

IEC 61850

Protocol IEC 61850

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Protocol description

Protocol IEC 61850 is an IEC standard designed for communication with Intelligent Electronic Devices (IED) at electrical substations (breakers, protections, transformers, switches etc).

Protocol IEC 61850 is - like [IEC 60870-6 ICCP/TASE.2](#) - based on the Manufacturing Message Specification (MMS) and therefore the implementation in the D2000 KOM process uses a common MMS framework.

Implementation of IEC 61850 protocol in D2000 system supports this functionality:

1. Periodic reading of values (polling)
2. Reading of values from predefined Datasets made available in predefined Information Reports - both buffered and unbuffered
3. Reading of fields elements of which are simple values
4. Writing to simple types of values (writing to arrays, array items and structures is not implemented yet)
5. Browsing - when a communication is established, following items can be browsed:
 - logical devices within a physical device (in the station address configuration)
 - objects located within the logical device (in the I/O tag configuration)
 - reports located within the logical device (in the I/O tag configuration)

There is no support for processing of GOOSE and GSSE reports.

The ISO over TCP / IP transmission layer is implemented according to the RFC 1006 specification.

Communication line configuration

- Communication line category: [TCP/IP-TCP](#).
- TCP Parameters:
 - Host: string max. 80 characters – server name in INET format (a name or numerical address a.b.c.d)
 - Port: TCP port number (0 to 65535), port 102 is used by default.
 - Line number: not used, set to 1

A valid host name or IP address of the device must be entered according to the rules above.

The port number where the device is listening must also be entered. The ISO over TCP/IP standard uses port 102.

In the case of redundant systems, it is also possible to enter multiple comma-separated names/addresses. When the connection is broken, the communication process will again attempt to establish a connection to the device at given address. If the attempt is unsuccessful, then the process tries to establish a connection to next address. This is repeated cyclically until the connection with one server is established.

Communication line protocol parameters

[Communication lines - configuration dialog box](#) - tab **Protocol parameters**.

These parameters influence some optional parameters of protocol. You can define the following parameters:

Table 1

Parameter	Meaning	Unit / Type	Default value
Adress parameters of local side (D2000 KOM process)			
Local TSEL (hex)	Octet string that represents the local Transport Selector. It identifies the Transport SAP. The maximum size is 32 octets (64 ASCII encoded hexadecimal digits).	octet string	00 01
Local SSEL (hex)	Octet string that represents the local Session Selector. It identifies the Session SAP. The maximum size is 16 octets (32 ASCII encoded hexadecimal digits).	octet string	00 01

Local PSEL (hex)	Octet string that represents the local Presentation Selector. It identifies the Presentation SAP. The maximum size is 16 octets (32 ASCII encoded hexadecimal digits).	octet string	00 00 00 01
Local AP Title	Local Application Process Title is an identifier that is assigned by an address manager. It represents a specific application process.	string	1.3.9999.1
Local AE Qualifier	Integer value used to identify the local Application Entity.	string	1
Adress parameters of remote side (the IED device)			
Remote TSEL (hex)	Octet string that represents the remote Transport Selector. It identifies the Transport SAP. The maximum size is 32 octets (64 ASCII encoded hexadecimal digits).	octet string	00 01
Remote SSE L (hex)	Octet string that represents the remote Session Selector. It identifies the Session SAP. The maximum size is 16 octets (32 ASCII encoded hexadecimal digits).	octet string	00 01
Remote PSE L (hex)	Octet string that represents the remote Presentation Selector. It identifies the Presentation SAP. The maximum size is 16 octets (32 ASCII encoded hexadecimal digits).	octet string	00 00 00 01
Remote AP Title	Remote Application Process Title is an identifier that is assigned by an address manager. It represents a specific application process.	string	1.3.9999.1
Remote AE Qualifier	Integer value used to identify the remote Application Entity.	string	1
Common adress parameters			
Bilateral Table ID	Name of the bilateral table. In case of IEC 61850 this can be an empt string.	-	
Max MMS Message Size	Maximum size of MMS messages.	bytes	32000
Max Requests Pending	Maximum proposed transactions that could be sent and unacknowledged. The value can be reduced if the other party suggests lower value at negotiation.	1 .. 32	5
Max Indications Pending	Maximum proposed transactions that could be received without sending an acknowledge. The value is sent to the other party.	1 .. 32	5
Max Nesting Level	Maximum level of nesting for MMS data structures.	1 .. 10	5
ISO TPDU Size	The maximum packet size for "ISO over TCP" protocol level (according to RFC 1006)	8192/4096 /2048 /1024/512 /256/128 bytes	1024 bytes
Heartbeat	Timer, which permits the sending ICCP message <i>Identify request</i> to the communicating party to find out the validity of TCP/IP connection. To enable the timer a nonzero value must be specified. If the connection was aborted on TCP/IP level, the fast detection ensures its faster restoring. This parameter is recommended in situations when transmitting data via large networks or when a small amount of data is transmitted via the active connection. The value 0 (implicit) turns off the HeartBeat timer. A positive value means the seconds to send Heartbeat message. If any message is sent, the Heartbeat timer is reset and Heartbeat message is sent only after timeout elapses without any communication between partners.	sec	0
Retry Delay	Delay inserted before repeated attempt to establish the connection after it has been broken. If the connection should be restored as fast as possible, set the low value or 0 seconds.	sec	10 sec
Inter Read Timeout	Maximum waiting time to receive TCP data. After this timeout elapses, the possible requirements (data) for sending to a communicating party are checked. As the communication is executed via one thread, the high value can reduce speed of interaction with the party. The recommended value is 50 to 150 milliseconds.	msec	100 msec
Parallel Stations	The parameter activates creating TCP connections for each station. If the device supports multiple clients, communication can be parallelised. If the parameter is set to NO, a single TCP connection will be created for all communication stations.	YES/NO	NO
Map IEC 61850 flags	The way IEC 61850 flags are mapped into D2000 flags FA..FM. IEC 61850 protocol has quality flags mapped into 13 bits of Quality attribute, details are given in the description of the parameter Quality Offset : Mapping can be: <ul style="list-style-type: none"> • <i>None</i> - flags FA .. FM are not set • <i>Simple</i> - Quality attribute directly maps to flags FA .. FM Note: after the change of this parameter we recommend a restart of KOM process or communication partner so that all values come into the system with properly set flags.	None / Simple	None

Authentication Type	Type of authentication. These types of authentication are supported: <ul style="list-style-type: none"> None - no authentication Password - password-based authentication. The password is transmitted unencrypted within <i>ISO 8650-1 OSI Association Control Service</i> layer. 	None Password	None
Password	Password used if Authentication Type = Password	string	
Debug settings			
Debug I/O binary packets info	Enables debug information on the level of binary packets. See Note 1 .	YES/NO	NO
Debug ISO packet level info	Enables debug information on ISO OSI layer. See Note 1 .	YES/NO	NO
Debug MMS level info	Enables debug information on MMS data level. See Note 1 .	YES/NO	NO
Full IEC61850 level info	Enables debug information on the top level of IEC 61850 data. See Note 1	YES/NO	NO
Incomming values info	Enables a detail debug information about incoming values (data values). See Note 1 .	YES/NO	NO
Outgoing values info	Enables a detail debug information about outgoing values (data values). See Note 1 .	YES/NO	NO

Note 1

If all debug info are enabled, it could cause an overload of communication workstation and decrease of data transfer rate from IED to D2000. After the communication is tuned and debugged, we recommend to minimize the amount of debug information.

Communication station configuration

- Communication protocol "**IEC 61850**".
- Polling parameters are used for reading of I/O tags of "Periodically polled value" type.
- Protocol does not support time synchronization.
- in [Time parameters](#) tab, monotonic UTC time (with offset 0) should be set, as IEC 61850 uses UTC-based timestamps (unless a specific implementation is non-compliant with this part of standard).

Station address

Img. No. 1, Station address

The image shows a software dialog box titled "IEC61850 Logical Device (MMS domain)". Inside the dialog, there is a label "Domain :" followed by a text input field containing the text "SampleIEDDevice1". To the right of the input field is a button labeled "Browse".

The station corresponds to one logical device. In one physical device, one or more logical devices can be defined. Domain is the name of the logical device values of which we want to read. Multiple stations can be on one line. For each station a dedicated TCP connection to defined physical device will be created.

The **Browse** button enables to get a list of logical devices (if the KOM process is running and communication is established). For Browsing functionality, the device must implement support for getNameList request with parameter ObjectClass = DOMAIN.

Station protocol parameters

[Communication station - configuration dialog box](#) - tab **Protocol parameters**.

These parameters influence some optional parameters of protocol. You can set the following station parameters:

Table 2

Object group	Parameter	Meaning	Unit / size	
Interpretation of quaternary values	QERR Value	Interpretation of Quaternary value Error from the received integer value or from 2-bit State value.	0, 1, 2, 3	3 (11 binary)

QOFF Value	Interpretation of Quaternary value Off from the received integer value or from 2-bit State value.	0, 1, 2, 3	2 (10 binary)
QON Value	Interpretation of Quaternary value On from the received integer value or from 2-bit State value.	0, 1, 2, 3	1 (01 binary)
QTRANS Value	Interpretation of Quaternary value Transient/Moving from the received integer value or from 2-bit State value.	0, 1, 2, 3	0 (00 binary)

I/O tag configuration

Permitted I/O tag types: **Ai, Ao, Ci, Co, Di, Dout, TiA, ToA, TiR, ToR, Qi, TxtI, TxtO**

I/O tag address

Img. No. 2, I/O tag address (Data Value)

The configuration of I/O tag address requires the following data:

I/O Tag Type

Type of I/O tag:

- **Buffered/unbuffered report value** - the I/O tag represents the value obtained from a buffered or unbuffered report. Such values are sent by the device spontaneously after they are changed.
- **Periodically polled value** - the I/O tag represents the periodically read value (polling). The reading period is configured in the station parameters. **Note:** Periodic reading may result in loss of values as a result of rapid changes, so it should only be used for slowly changing values or if the value can not be retrieved from the report.
- **Buffered/unbuffered report** - the I/O tag represents a buffered or unbuffered report. It is important that all reports that are used (i.e. which contain the requested data) are configured as I/O tags. Based on these I/O tags, a report is activated when a communication is established (write is performed to its attributes *\$TrgOps*, *\$RptEna*, *\$GI* and if the parameter *Integrity period* is specified, also to the attribute *\$IntgPd*).

If the I/O tag representing the report has a text value, the value will be set to the name of the Dataset (the *\$DataSet* attribute) that the report publishes.

If the I/O tag representing the report has an integer or a real value, the value will be

- 0 - when a communication has been established - after receiving the initiate-Response message and requesting the reading of the Dataset name (*\$DataSet* attribute) that the report publishes
- 1 - after reading the Dataset name (receiving the device response to the Dataset name read request)
- 2 - after reading report parameters
- 3 - after reading a list of objects that are contained in Dataset
- 4 - after successful report activation
- 5 and more - with the arrival of each additional Information Report, the value of the object that represents it will be increased
- invalid - if any of the communication steps fails

This mechanism can be used to define "watchdogs" guarding, for example, a communication failure, connection failure or non-working sending of Information Reports.

Name

A unique text string which identifying IEC 61850 object or its attribute (a reference). Maximum size is 64 characters.

Note: if I/O tag's address is specified as **%IGNORE**, such an I/O tag will be ignored.

According to the standard ISO/IEC IEC 61850-8-1 the reference is in form

<LNVariableName>\${FC}\${LNDDataName}\${AttributeName} (napr. XCBR1\$ST\$Pos\$stVal)

respectively - if subattributes are used - in form

<LNVariableName>\${FC}\${LNDDataName}\${AttributeName}\${subDataAttributeName} (napr. XCBR1\$ST\$Pos\$origin\$orCat)

where:

- *LNVariableName* is a name of a Logical Node. The name can be arbitrary, e.g. LLN0, Obj1XCBR1, Obj2XSWI1
- *FC* is a Functional Constraint. Table of defined functional constraints can be seen below.
- *LNDDataName* is a name of a DataObject. The name can be arbitrary, the standard contains recommended rules concerning naming conventions.
- *AttributeName* is a name of Attribute of a DataObject . Table of frequently used attributes can be seen below.
- *subDataAttributeName* is a name of Attribute of a SubDataObject. Table of frequently used attributes can be seen below.

The standard defines following naming conventions for individual components of a reference:

Defined Functional Constraints according to ISO/IEC IEC 61850-8-1:

FC Name	Description
MX	Measurands (analogue values)
ST	Status information
CO	Control service parameters
CF	Configuration
DC	Description
SP	Setting (outside setting group)
SG	Setting group
RP	Unbuffered report control blocks
LG	Log control blocks
BR	Buffered report control blocks
GO	GOOSE control blocks
GS	GSSE control blocks
SV	Substituted values
SE	Setting group editing
MS	Multicast Sampled Values control block
US	Unicast Sampled Values control block
EX	Name space for model extension
SR	Service tracking
OR	Operate received
BL	Blocking

Names of DataObject Attributes and SubDataObject Attributes are defined in ISO/IEC IEC 61850-7-3 and following table contains only the most common ones:

Attribute Name	Description
ctlModel	Specifies the control model of IEC 61850-7-2 that corresponds to the behaviour of the data.
d	Textual description of the data.
evalTm	Time window applied to interharmonic calculations. The value shall be represented in ms.
frequency	Nominal frequency of the power system or some other fundamental frequency in Hz.
instMag	Magnitude of a the instantaneous value of a measured value.
mag	Deadbanded value. Shall be based on a dead band calculation from instMag.

numCyc	Number of cycles of power frequency, which are used for harmonic, subharmonic and interharmonic calculations.
numHar	Number of harmonic and subharmonics or interharmonic values that are to be returned as the value attribute.
phsAHar, phsBHar, phsCHar	This array shall contain the harmonic and subharmonics or interharmonic values related to phase A (resp. B, C).
phsABHar, phsBCHar, phsCAHar	This array shall contain the harmonic and subharmonics or interharmonic values related to phase A to phase B (resp. B to C, resp. C to A).
q	Quality of the attribute(s) representing the value of the data
setCharact	This attribute shall describe the curve characteristic.
setMag	The value of an analogue setting or set point.
stVal	Status value of the data
swRev	SW-revision
t	Timestamp of the last change in one of the attribute(s) representing the value of the data or in the q attribute.
units	Units of the attribute(s) representing the value of the data (ISO/IEC IEC 61850-7-3 Annex A)
vendor	Name of the vendor.

Data Type

The list of permitted data types:

Data Type	Popis
-- - A u t o d e t e c t ---	<p>The Data Type will be queried by a GetVariableAccessAttributes-Request message after the connection establishment.</p> <p>Note 1: information is currently stored only in KOM process memory, therefore after its restart and the first connection establishment the data type detection is performed for all Autodetect I/O tags.</p> <p>Note 2: data types State and StateQ are undistinguishable by this mechanism, therefore objects of these types are detected as StateQ.</p> <p>Note 3: the same mechanism for data type detection is used in browsing.</p>
Discrete *	ICCP: Integer 32-bit value signed
DiscreteQ *	ICCP: Integer 32-bit signed value + ICCP Validity
DiscreteQTimeTag *	ICCP: Integer 32-bit signed value + ICCP Validity + Time stamp
DiscreteExtended *	ICCP: Integer 32-bit signed value + ICCP Validity + Current Source + Extended time stamp
Real *	ICCP: Float 32
RealQ *	ICCP: Float 32 + ICCP Validity
RealQTimeTag *	ICCP: Float 32 + ICCP Validity + Time stamp
RealExtended *	ICCP: Float 32 + ICCP Validity + Current Source + Extended time stamp
State *	ICCP: Discrete 2-bit value
StateQ *	ICCP: Discrete 2-bit value + ICCP Validity
StateQTimeTag *	ICCP: Discrete 2-bit value + ICCP Validity + Time stamp
StateExtended *	ICCP: Discrete 2-bit value + ICCP Validity + Current Source + Extended time stamp
Boolean	Boolean value

Float32	32-bit real value
Float64	64-bit real value
Integer8	8-bit signed integer value
Integer16	16-bit signed integer value
Integer32	32-bit signed integer value
Integer64	64-bit signed integer value
Unsigned8	8-bit unsigned integer value
Unsigned16	16-bit unsigned integer value
Unsigned24	24-bit unsigned integer value
Unsigned32	32-bit unsigned integer value
OctetString	Variable-length binary string
VisibleString	Variable-length text string
UnicodeString	Variable-length text string in UTF8 encoding
BitString	Variable-length bit string
UtcTime	Absolute time (format seconds since 1.1.1970 + milliseconds)
TimeOfDay	Absolute/relative time (format seconds and milliseconds of a day + optionally number of days since 1.1.1984)
Array of Boolean	Array of Boolean values
Array of Float32	Array of 32-bit real values
Array of Float64	Array of 64-bit real values
Array of Integer8	Array of 8-bit signed integer values
Array of Integer16	Array of 16-bit signed integer values
Array of Integer32	Array of 32-bit signed integer values
Array of Integer64	Array of 64-bit signed integer values
Array of Unsigned8	Array of 8-bit unsigned integer values
Array of Unsigned16	Array of 16-bit unsigned integer values
Array of Unsigned24	Array of 24-bit unsigned integer values
Array of Unsigned32	Array of 32-bit unsigned integer values
Array of OctetString	Array of variable-length binary strings
Array of VisibleString	Array of variable-length text strings
Array of UnicodeString	Array of variable-length text string in UTF8 encoding
Array of BitString	Array of variable-length bit strings
Array of UtcTime	Array of absolute times (format seconds since 1.1.1970 + milliseconds)

Array of TimeOfDay	Array of absolute/relative times (format seconds and milliseconds of a day + optionally number of days since 1.1.1984)
Structure	<p>Structure or Array. Structure can contain simple types, arrays, and nested structures. Arrays consist of elements that can be simple types (here, however, it is more efficient to use some of the <i>Array of</i> types), structures and arrays. If a data type of an I/O tag is configured as a <i>Structure</i>, the <i>Array Index</i> parameter specifies the <i>complex address</i> of the structure element to be read in the I/O tag.</p> <p>Note: multiple I/O tags can have the same <i>Name</i> parameter, the <i>Structure</i> data type, and differ only by the <i>Array Index</i> parameter to access the various elements of the structure. If these I/O tags are configured with the <i>I / O Tag Type = Periodically polled value</i>, a single reading request will be sent for all such points.</p>

Note * - types marked with asterisk (*) are used in IEC 60870-6 ICCP/TASE.2 protocol (which uses a common MMS framework). For IEC 61850, we recommend not using these types.

Array Index

- For the *Autodetect* object type and for arrays of elementary types (*Array of*): it is possible to specify an **index of element** within an array. The arrays in the IEC 61850 protocol are indexed from 0. Not specifying the index results in accessing the 0-th element.

Note: For arrays of elementary types (*Array of*), the IEC61850 supports writing the received values to a target column of a structured variable. If the Destination tab in the configuration of I/O tag has a Destination column set to a column of a structured variable, the corresponding array items will be written into it. This only works if the Array Index is not entered or is equal to 0.

- For the *Structure* object type: it is necessary to specify a **complex address** of element (of simple type) within a structure. The complex address is in form x.y.z... e.g. 0.2. Individual indices indicate order within a structure or field, a dot indicates a descend deeper. Example 1: Communication line log shows a structure consisting of VisibleString elements. Individual elements will be accessed by complex addresses 0.0, 0.1 and 0.2

Log line	Note	Simple element
08:08:14.322 29-06-2018 D MMS> [1] STRUCTURE{	Object of <i>Structure</i> type	
08:08:14.323 29-06-2018 D MMS> [1] Structure{	Level 0	
08:08:14.325 29-06-2018 D MMS> [1] VisibleString=INFO TECH	Level 0.0	yes
08:08:14.327 29-06-2018 D MMS> [1] VisibleString=1.0	Level 0.1	yes
08:08:14.329 29-06-2018 D MMS> [1] VisibleString=Current harmonics measurement	Level 0.2	yes
08:08:14.332 29-06-2018 D MMS> [1] }	End of structure	
08:08:14.334 29-06-2018 D MMS> [1] }	End of <i>Structure</i> object	

Example 2: Communication line log shows an array consisting of two structures that contain structures that contain elements of *Float32* type. Individual elements will be accessed by complex addresses 0.0.0 and 1.0.0

Log line	Note	Simple element
08:08:14.169 29-06-2018 D MMS> [1] ARRAY{	Object of <i>Array</i> type	
08:08:14.172 29-06-2018 D MMS> [1] Structure{	Level 0	
08:08:14.173 29-06-2018 D MMS> [1] Structure{	Level 0.0	
08:08:14.175 29-06-2018 D MMS> [1] Float32= 0.00000E+00	Level 0.0.0	yes
08:08:14.177 29-06-2018 D MMS> [1] }	End of structure	
08:08:14.179 29-06-2018 D MMS> [1] }	End of structure	
08:08:14.181 29-06-2018 D MMS> [1] Structure{	Level 1	
08:08:14.183 29-06-2018 D MMS> [1] Structure{	Level 1.0	
08:08:14.185 29-06-2018 D MMS> [1] Float32= 1.00000E+02	Level 1.0.0	yes
08:08:14.186 29-06-2018 D MMS> [1] }	End of structure	
08:08:14.188 29-06-2018 D MMS> [1] }	End of structure	
08:08:14.188 29-06-2018 D MMS> [1] }	End of Array	

Quality Offset

For the [Structure](#) object type: it is possible to specify offset where IEC 61850 Quality is located. Offset defines a position relative to position of value given by a [complex address](#). Offset 1 means that the IEC 61850 Quality is located directly after the value, offset -1 means that the quality is located directly before the value.

IEC 61850 Quality is of Bitstring type with length of 2 bytes. 13 quality bits are defined as follows (the standard numbers the bits so that the highest bit is 0 and the lowest is 15):

Bit(s)	Note
0-1	Validity:
2	Overflow
3	OutOfRange
4	BadReference
5	Oscillatory
6	Failure
7	OldData
8	Inconsistent
9	Inaccurate
10	Source (0-Process, 1-Substituted)
11	Test
12	OperatorBlocked
13-15	unused bits

If at least one of bits number 2-12 is set, value in D2000 has a Weak attribute.
See the example in [Time Offset](#).

Time Offset

For the [Structure](#) object type: it is possible to specify offset where timestamp is located. Offset defines a position relative to position of value given by a [complex address](#). Offset 1 means that the timestamp is located directly after the value, offset -1 means that the timestamp is located directly before the value.

If the *Time Offset* is not defined (or is equal to 0), the timestamp of the information report (for [I/O Tag Type=Buffered/unbuffered report value](#)) or the current time (for [I/O Tag Type=Periodically polled value](#)) will be used.

Example: information report contains a structure which contains a Bitstring value followed by qualit and timestamp. Therefore the object's address has *Array Index* = 0, *Quality Offset* = 1 and *Time Offset* = 2.

Log line	Note
14:35:36.198 09-07-2018 D MMS> [1] STRUCTURE{	Object of <i>Structure</i> type
14:35:36.200 09-07-2018 D MMS> [1] Bitstring=<80>	Value (<i>Array Index</i> = 0)
14:35:36.202 09-07-2018 D MMS> [1] Bitstring=<00><00>	Quality (<i>Quality Offset</i> = 1)

14:35:36.204 09-07-2018[D MMS> [1] seconds= 1531115260 fraction= 3223372800 (09-07-2018 07:47:40.751)	Timestamp (Time Offset = 2)
14:35:36.206 09-07-2018[D MMS> [1] }	End of Structure object

Integrity Period

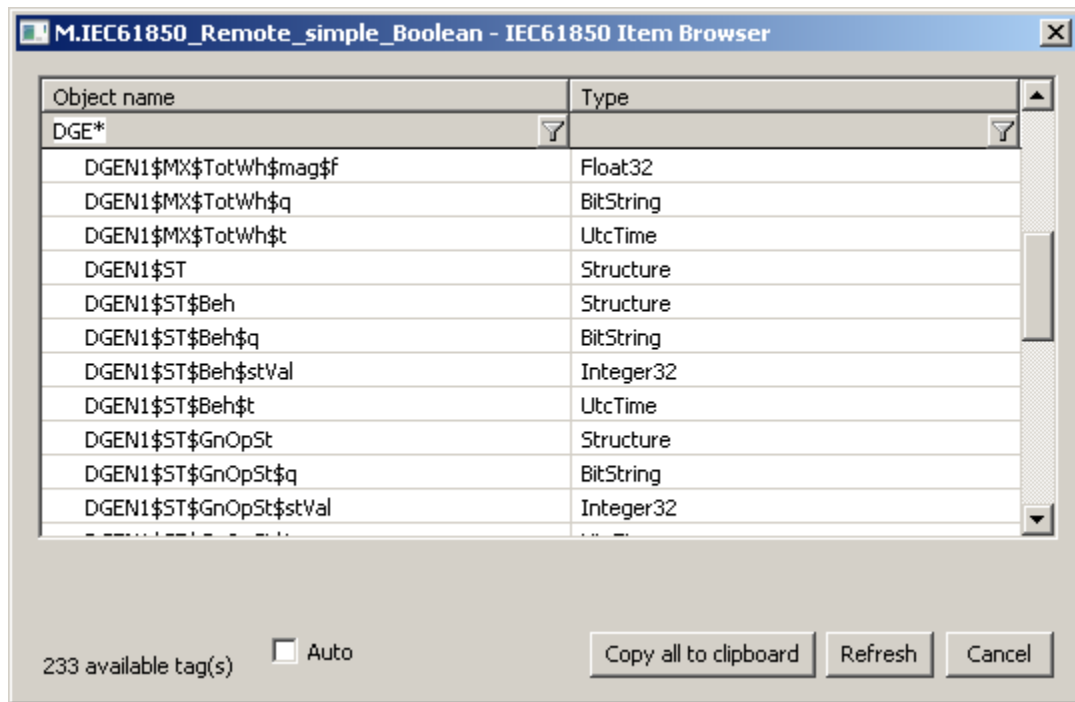
This parameter is enabled for the I/O tags of "**Buffered / Unbuffered Report**" type and it specifies a period (in ms) after which a report containing the values of all objects in the given datasheet is generated. Therefore, if a loss of value has occurred in some way, this Integrity Report will periodically restore the integrity of the data. Value 0 turns off the generation of Integrity Report. The non-zero value causes a write to the *\$IntgPd* report attribute during the report activation .

Note: Not all IEC 61850 servers support this parameter.

Browse

For the I/O tags, it is possible to find a list of objects and their data types, as long as the KOM process is running and communication is established. When a *Browse* button is clicked, the IEC61850 Browser window opens, and the KOM process begins to query the list of objects with the *GetNameList-Request* message and then their data types with the *GetVariableAccessAttributes-Request* message.

Img. no. 3, the IEC 61850 Item Browser window



Meaning of individual choices and buttons:

Auto

If this choice is active, the Data Type will be set to [Autodetect](#), otherwise to value discovered during browsing , e.g. Boolean or Integer32.

Copy all to clipboard

Copies the displayed objects and their respective data types into the Windows Clipboard.

Refresh

By pressing the Refresh button it is possible to enforce re-querying of the list of objects from the device. By default the KOM process reads the list of objects and their respective data types only during the first browse request and stores them in memory. This reading can take a longer time, depending on number of objects and speed of the device. These cached lists are sent to CNF process(es), so that consecutive filling of the Browse window is fast.

Filtering in the list of objects

The browse windows enables filtering by the object name and data type. It is not necessary to enter the full text in filter field. Notation **"*FILTERED EXPRESSION"** is supported. The symbol ***** represents any text before and after the expression (e.g. **momen**).

Note

In addition to objects with supported data types (Boolean, Integer32 ...), the object list can contain objects with Structure type. These are the structured objects that can not be directly read. The implementation only supports work with simple types and fields whose elements are simple types, therefore individual items of structured objects need to be communicated.

Literature

- RFC 1006 (ISO Transport Service on top of the TCP, Version: 3)
- International Standard ISO/IEC 8073 (Open Systems Interconnection — Protocol for providing the connection-mode transport service)
- International Standard ISO/IEC 8327-1 (Open Systems Interconnection — Connection-oriented Session protocol: Protocol Specification)
- International Standard ISO/IEC 8823-1 (Open Systems Interconnection — Connection-oriented Presentation protocol: Protocol Specification)
- International Standard ISO/IEC 8650-1 (Open Systems Interconnection — Connection-oriented protocol for the Association Control Service Element: Protocol Specification)
- International Standard ISO/IEC IEC 61850-1 (Communication networks and systems in substations – Part 1: Introduction and overview)
- International Standard ISO/IEC IEC 61850-2 (Communication networks and systems in substations – Part 2: Glossary)
- International Standard ISO/IEC IEC 61850-3 (Communication networks and systems in substations – Part 3: General requirements)
- International Standard ISO/IEC IEC 61850-4 (Communication networks and systems in substations – Part 4: System and project management)
- International Standard ISO/IEC IEC 61850-5 (Communication networks and systems in substations – Part 5: Communication requirements for functions and device models)
- International Standard ISO/IEC IEC 61850-6 (Communication networks and systems in substations – Part 6: Configuration description language for communication in electrical substations related to IEDs)
- International Standard ISO/IEC IEC 61850-7-1 (Communication networks and systems in substations – Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models)
- International Standard ISO/IEC IEC 61850-7-2 (Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI))
- International Standard ISO/IEC IEC 61850-8-1 (Communication networks and systems in substations – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3)
- International Standard ISO/IEC IEC 61850-9-1 (Communication networks and systems in substations – Part 9-1: Specific Communication Service Mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link)
- International Standard ISO/IEC IEC 61850-9-2 (Communication networks and systems in substations – Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3)

Changes and modifications

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Document revisions

- Ver. 1.0 - June 20, 2018 - Creation of document.



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[Communication protocols](#)