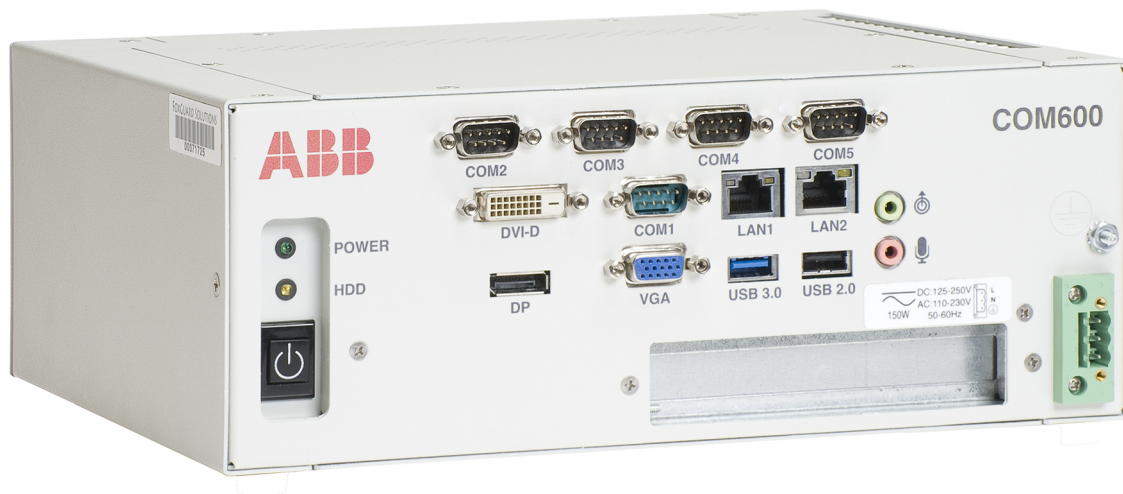


COM600 series, Version 5.1

IEC 60870-5-101 Slave (OPC) User's Manual



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<http://www.abb.com/substationautomation>

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This product is designed to be connected and to communicate information and data via a network interface, which should be connected to a secure network. It is sole responsibility of person or entity responsible for network administration to ensure a secure connection to the network and to establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB is not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95/EC). This conformity is the result of tests conducted by ABB in accordance with the product standards EN 50263 and EN 60255-26 for the EMC directive, and with the product standards EN 60255-1 and EN 60255-27 for the low voltage directive. The product is designed in accordance with the international standards of the IEC 60255 series.

1.4. Trademarks

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1.5. General information

This manual provides thorough information on the OPC Client for IEC 60870-5-101 Slave protocol (later referred to as IEC101 Slave OPC Client) and the central concepts related to it. You find instructions on to take it into use. The basic operation procedures are also discussed.

Information in this user's manual is intended for application engineers who configure IEC101 Slave OPC Client to establish communication to an OPC server.

As a prerequisite, you should understand IEC870-5-101 protocol and the basic procedures in Station Automation Builder 600 (later referred to as SAB600).

This user's manual is divided into following sections:

Introduction

This section gives an overview of the IEC101 Slave OPC Client and states the system requirements to be met when using the client.

Configuration

In this section you find an overview of the configuration tasks and instructions on how to create and configure IEC101 Slave OPC Client related objects.

Operation

This section covers the basic operation procedures you can carry out when transferring or activating Grid Automation Controller COM600 (later referred to as COM600) with new configurations.

You are also given instructions on how to monitor and control the IEC101 communication.

Technical reference

This section contains a list of status codes and information about the IEC 61850 data modeling.

1.6. Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press ESC E C indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
 - The following convention is used for menu operations: **MenuName > MenuItem > CascadedMenuItem**. For example: select **File > New > Type**.
 - The **Start** menu name always refers to the **Start** menu on the Windows taskbar.
- System prompts/messages and user responses/input are shown in the Courier font. For example, if you enter a value out of range, the following message is displayed:

`Entered value is not valid. The value must be 0 - 30 .`

- You can be asked to enter the string MIF349 in a field. The string is shown as follows in the procedure:

MIF349

- Variables are shown using lowercase letters:

sequence name

1.7. Use of symbols

This publication includes warning, caution, and information icons that point out safety-related conditions or other important information. It also includes tip icons to point out useful information to the reader. The corresponding icons should be interpreted as follows.



The electrical warning icon indicates the presence of a hazard which could result in electrical shock.



The warning icon indicates the presence of a hazard which could result in personal injury.



The caution icon indicates important information or warning related to the concept discussed in the text. It may indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader to relevant facts and conditions.



The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

1.8. Terminology

Term	Description
Alarm	An abnormal state of a condition.
Alarms and Events; AE	An OPC service for providing information about alarms and events to OPC clients.
COM600 Series; COM600	COM600 as a generic name for COM600S IEC and COM600F ANSI products

Term	Description
Data Access; DA	An OPC service for providing information about process data to OPC clients.
Data Object; DO	Part of a logical node object representing specific information, for example, status, or measurement. From an object-oriented point of view, a data object is an instance of a class data object. DOs are normally used as transaction objects; that is, they are data structures.
Data Set	The data set is the content basis for reporting and logging. The data set contains references to the data and data attribute values.
Device	A physical device that behaves as its own communication node in the network, for example, protection relay.
Event	Change of process data or an OPC internal value. Normally, an event consists of value, quality, and timestamp.
Intelligent Electronic Device	A physical IEC 61850 device that behaves as its own communication node in the IEC 61850 protocol.
Logical Device; LD	Representation of a group of functions. Each function is defined as a logical node. A physical device consists of one or several LDs.
Logical Node; LN	The smallest part of a function that exchanges data. An LN is an object defined by its data and methods.
OPC	Series of standards specifications aiming at open connectivity in industrial automation and the enterprise systems that support industry.
OPC item	Representation of a connection to the data source within the OPC server. An OPC item is identified by a string <object path>:<property name>. Associated with each OPC item are Value, Quality, and Time Stamp.
Property	Named data item.
Report Control Block	The report control block controls the reporting processes for event data as they occur. The reporting process continues as long as the communication is available.

1.9.

Abbreviations

Abbreviation	Description
AE	Alarms and Events
DA	Data Access
DO	Data Object
GW	Gateway, component connecting two communication networks together
WebHMI	Web Human Machine Interface

Abbreviation	Description
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
LAN	Local Area Network
LD	Logical Device
LN	Logical Node
NCC	Network Control Center
OLE	Object Linking and Embedding
OPC	OLE for Process Control
P&C	Protection & Control
PLC	Programmable Logic Controller
POU	Program Organization Unit
RTS	Request To Send
SA	Substation Automation
SCD	Substation Configuration Description
SCL	Substation Configuration Language
SFC	Sequential Function Chart
SLD	Single Line Diagram
XML	eXtended Markup Language

1.10. Related documents

Name of the manual	MRS number
COM600 User's Manual	1MRS756125

1.11. Document revisions

Document version/date	Product revision	History
A/30.6.2004	1.0	Document created
B/10.3.2005	1.1	Document revised
C/16.10.2006	3.0	Document revised
D/21.12.2007	3.1	Document revised
E/17.6.2008	3.2	Document revised
F/13.2.2009	3.3	Document revised

Document version/date	Product revision	History
G/06.11.2009	3.4	Document revised
H/30.6.2011	3.5	Document revised
J/31.5.2012	4.0	Document revised
K/13.3.2015	4.1	Document revised
L/24.5.2017	5.0	Document revised
M/6.3.2018	5.1	Document revised

2. Introduction

2.1. General information about the COM600 series

The COM600 product series are versatile Substation Management Units that help realize smart substation and grid automation solutions in industrial and utility distribution networks.

They get deployed together with protection and control IEDs, substation devices such as RTUs, meters and PLCs in dedicated cabinets and switchgear.

The COM600 product is an all-in-one unit that functions as:

- Communication gateway
- Web Human Machine Interface (WebHMI)
- Automation controller
- Real-time and historical data management unit

The COM600 product series use process information and device data, acquired over Ethernet or serial communication protocol interfaces to execute specific substation functions and applications. Thus, they are critical building blocks to realize substation secondary system solutions and in the process solving diverse customer needs.

2.2. COM600 product series variants and rationale

To facilitate substation and grid automation solutions in IEC and ANSI market areas, a variant-based system similar to Relion® 615 and 620 series is being followed from COM600 5.0 release.

The main reasons for such an approach are the following:

- To ensure all COM600 product series features are advantageously used in end-customer projects in the medium voltage substation automation domain.
- To ensure an optimum feature set to be bundled together to realize specific applications required in IEC and ANSI market areas.
- To ensure a future-proof product approach.

This release then comprises of two variants, based on the primary intent or application are defined as follows:

- COM600S IEC – COM600 for substation automation, analysis and data management (for IEC markets)
 - COM600S IEC is a substation automation, analyzer and data management unit that integrates devices, facilitates operations, manages communication and runs analysis applications pertinent to equipment or operations in utility or industrial distribution substations.
- COM600F ANSI – COM600 as distribution automation controller (for ANSI markets)

- COM600F is a dedicated distribution automation controller unit that runs distributed grid and feeder applications for ANSI power networks and inherits all core features of the COM600 series.

2.3. Functional overview

The IEC 60870-5-101 protocol slave interface of COM600 enables master systems communicating with 60870-5-101 protocol to receive data from and deliver commands to P&C devices connected to the GW. The IEC101 slave is implemented as an OPC client, which transfers and converts data between the IEC 60870-5-101 slave protocol interface and the OPC servers of COM600. See COM600 User's Manual for more details.

The IEC101 Slave OPC Client is configured using SAB600. SAB600 can also be used for diagnosing and controlling the operation of the IEC101 Slave OPC Client. COM600 has a web server that can be used for remote diagnostic of the Gateway including the IEC101 Slave OPC Client.

The IEC101 Slave OPC Client uses serial communication (RS232 interface). Before you can start using the IEC101 OPC Client, configure at least one OPC server to provide access to the process devices. In this user's manual, the term “IEC101 Device” is used for a virtual station in COM600 representing the slave stations visible to the IEC101 master system.

2.4. IEC101 Slave OPC Client features

The IEC101 Slave OPC Client supports the following features:

- OPC Data Access Client v. 1.0/2.0 for accessing data from the OPC servers
- OPC Alarms and Events specifications v. 1.10 for diagnostic and control purposes
- IEC 61850 data modeling
- System supervision:
 - NCC connection supervision
- Supported IEC 60870-5-101 data types and functions (see 6.1, Interoperability list for IEC101 OPC Client for more information):
 - Balanced and unbalanced communication
 - Redundant communication channels
 - Single and double indications
 - Measurement values
 - Direct and secured commands
 - Reception of time synchronization
- Parameterization and disturbance recorder upload via Transparent SPA
- File transfer
- Redundant communication according to NUC

3. Configuration

3.1. About this section

This section guides you in the configuration tasks required before you can start using the IEC101 Slave OPC Client. For information on the IEC 61850 data modeling, refer to COM600 User's Manual.

Start Station Automation Builder 600 (later referred to as SAB600) to open a project where at least one OPC server has been configured. You can also open and name a new project, where you configure at least one OPC server.

1. Select **File > Open/Manage Project...**
2. In the Open/Manage Project dialog, select the required location for the project:
 - Projects on my computer
 - Projects on network
3. Select **New Project** on the left.
 - Enter a Project Name. The Description is optional.
4. Click **Create**.
5. Click **Open Project**.

3.2. Overview of configuration

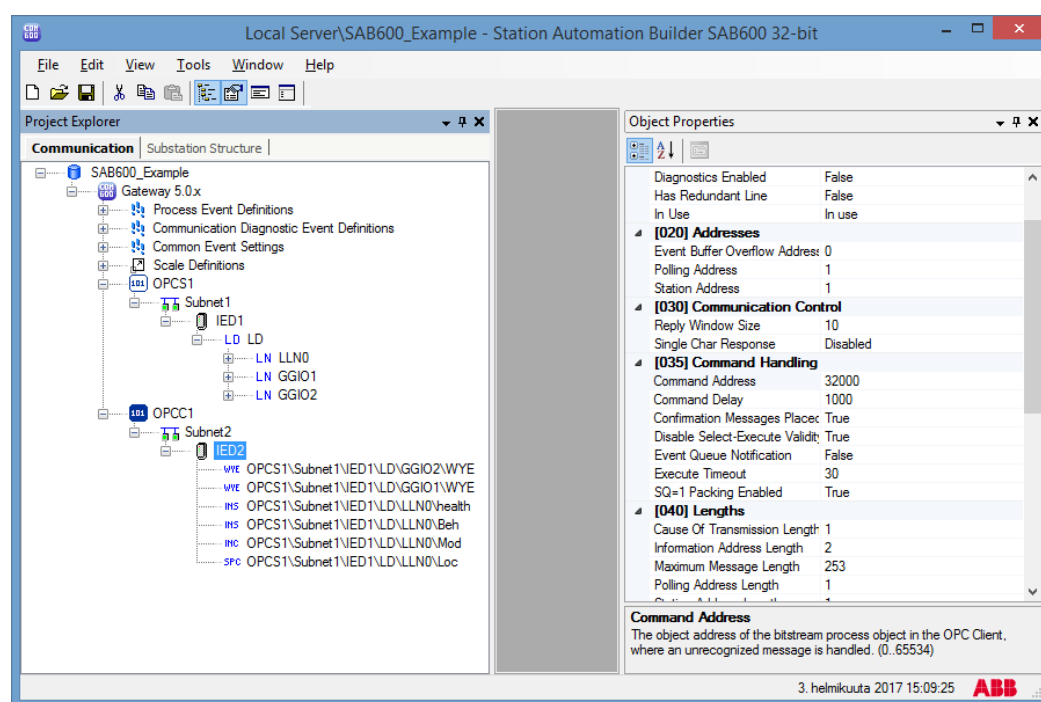
Before you can start using the IEC101 Slave OPC Client, you need to build and configure an object tree in SAB600 to define the Communication structure within the Gateway object.

- IEC101 Slave OPC Client
- IEC101 OPC Balanced Channel
- IEC101 OPC Unbalanced Channel
- IEC101 Device (IEC101 IED)
- Data objects

Figure 3.2-1 shows an example view of SAB600 including an object tree in the communication structure on the left and Object Properties window displaying the object properties on the right.



When configuring OPC servers the following characters cannot be used in object names: \ ` ' ' #



SAB600_IEC101_Slave_Example_View.png

Figure 3.2-1 Example view of SAB600

The configuration work can basically be divided into two separate tasks:

1. building an object tree, and
2. configuring object properties.

First, you need to build an object tree. This is done by adding objects to the object tree, see 3.3.1, General information about building object tree and 3.3.5, Adding data objects using Cross-References function.

Figure 3.2-1 shows an example of how the object tree may look like after it has been built. In the example tree you can see the IEC101 OPC Client object and its child objects like channels, devices, and data objects. Indentation is used to indicate the parent-child relationship between the objects.

After you have added the necessary objects to the object tree in the communication structure, you need to configure them, see 3.4.5.1, General information about configuring data objects.

Table 3.2-1 describes the objects shown in the object tree (Figure 3.2-1).

Table 3.2-1 IEC101 OPC Client related objects

Object	Description
IEC101 OPC Client	An object representing the IEC101 OPC Client.
IEC101 Balanced Channel	An object representing the IEC101 channel using balanced communication mode (point to point connection).

Object	Description
IEC101 Unbalanced Channel	An object representing IEC101 Channel using unbalanced communication mode (polled multipoint connection).
IEC101 Device (IEC101 IED)	IEC101 Device is used for a virtual station in COM600 representing the slave stations visible to the IEC101master system.
Data Object (DO)	A data object is an instance of one of the IEC Common data classes, for example single point status, measured value etc. Depending on the class, each data object has a set of attributes for monitoring and controlling the object, for instance value, quality and control. Data objects are connected from OPC servers to the IEC101 Slave OPC Client with the cross reference function. They are shown as child objects of the IEC101 Device object in the object tree.
Event Definitions	Event definitions are used for the diagnostic OPC A&E Server.

3.3. Building object tree

3.3.1. General information about building object tree

The object tree is built in the Communication structure of SAB600, see Figure 3.2-1. It is built by adding objects in a logical order starting from the IEC101 Slave OPC Client object.

Before the IEC101 Slave OPC Client can be taken into use, configure an OPC server for the process communication. For more information on this subject, refer to COM600 User's Manual.

You have several possible ways to add objects to the object tree in the Communication structure:

- You can right-click the object to which you want to add a child object.
- You can copy the object.

Add the objects in the following order:

1. IEC101 Slave OPC Client
2. IEC101 Balanced Channel / IEC101 Unbalanced Channel
3. IEC101 Device (IEC101 IED)
4. Data objects

3.3.2. Adding IEC101 Slave OPC Client

To add the OPC client object:

1. Add the IEC101 Slave OPC Client object in the Communication structure by selecting the Gateway object.
2. Right-click the Gateway object and select **New > IEC101 > IEC101 Slave OPC Client**.

3.3.3. Adding Channel objects

After the IEC101 Slave OPC Client object has been successfully added, you can continue building the object tree by adding either the IEC101 Balanced Channel object or the IEC101 Unbalanced Channel object.

To add IEC101 Channel object:

1. Select an IEC101 Slave OPC Client object and right-click it.
2. Add an IEC101 Balanced Channel object or an IEC101 Unbalanced Channel object.
3. Rename the new object. The names of the IEC101 Channels have to be unique.

3.3.4. Adding Device objects

After a channel object has been successfully added, you can continue building the structure by adding the IEC101 Device object. All the data can be connected to one device or divided to several slave devices. Before dividing data to several slave devices, it must be checked that the current protocol mode and the master system support the feature.

To add IEC101 Device object:

1. Select a Channel object.
2. Add an IEC101 Device object.
3. Rename the new object. The names within an IEC101 Channel have to be unique.

3.3.5. Adding data objects using Cross-References function

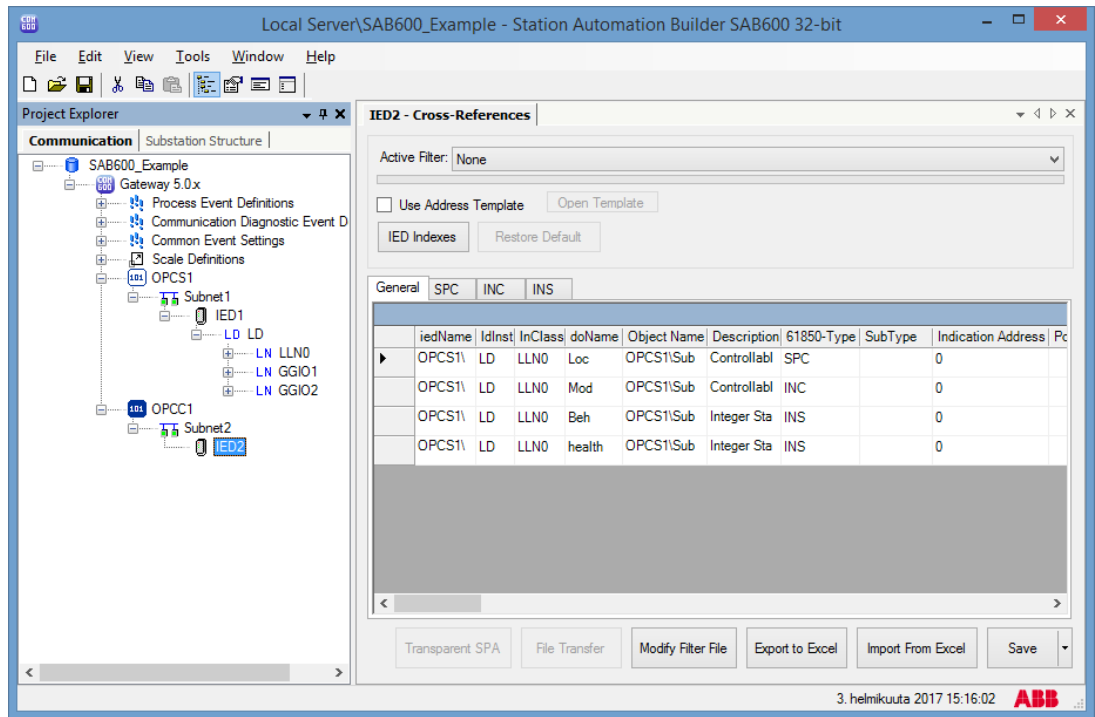
Data objects are added somewhat differently than the upper level objects. Basically, you drag and drop the data objects you need from an OPC server to the IEC101 Slave OPC Client.

To add data objects:

1. Select an IEC101 Device object (IEC101 IED) and right-click it.
2. Select Cross-References. The Cross References function appears (Figure 3.3.5-1).
3. In the Project Explorer, select now a logical node within an OPC server, from which you want to connect the data objects to IEC101 Slave OPC Client.

Note that you can also select an upper level (server, channel, etc.) object and drag and drop it into the Cross-References function. As a result, all the data objects within the selected object appear now in the Cross-References function and can be connected to IEC101 Slave OPC Client.

4. Drag and drop the logical node into the Cross-References function. The data objects within the logical node appear now in the Cross-References function.
Note that only data objects that have been given a non zero information address in the Cross-References table will be connected to the IEC101 Device.
5. At this point, click **Save** to create the cross-references (to connect the data objects to the IEC101 Device object).



SAB600_IEC101_Crossreferences.png

Figure 3.3.5-1 The Cross References window

For more detailed information about the Cross-References function, see *Cross-References function* in COM600 User's Manual.

3.3.6.

File transfer function

The **File transfer** function allows the transfer of disturbance recordings from COM600 to IEC101 master system. Configure COM600 to retrieve disturbance recording files from the IEDs, for example using IEC 61850 communication. The files retrieved can be offered to the IEC101 master. To enable the IEC101 file transfer function, you need configure the File Transfer properties of the slave IED object and further configure the file transfer addresses with the File Transfer of the Cross- References function.

- File Transfer Enabled: Specifies whether the file transfer function is enabled
- File Transfer Source Directory: Defines the source directory for the disturbance recording files. Default is C:\COMTRADE

File names in IEC101 file transfer are built from two numbers; IOA (Information object address) and NOF (name of file). For NOF a running number (1..0xFFFF) is used. For IOA, a unique number assigned to each source IED is used. The IOA is assigned with the File Transfer function of the Cross-References function. There must be at least one cross referenced signal from the IED, which must be included in the file transfer handling. When the File Transfer dialog is opened from the Cross-References function, it shows the source IEDs, which can be used for the file transfer. The Information Object Address is automatically assigned by the tool, but it can be manually changed if necessary .

All files belonging to the same disturbance recording are zipped into a single file, which is offered to the IEC 101 master. Only one file is offered at a time. When the file is transferred successfully, the next recording if available is offered. In the master system, the received file should be renamed with zip extension and unzipped to access the contents.

3.3.7. Transparent SPA function

COM600 supports encapsulated SPA telegrams over IEC 101 communication. It enables IEC101 master systems with SPA support accessing SPA parameters of IEDs connected to COM600. The IEC information address used for the SPA telegrams is configured using the Transparent SPA of the Cross-References function. There must be at least one cross referenced signal from the IED, which must be included in Transparent SPA handling. When the Transparent SPA dialog is opened from the Cross-References function, it shows the source IEDs which can be used for transparent SPA access. The Information Object Address for each source IED is assigned in the table of the dialog.

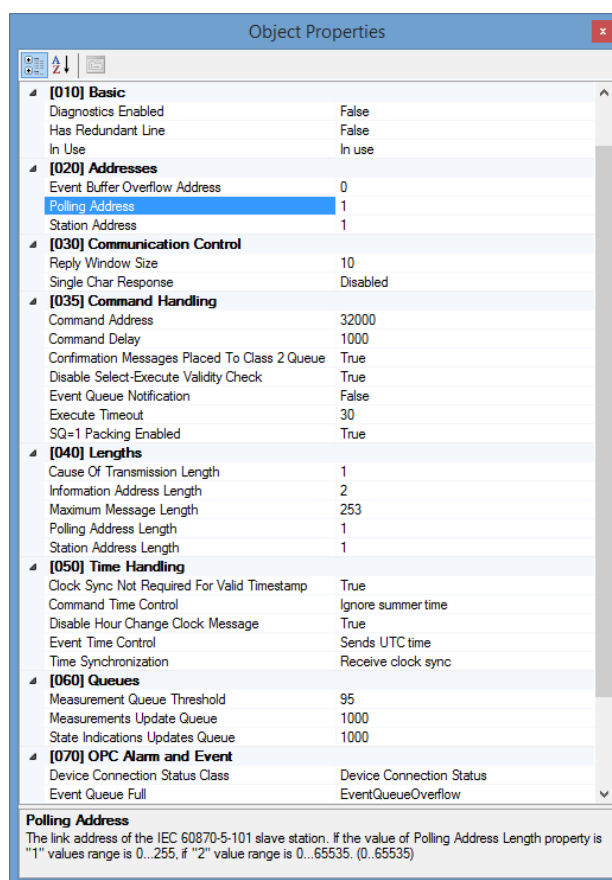
3.4. Configuring objects

3.4.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 3.4.1-1 shows an example of how to use SAB600 to configure the object properties for IEC101 Slave OPC Client.

To configure an object:

1. Select an object in the object tree of the communication structure.
 - The object properties appear now in the Object Properties window. The properties and their values can be viewed as shown in .
The object properties appear now in the Object Properties window. The properties and their values can be viewed as shown in Figure 3.4.1-1.



SAB600_IEC101_Object_Properties.png

Figure 3.4.1-1 Example of object properties in the Objects Properties window

2. Select the property you want to configure. Depending on the property value type, configuring is always done either by
 - selecting a predefined value from a drop-down menu, or
 - entering a text string or a numerical value in a text field.

The available properties for different objects are listed in the following subsections.

3.4.2.

Configuring IEC101 Slave OPC Client properties

Table 3.4.2-1 lists the configurable IEC101 Client properties and value ranges for them. The actual configuration by using SAB600 is performed as described in 3.2, Overview of configuration.

Table 3.4.2-1 IEC101 Slave OPC Client properties

Property / Parameter	Value or Value range/ Default	Description
Basic		

Property / Parameter	Value or Value range/ Default	Description
Maximum OPC Server Initialization Time	0...65535 Default: 5	Specifies the maximum time in seconds that any connected (configured) OPC Server requires to retrieve all its initial data.
Prog ID AE		Instance identification of diagnostic OPC alarm and event server.
ProgID DA		Instance identification of diagnostic OPC data access server.
Time Zone Correction	-720...720 Default: 0	The value of this property in minutes is added to the synchronization time received from an IEC101 master.
Station/Remote Switch		
Station/Remote Switch	Do not check Station/Remote switch position, command always allowed. Check Station/Remote switch position. Default: Do not check Station/Remote switch position, command always allowed.	Specifies if a position check for the station remote switch is going to be made.
Station/Remote Switch Error	Reject commands if position bad or unknown. Allow commands if position bad or unknown. Default: Reject commands if position bad or unknown	Specifies what to do with commands if the position of the switch is uncertain.

3.4.3. Configuring Channel Properties

3.4.3.1. Configuring IEC101 Balanced Channel properties

The IEC101 Balanced Channel properties that can be configured and value ranges for them can be found in Table 3.4.3.1-1. The actual configuration by using the COM600 Station Automation Builder 600 (SAB600) is performed as described in 3.4.1, General information about configuring objects.

Table 3.4.3.1-1 IEC101 Balanced Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		

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Property / Parameter	Value or Value range/ Default	Description
In Use	In use Not in use Default: In use	Specifies whether the channel is initially in use or not.
Protocol	IEC60870-5-101 Balanced Slave	Protocol
Communication Port		
Baud Rate	300 bits/s 600 bits/s 1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s 19200 bits/s 38400 bits/s 56000 bits/s 57600 bits/s 115200 bits/s 128000 bits/s 256000 bits/s Default: 19200 bits/s	Transmission rate used on the channel.
Communication Port	COM1...COM8 Default: COM1	Serial port used by the IEC60870-5-101 protocol. Number of ports depends on the used hardware.
Parity	No parity check Even Odd Default: Even	Specifies the parity check used for the characters transferred on the channel.
Receiver Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each received character.

Property / Parameter	Value or Value range/ Default	Description
Stop Bits	1 stopbit 2 stopbits Default: 1 stopbit	Specifies the number of data bits in each transmitted character.
Transmitter Data Bit Count	5...8 Default: 8	Specifies the number of stop bits attached to each transmitted character.
Communication Control		
Carrier Blocking	Carrier detect signal is ignored Carrier detect signal must be set Default: Carrier detect signal must be set	Determines whether the Carrier Detect signal of the serial port must be set in order for the IEC station to receive messages
CTS Delay	0...65535 Default: 50	Delay in milliseconds between activation of the RTS signal and start of new transmission.
Enquiry Limit	0...255 Default: 3	Specifies maximum number of times that a message is transmitted after timeout.
Header Timeout	0...65535 Default: 2000	Maximum waiting time in milliseconds of a link layer response.
Keep Alive Timeout	0...65535 Default: 5000	The connection is considered to be alive if the delay between two consecutive master messages is shorter than the specified time in milliseconds.
Link Type	RTS activated during transmission (Unbalanced slave) RTS always active, reception always enabled (Balanced slave) RTS activated during transmission, reception always enabled (Balanced slave) Default: RTS always active, reception always enabled (Balanced slave)	The type of the data link connection used on the channel.

Property / Parameter	Value or Value range/ Default	Description
Operating Mode	Handshaking messages not restarted Handshaking messages restarted Default: Handshaking messages not restarted	Specifies whether the handshaking messages (request, status of link, reset of remote link) are restarted when a 'request status of link' message is received from the remote end.
Response Timeout	0...255 Default: 2	The time that IEC link waits for the end of the received message in seconds.
RTS Keepup Delay	0...20 Default: 1	The number of characters for calculating delay for resetting RTS signal.
RTS Keepup Padding Characters	0...255 Default: 0	The number of padding characters inserted to the end of telegram to delay the resetting of RTS signal.
Transmission Wait Delay	0...65535 Default: 15	Delay in milliseconds between receiving CTS signal and start of transmission.

3.4.3.2.**Configuring IEC101 Unbalanced Channel properties**

The IEC101 Unbalanced Channel properties that can be configured and value ranges for them can be found in Table 3.4.3.2-1. The actual configuration by using the COM600 Station Automation Builder 600 (SAB600) is performed as described in 3.4.1, General information about configuring objects.

Table 3.4.3.2-1 IEC101 Unbalanced Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
In Use	In use Not in use Default: In use	Specifies whether channel is initially in use.
Protocol	IEC60870-5-101 Unbalanced Slave	Protocol
Communication Port		

Property / Parameter	Value or Value range/ Default	Description
Baud Rate	300 bits/s 600 bits/s 1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s 19200 bits/s 38400 bits/s 56000 bits/s 57600 bits/s 115200 bits/s 128000 bits/s 256000 bits/s Default: 19200 bits/s	Transmission rate used on the channel.
Communication Port	COM1...COM8 Default: COM1	Serial port used by the IEC60870-5-101 protocol. Number of ports depends on the used hardware.
Parity	No parity check Even Odd Default: Even	Specifies the parity check used for the characters transferred on the channel.
Receiver Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each received character.
Stop Bits	1 stopbit 2 stopbits Default: 1 stopbit	Specifies the number of data bits in each transmitted character.
Transmitter Data Bit Count	5...8 Default: 8	Specifies the number of stop bits attached to each transmitted character.
Communication Control		

Property / Parameter	Value or Value range/ Default	Description
Carrier Blocking	Carrier detect signal is ignored Carrier detect signal must be set Default: Carrier detect signal is ignored	Determines whether the Carrier Detect signal of the serial port must be set for the IEC station to receive messages.
CTS Delay	0...65535 Default: 50	Delay in milliseconds between activation of the RTS signal and start of new transmission.
Enquiry Limit	0...255 Default: 3	Specifies maximum number of times that a message is transmitted after timeout.
Header Timeout	0...65535 Default: 2000	Maximum waiting time in milliseconds of a link layer response.
Keep Alive Timeout	0...65535 Default: 5000	The connection is considered to be alive if the delay between two consecutive master messages is shorter than the specified time in milliseconds.
Link Type	RTS activated during transmission (Unbalanced slave) RTS always active, reception always enabled (Balanced slave) RTS activated during transmission, reception always enabled (Balanced slave) Default: RTS activated during transmission (Unbalanced slave)	The type of the data link connection used on the channel.
Operating Mode	Handshaking messages not restarted Handshaking messages restarted Default: Handshaking messages not restarted	Specifies whether the handshaking messages (request, status of link, reset of remote link) are restarted when a 'request status of link' message is received from the remote end.
Response Timeout	0...255 Default: 2	The time that IEC link waits for the end of the received message in seconds.
RTS Keepup Delay	0...20 Default: 1	The number of characters for calculating delay for resetting RTS signal.

Property / Parameter	Value or Value range/ Default	Description
RTS Keepup Padding Characters	0...255 Default: 0	The number of padding characters inserted to the end of telegram to delay the resetting of RTS signal.
Transmission Wait Delay	0...65535 Default: 15	Delay in milliseconds between receiving CTS signal and start of transmission.

3.4.4. Configuring Device Properties

3.4.4.1. Configuring IEC101 Device properties

Table 3.4.4.1-1 lists the configurable properties for IEC101 Device and value ranges for these properties. The actual configuration by using SAB600 is performed as described in 3.4.1, General information about configuring objects.

Table 3.4.4.1-1 IEC101 Device properties

Name	Value/Value range	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the station or not.
Has Redundant Line	True False Default: False	Specifies whether redundant channel is used or not.
In Use	In use Not in use Default: In use	Controls whether the station communication is initially in use or not.
Addresses		

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Name	Value/Value range	Description
Polling Address	0...255 or 0...65535 Default: 1 The maximum value depends on the corresponding Polling Address Length property value as follows: when Polling Address Length property value is 1, the value range for the Polling Address is 0...255 and when Polling Address Length property value is 2, the value range for the Polling Address is 0...65535	The link address of the IEC 60870-5-101 slave station
Station Address	0...255 or 0...65535 Default: 1 The maximum value depends on the corresponding Station Address Length property value as follows: when Station Address Length property value is 1, the value range for the Information Address is 0...255 and when Station Address Length property value is 2, the value range for the Station Address is 0...65535	The station address of the IEC 60870-5-101 slave station (the common address of ASDU in an IEC message)
Communication control		
Reply Window Size	0...100 Default: 10	Defines how many data items can be written without a reply or request from the master.
Single Char Response	Disabled Enabled Default: Disabled	Enables or disables single char responses.
Command Handling		

Name	Value/Value range	Description
Command Address	0...65535 Default: 32000	The object address of the bit-stream process object in the OPC Client, where an unrecognized message is handled.
Confirmation Messages Placed To Class 2 Queue	True False Default: True	Place confirmation messages to class 2 queue instead of class 1 queue.
Disable Select-execute Validity Check	True False Default: True	Disable select-execute validity check.
Execute time-out	0...65 Default: 30	The maximum time an execute command is waited after a select command.
Lengths		
Cause of Transmission Length	1...2 Default: 1	The length of the cause of transmission field in an IEC 60870-5-101 message
Information Address Length	1...3 Default: 2	The length of the information object address in octets. Information address maximum value: 0...255 when length = 1, 65535 when length = 2 and 16777215 when length = 3.
Maximum Message Length	20...255 Default: 253	The maximum length of transmitted message in octets.
Polling Address Length	1, 2 Default: 1	The length of the polling address in octets. Polling address maximum value: 0...255 when length = 1 and 65535 when length = 2.

Name	Value/Value range	Description
Station Address Length	1...2 Default: 2	The length of the station address in octets. Station address maximum value: 0...255 when length = 1 and 65535 when length = 2.
Time Handling		
Clock Sync Not Required For Valid Timestamp	True False Default: True	Received clock synchronization not required for valid timestamp.
Command Time Control	Ignore summer time Use summer time	Defines how incoming time stamped commands are handled.
Disable Hour Change Clock Message	True False Default: True	Disable sending of hour change clock synchronization message.
Event Time Control	Sends UTC time Sends local time	Controls the time stamps (UTC, local) of events (indications) sent to the NCC Master.
Time Synchronization	Receive clock sync Ignore clock sync Default: Receive clock sync	Determines the behavior of the slave device, when it receives a time synchronization message.
Queues		
Measurement Queue Threshold	1...100 Default: 95	Defines a threshold (percent of the queue capacity) which causes that update of a measurement removes the oldest entry of the same measurement from the queue.
Measurement Update Queue	0...65535 Default: 1000	Maximum number of measurement process data changes that are stored internally in a queue in the client.
State Indications Updates Queue	0...65535 Default: 1000	Maximum number of state indication process data changes that are stored internally in a queue in the client.
OPC Alarm and Event		

Name	Value/Value range	Description
Device Connection Status	Default: Device Connection Status	Device Connection Status Class definition used with current device.
Event Queue Full	EventQueueOverflow EventQueueSkipMultipleUpdatesThreshold Default: EventQueueOverflow	Defines current state of event buffers.
Multiple Updates Threshold Full	EventQueueOverflow EventQueueSkipMultipleUpdatesThreshold Default: EventQueueSkipMultipleUpdatesThreshold	Defines current state of skipping multiple measurements updates threshold.
File Transfer		
File Transfer Enabled	True False Default: False	States whether File Transfer functionality is enabled or not.
File Transfer Source Directory		Defines the source directory for file transfer.

3.4.5. Configuring Data objects

3.4.5.1. General information about configuring data objects

You can configure data objects either in the Object Properties window or in the Cross References window.

The actual configuration in Object Properties window by using the COM600 Station Automation Builder 600 (SAB600) is performed as described in 3.2, Overview of configuration.

The parameters are stored in Object properties in the COM600 Station Automation Builder 600 (SAB600) (see the tables for each data object type).

Clicking **Save** connects the data objects to the IEC101 Device. After clicking **Save** the connected data objects appears as child objects for the IEC101 Device. The cross reference information can then be also modified by selecting the data object and using the object properties window.

If you change the object names or structuring of objects of OPC Server, which are connected to the IEC101 Device, re-open the cross reference tool and verify that the changes

are correctly handled and then click **Save** to update the IEC101 configuration accordingly.

IEC101 Slave OPC Client supports data objects for status, measurements, controllable status, and controllable analog information. The following subsections list the configurable data object properties for the IEC101 Slave OPC Client.

3.4.5.2. Single point status (SPS)

Information in the following table applies also to the Internal SPS data object.

Table 3.4.5.2-1 Configurable SPS properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPS	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication
Common		
Class	1 = Class 1 2 = Class 2 Default: 1 = Class 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counter)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation (1...16).
Over Write	True (A new information object overwrites an older object in the queue) False (No overwriting) Default: False	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle of queue = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is paced in the class 1 and class 2 queues.
Update Rate	0...60000	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		

Property/ Parameter	Value or Value range/ Default	Description
Send as Double Point	True = 1 False = 0 Default: False	Specifies if a value of indication signal is sent as double point value.
Send as Inverse Value	True = 1 False = 0 Default: False	Specifies if a value of indication signal is sent as inverse value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.3. Double point status (DPS)

Table 3.4.5.3-1 Configurable DPS properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPS	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	1 = Class 1 2 = Class 2 Default: 1 = Class 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	1 = True 0 = False Default: 0 = False	Defines whether a new indication value overwrites an older one in the queue.

Property/ Parameter	Value or Value range/ Default	Description
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send as Inverse Value	True = 1 False = 0 Default: False	Specifies if a value of indication signal is sent as inverse value.
Send as Single Point	True = 1 False = 0 Default: False	Specifies if a value of indication signal is sent as single point value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.4. Integer status (INS)

Information in the following table applies also to the Internal INS data object.

Table 3.4.5.4-1 Configurable INS properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	INS	Common data class according to IEC 61850.
Addresses		

Property/ Parameter	Value or Value range/ Default	Description
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send as Indication as Value Type	Send with normalized value = 0 Send with scaled value = 1	Specifies whether the value of indication signal is sent as normalized or scaled value. Long timestamp format cannot be used with scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.5.

Enumerated Status (ENS)**Table 3.4.5.5-1 Configurable ENS properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ENS	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send as Indication as Value Type	Send with normalized value = 0 Send with scaled value = 1 Default: 0 (Send with normalized value).	Specifies whether the value of indication signal is sent as normalized or scaled value. Long timestamp format cannot be used with scaled value.

Property/ Parameter	Value or Value range/ Default	Description
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.6. Protection activation information (ACT)

Table 3.4.5.6-1 Configurable ACT properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACT	Common data class according to IEC 61850.
Addresses		
General Address	0...16777215	IEC address for general indication.
Neutral Address	0...16777215	IEC address for neutral indication
Phase A Address	0...16777215 0 = Not in use	IEC address for phase A.
Phase B Address	0...16777215 0 = Not in use	IEC address for phase B.
Phase C Address	0...16777215 0 = Not in use	IEC address for phase C.
Common		
Class	1 = Class 1 2 = Class 2 Default: 1 = Class 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.

Property/ Parameter	Value or Value range/ Default	Description
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send as Double Point	True = 1 False = 0	Specifies if the value of indication signal is sent as double point.
Send as Inverse Value	True = 1 False = 0	Specifies the value of indication signal is sent as inverse value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.7.

Directional protection activation information (ACD)**Table 3.4.5.7-1 Configurable ACD properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACD	Common data class according to IEC 61850.
Addresses		
General Address	0...16777215	IEC address for general indication
Neutral Address	0...16777215	IEC address for neutral
Phase A Address	0...16777215 0 = Not in use	IEC address for phase A
Phase B Address	0...16777215 0 = Not in use	IEC address for phase B

Property/ Parameter	Value or Value range/ Default	Description
Phase C Address	0...16777215 0 = Not in use	IEC address for phase C
Common		
Class	1 = Class 1 2 = Class 2 Default: 1 = Class 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send as Double Point	True = 1 False = 0	Specifies if a value of indication signal is sent as double point.
Send as Inverse Point	True = 1 False = 0	Specifies if a value of indication signal is sent as inverse value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.8.

Binary counter reading (BCR)**Table 3.4.5.8-1 Configurable BCR properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BCR	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default:0	IEC Address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.9. Measured value (MV)

Table 3.4.5.9-1 Configurable MV properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	MV	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default: 0	IEC Address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 2 = 2	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: True = 1	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send As Measurand As Value Type	Send with normalized value = 0 Send with scaled value = 1 Send with float value = 2	Specifies the type of the indication signal value. Long timestamp format cannot be used with a scaled value.

Property/ Parameter	Value or Value range/ Default	Description
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.10. Complex measured value (CMV)

Table 3.4.5.10-1 Configurable CMV properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	CMV	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default:0	IEC Address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 2 = 2	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: True = 1	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send As Measurand As Value Type	Send with normalized value = 0 Send with scaled value = 1 Send with float value = 2	Specifies the type of the indication signal value. Long timestamp format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.11.**WYE****Table 3.4.5.11-1 Configurable WYE properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	WYE	Common data class according to IEC 61850.
Addresses		
Neutral Address	0...16777215 0 = Not in use	IEC address for neutral.
Phase A Address	0...16777215 0 = Not in use	IEC address for phase A.
Phase B Address	0...16777215 0 = Not in use	IEC address for phase B.
Phase C Address	0...16777215 0 = Not in use	IEC address for phase C.

Property/ Parameter	Value or Value range/ Default	Description
Net Address	0...16777215 0 = Not in use	IED address for net.
Res Address	0...16777215 0 = Not in use	IED address for res.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 2 = 2	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: True = 1	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 1000	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send As Measurand As Value Type	Send with normalized value = 0 Send with scaled value = 1 Send with float value = 2	Specifies the type of the indication signal value. Long timestamp format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.12.

Delta (DEL)**Table 3.4.5.12-1 Configurable DEL properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DEL	Common data class according to IEC 61850.
Phase AB Address	0...16777215 0 = Not in use	IEC address for phase AB.
Phase BC Address	0...16777215 0 = Not in use	IEC address for phase BC.
Phase CA Address	0...16777215 0 = Not in use	IEC address for phase CA.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 2 = 2	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: True = 1	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 1000	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send As Measurand As Value Type	Send with normalized value = 0 Send with scaled value = 1 Send with float value = 2	Specifies the type of the indication signal value. Long timestamp format cannot be used with a scaled value.

Property/ Parameter	Value or Value range/ Default	Description
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.13. Controllable single point (SPC)

Information in the following table applies also to the Internal SPC data object.

Table 3.4.5.13-1 Configurable SPC properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.

Property/ Parameter	Value or Value range/ Default	Description
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Receive As Inverse Value	True = 1 False = 0	Specifies if a value of indication signal is sent as inverse value.
Send as Double Point Value	True = 1 False = 0	Specifies if a value of indication signal is sent as double point.
Send As Inverse Value	True False	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	

3.4.5.14.**Controllable double point (DPC)****Table 3.4.5.14-1 Configurable DPC properties for OPC client, subtype BASIC**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215	IEC address for command.
Indication Address	0...16777215	IEC address for indication.

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Property/ Parameter	Value or Value range/ Default	Description
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Direct Operate	True = 1 False = 0	If the value of this attribute is True, then no select is required.
Receive As Inverse Value	True = 1 False = 0	Specifies if the received open / close commands are handled inversely.
Send as Inverse Value	True = 1 False = 0	Specifies if a value of indication signal is sent as inverse value.
Send as Single Point	True = 1 False = 0	Specifies if a value of indication signal is sent as single point value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

Table 3.4.5.14-2 Configurable DPC properties for OPC client, subtype CMD_OVERRIDE

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215	IEC address for command.
Indication Address	0...16777215	IEC address for indication.
Command Address Interlock Override	0...16777215	IEC address for interlock override
Command Address Synch And Interlock Override	0...16777215	IEC address for synch and interlock override
Command Address Synch Override	0...16777215	IEC address for synch override

3.4.5.15.**Controllable integer status (INC)****Table 3.4.5.15-1 Configurable INC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	INC	Common data class according to IEC 61850
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.

Property/ Parameter	Value or Value range/ Default	Description
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send Indication As Value Type	Send with normalized value = 0 Send with scaled value = 1	Send value of indication signal as normalized or scaled. Long timestamp format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.16.**Controllable Enumerated Status (ENC)****Table 3.4.5.16-1 Configurable INC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ENC	Common data class according to IEC 61850
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.

Property/ Parameter	Value or Value range/ Default	Description
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send Indication As Value Type	Send with normalized value = 0 Send with scaled value = 1 Default: 0	Send value of indication signal as normalized or scaled. Long timestamp format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.17.

Binary controlled step position information (BSC)**Table 3.4.5.17-1 Configurable BSC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BSC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215	IEC address for command.
Position Address	0...16777215	IEC address for position.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send Indication As Value Type	Send with normalized value = 0 Send with scaled value = 1	Specifies if the value of indication signal is sent as normalized or scaled. Long timestamp format cannot be used with a scaled value.

Property/ Parameter	Value or Value range/ Default	Description
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.18.**Integer controlled step position information (ISC)****Table 3.4.5.18-1 Configurable ISC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ISC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215	IEC address for command.
Position Address	0...16777215	IEC address for position.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1 - 16 general or 1 - 4 counter interrogation.
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1, 2 Beginning of queue = 3	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Send Indication As Value Type	Send with normalized value = 0 Send with scaled value = 1	Specifies if the value of indication signal is sent as normalized or scaled. Long timestamp format cannot be used with a scaled value.
Time Tag Handling	Do not Send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short, or long. Long time tag format cannot be used with a scaled value.

3.4.5.19.**Analogue set point (APC)****Table 3.4.5.19-1 Configurable APC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	APC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		
Class	Class 1 = 1 Class 2 = 2 Default: Class 1 = 1	Class of ASDU. Data sent from the slave to the master can be assigned to two classes: class 1 and class 2. Data in class 1 is sent with higher priority than data in class 2.
Interrogation Group	1...16 (general) or 1...4 (counters)	Interrogation group. 1-16 general or 1-4 counter interrogation.

Property/ Parameter	Value or Value range/ Default	Description
Over Write	True = 1 False = 0 Default: False = 0	Defines whether a new indication value overwrites an older one in the queue.
Priority	0...3 End of queue = 0 Middle = 1,2 Beginning of queue = 3 Default: 0	Priority of ASDU. This property defines how the ASDU sent is placed in the class 1 and class 2 queues.
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between OPC server and client in milliseconds. 0 means that server sends all the changes to the client.
Data Class Specific		
Time Tag Handling	Do not send Time Tag = 0 Send Short Format Time Tag = 1 Send Long Format Time Tag (cannot be used with Scaled value) = 2 Default: Send Long Format Time Tag	Specifies the format of timestamp if one is used: none, short or long. Long time tag format cannot be used with a scaled value.
Basic		
Send Measurand as Value Type	Sendwithnormalizedvalue=0 Sendwithscaledvalue=1 Sendwithfloatvalue=2 Default: Sendwithnormalized-value	Send value of measurement signal as normalized or scaled or float value. Long timestamp format cannot be used with scaled value.

4. Operation

4.1. About this section

This section describes the basic operation procedures you can carry out after the object properties for the IEC101 Slave OPC Client have been configured.

After this, you can, for example, monitor and control the condition of connections in network. This is done by using the Online diagnostics function in SAB600.

4.2. Activating COM600 with new configurations

For information about activating COM600 with new configuration, see COM600 User's Manual.

4.3. IEC101 Slave OPC Client diagnostics

To view version information on IEC101 Slave OPC Client or to monitor and control the state of the client, right-click the IEC101 Slave OPC Client object and select **Online diagnostics**, see Figure 4.3-1.

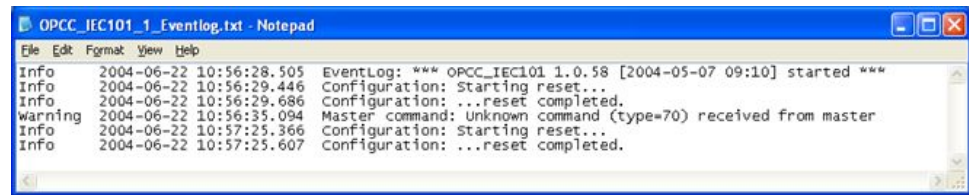


IEC101_Slave_OPC_Client_Online_diagnostics.jpg

Figure 4.3-1 IEC101 Slave OPC Client Online diagnostics

In Online diagnostics box you can:

- reset IEC101 Slave OPC Client
- view the event log file, see Figure 4.3-2
- clear the event log file



Event_Log101.jpg

Figure 4.3-2 Event log file

4.4. IEC101 Channel diagnostics

The IEC101 Channel activity can be monitored with the Online diagnostics function.

You can also take a channel into use or out of use as described in this section.

To monitor and control IEC101 Channel activity:

1. Select the channel you want to monitor in the object tree of SAB600.
2. Right-click the channel.
3. Select **Online diagnostics**.

In the Diagnostic counters field, you can monitor the channel activity. To reset Diagnostic counters, click **Reset counters**.

You can take an IEC101 Channel into use by marking the **In use** check box. If you unmark the check box, the channel is taken out of use. To manually update diagnostic counters, click **Refresh**.

For more information on the channel online diagnostics with the Analyzer function, see COM600 User's manual.

4.5. IEC101 Device diagnostics

The IEC101 Device communication can be monitored with the Online diagnostics function. You can also take a device into use or out of use as described in this section.

To monitor and control IEC101 Device communication:

1. Select the device you want to monitor in the object tree of SAB600.
2. Right-click the device.
3. Select **Online diagnostics**.

In the Status information field, you can monitor the device status.

The Diagnostic counters field provides information on device activity. To reset diagnostic counters, click **Reset counters**.

You can take an IEC101 Device into use by marking the **In use** check box. If you unmark the check box, the device is taken out of use. To manually update diagnostic counters, click **Refresh**.

4.6. Signal diagnostics

The IEC101 Slave OPC client has a diagnostic function which makes it possible to monitor the flow of process data changes and commands. The diagnostic function is activated by marking the **Diagnostic Events Enabled** check box, located in the Online diagnostics function of the IEC101 Device. When the diagnostic function is activated, the IEC101 OPC Client Alarm & Event server generates events with information about data changes and commands.

To view the event list:

1. Select the IEC101 Slave OPC Client object in the object tree of SAB600.
2. Right-click the IEC101 Slave OPC Client.
3. Select **Diagnostic AE client** (see Figure 4.6-1)

Event count: 22

Time	Type	Source	M...	Value	Quality
2004.05.25 13:00:12.682	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		60	GOOD (0x
2004.05.25 13:00:14.771	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		0	GOOD (0x
2004.05.25 13:01:12.859	DM - Command	LON Channel\LON REX IED\Logical Device\LLNO\DPC		2	
2004.05.25 13:01:12.906	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLNO\DPC			
2004.05.25 13:01:15.031	DM - Command	LON Channel\LON REX IED\Logical Device\LLNO\DPC		2	
2004.05.25 13:01:15.109	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLNO\DPC			
2004.05.25 13:01:15.109	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLNO\DPC			
2004.05.25 13:01:15.141	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		13	GOOD (0x
2004.05.25 13:01:15.141	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\DPC\stVal		2	GOOD (0x
2004.05.25 13:01:15.181	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		61	GOOD (0x
2004.05.25 13:01:15.231	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		114	GOOD (0x
2004.05.25 13:01:17.250	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		106	GOOD (0x
2004.05.25 13:01:27.687	DM - Applica...	IEC101 Balanced Channel.IEC101 IED			
2004.05.25 13:01:27.687	DM - Comma...	IEC101 Balanced Channel.IEC101 IED			
2004.05.25 13:01:15.141	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\DPC\stVal		2	GOOD (0x
2004.05.25 13:01:17.250	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		106	GOOD (0x
2004.05.25 13:01:27.703	DM - Comma...	IEC101 Balanced Channel.IEC101 IED			
2004.05.25 13:01:26.735	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		104	GOOD (0x
2004.05.25 13:01:35.843	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		105	GOOD (0x
2004.05.25 13:02:09.095	DM - Indication	LON Channel\LON REX IED\Logical Device\LLNO\MV\mag		104	GOOD (0x

IEC101_Diagnostic_AE_Client.jpg

Figure 4.6-1 IEC101 Slave OPC Client Diagnostic AE client

Detailed information about field values (ASDU types, qualifier values and so on) can be found in the IEC 60870-5-101 standard documentation.

5. Technical reference

5.1. About this section

This section provides reference information about the following issues:

- IEC 61850 data modeling
- Attributes
- Status codes

5.2. IEC 61850 data modeling

5.2.1. General information about IEC 61850 data modeling

The relationship between the IEC 61850 data modeling and IEC101 OPC Client is described in this section.

For each data class, there is a table giving a detailed description about the relation between the IEC101 data and IEC 61850 data object attributes and services. The tables also describe how the data is presented on the OPC Server name space.

The columns in the tables have the following content types:

- **Name** specifies the OPC item name of the attribute/service.
- **Type** specifies the IEC 61850 type of the attribute.
- **Value/ Value range** specifies the allowed values and ranges of the attribute/service.
- **Mandatory/Optional** specifies whether the attribute is considered as mandatory or optional according to the IEC 61850 standard.
- **IEC101 information element** specifies the IEC101 information element related to the attribute/service.
- **OPC data types** specify the OPC data type used for the OPC item.

5.2.2. Single point status (SPS)

SPS represents DMCD M_SP_NA_1, M_SP_TA_1, M_SP_TB_1.

Name	Type	Value/Value range	Mandato- ry/Optional	Protocol informa- tion element	OPC data types
stVal	BOOLEAN	TRUE FALSE	M	SPI(0=ON, 1=OFF)	VT_BOOL
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.3. Double point status (DPS)

DPS represents DMCD M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	ENUMERATED	Intermediate-state (0) off (1) on (2) bad-state (3)	M	DPI	VT_I4
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.4. Integer status (INS)

INS represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	INTEGER		M	NVA, COI	VT_I4
q	Quality		M	OV, BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.5. Enumerated Status (ENS)

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	ENUMERATED		M	NVA, COI	VT_I4
q	Quality		M	OV, BL, SB, NT, IV	VT_I4
t	Timestamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

ENS represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1

5.2.6. Protection activation information (ACT)

ACT represents DMCD M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
general	BOOLEAN		M	SPI	VT_BOOL
phsA	BOOLEAN		O	SPI	VT_BOOL
phsB	BOOLEAN		O	SPI	VT_BOOL
phsC	BOOLEAN		O	SPI	VT_BOOL
neut	BOOLEAN		O	SPI	VT_BOOL
q	Quality		M	EI, BL, SB, NT, IV	VT_I4

5.2.7. Directional protection activation information (ACD)

ACD represents M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
general	BOOLEAN		M	SPI	VT_BOOL
dirGeneral	ENUMERATED	unknown forward backward	M		VT_I4
phsA	BOOLEAN		O	SPI	VT_BOOL
dirPhsA	ENUMERATED	unknown forward backward	O		VT_I4
phsB	BOOLEAN		O	SPI	VT_BOOL
dirPhsB	ENUMERATED	unknown forward backward	O		VT_I4
phsC	BOOLEAN		O	SPI	VT_BOOL
dirPhsC	ENUMERATED	unknown forward backward	O		VT_I4
neut	BOOLEAN		O	SPI	VT_BOOL

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
dirNeut	ENUMERATED	unknown forward backward	O		VT_I4
q	Quality		M	EI, BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a, CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.8. Binary counter reading (BCR)

BCR represent DMCD M_IT_NA_1, M_IT_TA_1, M_IT_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
actVal	INTEGER		M	BCR	VT_I4
q	Quality		M	CY, CA, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.9. Measured value (MV)

MV represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1, M_ME_NB_1, M_ME_TB_1, M_ME_NC_1, M_ME_TC_1, M_ME_TF_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protection information element	OPC data types
mag	AnalogueValue		M	SVA, NVA, IEEE STD 754	VT_R4
range	Range		O	L1, L2, L3, L4	VT_I4
q	Quality		M	OV, BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a <none> Time of occurrence	VT_DATE
hhLim	REAL		O		VT_R4
hLim	REAL		O		VT_R4

Name	Type	Value/ Value range	Mandatory/Optional	Protection information element	OPC data types
ILim	REAL		O		VT_R4
ILLim	REAL		O		VT_R4
min	REAL		O		VT_R4
max	REAL		O		VT_R4
unit	SiUnit		O	Config	VT_I4
d	Description	Text	O		VT_BSTR

5.2.10. Complex measured value (CMV)

CMV is configured in the same way as MV. The only difference is that instead of a 'mag' item, there is a 'cVal' node containing a 'mag' item.

5.2.11. WYE

WYE represent DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1, M_ME_NB_1, M_ME_TB_1, M_ME_NC_1, M_ME_TC_1, M_ME_TF_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsA.cVal.mag	AnalogueValue		M	SVA, NVA	VT_R4
phsA.q	Quality		M	OV, BL, SB, NT, IV	VT_I4
phsA.t	TimeStamp		M	CP24Time2A	VT_DATE
phsB.cVal.mag	AnalogueValue		O	SVA, NVA	VT_R4
phsB.q	Quality		O	OV, BL, SB, NT, IV	VT_I4
phsB.t	TimeStamp		O	CP24Time2A	VT_DATE
phsC.cVal.mag	AnalogueValue		O	SVA, NVA	VT_R4
phsC.q	Quality		O	OV, BL, SB, NT, IV	VT_I4
phsC.t	TimeStamp		O	CP24Time2A	VT_DATE
neut.cVal.mag	AnalogueValue		O	SVA, NVA	VT_R4
neut.q	Quality		O	OV, BL, SB, NT, IV	VT_I4
neut.t	TimeStamp		O	CP24Time2A	VT_DATE

5.2.12. Delta (DEL)

DEL represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1, M_ME_NB_1, M_ME_TB_1, M_ME_NC_1, M_ME_TC_1, M_ME_TF_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsAB.cVal.mag t	AnalogueValue		M	SVA, NVA	VT_R4
phsAB.q	Quality		M	OV, BL, SB, NT, IV	VT_I4
phsAB.t	TimeStamp		M	CP24Time2A	VT_DATE
phsBC.cVal.mag q	AnalogueValue		M	SVA, NVA	VT_R4
phsBC.q	Quality		M	OV, BL, SB, NT, IV	VT_I4
phsBC.t	TimeStamp		M	CP24Time2A	VT_DATE
phsCA.cVal.mag q	AnalogueValue		M	SVA, NVA	VT_R4
phsCA.q	Quality		M	OV, BL, SB, NT, IV	VT_I4
phsCA.t	TimeStamp		M	CP24Time2A	VT_DATE

5.2.13. Controllable single point (SPC)

SPC represents DMCD C_SC_NA_1, C_DC_NA_1, M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	SPI		M	SCO	VT_BOOL
stVal		FALSE TRUE	M	SPI	VT_BOOL
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2A	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.14. Controllable double point (DPC)

DPC represents DMCD C_SC_NA_1, C_DC_NA_1, M_SP_NA_1, M_SP_TA_1, M_SP_TB_1, M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlOperOn	SPI	FALSE TRUE	O	SCO	VT_BOOL
ctlOperOff		FALSE TRUE	O	SCO	VT_BOOL

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlSelOn		FALSE TRUE	O	SCO	VT_BOOL
ctlSelOff		FALSE TRUE	O	SCO	VT_BOOL
stVal	ENUMERATED	intermediate-state (0) off (1) on (2) bad-state (3)	M	DPI	VT_I4
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24TIME2A	VT_DATE
ctlCan	BOOLEAN	FALSE TRUE	O	SCO	VT_BOOL
stSeld	BOOLEAN	FALSE TRUE	O	SPI	VT_BOOL
d	Description	Text	O		VT_BSTR

5.2.15. Controllable integer status (INC)

INC represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1, M_ME_NB_1, M_ME_TB_1, C_SE_NA, C_SE_NB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	INTEGER		M	NVA	VT_I4
stVal	INTEGER		M	VAI32	VT_I4
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24TIME2A	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.16. Controllable Enumerated Status (ENC)

ENC represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1, M_ME_NB_1, M_ME_TB_1, C_SE_NA, C_SE_NB_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	ENUMERATED		M	NVA	VT_I4
stVal	ENUMERATED		M	VAI32	VT_I4
q	Quality		M	BL, SB, NT, IV	VT_I4

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
t	Timestamp		M	CP24Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.17. Binary controlled step position information (BSC)

BSC represents DMCD M_ST_NA_1, M_ST_TA_1, M_ST_TB_1, M_RC_NA_1.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	ENUMERATED	stop (0) lower (1) higher (2) reserved (3)	M	RCO	VT_I1
valWTr	ValWithTrans		M	VTI	VT_I4
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.18. Integer controlled step position information (ISC)

ISC represents C_SE_NA_1, C_SE_NB_1, M_ST_NA_1, M_ST_TA_1, M_ST_TB_1.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	INTEGER	-64 ... 63	M	NVA	VT_I4
valWTr	ValWithTrans		M	VTI	VT_I4
q	Quality		M	BL, SB, NT, IV	V_I4
t	TimeStamp		M	CP24TIME2A	V_DATE
d	Description	Text	O		VT_BSTR

5.2.19. Analogue set point (APC)

APC represents DMCD C_SE_NC_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	AnalogueValue		M	IEEE STD 754, BSI, SVA	VT_R4
mxVal	AnalogueValue		M	IEEE STD 754, BSI, SVA	VT_R4
q	Quality		M	BL,SB,NT,IV	VT_I4
t	Timestamp		M	CP24Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.3. Status codes

5.3.1. Introduction

The following status codes are defined for the IEC 60870-5-101 slave protocol. Some typical reasons for some of the status codes are also given.

5.3.2. Link layer status codes

17600	IGTP_REMOTE_LINK_CONTINUOUSLY_BUSY. The Data Flow Control (DFC) bit of the messages from the master is set for more than 15 seconds.
17601	IGTP_TIMEOUT_WHILE_TRANSMITTING. The CTS signal or the end of transmitted message is not received in correct time. The DE attribute controls the CTS waiting time; the transmission time of message is automatically calculated.
17602	IGTP_TIMEOUT_WHILE_WAITING_RESPONSE. Timeout while waiting for an acknowledgment to a message.
17604	IGTP_LINK_NOT_READY. The application level sends a command before the communication between the master and the slave is established.
17605	IGTP_REMOTE_LINK_BUSY. Data sending fails since the Data Flow Control bit (DFC) is set in remote station and there is already one data message waiting to be reset. Not used in the unbalanced slave.
17606	IGTP_REMOTE_LINK_NOT_RESPONDING. The slave does not receive a reply from the master.
17607	IGTP_LINE_STARTED. The station has been set in use by using the IU attribute.
17608	IGTP_LINE_STOPPED. The station has been set out of use by using the IU attribute.

17609	IGTP_MESSAGE_RECEIVING_STOPPED. A watchdog mechanism in an unbalanced slave station has detected that it is polled no more. The line is automatically returned to OK, when polling is restarted.
17610	IGTP_RECEIVER_OUT_OF_BUFFERS. Internal software error.
17620	IGPC_ILLEGAL_ATTRIBUTE_VALUE. The value written to one of the line attributes is incorrect.

5.3.3. Application layer status codes

13851	ICCC_INVALID_ATTRIBUTE_VALUE. The value set to an attribute of an IEC station is incorrect, for example, one of the elements of the vector written to the SD attribute is out of range.
13852	ICCC_INVALID_INDEX_RANGE. The index range used when accessing an attribute of an IEC station is incorrect.
13853	ICCC_INVALID_ATTRIBUTE. The STA object attribute used is not valid for the IEC 60870-5-101 slave protocol.
13854	ICCC_ASDU_TABLE_NOT_CREATED. Internal software error.
13855	ICCC_UNKNOWN_ASDU_NAME. The name of the ASDU written to the SD or EV attribute is not supported.
13856	ICCC_ASDU_QUEUE_FULL. No more events can be written to one of the queues by using the SD or EV attribute since the queue is full.
13857	ICCC_MESSAGE_BUFFER_FULL. Internal software error. The value of the ML attribute may be too small.
13858	ICCC_MESSAGE_FILLING_ERROR. Internal software error. The value of the ML attribute may be too small.
13859	ICCC_UNKNOWN_ASDU. The number of the ASDU written to the SD or EV attribute is not supported.
13860	ICCC_NO_ACTIVE_COMMAND. There is no preceding command with the given address when confirming a command by using the CF attribute. Either the address is incorrect or the command has not been received.
13861	ICCC_INVALID_QUEUE_NUMBER. The index of the SD or EV attribute is incorrect.
13862	ICCC_SC_DATA_OVERFLOW. Internal software error.
13863	ICCC_DEVICE_SUSPENDED. The IEC station is in the suspended state. The reason for this could be that the link is not properly established (for example, incorrect cable wiring) or the master does not respond.
13864	ICCC_MESSAGE_SENDING_ERROR. Internal software error. This may be the result of a problem in wiring or hardware.
13865	ICCC_REMOTE_DEVICE_REPLIES_WITH_NACK. The master did not accept the message but responded with a negative acknowledgment instead. Not used in the unbalanced mode.
13866	ICCC_LINK_NOT_READY. A message is sent to a line with a non-established communication.

13868	ICCC_OUT_OF_BUFFERS. Internal software error. Operation could not be completed since the buffer pool has run out of buffers.
13869	ICCC_DONT_REPLY. Internal software error.
13872	ICCC_DEVICE_STOPPED. The station has been set out of use by using the IU attribute.
13873	ICCC_NO_ADDRESS_IN_ACP. Internal software error.
13875	ICCC_UNEXPECTED_TYPE_IN_ACP. Internal software error.

5.4. Attributes

5.4.1. General information about attributes

In addition to item tags for process data (indications and commands), the OPC servers and clients also provide some item tags for controlling the devices and retrieving status information from them. These item tags are called attributes.

There are three categories of attributes: IEC101 Slave OPC Client attributes, IEC101 Channel attributes and IEC101 Device attributes. These attributes are described in the following subsections.

5.4.2. Client attributes

Table 5.4.2-1 Client attributes

Property / Parameter	Value or Value range/ Default	Description
Protocol Stack Version	Value: Version information	The version information of the Protocol Stack.

5.4.3. Channel attributes

Table 5.4.3-1 Channel attributes

Property / Parameter	Value or Value range/ Default	Description
Basic		

Property / Parameter	Value or Value range/ Default	Description
In use	0 = Not in use, the channel communication is stopped. 1 = In use.	The state of the channel - whether it is in use or not. When a channel is not in use, no data can be transmitted on it, and no data is received from it. The channel attributes can be read as usual. Generally, a channel must be taken out of use by setting this attribute to 0 before the channel attributes can be written. When a channel is stopped by setting the In use attribute to 0, all data transmission on the channel ceases. However, before that, the protocol stack executes to the end all on-going data transactions. For example, the of the station in turn is completed.
Modem Signal		
Clear To Send (CTS)	0 = Passive signal 1 = Active signal	Indicates the state of the Clear To Send (CTS) signal.
Data Carrier Detect (DCD)	0 = Passive signal 1 = Active signal	Indicates the state of Data Carrier Detect (DCD) signal.
Diagnostic Counters		
Transmitted Messages		The number of transmitted data messages.
Failed Transmissions		The number of failed transmissions.
Transmitted Commands		The number of transmitted commands.
Transmitted Replies		The number of transmitted replies.
Received Messages		The number of received data messages.
Parity Errors		The number of times a parity error has occurred.
Overrun Errors		The number of times an overrun error has occurred.
Check Sum Errors		The number of times a redundancy error has occurred.
Framing Errors		The number of times a framing error has occurred.
Buffer Overflow Errors		The number of times there as been a buffer overflow.

5.4.4. Device attributes

Table 5.4.4-1 Device attributes

Property / Parameter	Value or Value range/ Default	Description
In use	0 = Out of use 1 = In use Default: 1	The operational status of the device - in use or out of use. Taking the device out of use with this attribute stops all data communication with the device. All operations that would result in a data exchange are disabled. The device itself is not affected by the attribute, only the protocol stack's image of the device. Setting In use to 1 is allowed only if the device address is legal.
Object Status	When written: 1 = Re-transmit system message When read: A status code, e.g. 0 = OK (communication works properly) 13863 = Device suspended. For more information, see 5.3.2, Link layer status codes and 5.3.3, Application layer status codes.	Indicates the detailed information about the station device status. Setting Object status of a device to 1 makes the protocol stack to re-transmit the last system message caused by the device. Possible 'Stopped' and 'Suspended' messages cause old marking of OPC items. By reading the Object Status attribute, the status code of the system message can be read.
Device Connection Status	True = Device connection OK False = Device connection suspended.	Indicates the status of the device connection.
Diagnostic Events Enabled	True = Diagnostic events enabled False = Diagnostic events disabled	This attribute enables or disables diagnostic events.
Pending Updates		Indicates the current number of pending updates between the client and the protocol stack.
Max Pending Updates		Indicates the maximum number of pending updates between the client and the protocol stack.
Diagnostic counters		
Suspension Counter		Indicates the number of times the connection has been suspended.

Property / Parameter	Value or Value range/ Default	Description
Transmitted Data Messages		The number of transmitted data messages.
Transmitted Command Messages		The number of transmitted command messages.
Transmitted Confirmation Messages		The number of transmitted confirmation messages.
Received Data Messages		The number of received data messages.
Received Command Messages		The number of received command messages.
Received Confirmation Messages		The number of received confirmation messages.
Received Unknown Messages		The number of unknown messages received.

Appendix 1

Interoperability list for IEC101 OPC Client

- ☐ Not supported
- ☒ Supported
- ☐ Supported, may need additional configuring

Application layer telegram formats

Interoperability

This companion standard presents sets of parameters and alternatives from which subsets have to be selected to implement particular telecontrol systems. Certain parameter values, such as the number of octets in the common address of ASDUs represent mutually exclusive alternatives. This means that only one value of the defined parameters is admitted per system. Other parameters, such as the listed set of different process information in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for the applications. This clause summarizes the parameters of the previous clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers, it is necessary that all the partners agree on the selected parameters.

The selected parameters must be marked in the white boxes.



The full specification of a system requires individual selection of certain parameters for certain parts of the system, for example, the individual selection of scaling factors for individually addressable measured values

Network configuration (network-specific parameter)

- | | |
|---|--|
| <input checked="" type="checkbox"/> Point-to-point | <input checked="" type="checkbox"/> Multi-point-party line |
| <input type="checkbox"/> Multiple point to point | <input type="checkbox"/> Multi-point-star |
| <input checked="" type="checkbox"/> Redundant lines | |



The use of redundant lines requires specific functionality from the master. Contact your local supplier for more details.

Physical layer (network-specific parameter)

Transmission speed (control direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.28
<input type="checkbox"/> 100 bit/s	<input checked="" type="checkbox"/> 2400 bit/s	<input type="checkbox"/> 2400 bit/s
<input type="checkbox"/> 200 bit/s	<input checked="" type="checkbox"/> 4800 bit/s	<input type="checkbox"/> 4800 bit/s
<input type="checkbox"/> 300 bit/s	<input checked="" type="checkbox"/> 9600 bit/s	<input type="checkbox"/> 9600 bit/s
<input type="checkbox"/> 600 bit/s	<input checked="" type="checkbox"/> 19200 bit/s	<input type="checkbox"/> 19200 bit/s
<input checked="" type="checkbox"/> 1200 bit/s		<input type="checkbox"/> 38400 bit/s
		<input type="checkbox"/> 56000 bit/s
		<input type="checkbox"/> 64000 bit/s

Transmission speed (monitor direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.28
<input type="checkbox"/> 100 bit/s	<input checked="" type="checkbox"/> 2400 bit/s	<input type="checkbox"/> 2400 bit/s
<input type="checkbox"/> 200 bit/s	<input checked="" type="checkbox"/> 4800 bit/s	<input type="checkbox"/> 4800 bit/s
<input type="checkbox"/> 300 bit/s	<input checked="" type="checkbox"/> 9600 bit/s	<input type="checkbox"/> 9600 bit/s
<input type="checkbox"/> 600 bit/s	<input checked="" type="checkbox"/> 19200 bit/s	<input type="checkbox"/> 19200 bit/s
<input checked="" type="checkbox"/> 1200 bit/s		<input type="checkbox"/> 38400 bit/s
		<input type="checkbox"/> 56000 bit/s
		<input type="checkbox"/> 64000 bit/s

Link layer (network-specific parameter)

Frame format FT 1.2, single character 1 and the fixed time-out interval are used exclusively in this companion standard.

Link transmission procedure	Address field of the link
<input checked="" type="checkbox"/> Balanced transmission	<input checked="" type="checkbox"/> not present
<input checked="" type="checkbox"/> Unbalanced transmission	<input checked="" type="checkbox"/> One octet
	<input checked="" type="checkbox"/> Two octets
Frame length	<input type="checkbox"/> Structured

230 Maximum length L (number of octets) ■ Unstructured

The maximum frame length per Controlled Station can be up to 255.

Application layer

Transmission mode for application data

Mode 1 (The least significant octet first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard

Common address of ASDU (system-specific parameter)

■ One octet ■ Two octets

Information object address (system-specific parameter)

■ One octet ■ structured
 ■ Two octets ■ unstructured
 ■ Three octets

Cause of transmission (system-specific parameter)

■ One octet ■ Two octets (with originator address)

Selection of standard ASDUs

Process information in monitor direction (station-specific parameter)

■	<1>	:=Single-point information	M_SP_NA_1
■	<2>	:=Single-point information with time tag	M_SP_TA_1
■	<3>	:=Double-point information	M_DP_NA_1
■	<4>	:=Double-point information with time tag	M_DP_TA_1
■	<5>	:=Step position information	M_ST_NA_1
■	<6>	:=Step position information with time tag	M_ST_TA_1
□	<7>	:=Bitstring of 32 bit	M_BO_NA_1
□	<8>	:=Bitstring of 32 bit with time tag	M_BO_TA_1
■	<9>	:=Measured value, normalized value	M_ME_NA_1
■	<10>	:=Measured value, normalized value with time tag	M_ME_TA_1

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■	<11>	:=Measured value, scaled value	M_ME_NB_1
■	<12>	:=Measured value, scaled value with time tag	M_ME_TB_1
■	<13>	:=Measured value, short floating point value	M_ME_NC_1
■	<14>	:=Measured value, short floating point value with time tag	M_ME_TC_1
■	<15>	:=Integrated totals	M_IT_NA_1
■	<16>	:=Integrated totals with time tag	M_IT_TA_1
□	<17>	:=Event of protection equipment with time tag	M_EP_TA1
□	<18>	:=Packed start events of protection equipment with time tag	M_EP_TB1
□	<19>	:=Packed output circuit information of protection equipment with time tag	M_EP_TC_1
□	<20>	:=Packed single point information with time tag	M_PS_NA_1
□	<21>	:=Measured value, normalized value without quality descriptor	M_ME_ND_1
■	<30>	:=Single-point information with time tag CP56Time2a	M_SP_TB_1
■	<31>	:=Double-point information with time tag CP56Time2a	M_DP_TB_1
■	<32>	:=Step position information with time tag CP56Time2a	M_ST_TB_1
■	<34>	:=Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
■	<36>	:=Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
■	<37>	:=Integrated totals with time tag CP56Time2a	M_IT_TB_1
□	<128>	:=Parameter byte string	M_SR_NA_1
■	<130>	:=101 Encapsulated SPA bus reply message	M_SB_NA_1

Process information in control direction (station-specific parameter)

■	<45>	:=Single command	C_SC_NA_1
■	<46>	:=Double command	C_DC_NA_1
■	<47>	:=Regulating step command	C_RC_NA_1
■	<48>	:=Set point command, normalized value	C_SE_NA_1

■	<49>	:=Set point command, scaled value	C_SC_NB_1
■	<50>	:=Set point command, short float point value	C_SC_NC_1
□	<51>	:=Bitstring of 32 bit	C_BO_NA_1
□	<131>	:=Parameter byte string	C_SR_NA_1
■	<133>	:=101 Encapsulated SPA bus message	C_SB_NA_1

System information in monitor direction (station-specific parameter)

■	<70>	:=End of initialization	M_EI_NA_1
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System information in control direction (station-specific parameter)

■	<100>	:=Interrogation command	C_IC_NA_1
■	<101>	:=Counter interrogation command	C_CI_NA_1
■	<102>	:=Read command	C_RD_NA_1
■	<103>	:=Clock synchronization command	C_CS_NA_1
■	<104>	:=Test command	C_TS_NB_1
■	<105>	:=Reset process command	C_RP_NC_1
□	<106>	:=Delay of acquisition command	C_CD_NA_1

Parameter in control direction (station-specific parameter)

□	<110>	:=Parameter of measured value, normalized value	P_ME_NA_1
□	<111>	:=Parameter of measured value, scaled value	P_ME_NB_1
□	<112>	:=Parameter of measured value, short floating point value	P_ME_NC_1
□	<113>	:=Parameter activation	P_AC_NA_1

File Transfer (station-specific parameter)

■	<120>	:=File ready	F_FR_NA_1
■	<121>	:=Section ready	F_SR_NA_1
■	<122>	:=Call directory, select file, call file, call section	F_SC_NA_1
■	<123>	:=Last section, last segment	F_LS_NA_1

■	<124> :=Ack file, ack section	F_AF_NA_1
■	<125> :=Segment	F_SG_NA_1
■	<126> :=Directory	F_DR_TA_1

Basic application functions

Station initialization (station-specific parameter)

- ☐ Remote initialization

An indication ASDU “Controlling Station Initialised” sent to the Controlled Station is not used.

General interrogation (system parameter or station-specific parameter)

■	global	■	group 7	■	group 13
■	group 1	■	group 8	■	group 14
■	group 2	■	group 9	■	group 15
■	group 3	■	group 10	■	group 16
■	group 4	■	group 11		
■	group 5	■	group 12		
■	group 6				

Addresses per group must be defined.

Clock synchronization (station-specific parameter)

- Clock synchronization

Command transmission (object-specific parameter)

- | | | | |
|--------------------------|--|--------------------------|--------------------------------------|
| ■ | Direct command transmission | ■ | Select and execute command |
| ■ | Direct set point command transmission | <input type="checkbox"/> | Select and execute set point command |
| | | <input type="checkbox"/> | C_SE ACTTERM used |
| ■ | No additional definition | | |
| <input type="checkbox"/> | Short pulse duration (duration determined by a system parameter in the outstation) | | |

- ☐ Long pulse duration (duration determined by a system parameter in the outstation)
- ☐ Persistent output

Transmission of integrated totals (station parameter or object-specific parameter)

- | | |
|---|---|
| <input checked="" type="checkbox"/> Counter request | <input checked="" type="checkbox"/> General request counter |
| <input type="checkbox"/> Counter freeze without reset | <input type="checkbox"/> Reset counter group 1 |
| <input type="checkbox"/> Counter freeze with reset | <input type="checkbox"/> Reset counter group 2 |
| <input type="checkbox"/> Counter reset | <input type="checkbox"/> Reset counter group 3 |
| <input type="checkbox"/> Short pulse duration (duration determined by a system parameter in the outstation) | <input type="checkbox"/> Reset counter group 4 |

Addresses per group have to be defined.

Parameter loading (object-specific parameter)

- ☐ Threshold value
- ☐ Smoothing factor
- ☐ Low limit for transmission of measured value
- ☐ High limit for transmission of measured value

Parameter activation (object-specific parameter)

- ☐ Act / deact of persistent cyclic or periodic transmission of the addressed object.

File transfer (station-specific parameter)

- ☒ File transfer in monitor direction
- ☐ File transfer in control direction

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