



zenon
by COPA-DATA

zenon driver manual IEC870

v.8.20



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1 Welcome to COPA-DATA help

ZENON VIDEO TUTORIALS

You can find practical examples for project configuration with zenon in our YouTube channel (https://www.copadata.com/tutorial_menu). The tutorials are grouped according to topics and give an initial insight into working with different zenon modules. All tutorials are available in English.

GENERAL HELP

If you cannot find any information you require in this help chapter or can think of anything that you would like added, please send an email to documentation@copadata.com.

PROJECT SUPPORT

You can receive support for any real project you may have from our customer service team, which you can contact via email at support@copadata.com.

LICENSES AND MODULES

If you find that you need other modules or licenses, our staff will be happy to help you. Email sales@copadata.com.

2 IEC870

Driver for the IEC 60870-5-101 (serial) and the IEC 60870-5-104 (TCP/IP) protocol.

Communication between zenon and the PLC is based on

- ▶ The serial IEC 60870-5-101 protocol
Here, zenon acts as a master in unbalanced communication mode. The communication channel can be shared between a 60870 Master (zenon) and several 60870 Slaves (PLC).
- ▶ or the TCP/IP protocol IEC 60870-5-104
Here, zenon acts as the master on protocol level and as a client on TCP level.

JOINT USE OF SERIAL AND TCP/IP CONNECTION

Connections in accordance with **870-104** (TCP/IP) and **870-101** (serial) should not be created together in a driver instance. The slower serial connection (101) would also slow down the TCP/IP connection (104). It could even lead to a TCP/IP timeout.

Hint: If you need connections via both protocols, create two instances of the driver in the zenon project.

3 IEC870 - data sheet

General:	
Driver file name	IEC870.exe
Driver name	IEC 60870-5-101_104
PLC types	IEC 60870-5-104 slaves or IEC 60870-5-101 slaves (controlled stations).
PLC manufacturer	Alstom; Siemens; IEC; SAT; Sprecher Automation; Areva

Driver supports:	
Protocol	IEC 60870-5-104; IEC 60870-5-101
Addressing: Address-based	Address based
Addressing: Name-based	--
Spontaneous communication	X
Polling communication	X
Online browsing	X
Offline browsing	--
Real-time capable	X
Blockwrite	--
Modem capable	--
RDA numerical	--

Driver supports:	
RDA String	--
Hysteresis	X
extended API	X
Supports status bit WR-SUC	X
alternative IP address	X

Requirements:	
Hardware PC	Standard network card (for -104) or serial interface RS-232 or RS-485 (for -101).
Software PC	--
Hardware PLC	--
Software PLC	--
Requires v-dll	X

Platforms:	
Operating systems	Windows 10; Windows 7; Windows 8; Windows 8.1; Windows Server 2008 R2; Windows Server 2012; Windows Server 2012 R2; Windows Server 2016

4 Configuration

In this chapter you will learn how to use the driver in a project and which settings you can change.

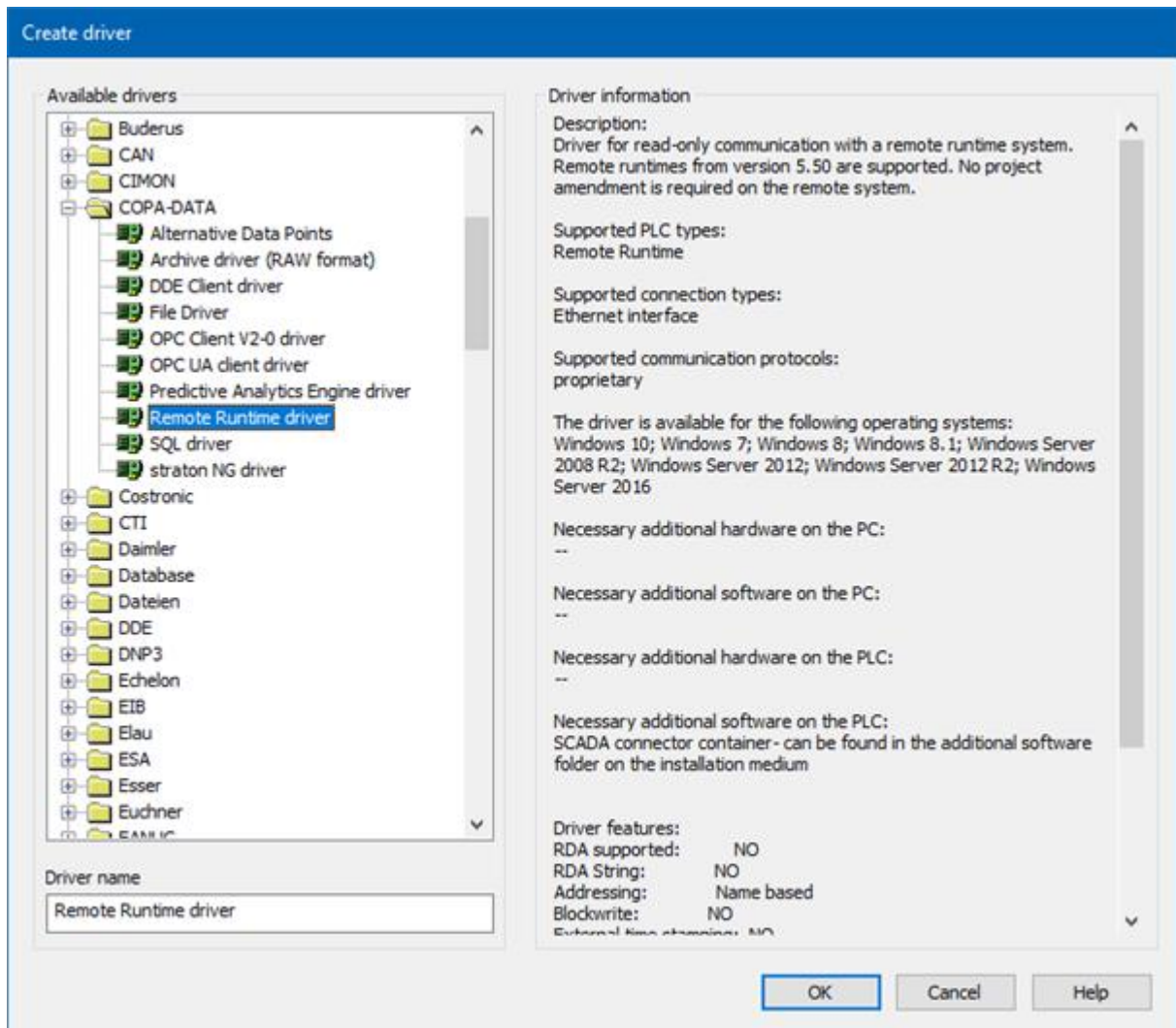


Information

Find out more about further settings for zenon variables in the chapter Variables of the online manual.

4.1 Creating a driver

In the **Create driver** dialog, you create a list of the new drivers that you want to create.



Parameter	Description
Available drivers	<p>List of all available drivers.</p> <p>The display is in a tree structure: [+] expands the folder structure and shows the drivers contained therein. [-] reduces the folder structure</p> <p>Default: <i>No selection</i></p>
Driver name	<p>Unique Identification of the driver.</p> <p>Default: <i>empty</i></p> <p>The input field is pre-filled with the pre-defined</p>

Parameter	Description
	Identification after selecting a driver from the list of available drivers.
Driver information	Further information on the selected driver. Default: <i>empty</i> The information on the selected driver is shown in this area after selecting a driver.

CLOSE DIALOG

Option	Description
OK	Accepts all settings and opens the driver configuration dialog of the selected driver.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.



Information

The content of this dialog is saved in the file called Treiber_[Language].xml. You can find this file in the following folder:

C:\ProgramData\COPA-DATA\zenon[version number].

CREATE NEW DRIVER

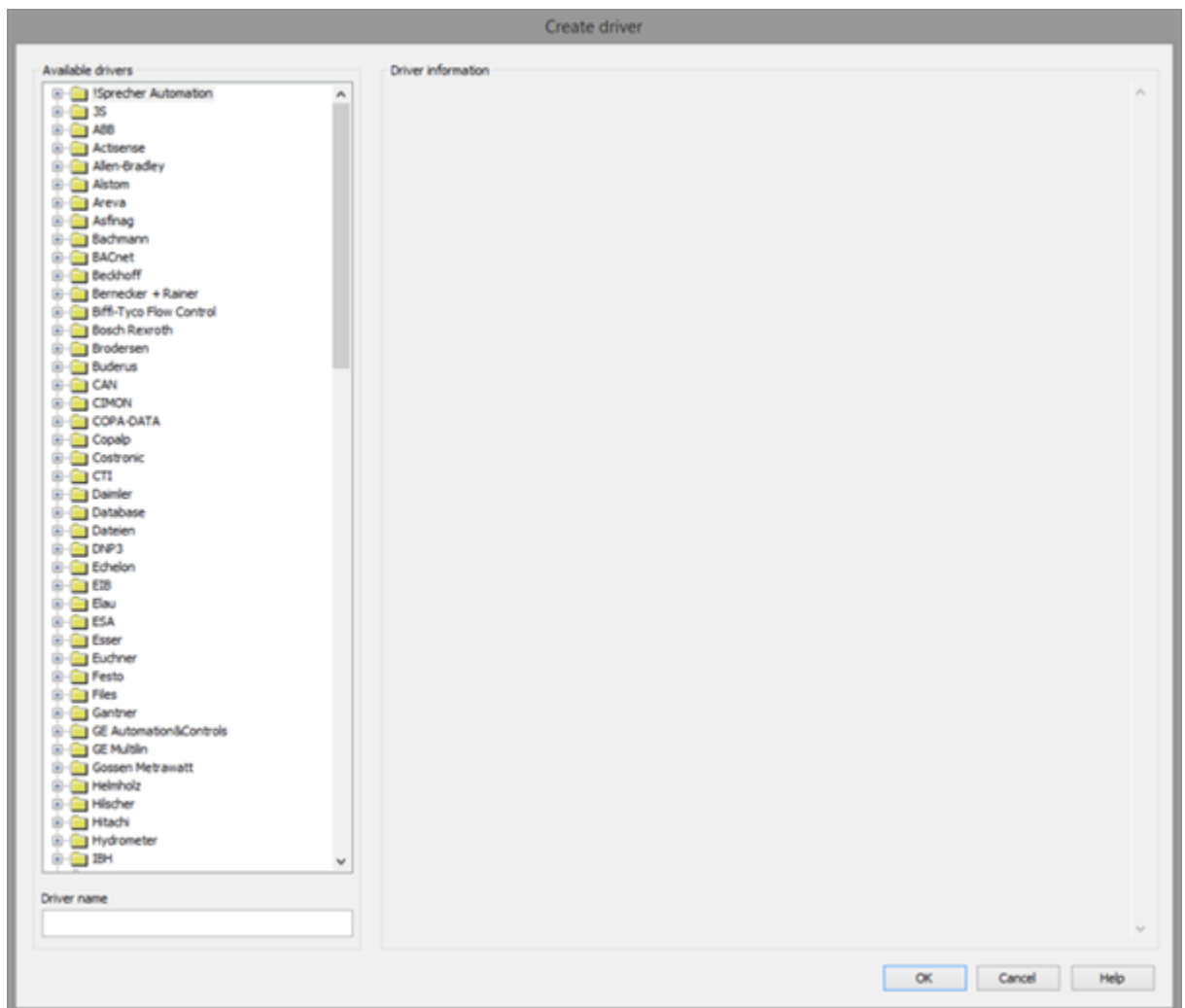
In order to create a new driver:

1. Right-click on **Driver** in the Project Manager and select **New driver** in the context menu.

Optional: Select the **New driver** button from the toolbar of the detail view of the **Variables**. The Create driver dialog is opened.

The **Create simple data type** dialog is opened.

2. The dialog offers a list of all available drivers.

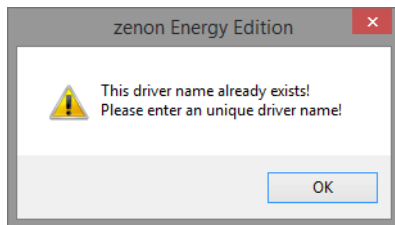


3. Select the desired driver and name it in the **Driver name** input field.
This input field corresponds to the **Identification** property. The name of the selected driver is automatically inserted into this input field by default.
The following is applicable for the **Driver name**:
 - ▶ The **Driver name** must be unique.
If a driver is used more than once in a project, a new name has to be given each time.
This is evaluated by clicking on the **OK** button. If the driver is already present in the project, this is shown with a warning dialog.
 - ▶ The **Driver name** is part of the file name.
Therefore it may only contain characters which are supported by the operating system.
Invalid characters are replaced by an underscore (_).
 - ▶ **Attention:** This name cannot be changed later on.
4. Confirm the dialog by clicking on the **OK** button.
The configuration dialog for the selected driver is opened.

Note: The language of driver names cannot be switched. They are always shown in the language in which they have been created, regardless of the language of the Editor. This also applies to driver object types.

DRIVER NAME DIALOG ALREADY EXISTS

If there is already a driver in the project, this is shown in a dialog. The warning dialog is closed by clicking on the **OK** button. The driver can be named correctly.



ZENON PROJECT

The following drivers are created automatically for newly-created projects:

- ▶ **Intern**
- ▶ **MathDr32**
- ▶ **SysDrv**



Information

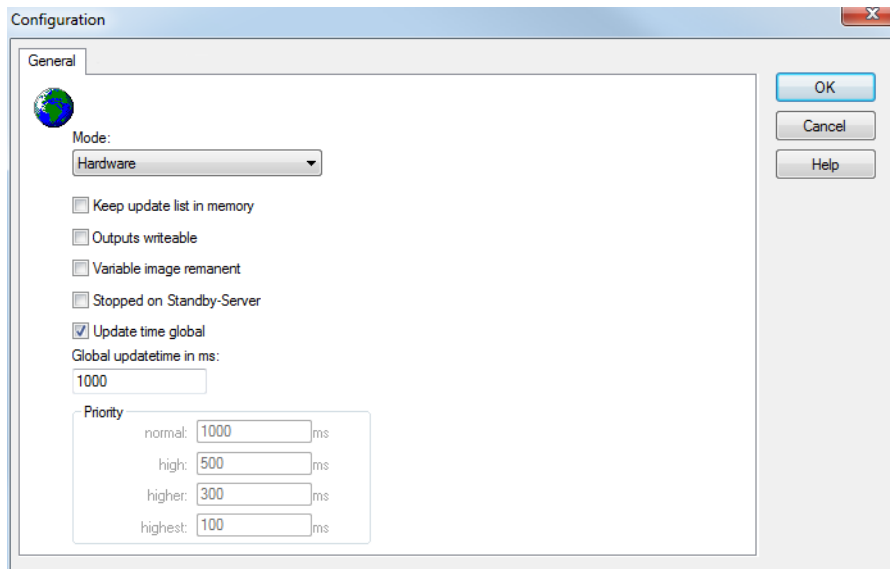
Only the required drivers need to be present in a zenon project. Drivers can be added at a later time if required.

4.2 Settings in the driver dialog

You can change the following settings of the driver:

4.2.1 General

The configuration dialog is opened when a driver is created. In order to be able to open the dialog later for editing, double click on the driver in the list or click on the **Configuration** property.



Option	Description
Mode	<p>Allows to switch between hardware mode and simulation mode</p> <ul style="list-style-type: none"> ▶ <i>Hardware:</i> A connection to the control is established. ▶ <i>Simulation - static:</i> No communication between to the control is established, the values are simulated by the driver. In this modus the values remain constant or the variables keep the values which were set by zenon Logic. Each variable has its own memory area. E.g. two variables of the type marker with offset 79 can have different values in the Runtime and do not influence each other. Exception: The simulator driver. ▶ <i>Simulation - counting:</i> No communication between to the control is established, the values are simulated by the driver. In this modus the driver increments the values within a value range automatically. ▶ <i>Simulation - programmed:</i> No communication is established to the PLC. The

Option	Description
	<p>values are calculated by a freely programmable simulation project. The simulation project is created with the help of the zenon Logic Workbench and runs in a zenon Logic Runtime which is integrated in the driver.</p> <p>For details see chapter Driver simulation.</p>
Keep update list in the memory	<p>Variables which were requested once are still requested from the control even if they are currently not needed. This has the advantage that e.g. multiple screen switches after the screen was opened for the first time are executed faster because the variables need not be requested again. The disadvantage is a higher load for the communication to the control.</p>
Output can be written	<ul style="list-style-type: none"> ▶ <i>Active:</i> Outputs can be written. ▶ <i>Inactive:</i> Writing of outputs is prevented. <p>Note: Not available for every driver.</p>
Variable image remanent	<p>This option saves and restores the current value, time stamp and the states of a data point.</p> <p>Fundamental requirement: The variable must have a valid value and time stamp.</p> <p>The variable image is saved in hardware mode if one of these statuses is active:</p> <ul style="list-style-type: none"> ▶ User status <i>M1 (0) to M8 (7)</i> ▶ <i>REVISION(9)</i> ▶ <i>AUS(20)</i> ▶ <i>ERSATZWERT(27)</i> <p>The variable image is always saved if:</p> <ul style="list-style-type: none"> ▶ the variable is of the Communication details object type ▶ the driver runs in simulation mode. (not programmed simulation) <p>The following states are not restored at the start of the Runtime:</p>

Option	Description
	<ul style="list-style-type: none"> ▶ <i>SELECT(8)</i> ▶ <i>WR-ACK(40)</i> ▶ <i>WR-SUC(41)</i> <p>The mode Simulation - programmed at the driver start is not a criterion in order to restore the remanent variable image.</p>
Stop on Standby Server	<p>Setting for redundancy at drivers which allow only one communication connection. For this the driver is stopped at the Standby Server and only started at the upgrade.</p> <p>Attention: If this option is active, the gapless archiving is no longer guaranteed.</p> <ul style="list-style-type: none"> ▶ <i>Active:</i> Sets the driver at the not-process-leading Server automatically in a stop-like state. In contrast to stopping via driver command, the variable does not receive status switched off but an empty value. This prevents that at the upgrade to the Server irrelevant values are created in the AML, CEL and Historian. <p>Default: <i>inactive</i></p> <p>Note: Not available if the CE terminal serves as a data server. You can find further information in the zenon Operator manual in the CE terminal as a data server chapter.</p>
Global Update time	<p>Setting for the global update times in milliseconds:</p> <ul style="list-style-type: none"> ▶ <i>Active:</i> The set Global update time is used for all variables in the project. The priority set at the variables is not used. ▶ <i>Inactive:</i> The set priorities are used for the individual variables. <p>Exceptions: Spontaneous drivers ignore this option. They generally use the shortest possible update time. For details, see the Spontaneous driver update time section.</p>

Option	Description
Priority	<p>The polling times for the individual priority classes are set here. All variables with the according priority are polled in the set time.</p> <p>The variables are allocated separately in the settings of the variable properties.</p> <p>The communication of the individual variables can be graded according to importance or required topicality using the priority classes. Thus the communication load is distributed better.</p> <p>Attention: Priority classes are not supported by each driver, e.g. spontaneously communicating zenon drivers.</p>

CLOSE DIALOG

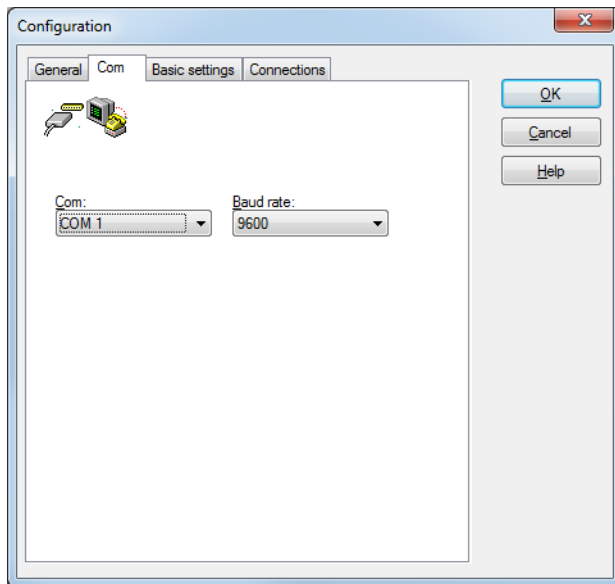
Option	Description
OK	Applies all changes in all tabs and closes the dialog.
Cancel	Discards all changes in all tabs and closes the dialog.
Help	Opens online help.

UPDATE TIME FOR SPONTANEOUS DRIVERS

With spontaneous drivers, for **Set value, advising** of variables and **Requests**, a read cycle is triggered immediately - regardless of the set update time. This ensures that the value is immediately available for visualization after writing. The update time is generally 100 ms.

Spontaneous drivers are **ArchDrv**, **BiffiDCM**, **BrTcp32**, **DNP3**, **Esser32**, **FipDrv32**, **FpcDrv32**, **IEC850**, **IEC870**, **IEC870_103**, **Otis**, **RTK9000**, **S7DCOS**, **SAIA_Slave**, **STRATON32** and **Trend32**.

4.2.2 Com



For this driver, only COM port and baud rate for the communication can be changed. All other communication parameters are defined and fixed in accordance with the IEC 60870-5-101 standard.

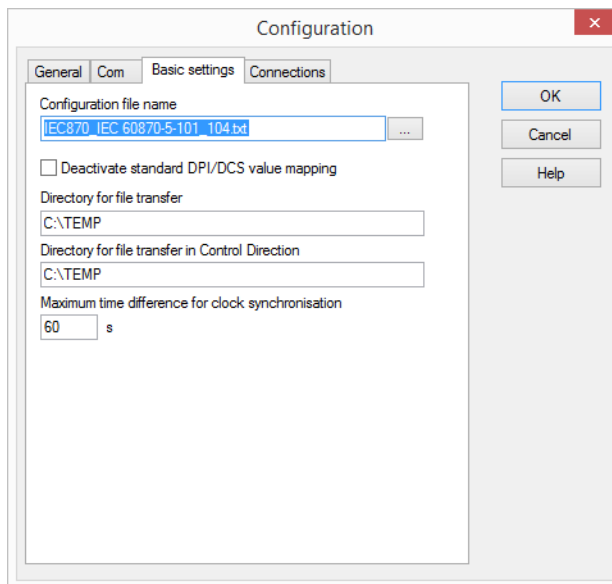
Values:

- ▶ **Parity:** *even*
- ▶ **Stopbit:** *1*
- ▶ **Start bit:** *1*
- ▶ **Data bit:** *8*

For details see: IEC 60870-5-1 "Part 5: Transmission protocols, Section One - Transmission frame formats".

4.2.3 Basic setting

Note: This dialog is only available in English.



Parameter	Description
Configuration file name	Enter the name of the configuration file here. This file is required for the definition of the driver connection.
Deactivate standard DPI/DCS value mapping	<p><i>Inactive</i>(default): The values of double messages (DPI and DCS) are adjusted to the operating elements of zenon. Use this configuration if you want to use the modules of zenon Energy.</p> <p>The driver converts the values of double messages (DPI and DCS) for the Runtime:</p> <ul style="list-style-type: none"> ▶ <i>intermediate off on fault</i> to: 2 0 1 3, so that in Runtime, for example, the value 0 means OFF and 1 means ON. <p><i>Active</i>: The values of double messages are forwarded to zenon exactly as they are:</p> <ul style="list-style-type: none"> ▶ <i>intermediate off on fault</i> = 0 1 2 3). <p>However, in this case you cannot use the command processing, for example, to write double messages.</p> <p>Note: The driver only converts a value of the variable that corresponds to the DPI/DCS value range (on page 53). DPI/DCS consists, according to the standard, of 2 bits; all other</p>

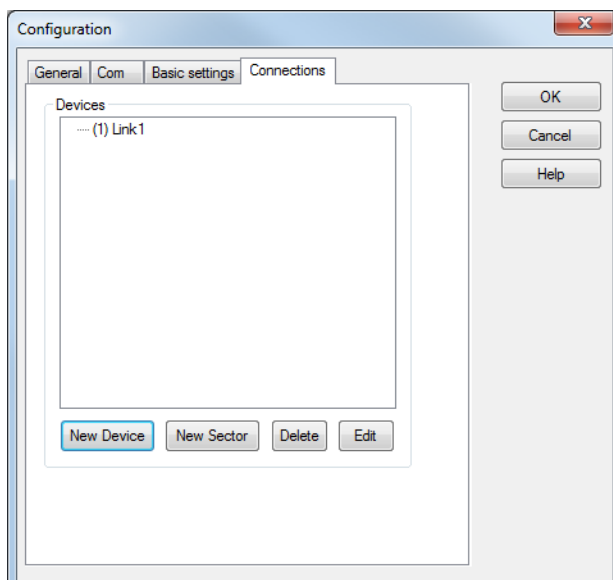
Parameter	Description
	bits of the variable are not transferred.
Directory for file transfer	Here, enter the folder in the Runtime computer in which the "file transfer" files are to be stored. In this folder, there are the files that are received by the IEC60870 slave (<i>GET</i>).
Directory for file transfer in Control Direction	Path of the directory in which the files for file transfer are located. In this folder, the files that are sent to the IEC60870 slave are stored(<i>PUT</i>).
Maximum time difference for clock synchronisation	These parameters define a maximum time limit up to which the time synchronizations in reverse direction will be performed automatically by the system. If the difference is bigger than the configured duration, the synchronization will not be performed. Default: 60 s

4.2.4 Connections

The connections can be defined here.

- ▶ Devices
- ▶ Sectors

attention: configured sectors must be present in the PLC.



Parameter	Description
Devices	List of configured devices and sectors.
New Device	Opens the dialog to configure new devices (on page 19).
New Sector	Opens the dialog to configure new sectors (on page 27).
Delete	Deletes selected entry from the list.
Edit	Opens the selected entry for editing.

CLOSE DIALOG

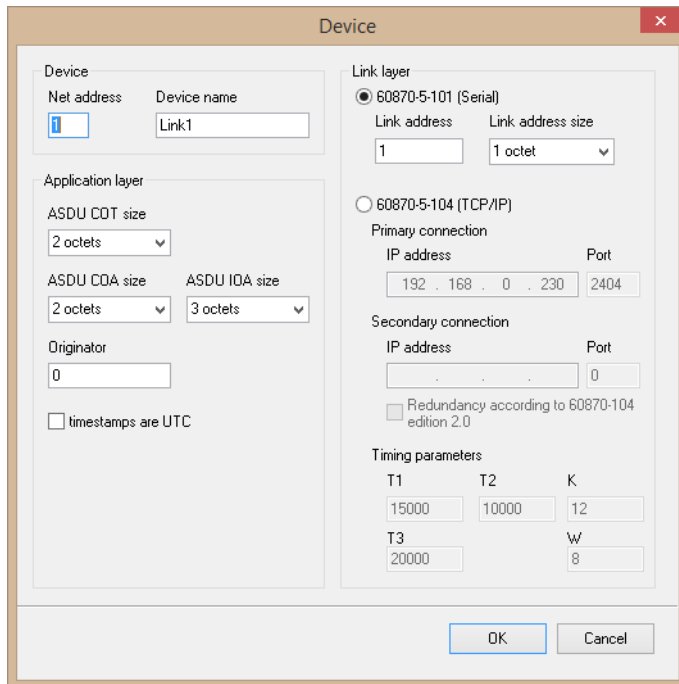
Options	Description
OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.

4.2.4.1 Device

A connection to a Device consists of a physical device connection and several sectors Common Address of ASDU within this device. Each device is identified:

- ▶ On the Runtime page through the **Net address**. This must correspond to the **net address** property of the respective variable.
- ▶ On the protocol page through the **Link address** or **IP address**.

Note: This dialog is only available in English.



DEVICE

Net address, name of the connection and reverse direction active.

Parameter	Description
Net address	Net address of Runtime. Serial number of the configured connection. Attention: Each connection should have a unique number. An automatic check of whether a number has already been issued is not carried out by zenon.
Device name	Approved name of the device: Name of the device that is displayed in the list. Note: Use short names. This name becomes part of the variable name during online import.
Reverse Direction	Determines whether reverse direction is active for this connection. Default: inactive

APPLICATION LAYER

Application level of the driver. Match the configuration in this area to that of your PLC. There will be no communication with the PLC if the configuration is incorrect.

Parameter	Description
ASDU COT size	<p>Defines the length of the COT (Cause of Transmission).</p> <p>Selection of address size from drop-down list. Valid:</p> <ul style="list-style-type: none"> ▶ 1 octet ▶ 2 octets <p>Note: If the 60870-5-104 (TCP/IP) connection type is selected for link layer, the value <i>2 octets</i> is expected in accordance with the standard.</p>
ASDU COA size	<p>Defines the length of the COA (Common Object Address/Common Address of ASDU).</p> <p>Selection of address size from drop-down list:</p> <ul style="list-style-type: none"> ▶ 1 octet ▶ 2 octets <p>Note: If the 60870-5-104 (TCP/IP) connection type is selected for link layer, the value <i>2 octets</i> is expected in accordance with the standard.</p>
ASDU IOA size	<p>Defines the length of the IOA (Information Object Address).</p> <p>Selection of address size from drop-down list. Valid:</p> <ul style="list-style-type: none"> ▶ 1 octet ▶ 2 octets ▶ 3 octets <p>Note: If the 60870-5-104 (TCP/IP) connection type is selected for link layer, the value <i>3 octets</i> is expected in accordance with the standard.</p>
Originator	<p>Numerical identification of the IEC60870 master. The identification is sent to the controller in commands. The PLC can thus distinguish commands from different masters.</p> <p>The value of the originator is only sent if, for ASDU COT-Size, the value <i>2 octets</i> is configured.</p> <p>The entry is validated. An error dialog is called up if the entry is invalid.</p> <p>Default: 0</p>

Parameter	Description
	<p>Input range: 0 - 255</p> <p>Grayed out if, for ASDU COT-Size, the value <i>1 octet</i> is configured.</p>
Timestamps are UTC	<p>Checkbox to select the expected time format. If this checkbox is activated, the time stamp in UTC format is expected or used for the command (e.g. <i>T103</i> time synchronization). A checkbox that is not activated means that the time stamp is interpreted as local time in accordance with the standard.</p> <p>Default: <i>inactive</i></p> <p>Attention: All components should use local time in accordance with the IEC60870 standard.</p>

LINK LAYER

Configuration of the physical connection for communication with serial interface or via TCP/IP.

SERIAL COMMUNICATION

Parameter	Description
870-101	<p><i>Selected:</i> Serial connection is made in accordance with 60870-5-101.</p>
Link address	<p>Serial address on protocol side.</p> <p>Default: <i>1</i></p> <p>Note: Only active if Link layer is <i>60870-5-101 (TCP/IP)</i>.</p>
Link address size	<p>Selection of address size from drop-down list:</p> <ul style="list-style-type: none"> ▶ <i>1 octet</i> ▶ <i>2 octets</i> <p>Default: <i>1 octet</i></p> <p>Note: Only active if Link layer is <i>60870-5-101 (TCP/IP)</i>.</p>

COMMUNICATION VIA TCP/IP NETWORK

Parameter	Description
870-104	<p><i>Selected:</i> Connection is made via the network in accordance with 60870-5-104.</p> <p>Note: Only active if Link layer is <i>60870-5-104 (Serial)</i>.</p>
Primary connection	Addressing of the primary connection of the controller.
IP address	<p>IP address of PLC.</p> <p>Note: Only active if Link layer is <i>60870-5-104 (Serial)</i>.</p>
Port	<p>Portnumber for primary IP_address.</p> <p>Default: 2404</p> <p>Note: Only active if Link layer is <i>60870-5-104 (Serial)</i>.</p>
Secondary connection	Addressing of the alternative connection of the controller.
IP address	<p>IP address on the protocol side for redundant controllers. Alternative connection in case the primary connection fails.</p> <p>Note: Only active if Link layer is <i>60870-5-104 (Serial)</i>.</p>
Port	<p>Portnumber for redundant IP_address.</p> <p>Default: 0</p>
Redundancy according to 870-104 ed. 2.0	<p>Active: Redundancy is implemented in accordance with 60870-104 edition 2.</p> <p>Activate this property only if you are sure that the controller supports the guidelines of Edition 2 for redundancy.</p> <p>Note: Only active if Link layer is <i>60870-5-104 (Serial)</i>.</p>

TIMING PARAMETERS

T0 corresponds to the timeout when establishing a TCP connection and cannot be set (it is defined by the operating system).

The properties of this group are only active if *60870-5-104 (TCP/IP)* has been selected as a connection type.

Parameter	Description
T1	Timeout in milliseconds for confirmation of the frames sent.

Parameter	Description
	<p>If, within T1, an ASDU or APCI frame is not confirmed, it is seen as a connection failure.</p> <p>Value range: 0 - 4294967295</p> <p>Default: 15000 ms</p>
T2	<p>Timeout in milliseconds, within which a confirmation via S frame (APCI) must take place if there was no exchange of data (via ASDU).</p> <p>Value range: 0 - 4294967295</p> <p>Default: 10000 ms</p> <p>Note: In accordance with the IEC 60870-5-104 standard, T2 should be less than T1; and the same on the master and slave.</p>
T3	<p>Timeout for test frames in milliseconds - periodic U-frames (APCI) for the purpose of a connection test procedure if there is no exchange of data (via ASDU).</p> <p>Value range: 0 - 4294967295</p> <p>Default: 20000 ms</p> <p>Note: The test procedure takes place in the background (Data Link Layer). If a test frame is not confirmed within T1, it is recognized as a connection failure. It is thus advisable to set T3 > T1. Exception: the redundant Data Link Layer in accordance with Edition 2 of the IEC 60870-5-104 standard - it is proposed to shorten T3 on the master's side (5s for example).</p>
K	<p>Maximum number of I-frames for which confirmations have not yet been received. If the number k of outstanding confirmations has been exceeded, it is recognized as a connection failure.</p> <p>Value range: 0 - 4294967295</p> <p>Default: 12</p> <p>Caution: both master and slave must use the same k value!</p> <p>Note: in fast Ethernet networks, it may be advisable to</p>

Parameter	Description
	increase the k and w parameters (in the master and slave) by a factor of 10 or 100, for example. k =120, w =80. This can increase performance.
W	<p>Maximum number of I-frames received until a confirmation is sent. The value w must be less than k.</p> <p>Value range: 0 - 4294967295</p> <p>Default: 8</p> <p>Caution: both master and slave must use the same w value!</p> <p>Note: in fast Ethernet networks, it may be advisable to increase the k and w parameters (in the master and slave) by a factor of 10 or 100, for example. k=120, w=80. This can increase performance.</p>

NAVIGATION**OK****Applies all changes and closes the dialog.****Cancel**

Discards all changes and closes the dialog.

OK

Applies all changes and closes the dialog.

⚠Attention

In accordance with the IEC 60870-5 standard, for each sector (**COA**) and transfer direction of the **Type ID** (monitoring or control direction), a 870 slave can only have one Information Object (IO) each, with a certain **IOA** address. An IO can, depending on the Cause of Transmission (**COT**) be transferred with or without a time tag.

Example: Transfer is carried out once as T01 due to a general query, once as T02 or T30 with spontaneous value change. All these three **Type ID** are single-point information, once without and once with time stamp (time tag).

An IO must not change its data type, for example from T01 - single to T03 - double.

If several variables are created in the IEC870 driver (master) that have the same COA, IOA and transfer direction, this can lead to unwanted actions in the Runtime.

Example: The following behavior is supported:

- ▶ Two variables T01 (monitoring direction) and T45 (commanddirection) with the same COA and IOA address.

It is conventional and recommended that a command and a response from an object have the same COA and IOA addressing.

- ▶ A variable T01 which then contains the value of an Information Object (with or without time stamp). The driver will transfer the value and the time stamp (if applicable) from an ASDU with T01, T02 or T30 (event with time tag) to the variable.

It is thus not necessary, for variables that have been created via **online import** (i.e. via the general query that provides the IOs without a time stamp), to amend the **Type ID** manually for an IO with time tag.

The following are supported to a limited extent:

- ▶ The two variables T01 (point information) and T30 (event with time tag) with the same COA and IOA address.

In this case, if an ASDU is received with the COA and IOA, the received value (T01) or value and time stamp (T02 or T30) are transferred to all variables that have this COA, IOA and the transfer direction.

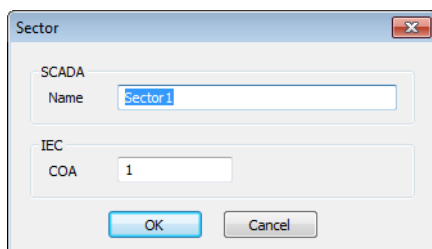
This is applicable from zenon version 8.10. In earlier versions, only one of the variables was supplied with values and all others were ignored.

4.2.4.2 Sector

Every **Device** can contain several sectors. A sector is identified using its Common Object Address (**COA**), also called Common Address of ASDU and can contain several data points - Information Objects.

At least one **Sector** must be defined for each **Device**. The driver ignores all ASDUs (frames with data) that a **Device** (870 slave) sends if the ASDU contains a **COA** that does not belong to any pre-defined **Sector**. When starting communication with the **Device**, the driver sends the General (Station) Interrogation - C_IC_NA_1 - solely for the **COA** of the defined sectors.

Note: This dialog is only available in English.



Parameter	Description
SCADA	Settings in the SCADA .
Name	Freely-definable name or short description of the sector.
IEC	Settings on protocol side.
COA	<p>The Common Object Address, also known (in IEC 60870-5-101 7.2.4) as Common Address of ASDU by which the sector is addressed. This number is issued by the manufacturer of the device (870 slave), is in the area 1..254 (0xFE) or 1..65534 (0xFFFE), depending on the CAO Size of the slave.</p> <p>Note: The COA 0xFF(FF) is interpreted by some slaves as a broadcast.</p>

CLOSE DIALOG

Option	Description
OK	Applies settings and closes the dialog.

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



Information

All sectors configured in the driver dialog (**COAs**) must be present in the PLC!

If a sector that does not exist in the slave is defined, the initial general query (C_IC_NA_1) cannot be completed.

5 Creating variables

This is how you can create variables in the zenon Editor:

5.1 Creating variables in the Editor

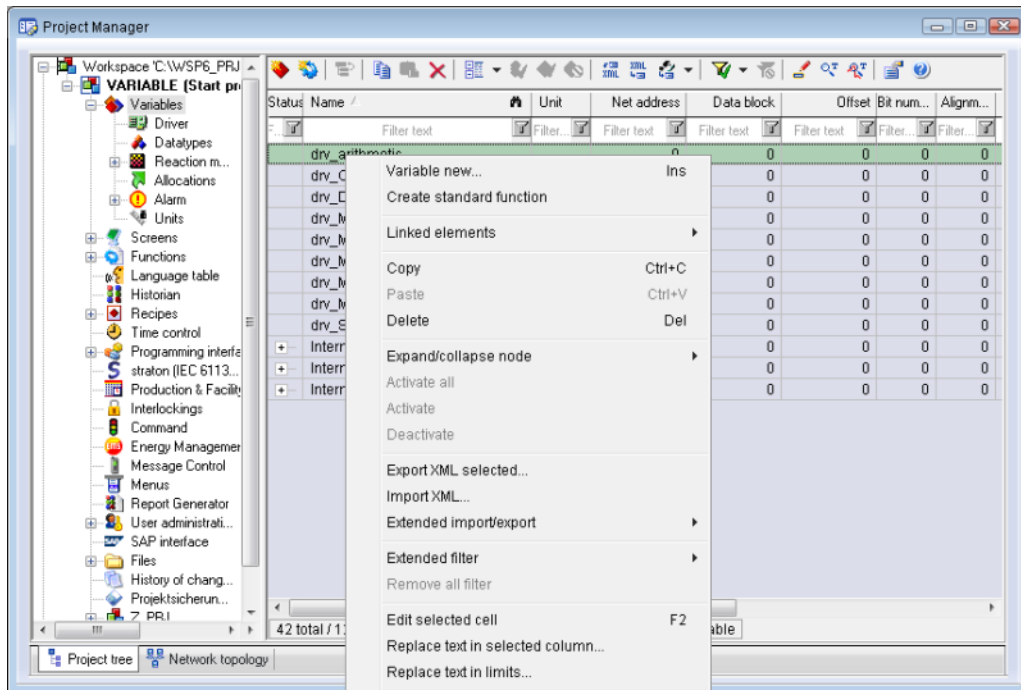
Variables can be created:

- ▶ as simple variables
- ▶ in arrays
- ▶ as structure variables

VARIABLE DIALOG

To create a new variable, regardless of which type:

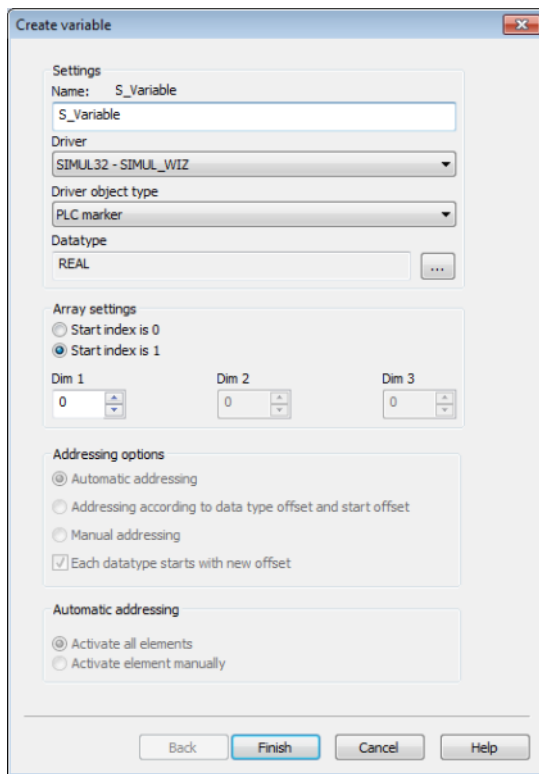
1. Select the **New variable** command in the **Variables** node in the context menu



The dialog for configuring variables is opened

2. Configure the variable
3. The settings that are possible depend on the type of variables

CREATE VARIABLE DIALOG



Property	Description
Name	<p>Distinct name of the variable. If a variable with the same name already exists in the project, no additional variable can be created with this name.</p> <p>Maximum length: 128 characters</p> <p>Attention: the characters # and @ are not permitted in variable names. If non-permitted characters are used, creation of variables cannot be completed and the Finish button remains inactive.</p> <p>Note: Some drivers also allow addressing using the Symbolic address property.</p>
Driver	<p>Select the desired driver from the drop-down list.</p> <p>Note: If no driver has been opened in the project, the driver for internal variables (Intern.exe) is automatically loaded.</p>
Driver Object Type	Select the appropriate driver object type from the drop-down list.
Data Type	Select the desired data type. Click on the ... button to open the selection dialog.
Array settings	Expanded settings for array variables. You can find details in the

Property	Description
	Arrays chapter.
Addressing options	Expanded settings for arrays and structure variables. You can find details in the respective section.
Automatic element activation	Expanded settings for arrays and structure variables. You can find details in the respective section.

SYMBOLIC ADDRESS

The **Symbolic address** property can be used for addressing as an alternative to the **Name** or **Identification** of the variables. Selection is made in the driver dialog; configuration is carried out in the variable property. When importing variables of supported drivers, the property is entered automatically.

Maximum length: 1024 characters.

The following drivers support the **Symbolic address**:

- ▶ 3S_V3
- ▶ AzureDrv
- ▶ BACnetNG
- ▶ IEC850
- ▶ KabaDPSTServer
- ▶ OPCUA32
- ▶ Phoenix32
- ▶ POZYTON
- ▶ RemoteRT
- ▶ S7TIA
- ▶ SEL
- ▶ SnmpNg32
- ▶ PA_Drv
- ▶ EUROMAP63

INHERITANCE FROM DATA TYPE

Measuring range, **Signal range** and **Set value** are always:

- ▶ derived from the datatype
- ▶ Automatically adapted if the data type is changed

Note for signal range: If a change is made to a data type that does not support the set **signal range**, the **signal range** is amended automatically. For example, for a change from **INT** to **SINT**, the **signal range** is changed to 127. The amendment is also carried out if the **signal range** was not inherited from the data type. In this case, the **measuring range** must be adapted manually.

5.2 Addressing

The data points are addressed via a COA (Common Object Address = Common Address of ASDU), of an IOA (Information Object Address) and the IEC 60870 Type. The type (= Type Identification) defines the function of the variable (see interoperability list). The COA corresponds to the sector of the device in which the variable resides. The IOA determines the offset in that sector.

SETTINGS FOR THE UNIQUE ADDRESSING OF VARIABLES

Property	Description
Name	Freely definable name. Attention: For every zenon project the name must be unambiguous.
Identification	Freely definable identification. E.g. for Resources label, comments, ...
Net address	Network address of variable. This address is used to define the allocation to the Device specified in the driver configuration. The Net address used there must be entered in the variable configuration accordingly.
Data block	not used for this driver
Offset	not used for this driver
Alignment	not used for this driver
Bit number	not used for this driver
String length	Only available for String variables. Maximum number of characters that the variable can take.
Symbolic address	not used for this driver
IEC870 Type identification	Defines the direction of communication, the type and function of the variable according to the IEC 60870 specification. Note: You can issue a type in the version "with time tag", "with time tag CP56Time2a" and without time stamp.

Property	Description
	<p>Example: If the variable has been created with <i>T01 single-point information</i> type, the driver accepts both values without time stamp for it - as well as <i>T02</i> or <i>T30</i>. In zenon Runtime, the values received with a "time tag ..." then have an external time stamp however.</p>
IEC870 COA	<p>Common Object Address (Common Address of ASDU).</p> <p>Corresponds to the sector of the Device in which the variable resides.</p>
IEC870 IOA	<p>Information Object Address.</p> <p>Addressing (offset) of the variable within a sector (a COA)</p>
IEC870 private Index	<p>Property only for variables with Type ID in private range, for example, <i>T160</i>.</p> <p>Default: 0</p>
Driver connection /Driver Object Type	<p>Object type of the variables. Depending on the driver used, is selected when the variable is created and can be changed here.</p> <p>Default: <i>PLC marker</i></p>
Driver connection/Data Type	<p>Data type of the variable. Is selected during the creation of the variable; the type can be changed here.</p> <p>Attention: If you change the data type later, all other properties of the variable must be checked and adjusted, if necessary.</p>
Driver connection/Priority	<p>not used for this driver The driver does not support cyclically-polling communication in priority classes.</p>
Read from Standby Server only	<p>Source of the variable value for display in Runtime if the project is used in a zenon network.</p> <p>Active: The variable visualizes the value from the driver on the standby server.</p>

⚠Attention

In accordance with the IEC 60870-5 standard, for each sector (**COA**) and transfer direction of the **Type ID** (monitoring or control direction), a 870 slave can only have one Information Object (IO) each, with a certain **IOA** address. An IO can, depending on the Cause of Transmission (**COT**) be transferred with or without a time tag.

Example: Transfer is carried out once as T01 due to a general query, once as T02 or T30 with spontaneous value change. All these three **Type ID** are single-point information, once without and once with time stamp (time tag).

An IO must not change its data type, for example from T01 - single to T03 - double.

If several variables are created in the IEC870 driver (master) that have the same COA, IOA and transfer direction, this can lead to unwanted actions in the Runtime.

Example: The following behavior is supported:

- ▶ Two variables T01 (monitoring direction) and T45 (commanddirection) with the same COA and IOA address.

It is conventional and recommended that a command and a response from an object have the same COA and IOA addressing.
- ▶ A variable T01 which then contains the value of an Information Object (with or without time stamp). The driver will transfer the value and the time stamp (if applicable) from an ASDU with T01, T02 or T30 (event with time tag) to the variable.

It is thus not necessary, for variables that have been created via **online import** (i.e. via the general query that provides the IOs without a time stamp), to amend the **Type ID** manually for an IO with time tag.

The following are supported to a limited extent:

- ▶ The two variables T01 (point information) and T30 (event with time tag) with the same COA and IOA address.

In this case, if an ASDU is received with the COA and IOA, the received value (T01) or value and time stamp (T02 or T30) are transferred to all variables that have this COA, IOA and the transfer direction.
This is applicable from zenon version 8.10. In earlier versions, only one of the variables was supplied with values and all others were ignored.

5.3 Driver objects and datatypes

Driver objects are areas available in the PLC, such as markers, data blocks etc. Here you can find out which driver objects are provided by the driver and which IEC data types can be assigned to the respective driver objects.

5.3.1 Driver objects

The following object types are available in this driver:

DRIVER OBJECT TYPES AND SUPPORTED IEC DATA TYPES FOR PROCESS VARIABLES IN ZENON

Driver Object Type	Channel type	Read	Write	Supported data types	Comment
PLC marker	8	X	X	BOOL, SINT, USINT, INT, UINT, DINT, UDINT, REAL, STRING	Variables that correspond to the Information Objects in the PLC and those with T00 (internal state). Type ID: <ul style="list-style-type: none"> ▶ 1..37, 126 - read only ▶ 45..103, 122 - write only
Communication details	35	X	X	BOOL, SINT, USINT, INT, UINT, DINT, UDINT, REAL, STRING	Variables for the static analysis of the communication; Values are transferred between driver and Runtime (not to the PLC). Note: The addressing and the behavior is the same for most zenon drivers.

Driver Object Type	Channel type	Read	Write	Supported data types	Comment
					You can find detailed information on this in the Communication details (Driver variables) (on page 47) chapter.

Key:

X: supported

--: not supported

CHANNEL TYPE

The term **Kanaltyp** is the internal numerical name of the driver object type. It is also used for the extended DBF import/export of the variables.

"**Kanaltyp**" is used for advanced CSV import/export of variables in the "**HWOBJECTType**" column.

5.3.2 Mapping of the data types

All variables in zenon are derived from IEC data types. The following table compares the IEC datatypes with the datatypes of the PLC.

MAPPING OF THE DATA TYPES FROM THE PLC TO ZENON DATA TYPES

Controller	ASDU type ID	zenon	Comment	Data type
M_SP_NA_1	1	BOOL	SPI <0..1> single-point information	8
M_SP_TA_1	2	BOOL	SPI ¹⁾ single-point information with time tag (CP24Time2a)	8
M_SP_TB_1	30	BOOL	SPI ²⁾ single-point information with time tag CP56Time2a	8
M_DP_NA_1	3	USINT	DPI <0..3> with Mapping of Double Point Values (on	9

Controller	ASDU type ID	zenon	Comment	Data type
			page 60) double-point information	
M_DP_TA_1	4	USINT	DPI ¹⁾ with Mapping of Double Point Values (on page 60)	9
M_DP_TB_1	31	USINT	DPI ²⁾ with Mapping of Double Point Values (on page 60)	9
M_ST_NA_1	5	USINT	Corresponds to whole VTI (IEC60870-5-101 7.2.6.5). Bit 8 is the Transient bit. step position information	9
M_ST_TA_1	6	USINT	VTI ¹⁾	9
M_ST_TB_1	32	USINT	VTI ²⁾	9
M_BO_NA_1	7	UDINT	BSI (32 bits) bitstring of 32 bits	4
M_BO_TA_1	8	UDINT	BSI ¹⁾	4
M_BO_TB_1	33	UDINT	BSI ²⁾	4
M_ME_NA_1	9	REAL	NVA $\langle -1..+1-2^{-15} \rangle$, in practice $\langle -1..0,9999 \rangle$ measured value, normalized value	5
M_ME_TA_1	10	REAL	NVA ¹⁾	5
M_ME_TD_1	34	REAL	NVA ²⁾	5
M_ME_NB_1	11	INT	SVA $\langle -2^{15}..+2^{15}-1 \rangle = \langle -32768..32767 \rangle$ measured value, scaled value	1
M_ME_TB_1	12	INT	SVA ¹⁾	1
M_ME_TE_1	35	INT	SVA ²⁾	1
M_ME_NC_1	13	REAL	R32 measured value, short floating point number	5
M_ME_TC_1	14	REAL	R32 ¹⁾	5
M_ME_TF_1	36	REAL	R32 ²⁾	5
M_IT_NA_1	15	DINT	BCR.Counter reading $\langle -2^{31}..+2^{31}-1 \rangle$	3

Controller	ASDU type ID	zenon	Comment	Data type
			integrated totals	
M_IT_TA_1	16	DINT	BCR.Counter reading ¹⁾	3
M_IT_TB_1	37	DINT	BCR.Counter reading ²⁾	3
C_SC_NA_1	45	BOOL	SCS single command	8
C_SC_TA_1	58	BOOL	SCS	8
C_DC_NA_1	46	USINT	DCS with Mapping of Double Point Values (on page 60) double command	9
C_DC_TA_1	59	USINT	DCS with Mapping of Double Point Values (on page 60)	9
C_RC_NA_1	47	USINT	RCS regulating step command	9
C_RC_TA_1	60	USINT	RCS	9
C_SE_NA_1	48	REAL	NVA set point command, normalized value	5
C_SE_TA_1	61	REAL	NVA	5
C_SE_NB_1	49	INT	SVA set point command, scaled value	1
C_SE_TB_1	62	INT	SVA	1
C_SE_NC_1	50	REAL	R32 set point command, short floating point number	5
C_SE_TC_1	63	REAL	R32	5
C_BO_NA_1	51	UDINT	BSI (32 bits) bitstring of 32 bits command	4
C_BO_TA_1	64	UDINT	BSI (32 bits)	4
C_IC_NA_1	100	BOOL	1 during execution	8

Controller	ASDU type ID	zenon	Comment	Data type
			(general) interrogation command	
C_CS_NA_1	103	BOOL	1 during execution clock synchronization command	8
F_SC_NA_1	122	STRING	Command for file transfer, e.g. "DIR" or "GET"	12
F_DR_TA_1	126	STRING	response variable for file transfer	12
	136 - 141 and 160	Numerical	Addressing for Siemens-specific private Type ID area.	

- 1) Time tag CP24Time2a only contains mm:ss.ms; is used for the time stamp of the variable, whereby the driver uses the PC clock to supplement the missing information. If the minute value is higher than that of the PC clock, the driver automatically sets the time back one hour.
- 2) Time tag CP56Time2a is used for the time stamp of the variable.

ASDU Type ID: IEC60870-5-101 Type identification, corresponds to the **IEC870 Type identification** property of a variable.

DATA TYPE

The term **data type** is the internal numerical identification of the data type. It is also used for the extended DBF import/export of the variables.

5.4 Creating variables by importing

Variables can also be imported by importing them. The XML and DBF import is available for every driver.



Information

You can find details on the import and export of variables in the Import-Export manual in the Variables section.

5.4.1 XML import

During XML import of variables or data types, these are first assigned to a driver and then analyzed. Before import, the user decides whether and how the respective element (variable or data type) is to be imported:

- ▶ *Import:*
The element is imported as a new element.
- ▶ *Overwrite:*
The element is imported and overwrites a pre-existing element.
- ▶ *Do not import:*
The element is not imported.

Note: The actions and their durations are shown in a progress bar during import. The import of variables is described in the following documentation. Data types are imported along the same lines.

REQUIREMENTS

The following conditions are applicable during import:

- ▶ **Backward compatibility**
At the XML import/export there is no backward compatibility. Data from older zenon versions can be taken over. The handover of data from newer to older versions is not supported.
- ▶ **Consistency**
The XML file to be imported has to be consistent. There is no plausibility check on importing the file. If there are errors in the import file, this can lead to undesirable effects in the project.
Particular attention must be paid to this, primarily if not all properties exist in the XML file and these are then filled with default values. E.g.: A binary variable has a limit value of 300.
- ▶ **Structure data types**
Structure data types must have the same number of structure elements.
Example: A structure data type in the project has 3 structure elements. A data type with the same name in the XML file has 4 structure elements. Then none of the variables based on this data type in the file are imported into the project.

Hint

You can find further information on XML import in the **Import - Export** manual, in the **XML import** chapter.

5.4.2 DBF Import/Export

Data can be exported to and imported from dBase.



Information

Import and Export via CSV or dBase supported; no driver specific variable settings, such as formulas. Use export/import via XML for this.

IMPORT DBF FILE

To start the import:

1. right-click on the variable list.
2. In the drop-down list of **Extended export/import...** select the **Import dBase** command.
3. Follow the instructions of the import assistant.

The format of the file is described in the chapter File structure.



Information

Note:

- ▶ Driver object type and data type must be amended to the target driver in the DBF file in order for variables to be imported.
- ▶ dBase does not support structures or arrays (complex variables) at import.

EXPORT DBF FILE

To start the export:

1. right-click on the variable list.
2. In the drop-down list of **Extended export/import...** select the **Export dBase...** command .
3. Follow the instructions of the import assistant.

⚠ Attention

DBF files:

- ▶ must correspond to the 8.3 DOS format for filenames (8 alphanumeric characters for name, 3 character suffix, no spaces)
- ▶ must not have dots (.) in the path name.
e.g. the path `C:\users\John.Smith\test.dbf` is invalid.
Valid: `C:\users\JohnSmith\test.dbf`
- ▶ must be stored close to the root directory in order to fulfill the limit for file name length including path: maximum 255 characters

The format of the file is described in the chapter File structure.



Information

dBase does not support structures or arrays (complex variables) at export.

FILE STRUCTURE OF THE DBASE EXPORT FILE

The dBaseIV file must have the following structure and contents for variable import and export:

⚠ Attention

dBase does not support structures or arrays (complex variables) at export.

DBF files must:

- ▶ conform with their name to the 8.3 DOS format (8 alphanumeric characters for name, 3 characters for extension, no space)
- ▶ Be stored close to the root directory (Root)

STRUCTURE

Identification	Type	Field size	Comment
KANALNAME	Character	128	Variable name. The length can be limited using the MAX_LAENGE entry in the project.ini file.
KANAL_R	C	128	The original name of a variable that is to be replaced by the new name entered under "VARIABLENNAME" (variable name) (field/column must be entered

Identification	Type	Field size	Comment
			manually). The length can be limited using the MAX_LAENGE entry in the project.ini file.
KANAL_D	Log	1	The variable is deleted with the 1 entry (field/column has to be created by hand).
TAGNR	C	128	Identification. The length can be limited using the MAX_LAENGE entry in the project.ini file.
EINHEIT	C	11	Technical unit
DATENART	C	3	Data type (e.g. bit, byte, word, ...) corresponds to the data type.
KANALTYP	C	3	Memory area in the PLC (e.g. marker area, data area, ...) corresponds to the driver object type.
HWKANAL	Num	3	Net address
BAUSTEIN	N	3	Datablock address (only for variables from the data area of the PLC)
ADRESSE	N	5	Offset
BITADR	N	2	For bit variables: bit address For byte variables: 0=lower, 8=higher byte For string variables: Length of string (max. 63 characters)
ARRAYSIZE	N	16	Number of variables in the array for index variables ATTENTION: Only the first variable is fully available. All others are only available for VBA or the Recipegroup Manager
LES_SCHR	L	1	Write-Read-Authorization 0: Not allowed to set value. 1: Allowed to set value.
MIT_ZEIT	R	1	time stamp in zenon (only if supported by the driver)
OBJEKT	N	2	Driver-specific ID number of the primitive object comprises TREIBER-OBJEKTYP and DATENTYP

Identification	Type	Field size	Comment
SIGMIN	Float	16	Non-linearized signal - minimum (signal resolution)
SIGMAX	F	16	Non-linearized signal - maximum (signal resolution)
ANZMIN	F	16	Technical value - minimum (measuring range)
ANZMAX	F	16	Technical value - maximum (measuring range)
ANZKOMMA	N	1	Number of decimal places for the display of the values (measuring range)
UPDATERATE	F	19	Update rate for mathematics variables (in sec, one decimal possible) not used for all other variables
MENTIEFE	N	7	Only for compatibility reasons
HDRATE	F	19	HD update rate for historical values (in sec, one decimal possible)
HDTIEFE	N	7	HD entry depth for historical values (number)
NACHSORT	R	1	HD data as postsorted values
DRRATE	F	19	Updating to the output (for zenon DDE server, in [s], one decimal possible)
HYST_PLUS	F	16	Positive hysteresis, from measuring range
HYST_MINUS	F	16	Negative hysteresis, from measuring range
PRIOR	N	16	Priority of the variable
REAMATRIZE	C	32	Allocated reaction matrix
ERSATZWERT	F	16	Substitute value, from measuring range
SOLLMIN	F	16	Minimum for set value actions, from measuring range
SOLLMAX	F	16	Maximum for set value actions, from measuring range
VOMSTANDBY	R	1	Get value from standby server; the value of the variable is not requested from the server but from the Standby Server in redundant networks
RESOURCE	C	128	Resources label. Free string for export and display in lists.

Identification	Type	Field size	Comment
			The length can be limited using the MAX_LAENGE entry in project.ini .
ADJWVBA	R	1	Non-linear value adaption: 0: Non-linear value adaption is used 1: Non-linear value adaption is not used
ADJZENON	C	128	Linked VBA macro for reading the variable value for non-linear value adjustment.
ADJWVBA	C	128	ed VBA macro for writing the variable value for non-linear value adjustment.
ZWREMA	N	16	Linked counter REMA.
MAXGRAD	N	16	Gradient overflow for counter REMA.

Attention

When importing, the driver object type and data type must be amended to the target driver in the DBF file in order for variables to be imported.

LIMIT VALUE DEFINITION

Limit definition for limit values 1 to 4, or status 1 to 4:

Identification	Type	Field size	Comment
AKTIV1	R	1	Limit value active (per limit value available)
GRENZWERT1	F	20	technical value or ID number of a linked variable for a dynamic limit value (see VARIABLEx) (if VARIABLEx is 1 and here it is -1, the existing variable linkage is not overwritten)
SCHWWERT1	F	16	Threshold value for limit value
HYSTERESE1	F	14	Is not used
BLINKEN1	R	1	Set blink attribute
BTB1	R	1	Logging in CEL
ALARM1	R	1	Alarm

Identification	Type	Field size	Comment
DRUCKEN1	R	1	Printer output (for CEL or Alarm)
QUITTIER1	R	1	Must be acknowledged
LOESCHE1	R	1	Must be deleted
VARIABLE1	R	1	Dyn. limit value linking the limit is defined by an absolute value (see field GRENZWERTx).
FUNC1	R	1	Functions linking
ASK_FUNC1	R	1	Execution via Alarm Message List
FUNC_NR1	N	10	ID number of the linked function (if "-1" is entered here, the existing function is not overwritten during import)
A_GRUPPE1	N	10	Alarm/Event Group
A_KLASSE1	N	10	Alarm/Event Class
MIN_MAX1	C	3	Minimum, Maximum
FARBE1	N	10	Color as Windows coding
GRENZTXT1	C	66	Limit value text
A_DELAY1	N	10	Time delay
INVISIBLE1	R	1	Invisible

Expressions in the column "Comment" refer to the expressions used in the dialog boxes for the definition of variables. For more information, see chapter Variable definition.

5.4.3 Online import

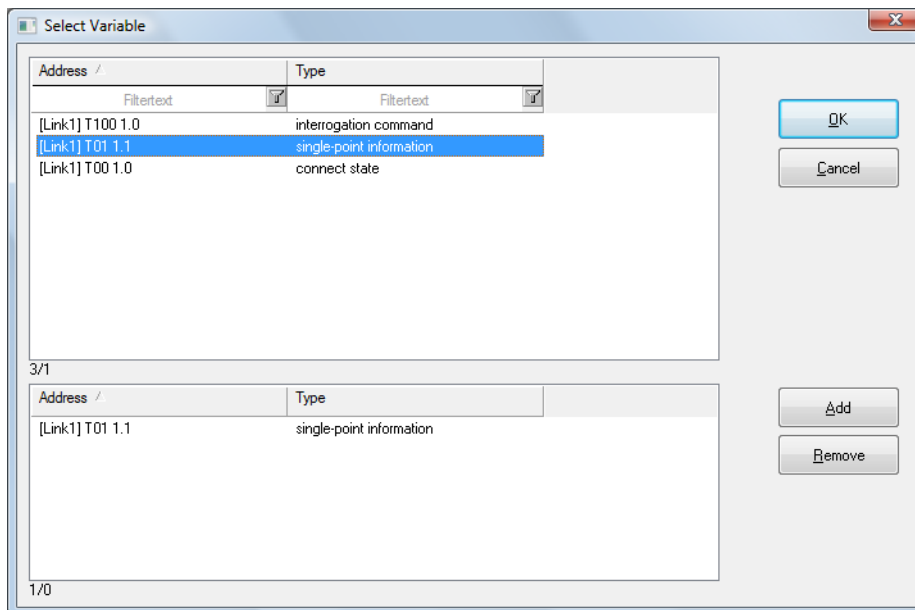
Variables can only be created by driver online import in message direction (T01..T39). You must create variables for the commands (T45..T64) manually, because the commands are *write-only* in the IEC 60870 protocol. It is not possible to read their addressing using the controller.

You can find the online import in the driver list in the context menu of the driver.

First select a component, whose variables you want to browse.

After that, a "general interrogation command" (GI) is sent to the selected device and all contained variables are displayed in a list.

After the GI is finished, you will see a dialog for selecting the variables to be imported:



Add a variable to the variables to be imported by double-clicking on it or by selecting it and pressing the "Add" button. Press the button OK to create all selected variables in zenon. The addressing is taken over from the device.

5.5 Communication details (Driver variables)

The driver kit implements a number of driver variables. These variables are part of the driver object type *Communication details*. These are divided into:

- ▶ Information
- ▶ Configuration
- ▶ Statistics and
- ▶ Error message

The definitions of the variables implemented in the driver kit are available in the import file **DRVVAR.DBF** and can be imported from there.

Path to file: %ProgramData%\COPA-DATA\zenon<Versionsnummer>\PredefinedVariables

Note: Variable names must be unique in zenon. If driver variables of the driver object type *Communication details* are to be imported from **DRVVAR.DBF** again, the variables that were imported beforehand must be renamed.



Information

Not every driver supports all driver variables of the driver object type *Communication details*.

For example:

- ▶ Variables for modem information are only supported by modem-compatible drivers.
- ▶ Driver variables for the polling cycle are only available for pure polling drivers.
- ▶ Connection-related information such as **ErrorMSG** is only supported for drivers that only edit one connection at a time.

INFORMATION

Name from import	Type	Offset	Description
MainVersion	<i>UINT</i>	0	Main version number of the driver.
SubVersion	<i>UINT</i>	1	Sub version number of the driver.
BuildVersion	<i>UINT</i>	29	Build version number of the driver.
RTMajor	<i>UINT</i>	49	zenon main version number
RTMinor	<i>UINT</i>	50	zenon sub version number
RTSp	<i>UINT</i>	51	zenon Service Pack number
RTBuild	<i>UINT</i>	52	zenon build number
LineStateIdle	<i>BOOL</i>	24.0	TRUE, if the modem connection is idle
LineStateOffering	<i>BOOL</i>	24.1	TRUE, if a call is received
LineStateAccepted	<i>BOOL</i>	24.2	The call is accepted
LineStateDialtone	<i>BOOL</i>	24.3	Dialtone recognized
LineStateDialing	<i>BOOL</i>	24.4	Dialing active
LineStateRingBack	<i>BOOL</i>	24.5	While establishing the connection
LineStateBusy	<i>BOOL</i>	24.6	Target station is busy
LineStateSpecialInfo	<i>BOOL</i>	24.7	Special status information received
LineStateConnected	<i>BOOL</i>	24.8	Connection established
LineStateProceeding	<i>BOOL</i>	24.9	Dialing completed
LineStateOnHold	<i>BOOL</i>	24.10	Connection in hold
LineStateConferenced	<i>BOOL</i>	24.11	Connection in conference mode.

Name from import	Type	Offset	Description
LineStateOnHoldPendConf	BOOL	24.12	Connection in hold for conference
LineStateOnHoldPendTransfer	BOOL	24.13	Connection in hold for transfer
LineStateDisconnected	BOOL	24.14	Connection terminated.
LineStateUnknow	BOOL	24.15	Connection status unknown
ModemStatus	UDINT	24	Current modem status
TreiberStop	BOOL	28	Driver stopped For <i>driver stop</i> , the variable has the value <i>TRUE</i> and an OFF bit. After the driver has started, the variable has the value <i>FALSE</i> and no OFF bit.
SimulRTState	UDINT	60	Informs the state of Runtime for driver simulation.
ConnectionStates	STRING	61	Internal connection status of the driver to the PLC. Connection statuses: <ul style="list-style-type: none"> ▶ 0: Connection OK ▶ 1: Connection failure ▶ 2: Connection simulated Formating: <Net address>:<Connection status>;...;; A connection is only known after a variable has first signed in. In order for a connection to be contained in a string, a variable of this connection must be signed in once. The status of a connection is only updated if a variable of the connection is signed in. Otherwise there is no communication with the corresponding controller.

CONFIGURATION

Name from import	Type	Offset	Description
ReconnectInRead	<i>BOOL</i>	27	If TRUE, the modem is automatically reconnected for reading
ApplyCom	<i>BOOL</i>	36	Apply changes in the settings of the serial interface. Writing to this variable immediately results in the method SrvDrvVarApplyCom being called (which currently has no further function).
ApplyModem	<i>BOOL</i>	37	Apply changes in the settings of the modem. Writing this variable immediately calls the method SrvDrvVarApplyModem. This closes the current connection and opens a new one according to the settings PhoneNumberSet and ModemHwAdrSet .
PhoneNumberSet	<i>STRING</i>	38	Telephone number, that should be used
ModemHwAdrSet	<i>DINT</i>	39	Hardware address for the telephone number
GlobalUpdate	<i>UDINT</i>	3	Update time in milliseconds (ms).
BGlobalUpdaten	<i>BOOL</i>	4	TRUE, if update time is global
TreiberSimul	<i>BOOL</i>	5	TRUE, if driver in sin simulation mode
TreiberProzab	<i>BOOL</i>	6	TRUE, if the variables update list should be kept in the memory
ModemActive	<i>BOOL</i>	7	TRUE, if the modem is active for the driver
Device	<i>STRING</i>	8	Name of the serial interface or name of the modem
ComPort	<i>UINT</i>	9	Number of the serial interface.
Baudrate	<i>UDINT</i>	10	Baud rate of the serial interface.
Parity	<i>SINT</i>	11	Parity of the serial interface
ByteSize	<i>USINT</i>	14	Number of bits per character of the serial interface Value = 0 if the driver cannot establish any serial connection.

Name from import	Type	Offset	Description
StopBit	<i>USINT</i>	13	Number of stop bits of the serial interface.
Autoconnect	<i>BOOL</i>	16	TRUE, if the modem connection should be established automatically for reading/writing
PhoneNumber	<i>STRING</i>	17	Current telephone number
ModemHwAdr	<i>DINT</i>	21	Hardware address of current telephone number
RxIdleTime	<i>UINT</i>	18	Modem is disconnected, if no data transfer occurs for this time in seconds (s)
WriteTimeout	<i>UDINT</i>	19	Maximum write duration for a modem connection in milliseconds (ms).
RingCountSet	<i>UDINT</i>	20	Number of ringing tones before a call is accepted
ReCallIdleTime	<i>UINT</i>	53	Waiting time between calls in seconds (s).
ConnectTimeout	<i>UINT</i>	54	Time in seconds (s) to establish a connection.

STATISTICS

Name from import	Type	Offset	Description
MaxWriteTime	<i>UDINT</i>	31	The longest time in milliseconds (ms) that is required for writing.
MinWriteTime	<i>UDINT</i>	32	The shortest time in milliseconds (ms) that is required for writing.
MaxBlkReadTime	<i>UDINT</i>	40	Longest time in milliseconds (ms) that is required to read a data block.
MinBlkReadTime	<i>UDINT</i>	41	Shortest time in milliseconds (ms) that is required to read a data block.
WriteErrorCount	<i>UDINT</i>	33	Number of writing errors
ReadSucceedCount	<i>UDINT</i>	35	Number of successful reading attempts
MaxCycleTime	<i>UDINT</i>	22	Longest time in milliseconds (ms) required to read all requested data.
MinCycleTime	<i>UDINT</i>	23	Shortest time in milliseconds (ms) required to read

Name from import	Type	Offset	Description
			all requested data.
WriteCount	UDINT	26	Number of writing attempts
ReadErrorCount	UDINT	34	Number of reading errors
MaxUpdateTimeNormal	UDINT	56	Time since the last update of the priority group Normal in milliseconds (ms).
MaxUpdateTimeHigher	UDINT	57	Time since the last update of the priority group Higher in milliseconds (ms).
MaxUpdateTimeHigh	UDINT	58	Time since the last update of the priority group High in milliseconds (ms).
MaxUpdateTimeHighest	UDINT	59	Time since the last update of the priority group Highest in milliseconds (ms).
PokeFinish	BOOL	55	Goes to 1 for a query, if all current pokes were executed

ERROR MESSAGE

Name from import	Type	Offset	Description
ErrorTimeDW	UDINT	2	Time (in seconds since 1.1.1970), when the last error occurred.
ErrorTimeS	STRING	2	Time (in seconds since 1.1.1970), when the last error occurred.
RdErrPrimObj	UDINT	42	Number of the PrimObject, when the last reading error occurred.
RdErrStationsName	STRING	43	Name of the station, when the last reading error occurred.
RdErrBlockCount	UINT	44	Number of blocks to read when the last reading error occurred.
RdErrHwAdresse	DINT	45	Hardware address when the last reading error occurred.
RdErrDatablockNo	UDINT	46	Block number when the last reading error occurred.
RdErrMarkerNo	UDINT	47	Marker number when the last reading error occurred.

Name from import	Type	Offset	Description
RdErrSize	<i>UDINT</i>	48	Block size when the last reading error occurred.
DrvError	<i>USINT</i>	25	Error message as number
DrvErrorMsg	<i>STRING</i>	30	Error message as text
ErrorFile	<i>STRING</i>	15	Name of error log file

6 Driver-specific functions

The driver supports the following functions:

VALUE CHANGES

Communication with the PLC is spontaneous. This means that all value changes of the PLC are processed by the driver. The general settings of a driver: **Global update time** and **Priority** do not influence the IEC870 driver.

Example:

The PLC sends three value changes at an interval of 5 ms; these changes are all forwarded to zenon. E.g. if you use a **reaction matrix** that reacts to every value change and triggers an entry in the **Chronological Event List (CEL)**, the **CEL** will contain three entries at intervals of 5 ms. The same applies to spontaneous archiving or alarms etc. None of the values are lost.

GENERAL INTERROGATION

As envisaged in the IEC 60870 standard, the driver automatically sends the General Interrogation *C_IC_NA_1* to the PLCs straight after the connection is established. The driver sends the initial general interrogations for all sectors (**COA**) that have been defined in the driver configuration.

If an End of Initialization *M_EL_NA_1* is received on a sector (**COA**) during an ongoing general interrogation (COT_actterm not yet received), the GI request is canceled and started again. If the initial general interrogation has not yet been completed for the **COA**, the driver will refuse any attempt to trigger a *T45..T64* command. The corresponding error message in the LOG is "Poke to unconnected device". Only once the initial GI request has been completed will a "write set value command to a *T45..T64* variable in the sector" be triggered by the driver to the slave.

Note: If the initial GI requests are completed, the driver sets the value of the communication status variable (*T00*, *COA 0*, *IOA 0*) to 5.

A general interrogation can be triggered manually at a later time. In order to do so, a BOOL variable of **type ID T100** must be written to. The **IOA** of these variables must be 0. The value of this variable is 1 whilst the general request is running. If the time general request could not be carried out correctly, this variable will get the status *INVALID*. Variables of type *T100* can be created separately for every sector (**COA**). This allows you to check whether the sectors of a slave (**Device**) can be reached.

COMMUNICATION STATUS (APPLICATION LAYER)

The current communication status of the connection to the 870 slave can be requested via a *USINT*-variable of the **type ID T00 internal state**, **COA 0** and **IOA 0**. If the value of this variable is 5, this means that there is a running, valid IEC 60870 Application Layer and the general interrogation has been completed successfully.



Information

Indication of an invalid connection:

The value of the connection status does not reach value 5 even after a long time, although:

- ▶ a connection to the driver is established.
- ▶ Data is exchanged and communication takes place.

For example, this can occur when sectors are configured in the driver configuration that are not available in the slave.

Note: If a connection is established and communication is in progress, but the value of the connection status has not reached 5 after a long period of time, this can indicate a communication problem.

Note: The Application Layer of the driver is the same for both IEC 60870-5-101 as well as IEC 60870-5-104 communication.

TCP/IP CONNECTION (IEC 60870-5-104 DATA LAYER)

The driver also supports, as an IEC 60870-5-104 master, connections to 870 slaves via dual Ethernet networks. This is configured in the configuration dialog of the driver in the option for **Secondary connection**. If the **Secondary connection** is configured, the driver can also use the redundancy of the Data Layer in accordance with the rules of Edition 2 of the IEC 60870-5-104 standard. This is optionally activated with the **Redundancy according to 870-104 ed. 2.0** checkbox.

In the event of a loss of connection, the server automatically carries out all necessary procedures for the reconnections or the switching between **Primary** and **Secondary connections**.

Example:

Without redundancy in accordance with Edition 2:

If the connection is interrupted via **Primary**, all variables (messages and commands) get the status bit *INVALID*. The driver automatically attempts to establish this connection again in the background. If this is not possible, the driver attempts to establish a connection to the controller via the **Secondary connection**. If the connection is successful, the driver sends the general query (*C_IC_NA_1*). After the connection has been successfully established or reestablished, the values of the variables of the messages (*T01-T37*) are marked with the status bit *SPONT* or *GI*. The variable of the commands that are solely *write-only* remain unchanged (value 0, *INVALID*) until a respective bit is set (= a command is given).

- ▶ If the driver has successfully switched to the **Secondary connection**, this connection is used for communication until the connection is disconnected. The next time there is a disconnection, there is another automatic attempt to switch to the **Primary connection**.
- ▶ If the 870 slave cannot be reached by either communication method, the driver attempts to establish a connection every 30 seconds. In doing so, the **Primary connection** and **Secondary connection** are used alternately to establish a connection.

STATUS OF THE DL LAYER FOR TCP/IP

The status of the Data Link Layer connection to an IEC60870-5-104 controller can be read with the help of a *T00 internal state type ID* variable and **COA 0** and **IOA 1**. The variable provides information on which of the two IPs the driver is currently using for communication. In the event of Edition 2 redundancy, information on the availability of the Data Link Layer is also provided.

Bit	Description
Bit 0	Connection status of the primary connection IP
Bit 1	Displays whether the primary connection is active (is used for communication)
Bit 4	Connection status of the secondary connection IP
Bit 5	Displays whether the secondary connection is active (is used for communication)

In accordance with the IEC 60870-5-104 standard, the availability of both Data Link Layers can be checked for the Edition 2 redundancy. For this purpose, the driver sends the time interval of the timeout **T3** ime (default value: 20 s) die **APCI** Frames TESTFR act. As confirmation, a TESTFR con is expected from the slave. If the TESTFRframe remains unconfirmed for timeout **T1** (default value 15s), the bit 0 or 4 of the status DL layer variable is reset accordingly. If it is a currently-active IP connection, it triggers the switching of the IP - the driver sends a STARTDT act to the other IP.

Note: For the redundant connections via land lines, Edition 2 of the standards proposes shortening the **T3** timeout.

MANUAL SWITCHING OF THE TCP/IP CONNECTION



Information

Only available if you have activated the **Redundancy according to 60870-104 edition 2.0** option in the driver.

You trigger manual switching to the redundant connection with the help of the driver-specific command **104_MANUAL_SWITCH** '*net address*'. The '*net address*' value stands for the corresponding network address of the slave.

Example: create zenon **driver commands** function and select the *driver-specific command* option in the **driver command** property. This opens the additional **Driver-specific command** input field. Write the following text in the input field: `104_MANUAL_SWITCH 1`.

If the function is called up in the Runtime, by means of a **button** for example, the driver will switch between both redundant IP addresses for the connection that has the **net address 1** in its configuration. With the currently active IP connection to the slave with net address 1, the driver sends an APCIfame with STOPDT act and with the previously passive IP - a STARTDT act.

FILETRANSFER

There are three functions implemented for the file transfer:

1. Request folder information (*DIR*)
2. Get file from the PLC (*GET*)
3. Send file to the PLC (*PUT*)
4. Delete file from the PLC (*DEL*)

1. REQUEST DIRECTORY INFORMATION (DIR)

To request the folder information:

1. Create two string variables in your zenon project:
 - a) The first variable is a "**call directory, call file**" type variable (T122) (hereinafter called a command variable). It can also be used to obtain and delete files.
 - a) The second variable of „**directory**“ type (T126) is only used for the result of the folder query. It receives the folder content as legible text. For this reason, its size (string length) should correspond to the maximum size of the file name (including the folder) in the PLC.
2. For the command variable (T122), set the value "*DIR*" (for the root directory) or "*DIR* <IOA>.<NOF>"

If the folder has been successfully received:

- ▶ The command variable changes its value to *DIR OK*
- ▶ The folder variable (T126) contains the received folder content.
One line of this text has the following format: **<IOA>.<NOF>;<File length>;<Time stamp>;SOF**

2. GET FILE FROM THE PLC (GET)

To get a file from the PLC, set the value "*GET <IOA>.<NOF>*" for the command variable (T122).

If the file has been successfully received:

- ▶ If it is saved in the folder that was defined as **Directory for file transfer** in the driver dialog basic settings (on page 17)
- ▶ The command variable changes its value to "*GET OK*"
- ▶ A subfolder is created for each COA

An active file transfer can be canceled by setting the value "*CANCEL*" to the command variable (T122). The driver thus does not expect any further segments of data and will also not request any further sections of the file. A deactivation is not sent to the PLC however. The file for which the transmission was cancelled is not saved.

Example

Get the file with IOA 1100 and NOF 'transparent' (1) from sector 151 if the folder was defined in the driver configuration as "C:\TEMP\IEC870":

- ▶ Send the target value "*GET 1100.1*" to a variable of type T122, COA 151 und IOA 0.
- ▶ The file is stored at C:\TEMP\IEC870\151\1100.1.

3. SEND FILE TO PLC (PUT)

To send a file to the PLC, set the value "*PUT <IOA>.<NOF>*" for the command variable (T122).

A file from the COA folder is sent. This folder is a subdirectory of the directory that is defined in the driver dialog basic settings (on page 17), in the **Directory for file transfer in Control Direction** input field.

Note: This folder must be created manually by the user.

If the file has been successfully sent:

- ▶ The command variable changes its value to *PUT OK*

If the transfer is in progress, "*PUT BUSY*" is displayed. An active file transfer can be canceled by setting the value "*CANCEL*" to the command variable (T122).

4TH DELETE FILE FROM THE PLC (DEL)

To delete a file on the PLC, set the value "DEL <IOA>.<NOF>" for the command variable (T122).

If the file was deleted successfully, the command variable changes its value to "DEL OK"

ERROR HANDLING

If an error occurs when the file transfer is carried out, the command variable changes its value to "XXX ERROR" (XXX = DIR, GET, PUT or DEL) and the driver optionally writes an entry into the log file (see also error analysis (on page 88)).

TIME SYNCHRONIZATION

By writing to a variable of Type ID C_CS_NA_1 (T103), the current time of the PC is sent to the PLC. The **IOA** of these variables must be 0.

Time synchronization in "monitoring direction":

The driver offers the possibility to accept and evaluate a T103 telegram in Monitoring Direction - from the device. If the device sends an ASDU<103> with COT=3, the time on the PC will be taken from the device, but only if the difference between the device time and the PC time does not exceed the configured **maximum difference** (see the Basic setting in the driver dialog).

STATUS BIT WR-SUC (BIT 41)

If, for a **Write set value** or **Write recipe** action or command processing, a write confirmation has been requested (WR_ACK), this status bit is set accordingly after the command has been sent (**COT_act**). There is no wait for **COT_actcon**.

STATUS BIT BL_870 (BIT 44)

Indicates IEC status *blocked*. The value is blocked for transferring and remains in the status it had before it was blocked. This status bit can be selected in Multi reaction matrices, in Combined elements and in the Interlocking formula.

In VBA the top 32 bits can be polled with `StatusExtValue()`. With `SetValueWithStatusEx()` all 64 status bits can be polled.

STATUS BIT SB_870 (BIT 45)

Indicates IEC status *substituted*. The value was set by an operator or an automatic source. This status bit can be selected in Multi reaction matrices, in Combined elements and in the Interlocking formula.

In VBA the top 32 bits can be polled with `StatusExtValue()`. With `SetValueWithStatusEx()` all 64 status bits can be polled.

STATUS BIT NT_870 (BIT 46)

Indicates IEC status *not topical*. The value was not updated or was not available for a certain period of time. This status bit can be selected in Multi reaction matrices, in Combined elements and in the Interlocking formula.

In VBA the top 32 bits can be polled with `StatusExtValue()`. With `SetValueWithStatusEx()` all 64 status bits can be polled.

STATUS BIT OV_870 (BIT 47)

Indicates *Overflow*. The value lies outside the predefined bandwidth.

STATUS BIT SE_870 (BIT 48)

Corresponds to IEC Qualifier S/E and is used in conjunction with the **Select before operate** functionality: serves to distinguish between *Select*- and *Execute*-status of a command.

STATUS BITS COTX (BITS 32..37)

The received value of the Cause of Transmission - see *IEC60870-5-101 7.2.3*) is portrayed to the status bits COTx.

STATUS BIT T_INVAL (BIT 49)

The status bit T_INVAL (real time invalid) is set by driver IEC870 if the received real time stamp is marked as invalid. In this case, the local PC time is stamped.

Note: In the process gateway IEC870 slave, this status bit is forwarded in the direction of messaging in the time stamp.

ASDUS WITH "TIME TAG CP24TIME2A"

The time information of type **CP24Time2a** only contains minutes, seconds and milliseconds. Date information (year, month, day) and information about the hour is not transferred. The driver reverts to the PC clock in order to complement the missing time information (year, month, day and hour). If a **CP24Time2a** with a difference of more than plus/minus 30 minutes is received, the driver corrects the time stamp automatically by one hour plus/minus. At this a possible date change is also considered.

Note: This does not influence **CP56Time2a** time stamps.

HYSTERESIS HANDLING

In general the driver supports hysteresis. The hysteresis is only considered for numeric data types if $\text{hysteresis} \neq 0$ was configured. For variables with $\text{hysteresis} = 0$ and for variables of type BOOL or STRING, the driver sends all received values to the Runtime.

SELECT & EXECUTE

In order to be able to use "select & execute" a **command processing** must be executed. In addition, the **Select Before Operate** property must be activated for the command variables. During the first stage of the action, the driver sends a *Select* command - an ASDU with IEC Qualifier S/E equals 1 (*select*). The *SE_870* status bit of the command variable is also set. There is then an *Execute* command - an ASDU with IEC Qualifier S/E equals 0 (*execute*), or a *Cancel* command - an ASDU with COT 8. A *Cancel (deactivation)* can only be triggered from a two-stage action - if the user cancels the command during execution of the action, instead of confirming it.

If the value is set directly - not by a command processing action - then:

- ▶ The driver ignores the **Select Before Operate** property of the command variable
- ▶ The driver uses the "*direct execute*" command and sends the command with the IEC Qualifier S/E = 0 (*execute*).

LIMITATIONS

- ▶ See IEC60870-5-101/104 interoperability list for information about supported communication parameters and type names.
- ▶ "*select and execute*" can only be used for command processing. Otherwise "*direct execute*" is always used.

6.1 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:

Parameter	Double Point	Value	Meaning
Intermediate	<i>00b</i>	<i>0</i>	Switches are neither open nor closed, for example the End-Position has not yet been reached
Off	<i>01b</i>	<i>1</i>	Switch open
On	<i>10b</i>	<i>2</i>	Close switch/switch closed
Fault	<i>11b</i>	<i>3</i>	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 in the same standard, the Single Point Values are defined with *OFF* = *0* and *ON* = *1*.

In order to avoid dangerous incorrect actions by the user, the zenon Energy driver offers its own Double Point Value Mapping. Without DPI Mapping, the user must always be aware of the technical level on which they are acting and receiving or sending information. In stress situations, this can very easily lead to serious errors, for example if *ON* is sent instead of *OFF*.

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*



Information

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.

DCS MAPPING IN DOUBLE COMMAND

In general, the following applies: If a set value is written to a command variable, the value is written to the PLC. The value is normally written to the controller exactly as it is.

However, if this command variable is:

- ▶ Type ID T46 or T59
- ▶ and has the value <3

communication to the controller is mapped:

Because DCS consists of two bits, all higher values are cut off and not sent. That means:

zenon value	DCS value	Meaning
0 = 00b	01b = 1*	Off
1 = 01b	10b = 2*	On
2 = 10b	00b = 0*	Intermediate
3 = 11b	11b = 3	Fault
4 = 100b	00b = 0	Intermediate
5 = 101b	01b = 1	Off
6 = 110b	10b = 2	On
7 = 111b	11b = 3	Fault

* mapped value

Values >4 are communicated to the controller as unmapped.

6.2 TLS encrypted communication

Encrypted communication between the IEC870 driver and the PLC is configured in the configuration file of the driver. This configuration file is in the project folder in the following subfolder by default:
 \zenon\custom\drivers.

The save location and the naming of the configuration file can also be configured in the driver dialog in the **Basic settings** (on page 17) tab in the **Configuration File name** option.

Hint: You can switch to the project folder in the zenon Editor with the **Ctrl + Alt + E** keyboard shortcut.

This configuration must contain the following entries:

*** LINK ***

The parameters of a secured connection can be configured separately for each connection.

Parameter	Description
[TLS activated]	<p>Type of secure communication</p> <ul style="list-style-type: none"> ▶ 0: deactivated No encrypted communication ▶ 1: activated Communication is in encrypted form on the basis of the following parameters <p>Default: 0</p>
[Encryption process list]	List of the supported encryption processes. The list contains an abbreviation in openssl format.
[Certificate]	<p>Name of the TLS certificate.</p> <p>The default save location is configured with the entry for the [save location of the certificates] (TLS_CERTIFICATE_STORE_PATH=) . The TLS certificate must be present in the PRIVATE folder.</p>
[Identification certificate]	<p>Client certificate identification used.</p> <p>The client certificate must contain the SUBJECT configured here. The connection is disconnected if they do not correspond.</p>
[Time until the key is renewed]	<p>Maximum duration of a key used before it is replaced.</p> <p>Only the key is renewed. The certificate is not updated in the process. The certificate is renewed</p>

Parameter	Description
	<p>after expiry of the configured time. Time indication in seconds.</p> <p>Default:43200</p>
<i>[Amount of data until the key is renewed]</i>	<p>Amount of data for which a key is used before it is renewed.</p> <p>The encryption is renewed after the configured amount of data has been transferred. The certificate is not updated in the process. Indication in bytes.</p> <p>Default:10485760</p>
<i>[Maximum duration of an encrypted connection]</i>	<p>Maximum duration of an encrypted connection before it is renewed.</p> <p>The encryption is reinitialized after the configured time has expired. In doing so, certificates and the key are replaced for new ones. Time indication in seconds.</p> <p>Default:86400</p>
<i>[Maximum transferred amount of data of an encrypted connection]</i>	<p>Amount of data for which an encrypted connection is used before it is renewed.</p> <p>The encryption is reinitialized after the configured amount of data has been reinitialized. In doing so, certificates and the key are replaced for new ones. Indication in bytes.</p> <p>Default:1048576</p>
<i>[checking interval of the REVOCATION LIST]</i>	<p>Time interval for the check to see whether the certificate currently being used is included in the REVOCATION LIST.</p> <p>The encrypted connection is no longer secure if the certificate is included in the REVOCATION LIST. The connection is terminated. Time indication in seconds.</p> <p>Default:21600</p>

*** TLS CONTEXT ***

The configuration of the save location of the certificates is applicable for the driver and cannot be configured individually per connection.

Parameter	Description
<i>[Storage location of the certificates]</i>	<p>Absolute save location of the certificates. This basic directory must contain the two subdirectories CA and PRIVATE .</p> <ul style="list-style-type: none"> ▶ CA for trusted certificates <p>and</p> <ul style="list-style-type: none"> ▶ PRIVATE for your own certificates

EXAMPLE

1

*** LINK ***

29

1

Link1

0

192.168.0.230

2404

1

1

2

2

3

0.0.0.0

0

15000

10000

20000

12

8

0

0

0

[TLS activated]

[Encryption process list]

[Certificate]

[Identification certificate]

0 [Time until the key is renewed] in seconds

0 [Amount of data until the key is renewed]

0 [Maximum duration of an encrypted connection]

0 [Maximum transferred amount of data of an encrypted connection]

0 [Checking interval of the REVOCATION LIST] in seconds

1

*** SECTOR ***

2

Sector1

1

1

*** TLS CONTEXT ***

1

C:\Certificates [save location of the certificates]

7 Driver command function

The zenon **Driver commands** function is to influence drivers using zenon. You can do the following with a driver command:

- ▶ Start
- ▶ Stop
- ▶ Shift a certain driver mode
- ▶ Instigate certain actions

Note: This chapter describes standard functions that are valid for most zenon drivers. Not all functions described here are available for every driver. For example, a driver that does not, according to the data sheet, support a modem connection also does not have any modem functions.

Attention

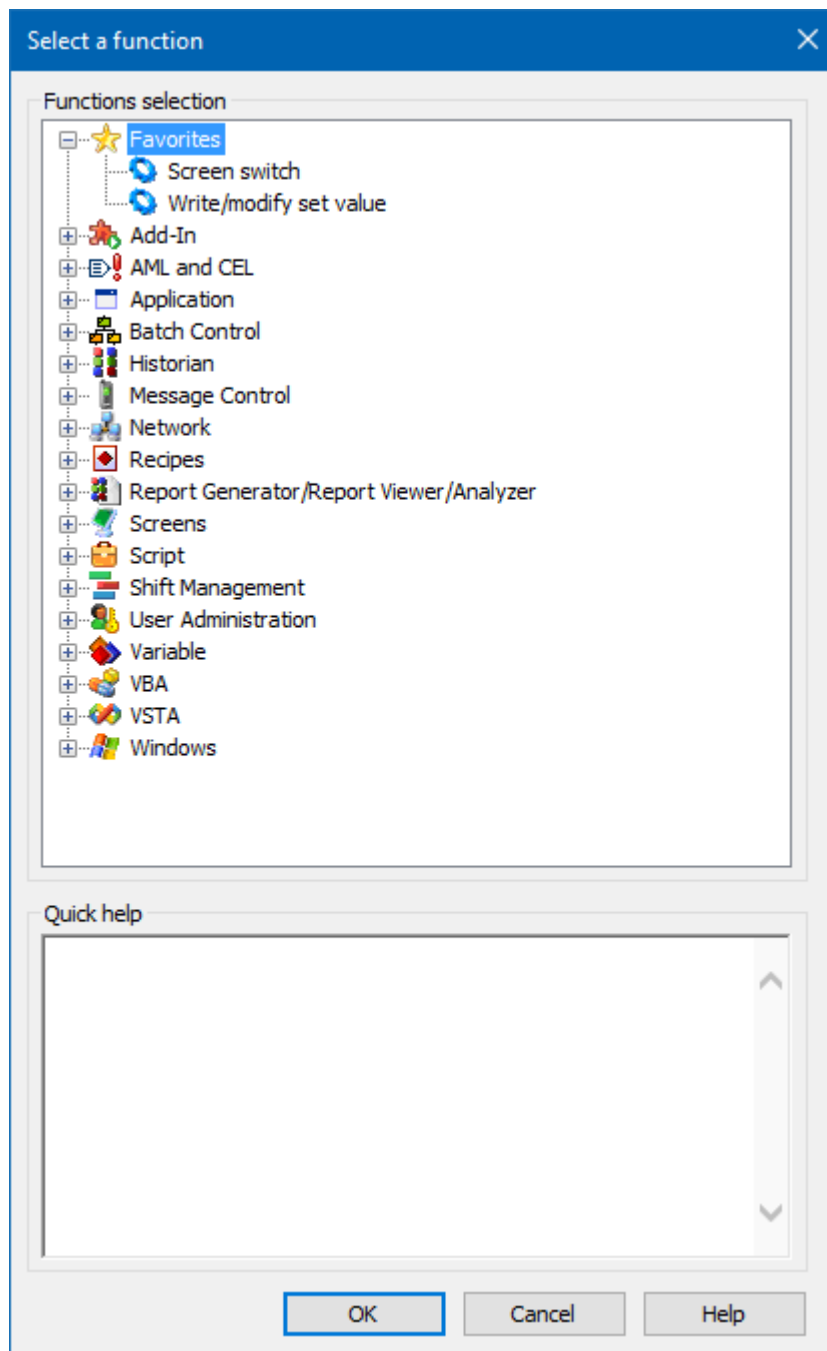
The zenon **Driver commands** function is not identical to driver commands that can be executed in the Runtime with Energy drivers!

CONFIGURATION OF THE FUNCTION

Configuration is carried out using the **Driver commands** function. To configure the function:

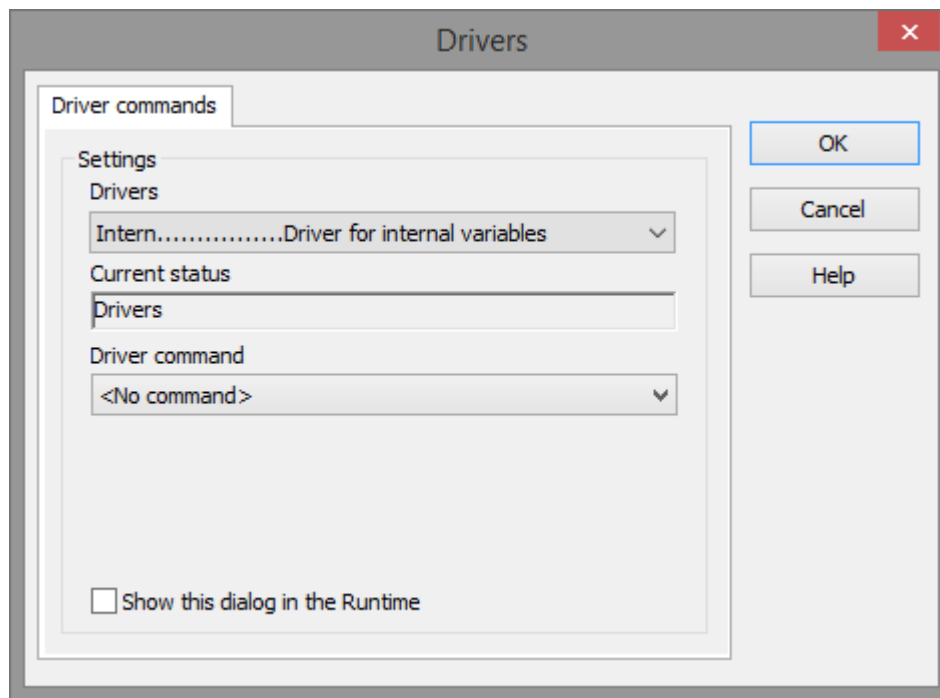
1. Create a new function in the zenon Editor.

The dialog for selecting a function is opened



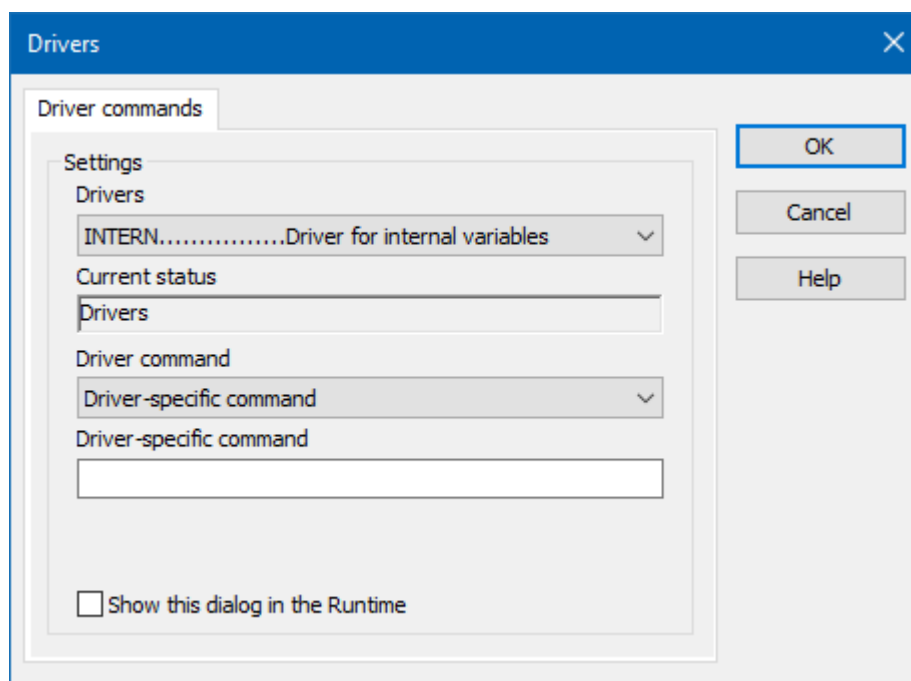
2. Navigate to the node **Variable**.
3. Select the **Driver commands** entry.

The dialog for configuration is opened



4. Select the desired driver and the required command.
5. Close the dialog by clicking on **OK** and ensure that the function is executed in the Runtime. Heed the notices in the **Driver command function in the network** section.

DRIVER COMMAND DIALOG



Option	Description
Driver	Selection of the driver from the drop-down list. It contains all drivers loaded in the project.
Current condition	Fixed entry that is set by the system. no function in the current version.
Driver command	no function in the current version. For details on the configurable driver commands, see the available driver commands section.
Driver-specific command	Entry of a command specific to the selected driver. Note: Only available if, for the driver command option, the <i>driver-specific command</i> has been selected.
Show this dialog in the Runtime	Configuration of whether the configuration can be changed in the Runtime: <ul style="list-style-type: none"> ▶ <i>Active</i>: This dialog is opened in the Runtime before executing the function. The configuration can thus still be changed in the Runtime before execution. ▶ <i>Inactive</i>: The Editor configuration is applied in the Runtime when executing the function. Default: <i>inactive</i>

CLOSE DIALOG

Options	Description
OK	Applies settings and closes the dialog.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.

AVAILABLE DRIVER COMMANDS

These driver commands are available - depending on the selected driver:

Driver command	Description
<i>No command</i>	No command is sent. A command that already exists can thus be removed from a configured function.

Driver command	Description
<i>Start driver (online mode)</i>	Driver is reinitialized and started. Note: If the driver has already been started, it must be stopped. Only then can the driver be re-initialized and started.
<i>Stop driver (offline mode)</i>	Driver is stopped. No new data is accepted. Note: If the driver is in offline mode, all variables that were created for this driver receive the status <i>switched off</i> (OFF; Bit 20).
<i>Driver in simulation mode</i>	Driver is set into simulation mode. The values of all variables of the driver are simulated by the driver. No values from the connected hardware (e.g. PLC, bus system, ...) are displayed.
<i>Driver in hardware mode</i>	Driver is set into hardware mode. For the variables of the driver the values from the connected hardware (e.g. PLC, bus system, ...) are displayed.
<i>Driver-specific command</i>	Entry of a driver-specific command. Opens input field in order to enter a command.
<i>Driver - activate set setpoint value</i>	Write set value to a driver is possible.
<i>Driver - deactivate set setpoint value</i>	Write set value to a driver is prohibited.
<i>Establish connection with modem</i>	Establish connection (for modem drivers) Opens the input fields for the hardware address and for the telephone number.
<i>Disconnect from modem</i>	Terminate connection (for modem drivers)
<i>Driver in counting simulation mode</i>	Driver is set into counting simulation mode. All values are initialized with 0 and incremented in the set update time by 1 each time up to the maximum value and then start at 0 again.
<i>Driver in static simulation mode</i>	No communication to the controller is established. All values are initialized with 0.
<i>Driver in programmed simulation mode</i>	The values are calculated by a freely-programmable simulation project. The simulation project is created with the help of the zenon Logic Workbench and runs in the zenon Logic Runtime.

DRIVER COMMAND FUNCTION IN THE NETWORK

If the computer on which the **Driver commands** function is executed is part of the zenon network, further actions are also carried out:

- ▶ A special network command is sent from the computer to the project server.
It then executes the desired action on its driver.
- ▶ In addition, the Server sends the same driver command to the project standby.
The standby also carries out the action on its driver.

This makes sure that Server and Standby are synchronized. This only works if the Server and the Standby both have a working and independent connection to the hardware.

8 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 in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for given applications. This clause summarizes the parameters of the previous clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers, it is necessary that all partners agree on the selected parameters.

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

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

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

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

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

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

1. SYSTEM OR DEVICE

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

[] System definition

[X] Controlling station definition (Master)

[] Controlled station definition (Slave)

2. NETWORK CONFIGURATION: 101 ONLY

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

Configuration types

[X] Point-to-point	[X] Multipoint-partyline
[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
[X] 100 bit/s	[X] 2400 bit/s	[] 2400 bit/s
[X] 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		[] 19200 bit/s
[X] 1200 bit/s		[] 38400 bit/s
		[] 56000 bit/s
		[] 64000 bit/s

TRANSMISSION SPEED (MONITOR DIRECTION)

Unbalanced interchange Circuit V.24/V.28 Standard	Unbalanced interchange Circuit V.24/V.28 Recommended if >1 200 bit/s	Balanced interchange Circuit X.24/X.27
[X] 100 bit/s	[X] 2400 bit/s	[] 2400 bit/s
[X] 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		[] 19200 bit/s
[X] 1200 bit/s		[] 38400 bit/s
		[] 56000 bit/s
		[] 64000 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	Address field of the link
[] Balanced transmission	[255] Maximum length L (number of octets)	[] not present (balanced transmission only)
[X] Unbalanced transmission		[X] One octet
		[X] Two octets
		[X] Structured
		[X] Unstructured

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

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

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

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

<i>Type identification</i>	<i>Cause of transmission</i>
any*	any

*assignment of any ASDU type to class 2 as well to class 1 is supported

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')

[X]	One octet	[X]	Two octets
-----	-----------	-----	------------

INFORMATION OBJECT ADDRESS

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

[X]	One octet	[X]	Structured
[X]	Two octets	[X]	Unstructured
[X]	Three octets		

CAUSE OF TRANSMISSION

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

[X] One octet	[X] Two octets (with originator address). Originator address is set to zero if not used
---------------------------	---

LENGTH OF APDU

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

The maximum length of the APDU is 253 (default). 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).

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

[X] <1>	:= Single-point information	M_SP_NA_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
[X] <30>	:= Single-point information with time tag CP56Time2a	M_SP_TB_1
[X] <31>	:= Double-point information with time tag CP56Time2a	M_DP_TB_1
[X] <32>	:= Step position information with time tag CP56Time2a	M_ST_TB_1
[X] <33>	:= Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
[X] <34>	:= Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
[X] <35>	:= Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
[X] <36>	:= Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
[X] <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).

[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)

[] <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).

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

PARAMETER IN CONTROL DIRECTION

(station-specific parameter, 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).

[] <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).

[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.

Black boxes: option not permitted in this companion standard

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
<1>	M_SP_NA_1		X	X								X	X		20		
<2>	M_SP_TA_1			X								X	X				
<3>	M_DP_NA_1		X	X								X	X		20		
<4>	M_DP_TA_1			X								X	X				
<5>	M_ST_NA_1		X	X								X	X		20		
<6>	M_ST_TA_1			X								X	X				
<7>	M_BO_NA_1		X	X											20		
<8>	M_BO_TA_1			X													
<9>	M_ME_NA_1	X	X	X											20		
<10>	M_ME_TA_1			X													

Type identification		Cause of transmission															
<11>	M_ME_NB_1	X	X	X											20		
<12>	M_ME_TB_1			X													
<13>	M_ME_NC_1	X	X	X											20		
<14>	M_ME_TC_1			X													
<15>	M_IT_NA_1			X													
<16>	M_IT_TA_1			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			X							X	X					
<31>	M_DP_TB_1			X							X	X					
<32>	M_ST_TB_1			X							X	X					
<33>	M_BO_TB_1			X													
<34>	M_ME_TD_1			X													
<35>	M_ME_TE_1			X													
<36>	M_ME_TF_1			X													
<37>	M_IT_TB_1			X													
<38>	M_EP_TD_1																
<39>	M_EP_TE_1																
<40>	M_EP_TF_1																
<45>	C_SC_NA_1						X	X	X	X	X						L
<46>	C_DC_NA_1						X	X	X	X	X						L
<47>	C_RC_NA_1						X	X	X	X	X						L

Type identification		Cause of transmission															
<48>	C_SE_NA_1						X	X			X						L
<49>	C_SE_NB_1						X	X			X						L
<50>	C_SE_NC_1						X	X			X						L
<51>	C_BO_NA_1						X	X			X						L
<58>	C_SC_TA_1						X	X	X	X	X						L
<59>	C_DC_TA_1						X	X	X	X	X						L
<60>	C_RC_TA_1						X	X	X	X	X						L
<61>	C_SE_TA_1						X	X			X						L
<62>	C_SE_TB_1						X	X			X						L
<63>	C_SE_TC_1						X	X			X						L
<64>	C_BO_TA_1						X	X			X						L
<70>	M_EI_NA_1*				X												
<100>	C_IC_NA_1						X	X			X						
<101>	C_CI_NA_1																
<102>	C_RD_NA_1																
<103>	C_CS_NA_1			X			X	X									
<104>	C_TS_NA_1																
<105>	C_RP_NA_1																
<106>	C_CD_NA_1																
<107>	C_TS_TA_1																
<110>	P_ME_NA_1																
<111>	P_ME_NB_1																
<112>	P_ME_NC_1																
<113>	P_AC_NA_1																
<120>	F_FR_NA_1													B			

Type identification		Cause of transmission															
<121>	F_SR_NA_1															B	
<122>	F_SC_NA_1					B										B	
<123>	F_LS_NA_1															B	
<124>	F_AF_NA_1															B	
<125>	F_SG_NA_1															B	
<126>	F_DR_TA_1*					X											

* Blank or X only

L - log

5. 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)

[] 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)

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

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
- 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

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

[not limited*] Maximum allowable delay of commands and set point commands

**only together with Command Input module*

TRANSMISSION OF INTEGRATED TOTALS

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

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

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

- [] General request counter
- [] Request counter group 1
- [] Request counter group 2
- [] Request counter group 3
- [] Request counter group 4

PARAMETER LOADING

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

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

PARAMETER ACTIVATION

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

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

TEST PROCEDURE

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

- [] Test procedure

FILE TRANSFER

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

File transfer in monitor direction

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

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

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

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

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

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

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

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

PORTNUMBER: 104 ONLY

<i>Parameter</i>	<i>Value</i>	<i>Remarks</i>
Portnumber	2404	configurable

REDUNDANT CONNECTIONS: 104 ONLY

[2] Number N of redundant connections according Edition 2 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.

9 Error analysis

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

9.1 Analysis tool

All zenon modules such as Editor, Runtime, drivers, etc. write messages to a joint log file. To display them correctly and clearly, use the Diagnosis Viewer program that was also installed with zenon. You can find it under **Start/All programs/zenon/Tools 8.20 -> Diagviewer**.

zenon driver log all errors in the LOG files. LOG files are text files with a special structure. The default folder for the LOG files is subfolder **LOG** in the folder **ProgramData**. For example:

%ProgramData%\COPA-DATA\LOG.

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

In the Diagnosis Viewer you can also:

- ▶ Follow newly-created entries in real time
- ▶ customize the logging settings
- ▶ change the folder in which the LOG files are saved

Note:

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

⚠ Attention

In Windows CE errors are not logged per default due to performance reasons.

You can find further information on the Diagnosis Viewer in the Diagnose Viewer manual.

9.2 Driver monitoring

Runtime monitors the availability of the driver by means of a watchdog. If a driver is no longer available, the *INVALID* status bit is also set for all checked-in variables.

Possible causes for a triggering of the watchdog:

- ▶ The driver process is no longer running.
Check whether the driver EXE file is still running in the Task Manager.
- ▶ Operating system is busy with processes that have a higher priority.

Check the configuration of your system to see whether there is sufficient memory and CPU power. In this case, the driver only resets the *INVALID* status bit if there is a value change on the connected party. Static values retain the *INVALID* status bit until the next time the Runtime or the driver is started.

CONFIGURATION OF WATCHDOG

For the monitoring of communication in the Runtime, the connection to the driver is checked in a fixed, prescribed time period of 60 seconds. This process is repeated several times. If, within 5 attempts (= within 5 minutes), no valid connection to the driver is detected, the *INVALID* bit is set for the checked-in (*advised*) variables. In addition, the *INVALID* bit is also set when new variables are advised. The *INVALID* bit will no longer be reset.

Corresponding LOG entries are created for this.

LOG ENTRY

An error message is logged in the LOG when the watchdog is triggered:

Parameter	Description
<i>Communication with driver:<drvExe>/<drvDesc>(id:<drvId>) timed out. No communication for <time> ms.</i>	No communication with driver within the given time. <ul style="list-style-type: none"> ▶ <time>: Time (in milliseconds) ▶ <drvDesc>: Driver name ▶ <drvExe>: Driver EXE name ▶ <drvId>: Driver ID in the zenon project
<i>Communication with %s timed out. Invalid-Bit will be set.</i>	Communication to the %s driver could not be established after 5 attempts within 60 seconds. The <i>INVALID</i> bit is set for the variable.
<i>Communication with %s timed out. Timeout happened %d times</i>	Communication to the %s driver could not be established after %d times within 60 seconds.

9.3 Check list

870-104

870-101

1. Is the COM port in use by another application or are the settings incorrect?

General

- 1.
2. Is the device (PLC) that you are trying to communicate with connected to the power supply?
3. Is the cable between PLC and PC/IPC connected correctly?
4. Have you analyzed the error file (which errors did occur)?
5. For further error analysis, please send a project backup, the INI and XML files of the IEC870 slave and the LOG file of the **Diagnosis Viewer** to the support team responsible for you.