Station Automation COM600 3.5 IEC 60870-5-104 Master (OPC) User's Manual

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1. About this manual

1.1. Copyrights

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1.3. General

This manual provides thorough information on the IEC 60870-5-104 Master protocol (later referred to as IEC104 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 IEC104 OPC Server.

As a prerequisite, you should understand IEC870-5-104 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 IEC104 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 IEC104 Master OPC Server related objects.

Operation

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

You are also given instructions on how to monitor and control the IEC104 communication.

Technical reference

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

1.4. Document conventions

The following conventions are used for the presentation of material:

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

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

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

  MIF349
- Variables are shown using lowercase letters:

  sequence name

1.5. 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.

1.6. Terminology

The following is a list of terms associated with COM600 that you should be familiar with. The list contains terms that are unique to ABB or have a usage or definition that is different from standard industry usage.

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.
Data Access; DA	An OPC service for providing information about process data to OPC clients.
Data Object; DO	Part of a logical node object representing specific information, for example, status, or measurement. From an object-oriented point of view, a data object is an instance of a class data object. DOs are normally used as transaction objects; that is, they are data structures.
Data Set	The data set is the content basis for reporting and logging. The data set contains references to the data and data attribute values.
Device	A physical device that behaves as its own communication node in the network, for example, protection relay.
Event	Change of process data or an OPC internal value. Normally, an event consists of value, quality, and timestamp.
Intelligent Electronic Device	A physical IEC 61850 device that behaves as its own communication node in the IEC 61850 protocol.
Logical Device; LD	Representation of a group of functions. Each function is defined as a logical node. A physical device consists of one or several LDs.
Logical Node; LN	The smallest part of a function that exchanges data. An LN is an object defined by its data and methods.
LON	A communication protocol developed by Echelon.
LON Application Guideline for substation automation; LAG	A proprietary method of ABB on top of the standard LON protocol.
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.

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

1.7. Abbreviations

The following is a list of abbreviations associated with COM600 that you should be familiar with. See also 1.6, Terminology.

Abbreviation	Description
AE	Alarms and Events
ASDU	Application Service Data Unit
BRCB	Buffered Report Control Block
DA	Data Access
DMCD	Data Message Code Definition
DO	Data Object
GW	Gateway, component connecting two communication networks together
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
LAG	LON Application Guideline for substation automation
LAN	Local Area Network
LD	Logical Device
LMK	LonMark interoperable device communicating in LonWorks network. In this document, the term is used for devices that do not support the ABB LON/LAG communication.
LN	Logical Node
LSG	LON SPA Gateway
NCC	Network Control Center
NUC	Norwegian User Convention
NV	Network Variable
OLE	Object Linking and Embedding
OPC	OLE for Process Control
P&C	Protection & Control

Abbreviation	Description
RTS	Request To Send
SA	Substation Automation
SAB600	Station Automation Builder 600
SCL	Substation Configuration Language
SLD	Single Line Diagram
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SOAP	Simple Object Access Protocol
RCB	Report Control Block
URCB	Unbuffered Report Control Block
XML	eXtended Markup Language

1.8. Related documents

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

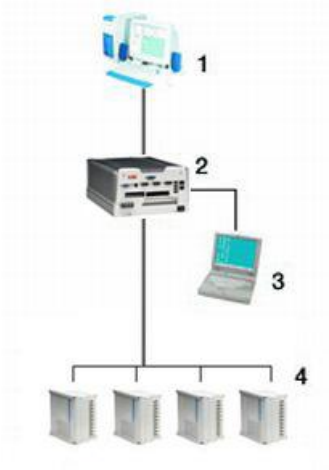
1.9. Document revisions

Document version/date	Product revision	History
A/13.2.2009	3.3	Document created
B/06.11.2009	3.4	Document revised
C/30.06.2011	3.5	Document revised

2. Introduction

2.1. Functional overview

The IEC104 OPC Server provides methods for OPC clients to exchange data with devices communicating via the IEC 60870-5-104 Master protocol.



IEC104_master_protocol.JPG

Figure 2.1-1 IEC 104 OPC Server system overview

(1) NCC (Network Control Center)

(2) COM600 with IEC 104 OPC Server

(3) Station Automation Builder 600 (SAB600)

(4) Protection and control devices communicating through the IEC 104 master protocol

The IEC104 OPC Server software has two parts: Engineering and diagnostic tools and the actual IEC104 OPC Server. Engineering and diagnostic tools utilize the SAB600 framework and provide the user interface for engineering and diagnosing the IEC104 OPC Server. The IEC104 OPC Server handles the data transfer and conversion between the IEC104 protocol and OPC interfaces.

To create a common and protocol independent data interface between the OPC server and client, the process data from the IEC104 devices is remodeled using the IEC 61850 data modeling.

The configuration data is stored in the SCL format. After the IEC104 OPC Server has been launched, it reads the configuration file and establishes communication with the IEC104 devices through the IEC104 protocol stack.

Configured IEC104 devices and data modeled according to the IEC 61850 model, are then exposed to OPC clients through a Data Access (DA) server.

2.2. IEC104 OPC Server features

The IEC104 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:
  - IEC104 channel communication
    IEC104 device communication
- Supported IEC 60870-5-104 data types and functions.
  See Appendix 1, Interoperability list for IEC104 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 IEC104 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

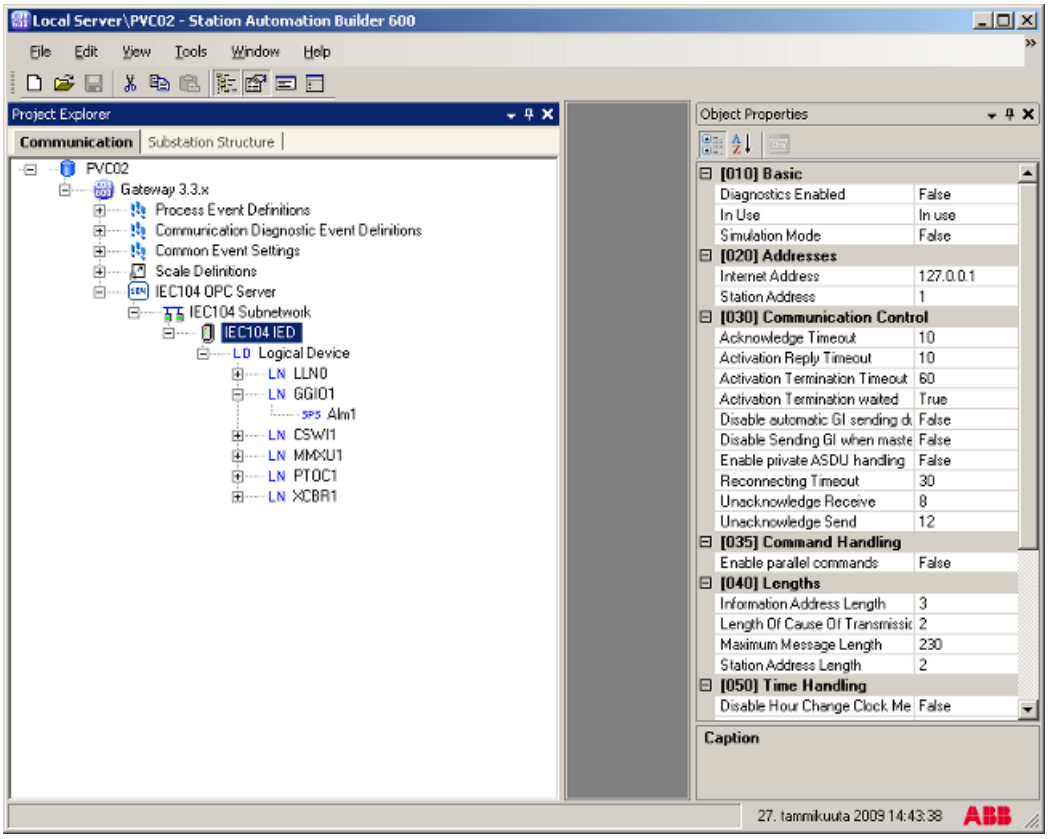
Before you can start using the IEC104 OPC Server, build, and configure an object tree in SAB600 to define the Communication structure.

The possible objects are:

- Gateway
- IEC104 OPC Server
- IEC104 Channel
- IEC104 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: \ ` ' ' #



IEC104_master_conf_overview.bmp

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 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 3.2-1shows an example of how the object tree looks like after it has been built. In the example tree, you can see the IEC104 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. See 3.4.1, General about configuring objects.

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

Table 3.2-1 IEC104 Server-related objects

Object	Description
IEC104 OPC Server	An object representing the IEC104 OPC Server.
IEC104 Channel	An object representing a physical communication channel. You can define up to three channels per OPC server.
IEC104 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 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 > IEC104 > IEC104 > 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. IEC104 OPC Server
3. IEC104 Channel
4. IEC104 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 IEC104 OPC Server object

After the Gateway object has successfully been added, you can continue building the object tree by adding an IEC104 OPC Server object.

To add IEC104 OPC Server object:
1. Select the Gateway object in the communication structure and right-click it.
2. Add IEC104 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 IEC104 Channel objects

To add an IEC104 Channel object:
1. Select an IEC104 OPC Server object and right-click it.
2. Add an IEC104Channel object
3. Rename the new object. The names of the IEC104 Channels have to be unique.

3.3.5. Adding IEC104 Device objects

To add an IEC104 Device object:
1. Select an IEC104 Channel object and right-click it.
2. Add an IEC104 Device object.
3. Rename the new object. The names within an IEC104 Devices within an IEC104 OPC Server have to be unique.

3.3.6. Adding Logical Device objects

To add a Logical Device object:
1. Select an IEC104 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 IEC104 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

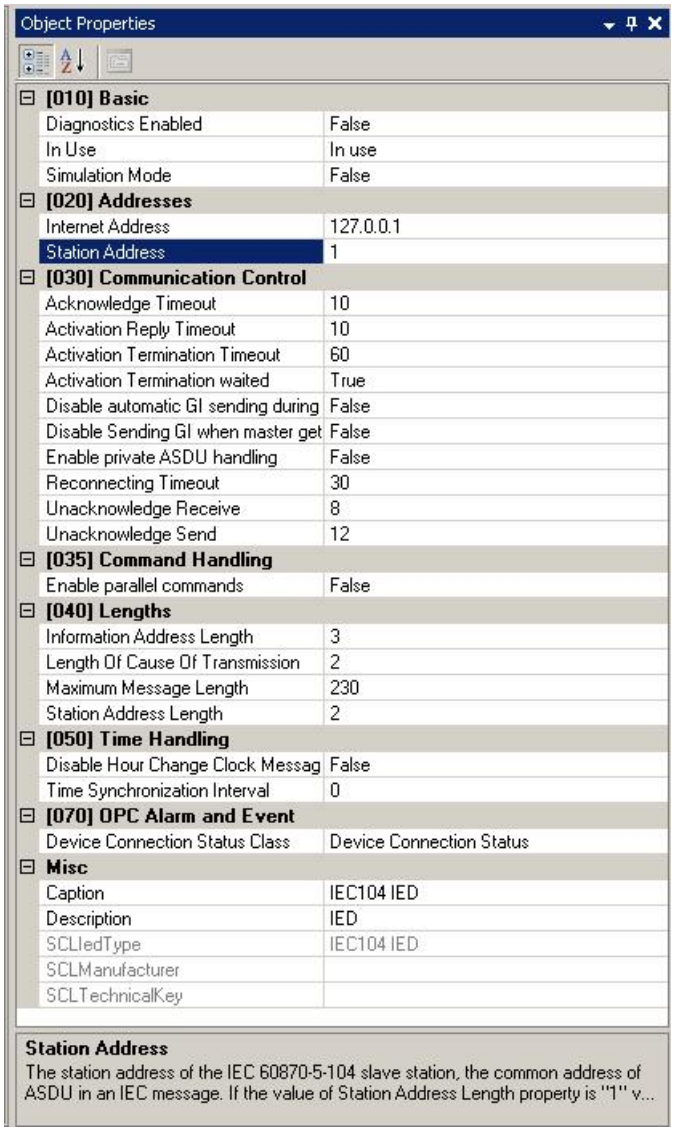
To add a data object:
1. Select a Logical Node object and right-click it.
2. Add a data object.
3. Rename the new object. The names of the data objects have to be unique.

3.4. Configuring objects

3.4.1. General about configuring objects

After the objects have been added, configure the object properties. Figure 3.4.1-1 shows an example of how to use SAB600 to configure the object properties for IEC104 Device.

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



ObjProp_IEC104_Master.jpg

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

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

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

3.4.2. IEC104 OPC Server properties

Table 3.4.2-1 lists the IEC104 OPC Server properties, their value ranges, defaults, and descriptions. These properties are not configurable.

Table 3.4.2-1 IEC104 OPC Server properties

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

3.4.3. Configuring IEC104 Channel Properties

The IEC104 Channel properties that can be configured and value ranges for them can be found in Table 3.4.3-1. The actual configuration by using SAB600 is performed as described in 3.4.1, General about configuring objects.

Table 3.4.3-1 IEC104 Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
In Use	In use Not in use Default: In use	Specifies whether the channel is initially in use or not.
Protocol	IEC60870-5-104 Master	Protocol
Communication Control		
Communication Test Interval	0...65535 Default: 20	Time interval for communication test messages in seconds.
Connect Timeout	0...65535	Defines the timeout of the TCP Connect operation in milliseconds. This is meaningful especially in multidrop configurations, since no other device is served while the master is connecting to an unconnected device. The value depends on the network structure and load, device count, etc. The value should be defined together with the value of the IED's Reconnecting Timeout. Value 0 means that a blocking Connect is used. In this case, the used timeout value depends on the TCP/IP stack implementation.
Response Timeout	0...255 Default: 15	Timeout in seconds for send or test APDUs. If no response is received within this timeout, the connection will be closed.

Property / Parameter	Value or Value range/ Default	Description
Communication Port		
Local Address	Default: 127.0.0.1	The IP Address which is locally used in COM600.

3.4.4. Configuring IEC104 Device properties

Table 3.4.4-1 lists the configurable properties for IEC104 Device and value ranges for these properties. The actual configuration by using SAB600 is performed as described in 3.4.1, General about configuring objects.

Table 3.4.4-1 IEC104 Device properties

Name	Value/Value range	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the station or not.
In Use	In use Not in use Default: In use	Controls if station communication is initially in use or not.
Simulation Mode	True False Default: False	Specifies whether the device is in simulation mode.
Addresses		
Internet Address	127.0.0.1	The IP address or the host name of the remote host.

Name	Value/Value range	Description
Station Address	0...255 or 0...65535 Default: 1 The maximum value depends on the corresponding Station Address Length property value as follows: • when Station Address Length property value is 1, the value range for the Information Address is 0...255 and • when Station Address Length property value is 2, the value range for the Station Address is 0...65535	The station address of the IEC 60870-5-104 slave station, the common address of ASDU in an IEC message.
Communication Control		
Acknowledge Timeout	0...100 Default: 10	The timeout for sending an acknowledgement if the amount of APDUs defined by the Unacknowledge Receive property is not received.
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 false, the timer length defined with the CT attribute is not started. False is needed with some IEC60870-5-104 slave implementations, which do no send activation termination messages at all.

Name	Value/Value range	Description
Disable automatic GI sending during communication initialization	True False Default: False	Sending of the general interrogation command when the master gets the zero (OK) status. When this is false, a general interrogation command is always sent when the object status of the IEC master station gets the value zero, e.g. when set in use or after a suspension. When this is true, general interrogation is not sent automatically at zero status.
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 this is false, a general interrogation command is always sent when the end of initialization message (ASDU 70) is received from the IEC slave. When this is true, general interrogation is not sent automatically when receiving ASDU 70.
Enable private ASDU handling	True False Default: False	Private ASDU handling. When this is true, the private range ASDUs 146, 148 and 160 are handled as unknown ASDUs. Thus, the contents of these ASDUs are sent to a bitstream process object if the Unrecognized Command Handling is set to true.
Reconnecting Timeout	0...255 Default: 30	The interval of reconnecting attempt while communication is not established.
Unacknowledge Receive	0...65535 Default: 8	The maximum number of APDUs that are received without acknowledging them to the remote host.
Unacknowledge Send	0...65535 Default: 12	The maximum number of APDUs sent without receiving acknowledgment from the remote host.
Command Handling		

Name	Value/Value range	Description
Enable parallel commands	True False Default: False	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.
Lengths		
Information Address Length	1...3 Default: 3	The length of the information object address in octets. 1 = 0...255, 2 = 0...65535 3 = 0...16777215
Length of Cause of Transmission	1...2 Default: 2	The length of the Cause Of Transmission field in an IEC 60870-5-104 message.
Maximum Message Length	20...255 Default: 230	The maximum length of transmitted message in octets.
Station Address Length	1...2 Default: 2	The length of the station address in octets.
Time Handling		
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: 0	Time synchronization interval in seconds.
OPC Alarm and Event		

Name	Value/Value range	Description
Device Connection Status Class	Device Connection Status	Device Connection Status Class is used for device connection status conditions.

3.4.5. Configuring data objects

3.4.5.1. Directional protection activation information (ACD)

Table 3.4.5.1-1 Configurable ACD properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACD	Common data class according to IEC 61850.
Addresses		
General Address	0...16777215 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).
OPC Alarm and Event		
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.
Indication Event for Phase C		Indication event used with phase C.

3.4.5.2. Protection activation information (ACT)

Table 3.4.5.2-1 Configurable ACT properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACT	Common data class according to IEC 61850.
Addresses		
General Index	0...65535 Default: 0	General Index
Neutral Index	0...65535 Default: 0	Neutral Index
Phase A Index	0...65535 Default: 0	Phase A Index
Phase B Index	0...65535 Default: 0	Phase B Index
Phase C Index	0...65535 Default: 0	Phase C Index
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.

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

3.4.5.3. Analogue set point (APC)

Table 3.4.5.3-1 Configurable APC properties for OPC servers

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

3.4.5.4. Binary counter reading (BCR)

Table 3.4.5.4-1 Configurable BCR properties for OPC servers

Property/Parameter	Value or Value range/ Default /Example	Description
Basic		
Common Data Class	BCR	Common Data Class according to IEC 61850.

Property/Parameter	Value or Value range/ Default /Example	Description
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication.
Scale and Unit		
Multiplier	Default: None	Multiplier for counter.
Unit	Default: Dimensionless	Unit for counter.

3.4.5.5. Binary controlled step position information (BSC)

Table 3.4.5.5-1 Configurable BSC properties for OPC servers

Property/Parameter	Value or Value range/ Default /Example	Description
Basic		
Common Data Class	BSC	Common Data Class according to IEC 61850.
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.
Position Address	0...16777215 Default: 0	IEC address for position.
OPC Alarm and Event		
Command Tracking Event		Command tracking event class used with this data object.
Indication Event		Indication event used with this data object.

3.4.5.6. Complex measured value (CMV)

Table 3.4.5.6-1 Configurable CMV properties for OPC servers

Property/Parameter	Value or Value range/ Default /Example	Description
Basic		
Common Data Class	CMV	Common Data Class according to IEC 61850.
Sub Type		

Property/Parameter	Value or Value range/ Default /Example	Description
Sub Type	MV Simple MV LIMITCHECK Default: MV Simple	Sub type description.
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication.
Scale and Unit		
Multiplier	Default: Deka	Multiplier for measurement.
Scale	Default: None	Scale for measurement.
Unit	Default: Dimensionless	Unit for measurement.
Limit Value Supervision		
Max	Default: 20000	Maximum value for measurement.
Min	Default: 0	Minimum value for measurement.

3.4.5.7. Delta (DEL)

Table 3.4.5.7-1 Configurable DEL properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DEL	Common data class according to IEC 61850.
Sub-Type		
Sub Type	DEL Full DEL Simple Default: DEL Simple	Sub Type description.
Addresses		
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).

Property/ Parameter	Value or Value range/ Default	Description
Phase CA Address	0...16777215 Default: 0	IEC Address for phase CA (0 = Not in use).
Scale and Unit		
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.
Limit Value Supervision		
Max	20000	Maximum value for measurement.
Min	0	Minimum value for measurement.

3.4.5.8. Controllable double point (DPC)

Table 3.4.5.8-1 Configurable DPC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Sub-Type		
Sub Type	IEC style command Indication only IEC style command	Object subtype.
Addresses		
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.

Property/ Parameter	Value or Value range/ Default	Description
Selected Address	0...65535 Default: 0	IEC Address for selected.
OPC Alarm and Event		
Command Tracking Event	SwitchOperation TapchangerSingleParallelOperation	Command tracking event used with this data object.
Indication Event		Indication event used with this data object.
Scale and Unit		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for indication.

3.4.5.9. Device Name Plate (DPL)

Table 3.4.5.9-1 Configurable DPL properties for OPC client

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

3.4.5.10. Double point status (DPS)

Table 3.4.5.10-1 Configurable DPS properties for OPC client

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

3.4.5.11. Controllable integer status (INC)

Table 3.4.5.11-1 Configurable INC properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	INC	Common data class according to IEC 61850.
Addresses		
Command Address	0...16777215 Default: 0	IEC address for command.
Indication Address	0...16777215 Default: 0	IEC address for indication.
OPC Alarm and Event		
Command Tracking Event	SwitchOperation TapchangerSingleParallelOperation	Command tracking event used with this data object.

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

3.4.5.12. Integer status (INS)

Table 3.4.5.12-1 Configurable INS properties for OPC client

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

3.4.5.13. Integer controlled step position information (ISC)

Table 3.4.5.13-1 Configurable ISC properties for OPC client

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

Property/ Parameter	Value or Value range/ Default	Description
Command Address	0...16777215 Default: 0	IEC address for command.
Position Address	0...16777215 Default: 0	IEC address for position.
OPC Alarm and Event		
Command Tracking Event	DirectOperate TapchangerAutoManualOperation Default: None	Command tracking event used with this data object.
Indication Event		Indication event used with this data object.

3.4.5.14. Logical Node Name Plate (LPL)

Table 3.4.5.14-1 Configurable LPL properties for OPC client

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

3.4.5.15. Measured value (MV)

Table 3.4.5.15-1 Configurable MV properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		

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

3.4.5.16. Controllable single point (SPC)

Table 3.4.5.16-1 Configurable SPC properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPC	Common data class according to IEC 61850.
Sub-Type		
Sub Type	Indication only IEC style command Default: IEC style command	Object subtype.
Addresses		

Property/ Parameter	Value or Value range/ Default	Description
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.
OPC Alarm and Event		
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.
Scale and Unit		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for measurement.

3.4.5.17. Single point status (SPS)

Table 3.4.5.17-1 Configurable SPS properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPS	Common data class according to IEC 61850.
Addresses		
Indication Address	0...16777215 Default: 0	IEC address for indication.
OPC Alarm and Event		
Indication Event		Indication event used with this data object.

Property/ Parameter	Value or Value range/ Default	Description
Scale and Unit		
Scale	Lookup Table Scale Stepwise Linear Scale Default: None	Scale for measurement.

3.4.5.18. WYE

Table 3.4.5.18-1 Configurable WYE properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	WYE	Common data class according to IEC 61850.
Sub-Type		
Sub Type	WYE Full WYE Simple Default: WYE Simple	Object subtype.
Addresses		
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.
OPC Alarm and Event		
ResMappedEvent	Default: None	ResMappedEventDesc

Property/ Parameter	Value or Value range/ Default	Description
Scale and Unit		
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.
Net Limit Value Supervision		
Net Max Limit	Default: 20000	Max limit for net.
Net Min Limit	Default: 0	Min limit for net.
Phase Limit Value Supervision		
Max	Default: 20000	Maximum value for measurement.
Min	Default: 0	Minimum value for measurement.
Res Limit Value Supervision		
Res Max Limit	Default: 20000	Max limit for res.
Res Min Limit	Default: 0	Min limit for res.
Neutral Limit Value Supervision		
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 IEC104 OPC Server has been configured.

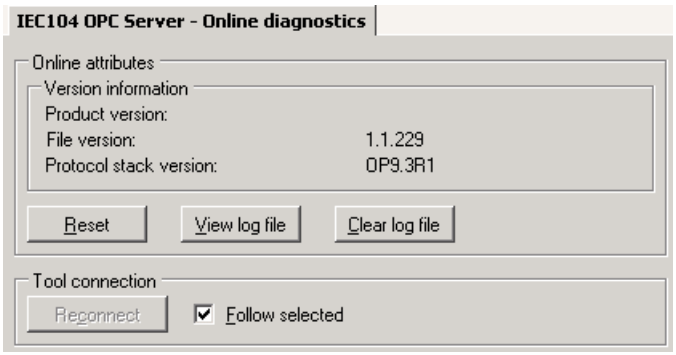
After this, you can, for example, monitor and control the condition of connections in an IEC104 network by using the Online diagnostics function SAB600.

4.2. Activating COM600 with new configurations

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

4.3. IEC104 OPC Server diagnostics

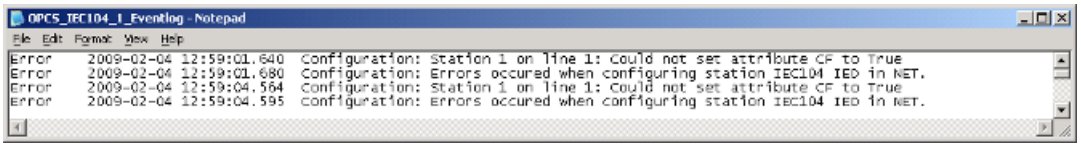
To view the IEC104 OPC Server diagnostics, right-click the IEC104 OPC Server object and select **Online diagnostics**, see Figure 4.3-1.



IEC104_OPC_Server_Online_diagnostics.bmp

Figure 4.3-1 IEC104 OPC Server Online diagnostics

You have the following alternatives:
- to view version information
- to reset the IEC104 OPC Server
- to view the event log file, see Figure 4.3-2
- to clear the log file



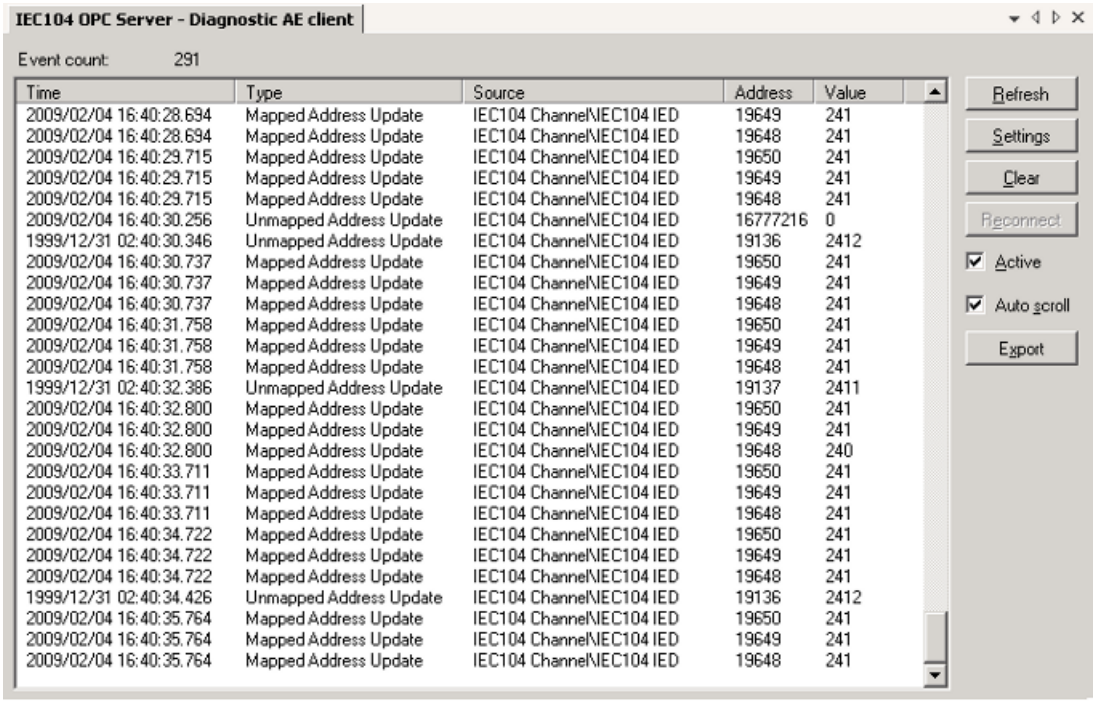
IEC104_OPC_Server_Event_Log.bmp

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.



IEC104_OPC_Server_Diagnostic_AE_Client.bmp

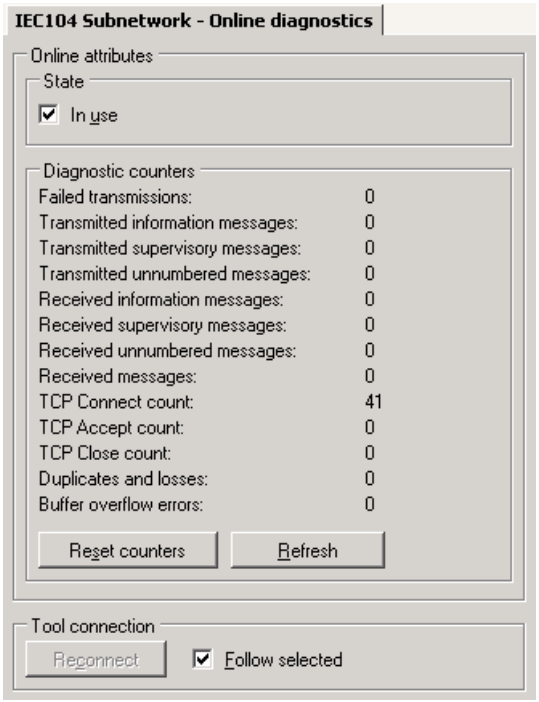
Figure 4.3-3 IEC101OPC Server Diagnostic AE client

4.4. Monitoring and controlling IEC104 Channel Activity

The IEC104 Channel activity can be monitored with the Online diagnostics function.

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

To monitor and control IEC104 Channel activity:
1. Select the channel you want to monitor in the object tree of SAB600.
2. Right-click the channel.
3. Select **Online diagnostics**.



IEC104_OPC_Subnetwork_Online_Diagnostics.bmp

Figure 4.4-1 IEC104 Channel Online Diagnostics

In the Diagnostic counters field, you can monitor the channel activity. The available attributes can be seen in Figure 4.4-1. To reset Diagnostic counters, click **Reset counters**.

You can take an IEC104Channel 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**.

4.5. Monitoring and controlling IEC104 Device communication

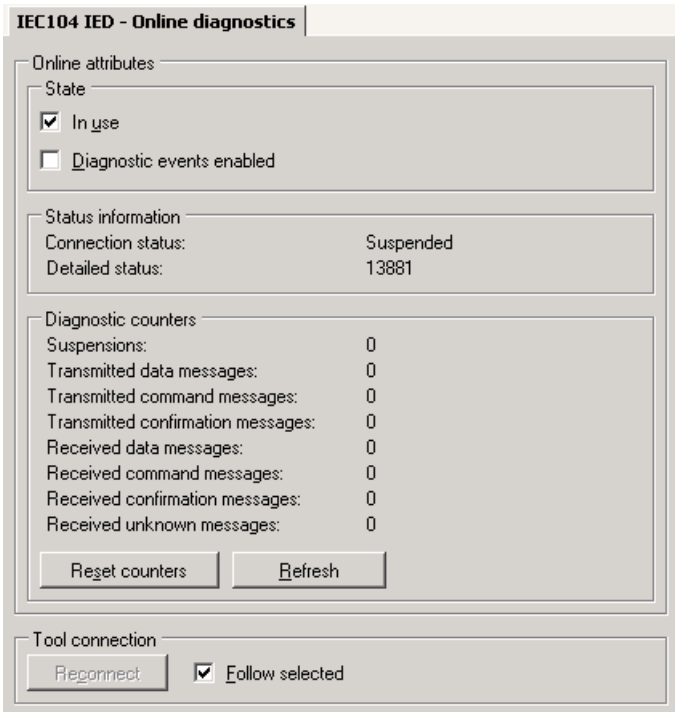
The IEC104 Device communication can be monitored with the Online diagnostics function. You can also take a device into use or out of use as described in this section.

To monitor and control IEC104 Device communication:
1. Select the device you want to monitor in the object tree of SAB600.
2. Right-click the device.
3. Select **Online diagnostics**.

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

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

You can take an IEC104 Device into use by marking the **In use** check box. If you unmark the check box, the device is taken out of use. To update diagnostic counters manually, click **Refresh**.



IEC104_OPC_IED_Online_Diagnostics.bmp

Figure 4.5-1 IEC104 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 about IEC 61850 data modeling

The relationship between the IEC 61850 data modeling and IEC104 OPC Server is described in this section.

For each data class, there is a table giving a detailed description about the relation between the IEC104 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.
- **IEC104 information element** specifies the IEC104 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	Mandatory/Optional	Protocol information element	OPC data types
stVal	BOOLEAN	TRUE | FALSE	M	SPI(0=ON, 1=OFF)	VT_BOOL
q	Quality		M	BL, SB, NT, IV	VT_I4
t	TimeStamp		M	CP24Time2a CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.3. Double point status (DPS)

DPS represents DMCD M_DP_NA_1, M_DP_TA_1, M_DP_TB_1.

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

5.2.4. Integer status (INS)

INS represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1.

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

5.2.5. Protection activation information (ACT)

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

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
general	BOOLEAN		M	SPI	VT_BOOL
phsA	BOOLEAN		O	SPI	VT_BOOL
phsB	BOOLEAN		O	SPI	VT_BOOL
phsC	BOOLEAN		O	SPI	VT_BOOL
neut	BOOLEAN		O	SPI	VT_BOOL

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
q	Quality		M	EI, BL, SB, NT, IV	

5.2.6. Directional protection activation information (ACD)

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

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
general	BOOLEAN		M	SPI	VT_BOOL
dirGeneral	ENUMERATED	unknown forward backward	M		VT_I4
phsA	BOOLEAN		O	SPI	VT_BOOL
dirPhsA	ENUMERATED	unknown forward backward	O		VT_I4
phsB	BOOLEAN		O	SPI	VT_BOOL
dirPhsB	ENUMERATED	unknown forward backward	O		VT_I4
phsC	BOOLEAN		O	SPI	VT_BOOL
dirPhsC	ENUMERATED	unknown forward backward	O		VT_I4
neut	BOOLEAN		O	SPI	VT_BOOL
dirNeut	ENUMERATED	unknown forward backward	O		VT_I4
q	Quality		M	EI, BL, SB, NT, IV	
t	TimeStamp		M	CP24Time2a, CP56Time2a	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.7. Binary counter reading (BCR)

BCR represent DMCD M_IT_NA_1, M_IT_TA_1, M_IT_TB_1.

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

5.2.8. Measured value (MV)

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

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

5.2.9. 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.

5.2.10. WYE

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

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

5.2.11. Delta (DEL)

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

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

5.2.12. Controllable single point (SPC)

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

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

5.2.13. Controllable double point (DPC)

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

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

5.2.14. Controllable integer status (INC)

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

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

5.2.15. 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	Mandatory/Optional	Protocol information 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

5.2.16. 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	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	INTEGER	-64 ... 63	M	NVA	VT_I4
valWTr	ValWithTrans		M	VTI	VT_I4
q	Quality		M	BL, SB, NT, IV	V_I4
t	TimeStamp		M	CP24TIME2A	V_DATE
d	Description	Text	O		VT_BSTR

5.2.17. Analogue set point (APC)

APC represents DMCD C_SE_NC_1.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
spMag	AnalogueValue		M	IEEE STD 754, BSI, SVA	VT_R4
d	Description	Text	O		VT_BSTR

5.3. Status codes

5.3.1. Introduction

The following status codes are defined for the IEC 60870-5-104 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 60870-5-104 slave protocol.
13854	ICCC_ASDU_TABLE_NOT_CREATED. Internal software error.
13855	ICCC_UNKNOWN_ASDU_NAME. The name of the ASDU written to the SD or EV attribute is not supported.
13856	ICCC_ASDU_QUEUE_FULL. No more events can be written to one of the queues by using the SD or EV attribute since the queue is full.
13857	ICCC_MESSAGE_BUFFER_FULL. Internal software error. The value of the ML attribute may be too small.
13858	ICCC_MESSAGE_FILLING_ERROR. Internal software error. The value of the ML attribute may be too small.
13859	ICCC_UNKNOWN_ASDU. The number of the ASDU written to the SD or EV attribute is not supported.
13860	ICCC_NO_ACTIVE_COMMAND. There is no preceding command with the given address when confirming a command by using the CF attribute. Either the address is incorrect or the command has not been received.
13861	ICCC_INVALID_QUEUE_NUMBER. The index of the SD or EV attribute is incorrect.
13862	ICCC_SC_DATA_OVERFLOW. Internal software error.
13863	ICCC_DEVICE_SUSPENDED. The IEC station is in the suspended state. The reason for this could be that the link is not properly established (for example, incorrect cable wiring) or the master does not respond.
13864	ICCC_MESSAGE_SENDING_ERROR. Internal software error. This may be the result of a problem in wiring or hardware.
13865	ICCC_REMOTE_DEVICE_REPLIES_WITH_NACK. The master did not accept the message but responded with a negative acknowledgment instead. Not used in the unbalanced mode.
13866	ICCC_LINK_NOT_READY. A message is sent to a line with a non-established communication.
13868	ICCC_OUT_OF_BUFFERS. Internal software error. Operation could not be completed since the buffer pool has run out of buffers.
13869	ICCC_DONT_REPLY. Internal software error.
13872	ICCC_DEVICE_STOPPED. The station has been set out of use by using the IU attribute.
13873	ICCC_NO_ADDRESS_IN_ACP. Internal software error.
13875	ICCC_UNEXPECTED_TYPE_IN_ACP. Internal software error.

5.4. Attributes

5.4.1. Server attributes

Table 5.4.1-1 IEC 104 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
Basic		
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 station in turn is completed.
Diagnostic Counters		
Transmitted telegrams		The number of transmitted data messages.
Failed transmissions		The number of failed transmissions.
Transmit errors		The number of transmitted commands.
Transmitted I format messages		The number of transmitted information messages.
Transmitted S format messages		The number of transmitted supervisory messages.
Transmitted U format messages		The number of transmitted unnumbered messages.

Property / Parameter	Value or Value range/ Default	Description
Received I format messages		The number of received information messages.
Received S format messages		The number of received supervisory messages.
Received U format messages		The number of received unnumbered messages.
Received messages		The number of received messages.
TCP Connect count		The count of TCP connect request.
TCP Accept count		The count of accepted TCP connect request.
TCP Close count		The count of closed TCP connection.
Duplicates and losses		The number of times duplicates and losses has occurred.
Buffer overflow errors		The number of times there as been a buffer overflow.

5.4.3. Device attributes

Table 5.4.3-1 Device attributes

Property / Parameter	Value or Value range/ Default	Description
Basic		
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.
Diagnostic Events Enabled	True = Diagnostic events enabled False = Diagnostic events disabled	This attribute enables or disables diagnostic events.
Status Information		
Connection Status	True = Device connection OK False = Device connection suspended.	Indicates the status of the device connection.

Property / Parameter	Value or Value range/ Default	Description
Detailed Status	When written: 1 = Re-transmit system message When read: A status code, e.g. 0 = OK (communication works properly) 13863 = Device suspended. For more information, see 5.3.2, Link layer status codes and 5.3.3, Application layer status codes.	Indicates the detailed information about the station device status. Setting Detailed Status of a device to 1 makes the protocol stack to re-transmit the last system message caused by the device. Possible 'Stopped' and 'Suspended' messages cause old marking of OPC items.
Diagnostic counters		
Suspensions		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 IEC104 OPC Server

☐ Not supported

■ Supported

▩ Supported, may need additional engineering

This companion standard presents sets of parameters and alternatives from which subsets must be selected to implement particular tele control systems. Certain parameter values, such as the choice of “structured“ or “unstructured“ fields of the Information Object Address (IOA) 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 types 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 partners agree on the selected parameters.

The interoperability list is defined as in the IEC 60870-5-104 protocol and extended with parameters used in this standard. The text descriptions of parameters which are not applicable to this companion standard are struck out (the corresponding check box is marked black).

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

Application layer telegram formats

☐ Function or ASDU is not used

☒ Function or ASDU is used as standardized (default)

R Function or ASDU is used in reverse mode

B Function or ASDU is used in standard and reverse mode

A Function or ASDU can need some additional application level work

The possible selection (blank, X, R, B or A) is specified for each specific clause or parameter. A black check box indicates that the option cannot be selected in this companion standard.

Device function (system-specific parameter)

- ☐ System definition
- ☒ Controlling station (Master)
- ☐ Controlled station (Slave)

Network configuration (network-specific parameter)

- ■ ~~Point to point~~
- ■ ~~Multiple point to point~~
- ■ ~~Multipoint partyline~~
- ■ ~~Multipoint star~~

Physical layer (network-specific parameter)

Transmission speed (control direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.27
■ ~~400 bit/s~~	■ ~~2400 bit/s~~	■ ~~2400 bit/s~~
■ ~~200 bit/s~~	■ ~~4800 bit/s~~	■ ~~4800 bit/s~~
■ ~~300 bit/s~~	■ ~~9600 bit/s~~	■ ~~9600 bit/s~~
■ ~~600 bit/s~~		■ ~~19200 bit/s~~
■ ~~4200 bit/s~~		■ ~~38400 bit/s~~
		■ ~~56000 bit/s~~
		■ ~~64000 bit/s~~

Transmission speed (monitor direction)

Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.27
■ ~~400 bit/s~~	■ ~~2400 bit/s~~	■ ~~2400 bit/s~~
■ ~~200 bit/s~~	■ ~~4800 bit/s~~	■ ~~4800 bit/s~~
■ ~~300 bit/s~~	■ ~~9600 bit/s~~	■ ~~9600 bit/s~~
■ ~~600 bit/s~~		■ ~~19200 bit/s~~
■ ~~4200 bit/s~~		■ ~~38400 bit/s~~
		■ ~~56000 bit/s~~
		■ ~~64000 bit/s~~

Link layer (network-specific parameter)

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

Link transmission procedure	Address field of the link
■ ~~Balanced transmission~~	■ ~~not present (balanced transmission only)~~
■ ~~Unbalanced transmission~~	■ ~~One octet~~
	■ ~~Two octet~~
Frame length	■ structured
■ Maximum length L (number of octets)	■ unstructured

When using an unbalanced link layer, the following ASDU types are returned in class 2 messages (low priority) with the indicated causes of transmission:

■ ~~The standard assignment of ASDUs to class 2 messages is used as follows:~~

Type identification	**~~Cause of transmission~~**
9, 11, 13, 21	<1>

■ ~~A special assignment of ASDUs to class 2 messages is used as follows:~~

Type identification	**~~Cause of transmission~~**

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)

Length of APDU (system-specific parameter)

The maximum length of the APDU is 253 (default). The maximum length can be reduced per system.

253	Maximum length of APDU per system

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~~
☐	~~<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
☐	<33>	:=Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
☒	<34>	:=Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
☐	<35>	:=Measured value, scaled value with time tag CP56Time2a	M_ME_TE_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
☐	<38>	:=Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
☐	<39>	:=Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1

☐	<40>	:=Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

Either the ASDUs of the set <2>, <4>, <6>, <8>, <10>, <12>, <14>, <16>, <17>, <18>, <19> or of the set <30> - <40> are used.

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
A	<51>	:=Bitstring of 32 bit	C_BO_NA_1
☐	<58>	:=Single command with time tag CP56Time2a	C_SC_TA_1
☐	<59>	:=Double command with time tag CP56Time2a	C_DC_TA_1
☐	<60>	:=Regulating step command with time tag CP56Time2a	C_RC_TA_1
☐	<61>	:=Set point command, normalized value with time tag CP56Time2a	C_SE_TA_1
☐	<62>	:=Set point command, scaled value with time tag CP56Time2a	C_SE_TB_1
☐	<63>	:=Set point command, short floating point value with time tag CP56Time2a	C_SE_TC_1
☐	<64>	:=Bitstring of 32 bit with time tag CP56Time2a	C_BO_TA_1

Either the ASDUs of the set <45> - <51> or of the set <58> - <64> are used.

System information in monitor direction (station-specific parameter)

☒	<70>	:=End of initialization	M _EI_NA_1

System information in control direction (station-specific parameter)

☒	<100>	:=Interrogation command	C_IC_NA_1
☐	<101>	:=Counter interrogation command	C_CI_NA_1
☐	<102>	:=Read command	C_RD_NA_1
☒	<103>	:=Clock synchronization command	C_CS_NA_1
■	~~<104>~~	~~:=Test command~~	~~C_TS_NA_1~~
☐	<105>	:=Reset process command	C_RP_NA_1
■	~~<106>~~	~~:=Delay acquisition command~~	~~C_CD_NA_1~~
☐	<107>	:=Test command with time tag CP56Time2a	C_TS_TA_1

Parameter in control direction (station-specific parameter)

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

File transfer (station-specific parameter)

☐	<120>	:=File ready	F_FR_NA_1
☐	<121>	:=Section ready	F_SR_NA_1
☐	<122>	:=Call directory, select file, call file, call section	F_SC_NA_1
☐	<123>	:=Last section, last segment	F_LS_NA_1
☐	<124>	:=Ack file, ack section	F_AF_NA_1
☐	<125>	:=Segment	F_SG_NA_1
☐	<126>	:=Directory (blank or X, only available in monitor (standard) direction)	F_DR_TA_1

Type identifier and cause of transmission assignments (station-specific parameters)

- Shaded boxes are not required
- Black boxes are not permitted in this companion standard
- Blank = Function or ASDU is not used
- Mark Type identification/Cause of transmission combinations:
  - **'X'** if supported only in the standard direction
  - **'R'** if supported only in the reverse direction
  - **'B'** if supported in both directions

Type identification		Cause of transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 10 36	37 10 41	44	45	46	47
<1>	M_SP_NA_1		X	X		X						X	X		X					
~~<2>~~	~~M_SP_TA_1~~																			
<3>	M_DP_NA_1		X	X		X						X	X		X					
~~<4>~~	~~M_DP_TA_1~~																			
<5>	M_ST_NA_1		X	X		X						X	X							
~~<6>~~	~~M_ST_TA_1~~																			
<7>	M_BO_NA_1																			
~~<8>~~	~~M_BO_TA_1~~																			
<9>	M_ME_NA_1	X	X	X		X									X					
~~<10>~~	~~M_ME_TA_1~~																			
<11>	M_ME_NB_1	X	X	X		X									X					
~~<12>~~	~~M_ME_TB_1~~																			
<13>	M_ME_NC_1	X	X	X		X									X					
~~<14>~~	~~M_ME_TC_1~~																			
<15>	M_IT_NA_1			X												X				
~~<16>~~	~~M_IT_TA_1~~																			
~~<17>~~	~~M_EP_TA_1~~																			
~~<18>~~	~~M_EP_TB_1~~																			
~~<19>~~	~~M_EP_TC_1~~																			
<20>	M_PS_NA_1																			
<21>	M_ME_ND_1																			
<30>	M_SP_TB_1			X		X						X	X							
<31>	M_DP_TB_1			X		X						X	X							
<32>	M_ST_TB_1			X		X						X	X							
<33>	M_BO_TB_1																			
<34>	M_ME_TD_1			X		X														
<35>	M_ME_TE_1			X		X														
<36>	M_ME_TF_1			X		X														
<37>	M_IT_TB_1			X												X				
<38>	M_EP_TD_1																			
<39>	M_EP_TE_1																			
<40>	M_EP_TF_1																			
<45>	C_SC_NA_1						X	X	X	X	X						X	X	X	X

Type identification		Cause of transmission																	
<46>	C_DC_NA_1						X	X	X	X	X						X	X	X	X
<47>	C_RC_NA_1						X	X	X	X	X						X	X	X	X
<48>	C_SE_NA_1						X	X	X	X	X						X	X	X	X
<49>	C_SE_NB_1						X	X	X	X	X						X	X	X	X
<50>	C_SE_NC_1						X	X	X	X	X						X	X	X	X
<51>	C_BO_NA_1																			
<58>	C_SC_TA_1																			
<59>	C_DC_TA_1																			
<60>	C_RC_TA_1																			
<61>	C_SE_TA_1																			
<62>	C_SE_TB_1																			
<63>	C_SE_TC_1																			
<64>	C_BO_TA_1																			
<70>	M_EI_NA_1[a]				X															
<100>	C_IC_NA_1						X	X	X	X	X									
<101>	C_CI_NA_1																			
<102>	C_RD_NA_1																			
<103>	C_CS_NA_1			X			X	X												
~~<104>~~	~~C_TS_NA_1~~																			
<105>	C_RP_NA_1																			
~~<106>~~	~~C_CD_NA_1~~																			
<107>	C_TS_TA_1																			
<110>	P_ME_NA_1																			
<111>	P_ME_NB_1																			
<112>	P_ME_NC_1																			
<113>	P_AC_NA_1																			
<120>	F_FR_NA_1																			
<121>	F_SR_NA_1																			
<122>	F_SC_NA_1																			
<123>	F_DR_TA_1																			
<124>	F_AF_NA_1																			
<125>	F_SG_NA_1																			
<126>	F_DR_TA[b]																			

a. blank or X only
b. blank or X only

Basic application functions

Station limitations (station-specific parameter)

☐ Remote initialization

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

Cyclic data transmission (station-specific parameter)

☐ Cyclic data transmission

Read procedure (station-specific parameter)

☐ Read procedure

Spontaneous transmission (station-specific parameter)

☐ Spontaneous transmission

Double transmission of information objects with cause of spontaneous transmission (station-specific parameter)

The following type identifications can be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list.

☐ Single-point information M_SP_NA1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1

☐ Double-point information M_DP_NA_1, M_DP_TA_1 and M_DP_TB_1

☐ Step position information M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1

☐ Bitstring of 32 bit M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1 (if defined for a specific project)

☐ Measured value, normalized value M_ME_NA_2, M_ME_TA_1, M_ME_ND_ 1 and M_ME_TD_1

☐ Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1

☐ Measured value, short floating point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

Station interrogation (system parameter or station-specific parameter)

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

Clock synchronization (station-specific parameter)

☒ Clock synchronization

Command transmission (object-specific parameter)

☒ Direct command transmission

☒ Direct set point command transmission

☒ Select and execute command

☒ Select and execute set point command

☒ C_SE ACTTERM used

☒ No additional information

☐ Short pulse duration (duration determined by a system parameter in the outstation)

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

☐ Persistent output

☒ Supervision of maximum delay in command direction of commands and set point commands.

255 s Maximum allowable delay of commands and set point commands

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

- ☐ Mode A: Local freeze with spontaneous transmission
- ☐ Mode B: Local freeze with counter interrogation
- ☐ Mode C: Freeze and transmit by counter interrogation commands
- ☐ Mode D: Freeze by counter interrogation command, frozen values reported spontaneously
- ☐ Counter read
- ☐ Counter freeze without reset
- ☐ Counter freeze with reset
- ☐ Counter reset
- ☐ General request counter
- ☐ Request counter group 1
- ☐ Request counter group 2
- ☐ Request counter group 3
- ☐ Request counter group 4

Define addresses per group.

Parameter loading (object-specific parameter)

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

Parameter activation (object-specific parameter)

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

Test procedure (object-specific parameter)

☒ Test procedure

File transfer (station-specific parameter)

File transfer in monitor direction

☐ Transparent file

☐ Transmission of disturbance data of protection equipment

☐ Transmission of sequences of events

☐ Transmission of sequences of recorded analogue values

File transfer in control direction

☐ Transparent file

Background scan (station-specific parameter)

☐ Background scan

Acquisition of transmission delay (station-specific parameter)

■ ~~Acquisition of transmission delay~~

Definition of time-outs

Parameter	~~Default-value~~	Remarks	~~Selected value~~
t_0	30 s	Time-out of connection establishment	1 - 255 s
t_1	15 s	Time-out of send or test APDUs	1 - 255 s
t_2	10 s	Time-out for acknowledges in case of no data messages t2 < t1	1 - 255 s
t_3	20	Time-out for sending test frames in case of a long idle state	1 - 255 s

Maximum range of values for all the time-outs: 1 seconds to 255 seconds , accuracy 1 s.

Maximum number of outstanding I format APDUs (k) and the latest acknowledgment (w)

Parameter	~~Default value~~	Remarks	~~Selected value~~
k	12 APDU	Maximum difference receive sequence number to send state variable	1-32767 s
w	8 APDUs	Latest acknowledg-ment after receiving w I-format APDUs	1-32767 s

Maximum range of values k: 1 to 32767 (215-1) APDUs, accuracy 1 APDU.

Maximum range of values w: 1 to 32767 APDUs, accuracy 1 APDU

(Recommendation: w should not exceed 2/3 of k).

Port number

Parameter	~~Default value~~	Remarks
Port number	2404	In all cases

RFC 2200 suite

RFC 2200 is an official Internet standard which describes the state of standardization of protocols used on the Internet as determined by the Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used in the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects must be chosen by the user of this standard.

☒ Ethernet 802.3

☐ Serial X.21 interface

☐ Other selection RFC 2200:

List of valid documents from RFC 2200

1. .....
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3. .....
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6. .....
7. and so on

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