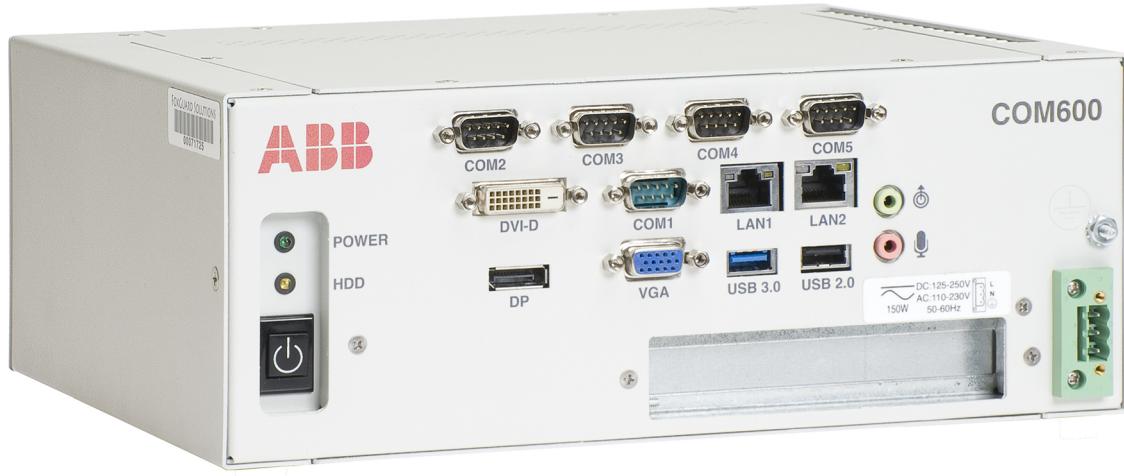


---

# **COM600 series, Version 5.1**

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





**Contents:**

<b>1. About this manual .....</b>	<b>7</b>
1.1. Copyright .....	7
1.2. Disclaimer .....	7
1.3. Conformity .....	8
1.4. Trademarks .....	8
1.5. General information .....	8
1.6. Document conventions .....	9
1.7. Use of symbols .....	10
1.8. Terminology .....	10
1.9. Abbreviations .....	11
1.10. Related documents .....	12
1.11. Document revisions .....	12
<b>2. Introduction .....</b>	<b>13</b>
2.1. General information about the COM600 series .....	13
2.2. COM600 product series variants and rationale .....	13
2.3. Functional overview .....	14
2.4. IEC101 OPC Server features .....	15
<b>3. Configuration .....</b>	<b>16</b>
3.1. About this section .....	16
3.2. Overview of configuration .....	16
3.3. Building object tree .....	18
3.3.1. General information about building object tree .....	18
3.3.2. Adding Gateway object .....	19
3.3.3. Adding IEC101 OPC Server object .....	19
3.3.4. Adding IEC101 Channel objects .....	19
3.3.5. Adding IEC101 Device objects .....	19
3.3.6. Adding Logical Device objects .....	20
3.3.7. Adding Logical Node objects .....	20
3.3.8. Adding data objects .....	20
3.4. Configuring objects .....	20
3.4.1. IEC101 OPC Server properties .....	20
3.4.2. Configuring Channel Properties .....	21
3.4.2.1. Configuring IEC101 Balanced Channel properties .....	21
3.4.2.2. Configuring IEC101 Unbalanced Channel properties .....	24
3.4.3. Configuring IEC101 Device properties .....	27
3.4.4. Configuring data objects .....	31
3.4.4.1. Directional protection activation information (ACD) .....	31
3.4.4.2. Protection activation information (ACT) .....	32
3.4.4.3. Analogue set point (APC) .....	33

3.4.4.4.	Binary counter reading (BCR) .....	34
3.4.4.5.	Binary controlled step position information (BSC) .....	34
3.4.4.6.	Complex measured value (CMV) .....	35
3.4.4.7.	Delta (DEL) .....	36
3.4.4.8.	Controllable double point (DPC) .....	36
3.4.4.9.	Device Name Plate (DPL) .....	37
3.4.4.10.	Double point status (DPS) .....	38
3.4.4.11.	Controllable integer status (INC) .....	39
3.4.4.12.	Integer status (INS) .....	39
3.4.4.13.	Integer controlled step position information (ISC) .....	40
3.4.4.14.	Logical Node Name Plate (LPL) .....	40
3.4.4.15.	Measured value (MV) .....	41
3.4.4.16.	Controllable single point (SPC) .....	42
3.4.4.17.	Single point status (SPS) .....	43
3.4.4.18.	WYE .....	43
<b>4. Operation .....</b>	<b>46</b>	
4.1.	About this section .....	46
4.2.	Activating COM600 with new configurations .....	46
4.3.	IEC101 OPC Server diagnostics .....	46
4.4.	Monitoring and controlling IEC101 Channel Activity .....	47
4.5.	Monitoring and controlling IEC101 Device communication .....	48
4.6.	Data object diagnostics .....	49
<b>5. Technical reference .....</b>	<b>50</b>	
5.1.	About this section .....	50
5.2.	IEC 61850 data modeling .....	50
5.2.1.	General information about IEC 61850 data modeling ....	50
5.2.2.	Single point status (SPS) .....	50
5.2.3.	Double point status (DPS) .....	51
5.2.4.	Integer status (INS) .....	51
5.2.5.	Enumerated Status (ENS) .....	51
5.2.6.	Protection activation information (ACT) .....	52
5.2.7.	Directional protection activation information (ACD) ....	52
5.2.8.	Binary counter reading (BCR) .....	53
5.2.9.	Measured value (MV) .....	53
5.2.10.	Complex measured value (CMV) .....	54
5.2.11.	WYE .....	54
5.2.12.	Delta (DEL) .....	55
5.2.13.	Controllable single point (SPC) .....	55
5.2.14.	Controllable double point (DPC) .....	55
5.2.15.	Controllable integer status (INC) .....	56
5.2.16.	Controllable Enumerated Status (ENC) .....	56
5.2.17.	Binary controlled step position information (BSC) .....	57
5.2.18.	Integer controlled step position information (ISC) .....	57

5.2.19. Analogue set point (APC) .....	58
5.3. Status codes .....	58
5.3.1. Introduction .....	58
5.3.2. Link layer status codes .....	58
5.3.3. Application layer status codes .....	59
5.4. Attributes .....	60
5.4.1. Server attributes .....	60
5.4.2. Channel attributes .....	60
5.4.3. Device attributes .....	61
<b>6. Appendix 1 .....</b>	<b>63</b>
6.1. Interoperability list for IEC101 OPC Server .....	63
<b>Index .....</b>	<b>71</b>



## 1. About this manual

### 1.1. Copyright

This document and parts thereof must not be reproduced or copied without written permission from ABB, and the contents thereof must not be imparted to a third party, nor used for any unauthorized purpose.

The software or hardware described in this document is furnished under a license and may be used, copied, or disclosed only in accordance with the terms of such license.

### Warranty

Please inquire about the terms of warranty from your nearest ABB representative.

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

### 1.2. Disclaimer

The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All persons responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. In particular, any risks in applications where a system failure and/ or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks.

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

This document has been carefully checked by ABB but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall ABB

be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

## **1.3.**

### **Conformity**

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

## **1.4.**

### **Trademarks**

ABB is a registered trademark of ABB Group. All other brand or product names mentioned in this document may be trademarks or registered trademarks of their respective holders.

## **1.5.**

### **General information**

This manual provides thorough information on the IEC 60870-5-101 Master protocol (later referred to as IEC101 OPC Server) and the central concepts and instructions related to it. The basic operation procedures are also discussed.

Information in this user's manual is intended for application engineers who configure IEC101 OPC Server.

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

This user's manual is divided into following sections:

#### **Introduction**

This section gives an overview of the IEC101 Master OPC Server and states the system requirements to be met.

#### **Configuration**

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

## **Operation**

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

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

## **Technical reference**

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

## **1.6.**

### **Document conventions**

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press ESC E C indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: **MenuItem** > **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.

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

## 1.9. Abbreviations

Abbreviation	Description
AE	Alarms and Events
DA	Data Access
DO	Data Object
GW	Gateway, component connecting two communication networks together
WebHMI	Web Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
LAN	Local Area Network
LD	Logical Device
LN	Logical Node

Abbreviation	Description
NCC	Network Control Center
OLE	Object Linking and Embedding
OPC	OLE for Process Control
P&C	Protection & Control
PLC	Programmable Logic Controller
POU	Program Organization Unit
RTS	Request To Send
SA	Substation Automation
SCD	Substation Configuration Description
SCL	Substation Configuration Language
SFC	Sequential Function Chart
SLD	Single Line Diagram
XML	eXtended Markup Language

## 1.10. Related documents

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

## 1.11. Document revisions

Document version/date	Product revision	History
A/13.2.2009	3.3	Document created
B/06.11.2009	3.4	Document revised
C/30.6.2011	3.5	Document revised
D/31.5.2012	4.0	Document revised
E/13.3.2015	4.1	Document revised
F/24.5.2017	5.0	Document revised
G/6.3.2018	5.1	Document revised

## 2. Introduction

### 2.1. General information about the COM600 series

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

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

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

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

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

### 2.2. COM600 product series variants and rationale

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

The main reasons for such an approach are the following:

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

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

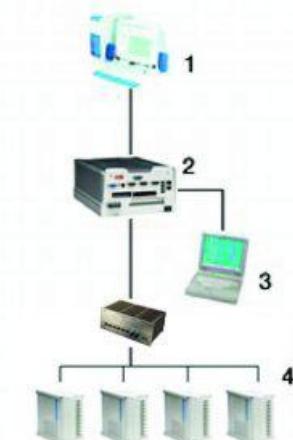
- COM600S IEC – COM600 for substation automation, analysis and data management (for IEC markets)
  - COM600S IEC is a substation automation, analyzer and data management unit that integrates devices, facilitates operations, manages communication and runs analysis applications pertinent to equipment or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

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

## 2.3.

### Functional overview

The IEC101 OPC Server provides methods for OPC clients to exchange data with devices communicating via the IEC 60870-5-101 Master protocol.



IEC101\_master\_protocol.JPG

Figure 2.3-1 IEC 101 OPC Server system overview

- (1) NCC (Network Control Center)
- (2) COM600 with IEC 101 OPC Server
- (3) Station Automation Builder 600 (SAB600)
- (4) Protection and control devices communicating through the IEC 101 master protocol

The IEC101 OPC Server software has two parts: Engineering and diagnostic tools and the actual IEC101 OPC Server. Engineering and diagnostic tools utilize the SAB600 framework and provide the user interface for engineering and diagnosing the IEC101 OPC Server. The IEC101 OPC Server handles the data transfer and conversion between the IEC101 protocol and OPC interfaces.

To create a common and protocol independent data interface between the OPC server and client, the process data from the IEC101 devices is remodeled using the IEC 61850 data modeling.

The configuration data is stored in the SCL format. After the IEC101 OPC Server has been launched, it reads the configuration file and establishes communication with the IEC101 devices through the IEC101 protocol stack.

Configured IEC101 devices and data modeled according to the IEC 61850 model, are then exposed to OPC clients through a Data Access (DA) server.

## 2.4.

### **IEC101 OPC Server features**

The IEC101 OPC Server supports the following features:

- OPC Data Access v. 1.0/2.0
- OPC Alarms and Events specifications v. 1.10
- IEC 61850 data modeling
- System supervision:
  - IEC101 channel communication
  - IEC101 device communication
- Supported IEC 60870-5-101 data types and functions.

See Appendix 16.1, Interoperability list for IEC101 OPC Server for more information.

## 3. Configuration

### 3.1. About this section

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

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**.

### 3.2. Overview of configuration

Before you can start using the IEC101 OPC Server, build, and configure an object tree in SAB600 to define the Communication structure.

The possible objects are:

- Gateway
- IEC101 OPC Server
- IEC101 Channel
- IEC101 IED
- Logical Device objects
- Logical Node objects
- Data objects

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



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

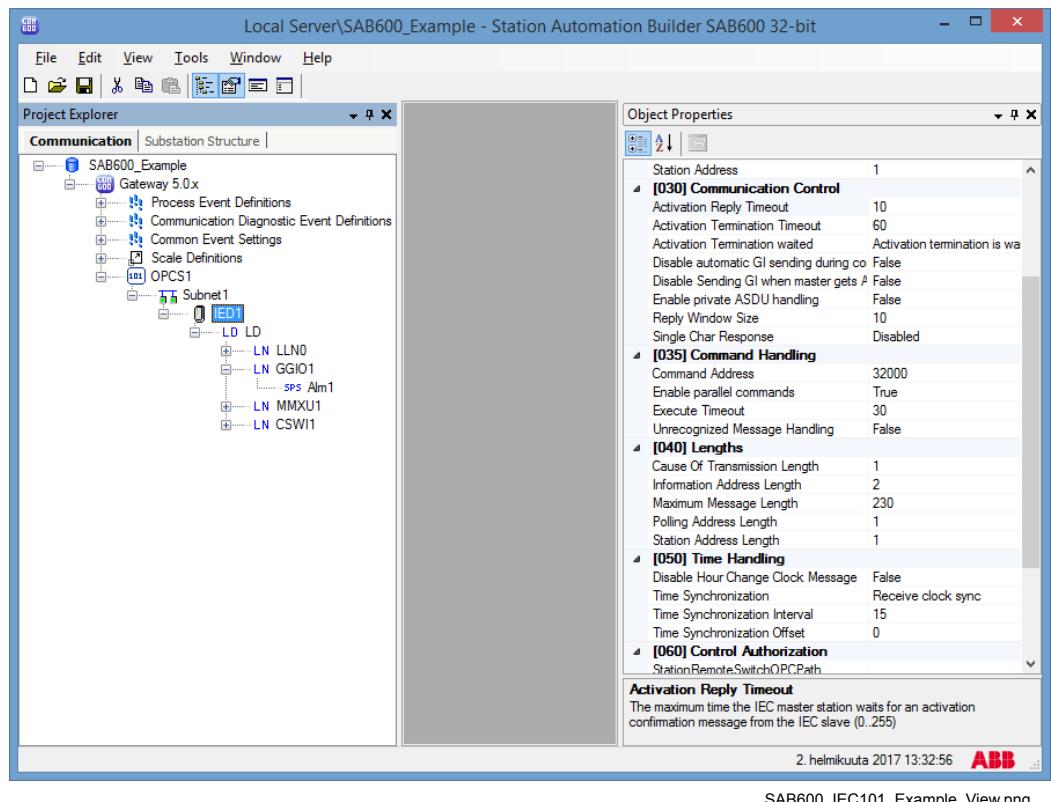


Figure 3.2-1 Example view of SAB600

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

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

First, build an object tree by adding objects to the object tree, see 3.3.1, General information about building object tree and 3.3.8, Adding data objects. Connectivity Packages for certain Protection and Control products usually contain preconfigurations and tools to facilitate the building of the object tree.

Figure 3.2-1 shows an example of how the object tree looks like after it has been built. In the example tree, you can see the IEC101 OPC Server 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, configure them.

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

**Table 3.2-1 IEC101 Server-related objects**

Object	Description
IEC101 OPC Server	An object representing the IEC101 OPC Server.

Object	Description
IEC101 Channel	An object representing a physical communication channel. You can define up to three channels per OPC server.
IEC101 IED	An object representing a physical device. You should not have more than 30 devices per each channel.
Logical Device (LD)	An object representing a group of functions. Each function is defined as a Logical Node. A physical device consists of one or several LDs.
Logical Node (LN)	An object defined by its data and methods. LN is the smallest part of a function that exchanges data.
Data Object (DO)	Data object is an instance of one of the IEC 61850 Data Object Classes such as Single point status and Measured Value. Depending on the class, each data object has a set of attributes for monitoring and controlling the object, for example, value, quality, and control.

## 3.3. Building object tree

### 3.3.1. General information about building object tree

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

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

- You can right-click the object to which you want to add a child object. Select **New > Object type group > Object name**, for example, **New > IEC101 > IEC101 > IED**.
- You can right-click the object type and select **New > New**. A New Object window appears. Select the object type you want to add and click **OK** or double-click it.
- You can copy the object.

Add the objects in the following order:

1. Gateway
2. IEC101 OPC Server
3. IEC101 Channel
4. IEC101 Device
5. Logical Device objects
6. Logical Node objects
7. Data objects

For information on building a substation structure, refer to COM600 HMI Configuration Manual.

**3.3.2.****Adding Gateway object**

To start building the object tree, add a Gateway object in the Communication structure by selecting the project name, right-click it and select **New > Communication > Gateway**.

**3.3.3.****Adding IEC101 OPC Server object**

After the Gateway object has successfully been added, you can continue building the object tree by adding an IEC101 OPC Server object.

To add IEC101 OPC Server object:

1. Select the Gateway object in the communication structure and right-click it.
2. Add IEC101 OPC Server object.

By using the SCL Import function, it is possible to import an entire server's or individual device's configurations without having to insert them manually. To open the SCL Import function, right-click the desired object, and select **SCL Import**.

For more information about the SCL Import function, see COM600 User's Manual.

Connectivity Packages for certain protection and control devices can also support other ways to build this structure, depending on the configuration of an individual device, for example device-related object types and wizards. Typically, Connectivity Packages include SCL description files which must be installed. For further information on these Connectivity Packages, see the Connectivity Package of a certain device in the product documentation.

**3.3.4.****Adding IEC101 Channel objects**

To add an IEC101 Channel object:

1. Select an IEC101 OPC Server object and right-click it.
2. Add an IEC101Channel object
3. Rename the new object. The names of the IEC101 Channels have to be unique.

**3.3.5.****Adding IEC101 Device objects**

To add an IEC101 Device object:

1. Select an IEC101 Channel object and right-click it.
2. Add an IEC101 Device object.
3. Rename the new object. The names within an IEC101 Devices within an IEC101 OPC Server have to be unique.

### 3.3.6.

### Adding Logical Device objects

To add a Logical Device object:

1. Select an IEC101 Device object and right-click it.
2. Add a Logical Device object.
3. Rename the new object. The names of the Logical Device objects have to be unique.



You should have at least one Logical Device object as a child object to each IEC101 physical device.

### 3.3.7.

### Adding Logical Node objects

To add a Logical Node:

1. Select a Logical Device object and right-click it.
2. Add a Logical Node object.
3. Rename the new object. The names of the Logical Node objects have to be unique.



You should have only one Logical Node 0 (LLN0) as a child object to a Logical Device object.

### 3.3.8.

### Adding data objects

To add a data object:

1. Select a Logical Node object and right-click it.
2. Add a data object.
3. Rename the new object. The names of the data objects have to be unique.

## 3.4.

## Configuring objects

### 3.4.1.

### IEC101 OPC Server properties

Table 3.4.1-1 lists the IEC101 OPC Server properties, their value ranges, defaults, and descriptions. These properties are not configurable.

**Table 3.4.1-1 IEC101 OPC Server properties**

Name	Value or Value range/ Default	Description
<b>Basic</b>		
Prog ID AE	Default: None	Instance identification of diagnostic OPC alarm and event server.

Name	Value or Value range/ Default	Description
Prog ID DA	Default: None	Instance identification of diagnostic OPC data access server.

### 3.4.2. Configuring Channel Properties

#### 3.4.2.1. Configuring IEC101 Balanced Channel properties

The IEC101 Balanced Channel properties that can be configured and value ranges for them can be found in Table 3.4.2.1-1.

**Table 3.4.2.1-1 IEC101 Balanced Channel properties**

Property / Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Buffer Pool Size	1...250 Defaults: 50	Specifies the number of message buffers reserved for the channel. Each Buffer can contain one message.
In Use	In use Not in use Default: In use	Specifies if channel is in use or not.
Protocol	IEC60870-5-101 Balanced Master	Protocol
<b>Communication Port</b>		

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

Property / Parameter	Value or Value range/ Default	Description
Bit Rate	300 bits/s 600 bits/s 1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s 19200 bits/s 38400 bits/s 56000 bits/s 57600 bits/s 115200 bits/s 128000 bits/s 256000 bits/s Default: 19200 bits/s	Transmission rate used on the channel.
Communication Port	COM1...COM16 Default: COM1	Serial port used by the IEC60870-5-101 protocol.
Parity	No parity check Even Odd Default: Even	Specifies the parity check used for the characters transferred on the channel.
Receiver Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each received character.
Stop Bits	1 stop bit 2 stop bits Default: 1 stop bit	Specifies the number of stop bits attached to each transmitted character.
Transmitter Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each transmitted character.
Communication Control		

<b>Property / Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Carrier Blocking	Carrier detect signal is ignored  Carrier detect signal must be set  Default: Carrier detect signal is ignored	Determines whether the Carrier Detect signal of the serial port must be set for the IEC station to receive messages.
CTS Delay	0...65535  Default: 50	Delay in milliseconds between activation of the RTS signal and start of new transmission.
Enquiry Limit	0...255  Default: 3	Specifies maximum number of times that a message is retransmitted after timeout.
Header Timeout	0...65535  Default: 2000	Maximum waiting time in milliseconds of a link layer response.
Keep Alive Timeout	0...65535  Default: 5000	The connection is considered to be alive if the delay between two consecutive messages is shorter than the specified time in milliseconds.
Link Type	RTS activated during transmission (Unbalanced)  RTS always active, reception always enabled (Balanced)  RTS activated during transmission, reception always enabled (Balanced)  Default: RTS always active, reception always enabled (Balanced)	The type of data link connection used on the channel.
Receive Interrupt Delay	0...255  Default: 0	Defines the delay after which the receiver of channel is enabled after a message has been issued.
Response Timeout	0...255  Default: 2	The time that IEC link waits for the end of the received message in seconds.
Restart Handshaking when request status of link	True  False  Default: False	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. When this is set to true handshaking is restarted.
RTS Keep Up Delay	0...20  Default: 1	The number of characters for calculating delay for resetting RTS signal.

Property / Parameter	Value or Value range/ Default	Description
RTS Keep Up Padding Characters	0...255 Default: 0	The number of padding characters inserted to the end of telegram to delay the resetting of RTS signal.
Single Char Response	Enabled Disabled Default: Disabled	Enables or disables single char responses.
Time Synchronization Interval	0...65535 Default: 15	Time synchronization interval in seconds.
Transmission Wait Delay	0...65535 Default: 15	Delay in milliseconds between receiving CTS signal and start of transmission.

### 3.4.2.2.

### Configuring IEC101 Unbalanced Channel properties

The IEC101 Unbalanced Channel properties that can be configured and value ranges for them can be found in Table 3.4.2.2-1. The actual configuration by using SAB600 is performed as described in 3.4.2.2, Configuring IEC101 Unbalanced Channel properties.

**Table 3.4.2.2-1 IEC101 Unbalanced Channel properties**

Property / Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Buffer Pool Size	1...250 Default: 50	Specifies the number of message buffers reserved for the line. Each Buffer can contain one message.
In Use	In use Not in use Default: In use	Specifies if channel is in use or not.
Protocol	IEC60870-5-101 Unbalanced Master	Protocol
<b>Communication Port</b>		

<b>Property / Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Bit Rate	300 bits/s 600 bits/s 1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s 19200 bits/s 38400 bits/s 56000 bits/s 57600 bits/s 115200 bits/s 128000 bits/s 256000 bits/s Default: 19200 bits/s	Transmission rate used on the line.
Communication Port	COM1...COM16 Default: COM2	Serial port used by the IEC 60870-5-101 protocol.
Parity	No parity check Even Odd Default: Even	Specifies the parity check used for the characters transferred on the line.
Receiver Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each received character.
Stop Bits	1 2 Default: 1 stop bit	Specifies the number of stop bits attached to each transmitted character.
Transmitter Data Bit Count	5...8 Default: 8	Specifies the number of data bits in each transmitted character.
<b>Communication Control</b>		

Property / Parameter	Value or Value range/ Default	Description
Carrier Blocking	Carrier detect signal is ignored Carrier detect signal must be set Default: Carrier detect signal must be set	This attribute determines whether the Carrier Detect signal of the serial port must be set for the IEC station to receive messages.
CTS Delay	0...65535 Default: 0	Delay in milliseconds between activation of the RTS signal and start of new transmission.
Enquiry Limit	0...255 Default: 3	Specifies maximum number of times that a message is retransmitted after timeout.
Header Timeout	0...65535 Default: 2000	Maximum waiting time in milliseconds of a link layer response.
Link Type	RTS activated during transmission (Unbalanced slave)	The type of data link connection used on the line.
Poll for One Device on One Link	True False Default: False	When this is set to true, the master infinitely polls the first link that responds. Only the device from which the first data is received is set to OK status and in case of communication failure, only this device is set to suspended state. This configuration is especially useful in a multistation configuration with dial-up, in which the device makes the call and there is only device behind the link. When this is set to false, all the links are polled normally.
Polling of Commanded device	True False Default: False	Polling of the commanded device. When this is set to true, the commanded device is always polled with the number of data polls defined with the Reply Poll Count. Both class 1 and class 2 polls are done. With this configuration, too big value in the Reply Poll Count can cause inefficiency in polling. When this is set to false, the commanded station is polled with the number of data polls defined with the Reply Poll Count only if the device requests for class 1 polling.
Polling when DFC Bit Active	True False Default: False	The polling method when a remote station sets the DFC bit on. When this is set to false, the master sends the 'request status of link' until the remote station clears the DFC bit. When this is set to true, the master polls normally.

<b>Property / Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Receive Interrupt Delay	0...255	Defines the delay after which the receiver of line is enabled after a message has been issued.
Response Timeout	0...255 Default: 2	The time that IEC link waits for the end of the received message in seconds.
RTS Keep Up Delay	0...20 Default: 1	The number of characters for calculating delay for resetting RTS signal.
RTS Keep Up Padding Characters	0...255 Default: 0	The number of padding characters inserted to the end of telegram to delay the resetting of RTS signal.
Time Synchronization Interval	0...65535 Default: 15	Time synchronization interval in seconds.
Transmission Wait Delay	0...65535 Default: 15	Delay in milliseconds between receiving CTS signal and start of transmission.
<b>Polling</b>		
Polling Delay	0...65535 Default: 50	Delay between polling messages.
Polling Limit	2...100 Default: 10	Limits the number of successive polls of station.
Polling Period	1...255 Default: 10	The polling frequency of suspended station.
Reply Poll Count	1...20 Default: 1	The reply polling specifies the number of successive polls to a station where command has been sent.
Secondary Polling Limit	0...100 Default: 0	Limits the number of successive class 2 polls of station. Value should be smaller than value of Polling Limit.

### 3.4.3.

### Configuring IEC101 Device properties

Table 3.4.3-1 lists the configurable properties for IEC101 Device and value ranges for these properties.

**Table 3.4.3-1 IEC101 Device properties**

<b>Name</b>	<b>Value/Value range</b>	<b>Description</b>
<b>Basic</b>		

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

Name	Value/Value range	Description
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the station or not.
In Use	In use Not in use Default: In use	Controls whether the station communication is initially in use or not.
Simulation Mode	True False Default: False	Specifies whether the device is in simulation mode.
<b>Addresses</b>		
Polling Address	0...255 or Default: 1	The link address of the IEC 60870-5-101 slave station.
Station Address	0...255 or Default: 1	The station address of the IEC 60870-5-101 slave station (the common address of ASDU).
<b>Communication control</b>		
Activation Reply Timeout	0...255 Default: 10	The maximum time the IEC master station waits for an activation confirmation message from the IEC slave.
Activation Termination Timeout	0...255 Default: 60	The maximum time the IEC master station waits for an activation termination message from the IEC slave.
Activation Termination waited	True False Default: True	The waiting of the activation termination message. With value True, the termination is waited according to the Activation Termination Timeout property. With value False, no activation termination is required from the slave IED.
Disable automatic GI sending during communication initialization	True False Default: False	Sending of the general interrogation command during communication initialization. When false, a general interrogation command is always sent when the communication with the slave is established or recovered. When true, general interrogation is not sent.

Name	Value/Value range	Description
Disable Sending GI when master gets ASDU 70	True False Default: False	Sending of the general interrogation command when the master receives ASDU 70. When false, a general interrogation command is always sent when the end of initialization message (ASDU 70) is received from the IEC slave. When true, general interrogation is not sent automatically when receiving ASDU 70.
Enable private ASDU handling	True False Default: False	Private ASDU handling. When true, the private range ASDUs 146, 148 and 160 are handled as unknown ASDUs. When false, ASDU 146 handled as ASDU 30, ASDU 148 handled as ASDU 31 and ASDU 160 handled as ASDU 37.
Reply Window Size	0...100 Default: 10	Defines how many data items can be written without a reply or request from the master.
<b>Command Handling</b>		
Command Address	0...65534 Default: 32000	The object address of the bit-stream process object in the OPC Client, where an unrecognized message is handled.
Enable parallel commands	True False Default: True	Parallel commands. When this is true, the sending of parallel commands is possible. The control is returned immediately back to application and the return status of command must be checked from the command termination process object. When this is false, sending another command is not possible before the previous command has been completed or the confirmation timeout has occurred.
Execute Timeout	0...65 Default: 30	The maximum time an execute command is waited after a select command.

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

Name	Value/Value range	Description
Unrecognized Message Handling	True False Default: False	Handling of the unrecognized messages. When this is false, unrecognized messages are ignored. When this is true, unrecognized messages sent by the slave are forwarded to an object with an address defined by the Unrecognized Messages Address property.
<b>Lengths</b>		
Cause of Transmission Length	1...2 Default: 1	The length of the cause of transmission field in an IEC 60870-5-101 message in octets.
Information Address Length	1...3 Default: 2	The length of the information object address in octets.
Maximum Message Length	20...255 Default: 230	The maximum length of transmitted message in octets.
Polling Address Length	0...2 Default: 1	The length of the polling address in octets.
Station Address Length	1...2 Default: 1	The length of the station address in octets.
<b>Time Handling</b>		
Disable Hour Change Clock Message	True False Default: False	The hour transmission method of the events to the master. When this is false, the master gets the year, date, and hour from the slave as hourly clock synchronization (ASDU 103). When this is true, the master adds the year, date, and hour from its internal clock to the events. Minutes and seconds should be provided in time-tagged events by the slave.
Time Synchronization Interval	0...65535 Default: 15	Time synchronization interval in seconds.
Time Synchronization Offset	-32768...32767	Time synchronization offset in tenth of milliseconds. This can be used to fine-tune the time synchronization accuracy, when there is a fixed delay caused by the used communication network.

Name	Value/Value range	Description
<b>OPC Alarm and Event</b>		
Device Connection Status Class		Device Connection Status Class Definition used with current device.

**3.4.4.****Configuring data objects****3.4.4.1.****Directional protection activation information (ACD)****Table 3.4.4.1-1 Configurable ACD properties for OPC servers**

Property/Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	ACD	Common data class according to IEC 61850.
<b>Addresses</b>		
General Address	0...16777215 Default: 0	IEC Address for general indication.
Neutral Address	0...16777215 Default: 0	IEC Address for neutral (0 = Not in use).
Phase A Address	0...16777215 Default: 0	IECAddress for phase A (0 = Not in use).
Phase B Address	0...16777215 Default: 0	IEC Address for phase B (0 = Not in use).
Phase C Address	0...16777215 Default: 0	IEC Address for phase C (0 = Not in use).
<b>OPC Alarm and Event</b>		
Indication Event for General		Indication event used with general phase.
Indication Event for Neutral		Indication event used with neutral phase.
Indication Event for Phase A		Indication event used with phase A.
Indication Event for Phase B		Indication event used with phase B.

Property/Parameter	Value or Value range/ Default	Description
Indication Event for Phase C		Indication event used with phase C.

### 3.4.4.2.

### Protection activation information (ACT)

**Table 3.4.4.2-1 Configurable ACT properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	ACT	Common data class according to IEC 61850.
<b>Addresses</b>		
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
<b>Common</b>		
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.
<b>Data Class Specific</b>		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
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.

### 3.4.4.3. Analogue set point (APC)

**Table 3.4.4.3-1 Configurable APC properties for OPC servers**

<b>Property/Parameter</b>	<b>Value or Value range/ Default /Example</b>	<b>Description</b>
<b>Basic</b>		
Common Data Class	APC	Common Data Class according to IEC 61850.
<b>Addresses</b>		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>OPC Alarm and Event</b>		
Command Tracking Event	Default: none	Command tracking event used with this data object.

Property/Parameter	Value or Value range/ Default /Example	Description
Indication Event	Default: none	Indication event used with this data object.
<b>Scale and Unit</b>		
Command Scale	Default: none	Scale to be used when issuing command.
Indication Scale	Default: none	Scale to be used with the indication value.

#### 3.4.4.4.

#### Binary counter reading (BCR)

*Table 3.4.4.4-1 Configurable BCR properties for OPC servers*

Property/Parameter	Value or Value range/ Default /Example	Description
<b>Basic</b>		
Common Data Class	BCR	Common Data Class according to IEC 61850.
<b>Addresses</b>		
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>Scale and Unit</b>		
Multiplier	Default: None	Multiplier for counter.
Unit	Default: Dimensionless	Unit for counter.

#### 3.4.4.5.

#### Binary controlled step position information (BSC)

*Table 3.4.4.5-1 Configurable BSC properties for OPC servers*

Property/Parameter	Value or Value range/ Default /Example	Description
<b>Basic</b>		
Common Data Class	BSC	Common Data Class according to IEC 61850.
<b>Addresses</b>		
Command Address	0...16777215 Default: 0	IEC address for command.
Position Address	0...16777215 Default: 0	IEC address for position.

Property/Parameter	Value or Value range/ Default /Example	Description
<b>OPC Alarm and Event</b>		
Command Tracking Event		Command tracking event class used with this data object.
Indication Event		Indication event used with this data object.

**3.4.4.6.****Complex measured value (CMV)****Table 3.4.4.6-1 Configurable CMV properties for OPC servers**

Property/Parameter	Value or Value range/ Default /Example	Description
<b>Basic</b>		
Common Data Class	CMV	Common Data Class according to IEC 61850.
<b>Sub Type</b>		
Sub Type	MV Simple MV LIMITCHECK Default: MV Simple	Sub type description.
<b>Addresses</b>		
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>Scale and Unit</b>		
Multiplier	Default: Deka	Multiplier for measurement.
Scale	Default: None	Scale for measurement.
Unit	Default: Dimensionless	Unit for measurement.
<b>Limit Value Supervision</b>		
Max	Default: 20000	Maximum value for measurement.
Min	Default: 0	Minimum value for measurement.

### 3.4.4.7.

### Delta (DEL)

**Table 3.4.4.7-1 Configurable DEL properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	DEL	Common data class according to IEC 61850.
<b>Sub-Type</b>		
Sub Type	DEL Full DEL Simple Default: DEL Simple	Sub Type description.
<b>Addresses</b>		
Phase AB Address	0...16777215 Default: 0	IEC Address for phase AB (0 = Not in use).
Phase BC Address	0...16777215 Default: 0	IEC Address for phase BC (0 = Not in use).
Phase CA Address	0...16777215 Default: 0	IEC Address for phase CA (0 = Not in use).
<b>Scale and Unit</b>		
Phase Multiplier	Default: Deka	Multiplier for phase.
Phase Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for phase.
Phase Unit	Default: Dimensionless	Unit for phase.
<b>Limit Value Supervision</b>		
Max	20000	Maximum value for measurement.
Min	0	Minimum value for measurement.

### 3.4.4.8.

### Controllable double point (DPC)

**Table 3.4.4.8-1 Configurable DPC properties**

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Common Data Class	DPC	Common data class according to IEC 61850.
<b>Sub-Type</b>		
Sub Type	IEC style command Indication only IEC style command	Object subtype.
<b>Addresses</b>		
Command Address	0...16777215 Default: 8	IEC address for command.
DMCD-Type	Single command Double command Default: Single command	DMCD-Type to be used.
Indication Address	0...16777215 Default: 0	IEC address for indication.
Selected Address	0...65535 Default: 0	IEC Address for selected.
<b>OPC Alarm and Event</b>		
Command Tracking Event	SwitchOperation TapchangerSingleParallelOperation	Command tracking event used with this data object.
Indication Event		Indication event used with this data object.
<b>Scale and Unit</b>		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for indication.

**3.4.4.9.****Device Name Plate (DPL)****Table 3.4.4.9-1 Configurable DPL properties for OPC client**

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
<b>Basic</b>		

Property/ Parameter	Value or Value range/ Default	Description
Common Data Class	DPL	Common data class according to IEC 61850.
<b>Vendor</b>		
Vendor	ABB	A simple text string, describing the vendor.
<b>Hardware Revision</b>		
Hardware Revision	0	A simple text string, describing the hardware revision.
<b>Software Revision</b>		
Software Revision	0	A simple text string, describing the software revision.
<b>Serial Number</b>		
Serial Number	0	A simple text string, describing the serial number.
<b>Location</b>		
Location	0	A simple text string, describing the location.

### 3.4.4.10.

### Double point status (DPS)

**Table 3.4.4.10-1 Configurable DPS properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	DPS	Common data class according to IEC 61850.
<b>Addresses</b>		
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>OPC Alarm and Event</b>		
Indication Event		Indication event used with this data object.
<b>Scale and Unit</b>		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for indication

**3.4.4.11.****Controllable integer status (INC)*****Table 3.4.4.11-1 Configurable INC properties for OPC client***

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	INC	Common data class according to IEC 61850.
<b>Addresses</b>		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>OPC Alarm and Event</b>		
Command Tracking Event	SwitchOperation TapchangerSingleParallelOperation	Command tracking event used with this data object.
Indication Event		Indication event used with this data object.
<b>Scale and Unit</b>		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for indication.

**3.4.4.12.****Integer status (INS)*****Table 3.4.4.12-1 Configurable INS properties for OPC client***

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	INS	Common data class according to IEC 61850.
<b>Addresses</b>		
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>OPC Alarm and Event</b>		

Property/ Parameter	Value or Value range/ Default	Description
Indication Event		Indication event used with this data object.
<b>Scale and Unit</b>		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for indication.

### 3.4.4.13. Integer controlled step position information (ISC)

*Table 3.4.4.13-1 Configurable ISC properties for OPC client*

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	ISC	Common data class according to IEC 61850.
<b>Addresses</b>		
Command Address	0...16777215 Default: 0	IEC address for command.
Position Address	0...16777215 Default: 0	IEC address for position.
<b>OPC Alarm and Event</b>		
Command Tracking Event	DirectOperate TapchangerAutoManualOperation Default: None	Command tracking event used with this data object.
Indication Event		Indication event used with this data object.

### 3.4.4.14. Logical Node Name Plate (LPL)

*Table 3.4.4.14-1 Configurable LPL properties for OPC client*

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Common Data Class	LPL	Common data class according to IEC 61850.
<b>Vendor</b>		
Vendor	ABB	A simple text string, describing the vendor.
<b>Software Revision</b>		
Software Revision		A simple text string, describing the software revision.
<b>Description</b>		
Description		A simple text string, describing the description for logical node.

**3.4.4.15. Measured value (MV)****Table 3.4.4.15-1 Configurable MV properties for OPC client**

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
<b>Basic</b>		
Common Data Class	MV	Common data class according to IEC 61850.
<b>Sub-Type</b>		
Sub Type	MW LIMITCHECK  MV Simple  Default: MV Simple	Object subtype.
<b>Addresses</b>		
Indication Address	0...16777215  Default: 0	IEC address for indication.
<b>Scale and Unit</b>		
Multiplier	Default: Deka	Multiplier for measurement.
Scale	Lookup Table Scale  Stepwise Linear Scale  Default: None	Scale for measurement.
Unit	Default: Dimensionless	Unit for measurement.
<b>Limit Value Supervision</b>		
Max	Default: 20000	Maximum value for measurement.

Property/ Parameter	Value or Value range/ Default	Description
Min	Default: 0	Minimum value for measurement.

### 3.4.4.16. Controllable single point (SPC)

*Table 3.4.4.16-1 Configurable SPC properties for OPC client*

Property/ Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
Common Data Class	SPC	Common data class according to IEC 61850.
<b>Sub-Type</b>		
Sub Type	Indication only IEC style command Default: IEC style command	Object subtype.
<b>Addresses</b>		
Command Address	0...16777215 Default: 0	IEC address for command.
DirectOperate	True False Default: False	DirectOperate description.
DMCD-Type	Single command Double command	DMCD-Type to be used.
Indication Address		IEC address for indication.
<b>OPC Alarm and Event</b>		
Command Tracking Event	DirectOperate TapchangerAutoManualOperation Default: None	Command tracking event used with this data object.
Indication Event	Default: None	Indication event used with this data object.
<b>Scale and Unit</b>		

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for measurement.

### 3.4.4.17. Single point status (SPS)

*Table 3.4.4.17-1 Configurable SPS properties for OPC client*

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
<b>Basic</b>		
Common Data Class	SPS	Common data class according to IEC 61850.
<b>Addresses</b>		
Indication Address	0...16777215 Default: 0	IEC address for indication.
<b>OPC Alarm and Event</b>		
Indication Event		Indication event used with this data object.
<b>Scale and Unit</b>		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for measurement.

### 3.4.4.18. WYE

*Table 3.4.4.18-1 Configurable WYE properties for OPC client*

<b>Property/ Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
<b>Basic</b>		
Common Data Class	WYE	Common data class according to IEC 61850.
<b>Sub-Type</b>		

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

Property/ Parameter	Value or Value range/ Default	Description
Sub Type	WYE Full WYE Simple Default: WYE Simple	Object subtype.
<b>Addresses</b>		
NetAddress	0...16777215 Default: 0	NetAddress description.
Neutral Address	0...16777215 Default: 0	IEC Address for neutral (0 = Not in use).
Phase A Address	0...16777215 Default: 0	IEC Address for phase A (0 = Not in use).
Phase B Address	0...16777215 Default: 0	IEC Address for phase B (0 = Not in use).
Phase C Address	0...16777215 Default: 0	IEC Address for phase C (0 = Not in use).
ResAddress	0...16777215 Default: 0	ResAddress description.
<b>Scale and Unit</b>		
Net Multiplier	Default: Deka	Multiplier for net.
Net Scale	Default: None	Scale for net.
Net Unit	Default: Dimensionless	Unit for net.
Neutral Multiplier	Default: Deka	Multiplier for neutral.
Neutral Scale	Default: None	Scale for neutral.
Neutral Unit	Default: Dimensionless	Unit for neutral.
Phase Multiplier	Default: Deka	Multiplier for phase.
Phase Scale	Default: None	Scale for phase.
Phase Unit	Default: Dimensionless	Unit for phase.
Res Multiplier	Default: Deka	Multiplier for res.
Res Scale	Default: None	Scale for res.
Res Unit	Default: Dimensionless	Unit for res.
<b>Net Limit Value Supervision</b>		
Net Max Limit	Default: 20000	Max limit for net.
Net Min Limit	Default: 0	Min limit for net.

Property/ Parameter	Value or Value range/ Default	Description
<b>Phase Limit Value Supervision</b>		
Max	Default: 20000	Maximum value for measurement.
Min	Default: 0	Minimum value for measurement.
<b>Res Limit Value Supervision</b>		
Res Max Limit	Default: 20000	Max limit for res.
Res Min Limit	Default: 0	Min limit for res.
<b>Neutral Limit Value Supervision</b>		
Max Limit	Default: 20000	Max limit for neutral.
Min Limit	Default: 0	Min limit for neutral.

## 4. Operation

### 4.1. About this section

This section describes the basic operation procedures you can carry out after the IEC101 OPC Server has been configured.

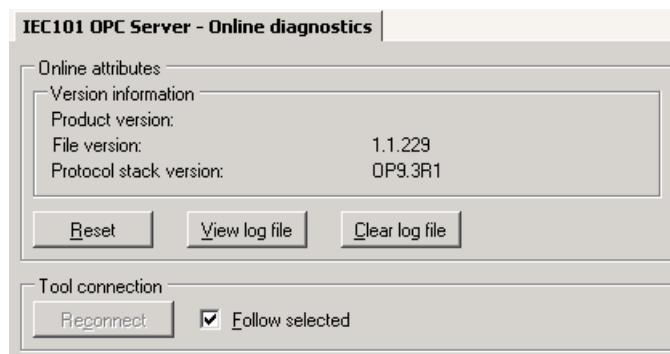
After this, you can, for example, monitor and control the condition of connections in an IEC101 network by using the Online diagnostics function SAB600.

### 4.2. Activating COM600 with new configurations

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

### 4.3. IEC101 OPC Server diagnostics

To view the IEC101 OPC Server diagnostics, right-click the IEC101 OPC Server object and select **Online diagnostics**, see Figure 4.3-1.



IEC101\_OPC\_Server\_Online\_Diagnostics.bmp

Figure 4.3-1 IEC101 OPC Server Online diagnostics

You have the following alternatives:

- to view version information
- to reset the IEC101 OPC Server
- to view the event log file, see Figure 4.3-2
- to clear the log file

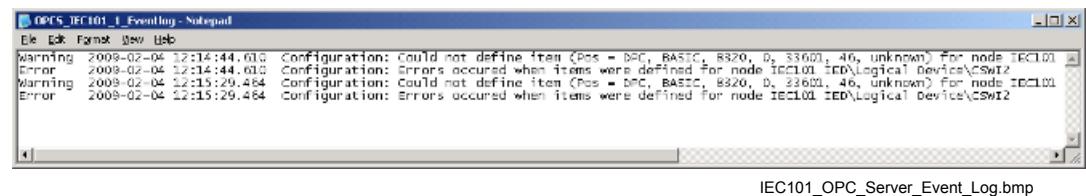


Figure 4.3-2 Event log file

### Diagnostic AE Client

Diagnostic events can be monitored and controlled using the Diagnostic AE Client function, see Figure 4.3-3. Click **Refresh** to update the status information. To be able to receive events from a certain device, diagnostic events must be enabled for this respective device.

To enable diagnostic events:

1. Right-click the device.
2. Select **Online diagnostics**.
3. Mark the Diagnostic events enabled check box. See Figure 4.3-3 for example.

IEC101 OPC Server - Diagnostic AE client						
Event count: 860						
Time	Type	Source	Address	Value		
2009/02/04 14:04:47.892	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:47.892	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:47.892	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
2009/02/04 14:04:48.923	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:48.933	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:48.933	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
1999/12/31 02:04:49.259	Unmapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19137	2405		
2009/02/04 14:04:49.884	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:49.895	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:49.895	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
2009/02/04 14:04:50.926	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:50.926	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:50.926	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
1999/12/31 02:04:51.298	Unmapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19136	2405		
2009/02/04 14:04:51.887	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:51.887	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:51.887	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
2009/02/04 14:04:52.929	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:52.929	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:52.929	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
1999/12/31 02:04:53.338	Unmapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19137	2405		
2009/02/04 14:04:53.890	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:53.890	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:53.890	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		
2009/02/04 14:04:54.932	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19650	240		
2009/02/04 14:04:54.932	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19649	240		
2009/02/04 14:04:54.932	Mapped Address Update	IEC101 Unbalanced ChannelNEC101 IED	19648	240		

IEC101\_OPC\_Server\_Diagnostic\_AE\_Client.bmp

Figure 4.3-3 IEC101OPC Server Diagnostic AE client

## 4.4. Monitoring and controlling IEC101 Channel Activity

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

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

To monitor and control IEC101 channel activity:

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

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

You can take an IEC101 Channel into use by marking the **In use** check box. If you unmark the check box, the channel is taken out of use. Diagnostic counters are updated every 2 seconds. To update them manually, click **Refresh**.

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

## 4.5. Monitoring and controlling IEC101 Device communication

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

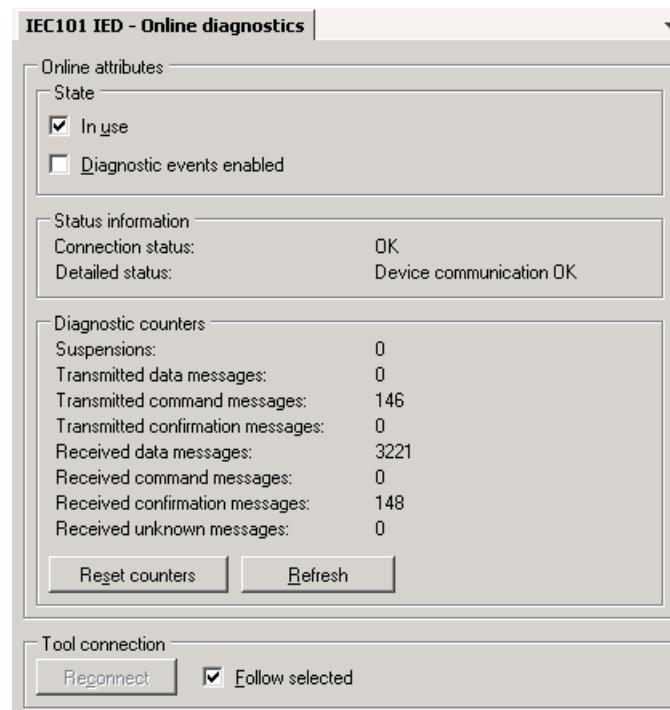
To monitor and control IEC101 Device communication:

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

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

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

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



IEC101IED\_Online\_Diagnostics.bmp

*Figure 4.5-1 IEC101 IED Online Diagnostics*

## 4.6.

## Data object diagnostics

For information on data object diagnostics, refer to COM600 User's Manual.

## 5. Technical reference

### 5.1. About this section

This section provides reference information about the following issues:

- IEC 61850 data modeling
- Attributes
- Status codes

### 5.2. IEC 61850 data modeling

#### 5.2.1. General information about IEC 61850 data modeling

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

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

The columns in the tables have the following content types:

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

#### 5.2.2. Single point status (SPS)

SPS represents DMCD M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1.

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

**5.2.3. Double point status (DPS)**

DPS represents DMCD M\_DP\_NA\_1, M\_DP\_TA\_1, M\_DP\_TB\_1.

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

**5.2.4. Integer status (INS)**

INS represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1.

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

**5.2.5. Enumerated Status (ENS)**

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

ENS represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1

**5.2.6.****Protection activation information (ACT)**

ACT represents DMCD M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1, M\_DP\_NA\_1, M\_DP\_TA\_1, M\_DP\_TB\_1.

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

**5.2.7.****Directional protection activation information (ACD)**

ACD represents M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1, M\_DP\_NA\_1, M\_DP\_TA\_1, M\_DP\_TB\_1.

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

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

### 5.2.8. Binary counter reading (BCR)

BCR represent DMCD M\_IT\_NA\_1, M\_IT\_TA\_1, M\_IT\_TB\_1.

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

### 5.2.9. Measured value (MV)

MV represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1, M\_ME\_NB\_1, M\_ME\_TB\_1, M\_ME\_NC\_1, M\_ME\_TC\_1, M\_ME\_TF\_1.

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

Name	Type	Value/ Value range	Mandat- ory/Optional	Protection inform- ation element	OPC data types
ILim	REAL		O		VT_R4
IILim	REAL		O		VT_R4
min	REAL		O		VT_R4
max	REAL		O		VT_R4
unit	SiUnit		O	Config	VT_I4
d	Description	Text	O		VT_BSTR

### 5.2.10. Complex measured value (CMV)

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

### 5.2.11. WYE

WYE represent DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1, M\_ME\_NB\_1, M\_ME\_TB\_1, M\_ME\_NC\_1, M\_ME\_TC\_1, M\_ME\_TF\_1.

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

**5.2.12. Delta (DEL)**

DEL represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1, M\_ME\_NB\_1, M\_ME\_TB\_1, M\_ME\_NC\_1, M\_ME\_TC\_1, M\_ME\_TF\_1.

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

**5.2.13. Controllable single point (SPC)**

SPC represents DMCD C\_SC\_NA\_1, C\_DC\_NA\_1, M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1, M\_DP\_NA\_1, M\_DP\_TA\_1, M\_DP\_TB\_1.

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

**5.2.14. Controllable double point (DPC)**

DPC represents DMCD C\_SC\_NA\_1, C\_DC\_NA\_1, M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1, M\_DP\_NA\_1, M\_DP\_TA\_1, M\_DP\_TB\_1.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlOperOn	SPI	FALSE   TRUE	O	SCO	VT_BOOL
ctlOperOff		FALSE   TRUE	O	SCO	VT_BOOL

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

### 5.2.15. Controllable integer status (INC)

INC represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1, M\_ME\_NB\_1, M\_ME\_TB\_1, C\_SE\_NA, C\_SE\_NB\_1.

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

### 5.2.16. Controllable Enumerated Status (ENC)

ENC represents DMCD M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_TD\_1, M\_ME\_NB\_1, M\_ME\_TB\_1, C\_SE\_NA, C\_SE\_NB\_1.

Name	Type	Value/ Value range	Mandat- ory/Optional	Protocol informa- tion element	OPC data types
ctlVal	ENUMERATED		M	NVA	VT_I4
stVal	ENUMERATED		M	VAI32	VT_I4
q	Quality		M	BT, SB, NT, IV	VT_I4

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

### 5.2.17. Binary controlled step position information (BSC)

BSC represents DMCD M\_ST\_NA\_1, M\_ST\_TA\_1, M\_ST\_TB\_1, M\_RC\_NA\_1.

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

### 5.2.18. Integer controlled step position information (ISC)

ISC represents C\_SE\_NA\_1, C\_SE\_NB\_1, M\_ST\_NA\_1, M\_ST\_TA\_1, M\_ST\_TB\_1.

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

## 5.2.19. Analogue set point (APC)

APC represents DMCD C\_SE\_NC\_1.

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

## 5.3. Status codes

### 5.3.1. Introduction

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

### 5.3.2. Link layer status codes

- 17600 IGTP\_REMOTE\_LINK\_CONTINUOUSLY\_BUSY. The Data Flow Control (DFC) bit of the messages from the master is set for more than 15 seconds.
- 17601 IGTP\_TIMEOUT\_WHILE\_TRANSMITTING. The CTS signal or the end of transmitted message is not received in correct time. The DE attribute controls the CTS waiting time; the transmission time of message is automatically calculated.
- 17602 IGTP\_TIMEOUT\_WHILE\_WAITING\_RESPONSE. Timeout while waiting for an acknowledgment to a message.
- 17604 IGTP\_LINK\_NOT\_READY. The application level sends a command before the communication between the master and the slave is established.
- 17605 IGTP\_REMOTE\_LINK\_BUSY. Data sending fails since the Data Flow Control bit (DFC) is set in remote station and there is already one data message waiting to be reset. Not used in the unbalanced slave.
- 17606 IGTP\_REMOTE\_LINK\_NOT\_RESPONDING. The slave does not receive a reply from the master.
- 17607 IGTP\_LINE\_STARTED. The station has been set in use by using the IU attribute.
- 17608 IGTP\_LINE\_STOPPED. The station has been set out of use by using the IU attribute.

---

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

**5.3.3.****Application layer status codes**

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

---

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

## 5.4. Attributes

### 5.4.1. Server attributes

**Table 5.4.1-1 IEC 101 OPC Server attributes**

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

### 5.4.2. Channel attributes

**Table 5.4.2-1 Channel attributes**

Property / Parameter	Value or Value range/ Default	Description
<b>Basic</b>		
In use	0 = Not in use, the channel communication is stopped. 1 = In use.	The state of the channel - whether it is in use or not. When a channel is not in use, no data can be transmitted on it, and no data is received from it. The channel attributes can be read as usual. Generally, a channel must be taken out of use by setting this attribute to 0 before the channel attributes can be written.  When a channel is stopped by setting the In use attribute to 0, all data transmission on the channel ceases. However, before that, the protocol stack executes to the end all on-going data transactions. For example, the of the station in turn is completed.
<b>Modem Signal</b>		

<b>Property / Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
Clear To Send (CTS)	0 = Passive signal 1 = Active signal	Indicates the state of the Clear To Send (CTS) signal.
Data Carrier Detect (DCD)	0 = Passive signal 1 = Active signal	Indicates the state of Data Carrier Detect (DCD) signal.
<b>Diagnostic Counters</b>		
Transmitted Messages		The number of transmitted data messages.
Failed Transmissions		The number of failed transmissions.
Transmitted Commands		The number of transmitted commands.
Transmitted Replies		The number of transmitted replies.
Received Messages		The number of received data messages.
Parity Errors		The number of times a parity error has occurred.
Overrun Errors		The number of times an overrun error has occurred.
Check Sum Errors		The number of times a redundancy error has occurred.
Framing Errors		The number of times a framing error has occurred.
Buffer Overflow Errors		The number of times there has been a buffer overflow.

#### 5.4.3.

#### Device attributes

**Table 5.4.3-1 Device attributes**

<b>Property / Parameter</b>	<b>Value or Value range/ Default</b>	<b>Description</b>
In use	0 = Out of use 1 = In use Default: 1	The operational status of the device - in use or out of use. Taking the device out of use with this attribute stops all data communication with the device. All operations that would result in a data exchange are disabled. The device itself is not affected by the attribute, only the protocol stack's image of the device. Setting In use to 1 is allowed only if the device address is legal.

Property / Parameter	Value or Value range/ Default	Description
Object Status	<p>When written: 1 = Retransmit system message</p> <p>When read: A status code, for example 0 = OK (communication works properly) 13863 = Device suspended.</p> <p>For more information, see 5.3.2, Link layer status codes and 5.3.3, Application layer status codes.</p>	Indicates the detailed information about the station device status. Setting Object status of a device to 1 makes the protocol stack to retransmit the last system message caused by the device. Possible 'Stopped' and 'Suspended' messages cause old marking of OPC items. By reading the Object Status attribute, the status code of the system message can be read.
Device Connection Status	<p>True = Device connection OK</p> <p>False = Device connection suspended.</p>	Indicates the status of the device connection.
Diagnostic Events Enabled	<p>True = Diagnostic events enabled</p> <p>False = Diagnostic events disabled</p>	This attribute enables or disables diagnostic events.
<b>Diagnostic counters</b>		
Suspension Counter		Indicates the number of times the connection has been suspended.
Transmitted Data Messages		The number of transmitted data messages.
Transmitted Command Messages		The number of transmitted command messages.
Transmitted Confirmation Messages		The number of transmitted confirmation messages.
Received Data Messages		The number of received data messages.
Received Command Messages		The number of received command messages.
Received Confirmation Messages		The number of received confirmation messages.
Received Unknown Messages		The number of unknown messages received.

## **Appendix 1**

### **Interoperability list for IEC101 OPC Server**

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

#### **Application layer telegram formats**

##### **Interoperability**

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

The selected parameters should be marked in the white boxes.



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

#### **Network configuration (network-specific parameter)**

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

#### **Physical layer (network-specific parameter)**

**Transmission speed (control direction)**

**Unbalanced interchange circuit V.24/V.28 Standard**    **Unbalanced interchange circuit V.24/V.28 Recommended**    **Balanced interchange circuit X.24/X.28 if > 1200 bit/s**

- |  |   |                                      |
|--|---|--------------------------------------|
| <input type="checkbox"/> 100 bit/s             | <input checked="" type="checkbox"/> 2400 bit/s  | <input type="checkbox"/> 2400 bit/s  |
| <input type="checkbox"/> 200 bit/s             | <input checked="" type="checkbox"/> 4800 bit/s  | <input type="checkbox"/> 4800 bit/s  |
| <input type="checkbox"/> 300 bit/s             | <input checked="" type="checkbox"/> 9600 bit/s  | <input type="checkbox"/> 9600 bit/s  |
| <input type="checkbox"/> 600 bit/s             | <input checked="" type="checkbox"/> 19200 bit/s | <input type="checkbox"/> 19200 bit/s |
| <input checked="" type="checkbox"/> 1200 bit/s |   | <input type="checkbox"/> 38400 bit/s |
|  |   | <input type="checkbox"/> 56000 bit/s |
|  |   | <input type="checkbox"/> 64000 bit/s |

**Transmission speed (monitor direction)**

**Unbalanced interchange circuit V.24/V.28 Standard**    **Unbalanced interchange circuit V.24/V.28 Recommended**    **Balanced interchange circuit X.24/X.28 if > 1200 bit/s**

- |  |   |                                      |
|--|---|--------------------------------------|
| <input type="checkbox"/> 100 bit/s             | <input checked="" type="checkbox"/> 2400 bit/s  | <input type="checkbox"/> 2400 bit/s  |
| <input type="checkbox"/> 200 bit/s             | <input checked="" type="checkbox"/> 4800 bit/s  | <input type="checkbox"/> 4800 bit/s  |
| <input type="checkbox"/> 300 bit/s             | <input checked="" type="checkbox"/> 9600 bit/s  | <input type="checkbox"/> 9600 bit/s  |
| <input type="checkbox"/> 600 bit/s             | <input checked="" type="checkbox"/> 19200 bit/s | <input type="checkbox"/> 19200 bit/s |
| <input checked="" type="checkbox"/> 1200 bit/s |   | <input type="checkbox"/> 38400 bit/s |
|  |   | <input type="checkbox"/> 56000 bit/s |
|  |   | <input type="checkbox"/> 64000 bit/s |

**Link layer (network-specific parameter)**

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

- |   |  |
|---|--|
| Link transmission procedure                                 | Address field of the link                        |
| <input checked="" type="checkbox"/> Balanced transmission   | <input checked="" type="checkbox"/> not present  |
| <input checked="" type="checkbox"/> Unbalanced transmission | <input checked="" type="checkbox"/> One octet    |
|   | <input checked="" type="checkbox"/> Two octets   |
| Frame length  | <input type="checkbox"/> Structured              |
| 230 Maximum length L (number of octets)                     | <input checked="" type="checkbox"/> Unstructured |

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

**Application layer**

**Transmission mode for application data**

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

**Common address of ASDU (system-specific parameter)**

- One octet
- Two octets

**Information object address (system-specific parameter)**

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

**Cause of transmission (system-specific parameter)**

- One octet
- Two octets (with originator address)

**Selection of standard ASDUs****Process information in monitor direction (station-specific parameter)**

- |   |           |
|---|-----------|
| ■ <1> :=Single-point information                                  | M_SP_NA_1 |
| ■ <2> :=Single-point information with time tag                    | M_SP_TA_1 |
| ■ <3> :=Double-point information                                  | M_DP_NA_1 |
| ■ <4> :=Double-point information with time tag                    | M_DP_TA_1 |
| ■ <5> :=Step position information                                 | M_ST_NA_1 |
| ■ <6> :=Step position information with time tag                   | M_ST_TA_1 |
| □ <7> :=Bitstring of 32 bit                                       | M_BO_NA_1 |
| □ <8> :=Bitstring of 32 bit with time tag                         | M_BO_TA_1 |
| ■ <9> :=Measured value, normalized value                          | M_ME_NA_1 |
| ■ <10> :=Measured value, normalized value with time tag           | M_ME_TA_1 |
| ■ <11> :=Measured value, scaled value                             | M_ME_NB_1 |
| ■ <12> :=Measured value, scaled value with time tag               | M_ME_TB_1 |
| ■ <13> :=Measured value, short floating point value               | M_ME_NC_1 |
| ■ <14> :=Measured value, short floating point value with time tag | M_ME_TC_1 |
| ■ <15> :=Integrated totals  | M_IT_NA_1 |
| ■ <16> :=Integrated totals with time tag                          | M_IT_TA_1 |

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

- <17> :=Event of protection equipment with time tag M\_EP\_TA1
- <18> :=Packed start events of protection equipment with time tag M\_EP\_TB1
- <19> :=Packed output circuit information of protection equipment with time tag M\_EP\_TC\_1
- <20> :=Packed single point information with time tag M\_PS\_NA\_1
- <21> :=Measured value, normalized value without quality descriptor M\_ME\_ND\_1
- <30> :=Single-point information with time tag CP56Time2a M\_SP\_TB\_1
- <31> :=Double-point information with time tag CP56Time2a M\_DP\_TB\_1
- <32> :=Step position information with time tag CP56Time2a M\_ST\_TB\_1
- <34> :=Measured value, normalized value with time tag CP56Time2a M\_ME\_TD\_1
- <36> :=Measured value, short floating point value with time tag CP56Time2a M\_ME\_TF\_1
- <37> :=Integrated totals with time tag CP56Time2a M\_IT\_TB\_1
- <128> :=Parameter byte string M\_SR\_NA\_1
- <130> :=101 Encapsulated SPA bus reply message M\_SB\_NA\_1

**Process information in control direction (station-specific parameter)**

- <45> :=Single command C\_SC\_NA\_1
- <46> :=Double command C\_DC\_NA\_1
- <47> :=Regulating step command C\_RC\_NA\_1
- <48> :=Set point command, normalized value C\_SE\_NA\_1
- <49> :=Set point command, scaled value C\_SC\_NB\_1
- <50> :=Set point command, short float point value C\_SC\_NC\_1
- <51> :=Bitstring of 32 bit C\_BO\_NA\_1
- <131> :=Parameter byte string C\_SR\_NA\_1
- <133> :=101 Encapsulated SPA bus message C\_SB\_NA\_1

**System information in monitor direction (station-specific parameter)**

- <70> :=End of initialization M\_EI\_NA\_1

**System information in control direction (station-specific parameter)**

- |                                     |                                       |           |
|-------------------------------------|---------------------------------------|-----------|
| <input checked="" type="checkbox"/> | <100> :=Interrogation command         | C_IC_NA_1 |
| <input type="checkbox"/>            | <101> :=Counter interrogation command | C_CI_NA_1 |
| <input type="checkbox"/>            | <102> :=Read command                  | C_RD_NA_1 |
| <input checked="" type="checkbox"/> | <103> :=Clock synchronization command | C_CS_NA_1 |
| <input type="checkbox"/>            | <104> :=Test command                  | C_TS_NB_1 |
| <input type="checkbox"/>            | <105> :=Reset process command         | C_RP_NC_1 |
| <input type="checkbox"/>            | <106> :=Delay of acquisition command  | C_CD_NA_1 |

**Parameter in control direction (station-specific parameter)**

- |                          |   |           |
|--------------------------|---|-----------|
| <input type="checkbox"/> | <110> :=Parameter of measured value, normalized value           | P_ME_NA_1 |
| <input type="checkbox"/> | <111> :=Parameter of measured value, scaled value               | P_ME_NB_1 |
| <input type="checkbox"/> | <112> :=Parameter of measured value, short floating point value | P_ME_NC_1 |
| <input type="checkbox"/> | <113> :=Parameter activation                                    | P_AC_NA_1 |

**File Transfer (station-specific parameter)**

- |                          |  |           |
|--------------------------|--|-----------|
| <input type="checkbox"/> | <120> :=File ready   | F_FR_NA_1 |
| <input type="checkbox"/> | <121> :=Section ready  | F_SR_NA_1 |
| <input type="checkbox"/> | <122> :=Call directory, select file, call file, call section | F_SC_NA_1 |
| <input type="checkbox"/> | <123> :=Last section, last segment                           | F_LS_NA_1 |
| <input type="checkbox"/> | <124> :=Ack file, ack section                                | F_AF_NA_1 |
| <input type="checkbox"/> | <125> :=Segment  | F_SG_NA_1 |
| <input type="checkbox"/> | <126> :=Directory  | F_DR_TA_1 |

**Basic application functions****Station initialization (station-specific parameter)**

- Remote initialization

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

**General interrogation (system parameter or station-specific parameter)**

- |                                     |         |                          |         |                          |          |
|-------------------------------------|---------|--------------------------|---------|--------------------------|----------|
| <input checked="" type="checkbox"/> | global  | <input type="checkbox"/> | group 7 | <input type="checkbox"/> | group 13 |
| <input type="checkbox"/>            | group 1 | <input type="checkbox"/> | group 8 | <input type="checkbox"/> | group 14 |
| <input type="checkbox"/>            | group 2 | <input type="checkbox"/> | group 9 | <input type="checkbox"/> | group 15 |

- |                                  |                                   |                                   |
|----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> group 3 | <input type="checkbox"/> group 10 | <input type="checkbox"/> group 16 |
| <input type="checkbox"/> group 4 | <input type="checkbox"/> group 11 |                                   |
| <input type="checkbox"/> group 5 | <input type="checkbox"/> group 12 |                                   |
| <input type="checkbox"/> group 6 |                                   |                                   |

Define addresses per group.

#### **Clock synchronization (station-specific parameter)**

- Clock synchronization

#### **Command transmission (object-specific parameter)**

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

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

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

Addresses per group have to be defined.

#### **Parameter loading (object-specific parameter)**

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

#### **Parameter activation (object-specific parameter)**

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

**File transfer (station-specific parameter)**

- File transfer in monitor direction
- File transfer in control direction



## **Index**

### **A**

activating COM600 .....	46
activation information	
properties .....	32
adding	
channel object .....	19
data object .....	20
device object .....	19
Gateway object .....	19
Logical Device object .....	20
Logical node .....	20
OPC Server object .....	19
analog set point	
properties .....	33
Analogue set point (APC) .....	58
attributes	
channel .....	60
client .....	60
device .....	61

### **B**

Balanced channel	
properties .....	21
Binary controlled step position information (BSC)	
IEC 61850 data modeling .....	57
properties .....	34
Binary counter reading (BCR)	
IEC 61850 data modeling .....	53
properties .....	34

### **C**

channel	
attributes .....	60
diagnostics .....	47
channel object	
adding .....	19
Complex measured value (CMV)	
IEC 61850 data modeling .....	54
properties .....	35
Controllable double point (DPC)	
IEC 61850 data modeling .....	55
properties .....	36
Controllable Enumerated Status (ENC)	

.....	56
Controllable integer status (INC)	
IEC 61850 data modeling .....	56
properties .....	39
Controllable single point (SPC)	
IEC 61850 data modeling .....	55
properties .....	42
<b>D</b>	
data object	
adding .....	20
diagnostics .....	49
Delta (DEL)	
IEC 61850 data modeling .....	55
properties .....	36
device	
attributes .....	61
diagnostics .....	48
device name plate	
properties .....	37
device object	
adding .....	19
diagnostics	
channel .....	47
device .....	48
server .....	46
Directional protection activation information (ACD)	
IEC 61850 data modeling .....	52
properties .....	31
Double point status (DPS)	
IEC61860 data modeling .....	51
properties .....	38
<b>E</b>	
Enumerated Status (ENS)	
.....	51
<b>G</b>	
Gateway object	
adding .....	19
<b>I</b>	
IEC 61850 data modeling	
Binary counter reading (BCR) .....	53
Complex measured value (CMV) .....	54
Controllable double point (DPC) .....	55

---

Controllable integer status (INC) .....	56
Controllable single point (SPC) .....	55
Delta (DEL) .....	55
Directional protection activation information (ACD) .....	52
Double point status (DPS) .....	51
Integer controlled step position information (ISC) .....	57
Integer status (INS) .....	51
Measured value (MV) .....	53
Protection activation information (ACT) .....	52
Single point status (SPS) .....	50
WYE .....	54
IEC101 device	
properties .....	27
Integer controlled step position (ISC)	
properties .....	40
Integer controlled step position information (ISC)	
IEC 61850 data modeling .....	57
Integer status (INS)	
IEC 61850 data modeling .....	51
properties .....	39

**L**

Logical Device object	
adding .....	20
Logical node	
adding .....	20
logical node name plate	
properties .....	40

**M**

Measured value (MV)	
IEC 61850 data modeling .....	53
properties .....	41

**O**

OPC server	
features .....	15
OPC Server	
properties .....	20
OPC Server object	
adding .....	19

**P**

properties	
activation information .....	32
analog set point .....	33

Balanced channel .....	21, 24
Binary controlled step position (BSC) .....	34
Binary counter reading (BCR) .....	34
Complex measured value (CMV) .....	35
Controllable double point (DPC) .....	36
Controllable integer status (INC) .....	39
Controllable single point (SPC) .....	42
Delta (DEL) .....	36
device name plate .....	37
Directional protection activation information (ACD) .....	31
Double point status (DPS) .....	38
IEC101 device .....	27
Integer controlled step position (ISC) .....	40
Integer status (INS) .....	39
logical node name plate .....	40
Measured value (MV) .....	41
OPC Server .....	20
Single point status (SPS) .....	43
WYE .....	43
Protection activation information (ACT)	
IEC 61850 data modeling .....	52

## S

server	
attributes .....	60
diagnostics .....	46
Single point status (SPS)	
IEC 61850 data modeling .....	50
properties .....	43

## U

Unbalanced channel	
properties .....	24

## W

WYE	
IEC 61850 data modeling .....	54
properties .....	43





---

**ABB Distribution Solutions**

**Distribution Automation**

P.O. Box 699

FI-65101 Vaasa, Finland

Phone: +358 10 22 11

**ABB Distribution Automation**

4300 Coral Ridge Drive

Coral Springs, Florida 33065

Phone: +1 954 752 6700

[www.abb.com/mediumvoltage](http://www.abb.com/mediumvoltage)

[www.abb.com/substationautomation](http://www.abb.com/substationautomation)