set-name	Y		
M7-5	data-reference	Y		
M7-6	buffer-overflow	Y		

		Client/ Subscriber	Server/ Publisher	Value/ Comments
M7-7	entryID	Y		
M7-8	BufTm	Y		
M7-9	IntgPd	Y		
M7-10	GI	Y		
M7-11	conf-revision	N		
M8	**Unbuffered report control**	Y		
M8-1	sequence-number	Y		
M8-2	report-time-stamp	Y		
M8-3	reason-for-inclusion	Y		
M8-4	data-set-name	Y		
M8-5	data-reference	Y		
M8-6	BufTm	Y		
M8-7	IntgPd	Y		
M8-8	GI	Y		
M8-9	conf-revision	N		
	Logging			
M9	**Log control**			
M9-1	IntgPd			
M10	**Log**			
M11	**Control**	Y		
M17	**File Transfer**	Y		
M18	**Application association**	Y		
M19	**GOOSE Control Block**			
M20	**Sample Value Control Block**			
If GSE (B31/B32) is supported				
M12	**GOOSE**			
M13	**GSSE**			**Deprecated in Ed2**
If SVC (B41/B42) is supported				
M14	Multicast SVC			

		Client/ Subscriber	Server/ Publisher	Value/ Comments
M15	Unicast SVC			
For all IEDs				
M16	**Time**	Y		
Y = Service is Supported N or Empty = Service is Not Supported				

1.4 ACSI Service Conformance Statement

The ACSI service conformance statement shall be as defined below:

Table 1.3: ACSI Services Conformance Statement

	Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Value / Comments
Server (Clause 7)					
S1	GetServerDirectory (LOGICAL-DEVICE)	TP			
Application association (Clause 8)					
S2	Associate	TP	Y		
S3	Abort	TP			
S4	Release	TP	Y		
Logical device (Clause 9)					
S5	GetLogicalDeviceDirectory	TP			
Logical node (Clause 10)					
S6	GetLogicalNodeDirectory	TP			
S7	GetAllDataValues	TP			
Data (Clause 11)					
S8	GetDataValues	TP	Y		
S9	SetDataValues	TP	Y		
S10	GetDataDirectory	TP			
S11	GetDataDefinition	TP	Y		
Data set (Clause 12)					
S12	GetDataSetValues	TP	Y		
S13	SetDataSetValues	TP			

	Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Value / Comments
S14	CreateDataSet	TP	Y		
S15	DeleteDataSet	TP	Y		
S16	GetDataSetDirectory	TP	Y		
Substitution					
S17	SetDataValues	TP			
Setting group control (Clause 16)					
S18	SelectActiveSG	TP			
S19	SelectEditSG	TP			
S20	SetSGValues	TP			
S21	ConfirmEditSGValues	TP			
S22	GetSGValues	TP			
S23	GetSGCBValues	TP			
Reporting (Clause 17)					
Buffered report control block (BRCB)					
S24	Report	TP	Y		
S24-1	data-change (dchg)		Y		
S24-2	qchg-change (qchg)		Y		
S24-3	data-update (dupd)		Y		
S25	GetBRCBValues	TP	Y		
S26	SetBRCBValues	TP	Y		
Unbuffered report control block (URCB)					
S27	Report	TP	Y		
S27-1	data-change (dchg)		Y		
S27-2	qchg-change (qchg)		Y		
S27-3	data-update (dupd)		Y		
S28	GetURCBValues	TP	Y		
S29	SetURCBValues	TP	Y		
Logging (Clause 17)					
Log control block					
S30	GetLCBValues	TP			

	Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Value / Comments
S31	SetLCBValues	TP			
Log					
S32	QueryLogByTime	TP			
S33	QueryLogAfter	TP			
S34	GetLogStatusValues	TP			
Generic substation event model (GSE) (14.3.5.3.4)					
GOOSE-CONTROL-BLOCK					
S35	SendGOOSEMessage	MC			
S36	GetGoReference	TP			
S37	GetGOOSEElementNumber	TP			
S38	GetGoCBValues	TP			
S39	SetGoCBValues	TP			
GSSE-CONTROL-BLOCK					
S40	SendGSSEMessage	MC			**Deprecated in Ed2**
S41	GetGsReference	TP			**Deprecated in Ed2**
S42	GetGSSEElementNumber	TP			**Deprecated in Ed2**
S43	GetGsCBValues	TP			**Deprecated in Ed2**
S44	SetGsCBValues	TP			**Deprecated in Ed2**
Transmission of sampled value model (SVC) (Clause 19)					
Multicast SVC					
S45	SendMSVMessage	MC			
S46	GetMSVCBValues	TP			
S47	SetMSVCBValues	TP			
Unicast SVC					
S48	SendUSVMessage	TP			
S49	GetUSVCBValues	TP			
S50	SetUSVCBValues	TP			
Control (Clause 20)					
S51	Select		Y		
S52	SelectWithValue	TP	Y		

	Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Value / Comments
S53	Cancel	TP			
S54	Operate	TP	Y		
S55	Command-Termination	TP	Y		
S56	TimeActivated-Operate	TP			
File transfer (Clause 23)					
S57	GetFile	TP	Y		
S58	SetFile	TP			
S59	DeleteFile	TP			
S60	GetFileAttributeValues	TP			
S61	GetServerDirectory (FILE-SYSTEM)	TP	Y		
Time (5.5)					
T1	Time resolution of internal clock			10	Nearest negative power of 2 in seconds
T2	Time accuracy of internal clock			T0: SNTP	T0
					T1
					T2
				T1: IRIG-B PTP	T3
					T4
					T5
T3	Supported TimeStamp resolution			10	Nearest negative power of 2 in seconds
Y = Service is Supported N or Empty = Service is Not Supported					

2. Model Implementation Conformance Statement (MICS)

2.1 Introduction

This model implementation conformance statement is applicable for the IEC 61850 client interface in G500 Firmware Version 2.10. This MICS document specifies the supported Common Data Classes for IEC 61850 Edition 1 and Edition 2.

Note: MICS template taken from 1p0p1_rev1, which is current latest released document.

Note: When a CDC is supported it is assumed that all mandatory and optional attributes are supported. All exceptions should be mentioned in the comment column.

Note:

In general, the FC=CO/MX/SP/ST are supported. Other FC are not supported by client configuration tool.

In general, the timestamp and quality are not shown in the configuration tool but are shown in the HMI. The values will be updated accordingly if they are reported in the FCD.

2.2 SUPPORTED COMMON DATA CLASSES

2.2.1 Common data class specifications for status information

CDC	Ed	Description	Supported	Comment
SPS	1,2	Single point status	Y	
DPS	1,2	Double point status	Y	
INS	1,2	Integer status	Y	
ENS	1,2	Enumerated status	Y	
ACT	1,2	Protection activation information	Y	
ACD	1,2	Directional protection activation information	Y	
SEC	1,2	Security violation counting	Y	Addr/addInfo is not supported
BCR	1,2	Binary counter reading	Y	
HST	1,2	Histogram	N	
VSS	1,2	Visible string status	N	
Notes:				

2.2.2 Common data class specifications for measurement information

CDC	Ed	Description	Supported	Comment
MV	1,2	Measured value	Y	
CMV	1,2	Complex measured value	Y	
SAV	1,2	Sampled value	N	
WYE	1,2	Phase to ground/neutral related measured values of a three-phase system	Y	
DEL	1,2	Phase to phase related measured values of a three-phase system	Y	
SEQ	1,2	Sequence	Y	
HMV	1,2	Harmonic value	N	
HWYE	1,2	Harmonic value for WYE	N	
HDEL	1,2	Harmonic value for DEL	N	
Notes:				

NOTE: It is assumed that when a CDC is supported, all supported control models as specified in the PIXIT are supported. Please specify exceptions in the comment's column.

2.2.3 Common data class specifications for controls

CDC	Ed	Description	Supported	Comment
SPC	1,2	Controllable single point	Y	
DPC	1,2	Controllable double point	Y	
INC	1,2	Controllable integer status	Y	
ENC	1,2	Controllable enumerated status	Y	
BSC	1,2	Binary controlled step position information	Y	Control value 00 is not supported.
ISC	1,2	Integer controlled step position information	Y	
APC	1,2	Controllable analogue process value	Y	Only DOns is supported.
BAC	1,2	Binary controlled analog process value	N	
Notes:				

2.2.4 Common data class specifications for status settings

CDC	Ed	Description	Supported	Comment
SPG	1,2	Single point setting	N	
ING	1,2	Integer status setting	N	
ENG	1,2	Enumerated status setting	N	
ORG	1,2	Object reference setting	N	
TSG	1,2	Time setting group	N	
CUG	2	Currency setting group	N	
VSG	2	Visible string setting	N	
Notes:				

2.2.5 Common data class specifications for analogue settings

CDC	Ed	Description	Supported	Comment
ASG	1,2	Analogue setting	N	
CURVE	1,2	Setting curve	N	
CSG	1,2	Curve shape setting	N	
Notes:				

2.2.6 Common data class specifications for description information

CDC	Ed	Description	Supported	Comment
DPL	1,2	Device name plate	N	
LPL	1,2	Logical node name plate	N	
CSD	1,2	Curve shape description	N	
Notes:				

2.2.7 Common data class specifications for tracking

CDC	Ed	Description	Supported	Comment
CST	2	Common service tracking	N	
BTS	2	Buffered report tracking service	N	
CTS	2	Control tracking service	N	
GTS	2	GOOSE Control block tracking service	N	
LTS	2	Log control block tracking service	N	
MTS	2	MSVCB tracking service	N	
NTS	2	USVCB control block tracking service	N	
OTS	2	Log tracking service	N	
STS	2	SGCB tracking service	N	
UTS	2	Unbuffered report tracking service	N	
Notes:				

Supported:

Y = Client can issue an ASCI service on this CDC and process the data from/to the CDC

N = Client can't issue an ASCI service on this CDC and doesn't process the data from/to the CDC

3. Protocol Implementation eXtra Information for Testing (PIXIT)

3.1 Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in the client system: "<G500>" with version "<2.10>", further referred to as "client".

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10.

The following chapters specify the PIXIT for each applicable ACSI service model as structured in IEC 61850-10 and the "Conformance Test Procedures for Client System with IEC 61850-8-1 interface".

3.2 PIXIT for Configuration

ID	Ed	Description	Value / Clarification
Cf1	1,2	Describe how the client handles nameplate configuration revision mismatches	Not Supported
Cf2	1,2	Describe how the client handles report control block configuration revision mismatches	Not Supported

3.3 PIXIT for Association model

ID	Ed	Description	Value / Clarification
As1	1,2	Guaranteed number of servers that can set-up an association simultaneously (one association per server)	500 (for Model G500-B - 4 core APU, 16 GB RAM) 250 (for Model G500-A - 2 core APU, 8 GB RAM)
As2	1,2	Lost connection detection time range (default range of TCP_KEEPALIVE is 1 – 20 seconds)	7200 seconds
As3	1,2	Describe the behavior when association fails	Retry after configured no of Seconds. Default time is 30 seconds. But user can configure using config tool.
As4	3	Is authentication supported?	N
As5	1,2	What is the maximum and minimum MMS PDU size?	Max MMS PDU size: It is a configuration parameter. Default is 32 KB Range: 64 to 262144

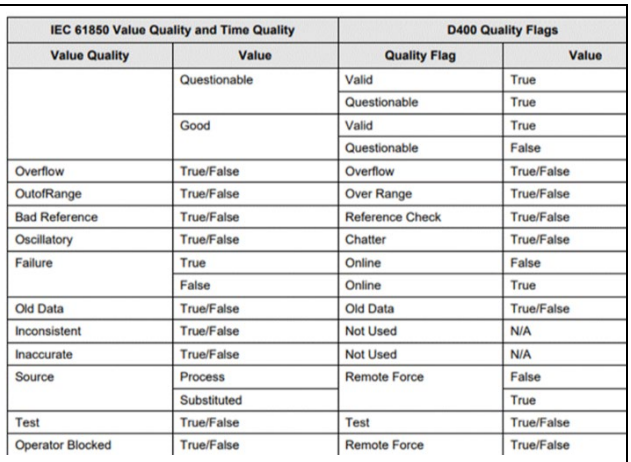
As6	1,2	What is the typical startup time after a power supply interrupt?	Time from power on to initialization complete is 2-3 minutes.
As7	1,2	How does the client disconnect from the server?	Release is supported. Restart of device or device's enable/disable option in HMI
		<Additional information>	After device startup, the device database points will initially be Invalid and Offline; Analog and Accumulator points will have zero value, and Digital Inputs will be OFF. Once association is established with the IED, the points will reflect the quality and value reported by the IED and Digital Outputs and Analog Outputs will be Online. Note that the device doesn't persist the point database so after restart, the points will again revert as indicated above: "After device startup".

3.4 PIXIT for Server model

ID	Ed	Description	Value / Clarification	
Sr1	1,2	Maximum object identification length.	ED2: 129 octets (64/64). ED1: 96 octets (32/64).	
Sr2	1,2	Does client support auto description?	Not supported	
Sr3	1,2	Describe how to view data values.	Data values can be viewed using Device Local HMI or Remote HMI	
Sr4	1,2	What analogue value (MX) quality bits are used in the client?	Y	Good,
			Y	Invalid,
			Y	Reserved,
			Y	Questionable
			Y	Overflow
			Y	OutofRange
			Y	BadReference
			Y	Oscillatory
			Y	Failure
			Y	OldData
			N	Inconsistent
			N	Inaccurate
			Y	Process
			Y	Substituted
			Y	Test
			Y	OperatorBlocked
Sr5	1,2	Which status value (ST) quality bits are used in the client?	Y	Good,
			Y	Invalid,
			Y	Reserved,
			Y	Questionable
			Y	BadReference
			Y	Oscillatory

			Y	Failure
			Y	OldData
			N	Inconsistent
			N	Inaccurate
			Y	Process
			Y	Substituted
			Y	Test
			Y	OperatorBlocked
Sr6	1,2	Describe how to view/display quality values	Quality Values can be viewed using the HMI except test flag. Use shmsingle command line tool for viewing test flag.	
Sr7	1,2	Describe how to force a SetDataValues request	The SetDataValues request is only sent in the client's control sequence and is only applicable to PulseConfig (always) and Persistent (if present). Enable the CF parameter write option in the Loader (Config tool), issue a control to IED from Local HMI and user shall see PulseConfig attributes in a SetDataValues request, and Persistent attribute in another SetDataValues request is Persistent is present.	
Sr8	1,2	Describe how to force a GetDataValues request	There are two ways to force the client to send GetDataValues request: 1: During the control sequence In the control sequence, before sending control requests (DOns, SBOns, DOes, SBOes), the client sends GetDataValues request to get the ctlModel/sboClass of this DO. 2. Via Polling a "virtual dataset" From the configuration tool, user can configure datasets which do not exist in the imported SCL file and configure these datasets into polling mode with time interval configurable. When this configuration file becomes active and the IED does not support dynamic dataset, the client sends GetDataValues request to get the data value in the "virtual datasets" in the configured interval. In HMI, user can use pseudo point "Point Details -> Digital Output -> Retrieve All Data Sets" to force the client sends GetDataValues to all the data in all the "virtual datasets" immediately.	
Sr9	1,2	Describe how to force a GetAllDataValues request	Not Supported	

Sr10	1,2	Does the client support writing blkEna values?	N
Sr11	1,2	Describe how the client behaves in case of: - GetDataDefinition response- - GetDataDefinition response+ with more or less attributes as expected - GetLogicalDeviceDirectory response- - GetAllDataValues response- - GetAllDataValues response+ with more or less attributes as expected - GetDataValues response- - GetDataValues response+ with more or less attributes as expected - SetDataValues response-	GetLogicalDeviceDirectory/ GetAllDataValues are not supported. GetDataDefinition response-: The data attribute/attributes will be shown as offline in HMI if the data is absent. If GetDataDefinition response- during the control sequence, the control process may be stopped. GetDataValues response-: When the client receives GetDataValues response- for a specific data, it sets the data point offline on the HMI if it is absent. If GetDataValues response- during the control sequence, the control process may be stopped. SetDataValues response- The client ignores the SetDataValues response-. In general, if the client can not find the data online, the data will be marked as offline in HMI. For extra attributes, the client does not process it. The HMI only shows the pre-configured data attributes.
Sr12	1,2	Which time quality attributes from the server are used in the client?	N Leap Second Known, N ClockFailure Y Clock not synchronized N Accuracy
Sr13	1,2	Describe how to view time quality attributes	Use shmsingle command line tool. When Clock not synchronized is detected, the TIME INVALID bit in the data quality is set in HMI.
		Additional Information: Mapping between G500 Quality Flags and the IEC 61850 Quality Value.	Note that the Quality Flags displayed in HMI are not only used for IEC 61850 protocol but also used for other protocols. The mapping between G500 Quality Flags and IEC 61850 Quality Value is as shown as below:

			 For the "test" flag, user needs to use shmsingle command line tool to view it as it is not shown in HMI.

IEC 61850 Value Quality and Time Quality		D400 Quality Flags	
Value Quality	**Value**	**Quality Flag**	**Value**
	Questionable	Valid	True
		Questionable	True
	Good	Valid	True
		Questionable	False
Overflow	True/False	Overflow	True/False
OutofRange	True/False	Over Range	True/False
Bad Reference	True/False	Reference Check	True/False
Oscillatory	True/False	Chatter	True/False
Failure	True	Online	False
	False	Online	True
Old Data	True/False	Old Data	True/False
Inconsistent	True/False	Not Used	N/A
Inaccurate	True/False	Not Used	N/A
Source	Process	Remote Force	False
	Substituted		True
Test	True/False	Test	True/False
Operator Blocked	True/False	Remote Force	True/False

3.5 PIXIT for Data set model

ID	Ed	Description	Value / Clarification
Ds1	1,2	Describe how to force a GetDataSetValues request	When a dataset in the imported SCL file is configured into Polling mode, the client sends GetDataSetValues request to the IED in configured polling interval. In HMI, user can use pseudo point "Point Details -> Digital Output -> Retrieve All Data Sets" to force the client sends GetDataSetValues to all the datasets in the IEDs.
Ds2	1,2	Describe how to force a SetDataSetValues request	Not Supported
Ds3	1,2	Describe how to force a DeleteDataSet request	If the IED has a mismatched dataset, then the client will try to delete the dataset and then create a dynamic dataset.
Ds4	1,2	Describe how the client handles following dataset mismatches between the SCL and the data sets exposed via MMS: (1) new dataset element (2) missing dataset element (3) Reordered dataset members in a dataset of a different data type (4) Reordered dataset members in a dataset of the same data type	If the dataset is configured into polling mode, the client will work as normal to send GetDatasetDirectory, GetDataDefinition for each dataset entry, and then poll the dataset in polling interval. The client will try to delete the dataset and then create a dynamic dataset. In case the IED does not support dynamic dataset: (1) The client does not process the new dataset element (2) If the data is not reported anywhere else, the client will mark the data point the missing dataset element offline and invalid (3) The client processes it as normal (4) The client processes it as normal

Ds5	1,2	Describe how the client behaves in case of: - GetLogicalNodeDirectory(DATA-SET) response- - GetDataSetDirectory response- - GetDataSetValues response- - SetDataSetValues response-	GetLogicalNodeDirectory is not supported. GetDataSetDirectory Response-: If the IED supports dynamic dataset, the client will try to create a dynamic dataset, otherwise the device logs a message in its diagnostic log window and marks the data points as offline and invalid if it can not get them from other reports or datasets. GetDataSetValues response-: If the IED supports dynamic dataset, the client will try to create a dynamic dataset, otherwise if the client's process can reach this stage, the client marks the missing data offline and invalid. SetDataSetValues response- : The client continues as normal.
Ds6	1,2	Maximum name length for dataset Maximum name length for dataset member, including LD and FC	ED2: <64/16$32> <64/61+3> ED1: <32/11$32> <32/61+3>
Ds11	1,2	Describe how to force a CreateDataSet request - non-persistent - persistent	CreateDataSet request will be issued automatically by the client if the user configured dynamic dataset is not created in the IED. CreateDataSet request will be issued automatically by the client if it detects any mismatch between configured dataset using SCL file and IED supported Dataset through MMS requests if the server supports dynamic datasets. The new dataset shall always be persistent. non-persistent is not supported by the client.
Ds12	1,2	Describe how to force a DeleteDataSet request - non-persistent - persistent	DeleteDataSet request will be issued automatically by the client if it detects any mismatch between configured dataset using SCL file and IED supported Dataset through MMS requests. The new dataset shall always be persistent. non-persistent is not supported by client.
Ds13	1,2	Describe how the client behaves in case of: - CreateDataSet response- - DeleteDataSet response-	Device logs the message in its diagnostic log and GetDataValues request will be sent provided the DataSet is configured into polling mode.

3.6 PIXIT for Substitution model

ID	Ed	Description	Value / Clarification
Sub1	1,2	Describe how to substitute a value	Not Supported

3.7 PIXIT for Setting group control model

ID	Ed	Description	Value / Clarification
Sg1	1,2	How can the client be forced to send a GetLogicalNodeDirectory(SGCB) request?	Not Supported
Sg2	1,2	Describe how to change the active setting group	Not Supported
Sg3	1,2	Describe how to get the actual setting group values	Not Supported
Sg4	1,2	Describe how to edit setting group values	Not Supported
Sg5	1,2	Describe how the client behaves in case of: - GetSGCBValues response- - SelectEditSG response- - SetEditSGValue response- - SelectActiveSG response- - ConfirmEditSGValues response- - The configured SG differs from the actual setting group	Not Supported
Sg6		Does the client read the optional ResvTms value?	Not supported

3.8 PIXIT for Reporting model

ID	Ed	Description	Value / Clarification
Rp1	1,2	Does the client search for RCB in all logical nodes? If not, specify the logical nodes	No Client does not search for RCB. It directly accesses the pre-configured RCB's
Rp2	1,2	Which dynamic RCB attributes are/can be configured by the client?	RptID Y DataSet Y Optional fields Y Trigger conditions Y Buffer time Y Integrity period Y
Rp3	1,2	Does the client support IED's with indexed and non-indexed report control blocks (RCB)?	BRCB indexed Y BRCB not indexed Y URCB indexed Y UCB not indexed Y
Rp4	1,2	The supported trigger conditions are	integrity Y data change Y quality change Y data update Y general interrogation Y

Rp5	1,2	The minimum required optional fields are	sequence-number N report-time-stamp Y reason-for-inclusion Y data-set-name N data-reference N buffer-overflow Y entryID Y confRev N Client writes only the above optional fields to during the enabling of RCB process and this behavior is fixed.
Rp6	1,2	Does the client support segmented reports?	Y
Rp7	1	Does the client support pre-assigned RCB?	N Client directly accesses the pre-configured RCB's
Rp8	1,2	Does the client support reported data set containing structured data objects or data attributes?	reporting of data objects Y reporting of data attributes Y (quality is not supported)
Rp9	1,2	Describe how the client does respond when a previously used URCB is reserved by another client for: • Indexed URCB with max>1 configured in SCL (static reporting) • Indexed URCB with max=1 configured in SCL (static reporting) • URCB not configured in SCL (dynamic Reporting)	Client works on pre-defined configuration. Client will continue to try and enable the previously know URCB.
Rp10	1,2	Describe how the client does respond when a previously used BRCB is reserved by another client for: • Indexed BRCB with max>1 configured in SCL (static reporting) • Indexed BRCB with max=1 configured in SCL (static reporting) • BRCB not configured in SCL (dynamic Reporting)	Client will continue to retry until BRCB is available.
Rp11	1,2	Describe how the client does respond on a SetBRCBValues(EntryID) respond-	No special processing. Client will always issue a write to the GI during RCB initialization.

Rp12	1,2	Describe how the client does respond when a report has an unknown: dataset, RptID, unexpected number of dataset entries, and/or unexpected data type format entries	The client will accept any report that has a matching RptID/dataset name and will process all expected dataset entries. It will ignore unexpected dataset entries.
Rp13	1,2	Describe how the client detects reporting configuration changes (mismatches). Does it check the "configuration revision" attributes and/or does it check the dataset members? Is the dataset update done online or offline?	Check ConfRev N Check dataset members Y Dataset update online or offline: **Online** If device supports deleting and creating of a dataset, update of dataset elements is Online else Offline.
Rp14	1,2	Describe how to force the client to change the RCB buffer time	Client will automatically write the RCB buffer time on startup based on the configuration.
Rp15	1,2	Does client set server TrgOps.GI prior to first issuance of GI command?	Y TrgOps.GI will always set by client.
Rp16	1,2	Describe how to force the client to send the GI request	In HMI, user can use pseudo point "Point Details -> Digital Output -> Retrieve All Data Sets" to force the client to send a GI to all configured RCBs.
Rp17	1,2	Describe how to force the client to enable a RCB	It is done automatically based on the configuration.
Rp18	1,2	Describe how the client does respond when a report control block is renamed or deleted - Does it prevent reading the deleted RCB - If it reads the missing RCB, how does it handle the GetURCBValues or GetBRCBValues response-	Device will read the missing RCB and log an error message in the diagnostic log.
Rp19	1,2	Describe how the client behaves in case of: - SetURCBValues response- - Unsupported optional fields - Unsupported trigger condition(s)	The client will continue to try to read/enable the RCB. The client will write the optional fields and trigger conditions as part of its initialization procedure. Client supports all the trigger conditions.
Rp20	1,2	Describe how the client behaves in case of: - Buffer overflow	The client sets the Reporting Buffer Overflow DI pseudo point, which can be viewed in the HMI.

			The client send GI request in the Buffered RCB after it finds buffer overflow. The new GI report will not have overflow and the Reporting Buffer Overflow DI pseudo point will be reset shortly.
Rp21	1,2	Describe how to force the client to send SetBRCBValues request for - EntryID - PurgeBuf	After the client has received at least one report, restart the device and it will write the EntryID received from the last report as part of initialization of the remote server. The client will never send a PurgeBuf.
Rp22	1,2	Does the client support writing resvTms?	Y The client always writes the value 1
Rp23	1,2	Does the client support reading owner?	N
Rp24	2	Does the device function only as test equipment?	N

3.9 PIXIT for Logging model

ID	Ed	Description	Value / Clarification
Lg1	1,2	Does the client search for LCB in all logical nodes? when not specify the logical nodes	Not Supported
Lg2	1,2	Describe how to change LCB attributes	Not Supported
Lg3	1,2	Describe how to force the client to enable a LCB	Not Supported
Lg4	1	Does the client support sending QueryLogByTime and/or QueryLogAfter?	Not Supported
Lg5	2	Describe how to force the client to change GLOG settings	Not Supported
Lg6	1,2	Describe how the client behaves in case of: - Renamed LCB - Removed LCB - Renamed Logical Device - Renamed LOG	Not Supported
Lg7	1,2	Describe how the client behaves in case of: - GetLCBValues response- - GetLogStatusValues response- - SetLCBValues response-	Not Supported

3.10 PIXIT for GOOSE control block model

ID	Ed	Description	Value / Clarification
		<additional items>	Not supported

3.11 PIXIT for Control model

ID	Ed	Description	Value / Clarification
Ctl1	1,2	What control modes are supported?	Y status-only Y direct-with-normal-security Y sbo-with-normal-security Y direct-with-enhanced-security Y sbo-with-enhanced-security *For APC, only DOns is supported
Ctl2	1,2	Is Time activated operate (operTm) supported?	N
Ctl3	1,2	Is "operate-many" supported?	Y
Ctl4	1,2	Can the client set the test flag?	Y Pseudo point in HMI "HMI -> Point Details -> Digital Output -> Enable Test Flag in Controls" can be used to set the test flag ON in control.
Ctl5	1,2	What check conditions can be set?	Y synchrocheck Y interlock-check This shall be set during the configuration time in the "Loader -> Map points -> Adjust Parameters -> Digital Output or Analog Output -> Check". The available values are Interlock, Syn, None or Both.
Ctl6	1,2	Which originator categories are supported and what is the originator identification?	Orcat **Station control, Remote control,** and **Automatic Station Control** are supported OrIdent is always **G500**
Ctl7	1,2	Describe if and how the client sets/increments the ctlNum	It is incremented automatically each time a new sequence control is done
Ctl8	1,2	What does the client when it receives a LastApplicationError and describe how to view the additional cause?	It displays the AddCause on its HMI page of "Point Details -> Analog Input"
Ctl9	1,2	What does the client when its receives a Select, SelectWithValue or Operate respond negative?	It displays "Problem issuing command" window when it receives a negative response. The AddCause information can be

			viewed on its HMI page of "Point Details -> Analog Input". If the control is not successful but no LastApplicationError, the AddCause will be shown as -255.
Ctl10	1,2	Can the client change the control model via online services?	No
Ctl11	1	What does the client when the ctlModel is not initialized in the SCL?	It retrieves the ctlModel from the IED and issues control accordingly. If it can not find the ctlModel, the control sequence will be stopped and "Problem issuing command" will be shown in HMI.
Ctl12	1,2	What does the client when the ctlModel in SCD and in SERVER SIMULATOR is different?	It retrieves the ctlModel from the IED and issues control accordingly.
Ctl13	1,2	Describe how to view a - CommandTermination request+ - CommandTermination request- - TimeActivatedOperateTermination request+ and request-	Command Termination request positive and negative responses will be logged by the device in its log file. The AddCause of the CommandTermination will be displayed in the HMI.

3.12 PIXIT for Time and time synchronization model

ID	Ed	Description	Value / Clarification
Tm1	1,2	Describe how to view the internal time & quality or how to expose the timestamp and timestamp quality via the IEC 61850 interface	View the timestamp and timestamp quality in a SelectWithValue or Operate request from the client.
Tm2	1,2	What time quality bits are supported?	Y LeapSecondsKnown (Ed2) N LeapSecondsKnown (Ed1) N ClockFailure Y ClockNotSynchronized (Ed2) N ClockNotSynchronized (Ed1)
Tm3	1,2	What is the behavior when the time synchronization signal/messages are lost?	No change in behavior. The ClockNotSynchronized quality bit in the SelectWithValue or Operate request from the client will be set.
Tm4	1,2	When is the quality bit "Clock failure" set?	Not Supported

Tm5	1	When is the quality bit "Clock not synchronized" set?	15 minutes
		Extra information	It may take up to 30 minutes for the device to synchronize and update the time.

3.13 PIXIT for File transfer model

ID	Ed	Description	Value / Clarification
Ft1	1,2	Describe when or how to force the client to request GetServerDirectory(FILE) and what it does with the responded filenames	The test configuration includes the ARRM application configured to retrieve files from a simulated IED defined in the test gateway IID file using the RDRE logical node and the RcdMade DI point. The ARRM application will automatically request the IEC 61850 client to retrieve new files whenever the RcdMade DI toggles. Toggle the RcdMade DI on the server simulator. The device will issue the request and then retrieve new files that were not retrieved since the last RcdMade DI change.
Ft2	1,2	Does the client uses a wildcard in the GetServerDirectory(FILE) request?	Y, wildcard = "*"
Ft3	1,2	Does the client support IED's that include the path in the file name in the GetServerDirectory(FILE) respond?	N path included Y path not included
Ft4	1,2	Does the client support IED's that use the file separator?	Y "/" N "\"
Ft5	1,2	What is the maximum file name size including path?	160
Ft6	1,2	Can the client read a file with size 0?	Y
Ft7	1,2	Are directory/file names case sensitive?	Case sensitive
Ft8	1,2	Maximum file size	100M
Ft9	1,2	Describe how the client behaves in case of: - GetFile response- - GetFileAttributes response- - SetFile response-	Device will log a message in the device diagnostic log and abort the file transfer. SetFile is not supported.

3.14 PIXIT for Service Tracking Model

ID	Ed	Description	Value / Clarification
Tr1	2	Which tracking services are supported by the client: - BrcbTrk - UrcbTrk - LocbTrk - GocbTrk - MsvcbTrk - UsvcbTrk - SgcbTrk - SpcTrk - DpcTrk - IncTrk - EncTrk - ApcFTrk - ApcIntTrk - BscTrk - IscTrk - BacTrk - GenTrk	 N N N N N N N N N N N N N N N N N N
Tr2	2	Describe how to view the tracking objects or their attributes	Not supported

4. TISSUES Implementation Conformance Statement (TICS)

4.1 Introduction

This tissue implementation conformance statement is applicable for the IEC 61850 client interface in G500 Firmware Version 2.10. According to the UCA IUG QAP the Tissue conformance statement is required to perform a conformance test and is referenced on the certificate.

4.2 Mandatory Edition 2 Tissues

Below tables give an overview of the applicable mandatory Tissues.

"Supported by client":

"**Y**": means that the client supports servers that have implemented the respective tissue.

"**ni**": No impact on testing

"**na**": not applicable if the client does not support the corresponding ACSI service(s)

4.2.1 Part 6 Tissue List

Part 6 Tissue	Description	Supported by client
658	Tracking related features	na
663	FCDA element cannot be a "functionally constrained logical node"	Y
668	Autotransformer modeling	na
719	ConfDataSet - maxAttributes definition is confusing	Y
721	Log element name	na
768	bType VisString65 is missing	Y
779	object references	Y
788	SICS S56 from optional to mandatory	na
789	ConfLdName as services applies to both server and client (supportsLdname)	na
804	valKind and IED versus System configuration (valimport)	Y
806	Max length of log name inconsistent between -6 and -7-2	ni
807	Need a way to indicate if "Owner" present in RCB	Y
822	Extension of IED capabilities	Y
823	ValKind for structured data attributes	Y
824	Short addresses on structured data attributes	Y
825	Floating point value	Y
845	SGCB ResvTms	na

853	SBO and ProtNs	Y
855	Recursive SubFunction	na
856	VoltageLevel frequency and phases	ni
857	Function/SubFunction for ConductingEquipment	na
886	Missing 8-1 P-types	na
901	tServices as AP or as IED element	Y
936	SupSubscription parameter usage is difficult	na
1175	IPv6 address lowercase only	na

4.2.2 Part 7-1 Tissue List

Part 7-1 Tissue	Description	Supported by client
828	Data model namespace revision IEC 61850-7-4:2007[A]	Y
1151	simulated GOOSE disappears after 1st appearance when LPHD.Sim = TRUE	na
1196	Extensions to standardized LN classes made by third parties Note: this tissue is not final yet	na

4.2.3 Part 7-2 Tissue List

Part 7-2 Tissue	Description	Supported by client
778	AddCause values – add value not-supported	Y
780	What are unsupported trigger option at a control block?	Y
783	TimOper Resp- ; add Authorization check	na
786	AddCause values 26 and 27 are switched	Y
820	Mandatory ACSI services (use for PICS template)	Y
858	typo in enumeration ServiceType	ni
861	dchg of ConfRev attribute	na
876	GenLogiclNodeClass and SGCB, GoCB, MsvCB, UsvCB	ni
1038	Loss of Info Detection After Resynch	Y
1062	Entrytime not used in CDC	ni
1071	Length of DO name	ni
1091	The sentence "The initial value of EditSG shall be 0", has to be stated in part 7.2 not in 8.1	na
1127	Missing owner attribute in BTS and UTS	na
1163	Old report in URCB	ni
1202	GI not optional	ni

4.2.4 Part 7-3 Tissue List

Part 7-3 Tissue	Description	Supported by client
697	persistent command / PulseConfig	Y
698	Wrong case is BAC.dB attribute	na
722	Units for 'h' and 'min' not in UnitKind enumeration.	ni
919	Presence Condition for sVC	ni
925	Presence of i or f attribute - Problem with writing	Y
926	Presence Conditions within RangeConfig	na

4.2.5 Part 7-4 Tissue List

Part 7-4 Tissue	Description	Supported by client
671	mistake in definition of Mod & Beh	Y
674	CDC of ZRRC.LocSta is wrong	na
675	SIML LN	ni
676	Same data object name used with different CDC	na
677	MotStr is used with different CDC in PMMS and SOPM LN classes	na
679	Remove CycTrMod Enum	na
680	SI unit for MHYD.Cndct	ni
681	Enum PIDAlg	ni
682	ANCR.ParColMod	ni
683	Enum QVVR.IntrDetMth	ni
685	Enum ParTraMod	ni
686	New annex H - enums types in XML	Y
694	Data object CmdBlk	ni
696	LSVS.St (Status of subscription)	ni
712	interpretation of quality operatorBlocked	Y
713	DO Naming of time constants in FFIL	na
724	ANCR.Auto	na
725	Loc in LN A-group	Y
734	LLN0.OpTmh vs. LPHD.OpTmh	na
735	ISAF.Alm and ISAF.AlmReset	na
736	PFSign	na
742	GAPC.Str, GAPC.Op and GAPC.StrVal	Y
743	CCGR.PmpCtl and CCGR.FanCtl	na
744	LN STMP, EEHealth and EEName	na
772	LPHD.PwrUp/PwrDn shall be transient	Y
773	Loc, LocKey and LocSta YPSH and YLTC	Y
774	ITCI.LocKey	na
775	KVLV.ClsLim and OpnLim	ni
776	LPHD.OutOv/InOv and LCCH.OutOv/InOv	ni
800	Misspelling in CSYN	na
802	CCGR and Harmonized control authority	na
808	Presence condition of ZMOT.DExt and new DOs	na
831	Setting of ConfRevNum in LGOS	na
838	Testing in Beh=Blocked	Y
844	MFLK.PhPiMax, MFLK.PhPiLoFil, MFLK.PhPiRoot DEL->WYE	na
849	Presence conditions re-assessing in case of derived statistical calculation	na
877	QVUB -settings should be optional	na
909	Remove ANCR.ColOpR and ColOpL	na
920	Resetable Counter is NOT resetable	Y
932	Rename AVCO.SptVol to AVCO.VolSpt	na
939	Change CDC for ANCR.FixCol	na
991	LGOS: GoCBRef (as well as LSVS.SvCBRef) should be mandatory	ni
1007	PTRC as fault indicator - Update of description required	ni
1044	TapChg in AVCO	na
1077	Rename DOnames within LTIM	na

Note: Tissues 675, 735, 772, 775, 776, 878 are not relevant for conformance testing.

4.2.6 Part 8-1 Tissue List

Part 8-1 Tissue	Description	Supported by client
784	Tracking of control (CTS)	na
817	Fixed-length GOOSE float encoding	ni
834	File dir name length 64	Y
951	Encoding of Owner attribute	Y
1040	More associate error codes	Y
1178	Select Response+ is non-null value	Y

Compare the TISSUE database for more details: www.tissues.iec61850.com

5. G500 Client ICD File

```
<?xml version="1.0" encoding="utf-8"?>

<SCL xmlns="http://www.iec.ch/61850/2003/SCL" version="2007" revision="B"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ge="http://www.ge.com/SAS/61850/GE_Extensions/2006-09"
xsi:schemaLocation="http://www.iec.ch/61850/2003/SCL /home/Configure/D400Schemas/SCL.xsd">

 <Header id="GE G500" version="1" revision="1" toolID="Loader" nameStructure="IEDName">

        <History>

         <Hitem version="1" revision="1" when="2008-10-15" who="GE Loader" />

         <Hitem version="2" revision="0" when="2020-07-29" who="GE Loader" />

          <Hitem version="3" revision="1" when="2020-08-17" who="GE Loader" what="release
         changed to 2007B, fixed myBeh DOType; removed server-related services, added missing
         communication section" why="uca test findings D-11236, D-11237, D-11239, D-11240"  />

         <Hitem version="3" revision="2" what="Changed AccessPoint name to match ConnectedAP"
         why="UCA test finding D-11388" who="GE Loader" when="2020-08-19" />

     </History>

 </Header>

<Communication>

        <SubNetwork name="Subnet1" type="8-MMS">

         <ConnectedAP apName="AP" iedName="TEMPLATE">

          <Address>

                <P type="IP">10.10.0.1</P>

                <P type="OSI-AP-Title">1,3,9999,23</P>

                <P type="IP-SUBNET">255.255.255.0</P>

                <P type="IP-GATEWAY">10.10.0.1</P>

                <P type="OSI-AE-Qualifier">23</P>

                <P type="OSI-PSEL">00000001</P>

                <P type="OSI-SSEL">0001</P>

                <P type="OSI-TSEL">0001</P>
```

```
        </Address>
       </ConnectedAP>
  </SubNetwork>
 </Communication>
 <IED name="TEMPLATE" manufacturer="GE" type="G500" originalSclVersion="2007"
originalSclRevision="B">
  <Services>
   <ClientServices bufReport="true" unbufReport="true">
    <TimeSyncProt c37_238="true" other="true" />
   </ClientServices>
  </Services>
  <AccessPoint name="AP">
   <Private type="GE_ClientLoader">
        <ge:ClientComm geMaxTPDULength="1024" geKeepAlive="true"
       geRfc1006MaxSpduOutstanding="50" geMaxMMSPDULength="32000"
       gelocalAPTitle="1,3,9999,11" gelocalAEQualifier="0" gelocalAPInvokeID="0"
       gelocalPSEL="00000001" gelocalSSEL="0001" gelocalTSEL="0001"
       geCurChnlCheckInterval="40" geConcurrentOps="40" geHostnameOrFQDN="4.0.7.5"
       gelocalSecIP="0.0.0.0" geIsHttps="true" />
   </Private>
   <LN lnType="MyITMI" prefix="" lnClass="ITMI" inst="1" />
  </AccessPoint>
 </IED>
 <DataTypeTemplates>
  <LNodeType id="MyITMI" lnClass="ITMI">
   <DO name="Beh" type="myBeh" />
  </LNodeType>
  <DOType id="myBeh" cdc="ENS">
   <DA name="stVal" fc="ST" bType="Enum" dchg="true" type="BehaviourModeKind" />
   <DA name="q" fc="ST" bType="Quality" qchg="true" />
   <DA name="t" fc="ST" bType="Timestamp" />
  </DOType>
```

```
    <EnumType id="BehaviourModeKind">
      <EnumVal ord="1">on</EnumVal>
      <EnumVal ord="2">blocked</EnumVal>
      <EnumVal ord="3">test</EnumVal>
      <EnumVal ord="4">test/blocked</EnumVal>
      <EnumVal ord="5">off</EnumVal>
    </EnumType>
  </DataTypeTemplates>
</SCL>
```

G500.icd

MODIFICATION RECORD

VERSION	REV.	DATE	Author	Change Description
1.00	0	2nd May, 2019	G. LaMarre	Created.
2.00	0	11th May, 2020	N. Kandula	Updated PICS for Ed2, appended MICS/PIXIT/TICS.
	1	13th May, 2020	G. LaMarre	Updated PIXIT for Association Model, PIXIT for File transfer model.
	2	3rd June, 2020	N. Kandula B. Popescu	Updated PIXIT for Dataset Model, PIXIT for Server Model, PIXIT for Reporting Model, ACSI Service Conformance Statement. Added clarification about MCP family and G500.
2.10	0	13th September 2020	P. Ren	Updated as per the feedbacks from the IEC61850 Client Level B Certification Test. Added Chapter 5: G500 Client ICD File