COPADATA
do it your way

zenon manuale

Process Gateway

v.7.50

Indice

1. Benvenuti nell'help COPA-DATA

GUIDA GENERALE

Nel caso in cui non abbiate trovato le informazioni che cercavate o se avete dei consigli relativi al completamento di questo capitolo dell'help, potete scrivere una Mail all'indirizzo documentation@copadata.com (mailto:documentation@copadata.com).

SUPPORTO ALLA PROGETTAZIONE

Se avete delle domande riguardo progetti concreti, potete rivolgervi via E-Mail all'indirizzo support@copadata.com (mailto:support@copadata.com).

LICENZE E MODULI

Nel caso in cui doveste constatare di avere bisogno di altri moduli o licenze, potete rivolgervi ai nostri collaboratori all'indirizzo 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.

Informazioni sulla licenza

Nell´Editor e nel Runtime (standalone, server, standby e client) è necessaria una licenza.

Informazioni su

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

In the Process Gateway, the respective assignment is carried out using the variable name.

This is important if:

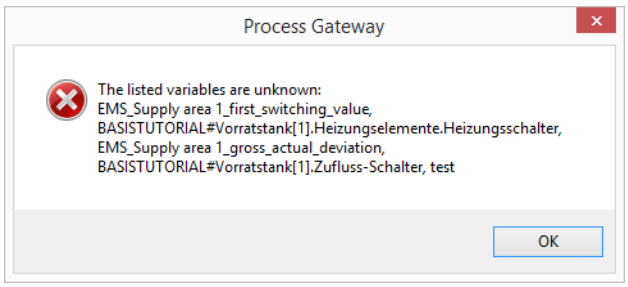
- Variable names in the project configuration are changed in zenon Editor.
- Variables in the project configuration in the Editor are deleted.
- zenon calls up a new start project.

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

Attenzione

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.

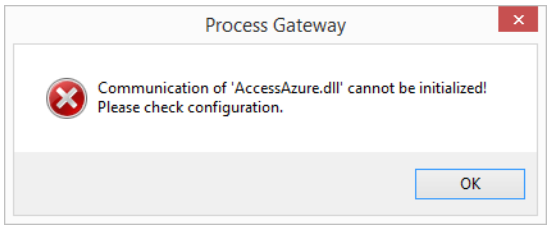
The first error dialog lists the unknown variables.



- 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.

Informazioni su

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 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
AccessDEC.dll	Slave for DEC	Hundamp;S-DEC-System
AccessDNP3.dll	Slave for DNP3	DNP3 master
AccessICCP.dll	ICCP/TASE.2 protocol	ICCP Server
AccessIEC870SI.dll	Slave for IEC 60870-5-01/104	IEC 60870 master
AccessMODBUS.dll	Slave for Modbus	Modbus master
AccessOPCUA.dll	OPC US Server	OPC UA client
AccessSNMP.dll	SNMP agent	SNMP client
AccessSQL.dll	SQL Online-Interface	SQL databases
AccessAzure.dll	MS Windows Azure	Microsoft Azure

Note: The module to be started is selected and configured in its own INI file (A pagina: 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`.

Attenzione

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 (A pagina: 171).

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
IEC870Sl	[GENERAL] DLL=AccessIEC870Sl.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.

Esempio

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

5.1 zenProcGateway.ini

[GENERAL]

Inserimento	Descrizione
[GENERAL]	Impostazioni generali per il Process Gateway, indipendentemente dal modulo prescelto.
DLL=	Selezione del file DLL da usare per il Process Gateway. Il file DLL selezionato determina la scelta del modulo. ▶ **AccessDEC.dll** ▶ **AccessSQL.dll** ▶ **AccessMODBUS.dll** ▶ **AccessDNP3.dll** ▶ **AccessIEC870SI.dll** ▶ **AccessSNMP.dll** ▶ **AccessOPCUA.dll** ▶ **AccessICCP.dll** ▶ **AccessAzure.dll**

5.2 Configuration Process Gateway

To configure Process Gateway:

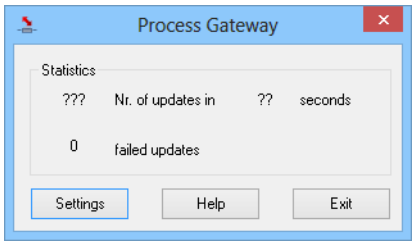
CREATE AN INI FILE (OPTIONAL):

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
```

Per motivi che hanno a che fare con il sistema, solamene ANSI e Unicode sono supportati per la lettura dei file INI.

> **Attenzione**
>
> Il formato di salvataggio UTF-8 non viene supportato!
>
> Perciò salvate sempre i vostri file INI come file di testo in formato ANSI o Unicode.

CONFIGURATION



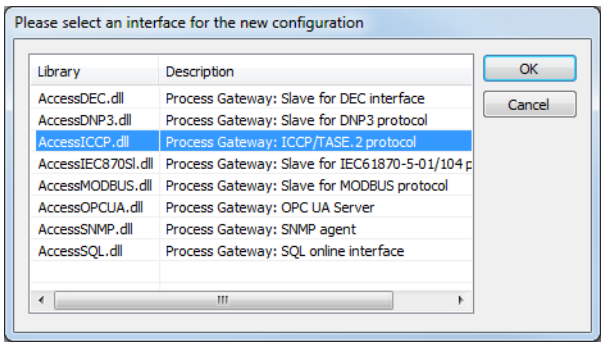
Start the Process Gateway:

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.

> **Informazioni su**
>
> 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 **OK** 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 (A pagina: 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.

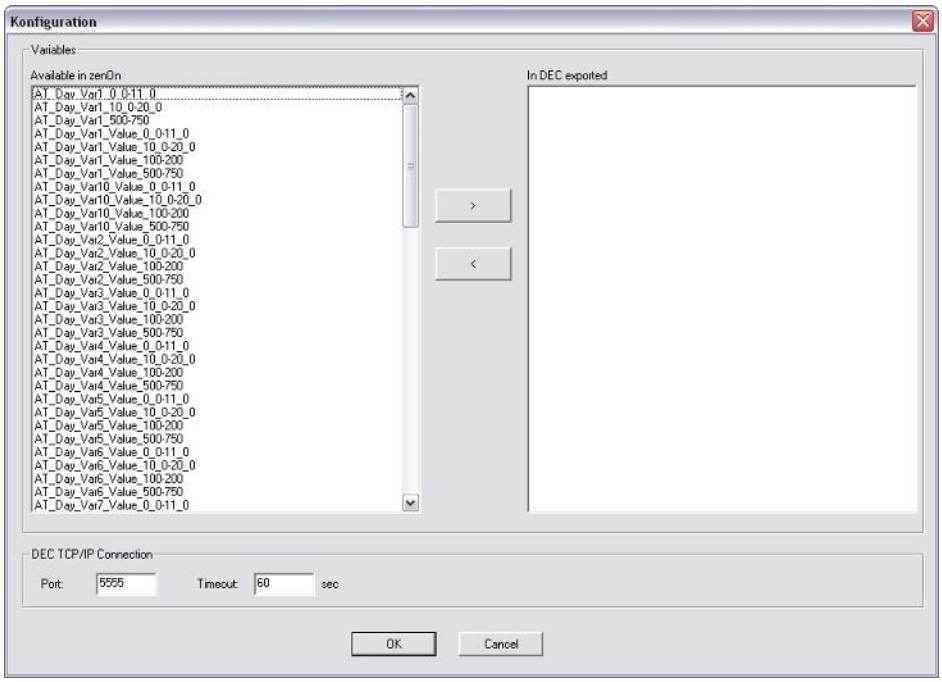
5.2.3 Security configuration

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.

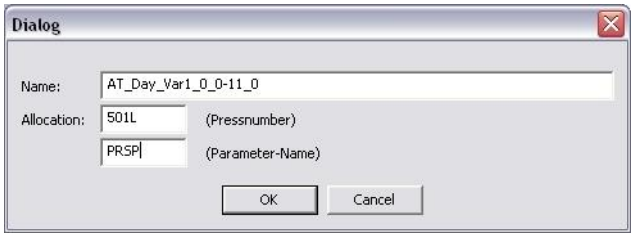
6. DEC

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.

Nota: Il file di configurazione deve trovarsi nella cartella di sistema.

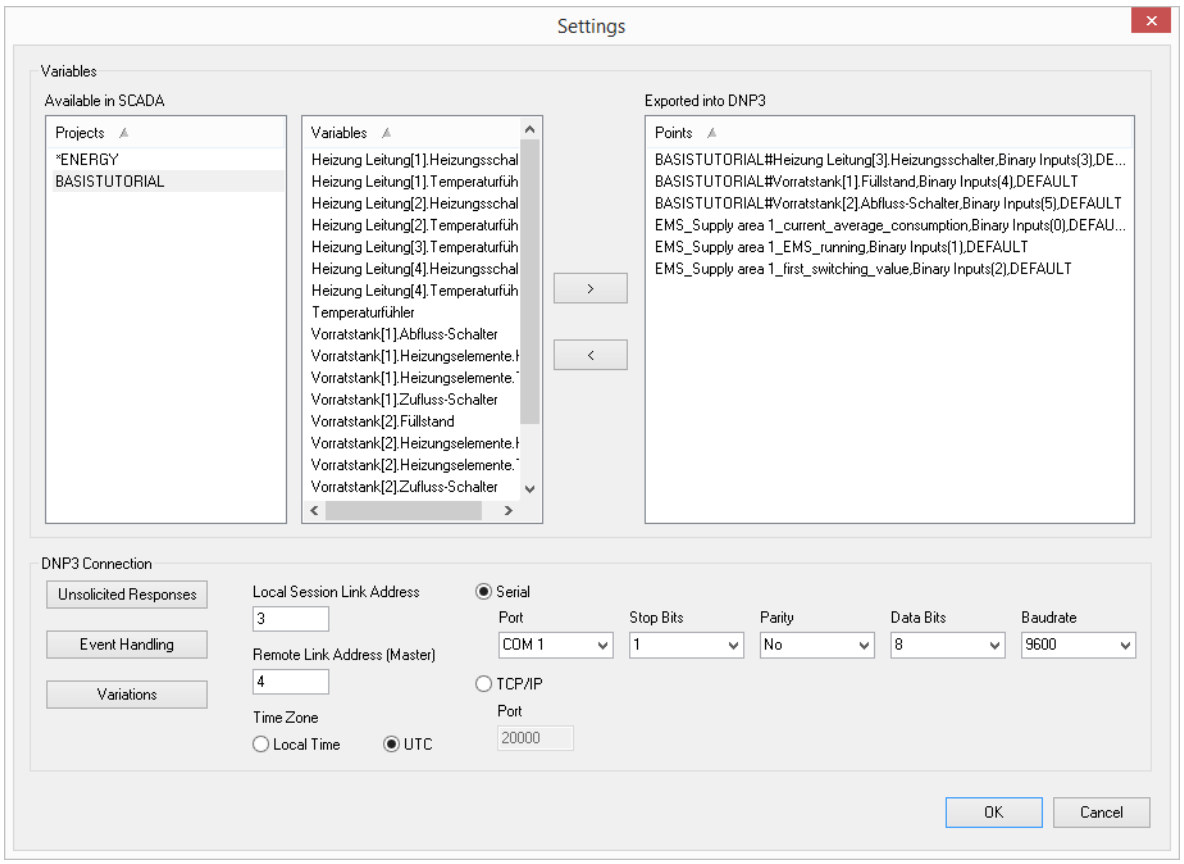
[DEC]

Inserimento	Descrizione
LOGFILE	Nome del file Log (se lo si desidera, per es. zenProcGateway.log)
PORT	Numero di porta dove il Process Gateway attende tentativi di connessione.
TCPTIMEOUT	Intervallo di timeout alla cui scadenza viene interrotta la connessione
REFRESHRATE	Intervallo in millisecondi in cui il sistema verifica se ci sono modifiche dell'immagine di processo di zenon.

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

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
Unsolicited Responses	Button for the configuration of responses that that are not requested (Unsolicited Responses), which the Process Gateway sends to the DNP3 master. Attention: The DNP3-Master can also request Unsolicited Responses from the Process Gateway. However to do this, the functionality must be activated in the Process Gateway. The number of events and the maximum time delay can be configured for each event class. Timeout and Retry are given for all event classes together. Clicking on the button opens the configuration dialog. Note: Entries are remanent.
Event Handling	Button for the configuration of event handling Clicking on the button opens the configuration dialog.
Variations	Button for the configuration of the Variations per object group. Clicking on the button opens the configuration dialog.
Local Session Link Adress	Link address of the slave. Default: 3 Note: Only one active session is supported, regardless of whether serial or TCP/IP communication is used.
Remote Link Address (Master)	Link address of the master. Default: 4 Note: Only one active session is supported, regardless of whether serial or TCP/IP communication is used.
Time Zone	Button to select the time format: ▶ Local Time ▶ UTC

SERIAL

Serial	Configurations of the serial interface for communication on the DNP3 slave
Port	Drop-down list for the configuration of the

	communication interface: Value range: `COM 1 to COM 64` Default: `COM 1` Note: Only active if **Serial** is activated as the communication method.
Stop Bits	Drop-down list for the configuration of the number of stopbits transferred: ▶ `1` ▶ `1.5` ▶ `2` Default: `1` Note: Only active if **Serial** is activated as the communication method.
Parity	Drop-down list for the configuration of the parity: ▶ `No` ▶ `Odd` ▶ `Even` Default: `No (= no parity)` Note: Only active if **Serial** is activated as the communication method.
Data Bits	Drop-down list for the configuration of the number of data bits transferred: ▶ `5` ▶ `6` ▶ `7` ▶ `8` Default: `8` Note: Only active if **Serial** is activated as the communication method.
Baudrate	Drop-down list to select the Baud rate for serial interface communication. Selection options: `110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200, 128000, 256000` Default: `9600` Note: Only active if **Serial** is activated as the communication method.

TCP/IP

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

CLOSE DIALOG

OK	Accetta le impostazioni e chiude il dialogo.
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

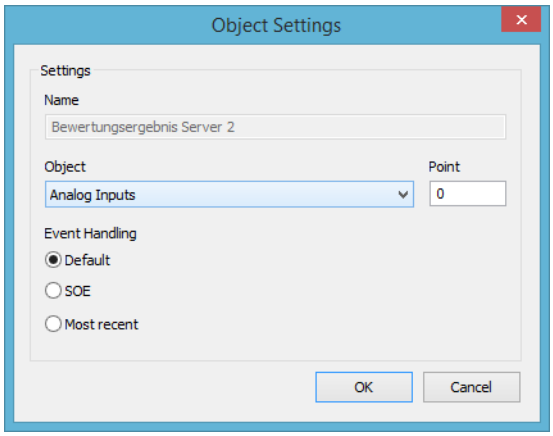
7.1.1 Naming of the variables for DNP3 in the Process Gateway.

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 (A pagina: 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 (A pagina: 18), in the **Available in SCADA** group, in the **Projects** .
- Variable name
  As configured in zenon.
- Object type
  As configured in the Object Settings (A pagina: 24) dialog.
- Point index
  As configured in the Object Settings (A pagina: 24) dialog.
- Event handling
  As configured in the Object Settings (A pagina: 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
Name	Name of the variable for which the configurations can be carried out. Note: For information only and grayed out, because it cannot be changed.
Object	Drop-down list to select the driver data type to the driver ▶ `Analog inputs` ▶ `Analog Output Status` (written value is mirrored as a response after successful writing) ▶ `Binary inputs` ▶ `Binary Output Status` ▶ `Running Counters` ▶ `String Data` Default: `Binary inputs`
Event Handling	Denotes which events can be processed: ▶ `Default` Events are handled as defined in the object group. For this, please note the configuration in the event handling (A pagina: 30) dialog. ▶ `SOE` Events are treated as a `Serie of Events`). ▶ `Most recent` Only the last change of a binary change event is retained. Note: Inactive if the data type is `string data`. Default: `Default`
Point	**Pointindex** for the event. Default: `0` Note: 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.

CLOSE DIALOG

OK	Accetta le impostazioni e chiude il dialogo.

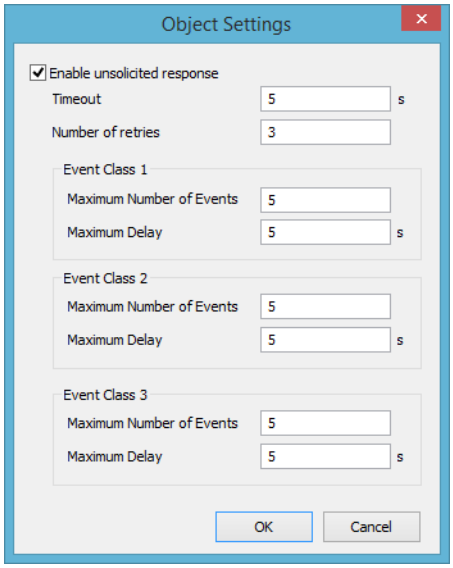
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo. Note: The variable is in this case not available on the DNP3 slave.

Informazioni su

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:



Parameters	Description
Enable unsolicited response	Check box to activate the use of **Unsollicited responses**. If this check box is not activated, no **unsolicited responses** are generated. Default: `Inactive` Note: If this property is not active, all of the following entries are grayed out. Attention: If this option is not active, no **unsolicited responses** are sent to the master. Even if these are requested by the master.
Timeout	Time in seconds for communication to the master. A time exceedance is triggered once this time has expired. Input range: `1 to 60 s` Default: `5 s` Note: This setting depends on the type and speed of its communication to the master. In principle, the slower the communication, the higher the **Timeout** time.
Number of retries	Number of retries for communication to the master. Input range: `0 - 65535` (`0` = an infinite amount of attempts) Default: `3` Example: If an **unsolicited response** 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 **Number of retries**. A new **unsolicited response** is then created.

EVENT CLASS 1

Maximum Number of Events	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: `0 - 255` Default: `5`
Maximum Delay	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una `unsolicited response`. Valori possibili: `0 - 65535 secondi` (`0` = nessun ritardo, cioè al cambio di valore).

	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

Maximum Number of Events	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: 0 – 255 Default: 5
Maximum Delay	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una unsolicited response. Valori possibili: 0 – 65535 secondi (0 = nessun ritardo, cioè al cambio di valore). Default: 5

EVENT CLASS 3

Maximum Number of Events	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: 0 – 255 Default: 5
Maximum Delay	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una unsolicited response. Valori possibili: 0 – 65535 secondi (0 = nessun ritardo, cioè al cambio di valore). Default: 5

CLOSE DIALOG

OK	Accetta le impostazioni e chiude il dialogo.

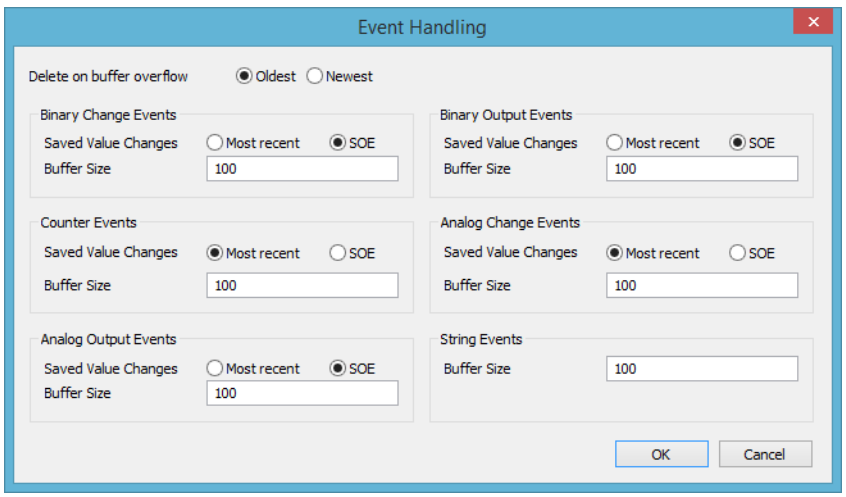
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

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



Parameters	Description
Delete on buffer overflow	Global setting for which event is deleted when the buffer is full: ▸ `Oldest` Oldest entries are deleted. ▸ `Newest` Most recent entries are deleted. Default: `Oldest`

BINARY CHANGE EVENTS

Parameters	Description
Buffer Size	Setting for buffer size for the respective event group. Input range: `1 - 65535` Default: `100`

BINARY OUTPUT EVENTS

Parameters	Description
Buffer Size	Setting for buffer size for the respective event group. Input range: `1 - 65535` Default: `100`

ANALOG CHANGE EVENTS

Parameters	Description
Buffer Size	Setting for buffer size for the respective event group. Input range: `1 - 65535` Default: `100`

ANALOG OUTPUT EVENTS

Parameters	Description

Buffer Size	Setting for buffer size for the respective event group. Input range: 1 – 65535 Default: 100

COUNTER EVENTS

Parameters	Description
Buffer Size	Setting for buffer size for the respective event group. Input range: 1 – 65535 Default: 100

STRING EVENTS

Parameters	Description
Buffer Size	Setting for buffer size for the respective event group. Input range: 1 – 65535 Default: 100

CHIUDI FINESTRA DI DIALOGO

Parametri	Descrizione
Ok	Accetta le impostazioni e chiude il dialogo.
Elimina	Annulla tutte le modifiche e chiude la finestra di dialogo.

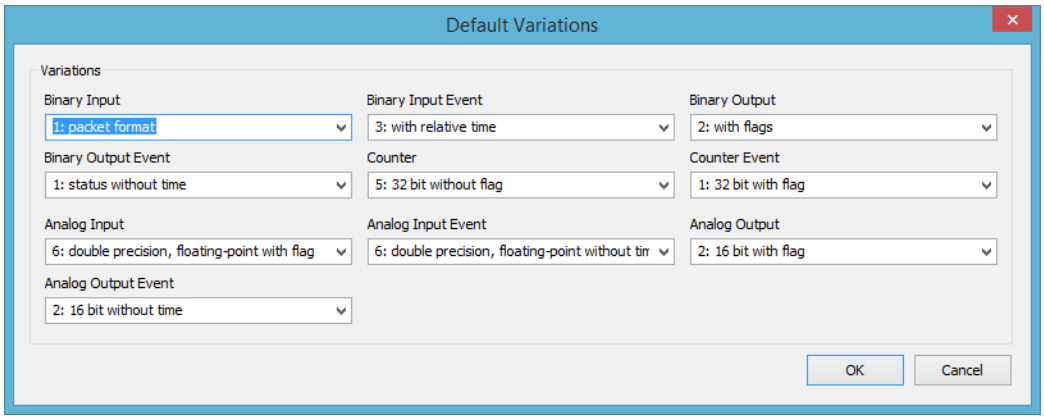
7.1.5 Variations per object group - variations

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:



Parameters	Description

Binary Input	Menù a tendina con le Variations supportate per il gruppo oggetti. Binary Input:
	`1: packet format`
	`2: with flags`
	Default: `1: packet format`

Binary Input Event	Menù a tendina con le Variations supportate per il gruppo oggetti. Binary Input Event:
	`1: without time`
	`2: with absolute time`
	`3: with relative time`
	Default: `3: with relative time`

Binary Output	Menù a tendina con le Variations supportate per il gruppo oggetti. Binary Output:
	`1: packet format`
	`2: with flags`
	Default: `1: with flags`

Binary Output Event	Menù a tendina con le Variations supportate per il gruppo oggetti. Binary Output Event:
	`1: status without time`
	`2: status with time`
	Default: `1: status without time`

Counter	Menù a tendina con le Variations supportate per il gruppo oggetti. Counter:
	`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`

Counter Event	Menù a tendina con le Variations supportate per il gruppo oggetti. Counter Event:
	`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`

Analog Input	Menù a tendina con le Variations supportate per il gruppo oggetti. Analog Input: 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
Analog Input Event	Menù a tendina con le Variations supportate per il gruppo oggetti. Analog Input Event: 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
Analog Output	Menù a tendina con le Variations supportate per il gruppo oggetti. Binary Input: 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
Analog Output Event	Menù a tendina con le Variations supportate per il gruppo oggetti. Analog Output Event: 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

CHIUDI FINESTRA DI DIALOGO

Parametri	Descrizione
Ok	Accetta le impostazioni e chiude il dialogo.
Elimina	Annulla tutte le modifiche e chiude la finestra di dialogo.

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 vales (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]

Inserimento	Descrizione
SERIAL=	comunicazione seriale (1) o comunicazione via TCP/IP (0)
COMPORT=	interfaccia seriale (COM1 = 0, COM2 = 1,...)
BAUD=	Baud rate dell'interfaccia seriale.
BYTESIZE=	Quantità dei bit di dato dell'interfaccia seriale.
PARITY=	Impostazioni di parità dell´interfaccia seriale (0=nessuna,1=dispari,2=pari)
STOPBITS=	Numero dei bit di stop dell'interfaccia seriale (0=1, 1=1.5, 2=2)
LINKADDRLOC=	Indirizzo di collegamento per la sessione locale
LINKADDRREM=	Indirizzo di collegamento per la sessione remota
PORT=	Porta per la comunicazione via TCP/IP Default: 20000
TIME_USE_UTC=	Formato del time stamp: ▶ 0= Ora locale ▶ 1 = UTC Default: 0
Obj1BinInput=	Menù a tendina con le Variations supportate per il gruppo oggetti. 1: packet format 2: with flags Default: 1: packet format
Obj2BinInputEvent=	Menù a tendina con le Variations supportate per il gruppo oggetti. 1: without time 2: with absolute time 3: with relative time Default: 3: with relative time
Obj10BinOutput=	Menù a tendina con le Variations supportate per il gruppo oggetti. 1: packet format 2: with flags Default: 1: with flags
Obj11BinOutputEvent=	Menù a tendina con le Variations supportate per il gruppo oggetti. 1: status without time 2: status with time Default: 1: status without time

Obj20Counter=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
Obj22CounterEvent=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
Obj30AnalogInp=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
Obj32AnalogInpEvent=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
Obj40AnalogOutStatus=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
Obj41AnalogOutput=	Menù a tendina con le Variations supportate per il gruppo oggetti. 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
UNSOLICITED_RESPONSES_ENABLED=	Attiva o disattiva Unsolicited Responses: ▶ 0 = non attiva ▶ 1 = attiva Default: Non attiva (0)
UNSOLICITED_RESPONSES_CONFIRMATION_TIMEOUT=	Tempo in secondi per la comunicazione con il master. Dopo lo scadere di questo intervallo di tempo, viene inizializzato un timeout. Intervallo di immissione: da 1 a 60 s Default: 5 s
UNSOLICITED_RESPONSES_RETRY_COUNTER=	Numero di tentativi di stabilire la comunicazione con il master. Intervallo di immissione: 0 - 65535 (0 = numero infinito di tentativi). Default: 3
UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_1=	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: 0 - 255 Default: 5
UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_2=	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: 0 - 255 Default: 5
UNSOLICITED_RESPONSES_MAXIMUM_EVENTS_CLASS_3=	Numero massimo di eventi (per classi di eventi) che vengono inseriti nel buffer prima che venga inviato un **unsolicited response**. Valori possibili: 0 - 255 Default: 5
UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_1=	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una unsolicited response. Valori possibili: 0 - 65535 secondi (0 = nessun ritardo, cioè al cambio di valore). Default: 5

UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_2=	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una `unsolicited response`. Valori possibili: `0 - 65535 secondi` (`0` = nessun ritardo, cioè al cambio di valore). Default: `5`
UNSOLICITED_RESPONSES_MAXIMUM_DELAY_CLASS_3=	Ritardo massimo per classe di eventi al cui scadere viene scritto un nuovo inserimento dopo la scrittura di una `unsolicited response`. Valori possibili: `0 - 65535 secondi` (`0` = nessun ritardo, cioè al cambio di valore). Default: `5`

[VARIABLES]

Inserimento	Descrizione
COUNT	Numero delle variabili da esportare
EVENT_%d	Gestione degli eventi: Gestione degli eventi per ogni variabile. Appartiene sempre a una variabile: p.es. `EVENT_0 appartiene a NAME_0` Valori: ▶ `DEFAULT` La gestione degli eventi avviene come nel gruppo oggetti. ▶ `MOST_RECENT` Mantiene solamente l´ultimo cambio di un evento di modifica binario. ▶ `SOE` Crea una serie di eventi. Default: `Default`
NAME_n	Nome della variabile con il numero n (0<=n<COUNT)
OBJECT_n	Tipo oggetto DNP3 della variabile con il numero n (0<=n<COUNT)
POINT_n	Numero del dato DNP3 della variabile con il numero 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
BOOL:	Set value **LATCH_ON**: 1 Set value **LATCH_OFF**: 0
USINT:	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
LATCH_ON	Binary Output Statuses	3
LATCH_OFF	Binary Output Statuses	4
Pulse On	Binary Output Statuses	1
Pulse Off	Binary Output Statuses	2
Trip	Binary Output Statuses	129
Close	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.

Communication in the ICCP protocol is spontaneous. An ICCP server reports the value changes to the remote client - to its communication partner. An ICCP client cannot however write the values to the remote server. In order to guarantee a two-way exchange, both communication partners should have a client and a server.

ESTABLISHING COMMUNICATION

If a remote client has established a connection to the ICCP server in the zenon Process Gateway, the zenon Process Gateway takes on the address settings from the received request in accordance with ISO 8650-1 (for example: AP-title, AE-qualifier). The ICCP client automatically uses this OSI addressing parameter for further communication with the remote server.

After the initialization of the communication with the zenon ICCP server by a remote client, the verification of the **bilateral table ID** is carried out. At the same time, the zenon ICCP client establishes the connection to the other point. The client registers the variables to be communicated on the remote server as a DataSet and activates the spontaneous communication of the DSTransferSet.

CONFIGURATION OF INI FILE

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

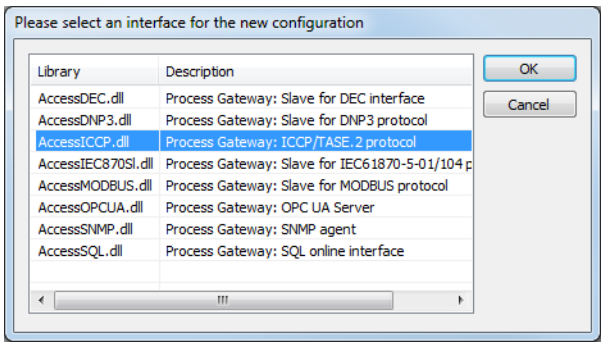
Note: Some of the INI entries can only be configured in the INI file directly. Configuration by means of a dialog is not available for all entries.

Inserimento	Descrizione
[ICCP]	Gruppo
SERVER_PORT=	Numero della porta IP del server; la porta consente la connessione di altri client. La porta viene aperta al momento dello start e rimane aperta. Default: 102
MAX_CONNECTIONS=	Numero massimo di connessioni di altri client ICCP con il server. Default: 0 (= illimitato)
MAJOR_VERSION_NUMBER=	Numero di versione principale del protocollo ICCP, per es.: 1996, 2000. Default: 2000
MINOR_VERSION_NUMBER=	Numero di sottoversione del protocollo ICCP. Default: 8
BILATERAL_TABLE_ID=	L´identificazione tabella bilaterale; viene sincronizzata quando si stabilisce la connessione fra tutti i server ICCP e client ICCP. Nota: l´identificazione tabella bilaterale univoca deve essere la stessa su tutti i dispositivi che comunicano con il Process Gateway ICCP:
LOCAL_DOMAIN_NAME=	Nome di dominio ICCP locale; impostazione per il server; deve essere impostata in modo speculare rispetto al partner della comunicazione.
REMOTE_DOMAIN_NAME=	Nome di dominio ICCP remoto; impostazione per il client; deve essere impostata in modo speculare rispetto al partner della comunicazione.
[VARIABLES]	Gruppo dei riferimenti configurati fra variabili di zenon e variabili ICCP. È elencato quanto segue: ▸ Parametri di ogni variabile ICCP ▸ Numero delle variabili. ▸ Nomi della variabili.
PARAM_0=	Parametri per variabile ICCP. La numerazione inizia da 0. Il contatore viene incrementato di 1 ad ogni nuovo parametro. Questo identificatore corrisponde a quello del nome variabile. **PARAM_0** corrisponde a **NAME_0**. Esempio: **PARAM_0**=1,0,0,ICCP_Name
COUNT=	Numero dei riferimenti configurati

NAME_0=	Nome delle variabili di zenon. La numerazione inizia da 0. Il contatore viene incrementato di 1 ad ogni nuovo parametro. Questo identificatore corrisponde a quello del parametro. **PARAM_0** corrisponde a **NAME_0**. Esempio: **NAME_0**=MyName

8.1 Module configuration

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



Parameters	Description
Library	Shows the names of the DLL.
Description	Describes functionality.
OK	Accepts selection and starts configuration dialog.
Cancel	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** (A pagina: 49)
   - Server variables (A pagina: 52)
   - Client variables (A pagina: 55)

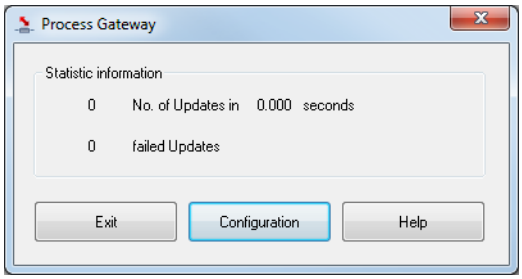
THE DIALOG TO SELECT THE MODULE IS NOT OFFERED

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

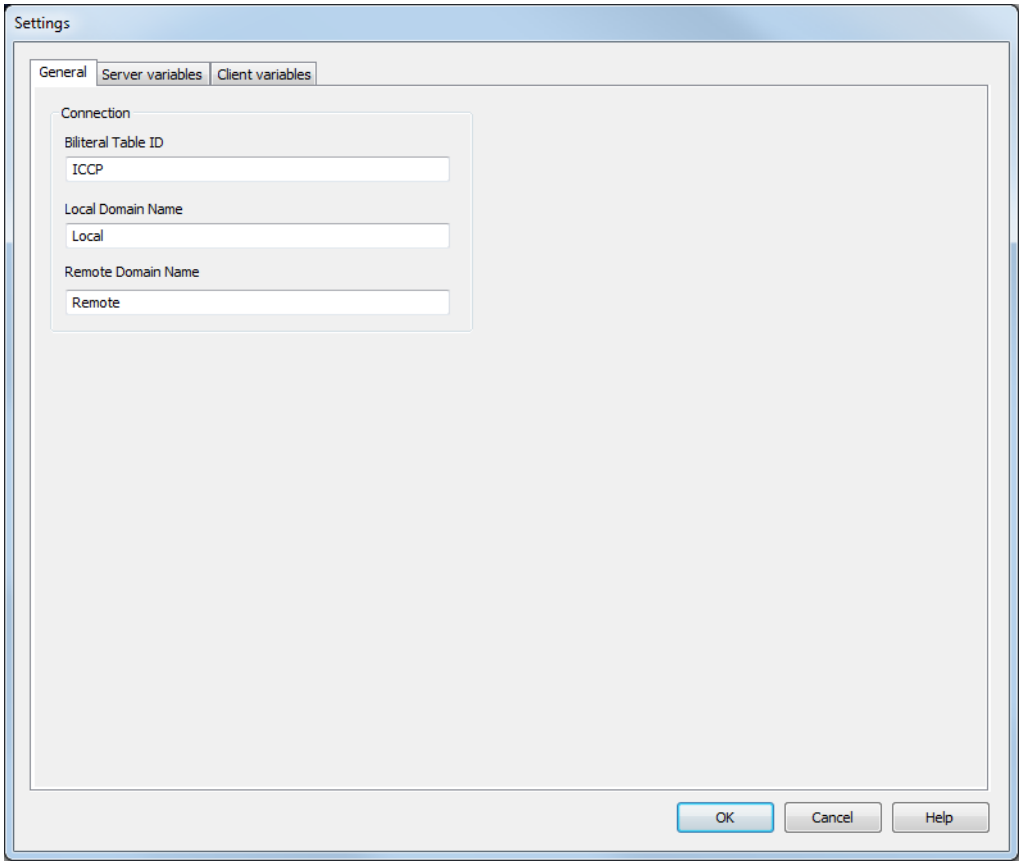
Start the Process Gateway with a module that has already been configured; a dialog with static data is opened.



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.



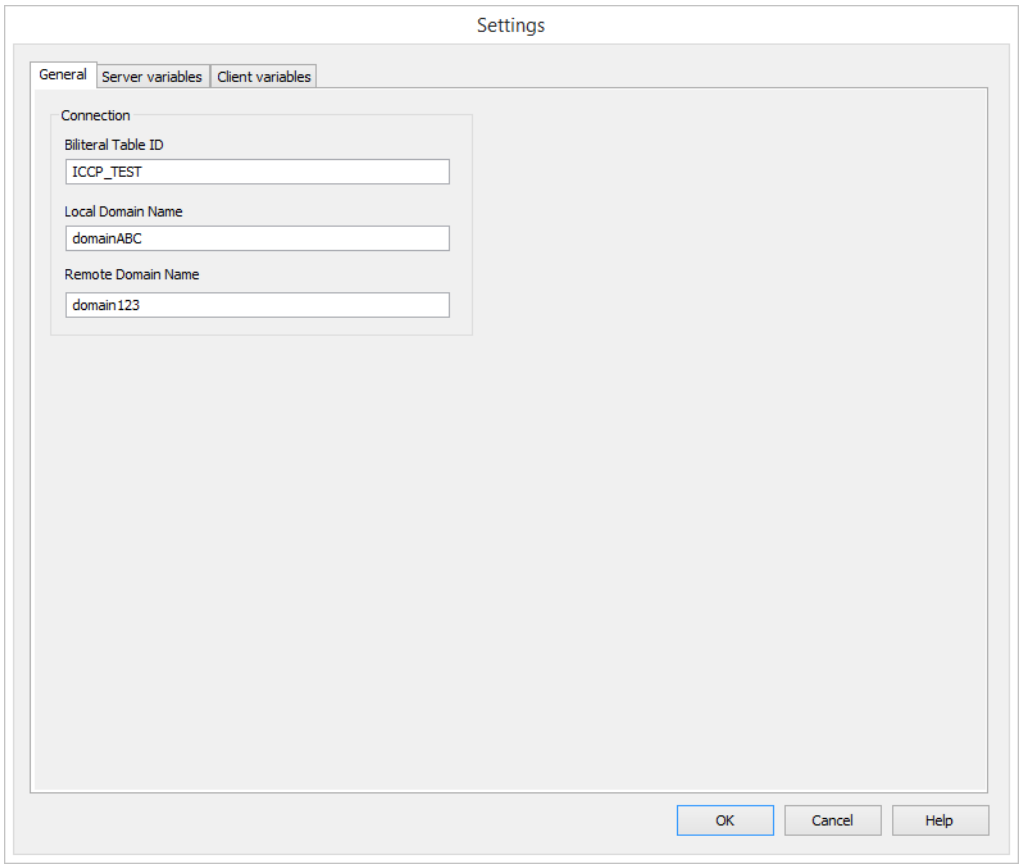
Parameters	Description
General (A pagina: 49)	General settings.
Server variables (A pagina: 52)	Configuration of the server variables. Selection of the variables that the ICCP server provides.
Client variables (A pagina: 55)	Configuration of the client variables. Selection of the variables that are read by the ICCP client.

CHIUDI FINESTRA DI DIALOGO

Parametri	Descrizione
Ok	Accetta le impostazioni e chiude il dialogo.
Annulla	Annulla tutte le modifiche e chiude la finestra di dialogo.
Guida	Apre la guida online.

8.1.1 General

Configuration of the general settings.



CONNECTION

The `Connection` settings are any desired strings that are coordinated on all devices in the system.

The unique bilateral table ID must be the same on all devices that communicate with the ICCP Process 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 ICCP-variables that are communicating. It must be set as the same mirror image for the partners.

These comparison rules are prescribed by the ICCP standard.

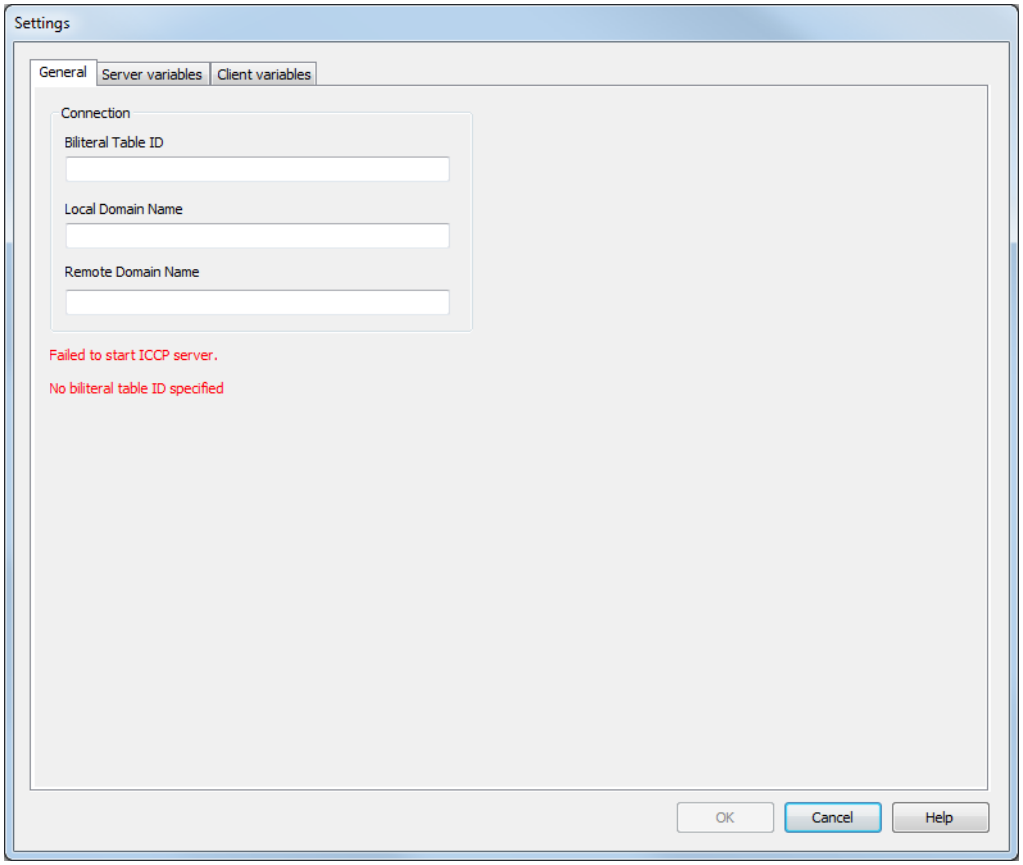
Parameters	Description
Connection	Connection settings.
Biliteral Table ID	The bilateral table identification is compared with the client when the server establishes a connection. Access to the data is only permitted for authorized clients. Note: The ID must be configured as exactly the same on both sides of the communication.
Local Domaine Name	Name of the local ICCP-domain that is used for all server variables. Note: the name must be set as mirrored on the communication partners (= the same as on the remote client).
Remote Domain Name	Name of the remote ICCP-domain that is used for all client variables. Note: the name must be set as mirrored on the communication partners (= the same as on the remote server).
Error message	Display of missing configuration data.

CLOSE DIALOG

Parameters	Description
OK	Accepts the settings of all tabs, saves the configuration in the **zenProcGateway.ini** file, starts the ICCP server and waits for incoming connections.
Cancel	Annulla tutte le modifiche in tutte le schede e chiude la finestra di dialogo.
Help	Apre la guida online.

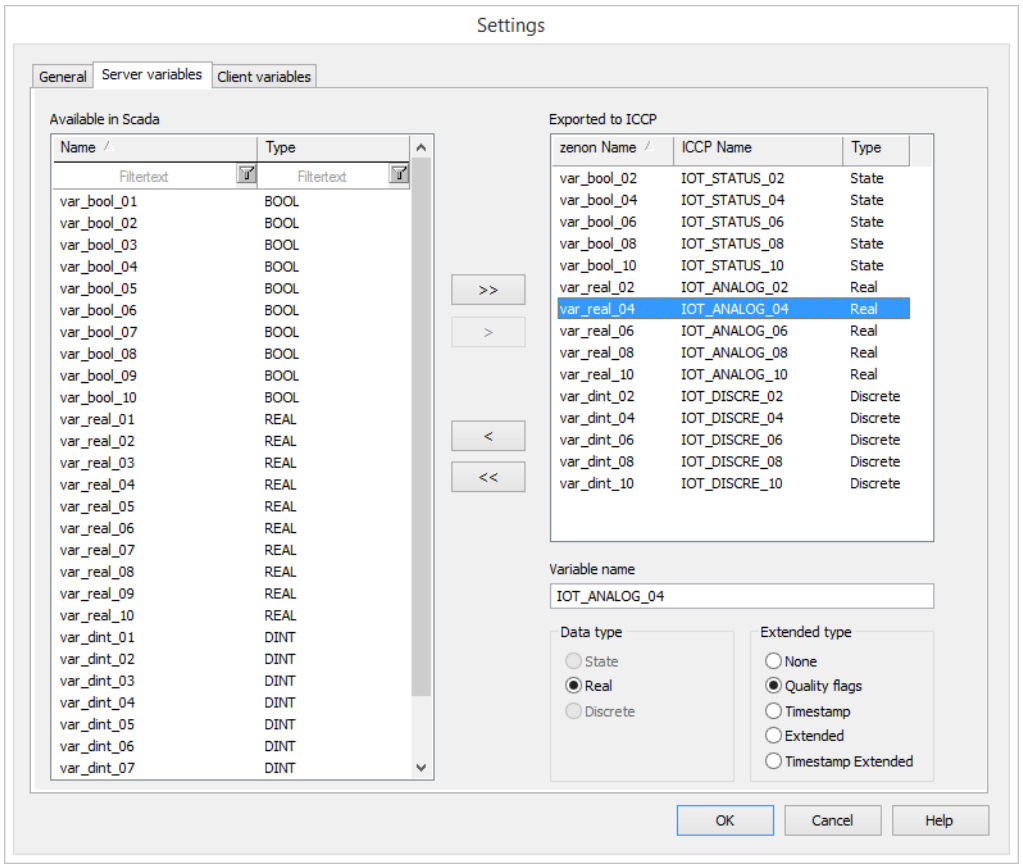
ERROR MESSAGES - EXAMPLE

Error messages are displayed in red font:



8.1.2 Server variables

Selection and configuration of the variables that the zenon Process Gateway provides as an ICCP server. The value changes of the variables are sent to the remote ICCP client spontaneously.



Parameters	Description
Available in SCADA	List of all variables available in the zenon project.
Exported to ICCP	List of the variables exported to ICCP. Variables from the list are provided by the server for a remote ICCP client. The list shows: ▸ Name in zenon ▸ Name in ICCP protocol (ICCP variable) ▸ ICCP Type The ICCP name and type can be amended using the **Variable name, Data type** and **Extended type** settings.
Cursor keys	Moving selected variables between the two lists. ▸ Key **>>**: Copies all variables from zenon to ICCP. ▸ Key **<<**: Removes all variables from the ICCP list. ▸ Key **>**: Copies selected variables from zenon to ICCP ▸ Key **<**: Removes selected variables from the ICCP list. Variables can also be added to the list for zenon by double clicking on the variable for the ICCP list.
Variable name	ICCP name of the variable. Allows renaming of the zenon variable names highlighted in the list for ICCP.
Data type	Selection of an ICCP data type for the variables selected in the list: ▸ **State** ▸ **Real** ▸ **Discrete** Standard display of zenon variables on ICCP: ▸ `BOOL` on `State` ▸ `REAL` on `Real` ▸ `INTEGER` on `Discrete` Depending on the variables provided by zenon, data types can also be unavailable (grayed out).
Extended type	Selection of an ICCP variable addition for the variables selected in the list: ▸ **None**: none ▸ **Quality flags**: Quality ▸ **Timestamp**: Quality + time stamp

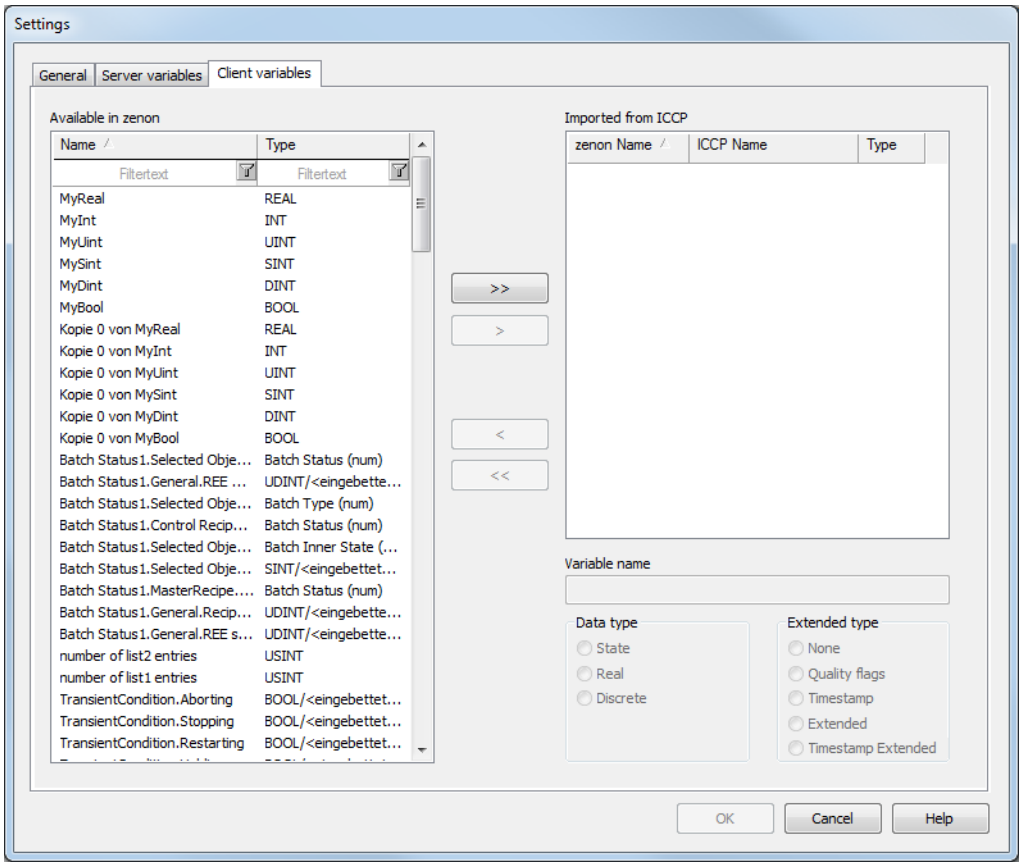
	▸ **Extended**: Quality + time stamp + change counter ▸ **Timestamp Extended**: Quality + extended timestamp Depending on the variables provided by zenon, data types can also be unavailable (grayed out).

CLOSE DIALOG

Parameters	Description
OK	Accepts the settings of all tabs, saves the configuration in the **zenProcGateway.ini** file, starts the ICCP server and waits for incoming connections.
Cancel	Annulla tutte le modifiche in tutte le schede e chiude la finestra di dialogo.
Help	Apre la guida online.

8.1.3 Client variables

Selection and configuration of the variables that the zenon Process Gateway uses as an ICCP client. The client transmits the value changes that it receives from the remote ICCP server to the zenon variables.



Parameters	Description
Available in SCADA	List of the variables available in the zenon project.
Exported to ICCP	List of the variables exported to ICCP. The client configures the remote ICCP server for spontaneous transfer of values from the list. It then transmits the values received to the zenon variables. The list shows: ▸ Name in zenon ▸ Name in ICCP protocol (ICCP variable) ▸ ICCP Type The ICCP name and type can be amended using the **Variable name, Data type** and **Extended type** settings.
Cursor keys	Moving selected variables between the two lists. ▸ Key **>>**: Copies all variables from zenon to ICCP. ▸ Key **<<**: Removes all variables from the ICCP list. ▸ Key **>**: Copies selected variables from zenon to ICCP ▸ Key **<**: Removes selected variables from the ICCP list. Variables can also be added to the list for zenon by double clicking on the variable for the ICCP list.
Variable name	ICCP name of the variable. Allows renaming of the zenon variable names highlighted in the list for ICCP.
Data type	Selection of an ICCP data type for the variables selected in the list: ▸ **State** ▸ **Real** ▸ **Discrete** Standard display of zenon variables on ICCP: ▸ `BOOL` on `State` ▸ `REAL` on `Real` ▸ `INT` on `Discrete` Depending on the variables provided by zenon, data types can also be unavailable (grayed out).
Extended type	Selection of an ICCP variable addition for the variables selected in the list: ▸ **None**: none

	▸ **Quality flags**: Quality ▸ **Timestamp**: Quality + time stamp ▸ **Extended**: Quality + time stamp + change counter ▸ **Timestamp Extended**: Quality + extended timestamp Depending on the variables provided by zenon, data types can also be unavailable (grayed out).

CLOSE DIALOG

Parameters	Description
OK	Accepts the settings of all tabs, saves the configuration in the **zenProcGateway.ini** file, starts the ICCP server and waits for incoming connections.
Cancel	Annulla tutte le modifiche in tutte le schede e chiude la finestra di dialogo.
Help	Apre la guida online.

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.

Informazioni su

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* ***Settaggio dati tramite VBA*** *property is active (****Salvataggio 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 (A pagina: 61)
  unlocks the settings for protocol 101 and locks all other input fields.
- (Protocol) 870-104 (A pagina: 63)
  unlocks the settings for protocol 104 and locks all other input fields.

DEVICES

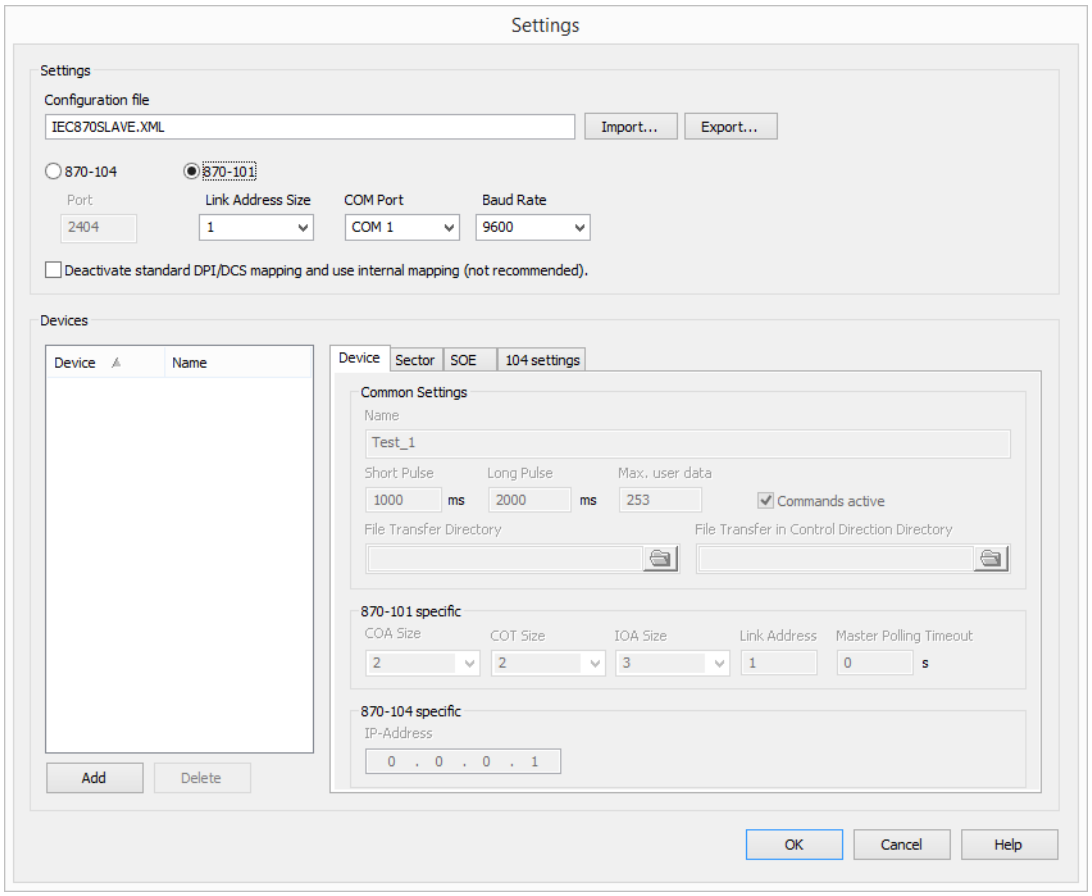
Devices are created and deleted in the **Devices** section of the main window. These devices are configured in the tabs.

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

- **Device** (A pagina: 73),
- **Sector** (A pagina: 76)
- Sequence of Events SOE (A pagina: 102) and
- **104 settings** (A pagina: 90)

Informazioni su

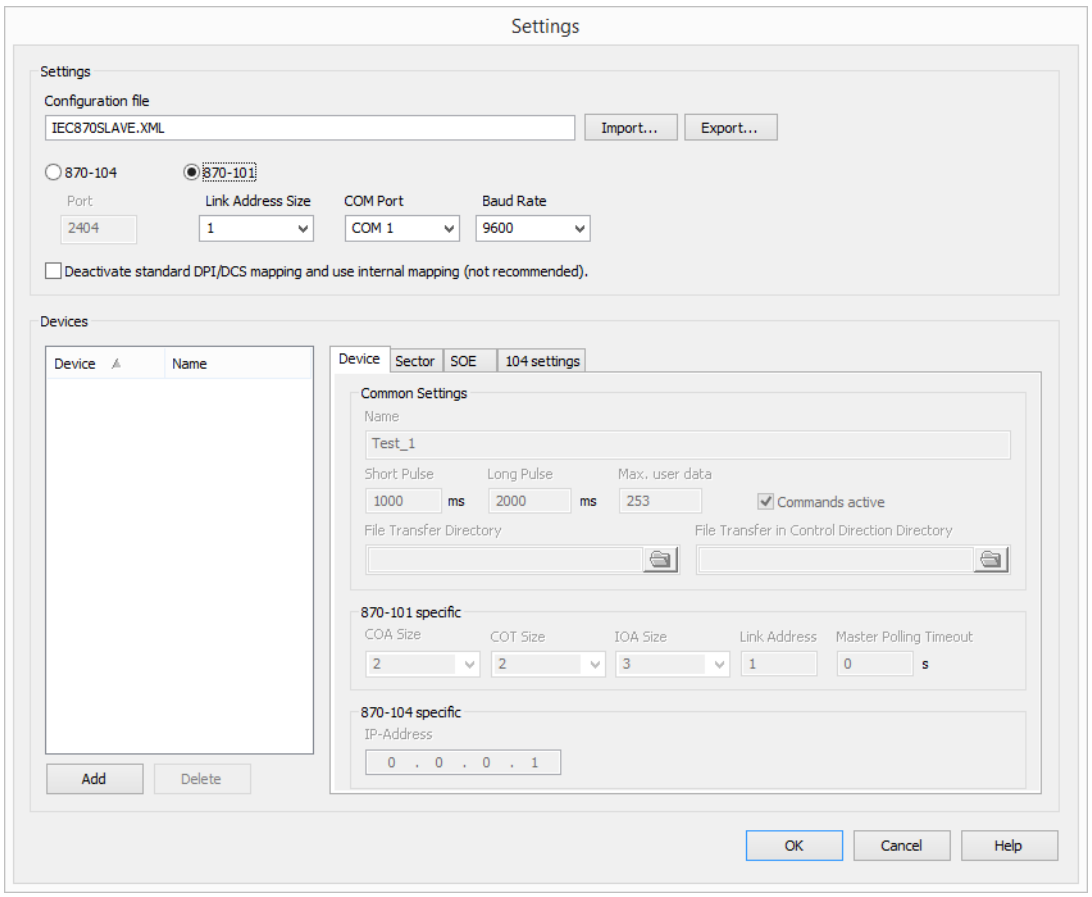
Only the general properties are documented in this section. You can find the protocol-dependent configurations in the section for the respective protocol or in the description of the respective device settings.



Parameters	Description
Settings	
Configuration file	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. 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. The file name will automatically be entered in the INI file of the process gateway as configuration. 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.
Import...	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.
Export...	Stores the current settings in a file. Attention: 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" (A pagina: 73).
870-104	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
871-101	activates protocol 101, unlocks all input fields for 101 and locks settings for 104.
Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).	Deactivates standard communication via DPI (Deep Packet Inspection) and DCS (Distributed Control System) and uses internal mapping for this. Default: `Inactive` Note: Not recommended!
Devices	List of configured devices.
Add	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.
Delete	Deletes the selected device. This button is not active if no device has been selected.
Device	Tab for the configuration of the devices (A pagina: 73)
Sector	Tab for the configuration of the sectors (A pagina: 76)
SOE	Tab for the configuration of the sequence of events (A pagina: 102)
104 settings	Tab for 870-104 protocol-specific configuration (A pagina: 63)

	Note: Not active if 870-101 is selected as a protocol.
OK	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.
Cancel	Discards all changed settings. Nothing is stored.
Help	Apre la guida online.

9.1.1 Settings for 870-101

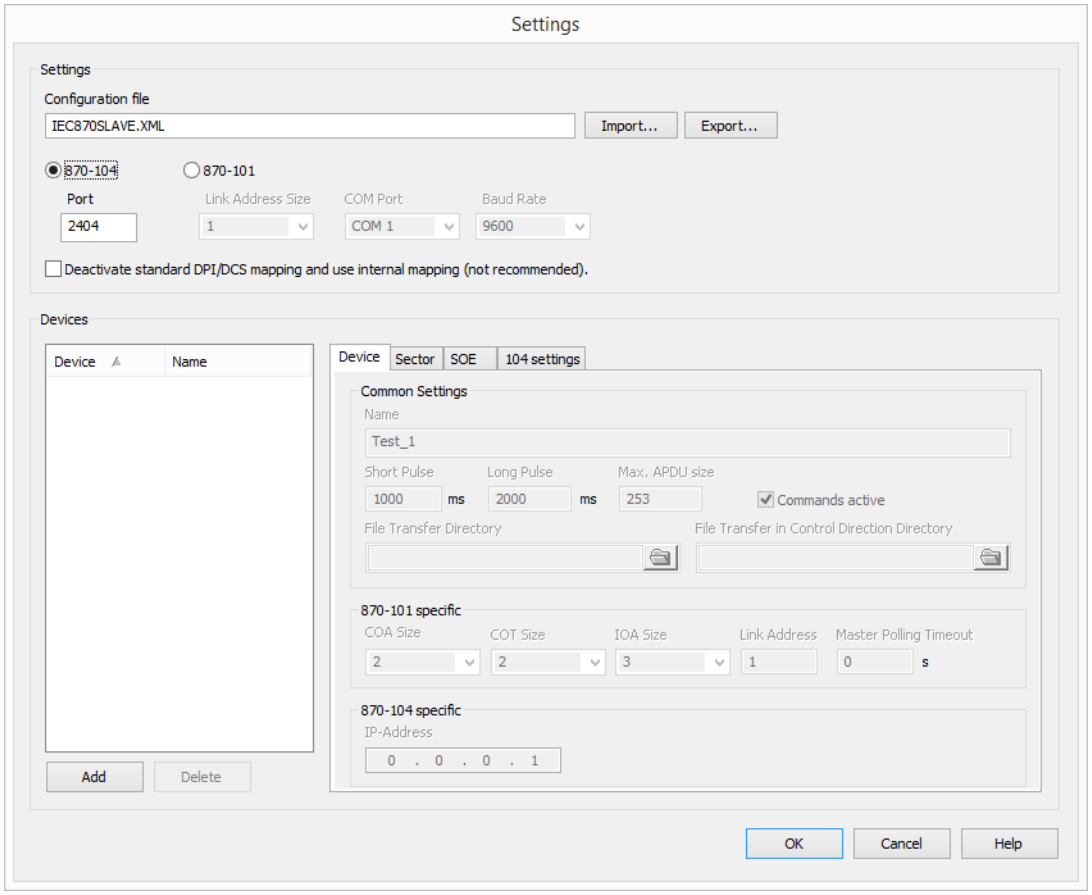


Informazioni su

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
Settings	
870-104	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
871-101	activates protocol 101, unlocks all input fields for 101 and locks settings for 104.
Port	Port for the communication to the end device. Default: `2404` Note: Inactive if 870-101 is selected as a protocol.
Deactivate standard DPI/DCS mapping and use internal mapping (not recommended).	Deactivates standard communication and uses internal mapping for this. Default: `Inactive`
Devices	List of configured devices.
Add	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.
Delete	Deletes the selected device. This button is not active if no device has been selected.
OK	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.
Cancel	Discards all changed settings. Nothing is stored.
Help	Apre la guida online.

9.1.2 Settings for 870-104



Informazioni su

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
Protocol 870-104	activates protocol 104, unlocks all input fields for 104 and locks settings for 101.
Port	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 65535`
Devices	List of configured devices.
Add	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.
Delete	Deletes the selected device. This button is not active if no device has been selected.
OK	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.
Cancel	Discards all changed settings. Nothing is stored.
Help	Apre la guida online.

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.

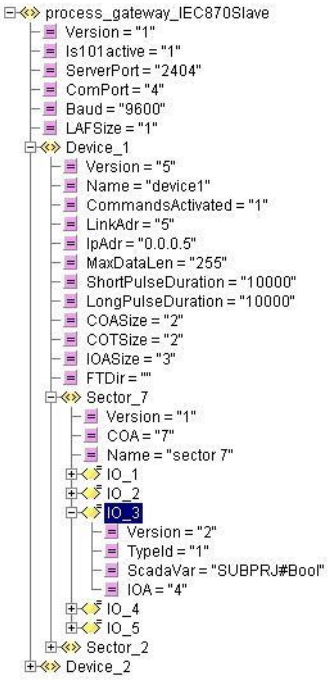
> **Attenzione**
>
> *XML entries are case sensitive. Pay attention to use correct upper and lower cases.*

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.

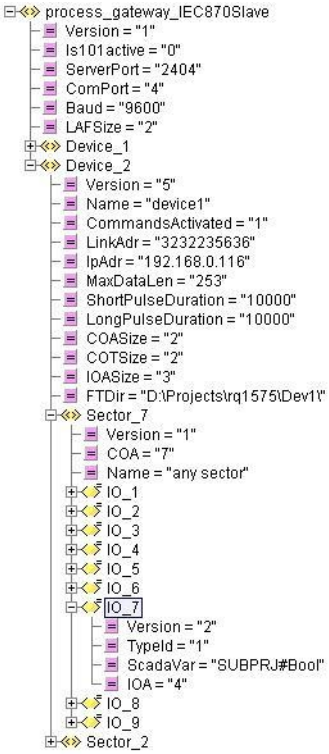
	0 deactivates the cyclical transfer. Default: 0 Available in version 2 and above
KindOfTransfer	States the type of data transfer. 0: Spontaneous. Is also the default value. 1: backscan 2: Cyclic 3: off 4: Spontaneous transfer with buffering Default: 0 Available in version 3 and above
DeActDPIStd	DPI /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	0 = inactive 1 = SOE active
MaxBufferedFilesSOE	Maximum number of buffered SOE files.
AutodeleteFilesSOE	0 = no Autodelete 1 = Autodelete if maximum file number reached
MaxEventsPerFileSOE	Maximum number of ASDU per file
PostTrgToSOE	Post trigger timeout in [ms]
FileToSOE	File timeout in [ms]
Information Object Einstellung für die SOE Unterstützung	Additional settings that must be made at the Information Object for SOE support.
Version	4: describes an XML file with the following fields for SOE support
KindOfTransfer	Defines when an update triggers a transfer. 0 Spontaneous 1 Background scan 2 periodic 3 no transfer
TrgSOE	0 = inactive 1 = IO acts as trigger
EvDetectionSOE	Determines when a change to an IO value or status can trigger a write in the SOE file.

	0 SOE active 1 Saves all changes. 2 Raising edges 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:



Mapping of double point values

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

Note: It is recommended that you leave the **Deactivate standard double point value mapping** option in the driver configuration as the default, inactive.

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 the HMI.

The driver always communicates with one device with values for Double Points with 2-bit information. This corresponds to the definitions of the energy standard. 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.

The user must always be aware of the technical level on which they are acting and receiving or 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 VOR HMI

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

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

Informazioni su

This function can be deactivated in the driver settings. However some features 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.

DPI MAPPING IN IEC61850 CLIENT DRIVER

In accordance with the IEC61850-7-3 standard, in Common Data Classes, Double Point Status (DPS) and Controllable Double Point (DPC), the `stVal` attribute has the data type `CODED ENUM` with the value range: intermediate-state (00) | off (01) | on (10) | bad-state (11). The driver therefore waits until a Double Point attribute of the data type `CODED ENUM` is mapped to the communication protocol as an MMS of the `bit string` data type. The `stVal` data attribute can thus have the following values: `0x00`, `0x40`, `0x80` and `0xC0`. This basic data type is permitted in the SCL language with the name `Dbpos` (IEC61850-6). In zenon, this corresponds to a variable with data type UDINT (default) or STRING (if changed manually) - see assignment of datatypes.

In the driver configuration, the **Deactivate standard double point value mapping** option should remain inactive by default in order to use the modules from the zenon Energy Edition, for example the functions of **Command Processing** and **ALC**.

With the default settings, the driver assigns values of the `stVal` data attributes of DPS and DPC in accordance with the following table:

Position value in the end device	zenon Dbpos value - STRING	zenon Dbpos value - UDINT unmapped	zenon Wert - value mapped
Intermediate (00b)	'00'	0	2
Off (01b)	'01'	64 (0x40)	0
On (10b)	'10'	128 (0x80)	1
Fault (11b)	'11'	192 (0xC0)	3

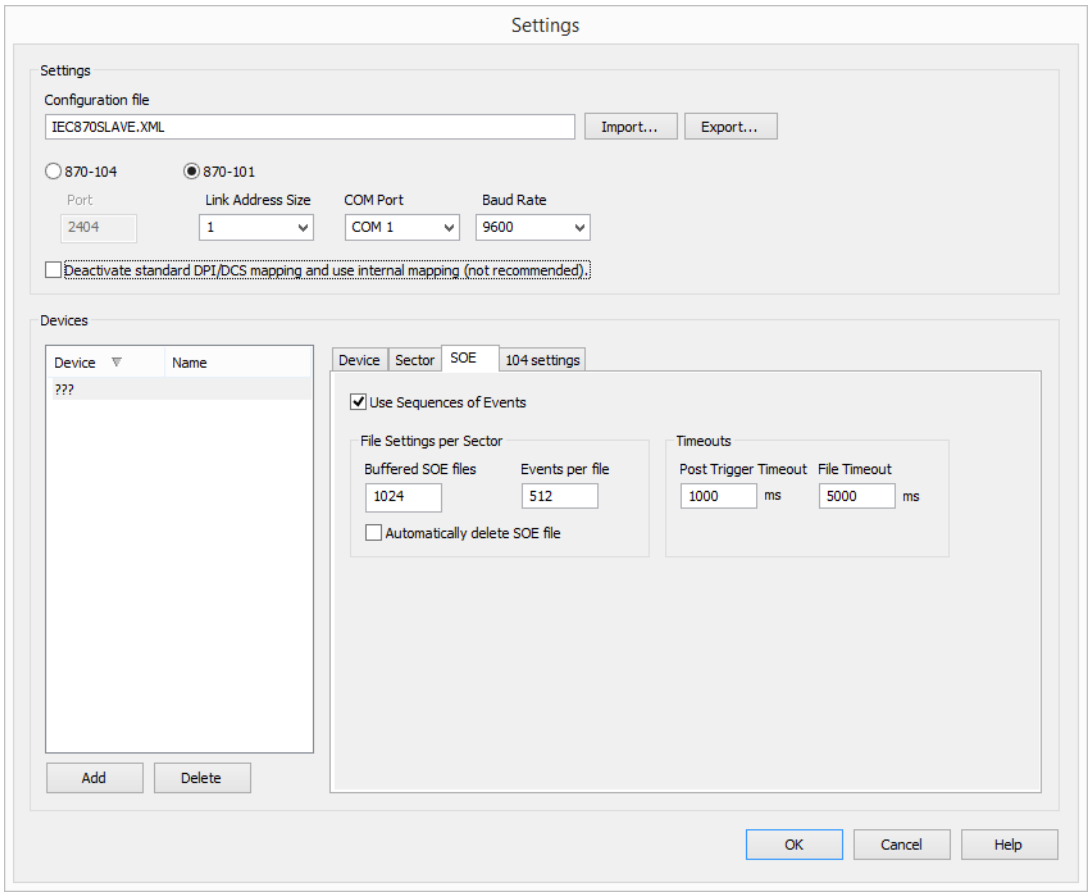
The driver only converts values for variables with the names `*/stVal` and numerical data type that corresponds to bType `'Dbpos'` in the SCL language (IEC61850-6). This means that the values of the `*/stVal` variable with a data type set to STRING manually are excluded from mapping.

This means in Runtime (for example):

Position of the switch	UDINT mapped	UDINT unmapped	STRING
off	0	64	'01'
on	1	128	'10'

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.



Setting	Functionality
Deactivate standard	`Active`: Mapping is deactivated. Values for DPI/DCS correspond directly to the values of zenon. `Inactive`: Values for DPI/DCS are mapped as follows, which also guarantees standard behavior for the Command Processing: ▸ zenon value `0` = DPI/DCS value `1` (= `OFF`) ▸ zenon value `1` = DPI/DCS value `2` (= `ON`) ▸ zenon value `2` = DPI value `0` ▸ zenon value `3` = DPI value `3` This setting is automatically activated if an XML File with version 1 is read in.

9.1.4 Devices

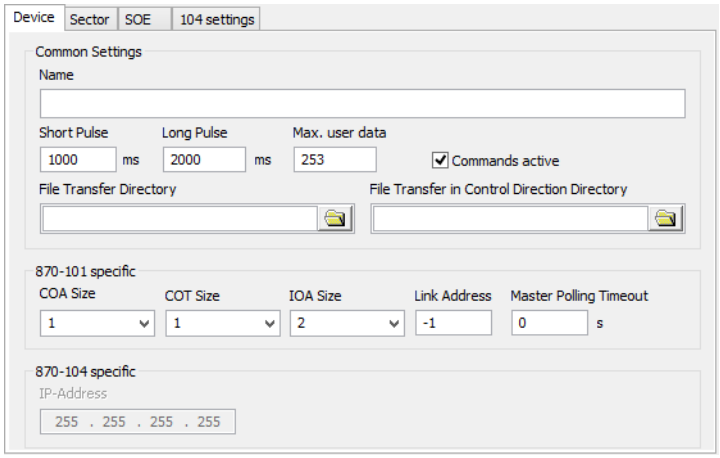
Parameters	Description
Device	ID of the device Default: `???`
Name	Name of the device
Add	Adds a new device with standard settings. By default, it gets the invalid ID '????' and invalid IP/link addresses. Before you can use or export the device, you must configure it.
Delete	Deletes the selected device.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

Devices are created or 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 104settings 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.



Parameters	Protocol	Description
Common Settings		
Name	101 104	Name of the device for easy identification
File transfer directory	101 104	Defines the directory for transfer of files and directories. Note: The files are sent to the master.
File Transfer in Control Direction Directory	101 104	Defines the directory in which the files for transfer of files and directories are stored. Note: 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.
Short pulse	101 104	Defines the size of the pulse for the **Qualifier of Command** (A pagina: 100) with the value 'short pulse duration' (QOC = 1) in milliseconds. Valid values: `0 to 4294967295` Default: `1000 ms` Note: 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.
Long pulse	101 104	Defines the size of the pulse for the **Qualifier of Command** (A pagina: 100) with the value 'long pulse duration' (QOC = 2) in milliseconds. Valid values: `0 to 4294967295.` Default: `2000 ms`
Max APDU size	104	Maximum length of APDU data as defined in the standard 870-5-104 5. Valid values: `between 25 and 253.` Default: `253`
Max. user data	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`
Commands active	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) (A pagina: 95). Default: `active`

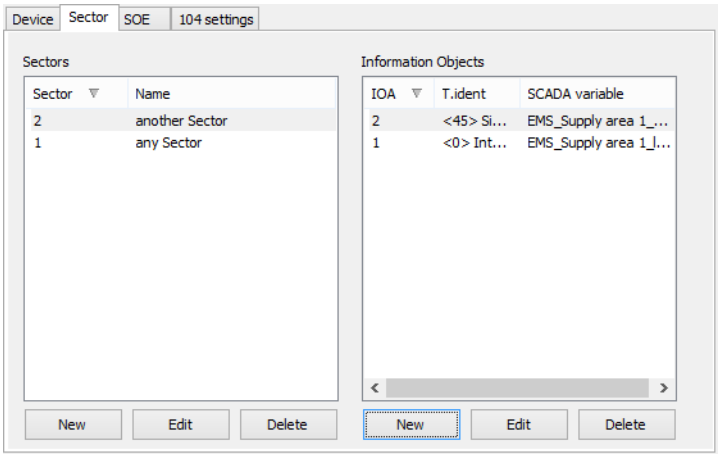
870-101 SPECIFIC

870-101 specific		
COA size	101	Defines the length of the COA (Common Object Address/Common Address of ASDU). Selection of address size from drop-down list: ▸ 1 octet ▸ 2 octets ▸ Note: If the **60870-5-104 (TCP/IP)** connection type is selected for link layer, the value `2 octets` is expected in accordance with the standard. Only change the default value for a connection with a non-compliant PLC. Default: `2`
COT size	101	Defines the length of the COT (cause of transmission). Selection of address size from drop-down list. Valid: ▸ 1 octet ▸ 2 octets ▸ Note: If the **60870-5-104 (TCP/IP)** connection type is selected for link layer, the value `2 octets` is expected in accordance with the standard. Only change the default value for a connection with a non-compliant PLC. Default: `2`
IOA size	101	Defines the length of the IOA (Information Object Address). Selection of address size from drop-down list. Valid: ▸ 1 octet ▸ 2 octets ▸ 3 octets ▸ Note: If the **60870-5-104 (TCP/IP)** connection type is selected for link layer, the value `3 octets` is expected in accordance with the standard. Only change the default value for a connection with a non-compliant PLC. Default: `3`
Link address	101	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. Link address size = `1 allows a range of 0 to 254` Link address size = `2 allows a range of 0 to 65534` Default: `-1`

		Note: The current value is lost if the protocol is changed.
Master polling timeout	101	Shows the time in seconds in which the master must execute a query to the slave. If there is no query within this time, the connection is ended. Default: 0 Note: 0 deactivates the monitoring.
870-104 specific		
IP-Adress	104	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. Note: The current value is lost if the protocol is changed.

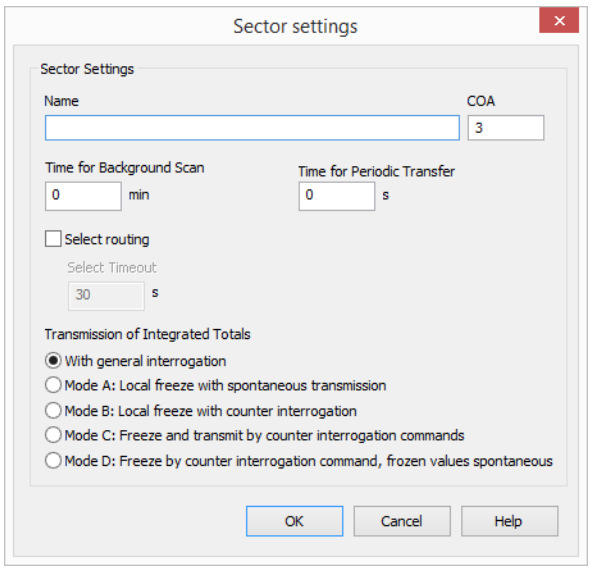
Sector

The **Sector** tab lists all sectors defined in the device. If you select a sector, its **Information Objects** (A pagina: 80) (IOs) will be displayed.



Parameters	Description
Sectors	
New	Activates the dialog for creating a new sector (A pagina: 77). You close this subsequent dialog and create a new sector by clicking on **OK**.
Edit	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.
Delete	Deletes the selected sector. This button is inactive if no sector was selected.
Information Objects	
New	Activates the dialog for creating new IOs (A pagina: 80). This subsequent dialog is closed and a new IO is created by clicking on 'OK'. This button is inactive if no sector was selected.
Edit	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.
Delete	Deletes the selected information object. This button is inactive if no IO was selected.

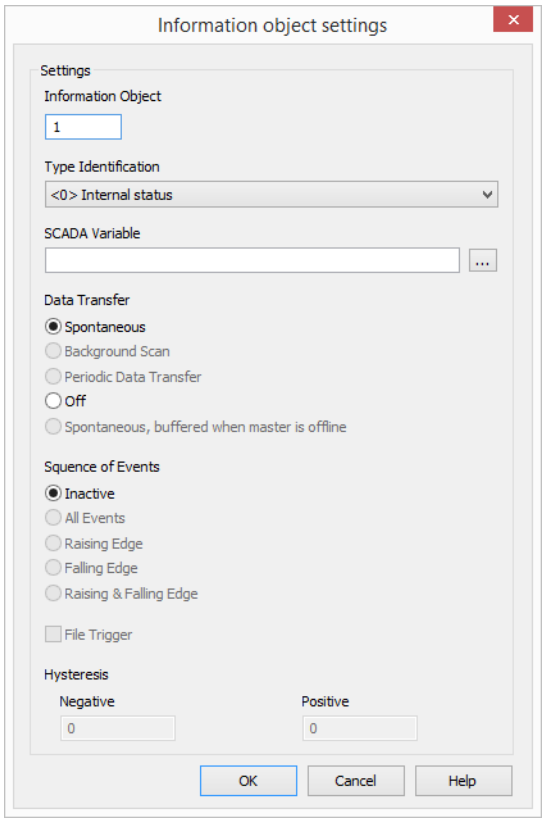
Sector Settings



Parameters	Description
Sector Settings	
Name	Any name. For easy identification of a sector.
COA	The COMMON ADDRESS OF ASDUs (IEC 60870-5-101 7.2.4) by which the sector is addressed. This number must be unique on the device side (1..254).
Time for Background scan [min]	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.
Time for periodic transfer [s]	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.
Select before execute	If active, a prior select is necessary for an execute.
SBE Timeout [s]	Timeout in seconds within which the select sequence must be ended and an execute must be carried out. Inactive if **Select before execute** is not active. Default: 30 s Input range: 1 to 65535
Transmition of integrated totals	Selection of the transfer mode (see IEC 60870-5-101 7.4.8) for the integrated totals - the IOs of type: ▸ 15 (M_IT_NA_1) ▸ 16 (M_IT_NA_1) ▸ 37 (M_IT_NA_1) 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.
With general interrogation	Integrated Totals are also transferred during a general interrogation (C_IC_NA_1).
Mode A: Local freeze with spontaneous	Integrated totals are transferred when a value is changed.

transmission	
Mode B: Local freeze with counter interrogation	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 `invalid` 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.
Mode C: freeze and transmit by counter interrogation Transmition of integrated totalscommands	As with mode B.
Mode D: freeze by counter interrogation command, frozen values spontaneous	Transfer as with mode C, mode A is activated after conclusion of the interrogation.
OK	By pressing the button **OK**, 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.
Cancel	Discards all entries and closes the dialog.
Help	Apre la guida online.

Information Objects



Parameters	Description
Settings	
Information Object	Defines the address under which the IO is addressed (IEC 60870-5-101 7.2.5). In combination with the type ID (Type identifications), it must be unique for each sector. Default: 1
Type identification	Drop-down list with the supported Type identifications (IEC 60870-5-101 7.2.1). Default: <0> Internal status This setting is also called type ID. It also determines the variables of the process control system that can be associated to the IO based on their data type. Note: You can also find more detailed information on type ID in the chapters Assignment of data types (A pagina: 85) and Interoperability (A pagina: 114).
SCADA variable	Defines the variable from the process control system associated with the IO. Syntax: <Project name>#<variable name> 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. The Button '**...**' opens the dialog for variable selection. Read more about this in the section 'Variable selection (A pagina: 84)'. (Scada stands for the name of the process control system.)
Data Transfer	Determines the type of data transfer for IOs Default: Spontaneous
Spontaneous	IO data transfer is spontaneous.
Background Scan	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. 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. 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 For these type IDs, they are mapped to the corresponding TID without a time stamp when the background scan is sent. The setting is not available for any other type ID.

Periodic Data Transfer	Periodic data transfer in accordance with IEC 60870-5-5-6.3 norm. IOs are transferred cyclically and not spontaneously. 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. The type ID =9,11,13 supports periodic transfer: M_ME_NA_1, M_ME_NB_1, M_ME_NC_1 The setting is not available for any other type ID.
Off	Changes in value are not transferred. No value is sent for the IO during a general interrogation (GI).
Spontaneous, buffered when master is offline	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. Buffering can be activated for the type IDs <30..37>: 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 The setting is not available for any other type ID.
Sequences of events	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 <30..37>: 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 Default: `Inactive`
Inactive	Data point is not used for SOE description. Is automatically used for all type IDs that do not support SOE.
All events	Each value or status change triggers a write in the open file. The setting is blocked if the type ID if not planned for the SOE function.
Raising Edge	If the value changes from 0 to <> 0, then it triggers the write mode in the open file. The setting is blocked if the type ID if not planned for the SOE function.
Falling Edge	If the value changes from <> 0 to 0, then it triggers the write mode in the open file. The setting is blocked if the type ID if not planned for the SOE function.
Raising + Falling Edge	A change of value from 0 to <> 0 or from <> 0 to 0 triggers a write in the open file. The setting is blocked if the type ID if not planned for the SOE function.
File trigger	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.

	The setting is blocked if the type ID if not planned for the SOE function. Default: `Inactive`
Hysteresis	Value changes that are within the hysteresis are not transferred for the permitted TID if they have the `Spontaneous` selection. A transfer is therefore triggered: ▶ If type identification allows hysteresis. The type identifications `<9> to <14>` and `<34> to <36>` are not permitted. ▶ With spontaneous transfer ▶ With a value change that acts >= the hysteresis (according to the direction).
Negative	Negative Hysteresis, from measuring range Default: `0` Note: only active if type identification is `not <9> to <14>` or `<34> to <36>`. This field is also inactive if the value **Data Transfer** is `not spontaneous`. 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.
Positive	Positive hysteresis, from measuring range Default: `0` Note: only active if type identification is `not <9> to <14>` or `<34> to <36>`. This field is also inactive if the value **Data Transfer** is `not spontaneous`. 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.
OK	Your settings are verified after pressing the button "OK". If they are valid, they are accepted and the dialog is closed.
Cancel	Discards all entries and closes the dialog.
Help	Apre la guida online.

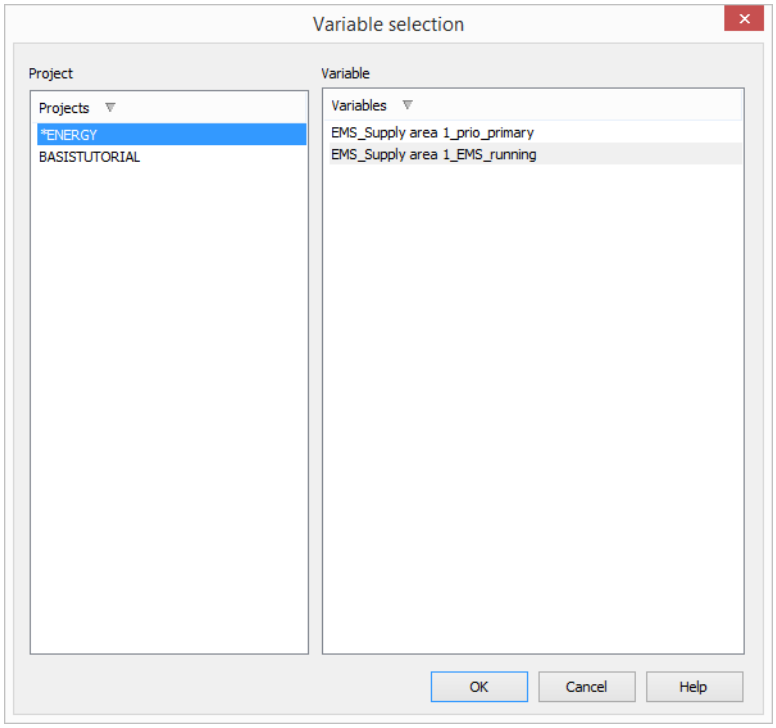
Note: The XML file of the configuration must, from zenon 7.11 onwards, contain the entry HysteresisNegative and HysteresisPositive for each IO.

Informazioni su

*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
Projekte	An asterisk (*) marks the default project.
Variablen	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.
OK	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. 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. 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.
Cancel	Discards all entries and closes the dialog.
Help	Apre la guida online.

Mapping of the data types

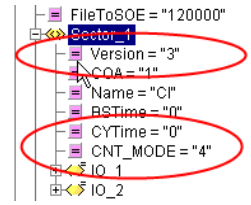
The zenon data types are compared to the IEC60870 data types in the following table.

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 Transient 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 'normalized values' <$-1 .. 1-2^{-15}$> are gone below or exceeded, the value of the IO is amended in ASDU 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 End of initialization to be sent to the master
C_SC_NA_1 (A	45	BOOL	mirrors the command direction during execution

pagina: 100)			
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
Version	The CNT_MODE field is expected from version 3 onwards.
CNT_MODE	Configured mode of integrated totals IOs.
Sector	The new items ToSBe and ob SBE are added for the sector: ▸ ToSBe: Timeout [ms] for Select before execute: 1000 - 65535000 ▸ SBE: 0 => not required 1 => necessary for execute

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	List of value changes for command variables with SBE too long. Value change has been lost. 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.
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

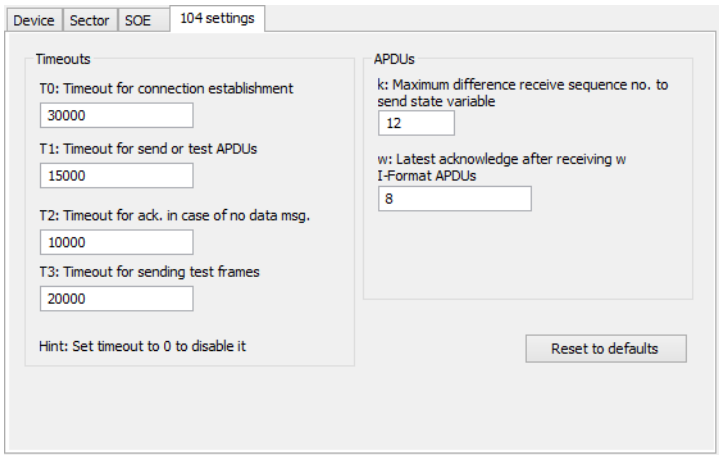
Code	Description
1011	QCC FRZ is only partly supported.
1012	Counter interrogation already active.
1014	Activation confirmation already confirmed.

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

Informazioni su

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

9.2 Communication

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

- Start (A pagina: 92)
- General query (A pagina: 93)
- Reset (A pagina: 93)
- Value changes (A pagina: 94)
- Priority (A pagina: 95)
- Read (A pagina: 107)
- Process Initialized (A pagina: 94)
- File transfer (A pagina: 101)
  - Storage and naming of files for transfer (A pagina: 101)
  - Spontaneous directory transfer (A pagina: 102)
- Sequence of Events (SOE) (A pagina: 102)
  - Warnings (A pagina: 104)
  - Error message (A pagina: 105)
- Time synchronization (A pagina: 98)
- DPI / DCS mapping (A pagina: 71)
- Select Before Operate (A pagina: 100)
- Qualifier of command (A pagina: 100)
- Invalid Bit Handling (A pagina: 99)
- Normalized Values
- Monitoring command (A pagina: 100)
- Internal type T00 (A pagina: 95)
- Pulse generation
- Reload project online (A pagina: 95)
- Broadcasts (A pagina: 98)
- Realtime invalid - Statusbit T_INVAL
- Test commands (A pagina: 108)

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.

Attenzione

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 zenon Runtime of the receipt of a C_RP_NA_1 command. To do this:

- create an IO of type T105with 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** (A pagina: 73) 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

Informazioni su

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 <> 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(FF) 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.

Attenzione

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

The Broadcast Adress 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	Remarks
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 Normalized Values (T09) go below or exceed the norm range <−1 .. 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_INVAL (time invalid)	Only in "Binary Time 2a" (CP24Time2a/CP56Time2a) BS[24]- IV (invalid)	The slave forwards the T_INVAL status bit in the time stamp of the IOs with "time tag" 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 Processing 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 pulse 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 (A pagina: 73) to 'OFF'.
- **QoC 2**: Long pulse. The zenon variable assumes the value 'ON' and changes, after the time defined in the Process Gateway settings (A pagina: 73) 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 (A pagina: 73): `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:

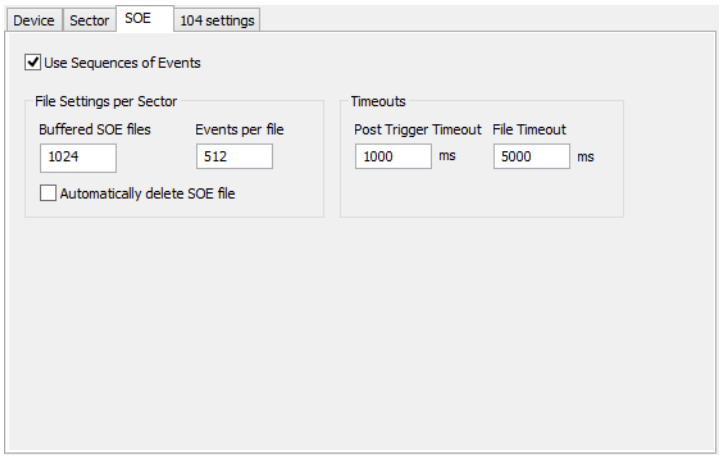
- create an IO of type F_DR_NA_1 (T126) with IOA '0'.

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:



Parameters	Description
Use sequences of events	If active, the SOE for the selected device is activated. If `inactive`, all SOE settings to the IOs are ignored. Default: `inactive`

FILE SETTINGS PER SECTOR

Parameters	Description
Buffered SOE Files	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). Value range `1 to 1024`. Default: `1024`
Events per File	Number of value changes that are written in a file before it is closed. Value range: `1 to 4096`. Default: `512`
Automatically delete SOE file	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.

TIMEOUTS

Parameters	Description
Post trigger timeout	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. Value range: `100ms to 120000ms` Default: `1000ms`
File timeout	Maximum time for which the file remains open (regardless of the number of events). Value range: `100ms to 120000ms` Default: `5000ms`

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 ready again 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 Slave 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(<TypeyId>)<<TypeId>> <TypeIdAsTxt> ioa:<IOA> id:<AdviseID> value:<Wert>
time:<TimeStamp> state:< QUALDESC > sir:<SBEValue>
```

LOG entry	Module/Level	Description
SBE IED processing. Device:(<deviceIp>)<devicename> 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>)<devicename> Sector:(<COA>)<SecName> <ValueChange>	OSI7/Warnung	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>)<devicename> 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 engineerd and runs in the background.

Informazioni su

You can find further information on command IDs the Interoperability (A pagina: 114) 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 7.50 -> Diagviewer. In general:

I driver di zenon protocollano tutti gli errori nei file LOG. La cartella standard per i file Log è la sottocartella **LOG** della directory `ProgramData`, per es.:

`%ProgramData%\COPA-DATA\LOG`. I file LOG sono file di testo con una struttura speciale:

Attenzione: con le impostazioni standard, un driver registra solamente le informazioni errate. Con il **Diagnosis Viewer**, invece, si può estendere il livello di diagnosi per la maggiore parte dei driver anche a "Debug" e "Deep Debug". In questo caso, il driver protocollerà anche tutte le altre attività e tutti gli altri eventi fondamentali.

Nel Diagnosis Viewer si può anche:

- Seguire nuovi inserimenti in tempo reale
- Individualizzare le impostazioni di registrazione

- Modificare la cartella in cui vengono salvati i file LOG

Nota:

1. Il Diagnosis Viewer visualizza tutti gli inserimenti in UTC (tempo coordinato universale) e non nell´ora locale.
2. Nella sua impostazione standard, il Diagnosis Viewer non visualizza tutte le colonne di un file LOG. Per visualizzare un numero maggiore di colonne, attivare la proprietà **Add all columns with entry** nel menù contestuale dell´intestazione della colonna.
3. Se si usa solamente l´**Error-Logging**, la descrizione del problema si trova nella colonna **Error text**. Per altri livelli di diagnosi, invece, questa descrizione si trova nella colonna **General text**.
4. In caso di problemi di comunicazione, molti driver registrano codici di errore che gli vengono trasmessi dal PLC. Questi codici vengono visualizzati nell´**Error text** e/o nell´ **Error code** e/o nel **Driver error parameter(1** e **2)**. Delle indicazioni relative al significato dei codici di errore si possono trovare nella documentazione driver e nella descrizione del protocollo/PLC.
5. Dopo aver eseguito i test, riportare il livello di diagnosi da **Debug** o **Deep Debug** alle impostazioni originarie. Con i livelli **Debug** e **Deep Debug**, infatti, c`è una grande quantità di dati che devono essere salvati sul disco fisso e questo potrebbe compromettere le prestazioni del sistema. Il sistema continua a registrare questi dati anche dopo che il **Diagnosis Viewer** è stato chiuso.

> **Attenzione**
>
> A causa delle limitate risorse disponibili, con Windows CE gli errori non vengono protocollati di default.

Note: Process Gateway is not available under Windows CE.

> **Informazioni su**
>
> *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.

Esempio

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 informationobject 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 incommand and in monitor direction allow the specification of the complete set orsubsets, as appropriate for given applications. This clause summarizes theparameters of the previous clauses to facilitate a suitable selection for aspecific 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 bemarked 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 ')

[X] Point-to-point	[X] Multipoint
[X] Multiple point to point	[ ] 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 adress	
101 only [X] One octet	[X] Two octets

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 adress	
101 only [X] One octet	[X] Structured
101 only [X] Two octets	[X] Unstructured
[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] One octet	[X] Two octets (with originator address) 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.

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
<1>	M_SP_NA_1		B	B		X									X					
<2>	M_SP_TA_1			B		X														
<3>	M_DP_NA_1		B	B		X									X					
<4>	M_DP_TA_1			B		X														
<5>	M_ST_NA_1		B	B		X									X					
<6>	M_ST_TA_1			B		X														
<7>	M_BO_NA_1		B	B		X									X					
<8>	M_BO_TA_1			B		X														
<9>	M_ME_NA_1	B	B	B		X									X					
<10>	M_ME_TA_1			B		X														
<11>	M_ME_NB_1	B	B	B		X									X					
<12>	M_ME_TB_1			B		X														
<13>	M_ME_NC_1	B	B	B		X									X					
<14>	M_ME_TC_1			B		X														
<15>	M_IT_NA_1			B		X									X[1]	X				
<16>	M_IT_TA_1			B		X										X				
<17>	M_EP_TA_1																			
<18>	M_EP_TB_1																			
<19>	M_EP_TC_1																			
<20>	M_PS_NA_1																			
<21>	M_ME_ND_1																			
<30>	M_SP_TB_1			B		X														
<31>	M_DP_TB_1			B		X														
<32>	M_ST_TB_1			B		X														
<33>	M_BO_TB_1			B		X														
<34>	M_ME_TD_1			B		X														
<35>	M_ME_TE_1			B		X														
<36>	M_ME_TF_1			B		X														
<37>	M_IT_TB_1			B		X										X				

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	X[2]	X[2]	X								X	X
<46>	C_DC_NA_1						X	X	X[2]	X[2]	X								X	X
<47>	C_RC_NA_1						X	X	X[2]	X[2]	X								X	X
<48>	C_SE_NA_1						X	X	X[2]	X[2]	X								X	X
<49>	C_SE_NB_1						X	X	X[2]	X[2]	X								X	X
<50>	C_SE_NC_1						X	X	X[2]	X[2]	X								X	X
<51>	C_BO_NA_1						X	X	X[2]	X[2]	X								X	X
<58>	C_SC_TA_1						X	X	X[2]	X[2]	X								X	X
<59>	C_DC_TA_1						X	X	X[2]	X[2]	X								X	X
<60>	C_RC_TA_1						X	X	X[2]	X[2]	X								X	X
<61>	C_SE_TA_1						X	X	X[2]	X[2]	X								X	X
<62>	C_SE_TB_1						X	X	X[2]	X[2]	X								X	X
<63>	C_SE_TC_1						X	X	X[2]	X[2]	X								X	X
<64>	C_BO_TA_1						X	X	X[2]	X[2]	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																			

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
<113>	P_AC_NA_1																			
<120>	F_FR_NA_1													X					X	
<121>	F_SR_NA_1													X					X	
<122>	F_SC_NA_1					X								X				X	X	
<123>	F_LS_NA_1													X					X	
<124>	F_AF_NA_1													X				X	X	
<125>	F_SG_NA_1													X					X	
<126>	F_DR_TA_1*			X		X														

* Blank or X only

[1] Optional.

[2] 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).

[X] Mode A: Local freeze with spontaneous transmission
[X] Mode B: Local freeze with counter interrogation
[X] Mode C: Freeze and transmit by counter-interrogation commands
[X] Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously

[X] Counter read
[X] Counter freeze without reset
[ ] Counter freeze with reset
[ ] Counter reset

[X] 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).

[X] 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.

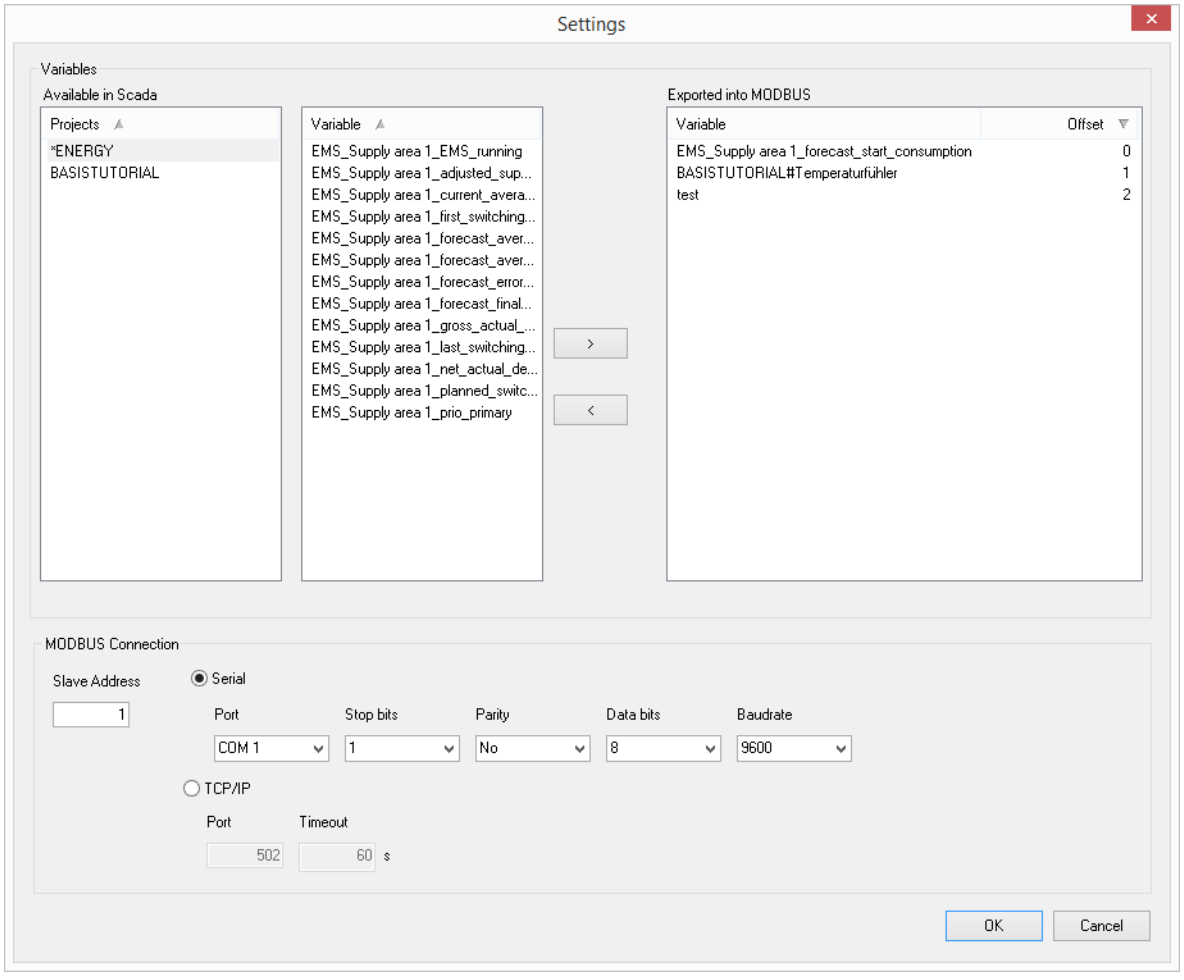
[ ] Ethernet 802.3
[ ] Serial X.21 interface
[ ] Other selection from RFC 2200:

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.



VARIABLES

Parameters	Description
Variables	Selection of variables that are exported to MODBUS and synchronized with zenon.
Available in Scada	Displays all variables available in zenon With multi-project administration, variables from active projects can be selected. - **Projects**: shows all available projects; the standard project is marker with a ***** - **Variables**: offers all variables from the selected project to be transferred
Exported into MODBUS	Lists all variables exported to MODBUS and their offset. List can be sorted by clicking on headings. - `Variables:` List of all SCADA variables that are exported to the MODBUS. 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. - `Offset:` Offset of the variable (MODBUS holding register offset)
Pfeiltasten	Allocation of the variables to MODBUS: - Clicking on the **>** button adds variables from the **Available in Scada** list to the **Exported into MODBUS** list. A dialog to allocate the address is opened (see **Allocation dialog** section). - Clicking on the **<** button removes variables from the `Exported into MODBUS` list and inserts them back into the `Available in Scada` list.

MODBUS CONNECTION

MODBUS Connection	MODBUS connection settings.

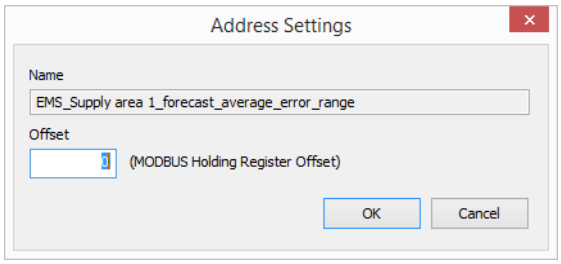
Slave Adress	Modbus hardware address. Default: `1`
Serial	`Active`: Serial connection is used. ▸ **Port**: Serial interface that is used for access to the MODBUS system. ▸ **Stop bits**: number of stop bits. Default: `1` ▸ **Parity:** Parity setting: `No` (default) `Odd` `Even` ▸ **Data bit**: number of data bits. Default: `8` ▸ **Baud rate**: baud rate of the serial interface. Default: `9600`
TCP/IP	`Active`: TCP/IP connection is used. ▸ Port: Port address for the connection. ▸ Timeout: Waiting period.
OK	Accetta le impostazioni e chiude il dialogo.
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

Note:

- Change of name of project 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 (A pagina: 137), 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 to the `Exported into MODBUS` list via clicking the button **>**, a dialog for the name assignment of the zenon variable to an offset in MODBUS opens:



Parameters	Description
Name	Name of the variable. Note: The name of the variable is grayed out, because it can no longer be changed.
Offset	Offset: MODBUS holding register offset. Offset of the variable in MODBUS Attention: 0 is always entered as the offset by default.
OK	Accetta le impostazioni e chiude il dialogo.
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

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 (A pagina: 133) with the **Slave Adress 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]

Inserimento	Descrizione
COMPORT	Interfaccia seriale (COM1 = 0, COM2 = 1,...). Può essere impostata usando il dialogo di configurazione (A pagina: 133).
BAUD	Baud rate della porta seriale Può essere impostata usando il dialogo di configurazione (A pagina: 133).
BYTESIZE	Quantità dei bit di dati dell'interfaccia seriale
PARITY	Impostazioni di parità dell'interfaccia seriale: 0=No 1=Odd 2=Even Può essere impostata usando il dialogo di configurazione (A pagina: 133).
STOPBITS	Quantità dei bit di stop dell'interfaccia seriale 0=1 1=1.5 2=2 Può essere impostata usando il dialogo di configurazione (A pagina: 133).
TIMEOUT	Intervallo di timeout in millisecondi per la comunicazione seriale.
HWADDRESS	Indirizzo hardware del sistema MODBUS. Default: 1 Può essere impostata usando il dialogo di configurazione (A pagina: 133).
REFRESHRATE	Tempo di update in millisecondi.
SERIELL	Comunicazione seriale o TCP/IP: 1 = seriale 0 = TCP/IP Può essere impostata usando il dialogo di configurazione (A pagina: 133).
PORT	Porta TCP/IP
TCPTIMEOUT	Intervallo di timeout TCP/IP in secondi.

[MODBUS VARIABLES]

Variabili che devono essere sostituite in AccessMODBUS.

Nota: a partire da zenon 7.11, questo inserimento sostituisce quello originario **[VARIABLES]**. Questo impedisce che per le variabili del progetto standard venga eseguita una sostituzione inutile tramite l´opzione **Logicper connessione SCADA**.

Inserimento	Descrizione
COUNT	Numero delle variabili da esportare
OFFSET_n	Indirizzo Modbus assegnato al numero corrispondente (**n**). La numerazione inizia da 0.
NAME_n	Nome della variabile assegnata al numero corrispondente (**n**). La numerazione inizia da 0. Esempi: ▶ OFFSET_0=0 NAME_0=EMS_Supply area 1_forecast_final_consumption Variabile dal progetto di partenza. ▶ OFFSET_1=2 NAME_1=BASISTUTORIAL#Temperaturfühler Variabile dal progetto "BASISTUTORIAL"

▶

11. MS Azure

AccessAzure.dll writes variable values of Runtime to an MS Azure service bus **Queue** or **Event Hub**. Data from the **Queue** can then be obtained from the **AzureDrv** driver from MS Azure and integrated into processes of zenon. Data from an **Event Hub** is for third-party applications and can no longer be read by zenon.

The Process Gateway establishes a connection to MS Azure cyclically and writes messages to the service bus Queue or the Event Hub.

To read the values from the Servicebus Queue, the **AzureDrv** driver establishes a connection to the service bus Queue with the configured name and takes all messages received from it. These messages are unpacked and the online values contained therein are allocated to the variables. The key for this is the **Indirizzo simbolico**.
All messages that are already in the queue when the connection is first successfully established are loaded and discarded. It is always only the current values that are displayed.

This means: Each driver instance on each computer has its own **Queue** as an input signal.
Example: The service bus Queue for the **MYSERVER1** computer and the **onlinedata** configured prefix 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.

You can also find general information on **MS Azure** in the MS Azure manual.

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
Available in Scada	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 **Exported into MS Azure** list.
Button **<**	Selected variables are removed from the **Exported into MS Azure** list.
Exported into MS Azure	List of the variables that are written to the MS Azure Service Bus by the Process Gateway. Naming: ▸ Project name ▸ # (as separator) ▸ Variable name. The key for the values in MS Azure is always PROJECTNAME#VARIABLENAME. Hint: Double clicking on the variable moves it.

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	Lists all connections to MS Azure configured. Each connection consists of the connection name (MS Azure Connection) and the Service Bus Queue Namen. ▶ Creation of a new connection with the button **New...** ▶ A selected connection can be amended with the **Edit...** button.
MS Azure Connection	**MS Azure** connection address.
Service Bus Queue name	Name of the queue in the MS Azure service bus.
New...	Opens dialog to configure the **MS Azure** connection.
Edit...	Opens existing connections to configure the **MS Azure** connection.
Delete	Deletes the selected **MS Azure** connection from the list.

MS AZURE SETTINGS

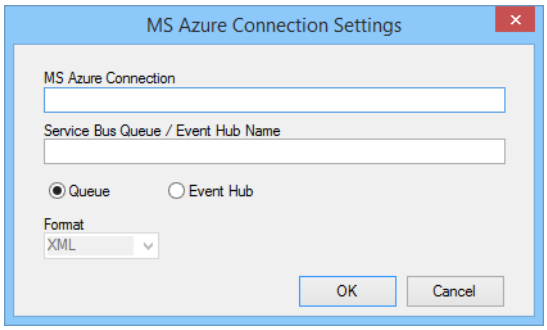
Parameters	Description
Integrity period	Time interval in which the current values of the selected variables are written as an image to the MS Azure Service Bus queue. If the value of a variable changes during this this interval, the value change is immediately transferred to the **MS Azure** queue. Default: 5 s

NAVIGATION

Parameters	Description
OK	Accetta le impostazioni e chiude il dialogo.
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

11.1.1 MS Azure Connection Settings

Configuration dialog for the connection to **MS Azure**:



Parameters	Description
MS Azure Connection	**MS Azure** connection address. Note: You can read and copy this address in the Azure administration portal under **Manage Connection Strings** of the desired **Servicebus Namespace**.
Service Bus Queue / Event Hub Name	Name of the **MS Azure Service Bus** queue or the **Event Hub**. Selection by means of radio buttons. Note: Only characters that appear in the name of an MS Azure Service Bus Queue or in an Event Hub are permitted. Use simple, short and meaningful names. Avoid special characters, language-specific letters and blank spaces. **Service Bus Queue** The name of the **Service Bus Queue** comprises: ▸ A freely-configurable prefix ▸ An underscore (_) ▸ The NETBIOS computer name (without domain name suffix) in small lettering If the name does not yet exist in the Namespace a Queue with this name is created. Requirement: The corresponding rights are present. **Event Hub** ▸ **Message format**: Select in the drop-down list in the **Format** option. ▸ **Event Hub Name**: Name of the Event Hubs in the MS Azure Service Bus The Event Hub must already be created with this name in the Namespace.
Queue	▸ `Active`: The connection is established using the name of the **Service Bus Queue**.
Event Hub	▸ `Active`: The connection is established using the name of the **Event Hub** . Selection of the message format using the **Format** option.
Format	Message format for connection via **Event Hub**. Select from drop-down list: ▸ `XML` ▸ `JSON` ▸ `BOND` (compact binary)
OK	Accetta le impostazioni e chiude il dialogo.
Cancel	Annulla tutte le modifiche e chiude la finestra di dialogo.

Informazioni su

The Service Bus Queue Name can be freely configured.
This queue is automatically created in MS Azure during the first communication to MS Azure.

For each computer that calls up data from MS Azure, use the **AzureDrv** driver to create a separate MS Azure Connection.

11.2 Message formats

SERVICE BUS QUEUE

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; }
}
```

EVENT HUB

When using the Event Hub as a connection, it is possible to choose between `XML`, `JSON` and `BOND` (compact binary) as a message format. Partition-Key is the zenon variable name.

FORMAT BOND

```
namespace AzureServiceBusShared

struct ArchiveMessage
{
  0: string strArvProject;
  1: string strArvName;
  2: string strVarProject;
  3: string strVarName;
  4: int64 nVarID;
  5: int16 nCalc;
  6: double fValue;
  7: string strValue;
  8: bool bValueIsString;
  9: int64 nTime_s;
  10: int16 nTime_milli;
  11: int64 nStatus;
}

struct OnlineValueMessage
{
  0: string strVarProject;
  1: string strVarName;
  2: int64 nVarID;
  3: double fValue;
  4: string strValue;
  5: bool bValueIsString;
  6: int64 nTime_s;
  7: int16 nTime_milli;
  8: int64 nStatus;
}
```

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]

Inserimento	Descrizione
INTEGRITYPERIOD=	Intervallo in secondi del ciclo di scrittura.

[VARIABLES]

Inserimento	Descrizione
Name_n=	Nome della variabile per il Process Gateway. Formato: `SOURCEPROJECT#SOURCEVARIABLE..` Numerazione (n): `n` rappresenta il numero progressivo della configurazione di connessione. Questa numerazione inizia da 0. Esempio: ▶ 1 variabile dà come risultato `n = 0` ▶ Con 3 variabili si ha, per il terzo inserimento, `n = 2`
Count=	Numero delle variabili. Nota: in questo caso la numerazione inizia da `1`. Otto connessioni danno come risultato `Count=8`.

[CONNECTIONS]

Inserimento	Descrizione
CONN_n=	Nome della connessione MS Azure. Numerazione (n): `n` rappresenta il numero progressivo della configurazione di connessione. Questa numerazione inizia da 0. Esempio: ▶ 1 connessione dà come risultato `n = 0` ▶ Con 3 connessioni si ha, per il terzo inserimento, `n = 2`
QUEUE_n=	Nome della coda MS Azure. Per la numerazione (_n) valgono le stesse regole che si applicano a **CONN**
COUNT=	Numero delle connessioni MS Azure configurate. Nota: in questo caso la numerazione inizia da `1`. Due connessioni danno come risultato `Count=2`.

12. OPC UA Server

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

Informazioni su

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

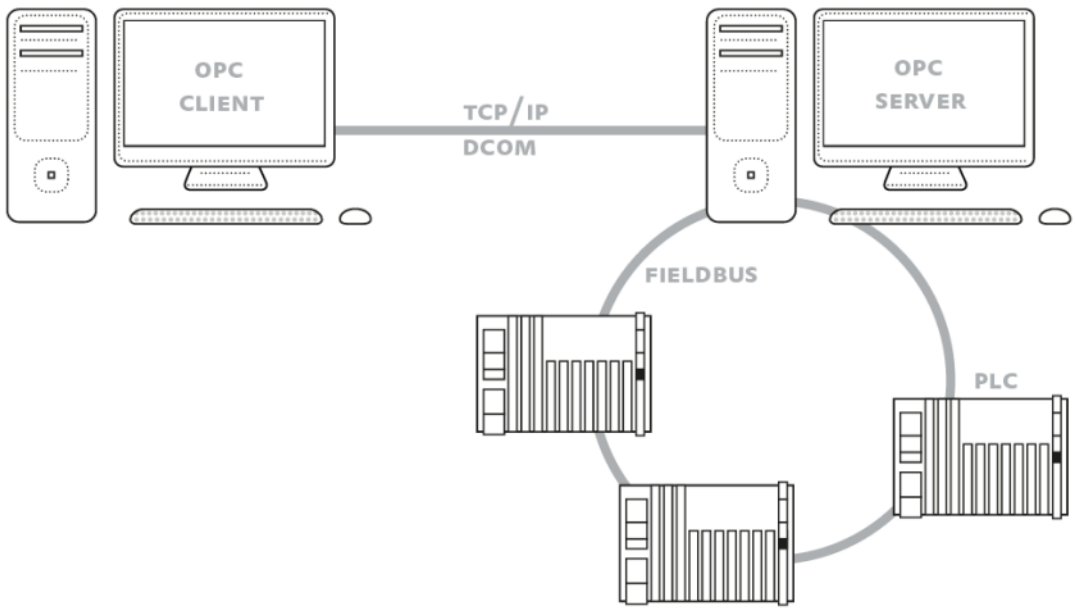
The OPC UA server is multi-project compatible from zenon 7.11 onwards. Variable from the Runtime project and all its subprojects can be selected. In doing so, the object name from the variable name and the project name are combined. Configurations for OPC UA clients that were created before zenon 7.11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

12.1 Confronto fra OPC Server e OPC UA Server

L´OPC UA Server ha preso il posto dell´OPC Server. Si raccomanda l´uso dell´OPC UA server per la maggior parte delle applicazioni.

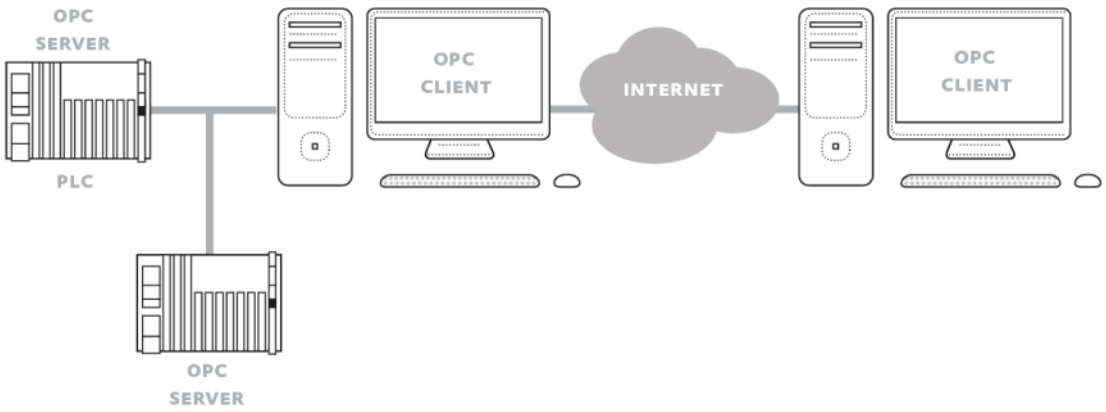
OPC SERVER

- OPC Task Force dal 1995
- Interfaccia universale per i sistemi di automazione.
- Basato sulla tecnologia COM/DCOM di Microsoft.
- OPC foundation dal 1996
- Diverse specifiche per differenti applicazioni.



OPC UA SERVER

- First vision 2003
- Release della prima versione nel 2006, non ancora tutte le parti.



CONFRONTO FRA OPC SERVER E OPC UA SERVER

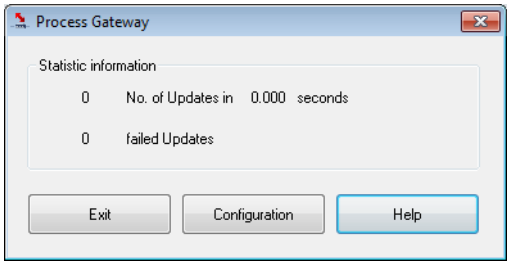
Parametri	OPC Server	OPC UA Server
Modello di dati	Limitato	Per tutte le applicazioni
Implementazione	Dipendente dal produttore	Indipendente dal produttore
Interoperabilità	No	Sì
Configurazione	Complicata	Semplice
Uso in rete	Sconsigliato (ragioni di sicurezza); Windows CE non può essere usato.	Sì
Tecnologia di rete	DCOM (soggetta ad errori, instabile)	OPC UA TCP binary Protocol
Prestazioni	Basse	Alte
Piattaforme	Solo Windows	Indipendente
Ridondanza	No	Sì
Fabbisogno di risorse	Alte	Più basso
Service-Oriented Architecture (SOA)	No	Sì
Sicurezza	Obsoleta	Al passo con gli standard attuali
Protezione connessione	No	Garantita
Windows CE	No	Sì

12.2 Module configuration

START

To start the process gateway with the OPC UA module, this must be entered into the `zenProcGateway.ini (A pagina: 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.



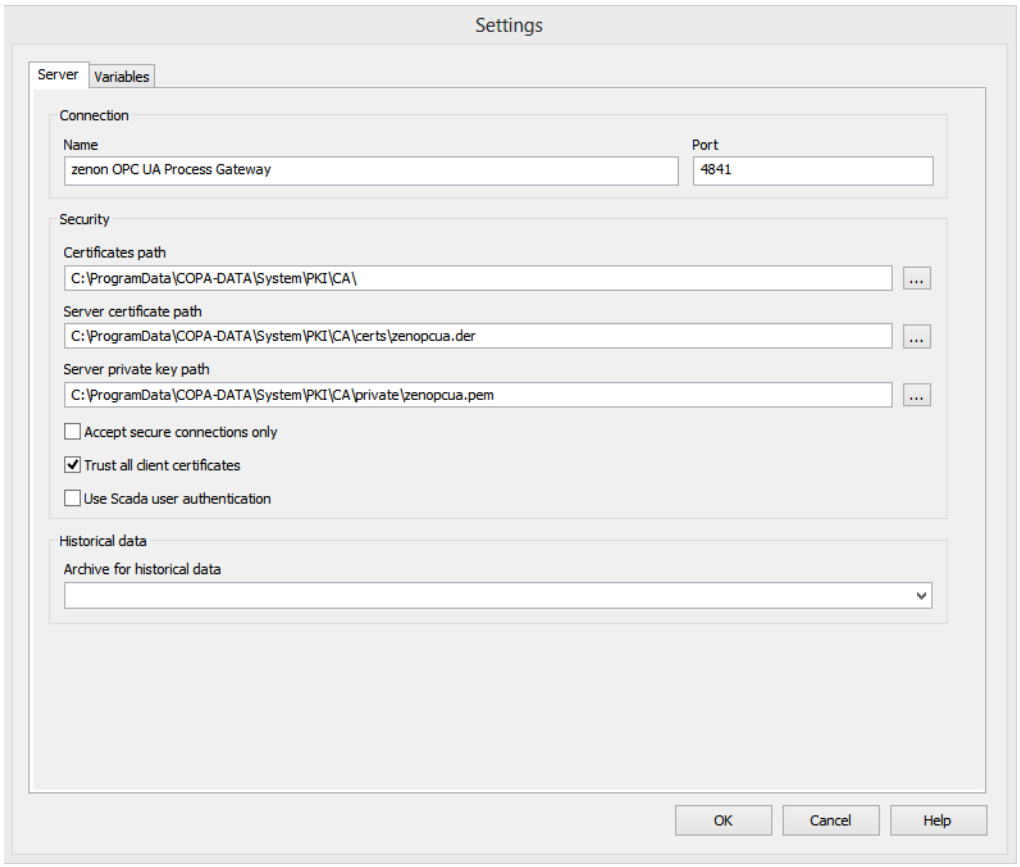
Parameters	Description
Exit	Closes process gateway.
Configuration	Opens configuration dialog.
Help	Opens help.

To configure the server and variables:

1. Click on Configuration
2. In the dialog that opens, you configure:
   - Server (A pagina: 153)
   - Variables (A pagina: 157)

12.2.1 Server

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



Parameters	Description
Name	Name of the server as it is shown on the client.
Port	TCP port via which the client establishes the connection. Default: `4841`
Certificates path	Path to the certificate files.
Server certificate path	File with the public key of the server. Used by the client for encrypting messages. ▸ Format: `DER` ▸ Suffix: **.der**
Server private key path	File with the private key of the server. Is used by the server to decrypt the messages from the client. ▸ Format: `PEM` ▸ No password.
Accept secure connections only	`Active`: Only secure connections are accepted for establishing a connection, with the signature or with signature and encryption: ▸ Basic128Rsa15: RSA15 as key wrap algorithm and 128-bit basic as algorithm for the message encryption ▸ Basic256: 256-bit basic as algorithm for message encryption Default: `Inactive` Note: for connections with a signature, the packages are secured against tampering, but the contents of the package are not encrypted.
Trust all client certificates	▸ `Active`: All client certificates are accepted and the connection is made. ▸ `Inactive`: 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 (**certificate trust list path**). Note: 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 **Trust List** folder.

Use zenon authentication	▸ `Active`: Clients can only log on to the server with a valid user ID and password. Note: The user administration must be active. ▸ `Inactive`: Anonymous login is possible. Attention: 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.
Archive for historical data	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.
OK	Riprende le modifiche in tutte le tab e chiude il dialogo. Attention: All active connections are ended and the server is restarted with the new settings. Connection errors may occur in the process.
Cancel	Annulla tutte le modifiche in tutte le schede e chiude la finestra di dialogo.
Help	Apre la guida online.

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 Qualitfied 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.

> **Attenzione**
>
> *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.

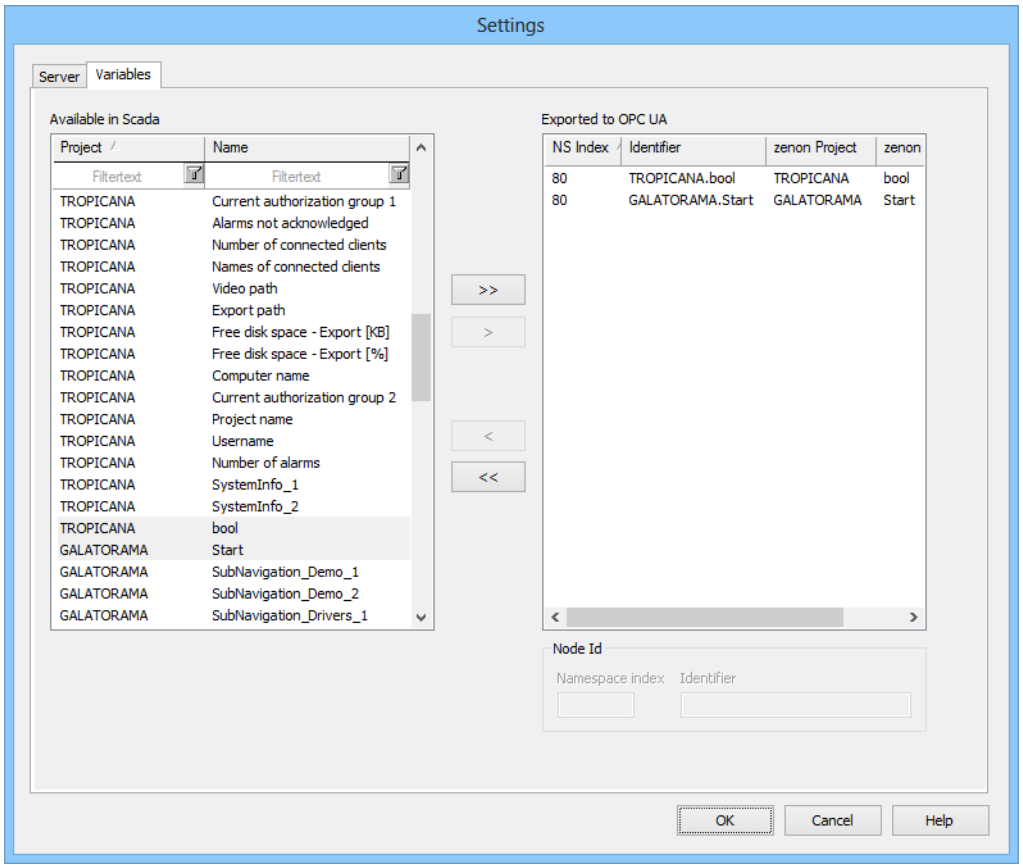
Attenzione

*Variables that do not have the **Settaggio valori attivo** 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
Available in Scada	List of existing variables.
Filter	The existing variables can be displayed as filtered according to: ▸ Project ▸ Name The placeholders (***** or **?**) are permitted for the filter text.
Exported to OPC UA	List of exported variables. The variables can be sorted according to: ▸ NS index ▸ Identifier ▸ Project ▸ zenon name
Node Id	
Namespace index	Defines the namespace index in the **node ID** for the selected OPC UA variable. The value: ▸ must not be empty ▸ must be numerical ▸ must be greater than 0
Identifier	Defines the identifier in the **node ID** for the selected OPC UA variable. ▸ A numerical identifier is automatically created with numerical input. ▸ If a GUID is entered, a GUID identified is created, otherwise the identifier is treated as a string. GUID-Form: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx) The field must not be empty.

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**.

Informazioni su

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**"
- I 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 (A pagina: 152) will be opened for you. If the configuration is not confirmed with OK, the process gateway is closed.

Attenzione

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 (A pagina: 161).

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 (A pagina: 152).

SECURE CONNECTIONS

If the **Accept secure connections only** (A pagina: 153) 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** (A pagina: 153) 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 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:

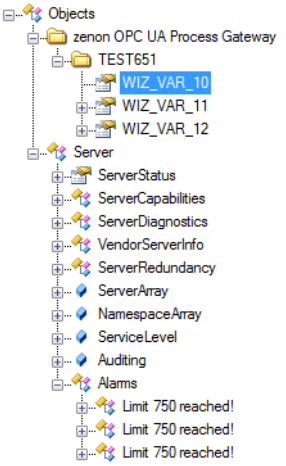
OPC UA range	zenon alarm/event class	OPC weighting
HIGH	20	1000
	19	950
	18	900
	17	850

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 limit values 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
Discovery Service Set	
FindServers	yes
GetEndpoints	yes
RegisterServer	no
SecureChannel Service Set	
OpenSecureChannel	Yes
CloseSecureChannel	Yes
Session Service Set	
CreateSession	yes
ActivateSession	yes
CloseSession	yes
Cancel	yes
NodeManagement Service Set	
AddNodes	no
AddReferences	no
DeleteNodes	no
DeleteReferences	no
View Service Set	
Browse	yes
BrowseNext	yes
TranslateBrowsePathsToNodeIds	yes
RegisterNodes	yes
UnregisterNodes	yes
Query Service Set	
QueryFirst	no
QueryNext	no
Attribute Service Set	
Read	yes

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

12.8 Error message

Error mesages in the log file:

Error message	Debug Level	Description
`Failed to validate client certificate`	Error	The client certificate could not be validated. It is either invalid (the date of validity may have been overwritten) or it was not found in the list of known client certificates. Additional information including an error number describes the error in more detail.
`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

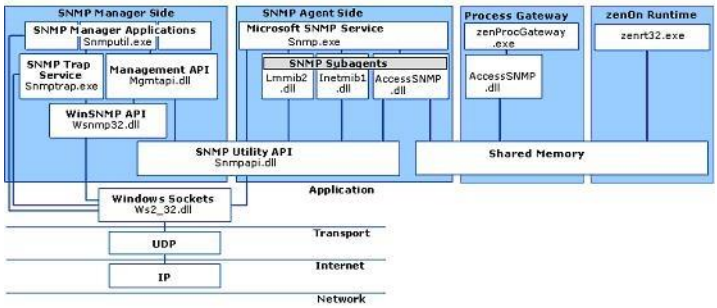
13.1 SNMP architecture

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

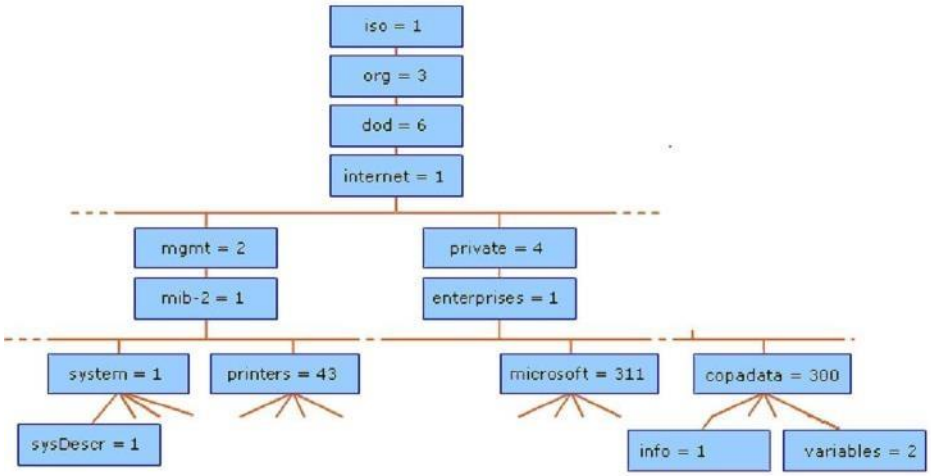
(http://technet2.microsoft.com/windowsserver/en/library/bf555774-2d63-4e96-b432-c4b7bcac6b531033.mspx)

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.



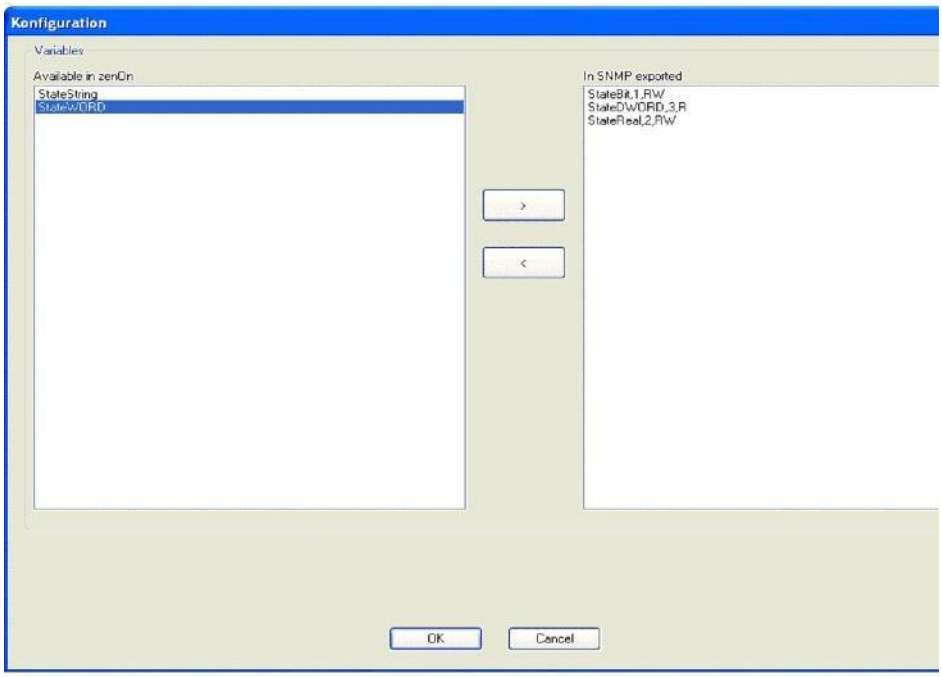
13.3 MIB structure

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

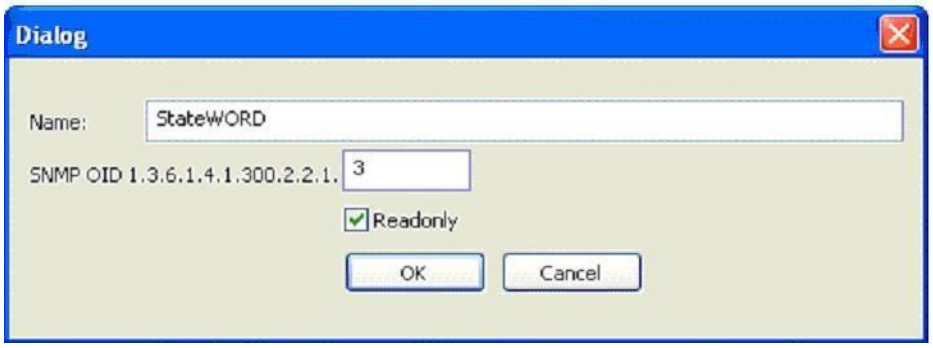
Variable structure (table) is dynamically adjusted, according to the configuration of the Process Gateway				
OID	**Description**	**Data Type**	**Access**	**Change is sent as Trap**
1.3.6.1.4.1.300.2.1.0	copadata.variables.ifNumber, number of configured variables=OID	integer	read	yes
1.3.6.1.4.1.300.2.2.1.X	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.ifValueAsString, 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 **>** With the button **<** they can be removed again. 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<=<COUNT)
PARAM_n	Parameter SNMP OID table offset and the information R=read only / RW=read and write with the number n (0<=n<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 7.50`
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:

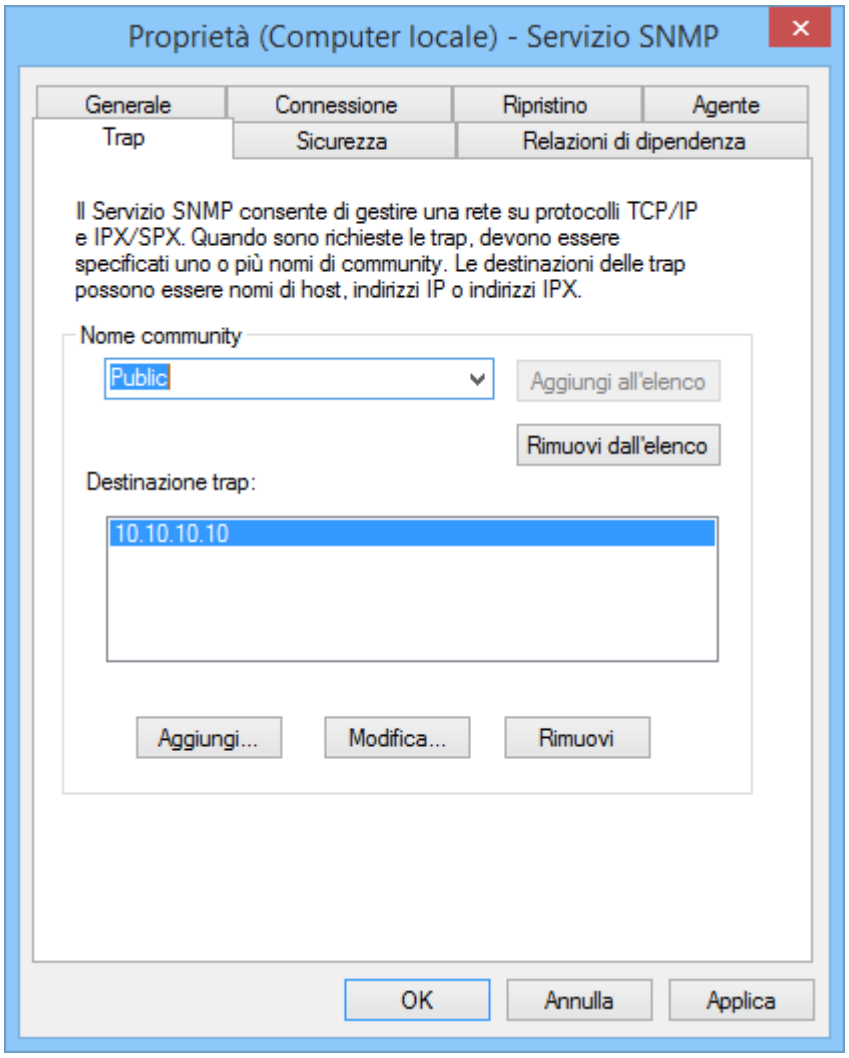
- **[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\SNMP\Parameters\ExtensionAgents]**
  Name=ProcessGateway
  Value=SOFTWARE\COPA-DATA\SNMP\CurrentVersion
- **[HKEY_LOCAL_MACHINE\SOFTWARE\COPA-DATA\SNMP\CurrentVersion]**
  Name=Pathname
  Wert=C:\Program Files\COPA-DATA\zenon 7.50 SP0\AccessSNMP.dll

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
  Wert=C:\Program Files (x86)\COPA-DATA\zenon 7.50 SP0\AccessSNMP.dll

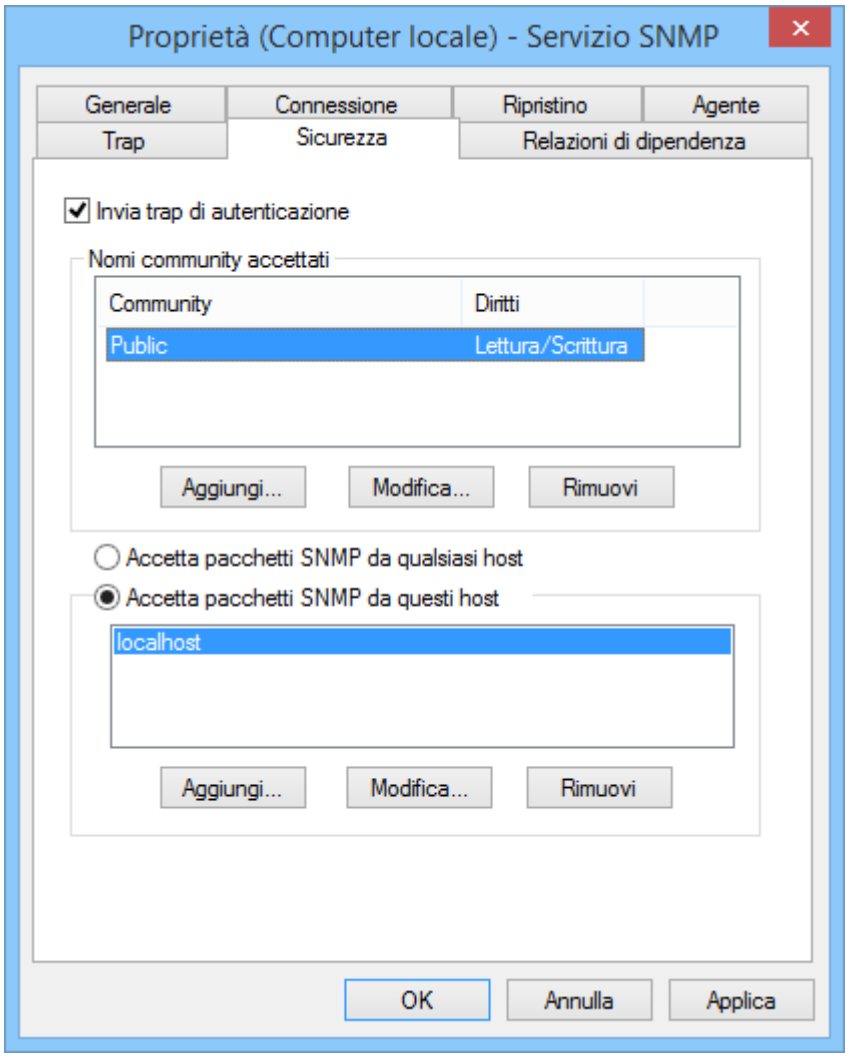
4. Start the SNMP service.
   This loads the process gateway file AccessSNMP.dll via the registry configuration.
   Further configuration settings for the Windows SNMP service: Control panel -> Administration-> Services-> SNMP service-> Properties

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.

> **Attenzione**
>
> *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.*

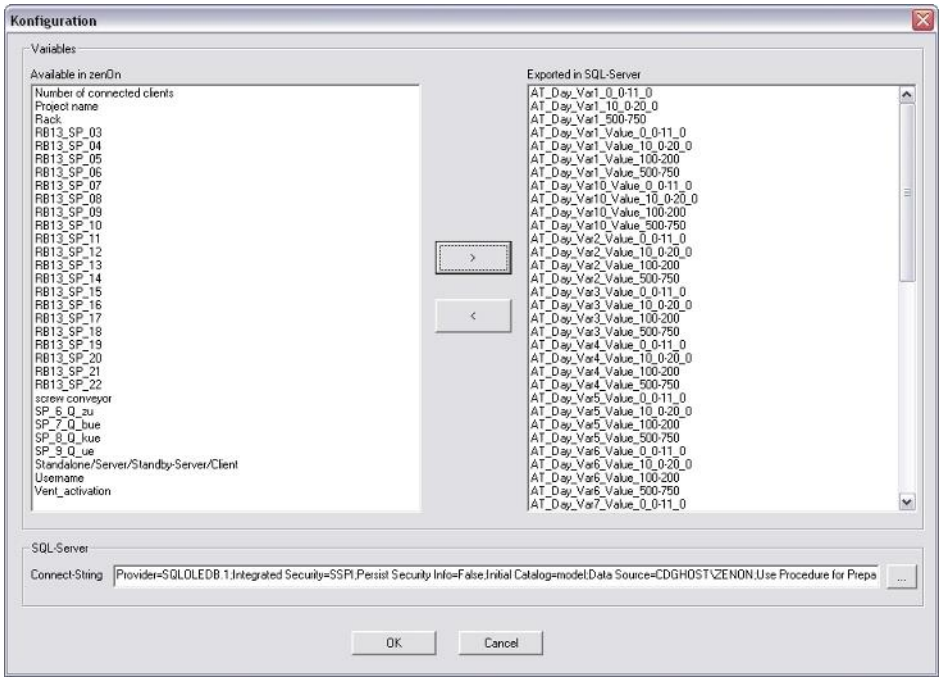
ORACLE DATABASES

Use of the Process Gateway and `AccessSQL.dll` in conjunction with Oracle databases can cause errors: It it 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.

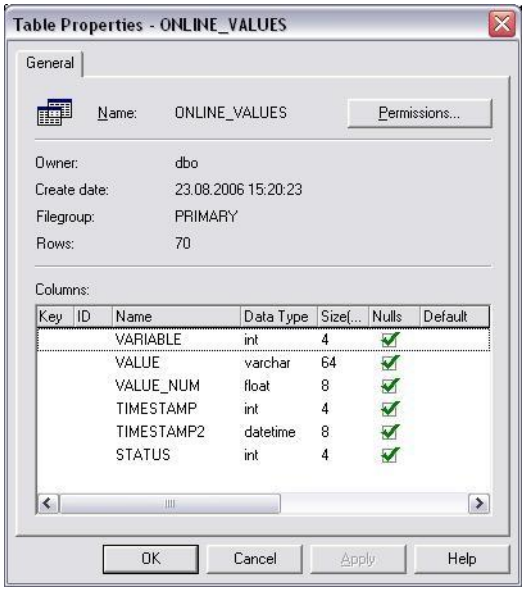
14.2 Variable selection

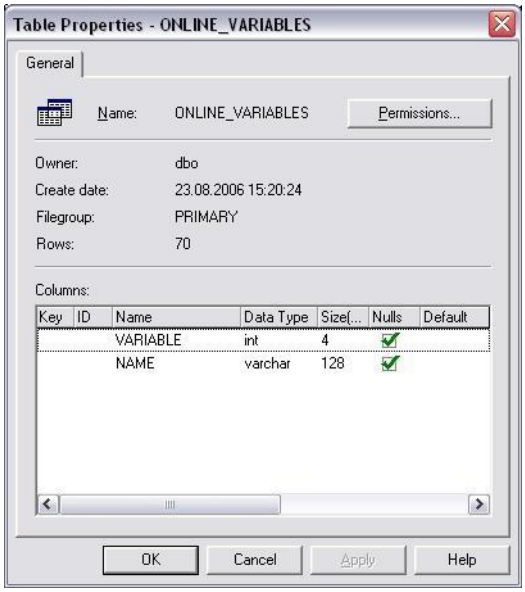
In the configuration dialog the zenon variables that should be written to the SQL process image can be defined. In order to do this the variables available in the zenon project - listed in the left part - have to be added to the image - listed in the right part.



14.3 Creating tables

After closing the configuration dialog with **OK**, 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 variation 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

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

14.6.2 Table for variable IDs

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