

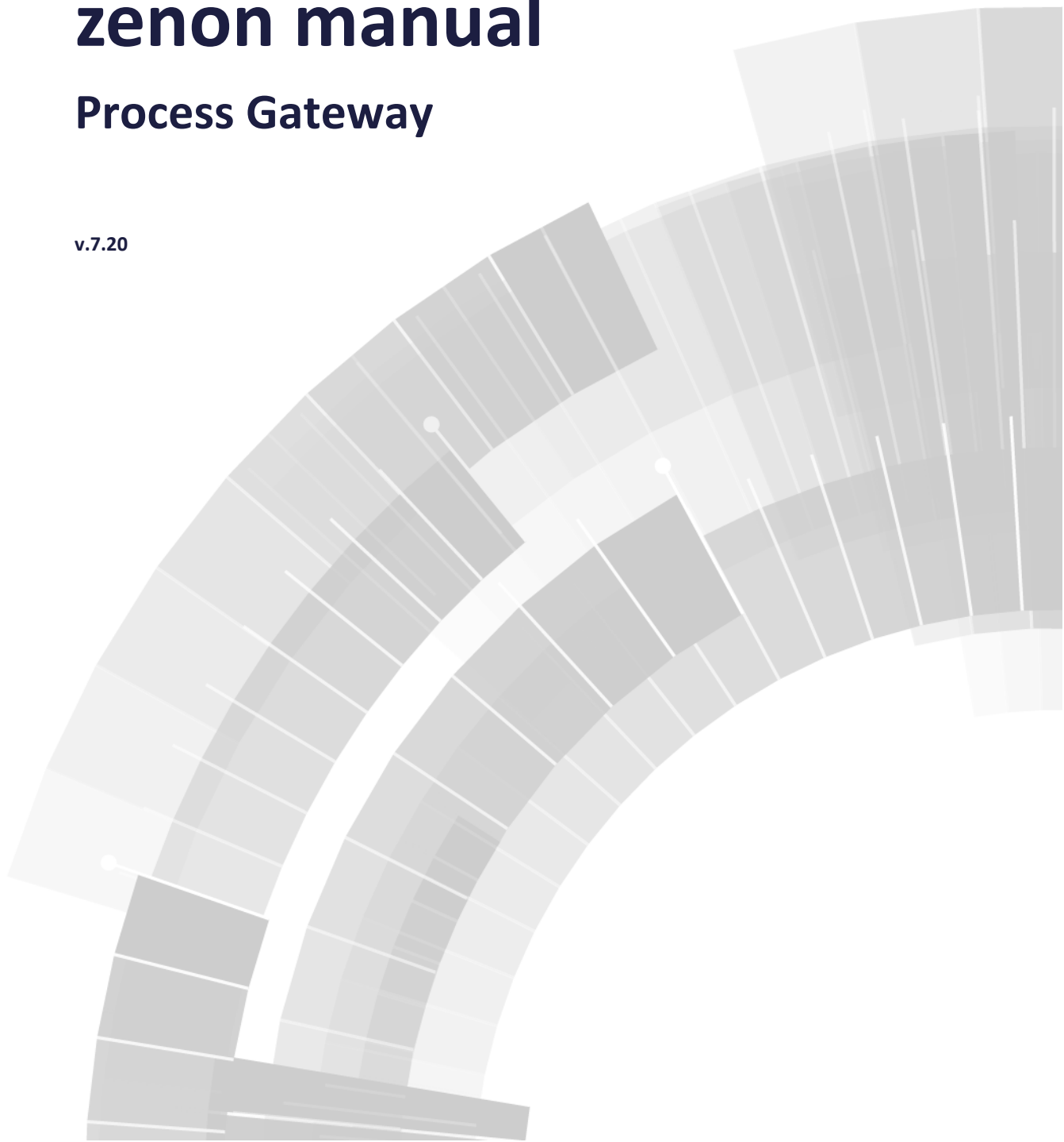


**COPADATA**  
do it your way

# zenon manual

## Process Gateway

v.7.20





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# Contents

<b>1. Welcome to COPA-DATA help .....</b>	<b>7</b>
<b>2. Process Gateway .....</b>	<b>7</b>
<b>3. General .....</b>	<b>8</b>
3.1 Variable assignment using names .....	8
<b>4. Requirements.....</b>	<b>9</b>
<b>5. Installation .....</b>	<b>10</b>
5.1 zenProcGateway.ini .....	12
5.2 Configuration Process Gateway .....	12
5.2.1 Project configuration .....	14
5.2.2 Module configuration.....	14
5.2.3 Security configuration .....	15
<b>6. DEC .....</b>	<b>15</b>
6.1 Module configuration .....	15
6.2 Logging .....	16
6.3 Configuration file: specific entries for AccessDEC.....	16
<b>7. DNP3 slave .....</b>	<b>18</b>
7.1 Module configuration .....	18
7.1.1 Naming of the variables for DNP3 in the Process Gateway. ....	23
7.1.2 Variable selection - object settings .....	24
7.1.3 Unsolicited Responses .....	26
7.1.4 Event Handling .....	30
7.1.5 Variations per object group - variations.....	32
7.2 Communication - procedure .....	36
7.3 Device Profile .....	37
7.4 Configuration file: specific entries for Access DNP3 .....	37
7.5 LATCH_ON and LATCH_OFF .....	41
<b>8. ICCP-TASE.2.....</b>	<b>42</b>

8.1	Module configuration .....	44
8.1.1	General .....	48
8.1.2	Server variables .....	50
8.1.3	Client variables .....	52
<b>9.</b>	<b>IEC870 Slave .....</b>	<b>54</b>
9.1	Module configuration .....	55
9.1.1	Settings for 870-101 .....	58
9.1.2	Settings for 870-104 .....	60
9.1.3	DPI / DCS mapping.....	68
9.1.4	Devices .....	69
9.2	Communication.....	87
9.2.1	Start:.....	88
9.2.2	General query.....	89
9.2.3	End of connection and resets.....	89
9.2.4	Transfer of the value changes .....	90
9.2.5	Reload project online .....	91
9.2.6	Data priorities.....	91
9.2.7	Internal type T00 (status variable) .....	91
9.2.8	Time synchronization .....	94
9.2.9	Broadcasts .....	94
9.2.10	Mapping of status bits in message direction.....	95
9.2.11	Commands.....	96
9.2.12	File transfer .....	97
9.2.13	Sequence of Events (SOE).....	98
9.2.14	Read - T102 - request .....	103
9.2.15	Test - T104 and T107 - requests .....	104
9.3	Error analysis.....	104
9.3.1	Analysis tool .....	104
9.3.2	Error codes .....	108
9.3.3	Check list.....	109
9.4	Interoperability .....	110
<b>10.</b>	<b>MODBUS Slave .....</b>	<b>129</b>
10.1	Module configuration .....	129
10.2	Hardware address of the MODBUS system .....	132
10.3	Configuration file: specific entries for AccessMODBUS .....	132

<b>11. MS Azure.....</b>	<b>134</b>
11.1 Module configuration .....	135
11.1.1 MS Azure Connection Settings .....	138
11.2 Message format .....	139
11.3 Error message .....	139
11.4 Configuration file: specific entries for MS Azure .....	140
<b>12. OPC UA Server.....</b>	<b>142</b>
12.1 Compare OPC Server and OPC UA Server .....	143
12.2 Module configuration .....	145
12.2.1 Server .....	146
12.2.2 Variables .....	150
12.3 Start:.....	153
12.4 Connection .....	153
12.5 Security .....	154
12.6 Alarms and states.....	154
12.7 Service Sets .....	157
12.8 Error message .....	158
<b>13. SNMP agent .....</b>	<b>159</b>
13.1 SNMP architecture .....	159
13.2 Management Information Base (MIB) .....	160
13.3 MIB structure .....	161
13.4 Module configuration .....	163
13.5 Configuration file: specific entries for Access SNMP .....	164
13.6 Configuration of the Windows SNMP agent .....	164
<b>14. SQL .....</b>	<b>166</b>
14.1 Module configuration .....	166
14.2 Variable selection.....	167
14.3 Creating tables .....	168
14.4 Operation in a redundant system .....	168
14.5 Configuration file: specific entries for AccessSQL .....	169
14.6 Table format.....	170
14.6.1 Table for process image .....	170
14.6.2 Table for variable IDs.....	170



# 1. Welcome to COPA-DATA help

## GENERAL HELP

If you cannot find any information you require in this help chapter or can think of anything that you would like added, please send an email to [documentation@copadata.com](mailto:documentation@copadata.com) (<mailto:documentation@copadata.com>).

## PROJECT SUPPORT

You can receive support for any real project you may have from our Support Team, who you can contact via email at [support@copadata.com](mailto:support@copadata.com) (<mailto:support@copadata.com>).

## LICENSES AND MODULES

If you find that you need other modules or licenses, our staff will be happy to help you. Email [sales@copadata.com](mailto:sales@copadata.com) (<mailto:sales@copadata.com>).

# 2. Process Gateway

*The Process Gateway serves as a coupling to higher-level systems. Parts of the zenon process image of other applications can be made available and be updated.*



### License information

*Must be licensed for Editor and Runtime (single-user, Server, Standby and Client).*



### Information

*The Process Gateway user interface is only available in English.*

## 3. General

It is thought as an add-on to the Runtime of the control system and only works in combination with it.

That means: If zenon Runtime has not been started, the Process Gateway does not start!

### 3.1 Variable assignment using names

Please note that assignment is always via the variable name in the Process Gateway.

This is particularly important if:

- ▶ Variable names in the project configuration are changed in zenon Editor.
- ▶ Variables in the project configuration in the Editor are deleted.
- ▶ zenon calls up a new start project.

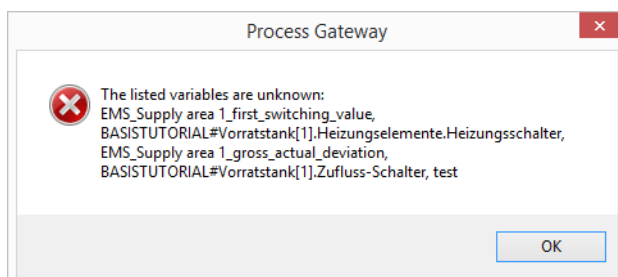
In this case, module-independent error dialogs appear when Process Gateway is started.



### Attention

*If a variable assignment is erroneous, the Process Gateway is not started! The Process Gateway only starts if the incorrect variable assignment has been corrected.*

The first error dialog lists the unknown variables.

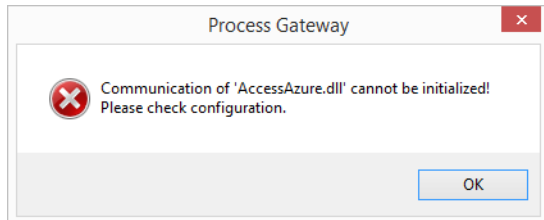


- ▶ In this case, amend the variable assignment again.



- To do this, remove all incorrectly-assigned variables from the respective export area and re-add the corresponding variables.

The dialog that follows contains module-dependent error messages.



## LOG ENTRY

The following LOG entry is created in the event of incorrect variable assignment:

LOG entry	Description
Failed to update value for variable %s.	No COM connection to zenon could be established, or the variable is not (or no longer) available in zenon or has been renamed.

## 4. Requirements

**Runtime:** On the computer on which the Process Gateway should run, the Runtime with the corresponding release version and a loaded project that corresponds to the configuration has to be started before it is started. If Runtime is stopped, the Process Gateway is also stopped automatically.



### Information

*The Process Gateway uses the COM interface to access zenon data. The COM interface is used by VBA and is only available if **zenon6.ini** is present in the file under **[VBA]** the entry **EVENT=1**.*

**Modules:** There are different modules for the Process Gateway, that take over the communication to external applications. At the moment these modules are:

File	Description	Connection to
<b>AccessDEC.dll</b>	Slave for DEC	Hundamp;S-DEC-System
<b>AccessDNP3.dll</b>	Slave for DNP3	DNP3 master
<b>AccessICCP.dll</b>	ICCP/TASE.2 protocol	ICCP Server
<b>AccessIEC870S1.dll</b>	Slave for IEC 60870-5-01/104	IEC 60870 master
<b>AccessMODBUS.dll</b>	Slave for Modbus	Modbus master
<b>AccessOPCUA.dll</b>	OPC US Server	OPC UA client
<b>AccessSNMP.dll</b>	SNMP agent	SNMP client
<b>AccessSQL.dll</b>	SQL Online-Interface	SQL databases
<b>AccessAzure.dll</b>	MS Windows Azure	Microsoft Azure

**Note:** The module to be started is selected and configured in its own INI file (on page 10) of the Process Gateway, not in zenon6.ini as is otherwise the case for zenon! This INI file is called zenProcGateway.INI and is located in the following folder: C:\ProgramData\COPA-DATA\System.



### Attention

If the Modbus Slave driver is used, the Process Gateway only supports:

- ▶ Function Code 3: Read Multiple Registers
- ▶ Function Code 16: Write Multiple Registers

## 5. Installation

The add-on only consists of the **zenProcGateway.exe** file. It is preferable to copy this to the zenon program folder. However it is possible to have any folder as the installation folder. The module to be used with the zenProcGateway has to be in the same folder as zenProcGateway.exe. Exception: SNMP (on page 164).

The configuration file **zenProcGateway.ini** is saved in the system folder. In this file, an entry DLL in the section [GENERAL] has to be set to the name of the module.

This INI file is called zenProcGateway.INI and is located in the following folder:  
C:\ProgramData\COPA-DATA\System.

Module	Entry in zenProcGateway.ini
DEC	[GENERAL] DLL=AccessDEC.dll
SQL	[GENERAL] DLL=AccessDEC.dll
MODBUS	[GENERAL] DLL=AccessMODBUS.dll
DNP3	[GENERAL] DLL=AccessDNP3.dll
IEC870SI	[GENERAL] DLL=AccessIEC870SI.dll
SNMP	[GENERAL] DLL=AccessSNMP.dll
OPCUA	[GENERAL] DLL=AccessOPCUA.dll
ICCP/TASE.2	[GENERAL] DLL=AccessICCP.dll

If a configuration file with a different name is to be used (e.g. for operation with multiple instances), you have to start `zenProcGateway.EXE` with the command line parameter `/ini:<file>`. That file must be in the system folder, too.



#### Example

```
zenProcGateway.EXE /ini:MyConfig.INI
```

## 5.1 zenProcGateway.ini

### [GENERAL]

Entry	Description
[GENERAL]	General setting for Process Gateway, regardless of the modules selected.
DLL=	<p>Selection of the DLL file that is to be used for Process Gateway. The selected DLL file determines the module selection</p> <ul style="list-style-type: none"> <li>▶ AccessDEC.dll</li> <li>▶ AccessSQL.dll</li> <li>▶ AccessMODBUS.dll</li> <li>▶ AccessDNP3.dll</li> <li>▶ AccessIEC870SI.dll</li> <li>▶ AccessSNMP.dll</li> <li>▶ AccessOPCUA.dll</li> <li>▶ AccessICCP.dll</li> <li>▶ AccessAzure.dll</li> </ul>

## 5.2 Configuration Process Gateway

To configure Process Gateway:

### CREATE AN INI FILE (OPTIONAL):

1. Create a project backup.
2. Save this with the name `zenProcGateway.ini` in the folder `C:\ProgramData\zenon\System`.
3. Create, in the text file, a text entry with the desired module (this example uses the DNP3 module):  

```
[GENERAL]
DLL=AccessDNP3.dll
```

Due to the system, only ANSI and Unicode are supported for reading the INI files.

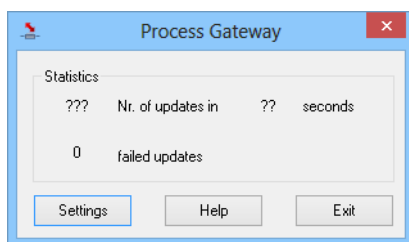


### Attention

UTF-8 format is not supported!

You should therefore always save your INI files as a text file in ANSI or Unicode format.

## CONFIGURATION



Start the Process Gateway:

Start the program zenProcGateway.exe by double clicking on it. You can find the program by default on your computer in the following folder: C:\Program Files (x86)\COPA-DATA\zenon 7.20 SP0. Alternatively, you can also start the Process Gateway in the **Startup Tool**:

1. Click, in the **Startup Tool**, the **Tools** button.
2. In the following dialog **start something else ...** Select **Process Gateway** from the list of tools.
3. Click on the **start** button.
4. The dialog for configuring Process Gateway is opened.
5. Clicking on the **settings** button opens a configuration dialog for the selected module.

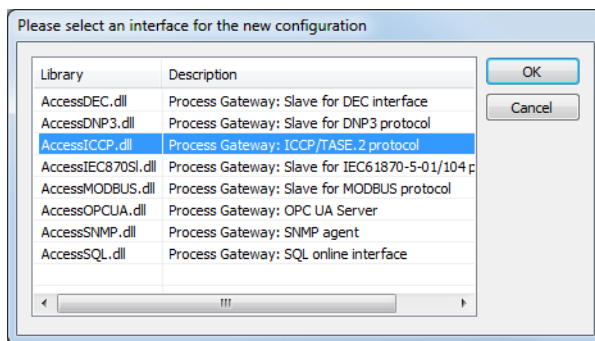



### Information

These configurations are considerably different from one another and depend on the selected module.

You can find documentation for the respective configuration dialog in the respective modules.

If the gateway is started without a valid configuration file or if this file does not contain an entry about the communication module, you will be offered a selection list with all available communication modules after the start:



Select the desired module and click on the button . A corresponding INI file is created and filled with the INI entry for the selected module. You can then continue with the configuration of the Process Gateway (on page 12).

## 5.2.1 Project configuration

If no special project name is defined in the configuration file (`zenProcGateway.ini`), all specifications refer to the first project loaded by the Runtime (integration project). Any project in the hierarchy of a multi project system can be accessed by setting the entry `PROJECT` in the section `[GENERAL]` of the configuration file (`zenProcGateway.ini`) to the corresponding project name.

## 5.2.2 Module configuration

The configuration of a single module depends on the type of this module. With the configuration button the configuration dialog of the module is opened.

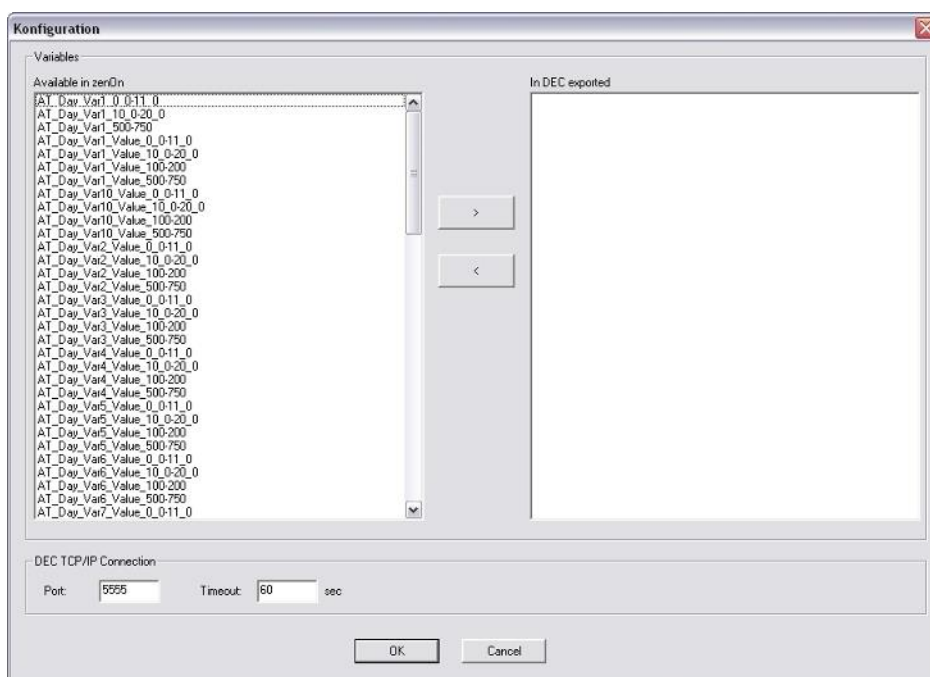
## 5.2.3 Security configuration

The Process Gateway can be executed hidden to protect it from unauthorized access. If the Process Gateway is started in the command line with the parameter /hide (or -hide), it starts invisible and cannot be configured or stopped. The Process Gateway closes automatically when zenon is closed.

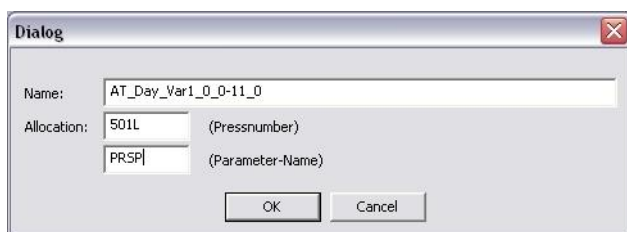
# 6. DEC

## 6.1 Module configuration

The following dialog appears after the **settings** button is clicked:



Here the variables that should be connected can be selected. In the list on the left-hand side all variables which are available in zenon are displayed. These can be selected and moved to the DEC export list with the '>' button. With the button '<' they can be removed again. If a variable is moved to the export list, a dialog for the name assignment of the zenon variable to the DEC variable opens:



The assignment is defined with a four digit press number and the four digit parameter name. Entered characters are automatically changed to upper case. The variables selected in this way then are continuously synchronized in zenon or in the connected DEC system.

In the lower part of the configuration dialog the TCP/IP connection to the DEC system can be configured.

The port number indicates the port where the Process Gateway waits for incoming connections.

The timeout is the time without response, after that the connection is closed.

## 6.2 Logging

All telegrams received by the DEC system and the responds from the Process Gateway can be logged.

To do this an entry LOGFILE in the section [DEC] of the configuration file with the name of the log file has to exist. This file then is created in the same folder as zenProcGateway.exe.

Example for this entry:

```
[DEC]
```

```
LOGFILE=zenProcGateway.log
```

## 6.3 Configuration file: specific entries for AccessDEC

The configuration file must be in the system folder.

**Note:** The configuration file must be in the system folder.



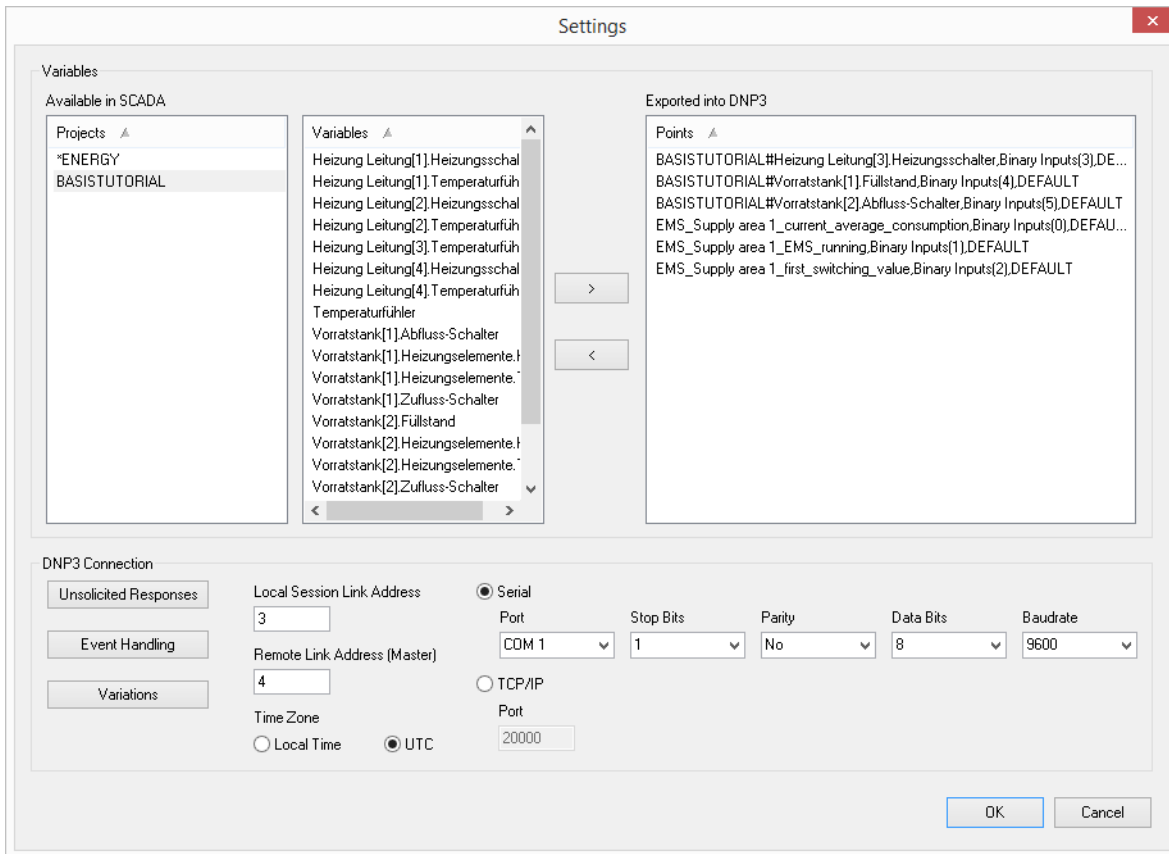
[DEC]

Entry	Description
<b>LOGFILE</b>	Name of the log file (if desired, e.g. zenProcGateway.log)
<b>PORT</b>	Port number, where the Process Gateway waits for connection attempts
<b>TCPTIMEOUT</b>	timeout interval, after which the connection is closed
<b>REFRESHRATE</b>	time interval in milliseconds, in which the process image of zenon is checked on changes.

## 7. DNP3 slave

### 7.1 Module configuration

The following dialog appears in the Process Gateway after the **Settings** button is clicked:



#### VARIABLES

Here the variables that should be connected can be selected. On the left-hand side all variables which are available in zenon are displayed. You can select them there and move them to the DNP3 export list with the button >. With the button < they can be removed again.

As a result of the fact that variables are selected from a list, it is ensured that each variable is only used once.

The point list (**Exported into DNP3**) also contains the project reference of a variable. If a variable belongs to the default project, it is displayed with "[Project]#[Variable Name]" in the point list. If it belongs to the default project (marked with \*), it is only listed in the point list with the variable name.

If a variable is moved to the export list, a dialog for the name assignment of the zenon variable to an object and point number in DNP3 opens.

The variables selected in this way then are available in the DNP3 slave and are continuously synchronized between zenon and the DNP3's object database.

#### **ALLOCATION OF OBJECT GROUPS TO EVENT CLASSES**

The allocation of object groups to event classes is defined and fixed and is as follows:

Event Class 1: Binary inputs

Event Class 2: Analog inputs

Event Class 3: Binary Outputs, Analog Outputs, Running Counters, Octet Strings

## VARIABLES

Parameters	Description
VARIABLES	Area for variable selection, depending on the selected project.
Available in SCADA	Area for the display of the available projects and the variables assigned to the selected project.
Projects	<p>List of the projects available in the DNP3 module of the Process Gateway.</p> <p>The default project is marked with a * in front of the project name. This is generally the configured start project.</p> <p>Exception: A different file is configured in the INI file.</p> <p>Please also note the information on naming the variables for DNP3 (on page 23) in the Process Gateway.</p>
Variables	<p>List of all variables of the selected project available in zenon. These are also displayed by selecting a project by clicking in the <b>Projects</b> area.</p> <p>The variables are selected in this area and applied using the &gt; button in the <b>Exported into DNP3</b> area.</p> <p>Note: Multiple selection (Shift or ALT key) is possible.</p>
Button >	<p>Selected variables from the <b>Variables</b> list are moved to <b>Exported into DNP3</b>.</p> <p>Clicking on the &gt; button opens the object settings (on page 24) dialog.</p>
Button <	Selected variables are removed from the <b>Exported into DNP3</b> list.
Exported into DNP3	<p>Export list of the assigned variables.</p> <p>Double clicking on the entry opens the object settings (on page 24) dialog.</p> <p>The variables selected in this way are available on the DNP3 slave. These variables are continually synchronized between zenon and the DNP3 object database.</p> <p>Please also note the information on naming the variables for DNP3 (on page 23) in the Process Gateway.</p>

## DNP3 CONNECTION

In the lower part of the configuration dialog the serial or TCP/IP connection for the DNP3 slave can be configured.

Parameters	Description
<b>Unsolicited Responses</b>	<p>Button for the configuration of responses that are not requested (<b>Unsolicited Responses</b>), which the Process Gateway sends to the DNP3 master.</p> <p><b>Attention:</b> The DNP3-Master can also request <b>Unsolicited Responses</b> from the Process Gateway. However to do this, the functionality must be activated in the Process Gateway.</p> <p>The number of events and the maximum time delay can be configured for each event class.</p> <p><b>Timeout</b> and <b>Retry</b> are given for all event classes together.</p> <p>Clicking on the button opens the configuration dialog.</p> <p><b>Note:</b> Entries are remanent.</p>
<b>Event Handling</b>	<p>Button for the configuration of event handling</p> <p>Clicking on the button opens the configuration dialog.</p>
<b>Variations</b>	<p>Button for the configuration of the <b>Variations</b> per object group.</p> <p>Clicking on the button opens the configuration dialog.</p>
<b>Local Session Link Address</b>	<p>Link address of the slave.</p> <p>Default: 3</p> <p><b>Note:</b> Only one active session is supported, regardless of whether serial or TCP/IP communication is used.</p>
<b>Remote Link Address (Master)</b>	<p>Link address of the master.</p> <p>Default: 4</p> <p><b>Note:</b> Only one active session is supported, regardless of whether serial or TCP/IP communication is used.</p>
<b>Time Zone</b>	<p>Button to select the time format:</p> <ul style="list-style-type: none"> <li>▶ Local Time</li> <li>▶ UTC</li> </ul>

## SERIAL

<b>Serial</b>	Configurations of the serial interface for communication on the DNP3 slave
<b>Port</b>	Drop-down list for the configuration of the communication interface:

	<p>Value range: COM 1 to COM 64</p> <p>Default: COM 1</p> <p>Note: Only active if <b>Serial</b> is activated as the communication method.</p>
<b>Stop Bits</b>	<p>Drop-down list for the configuration of the number of stopbits transferred:</p> <ul style="list-style-type: none"> <li>▶ 1</li> <li>▶ 1.5</li> <li>▶ 2</li> </ul> <p>Default: 1</p> <p>Note: Only active if <b>Serial</b> is activated as the communication method.</p>
<b>Parity</b>	<p>Drop-down list for the configuration of the parity:</p> <ul style="list-style-type: none"> <li>▶ No</li> <li>▶ Odd</li> <li>▶ Even</li> </ul> <p>Default: No (= no parity)</p> <p>Note: Only active if <b>Serial</b> is activated as the communication method.</p>
<b>Data Bits</b>	<p>Drop-down list for the configuration of the number of data bits transferred:</p> <ul style="list-style-type: none"> <li>▶ 5</li> <li>▶ 6</li> <li>▶ 7</li> <li>▶ 8</li> </ul> <p>Default: 8</p> <p>Note: Only active if <b>Serial</b> is activated as the communication method.</p>
<b>Baudrate</b>	<p>Drop-down list to select the Baud rate for serial interface communication.</p> <p>Selection options: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200, 128000, 256000</p> <p>Default: 9600</p> <p>Note: Only active if <b>Serial</b> is activated as the communication method.</p>

TCP/IP	Configurations for communication in a network via TCP/IP.
Port	<p>Input field for the configuration of the "Listener-/Horch-" protocol port</p> <p>Default: 20000</p> <p>Note: Only active if TCP/IP is activated as the communication method.</p>

#### CLOSE DIALOG

OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.

### 7.1.1 Naming of the variables for DNP3 in the Process Gateway.

The variable name of the DNP3 slave for communication to the DNP3 master comprises the following components:

- ▶ Project name
- ▶ #
 

A # character is inserted after the project name as a separator

**Attention:** There is no project name and separator with start projects!

If a variable name in the DNP3 module of the Process Gateway is not preceded by a project, the project defined in the INI file (on page 37) is automatically placed in front for communication to the DNP3 master.

If there is no project defined in the INI file, this corresponds to the start project in Runtime.

The start project is marked with a \* in the module configuration (on page 18), in the **Available in SCADA** group, in the **Projects** .
- ▶ Variable name
 

As configured in zenon.
- ▶ Object type
 

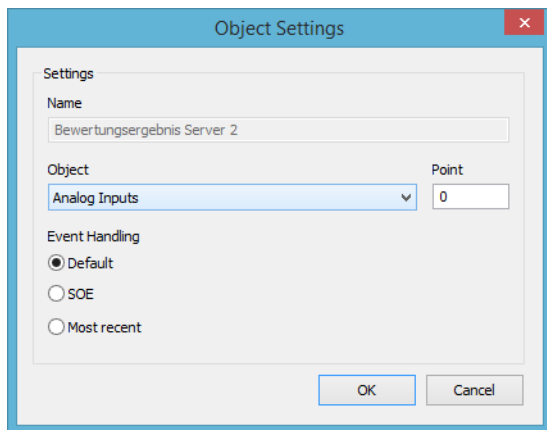
As configured in the [Object Settings](#) (on page 24) dialog .
- ▶ Point index
 

As configured in the [Object Settings](#) (on page 24) dialog .
- ▶ Event handling
 

As configured in the [Object Settings](#) (on page 24) dialog .

### 7.1.2 Variable selection - object settings

If a variable is moved to the export list, a dialog for the name assignment of the zenon variable to an object and point number in DNP3 opens:



The variables selected in this way then are available in the DNP3 slave and are continuously synchronized between zenon and the DNP3's object database.



## SETTINGS

Parameters	Description
<b>Name</b>	<p>Name of the variable for which the configurations can be carried out.</p> <p><b>Note:</b> For information only and grayed out, because it cannot be changed.</p>
<b>Object</b>	<p>Drop-down list to select the driver data type to the driver</p> <ul style="list-style-type: none"> <li>▶ Analog inputs</li> <li>▶ Analog Output Status (written value is mirrored as a response after successful writing)</li> <li>▶ Binary inputs</li> <li>▶ Binary Output Status</li> <li>▶ Running Counters</li> <li>▶ String Data</li> </ul> <p>Default: Binary inputs</p>
<b>Event Handling</b>	<p>Denotes which events can be processed:</p> <ul style="list-style-type: none"> <li>▶ Default Events are handled as defined in the object group. For this, please note the configuration in the event handling (on page 30) dialog.</li> <li>▶ SOE Events are treated as a Serie of Events).</li> <li>▶ Most recent Only the last change of a binary change event is retained.</li> </ul> <p><b>Note:</b> Inactive if the data type is string data.</p> <p>Default: Default</p>
<b>Point</b>	<p><b>Pointindex</b> For the event.</p> <p>Default: 0</p> <p><b>Note:</b> Ensure that the point index is unique for each variable. It is recommended that that the point index is started at 0 and numbered incrementally.</p>

## CLOSE DIALOG

<b>OK</b>	Applies settings and closes the dialog.
-----------	---

<b>Cancel</b>	Discards all changes and closes the dialog.  <b>Note:</b> The variable is in this case not available on the DNP3 slave.
---------------	---

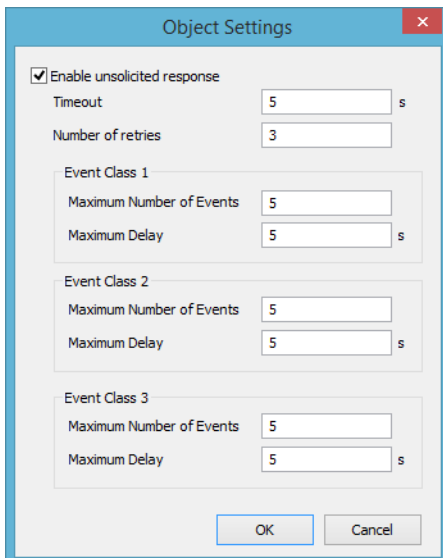


### Information

If several variables have been selected during module configuration, a switch to the configuration dialog of the next variable is made by clicking on the **OK** or **Cancel** buttons. A separate configuration dialog is thus called up step by step for each selected variable.

## 7.1.3 Unsolicited Responses

Dialog for the configuration of the **Unsolicited Responses** in the object settings:



The dialog box, titled "Object Settings", contains the following configuration options:

- ☒ Enable unsolicited response
- Timeout: 5 s
- Number of retries: 3
- Event Class 1
  - Maximum Number of Events: 5
  - Maximum Delay: 5 s
- Event Class 2
  - Maximum Number of Events: 5
  - Maximum Delay: 5 s
- Event Class 3
  - Maximum Number of Events: 5
  - Maximum Delay: 5 s

At the bottom are "OK" and "Cancel" buttons.

Parameters	Description
<b>Enable unsolicited response</b>	<p>Check box to activate the use of <b>Unsolicited responses</b>. If this check box is not activated, no <b>unsolicited responses</b> are generated.</p> <p>Default: <i>inactive</i></p> <p>Note: If this property is not active, all of the following entries are grayed out.</p> <p>Attention: If this option is not active, no <b>unsolicited responses</b> are sent to the master. Even if these are requested by the master.</p>
<b>Timeout</b>	<p>Time in seconds for communication to the master. A time exceedance is triggered once this time has expired.</p> <p>Entry range: 1 to 60 s</p> <p>Default: 5 s</p> <p>Note: This setting depends on the type and speed of its communication to the master. In principle, the slower the communication, the higher the <b>Timeout</b> time.</p>
<b>Number of retries</b>	<p>Number of retries for communication to the master.</p> <p>Entry range: 0 – 65535 (0 = an infinite amount of attempts)</p> <p>Default: 3</p> <p>Example: If an <b>unsolicited response</b> is sent to the master, this is confirmed by the master. If this confirmation from the master remains outstanding, a confirmation is sent as many times as configured in <b>Number of retries</b>. A new <b>unsolicited response</b> is then created.</p>

#### EVENT CLASS 1

<b>Maximum Number of Events</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 – 255</p> <p>Default: 5</p>
<b>Maximum Delay</b>	<p>Maximum delay per event class that is waited until a new entry is written after writing an <b>unsolicited response</b>.</p> <p>Entry range: 0 – 65535 seconds (0 = no delay, i.e. on value change)</p>

	Default: 5
--	------------

**Maximum Number of Events** and **Maximum Delay** work together. The value that is reached first triggers communication to the master.

**Note:** You can also prioritize the three event classes with these entries.

**EVENT CLASS 2**

<b>Maximum Number of Events</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 – 255 Default: 5</p>
<b>Maximum Delay</b>	<p>Maximum delay per event class that is waited until a new entry is written after writing an <b>unsolicited response</b>.</p> <p>Entry range: 0 – 65535 seconds (0 = no delay, i.e. on value change) Default: 5</p>

**EVENT CLASS 3**

<b>Maximum Number of Events</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 – 255 Default: 5</p>
<b>Maximum Delay</b>	<p>Maximum delay per event class that is waited until a new entry is written after writing an <b>unsolicited response</b>.</p> <p>Entry range: 0 – 65535 seconds (0 = no delay, i.e. on value change) Default: 5</p>

**CLOSE DIALOG**

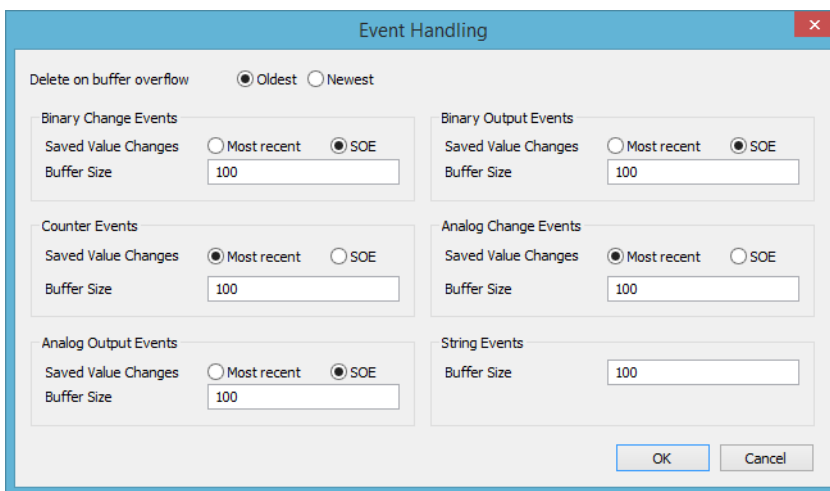
<b>OK</b>	Applies settings and closes the dialog.
<b>Cancel</b>	Discards all changes and closes the dialog.

### 7.1.4 Event Handling

Configuration dialog for event groups and their behavior when the value of variable is changed.

Possible options are:

- ▶ Behavior on deletion
- ▶ Behavior on value change
- ▶ Buffer size



The 'Event Handling' dialog box is a configuration window for event groups. It features a title bar with a close button (X). The main content area is divided into several sections for different event types, each with radio buttons for behavior and a text box for buffer size.

**Delete on buffer overflow:** ☒ Oldest ☐ Newest

**Binary Change Events:**  
Saved Value Changes: ☐ Most recent ☒ SOE  
Buffer Size: 100

**Binary Output Events:**  
Saved Value Changes: ☐ Most recent ☒ SOE  
Buffer Size: 100

**Counter Events:**  
Saved Value Changes: ☒ Most recent ☐ SOE  
Buffer Size: 100

**Analog Change Events:**  
Saved Value Changes: ☒ Most recent ☐ SOE  
Buffer Size: 100

**Analog Output Events:**  
Saved Value Changes: ☐ Most recent ☒ SOE  
Buffer Size: 100

**String Events:**  
Buffer Size: 100

At the bottom right, there are 'OK' and 'Cancel' buttons.

Parameters	Description
<b>Delete on buffer overflow</b>	<p>Global setting for which event is deleted when the buffer is full:</p> <ul style="list-style-type: none"> <li>▶ Oldest Oldest entries are deleted.</li> <li>▶ Newest Most recent entries are deleted.</li> </ul> <p>Default: Oldest</p>

**BINARY CHANGE EVENTS**

Parameters	Description
<b>Buffer Size</b>	<p>Setting for buffer size for the respective event group.</p> <p>Entry range: 1 – 65535 Default: 100</p>

**BINARY OUTPUT EVENTS**

Parameters	Description
<b>Buffer Size</b>	<p>Setting for buffer size for the respective event group.</p> <p>Entry range: 1 – 65535 Default: 100</p>

**ANALOG CHANGE EVENTS**

Parameters	Description
<b>Buffer Size</b>	<p>Setting for buffer size for the respective event group.</p> <p>Entry range: 1 – 65535 Default: 100</p>

**ANALOG OUTPUT EVENTS**

Parameters	Description
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<b>Buffer Size</b>	Setting for buffer size for the respective event group.  Entry range: 1 – 65535 Default: 100
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## COUNTER EVENTS

Parameters	Description
<b>Buffer Size</b>	Setting for buffer size for the respective event group.  Entry range: 1 – 65535 Default: 100

## STRING EVENTS

Parameters	Description
<b>Buffer Size</b>	Setting for buffer size for the respective event group.  Entry range: 1 – 65535 Default: 100

## CLOSE DIALOG

Parameters	Description
<b>OK</b>	Applies settings and closes the dialog.
<b>Cancel</b>	Discards all changes and closes the dialog.

### 7.1.5 Variations per object group - variations

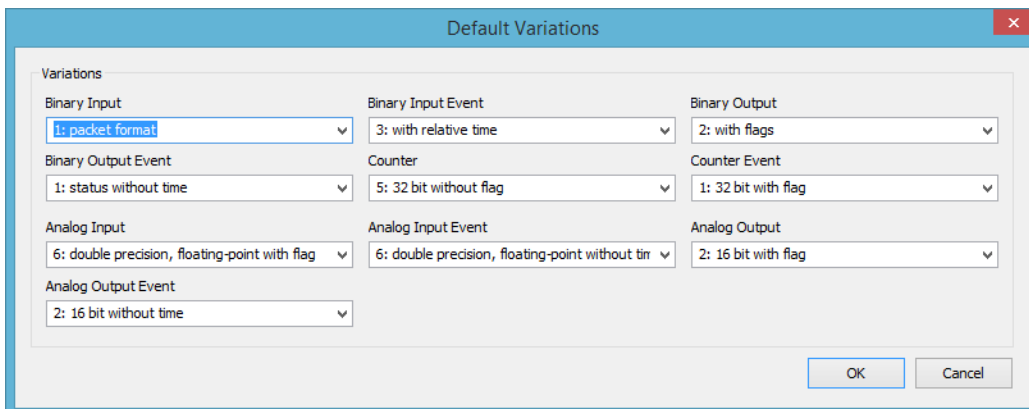
In this dialog, (**Variations**) can be configured for the following object groups:

- ▶ 1 Binary Input
- ▶ 2 Binary Input Event
- ▶ 10 Binary Output



- ▶ 11 Binary Output Event
- ▶ 20 Counter
- ▶ 22 Counter Event
- ▶ 30 Analog Input
- ▶ 32 Analog Input Event
- ▶ 40 Analog Output Status
- ▶ 42 Analog Output Event

Different variations are supported depending on the object group:



The image shows a dialog box titled "Default Variations" with a close button (X) in the top right corner. The dialog contains a section labeled "Variations" with a grid of dropdown menus for different object groups. The options are as follows:

Object Group	Available Variations
Binary Input	1: packet format
Binary Input Event	3: with relative time
Binary Output	2: with flags
Binary Output Event	1: status without time
Counter	5: 32 bit without flag
Counter Event	1: 32 bit with flag
Analog Input	6: double precision, floating-point with flag
Analog Input Event	6: double precision, floating-point without time
Analog Output	2: 16 bit with flag
Analog Output Event	2: 16 bit without time

At the bottom right of the dialog are "OK" and "Cancel" buttons.

Parameters	Description
<b>Binary Input</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Binary Input:</p> <p>1: packet format 2: with flags</p> <p>Default: 1: packet format</p>
<b>Binary Input Event</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Binary Input Event:</p> <p>1: without time 2: with absolute time 3: with relative time</p> <p>Default: 3: with relative time</p>
<b>Binary Output</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Binary Output:</p> <p>1: packet format 2: with flags</p> <p>Default: 1: with flags</p>
<b>Binary Output Event</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Binary Output Event:</p> <p>1: status without time 2: status with time</p> <p>Default: 1: status without time</p>
<b>Counter</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Counter:</p> <p>1: 32 bit with flag 2: 16 bit with flag 5: 32 bit without flag 6: 16 bit without flag</p> <p>Default: 5: 32 bit without flag</p>
<b>Counter Event</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Counter Event:</p> <p>1: 32 bit with flag 2: 16 bit with flag 5: 32 bit flag and time 6: 16 bit flag and time</p> <p>Default: 1: 32 bit with flag</p>

<b>Analog Input</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Analog Input:</p> <ul style="list-style-type: none"> <li>1: 32 bit with flag</li> <li>2: 16 bit with flag</li> <li>3: 32 bit without flag</li> <li>4: 16 bit without flag</li> <li>5: single precision, floating-point with flag</li> <li>6: double precision, floating-point with flag</li> </ul> <p>Default: 6: double precision, floating-point with flag</p>
<b>Analog Input Event</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Analog Input Event:</p> <ul style="list-style-type: none"> <li>1: 32 bit without time</li> <li>2: 16 bit without time</li> <li>3: 32 bit with time</li> <li>4: 16 bit with time</li> <li>5: single precision, floating-point without time</li> <li>6: double precision, floating-point without time</li> <li>7: single precision, floating-point with time</li> <li>8: double precision, floating-point with time</li> </ul> <p>Default: 6: double precision, floating-point without time</p>
<b>Analog Output</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Binary Input:</p> <ul style="list-style-type: none"> <li>1: 32 bit with flag</li> <li>2: 16 bit with flag</li> <li>3: single precision, floating-point with flags</li> <li>4: double precision, floating-point with flags</li> </ul> <p>Default: 2: 16 bit with flag</p>
<b>Analog Output Event</b>	<p>Drop-down list with the supported <a href="#">Variations</a> for the object group Analog Output Event:</p> <ul style="list-style-type: none"> <li>1: 32 bit without time</li> <li>2: 16 bit without time</li> <li>3: 32 bit with time</li> <li>4: 16 bit with time</li> <li>5: single precision, floating-point without time</li> <li>6: double precision, floating-point without time</li> </ul>

	7: single precision, floating-point with time 8: double precision, floating-point with time  Default: 2: 16 bit without time
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## CLOSE DIALOG

Parameters	Description
OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.

## 7.2 Communication - procedure

Value changes are executed via COM. An update in stack direction only occurs if:

- ▶ It is the first value for the object (initial value).
- ▶ The value changes (value change).
- ▶ The status bits `Invalid` or `Not current` change (value change of the status bit).

The time stamp of the change is applied in the event of a change. This time stamp is applied from the COM event and transferred to the stack event. The `Time Zone` setting determines the type of time stamp:

- ▶ Local time or
- ▶ UTC time

The stack no longer checks for a value change, but the gateway cyclically takes the value changes from the queue of the COM threads and forwards them to the stack for entry into the event buffer of the corresponding object group. Event values and static values (with poll in the stack) are read from the shadow of the item and no longer from the shared memory. The time stamp is applied from the COM event and transferred to the stack event as a local time with millisecond precision.

Binary and analog output variables are written from the master to the Process Gateway.

In addition, these variables send the value back to the master, the same thing that binary and analog input variables do if the assigned variables are changed in zenon Runtime.

As a result of the fact that variables are selected from a list, it is ensured that double selection is prevented.

## 7.3 Device Profile

The template for the Device Profile is installed together with the DNP3 Process Gateway by the setup. You can find the file `DNP3_ProcessGateway.xml` in the following folder:  
`%ProgramData%\COPA-DATA\zenon[Version]\CommunicationProfiles\Dnp3\ProcessGateway\`

## 7.4 Configuration file: specific entries for Access DNP3

The configuration file must be in the system folder. This INI file is called `zenProcGateway.INI` and is located in the following folder: `C:\ProgramData\COPA-DATA\System.`

**[DNP3]**

Entry	Description
<b>SERIAL=</b>	serial communication (1) or communication via TCP/IP (0)
<b>COMPORT=</b>	serial interface (COM1 = 0, COM2 = 1,...)
<b>BAUD=</b>	baud rate of the serial interface
<b>BYTESIZE=</b>	number of data bits of the serial interface
<b>PARITY=</b>	Parity settings of the serial interface: (0=none,1=odd,2=even)
<b>STOPBITS=</b>	number of stop bits of the serial interface (0=1, 1=1.5, 2=2)
<b>LINKADDRLOC=</b>	local session link address
<b>LINKADDRREM=</b>	remote session link address
<b>PORT=</b>	Communication port of communication via TCP/IP Default: 20000
<b>TIME_USE_UTC=</b>	Format of the time stamp: <ul style="list-style-type: none"> <li>▶ 0= Local time</li> <li>▶ 1 = UTC</li> </ul> Default: 0
<b>Obj1BinInput=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group 1: packet format 2: with flags Default: 1: packet format
<b>Obj2BinInputEvent=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group 1: without time 2: with absolute time 3: with relative time Default: 3: with relative time
<b>Obj10BinOutput=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group 1: packet format 2: with flags Default: 1: with flags
<b>Obj11BinOutputEvent=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group 1: status without time 2: status with time Default: 1: status without time
<b>Obj20Counter=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group 1: 32 bit with flag

	2: 16 bit with flag 5: 32 bit without flag 6: 16 bit without flag  Default: 5: 32 bit without flag
<b>Obj22CounterEvent=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group  1: 32 bit with flag 2: 16 bit with flag 5: 32 bit flag and time 6: 16 bit flag and time  Default: 1: 32 bit with flag
<b>Obj30AnalogInp=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group  1: 32 bit with flag 2: 16 bit with flag 3: 32 bit without flag 4: 16 bit without flag 5: single precision, floating-point with flag 6: double precision, floating-point with flag  Default: 6: double precision, floating-point with flag
<b>Obj32AnalogInpEvent=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group  1: 32 bit without time 2: 16 bit without time 3: 32 bit with time 4: 16 bit with time 5: single precision, floating-point without time 6: double precision, floating-point without time 7: single precision, floating-point with time 8: double precision, floating-point with time  Default: 6: double precision, floating-point without time
<b>Obj40AnalogOutStatus=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group  1: 32 bit with flag 2: 16 bit with flag 3: single precision, floating-point with flags 4: double precision, floating-point with flags  Default: 2: 16 bit with flag
<b>Obj41AnalogOutput=</b>	Drop-down list with the supported <a href="#">Variations</a> for the object group  1: 32 bit without time 2: 16 bit without time 3: 32 bit with time 4: 16 bit with time 5: single precision, floating-point without time 6: double precision, floating-point without time 7: single precision, floating-point with time 8: double precision, floating-point with time

	Default: 2: 16 bit without time
<b>UNSOLICITED_RESPONSES_ENABLED=</b>	<p>Activated or deactivated <b>Unsolicited Responses:</b></p> <ul style="list-style-type: none"> <li>▶ 0 = not active</li> <li>▶ 1 = active</li> </ul> <p>Default: Inactive (0)</p>
<b>UNSOLICITED_RESPONSES_CONFIRMATION_TIMEOUT=</b>	<p>Time in seconds for communication to the master. A time exceedance is triggered once this time has expired.</p> <p>Entry range: 1 to 60 s</p> <p>Default: 5 s</p>
<b>UNSOLICITED_RESPONSES_RETRY_COUNTER=</b>	<p>Number of retries for communication to the master.</p> <p>Entry range: 0 - 65535 (0 = an infinite amount of attempts)</p> <p>Default: 3</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_1=</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 - 255</p> <p>Default: 5</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_2=</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 - 255</p> <p>Default: 5</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_3=</b>	<p>Maximum number of events (per event class) that can be buffered before an <b>unsolicited response</b> is sent.</p> <p>Entry range: 0 - 255</p> <p>Default: 5</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_1=</b>	<p>Maximum delay per event class that is waited until a new entry is written after writing an <b>unsolicited response</b>.</p> <p>Entry range: 0 - 65535 seconds (0 = no delay, i.e. on value change)</p> <p>Default: 5</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_2=</b>	<p>Maximum delay per event class that is waited until a new entry is written after writing an <b>unsolicited response</b>.</p> <p>Entry range: 0 - 65535 seconds (0 = no delay, i.e. on value change)</p> <p>Default: 5</p>
<b>UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_3=</b>	<p>Maximum delay per event class that is waited until a new entry is</p>



<b>S_3=</b>	<p>written after writing an unsolicited response.</p> <p>Entry range: 0 - 65535 seconds (0 = no delay, i.e. on value change) Default: 5</p>
-------------	---

## [VARIABLES]

Entry	Description
<b>COUNT</b>	number of variables to be exported
<b>EVENT_%d</b>	<p>Event handling: Handling of the events per variable. Always belonging to a variable: e.g. EVENT_0 belongs to NAME_0</p> <p>Values:</p> <ul style="list-style-type: none"> <li>▶ <b>DEFAULT</b> Handling of events is the same as in the object group</li> <li>▶ <b>MOST_RECENT</b> Only includes the last change of a binary change event</li> <li>▶ <b>SOE</b> Creates a series of events</li> </ul> <p>Default: Default</p>
<b>NAME_n</b>	name of the variable with the number n (0<=n<COUNT)
<b>OBJECT_n</b>	DNP3 object type of variable number n (0<=n<COUNT)
<b>POINT_n</b>	DNP3 point number of variable number n (0<=n<COUNT)

## 7.5 LATCH\_ON and LATCH\_OFF

Command Control Code from the PLC is written to USINT variables as an 8-bit value via Process Gateway. The following applies for transfer to zenon variables:

Destination variable of the command	Result
<b>BOOL:</b>	<p>Set value <b>LATCH_ON</b>: 1</p> <p>Set value <b>LATCH_OFF</b>: 0</p>
<b>USINT:</b>	Set value corresponds to control code.
all other variables:	Command failed.

Only **direct control** is supported. **select**, **SBO** and **operate** are not supported.

Master, control mode direct	Process Gateway	Value zenon USINT
<b>LATCH_ON</b>	Binary Output Statuses	3
<b>LATCH_OFF</b>	Binary Output Statuses	4
<b>Pulse On</b>	Binary Output Statuses	1
<b>Pulse Off</b>	Binary Output Statuses	2
<b>Trip</b>	Binary Output Statuses	129
<b>Close</b>	Binary Output Statuses	65

For zenon **binary output statuses** `BOOL`, only **LATCH\_ON/LATCH\_OFF** is supported.

## 8. ICCP-TASE.2

The IEC 60870-6 TASE.2 ICCP protocol can be used with the `AccessICCP.dll` module via the zenon Process Gateway. ICCP-TASE.2 supports conformance blocks 1 and 2 as client and server. It acts in the same way as for establishing communication as a server.

With the initialization of communication, zenon Process Gateway applies the addressing settings from the request received in accordance with ISO 8650-1 (for example `AP-title`, `AE-qualifier`) and automatically uses these OSI addressing parameters for further communication.

### PORT

Communication is effected via port 102 by default, or another port defined in the configuration file. The port is opened on startup and remains open. It allows the connection of clients. The maximum number can be defined in the configuration file.

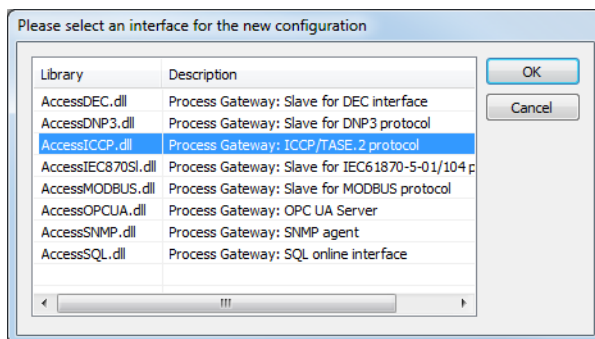
### CONFIGURATION OF INI FILE

Path to the configuration file: `%CD_SYSTEM%\zenProcGateway.ini`.

Entry	Description
[ICCP]	Group
SERVER_PORT=	Number of the port. Default: 102
MAX_CONNECTIONS=	Maximum number of connections. 0: unlimited
MAJOR_VERSION_NUMBER=	Main version number.
MINOR_VERSION_NUMBER=	Minor version number.
BILATERAL_TABLE_ID=	Name of bilateral table.
LOCAL_DOMAIN_NAME=	Local domain name.
REMOTE_DOMAIN_NAME=Remote	Remote domain name.
[VARIABLES]	Group for configured variables. The following are listed: <ul style="list-style-type: none"> <li>▸ Parameters of each variable</li> <li>▸ Number of variables</li> <li>▸ Names of the variable</li> </ul>
PARAM_0=	Parameter for variable.  The first is counted as 0 and the counter is increased by 1 with every further parameter. The identifier corresponds to the identifier of the variable name.  <b>PARAM_0</b> Corresponds to <b>NAME_0</b> .  Example: <b>PARAM_0=1,0,0,Variable</b>
COUNT=	Number of configured variables
NAME_0=	Name of the variable.  The first is counted as 0 and the counter is increased by 1 with every further variable. This identifier corresponds to the parameter identifier.  <b>PARAM_0</b> corresponds to <b>NAME_0</b> .  <b>Example: NAME_0=MyName</b>

## 8.1 Module configuration

The module must be configured when it is started for the first time.



Parameters	Description
<b>Library</b>	Shows the names of the DLL.
<b>Description</b>	Describes functionality.
<b>OK</b>	Accepts selection and starts configuration dialog.
<b>Cancel</b>	Cancels start of the Process Gateway.

### FIRST START

To start the Process Gateway with the ICCP/TASE.2 module:

1. Start the Process Gates  
(no other module can be configured).
2. The dialog to select the module is opened
3. Select **ICCP/TASE.2 protocol**
4. click on **OK**
5. The dialog for configuring the module is opened
6. Configure the tabs
  - **General** (on page 48)
  - **Server variables** (on page 50)
  - **Client variables** (on page 52)

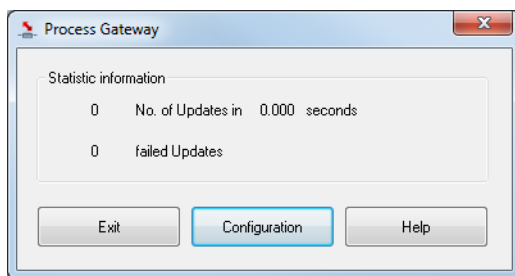
### THE DIALOG TO SELECT THE MODULE IS NOT OFFERED

Starts the Process Gateway with another module that has already been configured without offering the dialog to select a module, then:

1. Close the Process Gateway
2. Navigate to the INI file
3. Add a comment for the module in the file or delete the INI file
4. Restart the Process Gateway

## START WITH CONFIGURED MODULE

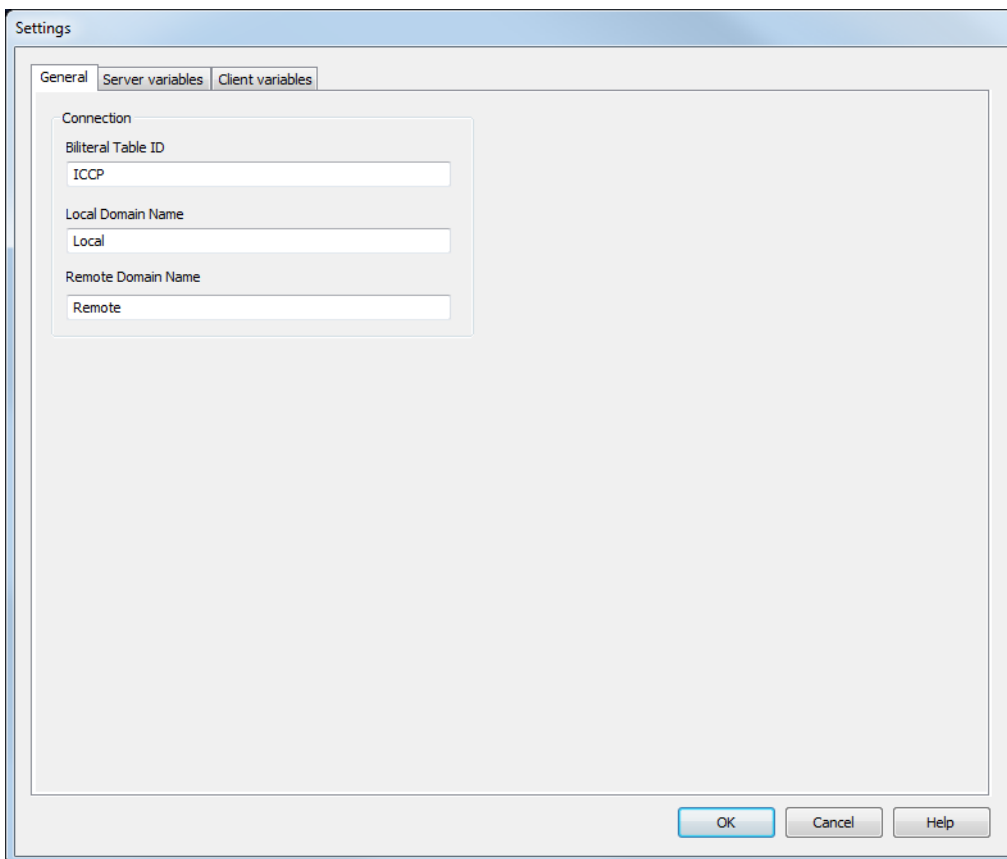
Start the Process Gateway with a module that has already been configured; a dialog with static data is opened.



Parameters	Description
Statistic information	Information on updates
Exit	Closes process gateway.
Configuration	Opens configuration dialog.
Help	Opens online help.

## CONFIGURATION

Configuration is carried out using three tabs. It can be confirmed and closed by clicking on OK if all three tabs have been configured.



The screenshot shows a 'Settings' dialog box with three tabs: 'General', 'Server variables', and 'Client variables'. The 'General' tab is active. It contains a 'Connection' section with three text input fields: 'Bilateral Table ID' (containing 'ICCP'), 'Local Domain Name' (containing 'Local'), and 'Remote Domain Name' (containing 'Remote'). At the bottom right of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

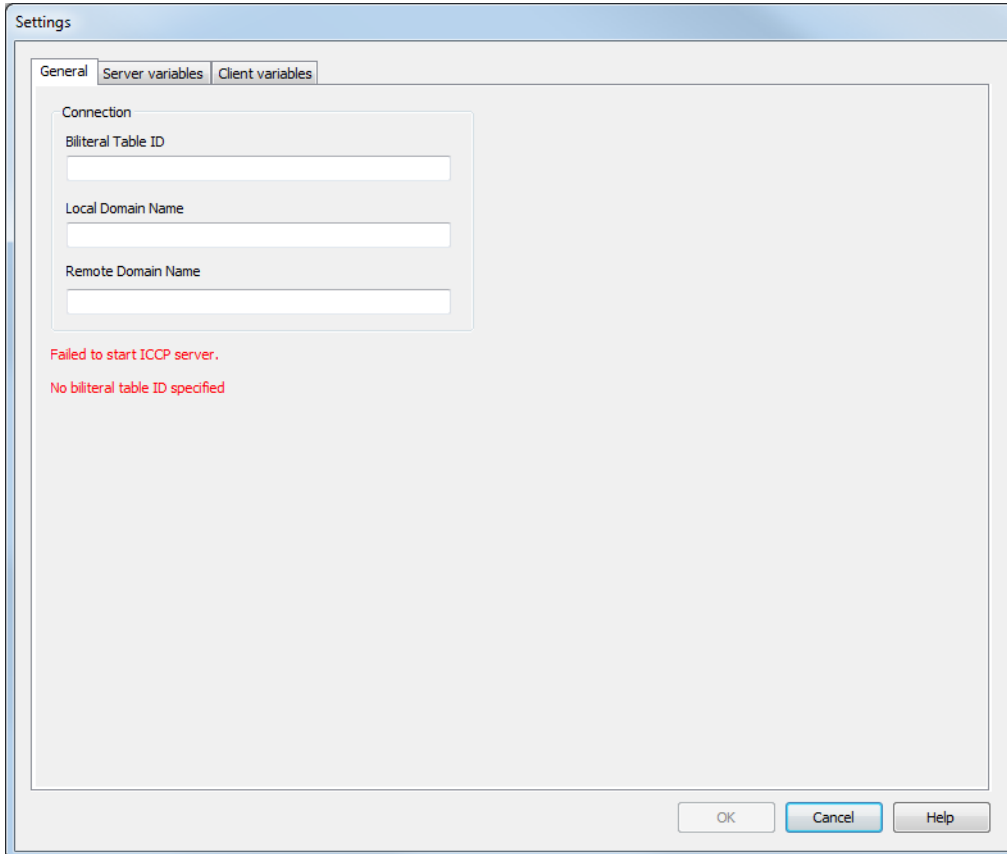
Parameters	Description
<b>General</b> (on page 48)	General settings.
<b>Server variables</b> (on page 50)	Configuration of the server variables.
<b>Client variables</b> (on page 52)	Configuration of the client variables.
<b>OK</b>	Accepts settings in all tabs and closes the dialog.
<b>Cancel</b>	Discards settings in all tabs and closes the dialog.
<b>Help</b>	Opens online help.

In both tabs for **server variables** (on page 50) and client variables (on page 52) the variables that are provided on the ICCP server or were read in via the ICCP server are selected.

If a connection to the server was made by a client, the verification of the bilateral table IDs is carried out. At the same time, a client connection to the counterpart is established and the variables to be communicated are registered as a dataset and spontaneous communication of the DSTransferSet is activated.

### 8.1.1 General

Configuration of the general settings.



The image shows a 'Settings' dialog box with three tabs: 'General', 'Server variables', and 'Client variables'. The 'General' tab is active. It contains a 'Connection' section with three input fields: 'Bliteral Table ID', 'Local Domain Name', and 'Remote Domain Name'. Below these fields, there are two red error messages: 'Failed to start ICCP server.' and 'No bliteral table ID specified'. At the bottom right of the dialog, there are three buttons: 'OK', 'Cancel', and 'Help'.

Settings

General | Server variables | Client variables

Connection

Bliteral Table ID

Local Domain Name

Remote Domain Name

Failed to start ICCP server.

No bliteral table ID specified

OK Cancel Help

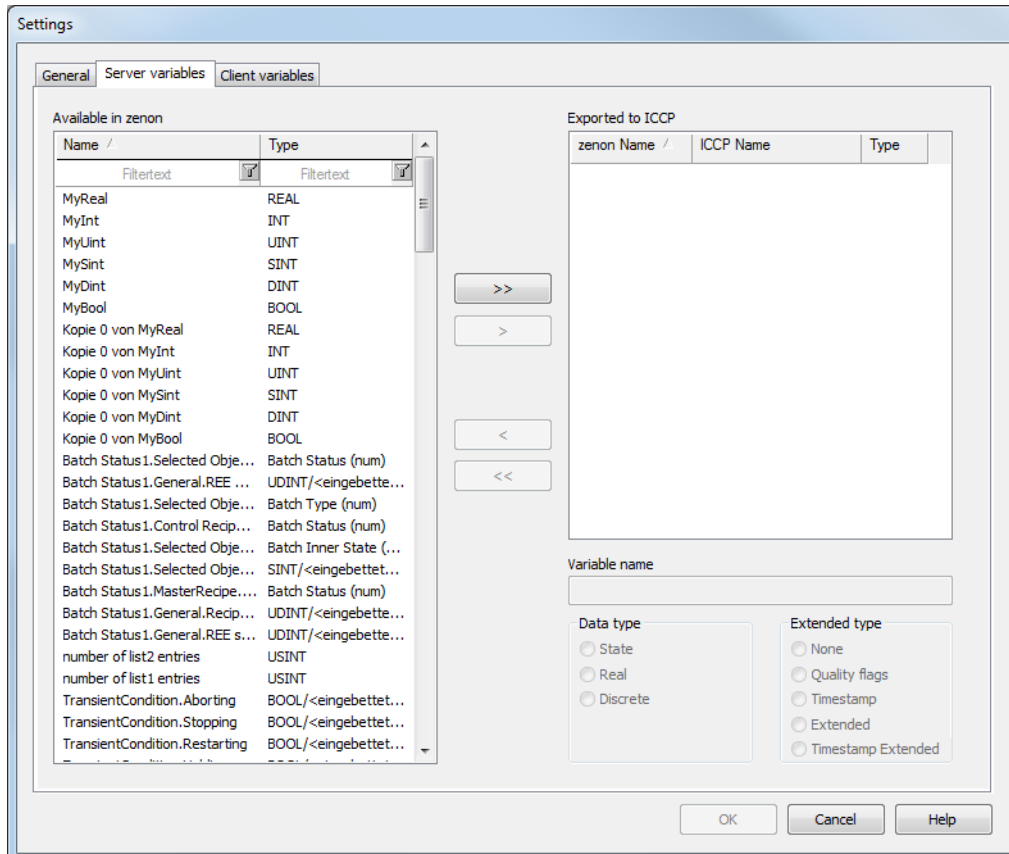


Parameters	Description
Connection	Connection settings.
Bilateral Table ID	The bilateral table ID is compared to the client by the server when the connection to the server is made and allows only authorized clients to have access to the data.
Local Domain Name	Name of the local domain that is used for all server variables.
Remote Domain Name	Name of the remote domain that is used for all client variables.
Error message	Display of missing configuration data.
OK	Accepts the settings of all tabs, saves the configuration in the <b>zenProcGateway.ini</b> file, starts the ICCP server and waits for incoming connections.
Cancel	Discards all changes in all tabs and closes the dialog.
Help	Opens online help.

**Note of bilateral table ID:** The unique bilateral table ID must be the same on all devices that communicate with the ICCP gateway. It is queried when a connection is made by both partners. The connection is disconnected if they do not correspond. The domain names provide the names used at MMS protocol level to variables that are communicating. It must be set as the same mirror image for the partners.

## 8.1.2 Server variables

Selection and configuration of the variables that are provided on the ICCP client.

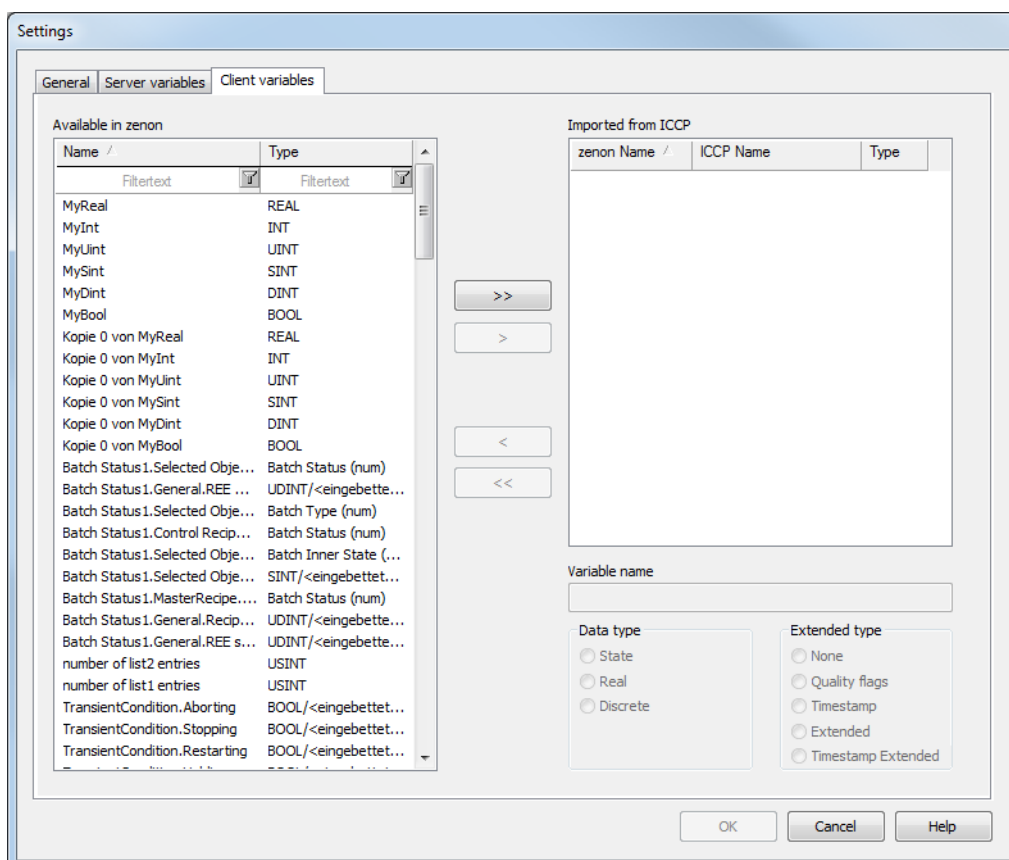


Parameters	Description
<b>Available in zenon</b>	List of the variables available in zenon.
<b>Exported to ICCP</b>	<p>List of the variables exported to ICCP. Display:</p> <ul style="list-style-type: none"> <li>▶ Name in zenon</li> <li>▶ ICCP-Name</li> <li>▶ Type</li> </ul> <p>ICCP name and type can be changed using the <b>Variable name</b>, <b>Data type</b> and <b>Extended type</b> options.</p>
<b>Cursor keys</b>	<p>Moving selected variables between the two lists.</p> <ul style="list-style-type: none"> <li>▶ Key &gt;&gt;: Copies all variables from zenon to ICCP.</li> <li>▶ Key &lt;&lt;: Removes all variables from the ICCP list.</li> <li>▶ Key &gt;: Copies selected variables from zenon to ICCP</li> <li>▶ Key &lt;: Removes selected variables from the ICCP list.</li> </ul> <p>Variables can also be added to the list for zenon by double clicking on the variable for the ICCP list.</p>
<b>Variable name</b>	Allows renaming of the zenon variable names highlighted in the list for ICCP.
<b>Data type</b>	<p>Selection of an ICCP data type for the variables selected in the list:</p> <ul style="list-style-type: none"> <li>▶ <b>State</b></li> <li>▶ <b>Real</b></li> <li>▶ <b>Discrete</b></li> </ul> <p>Standard display of zenon variables on ICCP:</p> <ul style="list-style-type: none"> <li>▶ BOOL on State</li> <li>▶ REAL on Real</li> <li>▶ INT on Discrete</li> </ul> <p>Depending on the zenon variables on which they are based, data types can also not be available (grayed out).</p>
<b>Extended type</b>	<p>Selection of an ICCP variable addition for the variables selected in the list:</p> <ul style="list-style-type: none"> <li>▶ <b>None</b>: none</li> <li>▶ <b>Quality flags</b>: Quality</li> <li>▶ <b>Timestamp</b>: Quality + time stamp</li> <li>▶ <b>Extended</b>: Quality + time stamp + change counter</li> <li>▶ <b>Timestamp Extended</b>: Quality + extended timestamp</li> </ul> <p>Depending on the zenon variables on which they are based, data types can also not be available (grayed out).</p>

<b>OK</b>	Accepts the settings of all tabs, saves the configuration in the <b>zenProcGateway.ini</b> file, starts the ICCP server and waits for incoming connections.
<b>Cancel</b>	Discards all changes in all tabs and closes the dialog.
<b>Help</b>	Opens online help.

### 8.1.3 Client variables

Selection and configuration of the variables that are provided on the ICCP client.



Parameters	Description
<b>Available in zenon</b>	List of the variables available in zenon.
<b>Exported to ICCP</b>	<p>List of the variables exported to ICCP. Display:</p> <ul style="list-style-type: none"> <li>▶ Name in zenon</li> <li>▶ ICCP-Name</li> <li>▶ Type</li> </ul> <p>ICCP name and type can be changed using the <b>Variable name</b>, <b>Data type</b> and <b>Extended type</b> options.</p>
<b>Cursor keys</b>	<p>Moving selected variables between the two lists.</p> <ul style="list-style-type: none"> <li>▶ Key &gt;&gt;: Copies all variables from zenon to ICCP.</li> <li>▶ Key &lt;&lt;: Removes all variables from the ICCP list.</li> <li>▶ Key &gt;: Copies selected variables from zenon to ICCP</li> <li>▶ Key &lt;: Removes selected variables from the ICCP list.</li> </ul> <p>Variables can also be added to the list for zenon by double clicking on the variable for the ICCP list.</p>
<b>Variable name</b>	Allows renaming of the zenon variable names highlighted in the list for ICCP.
<b>Data type</b>	<p>Selection of an ICCP data type for the variables selected in the list:</p> <ul style="list-style-type: none"> <li>▶ <b>State</b></li> <li>▶ <b>Real</b></li> <li>▶ <b>Discrete</b></li> </ul> <p>Standard display of zenon variables on ICCP:</p> <ul style="list-style-type: none"> <li>▶ BOOL on State</li> <li>▶ REAL on Real</li> <li>▶ INT on Discrete</li> </ul> <p>Depending on the zenon variables on which they are based, data types can also not be available (grayed out).</p>
<b>Extended type</b>	<p>Selection of an ICCP variable addition for the variables selected in the list:</p> <ul style="list-style-type: none"> <li>▶ <b>None</b>: none</li> <li>▶ <b>Quality flags</b>: Quality</li> <li>▶ <b>Timestamp</b>: Quality + time stamp</li> <li>▶ <b>Extended</b>: Quality + time stamp + change counter</li> <li>▶ <b>Timestamp Extended</b>: Quality + extended timestamp</li> </ul> <p>Depending on the zenon variables on which they are based, data types can also not be available (grayed out).</p>

OK	Accepts the settings of all tabs, saves the configuration in the <b>zenProcGateway.ini</b> file, starts the ICCP server and waits for incoming connections.
Cancel	Discards all changes in all tabs and closes the dialog.
Help	Opens online help.

## 9. IEC870 Slave

### LANGUAGE

The driver and its dialogs for configuration are only available in English.

### STRUCTURE

PLCs addressed with the IEC870SI driver, are divided into sectors. These sectors contain IOs (information objects) representing the actual variables. IOs refer to a variable of the process control system.

You can configure several PLCs with the IEC870SI driver. According to the used protocol, they are associated directly to a Master or polled by a Master.

### IDENTIFICATION AND ADDRESSING

- ▶ 870-101: The PLC is identified by a link address.
- ▶ 870-104: The PLC is identified by the IP address of the Master.
- ▶ Sector: Addressed by COA.
- ▶ IO: Addressed by type identification and IOA.

In the following chapters, you will read how to configure the IEC870SI driver, how communication takes place and you will read about compatibility issues.



#### Information

*For variables that are configured in the IEC870 Process Gateway as command variables, each command is logged as **Send value** via the COM interface in the CEL if the **Setting values with VBA** property is active (**Logging in CEL** group).*

## 9.1 Module configuration

There are many settings you can change in the IEC870SI driver. All lists in the configuration window can be sorted. To change the sorting sequence, simply click on the column title.

### SETTINGS:

The settings for protocols 101 and 104 differ.

In the **main window**, you can choose the protocol you want to use and define general settings:

- ▶ (Protocol) 870-101 (on page 58)  
unlocks the settings for protocol 101 and locks all other input fields.
- ▶ (Protocol) 870-104 (on page 60)  
unlocks the settings for protocol 104 and locks all other input fields.

### DEVICES

Devices are created and deleted in the **Devices** section of the main window. These devices are configured in the tabs.

The following device settings are available in Process Gateway for 870-101- and 870-104 protocols:

- ▶ **Device** (on page 69),
- ▶ **Sector** (on page 72)
- ▶ **Sequence of Events SOE** (on page 98) and
- ▶ **104 settings** (on page 86)



## Information

*Only the general properties are documented in this section. You can find the protocol-dependent configurations in the section for the respective protocol or in the description of the respective device settings.*

Settings

Settings

Configuration file

☐ 870-104
 ☒ 870-101

Port: 
Link Address Size: 
COM Port: 
Baud Rate:

☐ Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).

Devices

Device	Name

Device: 
Sector: 
SOE: 
104 settings

Common Settings

Name:

Short Pulse:  ms
 Long Pulse:  ms
 Max. user data: 
☒ Commands active

File Transfer Directory: 
File Transfer in Control Direction Directory:

870-101 specific

COA Size: 
COT Size: 
IOA Size: 
Link Address: 
Master Polling Timeout:  s

870-104 specific

IP-Address:



Parameters	Description
<b>Settings</b>	
<b>Configuration file</b>	<p>Name of the configuration file. This is where all active settings are stored and also loaded from. The name you enter must be a valid file name. Otherwise, no data can be stored. In this case, you will get an error message.</p> <p>Only enter the file name without path. You do not have to add the file extension XML, as it will be added automatically during saving. The current INI directory will be used as path.</p> <p>The file name will automatically be entered in the INI file of the process gateway as configuration.</p> <p>You can find the INI file in the system folder of the process control system. It is called 'SCADAProcGateway.ini' - SCADA is the placeholder for the name of the process control system.</p>
<b>Import...</b>	Loads configuration data from an XML configuration file. The current settings are replaced by the ones stored in the file. The current setting for the 'configuration file' remains the same.
<b>Export...</b>	<p>Stores the current settings in a file.</p> <p><b>Attention:</b> Device that still have the default ID '????' (defined during creation) will not be exported. To export them, you must first configure the device in the configuration window "Device" (on page 69).</p>
<b>870-104</b>	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
<b>871-101</b>	activates protocol 101, unlocks all input fields for 101 and locks settings for 104.
<b>Deactivate standard DPI/DCS mapping and use internal mapping (not recommended) .</b>	<p>Deactivates standard communication via DPI (Deep Packet Inspection) and DCS (Distributed Control System) and uses internal mapping for this.</p> <p>Default: Inactive</p> <p>Note: Not recommended!</p>
<b>Devices</b>	List of configured devices.
<b>Add</b>	Adds a new device with standard settings. By default, it gets the invalid ID '????' and invalid IP/link addresses. Before you can use or export the device, you must configure it.
<b>Delete</b>	Deletes the selected device. This button is not active if no device has been selected.
<b>Device</b>	Tab for the configuration of the devices (on page 69)
<b>Sector</b>	Tab for the configuration of the sectors (on page 72)
<b>SOE</b>	Tab for the configuration of the sequence of events (on page 98)
<b>104 settings</b>	Tab for 870-104 protocol-specific configuration (on page 60)

	Note: Not active if 870-101 is selected as a protocol.
<b>OK</b>	Accepts all changed settings. They will immediately be stored in the current configuration file (as defined in 'Configuration file'). Attention: After clicking on 'OK', all active Master connections will be closed and restarted with the new settings. There may be communication errors during that.
<b>Cancel</b>	Discards all changed settings. Nothing is stored.
<b>Help</b>	Opens online help.

### 9.1.1 Settings for 870-101

**Settings**

**Settings**

Configuration file  
IEC870SLAVE.XML Import... Export...

☐ 870-104
 ☒ 870-101

Port: 2404    Link Address Size: 1    COM Port: COM 1    Baud Rate: 9600

☐ Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).

**Devices**

Device	Name

Add Delete

**Device** **Sector** **SOE** **104 settings**

**Common Settings**

Name: Test\_1

Short Pulse: 1000 ms    Long Pulse: 2000 ms    Max. user data: 253    ☒ Commands active

File Transfer Directory:     File Transfer in Control Direction Directory:

**870-101 specific**

COA Size: 2    COT Size: 2    IOA Size: 3    Link Address: 1    Master Polling Timeout: 0 s

**870-104 specific**

IP-Address: 0 . 0 . 0 . 1

OK Cancel Help



### Information

Only the general properties of the 870-101 protocol are documented in this section. You can find further information in the general description of the respective device settings.

Parameters	Description
<b>Settings</b>	
<b>870-104</b>	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
<b>871-101</b>	activates protocol 101, unlocks all input fields for 101 and locks settings for 104.
<b>Port</b>	Port for the communication to the end device. Default: 2404  Note: Inactive if 870-101 is selected as a protocol.
<b>Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).</b>	Deactivates standard communication and uses internal mapping for this. Default: Inactive
<b>Devices</b>	List of configured devices.
<b>Add</b>	Adds a new device with standard settings. By default, it gets the invalid ID '????' and invalid IP/link addresses. Before you can use or export the device, you must configure it.
<b>Delete</b>	Deletes the selected device. This button is not active if no device has been selected.
<b>OK</b>	Accepts all changed settings. They will immediately be stored in the current configuration file (as defined in 'Configuration file'). Attention: After clicking on 'OK', all active Master connections will be closed and restarted with the new settings. There may be communication errors during that.
<b>Cancel</b>	Discards all changed settings. Nothing is stored.
<b>Help</b>	Opens online help.

## 9.1.2 Settings for 870-104

**Settings**

**Settings**

Configuration file

☒ 870-104 ☐ 870-101

Port: 
 Link Address Size: 
 COM Port: 
 Baud Rate:

☐ Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).

**Devices**

Device	Name

**Device** | **Sector** | **SOE** | **104 settings**

**Common Settings**

Name:

Short Pulse:  ms
 Long Pulse:  ms
 Max. APDU size:

☒ Commands active

File Transfer Directory: 
 File Transfer in Control Direction Directory:

**870-101 specific**

COA Size: 
 COT Size: 
 IOA Size: 
 Link Address: 
 Master Polling Timeout:  s

**870-104 specific**

IP-Address:



### Information

Only the general properties of the 870-104 protocol are documented in this section. You can find further information in the general description of the respective device settings.

Parameters	Description
<b>Protocol 870-104</b>	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
<b>Port</b>	TCP port to which the Masters connect. Defined by the norm as 2404. Our drivers allow you to have several instances of the Process Gateway running at the same time. That is why you can change this port: Allowed port numbers: 1200 to 65.535
<b>Devices</b>	List of configured devices.
<b>Add</b>	Adds a new device with standard settings. By default, it gets the invalid ID '????' and invalid IP/link addresses. Before you can use or export the device, you must configure it.
<b>Delete</b>	Deletes the selected device. This button is not active if no device has been selected.
<b>OK</b>	Accepts all changed settings. They will immediately be stored in the current configuration file (as defined in 'Configuration file'). <b>Attention:</b> After clicking on <b>OK</b> , all active Master connections will be closed and restarted with the new settings. There may be communication errors during that.
<b>Cancel</b>	Discards all changed settings. Nothing is stored.
<b>Help</b>	Opens online help.

## XML-File

The configuration of the IEC870SI is stored in an XML file. You can import and export different configurations with the buttons '**Export**' and '**Import**' in the main window.

The active configuration is stored in the INI file, for example:

[IEC 870]

SETTINGS=IEC870SLAVE.XML

You can choose any name. The path is the same as in the INI file.

## STRUCTURE OF THE XML FILE

The names of most fields intuitively indicate their meaning. The settings correspond to those that are permitted in the dialog.

The values and structure of the XML file are verified when the file is read. Erroneous entries trigger an error message that is also logged.



### Attention

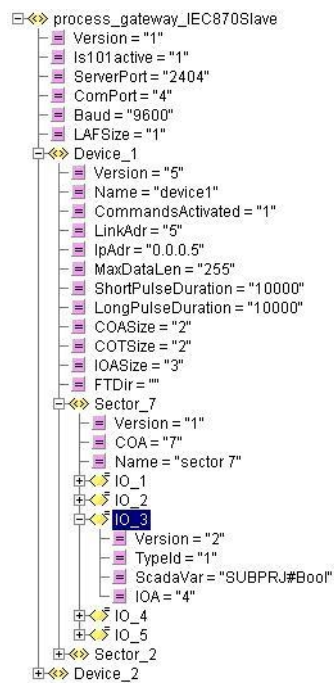
*XML entries are case sensitive. Pay attention to use correct upper and lower cases.*

Name	Property
process_gateway_IEC870Slave	The root node must have this name. Otherwise, the reading process will stop with an error.
VERSION	Contains the current version of attributes and nodes.
Device_x	Nodes for the device configuration. X is replaced by a consecutive number, starting with 1. This way of naming nodes is not obligatory. A device is created for every node.
LinkAdr	In protocol 101, the 'link address' is set here. It must be unique for all devices. For protocol 104, this entry has no meaning.
IpAdr	In protocol 104, the IP address of the Master is entered here. It must be unique for all devices. For protocol 101, this entry has no meaning.
Sector_x	Number of nodes per configured sector. X is replaced by the COA. This way of naming nodes is not obligatory. A sector is created for every node.
IO_x	Number of nodes per information object. X is replaced by a consecutive number, starting with 1. This way of naming nodes is not obligatory. An IO is created for every node.
ScadaVar	When the document is loaded, the existence of the specified variable in the project is verified. Variables without project reference are looked for in the default project. [ScadaProjectName#]ScadaVariableName. (Scada stands for the name of the process control system.)
TypeId	Type identification. When the document is loaded, the system will check if the type ID with the specified variable data type is possible.
COA	Common object address. Must be unique for every device per sector.
IOA	Information object address. In combination with the type ID, it must be unique per sector.
Is101active	With the value '1', the protocol 101 is activated, otherwise 104 will be active.
BSTime	Time for background scan Unit of measurement: ms. 0 deactivates the background scan. Default: 0
CYTime	time for cyclical data transfer Unit of measurement: ms. 0 deactivates the cyclical transfer. Default: 0

	Available in version 2 and above
KindOfTransfer	<p>States the type of data transfer.</p> <p>0: Spontaneous. Is also the default value.</p> <p>1: backscan</p> <p>2: Cyclic</p> <p>3: off</p> <p>4: Spontaneous transfer with buffering</p> <p>Default: 0</p> <p>Available in version 3 and above</p>
DeActDPIStd	DPI /DCS compliant (IEC60870 compliant) data transfer or internal control system format
Version	6: describes an XML file with the following fields for SOE support
EnableSOE	<p>0 = inactive</p> <p>1 = SOE active</p>
MaxBufferedFilesSOE	Maximum number of buffered SOE files.
AutodeleteFilesSOE	<p>0 = no Autodelete</p> <p>1 = Autodelete if maximum file number reached</p>
MaxEventsPerFileSOE	Maximum number of ASDUs per file
PostTrgToSOE	Post trigger timeout in [ms]
FileToSOE	File timeout in [ms]
Information Object setting for SOE support	Additional settings that must be made for SOE support at Information Object.
Version	4: describes an XML file with the following fields for SOE support
KindOfTransfer	<p>Defines when an update triggers a transfer.</p> <p>0: Spontaneous</p> <p>1: Background scan</p> <p>2: Periodic</p> <p>3: no diffusing</p>
TrgSOE	<p>0 = inactive</p> <p>1 = IO acts as trigger</p>
EvDetectionSOE	<p>determines when a change to an IO value or status can trigger a write in the SOE file.</p> <p>0: SOE active</p> <p>1: Saves all changes.</p> <p>2: Raising edges</p>

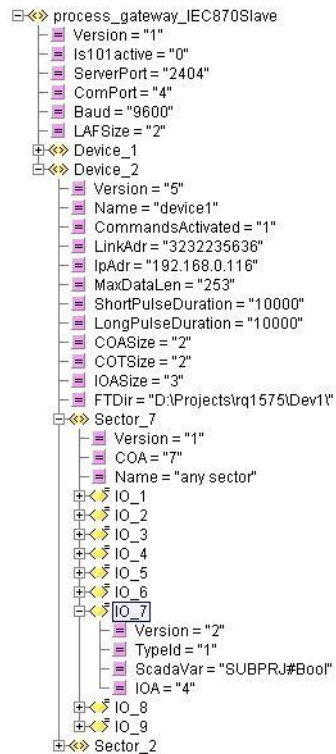
	3: Falling edges
	4: Raising and falling edges
HysteresisNegative	Value of the negative hysteresis
HysteresisPositive	Value of the positive hysteresis

Example configuration for protocol 101:





Example configuration for protocol 104:



## Double Point Value Mapping

**Double Point Value Mapping** Is a standard function of the zenon Energy driver. It only influences zenon Runtime and has no influence on the driver communication with a device. Configuration is carried out in the driver settings in the **Basic Settings** tab.

The driver uses **Double Point Value Mapping** to convert values so that they are displayed in a user-friendly manner. However this only applies to HMIs.

### DOUBLE POINT VALUES

The driver always communicates with one device with values for **Double Points** as defined in the Energy Standards with 2-bit information. That means:

Parameters	Double Point	Value	Meaning
Intermediate	00b	0	Switches are neither open nor closed, for example the end position has not yet been reached
Off	01b	1	Switch open
On	10b	2	Close switch/switch closed
Fault	11b	3	Error

**Double Points** Are coded with 2-bits in the energy sector for historical reasons: The transmission of a telegram to a serial connection (RS232) with a series of values that only contain 0 was not safeguarded against transmission errors. In order to increase the certainty, it was decided in the first standards that the value for OFF is not to be sent as 0 but as 01b, which corresponds to decimal 1. These **Double Point Values** also precisely reflect the type of how two sensors record the physical position of a switch.

However, the values sent this way may be confusing for people:

- ▶ OFF = 1
- ▶ ON = 2

Humans are used to all other devices and systems:

- ▶ OFF = 0
- ▶ ON = 1

At the same time, single point values are also defined with OFF = 0 in the same standard.

Thus everybody who is involved must always be aware of the technical level on which they are acting and receiving and sending information. In stressful situations, this can very easily lead to serious mistakes. For example, if ON is sent instead of OFF.

In order to avoid this dangerous error, the zenon Energy driver offers its own **Double Point Value Mapping**.

## MAPPING

With the **Double Point Value Mapping**, all **Double Points** in zenon have the following values:

- ▶ Intermediate = 2
- ▶ Off = 0
- ▶ On = 1
- ▶ Fault = 3



### Information

This function can be deactivated in the driver settings. However some functions such as command processing or ALC can no longer be used then.

**Recommendation:** Do not use numerical elements and numerical values to display OFF/ON or OPEN/CLOSE. Use combined elements with graphic symbols or text elements instead.

**TABLE**    **DOUBLE POINT VALUES**

The following is applicable to the `Inactive` setting of `Deactivate standard double point value mapping`:

The driver depicts the double point values for Runtime according to the zenon column (stVal : `CODED ENUM` in `DPS` and `DPC Classes`, IEC 61850-7-3).

Position	Position Decimal	position value Binary-string	Transferred Dbpos value (unmapped)	zenon (mapped)
<code>intermediate state</code>	0	00	0x00	2
<code>off</code>	1	01	0x40	0
<code>on</code>	2	10	0x80	1
<code>bad state</code>	3	11	0xC0	3

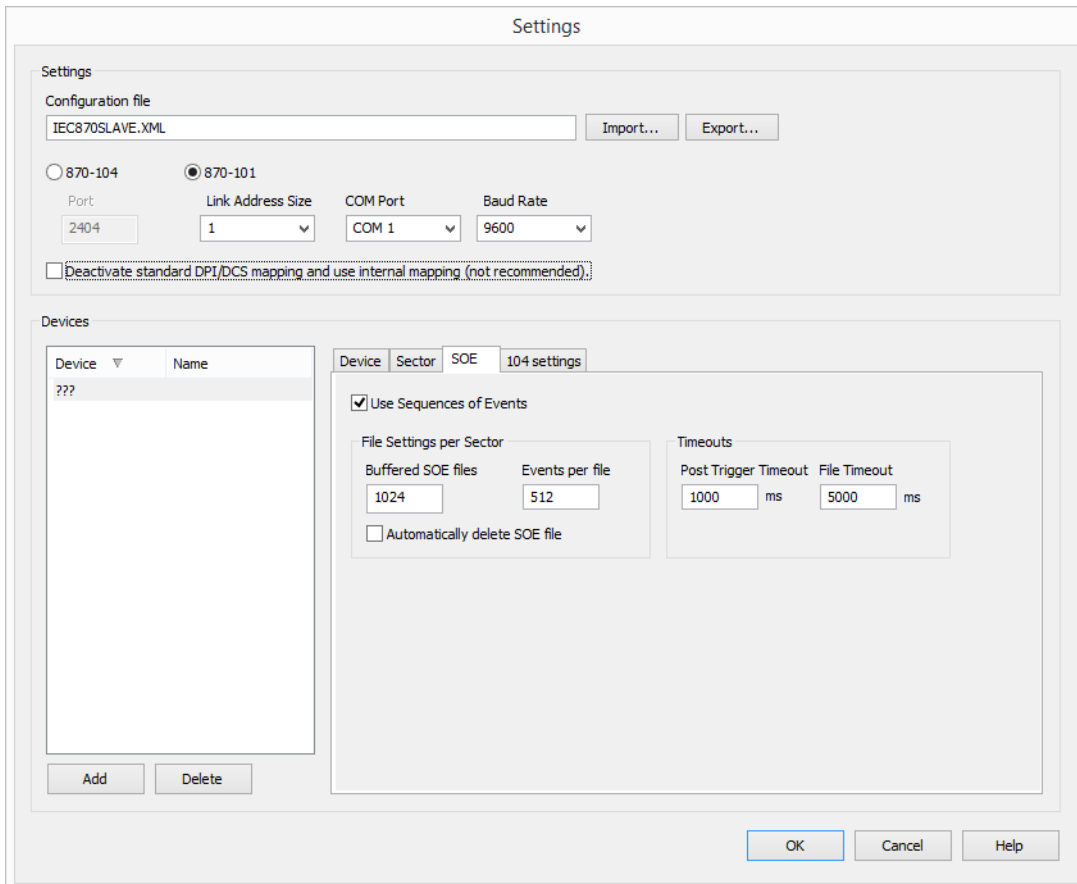
This means in Runtime (for example):

Parameters	mapped	unmapped
<code>off</code>	0	64
<code>on</code>	1	128

You can find further information in the chapter entitled: `Driver-specific functions`

### 9.1.3 DPI / DCS mapping

It is possible to configure whether DPI/DCS (double-point information/double command state) should be transferred in accordance with the IEC60870 standard or in the zenon internal display. The default is transfer (between Process Gateway and an IEC 60870 Master) in accordance with the norm.



The screenshot shows the 'Settings' dialog box. Under the 'Settings' tab, the 'Configuration file' is set to 'IEC870SLAVE.XML'. The '870-101' radio button is selected. The 'Port' is 2404, 'Link Address Size' is 1, 'COM Port' is COM 1, and 'Baud Rate' is 9600. A checkbox 'Deactivate standard DPI/DCS mapping and use internal mapping (not recommended):' is present. The 'Devices' tab is active, showing a table with columns 'Device' and 'Name'. Below the table are 'Add' and 'Delete' buttons. To the right, the '104 settings' sub-tab is active, showing 'Use Sequences of Events' checked, 'File Settings per Sector' with 'Buffered SOE files' at 1024 and 'Events per file' at 512, and 'Timeouts' with 'Post Trigger Timeout' at 1000 ms and 'File Timeout' at 5000 ms. There is also an 'Automatically delete SOE file' checkbox.

Setting	Functionality
<b>Deactivate standard</b>	<p>Active: Mapping is deactivated. Values for DPI/DCS correspond directly to the values of zenon.</p> <p>Inactive: Values for DPI/DCS are mapped as follows, which also guarantees standard behavior for command processing:</p> <ul style="list-style-type: none"> <li>▶ zenon value 0 = DPI/DCS value 1 (= OFF)</li> <li>▶ zenon value 1 = DPI/DCS value 2 (= ON)</li> <li>▶ zenon value 2 = DPI value 0</li> <li>▶ zenon value 3 = DPI value 3</li> </ul> <p>This setting is automatically activated if an XML File with version 1 is read in.</p>

### 9.1.4 Devices

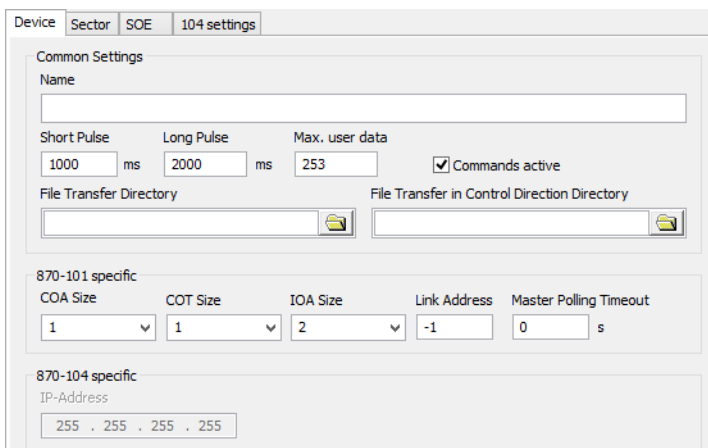
Parameters	Description
<b>Device</b>	ID of the device Default: ???
<b>Name</b>	Name of the device
<b>Add</b>	Adds a new device with standard settings. By default, it gets the invalid ID '???' and invalid IP/link addresses. Before you can use or export the device, you must configure it.
<b>Delete</b>	Deletes the selected device. This button is not active if no device has been selected.

Devices are created and deleted on the left-hand side of the dialog.

Clicking on the **Add** button adds a device, which is configured in the Device, Sector, SOE and 104 settings tabs. Several devices can be created. A simple click on the respective device in the list opens the attendant configuration.

#### Device

In the part of the main window called 'Device' you can define the settings of the device. Certain areas are grayed out depending on the protocol selected. A precise definition of which input fields are available for which protocol is in the list below.



Device | Sector | SOE | 104 settings

Common Settings

Name

Short Pulse: 1000 ms Long Pulse: 2000 ms Max. user data: 253 ☒ Commands active

File Transfer Directory: File Transfer in Control Direction Directory:

870-101 specific

COA Size: 1 COT Size: 1 IOA Size: 2 Link Address: -1 Master Polling Timeout: 0 s

870-104 specific

IP-Address: 255 . 255 . 255 . 255

Parameters	Protocol	Description
<b>Common Settings</b>		
<b>Name</b>	101 104	Name of the device for easy identification
<b>File transfer directory</b>	101 104	Defines the directory for transfer of files and directories. <b>Note:</b> The files are sent to the master.
<b>File Transfer in Control Direction Directory</b>	101 104	Defines the directory in which the files for transfer of files and directories are stored. <b>Note:</b> These files are received by the master.  All files with the NOF 255 (the temporary NOF for reverse file transfer) are ignored for the directory query.
<b>Short pulse</b>	101 104	Defines the size of the pulse for the <b>Qualifier of Command</b> (on page 96) with the value 'short pulse duration' (QOC = 1) in milliseconds. Valid values: 0 to 4294967295  Default: 1000 ms <b>Note:</b> In the debug mode, there will also be a pulse for values greater than/equal to 10000, even with QOC = 0. This allows you to test the pulse generation with our IEC870 drivers.
<b>Long pulse</b>	101 104	Defines the size of the pulse for the <b>Qualifier of Command</b> (on page 96) with the value 'long pulse duration' (QOC = 2) in milliseconds. Valid values: 0 to 4294967295.  Default: 2000 ms
<b>Max APDU size</b>	104	Maximum length of APDU data as defined in the standard 870-5-104 5. Valid values: between 25 and 253.  Default: 253
<b>Max. user data</b>	101	Maximum length of user data as defined in TF1.2 870-5-2 3.2 . Valid values: between (19 + LAF size + COA size + COT size + IOA size) and (255).  Default: 253
<b>Commands active</b>	101 104	This options allows you to activate write access. Process information in control direction are executed. If this options is deactivated, an entry in the error protocol is created.  This setting can be individualized by means of a variable in zenon (IOA 2) (on page 91).  Default: active

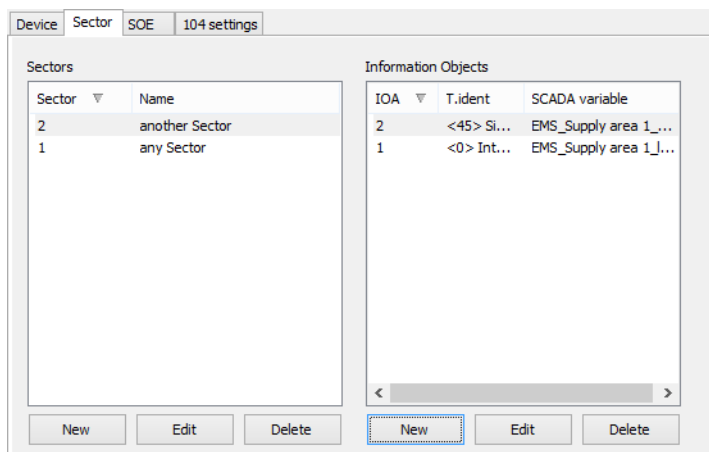
**870-101 SPECIFIC**

870-101 specific		
<b>COA size</b>	101	<p>Defines the length of the COA (<b>common object address</b>). You can only change the COA size for 101. For 104, the value is automatically set to 2, in accordance with the standard.</p> <p>Selection of address size from drop-down list. Valid:</p> <ul style="list-style-type: none"> <li>▶ 1 octet</li> <li>▶ 2 octets</li> </ul> <p>Default: 2</p>
<b>COT size</b>	101	<p>Defines the length of the COT (<b>cause of transmission</b>). You can only change the COT size for 101. For 104, the value is fixed as 2, in accordance with the standard.</p> <p>Selection of address size from drop-down list. Valid:</p> <ul style="list-style-type: none"> <li>▶ 1 octet</li> <li>▶ 2 octets</li> </ul> <p>Default: 2</p>
<b>IOA size</b>	101	<p>Defines the length of the IOA (<b>information object address</b>). You can only change the IOA size for 101. For 104, the value is fixed as 3, in accordance with the standard.</p> <p>Selection of address size from drop-down list. Valid:</p> <ul style="list-style-type: none"> <li>▶ 1 octet</li> <li>▶ 2 octets</li> <li>▶ 3 octets</li> </ul> <p>Default: 3</p>
<b>Link address</b>	101	<p>Link address Via the link address contained in the TF 1.2 frame, the master specifies the device that the command is intended for. With link addresses, a Master can communicate with multiple devices. The allowed range of the address depends on the setting 'links address size' in the main settings.</p> <p>Link address size = 1 allows a range of 0 to 254 Link address size = 2 allows a range of 0 to 65534</p> <p>Default: -1</p> <p>Note: The current value is lost if the protocol is changed.</p>
<b>Master polling timeout</b>	101	<p>Shows the time in seconds in which the master must execute a query to the slave.</p> <p>If there is no query within this time, the connection is ended.</p> <p>Default: 0</p> <p>Note: 0 deactivates the monitoring.</p>

<b>870-104 specific</b>		
<b>IP-Adress</b>	104	<p>IP address of the Master. This allows to identify the device that the Master communicates with. All IP addresses except 255.255.255.255 are allowed.</p> <p><b>Note:</b> The current value is lost if the protocol is changed.</p>

## Sector

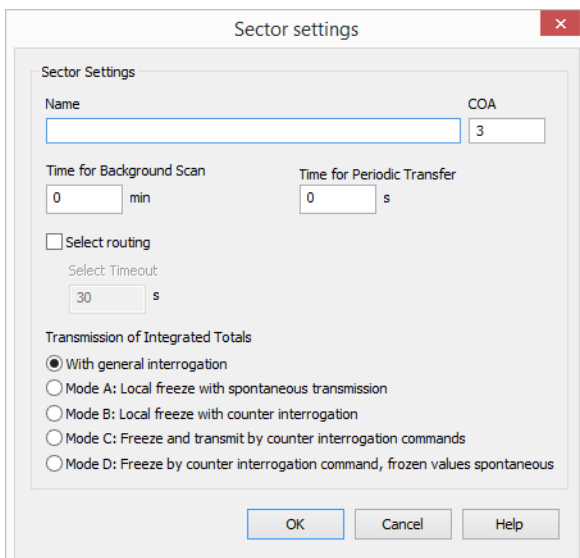
The **sector** tab lists all sectors defined in the device. If you select a sector, its **Information Objects** (on page 76) (IOs) will be displayed.





Parameters	Description
<b>Sectors</b>	
<b>New</b>	Activates the dialog for creating a new sector (on page 73). You close this subsequent dialog and create a new sector by clicking on <b>OK</b> .
<b>Edit</b>	Activates the dialog for editing the selected sector. You can also launch the editor by double-clicking on the sector in the list. This button is inactive if no sector was selected.
<b>Delete</b>	Deletes the selected sector. This button is inactive if no sector was selected.
<b>Information Objects</b>	
<b>New</b>	Activates the dialog for creating new IOs (on page 76). This subsequent dialog is closed and a new IO is created by clicking on 'OK'. This button is inactive if no sector was selected.
<b>Edit</b>	Activates the dialog for editing the selected IO. You can also launch the editor by double-clicking on the IO in the list. This button is inactive if no IO was selected.
<b>Delete</b>	Deletes the selected information object. This button is inactive if no IO was selected.

## Sector Settings



The screenshot shows the 'Sector settings' dialog box. It contains the following fields and options:

- Name:** A text input field.
- COA:** A numeric input field with the value '3'.
- Time for Background Scan:** A numeric input field with '0' and a unit of 'min'.
- Time for Periodic Transfer:** A numeric input field with '0' and a unit of 's'.
- Select routing:** An unchecked checkbox.
- Select Timeout:** A numeric input field with '30' and a unit of 's'.
- Transmission of Integrated Totals:** A section with five radio button options:
  - ☒ With general interrogation
  - ☐ Mode A: Local freeze with spontaneous transmission
  - ☐ Mode B: Local freeze with counter interrogation
  - ☐ Mode C: Freeze and transmit by counter interrogation commands
  - ☐ Mode D: Freeze by counter interrogation command, frozen values spontaneous
- Buttons:** 'OK', 'Cancel', and 'Help' at the bottom.

Parameters	Description
<b>Sector Settings</b>	
<b>Name</b>	Any name. For easy identification of a sector.
<b>COA</b>	The <b>COMMON ADDRESS OF ASDUs</b> (IEC 60870-5-101 7.2.4) by which the sector is addressed. This number must be unique on the device side (1..254).
<b>Time for Background scan [min]</b>	Supports the requirements of IEC 60870 Norm Chapter 7.4.13 "Background Scan". The values are sent with COT = 2. Cycle time is stated in minutes.  Values are transferred cyclically in the time grid set up for all IOs with the "Background Scan" option activated.  Values are only transferred cyclically if no spontaneous value is transferred within the time set.  If the value is "0", cyclical transfer of values is deactivated for this sector.
<b>Time for periodic transfer [s]</b>	Support of cyclical data transfer corresponding to the norm (IEC 60870-5-5 6.3). The values are sent with COT = 1. Cycle time is stated in seconds.  Values are transferred cyclically for all IOs with the "Periodic data transfer" option activated. IOs are transferred cyclically and not spontaneously.  If the value is "0", cyclical transfer of values is deactivated for this sector.
<b>Select before execute</b>	If active, a prior select is necessary for an execute.
<b>SBE Timeout [s]</b>	Timeout in seconds within which the select sequence must be ended and an execute must be carried out. Inactive if <b>Select before execute</b> is not active. Default: 30 s Input range: 1 to 65.535
<b>Transmission of integrated totals</b>	Selection of the transfer mode (see IEC 60870-5-101 7.4.8) for the integrated totals - the IOs of type: <ul style="list-style-type: none"> <li>▶ 15 (M_IT_NA_1)</li> <li>▶ 16 (M_IT_NA_1)</li> <li>▶ 37 (M_IT_NA_1)</li> </ul> No reset is supported. An FRZ with a reset triggers a warning.  For modes A to D, IOs are requested immediately after connecting to the master of zenon/zenon Logic. Value changes to integrated totals IOs are administered in their own buffer. This can buffer the larger value of (IT IO number) * 4, or 2048 value changes.
<b>With general interrogation</b>	Integrated Totals are also transferred during a general interrogation (C_IC_NA_1).
<b>Mode A: Local freeze with spontaneous</b>	Integrated totals are transferred when a value is changed.

<b>transmission</b>	
<b>Mode B: Local freeze with counter interrogation</b>	Integrated totals are only transferred with a counter interrogation command (C_CI_NA_1). To do this, a maximum of five seconds is waited after the interrogation is activated until all ITs have been supplied with values. ITs without a value are transferred with an <i>invalid</i> qualifier. The value changes are buffered until the interrogation is completed (freeze active). All ITs thus transfer the value of the point in time, when the last IT was supplied with a value.
<b>Mode C: freeze and transmit by counter interrogation Transmission of integrated totals commands</b>	As with mode B.
<b>Mode D: freeze by counter interrogation command, frozen values spontaneous</b>	Transfer as with mode C, mode A is activated after conclusion of the interrogation.
<b>OK</b>	By pressing the button <b>OK</b> , you can check whether the COA is available in the device. If it is already in use you will receive an error message. If it is available, the setting is accepted and the dialog is closed.
<b>Cancel</b>	Discards all entries and closes the dialog.
<b>Help</b>	Opens online help.

## Information Objects

Information object settings

Settings

Information Object  
1

Type Identification  
<0> Internal status

SCADA Variable  
...

Data Transfer  
☒ Spontaneous  
☐ Background Scan  
☐ Periodic Data Transfer  
☐ Off  
☐ Spontaneous, buffered when master is offline

Sequence of Events  
☒ Inactive  
☐ All Events  
☐ Raising Edge  
☐ Falling Edge  
☐ Raising & Falling Edge

☐ File Trigger

Hysteresis  
Negative  
0

Positive  
0

OK Cancel Help

Parameters	Description
<b>Settings</b>	
<b>Information Object</b>	<p>Defines the address under which the IO is addressed (IEC 60870-5-101 7.2.5). In combination with the type ID (<a href="#">Type identifications</a>), it must be unique for each sector.</p> <p>Default: 1</p>
<b>Type identification</b>	<p>Drop-down list with the supported <a href="#">Type identifications</a> (IEC 60870-5-101 7.2.1).</p> <p>Default: &lt;0&gt; Internal status</p> <p>This setting is also called type ID.</p> <p>It also determines the variables of the process control system that can be associated to the IO based on their data type.</p> <p>Note: You can also find more detailed information on type ID in the chapters Assignment of data types (on page 81) and Interoperability (on page 110).</p>
<b>SCADA variable</b>	<p>Defines the variable from the process control system associated with the IO. Syntax: &lt;Project name&gt;#&lt;variable name&gt; define the project connection. Variables without project reference are looked for in the default project. While entering, the system checks if the specified variable exists in the according project and if it has a data type compatible with the type identification.</p> <p>The Button '...' opens the dialog for variable selection.</p> <p>Read more about this in the section 'Variable selection (on page 80)'. (Scada stands for the name of the process control system.)</p>
<b>Data Transfer</b>	<p>Determines the type of data transfer for IOs</p> <p>Default: Spontaneous</p>
<b>Spontaneous</b>	IO data transfer is spontaneous.
<b>Background Scan</b>	<p>IOs are transferred as a background scan in accordance with the IEC 60870 norm. A data point that does not receive a new spontaneous value within the set background scan time is automatically sent by the gateway after the time has expired. Values are only transferred if no spontaneous value has yet been transferred within the time set.</p> <p>The setting is inactive if the background scan is locked at the sector (Time=0) or if the type ID used does not support the background scan.</p> <p>M_SP_TA_1, M_SP_TB_1, M_DP_TA_1, M_DP_TB_1, M_ST_TA_1, M_ST_TB_1, M_ME_TA_1, M_ME_TB_1, M_ME_TC_1, M_ME_TD_1, M_ME_TE_1, M_ME_TF_1, M_BO_TB_1, M_BO_TA_1</p> <p>For these type IDs, they are mapped to the corresponding TID without a time stamp when the background scan is sent.</p> <p>The setting is not available for any other type ID.</p>
<b>Periodic Data Transfer</b>	Periodic data transfer in accordance with IEC 60870-5-5-6.3 norm.

	<p>IOs are transferred cyclically and not spontaneously.</p> <p>The setting is inactive if periodic data transfer is locked for the sector (Time=0) or if the type ID used does not support periodic data transfer.</p> <p>The type ID =9,11,13 supports periodic transfer: M_ME_NA_1, M_ME_NB_1, M_ME_NC_1</p> <p>The setting is not available for any other type ID.</p>
<b>Off</b>	<p>Changes in value are not transferred. No value is sent for the IO during a general interrogation (GI).</p>
<b>Spontaneous, buffered when master is offline</b>	<p>The data is buffered until it can be read by the master again. All buffered data is sent with the status COT_spont (3). The last buffered value is sent with the status COT_inrogen (20) again.</p> <p>Buffering can be activated for the type IDs &lt;30..37&gt;: M_SP_TB_1, M_DP_TB_1, M_ST_TB_1, M_BO_TB_1, M_ME_TD_1, M_ME_TE_1, M_ME_TF_1 und M_IT_TB_1</p> <p>The setting is not available for any other type ID.</p>
<b>Sequences of events</b>	<p>These settings define the IO-specific behavior for SOE. The SOE transfer (see IEC norm 60870-5-101 7.4.11.3.1) can also be activated for the type IDs &lt;30..37&gt;: M_SP_TB_1, M_DP_TB_1, M_ST_TB_1, M_BO_TB_1, M_ME_TD_1, M_ME_TE_1, M_ME_TF_1 und M_IT_TB_1</p> <p>Default: Inactive</p>
<b>Inactive</b>	<p>Data point is not used for SOE description.</p> <p>Is automatically used for all type IDs that do not support SOE.</p>
<b>All events</b>	<p>Each value or status change triggers a write in the open file.</p> <p>The setting is blocked if the type ID if not planned for the SOE function.</p>
<b>Raising Edge</b>	<p>If the value changes from 0 to &lt;&gt; 0, then it triggers the write mode in the open file.</p> <p>The setting is blocked if the type ID if not planned for the SOE function.</p>
<b>Falling Edge</b>	<p>If the value changes from &lt;&gt; 0 to 0, then it triggers the write mode in the open file.</p> <p>The setting is blocked if the type ID if not planned for the SOE function.</p>
<b>Raising + Falling Edge</b>	<p>A change of value from 0 to &lt;&gt; 0 or from &lt;&gt; 0 to 0 triggers a write in the open file.</p> <p>The setting is blocked if the type ID if not planned for the SOE function.</p>
<b>File trigger</b>	<p>If a value is to be written due to the settings previously described, a new file is created and opened for the activated file, provided this has not yet been opened. The trigger event itself is also written to the SOE file.</p> <p>The setting is blocked if the type ID if not planned for the SOE function.</p>

	Default: Inactive
<b>Hysteresis</b>	<p>Value changes that are within the hysteresis are not transferred for the permitted <b>TID</b> if they have the <b>Spontaneous</b> selection.</p> <p>A transfer is therefore triggered:</p> <ul style="list-style-type: none"> <li>▶ If type identification allows hysteresis. The type identifications &lt;9&gt; to &lt;14&gt; and &lt;34&gt; to &lt;36&gt; are not permitted.</li> <li>▶ With spontaneous transfer</li> <li>▶ With a value change that acts <math>\geq</math> the hysteresis (according to the direction).</li> </ul>
<b>Negative</b>	<p>Negative Hysteresis, from measuring range</p> <p>Default: 0</p> <p>Note: only active if type identification is not &lt;9&gt; to &lt;14&gt; or &lt;34&gt; to &lt;36&gt;. This field is also inactive if the value <b>Data Transfer</b> is not spontaneous.</p> <p>Erroneous and meaningless entries (such as text input or incorrect hysteresis values) are ignored and must be taken into account by the person configuring the project.</p>
<b>Positive</b>	<p>Positive hysteresis, from measuring range</p> <p>Default: 0</p> <p>Note: only active if type identification is not &lt;9&gt; to &lt;14&gt; or &lt;34&gt; to &lt;36&gt;. This field is also inactive if the value <b>Data Transfer</b> is not spontaneous.</p> <p>Erroneous and meaningless entries (such as text input or incorrect hysteresis values) are ignored and must be taken into account by the person configuring the project.</p>
<b>OK</b>	Your settings are verified after pressing the button "OK". If they are valid, they are accepted and the dialog is closed.
<b>Cancel</b>	Discards all entries and closes the dialog.
<b>Help</b>	Opens online help.

**Note:** The XML file of the configuration must, from zenon 7.11 onwards, contain the entry **HysteresisNegative** and **HysteresisPositive** for each IO.

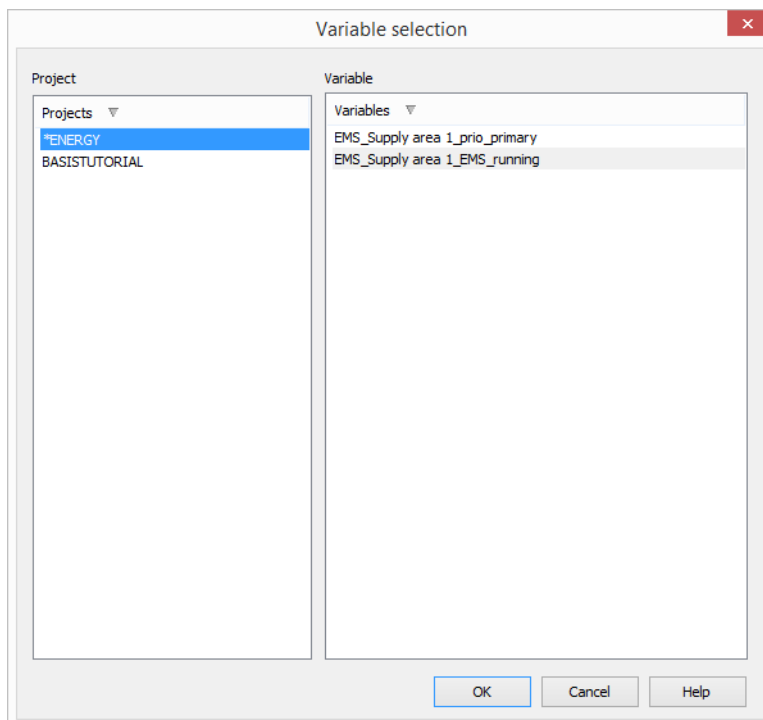


### Information

The communication for *Spontaneous* data transfer, *Background Scan* and *Periodic Data Transfer* starts once the first general request has been received (C\_IC\_NA\_1). For background scan and periodic data transfer, the start of the transfer cycle is calculated per IO from the time of the answer to the general query.

## Data point selection

This dialog lists all available projects and their variables.





Parameters	Description
<b>Projekte</b>	An asterisk (*) marks the default project.
<b>Variablen</b>	The list of variables is filtered. You only see the variables that can be used with the 'type identification' selected for the IO. Selecting a project updates the list of variables.
<b>OK</b>	<p>Assumes the selected variable. Alternatively, the variable can be assumed by double clicking. When loading, the currently configured project and the variable will be selected.</p> <p>The same variable can be used several times: for several IOs in the same sector or other sectors, for the same device or another one.</p> <p>If the dialog remains open and there is a reload in the Runtime, all lists will be emptied and refilled after the reload is finished.</p>
<b>Cancel</b>	Discards all entries and closes the dialog.
<b>Help</b>	Opens online help.

## Mapping of the data types

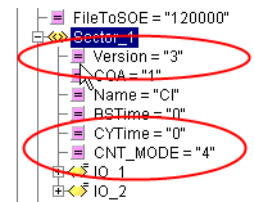
The zenon data types are compared to the IEC60870 data types in the following table.

Process Gateway		zenon	
IEC 60870-5-101 ASDU	Type identification	Data type	Comment
M_SP_NA_1	1	BOOL	
M_SP_TA_1	2	BOOL	
M_SP_TB_1	30	BOOL	
M_DP_NA_1	3	USINT	
M_DP_TA_1	4	USINT	
M_DP_TB_1	31	USINT	
M_ST_NA_1	5	USINT	Corresponds to whole VTI (IEC60870-5-101 7.2.6.5). Bit 8 is the <b>Transient</b> bit.
M_ST_TA_1	6	USINT	See above
M_ST_TB_1	32	USINT	See above
M_BO_NA_1	7	UDINT	
M_BO_TA_1	8	UDINT	
M_BO_TB_1	33	UDINT	
M_ME_NA_1	9	REAL	If, in zenon, values of the variables in the norm range for ' <b>normalized values</b> ' $<-1 \dots 1-2^{-15}>$ are gone below or exceeded, the value of the IO is amended in <b>ASDU</b> and the OV quality bit is set.
M_ME_TA_1	10	REAL	See above
M_ME_TD_1	34	REAL	See above
M_ME_NB_1	11	INT	
M_ME_TB_1	12	INT	
M_ME_TE_1	35	INT	
M_ME_NC_1	13	REAL	
M_ME_TC_1	14	REAL	
M_ME_TF_1	36	REAL	
M_IT_NA_1	15	DINT	
M_IT_TA_1	16	DINT	
M_IT_TB_1	37	DINT	
M_EI_NA_1	70	USINT	A value change from 126 to 127 causes <b>End of initialization</b> to be sent to the master
C_SC_NA_1 (on	45	BOOL	mirrors the command direction during execution

page 96)			
C_SC_TA_1	58	BOOL	See above
C_DC_NA_1	46	USINT	See above
C_DC_TA_1	59	USINT	See above
C_RC_NA_1	47	USINT	See above
C_RC_TA_1	60	USINT	See above
C_SE_NA_1	48	REAL	See above
C_SE_TA_1	61	REAL	See above
C_SE_NB_1	49	INT	See above
C_SE_TB_1	62	INT	See above
C_SE_NC_1	50	REAL	See above
C_SE_TC_1	63	REAL	See above
C_BO_NA_1	51	UDINT	See above
C_BO_TA_1	64	UDINT	See above
C_IC_NA_1	100	-	Is executed automatically and the execution is not reflected in zenon
C_CI_NA_1	101	-	Is executed automatically and the execution is not reflected in zenon
C_RD_NA_1	102	-	Is executed automatically and the execution is not reflected in zenon
C_CS_NA_1	103	BOOL	The enable variable of the time synchronization
C_TS_NA_1	104	-	Is executed automatically and the execution is not reflected in zenon
C_TS_TA_1	107	-	See above
C_RP_NA_1	105	USINT	QRP during execution
F_DR_TA_1	126	USINT	For spontaneous directory transfer

Sector

XML FIELDS



CNT_MODE	0
ToSbe	45000
SBE	1

(This tag has no subtags.)

Parameters	Description
<b>Version</b>	The CNT_MODE field is expected from version 3 onwards.
<b>CNT_MODE</b>	Configured mode of integrated totals IOs.
<b>Sector</b>	<p>The new items ToSBe and ob SBE are added for the sector:</p> <ul style="list-style-type: none"> <li>▶ ToSBe: Timeout [ms] for Select before execute: 1000 - 65535000</li> <li>▶ SBE: 0 =&gt; not required 1 =&gt; necessary for execute</li> </ul>

## CONFIGURED MODE

Parameters	Description
0	With general interrogation. (Default)
1	Mode A
2	Mode B
3	Mode C
4	Mode D

## ERROR CODES

Code	Description
13	Advise for integrated totals fail.
14	Queue overrun. Integrated totals values lost.
16	Advise failed for command variable
17	<p>List of value changes for command variables with SBE too long. Value change has been lost.</p> <p>2048 value changes are buffered as a minimum, or four times the number of active Select Before Execute (SBE) - depending on which value is greater.</p>
572	Counter interrogation. Unsupported QCC.
573	Counter interrogation. Unexpected IOA.
574	Counter interrogation. Unsupported COT.
575	Buffer for integrated totals interrogation data too small.

## WARNINGS

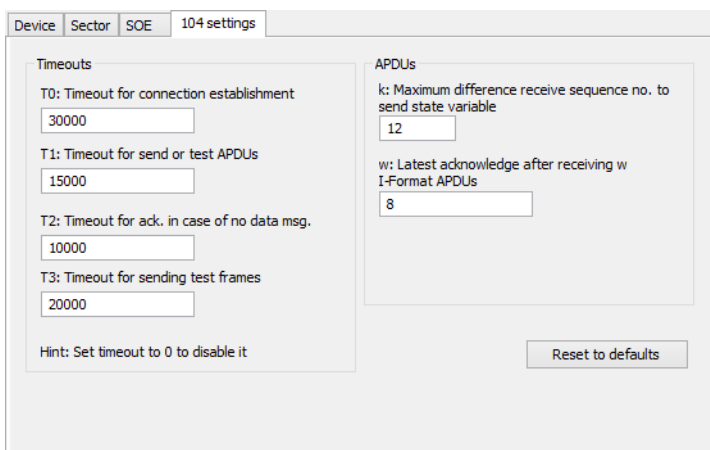
Code	Description
1011	QCC FRZ is only partly supported.
1012	Counter interrogation already active.
1014	Activation confirmation already confirmed.

## ERROR MESSAGE

Message	Description
Unsupported qualifier of counter interrogation. <command>	Unknown QCC. RQT is only supported with 5.
Counter interrogation processed without reset. < command>	Warning. Reset is not supported.
Can't advise IT data point. Device: (<device>)<device> Sector: (<COA>)<Sektorname> adv: 0x<Advise-ID>	Data points for integrated totals could not be requested.
IT Values lost, queue full! Device: (<device>)<device> Sector: (<COA>)<Sektorname> <Wertänderung>	The buffer for the value changes of IT IOs is full. The value change is lost.

## 104 settings

Set the timeout times and APDUs in the 104 tab.



Note: The input fields of this tab are only available if 870-104 has been selected as a protocol.

Parameters	Description
<b>Timeouts</b>	Timeout settings of the connection
<b>T0: time-out of connection establishment</b>	Timeout for establishing connection. Value range 0 - 4294967295 Default value: 30000
<b>T1: Time-out send or test APDUs</b>	Time-out for frame confirmation by the master. Value range: 0 - 4294967295 Default value: 15000
<b>T2: Time-out for ack. in case of no data msg</b>	Time-out, within which the master should confirm if no data is exchanged. Value range: 0 - 4294967295 Default value: 10000
<b>T3: Time-out for sending test frames</b>	Time after which a U-frame is sent to the master if no data is to be transferred. Value range: 0 - 4294967295 Default value: 20000
<b>APDUs</b>	<i>Settings for the ISO 7816 standard: Application Protocol Data Unit (APDU).</i>
<b>k: Maximum difference receive sequence nr to send state</b>	Number of maximum I-frames not yet confirmed by the master. Value range: 0 - 4294967295 Default value: 12
<b>w: Latest acknowledge after receiving w I-Format APDUs</b>	Number of I-frames received after a confirmation is sent. Value range: 0 - 4294967295 Default value: 8



### Information

*The **Reset to default** button resets all input to the default values*

## 9.2 Communication

This chapter explains details on the communication in the Process Gateway:

- ▶ Play (on page 88)
- ▶ General interrogation (on page 89)
- ▶ Reset (on page 89)
- ▶ Value changes (on page 90)
- ▶ Priority (on page 91)
- ▶ Read (on page 103)
- ▶ Process Initialized (on page 90)
- ▶ File transfer (on page 97)
  - Storage and naming of files for transfer (on page 97)
  - Spontaneous directory transfer (on page 98)
- ▶ Sequence of Events (SOE) (on page 98)
  - Warnings (on page 100)
  - Error message (on page 101)
- ▶ Time synchronization (on page 94)
- ▶ DPI / DCS mapping (on page 68)
- ▶ Select Before Operate (on page 96)
- ▶ Qualifier of command (on page 96)
- ▶ Invalid Bit Handling (on page 95)
- ▶ Normalized Values
- ▶ Monitoring command (on page 96)
- ▶ Internal type T00 (on page 91)
- ▶ Pulse generation
- ▶ Reload project online (on page 91)
- ▶ Broadcasts (on page 94)
- ▶ Realtime invalid - Statusbit T\_INVALID
- ▶ Test commands (on page 104)

### 9.2.1 Start:

When the process gateway is started, it loads the configured driver.

The driver then attempts to read its active configuration from the file entered in the INI file. If this is not possible, an error message is displayed and the configuration dialog is opened.



If the dialog is not left with OK, the application closes.



#### Attention

*If the application is launched as invisible, there will be no configuration dialog. The Process Gateway will automatically quit if its configuration is invalid or missing.*

### 9.2.2 General query

The general query triggers an establishment of the connection to zenon Runtime in the IEC870 slave. The receipt of the **GI - C\_IC\_NA\_1** - from a master is a requirement for spontaneous communication, **background scan** and **periodic data transfer**. This connection is built up in sectors.

If the connection cannot be established in Runtime, there is a negative confirmation of the general query. A query that is already active for the sector is ended and a warning is logged.

Value changes for IOs whose value has already been reported to the master are buffered as long as the **GI** is running.

During a project reload, it is not possible to connect to the RT. The general request will fail in this case.



#### Attention

In accordance with the IEC60870 standard, a master must start communication with a general query. For this reason, the slave closes the connection if the master has not sent a **GI** in the envisaged time.

### 9.2.3 End of connection and resets

The reset in the slave is triggered if a master connects:

- ▶ 870-101: All commands will be rejected until the function code for reset (0) has been received. The code causes a reset in the link layer and the application layer.
- ▶ 870-104: As a result of the connection being disconnected, a master can detect the interruption immediately and starts the initialization process again.

#### ENDING COMMUNICATION

In general, communication is ended if:

- ▶ The Process Gateway application is ended
- ▶ Changes to the configuration of the slave are activated
- ▶ Runtime reloads
- ▶ the master has established the connection but no general query was sent
- ▶ The list of the value changes that have not been sent for the sector has overflowed
- ▶ A non-supported command has been received (command is answered in the negative and the connection is ended for security reasons).
- ▶ A command with a non-supported address is received (command is answered in the negative and the connection is ended for security reasons).

### 'Reset process command' - T105 - request

The slave can inform <CD\_PRODUCNAME> Runtime of the receipt of a C\_RP\_NA\_1 command. To do this:

- ▶ create an IO of type T105 with IOA 0.

If a master is sent the command C\_RP\_NA\_1, the value of the variable is set to 0 and then to the value of QRP.

The slave confirms receipt of the command to the master and changes the value of the corresponding T105 variable for Runtime but otherwise the command has no effect in the slave. The optional sending of the 'End of initialization' (T70) is not executed automatically.

### 'End of Initialization' - T70 - send

From the process control system, it is possible to instigate an ASDU<70> - M\_EI\_NA\_1 ('End of initialization') being sent to the master. To do this:

- ▶ create an IO of type T70 with IOA 0.

The transfer is triggered if the current value of the variable is 126 and this is amended to 127. As COI (Cause of initialization), 2 (remote reset) is used.

## 9.2.4 Transfer of the value changes

The IEC870 slave receives, from zenon Runtime, all value changes of the requested variables. Because, as a result of this, the list of process information that has not yet been transferred to the master can become very large, the list of outstanding value changes is limited.

Limit: at least: 2048 values or 4 x number of IOs per sector.

If a master receives the values more slowly than they are generated in the process control system, the list can exceed this maximum. The slave can then no longer buffer the value changes that have not yet been transferred. The slave therefore terminates the connection to the master. The master is thus requested to obtain the next connection with a general query, so that it gets current, only recent variable values.



### Attention

The Master must be able to recognize a communication interrupt, so he can react with a new general request. This is why no process commands will be executed until the Master has caused a reset.

Every time there is a chance of data loss (value changes were lost), a reset will be triggered.

## 9.2.5 Reload project online

If one of the projects is reloaded in the zenon Runtime, the connection to all projects using the IOs in the sector will be closed. The device (`Device`) with the according sector must be reset. That means: The connection to the master is closed.

While the reload is active, you cannot establish a connection to the Runtime. This means that general requests are also not possible.

## 9.2.6 Data priorities

The driver supports `class 1` and `class 2` files.

Spontaneous communication, **background scan** and **periodic data transfer** belong to `class 1`.

The whole file transfer is treated as `class 2`. This makes sure that value changes will be transferred to the Master even during a file transfer.

## 9.2.7 Internal type T00 (status variable)

The internal type `T00` is used for communication between the Slave and the process control system.

For the status variables, each numeric zenon variable can be assigned, for example internal drivers.

## IOA 1

The variable provides the status information as to whether there is already a connection to the master. Create an IO of type T00 with IOA 1. If a connection is established, the value will change from 0 to 1.

## IOA 2

A decision as to whether commands are carried out *in control direction* can be made for each sector by means of a zenon variable for each sector. For rejected commands, a master receives COT\_actcon (7) + PN as confirmation. Rejected commands create a warning in the log.

The zenon variable must be of UINT or DWORD type and is assigned with T00 at IOA . If the value of the variable is = 1, the commands are approved. The variable must not have the status **INVALID**. The commands are always approved if no IO is configured.

This setting can be set globally using the **Commands active** (on page 69) property.

The enhanced meaning of the IOA 2 variable:

Value	Description
0	Commands are rejected; sets PN bit
1	Commands are approved
2	Silent mode: accept without execution or error message
3....	Reserved for future versions



### Information

*Attendant warning message:*

*Commands for sector deactivated, execution prohibited. <Command text>*

*Warning: 1009 command in control direction was received, but rejected due to a missing **enable**.*

## IOA 3

Status variable is set to 1 if the number of SOE files in the transfer directory exceeds the maximum number of buffered files.

## IOA 4

Variable provides status information on the current or most recently processed SOE file:

0 - initialization. As long as no SOE file was written.

1 - SOE file is opened

2 - file was closed

3 - too many SOE files in the directory

4 - error when writing the SOE file

5 - errors when creating the SOE file

### IOA 5

Variable provides status information by means of file transfer in `Monitoring Direction` ("Standard Direction" - from the master to the slave).

0 - no transfer active

1 - section is selected

2 - section is requested

3 - waiting on section confirmation

4 - waiting on confirmation of file transfer

255 - error when transferring

### IOA 6

Variable provides the number of SOE files present in the transfer directory.

### IOA 7

Variable provides status information by means of file transfer in `Control Direction` ("Reverse Direction" - from the slave to the master).

The information is integrated in a `DWORD` as follows: [IOA of the transferred files] \* 256 + [status information].

Possible status information:

1 = transfer is ongoing

2 - Transfer is ongoing - the transfer that had not been completed beforehand is terminated by the transfer that has currently been started.

Status 3 is also written for the transfer that has been terminated. However because the new status is

immediately written afterwards, it cannot be guaranteed in the case of zenon that this is visible in Runtime.

3 - Transfer was terminated due to an error.

4 - File transfer was completed and file is available.

### 9.2.8 Time synchronization

In order for time synchronization to be carried out - on receipt of `C_CS_NA_1`, there must be, at any desired Device/Sektor a type `T103` IO connected to a process variable. The first IO that uses type `T103` is used as an enable.

This variable must have a value of  $\neq 0$  and must not have any of the following status bits set:

- ▶ `INVALID` (Bit 18)
- ▶ `OFF` (Bit 20)
- ▶ `ALT_VAL` (Bit 27)
- ▶ `BL_870` (Bit 44)

Non execution of the command due to a missing enable (value 0 or status) does not lead to the connection being terminated, the command is only confirmed negatively - `COT_actcon + PN`.

The missing configuration of the enable variable or the missing value of the enable variable leads to the connection being lost when the `C_CS_NA_1` command is received.

### 9.2.9 Broadcasts

Global address `0xFF` in the Common Address of ASDU (COA) is supported for the following Typ IDs:

- ▶ `C_IC_NA_1` - General query - ASDU<100>
- ▶ `C_CS_NA_1` - Time synchronization - ASDU<103>

No additional project configuration steps are necessary for this.



### Attention

For **Data Link Layer**, the **Broadcast Address 0xFF(FF)** - "all outstations" is not supported in 60870-4-101 communication.

The **Broadcast Address 0xFF(FF)** - "all outstations" - in **Data Link Layer** in 60870-4-101 communication is not supported.

## 9.2.10 Mapping of status bits in message direction

The IEC870 slave supports the sending of quality bits for the information objects. The quality bits of the IO are set - in **ASDUs in 'monitor direction'** - using certain status bits of the linked zenon variable.

The quality bits are assigned to the status bits of the variables as follows:

Status bit in zenon	IEC60870 quality descriptor bits	Notes
INVALID	IV (invalid) NT (not topical)	The slave forwards the INVALID status bit in message direction as two quality bits.
OFF	IV (invalid)	
OV_870	OV (overflow)	OV_870 status bits that already have the variables in zenon are sent to the master.  If values for <b>Normalized Values (T09)</b> go below or exceed the norm range $<-1 \dots 1-2^{-15}>$ , the OV quality bit is set, even if the variable does not have the status bit in zenon.
BL_870	BL (blocked)	
SB_870	SB (substituted)	
ALT_VAL	SB (substituted)	Up to zenon version 7.10, it is mapped the same as the OFF bit.
NT_870	NT (not topical)	
T_INVALID (time invalid)	Only in " <b>Binary Time 2a</b> " (CP24Time2a/CP56Time2a)  BS[24]- IV (invalid)	The slave forwards the T_INVALID status bit in the time stamp of the IOs with " <b>time tag</b> " only.

### 9.2.11 Commands

A command received - T45..T64 - is set as the value for the zenon variables. In sectors without `Select routing`, a confirmation, which is always positive, is always sent to the master immediately - `COT_actcon` (7) and `COT_actterm` (10).

In such sectors, a `Select` is also immediately also confirmed automatically - `COT_actcon` + `SE` and the zenon variable change neither the value nor the status bit.

#### Select routing

`Select routing` can only be used together with **command module - auto/remote actions**.

If `Select routing` was configured for the sector being addressed, there is a wait in receipt of a `Select` until, via the command variable of zenon, the status `SE_870` is acknowledged with `COT_actcon` (7) and possibly with `N_CONF` (corresponds to `PN`).

Only once this has happened is a confirmation to the master (for example a `Control Center`) triggered. All others for this IO are rejected as long as a selection is taking place.

#### TIMEOUT, CANCEL AND MISSING SELECT

The following rules apply for the different possibilities for responding to a `Select routing`:

- ▶ If `Select routing` is configured on a sector, one `Select Timeout` per IO is started for each `Select`.
- ▶ The slave checks whether the `Timeout` has expired and then sets the variable to `SE`, `COT_actterm` (10) and `PN`.
- ▶ If a `Cancel` - `COT_deact` (8) is received by the master for an ongoing `Select`, confirmation is provided with `COT_deactcon` (9) and the `Select` is deleted.
- ▶ If an `Execute` or `Cancel` is received without a `Select` beforehand, it is responded to with `PN` - negative.

#### Pulse generation - 'Qualifier of Command'

The IEC870 slave supports pulse generation for commands received. The `Qualifier of Command` (`QoC`) is supported for all commands envisaged in the IEC60870 standard (T45, T46, T47 and T58, T59, T60).

For example, an individual command received - an `ASDU` of type T45 - with `QoC` has the following effect on a zenon variable:

- ▶ `qoc 0`: Undefined in accordance with IEC standard. Behaves in slave as in `QoC 3` `persistent output`.



- ▶ **QoC 1: Short pulse.** The zenon variable assumes the value 'ON' and changes, after the time defined in the Process Gateway settings (on page 69) to 'OFF'.
- ▶ **QoC 2: Long pulse.** The zenon variable assumes the value 'ON' and changes, after the time defined in the Process Gateway settings (on page 69) to 'OFF'.
- ▶ **QoC 3: Persistent output.** The zenon variable assumes the value 'ON' (or 'OFF') and retains the value. This must be reset to receive further commands.

As soon as communication is ended, the pulse for all other active pulse variables will be stopped (i.e. an OFF will be written). If a pulse is triggered for a running pulse generation, the active pulse generation will be stopped. The variable contains the value 'OFF'.

**Note:** For SCS (single command state), the value 'OFF' is always 0, for DCS (double command state) an 'OFF' is 00b at protocol level, then 2 or 0 in zenon, depending on the "DPI/DCS mapping" setting.

**Note:** In sectors with `Select routing`, pulse generation cannot be carried out because 'OFF' after `Select` is in conflict with `Execute`.

## 9.2.12 File transfer

The following applies for file transfer:

- ▶ The values 1-4 are supported in the `AFQ UI4`
- ▶ The values 0-6 are supported in the `SCQ UI4`; 0 and 1 are both 'select file'

If a new transfer is started while another one is still active, the currently active transfer will be interrupted and the new one will be started.

### Storage and naming

Use the following scheme for storage and naming:

<Configured folder>\<COA>\<IOA>.<NOF>

Only 1 = 'Name of file' is supported as NOF (transparent file).

The maximum size of files for transfer is 16.711.680 Bytes.

### EXAMPLE

Folder in the module configuration (on page 69): C:\TEMP\IEC870

File 1100.1: For IO of sector `coA=151` and `ioA 1100`

Save location: C:\TEMP\IEC870\151\1100.1

### Spontaneous directory transfer

Spontaneous transfer of files in the folder for file transfer can be triggered by the process control system. To do this:

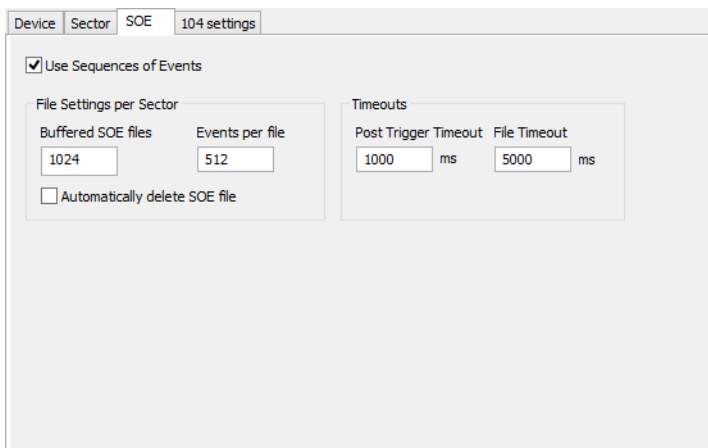
- create an IO of type F\_DR\_NA\_1 (T126) with IOA '0'.

Value	Meaning
Change from 1 to 2	Starting transfer
3	Transfer active
4	Transfer finished
5	Transfer failure

Nested activation is prevented.

## 9.2.13 Sequence of Events (SOE)

### SETTINGS IN THE MAIN SOE WINDOW:



Device Sector SOE 104 settings

☒ Use Sequences of Events

File Settings per Sector

Buffered SOE files: 1024 Events per file: 512

☐ Automatically delete SOE file

Timeouts

Post Trigger Timeout: 1000 ms File Timeout: 5000 ms

Parameters	Description
<b>Use sequences of events</b>	<p>If active, the SOE for the selected device is activated. If <i>inactive</i>, all SOE settings to the IOs are ignored.</p> <p>Default: <i>inactive</i></p>

#### FILE SETTINGS PER SECTOR

Parameters	Description
<b>Buffered SOE Files</b>	<p>If the number set for SOE files in the folder is reached for the sector, a spontaneous directory transfer (type ID "F_DT_TA_1") is triggered. If the number of files in the folder is doubled, the oldest file will start to be deleted (ring buffer function).</p> <p>Value range 1 to 1024.</p> <p>Default: 1024</p>
<b>Events per File</b>	<p>Number of value changes that are written in a file before it is closed.</p> <p>Value range: 1 to 4096.</p> <p>Default: 512</p>
<b>Automatically delete SOE file</b>	<p>If active, the reaction is that this is then automatically closed for type ID "F_AF_NA_1" (confirmation for file) for an SOE file.</p>

#### TIME-OUTS

Parameters	Description
<b>Post trigger timeout</b>	<p>If no ASDU is written to the file within this period of time, this is then closed. The time period starts over with each ASDU written.</p> <p>Value range: 100ms to 120000ms</p> <p>Default: 1000ms</p>
<b>File timeout</b>	<p>Maximum time for which the file remains open (regardless of the number of events).</p> <p>Value range: 100ms to 120000ms</p> <p>Default: 5000ms</p>

#### FIRST VALUE

The exchange of data for SOE starts immediately once the Gateway has been initialized. The exchange of data for data in monitoring direction only starts when a master has connected and triggered a general interrogation (GI). The first value that is initialized does not trigger an event and is thus also not entered into the file. The same applies if Runtime is again ready to exchange data after reloading.

## FILE TRANSFER

As part of the SOE function for transparent (1), event (3) is also supported as NOF.

Files are not transferred automatically if the maximum number of SOE files to be buffered is exceeded.

The IEC 60870 norm describes this with "may be activated". The Gateway does not support any file transfers activated by the salvo in the current version.

## DIRECTORY TRANSFER

As part of the SOE function for transparent (1), event (3) is also supported as NOF.

Automatic directory transfer:

In accordance with the IEC 60870 norm, an automatic spontaneous directory transfer is activated for the following reasons with existing SOE files:

- ▶ 24 hours after the last automatic directory transfer.
- ▶ if the master connects
- ▶ if the maximum number of files to be buffered is exceeded

## Warnings

Warning message	Meaning
Sequences of events for device <Devicename> sector <Sectorname> are activated but no trigger defined	The device has SOE activated, on the server there is an IO with SOE active but the trigger was not activated for any IO. No file is created without a trigger. At least one IO must have the trigger activated for the sector.
SOE value change without trigger and file is closed. Value lost! Device:(<Device ID>)<Device-Name> Sector:(<COA>)<Sector name> <Value information>	A value change was not written because the SOE file is not open.  Code:1010

## Error message

Error message	Meaning
Sequence of events active but no directory for the file transfer defined!	SOE files are archived in the file transfer folder. Therefore a folder for file transfer must be present.
SOE values lost, queue full! Device:(<Device ID>)<Device-Name> Sector:(<COA>)<Sector name> <Value information>	for IOs that have a SOE activated, data is exchanged to the stack via a queue. This can assume a value of 2048 or 4 * the number of SOE IO's in sector entries. If this number is exceeded, this error message is created and the value change is lost.  Error code: 6
Can't create subdirectory for file transfer. Device:(<Device ID>)<Device name> Sector:(<COA>)<Sector name> system error:<System error code>	The subfolder for the sector is automatically created for SOE in the folder for file transfers. This error shows that this folder could not be created. SOE then indicates that this sector is NOT available.  Error code: 10
System error code	Contains the error code returned from the operating system.
Can't advise SOE data point. Device:(<Device ID>)<Device name> Sector:(<COA>)<Sector name> adv:0x<Advise ID>	Data point request for SOE IOs failed. SOE then indicates that this sector is NOT available.  Error code: 11
Write asdu to file <Filename> fail! Device:(<Device ID>)<Device name> Sector:(<COA>)<Sector name> <Value> system error: <System error code>	ASDU write to SOE file failed.  Error code: 8
Illegal file name <Filename> detected! Device:(<Device ID>)<Device name> Sector:(<COA>)<Sector name>	Filenames for the file transfer have a defined format <IOA>.<NOF>. The file does not adhere to this convention.  Error code: 12
Auto delete for file failed! System error: <System error code> <File transfer information>	Error code: 9
File transfer information	Contains the information that identifies the file transfer.

## LOG entries

The sequence of events writes the following entries to the LOG file

Parameters	Description
deviceIp:	IP address from the device
devicename:	Name of device
COA:	Care of Address -> according to standard
SecName:	Sector description
TypeyId:	Command number
TypeIdAsTxt:	Command as text
IOA:	According to standard
AdviseID:	ID via which value changes are requested and assigned
Value:	Value transferred
TimeStamp:	Time of value change. From the driver or command
QUALDESC:	According to standard
SBEValue:	COT, select and pn mapped to unique enums: 0 : Not select relevant 1 : actcon+pn+select 2 : actcon+select 3 : deactcon+pn+select, 4 : deactcon+select 5 : actterm+pn+select, 6 : actterm+select,
Confirmed:	1 if select already confirmed
COT:	According to standard
CotTxt:	Cot asText
Qualifier:	According to standard and command
Originator:	According to standard
QU:	Qualifier of command QU 7.2.6.26
DCS:	7.2.6.16 Double command (IEV 371-03-03)
ControlCommand:	Depending on control command

--	--

**EXAMPLE FOR 45:**

```
<TypeId> <TypeIdAsTxt> Device:(<deviceip>)<devicename> Sector:(<IOA>)< SecName >
ioa:<IOA> cot:(<COT>)<CotTxt> ori:<Originator> sel:<QOC S/E> qu:<QU> dcs:<DCS>
ValueChange cmd(<TypeeyId>)<<TypeId>> <TypeIdAsTxt> ioa:<IOA> id:<AdviseID> value:<Wert>
time:<TimeStamp> state:< QUALDESC > sir:<SBEValue>
```

LOG entry	Module/Level	Description
SBE IED processing. Device:(<deviceIp>)<device name> Sector:(<COA>)<SecName> <ValueChange> SBE command: advise:<AdviseID> conf:<confirmed> <ControlCommand>	OSI7/Debug	Each value change that is processed for SBE creates this log message
Wrn:1014 SBE activation already confirmed! Device:(<DeviceIp>)<device name> Sector:(<COA>)<SecName> <ValueChange>	OSI7/Warning	Renewed conformation for Select received and ignored
Error:16 Advise for SBE data point fail. SBE command: advise:<AdviseId> conf:<confirmed> <ControlCommand>	Scada/error	Variable could not be requested.
Error:17 SBE value lost, queue full! Device:(<DeviceIp>)<device name> Sector:(<COA>)<SecName> <ValueChange>	Scada/Error	Value change for SBE lost because the source is full.

## 9.2.14 Read - T102 - request

Maximum 2048 read requests - C\_RD\_NA\_1 - can be active at the same time. Once this limit has been reached, further read requests are rejected.

A read request is executed for each IO with the requested IOA .

Several requests for one IO can be active at the same time.

Read requests will be processed even if the general request is not finished yet.

The response to the read command does not need to be configured and automatically runs in the background.

### 9.2.15 Test - T104 and T107 - requests

The IEC870 slave responds to the master automatically with the two test commands `C_TS_NA_1` (ASDU<104>) and `C_TS_TA_1` (ASDU<107>).

This response does not need to be engineered and runs in the background.



#### Information

You can find further information on command IDs the Interoperability (on page 110) chapter.

## 9.3 Error analysis

Should there be communication problems, this chapter will assist you in finding out the error.

### 9.3.1 Analysis tool

Process Gateway behaves like a zenon driver and writes messages to a common log file. To display them correctly and clearly, use the Diagnosis Viewer (main.chm::/12464.htm) program that was also installed with zenon. You can find it under Start/All programs/zenon/Tools 7.20 -> Diagviewer. In general:

zenon driver log all errors in the log files. The default folder for the log files is subfolder `LOG` in directory `ProgramData`, example:

`C:\ProgramData\COPA-DATA\LOG`. Log files are text files with a special structure.

**Attention:** With the default settings, a driver only logs error information. With the **Diagnosis Viewer** you can enhance the diagnosis level for most of the drivers to "Debug" and "Deep Debug". With this the driver also logs all other important tasks and events.

In the Diagnosis Viewer you can also:

- ▶ follow currently created entries live
- ▶ customize the logging settings
- ▶ change the folder in which the log files are saved



**Note:**

1. In Windows CE even errors are not logged per default due to performance reasons.
2. The Diagnosis Viewer displays all entries in UTC (coordinated world time) and not in local time.
3. The Diagnosis Viewer does not display all columns of a log file per default. To display more columns activate property **Add all columns with entry** in the context menu of the column header.
4. If you only use **Error logging**, the problem description is in column **Error text**. For other diagnosis level the description is in column **General text**.
5. For communication problems many drivers also log error numbers which the PLC assigns to them. They are displayed in **Error text** and/or **Error code** and/or **Driver error parameter (1 and 2)**. Hints on the meaning of error codes can be found in the driver documentation and the protocol/PLC description.
6. At the end of your test set back the diagnosis level from **Debug** or **Deep Debug**. At **Debug** and **Deep Debug** there are a great deal of data for logging which are saved to the hard drive and which can influence your system performance. They are still logged even after you close the **Diagnosis Viewer**.

**Note:** Process Gateway is not available under Windows CE.

**Information**

*You can find further information on the Diagnosis Viewer in the Diagnose Viewer (main.chm::/12464.htm) chapter.*

**Logging**

The driver supports a comprehensive logging function for:

- ▶ Client name
- ▶ zenProcGateway\_IEC870Slave
- ▶ Modules

**CLIENT NAME**

The way the name of the client is displayed in the diagnosis viewer depends on the configuration. That is why the name changes if you change the TCP port, the COM port or the protocol. In this case, the logging settings may also change.

If the Process Gateway is started several times with the same settings, the same client name will be used. The error messages of the different instances can be distinguished by the process ID.



### Example

#### **zenProcGateway\_IEC870Slave**

- ▶ 104 protocol with standard port 2404
- ▶ 101 if COM1 selected.
- ▶ If the configuration has not been loaded yet, error messages during startup will always be visible under this client.

#### **zenProcGateway\_IEC870Slave:COM4**

- ▶ 101 with COM4.  
The name contains the used COM port.

#### **zenProcGateway\_IEC870Slave:Port:12345**

- ▶ 104 with port 12345.  
The name contains the port for the Master connection.

## MODULES

Error messages are shown for all modules:

- ▶ IEC870 Slave
- ▶ OSI2
- ▶ OSI7
- ▶ SCADA Runtime (ScadaRT)

### IEC870 SLAVE

Concerns the connection to the Process Gateway and its configuration.

Information about:

- ▶ Errors during engineering

### OSI2

Concerns the protocol level. This where framing with its according functions is implemented.

Information about:

- ▶ Received data as byte dump
- ▶ Sent data as byte dump
- ▶ Function codes for 101

- ▶ Errors on this level, e.g. in the framing
- ▶ APCI for 104 (870-5-104 5)

#### Levels

- ▶ Msg: Frame interpreting
- ▶ Debug:  
Received and sent data  
Frame analysis.  
New Master connection.
- ▶ Deep Debug: Every request about existence of characters. Produces a large number of logging entries!

### **OSI7**

Concerns the application layer.

This is where commands are interpreted and executed.

Information about:

- ▶ Logging 'process and system information'
- ▶ Errors in the ASDUs

#### Levels:

- ▶ Warning: Recursive interrogation
- ▶ Msg: Process information, System information
- ▶ Debug: Confirmed I-frames
- ▶ Deep Debug: Interrogation runs. Produces a large number of logging entries!

### **SCADA RUNTIME (SCADART)**

Messages for connection to the Runtime:

Information about:

- ▶ advised and unadvised variables
- ▶ updated variables
- ▶ Deactivating the project

#### Levels

- ▶ Debug:  
changed values  
project inactive

### 9.3.2 Error codes

The following error codes can be displayed in the Diagnosis Viewer:

Error code	Meaning
570	Value change for unknown cyclical IO
571	Transfer buffer too small to transfer a cyclical IO

#### ERROR MESSAGES FOR FILE TRANSFER IN REVERSE DIRECTION

Error number	Error level	Description
20	Error message	Creation of the temporary file for the file transfer in reverse direction was unsuccessful.
1017	Warning	File transfer in reverse direction is already active, the ongoing one will be ended and a new one started.
21	Error message	Segment data write error occurred
22	Error message	Length of the data exceeds the expected file length
23	Error message	Checksum of the transferred segments incorrect for the sector.
24	Error message	Checksum for file incorrect.
25	Error message	Segment data transferred for sector exceeds the data length defined at the start
26	Error message	Sector data transfer is reported as finished but the amount of segment data transferred does not correspond to that stated at the start.
27	Error message	File data is reported as completed but the given file length does not correspond.
581	Error message	Unexpected IOA with SG
582	Error message	Unexpected NOF with SG
583	Error message	Unexpected NOS with SG
584	Error message	Unexpected NOS with LS
585	Error message	Unexpected NOS with LS
586	Error message	Unexpected NOS with LS
587	Error message	FR with non-supported NOF. We only support 1 == transparent

### 9.3.3 Check list

- ▶ Is the COM port in use by another application or are the settings incorrect?
- ▶ Is the device (PLC) that you are trying to communicate with connected to the power supply?

- ▶ Is the cable between PLC and PC/IPC connected correctly?
- ▶ Have you analyzed the error file (which errors did occur)?
- ▶ For additional error analyses, please send a project backup and the LOG file of the DiagViewer to the support team responsible for you.

## 9.4 Interoperability

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

The interoperability list is defined as in IEC 60870-5-101 and extended with parameters used in this standard. The text descriptions of parameters which are not applicable to this companion standard are strike-through (corresponding check box is marked black).

**NOTE** In addition, the full specification of a system may require individual selection of certain parameters for certain parts of the system, such as the individual selection of scaling factors for individually addressable measured values.

The selected parameters should be marked in the white boxes as follows:

- [    ] Function or ASDU is not used
- [ X ] Function or ASDU is used as standardized (default)
- [ R ] Function or ASDU is used in reverse mode
- [ B ] Function or ASDU is used in standard and reverse mode

The possible selection (blank, X, R, or B) is specified for each specific clause or parameter.

A black check box indicates that the option cannot be selected in this companion standard.

### 1. SYSTEM OR DEVICE

(system-specific parameter, indicate definition of a system or a device by marking one of the following with 'X')

- [    ] System definition
- [    ] Controlling station definition (Master)
- [ X ] Controlled station definition (Slave)

## 2. NETWORK CONFIGURATION: 101 ONLY

(network-specific parameter, all configurations that are used are to be marked 'x')

<input checked="" type="checkbox"/> Point-to-point	<input checked="" type="checkbox"/> Multipoint
<input checked="" type="checkbox"/> Multiple point to point	<input type="checkbox"/> Multipoint-star

## 3. PHYSICAL LAYER: 101 ONLY

(network-specific parameter, all interfaces and data rates that are used are to be marked 'x')

**TRANSMISSION SPEED (CONTROL DIRECTION)**

Unbalanced interchange Circuit V.24/V.28 Standard	Unbalanced interchange Circuit V.24/V.28 Recommended if >1 200 bit/s	Balanced interchange Circuit X.24/X.27
[   ] 100 bit/s	[ X ] 2400 bit/s	[   ] 2400 bit/s
[   ] 200 bit/s	[ X ] 4800 bit/s	[   ] 4800 bit/s
[ X ] 300 bit/s	[ X ] 9600 bit/s	[   ] 9600 bit/s
[ X ] 600 bit/s	[ X ] 19200 bit/s	[   ] 19200 bit/s
[ X ] 1200 bit/s	[ X ] 38400 bit/s	[   ] 38400 bit/s
	[ X ] 56000 bit/s	[   ] 56000 bit/s
	[ X ] 57600 bit/s	[   ] 64000 bit/s
	[ X ] 115200 bit/s	
	[ X ] 128000 bit/s	
	[ X ] 256000 bit/s	

**TRANSMISSION SPEED (MONITOR DIRECTION)**

Unbalanced interchange Circuit V.24/V.28 Standard	Unbalanced interchange Circuit V.24/V.28 Recommended if >1 200 bit/s	Balanced interchange Circuit X.24/X.27
[   ] 100 bit/s	[ X ] 2400 bit/s	[   ] 2400 bit/s
[   ] 200 bit/s	[ X ] 4800 bit/s	[   ] 4800 bit/s
[ X ] 300 bit/s	[ X ] 9600 bit/s	[   ] 9600 bit/s
[ X ] 600 bit/s	[ X ] 19200 bit/s	[   ] 19200 bit/s
[ X ] 1200 bit/s	[ X ] 38400 bit/s	[   ] 38400 bit/s
	[ X ] 56000 bit/s	[   ] 56000 bit/s
	[ X ] 57600 bit/s	[   ] 64000 bit/s
	[ X ] 115200 bit/s	
	[ X ] 128000 bit/s	
	[ X ] 256000 bit/s	

**4. LINK LAYER: 101 ONLY**

(network-specific parameter, all options that are used are to be marked 'X'. Specify the maximum frame length. If a non-standard assignment of class 2 messages is implemented for unbalanced transmission, indicate the Type ID and COT of all messages assigned to class 2.)



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

Link transmission	Frame length [octets]	Address field of the link
[   ] Balanced transmission	[255] Maximum length L (both directions)*	[   ] not present (balanced transmission only)
[ X ] Unbalanced transmission		[ X ] One octet
		[ X ] Two octets
		[ X ] Structured
		[ X ] Unstructured

\*may be reduced by the system

Link Address 0xFF(FF) - broadcast to all outstations - is not supported.

The structure of Link Address is not interpreted.

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

[   ] The standard assignment of ASDUs to class 2 messages is used as follows:

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

[ X ] A special assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission
120 - 126	All (as specified in the standard)

Note: (In response to a class 2 poll, a controlled station may respond with class 1 data when there is no class 2 data available).

## 5. APPLICATION LAYER

### TRANSMISSION MODE FOR APPLICATION DATA

Mode 1 (Least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

### COMMON ADDRESS OF ASDU

(system-specific parameter, all configurations that are used are to be marked ' X ')

ASDU address	
101 only	[ X ] Two octets
[ X ] One octet	

The ASDU address 0xFF(FF) - global address - is supported only for C\_IC\_NA\_1 and C\_CS\_NA\_1

### INFORMATION OBJECT ADDRESS

(system-specific parameter, all configurations that are used are to be marked 'X')

Object address	
101 only	[ X ] Structured
[ X ] One octet	
101 only	[ X ] Unstructured
[ X ] Two octets	
[ X ] Three octets	

### CAUSE OF TRANSMISSION

(system-specific parameter, all configurations that are used are to be marked 'X')

Cause of transmission	
101 only	[ X ] Two octets (with originator address)
[ X ] One octet	Originator address is set to zero if not used.

### LENGTH OF APDU: 104 ONLY

(system-specific parameter, specify the maximum length of the APDU per system)

The maximum length of APDU for both directions is 253. The maximum length may be reduced by the system.

[ 253 ] Maximum length of APDU per system

### SELECTION OF STANDARD ASDUS

### PROCESS INFORMATION IN MONITOR DIRECTION

(station-specific parameter, mark each Type ID 'X' if it is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

Mark	Parameter	Type
[ B ]	<1>: = Single-point information	M_SP_NA_1
[ B ]	<2>: = Single-point information with time TAG	M_SP_TA_1
[ B ]	<3>: = Double-point information	M_DP_NA_1
[ B ]	<4>: = Double-point information with time TAG	M_DP_TA_1
[ B ]	<5>: = Step position information	M_ST_NA_1
[ B ]	<6>: = Step position information with time TAG	M_ST_TA_1
[ B ]	<7>: = Bitstring of 32 bit	M_BO_NA_1
[ B ]	<8>: = Bitstring of 32 bit with time TAG	M_BO_TA_1
[ B ]	<9>: = Measured value, normalized value	M_ME_NA_1
[ B ]	<10>: = Measured value, normalized value with time TAG	M_ME_TA_1
[ B ]	<11>: = Measured value, scaled value	M_ME_NB_1
[ B ]	<12>: = Measured value, scaled value with time TAG	M_ME_TB_1
[ B ]	<13>: = Measured value, short floating point value	M_ME_NC_1
[ B ]	<14>: = Measured value, short floating point value with time TAG	M_ME_TC_1
[ B ]	<15>: = Integrated totals	M_IT_NA_1
[ B ]	<16>: = Integrated totals with time TAG	M_IT_TA_1
[ ]	<17>: = Event of protection equipment with time TAG	M_EP_TA_1
[ ]	<18>: = Packed start events of protection equipment with time TAG	M_EP_TB_1
[ ]	<19>: = Packed output circuit information of protection equipment with time TAG	M_EP_TC_1
[ ]	<20>: = Packed single-point information with status change detection	M_SP_NA_1
[ ]	<21>: = Measured value, normalized value without quality descriptor	M_ME_ND_1
[ B ]	<30>: = Single-point information with time TAG CP56Time2a	M_SP_TB_1
[ B ]	<31>: = Double-point information with time TAG CP56Time2a	M_DP_TB_1
[ B ]	<32>: = Step position information with time TAG CP56Time2a	M_ST_TB_1
[ B ]	<33>: = Bitstring of 32 bit with time TAG CP56Time2a	M_BO_TB_1
[ B ]	<34>: = Measured value, normalized value with time TAG CP56Time2a	M_ME_TD_1
[ B ]	<35>: = Measured value, scaled value with time TAG CP56Time2a	M_ME_TE_1
[ B ]	<36>: = Measured value, short floating point value with time TAG CP56Time2a	M_ME_TF_1
[ B ]	<37>: = Integrated totals with time TAG CP56Time2a	M_IT_TB_1
[ ]	<38>: = Event of protection equipment with time TAG CP56Time2a	M_EP_TD_1
[ ]	<39>: = Packed start events of protection equipment with time TAG CP56Time2a	M_EP_TE_1

[    ]	<40>:= Packed output circuit information of protection equipment with time TAG CP56Time2a	M_EP_TF_1
--------	---	-----------

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

## PROCESS INFORMATION IN CONTROL DIRECTION

(station-specific parameter, mark each Type ID ' X ' if it is only used in the standard direction, ' R ' if only used in the reverse direction, and ' B ' if used in both directions).

Mark	Parameter	Type
[ X ]	<45>:= Single command	C_SC_NA_1
[ X ]	<46>:= Double command	C_DC_NA_1
[ X ]	<47>:= Regulating step command	C_RC_NA_1
[ X ]	<48>:= Set point command, normalized value	C_SE_NA_1
[ X ]	<49>:= Set point command, scaled value	C_SE_NB_1
[ X ]	<50>:= Set point command, short floating point value	C_SE_NC_1
[ X ]	<51>:= Bitstring of 32 bit	C_BO_NA_1
[ X ]	<58>:= Single command with time TAG CP56Time2a	C_SC_TA_1
[ X ]	<59>:= Double command with time TAG CP56Time2a	C_DC_TA_1
[ X ]	<60>:= Regulating step command with time TAG CP56Time2a	C_RC_TA_1
[ X ]	<61>:= Set point command, normalized value with time TAG CP56Time2a	C_SE_TA_1
[ X ]	<62>:= Set point command, scaled value with time TAG CP56Time2a	C_SE_TB_1
[ X ]	<63>:= Set point command, short floating point value with time TAG CP56Time2a	C_SE_TC_1
[ X ]	<64>:= Bitstring of 32 bit with time TAG CP56Time2a	C_BO_TA_1

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

## SYSTEM INFORMATION IN MONITOR DIRECTION

(station-specific parameter, mark ' X ' if used)

Mark	Parameter	Type
[ X ]	<70> := End of initialization	M_EI_NA_1

## SYSTEM INFORMATION IN CONTROL DIRECTION

(station-specific parameter, mark each Type ID ' X ' if it is only used in the standard direction, ' R ' if only used in the reverse direction, and ' B ' if used in both directions).

Mark	Parameter	Type
[ X ]	<100>:= Interrogation command*	C_IC_NA_1
[ X ]	<101>:= Counter interrogation command	C_CI_NA_1
[ X ]	<102>:= Read command	C_RD_NA_1
[ X ]	<103>:= Clock synchronization command (option see 7.6)*	C_CS_NA_1
[ X ]	<104>:= Test command	C_TS_NA_1
[ X ]	<105>:= Reset process command	C_RP_NA_1
[ ]	<106>:= Delay acquisition command	C_CD_NA_1
[ X ]	<107>:= Test command with time TAG CP56Time2a	C_TS_TA_1

\*also with global address - with Common Address of ASDU = 0xFF(FF)

## PARAMETER IN CONTROL DIRECTION

(station-specific parameter, mark each Type ID ' X ' if it is only used in the standard direction, ' R ' if only used in the reverse direction, and ' B ' if used in both directions).

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

## FILE TRANSFER

(station-specific parameter, mark each Type ID ' X ' if it is only used in the standard direction, ' R ' if only used in the reverse direction, and ' B ' if used in both directions).

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

#### TYPE IDENTIFIER AND CAUSE OF TRANSMISSION ASSIGNMENTS

(station-specific parameters)

Shaded boxes: option not required.

Blank: functions or ASDU not used.

Mark Type Identification/Cause of transmission combinations:

'X' if only used in the standard direction;

'R' if only used in the reverse direction;

'B' if used in both directions.

119

Type identification		Cause of transmission																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47	
<38>	M_EP_TD_1																				
<39>	M_EP_TE_1																				
<40>	M_EP_TF_1																				
<45>	C_SC_NA_1						X	X	X²	X²	X								X	X	
<46>	C_DC_NA_1						X	X	X²	X²	X								X	X	
<47>	C_RC_NA_1						X	X	X²	X²	X								X	X	
<48>	C_SE_NA_1						X	X	X²	X²	X								X	X	
<49>	C_SE_NB_1						X	X	X²	X²	X								X	X	
<50>	C_SE_NC_1						X	X	X²	X²	X								X	X	
<51>	C_BO_NA_1						X	X	X²	X²	X								X	X	
<58>	C_SC_TA_1						X	X	X²	X²	X								X	X	
<59>	C_DC_TA_1						X	X	X²	X²	X								X	X	
<60>	C_RC_TA_1						X	X	X²	X²	X								X	X	
<61>	C_SE_TA_1						X	X	X²	X²	X								X	X	
<62>	C_SE_TB_1						X	X	X²	X²	X								X	X	
<63>	C_SE_TC_1						X	X	X²	X²	X								X	X	
<64>	C_BO_TA_1						X	X	X²	X²	X								X	X	
<70>	M_EI_NA_1*				X																
<100>	C_IC_NA_1						X	X	X	X	X								X		
<101>	C_CI_NA_1						X	X			X								X		
<102>	C_RD_NA_1					X												X	X	X	
<103>	C_CS_NA_1						X	X										X	X		
<104>	C_TS_NA_1						X	X													
<105>	C_RP_NA_1						X	X										X	X		
<106>	C_CD_NA_1																				
<107>	C_TS_TA_1						X	X													
<110>	P_ME_NA_1																				
<111>	P_ME_NB_1																				
<112>	P_ME_NC_1																				



<sup>2</sup> Slave confirms deactivations of write command (TI <45> ... <64>) but by deactivated '**Select routing**' the corresponding activation is already transferred to execution; COT\_actcon and COT\_actterm were already sent.

COT	Cause of Transmission	
<0>	not used	
<1>	periodic, cyclic	per/cyc
<2>	background scan	back
<3>	spontaneous	spont
<4>	initialized	init
<5>	request or requested	req
<6>	activation	act
<7>	activation confirmation	actcon
<8>	deactivation	deact
<9>	deactivation confirmation	deactcon
<10>	activation termination	actterm
<11>	return information caused by a remote command	retrem
<12>	return information caused by a local command	retloc
<13>	file transfer	file
<14...19>	reserved	
<20>	interrogated by station interrogation	inrogen
<21...36>	interrogated by interrogation of the group 1..16	inro1..16
<37>	requested by general counter request	reqcogen
<38...41>	requested by counter interrogation of the group 1 ... 4	reqco1..4
<42, 43>	reserved	
<44>	unknown type identification	
<45>	unknown cause of transmission	
<46>	unknown common address of ASDU	
<47>	unknown information object address	
<48, 63>	for special use (private range)	

## 6. BASIC APPLICATION FUNCTIONS

### STATION INITIALIZATION

(station-specific parameter, mark 'X' if function is used)

[     ] Remote initialization

## CYCLIC DATA TRANSMISSION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

[ X ] Cyclic data transmission

## READ PROCEDURE

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

[ X ] Read procedure

## SPONTANEOUS TRANSMISSION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions)

[ B ] Spontaneous transmission

## DOUBLE TRANSMISSION OF INFORMATION OBJECTS WITH CAUSE OF TRANSMISSION SPONTANEOUS

(station-specific parameter, mark each information type 'X' where both a Type ID without time and corresponding Type ID with time are issued in response to a single spontaneous change of a monitored object)

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

- [ ] Single-point information M\_SP\_NA\_1, M\_SP\_TA\_1, M\_SP\_TB\_1 and M\_PS\_NA\_1
- [ ] Double-point information M\_DP\_NA\_1, M\_DP\_TA\_1 and M\_DP\_TB\_1
- [ ] Step position information M\_ST\_NA\_1, M\_ST\_TA\_1 and M\_ST\_TB\_1
- [ ] Bitstring of 32 bit M\_BO\_NA\_1, M\_BO\_TA\_1 and M\_BO\_TB\_1 (if defined for a specific project)
- [ ] Measured value, normalized value M\_ME\_NA\_1, M\_ME\_TA\_1, M\_ME\_ND\_1 and M\_ME\_TD\_1
- [ ] Measured value, scaled value M\_ME\_NB\_1, M\_ME\_TB\_1 and M\_ME\_TE\_1
- [ ] Measured value, short floating point number M\_ME\_NC\_1, M\_ME\_TC\_1 and M\_ME\_TF\_1

## STATION INTERROGATION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

[ X ] global		
[ ] group 1	[ ] group 7	[ ] group 13
[ ] group 2	[ ] group 8	[ ] group 14
[ ] group 3	[ ] group 9	[ ] group 15
[ ] group 4	[ ] group 10	[ ] group 16
[ ] group 5	[ ] group 11	Information object addresses assigned to each group must be shown in a separate table.
[ ] group 6	[ ] group 12	

### CLOCK SYNCHRONIZATION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

[ X ] Clock synchronization

[ ] Day of week used

[ ] RES1, GEN (time tag substituted/ not substituted) used

[ B ] SU-bit (summertime) used

optional, see 7.6

### COMMAND TRANSMISSION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

[ X ] Direct command transmission

[ X ] Direct set point command transmission

[ X ] Select and execute command

[ X ] Select and execute set point command

[ X ] C\_SE ACTTERM used

[ X ] No additional definition

[ X ] Short-pulse duration (duration determined by a system parameter in the outstation)

[ X ] Long-pulse duration (duration determined by a system parameter in the outstation)

[ X ] Persistent output

[ setting ] Supervision of maximum delay in command direction of commands and set point commands

[ no limit ] Maximum allowable delay of commands and set point commands

## TRANSMISSION OF INTEGRATED TOTALS

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

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

## PARAMETER LOADING

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

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

## PARAMETER ACTIVATION

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

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

## TEST PROCEDURE

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

- ☒ Test procedure

## FILE TRANSFER

(station-specific parameter, mark 'X' if function is used).

File transfer in monitor direction

- [ X\* ] Transparent file
- [   ] Transmission of disturbance data of protection equipment
- [ X ] Transmission of sequences of events
- [   ] Transmission of sequences of recorded analogue values

\* a data can be transparently transported by the system but not generated or evaluated. Maximum file size is 16711680 bytes.

File transfer in control direction

- [ X ] Transparent file

## BACKGROUND SCAN

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

- [ X ] Background scan

## ACQUISITION OF TRANSMISSION DELAY

(station-specific parameter, mark 'X' if function is only used in the standard direction, 'R' if only used in the reverse direction, and 'B' if used in both directions).

- [   ] Acquisition of transmission delay

**DEFINITION OF TIME OUTS: 104 ONLY**

Parameter	Default value	Remarks	Selected value
t0	30 s	Time-out of connection establishment	setting
t1	15 s	Time-out of send or test APDUs	setting
t2	10 s	Time-out for acknowledges in case of no data messages; t2 < t1	setting
t3	20 s	Time-out for sending test frames in case of a long idle state; t3 > t1	setting

Recommended range for timeouts t0 - t2 : 1s to 255s, accuracy 1s

Recommended range for timeout t3 : 0s to 48hrs, accuracy 1s

Long timeouts for t3 may be needed in special cases where satellite links or dialup connections are used (e.g. to establish connection and collect values only once per day or week). For dialup connections it may be necessary to give up the connection supervision completely. This is achievable by setting the timeout t3 to zero.

**MAXIMUM NUMBER OF OUTSTANDING I FORMAT APDUS K AND LATEST ACKNOWLEDGE APDUS (W): 104 ONLY**

Parameter	Default value	Remarks	Selected value
k	12 APDUs	Maximum difference receive sequence number to send state variable	setting
w	8 APDUs	Latest acknowledge after receiving w I format APDUs	setting

Recommended range of values k: 1 to 32767 APDUs, accuracy 1 APDU

Recommended range of values w: 1 to 32767 APDUs, accuracy 1 APDU (Recommendation: w should not exceed two-thirds of k)

**PORTNUMBER: 104 ONLY**

Parameter	Default value	Remarks
Portnumber	2404	setting

**REDUNDANT CONNECTIONS**

[     ] Number N of redundancy group connections used

## RFC 2200 SUITE

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

- [    ] Ethernet 802.3
- [    ] Serial X.21 interface
- [    ] Other selection from RFC 2200:

List of valid documents from RFC 2200

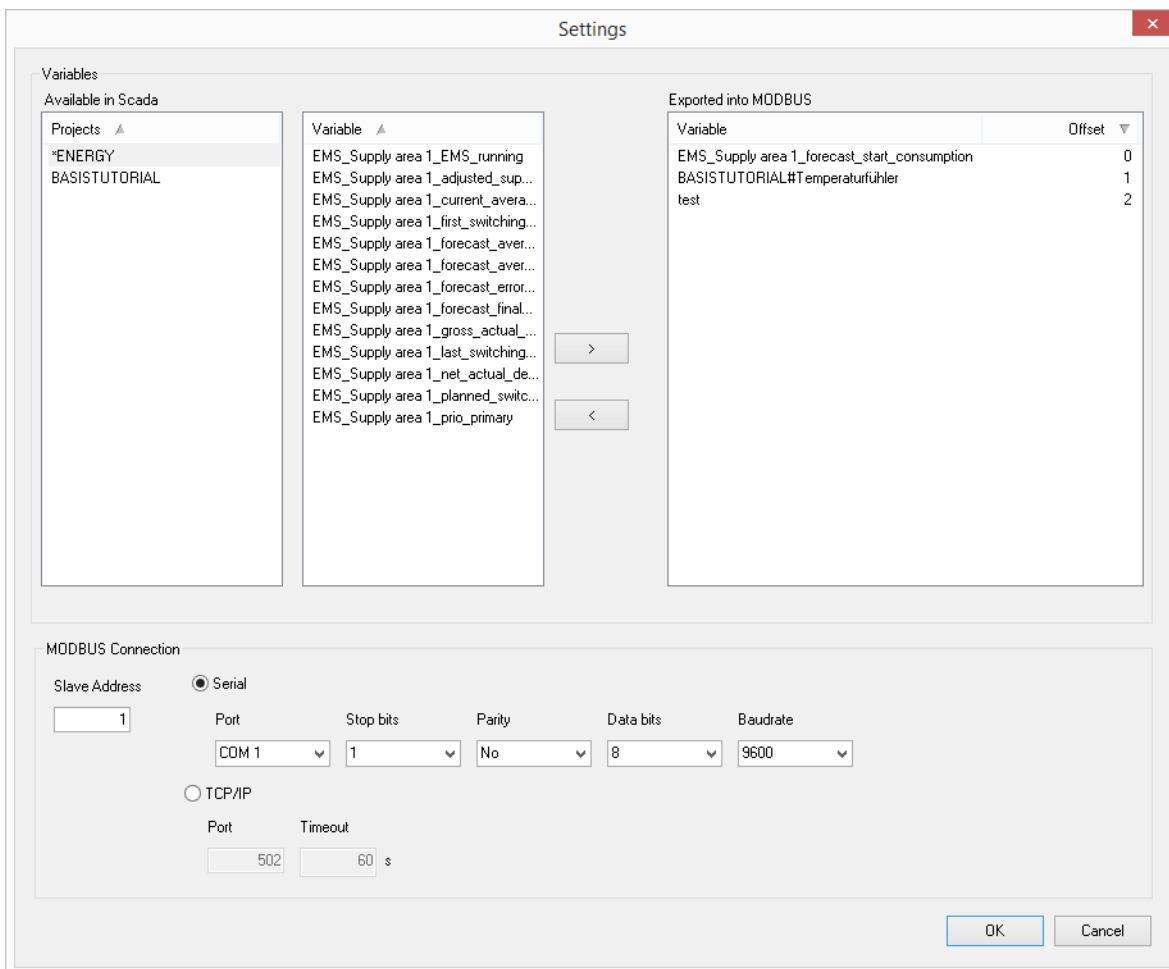
1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. etc.



## 10. MODBUS Slave

### 10.1 Module configuration

Clicking on the Settings button in the start dialog for the Process Gateway opens the dialog for selecting the variables. The variables selected in this way are continuously synchronized in zenon or in the MODBUS system.



The Settings dialog is divided into two main sections: Variables and MODBUS Connection.

**Variables Section:**

- Available in Scada:** A list of projects including \*ENERGY and BASISTUTORIAL.
- Variable:** A list of variables including EMS\_Supply area 1\_EMS\_running, EMS\_Supply area 1\_adjusted\_sup..., EMS\_Supply area 1\_current\_avera..., EMS\_Supply area 1\_first\_switching..., EMS\_Supply area 1\_forecast\_aver..., EMS\_Supply area 1\_forecast\_aver..., EMS\_Supply area 1\_forecast\_error..., EMS\_Supply area 1\_forecast\_final..., EMS\_Supply area 1\_gross\_actual..., EMS\_Supply area 1\_last\_switching..., EMS\_Supply area 1\_net\_actual\_de..., EMS\_Supply area 1\_planned\_swic..., and EMS\_Supply area 1\_prio\_primary.
- Exported into MODBUS:** A table showing the mapping of variables to MODBUS addresses.
 

Variable	Offset
EMS_Supply area 1_forecast_start_consumption	0
BASISTUTORIAL#Temperaturfühler	1
test	2

**MODBUS Connection Section:**

- Slave Address:** A text box containing the value 1.
- Serial Connection:** Selected by default.
  - Port:** A dropdown menu showing COM 1.
  - Stop bits:** A dropdown menu showing 1.
  - Parity:** A dropdown menu showing No.
  - Data bits:** A dropdown menu showing 8.
  - Baudrate:** A dropdown menu showing 9600.
- TCP/IP Connection:**
  - Port:** A text box containing the value 502.
  - Timeout:** A text box containing the value 60 s.

Buttons for OK and Cancel are located at the bottom right of the dialog.

## VARIABLES

Parameters	Description
<b>Variables</b>	Selection of variables that are exported to MODBUS and synchronized with zenon.
<b>Available in Scada</b>	<p>Displays all variables available in zenon</p> <p>With multi-project administration, variables from active projects can be selected.</p> <ul style="list-style-type: none"> <li>▶ <b>Project</b> shows all available projects; the standard project is marked with a *</li> <li>▶ <b>Variables</b> offers all variables from the selected project to be transferred</li> </ul>
<b>Exported into MODBUS</b>	<p>Lists all variables exported to MODBUS and their offset. List can be sorted by clicking on headings.</p> <ul style="list-style-type: none"> <li>▶ <b>Variables:</b> List of all SCADA variables that are exported to the MODBUS.</li> </ul> <p>Variables that do not come from the standard project, receive the project name as a prefix, separated by a # in front of the variable name.</p> <ul style="list-style-type: none"> <li>▶ <b>Offset:</b> Offset of the variable (MODBUS holding register offset)</li> </ul>
<b>Pfeiltasten</b>	<p>Allocation of the variables to MODBUS:</p> <ul style="list-style-type: none"> <li>▶ Clicking on the &gt; button adds variables from the <b>Available in Scada</b> list to the <b>Exported into MODBUS</b> list. A dialog to allocate the address is opened (see <b>Allocation dialog</b> section).</li> <li>▶ Clicking on the &lt; button removes variables from the <b>Exported into MODBUS</b> list and inserts them back into the <b>Available in Scada</b> list.</li> </ul>

## MODBUS CONNECTION

MODBUS Connection	MODBUS connection settings.
<b>Slave Adress</b>	<p>Modbus hardware address.</p> <p>Default: 1</p>
<b>Serial</b>	<p>Active: Serial connection is used.</p> <ul style="list-style-type: none"> <li>▶ <b>Port:</b> Serial interface that is used for access to the MODBUS system.</li> <li>▶ <b>Stop bits:</b> number of stop bits. Default: 1</li> </ul>

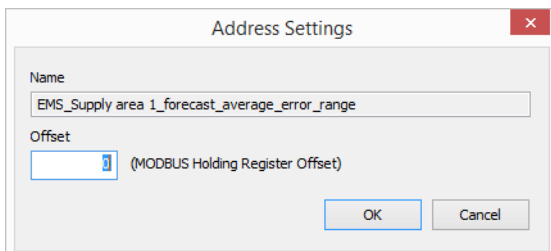
	<ul style="list-style-type: none"> <li>▶ <b>Parity:</b> Parity setting: No (default) Odd Even</li> <li>▶ <b>Data bit:</b> number of data bits. Default: 8</li> <li>▶ <b>Baud rate:</b> baud rate of the serial interface. Default: 9600</li> </ul>
<b>TCP/IP</b>	<p>Active: TCP/IP connection is used.</p> <ul style="list-style-type: none"> <li>▶ Port: Port address for the connection.</li> <li>▶ Timeout: Waiting period.</li> </ul>
<b>OK</b>	Applies settings and closes the dialog.
<b>Cancel</b>	Discards all changes and closes the dialog.

#### Note:

- ▶ Change of name of project and/or variables in the Editor:  
If a project name or a variable name is changed in the Editor, this change must subsequently be carried out in the configuration file (on page 132), so that the name in the INI file and in the prefix of the **Exported into MODBUS** are amended accordingly.
- ▶ Change to standard project:  
If the standard project is changed in multi-project administration, the variables must be amended.  
Variables of the standard project must not have a prefix. All other variables need a **Projectname#** prefix.

## ALLOCATION DIALOG

If a variable is moved, by clicking on the button> in the **Exported into MODBUS** list, the dialog to address the zenon variable to an offset in the MODBUS appears:



The dialog box is titled "Address Settings" and has a close button (X) in the top right corner. It contains two input fields: "Name" and "Offset". The "Name" field contains the text "EMS\_Supply area 1\_forecast\_average\_error\_range". The "Offset" field is a numeric input box with a small icon to its left, and it contains the text "(MODBUS Holding Register Offset)". At the bottom right of the dialog are two buttons: "OK" and "Cancel".

Parameters	Description
<b>Name</b>	Name of the variable. <b>Note:</b> The name of the variable is grayed out, because it can no longer be changed.
<b>Offset</b>	Offset: MODBUS holding register offset. Offset of the variable in MODBUS  <b>Attention:</b> 0 is always entered as the offset by default.
<b>OK</b>	Applies settings and closes the dialog.
<b>Cancel</b>	Discards all changes and closes the dialog.

## 10.2 Hardware address of the MODBUS system

The MODBUS system of the Process Gateway has a MODBUS hardware address that can be defined. This is set in the configuration dialog (on page 129) with the **Slave Address property**. The address 1 is given as standard.

## 10.3 Configuration file: specific entries for AccessMODBUS

The configuration file `zenProcGateway.ini` contains specific entries for MODBUS. The file must be in the system folder.

**[MODBUS]**

Entry	Description
<b>COMPORT</b>	serial interface (COM1 = 0, COM2 = 1,...). Can be set using the configuration dialog (on page 129).
<b>BAUD</b>	Baud rate of the serial interface. Can be set using the configuration dialog (on page 129).
<b>BYTESIZE</b>	number of data bits of the serial interface
<b>PARITY</b>	Parity settings of the serial interface: 0=No 1=Odd 2=Even Can be set using the configuration dialog (on page 129).
<b>STOPBITS</b>	Number of stop bits of the serial interface 0=1 1=1.5 2=2 Can be set using the configuration dialog (on page 129).
<b>TIMEOUT</b>	timeout interval for serial communication in milliseconds
<b>HWADDRESS</b>	Hardware address of the MODBUS system. Default: 1 Can be set using the configuration dialog (on page 129).
<b>REFRESHRATE</b>	Update time in milliseconds
<b>SERIELL</b>	Serial or TCP/IP communication: 1 = serial 0 = TCP/IP Can be set using the configuration dialog (on page 129).
<b>PORT</b>	TCP/IP port
<b>TCPTIMEOUT</b>	TCP/IP timeout interval in seconds

## [MODBUS VARIABLES]

Variables that are to be replaced in AccessMODBUS.

**Note:** This entry replaces the original **[VARIABLES]** entry from zenon 7.11 onwards. This prevents unnecessary replacement using shared memory for variables from the standard project.

Entry	Description
<b>COUNT</b>	number of variables to be exported
<b>OFFSET_n</b>	Modbus address that is allocated to the corresponding number ( <b>n</b> ). Numbering starts with 0.
<b>NAME_n</b>	Name of the variable that is allocated to the corresponding number ( <b>n</b> ). Numbering starts with 0. Examples: <ul style="list-style-type: none"> <li>▶ OFFSET_0=0 NAME_0=EMS_Supply area 1_forecast_final_consumption Variable from start project</li> <li>▶ OFFSET_1=2 NAME_1=BASISTUTORIAL#Temperaturfühler Variable from projekt "<b>BASISTUTORIAL</b>"</li> </ul>

▶

## 11. MS Azure

**AccessAzure.dll** Writes the variable values of Runtime to an MS Azure service bus queue. These can then be obtained with the **AzureDrv** driver from MS Azure and integrated into zenon or zenon Analyzer processes.

The Process Gateway then establishes a connection to MS Azure cyclically and takes all messages received from the the service bus queue with the configured names. These messages are unpacked and the online values contained therein are allocated to the variables. The key for this is the symbolic address.

All messages that are already in the queue when the connection is first successfully established are deleted and discarded.

This means: Each driver instance on each computer has its own queue as an input signal.

Example: The service bus queue for the computer **MYSERVER1** and the configured prefix **onlinedata** is called the following in MS Azure: **onlinedata\_myserver1**.

Numeric (`DOUBLE`) and alphanumeric (`STRING`) values are supported. The time stamp and the system status bits are transferred to the target variable.

## 11.1 Module configuration

Configuration dialog for MS Azure connection via Process Gateway.

### VARIABLES

In the **variables** group, you configure the variables whose values are saved by zenon in an MS Azure service bus.

Parameters	Description
<b>Available in Scada</b>	Displays all variables available in zenon  With multi-project administration, variables from active projects can be selected.
Projects	List of all available projects. The standard project is marked with a *.
Variables	List of all variables of the selected project.  List can be sorted; multiple selection is possible. Hint: Double clicking on the variable moves it.
Button >	Selected variables from the list of variables are moved to the <b>Exported into MS Azure</b> list.
Button <	Selected variables are removed from the <b>Exported into MS Azure</b> list.
<b>Exported into MS Azure</b>	List of the variables that are written to the MS Azure service bus queue by Process Gateway.  Naming: <ul style="list-style-type: none"> <li>▶ Project name</li> <li>▶ # (as separator)</li> <li>▶ Variable name.</li> </ul> <p>The key for the values in MS Azure is always <b>PROJECTNAME#VARIABLENAME</b>.</p> <p>Hint: Double clicking on the variable moves it.</p>

## MS AZURE CONNECTIONS

All target connections in which the current values of the selected variable are to be inserted in MS Azure are to be entered into the **MS Azure Connections** group.

In doing so, the current variable values are added to the connection created in **All** at the same time.



Parameters	Description
List of MS Azure connections	<p>Lists all connections to MS Azure configured. Each connection consists of the connection name (<b>MS Azure Connection</b>) and the <b>Service Bus Queue Namen</b>.</p> <ul style="list-style-type: none"> <li>► Creation of a new connection with the button <b>New...</b></li> <li>► A selected connection can be amended with the <b>Edit...</b> button.</li> </ul>
<b>MS Azure Connection</b>	MS Azure connection address.
<b>Service Bus Queue name</b>	Name of the queue in the MS Azure service bus.
<b>New...</b>	Opens dialog to configure the MS Azure connection.
<b>Edit...</b>	Opens existing connections to configure the MS Azure connection.
<b>Delete</b>	Deletes the selected MS Azure connection from the list.

## MS AZURE SETTINGS

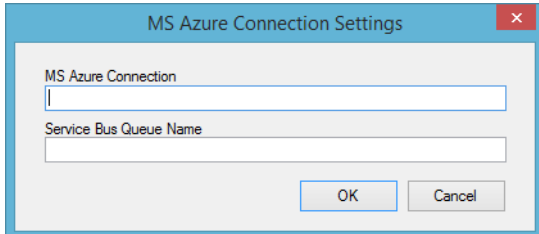
Parameters	Description
<b>Integrity period</b>	<p>Time interval in which the current values of the selected variables are written to the MS Azure service bus as an image.</p> <p>If the value of a variable changes during this this time period, the value change is immediately transferred to the MS Azure queue.</p> <p>Default: 5 s</p>

## NAVIGATION

Parameters	Description
<b>OK</b>	Applies settings and closes the dialog.
<b>Cancel</b>	Discards all changes and closes the dialog.

### 11.1.1 MS Azure Connection Settings

Configuration dialog for the connection to MS Azure:



Parameters	Description
<b>MS Azure Connection</b>	<p>MS Azure connection address.</p> <p><b>Note:</b> You can read and copy the desired <b>service bus name space</b> in the Azure administration portal under <b>Manage Connection Strings</b>.</p>
<b>Service Bus Queue name</b>	<p>Name of the MS Azure service bus queue.</p> <p>The name of the service bus queue comprises:</p> <ul style="list-style-type: none"> <li>▶ The freely-configurable prefix</li> <li>▶ An underscore ( _ )</li> <li>▶ The NETBIOS computer name (without domain name suffix) in small lettering</li> </ul> <p><b>Note:</b> Only characters that appear in the name of an MS Azure service bus queue are permitted. If possible, use a simple, short and meaningful name. Avoid special characters, language-specific letters and blank spaces.</p>



#### Information

*The **Service Bus Queue Name** can be freely configured.*

*This queue is automatically created in MS Azure during the first communication to MS Azure.*

*Create a separate **MS Azure Connection** for each computer that calls up data from MS Azure (via the AzureDrv driver).*

## 11.2 Message format

The messages in the queue must have a serialized .NET class `OnlineValueMessage` .

### FORMAT:

```
public class OnlineValueMessage
{
    public string strVarProject { get; set; }
    public string strVarName { get; set; }
    public long nVarID { get; set; }
    public double fValue { get; set; }
    public string strValue { get; set; }
    public bool bValueIsString { get; set; }
    public long nTime_s { get; set; }
    public short nTime_milli { get; set; }
    public long nStatus { get; set; }
}
```

## 11.3 Error message

Error message in the LOG file:

Error message	Debug Level	Description
Project %s inactive fail!	Error	The project-inactive event could not be processed by the Gateway in the given time.
Project %s active fail!	Error	The project-active event could not be processed by the Gateway in the given time.
Value change queue full: Value change for id:%u of project:%s lost!	Error	The queue for the value changes from Runtime is full. Additional values are discarded. The connection to Azure is probably too slow in order to forward all value changes.
Adding of %d Online Rows failed for '%s' Queue '%s'	Error	The insertion of value changes into the service bus queue was unsuccessful.
Adding of %d Online Rows succeeded for '%s' Queue '%s'	Deep Debug:	The insertion of value changes into the service bus queue was successful.
Starting to add Online Rows failed for '%s' Queue '%s'	Error	The establishment of the a connection to the service bus queue was unsuccessful.
Creating Azure Wrapper failed	Error	The ManagedAzureWrapper.dll could not be loaded.

## 11.4 Configuration file: specific entries for MS Azure

The configuration file `zenProcGateway.ini` contains specific entries for MS Azure.

**[AZURE]**

Entry	Description
<b>INTEGRITYPERIOD=</b>	Interval of the write cycle in seconds.

**[VARIABLES]**

Entry	Description
<b>Name_n=</b>	<p>Name of the variable for Process Gateway.  Format: SOURCEPROJECT#SOURCEVARIABLE.</p> <p>Numbering (n):  n Stands for the serial number of the connection configuration.  This numbering starts with 0.</p> <p>Example:</p> <ul style="list-style-type: none"> <li>▶ 1 variable results in n = 0</li> <li>▶ 3 variables result in, for the third entry n = 2</li> </ul>
<b>Count=</b>	<p>Number of variables.</p> <p><b>Note:</b> The numbering starts with 1 here. Eight connections result in Count=8.</p>

## [CONNECTIONS]

Entry	Description
<b>CONN_n=</b>	<p>Name of the MS Azure connection.</p> <p>Numbering (n):</p> <p>n Stands for the serial number of the connection configuration.</p> <p>This numbering starts with 0.</p> <p>Example:</p> <ul style="list-style-type: none"> <li>▶ 1 connection results in n = 0</li> <li>▶ 3 connections result in, for the third entry n = 2</li> </ul>
<b>QUEUE_n=</b>	<p>Name of the MS Azure queue.</p> <p>For the numbering (_n) the same rules apply as for <b>CONN</b></p>
<b>COUNT=</b>	<p>Number of the configured MS Azure connections.</p> <p><b>Note:</b> The numbering starts with 1 here. Two connections result in Count=2.</p>

## 12. OPC UA Server

The OPC server makes the variables of the project available for standard OPC client tools.



### Information

*The OPC UA server can be used for all zenon versions from 5.50.*

The predecessor to the OPC UA servers is the OPC server. This is not part of the Process Gateway.

The OPC UA driver and all dialogs are only available in English.

### MULTI-PROJECT CAPABILITY

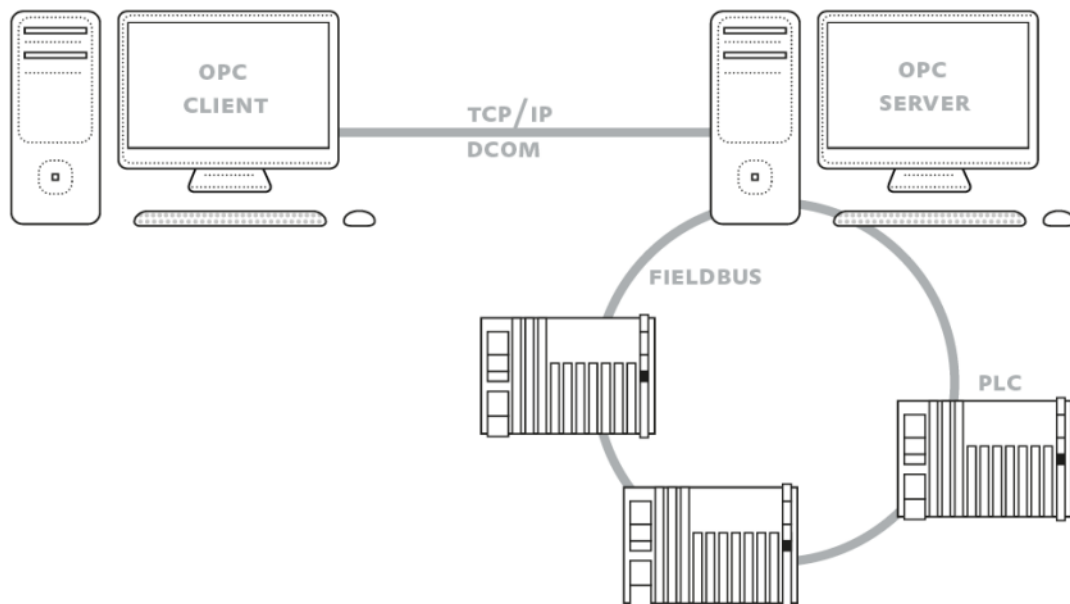
The OPC UA server is multi-project compatible from zenon 7.11 onwards. Variable from the Runtime project and all its subprojects can be selected. In doing so, the object name from the variable name and the project name are combined. Configurations for OPC UA clients that were created before zenon 7.11 are thus not compatible. These must be amended when using zenon 7.11 or higher.

## 12.1 Compare OPC Server and OPC UA Server

The OPC UA server system has superseded the OPC server. Use of an OPC UA server is recommended for most applications.

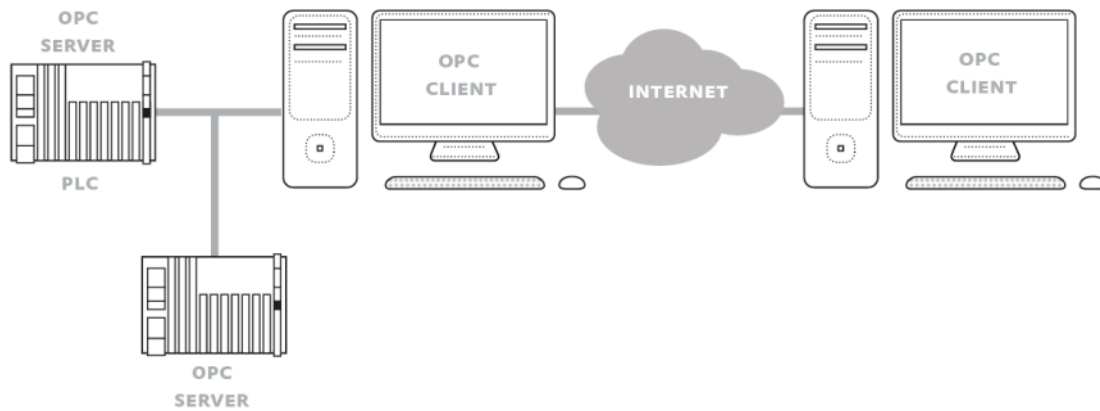
### OPC SERVER

- ▶ OPC Task Force since 1995
- ▶ Uniform interface for automation systems
- ▶ Based on Microsoft's COM/DCOM technology
- ▶ OPC foundation since 1996
- ▶ several specifications for different applications



### OPC UA SERVER

- ▶ First vision 2003
- ▶ Released in 2006, not yet all parts



## COMPARISON OF OPC SERVER TO OPC UA SERVER

Parameters	OPC Server	OPC UA Server
Data model	Limited	for all applications
Implementation	Manufacturer-dependent	Manufacturer-independent
Interoperability	no	yes
Configuration	laborious	simple
Network use	Not recommended (security); Windows CE cannot be used	yes
Network technology	DCOM (error-prone, unstable)	OPC UA TCP binary protocol
Performance	low	high
Platforms	Windows only	independent
Redundancy	no	yes
Resource requirements	high	lower
Service-orientated architecture	no	yes
Security	outdated	In accordance with current standards
Connection security	no	provided
Windows CE	no	yes

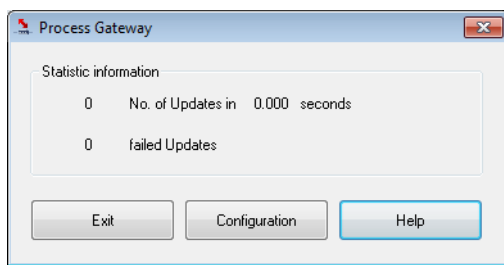


## 12.2 Module configuration

### START:

To start the process gateway with the OPC UA module, this must be entered into the `zenProcGateway.ini` (on page 10) . The configuration of the certificate is queried when the process gateway is first started with the OPC UA module. If no independent certificates are to be used, the certificates can be automatically created by clicking on **Yes**.

After the Process Gateway has been started, statistical information on the number of updates in the time period displayed and the number of unsuccessful updates is displayed. The configuration can also be started in this dialog.



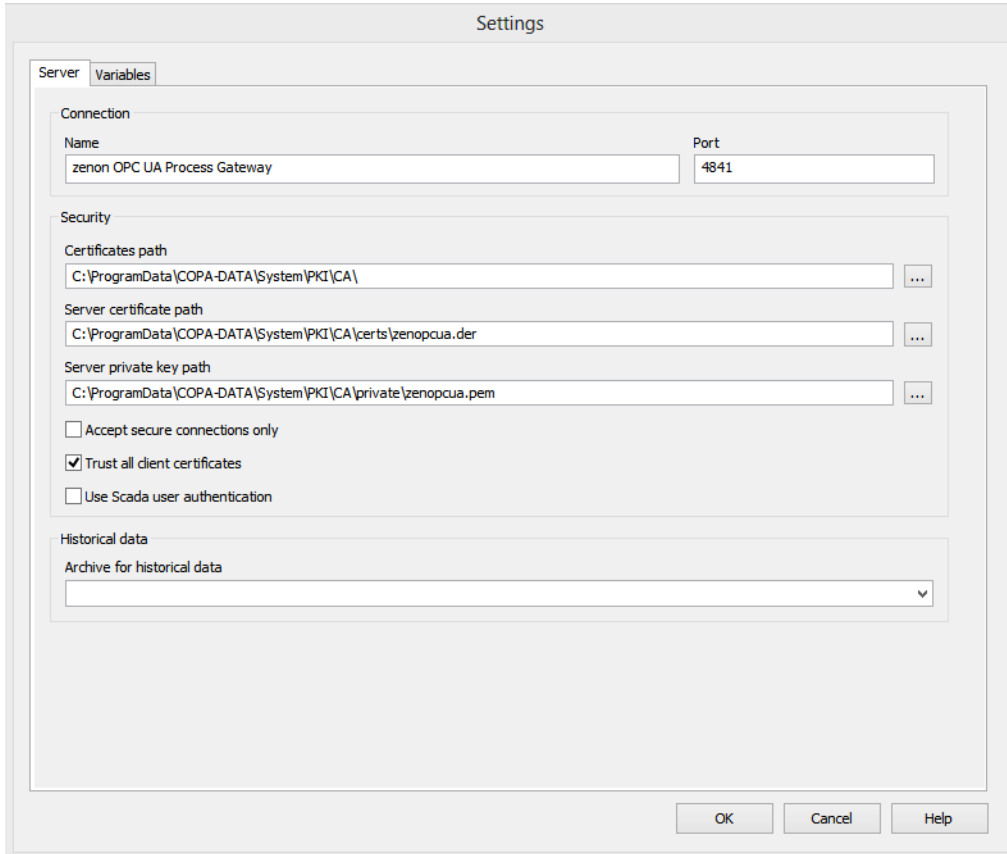
Parameters	Description
<b>Exit</b>	Closes process gateway.
<b>Configuration</b>	Opens configuration dialog.
<b>Help</b>	Opens help.

To configure the server and variables:

1. Click on Configuration
2. In the dialog that opens, you configure:
  - Server (on page 146)
  - Variables (on page 150)

## 12.2.1 Server

Clicking on **configuration** in the Process Gateway statistics dialog opens the configuration dialog:



Settings

Server Variables

Connection

Name: zenon OPC UA Process Gateway Port: 4841

Security

Certificates path: C:\ProgramData\COPA-DATA\System\PKI\CA\ ...

Server certificate path: C:\ProgramData\COPA-DATA\System\PKI\CA\certs\zenopcua.der ...

Server private key path: C:\ProgramData\COPA-DATA\System\PKI\CA\private\zenopcua.pem ...

☐ Accept secure connections only

☒ Trust all client certificates

☐ Use Scada user authentication

Historical data

Archive for historical data: ...

OK Cancel Help

Parameters	Description
<b>Name</b>	Name of the server as it is shown on the client.
<b>Port</b>	TCP port via which the client establishes the connection. Default: 4841
<b>Certificates path</b>	Path to the certificate files.
<b>Server certificate path</b>	File with the public key of the server. Used by the client for encrypting messages. <ul style="list-style-type: none"> <li>▶ Format: DER</li> <li>▶ Suffix: <b>.der</b></li> </ul>
<b>Server private key path</b>	File with the private key of the server. Is used by the server to decrypt the messages from the client. <ul style="list-style-type: none"> <li>▶ Format: PEM</li> <li>▶ No password.</li> </ul>
<b>Accept secure connections only</b>	<p><b>Active:</b> Only secure connections are accepted for establishing a connection, with the signature or with signature and encryption:</p> <ul style="list-style-type: none"> <li>▶ Basic128Rsa15: RSA15 as key wrap algorithm and 128-bit basic as algorithm for the message encryption</li> <li>▶ Basic256: 256-bit basic as algorithm for message encryption</li> </ul> <p>Default: <i>inactive</i></p> <p><b>Note:</b> for connections with a signature, the packages are secured against tampering, but the contents of the package are not encrypted.</p>
<b>Trust all client certificates</b>	<ul style="list-style-type: none"> <li>▶ <b>Active:</b> All client certificates are accepted and the connection is made.</li> <li>▶ <b>Inactive:</b> All clients that want to connect with the server must send a valid certificate. This certificate is also checked to see if it is in the list of known client certificates (<b>certificate trust list path</b>).</li> </ul> <p><b>Note:</b> An OPCUA client without a secure connection does not send a certificate. For an OPCUA client with a secure connection, the certificate must always be stored in the <b>Trust List</b> folder.</p>

<b>Use zenon authentication</b>	<ul style="list-style-type: none"> <li>▶ <b>Active:</b> Clients can only log on to the server with a valid user ID and password. <b>Note:</b> The user administration must be active.</li> <li>▶ <b>Inactive:</b> Anonymous login is possible.</li> </ul> <p><b>Attention:</b> The user name and password are not transferred in encrypted form in the OPCUA telegram. If necessary, use your own users in the project without assigned authorization levels.</p>
<b>Archive for historical data</b>	<p>Archive for historical data. Selection of the archive description from the drop-down list. Only one individual archive from one of the projects can be selected in Runtime. The archive must already have been created in the project.</p>
<b>OK</b>	<p>Applies all changes in all tabs and closes the dialog.</p> <p><b>Attention:</b> All active connections are ended and the server is restarted with the new settings. Connection errors may occur in the process.</p>
<b>Cancel</b>	<p>Discards all changes in all tabs and closes the dialog.</p>
<b>Help</b>	<p>Opens online help.</p>

## Certificates

*All certificates must correspond to the format **X509**.*

### CERTIFICATE STORE

*The OPC UA server in the Process Gateway uses an **OpenSSL Directory certificate store**. The OPCUA server cannot currently be configured and the **Windows Certificate Store** (local user or local machine) cannot be used.*

### SERVER CERTIFICATE

*The server certificate created on initial startup is a self-signed certificate. The certificate contains a public key. A suitable 1024-large private RSA key is also generated.*

*As a uniform resource identifier (URI) in the **SubjectAltName** field, it contains the **Full Qualified Domainname** (FQN) of the computer and the default port number 4841 from the OPC UA server and a DNS entry with the computer name. The URI of the OPCUA servers is compiled dynamically and changes if, for example, the port number is changed. The server certificate is not changed in this case. A client that carries out a strict check of the server certificate can, under certain circumstances, reject the server certificate.*

*It is also possible to use your own certificate with a suitable private key. The certificate must comply with the guidelines for **Application Instance certificates** in accordance with the OPC UA standard. The **SubjectAltName** field must contain the URI of the server.*

### CERTIFICATE TRUST LIST/CERTIFICATE TRUST CHAIN

*All certificates with the suffix **.der** are checked by the OPC UA server and classed as a trustworthy certificate. As an alternative to the self-designated **Application Instance certificate** of an OPC UA clients, the public root certificate of the **Certificate Authority** that was used to sign an **Application Instance certificate** of an OPC UA client can also be stored. The **Application Instance certificate** of the client does not need to be present on the server in this case.*

### CERTIFICATE REVOCATION LIST

If an OPC UA client uses an **Application Instance certificate** that is signed by a **Certificate Authority**, the **Certificate Revocation List** is also checked by the server in addition to the certificate. The OPC UA server checks all files with the suffix **.crl** in the **crl** subfolder.

**Attention:** The **.crl** file must be stored in **PEM** format. Only one single **.crl** file can be present per certificate authority.

The connection is denied if:

- ▶ The client certificate is included in the **Revocationlist** **BadCertificateRevoked**
- ▶ The CRL is no longer current (**BadCertificateTimeInvalid**)

If, for a certificate that has been signed by a **Certificate Authority**, there is no **Certificate Revocation List**, it is assumed that there is none and the certificate is considered trustworthy.

## Generate new certificate

If necessary, new certificates can be generated when the OPC UA server is started.  
To do this:

1. Remove the existing certificates.  
There are two possibilities for doing so:
  - a) Delete the following folder: %programdata%\COPA-DATA\system\PKI.  
In doing so, all trusted certificates and certificate revocation lists are removed.  
Or:
  - b) Delete the following files in order to get all other certificates and lists:
    - zenopcua.der** in the folder %programdata%\COPA-DATA\system\PKI\CA\certs
    - zenopcua.pem** in the folder  
%programdata%\COPA-DATA\system\PKI\CA\private
    - zenopcua.crl** in the folder %programdata%\COPA-DATA\system\PKI\CA\crl
2. Open the **zenprocgateway.ini** configuration file.
3. Navigate to the section **[OPCUA]**.
4. Remove the following entries:
  - **CERTIFICATES\_PATH=**
  - **SERVER\_CERTIFICATE\_LOCATION=**
  - **SERVER\_PRIVATE\_KEY\_LOCATION=**
5. Start the OPCUA Process Gateway.
6. Confirm the message box with yes in order to create new certificates.



### Attention

*If server certificates need to be renewed, each OPC UA client that needs a valid server certificate must receive the renewed certificate.*

## 12.2.2 Variables

### VARIABLES

Variables for the OPC UA Process Gateway can be selected automatically or individually.

There are variables from the current project and its subprojects available. The name on the server consists of the variable names and the project names.



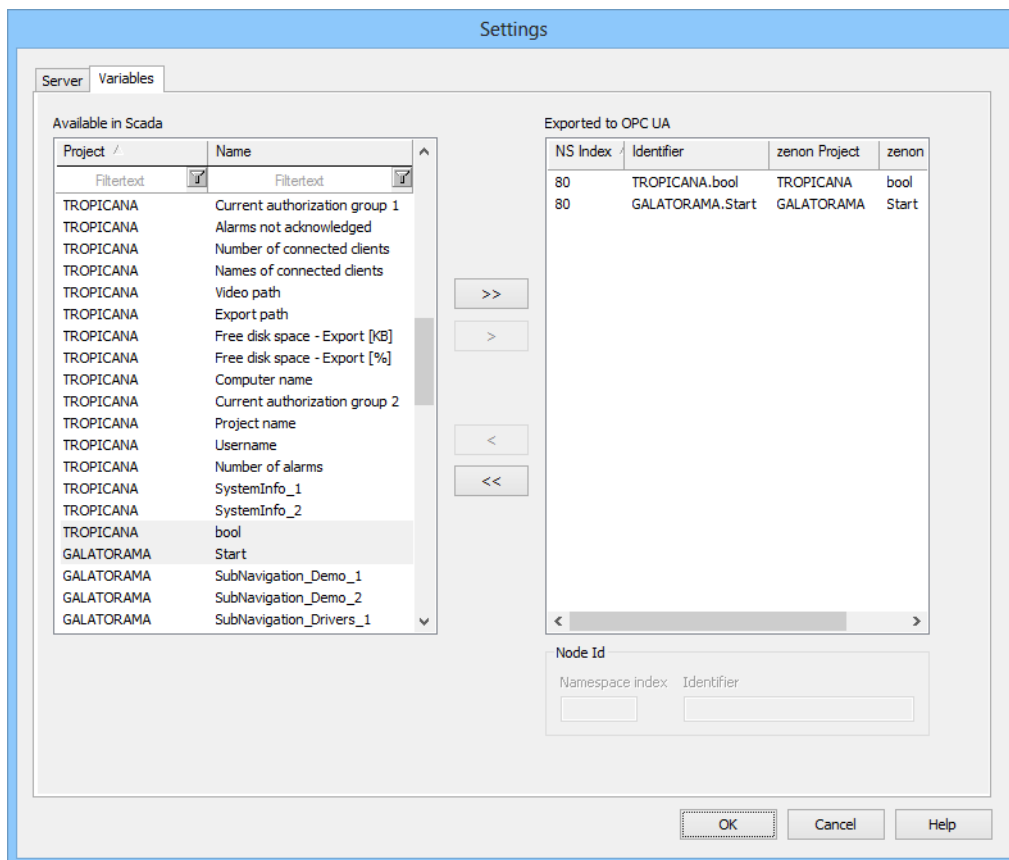
## Attention

Variables that do not have the *Setting values active* property set in the Editor cannot be written to by an OPC UA client.

## DEFINING VARIABLES

If no variables are defined in the OPC UA server configuration, then all variables from the zenon project are added to the OPC UA address space. All variables (including system variables) are visible for the clients. In doing so, each variable is given its own node with an automatically-issued numerical **identifier** and **namespace index 80**.

with manual configuration (at least one configured variable), the values defined by the user are used. The **namespace index 80** and a **string identifier** with the variable names are also entered as standard.



Parameters	Description
<b>Available in Scada</b>	List of existing variables.
<b>Filter</b>	<p>The existing variables can be displayed as filtered according to:</p> <ul style="list-style-type: none"> <li>▶ Project</li> <li>▶ Name</li> </ul> <p>The placeholders (* or ?) are permitted for the filter text.</p>
<b>Exported to OPC UA</b>	<p>List of exported variables.</p> <p>The variables can be sorted according to:</p> <ul style="list-style-type: none"> <li>▶ NS index</li> <li>▶ Identifier</li> <li>▶ Project</li> <li>▶ zenon name</li> </ul>
<b>Node Id</b>	
<b>Namespace index</b>	<p>Defines the namespace index in the <b>node ID</b> for the selected OPC UA variable.</p> <p>The value:</p> <ul style="list-style-type: none"> <li>▶ must not be empty</li> <li>▶ must be numerical</li> <li>▶ must be greater than 0</li> </ul>
<b>Identifier</b>	<p>Defines the identifier in the <b>node ID</b> for the selected OPC UA variable.</p> <ul style="list-style-type: none"> <li>▶ A numerical identifier is automatically created with numerical input.</li> <li>▶ If a GUID is entered, a GUID identified is created, otherwise the identifier is treated as a string. GUID-Form: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxxx)</li> </ul> <p>The field must not be empty.</p>

To export variables to OPC UA:

1. Select the desired variables in **Available in zenon** (multiple selection is possible)
2. Click on the arrow direction **Exported to OPC UA**

To export all variables, click on the double arrow

The zenon variable name is used as **browser name** and **display name**.





### Information

For zenon variables with a slash (/) in the names, the / is replaced by a dot (.). The parts of the name separated by a slash are saved in their own subfolders.

*Example:* The zenon variable "**Static/Scalar/Int32**" is divided into:

- ▶ An OPC UA variable "**Int32**"
- ▶ A folder called "**Scalar**",
- ▶ which is a subfolder of the "**Static**" folder

*This works with all data types, multi-dimensional arrays, umlauts in names and slashes at the end.*

## 12.3 Start:

When started, the process gateway loads the configured driver.

The driver tries to read the active configuration from the given INI file. If this is not possible, an error message will be given and the configuration dialog (on page 145) will be opened for you. If the configuration is not confirmed with OK, the process gateway is closed.



### Attention

*If the application is started as invisible, there is also no configuration dialog displayed. If the configuration is invalid or not present, the process gateway is automatically closed.*

## 12.4 Connection

The OPC UA process gateway only supports the OPC UA TCP binary protocol and does not contain a discovery server. The client must also connect directly to the server. The connection address corresponds to the scheme: `opc.tcp://hostname.of.server:port`

The connection can be secured (on page 154).

## 12.5 Security

The module uses the security procedures that correspond to OPC UA (signing and encrypting messages) as defined in the standard. Certificates can be checked or all accepted, depending on the setting (on page 145).

### SECURE CONNECTIONS

If the **Accept secure connections only** (on page 146) option is activated, then the server only accepts connections that use either `sign` or `sign & encrypt` as a **security mode**. Furthermore, `Basic128Rsa15` or `Basic256` must be used by the client as a **Security Policy**. If this option is deactivated, any desired combination of **security mode** and **security policy** is accepted.

### USER ADMINISTRATION

If user administration is activated in the zenon project and at least one user is created, the option **use zenon user authentication** (on page 146) is available. If it is activated, only clients that send a valid user/password combination have access to the data on the OPC UA server. If it is inactive, no check is carried out and both anonymous and all user/password combinations are accepted.

## 12.6 Alarms and states

The OPC UA Process Gateway supports the zenon information model for alarms and states. It is activated as soon as a variable has at least a limit value.

From the time of activation, a linked client can be informed about limit values of a variable being exceeded. It is also in a position to confirm the alarm, as in zenon Runtime.

The OPC weighting, as defined in the standard, is shown on the index of the alarm/event classes linked to the limit value. The index of an alarm/event class is automatically incremented by the zenon Editor with each new alarm/event class and can be checked in the properties. Up to 20 classes with the following allocation are supported:

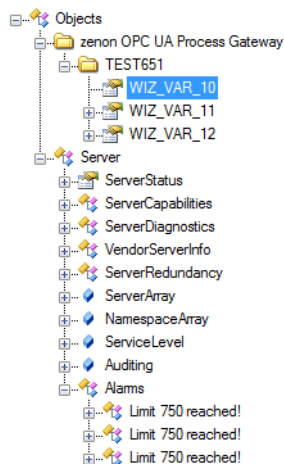
OPC UA range	zenon alarm/event class	OPC weighting
HIGH	20	1000
	19	950
	18	900
	17	850

MEDIUM HIGH	16	800
	15	750
	14	700
	13	650
MEDIUM	12	600
	11	550
	10	500
	9	450
MEDIUM LOW	8	400
	7	350
	6	300
	5	250
LOW	4	200
	3	150
	2	100
	1	50

If a variable with no alarm class is linked, the lowest possible classification 1 (LOW) is used.

## ILLUSTRATION ZENON ALARM AS OBJECT

zenon variables and related alarms are illustrated in the OPC UA server as objects.



The screenshot displays the inclusion of the zenon project (**TEST651**) and the zenon variables (**WIZ\_VAR\_10**, **WIZ\_VAR\_11**, **WIZ\_VAR\_12**) as objects in the upper area. This includes the alarms when the limits set up have been reached (**Limit 750 reached!** etc).

## **LOGGING**

The driver supports a comprehensive logging function via the diagnosis viewer.

## 12.7 Service Sets

Service Set	Is supported
<b>Discovery Service Set</b>	
FindServers	yes
GetEndpoints	yes
RegisterServer	No
<b>SecureChannel Service Set</b>	
OpenSecureChannel	no
CloseSecureChannel	no
<b>Session Service Set</b>	
CreateSession	yes
ActivateSession	yes
CloseSession	yes
Cancel	no
<b>NodeManagement Service Set</b>	
AddNodes	no
AddReferences	no
DeleteNodes	no
DeleteReferences	no
<b>View Service Set</b>	
Browse	yes
BrowseNext	no
TranslateBrowsePathsToNodeIds	yes
RegisterNodes	no
UnregisterNodes	no
<b>Query Service Set</b>	
QueryFirst	no
QueryNext	no
<b>Attribute Service Set</b>	
Read	yes
HistoryRead	yes

Write	yes
HistoryUpdate	no
<b>Method Service Set</b>	
Call	yes
<b>MonitoredItem Service Set</b>	
CreateMonitoredItems	yes
ModifyMonitoredItems	yes
SetMonitoringMode	yes
SetTriggering	no
DeleteMonitoredItems	yes
<b>Subscription Service Set</b>	
CreateSubscription	yes
ModifySubscription	yes
SetPublishingMode	yes
Publish	yes
Republish	yes
TransferSubscriptions	no
DeleteSubscriptions	yes

## 12.8 Error message

Error messages in the log file:

Error message	Debug Level	Description
Failed to validate client certificate	Error	<p>The client certificate could not be validated.</p> <p>It is either invalid (the date of validity may have been overwritten) or it was not found in the list of known client certificates.</p> <p>Additional information including an error number describes the error in more detail.</p>
Wrong user/password supplied while trying to activate session (User: %s)	Error	User authentication failed. The name for the user to be authenticated is displayed.
Login of user '%s' succeeded.	Deep Debug:	User authentication successful.
Variable '%s' could not be added to OPC UA address space, because node '%s' with the same node identifier already exists	Error	A variable defined by the user could not be created, because another variable with the same identifier already exists.
Failed to initialize server architecture: An internal error occurred as a result of a programming or configuration error. (0x80020000)	Error	A certificate file, private key file or certificate revocation list file is not in the correct format.

## 13. SNMP agent

### 13.1 SNMP architecture

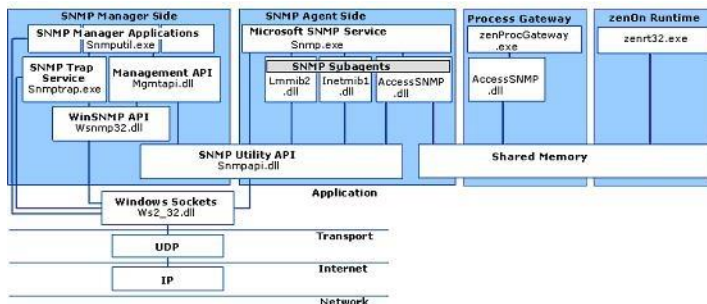
The Windows SNMP agent supports SNMP version 2 (SNMPv2c). It also supports the SNMP functions (GET, GETNEXT, GETBULK, SET, TRAP).

More details about Microsoft's implementation of the SNMP can be found on the Microsoft TechNet Website: "How SNMP Works"

<http://technet2.microsoft.com/windowsserver/en/library/bf555774-2d63-4e96-b432-c4b7bcac6b531033.mspx>

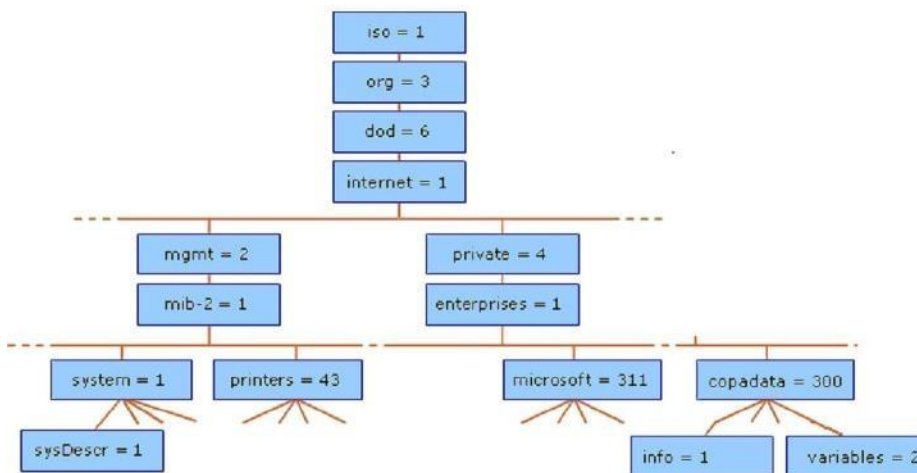
(<http://technet2.microsoft.com/windowsserver/en/library/bf555774-2d63-4e96-b432-c4b7bcac6b531033.mspx>)

## WINDOWS OPERATING SYSTEM COMPONENTS WITH A CONNECTION TO THE PROCESS GATEWAY AND THE RUNTIME:



## 13.2 Management Information Base (MIB)

The Management Information Base (MIB) is organized in the form of a tree structure, in which the SNMP agent provides the variables = (OID – Object Identifier). See below: the MIB structure, with additional variables provided via the Process Gateway.





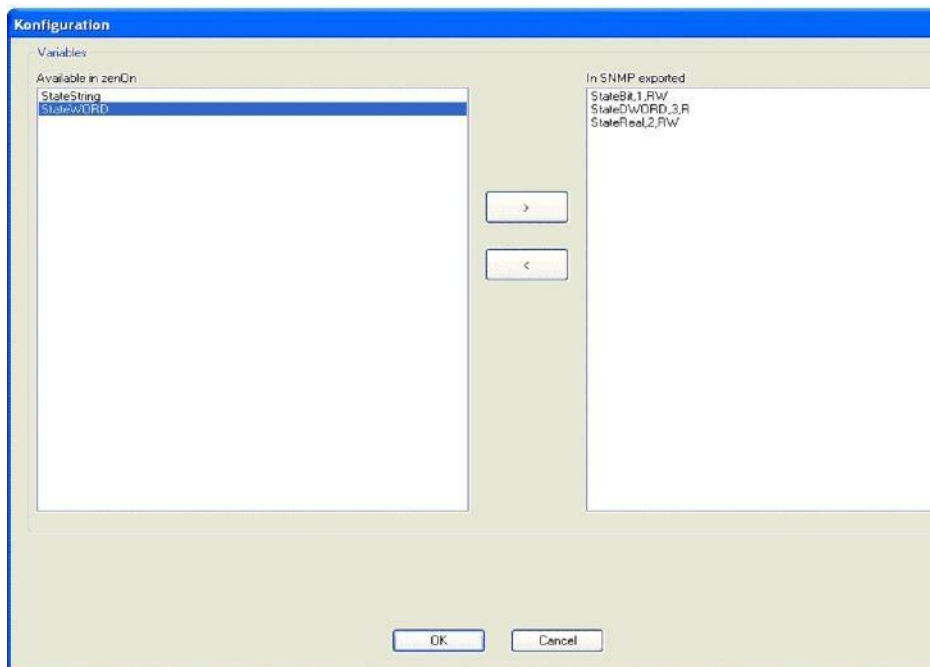
### 13.3 MIB structure

Info block structure is always present				
OID	Description	Data type	Access	Change is sent as Trap
1.3.6.1.4.1.300.1.1.0	copadata.info.statusinfo, Runtime is (Online, Offline)	string	read	yes
1.3.6.1.4.1.300.1.2.0	copadata.info.statusval, Runtime is 1=Online 0=Offline	integer	read	yes
1.3.6.1.4.1.300.1.3.0	copadata.info.watchdog	integer	read	no
1.3.6.1.4.1.300.1.4.0	copadata.info.project, name of project which the Process Gateway reads variables from	string	read	no

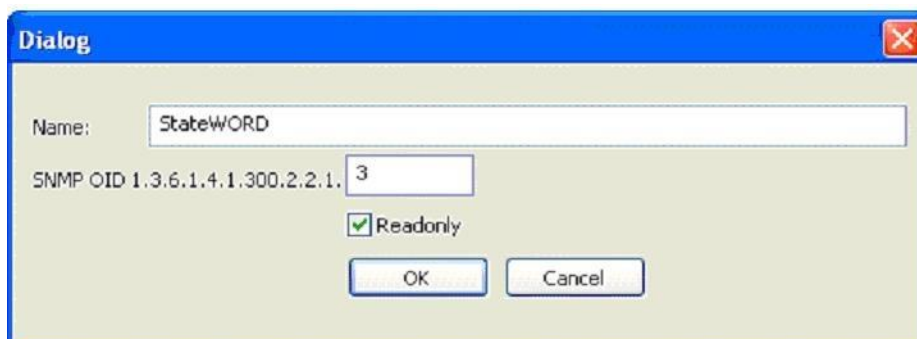
Variable structure (table) is dynamically adjusted, according to the configuration of the Process Gateway				
OID	Description	Data type	Access	Change is sent as Trap
1.3.6.1.4.1.300.2.1.0	copadata.variables.ifNumber, number of configured variables=OID	integer	read	yes
1.3.6.1.4.1.300.2.2.1.X	copadata.variables.ifTables.ifIndex, configured OID index from the Process Gateway configuration	integer	read	no
1.3.6.1.4.1.300.2.2.2.X	copadata.variables.ifTables.ifName, variable name	string	read	no
1.3.6.1.4.1.300.2.2.3.X	copadata.variables.ifTables.ifValue, variable value as Integer. All numerical data types are formatted to an SNMP Integer data type. ATTENTION: the decimal places of REAL and DOUBLE are lost.	integer	according to configuration in Process Gateway	no
1.3.6.1.4.1.300.2.2.4.X	copadata.variables.ifTables.ifValueAs String, variable value as String. All numerical data types are formatted to an SNMP String data type.	string	according to configuration in Process Gateway	yes
1.3.6.1.4.1.300.2.2.5.X	copadata.variables.ifTables.ifStatus, variable status value	integer	read	yes
1.3.6.1.4.1.300.2.2.6.X	copadata.variables.ifTables.ifTimestamp, variable time stamp	integer	read	yes

## 13.4 Module configuration

The following dialog appears after the **Settings** button is clicked:



Here the variables that should be connected can be selected. On the left-hand side all variables which are available in zenon are displayed. You can select them there and move them to the SNMP export list with the button >. You can remove them from the export list with the button "<". If you move a variable to the export list, a dialog for the name assignment of the zenon variable to an OID address in the SNMP structure appears:



The variables selected in this way are then available on the SNMP server and are continuously synchronized between zenon and the SNMP OID structure. For every OID address you can define whether it can be write-accessed via SNMP SET. The exact structure of every OID address is described in the chapter "MIB structure".

## 13.5 Configuration file: specific entries for Access SNMP

The configuration file must be in the system folder.

Parameters	Description
[SNMP]	
REFRESHRATE	Update time in milliseconds

Parameters	Description
[VARIABLES]	
COUNT	number of variables to be exported
NAME_n	name of the variable with the number n ( $0 \leq n < \text{COUNT}$ )
PARAM_n	Parameter SNMP OID table offset and the information R=read only / RW=read and write with the number n ( $0 \leq n < \text{COUNT}$ )

### EXPORT OF VARIABLES

For the successful export the project name in `zenProcgateway.ini` in folder `%CD_SYSTEM%` must be entered correctly. Enter it here:

```
[DEFAULT]
PROJECT=
```

Attention: If the entry is wrong or missing the gateway is closed without any error messages. Thus the variable is not available.

## 13.6 Configuration of the Windows SNMP agent

To make sure that the Windows SNMP Agent (`SNMP.exe`) provides the zenon MIB partial structure, the Process Gateway file `AccessSNMP.dll` in the registry must be configured accordingly:

1. Installation of the Windows SNMP service via the control panel:
  - Via module: Programs and functions - >Activate or deactivate Windows functions.

Note: With Windows 8, the computer must be restarted once the SNMP service has been added.
2. Installation of Process Gateway with the file `AccessSNMP.dll` in the folder  
`%Program Files (x86)%\COPA-DATA\zenon 7.20`
3. Add the following keys and character strings using the registry editor. The paths and content are sometimes different for 32-bit systems and 64-bit systems:

32-Bit:

- [HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\SNMP\Parameters\ExtensionAgents]  
Name=ProcessGateway  
Value=SOFTWARE\COPA-DATA\SNMP\CurrentVersion
- [HKEY\_LOCAL\_MACHINE\SOFTWARE\COPA-DATA\SNMP\CurrentVersion]  
Name=Pathname  
Wert=C:\Program Files\COPA-DATA\zenon 7.20\AccessSNMP.dll

64-Bit:

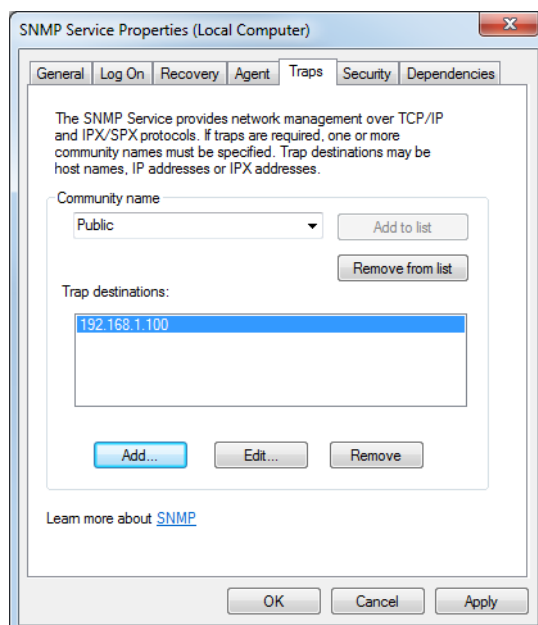
- [HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\SNMP\Parameters\ExtensionAgents]  
Name=ProcessGateway  
Value=SOFTWARE\COPA-DATA\SNMP\CurrentVersion
- [HKEY\_LOCAL\_MACHINE\SOFTWARE\Wow6432Node\COPA-DATA\SNMP\CurrentVersion]  
Name=Pathname  
Value=C:\Program Files (x86)\COPA-DATA\zenon 7.20\AccessSNMP.dll

## 4. Start the SNMP service.

This loads the process gateway file AccessSNMP.dll via the registry configuration.

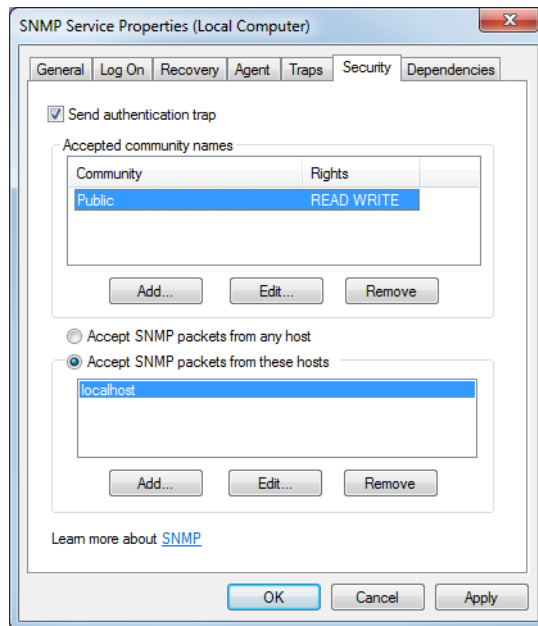
Further configuration settings for the Windows SNMP service: Control panel ->

Administration-> Services-> SNMP service-> Properties

a) **Traps:** tab Defines the IP address in the network to which traps are sent:

- **Communityname:** Must be identical on manager and agent
- **Trap destinations:** Addresses of the destinations as host names, IP addresses or IPX addresses

a) **Security:** tab Defines the rights with which an SNMP client can access the SNMP agent:



- **Rights:** Must be set to "READ WRITE"
- **Community:** Must be identical on manager and agent

## 14. SQL

### 14.1 Module configuration

The configuration of the database connection consists of two parts.

1. OLE-DB connection: This OLE-DB connection can be defined in the configuration dialog using the selection button for the connect string. Then the standard dialog for data connection properties is opened.
2. Additionally the name of the table can be defined, if the standard name ONLINE\_VALUES should not be used.  
This can be set with the **TABLE** entry in the **[DATABASE]** section of the configuration file (`zenProcGateway.ini`). The settings are taken over by the add-on when starting it.



### Attention

*If table names are defined manually in the configuration file (zenProcGateway.ini), these table names must also be amended or created in the database by hand.*

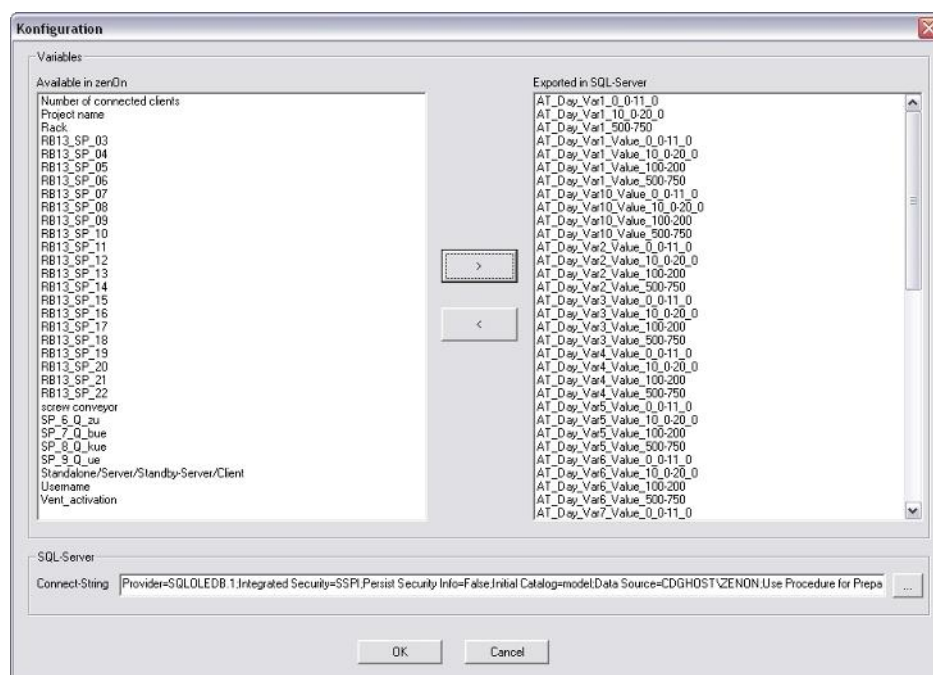
## ORACLE DATABASES

Use of the Process Gateway and `AccessSQL.dll` in conjunction with Oracle databases can cause errors: It is possible, with some ODBC drivers, that no online values are written to the database. The advanced ODBC logging then issues the error message "1843".


The problem can be solved by changing the ODBC driver. For example, the ODBC driver 9.02.00.05 for Oracle 9.2 works.

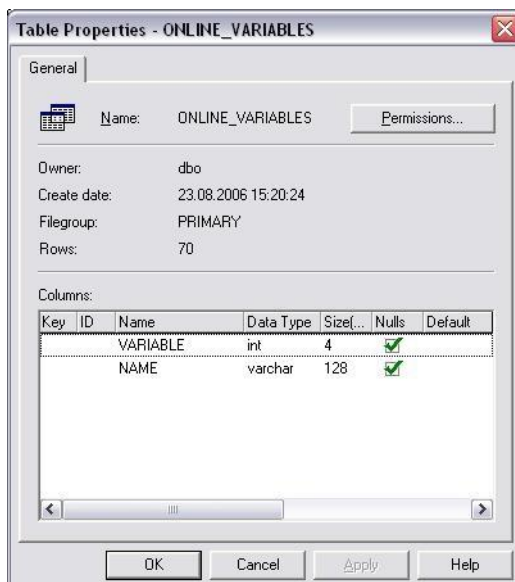
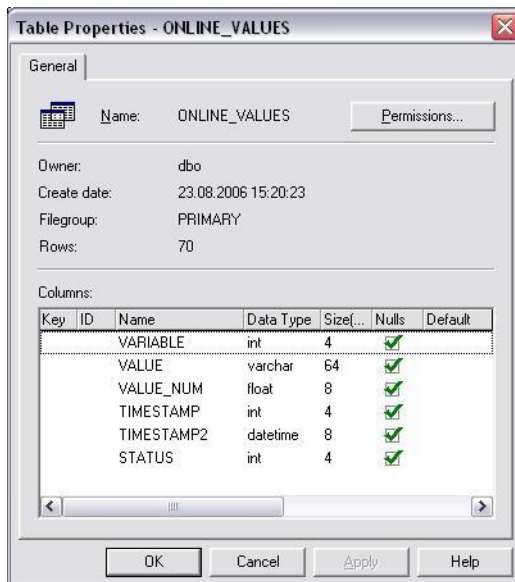
## 14.2 Variable selection

In the configuration dialog the zenon variables that should be written to the SQL process image can be defined. In order to do this the variables available in the zenon project - listed in the left part - have to be added to the image - listed in the right part.



## 14.3 Creating tables

After closing the configuration dialog with , the table structure of the SQL database is automatically generated. For the case, that it is created by hand:



## 14.4 Operation in a redundant system

In redundant operation two alternatives are available. In the first way the SQL database runs locally on both servers and the Process Gateway also runs on both servers. As only online values are handled no



further alignment between the databases is necessary. The big disadvantage of this version is the high network load that is a result from the additional reading of online values on the Standby Server.

In the second version the Process Gateway only runs on the Runtime server and writes data to a local or a remote SQL database. In this alternative no additional network load between the Runtime Server and the Standby Server occurs and in the case of the remote SQL database the Server is not strained by external requests to that database.

## 14.5 Configuration file: specific entries for AccessSQL

The configuration file must be in the system folder.

Parameters	Description
[DATABASE]	
INITSTRING	OLE-DB connect-string to the SQL database
TABLE_ONL	name of the table that receives the process image
TABLE_VAR	name of the table that receives the variable IDs
REFRESHRATE	maximum refresh rate in milliseconds

Parameters	Description
[VARIABLES]	
COUNT	number of variables to be exported
NAME_n	name of variable number n (0

## 14.6 Table format

### 14.6.1 Table for process image

<b>VARIABLE</b>	int[4]	ID of the zenon variable
<b>VALUE</b>	varchar[64]	current value as string
<b>VALUE_NUM</b>	float	current value as float
<b>TIMESTAMP</b>	int[4]	time stamp of the current value (as UNIX time)
<b>TIMESTAMP 2</b>	datetime	time stamp of the current value (as datetime)
<b>STATUS</b>	int[4]	status word of the current value

### 14.6.2 Table for variable IDs

<b>VARIABLE</b>	int[4]	ID of the zenon variable
<b>NAME</b>	varchar[128]	name of the control system variable