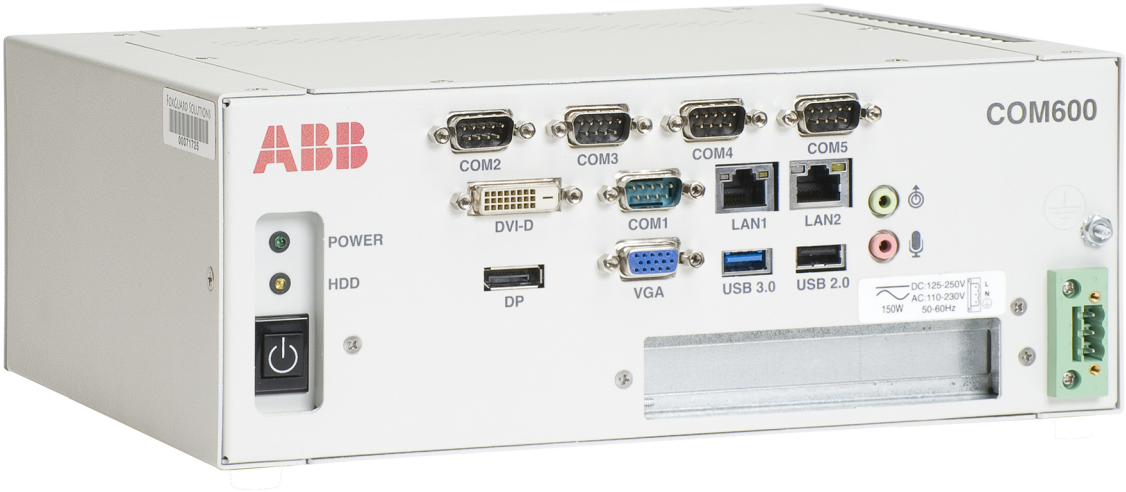
COM600 Series 5.1

Slave Protocols (Ethernet based) Configuration and Operation Manual



Contents:

1. About this manual

1.1. Copyright

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1.5. General information

This manual provides thorough information on all the Ethernet-based Slave protocols supported by the COM600 and and their central concepts. You will find instructions on how to configure the related objects belonging to the different Ethernet-based slave protocol servers. The basic operation procedures are also discussed.

Information in this user’s manual is intended for application engineers.

As a prerequisite, you should understand the basic principles of the different Ethernet-based slave protocols and the IEC 61850 standard.

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
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.

Term	Description
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.
SPA	ABB proprietary communication protocol used in substation automation.
SPA device	Protection and/or Control Product supporting the SPA protocol version 2.5 or earlier.
Substation Configuration Language; SCL	XML-based description language for configurations of electrical substation IEDs. Defined in IEC 61850 standard.

1.9. Abbreviations

The following is a list of abbreviations associated with COM600 that you should be familiar with. See also 1.8, Terminology.

Abbreviation	Description
AE	Alarms and Events
ASDU	Application Service Data Unit
BRCB	Buffered Report Control Block
DA	Data Access
DMCD	Data Message Code Definition
DO	Data Object
GW	Gateway, component connecting two communication networks together
WebHMI	Web Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
LAN	Local Area Network
LD	Logical Device
LN	Logical Node
NCC	Network Control Center
NUC	Norwegian User Convention
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

Abbreviation	Description
SA	Substation Automation
SCD	Substation Configuration Description
SCL	Substation Configuration Language
SFC	Sequential Function Chart
SLD	Single Line Diagram
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
RCB	Report Control Block
URCB	Unbuffered Report Control Block
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/24.5.2017	5.0	Document created
B/22.3.2018	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

COM600 supports multiple slave communication protocols by which it exchanges data with field devices such as protection and control IEDs, meters or other devices such as station controllers, Ethernet switches and WebHMIs. The data communication can be accomplished using Ethernet or serial interfaces such as RS 232 or RS 485. The following slave protocols are supported by the COM600:

1. Ethernet-based protocols
   - IEC 61850-8-1
   - IEC 60870-5-104
   - DNP 3.0 LAN/WAN
   - Modbus
   - OPC
2. Serial interface-based protocols
   - IEC 60870-5-101
   - DNP 3.0 Serial
   - Modbus

COM600 converts all field data, acquired using the communication protocols listed above, into OPC. An OPC server is dedicated to every supported protocol. This OPC server enables other OPC clients (internal) to access process data from slave devices.

This manual specifically covers the above listed Ethernet based slave protocols.

The protocol handling, that is, configuration and operation aspects comprise of generic and specific aspects. These generic and specific parts will be described separately in this manual.

Handling in brief:

All slave protocols have two common aspects

- An OPC server layer
- Data modeling based on IEC 61850

3. IEC 61850 Proxy server configuration

3.1. About this section

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

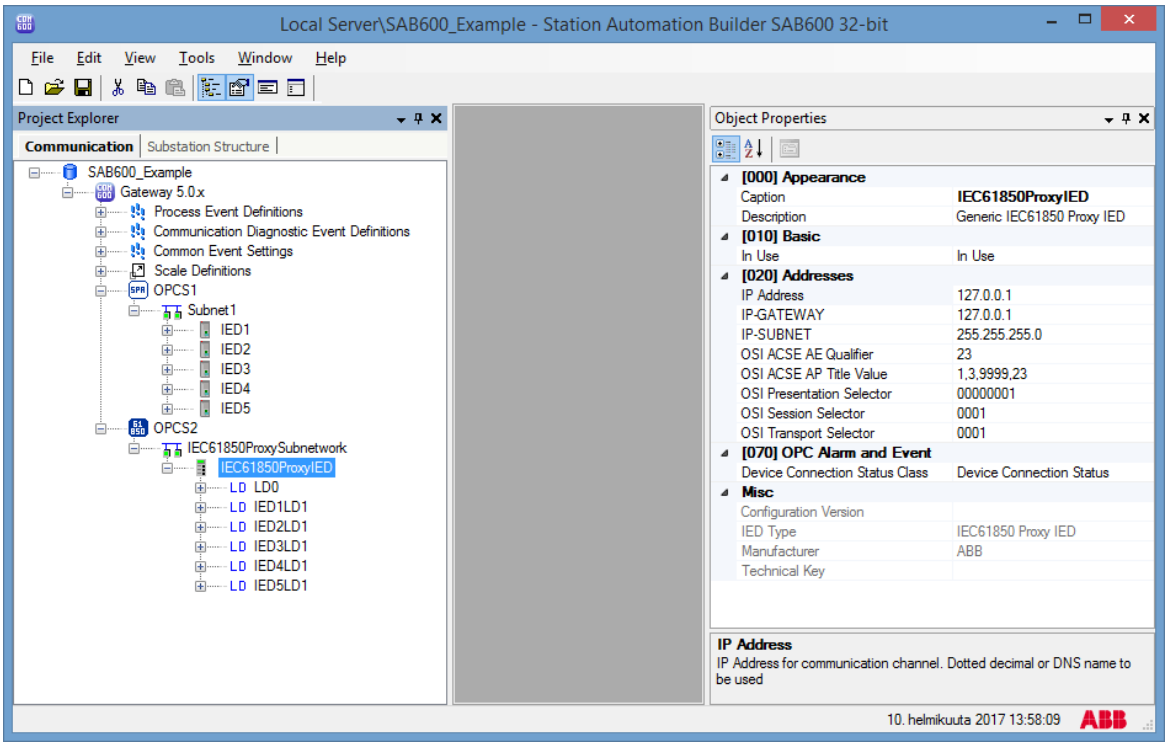
1. Select **File** > **Open/Manage Project...**.
2. In the Open/Manage Project dialog, select the required location for the project:
   - Projects on my computer
   - Projects on network
3. Select **New Project** on the left.
   - Enter a Project Name. The Description is optional.
4. Click **Create**.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

3.2. Overview of configuration

Before you can start using the IEC 61850 Proxy Server, you need to build and configure an object tree in SAB600 to define the communication structure. Start the configuration by first configuring an OPC Server, for example, SPA OPC Server. Then continue to configure the IEC 61850 Proxy Server. For information on configuring the OPC Server, see the related configuration manual.

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: \ ` ' ' #. Also avoid using a space in object names.



SAB600_Proxy_Example_View.png

Figure 3.2-1 Example view of SAB600 communication structure

The configuration work can 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.

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 IEC 61850 Proxy Server OPC Client object and its child objects, such as subnetwork, 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 3.5.1, General information about configuring objects.

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 OPC Server object.

Before the IEC 61850 Proxy Server can be taken into use, you need to configure an OPC server for the process communication. For more information on creating an OPC server, refer to COM600 User's Manual.

You can add objects to the object tree in the Communication structure the following way:

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

First add the IEC 61850 Proxy Server OPC Client. The following objects are created by the Proxy Configuration Tool, and should not be added manually:

- IEC 61850 Proxy Subnetwork
- IEC 61850 Proxy IED
- Logical Devices
- Data objects

3.3.2. Adding IEC 61850 Proxy Server OPC Client object

To add the IEC 61850 Proxy Server OPC Client object:

1. Add the IEC 61850 Proxy Server OPC Client object in the Communication structure by selecting the Gateway object.
2. Right-click the Gateway object and select the server object, for example **New > IEC 61850 > IEC 61850 Proxy Server OPC Client**.

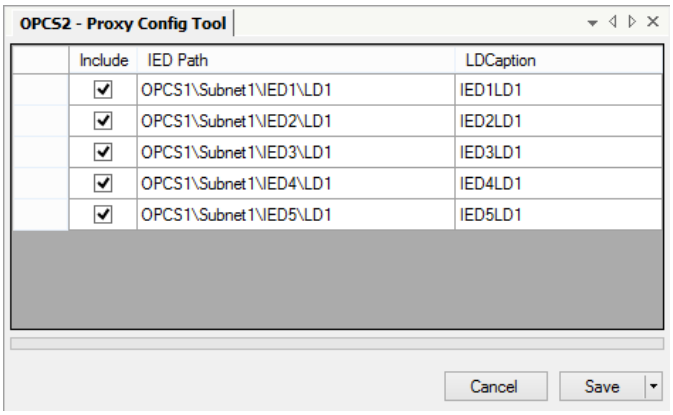
3.3.3. Configuring IEC 61850 Proxy Server with Proxy Configuration Tool

Before configuring Proxy IEC 61850 Proxy Server, an OPC server handling the IED communication needs to be configured to the communication structure.

To configure IEC 61850 Proxy Server with the Proxy Configuration Tool:

1. Right-click the IEC 61850 Proxy Server OPC Client object and select **Proxy Config Tool**.

2. Select the check-boxes in the first column to add LDs to the IEC 61850 Proxy Server OPC Client configuration.
3. Click **Save** to create the configuration with the selected IEDs to the communication structure.



SAB600_Proxy_Tool.png

Figure 3.3.3-1 Proxy Configuration Tool

The Proxy Configuration Tool includes the following columns:
- **Include**: specifies if the LD is part of the Proxy configuration
- **IED Path**: the OPC path of the selected LD
- **LD Caption**: specifies the name of the referenced LD in the Proxy configuration

3.4. IEC 61850 data publishing

3.4.1. About data sets

A data set is an ordered group of data objects and data attributes organized as a single collection for the convenience of the client. Data sets are used to define the values of data to be transmitted in case a value of a data set member changes. A data set is used for reporting and GOOSE messaging.

3.4.2. Configuring data sets

3.4.2.1. Dataset Editor

A data set groups selected data so that a client can access it easily with a single read operation. A data set is also used for event reporting; data is linked to spontaneous event sending only via report control blocks (RCB) data set definition. The client reads other data separately. Data set definitions are located always under the logical device LD0 and logical node LLN0.

The data set can be modified with the Dataset Editor. Open the Dataset Editor by right-clicking the Dataset object and selecting **Dataset Editor**.

The Dataset object has a set of data attributes:
- **IdInst**: Instance of Logical Device to which the referenced data set belongs.
- **Prefix**: Freely configurable part of LN caption.
- **InInst**: Instance of the LN type.
- **InClass**: Logical node class.
- **doName**: Name of the data object from which the data set is formed.
- **daName**: Name of the data attribute from which the data set is formed.
  Data attributes are collected to the data set in groups, and the functional constraint defines the data attributes.
- **fc**: functional constraint
  Functional constraint divides data attributes, which have the same functional constraint, to groups under the same data object. For example, functional constraint ST (status information) groups stVal, q and t data attributes to the data set.

The caption in the object tree consists of Prefix, InClass and InInst values.

3.4.3. Data reporting

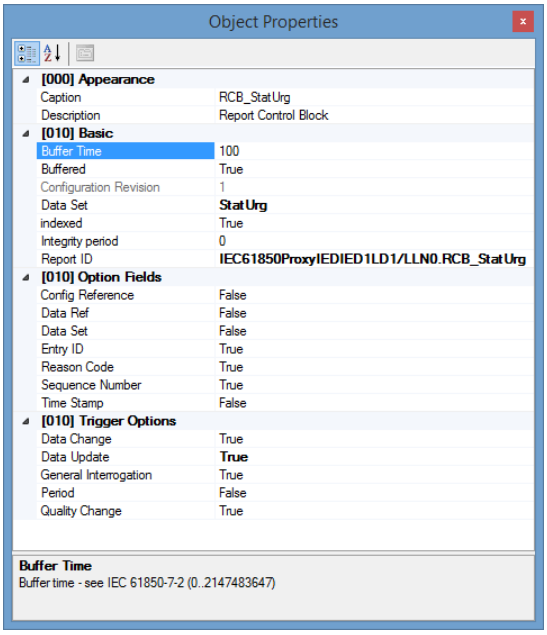
3.4.3.1. About data reporting

Data changes are used as a trigger for reporting. This information is grouped using a data set. The data set is the content basis for reporting. Reporting uses information reports to transmit data. The data configured in a data set is transmitted in information reports. Reporting is controlled by report control blocks.

3.4.3.2. Report control block

Report control describes the conditions for generating information reports based on parameters set by configuration or by a client. Report Control Blocks control the procedures that are required for reporting values of data from logical nodes to one client.

There are buffered and unbuffered report control blocks:
- In a **Buffered Report Control Block (BRCB)** internal events issue immediate sending of reports, or buffer the events for transmission. This way the values of a data object are not lost due to transport flow control constraints or loss of connection. BRCB provides sequence-of-events functionality.
- In an **Unbuffered Report Control Block (URCB)** internal events issue immediate sending of reports on a best efforts basis. If no association exists, or if the transport data flow is not fast enough to support it, events may be lost.



SAB600_Proxy_RCB_Properties.png

Figure 3.4.3.2-1 Report control block properties

Table 3.4.3.2-1 Report Control Block object properties

Property/Parameter	Value or value range/Default	Description
Basic		
Buffer Time	Default: 0 milliseconds	With this value, RCB can be configured to wait for other events after the first change before sending the report. Value 0 means that a new change is immediately reported to the client. Configurable.
Buffered	True False Default: True	Controls if the RCB is buffered or unbuffered.
Configuration Revision	0...2147483647	Configuration revision of the data set referenced by this RCB. Every modification in the data set increases the Configuration Revision property by one.
Data Set		The name of the data set to be sent by the report control block.
Indexed	True False Default: True	Indicates if this RCB is configured with indexed naming convention.

Property/Parameter	Value or value range/Default	Description
Integrity period	0...214748647 Default: 0	Integrity period in milliseconds. If this attribute has a value > 0 ms, an integrity report with all data listed in the data set is sent periodically in this interval. By default, this feature is not enabled, because it generates an unnecessary load to the server and network. If this feature is used, the Trigger Option 'Period' in RCB needs to be enabled. Configurable.
Report ID		Used as identification in information reports to specify that the report is from this RCB. By default report control block MMS path name is used. Configurable.
Option Fields		Defines what information is sent with the information report. Configurable.
Config Reference	True False Default: False	Config Reference
Data Ref	True False Default: False	Data Ref
Data Set	True False Default: False	Data Set
Entry ID	True False Default: True	Entry ID
Reason Code	True False Default: True	Reason Code
Sequence Number	True False Default: True	Sequence Number

Property/Parameter	Value or value range/Default	Description
Time Stamp	True False Default: False	Time Stamp
Trigger Options		Defines the triggering conditions for creating reports.
Data change	True False Default: True	Specifies whether a report entry shall be generated due to a change of the value of the data attribute.
Data Update	True False Default: False	Specifies whether a report entry shall be generated due to freezing the value of an unfreezable attribute or updating the value of any other attribute. An updated value may have the same value as the old value.
Period	True False Default: False	Specifies whether a report entry shall be generated on the expiration of the integrity period.
Quality Change	True False Default: True	Specifies whether a report entry shall be generated due to a change of the value of the quality attribute.

3.4.4. Configuring reporting

To configure reporting:
1. Create and configure a **Data Set** object.
2. Create a **Report Control Block** object.
3. Add a **Report Enabled** object. Add a **ReportClient** object for each IEC 61850 client. ReportClients create the same amount of instances of the RCB, each dedicated for one client.
4. Configure the report control block.
5. Configure the data set of the report control block.

3.4.5. GOOSE messaging

The generic object oriented substation event (GOOSE) is used in substation automation for fast horizontal communication between IEDs. It can be used to exchange, for example, interlocking and blocking information. The information is shared from one IED to one

or several IEDs using Ethernet multicast messages. A message is an image of a sent MMS data set that is defined in the CID configuration.

IEC 61850 Proxy Server supports sending of GOOSE messages. The receiving of GOOSE messages is handled by the IEC 61850 OPC Server.

The GOOSE data is sent periodically in 802.1Q multicast frames over the local network. When data changes, the GOOSE frame is sent several times in a fast cycle to prevent data losses.

In GOOSE, the sent data is based on the data set and GOOSE Control Block (GoCB). The data set defines what type of data is sent in the GOOSE frame. GoCB links the GOOSE Control Block structure and its information to the data.

Table 3.4.5-1 lists the configurable GoCB object properties.

Table 3.4.5-1 GoCB object properties

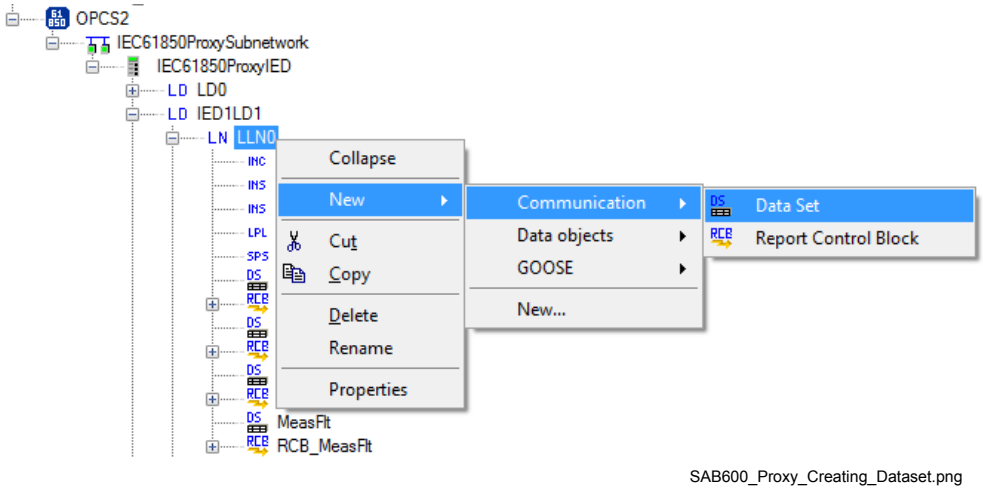
Property/Parameter	Value or value range/Default	Description
Basic		
Configuration Revision	1	Configuration Revision identifies the version of GoCB.
Data Set	Data Set Default: None	Data set to be sent in GOOSE.
GSEType	Default: GOOSE	GSEType identifies the type of GSE Element in configuration file (read only parameter).
Goose Address		
APPID	0000 - 3FFF Default: 0000	Application ID for the GOOSE control block (hex value).
GoID	Default: (GOOSE control block path)	String identifier for the GOOSE control block.
Max Time	0...65535 Default: 10000	Supervision heartbeat cycle time (ms).
Min Time	0...65535 Default: 2	Maximal sending delay on a data change (ms).
Multicast Address	01-0C-CD-01-00-00 to 01-0C-CD-01-01-FF Default: 01-0C-CD-01-00-00	A multicast addressing scheme is used when sending GOOSE messages. A multicast address can be shared by several sending devices or it can be IED-specific.
VLAN-ID	000 - FFF Default: 000	VLAN-ID hex value.

Property/Parameter	Value or value range/Default	Description
VLAN-Priority	0...7 Default: 4	VLAN-Priority.

3.4.6. Configuring GOOSE publishing

To send GOOSE data, you must first define the sending data set used by the GOOSE control block and then create the control block.

1. Create a new **Data Set**. Rename it if you plan to use several different sets of data (see 3.4.2.1, Dataset Editor).

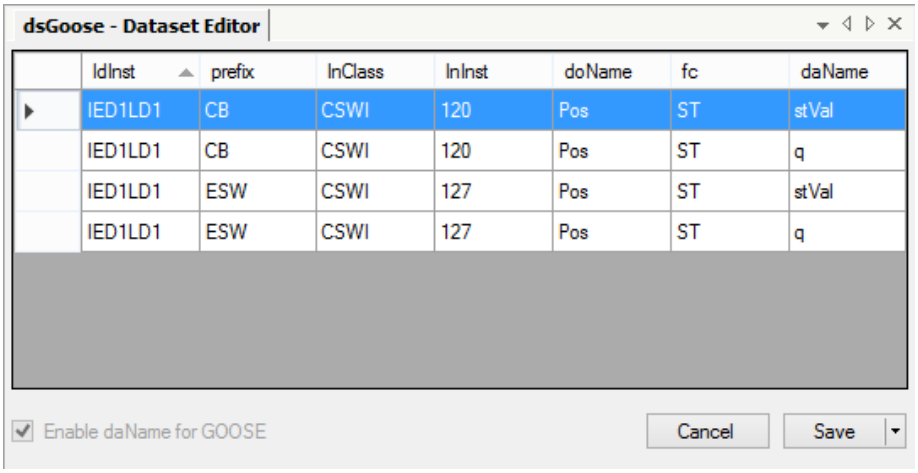


SAB600_Proxy_Creating_Dataset.png

Figure 3.4.6-1 Creating a new data set

2. Modify the data set to be sent with GOOSE.

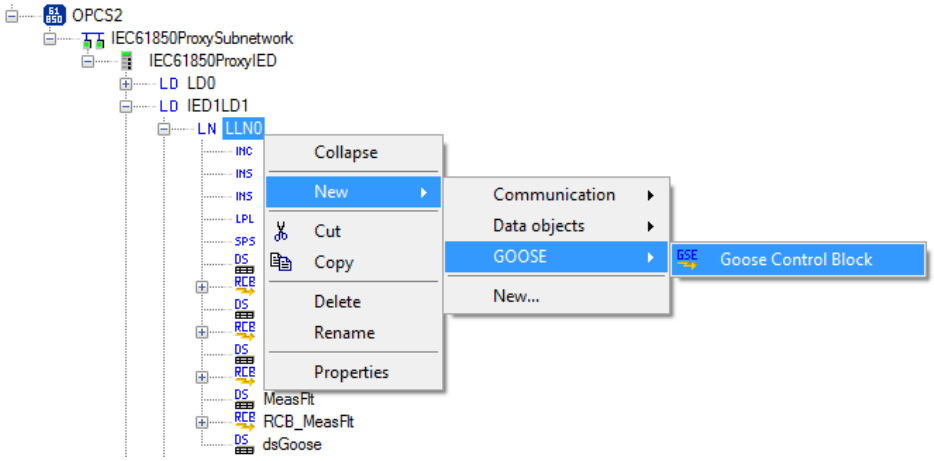
Normally GOOSE data sets are configured to the attribute level and only the value and quality are used (e.g. **Pos.stVal** and **Pos.q**). Use the **Enable daName for GOOSE** option and manually remove the unnecessary attributes from the data set.



SAB600_Proxy_Modifying_Dataset.png

Figure 3.4.6-2 Modifying the data set to be sent with GOOSE

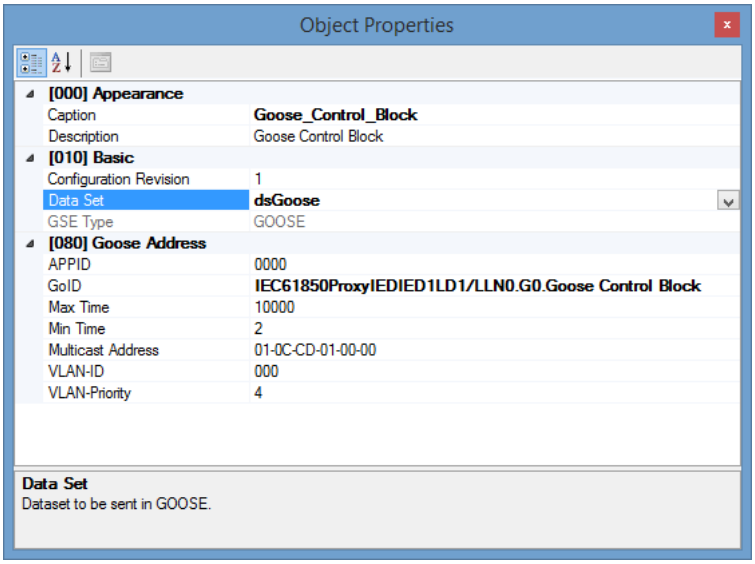
3. Create a new **GOOSE Control Block (GoCB)**.



SAB600_Proxy_Creating_GCB.png

Figure 3.4.6-3 Creating GOOSE Control Block

4. Configure the GOOSE control block, see Figure 3.4.6-4.
   - Select the created data set.
   - Define APPID (Application Identifier) which is unique within the system. It identifies the purpose of this particular dataset.
   - Define a multicast address to which the specific GOOSE data is sent. The receiving IED understands which frames with a specific multicast address are the interesting ones and starts to process them.



SAB600_Proxy_ GCB_Properties.png

Figure 3.4.6-4 GOOSE Control Block properties

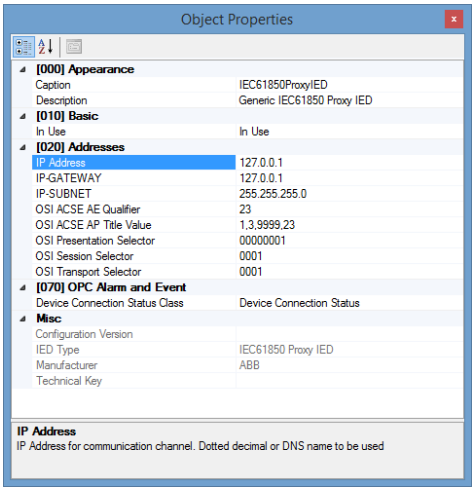
3.5. Configuring objects

3.5.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 3.5.1-1 shows an example of how to use SAB600 to configure the object properties for IEC 61850 Proxy Server OPC Client.

To configure an object:

1. Select an object in the object tree of the communication structure. The object properties appear in the Object Properties window. The properties and their values can be viewed as shown in Figure 3.5.1-1.



SAB600_Proxy_ Object_Properties.png

Figure 3.5.1-1 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.

3.5.2. Configuring IEC 61850 Proxy Server OPC Client

IEC 61850 Proxy Server OPC Client does not have any configurable properties.

Table 3.5.2-1 IEC 61850 Proxy Server OPC Client properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
AE Prog ID	ABB.IEC61850_Slave_OPC_AE_Server.Instance[1]	ProgID for OPC Alarm and Event Server. (not configurable)
DA Prog ID	ABB.IEC61850_Slave_OPC_DA.Instance[1]	ProgID for OPC Data Access Server. (not configurable)

3.5.3. Configuring IEC 61850 Proxy Subnetwork

Table 3.5.3-1 lists the configurable IEC 61850 Proxy Subnetwork object properties and the value ranges for them. The actual configuration using SAB600 is performed as described in 3.2, Overview of configuration.

Table 3.5.3-1 IEC 61850 Proxy Subnetwork properties

Property / Parameter	Value or Value range/ Default	Description
Communication Port		
Communication Port	ETH0 ETH1 Default: ETH0	LAN port used by the IEC 61850 protocol used for GOOSE sending. Values shown here are default values when no connection to COM600 has been made. When the first connection is made the communication port information is read from COM600 and the corresponding NIC value is written to NICInformation property.
IP Address	Default: 127.0.0.1	Communication channel IP address in dotted decimal format.
Communication Control		
TCP/IP Keepalive Timeout	1...3600 Default: 15 seconds	TCP/IP keepalive timeout in seconds.

3.5.4. Configuring IEC 61850 Proxy IED

Table 3.5.3-1 lists the configurable IEC 61850 Proxy IED object properties and the value ranges for them. The actual configuration using SAB600 is performed as described in 3.2, Overview of configuration.

Table 3.5.4-1 IEC 61850 Proxy IED properties

Property / Parameter	Value or Value range/ Default	Description
Addresses		
IP Address	Default: 127.0.0.1	Communication IP address in dotted decimal format. (not configurable)
OSI ACSE AE Qualifier	Default: 23	ACSE protocol level configuration parameter. AE Qualifier.
OSI ACSE AP Title Value	Default = 1,3,9999,23	ACSE protocol level configuration parameter. AP Title.
OSI Presentation Selector	Default = 00000001	ACSE protocol level configuration parameter. Presentation selector.
OSI Session Selector	Default = 0001	ACSE protocol level configuration parameter. Session selector.
OSI Transport Selector	Default = 0001	ACSE protocol level configuration parameter. Transport selector.

3.5.5. Configuring IEC 61850 Proxy Device properties

IEC 61850 Proxy Device does not have any configurable properties.

3.6. Exporting configuration to other systems

When IEC 61850 Proxy configuration is finalized from the COM600 point of view, configuration needs to be exported from the IEC 61850 Proxy IED level using the CID Export function. With this exported CID file, you can configure the IEC 61850 client side. Refer to the manuals of the other systems.

The IEC 61850 Proxy configuration needs to be exported using the CID export function on the IEC 61850 Proxy IED level.

4. IEC 104 OPC slave configuration

4.1. About this section

This section guides you in the configuration tasks required before you can start using the IEC104 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.

Start SAB600 to open and name a project.

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**.

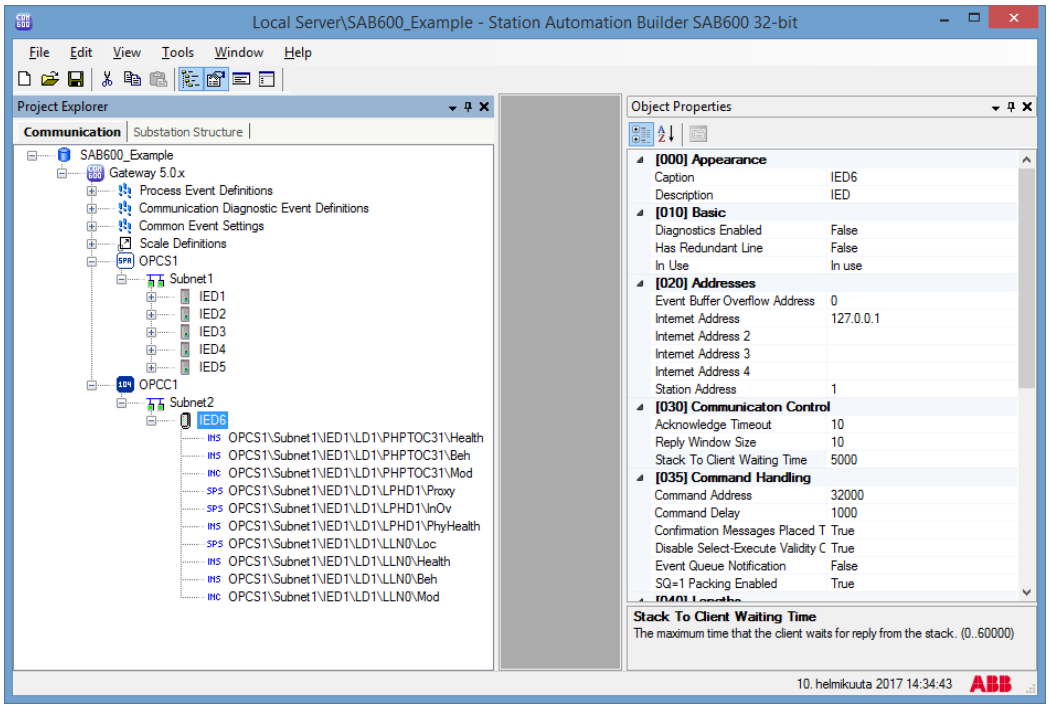
4.2. Overview of configuration

Before you can start using the IEC104 Slave OPC Client, you need to build and configure an object tree in SAB600 to define the Communication structure within the Gateway object.

- IEC104 Slave OPC Client
- IEC104 OPC Channel
- IEC104 Device (IEC104 IED)
- Data objects

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_IEC104_Slave_Example_View.png

Figure 4.2-1 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 4.3.1, General information about building object tree and 4.3.5, Adding data objects using Cross-References function.

Figure 4.2-1 shows an example of how the object tree may look like after it has been built. In the example tree you can see the IEC104 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 4.4.1, General information about configuring objects.

Table 4.2-1 describes the objects shown in the object tree (Figure 4.2-1).

Table 4.2-1 IEC104 OPC Client related objects

Object	Description
IEC104 OPC Client	An object representing the IEC104 OPC Client.
IEC104 Channel	An object representing the IEC104 channel

Object	Description
IEC104 Device (IEC104 IED)	IEC104 Device is used for a virtual station in COM600 representing the slave stations visible to the IEC104 master 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 IEC104 Slave OPC Client with the cross reference function. They are shown as child objects of the IEC104 Device object in the object tree.
Event Definitions	Event definitions are used for the diagnostic OPC Alarm and Event Server.

4.3. Building object tree

4.3.1. General information about building object tree

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

Before the Slave OPC Client can be taken into use, configure an OPC server for the process communication.

You can add objects to the object tree in the Communication structure the following way:

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

Add the objects in the following order:
1. Slave OPC Client
2. Slave channel
3. Slave IED
4. Add Data Objects by using Cross-References

4.3.2. Adding IEC104 Slave OPC Client

To add the OPC client object:

1. Add the IEC104 Slave OPC Client object in the Communication structure by selecting the Gateway object.
2. Right-click the Gateway object and select **New > IEC104 > IEC104 Slave OPC Client**.

4.3.3. Adding Channel objects

After the IEC104 Slave OPC Client object has been successfully added, you can continue building the object tree by adding the IEC104 Channel object.

To add IEC104 Channel object:
1. Select an IEC104 Slave OPC Client object and right-click it.
2. Add an IEC104 Channel object.
3. Rename the new object. The names of the IEC104 Channels have to be unique.

4.3.4. Adding Device objects

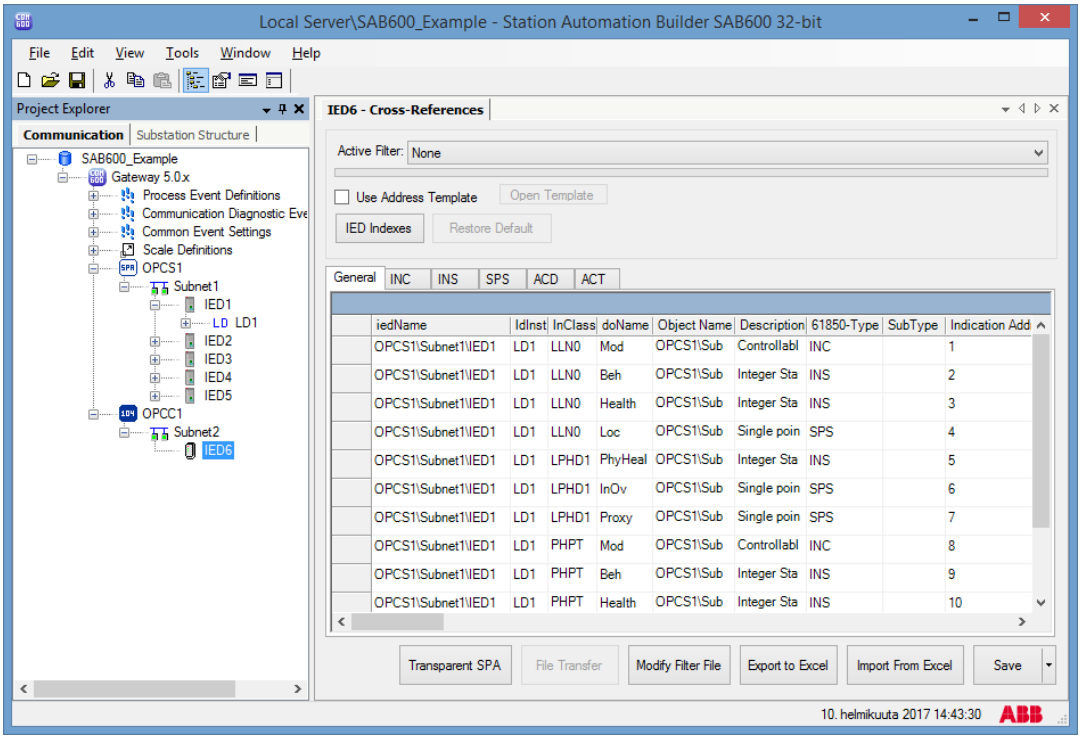
After a channel object has been successfully added, you can continue building the structure by adding the IEC104 Device object. All the data can be connected to one device or divided to several slave devices. Before dividing data to several slave devices, it must be checked that the current protocol mode and the master system support the feature.

To add IEC104 Device object:
1. Select a Channel object.
2. Add an IEC104 Device object.
3. Rename the new object. The names within an IEC104 Channel have to be unique.

4.3.5. 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 IEC104 Slave OPC Client.

To add data objects:
1. Select IEC104 Device object (IEC104 IED) and right-click it.
2. Select Cross-References. The Cross References function appears (Figure 4.3.5-1).
3. In the Project Explorer, select now a logical node within an OPC server, from which you want to connect the data objects to IEC104 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 IEC104 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 IEC104 Device.
5. At this point, click **Save** to create the cross-references (to connect the data objects to the IEC104 Device object).



SAB600_IEC104_Slave_Cross_References.png

Figure 4.3.5-1 The Cross References window

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

4.3.6. File transfer function

The **File transfer** function allows the transfer of disturbance recordings from COM600 to IEC104 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 IEC104 master. To enable the IEC104 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 IEC104 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 104 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.

4.3.7. Transparent SPA function

COM600 supports encapsulated SPA telegrams over IEC 104 communication. It enables IEC104 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.

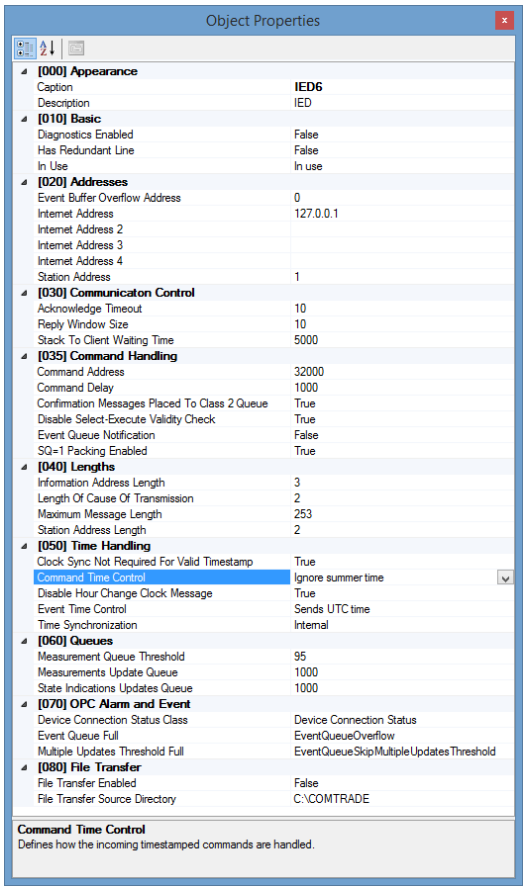
4.4. Configuring objects

4.4.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 4.4.1-1 shows an example of how to use SAB600 to configure the object properties for IEC104 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 .



SAB600_IEC104_ Object_Properties.png

Figure 4.4.1-1 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.

4.4.2. Configuring IEC104 Slave OPC Client properties

Table 4.4.2-1 lists the configurable IEC104 Client properties and value ranges for them. The actual configuration by using SAB600 is performed as described in 4.2, Overview of configuration.

Table 4.4.2-1 IEC104 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 master.
Station/Remote Switch		
Station/Remote Switch Handling	Do not check Station/Remote switch position. Check Station/Remote switch position. Default: Do not check Station/Remote switch position.	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.

4.4.3. Configuring IEC104 Channel Properties

The IEC104 Channel properties that can be configured and value ranges for them can be found in Table 4.4.3-1. The actual configuration by using the COM600 Station Automation Builder 600 (SAB600) is performed as described in 4.2, Overview of configuration.

Table 4.4.3-1 IEC104 Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
In Use	In use Not in use Default: In use	Specifies whether the channel is initially in use or not.

Property / Parameter	Value or Value range/ Default	Description
Protocol	IEC60870-5-104 Slave	Protocol
Communication Control		
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.
Polling Delay	0...65535 Default: 5000	Delay between the communication test polling messages in seconds.
Response Timeout	0...255 Default: 2	The time that IEC link waits for the end of the received message in seconds.
Communication Port		
Local Address	127.0.0.1	The IP address which is locally used in COM600. When redundant communication is used, multiple IP addresses can be given separated by a space, for example, "127.0.1.1 127.0.2.2". Port number can be configured by using semicolon. For example, "127.0.1.1;8080 127.0.2.2;8080".

4.4.4. Configuring IEC104 Device properties

Table 4.4.4-1 lists the configurable properties for IEC104 Device and value ranges for these properties. The actual configuration by using SAB600 is performed as described in 4.2, Overview of configuration.

Table 4.4.4-1 IEC104 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.

Name	Value/Value range	Description
In Use	In use Not in use Default: In use	Controls whether the station communication is initially in use or not.
Addresses		
Internet Address 1		The IP address or the host name of the remote host. With redundant communication, the used Local Address is specified with an index after the IP Address separated by a colon. The index points to the IP Addresses specified in the Local Address property of the channel object, for example, "127.0.1.12:1".
Internet Address 2		The IP address or the host name of the remote host. With redundant communication, the used Local Address is specified with an index after the IP Address separated by a colon. The index points to the IP Addresses specified in the Local Address property of the channel object, for example, "127.0.1.12:1”.
Internet Address 3		The IP address or the host name of the remote host. With redundant communication, the used Local Address is specified with an index after the IP Address separated by a colon. The index points to the IP Addresses specified in the Local Address property of the channel object. For example, "127.0.1.12:1”.
Internet Address 4		The IP address or the host name of the remote host. With redundant communication, the used Local Address is specified with an index after the IP Address separated by a colon. The index points to the IP Addresses specified in the Local Address property of the channel object, for example, "127.0.1.12:1”.

Name	Value/Value range	Description
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 60870-5-104 slave station (the common address of ASDU in an IEC message).
Communication Control		
Acknowledge Timeout	0...100 Default: 10	The timeout for sending an acknowledgment if the amount of APDUs defined by the Unacknowledge Receive property is not received.
Reply Window Size	0...100 Default: 10	Defines how many data items can be written without a reply or request from the master.
Stack To Client Waiting Time	0...60000 Default: 5000	The maximum time that the client waits for reply from the stack.
Command Handling		
Command Address	0...65535 Default: 32000	The object address of the bitstream process object in the OPC Client, where an unrecognized message is handled.
Command Delay	0...65535 Default: 1000	Specifies the maximum delay for timestamped commands, if the timestamp of the incoming command message indicates that the transmission delay has been bigger than the value defined with this attribute, the command is not accepted. The attribute defines a time window in which the timestamped command is accepted.

Name	Value/Value range	Description
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.
Lengths		
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.
Length of Cause of Transmission	1...2 Default: 1	The length of the cause of transmission field in an IEC 60870-5-104 message
Maximum Message Length	20...255 Default: 253	The maximum length of transmitted message in octets.
Station Address Length	1...2 Default: 1	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.

Name	Value/Value range	Description
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		
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.

Name	Value/Value range	Description
File Transfer Working Directory		Defines working directory for file transfer.

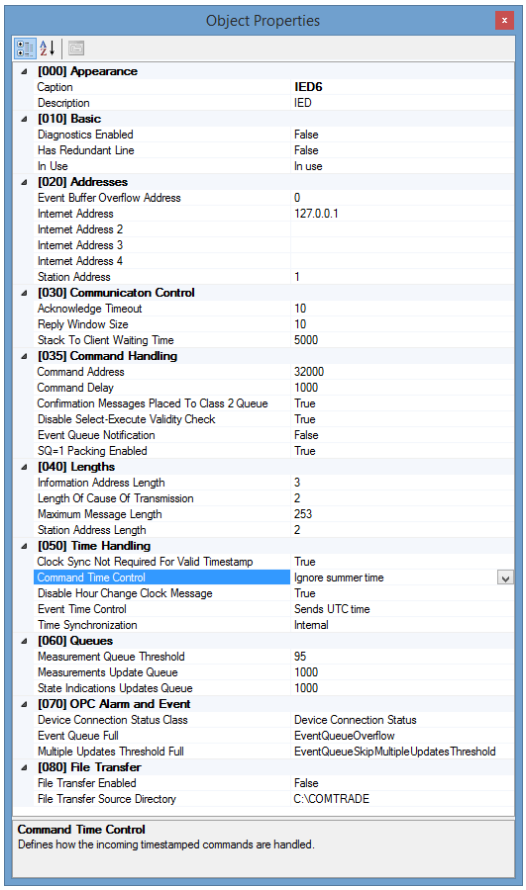
4.4.5. Configuring Data objects

4.4.5.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 4.4.1-1 shows an example of how to use SAB600 to configure the object properties for IEC104 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 .



SAB600_IEC104_ Object_Properties.png

Figure 4.4.5.1-1 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.

4.4.5.2. Single point status (SPS)

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

Table 4.4.5.2-1 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.

Property/ Parameter	Value or Value range/ Default	Description
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		
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.

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.

4.4.5.3. Double point status (DPS)

Table 4.4.5.3-1 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.
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 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.

4.4.5.4. Integer status (INS)

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

Table 4.4.5.4-1 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		
Indication Address	0...16777215 Default: 0	IEC address for indication.
Common		

Property/ Parameter	Value or Value range/ Default	Description
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.

4.4.5.5. Enumerated Status (ENS)

Table 4.4.5.5-1 Configurable ENS properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		

Property/ Parameter	Value or Value range/ Default	Description
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.
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.

4.4.5.6. Protection activation information (ACT)

Table 4.4.5.6-1 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.
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		

Property/ Parameter	Value or Value range/ Default	Description
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.

4.4.5.7. Directional protection activation information (ACD)

Table 4.4.5.7-1 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
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.

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 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.

4.4.5.8. Binary counter reading (BCR)

Table 4.4.5.8-1 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		

Property/ Parameter	Value or Value range/ Default	Description
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.

4.4.5.9. Measured value (MV)

Table 4.4.5.9-1 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		

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 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.
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.

4.4.5.10. Complex measured value (CMV)

Table 4.4.5.10-1 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.
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.

4.4.5.11. WYE

Table 4.4.5.11-1 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.
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.

Property/ Parameter	Value or Value range/ Default	Description
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.

4.4.5.12. Delta (DEL)

Table 4.4.5.12-1 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.

Property/ Parameter	Value or Value range/ Default	Description
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.

4.4.5.13. Controllable single point (SPC)

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

Table 4.4.5.13-1 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	

4.4.5.14. Controllable double point (DPC)

Table 4.4.5.14-1 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.

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 4.4.5.14-2 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

4.4.5.15. Controllable integer status (INC)

Table 4.4.5.15-1 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.

4.4.5.16. Binary controlled step position information (BSC)

Table 4.4.5.16-1 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		

Property/ Parameter	Value or Value range/ Default	Description
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.
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.

4.4.5.17. Integer controlled step position information (ISC)

Table 4.4.5.17-1 Configurable ISC properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		

Property/ Parameter	Value or Value range/ Default	Description
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.
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.

4.4.5.18. Controllable Enumerated Status (ENC)

Table 4.4.5.18-1 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.
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.

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.

4.4.5.19. Analogue set point (APC)

Table 4.4.5.19-1 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.
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 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		
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 (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.

4.5. Configuring communication redundancy

Communication redundancy can be configured using the Local Address property of the channel object and the Internet Address properties of the IED object. The Local Address property specifies the IP addresses of the COM600 computer used for the communication. The Internet Address properties of the IED object specify the possible IEC104 master IP addresses.

Only one configured connection should be active at a time. If multiple connections are active simultaneously, it is recommended to configure an IEC104 OPC Client for each.

See Example 1: One master connected with two redundant communication networks and Example 2: Two redundant masters connected with two redundant communication networks for more information.

Example 1: One master connected with two redundant communication networks

Local address is configured with two IP addresses, one for each communication network.

For example, local address = "127.0.1.1 127.0.2.1"

IED Internet addresses are configured to specify the corresponding IEC104 master addresses. The index separated by a colon specifies the used local address.

For example,

- Internet address 1 = "127.0.1.11:1"
- Internet address 2 = "127. 0.2.11:2"

Example 2: Two redundant masters connected with two redundant communication networks

Local address is configured with two IP addresses, one for each communication network.

For example, local address = "127.0.1.1 127.0.2.1"

IED Internet addresses are configured to specify the corresponding IEC104 master addresses. The index separated by a colon specifies the used local address.

For example,

```
Internet Address 1 = “127.0.1.11:1”     // First master using network 1
Internet Address 2 = “127.0.2.11:2”     // First master using network 2
Internet Address 3 = “127.0.1.12:1”     // Second master using network 1
Internet Address 4 = “127.0.2.12:2”     // Second master using network 2
```

5. DNP3 LAN/WAN OPC slave configuration

5.1. About this section

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

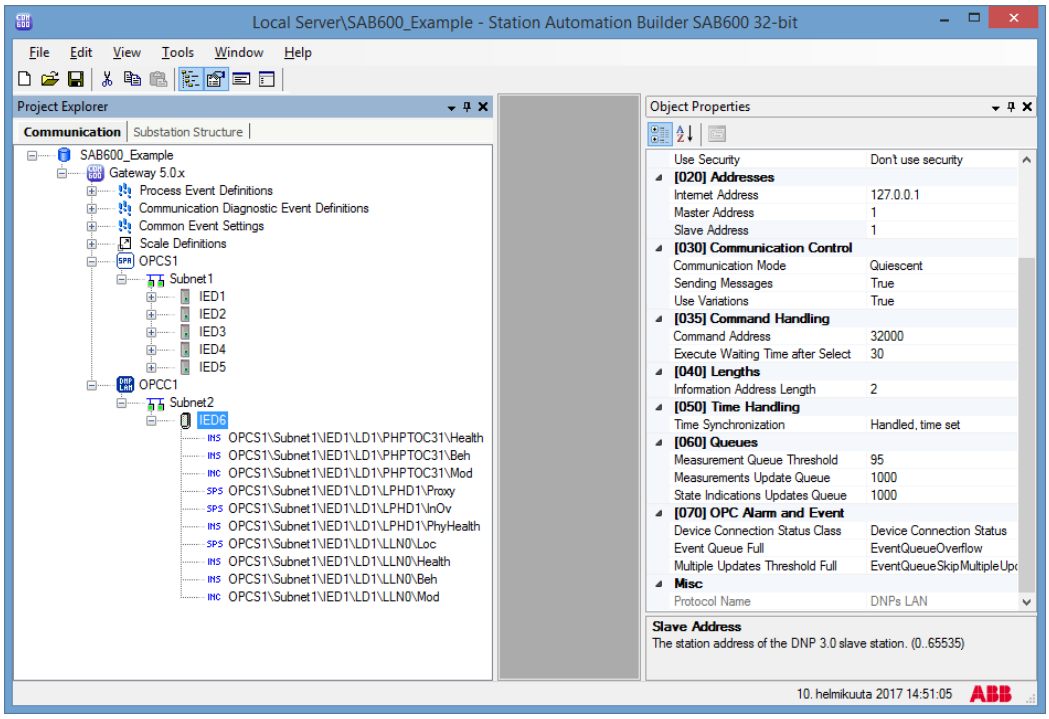
1. Select **File** > **Open/Manage Project...**.
2. In the Open/Manage Project dialog, select the required location for the project:
   - Projects on my computer
   - Projects on network
3. Select **New Project** on the left.
   - Enter a Project Name. The Description is optional.
4. Click **Create**.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

5.2. Overview of configuration

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

Figure 5.2-1 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_DNP_Slave_Example_View.png

Figure 5.2-1 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 5.3.1, General information about building object tree and 5.3.5, Adding data objects using Cross-References function.

Figure 5.2-1 shows an example of how the object tree may look like after it has been built. In the example tree you can see the DNP LAN Slave 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 5.4.1, General information about configuring objects.

Table 5.2-1 describes the objects shown in the object tree (Figure 5.2-1).

Table 5.2-1 DNP LAN Slave OPC Client related objects

Object	Description
DNP LAN Slave OPC Client	An object representing the DNP LAN Slave OPC Client.
DNP LAN Channel	An object representing the channel

Object	Description
DNP LAN IED	A DNP LAN IED is used for a virtual station in COM600 representing the slave stations visible to the DNP master system. IED objects can be configured to use DNP 3.0 Secure Authentication v2 or v5 using the Security related properties. DNP 3.0 Secure Authentication v2 and v5 is based on IEC/TS 62351 and standards IEEE 1815-2010 (v2) and IEEE 1815-2012 (v5). Version v2 uses pre-shared update keys and does not contain roles for users. Version v5 is able to define users and their roles and keys on-line using DNP 3.0. The databases for user sets and necessary keys are created using separate tools (see chapter '5.5 Secure authentication using IEC/TS 62351-5' for more information). This database is called "key storage" and is defined for the DNP LAN Slave OPC Client instance using its “Key Storage File” property. Key storage file is always encrypted.
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 DNP LAN Slave OPC Client with the cross reference function. They are shown as child objects of the DNP LAN IED object in the object tree.
Event Definitions	Event definitions are used for the diagnostic OPC A&E Server.

5.3. Building object tree

5.3.1. General information about building object tree

The object tree is built in the Communication structure of SAB600, see Figure 5.2-1. It is built by adding objects in a logical order starting from the DNP LAN Slave OPC Client object.

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

You can add objects to the object tree in the Communication structure the following way:

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

Add the objects in the following order:
1. DNP LAN Slave OPC Client
2. DNP LAN Channel
3. DNP LAN IED
4. Data objects

5.3.2. Adding DNP LAN Slave OPC Client object

To add the OPC client object:

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

5.3.3. Adding Channel objects

After the DNP LAN Slave OPC Client object has been successfully added, you can continue building the object tree by adding a DNP LAN Channel object.

To add DNP LAN Channel object:
1. Select a DNP LAN Slave OPC Client object and right-click it.
2. Add a DNP LAN Channel object.
3. Rename the new object. The names of the DNP LAN Channel objects within a DNP LAN Slave OPC Client have to be unique.

5.3.4. Adding DNP LAN IED object

After a channel object has been successfully added, you can continue building the structure by adding the DNP LAN IED 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.

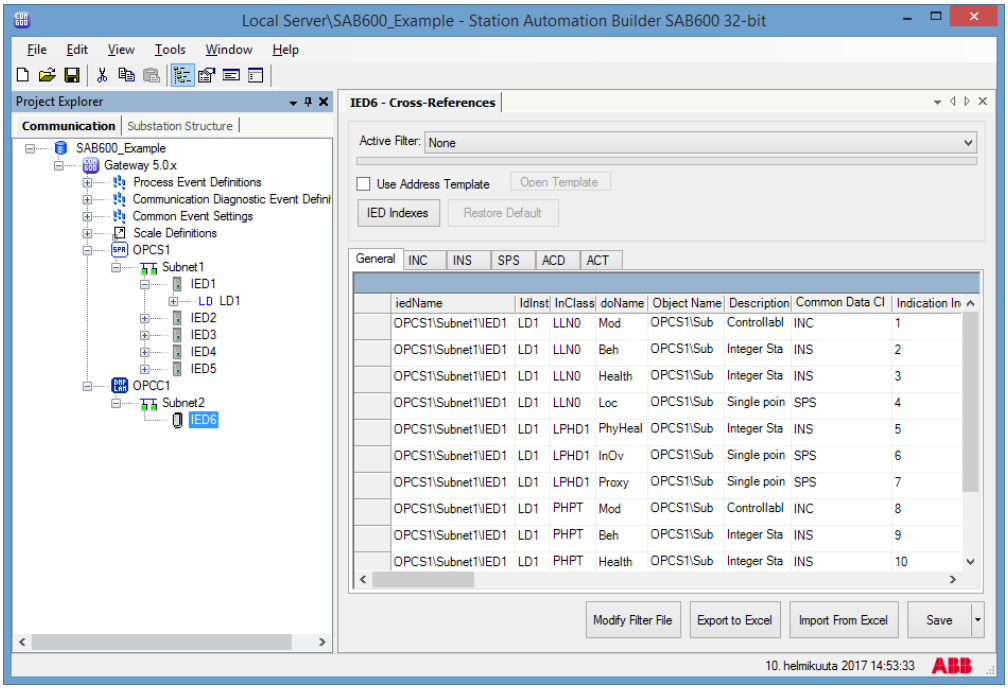
To add DNP LAN IED object:
1. Select a DNP LAN Channel object.
2. Add a DNP LAN IED object.
3. Rename the new object. The names within DNP LAN Channel have to be unique.

5.3.5. 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 DNP LAN Slave OPC Client.

To add data objects:

1. Select DNP LAN IED object and right-click it.
2. Select Cross-References. The Cross References function appears (Figure 5.3.5-1).
3. In the Project Explorer, select now a logical node within an OPC server, from which you want to connect the data objects to the DNP LAN 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 the DNP LAN 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 DNP LAN IED.
5. At this point, click **Save** to create the cross-references (to connect the data objects to the DNP LAN IED).



SAB600_DNP_Slave_Cross_References.png

Figure 5.3.5-1 The Cross References window

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

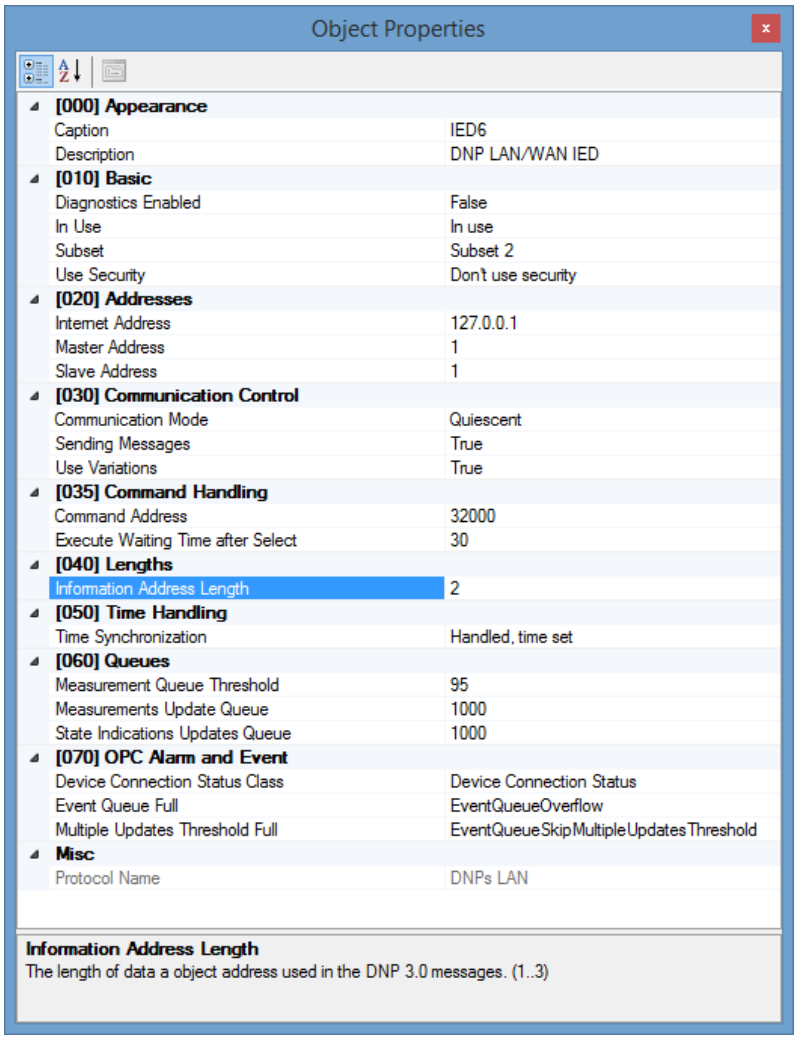
5.4. Configuring objects

5.4.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 5.4.1-1 shows an example of how to use SAB600 to configure the object properties for DNP LAN 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 .



SAB600_DNP_ Object_Properties.png

Figure 5.4.1-1 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.

5.4.2. Configuring DNP LAN Slave OPC Client properties

Table 5.4.2-1 lists the configurable DNP LAN Slave OPC Client properties and value ranges for them. The actual configuration by using SAB600 is performed as described in 5.2, Overview of configuration.

Table 5.4.2-1 DNP LAN Slave OPC Client properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
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 a DNP master.
Station/Remote Switch		
Station/Remote Switch Handling	Do not check Station/Remote switch position. Check Station/Remote switch position. Default: Do not check Station/Remote switch position.	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	
Security		
Key Storage File		Defines path to key storage file in COM600.

Property / Parameter	Value or Value range/ Default	Description
UAL Event Identification		The name to identify the source of UAL events. Maximum length 16 characters. If left empty, then the OPC Client node name will be used.
User Activity Logging	Enabled/Disabled Default: Enabled	Defines if User Activity Logging is enabled. This setting only affects the OPC client node itself, UAL is configured separately for each DNP slave IED object as well.

5.4.3. Configuring DNP LAN Channel properties

The DNP LAN channel properties that can be configured and value ranges for them can be found in Table 5.4.3-1. The actual configuration by using the SAB600 is performed as described in 5.4.1, General information about configuring objects.

Table 5.4.3-1 DNP LAN Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
In Use	In use Not in use Default: In use	Specifies whether the channel is in use or not.
Protocol	DNP Slave over LAN interface	Protocol
Communication Port		
Local Address	Default: 127.0.0.1	The IP address which is locally used. Port number can be configured by using semicolon. For example, "127.0.0.1;8080".
Communication Control		
Allow Connection From Any IP Address	True False Default: False	Specifies whether the connection from any IP address is allowed. If set to false, connection is only allowed from the host IP Address configured to the IED object.
Connection Type	Default: TCP/IP	ConnectionTypeDesc
Link Layer Confirmations Enabled	In use Not in use Default: In use	Determines whether the link layer confirmations are in use.

Property / Parameter	Value or Value range/ Default	Description
Maximum Message Length	50...249 Default: 230	Maximum length of a data link fragment.
Test Function of Link Interval	0...65535 Default: 500	Delay in milliseconds between the test function of link commands. If the value is set to zero, the test function of a link command is not sent.
Response Timeout	0...255 Default: 2	Specifies the time in seconds that the DNP 3.0 link waits for the end of the received message.
Test Function For Link	True False Default: False	Specifies if “Test Function for Link” is enabled.

5.4.4. Configuring DNP LAN IED properties

Table 5.4.4-1 lists the configurable properties for DNP LAN IED and value ranges for these properties. The actual configuration by using the SAB600 is performed as described in 5.4.1, General information about configuring objects.

Table 5.4.4-1 DNP LAN IED properties

Name	Value/Value range	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the station.
In Use	In use Not in use Default: In use	Defines if the IED is in use or not.
Subset	Subset 2 Subset 3 Default: Subset 2	Defines the subset level that is currently used.
Use Security	Don’t use security Use security Use security and modify critical requests Default: Don’t use security	Controls whether security is enabled and which security properties are available for configuration.

Name	Value/Value range	Description
Addresses		
Internet Address	Default: 127.0.0.1	The IP address of the remote host.
Master Address	0...65535 Default: 1	The station address of the master station.
Slave Address	0...65535 Default: 1	The station address of the DNP 3.0 slave station.
Communication Control		
Sending Messages	True False Default: True	Sending messages while waiting for a confirmation.
Use Variations	True False Default: True	Variations in response messages.
Command Handling		
Command Address	0...65535 Default: 32000	The object address of the bitstream process object.
Execute Waiting Time after Select	0...65 Default: 30	The maximum time in seconds that the slave waits for an execute command after receiving an operator command.
Lengths		
Information Address Length	1...3 Default: 2	The length of a data object address used in the DNP 3.0 messages.
Time Handling		
Time Synchronization	Handled, time set Positive acknowledged, time not set Negative acknowledged, time not set Default: Handled, time set	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.

Name	Value/Value range	Description
Measurements Update Queue	0...65535 Default: 0	Maximum number of measurement process data changes that are stored internally in a queue in the client.
State Indications Updates Queue	0...65535 Default: 0	Maximum number of state indication process data changes that are stored internally in a queue in the client.
Security		
Aggressive Mode	Enabled Disabled Default: Enabled	Defines whether the aggressive mode of authentication is used. The aggressive mode uses less bandwidth and using it is recommended. Modifying this attribute is possible only if it is enabled in the key storage using the setting 'Allow external modification of security attributes'.
Authentication Used	Enabled v5 (update key negotiation) Enabled v2 (preshared update keys) Not in use Default: Enabled v5	Defines whether secure authentication is used or not, can also choose between v2 and v5 (recommended) type.
Authority Certification Key Length	All 32 bytes used in MAC calculation. First 16 bytes used in MAC calculation. Default: All 32 bytes used ….	Authority certification key length with SHA-1 Update Key Change Method.
Challenge Data Length Critical Request	0..65535 Default: 8	Challenge data length for critical request
Challenge Data Length Session Key Status	0..65535 Default: 8	Challenge data length for session key status.
Challenge Data Length Update Key Reply	0..65535 Default: 32	Challenge data length for update key reply.

Name	Value/Value range	Description
Key Change Interval	0..65535 Default: 900	The key change interval in seconds. If the specified interval has expired twice without session key renegotiation between the expirations, the session keys for the user are invalidated and the corresponding UAL event is reported. After this, no critical operations for the user are authenticated in either directions and session keys must be renegotiated.
Key Storage ID	0..65535 Default: 1	Defines the keys and user set of the slave station in the key storage. Must match the 'Station Identifier' value in the Authority Tool. This value must be unique within the slave stations accessing the same key storage. Value = 0 means that the slave station is not attached to any user set and enabling authentication is not possible.
UAL Event Identification		The name to identify the source of UAL events. Maximum length 16 characters. If left empty, then the slave station node name will be used.
UAL Event Used	Special Logging Extended Logging Standard Logging Disabled Default: Extended Logging	Defines whether the UAL events are generated by the slave station. Special Logging is the most “noisy” mode and also includes non-standard UAL events, and is thus only recommended for troubleshooting.
TLS - Settings		
Certificate Passphrase		Define the passphrase to open the private key in the certificate file. If the certificate does not require passphrase, this attribute may be an empty string. If the creation of self-signed certificates is enabled the contents of this property is included to the passphrase of the private key of the created certificate. When set, has an effect on all slave stations with the same Internet Address.
Certificate Store Type	.pem file Default: .pem file	Type of the certificate store, currently only .pem files are supported.

Name	Value/Value range	Description
Error Logging	No error logging Error logging enabled Default: No error logging.	Defines if TLS error logging is enabled.
Maximum TLS version	TLS 1.2/SSL 3.3 Default: 1.2/SSL 3.3	The maximum supported TLS version.
Minimum TLS version	TLS 1.2/SSL 3.3 Default: 1.2/SSL 3.3	The minimum supported TLS version.
Self-signed Certificate Generation	Never Always Default: Never	Defines when and if self-signed certificates are generated.
TLS Key Renegotiation Interval	0..86400 Default: 830	Defines the session renegotiation interval for TLS in seconds. Timer is triggered when the authentication level session keys for user "Common" are negotiated. The value of the property should be slightly less than the configured authentication level session key change interval value in the DNP master (default in DNP3 standard is 15 minutes i.e. 900 seconds).
Validation Failure Action	Ignore, continue communication Close connection Default: Close connection	Action taken when remote certification validation fails.
TLS - Certificate		
Certificate Key File		Defines the certificate key file for TLS communication. When set, has an effect on all slave stations with the same Internet Address. The TLS functionality is activated when both certificate key file and trusted certificate authority file are set.

Name	Value/Value range	Description
Trusted Certificate Authority File		Defines the trusted certificate authority file for TLS communication. When set, has an effect on all slave stations with the same Internet Address. The TLS functionality is activated when both certificate key file and trusted certificate authority file are set.
TLS - Self-Signed Certificate		
Certificate Name		Defines the subject of the self-signed certificate. It must have the exact values of the "Common Name" and "Country Code" properties and also 'ABB' as organization. Exact format in the example below. Example value: "CN=ABB_COM600 O=ABB C=FI" (When using country code "FI" and common name "ABB_COM600".) The name and location of the created certificate is defined using the "Certificate Key File" property. The "Trusted Certificate Authority File" property value doesn’t matter when using a self-signed certificate and it can be same as "Certificate Key File". When set, has an effect on all slave stations with the same Internet Address. This property is meaningful only if the creation of self-signed certificates is enabled and should be left empty otherwise.
Common Name		Defines the common name of the self-signed certificate. No spaces are accepted. When set, has an effect on all slave stations with the same Internet Address. This property is meaningful only if the creation of self-signed certificates is enabled and should be left empty otherwise.

Name	Value/Value range	Description
Country Code		Defines the country code of the self-signed certificate. Must be a string with only two characters. When set, has an effect on all slave stations with the same Internet Address. This property is meaningful only if the creation of self-signed certificates is enabled and should be left empty otherwise.
Critical Requests		
Function Code [0..131]	not critical critical critical only remotely critical only locally Default: varies with function code	Via these properties it's possible to configure if a function code is considered critical by the authentication or not. It's generally not recommended to change the default values.

5.4.5. Configuring data objects

5.4.5.1. 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 SAB600 is performed as described in 5.4.1, General information about configuring objects.

To configure the data objects in Cross References window:

1. Select the IED object in the object tree and right-click it.
2. Choose the Cross References window from the context menu.
3. Change the values in cross references table by simply writing the new value in table cell with the desired property.
4. Finally, click **Save** to save the changes.

The parameters are stored in Object properties in SAB600 (see the tables for each data object type).

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

When configuring address values for DNP IED data objects, the valid address range is 0 - 65535 . If the value is -1, then the address is not available.

If you change the object names or structuring of objects of OPC Server, which are connected to the IED, open the cross reference tool and verify that the changes are correctly handled and then click **Save** to update the configuration accordingly.

DNP 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 DNP OPC Client.

5.4.5.2. Directional protection activation information (ACD)

Table 5.4.5.2-1 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 Index	0...65535 Default: 0	General Index
Neutral Index	0...65535 Default: 0	Neutral Index
Phase A Index	0...65535 Default: 0	Phase A Index
Phase B Index	0...65535 Default: 0	Phase B Index
Phase C Index	0...65535 Default: 0	Phase C Index
Common		

Property/ Parameter	Value or Value range/ Default	Description
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Double Point	True False Default: False	Defines if a value is sent as double point.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.3. Protection activation information (ACT)

Table 5.4.5.3-1 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 Index	0...65535 Default: 0	General Index
Neutral Index	0...65535 Default: 0	Neutral Index
Phase A Index	0...65535 Default: 0	Phase A Index
Phase B Index	0...65535 Default: 0	Phase B Index
Phase C Index	0...65535 Default: 0	Phase C Index
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.

Property/ Parameter	Value or Value range/ Default	Description
Send As Double Point	True False Default: False	Defines if a value is sent as double point.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.4. Analog set point (APC)

Table 5.4.5.4-1 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		
Control Index	0...65535 Default: -1	Control index.
Indication Index	0…65535 Default: -1	Indication index.
Common		
Class	Class 0…3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0…65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all changes to the client.

Property/ Parameter	Value or Value range/ Default	Description
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All updates	True False Default: False	Defines whether all changes in value are send to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines whether the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time and Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.5. Binary counter reading (BCR)

Table 5.4.5.5-1 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 Index	0...65535 Default: 0	Indication index.
Common		

Property/ Parameter	Value or Value range/ Default	Description
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Counter Object	Binary counter (20) Frozen counter (21) Default: Binary counter (20)	Object number for counter.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit value (for APC, CMV, DEL, MV, WYE).
Send As Delta Counter	Send as binary counter Send as delta counter Default: Send as delta counter	Defines if the value is sent as delta or binary counter.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.6. Binary controlled step position information (BSC)

Table 5.4.5.6-1 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.

Property/ Parameter	Value or Value range/ Default	Description
Addresses		
Control Index	0...65535 Default: 0	Control index.
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milli-seconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Vari-ation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.7. Complex measured value (CMV)

Table 5.4.5.7-1 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 Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 float bit value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.

Property/ Parameter	Value or Value range/ Default	Description
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

5.4.5.8. Delta (DEL)

Table 5.4.5.8-1 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.
Addresses		
Phase AB Index	0...65535 Default: 0	Phase AB Index
Phase BC Index	0...65535 Default: 0	Phase BC Index
Phase CA Index	0...65535 Default: 0	Phase CA Index
Common		
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.

Property/ Parameter	Value or Value range/ Default	Description
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

5.4.5.9. Controllable double point (DPC)

Table 5.4.5.9-1 Configurable DPC properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Addresses		
Control Index	0...65535 Default: 0	Control index.
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.

Property/ Parameter	Value or Value range/ Default	Description
Data Class Specific		
Control Object	Default: Binary control output block (12).	Object number for control.
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.
Send As Single Point	True False Default: False	Defines if a value is sent as single point.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.10. Double point status (DPS)

Table 5.4.5.10-1 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		

Property/ Parameter	Value or Value range/ Default	Description
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.
Send As Single Point	True False Default: False	Defines if a value is sent as single point.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.11. Controllable integer status (INC)

Table 5.4.5.11-1 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		
Control Index	0...65535 Default: 0	Control index.
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).

Property/ Parameter	Value or Value range/ Default	Description
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.12. Integer status (INS)

Table 5.4.5.12-1 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		
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.

Property/ Parameter	Value or Value range/ Default	Description
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.13. Integer controlled step position information (ISC)

Table 5.4.5.13-1 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		
Control Index	0...65535 Default: 0	Control index.
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.

Property/ Parameter	Value or Value range/ Default	Description
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.14. Measured value (MV)

Table 5.4.5.14-1 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 Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.

Property/ Parameter	Value or Value range/ Default	Description
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

5.4.5.15. Controllable single point (SPC)

Table 5.4.5.15-1 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		
Control Index	0...65535 Default: 0	Control index.

Property/ Parameter	Value or Value range/ Default	Description
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Control Object	Default: Binary control output block (12).	Object number for control.
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Double Point	True False Default: False	Defines if a value is sent as double point.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.16. Single point status (SPS)

Table 5.4.5.16-1 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 Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Double Point	True False Default: False	Defines if a value is sent as double point.
Send As Inverse Value	True False Default: False	Defines if the value of a message is inverse.

Property/ Parameter	Value or Value range/ Default	Description
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.17. WYE

Table 5.4.5.17-1 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 Index	0...65535 Default: 0	Neutral Index
Phase A Index	0...65535 Default: 0	Phase A Index
Phase B Index	0...65535 Default: 0	Phase B Index
Phase C Index	0...65535 Default: 0	Phase C Index
Net Index	0...65535 Default: 0	Net Index
Res Index	0...65535 Default: 0	Res Index
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

5.4.5.18. Controllable Enumerated Status (ENC)

Table 5.4.5.18-1 Configurable ENC 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		

Control Index	0…65535 Default: -1	Control index.
Indication Index	0…65535 Default: -1	Indication index.
Common		
Class	Class 0…3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0…65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milli-seconds. 0 means that the server sends all changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All updates	True False Default: False	Defines whether all changes in value are send to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines whether the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time and Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.5.19. Enumerated Status (ENS)

Table 5.4.5.19-1 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 Index	0…65535 Default: -1	Indication index.
Common		
Class	Class 0…3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0…65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milli-seconds. 0 means that the server sends all changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All updates	True False Default: False	Defines if all changes in value are send to the master.
Send As Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time and Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

5.4.6. Configuring security

For more information about the secure authentication offered by DNP 3.0 slave, see 5.5, Secure authentication using IEC/TS 62351-5. This section will just give a short overview of how it is configured.

If possible, it's easiest to first configure the project normally without enabling security, any other potential communication problems can then be detected and addressed without extra interference from the security mechanisms.

Then, create and configure the needed key storage using the provided Authority Tool and take it into use for the OPC Client object via the Key Storage File property. Enable security for the affected IED objects via the "Use Security" property. Configure the IED Security properties to match the corresponding values in the key storage and the remote master.

Transport Layer Security (TLS) is optional and can be configured once the normal authentication is working. See 5.4.7, Configuring Transport Layer Security (TLS)for more information.

For troubleshooting authentication problems the IED tools "Online diagnostics" and "Security diagnostics" can be used, also the Security Events list in the COM600 WebHMI might contain useful information.

5.4.7. Configuring Transport Layer Security (TLS)

To use TLS, enable security for the affected IED objects via the "Use Security" property. Note that this will by default also enable secure authentication.

Then configure certificate key file and certificate authority file for the IED using the corresponding properties. The file names refer to the full file system paths for these files on the COM600 device. Currently only pem-file type is supported.

If a self-signed certificate is used, then certificate name, common name and country code must also be configured for that part, otherwise those properties must be left empty. When a self-signed certificate is used the certificate key file and certificate authority file will be generated to the file paths configured above for those properties.

It's recommended to use certificates issued by a proper certificate authority, but it's also possible to generate private certificates for internal use with e.g. OpenSSL, see below for an example.

Generating certificates with OpenSSL

This is a short example of the openssl commands needed to generate certificates for TLS use for the COM600 DNP slave and the remote DNP master. The commands are taken

from http://datacenteroverlords.com/2012/03/01/creating-your-own-ssl-certificate-authority/.

It is assumed here that openssl is installed. It is also assumed the remote DNP master accepts pem-files, similarly to the COM600 DNP slave.

openssl genrsa -out rootCA.key 2048

openssl req -x509 -new -nodes -key rootCA.key -days 1024 -out rootCA.pem

openssl genrsa -out client1.key 2048

openssl req -new -key client1.key -out client1.csr

openssl x509 -req -in client1.csr -CA rootCA.pem -CAkey rootCA.key -CAcreateserial -out client1.crt -days 500

type client1.key client1.crt > client1.pem

openssl genrsa -out server.key 2048

openssl req -new -key server.key -out server.csr

openssl x509 -req -in server.csr -CA rootCA.pem -CAkey rootCA.key -CAcreateserial -out server.crt -days 500

type server.key server.crt >server.pem

copy server.crt server_c.pem

The only openssl question that needs an answer is “Common Name”; for the rootCA and server the COM600 IP address (should be same as “Local Address” property value of the line object) can be used and for the client the DNP master’s IP address (should be same as “Internet Address” property value of IED object) can be used.

All other questions can be bypassed by simply pressing Enter.

After this, certificates are defined for DNP 3.0 communication followingly:

DNP Slave (Server)

Certificate Key File = C:\Program Files\COM610 GW SW\DNP-LAN_WAN OPC Client\bin\OPCC_DNP_LAN_1\server.pem

Trusted Certificate Authority File = C:\Program Files\COM610 GW SW\DNP-LAN_WAN OPC Client\bin\OPCC_DNP_LAN_1\rootCA.pem

Copy the files above to these places in the COM600 computer. The used directory is freely selectable, in this example the instance directory of the DNP OPC Client was used.

DNP Master (Client)

Certificate Key File or corresponding setting = D:\..\client1.pem

Trusted Certificate Authority File or corresponding setting = D:\..\server_c.pem

Copy the mentioned files to the selected places in the master computer as needed.

Known problems

TCP connection can be disconnected when TLS keys are negotiated. More likely to happen when “Link Layer Confirmations Enabled” property is set to enabled and the “TLS Key Renegotiation Interval” property is set to a quite small interval. Depends on master key change interval settings as well.

Workaround: Do not use link layer confirmations if TLS is used.

5.5. Secure authentication using IEC/TS 62351-5

5.6. Secure authentication using IEC/TS 62351-5

DNP 3.0 slave protocol stack supports secure authentication as defined in IEC/TS 62351-5 and IEEE 1815-2010 (when v2 used) and IEEE 1815-2012 (when v5 used). Transport Layer Security (TLS) defined by IEC/TS 62351-3 may be used together with secure authentication.

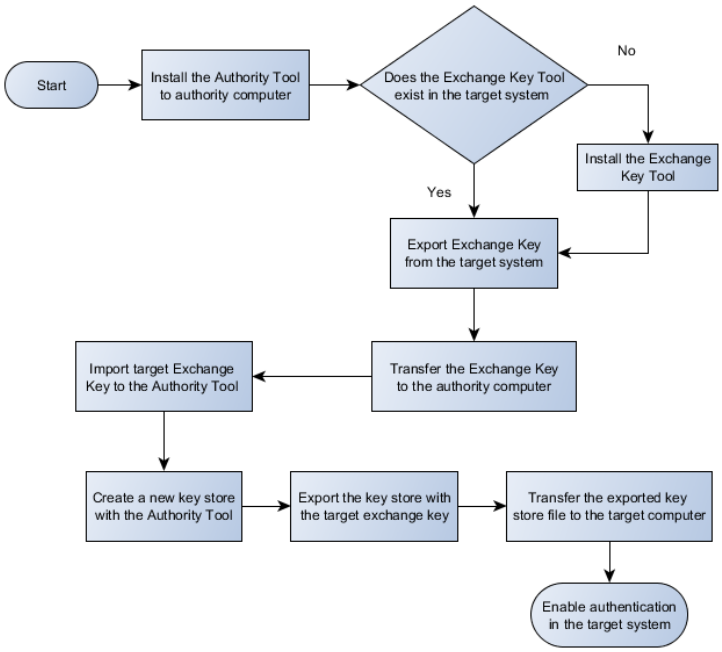
A separate Authority Tool is needed to create an encrypted database for user sets and the update keys for each station (*) object connected to DNP 3.0 master or slave lines. This Authority Tool is delivered separately and the feature described in this chapter cannot be used without the key storage database created with the Authority Tool. An online help is provided with the Authority Tool. Authority Tool is used for configuring the application layer authentication only and not the TLS defined in IEC/TS 62351-3.

Contact the nearest ABB representative for the Authority Tool and the detailed description of the creation and handling of the key storages.

(*) The Authority Tool uses the term ‘station’ for what is a DNP master or slave IED in the SAB600 communication tree. Currently SAB600 only supports secure authentication for DNP 3.0 slave, while the Authority tool supports both master and slave.

The usage of secure authentication in the mentioned protocols protects the systems from unauthorized access and helps to reveal possible attacks. IEC/TS 62351 part 3 and part 5 describes the addressed threats in detail. It is assumed here that the reader of this chapter knows the principles and motives of IEC/TS 62351.

Following picture describes the main steps of the configuration of the secure authentication. If possible, doing the testing of the communication channels and signal engineering separately without secure authentication is worth to be considered. The configuration of the key storage can be made concurrently with other testing activities. When other tests are completed, the secure authentication can be enabled and tested.



Flowchart_secure_authentication_configuration.png

Figure 5.6-1 Flowchart of the secure authentication configuration

If the secure authentication feature is used, it is very important to keep all symmetric keys (Update keys, Authority Certification key) in secret, otherwise the benefit of the usage of the feature is compromised. The key storage databases used by the protocol stack must be encrypted with a key created with the Export Exchange Key Tool included on the COM600 device. The encryption key is bound to the device in question. From an engineering of point view, the usage of v5 authentication with asymmetric mode is easier since all the keys visible during engineering are public keys and those need not be kept secret.

The supported algorithms in symmetric mode are 'SYMMETRIC_AES128_SHA1_HMAC' and 'SYMMETRIC_AES256_SHA256_HMAC' and in asymmetric mode 'ASYMMETRIC_RSA1024_DSA_SHA1_HMAC_SHA1'. In case some other algorithm is needed, contact the nearest ABB representative.

Not all algorithms listed in the Authority Tool are currently supported with COM600.

The principal sequence of the configuration is described below. Most of the steps are the same for v2 and v5 versions and for master and slave. Steps 7 and 8 are different depending on the used authentication mode and the master/slave role of the station object in question. The naming of the fields follows IEEE 1815 but if the system is connected to a system from a different vendor, the naming may also differ. If v5 authentication is used and the station objects uses symmetric update key change mode, the instructions given for asymmetric mode can be ignored (and vice versa).

1. Install the Authority Tool to a separate computer in a safe place. Identify the persons who may have access to the key information kept in secrecy (Authority Certification key and Update keys). The instructions for the Authority Tool installation are delivered together with the tool.
2. Export the Exchange Key using the Exchange Key Tool in the COM600 computer. See the chapter 'Exchange key file importing and exporting' for the usage details of the Exchange Key Tool. Select "No, do not export private key" and the type of the exported key will be Signed public key. (Private key exporting is also supported but not needed in COM600).
3. Transfer the Exchange Key file to the computer where Authority Tool is used.
4. Import the Exchange Key file to the Authority Tool.
5. From the SAB600 communication tree, identify the station (IED) objects which will use secure authentication.
6. Create a key storage for the COM600 computer. The same key storage can be used by multiple DNP Slave instances but one DNP Slave instance can use only one key storage. It is also possible to have a separate key storage for each DNP Slave instance.
7. Create necessary users, user sets and station objects to the key storage. Assign user numbers and names as needed. The station names are freely selectable but their content must be the same in both master and slave (technically, matching not necessary with v2 but is recommended). The field name may also be called as 'out-station name' when connected to a third party system.
   Station identifier should match the value of the “Key Storage ID” property of the corresponding IED object in the SAB600 communication tree.
   If DNP3 secure authentication v5 is configured and the station object is connected to a slave line (as is always the case in DNP slave), create a user set which contains no other users but "Common" (present as default) and define this user set in the station creation. When the COM600 system is connected to the NCC and the update keys are successfully negotiated, the users and their roles for the IED in COM600 are the same as defined in the NCC.
   Thus, in DNP3 Secure authentication v5, the users are created online using DNP3.
   If DNP3 secure authentication v5 is configured and the station object is connected to a master, a Role, Role Expiry Interval and Update Key Change Method must be given to each user. The given update key change method should follow the update key mode accepted by the slave system (symmetric/asymmetric). In most cases, the Update Key Change Method is the same for each user.
   If the Update Key Change Method is set to 'SYMMETRIC_AES128_SHA1_HMAC' or 'ASYMMETRIC_RSA1024_DSA_SHA1_HMAC_SHA1', the update key length may be set to 16 bytes, with other selections to 32 bytes. If the session key wrapping algorithm is AES-256, the update key length must always be 32 bytes. When the

update key length is changed in 'Stations' level and a red mark is visible beside the update key, selecting the users from column 'Selected' and pressing the button 'Generate Update Keys for Selected users' is needed, also when v5 is used.

8. For stations using DNP3 secure authentication v2 connected:
   a. For stations connected to slave lines: enter the Update Key manually for each user in each station object according to the settings in the master end. This applies in all cases, i.e. when the master is ABB SYS600 or when it is a third party system.
   b. For stations connected to master lines: generate the Update Key for each user in each station object. The configured user names can be case-sensitive depending on the master system. If the name is not found in the key storage for the station object, the user is not able to send control commands to the station. Make a clear-text copy of the settings of each station (e.g. a screenshot) and store them in a safe place. These copies are used when the corresponding configuration is made to the slave devices using their own tools (= third party system).

   For stations using DNP3 secure authentication v5 connected:
   a. For stations connected to slave lines:
      If symmetric mode is used, in 'System' level of the Authority Tool, paste 'Authority Certification Key' provided from the master/authority system. In 'Stations' level, set Update Key Mode of the station to 'Symmetric' and the Authority Certification Key entered in 'System' level is copied automatically for the created station. If the station is created before the setting of the authority certification key, paste it manually for each station in 'Stations' level. In case a different authority certification key is needed for each slave line, the authority certification key from different masters can be pasted manually for each created station (in 'Stations' level). The authority certification key visible in 'Station' level is always the one used in communication. If the used update key method is 'SYMMETRIC_AES128_SHA1_HMAC', the authority certification key length may be 16 bytes (128 bits) or 32 bytes (256 bits). This is dependent on the functionality of the remote system, and can be configured if needed via the “Authority Certification Key Length” property in SAB600. With other symmetric update key algorithms, the authority certification key length is 32 bytes (256 bits).
      If asymmetric mode is used, in 'System' level of the Authority Tool, import 'Authority Public Key' provided from the master/authority system. In 'Stations' level, set Update Key Mode to 'Asymmetric', select Station(s) and press 'Generate Station Key pair(s)' to generate asymmetric key pairs for stations. Export the outstation public key using button 'Export station public key(s)' to be used the in the master system. If multiple slave lines are used in asymmetric mode and those use different authorities, the slave lines must configured to different DNP Slave instances and they must use separate keystorages.
   b. For stations connected to master lines:
      If symmetric mode is used, in 'System' level of the Authority Tool, press 'Generate' button to generate an 'Authority Certification Key' and copy it to be provided for the slave system. In 'Stations' level, set Update Key Mode to 'Symmetric', select Station(s) and paste the generated authority certification key

from 'System' level for each station in 'Stations' level. In case a different authority certification key is needed for some of the remote IEDs, a dedicated authority certification key can be pasted manually for any created station (in 'Stations' level). The authority certification key visible in 'Station' level is always the one used in communication. If the used update key method is 'SYMMETRIC_AES128_SHA1_HMAC', the authority certification key length may be 16 bytes (128 bits) or 32 bytes (256 bits). This is dependent on the functionality of the remote system, and can be configured if needed via the “Authority Certification Key Length” property in SAB600.. With other symmetric update key algorithms, the authority certification key length is 32 bytes (256 bits).
If asymmetric mode is used, in 'System' level of the Authority Tool, press 'Generate' to generate an authority key pair and export 'Authority Public Key' for the slave system. In 'Stations' level, set Update Key Mode to 'Asymmetric', select Station and press 'Import outstation public key' to import the public key of the slave system.

9. Save the key storage database and make a backup. In case of a slave on DNP3 secure authentication v5, the backup can be used to restore a situation where no users have been created for the slave. If this done, the master must repeat the 'User Add' operation and the update key negotiation for each user.
10. Export (i.e. encrypt) the stored key storage database using the Exchange Key from COM600 computer. Name the file according to the role of the COM600 computer.
11. Transfer the exported key storage database file to the COM600 computer. In SAB600, configure the name and path of the key storage using the “Key Storage File” property of the DNP OPC Client object.
12. Activate and test the secure authentication in SAB600 by configuring the “Authentication Used” property of the corresponding station/IED object. For stations connected to master lines, the corresponding settings must be done to the slave devices using e.g. the clear-text copy of the Update Keys and users (v2 only).
13. Repeat steps 2 to 12 for each COM600 computer using secure authentication.

Limitations

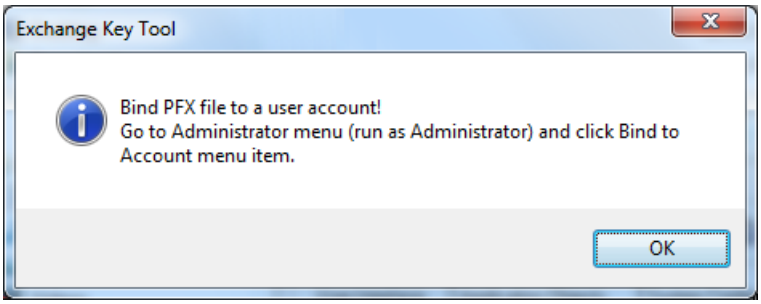
- One DNP OPC Client instance can use only one key storage.
- A station object can use either v2 authentication of v5 authentication but not both.
- A station object can use either symmetric or asymmetric update key change methods but not both.

Troubleshooting

In case there are problems when connecting to another system, the following tips may help:

- In Authority Tool a red mark besides the update key field may be visible when the update key length has been changed. In this situation, it is necessary to select all users from 'Selected' column and press the button 'Generate Update Keys for Selected users'.

- When setting up the system, more UAL events related to error situations are visible when the SAB600 “UAL Event Used” property of the IED object is set to its highest reporting level.
- Communication log can be taken using any network analyzer (TCP and UDP). In case the TLS encryption is used in TCP mode, the unencrypted communication log can be recorded using the protocol analyzer of the DNP Slave, see SAB600 online diagnostics tool for the subnetwork/line object.
- Authentication diagnostics in SAB600 provides information if some operation fails repeatedly. If the failed operation is directly related to certain user, repeating the same operation and recording the changes in the authentication diagnostic counters for that user provides helpful information for the analysis.
- If the used key storage database file size changes to 0kb after the file is updated, it could mean that the PFX file is not correctly bound to the user account. Start the Exchange Key Tool in that computer and login in with the key user role. If a note appears that advice to bind the PFX file (see figure below), rebind the PFX file using the instructions given in the part 'Installation of the Exchange Key Tool' in this chapter.



Bind_PFX_file.png

Figure 5.6-2 Bind PFX file

Notes and tips related to handling of key storage files

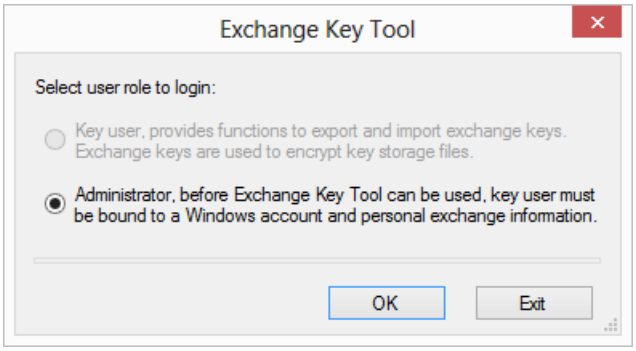
- An exported key storage file cannot be used in another computer but must be exported again using the Exchange key from the new (COM600) target computer.
- Take a good care of the Authority Tool database because if it is lost, the exported databases from the same key storage file cannot be utilized as a back-up.
- Key storage may contain station objects and user sets which are not used by the SAB600 yet. This will help to test the system step by step.
- It is safest to create at least one key storage for each geographical location. If one of those is compromised, the information cannot be utilized for an attack to another location.
- Same communication line in DNP OPC Client may contain stations that use authentication and stations that do not.
- If COM600 is used both in the master (currently not supported) and slave end, the same key storage can be exported twice and no manual entering of the user numbers and update keys are needed for key storage used in the computer operating as slave.

Each key storage must still be exported using the Exchange Key from the target computer. This practice is applicable only with DNP3 secure authentication v2.
- Temporary key storages can be created to test the system's functionality with secure authentication.
- If a 'User Add' operation is made for an existing user in slave using v5, it is handled as 'User Change'.

5.7. Installation of the Exchange Key Tool

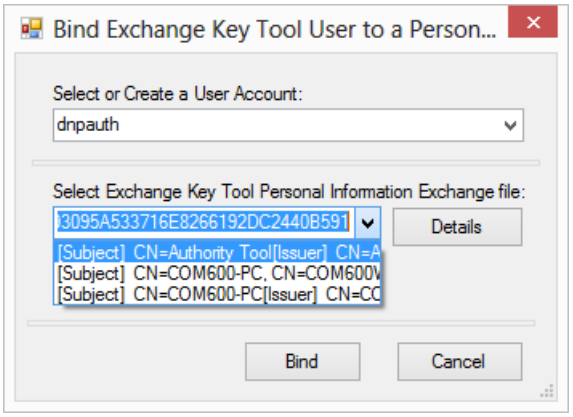
Exchange Key Tool is by default included on the COM600 device. The installation of this tool is needed only if the secure authentication, as described in “Secure authentication using IEC/TS 62351-5”, is used on the computer in question.

To install:
1. Run “C:\Program Files\COM610 GW SW\Common\bin\ekt.exe” as administrator.
2. Select administrator.
3. Select administrators > Bind to Account from the Menu bar.
4. Enter a username, e.g. "dnpauth" to the Select or Create Username field. If a new username is given, a Windows user with this name will be created. DO NOT use the “COM600” user account for this!
5. Press Import new to select a PFX file, select the PFX file (delivered separately together with the Authority Tool or created according to the customer's requirements)
6. Enter the required password for the PFX file.
7. Select the imported PFX from the list and press Bind
8. If a new username was given in step 8, a password for the created Windows user must be entered in this phase.
9. Binding of the Exchange Key Tool to a Windows user should be successful. Close the tool. See next chapter for Exchange key file importing and exporting.



exchange_key_tool.png

Figure 5.7-1 Role selection dialog in Exchange Key Tool



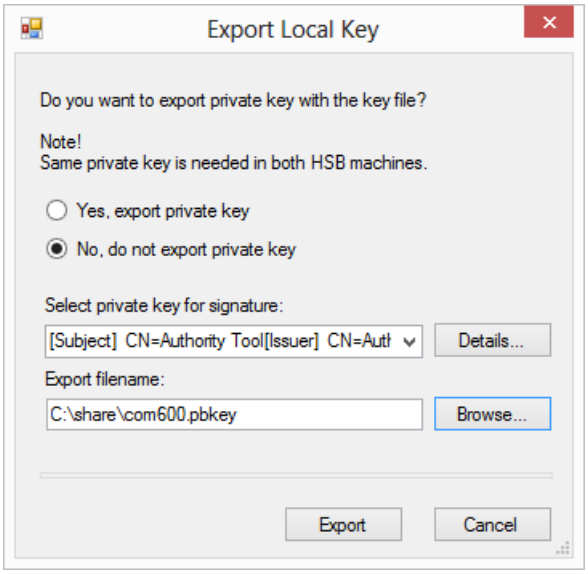
bind_exchange_key_tool.png

Figure 5.7-2 Bind Exchange Key Tool user to PFX

5.8. Exchange key file importing and exporting

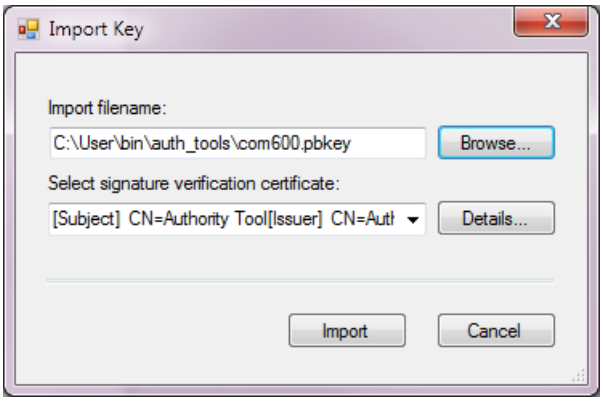
To start Exchange Key Tool:

1. Launch “C:\Program Files\COM610 GW SW\Common\bin\ekt.exe”.
2. Select Key user.
3. Enter the password. If the Exchange Key Tool is started for the first time as a Key user after having been installed and/or bound to an account, the Old Password is the password of the Windows user given in step 12 of the installation phase.
   Enter a new password.
   When a new password is entered, the tool closes itself and needs to be restarted. In this case, proceed from step 1.
4. Select Key Management > Export Exchange Key.
5. A private key is not needed for COM600 use, so choose public key.
6. Press Browse and define the filename. Make sure to choose a target folder that the user account used by the Exchange Key Tool has write access to, e.g. the COM600 user home directory cannot be used.
7. Press Export. Store the created file, for example to a USB stick.
8. The exchange key will be used as an encryption key for all key storages in the computer in question.
9. Transfer the exchange key file to the computer where Authority Tool is used. Start it and select Key Management -> Import Exchange Key.



export_local_key.png

Figure 5.8-1 Key exporting



import_key.png

Figure 5.8-2 Key importing

5.9. Secure authentication device profile

DNP 3.0 in COM600 supports secure authentication versions v2 and v5.

For secure authentication version v2, the supported message types are of object type 120 (Authentication), variations 1-7 and 9.

For secure authentication version v5, the supported message types are of object type 120 (Authentication), variations 1-7 and 9-15.

The function codes used with these object types are 32 = Authentication Request and 131 = Authentication Response. The supported qualifiers are fixed in DNP 3.0 standard.

6. Modbus TCP slave configuration

6.1. About this section

This section guides you in the configuration tasks required before you can start using the Modbus TCP Slave OPC Client. For information on the IEC 61850 data modeling, see 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 the network
3. Select **New Project** on the left.
   - Enter a project name. The description is optional.
4. Click **Create**.
5. Click **Open Project**.

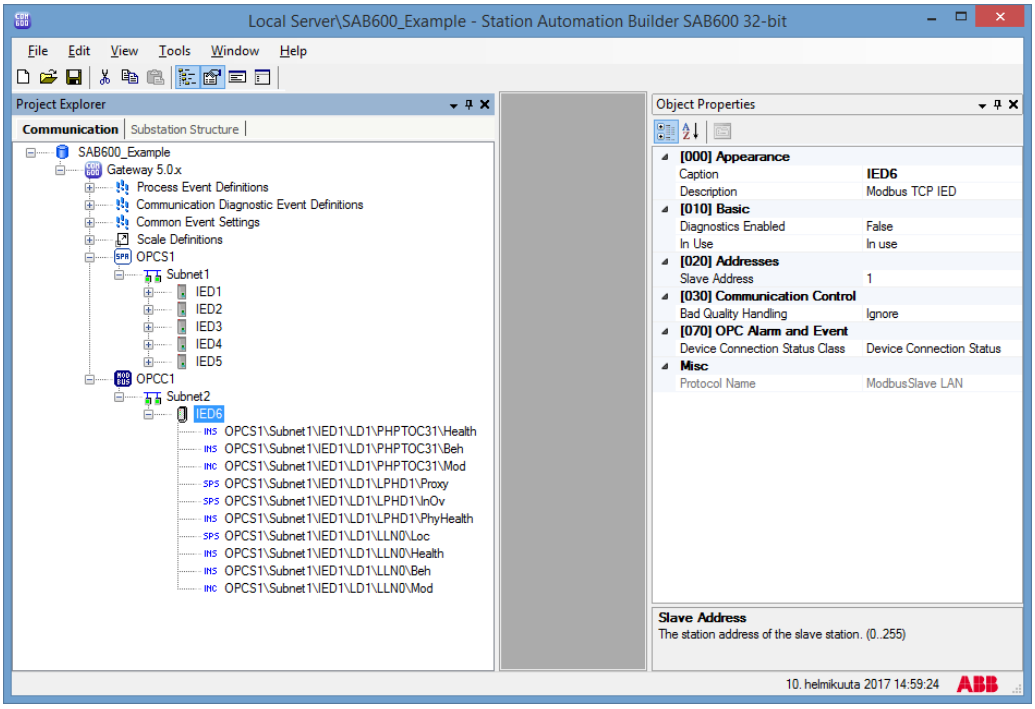
6.2. Overview of configuration

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

- Modbus TCP Slave OPC Client
- Modbus TCP Channel
- Modbus TCP IED
- Data objects

Figure 6.2-1 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_Modbus_Slave_Example_View.png

Figure 6.2-1 Example view of SAB600

To configure an object tree:

1. Build an object tree by adding the necessary objects to the object tree, see 6.3.1, General information about building object tree and 6.3.5, Adding data objects using Cross-References function.
   Figure 6.2-1 shows an example of how the object tree may look like after it has been built. In the example tree you can see the Modbus TCP Slave OPC Client object and its child objects, such as channels, devices, and data objects. Indentation is used to indicate the parent-child relationship between the objects.
2. Configure the object properties in the communication structure, see 6.4.1, General information about configuring objects.

The following table describes the objects shown in the object tree (Figure 6.2-1).

Table 6.2-1 Modbus TCP Slave OPC Client related objects

Object	Description
Modbus TCP Slave OPC Client	An object representing the Modbus TCP Slave OPC Client.
Modbus TCP Channel	An object representing the channel.
	A Modbus TCP IED is used for a virtual station in COM600 representing the slave stations visible to the Modbus master system.

Object	Description
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 Modbus TCP Slave OPC Client with the cross-reference function. They are shown as child objects of the Modbus TCP IED object in the object tree.
Event Definitions	Event definitions are used for the diagnostic OPC A&E Server.

6.3. Building object tree

6.3.1. General information about building object tree

The object tree is built in the communication structure of SAB600 by adding objects in a logical order starting from the Modbus TCP Slave OPC Client object. For more information, see Figure 6.2-1.

Before the Modbus TCP Slave OPC Client can be taken into use, configure an OPC server for the process communication. For more information on creating an OPC server, see COM600 User's Manual.

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.

Add the objects in the following order:
1. Modbus TCP Slave OPC Client
2. Modbus TCP Channel
3. Modbus TCP IED
4. Data objects.

6.3.2. Adding object

To add the OPC client object in the communication structure:
1. Select the gateway object.
2. Right-click the gateway object and select **New > Modbus > Modbus TCP Slave OPC Client**

6.3.3. Adding channel objects

After the Modbus TCP Slave OPC Client object has been successfully added, continue building the object tree by adding a Modbus TCP Channel object.

To add Modbus TCP Channel object:
1. Select a Modbus TCP Slave OPC Client object and right-click it.
2. Add a Modbus TCP Channel object.
3. Rename the new object. The names of the Modbus TCP Channel objects within a Modbus TCP Slave OPC Client must be unique.

6.3.4. Adding IED object

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

To add a Modbus TCP IED object:
1. Select a Modbus TCP Channel object.
2. Add a Modbus TCP IED object.
3. Rename the new object. The names within Modbus TCP Channel must be unique.

6.3.5. Adding data objects using Cross-References function

Data objects are added by dragging and dropping from an OPC server to the Modbus TCP Slave OPC Client.

To add data objects:
1. Select a Modbus TCP IED object and right-click it.
2. Select **Cross-References**. The Cross-References function appears (see Figure 6.3.5-1).
3. In the Project Explorer, select a logical node within an OPC server, from which you want to connect the data objects to the Modbus TCP Slave OPC Client.

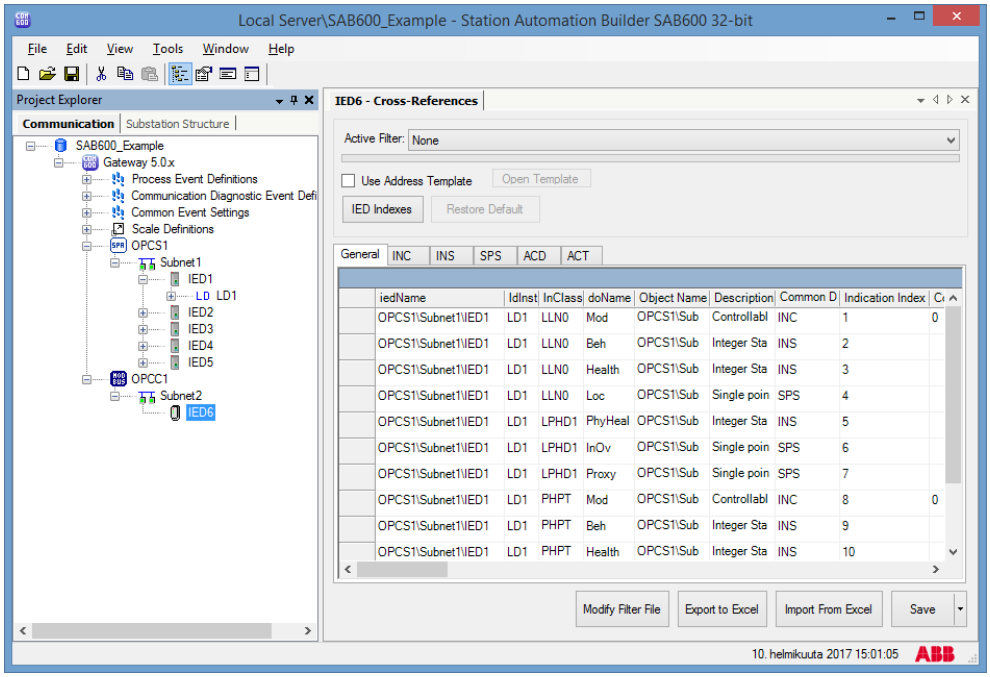
You can also select an upper level (server, channel, etc.) object and drag and drop it into the Cross-References function. All the data objects within the selected object appear in the Cross-References function and can be connected to the Modbus TCP Slave OPC Client.

4. Drag and drop the logical node into the Cross-References function. The data objects within the logical node appear in the Cross-References function.
5. Specify the addresses that map to the data objects.

Only Coils and Holding registers can be mapped, input status and input registers should not be used.

Only data objects that have been given a non-zero information address in the Cross-References table are connected to the Modbus TCP IED.

6. Click **Save** to create the cross-references (to connect the data objects to the Modbus TCP IED).



SAB600_Modbus_Slave_Cross_References.png

Figure 6.3.5-1 The Cross-References window

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

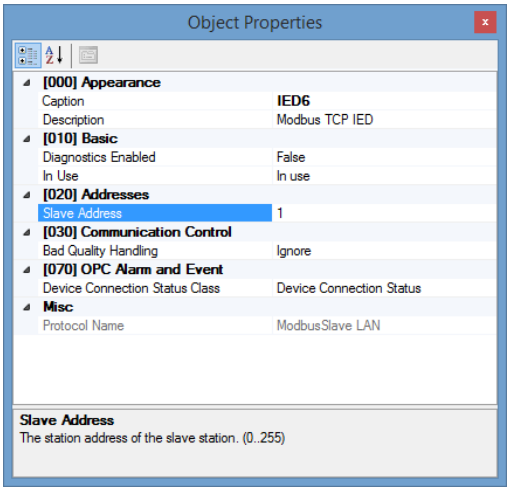
6.4. Configuring objects

6.4.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 6.4.1-1 shows an example of how to use SAB600 to configure the object properties for Modbus TCP 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.



SAB600_Modbus_ Object_Properties.png

Figure 6.4.1-1 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 done by:
   - selecting a predefined value from a drop-down menu, or
   - entering a text string or a numerical value into a text field.

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

6.4.2. Configuring Modbus TCP Slave OPC Client properties

Table 6.4.2-1 lists the configurable Modbus TCP Slave OPC Client properties and their value ranges. The actual configuration by using SAB600 is performed as described in 6.2, Overview of configuration.

Table 6.4.2-1 Modbus TCP Slave OPC Client properties

Property/Parameter	Value or Value range/Default	Description
Basic		
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 a diagnostic OPC alarm and event server.
Prog ID DA		Instance identification of a diagnostic OPC data access server.
Station/Remote Switch		

Property/Parameter	Value or Value range/Default	Description
Station/Remote Switch Handling	Do not check Station/Remote switch position. Check Station/Remote switch position. Default: Do not check Station/Remote switch position.	Specifies if the position of the station remote switch is going to be checked.
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.	Defines command handling, if the position is bad or unknown.

6.4.3. Configuring Modbus TCP Channel properties

The Modbus TCP Channel properties that can be configured and their value ranges are listed in Table 6.4.3-1. The actual configuration by using SAB600 is performed as described in 6.4.1, General information about configuring objects.

Table 6.4.3-1 Modbus TCP Channel properties

Property/Parameter	Value or Value range/Default	Description
Basic		
In use	In use Not in use Default: In use	Specifies whether the channel is in use or not.
Protocol	Modbus Slave over TCP interface protocol	
Communication Port		
Local Address	Default: 127.0.0.1	The locally used IP address.
Communication Port	Default: 502	The port that the server is listening on.
Allow Any Master Address	True/False Default: False	Specifies whether any master address is allowed to connect (True) or only the configured ones (False).
Allowed Master Addresses	List of IP-addresses separated by a space. Default: 127.0.0.1	Specifies the master/client addresses that are allowed to connect when not any master address is allowed to connect.

Property/Parameter	Value or Value range/Default	Description
Connection Idle Timeout	Seconds Default: 120	The idle timeout in seconds for the Modbus master connection, not enabled if set to zero. If no Modbus application message is received from the master before this timeout has elapsed, then the master will be disconnected and the connection discarded. The timeout is restarted each time a Modbus application message is received and processed.
Max Modbus Transactions	0..65535 Default: 10	The maximum number of concurrent transactions.
Max TCP Client Connections	0..65535 Default: 32	The maximum number of connected masters/clients.
TCP Keep Alive Interval	Seconds Default: 1	Specifies the interval, in seconds, between when successive TCP keep-alive packets are sent if no acknowledgement is received.
TCP Keep Alive Timeout	Seconds Default: 0	Setting this to a non-zero value enables the TCP keep-alive timer for the Modbus master connection. The value specifies the timeout, in seconds, with no activity until the first keep-alive packet is sent. The related TCP Keep Alive Interval property specifies the interval, in seconds, between when successive keep-alive packets are sent if no acknowledgement is received. The number of keep-alive probes (data retransmissions) is fixed (currently 10) and cannot be changed.

6.4.4. Configuring Modbus TCP IED properties

Table 6.4.4-1 lists the configurable properties for Modbus TCP IED and their value ranges. The actual configuration by using SAB600 is performed as described in 6.4.1, General information about configuring objects.

Table 6.4.4-1 Modbus TCP IED properties

Name	Value/Value range	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies if diagnostic AE events are sent for the station.
In Use	In use Not in use Default: In use	Defines if the IED is in use or not.
Addresses		
Slave Address	0...255 Default: 1	The station address of the slave station.
Bad Quality Handling	Ignore Zero Send Exception Response No Response Default: Ignore	Determines how bad quality of mapped data is handled in response processing. It can either be ignored, zero-valued response data can be sent, an exception response can be sent, or no response at all may be sent.
OPC Server Command Timeout	0..3600 Default: 30	Timeout in seconds for the enforced OPC server write command.

6.4.5. Data object configuration

6.4.5.1. Configuring data objects

Configure data objects either in the **Object Properties** window or in the **Cross-References** window.

The actual configuration in the **Object Properties** window by using SAB600 is performed as described in 6.4.1, General information about configuring objects.

To configure the data objects in the Cross-References window:
1. Select the IED object in the object tree and right-click it.
2. Select the **Cross-References** window from the context menu.

3. Change the values in cross-references table by entering the new value in the table cell with the desired property.
4. Click **Save** to save the changes and to connect the data objects to the IED. The connected data objects appear as child objects for the IED. Modify the cross-reference information by selecting the data object and using the object properties window.

The parameters are stored in the object properties in SAB600 (see the tables for each data object type).

Table 6.4.5.1-1 Valid address ranges for configuring address values for Modbus IED data objects

Value range	Address value
00001..9999	Coils, 0X references
40001..49999	Holding registers, 4X references

Address value 0 means that the corresponding information is not available or not used in the configuration.

If you change the object names or the structure of objects connected to the IED in the OPC Server, open the cross-reference tool and verify that the changes are correctly handled. Click **Save** to update the configuration accordingly.

Modbus 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 Modbus OPC Client.

6.4.5.2. Directional protection activation information (ACD)

Table 6.4.5.2-1 Configurable ACD properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACD	Common data class according to IEC 61850.
Addresses		
General Address	0...65535 Default 0	General Address.
Neutral Address	0...65535 Default 0	Neutral Address.

Property/ Parameter	Value or Value range/ Default	Description
Phase A Address	0...65535 Default 0	Phase A Address.
Phase B Address	0...65535 Default 0	Phase B Address.
Phase C Address	0...65535 Default 0	Phase C Address.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Send as Double Point	True False Default: False	Specifies if a value of an indication signal is sent as a double point value.
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.

6.4.5.3. Protection activation information (ACT)

Table 6.4.5.3-1 Configurable ACT properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACT	Common data class according to IEC 61850.
Addresses		
General Address	0...65535 Default: 0	General Address.
Neutral Address	0...65535 Default: 0	

Property/ Parameter	Value or Value range/ Default	Description
Phase A Address	0...65535 Default: 0	Phase A Address.
Phase B Address	0...65535 Default: 0	Phase B Address.
Phase C Address	0...65535 Default: 0	Phase C Address.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Send as Double Point	True False Default: False	Specifies if a value of an indication signal is sent as a double point value.
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.

6.4.5.4. Analogue set point (APC)

Table 6.4.5.4-1 Configurable APC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	APC	Common data class according to IEC 61850.
Addresses		
Control Address	0...65535 Default: 0	Control address. Holding register address for the control. Holding register (4X reference) address range 40001-49999. Address 0 equals no information available.

Property/ Parameter	Value or Value range/ Default	Description
Indication Address	0…65535 Default: 0	Indication address. Holding register address for the control. Holding register (4X reference) address range 40001-49999. Address 0 equals no information available.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for write value.
Common		
Update Rate	0…60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.5. Binary counter reading (BCR)

Table 6.4.5.5-1 Configurable BCR properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BCR	Common data class according to IEC 61850.
Addresses		
Indication Address	0...65535 Default:0	Indication address.

Property/ Parameter	Value or Value range/ Default	Description
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for counter value.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.6. Binary controlled step position information (BSC)

Table 6.4.5.6-1 Configurable BSC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BSC	Common data class according to IEC 61850.
Addresses		
Control Address	0...65535 Default: 0	Control address.
Indication Address	0...65535 Default: 0	Indication address.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for position value.

Property/ Parameter	Value or Value range/ Default	Description
Scale	Default: None	Scale used with position information.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Received as Inverse Control Value	True False Default: False	Specifies if a control value is received as an inverse value.

6.4.5.7. Complex measured value (CMV)

Table 6.4.5.7-1 Configurable CMV properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	CMV	Common data class according to IEC 61850.
Addresses		
Address	0...65535 Default: 0	Indication address.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for measurement value.
Scale	Default: None	Scale used with measurement information.
Common		

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.8. Delta (DEL)

Table 6.4.5.8-1 Configurable DEL properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DEL	Common data class according to IEC 61850.
Addresses		
Phase AB Address	0...65535 Default: 0	Phase AB Address.
Phase BC Address	0...65535 Default: 0	Phase BC Address.
Phase CA Address	0...65535 Default: 0	Phase CA Address.
Data format Phase AB, BC, CA	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for measurement values.
Scale	Default: None	Scale used with measurement information.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.9. Controllable double point (DPC)

Table 6.4.5.9-1 Configurable DPC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Addresses		
Control Address	0...65535 Default: 0	Address for Control command.
Indication Address	0...65535 Default: 0	Address for Indication.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Received as Inverse Control Value	True False Default: False	Specifies if a control value is received as an inverse value.
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.
Send as Single Point	True False Default: False	Specifies if a value of an indication signal is sent as a single point value.

6.4.5.10. Double point status (DPS)

Table 6.4.5.10-1 Configurable DPS properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		

Property/ Parameter	Value or Value range/ Default	Description
Common Data Class	DPS	Common data class according to IEC 61850.
Addresses		
Indication	0...65535 Default: 0	Indication address.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.
Send as Single Point	True False Default: False	Specifies if a value of an indication signal is sent as a single point value.

6.4.5.11. Controllable integer status (INC)

Table 6.4.5.11-1 Configurable INC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	INC	Common data class according to IEC 61850.
Addresses		
Control Address	0...65535 Default: 0	Control address.
Indication Address	0...65535 Default: 0	Indication address.

Property/ Parameter	Value or Value range/ Default	Description
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for indication value.
Scale	Default: None	Scale used with indication value.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.12. Integer status (INS)

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

Table 6.4.5.12-1 Configurable INS properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	INS	Common data class according to IEC 61850.
Addresses		
Address	0...65535 Default: 0	Indication address.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format.

Property/ Parameter	Value or Value range/ Default	Description
Scale	Default: None	Scale used with indication value.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.13. Integer controlled step position information (ISC)

Table 6.4.5.13-1 Configurable ISC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ISC	Common data class according to IEC 61850.
Addresses		
Control Address	0...65535 Default: 0	Control address.
Indication Address	0...65535 Default: 0	Indication address.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format.
Scale	Default: None	Scale used with indication value.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.14. Measured value (MV)

Table 6.4.5.14-1 Configurable MV properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	MV	Common data class according to IEC 61850.
Addresses		
Address	0...65535 Default: 0	Indication address.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format.
Scale	Default: None	Scale used with measurement information.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.15. Controllable single point (SPC)

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

Table 6.4.5.15-1 Configurable SPC properties

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

Property/ Parameter	Value or Value range/ Default	Description
Control Address	0...65535 Default: 0	Control address.
Indication Address	0...65535 Default: 0	Indication address.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Received as Inverse Control Value	True False Default: False	Specifies if a control value is received as an inverse value.
Send as Double Point	True False Default: False	Specifies if a value of an indication signal is sent as a double point value.
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.

6.4.5.16. Single point status (SPS)

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

Table 6.4.5.16-1 Configurable SPS properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPS	Common data class according to IEC 61850.
Addresses		
Address	0...65535 Default: 0	Address.
Common		

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.
Data Specific		
Send as Double Point	True False Default: False	Specifies if a value of an indication signal is sent as a double point value.
Send as Inverse Value	True False Default: False	Specifies if a value of an indication signal is sent as an inverse value.

6.4.5.17. WYE

Table 6.4.5.17-1 Configurable WYE properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	WYE	Common data class according to IEC 61850.
Subtype		
Subtype	WYE Simple	Subtype of WYE.
Addresses		
Neutral Address	0...65535 Default: 0	Neutral address.
Phase A Address	0...65535 Default: 0	Phase A address.
Phase B Address	0...65535 Default: 0	Phase B address.
Phase C Address	0...65535 Default: 0	Phase C address.
Net Address	0...65535 Default: 0	Net address.

Property/ Parameter	Value or Value range/ Default	Description
Res Address	0...65535 Default: 0	Res address.
Data Format (Phase A, B, C, Net, Res)	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format.
Phase Scale	Default: None	Scale used for phase measurement value.
Neutral Scale	Default: None	Scale used for neutral.
Net Scale	Default: None	Scale used for Net.
Res Scale	Default: None	Scale used for Res.
Common		
Update Rate	0...60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.18. Controllable Enumerated Status (ENC)

Table 6.4.5.18-1 Configurable ENC properties

Property/Parameter	Value or Value range/Default	Description
Basic		
Common Data Class	ENC	Common data class according to IEC 61850.
Addresses		
Control Address	0..65535 Default: 0	Control address. Holding register address for the control. Holding register (4X reference) address range 40001-49999. Address 0 equals no information available.

Indication Address	0..65535 Default: 0	Indication address. Holding register address for the control. Holding register (4X reference) address range 40001-49999. Address 0 equals no information available.
Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for indication value.
Scale	Default: None	Scale used with indication value.
Common		
Update Rate	0…60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

6.4.5.19. Enumerated Status (ENS)

Table 6.4.5.19-1 Configurable ENS properties

Property/Parameter	Value or Value range/Default	Description
Basic		
Common Data Class	ENS	Common data class according to IEC 61850.
Addresses		
Indication Address	0..65535 Default: 0	Indication address. Holding register address for the control. Holding register (4X reference) address range 40001-49999. Address 0 equals no information available.

Data Format	1 = WORD 2 = Integer 3 = Long MSW First 4 = Long MSW Last 5 = Float MSW First 6 = Float MSW Last Default: 1	Data format for indication value.
Scale	Default: None	Scale used with indication value.
Common		
Update Rate	0…60000 Default: 0	Maximum update rate of indication changes between the OPC server and the client in milliseconds. The value 0 means that the server sends all the changes to the client.

7. External OPC client configuration

7.1. About this section

In this section, there is a list of the requirements that have to met by the 3rd party OPC Client as well as information on Windows settings (user IDs, DCOM).

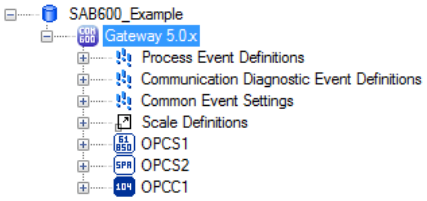
This section also gives you an overview of how to access the OPC servers of COM600 with a 3rd party OPC Client.

7.2. Requirements for the OPC Client

- Windows 2000 or newer operating system
- Support for OPC Data Access 2.0 Specification
- LAN/DCOM connection to COM600
- Possibility to modify DCOM and possible firewall settings to allow OPC DCOM communication with COM600

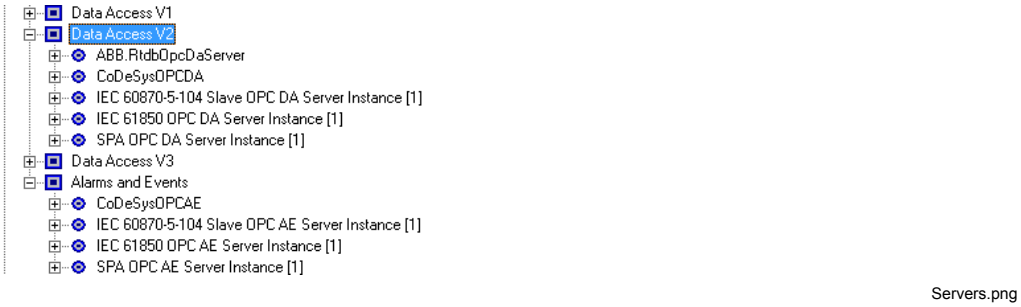
7.3. COM600 OPC servers

In Figure 7.3-1 and Figure 7.3-2 you can see the difference between viewing the OPC servers and clients of an example project in Station Automation Builder 600 (later referred to as SAB600), and viewing them in a 3rd party browser.



SAB600_Servers.png

Figure 7.3-1 Example project as seen in SAB600



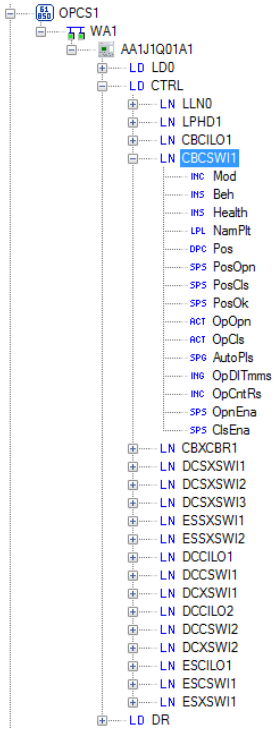
Servers.png

Figure 7.3-2 Example project loaded to COM600 and browsed with a 3rd party OPC Client

The 3rd party browser shows the separate servers for the Data Access and Alarms and Events. The instance numbers of the servers are embedded in brackets to the name of the server. The diagnostic and control OPC servers for the IEC101 Slave are also shown in the list.

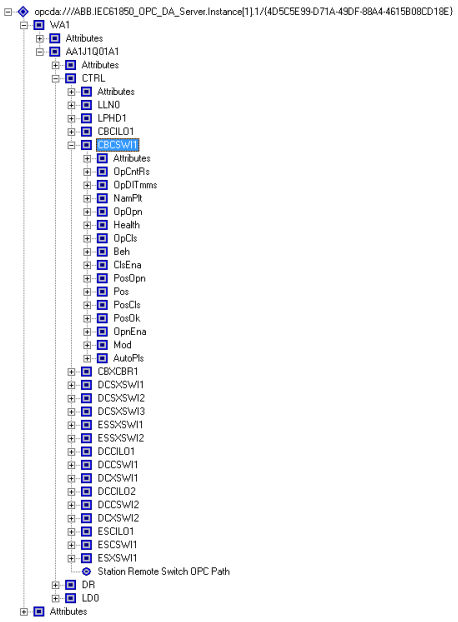
7.4. Data access

The OPC server namespace consists of channels, IEDs, logical devices, logical nodes, and data objects.



SAB600_IEC61850_OPC_Server_Namespace.png

Figure 7.4-1 IEC 61850 OPC Server namespace in SAB600

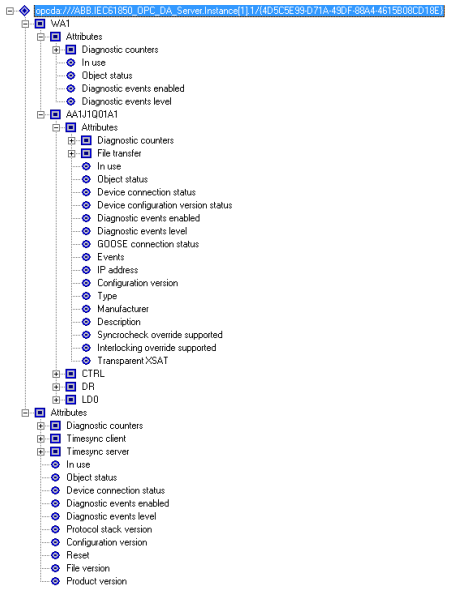


IEC61850_OPC_Server_Namespace.png

Figure 7.4-2 IEC 61850 OPC Server namespace in 3rd party OPC Client

IEC 61850 OPC Server namespace in SAB600 and 3rd party OPC Client are almost identical with some differences. For example, the scale definitions seen in the SAB600 namespace are not visible in the OPC server namespace, and the attributes appear in the OPC server namespace but not in the SAB600 namespace.

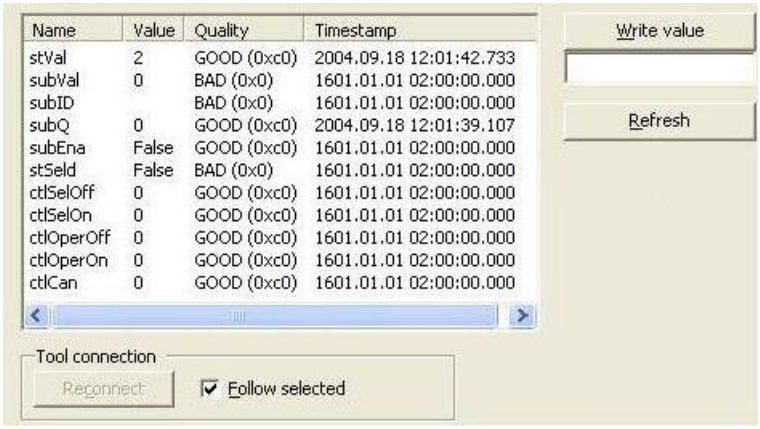
Attributes (Figure 7.4-3) contain OPC items for communication diagnostics and special functions like file transfer and transparent communication access.



IEC61850_OPC_Server_Namespace_Attributes.png

Figure 7.4-3 IEC 61850 OPC Server namespace and the attributes

The OPC items in data objects contain the actual process data. The items are not visible in the SAB600 namespace but they can be monitored online using the Diagnostic Tool in Figure 7.4-4.



pos_dpc_online_diagnostics.jpg

Figure 7.4-4 OPC items of Pos data object monitored with SAB600 online diagnostics. Pos object is an instance of DPC (Controllable Double Point) data class.

For the 3rd party OPC Client, the OPC items can be found from the namespace below the data objects in Figure 7.4-5. OPC items of a data object are specified by the data class of the object.

Generally, the names and the usage of these OPC items are protocol independent. Further information about the data classes, their OPC items and mapping to certain protocol can

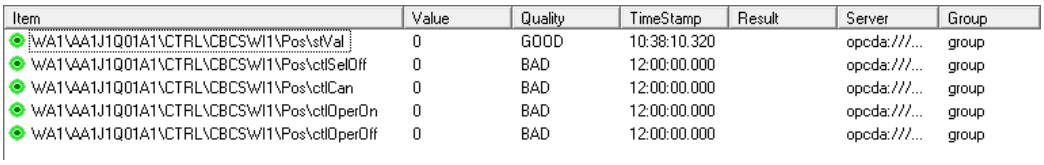
be found from the data object modeling chapter in the technical reference of protocol-specific user's manuals.

For more information on data modeling according to the IEC 61850 standard, refer to the section IEC 61850 Data modeling in COM600 User's Manual.

IEC61850_OPC_Server_Pos.png

Figure 7.4-5 OPC server namespace with the OPC items of Pos data object viewed with 3rd party OPC Client

Figure 7.4-6 shows group of OPC items subscribed by 3rd party OPC Client and monitored in a Diagnostic Tool. The figure also shows how the full OPC item name consists of the complete path name to the object with the backslash '\' character as a separator.



Item	Value	Quality	TimeStamp	Result	Server	Group
WA1\AA1J1Q01A1\CTRL\CBCSWI1\Pos\stVal	0	GOOD	10:38:10.320		opcda:///...	group
WA1\AA1J1Q01A1\CTRL\CBCSWI1\Pos\ctlSelOff	0	BAD	12:00:00.000		opcda:///...	group
WA1\AA1J1Q01A1\CTRL\CBCSWI1\Pos\ctlCan	0	BAD	12:00:00.000		opcda:///...	group
WA1\AA1J1Q01A1\CTRL\CBCSWI1\Pos\ctlOperOn	0	BAD	12:00:00.000		opcda:///...	group
WA1\AA1J1Q01A1\CTRL\CBCSWI1\Pos\ctlOperOff	0	BAD	12:00:00.000		opcda:///...	group

OPC_Item_Monitoring.png

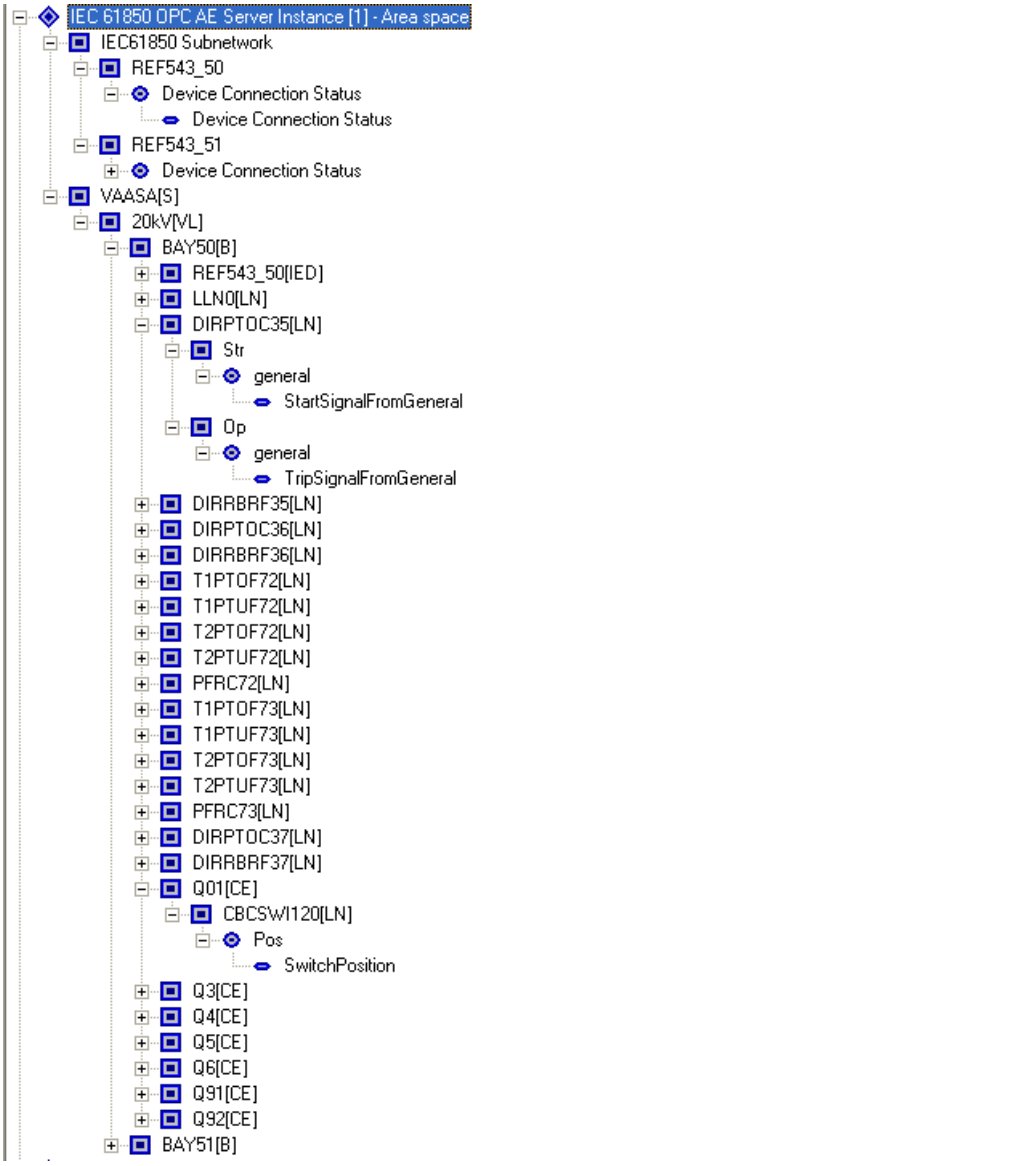
Figure 7.4-6 OPC items monitored with 3rd party OPC Client

7.5. Alarms and Events

The OPC Alarms and Events server interface is available for each master and slave protocol component. For both master and slave components, it can be used for supervising the communication status with diagnostics events. For master protocols, it is also possible to configure alarms and events for process data. Alarms and events are configured by linking the data objects and event definitions. See COM600 User's Manual for detailed information about the configuration of alarms and events.

The names for alarms and events are based either on the communication structure or substation structure names. If the data is connected to the substation structure, the name is based on the substation structure, otherwise the name is based on the communication structure.

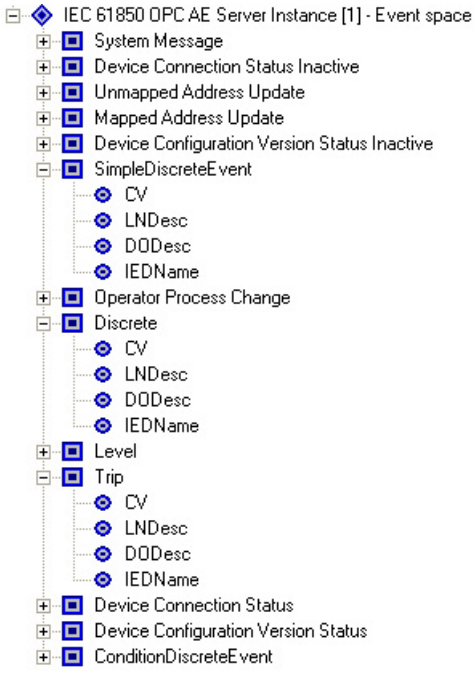
Simple and condition type events can be configured for discrete signals, for example single and double point status as well as for measurement limit value supervision. Control operations can be configured for tracking events. The event area of the OPC servers can be browsed using the browsing interface, see Figure 7.5-1.



AE_Area_space.bmp

Figure 7.5-1 An example view of the area space of an OPC server

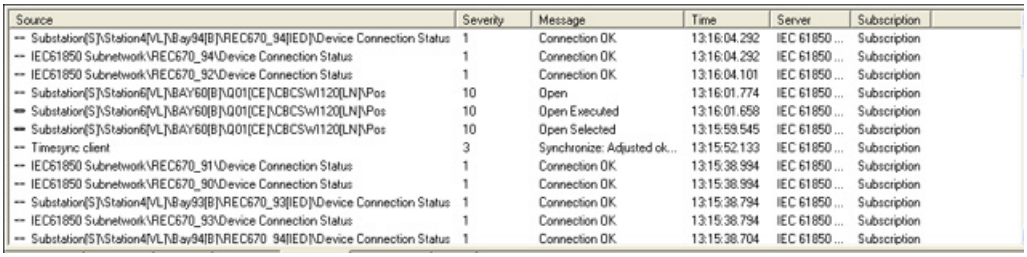
Event categories and their vendor-specific attributes are shown in Figure 7.5-2.



AE_Event_space.jpg

Figure 7.5-2 An example view of event categories of an OPC server

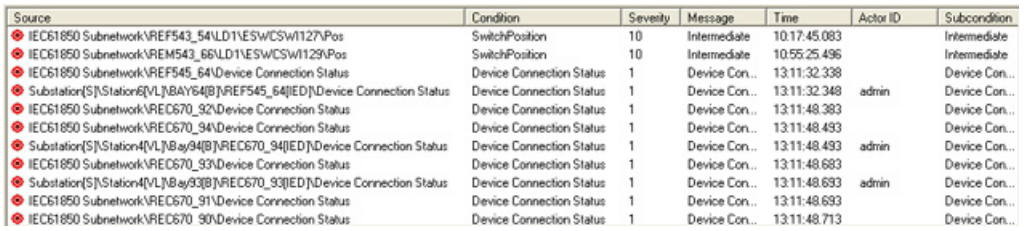
Example views of simple and tracking events and condition events are shown in Figure 7.5-3 and Figure 7.5-4.



Source	Severity	Message	Time	Server	Subscription
Substation[S]\Station4[VL]\Bay94[B]\REC670_94[IED]\Device Connection Status	1	Connection OK	13:16:04.292	IEC 61850 ...	Subscription
IEC61850 Subnetwork\REC670_94\Device Connection Status	1	Connection OK	13:16:04.292	IEC 61850 ...	Subscription
IEC61850 Subnetwork\REC670_92\Device Connection Status	1	Connection OK	13:16:04.101	IEC 61850 ...	Subscription
Substation[S]\Station6[VL]\BAY60[B]\Q01[CE]\CBCSWI120[LN]\Pos	10	Open	13:16:01.774	IEC 61850 ...	Subscription
Substation[S]\Station6[VL]\BAY60[B]\Q01[CE]\CBCSWI120[LN]\Pos	10	Open Executed	13:16:01.658	IEC 61850 ...	Subscription
Substation[S]\Station6[VL]\BAY60[B]\Q01[CE]\CBCSWI120[LN]\Pos	10	Open Selected	13:15:59.545	IEC 61850 ...	Subscription
Timesync client	3	Synchronize: Adjusted ok...	13:15:52.133	IEC 61850 ...	Subscription
IEC61850 Subnetwork\REC670_91\Device Connection Status	1	Connection OK	13:15:38.994	IEC 61850 ...	Subscription
IEC61850 Subnetwork\REC670_90\Device Connection Status	1	Connection OK	13:15:38.994	IEC 61850 ...	Subscription
Substation[S]\Station4[VL]\Bay93[B]\REC670_93[IED]\Device Connection Status	1	Connection OK	13:15:38.794	IEC 61850 ...	Subscription
IEC61850 Subnetwork\REC670_93\Device Connection Status	1	Connection OK	13:15:38.794	IEC 61850 ...	Subscription
Substation[S]\Station4[VL]\Bay94[B]\REC670_94[IED]\Device Connection Status	1	Connection OK	13:15:38.704	IEC 61850 ...	Subscription

AE_simple_tracking_events.jpg

Figure 7.5-3 An example view of simple and tracking events



Source	Condition	Severity	Message	Time	Actor ID	Subcondition
IEC61850 Subnetwork\REF543_54\LD1\ESWCSWI127\Pos	SwitchPosition	10	Intermediate	10:17:45.083		Intermediate
IEC61850 Subnetwork\REM543_66\LD1\ESWCSWI129\Pos	SwitchPosition	10	Intermediate	10:55:25.496		Intermediate
IEC61850 Subnetwork\REF545_64\Device Connection Status	Device Connection Status	1	Device Con...	13:11:32.338		Device Con...
Substation[S]\Station6[VL]\BAY64[B]\REF545_64[IED]\Device Connection Status	Device Connection Status	1	Device Con...	13:11:32.348	admin	Device Con...
IEC61850 Subnetwork\REC670_92\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.383		Device Con...
IEC61850 Subnetwork\REC670_94\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.493		Device Con...
Substation[S]\Station4[VL]\Bay94[B]\REC670_94[IED]\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.493	admin	Device Con...
IEC61850 Subnetwork\REC670_93\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.683		Device Con...
Substation[S]\Station4[VL]\Bay93[B]\REC670_93[IED]\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.693	admin	Device Con...
IEC61850 Subnetwork\REC670_91\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.693		Device Con...
IEC61850 Subnetwork\REC670_90\Device Connection Status	Device Connection Status	1	Device Con...	13:11:48.713		Device Con...

pics/AE_conditions.jpg

Figure 7.5-4 An example view of condition events

7.6. DCOM configuration

User authentication is required between the client and the server computer. In practice, this means that the same user account with the same password must exist in the COM600 Computer and in the 3rd party OPC Client computer. The OPC Client must be run within this user account.

OPC servers in COM600 Computer are run within a preconfigured user account named as COM600 (factory default password: aEc2006rs). One possibility is to create the COM600 user to the client computer as well, and run the OPC Client within this user account. Another possibility is to create a new user to the COM600 Computer, the same user that is used in the client computer. In the latter case it is still required to create the COM600 user to the client computer as it is needed for the OPC servers' access to the client computer.

Note that if you want to change the default COM600 user's password it must be done using the management tool in SAB600, as the password is configured in the DCOM configuration for each component in COM600.

It is also required to enable the DCOM in the client computer. This can be done using the DCOMCNFG program. In some operating systems like Windows XP you must note the following: the default installation for XP forces remote users to authenticate as Guest. This means that DCOM clients cannot connect to a server running on an XP computer unless the Guest account is enabled and has enough rights to launch the server.

To adjust the setting from the control panel:
1. Click **Start/Control Panel/Administrative Tools**.
2. Open the **Local Security Settings** window.
3. Expand the tree view and select **Security Options** in the left-hand pane.
4. In the right-hand pane, scroll down and select **Network Access**: Sharing and security settings for local accounts.
5. Right-click and select **Properties**.
6. Select **Classic - local users authenticate as themselves**.

More information about setting up the DCOM can be found from the Microsoft and OPC Foundation internet sites. OPC Foundation has published a number of reports about using OPC via DCOM, which can be downloaded from their internet site (www.opcfoundation.org)

8. IEC 61850 Proxy server operation

8.1. About this section

This section describes the basic operation procedures you can carry out after the IEC 61850 Proxy Server object properties have been configured.

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

Please note that IEC 61580 Proxy OPC Server supports only IEC 61850 Ed1.

8.2. Activating COM600 with new configurations

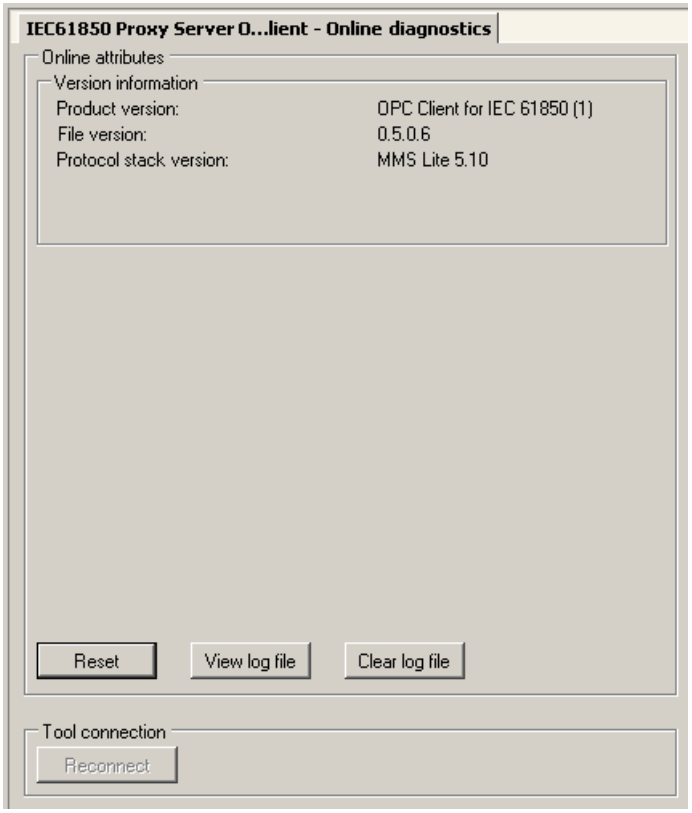
For information about activating COM600 with new configuration, see COM600 User's Manual.

8.3. Diagnostics

8.3.1. IEC 61850 Proxy Server OPC Client

8.3.1.1. Online diagnostics

To view version information on IEC 61850 Proxy Server Client or to monitor and control the state of the client, right-click the IEC 61850 Proxy Server OPC Client and select **Online diagnostics**.



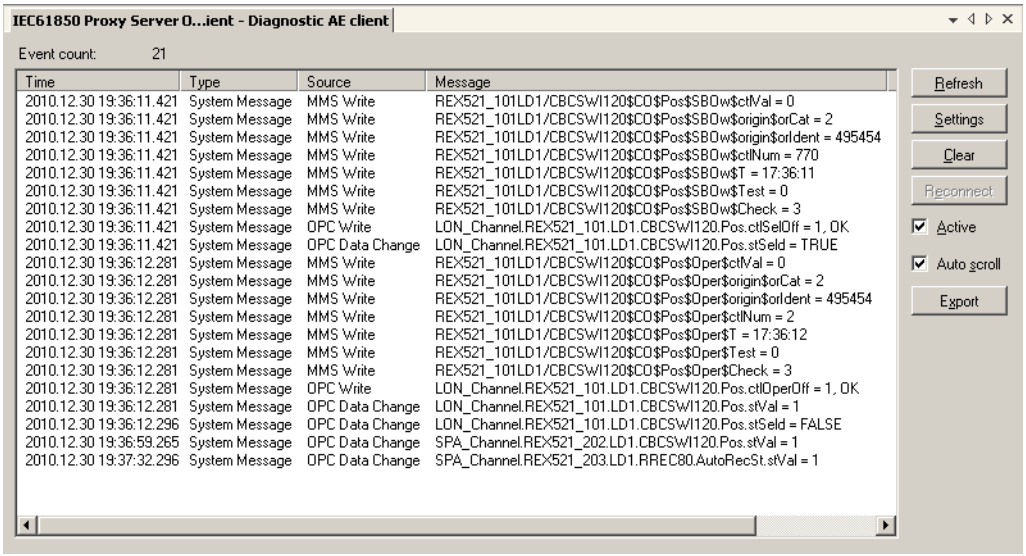
Proxy_online_diagnostics.png

Figure 8.3.1.1-1 IEC 61850 Proxy Server Online diagnostics

In Online diagnostics dialog box you can:
- reset the IEC 61850 Proxy Server OPC Client
- view the event log file
- clear the event log file

8.3.1.2. Diagnostic AE client

Diagnostic events can be monitored and controlled using the Diagnostic AE Client function, see Figure 8.3.1.2-1.



Proxy_diagnostic_AE_client.png

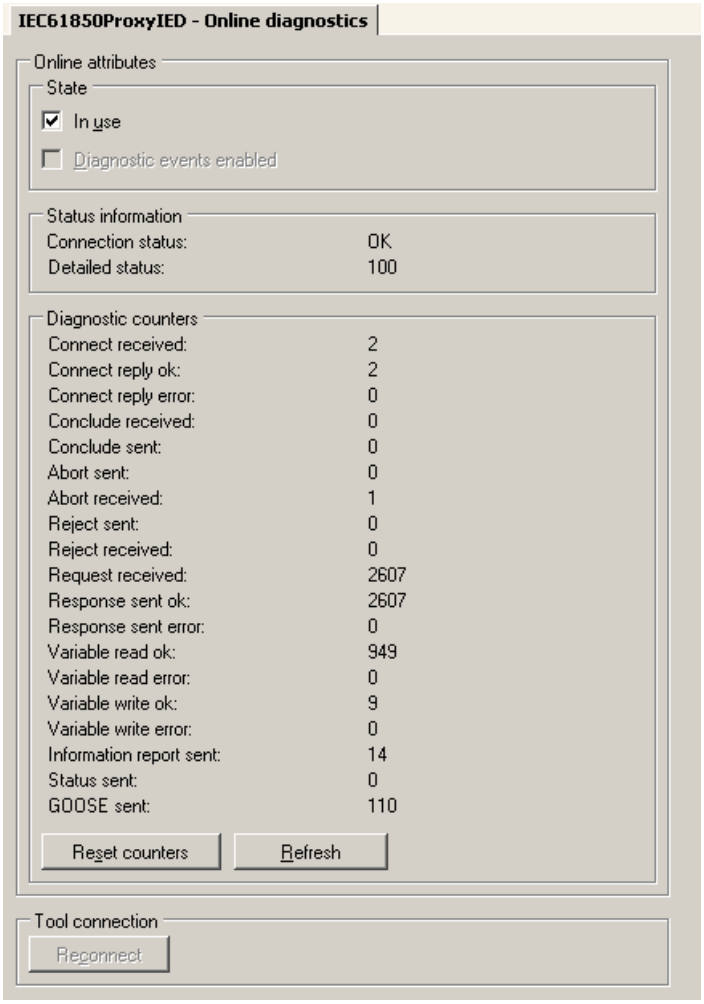
Figure 8.3.1.2-1 IEC 61850 Proxy Server Diagnostic AE client

8.3.2. IEC 61850 Proxy IED

8.3.2.1. Online diagnostics

The IEC 61850 communication activity can be monitored with the Online diagnostics function, see Figure 8.3.2.1-1:

- In the Status information field, you can monitor the device status.
- In the Diagnostic counters field, you can monitor the communication activity. The available attributes can be seen in Figure 8.3.2.1-1.
- To reset Diagnostic counters, click **Reset counters**.
- To take the IEC 61850 communication into use, select the **In use** checkbox. To take the communication out of use, clear the checkbox.
- Diagnostic counters are updated every 2 seconds. To update them manually, click **Refresh**.



IED_online_diagnostics.png

Figure 8.3.2.1-1 IEC 61850 Proxy IED online diagnostics

9. IEC 104 OPC slave operation

9.1. About this section

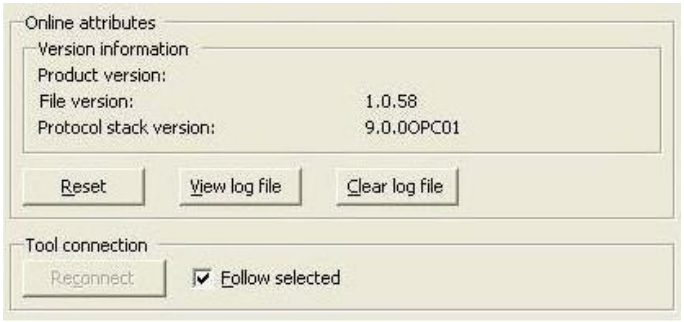
This section describes the basic operation procedures you can carry out after the object properties for the IEC104 Slave OPC Client have been configured.

9.2. Activating COM600 with new configurations

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

9.3. IEC104 Slave OPC Client diagnostics

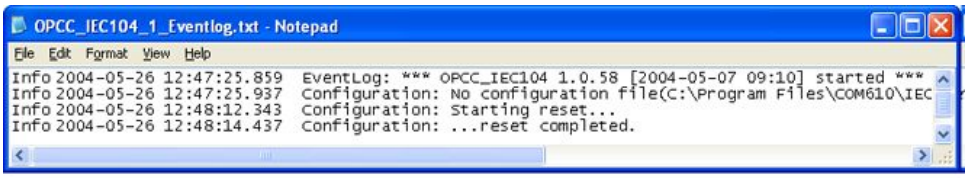
To view version information on IEC104 Slave OPC Client or to monitor and control the state of the client, right-click the IEC104 Slave OPC Client and select **Online diagnostics**, see Figure 9.3-1.



IEC104_Slave_OPC_Client_Online_diagnostics.jpg

Figure 9.3-1 IEC104 Slave OPC Client Online diagnostics

In Online diagnostics box you can:
- reset IEC104 Slave OPC Client
- view the event log file, see Figure 9.3-2
- clear the event log file



IEC104_OPC_Client_Online_Diagnostics_view_log_file.jpg

Figure 9.3-2 Event log file

9.4. IEC104 Channel diagnostics

The IEC104 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 IEC104 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 IEC104 Channel into use by marking the **In use** check box. If you unmark the check box, the channel is taken out of use. To update diagnostic counters, click **Refresh**.

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

9.5. IEC104 Device diagnostics

The IEC104 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 IEC104 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 IEC104 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**.

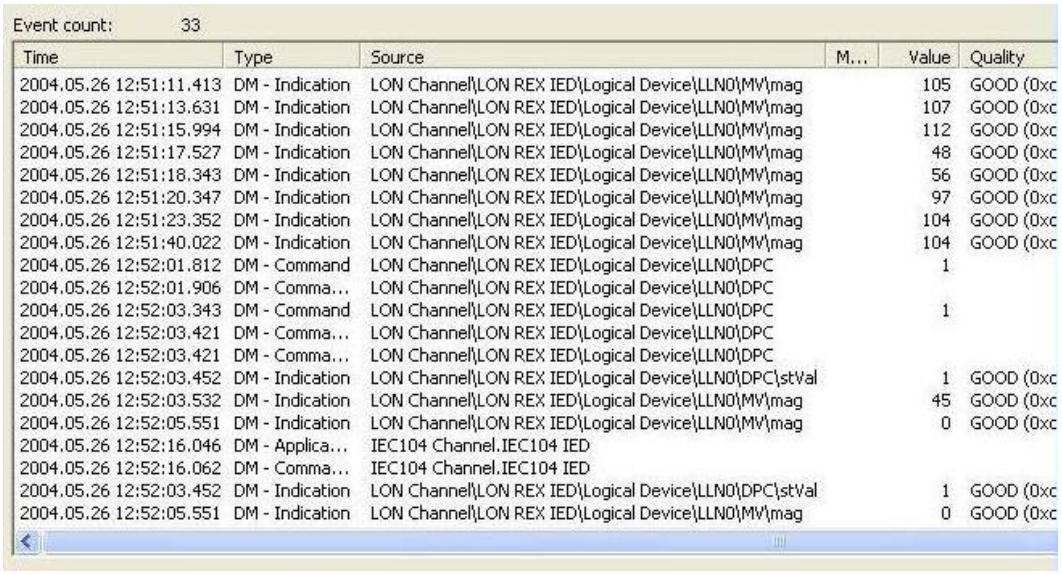
9.6. Signal diagnostics

The IEC104 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 IEC104 Device. When the diagnostic function is activated,

the IEC104 OPC Client Alarm & Event server generates events with information about data changes and commands.

To view the event list:

1. Select the IEC104 Slave OPC Client object in the object tree of SAB600.
2. Right-click the IEC104 Slave OPC Client.
3. Select **Diagnostic AE client** (see Figure 9.6-1)



Event count: 33

Time	Type	Source	M...	Value	Quality
2004.05.26 12:51:11.413	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		105	GOOD (0xc
2004.05.26 12:51:13.631	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		107	GOOD (0xc
2004.05.26 12:51:15.994	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		112	GOOD (0xc
2004.05.26 12:51:17.527	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		48	GOOD (0xc
2004.05.26 12:51:18.343	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		56	GOOD (0xc
2004.05.26 12:51:20.347	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		97	GOOD (0xc
2004.05.26 12:51:23.352	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		104	GOOD (0xc
2004.05.26 12:51:40.022	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		104	GOOD (0xc
2004.05.26 12:52:01.812	DM - Command	LON Channel\LON REX IED\Logical Device\LLN0\DPC		1	
2004.05.26 12:52:01.906	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLN0\DPC			
2004.05.26 12:52:03.343	DM - Command	LON Channel\LON REX IED\Logical Device\LLN0\DPC		1	
2004.05.26 12:52:03.421	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLN0\DPC			
2004.05.26 12:52:03.421	DM - Comma...	LON Channel\LON REX IED\Logical Device\LLN0\DPC			
2004.05.26 12:52:03.452	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\DPC\stVal		1	GOOD (0xc
2004.05.26 12:52:03.532	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		45	GOOD (0xc
2004.05.26 12:52:05.551	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		0	GOOD (0xc
2004.05.26 12:52:16.046	DM - Applica...	IEC104 Channel.IEC104 IED			
2004.05.26 12:52:16.062	DM - Comma...	IEC104 Channel.IEC104 IED			
2004.05.26 12:52:03.452	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\DPC\stVal		1	GOOD (0xc
2004.05.26 12:52:05.551	DM - Indication	LON Channel\LON REX IED\Logical Device\LLN0\MV\mag		0	GOOD (0xc

IEC104_Diagnostic_AE_Client.jpg

Figure 9.6-1 IEC104 Slave OPC Client Diagnostic AE client

Detailed information about field values (ASDU types, qualifier values and so on) can be found in the IEC 60870-5-104 standard documentation.

10. DNP3 LAN/WAN OPC slave operation

10.1. About this section

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

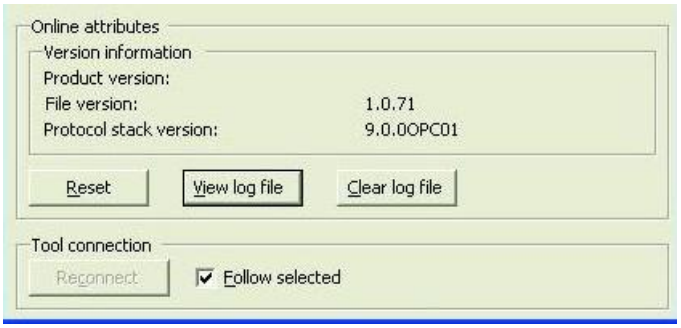
After this, you can, for example, monitor and control the condition of connections in the network. This is done by using the Online diagnostics function in SAB600.

10.2. Activating COM600 with new configurations

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

10.3. DNP LAN Slave OPC Client diagnostics

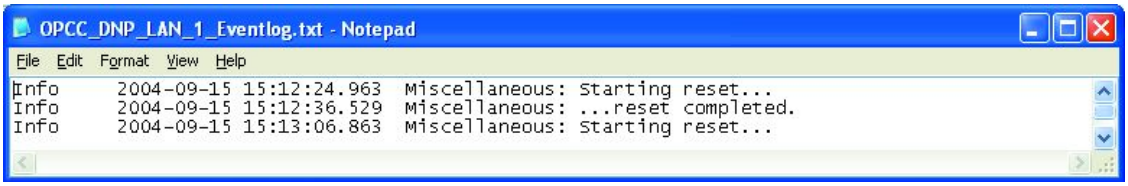
To view version information on DNP LAN Slave OPC Client or to monitor and control the state of the client, right-click the DNP LAN Slave OPC Client object and select **Online diagnostics**, see Figure 10.3-1.



A040346.jpg

Figure 10.3-1 DNP LAN Slave OPC Client Online diagnostics

In Online diagnostics box you can:
- reset DNP LAN Slave OPC Client
- view the event log file, see Figure 10.3-2
- clear the event log file



A040347.jpg

Figure 10.3-2 Event log file

10.4. DNP LAN Channel diagnostics

The DNP LAN 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 DNP LAN 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 a DNP LAN 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.

10.5. DNP LAN IED diagnostics

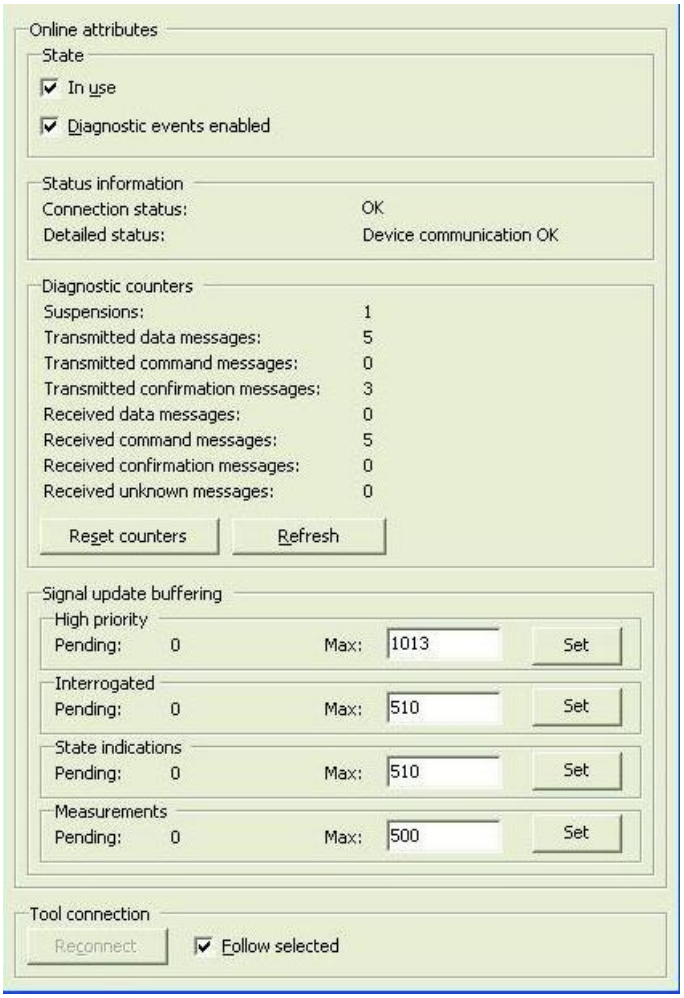
The DNP LAN IED communication can be monitored with the Online diagnostics function. You can also take a device into use or out of use as described in this section.

To monitor and control DNP LAN IED 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 a DNP LAN IED 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**.



A040349.jpg

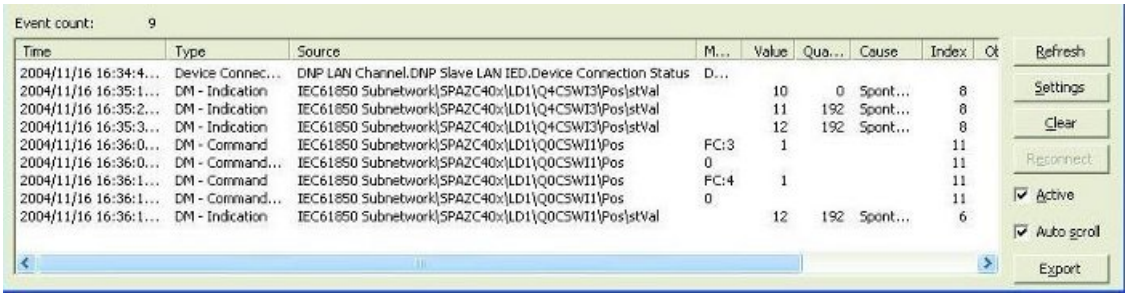
Figure 10.5-1 DNP LAN IED Online diagnostics

10.6. Signal diagnostics

The DNP LAN 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 DNP LAN IED. When the diagnostic function is activated, the DNP OPC Client Alarm & Event server generates events with information about data changes and commands.

To view the event list:

1. Select the DNP LAN Slave OPC Client object in the object tree of SAB600.
2. Right-click the DNP LAN Slave OPC Client.
3. Select **Diagnostic AE client** (see Figure 10.6-1)



A040350.jpg

Figure 10.6-1 DNP LAN Slave OPC Client Diagnostic AE client

Detailed information about field values (ASDU types, qualifier values and so on) can be found in the DNP standard documentation.

11. Modbus TCP slave operation

11.1. About this section

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

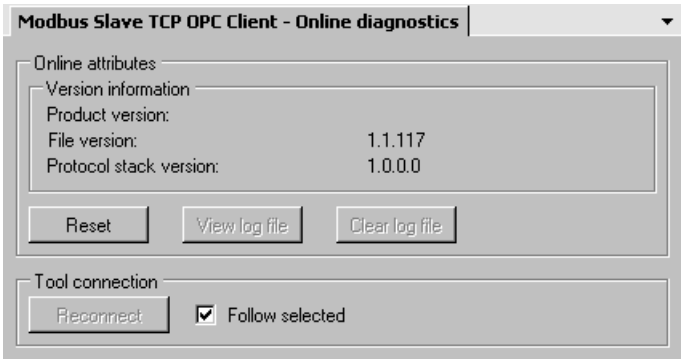
After this you can, for example, monitor and control the condition of connections in the network. This is done by using the Online diagnostics function in SAB600.

11.2. Activating COM600 with new configurations

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

11.3. Modbus TCP Slave OPC Client diagnostics

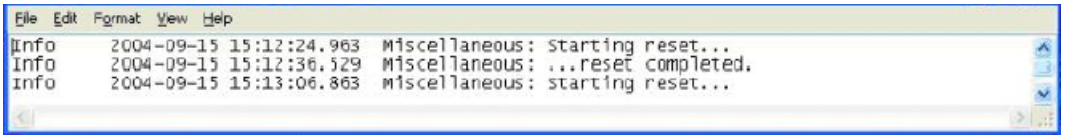
To view version information on Modbus TCP Slave OPC Client or to monitor and control the state of the client, right-click the Modbus TCP Slave OPC Client object and select **Online diagnostics**, see Figure 11.3-1.



Modbus_TCP_Slave_OPC_Client.jpg

Figure 11.3-1 Modbus TCP Slave OPC Client Online diagnostics

In the Online diagnostics box you can:
- reset Modbus TCP Slave OPC Client
- view the event log file, see Figure 11.3-2
- clear the event log file.



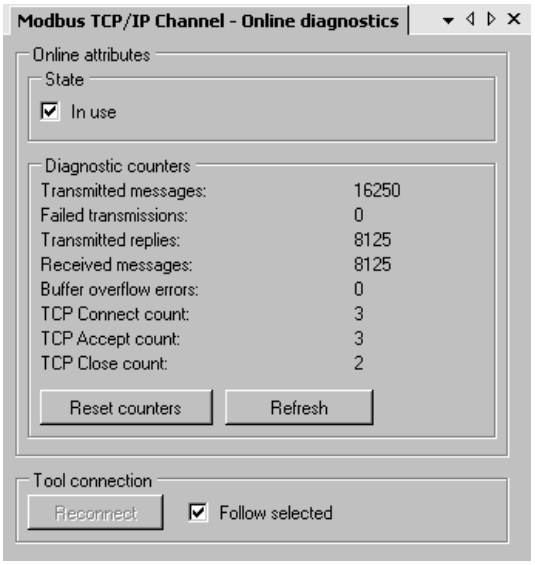
Event_log_file.png

Figure 11.3-2 Event log file

11.4. Monitoring Modbus TCP Channel activity

The Modbus TCP 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 Modbus TCP 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**.
4. Monitor the channel activity in the **Diagnostic counters** field. The available attributes can be seen in Figure 11.4-1.
5. To reset Diagnostic counters, click **Reset counters**.



Modbus_TCP_Channel_Online_diagnostics.png

Figure 11.4-1 Modbus TCP Channel Online diagnostics

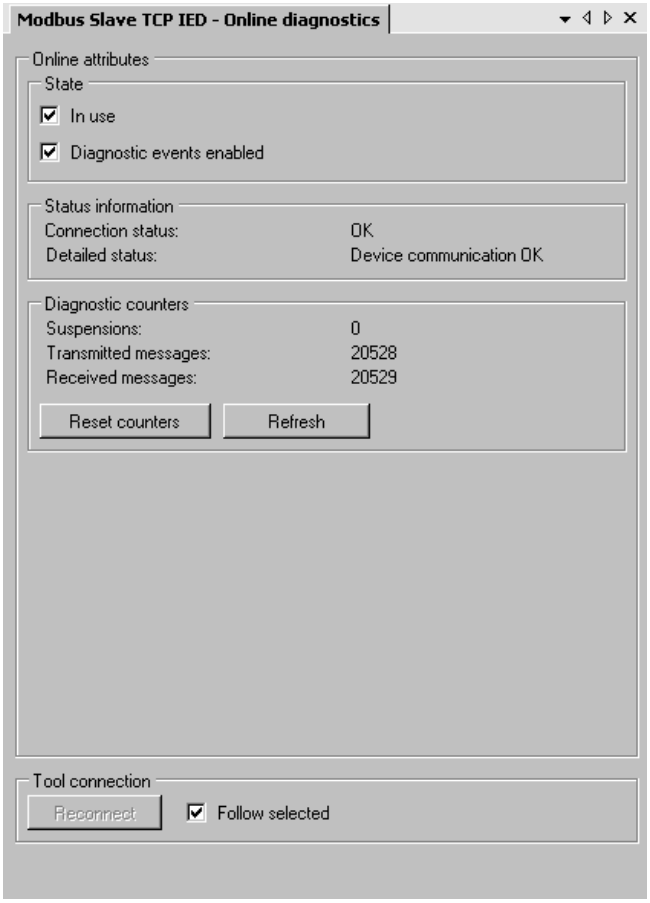
To take a Modbus TCP Channel into use:
1. Select the **In use** check-box. If you clear the check-box, the channel is taken out of use.
2. Update diagnostic counters by clicking **Refresh**.

11.5. Monitoring Modbus TCP IED communication

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

To monitor and control Modbus TCP IED communication:
1. Select the device you want to monitor in the object tree of SAB600.
2. Right-click the device.
3. Select **Online diagnostics**.
4. Monitor the device status in the **Status information** field. The **Diagnostic counters** field provides information on the device activity.
5. To reset diagnostic counters, click **Reset counters**.

To take a Modbus TCP IED into use:
1. Select the **In use** check-box. If you clear the check-box, the device is taken out of use.
2. Update diagnostic counters by clicking **Refresh**.



Modbus_TCP_IED_Online_diagnostics.png

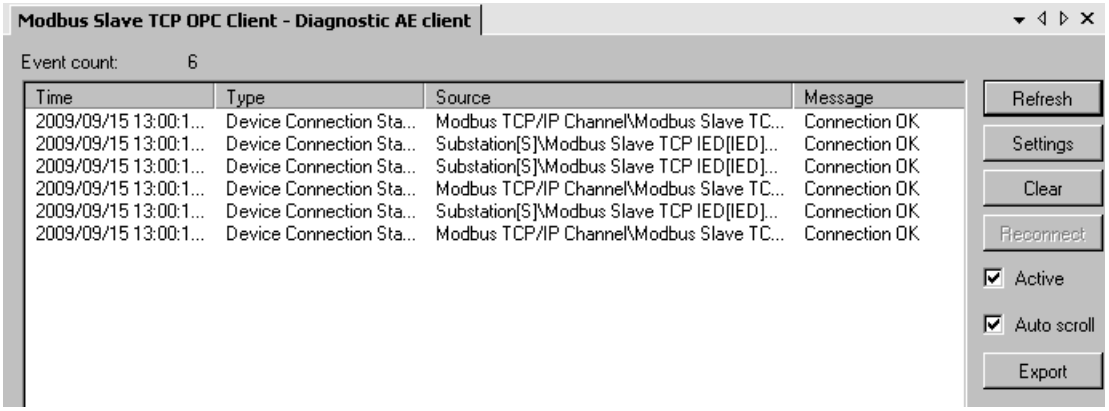
Figure 11.5-1 Modbus TCP IED Online diagnostics

11.6. Viewing events

The Modbus TCP Slave OPC Client has a diagnostic function, which enables monitoring of the flow of process data changes and commands. When the diagnostic function is activated, the Modbus OPC Client Alarm & Event server generates events with information about data changes and commands.

To view the event list:

1. Activate the diagnostics function by selecting the **Diagnostic Events Enabled** check-box, located in the Online diagnostics function of the Modbus TCP IED.
2. Select the Modbus TCP Slave OPC Client object in the object tree of SAB600.
3. Right-click the Modbus TCP Slave OPC Client.
4. Select **Diagnostic AE client**



Modbus_TCP_Slave_OPC_Client_Diagnostics_AE_Client.png

Figure 11.6-1 Modbus TCP Slave OPC Client Diagnostic AE client

Index

A

B

C

D

E

F

G

I

M

O

P

R

S

U

V

W

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