COPA-DATA
do it your way

zenon driver manual

IEC870

v.7.00

Contents

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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.

> **Attention**
>
> *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. Should you need both connections, we recommend the 101 and 104 connections in two separate driver instances.*

3. IEC870 - Data sheet

General:	
Driver file name	IEC870.exe
Driver description	IEC 60870-5-101_104
PLC types	PLCs supporting the IEC 60870-5-101 or the IEC 60870-5-104 protocol.
PLC manufacturer	Alstom; Siemens; IEC; SAT; Sprecher Automation; Areva;

Driver supports:	
Protocol	IEC 60870-5-104; IEC 60870-5-101;
Addressing: address based	x
Addressing: name based	-
Spontaneous communication	x

Polling communication	x
Online browsing	x
Offline browsing	-
Real-time capable	x
Blockwrite	-
Modem capable	-
Serial logging	x
RDA numerical	-
RDA String	-

Prerequisites:	
Hardware PC	RS 232 or standard network card
Software PC	-
Hardware PLC	-
Software PLC	-
Requires v-dll	x

Platforms:	
Operating systems	Windows CE 5.0, CE 6.0; Windows XP, Vista, 7, Server 2003, Server 2008/R2;
CE platforms	x86; ARM; Pocket-PC;

4. Driver history

Date	Driver version	Change
07.07.08	4500	Created driver documentation
26.09.08	4700	Updated interoperability list.
23.03.2010	6000	Values from Buffered Reports are transferred to the archive at Runtime start.

5. Requirements

This chapter contains information on the requirements that are necessary for use of this driver.

6. Configuration

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

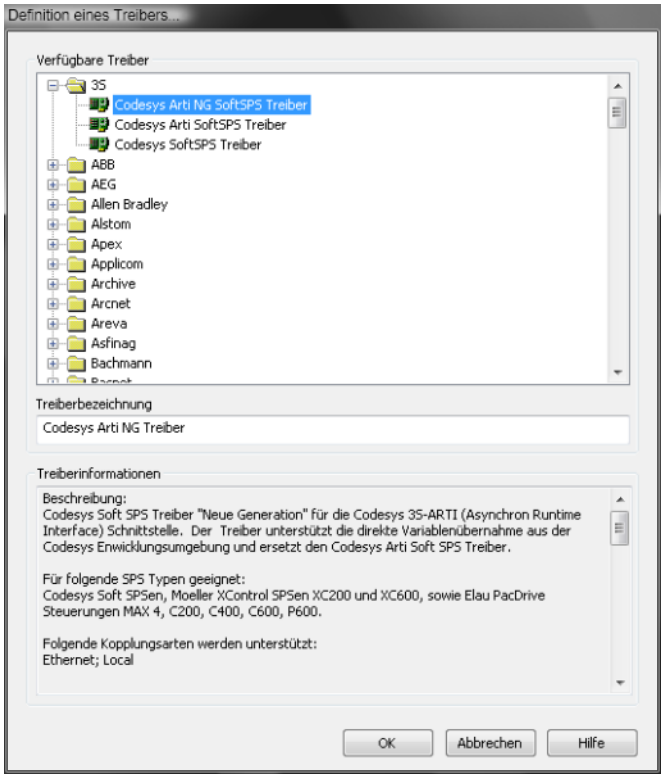
> **Info**
>
> *Find out more about further settings for zenon variables in the chapter Variables (main.chm::/15247.htm) of the online manual.*

6.1 Creating a driver

In order to create a new driver:

- Right-click on **Driver** in the Project Manage and select **Driver new** in the context menu.

- In the following dialog the control system offers a list of all available drivers.



- Select the desired driver and give it a name:
  - The driver name has to be unique, i.e. if one and the same driver is to be used several times in one project, every time a new name has to be given each time.
  - 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.
- Confirm the dialog with OK. In the following dialog the single configurations of the drivers are defined.
- Only the respective required drivers need to be loaded for a project. Later loading of an additional driver is possible without problems.

Info

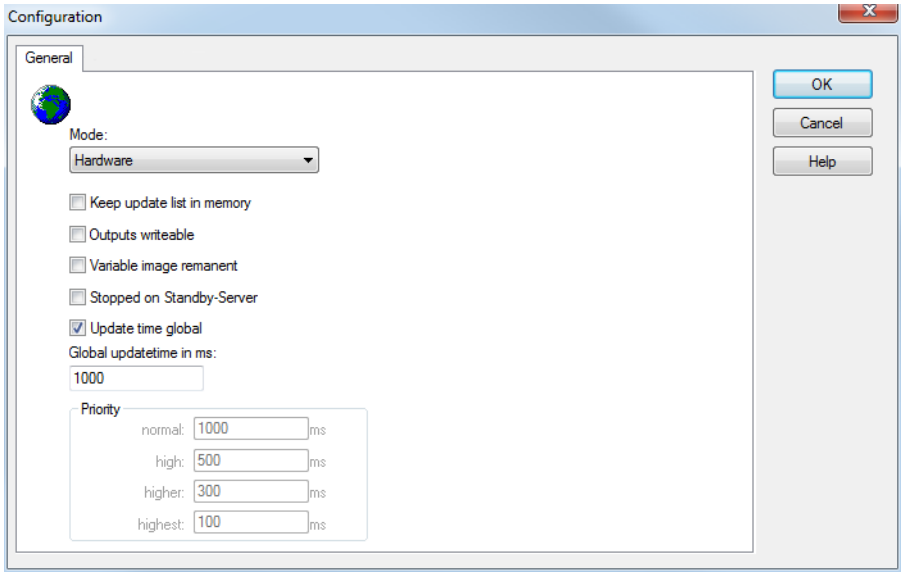
For new projects and for existing projects which are converted to version 6.21 or higher, the following drivers are created automatically:

- Internal
- MathDr32
- SysDrv.

6.2 Settings in the driver dialog

You can change the following settings of the driver:

6.2.1 General



Parameters	Description
Mode	Allows to switch between hardware mode and simulation mode ▸ Hardware: A connection to the control is established. ▸ Simulation static 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. ▸ Simulation - counting 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. ▸ Simulation - programmed N communication is established to the PLC. 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 a zenon Logic Runtime which is integrated in the driver. For details see chapter Driver simulation (main.chm::/25206.htm).
Keep update list in the memory	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.
Output can be written	Active: Outputs can be written. Inactive: Writing of outputs is prevented. **Note**: Not available for every driver.

Variable image remanent	This option saves and restores the current value, time stamp and the states of a data point. Fundamental requirement: The variable must have a valid value and time stamp. The variable image is saved in mode hardware if: ▸ one of the states S_MERKER_1(0) up to S_MERKER8(7), REVISION(9), AUS(20) or ERSATZWERT(27) is active The variable image is always saved if: ▸ the variable is of the object type Driver variable ▸ the driver runs in simulation mode. (not programmed simulation) The following states are not restored at the start of the Runtime: ▸ SELECT(8) ▸ WR-ACK(40) ▸ WR-SUC(41) The mode **Simulation - programmed** at the driver start is not a criterion in order to restore the remanent variable image.
Stop at the Standby Server	Setting for redundancy at drivers which allow only on communication connection. For this the driver is stopped at the Standby Server and only started at the upgrade. **Attention:** If this option is active, the gapless archiving is no longer guaranteed. Active: 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** (**statusverarbeitung.chm::/24150.htm**) but an empty value. This prevents that at the upgrade to the Server irrelevant values are created in the AML, CEL and Historian.
Global Update time	Active: The set Global update time in ms is used for all variables in the project. The priority set at the variables is not used. Inactive: The set priorities are used for the individual variables.
Priority	Here you set the polling times for the individual priorities. All variables with the according priority are polled in the set time. The allocation is taken

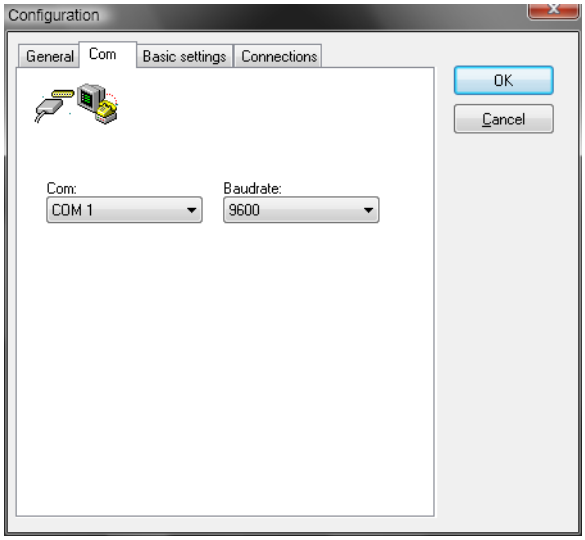
	place for each variable separately in the settings of the variable properties. The communication of the individual variables are graduated in respect of importance or necessary topicality using the priorities. Thus the communication load is distributed better.

UPDATE TIME FOR CYCLICAL DRIVER

The following applies for cyclical drivers:

For **`Set value`**, **`Advising`** of variables and **`Requests`**, a read cycle is immediately triggered for all drivers - regardless of the set update time. This ensures that the value is immediately available for visualization after writing. Update times can therefore be shorter than pre-set for cyclical drivers.

6.2.2 Com



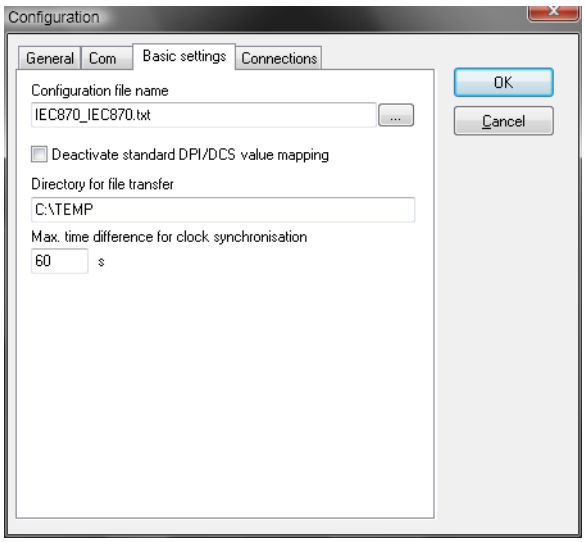
For this driver, only COM port and baud rate for the communication can be changed. All other communication parameters are defined and fixed in accordance with the IEC 870-5-101 standard.

Values:

- Parity: even
- Stop bit: 1
- Start bit: 1
- Data bit: 8

For details see: 870-5-1 "Part 5: Transmission protocols, Section One - Transmission frame formats".)

6.2.3 Basic setting



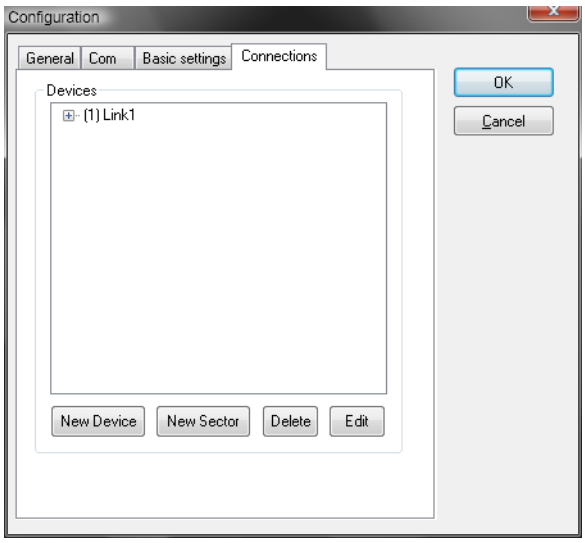
Parameters	Description
`Configuration file name`	Enter the name of the configuration file here. This file is required for the definition of the driver connection.
`Deactivate standard DPI/DCS value mapping`	`Inactive`(default): The values of double messages (DPI and DCS) are adjusted to the operating elements of zenon. Use this configuration if you want to use the modules of zenon Energy. The driver converts the values of double messages (DPI and DCS) for the Runtime: ▸ `intermediate | off | on | fault` to: `2 | 0 | 1 | 3`, so that in Runtime, for example, the value `0` means OFF and `1` means ON. `Active`: The values of double messages are forwarded to zenon exactly as they are: ▸ `intermediate | off | on | fault` = `0 | 1 | 2 | 3`).

	However, in this case you cannot use the command input, for example, to write double messages. **Hint:** The driver only converts a value of the variable that corresponds to the DPI/DCS value range (on page 42). DPI/DCS consists, according to the standard, of 2 bits; all other bits of the variable are not transferred.
Directory for file transfer	Specify the folder on the Runtime computer in which the "file transfer" files are to be stored.
Maximum time difference for clock synchronization	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.

6.2.4 Connections

The connections can be defined here.

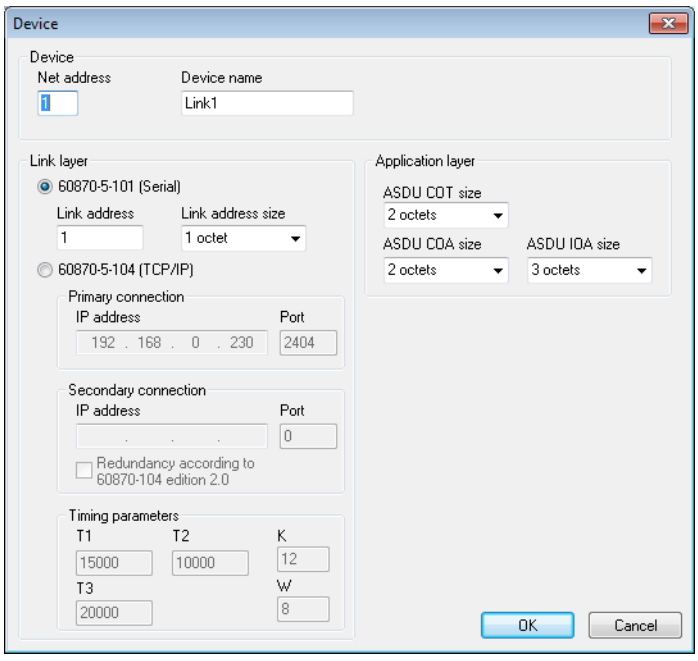
- Devices
- Sectors (caution: configured sectors must be present in the PLC)



Parameters	Description
Devices	List of configured devices and sectors.
New Device	Opens the dialog for configuring new devices.
New Sector	Opens the dialog for configuring new sectors.
Delete	Deletes selected entry from the list.
Edit	Opens the selected entry for editing.
OK	Applies all changes and closes dialog.
Cancel	Discards all changes and closes dialog.
Help	Opens online help.

DEVICES

A connection consists of a physical device connection and several sectors within this device. Each device is identified by the **Net address** by Runtime side and by the **link address** or **IP address** by the protocol.



Parameters	Description
Net address	Net address of Runtime.
Device name	Name of the device as it is displayed in the list.
Link layer	Physical connection
60870-5-101 (Serial)	Selected: Serial connection is made in accordance with **60870-5-101**.
Link address	Serial address on protocol side.
Link address size	Selection of address size from drop-down list: ▸ 1 octet ▸ 2 octets
Application layer	Application layer.
ASDU COT size	Defines the length of the COT (cause of transmission). You can only change the COT size for 101. For 104, the value is fixed as 2, in accordance with the standard. Selection of address size from drop-down list. Valid: ▸ 1 octet ▸ 2 octets
ASDU COT size	Defines the length of the COA (common object address). You can only change the COA size for 101. For 104, the value is automatically set to 2, in accordance with the standard. Selection of address size from drop-down list. Valid: ▸ 1 octet ▸ 2 octets
ASDU IOA size	Defines the length of the IOA (information object address). You can only change the IOA size for 101. For 104, the value is fixed as 3, in accordance with the standard. Selection of address size from drop-down list. Valid: ▸ 1 octet

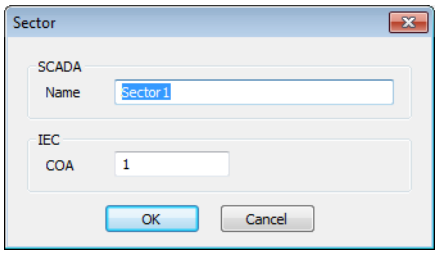
	▸ 2 octets ▸ 3 octets

60870-5-104 (TCP/IP)	Selected: Connection is made via the network in accordance with **60870-5-104**.
Primary connection	Primary connection.
IP address	IP address on protocol side.
Port	Port number.
Secondary connection	Alternative connection in case the primary connection fails.
IP address	IP address.
Port	Port number.
Redundancy according to 60870-104 edition 2.0	Active: Redundancy is implemented in accordance with **60870-104 edition 2.0**.
Timing parameters	Parameter for timing. T0 corresponds to the time-out when a connection is created and cannot be adjusted.
T1	Time-out for frame confirmation by the master. Value range: 0 - 4294967295 Default value: 15000
T2	Time-out, within which the master should confirm if no data is exchanged. Value range: 0 - 4294967295 Default value: 10000
T3	Time after which a U-frame is sent to the master if no data is to be transferred. Value range: 0 - 4294967295 Default value: 20000
k	Number of maximum I-frames not yet confirmed by the master. Value range: 0 - 4294967295 Default value: 12
w	Number of I-frames received after a confirmation is sent. Value range: 0 - 4294967295

	Default value: 8
OK	Applies all changes and closes the dialog.
Cancel	Discards all changes and closes the dialog.

SECTORS

Every device can contain several sectors. Every sector is a structural element by definition and can contain several data points. The sectors must be defined for special commands (e.g. “general interrogation”) in the driver configuration.



Parameters	Description
SCADA	Settings in the SCADA .
Name	Sector name.
IEC	Settings on protocol side.
COA	The COMMON ADDRESS OF ASDUs (IEC 60870-5-101 7.2.4) by which the sector is addressed. This number must be unique on the device (1 ... 254).
OK	Applies all changes and closes dialog.
Cancel	Discards all changes and closes dialog.

Info

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

7. Creating variables

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

7.1 Creating variables in the Editor

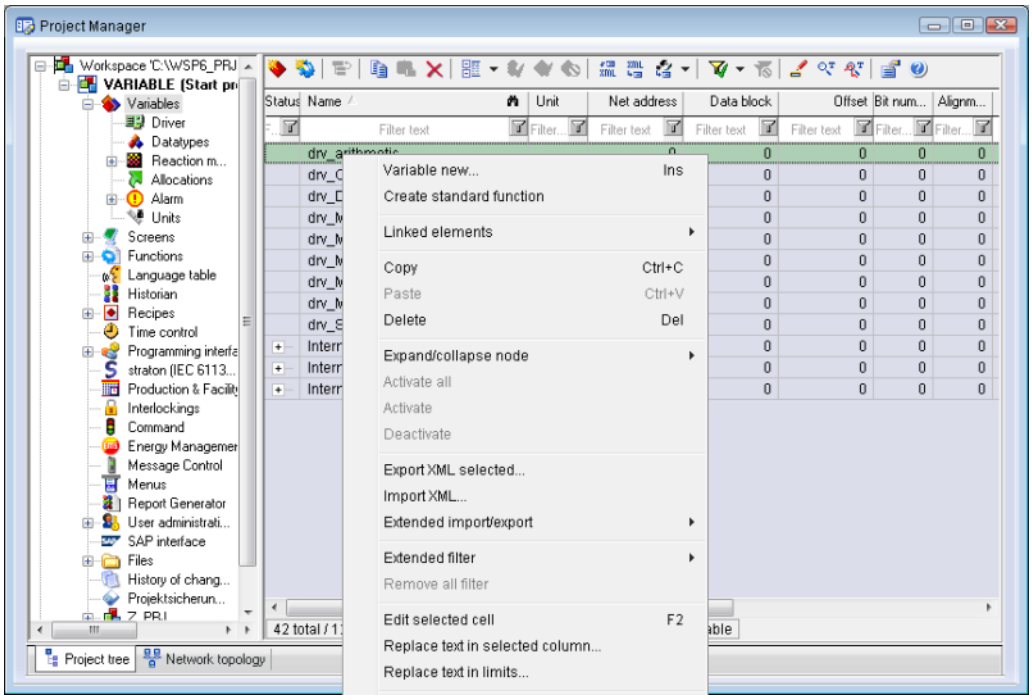
Variables can be created:

- as simple variables
- in arrays main.chm::/15262.htm
- as structure variables main.chm::/15278.htm

VARIABLE DIALOG

To create a new variable, regardless of which type:

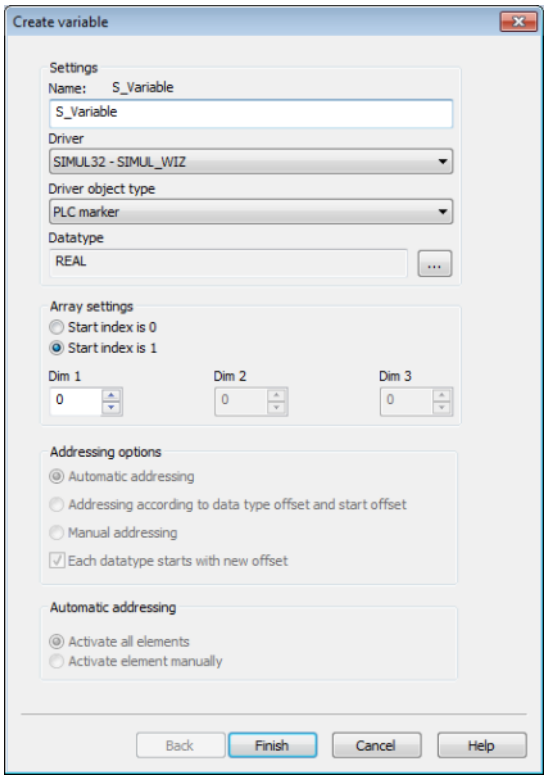
1. Select the **`New variable`** command in the **`Variables`** node in the context menu



2. The dialog for configuring variables is opened

3. configure the variable

4. The settings that are possible depends on the type of variables



Property	Description
Name	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. **Attention:** The **#** character is not permitted in variable names. If non-permitted characters are used, creation of variables cannot be completed and the **Finish** button remains inactive.
Drivers	Select the desired driver from the drop-down list. **Note:** If no driver has been opened in the project, the driver for internal variables (Intern.exe (Main.chm::/Intern.chm::/Intern.htm)) is automatically loaded.
Driver object type (cti.chm::/28685.htm)	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 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.

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.

7.2 Addressing

The data points are addressed via a COA (common object address), an IOA (information object address) and the IEC870 Type. The type 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	Any name may be chosen. ATTENTION: the name must be unique within every control system project.
Identification	Any text can be entered here, e.g. for resource labels, comments ...
Net address	Bus address or net address of the 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.
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.
Driver object type	Depending on the employed driver, an object type is selected during the creation of the variable; the type can be changed here later.
Data type	Data type of the variable, which is selected during the creation of the variable; the type can be changed here later. ATTENTION: If you change the data type later, all other properties of the variable must be checked and adjusted, if necessary.
IEC870 type	Defines the type and function of the variable according to the IEC870 specification.
IEC870 COA1	Corresponds to the sector of the device in which the variable resides.
IEC870 IOA1	Address of the variable within a sector

The current connection status can be requested via a USINT variable of type “internal state” (T00). If the value of this variable is 5, this means that a connection is active and that the general request was finished successfully.

The communication is spontaneous, This means that all value changes of the PLC are processed by the driver.

Example:
The PLC sends three value changes at intervals of 5 ms, which are passed on to zenon. If the changes occur within the update time, in which the driver cyclically reads telegrams, the single telegram contains all value changes.
E.g. if you use a reaction matrix that reacts to every value change and triggers a log entry in the Chronological Event List (CEL), the CEL will contain three entries at intervals of 5 ms. The same applies to spontaneous archiving and alarms. None of the values are lost.

7.3 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.

7.3.1 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	R / W	BOOL, SINT, USINT, INT, UINT, DINT, UDINT, REAL, STRING	
Driver variable	35	R / W	BOOL, SINT, USINT, INT, UINT, DINT, UDINT, REAL, STRING	Variables for the statistical analysis of communication. Find out more in the chapter about the Driver variables (on page 37)

7.3.2 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

PLC	ASDU Type	zenon	Comment	Data type
M_SP_NA_1	1	BOOL	SPI <0..1>	8
M_SP_TA_1	2	BOOL	SPI [1)]	8
M_SP_TB_1	30	BOOL	SPI [2)]	8
M_DP_NA_1	3	USINT	DPI <0..3>	9
M_DP_TA_1	4	USINT	DPI [1)]	9
M_DP_TB_1	31	USINT	DPI [2)]	9
M_ST_NA_1	5	USINT	Corresponds to whole VTI (IEC60870-5-101 7.2.6.5). Bit 8 is the Transient bit.	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)	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 <–1..+1 -2^{-15}>, in practice <-1..0,9999>	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 <-2^{15}..$+2^{15}-1$> = <-32768..32767>	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	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 <-2^{31}..$+2^{31}$-1>	3
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		8
C_SC_TA_1	58	BOOL		8
C_DC_NA_1	46	USINT		9
C_DC_TA_1	59	USINT		9
C_RC_NA_1	47	USINT		9
C_RC_TA_1	60	USINT		9
C_SE_NA_1	48	REAL		5
C_SE_TA_1	61	REAL		5
C_SE_NB_1	49	INT		1
C_SE_TB_1	62	INT		1
C_SE_NC_1	50	REAL		5
C_SE_TC_1	63	REAL		5
C_BO_NA_1	51	UDINT		4
C_BO_TA_1	64	UDINT		4
C_IC_NA_1	100	BOOL	1 during execution	8
C_CS_NA_1	103	BOOL	1 during execution	8
F_SC_NA_1	122	STRING	Command for file transfer, for example "DIR" or "GET"	12
F_DR_TA_1	126	STRING	response variable for file transfer	12

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

Data type: The property `Data type` is the internal numerical name of the data type. It is also used for the extended DBF import/export of the variables.

7.4 Creating variables by importing

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

7.4.1 XML import of variables from another zenon project

For the import/export of variables the following is true:

- The import/export must not be started from the global project.
- The start takes place via:
  - Context menu of variables or data typ in the project tree
  - or context menu of a variable or a data type
  - or symbol in the symbol bar variables

> **Attention**
>
> *When importing/overwriting an existing data type, all variables based on the existing data type are changed.*
>
> ***Example:***
>
> *There is a data type XYZ derived from the type `INT` with variables based on this data type. The XML file to be imported also contains a data type with the name XYZ but derived from type `STRING`. If this data type is imported, the existing data type is overwritten and the type of all variables based on it is adjusted. I.e. the variables are now no longer `INT` variables, but `STRING` variables.*

7.4.2 DBF Import/Export

Data can be exported to and imported from dBase.

IMPORT DBF FILE

To start the import:

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

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

Info

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 menu of **Extended export/import...** select the **Export dBase** command
3. follow the export 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.

Info

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) when exporting.

DBF files must:

- correspond to the 8.3 DOS format for filenames (8 alphanumeric characters for name, 3 character suffix, no spaces)
- Be stored close to the root directory (Root)

DESIGN

Description	Type	Field size	Comment
KANALNAME	Char	128	Variable name. The length can be limited using the MAX_LAENGE entry in **project.ini** .
KANAL_R	C	128	The original name of a variable that is to be replaced by the new name entered under "KANALNAME" (field/column must be entered manually). The length can be limited using the MAX_LAENGE entry in **project.ini** .
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 **project.ini** .
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	Bus 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 Recipe Group Manager
LES_SCHR	R	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 KANALTYP and DATENART
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
MEMTIEFE	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	Resource label. Free string for export and display in lists. 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	Linked 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 DEFINITION

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

Description	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 (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
HYSTERESE1	F	14	Hysteresis in %
BLINKEN1	R	1	Set blink attribute
BTB1	R	1	Logging in CEL
ALARM1	R	1	Alarm
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	Function linking
ASK_FUNC1	R	1	With interrogation before execution
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.

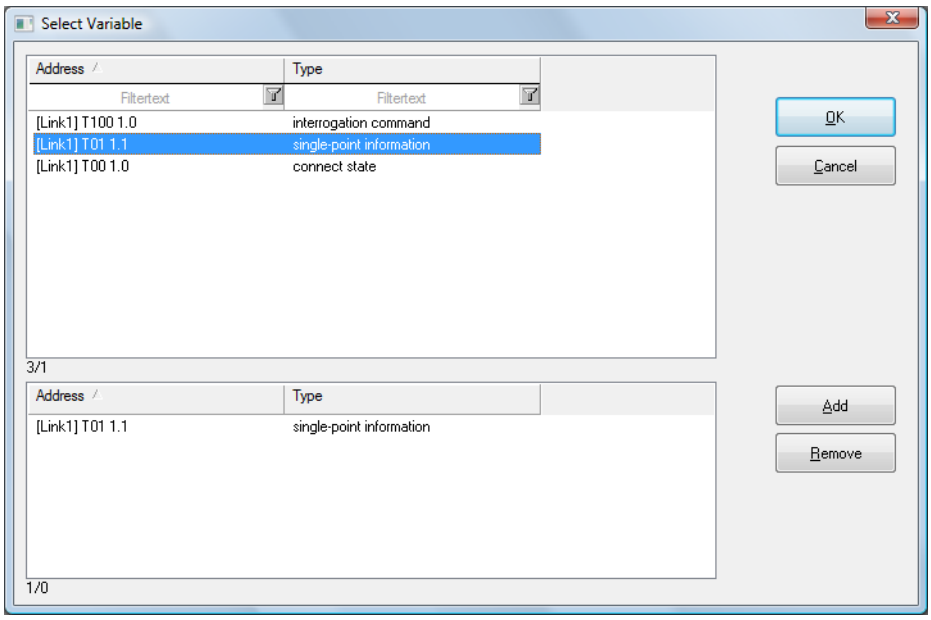
7.4.3 Online import

Variables in message direction are created with the driver online import. You will find the command in the context menu of the driver in the driver list.

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 import list 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.

7.5 Driver variables

The driver kit implements a number of driver variables. These are divided into:

- Information
- Configuration
- Statistics and
- Error messages

The definitions of the variables defined in the driver kit are available in the import file **drvvar.dbf** (on the CD in the directory: CD_Drive:/Predefined/Variables) and can be imported from there.

Hint: Variable names must be unique in zenon. If driver variables are to be imported from **drvvar.dbf** again, the variables that were imported beforehand must be renamed.

Info

Not every driver supports all driver variants.

For example:

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

INFORMATION

Name from import	Type	Offset	Description
MainVersion	UINT	0	Main version number of the driver.
SubVersion	UINT	1	Sub version number of the driver.
BuildVersion	UINT	29	Build version number of the driver.
RTMajor	UINT	49	zenon main version number
RTMinor	UINT	50	zenon sub version number
RTSp	UINT	51	zenon service pack number
RTBuild	UINT	52	zenon build number
LineStateIdle	BOOL	24.0	TRUE, if the modem connection is idle
LineStateOffering	BOOL	24.1	TRUE, if a call is received
LineStateAccepted	BOOL	24.2	The call is accepted
LineStateDialtone	BOOL	24.3	Dialtone recognized
LineStateDialing	BOOL	24.4	Dialing active
LineStateRingBack	BOOL	24.5	While establishing the connection
LineStateBusy	BOOL	24.6	Target station is busy
LineStateSpecialInfo	BOOL	24.7	Special status information received
LineStateConnected	BOOL	24.8	Connection established
LineStateProceeding	BOOL	24.9	Dialing completed
LineStateOnHold	BOOL	24.10	Connection in hold
LineStateConferenced	BOOL	24.11	Connection in conference mode.
LineStateOnHoldPendConf	BOOL	24.12	Connection in hold for conference
LineStateOnHoldPendTransfer	BOOL	24.13	Connection in hold for transfer
LineStateDisconnected	BOOL	24.14	Connection stopped
LineStateUnknow	BOOL	24.15	Connection status unknown
ModemStatus	UDINT	24	Current modem status
TreiberStop	BOOL	28	Driver stopped

			For `driver stop`, the variable has the value `TRUE` and an **`OFF`** bit. After the driver has started, the variable has the value `FALSE` and no **`OFF`** bit.
SimulRTState	UDINT	60	Informs the status of Runtime for driver simulation.

CONFIGURATION

Name from import	Type	Offset	Description
ReconnectInRead	BOOL	27	If TRUE, the modem is automatically reconnected for reading
ApplyCom	BOOL	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	BOOL	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	STRING	38	Telephone number, that should be used
ModemHwAdrSet	DINT	39	Hardware address for the telephone number
GlobalUpdate	UDINT	3	Update time in milliseconds (ms).
BGlobalUpdaten	BOOL	4	TRUE, if update time is global
TreiberSimul	BOOL	5	TRUE, if driver in sin simulation mode
TreiberProzab	BOOL	6	TRUE, if the variables update list should be kept in the memory
ModemActive	BOOL	7	TRUE, if the modem is active for the driver

Device	STRING	8	Name of the serial interface or name of the modem
ComPort	UINT	9	Number of the serial interface.
Baud rate	UDINT	10	Baud rate of the serial interface.
Parity	SINT	11	Parity of the serial interface
ByteSize	SINT	14	Number of bits per character of the serial interface Value = 0 if the driver cannot establish any serial connection.
StopBit	SINT	13	Number of stop bits of the serial interface.
Autoconnect	BOOL	16	TRUE, if the modem connection should be established automatically for reading/writing
PhoneNumber	STRING	17	Current telephone number
ModemHwAdr	DINT	21	Hardware address of current telephone number
RxIdleTime	UINT	18	Modem is disconnected, if no data transfer occurs for this time in seconds (s)
WriteTimeout	UDINT	19	Maximum write duration for a modem connection in milliseconds (ms).
RingCountSet	UDINT	20	Number of ringing tones before a call is accepted
ReCallIdleTime	UINT	53	Waiting time between calls in seconds (s).
ConnectTimeout	UDINT	54	Time in seconds (s) to establish a connection.

STATISTICS

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

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	UDINT	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.
RdErrSize	UDINT	48	Block size when the last reading error occurred.
DrvError	SINT	25	Error message as number
DrvErrorMsg	STRING	30	Error message as text
ErrorFile	STRING	15	Name of error log file

8. Driver-specific functions

This driver supports the following functions:

GENERAL INTERROGATION

A general request can be re-executed at a later time. In order to do so, a BOOL variable of type C_IC_NA_1 (T100) must be written to. The IOA of these variables must be 0. While the general request is

active, the value of this variable is 1. If the general interrogation could not be executed correctly, this variable will receive INVALID. Variables of type T100 can be created separately for every sector (COA). This allows you to check whether the sectors of a device can be reached.

CONNECTION STATUS

The current status of the connection to the PLC can be requested via a USINT variable of the type "internal state" (T00) and COA 0 and IOA 0. If the value of this variable is `5`, this means that a connection is active and that the general request was finished successfully.

STATUS OF THE DL LAYER

The status of the data security layer connection to the PLC can be read with the help of "internal state" (T00) and COA 0 and IOA 1 variables: The variable relates to the Data Link Layer and at the same time to both connections to redundancy if the secondary connection was defined in the driver configuration:

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

MANUAL SWITCHING OF THE CONNECTION

Info

Only available if you have activated the `Redundancy according to 60870-104 edition 2.0` option when creating 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 connection.

FILETRANSFER

There are three functions implemented for the file transfer:

1. Request folder information
2. Get file from the PLC
3. Delete file

1. REQUEST FOLDER INFORMATION

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.
   b) 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

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 14)
- The command variable changes its value to "GET OK"
- A subfolder is created for each COA

An active file transfer can be cancelled 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. DELETE FILE

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`"

TROUBLESHOOTING

If errors occur when carrying out the file transfer, the command variable changes its value to "`XXX ERROR`" (XXX = DIR, GET or DEL) and the driver optionally writes an entry into the log file (see also error analysis (on page 68)).

TIME SYNCHRONIZATION

By writing to a variable of Type 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 reverse direction:

The driver can accept and evaluate a T103 telegram in reverse direction from the device. If the device sends a T03 telegram, the time on the PC will be taken from the device, however only if the difference between the device time and the PC time does not exceed the configured maximum difference (see driver dialog basic setting).

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)

This S/E bit is used together with functionality **Select before operate** and serves for distinction between Select and Execute states of a command.

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. 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 to 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. This does not influence time stamps concerning **CP56Time2a**.

HYSTERESIS HANDLING

In general the driver supports hysteresis. The hysteresis is only considered for numeric data types if hysteresis <>0 was engineered. For variables with hysteresis=0 and for variables of type BOOL or STRING, the driver sends all received values to the Runtime.

SELECT & EXECUTE

To be able to use "select & execute", a **command input** with a two-stage action must be executed. In addition, the `Select Before Operate` property must be activated for the command variables.

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

- The driver ignores the `Select Before Operate` property of the command input
- The driver uses "**direct execute**" and sends the command with SE_870 BIT `execute` instead of `select`.

DCS MAPPING

The driver only maps (on page 14) variable values <3. 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 can be used to send double commands for variables without mapping.

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 input. Otherwise, "direct execute" will be used.

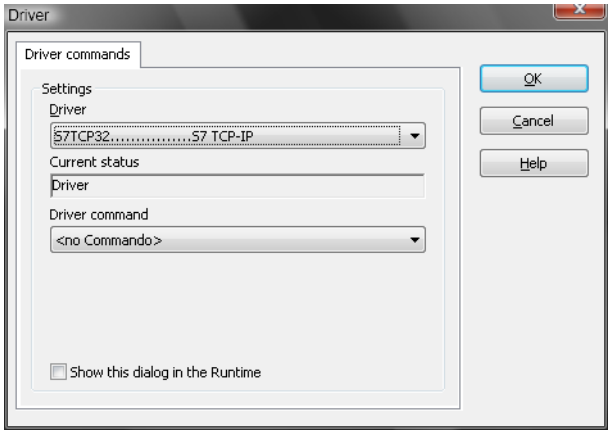
9. Driver commands

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.

Driver commands are used to influence drivers using zenon; start and stop for example.
The engineering is implemented with the help of function **Driver commands**. To do this:

- create a new function
- select *Variables -> Driver commands*

- The dialog for configuration is opened



Parameters	Description
Drivers	Drop-down list with all drivers which are loaded in the project.
Current state	Fixed entry which has no function in the current version.
Driver commands	Drop-down list for the selection of the command.
▸ Start driver (online mode)	Driver is reinitialized and started.
▸ Stop driver (offline mode)	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 switched off (OFF; Bit 20).
▸ Driver in simulation mode	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.
▸ Driver in hardware mode	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.
▸ Driver-specific command	Enter driver-specific commands. Opens input field in order to enter a command.
▸ Activate driver write set value	Write set value to a driver is allowed.
▸ Deactivate driver	Write set value to a driver is prohibited.

write set value	
▸ Establish connection with modem	Establish connection (for modem drivers) Opens the input fields for the hardware address and for the telephone number.
▸ Disconnect from modem	Terminate connection (for modem drivers)
Show this dialog in the Runtime	The dialog is shown in Runtime so that changes can be made.

DRIVER COMMANDS IN THE NETWORK

If the computer, on which the **driver command** function is executed, is part of the zenon network, additional actions are carried out. A special network command is sent from the computer to the project server, which 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.

10. Interoperability

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

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

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

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

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

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

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

1. SYSTEM OR DEVICE

(system-specific parameter, indicate definition of a system or a device by marking one of the following with ' X ')
[ ] System definition
[X] Controlling station definition (Master)
[ ] Controlled station definition (Slave)

2. NETWORK CONFIGURATION

(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

(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

(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:

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

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

Type identification	Cause of transmission

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.

[ ] 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
[ ] <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
[B] <103>	:= Clock synchronization command (option see 7.6). Only supported by zenon master.	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).

[X] <120>	:= File ready	F_FR_NA_1
[X] <121>	:= Section ready	F_SR_NA_1
[X] <122>	:= Call directory, select file, call file, call section	F_SC_NA_1
[X] <123>	:= Last section, last segment	F_LS_NA_1
[X] <124>	:= Ack file, ack section	F_AF_NA_1
[X] <125>	:= Segment	F_SG_NA_1
[B] <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																
<2>	M_SP_TA_1																
<3>	M_DP_NA_1																
<4>	M_DP_TA_1																
<5>	M_ST_NA_1																
<6>	M_ST_TA_1																

<7>	M_BO_NA_1																
<8>	M_BO_TA_1																
<9>	M_ME_NA_1																
<10>	M_ME_TA_1																
<11>	M_ME_NB_1																
<12>	M_ME_TB_1																
<13>	M_ME_NC_1																
<14>	M_ME_TC_1																
<15>	M_IT_NA_1																
<16>	M_IT_TA_1																
<17>	M_EP_TA_1																
<18>	M_EP_TB_1																
<19>	M_EP_TC_1																
<20>	M_PS_NA_1																
<21>	M_ME_ND_1																
<30>	M_SP_TB_1																
<31>	M_DP_TB_1																
<32>	M_ST_TB_1																
<33>	M_BO_TB_1																
<34>	M_ME_TD_1																
<35>	M_ME_TE_1																
<36>	M_ME_TF_1																

<37>	M_IT_TB_1															
<38>	M_EP_TD_1															
<39>	M_EP_TE_1															
<40>	M_EP_TF_1															
<45>	C_SC_NA_1															
<46>	C_DC_NA_1															
<47>	C_RC_NA_1															
<48>	C_SE_NA_1															
<49>	C_SE_NB_1															
<50>	C_SE_NC_1															
<51>	C_BO_NA_1															
<58>	C_SC_TA_1															
<59>	C_DC_TA_1															
<60>	C_RC_TA_1															
<61>	C_SE_TA_1															
<62>	C_SE_TB_1															
<63>	C_SE_TC_1															
<64>	C_BO_TA_1															
<70>	M_EI_NA_1*															
<100>	C_IC_NA_1															
<101>	C_CI_NA_1															
<102>	C_RD_NA_1															

<103>	C_CS_NA_1																
<104>	C_TS_NA_1																
<105>	C_RP_NA_1																
<106>	C_CD_NA_1																
<107>	C_TS_TA_1																
<110>	P_ME_NA_1																
<111>	P_ME_NB_1																
<112>	P_ME_NC_1																
<113>	P_AC_NA_1																
<120>	F_FR_NA_1																
<121>	F_SR_NA_1																
<122>	F_SC_NA_1																
<123>	F_LS_NA_1																
<124>	F_AF_NA_1																
<125>	F_SG_NA_1																
<126>	F_DR_TA_1*																
* Blank or X only																	

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 13
[ ] group 2	[ ] group 8	[ ] group 14
[ ] group 3	[ ] group 9	[ ] group 15
[ ] group 4	[ ] group 10	[ ] group 16
[ ] group 5	[ ] group 11	
[ ] group 6	[ ] group 12	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
[ ] C_SE ACTTERM used

[X] No additional definition
[ ] Short-pulse duration (duration determined by a system parameter in the outstation)
[ ] Long-pulse duration (duration determined by a system parameter in the outstation)
[ ] Persistent output

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

TRANSMISSION OF INTEGRATED TOTALS

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

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

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

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

PARAMETER LOADING

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

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

PARAMETER ACTIVATION

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

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

TEST PROCEDURE

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

[ ] Test procedure

FILE TRANSFER

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

File transfer in monitor direction

[X] Transparent file

[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

[ ] 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).

[ ] 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

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

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)

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

Maximum range of values k: 1 to 32767 (215–1) APDUs, accuracy 1 APDU
Maximum range of values w: 1 to 32767 APDUs, accuracy 1 APDU (Recommendation: w should not exceed two-thirds of k)

PORT NUMBER

Parameters	Value	Remarks
Port number	2404	in all cases

RFC 2200 suite

RFC 2200 is an official Internet Standard which describes the state of standardization of protocols used 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.

11. Error analysis

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

11.1 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 (main.chm::/12464.htm) program that was also installed with zenon. You can find it under *Start/All programs/zenon/Tools 7.00 -> Diagviewer.*

zenon driver log all errors in the log files. The default folder for the log files is subfolder **LOG** in directory `ProgramData`, example: `C:\ProgramData\zenon \zenon700\LOG` for zenon version 7.00 SP0. Log files are text files with a special structure.

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

In the Diagnosis Viewer you can also:

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

Hints:

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

Info

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

11.2 Check list

- Is the COM port in use by another application or are the settings incorrect?
- Is the device (PLC) that you are trying to communicate with connected to the power supply?
- Is the cable between PLC and PC/IPC connected correctly?
- Have you analyzed the error file (which errors did occur)?
- For additional error analyses, please send a project backup and the LOG file of the DiagViewer to the support team responsible for you.