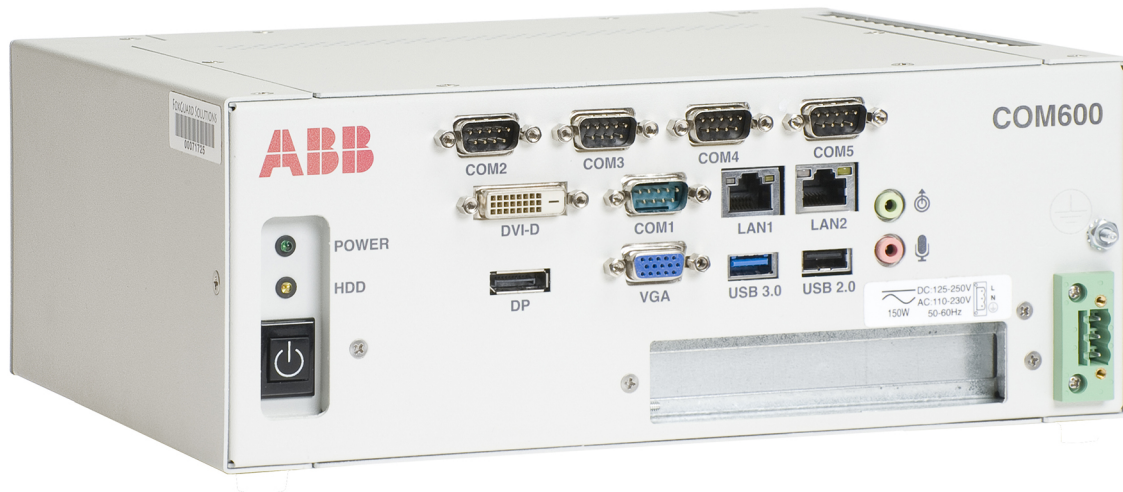


COM600 series, Version 5.1

DNP 3.0 Serial Slave (OPC) User's Manual



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1. About this manual

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

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

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

1.4. Trademarks

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1.5. General information

This manual provides thorough information on the OPC Client for DNP 3.0 Serial Slave protocol (later referred to as DNP Serial Slave OPC Client) and the central concepts related to it. You find instructions on how to take it into use. The basic operation procedures are also discussed.

The information in this user's manual is intended for application engineers who configure DNP Serial Slave OPC Client to establish data transfer between the DNP master system and process devices connected to Grid Automation Controller COM600 (later referred to as COM600).

As a prerequisite, you should understand the DNP 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 DNP Serial Slave OPC Client and its features.

Configuration

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

Operation

This section covers the basic operation procedures you can carry out when transferring or activating the COM600 computer with new configurations.

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

Technical reference

This section describes the IEC 61850 data modeling, contains attributes and a list of status codes.

1.6.

Document conventions

The following conventions are used for the presentation of material:

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

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

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

MIF349

- Variables are shown using lowercase letters:

sequence name

1.7. Use of symbols

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



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



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



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



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



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

1.8. Terminology

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

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

1.9.

Abbreviations

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

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

1.10. Related documents

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

1.11. Document revisions

Document version/date	Product revision	History
A/10.3.2005	1.0	Document created
B/16.10.2006	3.0	Document revised
C/21.12.2007	3.1	Document revised
D/17.6.2008	3.2	Document revised
E/13.2.2009	3.3	Document revised
F/06.11.2009	3.4	Document revised

Document version/date	Product revision	History
G/30.6.2011	3.5	Document revised
H/31.5.2012	4.0	Document revised
K/13.3.2015	4.1	Document revised
L/24.5.2017	5.0	Document revised
M/28.3.2018	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 DNP protocol slave interface of COM600 enables master systems communicating with DNP protocol to receive data from and deliver commands to P&C devices connected to the GW. The DNP slave is implemented as an OPC client, which transfers and converts data between the DNP slave protocol interface and the OPC servers of COM600. See COM600 User's Manual for more details.

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

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

2.4. DNP Serial Slave OPC Client features

The DNP Serial Slave OPC Client supports the following features:

- OPC Data Access Client v. 1.0/2.0 for accessing data from the OPC servers
- OPC Alarms and Events specifications v. 1.10 for diagnostic and control purposes
- IEC 61850 data modeling
- System supervision:
 - NCC connection supervision
- DNP 3.0 subset level 2 and level 3 support.

3. Configuration

3.1. About this section

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

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

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

3.2. Overview of configuration

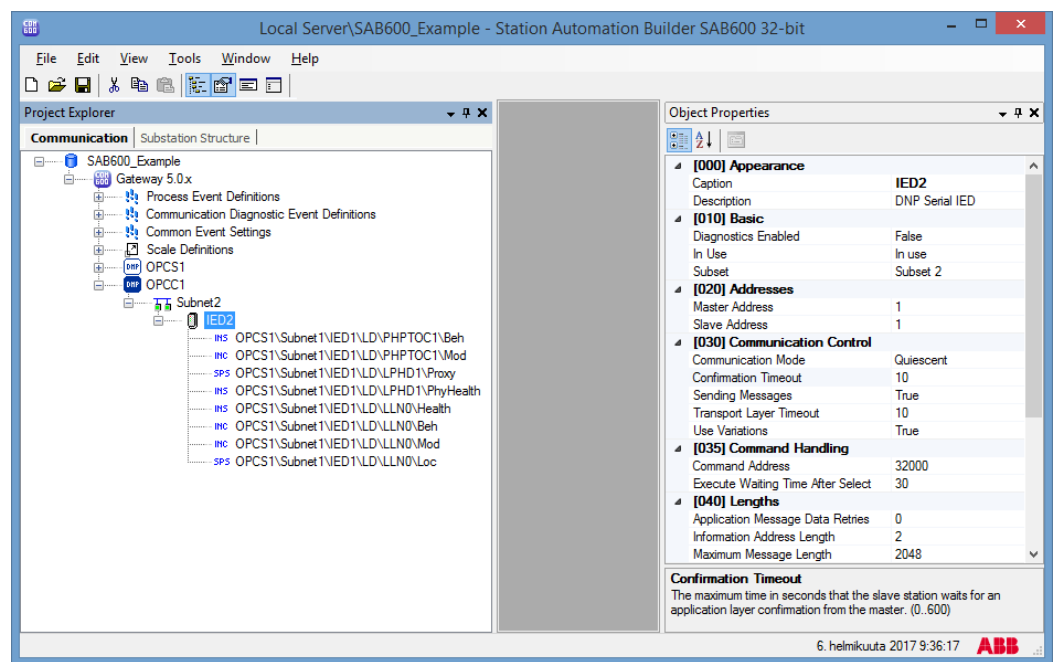
Before you can start using the DNP Serial Slave OPC Client, you need to build and configure an object tree in SAB600 to define the Communication structure within the Gateway object.

- DNP Serial Slave OPC Client
- DNP Serial Channel
- DNP Serial IED
- Data objects

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



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



SAB600_DNP_Serial_Slave_Example_View.png

Figure 3.2-1 Example view of SAB600

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

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

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

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

After you have added the necessary objects to the object tree in the communication structure, you need to configure them, see 3.4.1, General information about configuring data objects.

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

Table 3.2-1 DNP Serial Slave OPC Client related objects

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

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

3.3. Building object tree

3.3.1. General information about building object tree

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

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

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

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

Add the objects in the following order:

1. DNP Serial Slave OPC Client
2. DNP Serial Channel
3. DNP Serial IED
4. Data objects

3.3.2. Adding DNP Serial Slave OPC Client object

To add the OPC client object:

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

3.3.3. Adding Channel objects

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

To add DNP Serial Channel object:

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

3.3.4. Adding DNP Serial IED object

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

To add DNP Serial IED object:

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

3.3.5. Adding data objects using Cross-References function

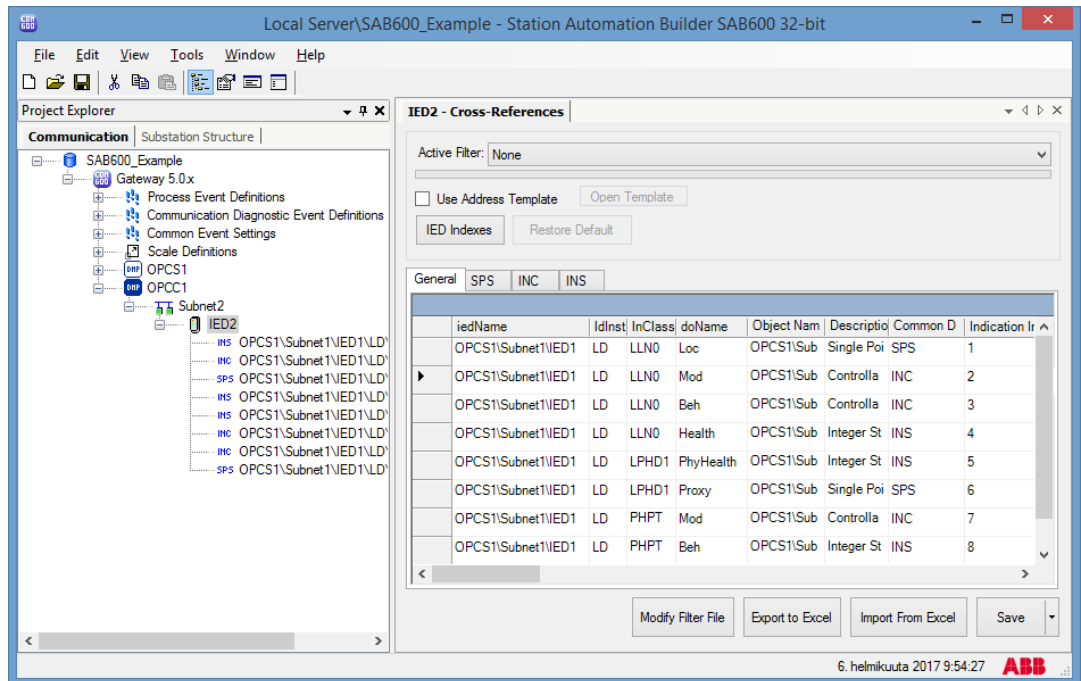
Data objects are added somewhat differently than the upper level objects. Basically, you drag and drop the data objects you need from an OPC server to the DNP Serial Slave OPC Client.

To add data objects:

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

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

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



SAB600_DNP_Serial_Slave_Cross_References.png

Figure 3.3.5-1 Cross-References window

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

3.4. Configuring objects

3.4.1. General information about configuring data objects

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

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

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

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

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

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

3.4.2. Configuring DNP Serial Slave OPC Client properties

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

Table 3.4.2-1 DNP Serial Slave OPC Client properties

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

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Property / Parameter	Value or Value range/ Default	Description
Station/Remote Switch Error	Reject commands if position bad or unknown. Allow commands if position bad or unknown. Default: Reject commands if position bad or unknown	Defines command handling if the position is bad or unknown.

3.4.3.

Configuring DNP Serial Channel properties

The DNP Serial 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 the SAB600 is performed as described in 3.2, Overview of configuration.

Table 3.4.3-1 DNP Serial Channel properties

Property / Parameter	Value or Value range/ Default	Description
Basic		
In Use	In use Not in use Default: In use	Specifies whether the channel is in use or not.
Protocol	DNP 3.0 Slave	Protocol
Communication Port		

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...COM8 Default: COM1	Serial port used by the DNP 3.0 serial protocol. Number of ports depends on the used hardware.
Parity	No parity check Even parity Odd parity Default: Even parity	Defines 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		

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Property / Parameter	Value or Value range/ Default	Description
CTS Delay	0...65535 Default: 0	Time delay in milliseconds between the activation of the RTS signal and the start of a new transmission.
Enquiry Limit	0...255 Default: 3	Specifies the maximum number of times that a message is retransmitted after a timeout.
Header Timeout	0...65535 Default: 2000	Specifies the maximum waiting time in milliseconds within which the first byte of a link layer response should have been received.
Link Layer Confirmations Enabled	In use Not in use Default: In use	Determines whether the link layer confirmations are in use.
Collision Detection	Collision detection in use Collision detection not in use Default: Collision detection not in use	Specifies whether the collision detection is used.
Maximum Message Length	50...249 Default: 230	Maximum length of a data link fragment.
Maximum Random Delay for Retransmission	0...65535 Default: 0	Delay in milliseconds between retransmissions.
Test Function of Link Interval	0...65535 Default: 500	Delay in milliseconds between the test function of link commands. If the value is set to zero, the test function of a link command is not sent.
Response Timeout	0...255 Default: 2	Specifies the time in seconds that the DNP 3.0 link waits for the end of the received message.
RTS Keep Up Padding Characters	0...255 Default: 0	The number of padding characters inserted in the end of a telegram to delay the passivation of the RTS signal.
Test Function for Link	True False Default: False	Specifies if "Test Function for Link" is enabled.
Transmission Wait Delay	0...65535 Default: 15	Specifies the transmission delay in milliseconds the protocol stack must wait after receiving a CTS signal until starting the transmission of a message.

3.4.4. Configuring DNP Serial IED properties

Table 3.4.4-1 lists the configurable properties for DNP Serial IED and value ranges for these properties. The actual configuration by using the SAB600 is performed as described in 3.2, Overview of configuration.

Table 3.4.4-1 DNP Serial IED properties

Name	Value/Value range	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the station.
In Use	In use Not in use Default: In use	Defines if the IED is in use or not.
Subset	Subset 2 Subset 3 Default: Subset 2	Defines the subset level that is currently used.
Addresses		
Master Address	0...65535 Default: 1	The station address of the master station.
Slave Address	0...65535 Default: 1	The station address of the slave station.
Communication Control		
Confirmation Timeout	0...600 Default: 10	The maximum time in seconds that the slave station waits for an application layer confirmation from the master.
Sending Messages	True False Default: True	Sending messages while waiting for a confirmation.
Transport Layer Timeout	0...600 Default: 10	The maximum time in seconds that the transport layer is allowed to assemble one application message fragment.
Use Variations	True False Default: True	Variations in response messages.

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Name	Value/Value range	Description
Command Handling		
Command Address	0...65535 Default: 32000	The object address of the bitstream process object.
Execute Waiting Time After Select	0...600 Default: 30	The maximum time in seconds that the slave waits for an execute command after receiving an operator command.
Lengths		
Application Message Data Retries	0...5 Default: 0	The maximum number of retransmissions of an application data fragment.
Information Address Length	1...2 Default: 2	The length of a data object address used in the DNP 3.0 messages.
Maximum Message Length	249...2048 Default: 2048	The maximum length of an application data fragment.
Time Handling		
Time Synchronization	Handled, time set Positive acknowledged, time not set Negative acknowledged, time not set Default: Handled, time set	Determines the behavior of the slave device when it receives a time synchronization message.
Queues		
Measurement Queue Threshold	1...100 Default: 95	Defines a threshold (percent of the queue capacity) which causes that update of a measurement removes the oldest entry of the same measurement from the queue.
Measurement Update Queue	0...65535 Default: 1000	Maximum number of measurement process data changes that are stored internally in a queue in the client.
State Indications Updates Queue	0...65535 Default: 1000	Maximum number of state indication process data changes that are stored internally in a queue in the client.

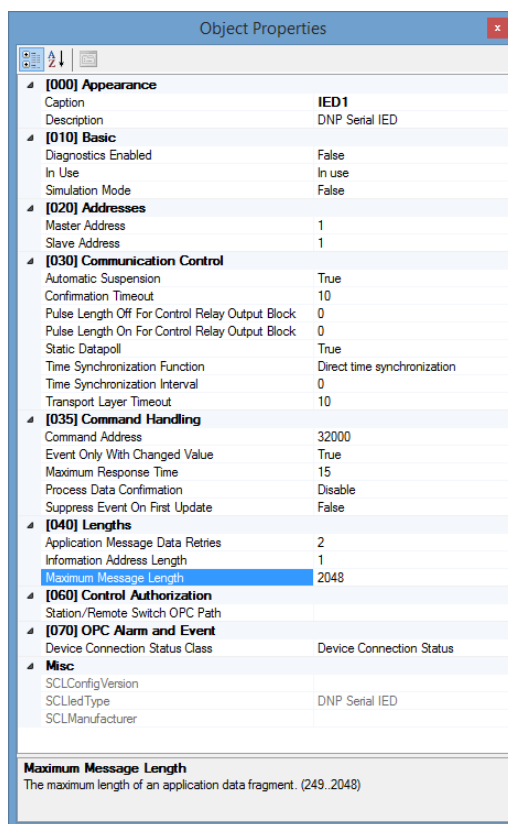
3.4.5. Configuring data objects

3.4.5.1. General information about configuring objects

After the objects have been added, configure the object properties. Figure 3.4.5.1-1 shows an example of how to use SAB600 to configure the object properties for DNP OPC Server.

To configure an object:

1. Select an object in the object tree of the communication structure.
2. The object properties appear now in the Object Properties window. The properties and their values can be viewed as shown in Figure 3.4.5.1-1.



SAB600_DNP_Serial_Slave_Object_Properties.png

Figure 3.4.5.1-1 Example of object properties in the Objects Properties window

3. Select the property you want to configure. Depending on the property value type, configure 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.

3.4.5.2.

Directional protection activation information (ACD)**Table 3.4.5.2-1 Configurable ACD properties**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACD	Common data class according to IEC 61850
Addresses		
General Index	-1..65535 Default: -1	General Index
Neutral Index	-1..65535 Default: -1	Neutral Index
Phase A Index	-1..65535 Default: -1	Phase A Index
Phase B Index	-1..65535 Default: -1	Phase B Index
Phase C Index	-1..65535 Default: -1	Phase C Index
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
OPC Alarm and Event		
Indication Event Class for General		Event class used with this signal
Indication Event Class for Neutral		Event class used with this signal
Indication Event Class for Phase A		Event class used with this signal
Indication Event Class for Phase B		Event class used with this signal
Indication Event Class for Phase C		Event class used with this signal

3.4.5.3. Protection activation information (ACT)

Table 3.4.5.3-1 Configurable ACT properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACT	Common data class according to IEC 61850.
Addresses		
General Index	-1..65535 Default: -1	General Index
Neutral Index	-1..65535 Default: -1	Neutral Index
Phase A Index	-1..65535 Default: -1	Phase A Index
Phase B Index	-1..65535 Default: -1	Phase B Index
Phase C Index	-1..65535 Default: -1	Phase C Index
Data Class Specific		
Indication Object	Binary input (1, 2) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
OPC Alarm and Event		
Indication Event Class for General		Event class used with this signal
Indication Event Class for Neutral		Event class used with this signal
Indication Event Class for Phase A		Event class used with this signal
Indication Event Class for Phase B		Event class used with this signal
Indication Event Class for Phase C		Event class used with this signal

3.4.5.4.

Analog set point (APC)**Table 3.4.5.4-1 Configurable APC properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	APC	Common data class according to IEC 61850.
Addresses		
Control Index	-1...65535 Default: -1	Control index.
Indication Index	-1...65535 Default: -1	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All updates	True False Default: False	Defines whether all changes in value are send to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).

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

3.4.5.5. Binary counter reading (BCR)

Table 3.4.5.5-1 Configurable BCR properties for OPC client

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BCR	Common data class according to IEC 61850.
Addresses		
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Counter Object	Binary counter (20) Frozen counter (21) Default: Binary counter (20)	Object number for counter.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.

Property/ Parameter	Value or Value range/ Default	Description
Send As 16 Bit Value	Send as 32 bit value Send as 16 bit value Default: Send as 16 bit value	Defines if the value is sent as 16 or 32 bit value.
Send As Delta Counter	Send as binary counter Send as delta counter Default: Send as delta counter	Defines if the value is sent as delta or binary counter.
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

3.4.5.6.

Binary controlled step position information (BSC)*Table 3.4.5.6-1 Configurable BSC properties for OPC client*

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

Property/ Parameter	Value or Value range/ Default	Description
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type 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.

3.4.5.7.

Complex measured value (CMV)

Table 3.4.5.7-1 Configurable CMV properties for OPC client

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

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Property/ Parameter	Value or Value range/ Default	Description
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

3.4.5.8.**Delta (DEL)****Table 3.4.5.8-1 Configurable DEL properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		

Property/ Parameter	Value or Value range/ Default	Description
Common Data Class	DEL	Common data class according to IEC 61850.
Addresses		
Phase AB Index	0...65535 Default: 0	Phase AB Index
Phase BC Index	0...65535 Default: 0	Phase BC Index
Phase CA Index	0...65535 Default: 0	Phase CA Index
Common		
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).

Property/ Parameter	Value or Value range/ Default	Description
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.
Scale and Unit		
Multiplier	1...1000000000 Default: 1	Multiplier for scaling decimal values.

3.4.5.9.**Controllable double point (DPC)****Table 3.4.5.9-1 Configurable DPC properties**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850.
Addresses		
Control Index Close	-1..65535 Default: -1	General Index
Control Index Open	-1..65535 Default: -1	Neutral Index
Index BFI	-1..65535 Default: -1	Phase A Index
Index Close (52a)	-1..65535 Default: -1	Phase B Index
Index Close (52b)	-1..65535 Default: -1	Phase C Index
Data Class Specific		

Property/ Parameter	Value or Value range/ Default	Description
Control Code Qualifier	Momentary Latched Pulse Default: Momentary	Qualifier for control
Control Object	Default: Binary control output block (12).	Object number for control.
Control Variation	0..65535 Default: 1	
Indication Object	Binary input (1, 2) Double binary input (3, 4) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Operate	Direct Operate Select Before Operate Default: Direct Operate	Specifies using two-step, select-before-operate method for issuing the control request.
OPC Alarm and Event		
Command Tracking Event		Event class used with this signal
Indication Event		Event class used with this signal

3.4.5.10.**Double point status (DPS)****Table 3.4.5.10-1 Configurable DPS properties**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPS	Common data class according to IEC 61850.
Addresses		
Index BFI	-1..65535 Default: -1	Phase A Index
Index Close (52a)	-1..65535 Default: -1	Phase B Index

Property/ Parameter	Value or Value range/ Default	Description
Index Close (52b)	-1..65535 Default: -1	Phase C Index
Data Class Specific		
Indication Object	Binary input (1, 2) Double binary input (3, 4) Binary output (10) Default: Binary input (1, 2)	Object number for indication.
Operate	Direct Operate Select Before Operate Default: Direct Operate	Specifies using two-step, select-before-operate method for issuing the control request.
OPC Alarm and Event		
Indication Event		Event class used with this signal

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		
Control Index	0...65535 Default: 0	Control index.
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.

Property/ Parameter	Value or Value range/ Default	Description
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
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.

3.4.5.12.**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 Index	0...65535 Default: 0	Indication index.

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

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

3.4.5.14.

Measured value (MV)**Table 3.4.5.14-1 Configurable MV properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	MV	Common data class according to IEC 61850.
Addresses		
Indication Index	0...65535 Default: 0	Indication index.
Common		
Class	Class 0...3 Default: Class 3	Class of ASDU. Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 1000	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all the changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All Updates	True False Default: False	Defines if all changes in value are sent to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value Send as 32 bit float value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time And Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event without time	Specifies the type of the timestamp a message is sent with.

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

3.4.5.15. Controllable single point (SPC)

Table 3.4.5.15-1 Configurable SPC properties

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPC	Common data class according to IEC 61850.
Addresses		
Control Index	-1...65535 Default: -1	Control index
Indication Index	-1...65535 Default: -1	Indication index
Data Class Specific		
Control Code Qualifier	Momentary Latched Pulse Default: Momentary	Qualifier for control
Control Object	Default: Binary control output block (12).	Object number for control
Control Variation	0...65535 Default: 1	Variation for control
Indication Object	Binary input (1, 2) Double binary input (3, 4) Binary output (10) Default: Binary input (1, 2)	Object number for indication

Property/ Parameter	Value or Value range/ Default	Description
Operate	Direct Operate Select Before Operate Default: Direct Operate	Specifies using two-step, select-before-operate method for issuing the control request.
OPC Alarm and Event		
Command Tracking Event		Event class used with this signal
Indication Event		Event class used with this signal
Scale and Unit		
Control Scale		Scale used with this type
Input Scale		Scale used with this type

3.4.5.16.

Single point status (SPS)

Table 3.4.5.16-1 Configurable SPS properties for OPC client

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

Property/ Parameter	Value or Value range/ Default	Description
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.

3.4.5.17.**WYE****Table 3.4.5.17-1 Configurable WYE properties for OPC client**

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	WYE	Common data class according to IEC 61850.
Addresses		
Neutral Index	0...65535 Default: 0	Neutral Index
Phase A Index	0...65535 Default: 0	Phase A Index
Phase B Index	0...65535 Default: 0	Phase B Index

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

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

3.4.5.18.**Controllable Enumerated Status (ENC)****Table 3.4.5.18-1 Configurable ENC properties for OPC client**

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ENC	Common data class according to IEC 61850.
Addresses		
Control Index	-1...65535 Default: -1	Control index.
Indication Index	-1...65535 Default: -1	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all changes to the client.
Data Class Specific		
Control Object	Default: Analog control output block (41).	Object number for control.
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.
Send All updates	True False Default: False	Defines whether all changes in value are send to the master.

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

3.4.5.19. Enumerated Status (ENS)

Table 3.4.5.19-1 Configurable ENS properties for OPC client

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ENS	Common data class according to IEC 61850.
Addresses		
Indication Index	-1...65535 Default: -1	Indication index.
Common		
Class	Class 0...3 Default: Class 0	Data sent from the slave to the master can be assigned to four classes. Data in class 1 is sent with higher priority than data in class 3.
Update Rate	0...65535 Default: 0	Maximum update rate of signal state changes between the OPC server and client in milliseconds. 0 means that the server sends all changes to the client.
Data Class Specific		
Indication Object	Analog input (30, 32) Analog output (40) Default: Analog input (30, 32)	Object number for indication.

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Send All updates	True False Default: False	Defines if all changes in value are send to the master.
Send as Value Type	Send as 16 bit integer value Send as 32 bit integer value	Defines if the value is sent as 16 or 32 bit integer or 32 bit float value (for APC, CMV, DEL, MV, WYE).
Time and Type Variation	Send as static data (always without time) Event without time Event with time Event with relative time (valid for binary inputs only) Default: Event with time	Specifies the type of the timestamp a message is sent with.

4. Operation

4.1. About this section

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

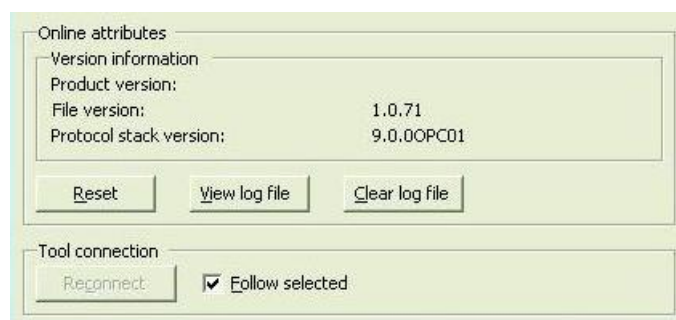
After this, you can, for example, monitor and control the condition of connections in network. This is done by using the Online diagnostics function in SAB600.

4.2. Activating COM600 with new configurations

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

4.3. DNP Serial Slave OPC Client diagnostics

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

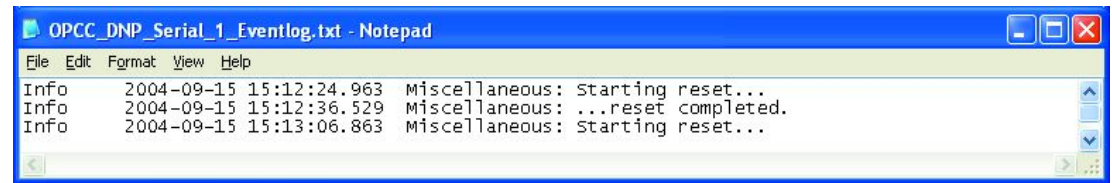


A040307.jpg

Figure 4.3-1 DNP Serial Slave OPC Client Online diagnostics

In Online diagnostics box you can:

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



A040308.jpg

Figure 4.3-2 Event log file

4.4. DNP Serial Channel diagnostics

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

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

To monitor and control DNP Serial Channel activity:

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

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

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

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

4.5. DNP Serial IED diagnostics

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

To monitor and control DNP Serial IED communication:

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

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

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

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

Online attributes

State

☒ In use

☒ Diagnostic events enabled

Status information

Connection status: OK

Detailed status: Device communication OK

Diagnostic counters

Suspensions:	1
Transmitted data messages:	5
Transmitted command messages:	0
Transmitted confirmation messages:	3
Received data messages:	0
Received command messages:	5
Received confirmation messages:	0
Received unknown messages:	0

Reset counters Refresh

Signal update buffering

High priority

Pending: 0 Max: 1013 Set

Interrogated

Pending: 0 Max: 510 Set

State indications

Pending: 0 Max: 510 Set

Measurements

Pending: 0 Max: 500 Set

Tool connection

Reconnect ☒ Follow selected

A040337.jpg

Figure 4.5-1 DNP Serial IED Online diagnostics

4.6. Signal diagnostics

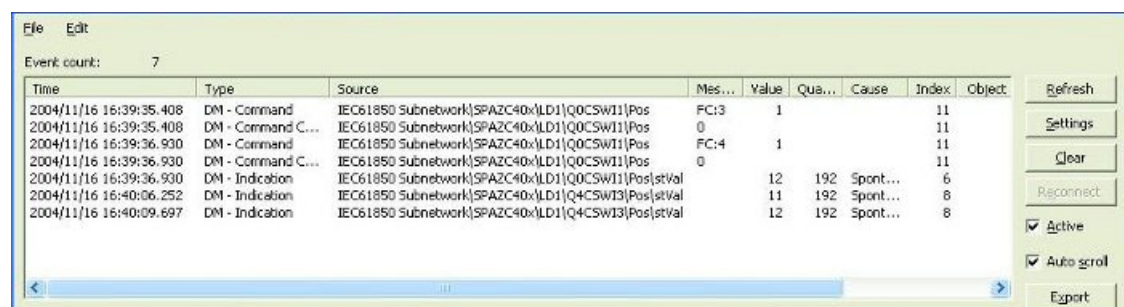
The DNP Serial Slave OPC client has a diagnostic function which makes it possible to monitor the flow of process data changes and commands. The diagnostic function is activated by marking the **Diagnostic Events Enabled** check box, located in the Online diagnostics function of the DNP Serial IED. When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

To view the event list:

1. Select the DNP Serial Slave OPC Client object in the object tree of SAB600.

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2. Right-click the DNP Serial Slave OPC Client.
3. Select **Diagnostic AE client** (see Figure 4.6-1)



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Figure 4.6-1 DNP Serial Slave OPC Client Diagnostic AE client

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

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 DNP Serial Slave OPC Client is described in this section.

For each data class, there is a table giving a detailed description about the relation between the DNP 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.
- **DNP information element** specifies the DNP 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)

Name	Type	Value/Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
stVal	BOOLEAN	TRUE FALSE	M	state (1=ON, 0=OFF)	VT_BOOL
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.3. Double point status (DPS)

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	state (0=OFF, 1=ON)	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.4. Integer status (INS)

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	INTEGER		M	Current value	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.5. Enumerated Status (ENS)

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	ENUMERATED		M		
q	Quality		M		VT_I4
t	Timestamp		M		VT_DATE

ENS represents DMCD M_ME_NA_1, M_ME_TA_1, M_ME_TD_1.

5.2.6. Protection activation information (ACT)

ACT phases information is mapped in the same way as SPS stVal.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
general	BOOLEAN		M	state (0=OFF, 1=ON)	VT_BOOL
phsA	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
phsB	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
phsC	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
neut	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.7. Directional protection activation information (ACD)

The ACT-related directional protection activation information is processed like ACT.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
general	BOOLEAN		M	state (0=OFF, 1=ON)	VT_BOOL
phsA	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
phsB	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
phsC	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
neut	BOOLEAN		O	state (0=OFF, 1=ON)	VT_BOOL
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	

5.2.8. Binary counter reading (BCR)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
actVal	INTEGER		M	Value Frozen value Current value	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.9. Measured value (MV)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protection inform-ation element	OPC data types
mag	AnalogueValue		M	CurrentValue	VT_R4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

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 tag, there is a cVal node containing a mag tag in the OPC namespace structure.

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data type
cVal.mag	AnalogueValue		M	CurrentValue	VT_R4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

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5.2.11. WYE

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsA.cVal.mag	AnalogueValue		M	Phase A Current Value	VT_R4
phsA.q	Quality		M		VT_I4
phsA.t	TimeStamp		M	DNP status <none> Time of occurrence	VT_DATE
phsB.cVal.mag	AnalogueValue		O	Phase B Current Value	VT_R4
phsB.q	Quality		O		VT_I4
phsB.t	TimeStamp		O	DNP status <client provided if none>	VT_DATE
phsC.cVal.mag	AnalogueValue		O	Phase C Current Value	VT_R4
phsC.q	Quality		O		VT_I4
phsC.t	TimeStamp		O	DNP status <none> Time of occurrence	VT_DATE
neut.cVal.mag	AnalogueValue		O	Neutral Current Value	VT_R4
neut.q	Quality		O		VT_I4
neut.t	TimeStamp		O	DNP status <none> Time of occurrence	VT_DATE
net.cVal.mag	AnalogValue		O	Net current value	VT_R4
net.q	Quality		O	DNP status	VT_I4
net.t	Timestamp		O	<client provided if none>	VT_DATE
res.cVal.mag	AnalogValue		O	Res current value	VT_R4
res.q	Quality		O	DNP status	VT_I4
res.t	Timestamp		O	<client provided if none>	VT_DATE

5.2.12. Delta (DEL)

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsAB.cVal.mag t	AnalogueValue		M	Phase AB Current Value	VT_R4
phsAB.q	Quality		M	DNP status	VT_I4
phsAB.t	TimeStamp		M	<none> Time of occurrence	VT_DATE
phsBC.cVal.mag q	AnalogueValue		M	Phase BC Current Value	VT_R4
phsBC.q	Quality		M	DNP status	VT_I4
phsBC.t	TimeStamp		M	<none> Time of occurrence	VT_DATE
phsCA.cVal.mag q	AnalogueValue		M	Phase CA Current Value	VT_R4
phsCA.q	Quality		M	DNP status	VT_I4
phsCA.t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.13. Controllable single point (SPC)

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
ctlVal	SPI		M	Control Code	VT_BOOL
stVal		FALSE TRUE	M	State (0=OFF, 1=ON)	VT_BOOL
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.14. Controllable double point (DPC)

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

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Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlSelOff		FALSE TRUE	O	Control Code	VT_BOOL
stVal	ENUMERATED	intermediate-state (0) off (1) on (2) bad-state (3)	M	State (0=OFF, 1=ON)	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE
ctlCan	BOOLEAN	FALSE TRUE	O	-	VT_BOOL
stSeld	BOOLEAN	FALSE TRUE	O	State (0=OFF, 1=ON)	VT_BOOL

5.2.15. Controllable integer status (INC)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	INTEGER		M	Control Value	VT_I4
stVal	INTEGER		M	Current Value	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.16. Controllable Enumerated Status (ENC)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	ENUMERATED		M		
stVal	ENUMERATED		M		
q	Quality		M		VT_I4
t	Timestamp		M		VT_DATE

5.2.17. Binary controlled step position information (BSC)

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	Control Value	VT_I1
valWTr	ValWithTrans		M	State	VT_I4
q	Quality		M	DNP status	VT_I4
t	TimeStamp		M	<none> Time of occurrence	VT_DATE

5.2.18. Integer controlled step position information (ISC)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	INTEGER	-64 ... 63	M	Control Value	VT_I1
valWTr	ValWithTrans		M	State	VT_I4
q	Quality		M	DNP status	V_I4
t	TimeStamp		M	<none> Time of occurrence	V_DATE

5.2.19. Analogue set point (APC)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
ctlVal	AnalogueValue		M	Control Value	VT_R4

5.3. Status codes**5.3.1. Introduction**

The following status codes are defined for the DNP slave protocol. Some typical reasons for some of the status codes are also given.

5.3.2. Link layer status codes

17650	The Data Flow Control (DFC) bit of the messages from the master is set for more than 15 seconds.
17651	The DCD or CTS signal or the end of the transmitted message is not received in correct time.
17652	Timeout while waiting for an acknowledgment to a request.
17654	The application level sends a command before the communication between the master and the slave is established.
17655	The Data Flow Control bit of the messages from the master is set for too long.
17656	The slave does not receive a reply from the master.
17657	The channel has been set in use.
17658	The channel has been set out of use.
17659	The protocol stack out of buffers error.
17670	The value written to one of the channel properties is incorrect.

5.3.3. Application layer status codes

13901	The value set to a property of the device is incorrect.
13904	No more events can be written to one of the unsolicited message queues since the queue is full.
13905	Internal message buffer full error.
13906	Internal message filling error.
13907	The used data object type is not supported.
13909	Internal data overflow error.
13910	The device is in the suspended state. The reason for this can be that the link is not properly established (for example incorrect cable wiring) or the master station does not respond.
13911	Internal message sending error.
13913	A command is sent to a channel with a non-established communication.
13914	Internal out of buffers error.
13918	The device has been set out of use.
13919	The device has been set in use.
13924	Internal buffer error.
13925	There is not any preceding command with the address given when confirming a command. Either the address is incorrect or the command has not been received.
13926	Internal software error.
13927	The channel to which the device is created is incorrect.
13931	The CODE item of a received control block message is unknown.

5.4. Attributes

5.4.1. General information about attributes

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

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

The attributes are not updated automatically by the server according to the update rate of the OPC group. Instead, it is required that the client explicitly refreshes the group or requests a read of single attributes to retrieve the latest values. This does not matter for most attributes, since they do not change value spontaneously. The exceptions are the diagnostic counters and object status attributes. Object status attributes are updated automatically by system messages, so in practice only diagnostic counters are affected by this rule. It was introduced to avoid overloading the communication link between the protocol stack and OPC server.

5.4.2. DNP Serial Slave OPC Client attributes

Table 5.4.2-1 DNP Serial Slave OPC Client attributes

Property / Parameter	Value or Value range/ Default	Description
Protocol Stack Version	Value: Version information	Data type: Text Access: Read-only The version information of the Protocol Stack.

5.4.3.

DNP Serial Channel attributes**Table 5.4.3-1 DNP Serial Channel attributes**

Property / Parameter	Value or Value range/ Default	Description
In Use	0 = Not in use, the channel communication is stopped 1 = In use Default: 0	Data type: Integer Access: No limitations 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 polling of the station in turn is completed.
Modem Signal		
		Data type: Integer Access: Read-only The state of the modem signal - active or passive. This information is for direct supervision and control of the state of the modem signal and communication. These values are located in an own Modem Signals node.
CTS (Clear To Send)	0 = Passive signal 1 = Active signal	Indicates the state of the Clear To Send (CTS) signal.
DCD (Data Carrier Detect)	0 = Passive signal 1 = Active signal	Indicates the state of the Data Carrier Detect (DCD) signal.
Diagnostic Counters (DNP Serial Channel)		
		Data type: Integer Access: No limitations
Transmitted Telegrams		The number of transmitted telegrams.

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

5.4.4. DNP Serial IED attributes

Table 5.4.4-1 DNP Serial IED attributes

Property / Parameter	Value or Value range/ Default	Description
In Use	0 = Out of use 1 = In use Default: 0	Data type: Integer Access: No limitations 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.

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Property / Parameter	Value or Value range/ Default	Description
Object Status	<p>When written:</p> <p>1 = Re-transmit system message</p> <p>When read:</p> <p>A status code, for example,</p> <p>0 = OK (communication works properly)</p> <p>13910 = Device suspended</p> <p>For more information, see 5.3.2, Link layer status codes and 5.3.3, Application layer status codes.</p>	<p>Data type: Integer</p> <p>Access: No limitations</p> <p>Indicates the detailed information about the station device status. Writing to the Object Status attribute (Object Status = 1) of a device makes the protocol stack to re-transmit the latest 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.</p>
Device Connection Status	<p>True = Device connection OK</p> <p>False = Device connection suspended</p>	<p>Data type: Boolean</p> <p>Access: Read-only</p> <p>Indicates the status of the device connection.</p> <p>(Does not exist in Configuring Micro-SCADA for DNP slave.)</p>
Diagnostic Counters		
		<p>Data type: Integer</p> <p>Access: No limitations</p>
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.

Property / Parameter	Value or Value range/ Default	Description
Queue Diagnostics		
		Data type: Integer Access: No limitations
Size of APDU in-queue		
Size of APDU out-queue		
Size of TSDU in-queue		
Size of TSDU out-queue		
Size of WAIT CONFIRM queue		
Size of OPC Client transition queue		
Size of Confirmation transition queue		
Size of Select transition queue		
Size of Free APDU queue		
Size of Free events queue		
Size of Free OPC Client transitions queue		

Appendix 1

Device profile

Table A1-1 Device profile describing the implementation of DNP V3.00 slave protocol in COM600 SUBSET 2: the default subset

DNP V3.00DEVICE PROFILE DOCUMENT	
Vendor Name: ABB Oy Substation Automation Products	
Device Name: COM600	
Highest DNP Level Supported:	
For Requests: Subset Level 2 For Responses: Subset Level 2	Device Function: [] Master [x] Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported	
(the complete list is described in the attached table):	
Additions to level 2 are shaded in the accompanying implementation tables.	
Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted: 58...292	Transmitted: 255...2048
Received: (must be 292)	Received : 2048
Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
[] None	[] None
[] Fixed at _____	
[x] Configurable, range 0 to 10	[x] Configurable, range 0 to 5
Requires Data Link Layer Confirmation:	
[] Never	
[] Always	
[] Sometimes If 'Sometimes', when? _____	
[x] Configurable	
Requires Application Layer Confirmation:	
[] Never	
[] Always (not recommended)	
[] When reporting Event Data (Slave devices only)	
[] When sending multi-fragment responses (Slave devices only)	
[] Sometimes. If 'Sometimes', when? _____	

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Requires Data Link Layer Confirmation:			
<input checked="" type="checkbox"/> Configurable			

Timeouts while waiting for:			
Data Link Confirm			
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Complete Appl. Fragment			
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Application Confirm			
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Complete Appl. Response			
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____	<input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable

Others:
Retransmission after a collision
Complete data link frame

Sends/Executes Control Operations:			
WRITE Binary Outputs			
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
SELECT/OPERATE			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
DIRECT OPERATE			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
DIRECT OPERATE - NO ACK			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Count > 1			
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse On			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse Off			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch On			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable

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Sends/Executes Control Operations:			
Latch Off			
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Queue			
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Clean Queue			
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always	<input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:	
Reports Binary Input Change Events when no specific variation requested:	Reports time-tagged Binary Input Change Events when no specific variation requested:
<input type="checkbox"/> Never	<input type="checkbox"/> Never
<input type="checkbox"/> Only time-tagged	<input type="checkbox"/> Binary Input Change With Time
<input type="checkbox"/> Only non-time-tagged	<input type="checkbox"/> Binary Input Change With Relative Time
<input checked="" type="checkbox"/> Configurable to send one or the other, depends on data point init	<input checked="" type="checkbox"/> Configurable, depends on data point initialization
Sends Unsolicited Responses:	Sends Static Data in Unsolicited Responses:
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Never
<input checked="" type="checkbox"/> Configurable, depends on data point initialization	<input type="checkbox"/> When Device Restarts (depends on data point initialization)
<input type="checkbox"/> Only certain objects	<input type="checkbox"/> When Status Flags Change (depends on data point initialization)
<input type="checkbox"/> Sometimes (attach explanation)	No other options are permitted
<input type="checkbox"/> ENABLE/DISABLE UNSOLICITED function codes supported	
Default Counter Object/ Variation:	Counters Roll Over at:
<input type="checkbox"/> No Counters Reported	<input type="checkbox"/> No Counters Reported
<input checked="" type="checkbox"/> Configurable, depends on data point initialization	<input type="checkbox"/> Configurable (attach explanation)
<input type="checkbox"/> Default Object _____	<input type="checkbox"/> 16 bit
<input type="checkbox"/> Default Variation _____	<input checked="" type="checkbox"/> 32 Bits, roll-over bits not set
<input type="checkbox"/> Point-by-point list attached	<input type="checkbox"/> Other Value _____
	<input type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses:	
<input checked="" type="checkbox"/> Yes	
<input type="checkbox"/> No	

Supported function codes

Table A1-2 Supported function codes

CODE	FUNCTION	DESCRIPTION	Supported
Transfer Function Codes			
0	Confirm	Message fragment confirmation No response	Yes
1	Read	Request objects from outstation Respond with requested objects	Yes
2	Write	Store the specified objects to outstation. Respond with status of operation	Yes
Control Function Codes			
3	Select	Select the output point of outstation Respond with status of control point	Yes
4	Operate	Set the output that has previously been selected Respond with status of control point	Yes
5	Direct operate	Set the output directly Respond with status of control point	Yes
6	Direct operate - no ack	Set the output directly No respond	Yes
Freeze Function Codes			
7	Immediate Freeze	Copy the specified objects to freeze buffer Respond with status of operation	Yes
8	Immediate Freeze -no ack	Copy the specified objects to freeze buffer No respond	Yes
9	Freeze and Clear	Copy the specified objects to freeze buffer and clear objects Respond with status of operation	Yes
10	Freeze and Clear -no ack	Copy the specified objects to freeze buffer and clear objects No respond	Yes

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CODE	FUNCTION	DESCRIPTION	Supported
11	Freeze with time	Copy the specified objects to freeze buffer at specified time Respond with status of operation	No
12	Freeze with time -no ack	Copy the specified objects to freeze buffer at specified time No respond	No
Application Control Function Codes			
13	Cold Restart	Perform desired reset sequence Respond with a time object	Yes
14	Warm Restart	Perform desired partial reset operation Respond with a time object	Yes
15	Initialize Data to Defaults	Initialize the specified data to default Respond with status of operation	No
16	Initialize Application	Prepare the specified application to run Respond with status of operation	No
17	Start Application	Start the specified application to run Respond with status of operation	No
18	Stop Application	Stop the specified application to run Respond with status of operation	No
Configuration Function Codes			
19	Save configuration	Save the configuration Respond with status of operation	No
20	Enable Unsolicited Messages	Enable Unsolicited Messages Respond with status of operation	No
21	Disable Unsolicited Messages	Disable Unsolicited Messages Respond with status of operation	No
22	Assign Class	Assign specified objects to a class Respond with status of operation	No
Time Synchronization Function Codes			

CODE	FUNCTION	DESCRIPTION	Supported
23	Delay Measurement	Perform propagation delay measurement	Yes
24	Record current time	Used in a network application to allow the Master station and the Outstation to record their time at the same instant	Yes
Response Function Codes			
0	Confirm	Message fragment confirmation	Yes
129	Response	Response to requested message	Yes
130	Unsolicited Message	Spontaneous message without request	Yes

Supported objects

Table A1-3 Supported objects

OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
1	0	Binary Input - All Variations	1	06		
1	1	Binary Input	1	00,01,06	129, 130	00, 01
1	2	Binary Input with Status	1	00,01,06	129, 130	00, 01
2	0	Binary Input Change - All Variations	1	06,07,08		
2	1	Binary Input Change without Time	1	06,07,08	129, 130	17, 28
2	2	Binary Input Change with Time	1	06,07,08	129, 130	17, 28
2	3	Binary Input Change with Relative Time	1	06,07,08	129, 130	17, 28
10	0	Binary Output - All Variations	1	06		
10	1	Binary Output				
10	2	Binary Output Status	1	00,01,06	129, 130	00, 01

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
12	0	Control Block - All Variations				
12	1	Control Relay Output Block	3, 4, 5, 6	17, 27,28	129	echo of request + status
12	2	Pattern Control Block				
12	3	Pattern Mask				
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10	06		
20	1	32-Bit Binary Counter	1	00,01,06	129, 130	00, 01
20	2	16-Bit Binary Counter			129, 130	00, 01
20	3	32-Bit Delta Counter			129, 130	00, 01
20	4	16-Bit Binary Counter			129, 130	00, 01
20	5	32-Bit Binary Counter without Flag	1	00,01,06	129, 130	00, 01
20	6	16-Bit Binary Counter without Flag			129, 130	00, 01
20	7	32-Bit Delta Counter without Flag			129, 130	00, 01
20	8	16-Bit Delta Counter without Flag			129, 130	00, 01
21	0	Frozen Counter - All Variations	1	06		
21	1	32-Bit Frozen Counter			129, 130	00, 01
21	2	16-Bit Frozen Counter			129, 130	00, 01
21	3	32-Bit Frozen Delta Counter				
21	4	16-Bit Frozen Delta Counter				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
21	5	32-Bit Frozen Counter with Time of Freeze				
21	6	16-Bit Frozen Counter with Time of Freeze				
21	7	32-Bit Frozen Delta Counter with Time of Freeze				
21	8	16-Bit Frozen Delta Counter with Time of Freeze				
21	9	32-Bit Frozen Counter without Flag			129, 130	00, 01
21	10	16-Bit Frozen Counter without Flag			129, 130	00, 01
21	11	32-Bit Frozen Delta Counter without Flag				
21	12	16-Bit Frozen Delta Counter without Flag				
22	0	Counter Change Event - All Variations	1	06,07,08		
22	1	32-Bit Counter Change Event without Time			129, 130	17, 28
22	2	16-Bit Counter Change Event without Time			129, 130	17, 28
22	3	32-Bit Delta Counter Change Event without Time				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
22	4	16-Bit Delta Counter Change Event without Time				
22	5	32-Bit Counter Change Event with Time				
22	6	16-Bit Counter Change Event with Time				
22	7	32-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter Change Event with Time				
23	0	Frozen Counter Event - All Vari- ations				
23	1	32-Bit Frozen Counter Event without Time				
23	2	16-Bit Frozen Counter Event without Time				
23	3	32-Bit Frozen Delta Counter Event without Time				
23	4	16-Bit Frozen Delta Counter Event without Time				
23	5	32-Bit Frozen Counter Event with Time				
23	6	16-Bit Frozen Counter Event with Time				
23	7	32-Bit Frozen Delta Counter Event with Time				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
23	8	16-Bit Frozen Delta Counter Event with Time				
30	0	Analog Input - All Variations	1	06		
30	1	32-Bit Analog Input			129, 130	00, 01
30	2	16-Bit Analog Input	1	00,01,06	129, 130	00, 01
30	3	32-Bit Analog Input without Flag			129, 130	00, 01
30	4	16-Bit Analog Input without Flag	1	00,01,06	129, 130	00, 01
31	0	Frozen Analog Input - All Vari- ations				
31	1	32-Bit Frozen Analog Input				
31	2	16-Bit Frozen Analog Input				
31	3	32-Bit Frozen Analog Input with Time of Freeze				
31	4	16-Bit Frozen Analog Input with Time of Freeze				
31	5	32-Bit Frozen Analog Input without Flag				
31	6	16-Bit Frozen Analog Input without Flag				
32	0	Analog Change Event - All Vari- ations	1	06,07,08		

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
32	1	32-Bit Analog Change Event without Time			129,130	17,28
32	2	16-Bit Analog Change Event without Time			129,130	17,28
32	3	32-Bit Analog Change Event with Time				
32	4	16-Bit Analog Change Event with Time				
33	0	Frozen Analog Event - All Vari- ations				
33	1	32-Bit Frozen Analog Event without Time				
33	2	16-Bit Frozen Analog Event without Time				
33	3	32-Bit Frozen Analog Event with Time				
33	4	16-Bit Frozen Analog Event with Time				
40	0	Analog Output Status - All Vari- ations	1	06		
40	1	32-Bit Analog Output Status				
40	2	16-Bit Analog Output Status			129, 130	00, 01
41	0	Analog Output Block - All Vari- ations				
41	1	32-Bit Analog Output Block				
41	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request + status

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
50	0	Time and Date - All Variations				
50	1	Time and Date	2	06 07 quantity = 1		
50	2	Time and Date with Interval				
51	0	Time and Date CTO - All Vari- ations				
51	1	Time and Date CTO			129, 130	07, quantity=1
51	2	Unsynchronized Time and Date CTO			129, 130	07, quantity=1
52	0	Time Delay - All Variations				
52	1	Time Delay Coarse			129	07, quantity=1
52	2	Time Delay Fine			129	07, quantity=1
60	0					
60	1	Class 0 Data	1	06		
60	2	Class 1 Data	1	06,07,08		
60	3	Class 2 Data	1	06,07,08		
60	4	Class 3 Data	1	06,07,08		
70	1	File Identifier				
80	1	Internal Indica- tions	1 2	All 00,index=7		
81	1	Storage Object				
82	1	Device Profile				
83	1	Private Registra- tion Object				
83	2	Private Registra- tion Object Descriptor				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
90	1	Application Identifier				
100	1	Short Floating Point				
100	2	Long Floating Point				
100	3	Extended Floating Point				
101	1	Small Packed Binary-Coded Decimal				
101	2	Medium Packed Binary-Coded Decimal				
101	3	Large Packed Binary-Coded Decimal				
		No Object	13			
		No Object	23			

Table A1-4 Device profile describing the implementation of DNP V3 slave protocol in COM600 SUBSET 3: the used subset is selected using the IED's subset property

DNP V3.00DEVICE PROFILE DOCUMENT	
Vendor Name: ABB Oy Substation Automation Products	
Device Name: COM600	
Highest DNP Level Supported:	Device Function:
For Requests: Subset Level 3 For Responses: Subset Level 3	[] Master [x] Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported	
(the complete list is described in the attached table):	
Additions to level 3 are shaded in the accompanying implementation tables. Default subset is 2, but if the master makes a subset request, the used subset level is automatically raised.	
Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted: 58...292	Transmitted: 255...2048
Received: (must be 292)	Received : 2048

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DNP V3.00DEVICE PROFILE DOCUMENT	
Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
<input type="checkbox"/> None	<input type="checkbox"/> None
<input type="checkbox"/> Fixed at _____	
<input checked="" type="checkbox"/> Configurable, range 0 to 10	<input checked="" type="checkbox"/> Configurable, range 0 to 5

Requires Data Link Layer Confirmation:
<input type="checkbox"/> Never
<input type="checkbox"/> Always
<input type="checkbox"/> Sometimes If 'Sometimes', when? _____
<input checked="" type="checkbox"/> Configurable
Requires Application Layer Confirmation:
<input type="checkbox"/> Never
<input type="checkbox"/> Always (not recommended)
<input type="checkbox"/> When reporting Event Data (Slave devices only)
<input type="checkbox"/> When sending multi-fragment responses (Slave devices only)
<input type="checkbox"/> Sometimes. If 'Sometimes', when? _____
<input checked="" type="checkbox"/> Configurable

Timeouts while waiting for:		
Data Link Confirm		
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Complete Appl. Fragment		
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Application Confirm		
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Complete Appl. Response		
<input type="checkbox"/> None	<input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable	<input checked="" type="checkbox"/> Configurable
Others:		
Retransmission after a collision		
Complete data link frame		

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Timeouts while waiting for:		
Sends/Executes Control Operations:		
WRITE Binary Outputs		
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
SELECT/OPERATE		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
DIRECT OPERATE		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
DIRECT OPERATE - NO ACK		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Count > 1		
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse On		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Pulse Off		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch On		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Latch Off		
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Queue		
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable
Clear Queue		

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Timeouts while waiting for:		
<input checked="" type="checkbox"/> Never	<input type="checkbox"/> Always <input type="checkbox"/> Sometimes	<input type="checkbox"/> Configurable

FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:	
Reports Binary Input Change Events when no specific variation requested:	Reports time-tagged Binary Input Change Events when no specific variation requested:
<input type="checkbox"/> Never	<input type="checkbox"/> Never
<input type="checkbox"/> Only time-tagged	<input type="checkbox"/> Binary Input Change With Time
<input type="checkbox"/> Only non-time-tagged	<input type="checkbox"/> Binary Input Change With Relative Time
<input checked="" type="checkbox"/> Configurable to send one or the other, depends on data point initialization.	<input checked="" type="checkbox"/> Configurable, depends on data point initialization.
Sends Unsolicited Responses:	Sends Static Data in Unsolicited Responses:
<input type="checkbox"/> Never	<input checked="" type="checkbox"/> Never
<input checked="" type="checkbox"/> Configurable, depends on data point initialization	<input type="checkbox"/> When Device Restarts (depends on data point initialization)
<input type="checkbox"/> Only certain objects	<input type="checkbox"/> When Status Flags Change (depends on data point initialization)
<input type="checkbox"/> Sometimes (attach explanation)	No other options are permitted
<input checked="" type="checkbox"/> ENABLE/DISABLE UNSOLICITED function codes supported	
Default Counter Object/ Variation:	Counters Roll Over at:
<input type="checkbox"/> No Counters Reported	<input type="checkbox"/> No Counters Reported
<input checked="" type="checkbox"/> Configurable, depends on data point initialization	<input type="checkbox"/> Configurable (attach explanation)
<input type="checkbox"/> Default Object_____	<input type="checkbox"/> 16 bit
<input type="checkbox"/> Default Variation_____	<input checked="" type="checkbox"/> 32 Bits, roll-over bits not set
<input type="checkbox"/> Point-by-point list attached	<input type="checkbox"/> Other Value_____
	<input type="checkbox"/> Point-by-point list attached
Sends Multi-Fragment Responses:	
<input checked="" type="checkbox"/> Yes	
<input type="checkbox"/> No	

Table A1-5 Supported function codes

CODE	FUNCTION	DESCRIPTION	Supported
Transfer Function Codes			
0	Confirm	Message fragment confirmation No response	Yes

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CODE	FUNCTION	DESCRIPTION	Supported
1	Read	Request objects from outstation Respond with requested objects	Yes
2	Write	Store the specified objects to outstation. Respond with status of operation	Yes
Control Function Codes			
3	Select	Select the output point of outstation Respond with status of control point	Yes
4	Operate	Set the output that has previously been selected Respond with status of control point	Yes
5	Direct operate	Set the output directly Respond with status of control point	Yes
6	Direct operate - no ack	Set the output directly No respond	Yes
Freeze Function Codes			
7	Immediate Freeze	Copy the specified objects to freeze buffer Respond with status of operation	Yes
8	Immediate Freeze -no ack	Copy the specified objects to freeze buffer No respond	Yes
9	Freeze and Clear	Copy the specified objects to freeze buffer and clear objects Respond with status of operation	Yes
10	Freeze and Clear -no ack	Copy the specified objects to freeze buffer and clear objects No respond	Yes
11	Freeze with time	Copy the specified objects to freeze buffer at specified time Respond with status of operation	No
12	Freeze with time -no ack	Copy the specified objects to freeze buffer at specified time No respond	No

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CODE	FUNCTION	DESCRIPTION	Supported
Application Control Function Codes			
13	Cold Restart	Perform desired reset sequence Respond with a time object	Yes
14	Warm Restart	Perform desired partial reset operation Respond with a time object	Yes
15	Initialize Data to Defaults	Initialize the specified data to default Respond with status of operation	No
16	Initialize Application	Prepare the specified application to run Respond with status of operation	No
17	Start Application	Start the specified application to run Respond with status of operation	No
18	Stop Application	Stop the specified application to run Respond with status of operation	No
Configuration Function Codes			
19	Save configuration	Save the configuration Respond with status of operation	No
20	Enable Unsolicited Messages	Enable Unsolicited Messages Respond with status of operation	Yes
21	Disable Unsolicited Messages	Disable Unsolicited Messages Respond with status of operation	Yes
22	Assign Class	Assign specified objects to a class Respond with status of operation	Yes
Time Synchronization Function Codes			
23	Delay Measurement	Perform propagation delay measurement	Yes
24	Record current time	Used in a network application to allow the Master station and the Outstation to record their time at the same instant	Yes
Response Function Codes			

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CODE	FUNCTION	DESCRIPTION	Supported
0	Confirm	Message fragment confirmation	Yes
129	Response	Response to requested message	Yes
130	Unsolicited Message	Spontaneous message without request	Yes

Supported objects**Table A1-6 Supported objects**

OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
1	0	Binary Input - All Variations	1,22	00,01,06		
1	1	Binary Input	1	00,01,06	129, 130	00, 01
1	2	Binary Input with Status	1	00,01,06	129, 130	00, 01
2	0	Binary Input Change - All Variations	1	06,07,08		
2	1	Binary Input Change without Time	1	06,07,08	129, 130	17, 28
2	2	Binary Input Change with Time	1	06,07,08	129, 130	17, 28
2	3	Binary Input Change with Relative Time	1	06,07,08	129, 130	17, 28
10	0	Binary Output - All Variations	1	00,01,06		
10	1	Binary Output				
10	2	Binary Output Status	1	00,01,06	129, 130	00, 01
12	0	Control Block - All Variations				
12	1	Control Relay Output Block	3, 4, 5, 6	17, 27,28	129	echo of request
12	2	Pattern Control Block	5, 6	17, 28	129	echo of request
12	3	Pattern Mask	5, 6	00,01	129	echo of request

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10, 22	00,01,06		
20	1	32-Bit Binary Counter	1	00,01,06	129, 130	00, 01
20	2	16-Bit Binary Counter	1	00,01,06	129, 130	00, 01
20	3	32-Bit Delta Counter	1	00,01,06	129, 130	00, 01
20	4	16-Bit Binary Counter	1	00,01,06	129, 130	00, 01
20	5	32-Bit Binary Counter without Flag	1	00,01,06	129, 130	00, 01
20	6	16-Bit Binary Counter without Flag	1	00,01,06	129, 130	00, 01
20	7	32-Bit Delta Counter without Flag	1	00,01,06	129, 130	00, 01
20	8	16-Bit Delta Counter without Flag	1	00,01,06	129, 130	00, 01
21	0	Frozen Counter - All Variations	1,22	00,01,06		
21	1	32-Bit Frozen Counter	1	00,01,06	129, 130	00, 01
21	2	16-Bit Frozen Counter	1	00,01,06	129, 130	00, 01
21	3	32-Bit Frozen Delta Counter	1	00,01,06	129, 130	00, 01
21	4	16-Bit Frozen Delta Counter	1	00,01,06	129, 130	00, 01
21	5	32-Bit Frozen Counter with Time of Freeze				
21	6	16-Bit Frozen Counter with Time of Freeze				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
21	7	32-Bit Frozen Delta Counter with Time of Freeze				
21	8	16-Bit Frozen Delta Counter with Time of Freeze				
21	9	32-Bit Frozen Counter without Flag	1	00,01,06	129, 130	00, 01
21	10	16-Bit Frozen Counter without Flag	1	00,01,06	129, 130	00, 01
21	11	32-Bit Frozen Delta Counter without Flag				
21	12	16-Bit Frozen Delta Counter without Flag				
22	0	Counter Change Event - All Vari- ations	1	06,07,08		
22	1	32-Bit Counter Change Event without Time	1	06,07,08	129, 130	17, 28
22	2	16-Bit Counter Change Event without Time	1	06,07,08	129, 130	17, 28
22	3	32-Bit Delta Counter Change Event without Time	1	06,07,08	129, 130	17, 28
22	4	16-Bit Delta Counter Change Event without Time	1	06,07,08	129, 130	17, 28
22	5	32-Bit Counter Change Event with Time				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
22	6	16-Bit Counter Change Event with Time				
22	7	32-Bit Delta Counter Change Event with Time				
22	8	16-Bit Delta Counter Change Event with Time				
23	0	Frozen Counter Event - All Vari- ations	1	06,07,08		
23	1	32-Bit Frozen Counter Event without Time	1	06,07,08	129, 130	17, 28
23	2	16-Bit Frozen Counter Event without Time	1	06,07,08	129, 130	17, 28
23	3	32-Bit Frozen Delta Counter Event without Time	1	06,07,08	129, 130	17, 28
23	4	16-Bit Frozen Delta Counter Event without Time	1	06,07,08	129, 130	17, 28
23	5	32-Bit Frozen Counter Event with Time				
23	6	16-Bit Frozen Counter Event with Time				
23	7	32-Bit Frozen Delta Counter Event with Time				
23	8	16-Bit Frozen Delta Counter Event with Time				
30	0	Analog Input - All Variations	1,22	00,01,06		
30	1	32-Bit Analog Input	1	00,01,06	129, 130	00, 01

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
30	2	16-Bit Analog Input	1	00,01,06	129, 130	00, 01
30	3	32-Bit Analog Input without Flag	1	00,01,06	129, 130	00, 01
30	4	16-Bit Analog Input without Flag	1	00,01,06	129, 130	00, 01
31	0	Frozen Analog Input - All Vari- ations				
31	1	32-Bit Frozen Analog Input				
31	2	16-Bit Frozen Analog Input				
31	3	32-Bit Frozen Analog Input with Time of Freeze				
31	4	16-Bit Frozen Analog Input with Time of Freeze				
31	5	32-Bit Frozen Analog Input without Flag				
31	6	16-Bit Frozen Analog Input without Flag				
32	0	Analog Change Event - All Vari- ations	1	06,07,08		
32	1	32-Bit Analog Change Event without Time	1	06,07,08	129,130	17, 28
32	2	16-Bit Analog Change Event without Time	1	06,07,08	129,130	17, 28
32	3	32-Bit Analog Change Event with Time				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
32	4	16-Bit Analog Change Event with Time				
33	0	Frozen Analog Event - All Vari- ations				
33	1	32-Bit Frozen Analog Event without Time				
33	2	16-Bit Frozen Analog Event without Time				
33	3	32-Bit Frozen Analog Event with Time				
33	4	16-Bit Frozen Analog Event with Time				
40	0	Analog Output Status - All Vari- ations	1	00,01,06		
40	1	32-Bit Analog Output Status	1	00,01,06	129, 130	00, 01
40	2	16-Bit Analog Output Status	1	00,01,06	129, 130	00, 01
41	1	32-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	00, 01
41	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
50	0	Time and Date - All Variations				
50	1	Time and Date	2 (see 4.14) 1	07 quantity = 1 07 quantity = 1	129	07 quantity = 1
50	2	Time and Date with Interval				
51	0	Time and Date CTO - All Vari- ations				
51	1	Time and Date CTO			129, 130	07, quantity=1

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
51	2	Unsynchronized Time and Date CTO			129, 130	07, quantity=1
52	0	Time Delay - All Variations				
52	1	Time Delay Coarse			129	07, quantity=1
52	2	Time Delay Fine			129	07, quantity=1
60	0					
60	1	Class 0 Data	1	06		
60	2	Class 1 Data	1 20, 21, 22	06,07,08 06		
60	3	Class 2 Data	1 20, 21, 22	06,07,08 6		
60	4	Class 3 Data	1 20, 21, 22	06,07,08 06		
70	1	File Identifier				
80	1	Internal Indica- tions	1 2	00,01 00 index = 7		
81	1	Storage Object				
82	1	Device Profile				
83	1	Private Registra- tion Object				
83	2	Private Registra- tion Object Descriptor				
90	1	Application Identi- fier				
100	1	Short Floating Point				
100	2	Long Floating Point				
100	3	Extended Float- ing Point				

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OBJECT Obj	Var	Description	REQUEST (slave must parse) Func Codes (dec)	Qual Codes(hex)	RESPONSE (master must parse) Func Codes	Qual Codes (hex)
101	1	Small Packed Binary-Coded Decimal				
101	2	Medium Packed Binary-Coded Decimal				
101	3	Large Packed Binary-Coded Decimal				
		No Object	13			
		No Object	23			

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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
www.abb.com/substationautomation