

60 SERIES MEASUREMENT SYSTEM

IEC61850 Protocol Manual



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This Bitronics 60 Series IEC61850 Protocol Manual is made up of the following sections

INTRODUCTION	60 SERIES BACKGROUND INFORMATION
SECTION 1	IEC61850 IMPLEMENTATION DETAILS
SECTION 2	PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS)
SECTION 3	MODEL IMPLEMENTATION CONFORMANCE STATEMENT (MICS)
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SECTION 5	PROTOCOL IMPLEMENTATION EXTRA INFORMATION FOR TESTING (PIXIT)

60 SERIES BACKGROUND INFORMATION

60 Series version information

Versions				
Description	Host Firmware	ICD file version		Release Date
M66x Family				
M66x Product Release	2.00.0	1.00		26 Nov. 2014
M66x add TCP Keepalive	2.01.0	1.00		30 Jan. 2015
M66x add Ed2 support	2.02.0	1.01		13 Mar. 2015
M66x general update	2.09.0	1.06		20 Nov. 2015
M66x fix instCVal RCB trigger bug	2.10.0	1.06		22 Dec 2015
M66x new ICD template files	2.11.0	1.07		15 Jan 2016

60 SERIES MANUAL SET

ML0036	50 and 60 Series DNP3 Protocol
ML0037	50 and 60 Series Modbus Protocol
ML0042	60 Series User Manual
ML0043	60 Series IEC61850® Protocol Manual

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SAFETY SECTION

Please refer to the 60 Series User Manual, ML00xx, for information regarding safety, installation, commissioning and decommissioning.

Section 1

IEC61850 Implementation Details

1. IEC61850 IMPLEMENTATION DETAILS

1.1 Introduction

IEC61850 is the international standard for Ethernet-based communication in substations. It enables integration of all protection, control, measurement and monitoring functions within a substation, and additionally provides the means for interlocking and inter-tripping. It combines the convenience of Ethernet with the security which is essential in substations today.

Bitronics has been involved in the Working Groups which formed the standard, building on experience gained with UCA2.0, the predecessor of IEC61850.

The 60 Series Measurement SCADA IEDs, models M660 and M661, support the IEC61850 protocol over the Ethernet interface.

1.2 What is IEC61850?

IEC61850 is an international standard, comprised of 14 parts, which defines a communication architecture for electric utility substations.

The standard defines and offers much more than just a protocol. It provides:

- Standardized models for IEDs and other equipment within the substation
- Standardized communication services (the methods used to access and exchange data)
- Standardized formats for configuration files
- Peer-to-peer communication between devices

The standard includes mapping of data onto Ethernet. Using Ethernet in the substation offers many advantages, but most significantly, including:

- High-speed data rates (currently 100 Mbits/s or higher, rather than 10's of kbits/s or less used by most serial protocols)
- Multiple masters (called "clients")
- Ethernet, as an open standard in every-day use

1.2.1 Interoperability

A major benefit of IEC61850 is interoperability. IEC61850 standardizes the data model of substation IEDs. This responds to the utilities' desire of having easier integration for different vendors' products, i.e. interoperability. It means that data is accessed in the same manner in different IEDs from either the same or different IED vendors, even though, for example, the measurement and protection algorithms of different vendors' IED (or device) types remain different.

When a device is described as IEC61850-compliant, this does not mean that it is interchangeable, but it does mean that it is interoperable. You cannot simply replace one product with another. The terminology, however, is pre-defined and anyone with prior knowledge of IEC 61850 should be able to very quickly integrate a new device without the need for mapping of all of the new data. IEC61850 will inevitably bring improved substation communications and interoperability, at a lower cost to the end user.

1.2.2 Summary of 60 Series IEC61850 Features (Based on part 7-2 of the IEC61850 standard)

This table summarizes the IEC61850 features for M66x type devices.	
<i>Section 6</i>	Server Model
	<ul style="list-style-type: none"> 2 logical devices – Measurements and System
<i>Section 7</i>	Association
	<ul style="list-style-type: none"> Two Party Application Association Model – used for normal data and reporting. Includes a simple method to inhibit writing for view-only applications
<i>Section 8</i>	Logical Device
	M66x Measurement SCADA IEDs
<i>Section 9</i>	Logical Nodes
	<ul style="list-style-type: none"> 21 Logical Nodes as defined in the Model Implementation Conformance Statement (MICS). 24 pre-defined datasets 12 pre-defined URCBs (Unbuffered Report Control Blocks) in System/LLN0 4 pre-defined BRCBs (Buffered Report Control Blocks) in System/LLN0
<i>Section 10</i>	Data
	<ul style="list-style-type: none"> Includes all features except access controls (however, the writability of points depends upon association parameters)
<i>Section 11</i>	Datasets
	<ul style="list-style-type: none"> 24 definable datasets with FCD/FCDA capability. (A dataset consists of a named list of variables)
<i>Section 12</i>	Substitution
	NOT SUPPORTED
<i>Section 13</i>	Settings Groups
	NOT SUPPORTED
<i>Section 14</i>	Report Control Blocks (and Reports)
	<ul style="list-style-type: none"> 12 indexed UCRBs (Unbuffered Report Control Blocks) Power-on configurability includes cbName (control block name) and DataSet (dataset). Dynamic configurability includes RptID (report ID), OptFlds (option fields), BufTm (buffer time), and TrgOps (trigger options). 4 indexed BRCB (Buffered Report Control Blocks). LCBs (Log Control Blocks) are NOT SUPPORTED Dynamic RCBs (Report Control Blocks) are NOT SUPPORTED.

<i>Section 15</i>	Generic Substation Events – GSE (and GOOSE)
	NOT SUPPORTED
<i>Section 16</i>	Sampled Measured Values
	NOT SUPPORTED
<i>Section 17</i>	Controls – Control Models
	NOT SUPPORTED
<i>Section 18</i>	Time Synchronization
	<ul style="list-style-type: none"> Two SNTP servers using optional many-cast (or any-cast) mode of operation is supported along with a configurable polling time. SNTP configuration is performed using the IED's built-in web (http) server
<i>Section 20</i>	Files
	<p>IEC61850 file transfer is NOT SUPPORTED</p> <p>NOTE: The M66x ICD file is available as a download, and the IEC61850 configuration (CID) file can be uploaded as well as downloaded, via the IED's built-in web (http) server</p>

1.2.3 The data model

To ease understanding, the data model of any IEC61850 IED can be viewed as a hierarchy of information. The categories and naming of this information is standardized in the IEC61850 specification.

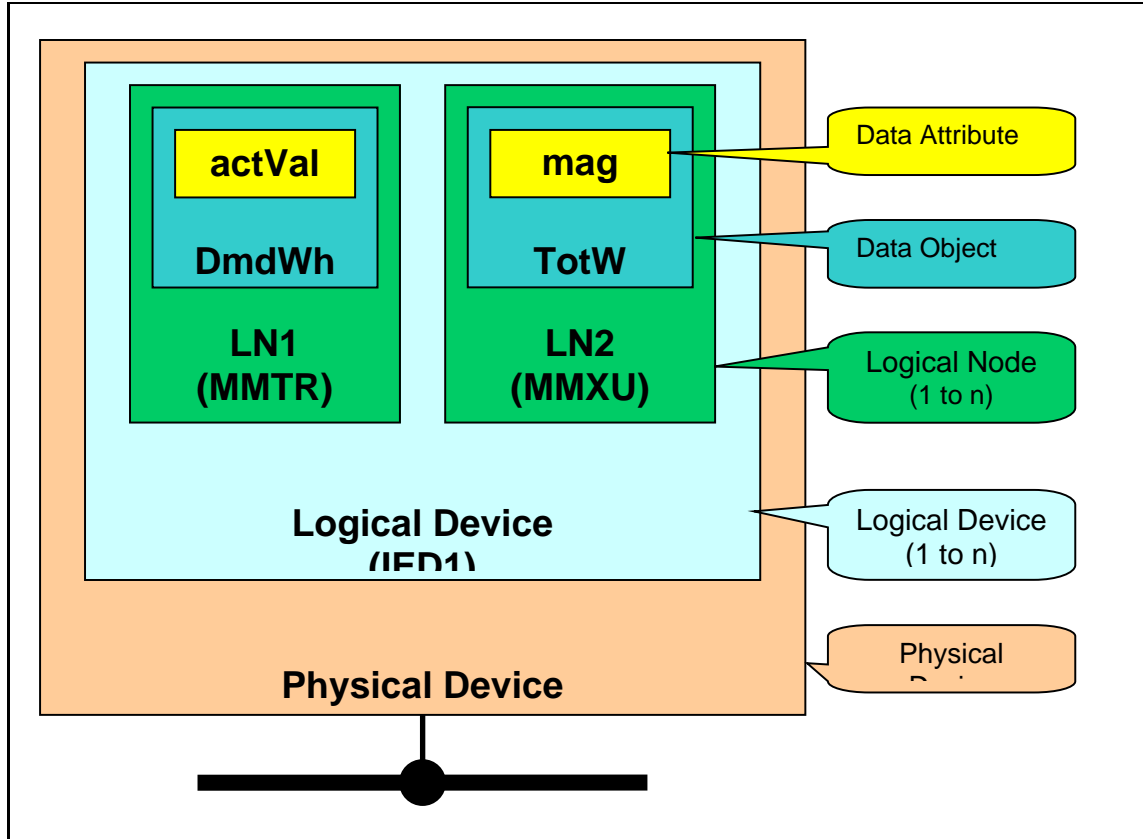


Figure 1: Data model layers in IEC 61850

The levels of this hierarchy can be described as follows:

- Physical Device
 - Identifies the actual IED within a system. Typically the device's name or IP address can be used. (for example **Feeder_1** or **192.168.0.171**).
- Logical Device
 - Identifies groups of related Logical Nodes within the Physical Device. For the Mx60 IEDs 2 Logical Devices exist: **Measurements, System**.

- Wrapper/Logical Node Instance – Identifies the major functional areas within the IEC 61850 data model. Either 3 or 6 characters are used as a prefix to define the functional group (wrapper) while the actual functionality is identified by a 4 character Logical Node name suffixed by an instance number.

For example, MMTR1 (Standard Energy Measurements), MMXU1 (Measurements Bus 1), DmdMMXU1 (Present thermal demands for Bus 1).
- Data Object – This next layer is used to identify the type of data you will be presented with. For example, **DmdWh** (Demand Watt-hours) of Logical Node **MMTR**
- Data Attribute – This is the actual data (measurement value, status, description, etc.).

For example, **actVal**.(actual value) indicating the actual binary counter status of the Watt-hour demand. These Data attributes may be simple type (for example, an integer or a visible string); or a complex type (such as data for a single phase of voltage).

1.3 IEC61850 in the M66x IEDs

IEC61850 protocol can be implemented in M66x IEDs.

The **IEC61850 IED Configurator** software is used to create a working IEC61850 configuration within the M66x IED. An MMS browser such as SISCO's AX-S4 61850 Explorer or Omicron's IEDScout can be used to view the data within the device.

- IED Capability Description (ICD) file: The 60 Series ICD file is an IEC61850 Substation Configuration Language (SCL) file which contains the IEC61850 'capability' description of the 60 Series IED. It is used by the IEC61850 IED Configurator tool to perform an IEC61850 configuration. The ICD file is stored on the M66x IED in flash memory. The ICD file can be downloaded from the IED using the built-in web interface.
- The IEC61850 IED Configuration tool uses the ICD file as a template from which it can create an IEC61850 device configuration. After configuration is completed and verified, the user should export that configuration as a CID file to the local PC.

The built-in Web browser in the 60 Series IED is then used to upload the configuration file from the PC, reset the configuration and reboot the M66x device. The CID file is stored in flash memory when it is uploaded to the M66x device and will remain the active configuration until a new configuration is uploaded or the user overwrites the configuration with a built-in demo configuration.

1.3.1 Capability

The IEC61850 interface provides the following capabilities:

1. Read access to measurements

All measurands are presented using the measurement Logical Nodes, in the 'Measurements' Logical Device. Reported measurement values are refreshed by the IED once per second, in line with the IEDs user interface

2. Generation of unbuffered and buffered reports on change of status/measurement

Through the 61850 client, reports are enabled when the RptEna bit is set to a value of 1 in the Unbuffered and Buffered Report Control Blocks (URCB and BRCB). When reports are enabled, any change of state in statuses and/or measurements are reported to the client. Unbuffered and Buffered Report Control Blocks (URCB and BRCB) can be configured in M66x devices by using the "IEC 61850 Configurator" tool, however the client must set the RptEna to 1 in order to enable a report to be sent to the client. For the purpose of viewing the contents of reports, an MMS browser can be used as the client performing that purpose. As an example if using a browser such as SISCO's MMS Object Explorer, a Report Control Block (RCB) can be enabled by right clicking on the RCB (such as urcb01), selecting "Monitor Reports", then clicking on the RCB (such as urcb01) and selecting "Enable Reports.

3. Support for time synchronization over an Ethernet link

Time synchronization is supported using SNTP (Simple Network Time Protocol); this protocol is used to synchronize the internal real time clock in substation devices (i.e., control systems, relays, IEDs). SNTP time sync configuration is performed using the 60 Series built-in web interface.

1.3.2 IEC61850 Configuration

One of the main objectives of IEC61850 is to allow IEDs to be directly configured from a configuration file generated at system configuration time. At the system configuration level, the capabilities of the IED are determined from an IED Capability Description (ICD) file. The ICD file for the 60 Series IED is stored in non-volatile memory and can be obtained and downloaded from the IED using the built-in web interface. Please see the 60 Series User's manual for details.

In order for an IEC61850 configuration to take place, the ICD file needs to be made available to the IEC61850 IED Configurator tool. If the IEC61850 IED Configurator installation path is known, simply download the 60 Series ICD file to the following location,

"<IEC61850 IED Configurator installation folder>\Templates\M66X"

Alternatively if the installation location is not known, the user can use the IEC61850 IED Configurator tool to locate the ICD file stored anywhere on the host computer. To use this method simply perform the following steps,

Step 1 – From within the IEC61850 IED Configurator tool, select **"File->New"**

Step 2 – After the **"Select Template using Model Number...."** window opens, click on the button labelled **"Browse for external"** which is located at the bottom left corner of the window

Step 3 – After the **"Select Template ICD file"** windows opens, the user should navigate to the location where the ICD file resides. Finally, highlight the file and click the **Open** button. The ICD file will now be available to the IEC61850 IED Configurator tool.

Using a collection of these ICD files from varying products, the entire protection and measurement function of a substation can be designed, configured and tested (using simulation tools) before the product is even installed into the substation. Alternatively, the ICD file can be exported to a third-party System Configuration Tool (not included with the product).

1.4 The data model of M66x IEDs

The data model naming convention, which was adopted in the M66x Measurement IEDs, has been standardized for consistency. Hence the Logical Nodes are allocated to one of the two Logical Devices; Measurements or System as appropriate, and the wrapper names used to instantiate Logical Nodes will remain consistent between the M66x IEDs

The data model is described in the Model Implementation Conformance Statement (MICS) document, which is available as a separate section of this IEC 61850 user manual. The MICS document provides lists of Logical Device definitions, Logical Node definitions, Common Data Class and Attribute definitions, Enumeration definitions, and MMS data type conversions. It generally follows the format used in Parts 7-3 and 7-4 of the IEC 61850 standard.

1.5 The communication services of M66x IEDs

The IEC 61850 communication services which are implemented in the M66x IEDs are described in the Protocol Implementation Conformance Statement (PICS) document, which is available within a separate section of this IEC 61850 user manual. The PICS document provides the Abstract Communication Service Interface (ACSI) conformance statements as defined in Annex A of Part 7-2 of the IEC 61850 standard.

1.6 Ethernet functionality

1.6.1 Ethernet disconnection

IEC61850 'associations' are unique and made to the IED between the client (master) and server (IEC61850 device). In the event that the Ethernet is disconnected, such associations are lost, and will need to be re-established by the client. The TCP Keepalive function is implemented in M66x devices to monitor each association, and terminate any which are no longer active.

1.6.2 Loss of power

M66x devices allow the re-establishment of associations by the client without a negative impact on the IED's operation after having its power removed. As the M66x device acts as a server in this process, the client must request the association. When power is lost, reports requested by connected clients are reset and must be re-enabled by the client when it next creates the new association to the IED.

Section 2 PICS

Protocol Implementation Conformance Statement

2. PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS)

2.1 Introduction

This section is the **Protocol Implementation Conformance Statement (PICS)** and presents the ACSI conformance statements as defined in Annex A of Part 7-2 of the IEC61850 standard.

The 60 Series IEC61850 standard implementation shall conform to the Protocol Implementation Conformance Statement below:

2.2 ACSI basic conformance statement

The basic conformance statement shall be as defined in Table A.1.

Table A.1 - Basic conformance statement

		Client/ Subscriber	Server/ Publisher	Value/Comments
Client-Server roles				
B11	Server side (of TWO-PARTY-APPLICATION-ASSOCIATION)	—	Y	
B12	Client side of (TWO-PARTY-APPLICATION-ASSOCIATION)	N	—	
SCSMs supported				
B21	SCSM: IEC 61850-8-1 used	N	Y	
B22	SCSM: IEC 61850-9-1 used		N	
B23	SCSM: IEC 61850-9-2 used		N	
B24	SCSM: other		N	
Generic substation event model (GSE)				
B31	Publisher side	—	N	
B32	Subscriber side	N	—	
Transmission of sampled value model (SVC)				
B41	Publisher side	—	N	
B42	Subscriber side	N	—	
Y =Yes (supported) N or empty = No (not supported)				

2.3 ACSI models conformance statement

The ACSI models conformance statement shall be as defined in Table A.2.

Table A.2 - ACSI models conformance statement

		Client/ Subscriber	Server/ Publisher	Value/Comments
If Server side (B11) and/or Client side (B12) supported				
M1	Logical device	N	Y	
M2	Logical node	N	Y	
M3	Data	N	Y	
M4	Data set	N	Y	
M5	Substitution	N	N	
M6	Setting group control	N	N	
	Reporting			
M7	Buffered report control	N	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	
M7-7	entryID		Y	
M7-8	BufTim		Y	
M7-9	IntgPd		Y	
M7-10	GI		Y	
M7-11	conf-revision (revision 2 adds this row entry)		Y	
M8	Unbuffered report control	N	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	BufTim		Y	
M8-7	IntgPd		Y	
M8-8	GI		Y	
M8-9	conf-revision (revision 2 adds this row entry)		Y	
	Logging	N	N	
M9	Log control	N	N	
M9-1	IntgPd	N	N	
M10	Log	N	N	
M11	Control	N	N	
M17	File Transfer	N	N	
If GSE (B31/32) is supported				
M12	GOOSE	N	N	

		Client/ Subscriber	Server/ Publisher	Value/Comments
M12-1	entryID (revision 2 removes this row entry)		N	
M12-2	DataRefInc (revision 2 removes this row entry)		N	
M13	GSSE	N	N	
If SVC (B41/42) is supported				
M14	Multicast SVC	N	N	
M15	Unicast SVC	N	N	
Applies to all IEDs				
M16	Time	Y	N	Time source with required accuracy shall be available
M17	File Transfer	N	N	
Y = Yes (service is supported) N or empty = No (service is not supported)				

2.4 ACSI service conformance statement

The ACSI service conformance statement shall be as defined in Table A.3 (depending on the statements in Table A.1).

Table A.3 - ACSI service conformance statement

	Ed	ASCI Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Comments
Server (clause 6)						
S1	1,2	ServerDirectory	TP	N	Y	
Application association (clause 7)						
S2	1,2	Associate	TP	N	Y	
S3	1,2	Abort	TP	N	Y	
S4	1,2	Release	TP	N	Y	
Logical node (clause 9)						
S5	1,2	LogicalDeviceDirectory (Logical-Device)	TP	N	Y	
Logical node (clause 9)						
S6	1,2	LogicalNodeDirectory	TP	N	Y	
S7	1,2	GetAllDataValues	TP	N	Y	
Data (clause 10)						
S8	1,2	GetDataValues	TP	N	Y	
S9	1,2	SetDataValues	TP	N	Y	
S10	1,2	GetDataDirectory	TP	N	Y	
S11	1,2	GetDataDefinition	TP	N	Y	

	Ed	ASCI Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Comments
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Data set (clause 11)						
S12	1,2	GetDataSetValues	TP	N	Y	
S13	1,2	SetDataSetValues	TP	N	N	
S14	1,2	CreateDataSet	TP	N	N	
S15	1,2	DeleteDataSet	TP	N	N	
S16	1,2	GetDataSetDirectory	TP	N	Y	

Substitution (clause 12) (Ed1 only)						
S17	1	SetDataValues	TP	N	N	

Setting group control (clause 13)						
S18	1,2	SelectActiveSG	TP	N	N	
S19	1,2	SelectEditSG	TP	N	N	
S20	1,2	SetEditSGValues	TP	N	N	
S21	1,2	ConfirmEditSGValues	TP	N	N	
S22	1,2	GetEditSGValues	TP	N	N	
S23	1,2	GetSGCBValues	TP	N	N	

Reporting (clause 14)						
Buffered report control block (BRCB)						
S24	1,2	Report	TP	N	Y	
S24-1	1,2	data-change (dchg)		N	Y	
S24-2	1,2	quality-change (qchg)		N	Y	
S24-3	1,2	data-update (dupd)		N	N	
S25	1,2	GetBRCBValues	TP	N	Y	
S26	1,2	SetBRCBValues	TP	N	Y	
Unbuffered report control block (URCB)						
S27	1,2	Report	TP	N	Y	
S27-1	1,2	data-change (dchg)		N	Y	
S27-2	1,2	quality-change (qchg)		N	Y	
S27-3	1,2	data-update (dupd)		N	N	
S28	1,2	GetURCBValues	TP	N	Y	
S29	1,2	SetURCBValues	TP	N	Y	

Logging (clause 14)						
Log control block						
S30	1,2	GetLCBValues	TP	N	N	
S31	1,2	SetLCBValues	TP	N	N	
Log						
S32	1,2	QueryLogByTime	TP	N	N	
S33	1,2	QueryLogAfter	TP	N	N	
S34	1,2	GetLogStatusValues	TP	N	N	

	Ed	ASCI Services	AA: TP/MC	Client/ Subscriber	Server/ Publisher	Comments
Generic substation event model (GSE) (clause 14.3.5.3.4)						
GOOSE-CONTROL-BLOCK						
S35	1,2	SendGOOSEMessage	MC	N	N	
S36	1,2	GetGoReference	TP	N	N	
S37	1,2	GetGOOSEElementNumber	TP	N	N	
S38	1,2	GetGoCBValues	TP	N	N	
S39	1,2	SetGoCBValues	TP	N	N	
GSSE-CONTROL-BLOCK						
S40	1,2	SendGSSEMessage	MC	N	N	
S41	1,2	GetGsReference	TP	N	N	
S42	1,2	GetGSSEElementNumber	TP	N	N	
S43	1,2	GetGsCBValues	TP	N	N	
S44	1,2	SetGsCBValues	TP	N	N	
c8 – shall declare support for at least one (SendGOOSEMessage or SendGSSEMessage) c9 – shall declare support if TP association is available						

Transmission of sampled value model (SVC) (clause 16)						
Multicast SVC						
S45	1,2	SendMSVMessage	MC	N	N	Use for 9-2LE or IEC 61869-9
S46	1,2	GetMSVCBValues	TP	N	N	
S47	1,2	SetMSVCBValues	TP	N	N	
Unicast SVC						
S48	1,2	SendUSVMessage	TP	N	N	
S49	1,2	GetUSVCBValues	TP	N	N	
S50	1,2	SetUSVCBValues	TP	N	N	

Control (clause 17.5.1)						
S51	1,2	Select	TP	N	N	SBO Normal Security
S52	1,2	SelectWithValue	TP	N	N	SBO Enhanced Security
S53	1,2	Cancel	TP	N	N	
S54	1,2	Operate	TP	N	N	
S55	1,2	Command-Termination	TP	N	N	
S56	1,2	TimeActivated-Operate	TP	N	N	

File transfer (clause 20)						
S57	1,2	GetFile	TP	N	N	
S58	1,2	SetFile	TP	N	N	
S59	1,2	DeleteFile	TP	N	N	
S60	1,2	GetFileAttributeValues	TP	N	N	
S61	1,2	GetServerDirectory (FILE-SYSTEM)	TP	N	N	

Time (5.5)						
T1	1,2	Time resolution of internal clock	-		10 (5µs)	nearest negative power of 2 in seconds
T2	2	Time accuracy of internal clock				TL (ms) (low accuracy), T3 < 7) (only Ed2)
	1,2		-			T0
	1,2		-		10 (1ms)	T1
	1,2		-			T2
	1,2		-			T3
	1,2		-			T4
	1,2		-			T5
T3	1,2	supported TimeStamp resolution	-		10 (1 ms)	Nearest value of 2 ^{**n} in seconds according to 5.5.3.7.3.3

Section 3 MICS

Model Implementation Conformance Statement

3. MODEL IMPLEMENTATION CONFORMANCE STATEMENT (MICS)

3.1 Introduction

This specification is the Model Implementation Conformance Statement (MICS) and presents the top-level IEC61850 data model that has been implemented. The definitions of all used Logical Nodes and their associated Common Data Classes, components and associated enumerated values are also included for completeness.

The reader is expected to be conversant with the terminology presented within the IEC61850 part 7 series of specifications.

3.2 Objective

To provide comprehensive details of the standard data object model elements supported by each one of the logical devices in the 60 Series product family; M660 and M661. The MICS is conformant to the devices associated ICD (Substation Configuration Language) file, according to part 6 of the IEC61850 standards. The layout of the presented tables within this document is conformant to the Part 7 series of the IEC61850 standard specifications with the following exceptions:

- The "Trigger Options" field is not presented within the data object tables.
- The "M/O" (Mandatory/Optional) field is not present in the data object tables, as the definitions are as deployed within the models
- An additional column "X" is used to signify Bitronics custom objects or attributes

3.3 Logical Device definitions

The M66x IED implements an IEC61850 server that contains two Logical Devices; Measurements and System. Each of these Logical Devices contains a data model built from instances of specific Logical Nodes and must consist of at least an instance of the LPHD Logical Node (for addressing common issues across all Logical Devices) and an instance of the LLN0 Logical Node (for addressing common issues across a single Logical Device).

The IEC61850 data model is contained within the Logical Devices detailed in the table below. All Bitronics devices will name the supported Logical Devices consistently to ensure that data model variables with the same purpose will have the same name within each Bitronics server.

Logical Device	Comment/Usage
Measurements	M66x IED Measurements Domain contains the Measurements Logical Nodes
System	M66x IED System Domain contains the System Logical Nodes

3.3.1 IEC61850 logical device data model

The IEC61850 Logical Device top-level data model consists of instances of Logical Nodes. The data model name for a Logical Node instance is constructed from an optional prefix (known as the wrapper), the Logical Node name, and an instance ID (or suffix).

The data models for each of the logical devices are presented in this document. The logical order is used to describe each of the physical devices. However, when it comes to the data objects, data attributes and enumeration tables these are alphabetically sorted so that searching is made easier.

The following Tables indicate the Logical Node Description Lists. The "LN Types" that are used for the M66x IED measurement device is found in Table 1. It is necessary to use the "LN Types"

indicated to create the mapping necessary for the “LN Instance”. LN Type is remapped to LN Instance in order to define each Logical Node per the standard, IEC61850 Part 7. Table 1 defines the Logical Devices while table 2 defines the “LN Types”. Note that the “LN Type” name may be altered by an IEC 61850 System Configuration Tool which will result in possibly different type names appearing in the output SCD or CID files. Refer to section 5.11.1 for more information.

Table 1 – M66x IED

LD	LN Instance	LN Type	Description
Measurements			
	DmdMMXU1	MMXU_BASIC	Present Thermal Demands Measurements
	DmnMMXU1	MMXU_BASIC_NOA_NODB	Minimum Thermal Demands
	DmxMMXU1	MMXU_BASIC_NODB	Maximum Thermal Demands
	FndDmdMMXU1	MMXU_A	Fundamental Thermal Demands
	FndDmxMMXU1	MMXU_A_NODB	Fundamental Maximum Thermal Demands
	FndMMXU1	MMXU_BASIC2	Fundamental Measurements
	LLN0	LLN0_STANDARD	Measurements Logical Device
	LPHD1	LPHD_STANDARD	Physical Device Information
	MHAI1	MHAI_BASIC	Harmonics Measurements
	MMTR1	MMTR_BASIC	Energy Metering Measurement
	MMXU1	MMXU_BASIC2	Present Measurements
System			
	LLN0	LLN0_STANDARD	System Logical Device
	LPHD1	LPHD_STANDARD	Physical Device Information
	TVTR1	TVTR_BASIC	Voltage Transformer Phase A
	TVTR2	TVTR_BASIC	Voltage Transformer Phase B
	TVTR3	TVTR_BASIC	Voltage Transformer Phase C
	TVTR4	TVTR_BASIC	Neutral Voltage Transformer
	TCTR1	TCTR_BASIC	Current Transformer Phase A
	TCTR2	TCTR_BASIC	Current Transformer Phase B
	TCTR3	TCTR_BASIC	Current Transformer Phase C
	TCTR4	TCTR_BASIC	Residual Current Transformer

3.4 Logical Node definitions

The definition tables for each of the Logical Nodes in the top-level data model are presented in the following sub-sections.

The following table presents a summary of the Logical Node templates used across the Logical Devices within the overall IEC61850 product data model:

In Table 8 below, Name Space “DEFAULT” means either of;

Edition 1: “IEC 61850-7-4:2003”

Edition 2: “IEC 61850-7-4:2007A”

Table 8: LN Type Definitions

LN Type	(LN Class)	Description	Name Space
LLN0_STANDARD	(LLN0)	Common information for the logical device, which applies to logical nodes in the designated domain	DEFAULT
LPHD_STANDARD	(LPHD)	M66x Physical Device Information.	DEFAULT
MHAI_BASIC	(MHAI)	Harmonic information for volts and amps, etc. including the individual harmonics, phase related K factor and harmonic demand.	DEFAULT
MMTR_BASIC	(MMTR)	Standard Energy measurements (Provides for acquiring of polyphase metering values pertaining to a field device or circuit.)	DEFAULT
MMXU_BASIC	(MMXU)	Standard Measurements Present Demand Measurements (Provides measurements of single phase or polyphase analog values, including residual current, pertaining to a wye or delta connected field device or circuit.)	DEFAULT
MMXU_BASIC_NOA_NODB	(MMXU)	Standard Measurements without Currents (no deadbands) Minimum Demand Measurements (Provides measurements of single phase or polyphase analog values, pertaining to a wye or delta connected field device or circuit.)	DEFAULT
MMXU_BASIC_NODB	(MMXU)	Standard Measurements (no deadbands) Maximum Demand Measurements (Provides measurements of single phase or polyphase analog values, including residual current, pertaining to a wye or delta connected field device or circuit.)	DEFAULT
MMXU_A	(MMXU)	Standard Current Measurements Fundamental Demand Measurements (Provides measurements of polyphase analog values, including residual current, pertaining to a wye connected field device or circuit.)	DEFAULT

LN Type	(LN Class)	Description	Name Space
MMXU_A_NODB	(MMXU)	Standard Current Measurements (no deadbands) Fundamental Maximum Demand Measurements (Provides measurements polyphase analog values, including residual current, pertaining to a wye connected field device or circuit.)	DEFAULT
MMXU_BASIC2	(MMXU)	Standard Measurements including Power Factor Fundamental Measurements (Provides measurements of single phase or polyphase analog values, including residual current, pertaining to a wye or delta connected field device or circuit.)	DEFAULT
TCTR_BASIC	(TCTR)	Standard Current Transformer (CT) – per phase	DEFAULT
TVTR_BASIC	(TVTR)	Standard Voltage Transformer (VT) - per phase	DEFAULT

3.4.1 Logical Node: LLN0_STANDARD

Description: General Logical Node 0 (All Domains)

LN Class: LLN0

DATA (Attribute)	(Attr.) Type	Description (Explanation)	T	X
Mod	MY_MOD	Mode		
Beh	MY_BEH	Behavior		
Health	MY_HEALTH	Health		
NamPlt	LPL_LLNO	Name Plate		

3.4.2 Logical Node: LPHD_STANDARD

Description: Physical Device Information (All Domains)

LN Class: LPHD

DATA (Attribute)	(Attr.) Type	Description (Explanation)	T	X
PhyNam	DPL_0	Physical device name plate		
PhyHealth	MY_HEALTH_D	Physical device health		
Proxy	SPS_0	Indicates if this LN is a proxy		

3.4.3 Logical Node: MHAI_BASIC

Description: Standard Harmonics Measurements -
 Harmonics Measurements LN

LN Class: MHAI

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
Hz	MV_0	O	Basic Frequency		
HKf	WYE_0	O	Phase related K factor for A, B, C, R (Transformer derating)		
TddA	WYE_0	O	Total Current Demand Distortion (per IEEE 519, phase related)		
ThdPhV	WYE_1	O	Voltage total Harmonic or Inter-harmonic Distortion for phase to ground (phase related)		
ThdPPV	DEL_0	O	Voltage total Harmonic or Inter-harmonic Distortion for phase to phase		

3.4.4 Logical Node: MMTR_BASIC

Description: Energy measurements -
 Energy Measurements LN

LN Class: MMTR

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
TotVAh	BCR_0	O	Total apparent power since last rest.		
SupWh	BCR_0	O	Real energy supply (default supply direction energy flow towards bus bar)		
SupVArh	BCR_0	O	Reactive energy supply (default supply direction energy flow towards bus bar)		
DmdWh	BCR_0	O	Real energy demand (default demand direction energy flow away from bus bar)		
DmdVArh	BCR_0	O	Reactive energy demand (default demand direction energy flow away from bus bar)		

3.4.5 Logical Node: MMXU_BASIC

Description: Standard measurements -
 Demand Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
TotW	MV_0	O	Total active power (Total P)		
TotVAr	MV_0	O	Total reactive power (Total Q)		
TotVA	MV_0	O	Total apparent power (Total S)		
PPV	DEL_0	O	Phase to Phase voltages		
PhV	WYE_1	O	Phase to Ground voltages (A,B,C)		
A	WYE_0	O	Phase Currents (A,B,C, Residual)		
W	WYE_1	O	Phase active power (P)		
VAr	WYE_1	O	Phase reactive power (Q)		
VA	WYE_1	O	Phase apparent power (S)		

3.4.6 Logical Node: MMXU_BASIC_NODB

Description: Standard measurements without deadbands -
 Maximum Demand Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
TotW	MV_0_NODB	O	Total active power (Total P)		
TotVAr	MV_0_NODB	O	Total reactive power (Total Q)		
TotVA	MV_0_NODB	O	Total apparent power (Total S)		
PPV	DEL_0_NODB	O	Phase to Phase voltages		
PhV	WYE_1_NODB	O	Phase to Ground voltages (A,B,C)		
A	WYE_0_NODB	O	Phase Currents (A,B,C,Residual)		
W	WYE_1_NODB	O	Phase active power (P)		
VAr	WYE_1_NODB	O	Phase reactive power (Q)		
VA	WYE_1_NODB	O	Phase apparent power (S)		

3.4.7 Logical Node: MMXU_BASIC_NOA_NODB

Description: Standard measurements without Phase Currents and without deadbands -
 Minimum Demand Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
TotW	MV_0_NODB	O	Total active power (Total P)		
TotVAr	MV_0_NODB	O	Total reactive power (Total Q)		
TotVA	MV_0_NODB	O	Total apparent power (Total S)		
PPV	DEL_0_NODB	O	Phase to Phase voltages		
PhV	WYE_1_NODB	O	Phase to Ground voltages (A,B,C,N)		
W	WYE_1_NODB	O	Phase active power (P)		
VAr	WYE_1_NODB	O	Phase reactive power (Q)		
VA	WYE_1_NODB	O	Phase apparent power (S)		

3.4.8 Logical Node: MMXU_A

Description: Standard Current measurements -
 Fundamental Demand Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
A	WYE_0	O	Phase Currents (A,B,C,Residual)		

3.4.9 Logical Node: MMXU_A_NODB

Description: Standard Current measurements without deadbands -
 Fundamental Maximum Demand Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
A	WYE_0_NODB	O	Phase Currents (A,B,C,Residual)		

3.4.10 Logical Node: MMXU_BASIC2

Description: Standard measurements plus Power Factor -
 Present Measurements LN
 Fundamental Measurements LN

LN Class: MMXU

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
TotW	MV_0	O	Total active power (Total P)		
TotVAr	MV_0	O	Total reactive power (Total Q)		
TotVA	MV_0	O	Total apparent power (Total S)		
TotPF	MV_0	O	Average power factor (Total PF)		
Hz	MV_0	O	Frequency		
PPV	DEL_0	O	Phase to Phase voltages (AB,BC,CA)		
PhV	WYE_1	O	Phase to Ground voltages (A B,C)		
A	WYE_0	O	Phase Currents (A,B,C,Residual)		
W	WYE_1	O	Phase active power (P)		
VAr	WYE_1	O	Phase reactive power (Q)		
VA	WYE_1	O	Phase apparent power (S)		
PF	WYE_1	O	Phase power factor		

3.4.11 Logical Node: TCTR_BASIC

Description: Standard Current Transformer

LN Class: TCTR

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
Amp (Ed. 1 only) AmpSv (Ed. 2 only)	SAV_0 SAV_0	M C1	Current (sampled value)		
Rat	ASG_0_RO	O	Winding ratio of an external current transformer (transducer)		

3.4.12 Logical Node: TVTR_BASIC

Description: Standard Voltage Transformer

LN Class: TVTR

DATA (Attribute)	(Attr.) Type	M/O	Description (Explanation)	T	X
Mod	MY_MOD	M	Mode		
Beh	MY_BEH	M	Behavior		
Health	MY_HEALTH	M	Health		
NamPlt	LPL_LN	M	Name Plate		
Vol (Ed. 1 only)	SAV_0	M	Voltage (sampled value)		
VolSv (Ed. 2 only)	SAV_0	C1			
Rat	ASG_0_RO	O	Winding ratio of an external voltage transformer (transducer)		

3.5 Common Data Class definitions

The definition tables for each of the Common Data Classes used in the Logical Node definitions are presented in the following sub-sections.

From an application point-of-view the data attributes of a Common Data Class are classified according to their specific use. The characterization of data attributes, and the services that they support/provide, will be through the use of 'Functional Constraints'. The Functional Constraints are specified by the table below:

FC Name	Semantic	Source Definition	Ed.
BL	Blocking – not used in M66x devices	IEC61850-7-2	2
BR	Buffered reports	IEC61850-7-2	1,2
CF	Configuration	IEC61850-7-2	1,2
CO	Control – not used in M66x devices	IEC61850-7-2	1,2
DC	Description	IEC61850-7-2	1,2
EX	Extended Definition	IEC61850-7-2	1,2
GO	GOOSE Control – not used in M66x devices	IEC61850-7-2	1,2
GS	GSSE Control (UCA2 GOOSE) – not used in M66x devices	IEC61850-7-2	1,2
LG	Logging – NOT USED in M66x devices	IEC61850-7-2	1,2
MS	Multicast sampled value control – not used in M66x devices	IEC61850-7-2	1,2
MX	Measurands (Analogue values)	IEC61850-7-2	1,2
OR	Operate Received – not used in M66x devices	IEC61850-7-2	2
RP	Unbuffered reports	IEC61850-7-2	1,2
SE	Setting Group Editable – not used in M66x devices	IEC61850-7-2	1,2
SG	Setting Group	IEC61850-7-2	1,2
SR	Service Response – not used in M66x devices	IEC61850-7-2	2
SP	Set Point	IEC61850-7-2	1,2
ST	Status Information	IEC61850-7-2	1,2
SV	Substitution Values – not used in M66x devices	IEC61850-7-2	1,2
US	Unicast sampled value control – not used in M66x devices	IEC61850-7-2	1,2
XX	Representing all data attributes as a service parameter	IEC61850-7-2	1,2

3.5.1 Common Data Class:ASG_0_RO

Description: Analogue Setting (Read Only)

CDC Class: ASG

Attribute	Type	FC	Enumeration	Comment	X
Settings					
setMag	AnalogueValue_Float_ReadOnly	SP		AnalogueValue (Read Only)	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.2 Common Data Class: BCR_0

Description: Binary counter reading

CDC Class: BCR

Attribute	Type	FC	Enumeration	Comment	X
Status					
actVal	INT32 (Ed. 1) INT64 (Ed. 2)	ST		Binary counter status is a 32 or 64 bit Integer value.	
q	Quality	ST		Quality of the measurement value	
t	TimeStamp	ST		Time of last actVal update.	
Configuration, Description					
units	Unit_No_Multiplier	CF		Units of the attributes that represent the data – no multiplier	
pulsQty	FLOAT32	CF		Engineering units = PulsQty x actVal	
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.3 Common Data Class: CMV_0_NODB

Description: Complex Measured value (Floating Point Magnitude)

CDC Class: CMV

Attribute	Type	FC	Enumeration	Comment	X
Measurand					
cVal	Vector_Magnitude_Float	MX		Complex measured vector value (Magnitude only). The value of cVal is updated to the current value of instCVal. I.e. cVal will track to instCVal for this CDC.	
q	Quality	MX		Quality of the measurement value	
t	TimeStamp	MX		Measured value Timestamp	
Configuration, Description					
units	Unit_Multiplier	CF		Units of the attributes that represent the data	

3.5.4 Common Data Class: CMV_0

Description: Complex Measured value (Floating Point Magnitude) with deadband configuration

CDC Class: CMV

Attribute	Type	FC	Enumeration	Comment	X
Measurand					
instCVal	Vector_Magnitude_Float	MX		Instantaneous complex measured vector value	
cVal	Vector_Magnitude_Float	MX		Deadband complex measured vector value (Magnitude only). If db=0, then cVal is updated to the current value of instCVal, i.e. cVal will track to instCVal.	
q	Quality	MX		Quality of the measurement value	
t	TimeStamp	MX		Measured value Timestamp	
Configuration, Description					
units	Unit_Multiplier	CF		Units of the attributes that represent the data	
db	INT32U	CF		Configuration parameter used to calculate all deadband attributes	
rangeC	RangeConfig_Deadband	CF		Configuration parameters as used in the context with the range attribute	

3.5.5 Common Data Class: DEL_0

Description: Phase to phase measurements for a 3-Phase system with deadband configuration

CDC Class: DEL

Attribute	Type	FC	Enumeration	Comment	X
phsAB	CMV_0	--		Measurement values for Phase A to Phase B	
phsBC	CMV_0	--		Measurement values for Phase B to Phase C	
phsCA	CMV_0	--		Measurement values for Phase C to Phase A	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.6 Common Data Class: DEL_0_NODB

Description: Phase to phase measurements for a 3-Phase system with no deadband configuration

CDC Class: DEL

Attribute	Type	FC	Enumeration	Comment	X
phsAB	CMV_0_NODB	--		Measurement values for Phase A to Phase B	
phsBC	CMV_0_NODB	--		Measurement values for Phase B to Phase C	
phsCA	CMV_0_NODB	--		Measurement values for Phase C to Phase A	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.7 Common Data Class: DPL_0

Description: Standard Device Name Plate

CDC Class: DPL

Attribute	Type	FC	Enumeration	Comment	X
Configuration, Description					
vendor	VISIBLE_STRING255	DC		Name of the vendor	
hwRev	VISIBLE_STRING255	DC		Hardware revision	
swRev	VISIBLE_STRING255	DC		Software revision	
serNum	VISIBLE_STRING255	DC		Serial Number	
model	VISIBLE_STRING255	DC		Model Number	
location	VISIBLE_STRING255	DC		Physical location of device	

3.5.8 Common Data Class: MY_MOD

Description: Controllable Integer Status (used for Logical Node Mode control)

CDC Class: INC (enum) (Ed. 1), ENC (Ed. 2)

Attribute	Type	FC	Enumeration	Comment	X
Status					
stVal	Enum	ST	Mod	The element status	
q	Quality	ST		Quality of the status value	
t	TimeStamp	ST		Timestamp of the last change in state of status value	
Configuration, Description					
ctlModel	Enum(MMS Type: INT8)	CF	ctlModel	Control model (Corresponding to the behavior of the data)	

3.5.9 Common Data Class: MY_BEH

Description: Integer Status (for Behavior)

CDC Class: INS (enum) (Ed. 1), ENS (Ed. 2)

Attribute	Type	FC	Enumeration	Comment	X
Status					
stVal	Enum	ST	Beh	The element status	
q	Quality	ST		The quality of the status value	
t	TimeStamp	ST		Timestamp of the last change in state	

3.5.10 Common Data Class: MY_HEALTH

Description: Integer Status (for Physical Device Health)

CDC Class: INS (enum) (Ed. 1), ENS (Ed. 2)

Attribute	Type	FC	Enumeration	Comment	X
Status					
stVal	Enum	ST	Health	The element status	
q	Quality	ST		The quality of the status value	
t	TimeStamp	ST		Timestamp of the last change in state	

3.5.11 Common Data Class: MY_HEALTH_D

Description: Integer Status (for Physical Device Health with Description)

CDC Class: INS (enum) (Ed. 1), ENS (Ed. 2)

Attribute	Type	FC	Enumeration	Comment	X
Status					
stVal	Enum	ST	Health	The element status	
q	Quality	ST		The quality of the status value	
t	TimeStamp	ST		Timestamp of the last change in state	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.12 Common Data Class: LPL_LLNO

Description: Logical Node 0 Name Plate

CDC Class: LPL

Attribute	Type	FC	Enumeration	Comment	X
Configuration, Description					
vendor	VISIBLE_STRING255	DC		Name of the vendor	
swRev	VISIBLE_STRING255	DC		Software revision	
d	VISIBLE_STRING255	DC		Description - a text string that refers to the logical node	
configRev	VISIBLE_STRING255	DC		Uniquely identifies the configuration of a local device instance	
Extension					
ldNs	VISIBLE_STRING255	EX		Logical Device name space	

3.5.13 Common Data Class: LPL_LN

Description: Standard (or Basic) Logical Node Name Plate

CDC Class: LPL

Attribute	Type	FC	Enumeration	Comment	X
Configuration, Description					
vendor	VISIBLE_STRING255	DC		Name of the vendor	
swRev	VISIBLE_STRING255	DC		Software revision	
d	VISIBLE_STRING255	DC		Description - a text string that refers to the logical node	

3.5.14 Common Data Class: MV_0_NODB

Description: Measured values (Floating Point values) and Description

CDC Class: MV

Attribute	Type	FC	Enumeration	Comment	X
Measurand					
mag	AnalogueValue_Float	MX		Magnitude of the instantaneous value of a measured value or harmonic value.	
q	Quality	MX		Quality of the measurement value	
t	TimeStamp	MX		Time when mag was last updated	
Configuration, Description					
units	Unit_Multiplier	CF		Units of the attributes that represent the data	
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.15 Common Data Class: MV_0

Description: Measured instantaneous and deadbanded values (Floating Point values) with deadband configuration and Description

CDC Class: MV

Attribute	Type	FC	Enumeration	Comment	X
Measurand					
instMag	AnalogueValue_Float	MX		Magnitude of the instantaneous measured value.	
mag	AnalogueValue_Float	MX		Deadbanded magnitude of the instantaneous value of a measured value or harmonic value. If db=0, then mag is updated to the current value of instMag, i.e. mag will track to instMag	
q	Quality	MX		Quality of the measurement value	
t	TimeStamp	MX		Time when deadbanded magnitude last exceeded its db configuration parameter	
Configuration, Description					
units	Unit_Multiplier	CF		Units of the attributes that represent the data	
db	INT32U	CF		Configuration parameter used to calculate all deadbanded attributes	
rangeC	RangeConfig_Deadband	CF		Configuration parameters as used in the context with the range attribute	
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.16 Common Data Class: SAV_0

Description: Samples of instantaneous analogue values

CDC Class: SAV

Attribute	Type	FC	Enumeration	Comment	X
Measurand					
instMag	AnalogueValue_Integer_ReadOnly	MX		Magnitude of the sampled value (Read Only)	
q	Quality	MX		Quality of the sampled value	
Configuration, Description					
sVC	ScaledValueConfig	CF			
d	VISIBLE_STRING255	DC		Textual description of the data	

3.5.17 Common Data Class: SPS_0

Description: Standard Single Point Status

CDC Class: SPS

Attribute	Type	FC	Enumeration	Comment	X
Status					
stVal	BOOLEAN	ST		The element status (TRUE or FALSE)	
q	Quality	ST		The quality of the status value	
t	TimeStamp	ST		Timestamp of the last change in state	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.18 Common Data Class: WYE_0

Description: Phase to ground measurements for a 3-Phase system (Phase A, B, C, Residual) including Description with deadband configuration

CDC Class: WYE

Attribute	Type	FC	Enumeration	Comment	X
phsA	CMV_0	--		Measurement values for Phase A	
phsB	CMV_0	--		Measurement values for Phase B	
phsC	CMV_0	--		Measurement values for Phase C	
res	CMV_0			Measurement values for residual	
Configuration, Description					

Attribute	Type	FC	Enumeration	Comment	X
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.19 Common Data Class: WYE_0_NODB

Description: Phase to ground measurements for a 3-Phase system (Phase A, B, C, Residual) including Description

CDC Class: WYE

Attribute	Type	FC	Enumeration	Comment	X
phsA	CMV_0_NODB	--		Measurement values for Phase A	
phsB	CMV_0_NODB	--		Measurement values for Phase B	
phsC	CMV_0_NODB	--		Measurement values for Phase C	
res	CMV_0_NODB			Measurement values for residual	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.20 Common Data Class: WYE_1

Description: Phase to ground measurements for a 3-Phase system (Phase A, B, C) including Description with deadband configuration

CDC Class: WYE

Attribute	Type	FC	Enumeration	Comment	X
phsA	CMV_0	--		Measurement values for Phase A	
phsB	CMV_0	--		Measurement values for Phase B	
phsC	CMV_0	--		Measurement values for Phase C	
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.5.21 Common Data Class: WYE_1_NODB

Description: Phase to ground measurements for a 3-Phase system (Phase A, B, C) including Description with no deadband configuration

CDC Class: WYE

Attribute	Type	FC	Enumeration	Comment	X
phsA	CMV_0_NODB	--		Measurement values for Phase A	
phsB	CMV_0_NODB	--		Measurement values for Phase B	
phsC	CMV_0_NODB	--		Measurement values for Phase C	

Attribute	Type	FC	Enumeration	Comment	X
Configuration, Description					
d	VISIBLE_STRING255	DC		Description of the status element. Textual description of the data	

3.6 Common data attribute type definitions

Common data attribute types, known herein as components, are defined for use in the Common Data Classes defined in the sections above.

3.6.1 Component: AnalogueValue_Float

Comment: General analogue value (Floating Point)

Parent Type: AnalogueValue

Attribute	Type	Enumeration	Comment	X
f	FLOAT32		Floating point value	

3.6.2 Component: AnalogueValue_Float_ReadOnly

Comment: General analogue read only value (Floating Point)

Parent Type: AnalogueValue

Attribute	Type	Enumeration	Comment	X
f	FLOAT32		Read only Floating point value	

3.6.3 Component: AnalogueValue_Integer_ReadOnly

Comment: General integer read only value

Parent Type: AnalogueValue

Attribute	Type	Enumeration	Comment	X
f	INT32		Read only integer value	

3.6.4 Component: RangeConfig_Deadband

Comment: Measurement Range Configuration - Limits that define the range of a measured value.

Parent Type: rangeC

Attribute	Type	Enumeration	Comment	X
hhLim	AnalogueValue_Float		Read only – always returns 0	
hLim	AnalogueValue_Float		Read only – always returns 0	
lLim	AnalogueValue_Float		Read only – always returns 0	
llLim	AnalogueValue_Float		Read only – always returns 0	
min	AnalogueValue_Float		minimum process measurement for which values of l or f are considered within process limits	
max	AnalogueValue_Float		maximum process measurement for which values of i or f are considered within process limits	

3.6.5 Component: ScaledValueConfig

Comment: Scaled Value Configuration definition - Object that contains scaleFactor & offset attributes

Parent Type: ScaledValue

Attribute	Type	Enumeration	Comment	X
scaleFactor	FLOAT32		Float to integer scale factor	
offset	FLOAT32		Float to integer offset value	

3.6.6 Component: Unit_Multiplier

Comment: Unit Type definition - Object that contains SI Unit and multiplier attributes

Parent Type: Unit

Attribute	Type	Enumeration	Comment	X
SIUnit	Enum	SIUnit	8-bit signed integer value	
multiplier	Enum	multiplier	8-bit signed integer value used as the exponent of the multiplier value in base 10, i.e. $10^{\text{units.multiplier}}$ Default value of units.multiplier = 0 (i.e. multiplier = $10^0 = 1$)	

3.6.7 Component: Unit_No_Multiplier

Comment: Unit Type definition - Object that contains SI Unit attribute only

Parent Type: Unit

Attribute	Type	Enumeration	Comment	X
SIUnit	Enum	SIUnit	8-bit signed integer value	

3.6.8 Component: Vector_Magnitude_Float

Comment: Complex vector (Floating Point Magnitude value)

Parent Type: Vector

Attribute	Type	Enumeration	Comment	X
mag	AnalogueValue_Float		The magnitude of the complex value	

3.7 Enumerated type definitions

The following sub-sections specify the enumerations that are associated to some Common Data Class attributes. The definition of the enumerations is according to IEC61850-7-3 and IEC61850-7-4 unless otherwise stated.

3.7.1 Enumerated type: Beh

Description: Behavior

Ordinal	Semantic
1	on
2	blocked
3	test
4	test/blocked
5	off

3.7.2 Enumerated type: ctrlModel

Description: Control Model

Ordinal	Semantic
0	status-only

3.7.3 Enumerated type: Health

Description: Health

Ordinal	Semantic
1	Ok
2	Warning
3	Alarm

3.7.4 Enumerated type: Mod

Description: Mode

Ordinal	Semantic
1	on

3.7.5 Enumerated type: multiplier

Description: Exponents of the multiplier value in base 10.

Ordinal	Semantic	Explanation
-24	y	Yocto
-21	z	Zepto
-18	a	Atto
-15	f	Femto
-12	p	Pico
-9	n	Nano
-6	μ	Micro
-3	m	Milli
-2	c	Centi
-1	d	Deci
0		
1	da	Deca
2	h	Hecto
3	k	Kilo
6	M	Mega
9	G	Giga
12	T	Tera
15	P	Petra
18	E	Exa
21	Z	Zetta
24	Y	Yotta

3.7.6 Enumerated type: SIUnit

Description: SI Units derived from ISO/IEC 1000

Ordinal	Semantic	Explanation
1		dimensionless
2	m	meter
3	kg	kilogram
4	s	second
5	A	ampere
6	K	Kelvin
7	mol	mole
8	cd	candela
9	deg	degrees
10	rad	radian
11	sr	steradian
21	Gy	Gray
22	q (Ed1) Bq (Ed2)	becquerel
23	°C	degrees Celsius
24	Sv	sievert
25	F	farad
26	C	coulomb
27	S	siemens
28	H	henry
29	V	volt
30	ohm	ohm
31	J	joule
32	N	newton
33	Hz	hertz
34	lx	lux
35	Lm	lumen
36	Wb	weber
37	T	tesla
38	W	watt
39	Pa	pascal
41	m ²	square meter
42	m ³	cubic meter
43	m/s	meters per second
44	m/s ²	meters per second ²
45	m ³ /s	cubic meters per second
46	m/m ³	meters per cubic meter
47	M	kilogram meter

Ordinal	Semantic	Explanation
48	kg/m ³	kilogram/cubic meter
49	m ² /s	meter square/second
50	W/m K	watt/meter Kelvin
51	J/K	joule/Kelvin
52	ppm	parts per million
53	1/s	rotations per second
54	rad/s	radians per second
61	VA	volt ampere
62	Watts	watts
63	VAr	volt ampere reactive
64	phi	degrees (phase angle)
65	cos(phi)	(dimensionless – power factor)
66	Vs	volt seconds
67	V ²	volt square
68	As	amp second
69	A ²	amp square
70	A ² t	amp square second
71	VAh	volt ampere hours
72	Wh	watt hours
73	VArh	volt ampere reactive hours
74	V/Hz	volts per hertz

3.8 MMS data-type conversions

The following table shows the relationships between the Part 7 and Part 8-1 data types. The definitions presented above use Part 7 data types, however these are subject to 'translation' when exposed over an MMS (Part 8-1) interface:

Part 7 Type	MMS Type	Part 7 Description
BOOLEAN	Bool	Logical TRUE/FALSE value
BVstring13	BVstring13	Variable bit string (up to 13 bits)
CODED_ENUM	Byte	Coded enumeration
CODED_ENUM2	Byte	Coded enumeration (2)
EntryTime	Btime6	Part 8-1 Section 8.1.3.7 (Ed1), 8.1.3.8 (Ed2)
Enum	Byte	8 bit enumerated value
FLOAT32	Float	32 bit floating point value
FLOAT64	Double	64 bit floating point value
INT128	Long	128 bit signed integer value
INT16	Short	16 bit signed integer value
INT16U	Ushort	16 bit unsigned integer value
INT24U	Ulong	24 bit unsigned integer value
INT32	Long	32 bit signed integer value
INT32U	Ulong	32 bit unsigned integer value
INT8	Byte	8 bit signed integer value
INT8U	Ubyte	8 bit unsigned integer value – used in Unbuffered Report Control Blocks (URCBs)
OCTET_STRING6	Ostring6	6 character string (8 bits per character) – used in GOOSE MAC address
Octet64	Ostring64	64 character string (8 bits per character)
OCTET_STRING8	Ostring8	8 character string (8 bits per character)
Quality	BVstring13	IEC61850 Quality
TimeStamp	Utctime	IEC61850 Time stamp
UNICODE_STRING255	UTF8Vstring255	255 character string (16 bits per unicode character)
UTC_TM	Utctime	UTC Timestamp
VISIBLE_STRING255	Vstring255	255 character string
VISIBLE_STRING64	Vstring64	64 character string
VISIBLE_STRING65	Vstring65	65 character string
VISIBLE_STRING97	Vstring97	97 character string

Section 4 TICS

Technical Issues Conformance Statement

4. IEC61850 TECHNICAL ISSUES (TISSUES) CONFORMANCE STATEMENT - TICS

4.1 Introduction

This **Technical Issues Conformance Statement (TICS)** specifies the conformance level attributed to M66x Series of Intelligent Electronic Devices (M66x IEDs) with respect to the **Technical Issues (TISSUES)** logged against the various parts of the IEC61850 standard. This document, along with the **Protocol Implementation eXtra Information for Testing** document (**PIXIT**), defines the basis for conformance testing in accordance with part 10 of the IEC61850 standard specifications.

This document identifies numerous Tissues that have an impact on conformance testing of the M66x IED. TISSUES have been classed into the following categories:

- Tissues identified as either editorial, or related to the XML schema or a client. Tissues that are not applicable to the IEC 61850 implementation in the M66x devices are grouped in this class.
- Tissues identified as status “Blue”, which are considered questions only.
- Tissues that have not completed or closed within the last year, or Tissues that have a status other than Green. These Tissues may or may not be listed in the conformance tables. Their numbers are included for completeness, and for tracking Tissues requiring future consideration.
- Technical issues with applicability under the IEC 61850 implementation in the M66x devices.

According to the UCA IUG QAP the Tissue conformance statement is required to perform a conformance test and is referenced on the certificate

For more details on the logged Technical Issues, refer to the website:

<http://www.tissues.iec61850.com>

4.2 Edition 1 Tissues considered (TICS Summary)

This document incorporates Edition 1 Interoperability Tissues closed prior to the latest revision of this document.

4.2.1 Mandatory Intop Tissues (TICS) - Summary

During the October 2006 meeting IEC TC57 working group 10 decided that:

- green Tissues with the category “IntOp” are mandatory for IEC 61850 edition 1
- Tissues with the category “Ed.2” Tissues should not be implemented.

Below table gives an overview of the implemented IntOp Edition1 Tissues.

Part	Tissue Nr	Description	Implemented Y/na
Part 6	1	Syntax	Y
	5	tExtensionAttributeNameEnum is restricted	na
	8	SIUnit enumeration for W	Y
	10	Base type for bitstring usage	na
	17	DAI/SDI elements syntax	Y
	169	Ordering of enum differs from 7-3	na
	245	Attribute RptId in SCL	Y
	529	Replace sev - Unknown by unknown	na
7-2	30	control parameter T	Y
	31	Typo	na
	32	Typo in syntax	na
	35	Typo Syntax Control time	na
	36	Syntax parameter DSet-Ref missing	na
	37	Syntax GOOSE "T" type	na
	39	Add DstAddr to GoCB	na
	40	GOOSE Message "AppID" to "GoID"	na
	41	GsCB "AppID" to "GslD"	na
	42	SV timestamp: "EntryTime" to "TimeStamp"	na
	43	Control "T" semantic	Y
	44	AddCause - Object not sel	na
	45	Missing AddCauses (neg range)	na
	46	Synchro check cancel	na
	47	"." in LD Name?	Y
	49	BRCB TimeOfEntry (part of #453)	-
	50	LNNName start with number?	Y
	51	ARRAY [0..num] missing	Y
	52	Ambiguity GOOSE SqNum	na
	53	Add DstAddr to GsCB, SV	na
	151	Name constraint for control blocks etc.	Y
	166	DataRef attribute in Log	na
	185	Logging - Integrity periode	na
	189	SV Format	na
	190	BRCB: EntryId and TimeOfEntry (part of #453)	-
	191	BRCB: Integrity and buffering reports (part of #453)	-
	275	Confusing statement on GI usage (part of #453)	-
278	EntryId not valid for a server (part of #453)	-	
333	Enabling of an incomplete GoCB	na	
453	Combination of all reporting and logging tissues	Y	
1281	Trigger option GI is TRUE by default	Y	
7-3	28	Definition of APC	na
	54	Point def xVal, not cVal	na
	55	Ineut = Ires ?	Y
	63	mag in CDC CMV	Y
	65	Deadband calculation of a Vector and trigger option	na
	219	operTm in ACT	na
	270	WYE and DEL rms values	Y
1199	BCR	Y	
7-4	None		

Part	Tissue Nr	Description	Implemented Y/na
8-1	116	GetNameList with empty response?	Y
	165	Improper Error Response for GetDataSetValues	Y
	183	GetNameList error handling	Y
	246	Control negative response (SBOs) with LastApplError	na
	545	Skip file directories with no files	na

NOTE: Tissue 49, 190, 191, 275 and 278 are part of the tissue #453, all other technical tissues in the table are mandatory if applicable.

NOTE: Editorial tissues are marked as "na".

4.2.2 Other Implemented Tissues - Summary

These tissues should have no impact on interoperability. Please refer to the appropriate sections that follow on Tissues pertaining to each part of the IEC 61850 standard.

Part	Tissue Number	Description
-	-	Refer to appropriate sections that follow

4.2.3 Comments

- Tissue 235 "Extension of name length" for dataset references has been changed from IntOp to Ed.2 and has been removed from the IntOp list
- Tissue 38 "Change Appld into Gold" to match part 7-2 with part 8-1 has been changed from IntOp to Ed.2 and has been removed from the IntOp list
- Even intop tissues may change. Compare <http://www.tissues.iec61850.com> for most recent status
- Questions and comments can be e-mailed to: helpdesk@ucausersgroup.org

4.3 Edition 2 Tissues considered (TICS Summary)

This document incorporates Edition 2 Interoperability Tissues closed prior to the latest revision of this document. It is based on TICS Template Ed2 for TPCL 1.0

4.3.1 Edition 2 Tissues considered (TICS Summary)

Below table gives an overview of the implemented IntOp Tissues.

Part 6 Tissue	Description	Implemented Y/na
658	Tracking related features	na
663	FCDA element cannot be a "functionally constrained logical node"	Y
668	Autotransformer modeling	na
687	SGCB ResvTms	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	Y
804	valKind and IED versus System configuration	Y
806	Max length of log name inconsistent between -6 and -7-2	Y
807	Need a way to indicate if "Owner" present in RCB	Y
822	Short addresses on structured data attributes	See Note
823	ValKind for structured data attributes	Y
824	Short addresses on structured data attributes	3
825	Floating point value	Y
845	SGCB ResvTms	na
853	SBO and ProtNs	na
855	Recursive SubFunction	na
856	VoltageLevel frequency and phases	na
857	Function/SubFunction for ConductingEquipment	na
886	Missing 8-1 P-types	na
901	tServices as AP or as IED element	3
936	SupSubscription parameter usage is difficult	Y
1168	doName and daName of ExtRef; doName may have one dot (DO.SDO)	Y
1175	IPv6 address lowercase only	na

Note: SISCO recommends that Tissue #822 should be deleted. It is resolved by Tissue #789. The Description in the TICS is incorrect.

Part 7-1 Tissue	Description	Implemented Y/na
828	Data model namespace revision IEC 61850-7-4:2007[A]	Y
1129	Rules for extending nameplate information (new CDC VSD)	na
1151	Simulated GOOSE disappears after 1 st appearance when LPHD.Sim = TRUE	na
1196	Extensions to standardized LN classes made by third parties	na

Part 7-2 Tissue	Description	Implemented Y/na
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	na
861	dchg of ConfRev attribute	na
876	GenLogicNodeClass and SGCB, GoCB, MsvCB, UsvCB	na
1038	Loss of Info Detection After Resynch	na
1050	GTS Phycomaddr definition in SCL	na
1062	Entrytime not used in CDC	na
1071	Length of DO name	na
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	Y
1202	GI not optional	Y

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

Part 7-4 Tissue	Description	Implemented Y/na
671	mistake in definition of Mod & Beh	na
674	CDC of ZRRC.LocSta is wrong	na
675	SIML LN	na
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	na
681	Enum PIDAlg	na
682	ANCR.ParColMod	na
683	Enum QVVR.IntrDetMth	na
685	Enum ParTraMod	na
686	New annex H - enums types in XML	Y
694	Data object CmdBlk	na
696	LSVS.St (Status of subscription)	na
712	interpretation of quality operatorBlocked	na
713	DO Naming of time constants in FFIL	na
724	ANCR.Auto	na
725	Loc in LN A-group	na
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	na
743	CCGR.PmpCtl and CCGR.FanCtl	na
744	LN STMP, EEHealth and EEName	na
772	LPHD.PwrUp/PwrDn shall be transient	na
773	Loc, LocKey and LocSta YPSH and YLTC	na
774	ITCI.LocKey	na
775	KVLV.ClsLim and OpnLim	na
776	LPHD.OutOv/InOv and LCCH.OutOv/InOv	na
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	na
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
912	Clarification of PwrRtg/VARtg	na

Part 7-4 Tissue	Description	Implemented Y/na
920	Resetable Counter is NOT resettable	na
932	Rename AVCO.SptVol to AVCO.VolSpt	na
991	LGOS: GoCRef (as well as LSVS.SvCBRef) should be mandatory	na
1007	PTRC as fault indicator – Update of descriptions required	na
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

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

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

4.4 Document structure (TICS)

This document is broken down into several sub-sections; one per part of the IEC61850 standard specifications.

Each subsection contains

- a list of tissue numbers that relate only to editorial or schema changes,
- a list of tissue numbers that are questions only (status = Blue)
- a table of the remaining tissues that provides, for each tissue:
 - The TISSUE number
 - A reference into the appropriate section, paragraph, annexe etc.
 - The subject of the TISSUE
 - The TISSUE status (Red/Green/Yellow etc.)
 - The required conformance
 - Indication if the TISSUE is supported

The required conformance column provides the following information:

Value	Meaning
Mx.y	TISSUE is included in the UCA Device conformance test procedures version x.y and is stated as mandatory.
O	TISSUE is not yet included in the UCA Device conformance test procedures, or it's a recommendation, or it's optional in the IEC 61850 documents.
tbd	To be defined. The proposal is not defined in such detail to be implemented or tested.
-	Not applicable, no change for implementation and testing.
?	Conformance is not known or unclear for the TISSUE.

The supported column provides the following information:

Value	Meaning
✓	The TISSUE is implemented in the M66x IED.
✗	The TISSUE has not been implemented in the M66x IED.
N/A	The TISSUE is not applicable to the M66x IED.
?	Support is not known or unclear for the TISSUE.

Note: All Tissues whose status is other than Green will indicate a conformance status of '?' and a supported status of '?'.

4.5 Document Revision Information (TICS)

Revision History

Revision	Date	Note
A	20-Jan-2015	Initial Document prepared. Tissues are included up to January 2015 pertaining to Ed.1 and Ed.2 implementations.

Firmware Applicability

This manual is applicable to IEC61850 for M66x firmware version v1.00 and later.

4.6 Part 5 Standard (TICS)

4.6.1 Specification scope

The scope of part 5 of the IEC61850 standards covers the communication requirements for functions and device models.

4.6.2 Editorial and schema related TISSUES

At the time of writing there are no logged editorial and schema related technical issues against part 5.

4.6.3 Question only Tissues

At the time of writing there are no *question only* technical issues against part 5.

4.6.4 Technical Issues

At the time of writing there are no logged technical issues against part 5.

4.7 Part 6 Standard (TICS)

4.7.1 Specification scope

The scope of part 6 of the IEC61850 standards covers the configuration description language for communication in electrical substations related to IEDs.

4.7.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:

4,12,14,16, 157,176,197,201,211,212,273,284,285,286,291,303

The following technical issues are considered not relevant for IEC61850 implementation on M66x devices and so they are classified as Not Applicable (N/A):

13,15,24,170,313,317,355,356,366,378,425,428,460,465,532,533,534,617,622,,640,737,738,739,740,798,799,1133,1144,1160,1211,1243,1254.

4.7.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

2,19,20,21,22,23,158,203,210,277,280,296,318,341,353,354,357,367,371,436,445,452,454,458,471,472, 484,491,589.

4.7.4 Unaddressed Tissues

The following Tissues were not considered in the present implementation of IEC 61850 Edition 1 in the M66x devices: 627,662,678

4.7.5 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
1	Annex A5	Syntax	Green	Correction to IP Address syntax to include missing “\” character.	IEC 61850 Ed. 1 IntOp	✓
3	Annex B	Missing ENUMs	Green	Appendix: the ENUMs of stVal/ctlVal are defined, but the ENUMs are missing for: - AutoRecSt - FltLoop - PmpCtl.	M1.1	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
				The M66x data model/ICD file does not use all defined enumerations. ENUMs AutoRecSt, FitLoop, PmpCtl, which were added, are not applicable.		
5	Annex A	tExtensionAttributeNameEnum is restricted	Green	Schema and editorial issue for Attribute names that may impact ICD and SCD validation against the SCL schema. Addressable as a document revision to part 8-1 of the standard.	IEC 61850 Ed. 1 IntOp	N/A
6	SCL schema	ReportControl/OptFields	Green	The "segmentation" attribute in the* ReportControl/OptFields* section of SCL should be deleted. There is no OptField within RCB, only used in reports dynamically.	tbd	✓
7	SCL schema	Duplication of attributes	Green	Setting Groups Schema The unique key in SCL schema is the name without FC, therefore it is not possible to specify the same attribute with different FCs. This is also not needed: the only attribute with two FCs are setting parameters (FC=SG, SE), where each specification with SG implicitly means an SE on MMS level, if editing is supported at all.	O	N/A
8	Annex B	SIUnit enumeration for W	Green	Use name Watts for code 62 instead of W.	IEC 61850 Ed. 1 IntOp	✓
9	Annex A	Data Set reference in CBs	Green	For ICD files change XML schema to allow control blocks (CBs)	O	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
				without a dataset reference. CBs without datasets are deactivated.		
10	Annex A	Base type for bitstring usage	Green	Part 8-1 introduces the attribute "Check" as a bitstring, however SCL does not support bitstrings. The philosophy is to have a separate base type for each kind of bitstring usage, so bType Check is added to the schema, to be used for the Check attribute. The Check attribute is not used in the M66x data model	IEC 61850 Ed. 1 IntOp	N/A
11	SCL schema	Schema for IP Addr?	Green	-	O	N/A
17	Schema	DAI/SDI elements syntax	Green	SIUnit is not used	IEC 61850 Ed. 1 IntOp	N/A
18	9.3.4, Table 14	Functional naming and LDevice	Green	M66x uses old method, which is to always use "IEDName + inst." "inst" is the attribute name identifying the LDevice within the IED. The full LD name contains an additional part before the "inst" value.	?	N/A
130	General	LDName length	Green	LDName is not used in M66x IEDs. Issue is supported by the S1 IED Configurator, IdName = iedName+IdInst	M1.1	✓
169	p. 119, Appendix B	Ordering of enum differs from 7-3	Green	"AngId" enumeration is not used in M66x data models	IEC 61850 Ed. 1 IntOp	N/A
186	Table 21	Definition of DataSet Members	Green	Datasets are not allowed to contain Control Blocks.	M1.1	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
				<p>The proposed solution is that a data set might contain FCDA elements as reference to the data model, and FCCB elements as reference to the control blocks. This allows the highest level of checking on XML schema level the correctness of the object references.</p> <p>This is a change to SCL but does not presently have an impact to M66x devices.</p>		
233	-	9-2 Security Attribute	Green	<p>The attributes "security" and "noASDU" are mapping specific and defined in 9-2. Add the security attribute to the SCL.</p> <p>M66x does not support part 9-2 of the standard.</p>	?	N/A
243	p. 65, 9.3.8	RCB Naming	Green	<p>Resolved by always using the default "index" naming. Report Control Blocks (RCBs). URCB01-URCB12 are the unbuffered control blocks used.</p>	-	*
245	p. 59, 9.3.8	Attribute RptId in SCL	Green	<p>To make the setting of a NULL value respective the non-setting in SCL completely clear, this shall be indicated by not specifying the rptID attribute at all, instead of using the</p>	O	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
				empty string value.		
272	p. 23, 8.2.6	Private section type	Green	<p>Make the use of the "type" attribute of the "Private" element as 'required' instead of 'optional'.</p> <p>The "type" attribute is always used.</p> <p>(Note: MiCOM S1 IED configuration issue, such that IED configurator always uses type.)</p>	?	✓
302	P 58, 9.3.7 Attributes of the FCDA element	References for arrays in DataSets	Green	Although the M66x does support harmonic array elements in its data model. Data set members cannot contain individual array elements.	-	N/A
307	9.3.2	Flag buffered/unbuffered reporting in element service	Green	Can't implement this yet. It is an Issue for Edition 2 to address that involves the tree structure defined in the Schema. It is not possible to resolve under Edition 1 of the IEC 61850 implementation.	?	?
315		Number of client associations	Green	<p>Proposal entails adding an element to the service section of the IED section that holds the maximal number of supported client associations</p> <p>Can't implement this</p>	?	?

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
				yet, since this service isn't supported under Edition 1 of the IEC 61850 implementation		
529	p. 118, Annex B (normative)	Sev	Green	The first EnumVAI for <Enumtype id="sev"> is not Unknown but unknown. Proposal is to replace Unknown by unknown. "Sev" is not used by M66x devices.	O	N/A

4.8 Part 7-1 Standard (TICS)

4.8.1 Specification scope

The scope of part 7-1 of the IEC61850 standards covers the architecture for communication and interactions between substation devices such as protection devices, breakers, transformers, substation hosts etc.

4.8.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:
 174, 267, 611.

4.8.3 Question only Tissues

The following technical issues are questions only and no compliance is required:
 450, 684.

4.8.4 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
129	13.2.2, Table 13	Coming/Going events?	Green	Both edges trigger in order to capture signals that transition from 0 to 1 and from 1 to 0. Note that a client can filter out the signal changes or transitions that are not desired.	-	✓
250	p.75, 13.2.2	Trigger option used, if not defined	Green	TrgOps value masks triggers in event generation. If attribute is not marked for dchg or qchg, then changes will not trigger reports or logs.	tbd-	✓

4.9 Part 7-2 Standard (TICS)

4.9.1 Specification scope

The scope of part 7-2 of the IEC61850 standards covers the layered substation communication architecture principles.

4.9.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:

29,33,137,142,149,192,195,308,338,339,342,351(rejected),361,369,379,
 385,387,388,390,392,393,398,399,400,404,406,408,409,410, 411,415,
 418,449,451,456,457,461,473,474,490.

4.9.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

172,181,193,251,287,293,295,345,346,347,350,352,389,402,412,413,427,435,440,449,462,540,
 546,623,635,659,667,941,1080,1301.

4.9.4 Unaddressed or open Tissues

The following Tissues were not considered in the present implementation of IEC 61850 Edition 1 in the M66x devices:

310,403,407,416,429,447,492,493,494,495,496,497,498,499,500,501,502,503,505,506,507,508,50
 9,510,512,513,514,515,516,517,518,520,521,522,523,524,526,536,537,549,580,593,595,610,867,
 1234,1326.

4.9.5 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
30	17.5.2.3	Control parameter T	Green	Change sentence to “The parameter T shall be the time when the client sends the control requests” (plural for request indicating there may be several requests). There are some further clarifications regarding the T parameter required as follows: - The T-parameter shall not be modified by the server - it will be mirrored with the response - the client may use it, to associate a response with the request - any other uses of T are local issues and outside the scope of the standard	IEC 61850 Ed. 1 IntOp	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
31	14.2.3.2.3.2	Typo	Green	Change the last sentence in the clause from "on a quality-change" to "On a data-update". Dupd is not used	IEC 61850 Ed. 1 IntOp	N/A
32	14.2.2.1 14.4.2.1	Typo in syntax	Green	BRCB class Syntax, (page 77) URCB class Syntax, (page 94) The attribute "TrgOp" shall be plural as "TrgOps"	IEC 61850 Ed. 1 IntOp	✓
34	15.1	Publish.request explanation	Green	Ed2: The devices trigger GOOSE events on both data transitions. GOOSE publishing is not currently supported in M66x	M1.1	N/A
35	17.5.2.3, Table 36	Typo Syntax Control time	Green	Proposal is to Change Attribute type from "EntryTime" to "TimeStamp".	IEC 61850 Ed. 1 IntOp	✓
36	15.2.2.3, 15.2.2.4	Syntax parameter DSet-Ref missing	Green	Proposal: Add the missing text, "15.2.2.3.3.3 (15.2.2.4.3.3) DataSetReference The parameter DataSetReference shall contain the Reference of the DATA-SET whose members have been requested." GOOSE Management is not supported in M66x devices.	IEC 61850 Ed. 1 IntOp	N/A
37	15.2.3.1	Syntax GOOSE "T" type	Green	This issue involves the GOOSE message syntax The Attribute type "T" is a time handled by the application. "EntryTime" is not correct, because "EntryTime" is for "internal" use: see clause 5.5.3.8. The proposal changes Attribute type from "EntryTime" to "TimeStamp". M66x devices do NOT currently support GOOSE.	M1.1 IEC 61850 Ed. 1 IntOp	N/A
38	15.2.1 15.2.1.4	Syntax "AppID" or "GoID"	Green	Ed.2: Change Attribute name from "AppID" to "GoID".	M1.1	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
39	15.2.1	Add DstAddr to GoCB	Green	<p>Issue: Additional attribute in GoCB definition required. Proposal: Add Attribute "DstAddress" after the Attribute "NdsCom" "15.2.1.8 DstAddress The attribute DstAddress shall be the SCSM specific addressing information like media access address, priority, and other information." M66x devices do NOT currently support GoCB.</p>	M1.1 IEC 61850 Ed. 1 IntOp	N/A
40	15.2.3.1 15.2.3.3	GOOSE Message <i>AppID</i> to <i>GoID</i>	Green	<p>Issue: GOOSE message syntax (page 116) AppID – application identifier (page 116) The Attribute name "AppID" is misleading and too general. IEC 61850-8-1 uses "GoID" instead Proposal: Change Attribute name from "AppID" to "GoID". M66x devices do NOT currently support GOOSE.</p>	M1.1 IEC 61850 Ed. 1 IntOp	N/A
41	15.3.1 15.3.4.1	GsCB <i>AppID</i> to <i>GsID</i>	Green	<p>Issue: GsCB class definition (page 118) Syntax (page 125) The Attribute name "AppID" is misleading and too general. IEC 61850-8-1 uses "GsID" instead Proposal: Change Attribute name from "AppID" to "GsID". M66x devices do NOT support GsCB. GsCB not supported in M66x.</p>	IEC 61850 Ed. 1 IntOp	N/A
42	p.138, 16.4	SV timestamp: <i>EntryTime</i> to <i>TimeStamp</i>	Green	M66x devices do not support Sampled Values at this time	IEC 61850 Ed. 1 IntOp	N/A
43	p.148, 17.5.2.3	Control "T" semantic	Green	<p>"The parameter T shall be the time when the client sends the control requests. Add NOTE: "Control requests can be Select, Operate, or Cancel."</p>	IEC 61850 Ed. 1 IntOp	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
44	17	AddCause - Object not sel	Green	ACSI AddCause values. Under part 8-1 has defined a new value as "Object-not-selected 18". AddCause is used only for Enhanced-Security Control. M66x devices use only Normal-Security Controls.	IEC 61850 Ed. 1 IntOp	N/A
45*	17.5.2.6	Missing AddCauses	Green	Add additional cause types?	IEC 61850 Ed. 1 IntOp	N/A
46	17.3.3	Synchro check cancel	Green	Synchro-check is ignored by Controls.	IEC 61850 Ed. 1 IntOp	N/A
47	19.2, Figure 40	"," in LD Name?	Green	The LDName is limited to 64 characters. '.' or '\$' or other '=' are not allowed. The IEC61850-7-2 standard will be corrected correspondingly.	IEC 61850 Ed. 1 IntOp	✓
48	17.2.1, Figure 30	Syntax in state machine	Green	Time activated controls are not supported		N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
49	14.2.2.16	BRCB TimeOfEntry	Green	<p>"The report handler assigns EntryID(s) and TimeOfEntry(s) to the values contained within a set of notifications. The number of notifications combined into a single EntryID is determined by the RCB control parameters (e.g. BufTim). The value of the EntryID is a local issue but it shall be a unique arbitrary OCTETSTRING whose value is unique within the scope of entries for a specific RCB. The value of the TimeOfEntry shall be the timestamp representing the time at which the report handler received the first notification that is used to form an EntryID."</p> <p>Within the GetBRCBValues : "The value, returned in a GetBRCBValues response, shall provide the time stamp of the EntryID whose value is exposed in the control block. The value exposed for TimeOfEntry, when the value of EntryID is zero(0), is a local issue."</p> <p>Therefore, after having set the BRCB state in resync, the client is able to check if the EntryID that is set, is the one that knows, since the couple "EntryID, TimeOfEntry" will always be unique during the whole lifetime of an IED (and of its replace part if a replacement should occur)</p>	IEC 61850 Ed. 1 IntOp	✓ part of 453
50	19.2	LNName start with number	Green	The LNName prefix shall start with a letter. Otherwise, mapping to MMS should restrict it, since MMS variable names are not allowed to start with a number.	IEC 61850 Ed. 1 IntOp	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
51	5.5.2	ARRAY [0..num] missing		<p>Text to be included in draft Ed2:</p> <p>The type ARRAY shall be as defined as follows: ARRAY [n..m] OF p with n = 0 or n = 1; m > 0; p = Common data attribute type or BasicType or Common ACSI type shall represent a list of elements numbered from "n" to "m". The type of the elements shall be as specified by "p".</p> <p>The ARRAY type shall be applied for DataAttributes only.</p> <p>NOTE Common data attribute types for substation automation applications are defined in IEC</p> <p>This text is posted under Tissue 456.</p> <p>The impact of the new type ARRAY on the services GetData... and others has to be analyzed. Will be resolved with clause 10 tissues.</p>	IEC 61850 Ed. 1 IntOp	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
52	15.2.3.6	Ambiguity GOOSE SqNum	Green	<p>Issue: There is a discrepancy between the 7-2 and 8-1 definitions of GOOSE SqNum. 7-2 clause 15.2.3.6 states: 'The initial value for SqNum shall be 1. The value of 0 shall be reserved.' Whereas 8-1 clause 18.1.2.15 states: 'The value of 0 is reserved for the first transmission of a StNum change.' Proposal: Change part 7-2 to match 8-1. The SqNum shall be set to 0 to indicate the first GOOSE transmission initiated by a value (increment of StNum) change. The first GOOSE message after a state change should be easily distinguishable from all other messages.</p> <p>The revised Text is: "Following a StNum change, the counter SqNum shall be set to a value of 0. If the counter SqNum overruns, it shall be set to a value of 1. The initial value for SqNum upon a transition of GoEna to TRUE shall be 1."</p> <p>M66x devices do NOT support GOOSE.</p>	IEC 6185 0 Ed. 1 IntOp	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
53	15.3.1, 16.2.1, Table 30,32	Add DstAddr to GsCB, SV	Green	<p>Within the current scheme of 61850, the GSE and SMV control blocks do not contain the destination (multicast) MAC address, while the Goose control blocks do. This means that the only way of finding out the group addresses for GSE and SMV are through SCL. This is fine if everything is configured correctly, but does not allow for the validation of the configuration, and will make diagnostics needlessly difficult. If we made the addresses visible in MMS, life will be much simpler for utilities. Proposal: Add the group addresses for GSE and SMV.</p> <p>Neither GsCB nor SMV are used in M66x devices.</p> <p>M66x devices do NOT support GsCB.</p>	IEC 61850 Ed. 1 IntOp	N/A
150	p.58 11.2.2.3	Attributes of Control Blocks as members of DataSets	Green	Ed2: Unsupported in M66x devices	?	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
151	p.156-157, 19.2	Name constraint for control blocks etc.	Green	<p>Issue: The instance names for the following classes need to be constraint in clause 19.2:</p> <ul style="list-style-type: none"> - DataSet - all Controlblocks <p>The instance names are concatenated with LNNames. The "LNName.xxName" must fit into 32 (according to 8-1 64) characters.</p> <p>See also comment #141 and IEC 61850-8-1 clause 17.1.1.1 (-2) Note below table 37 (39).</p> <p>Proposal: Define the (common) rule for building instance names for DataSet and control blocks. In clause 19.2, the explanation of FCD shall be changed from "29 characters..." to "61 characters..."</p>	IEC 61850 Ed. 1 IntOp	✓
163	10.2.2.4.3	TISSUE 65 from 7-3	Green	Edition 2 tissue.	-	N/A
166	14.3.3.2.7.3	DataRef attribute in Log	Green	<p>The parameter DataRef shall contain the DataSet member reference of the value of the EntryData. The parameter value shall contain the DataSet member values to be included in the EntryData.</p> <p>Logging is not supported by M66x.</p>	-	N/A
180	12 Figure 16	Figure substitution misleading	Green	Substitution is not supported	-	N/A
185	14.3.3.2.7.3	Logging - Integrity period	Green	Logging is not supported by M66x.	IEC 61850 Ed. 1 IntOp	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
187	16	OptFids in SV CB's not exposed for client specification	Green	ED 2: Include the OptFids MSVCB and USVCB in the control block get and set services, however, this is only true for SV Control Blocks (CB); in GOOSE CB we do not have OptFids. SV is not supported by M66x devices	Tbd	N/A
188	p.138, 16.4, Table 34	SV Format	Green	Ed2: SV not supported in M66x devices	-	N/A
189	p. 134, 16.4, Table 34	SV Format	Green	SV not supported in M66x devices	IEC 61850 Ed. 1 IntOp	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
190	p.77, 14.2.2.1	BRCB: EntryId and TimeOfEntry	Green	<p>See Tissue 49 for definition of TimeOfEntry and interaction with EntryID, and uniqueness within the system. see Tissue 453 for chapter edition including the BRCB state machine.</p> <p>EntryID in GetBRCBValues: "The value of EntryID, returned in a GetBRCBValues response shall be defined as follows:</p> <ul style="list-style-type: none"> • When the BRCB state is disabled: a GetBRCBValues shall return the EntryID value that represents the last (i.e..newest) entry that has been entered into the buffer. • When the BRCB state is resync: a GetBRCBValues shall return the value of the EntryID specified within the last SetBRCBValues. • When the BRCB state is enabled: The value of EntryID, returned in a GetBRCBValues response, shall be the EntryID of the last set of events sent. An EntryID value of all zeros(0) is reserved to indicate an empty buffer, no reported EntryID shall have a value of zero(0)." <p>TimeOfEntry in GetBRCBValues: "The value, returned in a GetBRCBValues response, shall provide the time stamp of the EntryID whose value is exposed in the control block. The value exposed for TimeOfEntry, when the value of EntryID is zero(0), is a local issue."</p>	IEC 61850 Ed. 1 IntOp	✓ part of 453

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
191	p.78/81, 14.2.2.5 14.2.2.12	BRCB: Integrity and buffering reports	Green	<p>see Tissue 453 for the revised chapter, inc. the GI state machine.</p> <p>GI are not buffered except the last one, till the next GI request is received, then the previous GI is removed from the Buffer. Buffering the Last GI has been decided to avoid BufOflv and therefore transmission of the whole history.</p> <p>Integrity reports are buffered, but a note has been added regarding to the memory limitation.</p> <p>"The BRCB shall buffer entries based on the trigger options data-change, quality-change, data-update, and integrity during loss of association. After the association is available again, after the client has set the EntryID, and enabled the BRCB, the BRCB shall start sending the reports of events that have been buffered. The BRCB shall use the sequence and subsequence numbers so that no gaps occur. NOTE Since the buffer events based on the trigger option integrity are buffered by the BRCB, and the memory of the IED dedicated for the buffering is limited, it is recommended to use the trigger option integrity in the BRCB with great care, to avoid a BufOvfl, and keep a long historical of the events."</p>	IEC 61850 Ed. 1 IntOp	✓ part of 453

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
220	p.48, 10.2.2.4.2, Table 18	FC SP	Green	<p>Issue: Referring to TISSUE 28 of 7-3, the definition of SP in Table 18 is not correct anymore (and it was never completely correct anyway).</p> <p>SP is now only used for setting parameters, and not for setpoints anymore. SP attributes can be changed using the SetDataValue service (see 7.7.1 of IEC 61850-7-3, Ed1).</p> <p>Proposal: Change Text in Table 18 as follows: "DataAttribute shall represent a setting parameter information whose value may be written and read. Changes of values shall become effective immediately"</p>		✓
234	p.21, 5.5.2	New type CtxInt	Green	As a consequence of TISSUE 146 (General) and TISSUE 120 (8-1), a new basic type CtxInt is added.	IEC 61850 Ed. 1 IntOp	N/A
236	19.2	Name length	Green	Ed2: LD name length up to 64 LN Name + rest length up to 64	?	✓
261	19	IEDName starts with number?	Final Proposal	<p>Ed2: New MMS release allows MMS domain to start with a number. However, previous MMS does not allow MMS domain (i.e. in 7-2 iedName or LDName) to start with a number. CIM does not allow it neither.</p> <p>Proposal: the iedName can</p>	?	N/A

				<p>either start with a letter (upper or lower case) or an underscore. The underscore can be follow by a numeric character. It granted the backward compatibility AND facilitates the CIM harmonization.</p>		
275	p.88	Confusing statement on GI usage	Green	<p>Correct interpretation is used.</p>	IEC 61850 Ed. 1 IntOp	<p>✓ part of 453</p>

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
278	p.82, 14.2.2.15	EntryId not valid for a server	Green	<p>The state resync has been added. The BRCB is and remains in state resync while it is not enabled and the client set EntryIDs of entries that are available in the buffer of entries.</p> <p>If no entry is found in the buffer of entries corresponding to the value of the EntryID set by the Client in the SetBRCBValues, then the state of the BRCB goes to disable.</p> <p>Use of EntryID within the BRCB :</p> <p>The reported entries are dependent upon the transitions of state of the BRCB and are handled as follows:</p> <ul style="list-style-type: none"> • A transition from disabled to enabled shall start reporting with the first available entry (i.e. oldest) in the queue of entries. Reporting of the next sequential entries shall occur. • A transition from resync to enabled shall start reporting with the next available entry (i.e. in time sequence), in the queue of entries, after the entry associated with the EntryID value set by the client. Reporting of the next sequential entries shall occur. <p>The value of EntryID, returned in a GetBRCBValues response shall be defined as follows:</p> <ul style="list-style-type: none"> • When the BRCB state is disabled: a GetBRCBValues shall return the EntryID value that represents the last (i.e..newest) entry that has been entered into the buffer. (continued) 	IEC 6185 0 Ed. 1 IntOp	✓ Part of 453

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
		(278 continued from previous page)		<ul style="list-style-type: none"> • When the BRCB state is resync: a GetBRCBValues shall return the value of the EntryID specified within the last SetBRCBValues. • When the BRCB state is enabled: The value of EntryID, returned in a GetBRCBValues response, shall be the EntryID of the last set of events sent. An EntryID value of all zeros(0) is reserved to indicate an empty buffer, no reported EntryID shall have a value of zero(0). 		
289	10 and 19	Instantiation of DATA	Green	Ed2: LNName consists of LN-Prefix, LN class name and LN-Instance-ID. To be consistent, it should be defined that DataName =Data class name [Data-Instance-ID] Data class name = up to 10 characters Data-Instance-ID = n numeric characters, optional; n shall be equal for all instances of the same data	?	✓
297	14.2.2.10	Sequence number	Green	Definition of SqNum : "The BRCB that has report enable set to TRUE shall maintain the parameter SqNum. This number shall be incremented by the BRCB for each report generated and sent on the basis of the BRCB. The increment shall occur once the BRCB has formatted the report for transmission. The first report following the setting of the report enable to TRUE shall contain sequence number 0. The sequence number shall roll over to 0 at its maximal value."	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
298	Table 23 & 25	Type of SqNum	Green	Attribute size for SqNum remains INT16U for Buffered Report Control Blocks (BRCB) and INT8U for Unbuffered Report Control Blocks (URCB)	?	✓
300	p.77 14.2.2.1 Table 23	Attribute Resv in BRCB	Green	Creation of ResvTms-Reservation Time- as optional new attribute added to Buffered Report Control Block (BRCB). New Attribute ResvTms is optional. But this is unchanged from the IEC 61850 standard	?	✗
305	p. 80, p.85, 14.2.2.9, 14.2.3.2.2.9	Reporting with BufTm=0	Green	If more than one member of a data set changes at the same time then multiple reports are sent. In general each data change causes a new Goose/Report. GOOSE reporting is not currently supported in M66x, only buffered and unbuffered reporting.	?	✓
322	14.2.2.1 & 14.2.4.1	Write Configuration attribute of BRCBs	Green	This does not apply to BRCB. DataSet in M66x devices because the ICD file defines it as type 'Conf' in the Services section.	Y	✓
325	p.24, 5.5.3.7.2 Table 7	TimeStamp definition	Green	Ed2: Correct the Attribute type from INT32 to INT32U in order to extend time reach from 2038 to 2106. Seconds is unsigned INT32	-	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
329	P.85, 14.2.3.2.2.8 Para 1	Reporting and BufOvl	Green	BRCB is supported in M66x devices. BufOvfl shall indicate to the client that entries within the buffer may have been lost. The detection of possible loss of information occurs when a client requests a resync to a non-existent entry or to the first entry in the queue. If one of the Entrys discarded causes the Report Handler to move the pointer to the Next Entry for transmission, the implementation shall indicated BufOvfl=TRUE in the next entry that is formatted and transmitted only. In other words, the buffer overflow bit should only be True if the Resync EntryID is not found in the buffer, and buffered information has been discarded prior to resync/enabling of reporting. See Tissue 453	-	✓
331	p.143, 17.2.2 Para. d)	SBO Control Normal Security	Green	Ed2: This is a specification issue, such that. "the control object shall turn to the state Ready if sboClass = OPERATE_MANY, or Unselected if sboClass = OPERATE_ONCE"	-	✓
332	p.88, 14.2.3.2.3.2	Ambiguity in use of trigger options	Green	Data attributes with empty trigger options will not trigger any reports other than those due to GI & integrity poll.	-	✓
333	p.110, 15.2.1.3	Enabling of an incomplete GoCB	Green	The revised text is: "If there are inconsistent attribute values in the GoCB (e.g. the value of DataSet is Null) or if the value of ConfRev equals 0, a SetGoCBValues with the parameter GoEna equals TRUE shall fail and a negative response shall be issued." M66x does not support GOOSE.	-	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
334	p.142, 17.3.3	Select a SBO object twice	Green	<p>Ed2: Resetting the SBO Timeout timer may lead to security issues. The purpose of the SBO Timeout was to introduce an automatic un-selection to avoid that a control object remains unavailable for a long time after a selection. The proper AddCause depends on the state of the state machine associated to the control object. If the second select occurs before the operate request, then the AddCause shall be Already-selected.</p> <p>If the second select occurs after the operate request, then the AddCause shall be command-already-in-execution in both cases regardless if same or another client.</p> <p>Extend the Select timeout period for SBO. The tissue refers to SBO ES which we don't do. Under SBO ES you indicate reason to fail the operation. Under SBO the timeout is supported by extending the timeout (This is really a PIXIT issue)</p> <p>This TISSUE has had many contradictory possible resolutions. The M66x performs a "extend timeout" upon a second select from the same client.</p>	-	✓
335	p. 85, 14.2.3.2.2.8	Clearing of Bufovfl	Green	<p>Buffer Report Control Blocks are implemented in the M66x Series.</p> <p>The specification should add the following sentence; The BRCB shall clear the BufOvfl flag after the BRCB is able to buffer new un-reported events, which generally occurs immediately after the BRCB sends a report.</p>	-	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
337	p.164, Annex A, Table A.2, M7 and M8	Configuration Revision option missing	Green	Ed2: Add the options missing in the "ASCI models conformance statement as follows: M7-11 : conf-revision M8-9 : conf-revision The Protocol Implementation Conformance Statement (PICS) is updated to include configuration revision		✓
348	p.92, 93, 14.2.4, Para 14.2.5.2	URCB class and report	Green	Allow TimeOfEntry (report time stamp) of URBC reports to exist independent of missing EntryID.		✓
349	p.75, Para. 14.2.2.16, 14.2.3.2.2.9	BRCB TimeOfEntry has two definitions	Green	See Tissue 49 for definition of TimeOfEntry and interaction with EntryID, and uniqueness within the system. See Tissue 453 for chapter edition including the BRCB state machine. EntryID in GetBRCBValues: "The value of EntryID, returned in a GetBRCBValues response shall be defined as follows: • When the BRCB state is disabled: a GetBRCBValues shall return the EntryID value that represents the last (i.e.newest) entry that has been entered into the buffer. • When the BRCB state is resync: a GetBRCBValues shall return the value of the EntryID specified within the last SetBRCBValues. • When the BRCB state is enabled: The value of EntryID, returned in a GetBRCBValues response, shall be the EntryID of the last set of events sent. (continued)		✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
		(349 continued from previous page)		<p>An EntryID value of all zeros(0) is reserved to indicate an empty buffer, no reported EntryID shall have a value of zero(0).</p> <p>TimeOfEntry in GetBRCBValues: "The value, returned in a GetBRCBValues response, shall provide the time stamp of the EntryID whose value is exposed in the control block. The value exposed for TimeOfEntry, when the value of EntryID is zero(0), is a local issue."</p>		
370	p.146,147 17.4 Procedure b)	Time-activated operate and further conditions like mode	Final proposal	<p>Ed2: Add the conditions that have to be met before the action can be activated:</p> <p>"b) On expiration of the timer the wanted action shall be activated (if the conditions LNBeh = on or test AND LDMode = on or test AND Loc of LN = false AND Loc of LLN0 = false) and a response shall be sent to the client."</p> <p>In general: the State Machines for control should reflect these conditions as well ... maybe it would be sufficient to state this at the beginning of clause 17 (Control). These conditions have to be met in any case.</p> <p>Note: The M66x does not support time activated operate</p>	-	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
373	p.64, clause 12	Substitution subVal and subID	Green	<p>Ed2: To keep track which client issued the last set it is required to set the subID anytime when a new value is set for: subVal, subMag, subCMag, and subQ.</p> <p>This may be implemented in an SCSM by a set service that carries two values: one for subXxx and one for subID.</p> <p>With reporting and logging one could track the sequence of changes.</p> <p>If we want to prevent a second client to change any substitution values (in state subEna=True), then we would need a semaphore for substitution (or a similar mechanism).</p> <p>The M66x does not support substitution.</p>	-	N/A
374	p.64, clause 12	Over-write substitution values	Green	<p>Ed2: After subEna is set to True it shall be possible to set new values (over-write the current values) for subVal, subMag, subCMag, subQ, and subID. The updated values shall be used to update the corresponding process values (stVal, ...).</p> <p>The over-write of the values subVal, subMag, subCMag, and subQ shall be accompanied by a new value for subID.</p> <p>TheM66x devices do not support substitution.</p>	-	N/A
384	p.18, 5.3, Figure 3	Conceptual service model in 5.3	Green	Log is not used	-	N/A
386	p.54, 10.4.2.3	GetDataValues - leafs not access	Green	The attempt to set a DataAttribute or an underlying component that is not available shall be interpreted as a service failure.	-	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
391	p.21, 5.5.2, Table 2	Basic Types (STRING)	Green	Full name is 129 octets	-	✓
405	p.160 & 161 20.2.2	SetFile	Green	SetFile is not supported	-	N/A
417	p.120, 15.3.3.1	GSSE service definitions	Green	GSSE is not supported	-	N/A
426	p.58, 11.2.1	Dataset contents configurability	Green	Ed2: The following text has been added: An IED which claims to support dynamic creation of datasets (CreateDataSet) shall be able to receive (as a server), send (as a client), and process (as a server or as a client) any valid FCD or FCDA definition contained in the CreateDataSet request. An IED which claims to support configuration of datasets (via SCL) shall be able to process (as a server or as a client) any valid FCD or FCDA definition contained in the corresponding SCL file. Note: Unknown whether the Alstom MiCOM IEC 61850 IED Configurator will support this configurability	-	✓
453	p.17 Clause 14	Reporting & Logging model revision	Green	Ed 2 Behavior is followed including resync	○	✓
455	Clause 17	Canceling a started control sequence	Green	Ed.2: Canceling a started control sequence shall be possible. The Edition 1 (Ed.1) does limit the use of cancel for too few cases. It should also be clarified when a cancel can be successfully performed by another client than the one that started the control sequence. Clarify in Edition 2.	-	✓
1281	p. 88, Clause 14.2.3.2.3.4, Paragraph 1	Default for TrgOps.GI is True	Green	'The default status of TrgOps.GI is required to be TRUE following a power up and/or reconfiguration of the RCB.'	-	✓

4.10 Part 7-3 Standard (TICS)

4.10.1 Specification scope

The scope of part 7-3 of the IEC61850 standards covers the abstract common data class definitions.

4.10.2 Editorial and schema related TISSUES

The following technical issues are editorial or schema related only:

56,57,58,59, 61,62,64,138,161,182,213,266,340,358,359,414,424,483

4.10.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

66,67,214,223,274,312,437,489,530,531,542,581,619

4.10.4 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
28	7.6.2	Definition of APC	Green	The APC Common data class (CDC) is not used within the M66x data model.	IEC 61850 Ed. 1 IntOp	N/A
54	6.11	Point def xVal, not cVal	Green	“Point “ is not used	IEC 61850 Ed. 1 IntOp	N/A
55	7.4.5 Table 25	Ineut = Ires ?	Green	Three currents are available for direct measurement using CTs (IA,IB,IC). The M66x device use Ires = sum(IA,IB,IC)	IEC 61850 Ed. 1 IntOp	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
		(55 continued from previous page)				

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
60	Table 13/21 and other	Services missing in tables	Green	Document issue is resolved by defining the list of services supported by the data attributes: for GSE models (SendGOOSEMessage, ...)	?	N/A
63	General	mag in CDC CMV	Green	Add the following notes: - that the instCVal.mag (the mag component of Vector) is NOT a deadbanded value. - that the deadband calculation for cVal.mag and cVal.ang is based on instCVal.mag and instCVal.ang - Data attribute mag is not the same as data attribute component of the data attribute type vector.	IEC 61850 Ed. 1 IntOp	✓
65	General	Deadband calculation of a Vector and trigger option	Green	Deadbands of vectors apply only to cVal.mag component.	IEC 61850 Ed. 1 IntOp	N/A
68	General	New CDC ACI	Green	The Common Data class ACI is unused in M66x devices.	O	N/A
164	6.5	Deadband on range limits	Green	Edition 2 tissue.	?	N/A
171	p.24,p.40 p.46	Enums from 7-4	Green	The issue was already addressed and solved as Part of Tissues 120/146.	?	✓
204	7.7 and 7.8	Reporting of setting values	Green	M66x doesn't do reporting of control settings	?	✘
205	p.42 7.9.2 table 46	Device name plate - missing description "d" and "dU"	Green	Attributes "d" and "dU" are always optional. M66x utilizes "d" description but not dU".	O	✘
217		CDC for LN Inputs	Green	M66x data models do not use the ORG Common Data Class (CDC)	?	N/A
219	7.3.5 Table 17	operTm in ACT	Green	ACT is not used in the M66x data model	? IEC 61850 Ed. 1 IntOp	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
239	p.22, clause 7.2, Table 12	Conflict of LPL definitions with requirements of Namespace	Green	Logical device Namespace, LdNs, is in LLN0.LPL	?	✓
240	p.61, Table A.4	New type of SI unit	Green	PFRC is not used in M66x	Tbd	N/A
247	p.60-62, Table A	Miss % representation	Green	For %, SIUnit: Value = 1 (dimensionless), multiplier: Value = 2	?	✓
265	6.2.1	Quality extension	Red	Edition 2 tissue.	?	N/A
266	p.28, and more, 7.4.2 and more, Table 22 and more	Open Enumeration of range	Green	Optional MX component "range" not supported in M66x.	?	N/A
270	p.31, clauses 7.4.5, 7.4.6	WYE and DEL rms values	Green	Interpretation of magnitude (rms or phasors): If there is an angle present, the values are phasor values and attribute mag represents the maximum value of the sinusoidal wave form. If there is no angle present, the attribute mag represents an rms value. Default of Rms is used in M66x.	IEC 61850 Ed. 1 IntOp	✓
327	p.61, Table A.4	More new types of unit	Green	New unit types "Number of characters" and "Baud" are not applicable	?	N/A
328	p.61, Table A.4	New unit for frequency functions	Green	New unit types "Number of cycles" and "Baud" are not applicable	?	N/A
330	7.4.8 thru 7.4.10	CDC HMV, HWYE, HDEL	Green	Substitution is not supported in the M66x devices.	?	N/A
375	p.25, 7.3.6	Directional loop activation information	Green	Common Data Class ACD is not used.	?	N/A
439	p.47, 7.8.2 (ASG) Table 43	Lower limit of stepSize in ASG	Green	stepSize is not used	?	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
469	-	oper timeout missing in controllable CDC	Green	Enhanced security is not used	?	N/A
482	p.29, 7.4.3, Table 23	Quality evaluation of a Vector	Yellow			
519	Annex A	Add new unit to table A4	Green	New unit turbine inertia is not used.	?	N/A
525	7.4.2, Table 22	subMag and instMag in CDC MV	Final proposal			
582	p. 26, 7.3.8	BCR actVal as INT128	Green	CDC BCR values are specified as INT128, but embedded IED processors generally do not support data types greater than 64 bits. Most usage of BCRs need far fewer than 32 bits. However, MMTR.TotWh expresses energy accumulators as signed watt-hours which requires more than 32 bits. Remove the INT128 and replace it with INT64. (Ed2 only)		x
615	p.22, Table 12	dataNs, cdcNs, InNs definitions	Final proposal			
1199	p.26, 7.3.8	Allow INT32 for CDC BCR	Green	INT32 now required for BCR.actVal/frVal for Ed1		✓

4.11 Part 7-4 Standard (TICS)

4.11.1 Specification scope

The scope of part 7-4 of the IEC61850 standards covers the compatible Logical Node class and data class definitions.

4.11.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:

69,70,71, ,77,78, ,87,88,89,100,107,108,145, 255,
381,382,383,394,395,396,397,401,432,441,442,443,485,486,487,588,1305

4.11.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

81,93,103,152,153,215,221,241,248,257,283,304,309,311,321,324,444,448,464,481,538,543,544,
614,618,624,723.

4.11.4 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
72	General	Single phase metering missing	Green	The M66x devices do not support Non phase related Metering; hence this new Logical Node MMTN is not used within the data model.	M1.1	N/A
73	5.11.3 5.11.4	Instances of LN SIMG (SIML)	Green	Logical Node SIMG (SIML) on insulation medium supervision is not used in M66x devices.	Tbd	N/A
74	Clause 6	PresTr	Green	The Data Object named Insulation Liquid pressure trip (PresTr) and Logical Node Insulation medium supervision (liquid) are not used. in M66x devices		N/A
75	5.7.1	Str and Op	Green	Str and Op are already optional in the GAPC logical node, however M66x devices do not use this logical node within the data model.	Tbd	N/A
76	Clause 6	CBOpCap and SwOpCap	Green	Data Objects CBOpCap and SwOpCap are not used in the M66x.	?	N/A
79	Clause 6, Table 9	AutoRecSt and Lockout	Green	These Data objects are not used.	?	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
80	5.13	TCTR and TVTR - Over	Green	This tissue makes Amp and Vol conditional for Ed2 only.	?	N/A
82	5.10	New LN Class, control measuring function	Green	New Logical Node class MCXL is not used in M66x devices.	?	N/A
83	5.6.6	Operation by CSWI.	Green	CSWI is not used	?	N/A
84	Clause 6, Table 9	Data Name "InOv"?	Green	LPHD.InOv is not used in M66x devices	?	N/A
85	Clause 6, Table 9	RsStat - device security statistics	Green	RsStat is not used in M66x devices	?	N/A
86	Clause 6, Table 9	PwrSupAlm and EEHealth	Green	Data objects are not used in M66x devices.	?	N/A
90	5.6.5	Start a point on wave	Green	CPOW is not used in M66x data models.	TBD	N/A
91	5.11.3	SIMG mix of ...	Green	SIMG is not used in M66x data models.	TBD	N/A
92	5.11.4	PresAlm and PresTr	Green	SIML and SIMG are not used in M66x data models	TBD	N/A
94	5.3.4	Loc and CDC SPS/SPC?	Green	-Loc is not used	TBD	N/A
95	5.3.4	Proposed called BlkStat	Green	-Proposal was bit accepted	TBD	N/A
96	5.7.3	LN GSAL - OpCntRs	Green	GSAL is not used in M66x data models	TBD	N/A
97	5.8.1	LN IARC and OpCntRs	Green	GSAL is not used in M66x data models	TBD	N/A
98	5.7.3 5.8.1	GSAL/IARC and NumCntRs	Green	GSAL and IARC Logical Nodes are not used within M66x data models	TBD	N/A
99	Clause 6	NamPlt of LLN0	Green	The LLN0 contains common information for the LD like Health, Mode and Beh and NamPlt.	?	✓
101	5.5.2	LevMod - disturbance recorder	Green	LevMod is not used	-	N/A
102	5.5.2	RDRE - Sample Rate	Green	New Attribute RDRE sample rate is not applicable	-	N/A
104	5.6.6	LN CSWI - open/close	Green	LN CSWI not used in M66x data models	?	N/A
105	5.10.	LN Group M - EEHealth	Green	EEHealth is not used	?	N/A
106	5.10.7.	MMXU – EEHealth	Green	EEHealth is not used	?	N/A
132	5.12.4	SwARsAlm in XCBR	Green	XCBR is not used	?	?
133		LN RREC – Unsuccessful	Green	RREC is not used	-	N/A

134	5.7.2	LN GGIO	Green	More than one Data of the same type is allowed. Data Instances are used (e.g. Ind1, Ind2, Ind3). LN GGIO is not supported in M66x devices.	?	NA
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Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
147	p.80, clause 6, Table 9	Mod	Green	Mod is read only	-	N/A
148	5.7.3, 5.8.1	OpCntRs	Green	OpCntRs is not used	?	N/A
199		Input of logical nodes	Green	Duplicate Tissue. See Tissue 216.	?	N/A
208	5.7.3, 5.8.1	NumCntRs - Control?	Green	NumCntRs is not used	?	N/A
209	p.46, 5.7.3	Authorization Failure	Green	Authorization is not used		N/A
216	5.3.3	Description of LN inputs	Green	New Features to add generic CDC input	Tbd	NA
252	p.31, 5.4.22	PTTR.AImThm	Green	AImThm is defined to be of ACT class. The ACT class is not used.	?	NA
256	p.55, 5.10.7	MMXU and rms values	Green	Values of MMXU of CDC WYE/DEL can have two meanings: - with angle present they are phasors and the attribute mag represents the maximum value of the sinusoidal waveform - with angle not present, they should represent rms values. Angle is not present, Mag is rms for A, PhV and PPV	?	✓
263		Setting Local time or summer/winter time	Green	Proposed to add two new settings to LPHD: - time of next change to daylight saving time - time of next change to standard time These settings would be of new CDC to be defined. The proposed Data objects are not used	?	N/A
264	General	LN's SCBR, SSWI	Green	Ed2: These Logical Nodes (LN's) for condition monitoring information from switchgear are not used	?	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
268	p.29, 5.4.18	PTOC Enabling Blocking by Harmonic restraint	Green	Unused in M66x devices	?	N/A
269	p.30, 5.4.21	PTRC and Switch on to fault	Green	Unused in M66x devices	?	N/A
281	p.40, 5.5.9	LN RPSB	Green	Unused in M66x devices	?	N/A
288	p.36, 5.5.2	RDRE.RcdTrg	Green	The proposal to trigger a recorder from an external command was not accepted No change to the standard has resulted.	?	N/A
306	-	Local / Remote	Green	Loc is not used	?	N/A
319	71 5.3.3	'behavior' attribute is not required for LLN0	Green	Behavior attribute "Mod" was mandatory and will become optional.	?	N/A
320	p.91, clause A.1.1.2, Para.2	Numbering of extended data	Green	Issue for Ed2 only The numbering convention to be applied is unclear in regards to additional Data needed more times than defined in the Logical Node class. AnIn isn't used. For the Logical node class in M66x devices GosGGIO1 has Data Objects, AnIn1 and AnIn2, but AnIn has been suppressed per Tissue 320	?	N/A
343	p.48, 5.9.4	ATCC.ParOp	Green	The parallel operation attribute in ATCC is not used in M66x.	?	N/A
360	p.48-49 5.9.4	ATCC.LTCBik <--> ATCC.Auto	Green	The proposal to change attribute name and type was rejected. Not used by M66x.	-	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
362	-	SP versus DP on electrical IED inputs	Green	Double point information on model level was introduced because all 4 resulting states have some semantic meaning and not because of communication reliability. No change proposed.	-	N/A
363	-	L/R Security versus Information	Green	Issue for Ed.2: An IED Loc, Local/Remote switch, is not used in M66x:	?	N/A
467	p.45, 5.7.2, Para 1	GGIO -- Limitation of Floating point set point	Green	New Data Object (DO)	?	N/A
468	p.37, 5.5.3.5.5.4	DR -- Requires more explanation	Green	RADR and RBDR are not used	?	N/A
475	p.92, Annex A.3 all para.	Specialization of data by use of the number extension	Green	Not applicable to M66x devices	?	N/A
476	p.49, 5.9.4	ATCC.BIkVLo / BIkVHi	Green	Not used in M66x devices	?	N/A
477	p.59, 5.12.1	XCBR.HeatAlm	Green	Not used in M66x devices	?	N/A
478	p.46, 5.8.2	emergency off, IHMI.EmgOff	Green	Not used in M66x devices	?	N/A
479	-	%-change of measured values	Green	Consider this as a status "Blue" question Tissue.	?	N/A
480	p.58, 5.11.4	SIML.TmpAlm	Green	Not used in M66x devices	?	N/A
488	-	Input for Logical Nodes: Data Object binding	Green		?	N/A
539	-	Dynamic Protection Blocking	Green		?	N/A
584	p.36, 5.5.2	RDRE missing FullSt	Green		?	N/A
585	p.36, 5.5.2	RDRE and associated file directory location	Green		?	N/A
591	-	SIML	Green		?	N/A

4.12 Part 8-1 Standard (TICS)

4.12.1 Specification scope

The scope of part 8-1 of the IEC61850 standards covers the specific communication service mapping (SCSM) to the MMS protocol.

4.12.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:

109,110,111,112,115, 117,120,121,123,143,144,
 224,227,231,237,276,279,290,299,314,323,344,365,419,430,459

4.12.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

113,131,140,162,167,175,194,200,202,207,225,226,228,229,230,232,238,242,249,301,326,380,46
 6,470,620,625,628,636,639,655,656,771,809,959,969,977.

4.12.4 Tissues - Not Applicable for M66x:

143,144,222,377,612,616,621,717.

4.12.5 Tissues – Unresolved:

246,527,528,535,541,547,583,596,1286

4.12.6 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
114	17.1.1.1 & 17.1.1.2	Naming URCB	Green	Tissue was not accepted	-	N/A
116	8.2.1.3, 9.2.2.3	GetNameList with empty response?	Green	The GetLogicalDeviceDirectory response- should be an MMS GetNamedList response+ with moreFollows=FALSE and a NULL List. If the GetNamedList service is issued for a Domain scoped object and the Domain does not exist, then a Confirmed-Error response with object-non-existent shall be returned.	IEC 61850 Ed. 1 IntOp	✓
117	18.1.2.5	TimeAllowedtoLive - how long to wait?	Green	Tissue was not accepted, however document is revised so that Client/Server was replaced by Publisher/Subscribers	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
118	23.1	File directory	Green	The File list excluded the "Directory". KEMA recommends always including the directory separator. When the last character of FileName is the file separator "\", it's a directory	?	N/A
119	-	MMS GetCapabilityList required?	Green	Ed 2 - MMS GetCapabilityList service: Services from the SCL-File shall be given as an example in edition 2 GetCapabilityList is not supported because tissue is not clear enough without an example to implement a technical resolution. Issue needs to be further clarified.	?	x
122	25.1.1.1, Table 111	P-Type = IP; DNS name	Green	DNS name is not allowed and is removed from the table	?	✓
128	18, 19	Add DstAddr to GsCB, SV	Green	M66x devices do not use GSCB and SVCB in the data models.	-	N/A
165	p.47 14.3.1	Improper Error Response for GetDataSetValues	Green	Issue is regarding an ACCESS error to GetDataSetValues requests executed for a non-existent DataSet (e.g. VGET in MMS), MMS ErrorResponse of Class= ACCESS and Error Code= OBJECT-NON-EXISTENT to be returned	IEC 61850 Ed. 1 IntOp	✓
168	p.32 7.3.2 Para 2	Order of attributes in MMS components	Green	Within a MMS component, representing IEC 61850-7-4 DATA, the order of MMS components is determined by the order of the names of the common data classes (as defined in IEC 61850-7-3 or IEC extensions of it). For private CDCs the order of attributes within the MMS component shall be identical to the order within the SCL ICD file describing the data model.	?	✓
177	p.52 17.1.1.2 Table 39	Ignoring OptFlds bits for URCB	Green	For Ed2 only. For an Unbuffered Report Control Block (URCB), the Server ignores the values of bits buffer-overflow and entryID in a write request and the value is always 0 when reading these bits.	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
183	p. 39 9.3 Table 17	GetNameList error handling	Green	No change is needed since tissue 116 resolves this issue. The GetServerDirectory service is restricted to return the list of LogicalDevices (e.g. Domains) or a list of Files. Therefore, it is not possible to request a Domain object scope. The text explicitly specifies that the MMS GetNamedList objectClass is Domain. Deleted reference to Table 17 in clause 11. Tissue 116 resolution added text to clause 11 that resolved this issue	IEC 61850 Ed. 1 IntOp	✓
196	Annex E	SCL for Control	Green	See 173; Add an example in part 6 and 8-1	?	✓
198	see tissue #114	Instantiation of URCB	Green	This is linked to part 6 tissue 243. Unbuffered Report control Blocks (URCBs) are always indexed.	Tbd	✓
235	8.1.3.2	Extension of Name length	Green	The length of names has been expanded; changes are required to adapt to the new name length. Change 65 to 129. Then after the -VMD paragraph add: "The maximum MMS Object Name and Domain Name size shall be constrained by the MMS maxidentifier size of 64 (see Annex G)."	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
260	p.93 23.2.4 Para 1	GetFileAttributeValues	Green	<p>Change Clause 23.2.4 (IEC 61850-8-1) to: "The ACSI GetFileAttributeValues should be mapped to a MMS FileDirectory service as expressed in table 83. An ACSI GetFileAttributeValues Request shall cause an MMS FileDirectory request to be issued. Only one answer of the MMS FileDirectory should return with the FileName and FileAttributes of the requested file. This is the information that shall be indicated as part of the ACSI GetFileAttributeValues Response +."</p> <p>Change in Table 83 (col. 2, row 3) "FileName" to "FileSpecification" in the MMS FileDirectory Request to be more accurate.</p> <p>File Directories are not supported in M66x devices.</p>	?	N/A
262	p.88 20.8	LastApplError Error codes	Green	<p>Define in Part 8-1 how enhanced security is used: TimeOut Test Not OK shall be returned if a TimeActivated Control CMD is issued, with TEST=TRUE, and the operation fails.</p> <p>Operator Test Not OK shall be returned if an OPER control CMD is issued, with TEST=TRUE, and the operation fails.</p> <p>Error codes are only applicable to enhanced security. Enhanced security is not implemented for M66x devices.</p>	?	N/A

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
292	p. 18 clause 4	Explanation of r and w	Green	Characteristics are clarified as follows: "r = mandates that the item is readable. The ability to write the item is a local issue." "rw"= Mandates that the item is both readable and writeable." "w = Mandates that the item is writeable. The ability to read the item is a local issue."	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
368	p.84, p.86, 20.5, 20.7, 20.7.1.3	Mapping of analog setpoints (SP)	Green	Indicate that 7-2 "Value" is mapped to the underlying CDC of the control object. For example, part of PDIS.PoRch setpoint data is mapped to PDIS.PoRch.Oper.setMag.f and allow the setMag structured attribute of setpoints to be used. -Change 3 place 'Where <xxx> is the appropriate CDC (e.g. ctlVal or setMag)' to 'Where <xxx> is the appropriate CDC (e.g. ctlVal or setMag\$f or setMag\$i)' -The suggestion for Table E.8 shows mxVal for CDC APC. This CDC has only setMag and not mxVal. The M/O/C entry for this line should be as 'M for APC and ASG'. -Tables E.9 and E.10 should be modified like E.8 shown above	?	✓
422	p.34 7.3.1	Order of extension data objects and data attributes	Green	"Within a MMS component, representing IEC 61850-7-4 DATA, the order of MMS components is determined by the order of the names of the common data classes (as defined in IEC 61850-7-3 or IEC extensions of it). For private CDCs, or private Extensions the order of attributes within the MMS component shall be identical to the order within the SCL ICD file describing the data model."	?	✓
433	p.122-126 Clause E.4	Order of attributes in specialized CDCs for control service mapping	Green	The TISSUE 168 resolves the issue. Normative Annex E (E.3 and E.4) of 8-1 is what is called an IEC extension. The Annex E.3 defines the order of the SBO, SBOw, Oper and Cancel attributes, E.4 the order of the service parameters of the CDCs (ctlVal, origin, ctlNum, ...) within SBOw, Oper and Cancel structures.	?	✓
438	p.36 8.1.3.7	EntryTime base should be GMT	Green	EntryTime maps to MMS BINARY-TIME. Clarification was needed that EntryTime is based on GMT.	?	✓

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
446	-	Send only values(not structures) by GOOSE	Blue	Ed.2: IEC61850-7-2, allows Datasets to contain structures or single attributes. GOOSE is not support by M66x.	?	N/A
545	p. 89 Clause 23.1	File directories	Green	The M66x device does not have files specific to any of the Logical Devices. Therefore, M66x devices do not contain any root- based "LD" directories. File Directories are not supported in M66x devices.	?	N/A
586	-	GOOSE re-transmission & TATL	Blue	Ed.2: 2 Messages are sent within the GOOSE TimeAllowedToLive (TATL) time. GOOSE is not supported in M66x devices.	?	N/A
587	p.33, 8.1.1	INT128 Range is not usable	Green	Removed INT128 and replace with INT64	?	✓
609	p.125 clause E.4.2	origin and ctlNum optional?	Blue	Ed.2: Proposal will either make these attributes optional or mandatory. Data attributes Origin and ctlNum are both present in M66x devices.	?	✓

4.13 Part 9-1 Standard (Not supported)

4.13.1 Specification scope

The scope of part 9-1 of the IEC61850 standards covers the specific communication service mapping (SCSM) for sampled values over a serial unidirectional multi-drop point-to-point link.

4.13.2 Technical Issues

The M66x IED device does not support part 9-1 of the IEC61850 standard. TISSUES relating to this part therefore do not affect the application implementation; hence Tissues are not listed in this section.

4.14 Part 9-2 Standard (Not supported)

4.14.1 Specification scope

The scope of part 9-2 of the IEC61850 standards covers the specific communication service mapping (SCSM) for sampled values over ISO/IEC 8802-3

4.14.2 Technical Issues

The M66x IED device does not support part 9-2 of the IEC61850 standard. TISSUES relating to this part therefore do not affect the application implementation; hence Tissues are not listed in this section.

4.15 Part 10 Standard (TICS)

4.15.1 Specification scope

The scope of part 10 of the IEC61850 standards covers the conformance testing of a device.

4.15.2 Editorial and schema related TISSUES

The following technical issues are editorial and schema related only:

156,637

4.15.3 Question only Tissues

The following technical issues are questions only and no compliance is required:

372,613,638,641,1325

4.15.4 Technical Issues

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
206	5.4.1, 6.2.4.5, 5.5	Add Conformance Blocks	White		?	?
218		Need new test case	Red	Ed.2: GOOSE, in 7-2, allows both FCD and FCDA information to be conveyed. A test case needs to be created that tests an implementation's ability to receive an FCD.	?	?
336	Clause 5.5, last paragraph	Test context	Red	Conformance test documentation shall be supplied to the initiator and made available (on request) to potential customers of the device tested. The test certificate will indicate the conformance test has been performed according to IEC 61850-10 and refer to: : -PICS - IEC 61850 Protocol Information Conformance statement; - MICS - IEC 61850 Model Implementation Conformance statement, and - TICS - technical issue conformance statement. (continued)	?	?

Num	Doc. Ref.	Subject	Status	Comment	Conformance	Supported
		(336 continued from previous page)		- PIXIT - Protocol Implementation extra information for testing" Supplying conformance documentation should not be made mandatory in Part 10		
376	p.25, 6.2.4.9.2	Negative Test case on substitution	Final Proposal	M66x devices do not support substitution.	?	N/A
420	p.20, 6.2.4.3	Configuration file test cases	Red		?	?
421	p.20, 6.2.4.3	Versioning of schema for configuration files	White		?	?
594	p.35, Table 28 Para. CtIN3	Controls to the same direction	Final Proposal	XCBR breaker commands are not supported in M66x devices.	?	N/A
597	p.35, Table 27	TimeActivatedOperate in 61850-7-2 is not the same to TimeActivation of 61850-8-1	Final Proposal		?	?
864	p. 20, clause 6.2.4.4	verifying no incorrect use of GGIO	Yellow	GGIO is not supported in M66x devices		N/A
990	p.34 table 16	EntryID should be enabled and checked in Segmentation of reports	White	Buffered reporting positive test cases	?	?
1121	Pgs 30,32, Clauses 6.2.4.13, 6.2.4.14	Ed2: integrity or GI report can not be interrupted by change of a value	White	So here the test case description should be "Verify that an update of a data value during sending of a segmented report caused by an integrity or general - interrogation trigger cannot be interrupted by a report with change of one of the data values with a new sequence number. (IEC61850-7-2 Subclause 17.2.3.2.3.5)"	?	?

Section 5 PIXIT

Protocol Implementation Extra Information for Testing

5. PROTOCOL IMPLEMENTATION EXTRA INFORMATION FOR TESTING (PIXIT)

5.1 Introduction

This document specifies the **P**rotocol **I**mplementation **eX**tra **I**nformation for **T**esting (**PIXIT**) of the IEC61850 interface for the M66x IED SCADA Power measurement device.

5.2 Details

Together with the PICS and MICS specifications the PIXIT forms the basis for conformance testing in accordance with part 10 of the IEC61850 standard specifications. The PIXIT entries contain information which is not available in the PICS, MICS, TICS sections or SCL file.

5.3 Structure

Each section within this specification specifies the PIXIT for each supported ACSI service model as structured in parts 7-2 and 10 of the IEC61850 standard specifications. The “Ed” column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2.

5.4 Template version

This PIXIT section is based on PIXIT Template for Server Ed2 version 1.1.

5.5 Application Association Model

Table 3: PIXIT for Association model

ID	Ed	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	4
As2	1,2	TCP KEEPALIVE value. The recommended ranges is 1..20s	1 - 3600 seconds (user selectable via IED's built-in web server) default = 30
As3	1,2	Lost connection detection time	TCP KEEPALIVE + 8 seconds
As4	-	Authentication is not supported yet	
As5	1,2	What association parameters are necessary for successful association	Transport selector Y Session selector Y Presentation selector Y AP Title N AE Qualifier N
As6	1,2	If association parameters are necessary for association, describe the correct values e.g.	Transport selector 0001 Session selector 0001 Presentation selector 00000001 AP Title n/a AE Qualifier n/a
As7	1,2	What is the maximum and minimum MMS PDU size	Max MMS PDU size 32000 bytes Min MMS PDU size 1000 bytes
As8	1,2	What is the maximum start up time after a power supply interrupt	24 seconds
As9	1,2	Does this device function only as test Equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N
		<additional items>	

5.6 Server Model

Table 4: PIXIT for Server Model

ID	Ed	Description	Value/Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable N Overflow Y OutofRange N BadReference N Oscillatory N Failure N OldData Y Inconsistent Y Inaccurate Source: Y Process N Substituted N Test N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, N Invalid, N Reserved, Y Questionable N BadReference N Oscillatory N Failure N OldData N Inconsistent Y Inaccurate Source : Y Process N Substituted N Test N OperatorBlocked
Sr3	-	What is the maximum number of data object references in one GetDataValues request	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported (IEC61850-6:2009 clause 9.5.6 states that if only a subrange of the enumeration value set is supported, this shall be indicated within an ICD file by an enumeration type, where the unsupported values are missing)	On Y Blocked N Test N Test/Blocked N Off N

ID	Ed	Description	Value/Clarification
		<additional items>	
	1		The CDC definition BCR includes a data attribute actVal whose type is INT32 according to Edition 1 of the standard. (refer to tissue #1199)
	1,2		Deadbands are supported in M66x IEDs for objects in some MMXU logical nodes. M66x IEDs do not have a built-in range limit for measurements, but deadbands are specified as a percentage change based on such a range. To resolve this, each measurement provides a range configuration in the data model where a minimum and maximum value can be set. Deadbands will be configured based on a percentage change of the applied measurement range. A deadband setting of zero (0) forces the measurement to follow the instantaneous value.
	1,2	Forcing supported MX quality bits for testing purpose – Questionable:OutOfRange	This quality is indicated when a measurement goes above or below the configured rangeC.max or rangeC.min setting, respectively. The tester can force this quality type by configuring the IED for CF.PhV.PhsA.rangeC.max = 100, and then applying 120Vac to the Phase A Voltage input terminal.
	1,2	Forcing supported MX quality bits for testing purpose – Questionable:Inconsistent	This quality is indicated for frequency (MX.Hz) or per-phase power factor (MX.PF.phsA) measurements when the voltage input signal is below a minimum threshold (< 1Vac) with which to maintain stated accuracy. The tester can force this quality type by applying 0.5Vac input signal to the Phase A Voltage input terminal, and then viewing the Phase A Power Factor quality attribute, i.e. MX.PF.PhsA.q

ID	Ed	Description	Value/Clarification
	1,2	Forcing supported MX or ST quality bits for testing purpose – Questionable:Inaccurate	This quality type for both MX and ST is indicated for an uncalibrated IED. There is no practical method for the tester to use to force this quality type. Please contact the factory for obtaining an uncalibrated IED if the tester desires to confirm this quality type.
	1,2	Forcing supported MX quality bits for testing purpose – Invalid	This quality is indicated when a measurement is not valid for the IED's Input Configuration setting. For example, "per phase" measurements are not valid for (2) two Element input configurations. The tester can force this quality type by navigating to the Setting tab on the IED's built-in http (web) interface and changing the "Input->Input Configuration" setting to "2 Element" . After the IED reboots, the quality field for all phase-related measurements, such as MX.PhV.PhsA.q, should indicated invalid .

5.7 Data Set Model

Table 5: PIXIT for Data Set Model

ID	Ed	Description	Value/Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	250 FCDA's
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	Dynamic data set creation is not supported
Ds3	1	How many non-persistent data sets can be created by one or more clients	Dynamic data set creation is not supported
		<additional items>	
	1,2	Number of user definable data sets	24 (at configuration time)

5.8 Reporting Model

Table 8: PIXIT for Reporting Model

ID	Ed	Description	Value/Clarification
Rp1	1	The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update N general interrogation Y
Rp2	1	The supported optional fields are	sequence-number Y report-time-stamp Y reason-for-inclusion Y data-set-name Y data-reference Y buffer-overflow Y entryID Y conf-rev Y segmentation Y
Rp3	1,2	Can the server send segmented reports	Y
Rp4	1,2	Mechanism on second internal data change notification of the same analogue (FC=MX) data value within buffer period (Compare IEC 61850-7-2 §14.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2:2003 §14.2.1)	Each URCB is visible to all clients
Rp6	-	What is the format of Entry ID	Deprecated
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered	50k bytes per report control block.
Rp8	-	Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also ICD report settings)	Deprecated
Rp9	1	May the reported data set contain: - structured data objects - data attributes	Y Y
Rp10	1,2	What is the scan cycle for binary events Is this fixed, configurable	Event driven Fixed
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart	Restored from the original configuration
		<additional items>	
	1,2	Number of Report Control Blocks	Unbuffered (URCB) 12 Buffered (BRCB) 4
	1	Does the IED append index values to the existing RCB names	No, the RCB names as defined in SCL (urcb01 .. urcb12, brcb01 .. brcb04) are not changed at run-time.

5.9 Time and Time Synchronization

Table 12: PIXIT Time and Time Synchronization Model

ID	Ed	Description	Value/Clarification
Tm1	1,2	What quality bits are supported (may be set by the IED)	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the Behavior when the time server(s) ceases to respond What is the time server lost detection time	When the highest priority server fails for the hold-over period, the next highest valid server is used, with its associated time quality. When all time servers fail: The "ClockNotSynchronized" bit will be set and the DUT will maintain the time based on the last valid server timestamp using its internal high resolution timer. NOTE – please see additional items below for a list of available time servers sorted by priority 3x source poll rate
Tm3	1,2	How long does it take to take over the new time from time server	Consider two (2) cases, 1. When there is no time server, and suddenly the time server begins to work. In this case it takes '3x source poll rate' 2. When the time server exists and works fine and the time is synchronized. But the time in the time server is changed. In this case it takes '1x source poll rate'
Tm4	1,2	When is the time quality bit "ClockFailure" set	When the DUT detects during boot-up a failure of the Real-Time Clock (RTC) hardware or an exhausted Supercapacitor. Additionally, if the RTC provides during boot-up an invalid date or a date before 1984, the ClockFailure will be set. The ClockFailure bit will clear when a valid time source becomes available or the time is set manually via the web interface.

ID	Ed	Description	Value/Clarification
Tm5	1,2	When is the time quality bit "ClockNotSynchronized" set	When the DUT detects that neither of the SNTP time servers are available.
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated
Tm7	1	Does the device support time zone and daylight saving?	N
Tm8	1,2	Which attributes of the SNTP response packet are validated	Y Leap indicator not equal to 3 Y Mode is equal to SERVER Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp N RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 and/or 4 N other (describe)
Tm9	1,2	Do the COMTRADE files have local time or UTC time and is this configurable	n/a
		<additional items>	
	1,2	Available time servers	Ordered from highest priority to lowest; 1. SNTP1 2. SNTP2 3. DNP3.0 NOTE - The time can also be set manually via the Time Sync Settings page of the web interface.
	1,2		SNTP settings (IP addresses and poll rate) can only be entered through the IED's web interface (http server). NOTE – SNTP settings in SCD file are ignored
	1,2		DUT can be configured for two (2) external SNTP time servers (SNTP1 & SNTP2).
	1,2		Real-Time Clock (RTC) updated from DUT system time every four (4) hours.

5.10 Sub-station Configuration Language (SCL)

5.10.1 Conformance level

M66x IEDs are conformant to **SCL.1** as defined by part 8-1 of the IEC61850 standards; annex D.

Edition 1 and Edition 2 ICD template files are available as downloads from the IED's web interface (http server).

5.10.2 Private data

The M66x ICD files contain private SCL data. This is required by the IED Configurator tool in order to correctly extract, process, and configure a device. IEC61850 defines that private data is ignored outside of the vendor specific tools.

5.10.3 IED Name

The Substation Configuration Language (SCL) allows customizable IED names. M66x IEDs support user-definable IED names. It is recommended, however, that these names be restricted to a maximum of **eight** (8) characters in length. Otherwise, long IED names may cause network problems due to maximum object name size.

5.11 IED Configuration

5.11.1 Configuration

The M66x IEDs do not support on-line setting changes of elements over the IEC61850 interface.

Configuration of M66x IEDs is achieved through the use of the following software tools:

- M66x IED built-in web interface (http server)
 - Network address parameters - IP, Subnet mask and Router address
 - SNTP time sync configuration – IP addresses and poll rate
- MiCOM S1 IEC61850 IED Configurator software package

M66x devices utilize flash memory for holding IED IEC61850 configuration stored in the CID Substation Configuration Language (SCL) file.

Revision	Date	Changes	By
A	1/20/2015	Initial release of ML0043 - 60 Series IEC61850 protocol manual. Included sections cover IEC61850 Implementation Information, MICS, PICS, TICS and PIXIT.	R.Fisher/ G. Nelson
B	1/28/2015	Change type VisString255 to VISIBLE_STRING255 in several instances	R. Fisher/ G. Nelson
C	5/8/2015	Corrected firmware version number, added Ed2 support, renamed DOType names INC_MOD, INS_BEH, INS_HEALTH & INS_HEALTH_D to MY_MOD, MY_BEH, MY_HEALTH & MY_HEALTH_D respectively. Integrated PIXIT template "Server Ed2 version 1.1". Removed references to non-existent M662 and M663 models. Add As9 to PIXIT section.	G. Nelson
D	11/20/2015	Summary section changes; total number of logical nodes to 21, and number of datasets to 24. Created two new common data attribute type definitions; ScaledValueConfig and AnalogueValue_Integer_ReadOnly. Changed SAV_0 instMag to use new AnalogueValue_Integer_ReadOnly type definition. Renamed CDAs AnalogueValue_0, AnalogueValue_0_Zero and AnalogueValue_0_ReadOnly to AnalogueValue_Float, AnalogueValue_Fixed_0 & AnalogueValue_Float_ReadOnly, respectively. Renamed CDA type definition Vector_0 to Vector_Magnitude_Float. In Table 1; 1.) Removed notes about "LN is extended to include custom measurements" from MHA1 and MMTR, 2.) Added two new Logical nodes TVTR4 and TCTR4 to model neutral voltage and residual current transformers. In section 3.7, Enumerated Type Definitions; 1.) Removed all but "status-only" for ctilModel, and 2.) Removed all but "on" for Mod. Added new (additional) note to Reporting Model section 5.8 to further clarify that the IED does not use indexing functionality with RCB names. Updated Table 12, PIXIT for Time and Time Synchronization Model; 1.) ClockFailure bit is supported. 2.) Changed value/clarification for items Tm2, Tm4 and Tm5. 3.) Added additional items for time server list and note about RTC update time. Updated Table 8, PIXIT for Reporting Model, changed value/clarification for Rp5. Added Ed. 2 Data Attribute names AmpSv and VolSv to LNs TCTR and TVTR, respectively. Updated table of Functional Constraints in section 3.5 to reflect Edition 2 specific FCs.	G. Nelson
E	12/22/2015	Table 1: corrected name of LN Instance for LPHD in both logical devices to "LPHD1". Table 4: PIXIT for Server Model, item Sr2 "(ST) Quality bits"; 1.) Changed Invalid from "Y" to "N", 2.) Changed Inaccurate from "N" to "Y", 3.) Added <additional items> entries for explanation of and methods the tester can use to force some supported quality bits. Table 8: PIXIT for Reporting Model; 1.) Changed Rp1 trigger condition "data update" to not support "N", 2.) Changed Rp7 BRCB buffer size to 50k, and removed "Approximately 100 single event reports". In PICS, for both items S24-3 and S27-3 for BRCB and URCB, respectively, changed data-update (dupd) to not supported, "N". Added new semantic value "Bq" for Ed2 version of Ordinal=22 in enumerated type table, SIUnit, in section 3.7.6.	G. Nelson

F	1/15/2016	<p>Removed the "X" from the X column (indicating private type) from the 'mag' attribute of MV_0_NODB, section 3.5.14. Removed "X" from X column (indicating private type) from the 'mag' attribute of MV_0, section 3.5.15. Added missing CDC Class line from MV_0_DB, section 3.5.14. Changed Type for hhLim, hLim, lLim and lLim attributes for RangeConfig_Deadband to AnalogueValue_Float in section 3.6.4. Removed unused definition for AnalogueValue_Fixed_0, section 3.6.3. Provide more detail for PIXIT item 'Tm3' in table 12. Updated Ed2 TICS according to the latest TICS template. New Tissue entries are (Part 6: 1168, 1175. Part 7-1: 828, 1129, 1151, 1196. Part 7-2: 820, 858, 861, 876, 1038, 1050, 1062, 1071, 1091, 1127, 1163, 1202. Part 7-3: 919, 925, 926. Part 7-4: 671, 679, 831, 844, 849, 877, 909, 912, 920, 932, 939, 991, 1007, 1044, 1077. Part 8-1: 784, 834, 1040, 1178.</p> <p>Corrected typo in section 4.3, changed TCPL to TPCL 1/21/16.</p>	G. Nelson
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