



COPADATA
do it your way

zenon driver manual

BACnet32

v.7.10





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1. Welcome to COPA-DATA help

GENERAL HELP

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

PROJECT SUPPORT

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

LICENSES AND MODULES

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

2. BACnet32

The BACnet driver is used for communication between one or more devices supporting BACnet (BACnet automation stations) and the zenon Runtime. This requires that the connected BACnet devices run as servers. Only client functionality is implemented in the driver.

2.1 BACNET32 - Data sheet

General:	
Driver file name	BACNET32.exe
Driver name	Bacnet and DDC4000 driver
PLC types	All Bacnet "BACnet/IP, Annex J" compliant PLCs; Kieback + Peter DDC4000 PLCs
PLC manufacturer	Kieback + Peter; BACnet;

Driver supports:	
Protocol	BACnet/IP;
Addressing: Address-based	-
Addressing: Name-based	x
Spontaneous communication	x
Polling communication	x
Online browsing	x
Offline browsing	-
Real-time capable	x
Blockwrite	-
Modem capable	-
Serial logging	-
RDA numerical	-
RDA String	-

Prerequisites:	
Hardware PC	Standard network card
Software PC	WinPcap.dll
Hardware PLC	-
Software PLC	-
Requires v-dll	-

Platforms:	
Operating systems	Windows Vista, 7, 8, Server 2008/R2, Server 2012;
CE platforms	-;

2.2 Driver history

Date	Driver version	Change
07.07.08	3600	Re-created driver documentation
27.10.08	3800	New functionality: configurable priority and read delay
17.11.08	4000	Corrected errors in documentation links

2.3 Requirements

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

2.3.1 PC

Driver files: Copy BACnet32.exe, PTP.dll, nb_link_settings.dll to the program directory, if they are not already there.

WinPcap.dll; installation set available for free in the Internet, e.g. at <http://www.winpcap.org/install/default.htm>

Copy the file WinPcap.dll to the directory system32.

We recommend version 3.0 or higher.

2.4 Configuration

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



Info

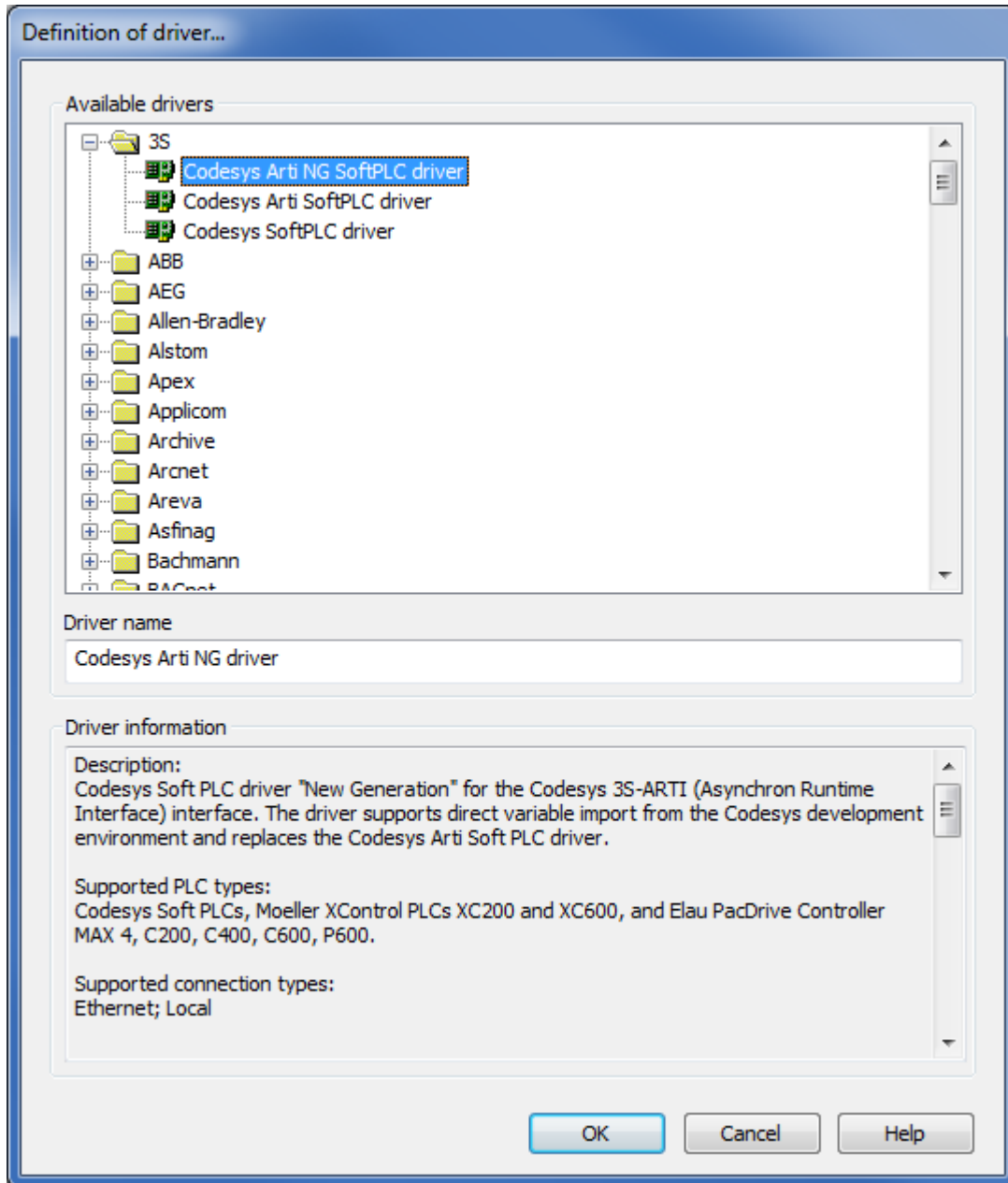
Find out more about further settings for zenon variables in the chapter Variables (main.chm::/15247.htm) of the online manual.

2.4.1 Creating a driver

In order to create a new driver:

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


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



3. 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, 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.
4. 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**

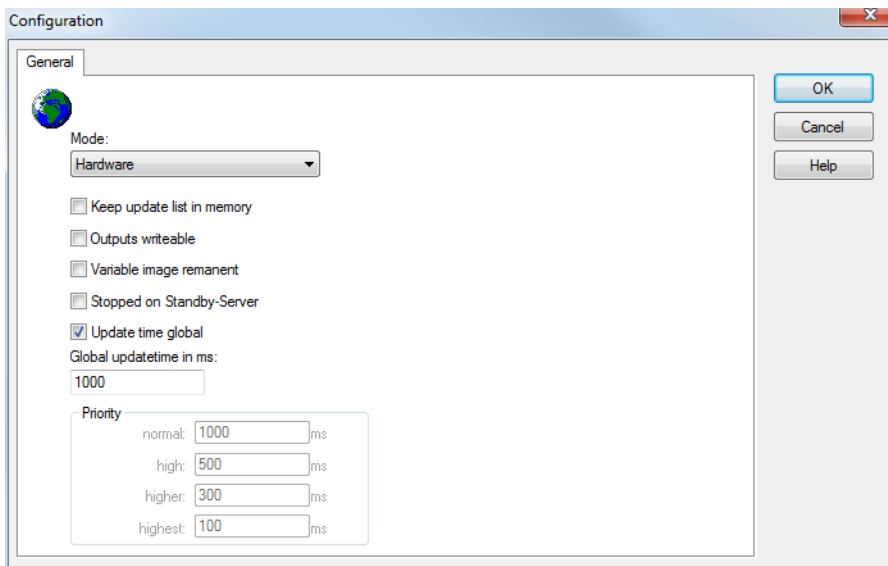
For new projects and for existing projects which are converted to version 6.21 or higher, the following drivers are created automatically:

- ▶ Internal
- ▶ MathDr32
- ▶ SysDrv.

2.4.2 Settings in the driver dialog

You can change the following settings of the driver:

General



Parameter	Description
Mode	<p>Allows to switch between hardware mode and simulation mode</p> <ul style="list-style-type: none"> ▶ 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	<p>Variables which were requested once are still requested from the control even if they are currently not needed.</p> <p>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	<p>Aktiv: Outputs can be written.</p> <p>Inactive: Writing of outputs is prevented.</p> <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 mode hardware if:</p> <ul style="list-style-type: none"> ▶ one of the states <code>S_MERKER_1(0)</code> up to <code>S_MERKER8(7)</code>, <code>REVISION(9)</code>, <code>AUS(20)</code> or <code>ERSATZWERT(27)</code> is active <p>The variable image is always saved if:</p> <ul style="list-style-type: none"> ▶ the variable is of the object type <code>Driver variable</code> ▶ the driver runs in simulation mode. (not programmed simulation) <p>The following states are not restored at the start of the Runtime:</p> <ul style="list-style-type: none"> ▶ <code>SELECT(8)</code> ▶ <code>WR-ACK(40)</code> ▶ <code>WR-SUC(41)</code> <p>The mode Simulation - programmed at the driver start is not a criterion in order to restore the remanent variable image.</p>
Stop at the Standby Server	<p>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.</p> <p>Attention: If this option is active, the gapless archiving is no longer guaranteed.</p> <p>Aktiv: 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 (<code>statusverarbeitung.chm: :/24150.htm</code>) but an empty value. This prevents that at the upgrade to the Server irrelevant values are created in the AML, CEL and Historian.</p>
Global Update time	<p>Aktiv: The set <code>Global update time</code> in ms is used for all variables in the project. The priority set at the variables is not used.</p> <p>Inactive: The set priorities are used for the individual variables.</p>
Priority	<p>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</p>

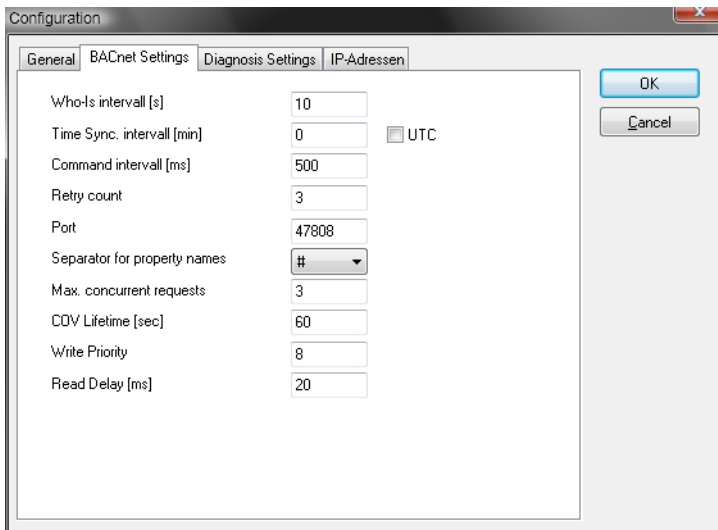
	place for each variable separately in the settings of the variable properties. The communication of the individual variables are graduated in respect of importance or necessary topicality using the priorities. Thus the communication load is distributed better.
OK	Accepts settings in all tabs and closes dialog.
Cancel	Discards all changes and closes the dialog.
Help	Opens online help.

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.

Driver dialog BACnet settings



Configuration

General | **BACnet Settings** | Diagnosis Settings | IP-Adressen

Who-Is interval [s]: 10

Time Sync. interval [min]: 0 ☒ UTC

Command interval [ms]: 500

Retry count: 3

Port: 47808

Separator for property names: #

Max. concurrent requests: 3

COV Lifetime [sec]: 60

Write Priority: 8

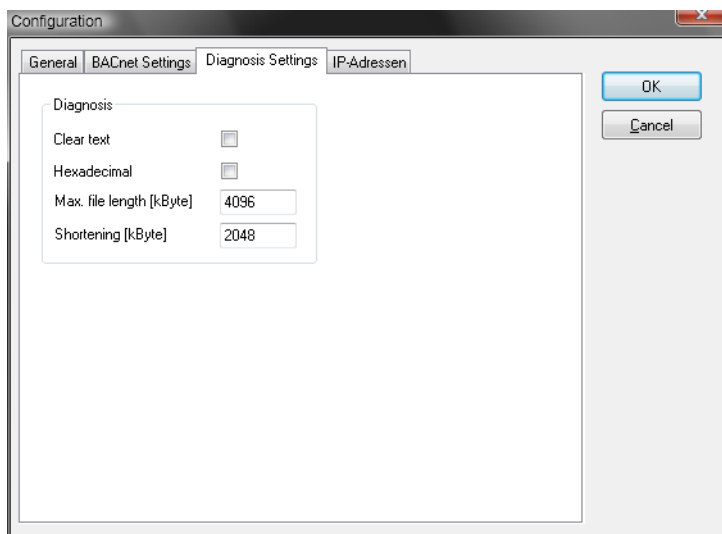
Read Delay [ms]: 20

OK

Cancel

Parameters	Description
Who-Is cycle [s]	Cycle time for sending the "Who-Is" service
Time synchronization cycle [min]	Cycle time for time synchronization [min], default=0 (no synchronization)
Command output time [ms]	Command output time for sending strategy 1 (single command) [ms]
Number of retries	max. number for sending out the "Who-Has" service per object
Port	Configuration of the UDP port in the decimal format. (Default for BACnet: 47808)
Separator for property names	
Number of simultaneous queries	Maximum number of simultaneous COV subscription packets. Used for BACnet devices that can only buffer and process a certain number of packets.
COV lifetime [sec]	After this time, registered COV subscriptions will become invalid and will then be requested from the driver again (see BACnet standard).
Write priority	Defines the write priority for variables. (see BACnet standard). The lower the value, the higher the priority ATTENTION: Values under "8" are often used by the PLC itself and should therefore be used with caution.
Read delay [ms]	Configurable delay between 2 polling queries. This is required for devices with performance problems.

Driver dialog diagnosis settings



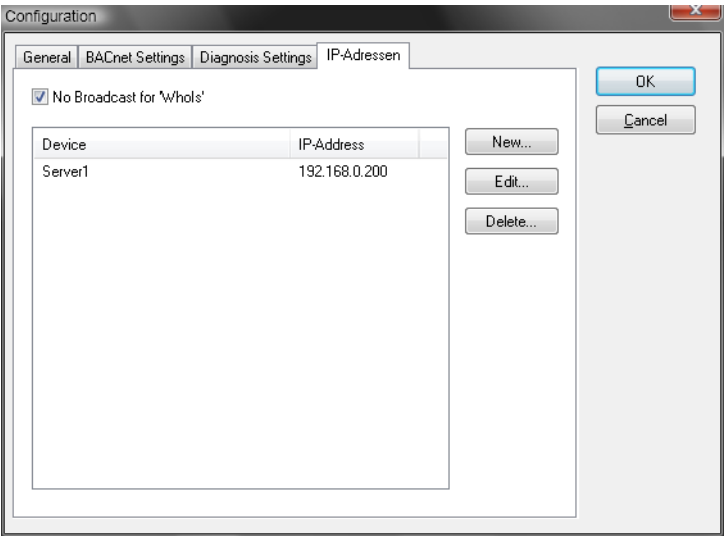
Parameters	Description
Plain text	Logging of the BACnet telegram in plain text
Hex format	Logging of the BACnet telegram in hexadecimal format
Max file size [kByte]	Max. size of the log file
Shortening [kByte]	Shortening of the log file, if max. file length is reached

Data is stored in the file <runtimepath>\RT\FILES\zenon\custom\drivers\BACnet.log

For Editor communication (browsing), the following file is used:

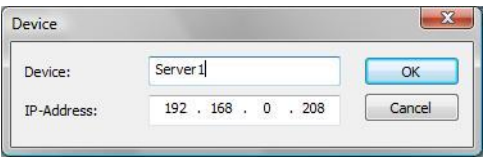
<SQLpath>\<ProjektGUID>\FILES\zenon\custom\drivers\BACnet.log.

Driver dialog IP addresses



Parameters	Description
No broadcast for 'WhoIs'	<p>If this option is active, 'Whols' messages will only be sent to the BACNet stations in the list below.</p> <p>ATTENTION: This function is not a part of the BACNet standard. We cannot guarantee that it works with all BACNet PLCs.</p>
New...	<p>Create a new station:</p> <p>Device: Specify the device name (e.g. device name in BACNet)</p> <p>IP address: IP address of the target device</p>
Edit...	Edits the selected address
Delete...	Deletes the selected address

DIALOG FOR CREATING AND MODIFYING CONNECTIONS



Device	Freely definable name of the connection
IP address	IP address of the BACnet device

2.5 Creating variables

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

2.5.1 Creating variables in the Editor

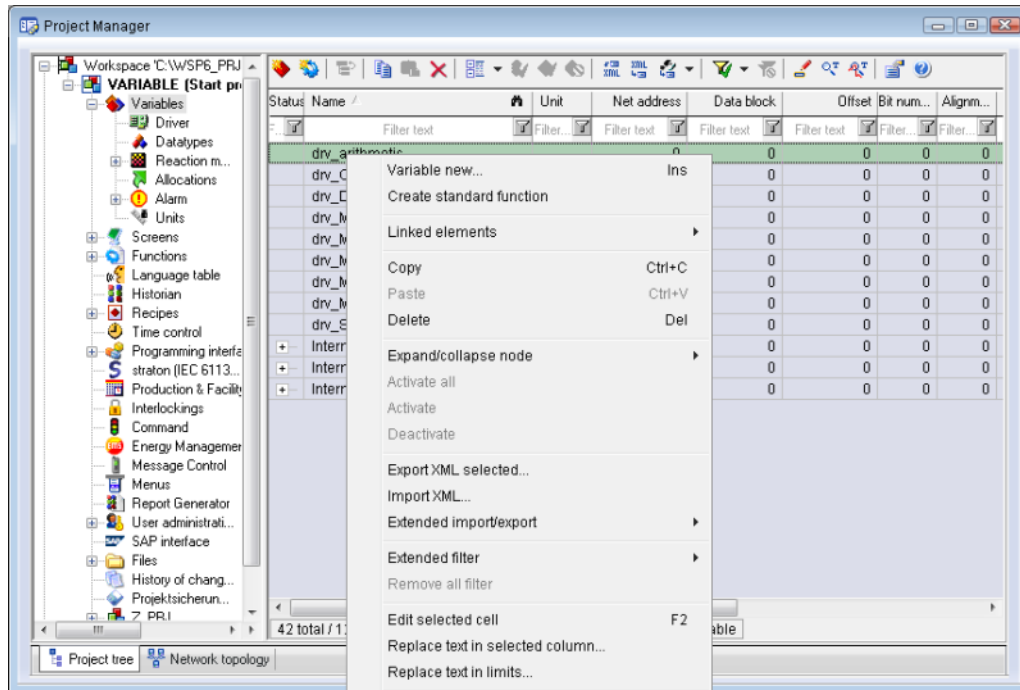
Variables can be created:

- ▶ 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	<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 # 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.</p>
Drivers	<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 (Main.chm::/Intern.chm::/Intern.htm)) is automatically loaded.</p>
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.

2.5.2 Addressing

Addressing the variables of the BACnet driver is done with the unique names of the variables. The datapoints of the BACnet driver are uniquely referenced by the object names. The object name of the device object is placed before the object name of the BACnet object; the names are separated by a dot (e.g. BPS10.d10a002); for schedule objects, the name of the property is attached, again separated by a dot. The virtual datapoints of the type BACnet component status represent the status of the connection. They are uniquely identified by the object name of the device object.

SETTINGS FOR THE UNIQUE ADDRESSING OF VARIABLES

Property	Description
Name	Used for the unique addressing. Format: device-name.object-name[.property]
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 refers to the bus address in the connection configuration of the driver. This defines the PLC, on which the variable resides.
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.

2.5.3 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.

Driver objects

The following object types are available in this driver:

Driver object type	Channel type	Read / Write	Supported data types	Comment
Output	11	R / W	BOOL, REAL, SINT, USINT	
Input	10	R / W	BOOL, REAL, SINT, USINT	
PLC marker	8	R / W	BOOL, REAL, SINT, USINT	
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 33)

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

Driver object types	Supported datatypes	Read	Write	BACnet Object Type
Input	BOOL	Y	N	Binary Input
	REAL	Y	N	Analog Input
	SINT, USINT	Y	N	Multistate Input
Output	BOOL	N	Y	Binary Output
	REAL	N	Y	Analog Output
	SINT, USINT	N	Y	Multistate Output
PLC marker	BOOL	Y	Y	Binary Value
	REAL	Y	Y	Analog Value Schedule - Present Value
	USINT	Y	Y	Component status
	STRING *	Y	Y	Schedule - Effective Period Schedule - Weekly Schedule

				Schedule - Exception Schedule
--	--	--	--	----------------------------------

* The individual properties of schedule objects have a complex and variable structure (See BACnet standard). That is why you can only hand them over as Strings to zenon. Depending on the property, these Strings have different formats (you can leave out spaces when setting values):

EFFECTIVE PERIOD

Effective Period:	<Start date> - <End date> }
Date:	<Year – 1900>.<Month (1..12)>.<Day (1..31)>.<Weekday (1..7, 1 = Monday)>

WEEKLY SCHEDULE

Weekly Schedule:	{ Array [1..7] of <Daily Schedule> }	
Daily Schedule:	{ List of <Time Value> }	
Time Value:	<Time>, [<Type>] <Value> }	
Time:	<Hour>:<Minute>:<Second>:<1/100 sec.>	
Type:	1	BOOLEAN
	2	UNSIGNED
	3	SIGNED
	4	REAL
	5	DOUBLE
	6	OCTET_STRING
	7	CHARACTER_STRING
	8	BIT_STRING
	9	ENUMERATED
	10	DATE
	11	TIME
	12	OBJECT_IDENTIFIER

EXCEPTION SCHEDULE

Exception Schedule:	{ Array [1..n] of <Special Event> }
Special Event:	<Period> { List of <Time Value>* } <Event Priority> }
Period:	{ [0] <Calendar Entry> } or { [1] <Calendar Reference> }

Calendar Reference:	Instance no. of the referenced calendar object
Calendar Entry:	[0] <Date>** or [1] <Start date>** - <End date>** or [2] <WeekNDay>
WeekNDay:	<Month (1..12)>.<Week of month (1..6)>.<Weekday (1..7)>
Event Priority:	1..16, 1 = highest priority, 16 = lowest priority

* see Weekly Schedule, ** see Effective Period

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.

EXAMPLES FOR ALL POSSIBLE IEC DATA TYPES

PLC	zenon	Range of values
8 Bit signed	SINT	-128 to 127
8 Bit unsigned	USINT	0 to 255
32 bit floating point	REAL	$\pm 3.4E \pm 38$
Boolean	BOOL	0, 1

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.

2.5.4 Creating variables by importing

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

**Info**

You can find details on the import and export of variables in the Import-Export (main.chm::/13028.htm) manual in the Variables (main.chm::/13045.htm) section.

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.

DBF Import/Export

Data can be exported to and imported from dBase.

**Info**

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 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 **Import 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) at export.

DBF files must:

- ▶ conform with there 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)

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 "VARIABLENNAME" (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 .
Unit	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 zenon (only if supported by the driver)
OBJEKT	N	2	Driver-specific ID number of the primitive object comprises TREIBER-OBJEKTYP and DATENTYP
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. 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 DEFINITION

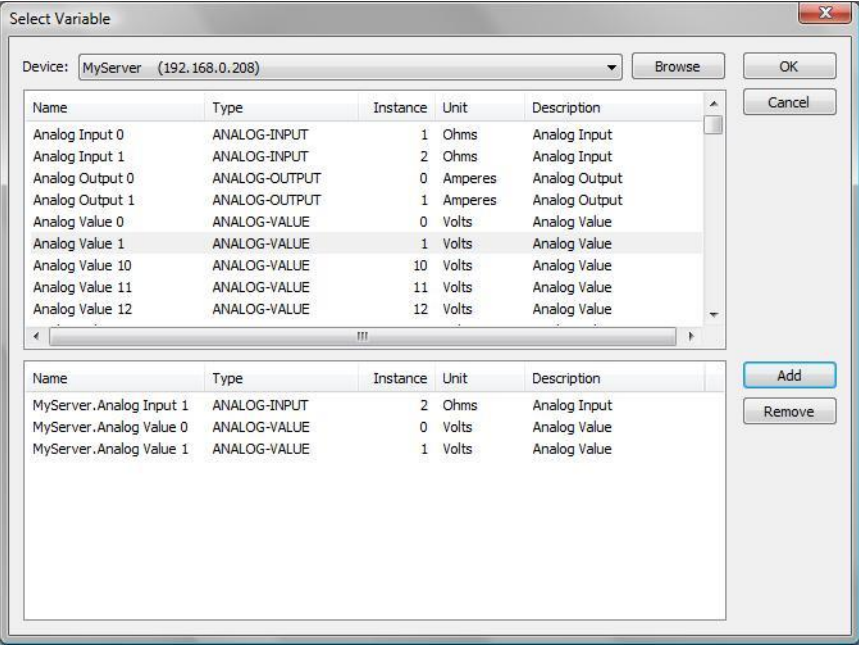
Limit definition for limit values 1 to 4, and status 1 bis 4:

Description	Type	Field size	Comment
AKTIV1	R	1	Limit value active (per limit value available)
GRENZWERT1	F	20	hnical 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	Is not used
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	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.

Online import

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



Parameters	Description
Device	Select the device to be browsed
Button "Browse"	Reads out the variables of the device
Button "Add"	Adds the selected variable to the selection
Button "Remove"	Removes the selected variable from the selection
Button "OK"	Adds the selected variables to the variable list
Button "Cancel"	Cancel the import

2.5.5 Treibervariablen

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.

Note: 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 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	12:00 AM	Connection in hold
LineStateConferenced	BOOL	12:00 AM	Connection in conference mode.
LineStateOnHoldPendConf	BOOL	12:00 AM	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 <code>driver stop</code> , 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 <code>SrvDrvVarApplyCom</code> 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 <code>SrvDrvVarApplyModem</code> . 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	USINT	14	Number of bits per character of the serial interface Value = 0 if the driver cannot establish any serial connection.
StopBit	USINT	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	UINT	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	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.
RdErrSize	UDINT	48	Block size when the last reading error occurred.
DrvError	USINT	25	Error message as number
DrvErrorMsg	STRING	30	Error message as text
ErrorFile	STRING	15	Name of error log file

2.6 Driver-specific functions

This driver supports the following functions:

PROTOCOL

The protocol was defined by the ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.) and is described extensively in the ASHRAE standard 135-2001 + Appendix A – L "A Data Communication Protocol for Building Automation and Control Networks".

CONNECTION

The BACnet standard offers five options on the data link and physical layers of the OSI layer model (which is reduced to four layers). The driver only supports the option ISO 8802-3, known as “Ethernet”. This option (together with the other layers of the BACnet protocol) is also called “BACnet/IP, Annex J”.

BACnet Layers				
BACnet Application Layer				
BACnet Network Layer				
ISO 8802-2 Type1		MS/TP	PTP	LonTalk
ISO 8802-3	ARCNET	EIA-485 (RS485)	EIA-232 (RS232)	

The communication of this option is based on ISO 8802-2 Type1 (Ethernet) in the data link layer. This means that the PC requires an Ethernet card with connection to a TCP/IP network.

DEFINITION

Term	Description
BAS	BACnet automation station
BAZ	Command output time
COV	Change of Value
DA	Data type
DCS	Double Command State for TK 46
KT	Channel type
OB	Object
RPM	ReadPropertyMultiple

GENERAL FUNCTION DESCRIPTION

The BACnet automation station (BAS) is represented as a Device-Object in the BACnet driver. The BAS behaves as a server. For the peer-to-peer data exchange the BACnet driver connects as a client. Each datapoint of the BAS is modeled as a BACnet object. For the data update the COV Subscription as well as the ReadPropertyMultiple (RPM) service can be used. The cycle time for the resubscription as well as

the polling interval for the RPM service can be defined in four priority groups (see Configuration of the BACnet driver).

A time synchronization from the BACnet driver in the direction of BAS can be defined.

ESTABLISHING CONNECTION AND EXCHANGING DATA

As a client the BACnet driver sends the “Who-Is” service to the subnet mask as a broadcast. The existing BAS answers with an “I-Am”. The driver variable of the type “Component status” resembling the name of the device object is set to 0 (OK).

With the service “Who-Has(object_name)” the client gets the BACnet objects of the according server. With the service “I-Have” the server sends the objects (incl. the properties “object_instance” and “object_type”) to the client. Unanswered “Who-Has” services are repeated according to the defined number of retries. If there are BACnet objects that still do not answer with the “I-Have” service, the component status of the according BAS is set to 1 (initializing error). The corresponding object names are written into the log file.

The client then starts the COV subscriptions or RPM services for the existing objects. If the value (present_value) or the status (status_flags) of a COV object changes, the client is informed with a COV notification. Then it requests the time stamp (event_time_stamps) for the according object from the server with the ReadProperty service. With the RPM services the properties Present_Value, Status_Flags and Event_Time_Stamps are cyclically requested from the server.

Send data (Present_Value, Status_Flags, Event_Time_Stamps) are sent to the server with the WritePropertyMultiple service. If one of these properties cannot be written on the server, the server acknowledges this with an error message („Rec_error: WritePropertyMultiple”).

SAVING VALUE AND STATUS

Values, stati and time stamps of the output variables are saved spontaneously. So a data loss in the case of a computer breakdown is avoided. The saved information is read on a restart.

BREAKDOWN MONITORING

In order to check the presence of the server the client cyclically sends “Who-Is” telegrams. The cycle time is defined in the driver configuration dialog under BACnet settings.

If the server does not answer with an "I-Am" within a certain time, the interface will be considered as not operative. The corresponding virtual datapoint of the type BACnet component status is set to 64 (NOK). All process datapoints of this BAS are set to disturbed (invalid).

The server announces the reestablishment of the connection with an "I-Am". The further procedure is the same as the one with the connection establishment.

ACCESS METHODS

The values of the variables can be read spontaneous or by polling. The type of polling can be selected via the property "priority" of the individual variables

If the hardware allows the reading of time stamps, the variables get these time stamps, otherwise the variables get the time stamps from the driver.

Polling	If the variable property "Priority" is set to "Higher", "High" or "Highest", the variable values will be polled in the interval defined for the according priority in the driver configuration (page "General"). For this, the BACnet service ReadPropertyMulti (reads the object properties "present_value", "status_flags" and "event_time_stamps") is used.
Spontaneous	<p>If the variable property "Priority" is set to "Normal", the variable values will be read with the BACnet service COV ("change of value"). After the first request of the variable value, a so-called "COV subscription" will be executed, i.e. the according object will be asked to send a COV notification telegram each time the value changes.</p> <p>The COV subscription is valid for the time defined for the priority "Normal" in the driver configuration. After that time the device will stop sending value changes. If in this case the variable value is still needed, the driver will execute another COV subscription.</p>

After receiving the COV notification of BACnet objects, the properties "present_value" and "status_flags" (FAULT \Leftrightarrow IBit) are read and "event_time_stamps" is requested with the service ReadProperty. If the received time is invalid (0 or 255), the BACnet driver will use the current computer time.

TAKING BACK VALUES FROM THE PRIORITY ARRAY:

For some object types, you can remove values set by zenon from the BACnet priority array of the variable on the PLC. However, this cannot be achieved directly via the driver; you will need a VBA script for this.

Example for a VBA script:

```
Sub ResetPrioArray()
```

```
    Dim Var As Variable
```

```
    Set Var = Variables.Item("TestVar 0")
```

```
    Var.SetValueWithStatus 0, 262144, 0, 0 '262144 = Hex 40000, corresponds to the set INVALID bit
```

```
End Sub
```

LIMITATIONS

If you launch the driver several times, you will need different UDP ports for every driver. These ports also have to be configurable on the PLCs (BACnet Server).

Priority: The driver sends set values with priority 8

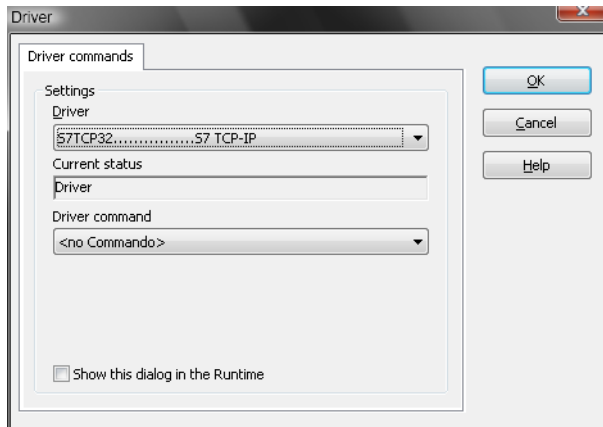
2.7 Driver commands

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	Write set value to a driver is prohibited.
► 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.

2.8 Error analysis

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

2.8.1 Error analysis

LOGGING

You can choose to log the entire telegram traffic between the BACnet driver and the BAS (see BACnet32_DiagnosticSetting (on page 14)).

Data is stored in the file <runtimepath>\RT\FILES\zenon\custom\drivers\BACnet.log

For Editor communication (browsing), the following file is used:

<SQLpath>\<ProjektGUID>\FILES\zenon\custom\drivers\BACnet.log.

2.8.2 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 7.10 -> 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\zenon7.10\LOG` for zenon Version 7.10. 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.

2.8.3 Check list

Is the PLC connected to the power supply
Are the participants available in the TCP/IP network
Can the PLC be reached via the PING command
Can the PLC be reached via TELNET
Are the PLC and the PLC connected with the right cable
Did you select the right COM port
Do the communication parameters match (Baud rate, parity, start/stop bits,...)
Is the COM port blocked by another application
Did you configure the net address correctly, both in the driver dialog and in the address properties of the variable
Did you use the right object type for the variable
Does the offset addressing of the variable match the one in the PLC

Use the DiagViewer for further analysis -> Which messages does it show

2.9 PICS (Protocol Implementation Conformance Statement)

Date	September 21, 2005
Vendor Name	COPA-DATA GmbH
Product Name	BACnet-driver for process control system (HMI/SCADA)
Product Model Number:	Version 6.20 SP1
Applications Software Version	6.20.1
BACnet protocol Revision	2

PRODUCT DESCRIPTION

The BACnet driver allows communication and data exchange between one or more BACnet-capable devices and the SCADA-Runtime. Therefore it's required that the connected BACnet devices are operating as servers. In the BACnet driver only the Client functionality is implemented.

BACNET STANDARDIZED DEVICE PROFILE (ANNEX L):

X	BACnet Operator Workstation (B-OWS)
	BACnet Building Controller (B-BC)
	BACnet Advanced Application Controller (B-AAC)
	BACnet Application Specific Controller (B-ASC)
	BACnet Smart Sensor (B-SS)
	BACnet Smart Actuator (B-SA)

ADDITIONAL BACNET INTEROPERABILITY BUILDING BLOCKS SUPPORTED (ANNEX K):

DS-RP-A, DS-RPM-A, DS-WP-A, DS-WPM-A, DS-COV-A, DM-DDB-A, DM-DOB-A, DM-TS-A, DM-UTC-A, SCHED-A

SEGMENTATION CAPABILITY:

	Segmented requests supported	Window Size _____
	Segmented responses supported	Window Size _____

STANDARD OBJECT TYPES SUPPORTED:

Analog-Input, Analog-Output, Binary-Input, Binary-Output, Multi-State-Input, Multi-State-Output, Schedule, Device

OBJECT DEFINITIONS

1. ANALOG INPUT

Property	Client uses
Present_Value	R
Status_Flags	R
Event_Time_Stamps	R

2. ANALOG OUTPUT

Property	Client uses
Present_Value	W
Status_Flags	W
Event_Time_Stamps	W

3. ANALOG VALUE

Property	Client uses
Present_Value	R / W
Status_Flags	R / W
Event_Time_Stamps	R / W

4. BINARY INPUT

Property	Client uses
Present_Value	R
Status_Flags	R
Event_Time_Stamps	R

5. BINARY OUTPUT

Property	Client uses
Present_Value	W
Status_Flags	W
Event_Time_Stamps	W

6. BINARY VALUE

Property	Client uses
Present_Value	R / W
Status_Flags	R / W
Event_Time_Stamps	R / W

7. MULTI STATE INPUT

Property	Client uses
Present_Value	R
Status_Flags	R
Event_Time_Stamps	R

8. MULTI STATE OUTPUT

Property	Client uses
Present_Value	R
Status_Flags	R
Event_Time_Stamps	R

9. MULTI STATE VALUE

Property	Client uses
Present_Value	R / W
Status_Flags	R / W
Event_Time_Stamps	R / W

10. SCHEDULE

Property	Client uses
Effective_Period	R / W (as String)
Weekly_Schedule	R / W (as String)
Exception_Schedule	R / W (as String)

11. DEVICE

Property	Client uses
Local_Date	W
Local_Time	W

DATA LINK LAYER

X	BACnet/IP, (Annex J)
	BACnet/IP, (Annex J), Foreign Device
	ISO 8802-2, Ethernet (Clause 7)
	ASTM 878.1, 2.5Mb. ARCNET (Clause 8)
	ASTM 878.1, RS485 ARCNET (Clause 8), baud rate(s): _____
	MS/TP master (Clause 9), baud rate(s): _____
	MS/TP slave (Clause 9), baud rate(s): _____
	Point-To-Point, EIA 232 (Clause 10), baud rate(s): _____
	Point-To-Point, modem (Clause 10), baud rate(s): _____
	LonTalk, (Clause 11), medium: _____
	Other

NETWORKING OPTIONS

	Router, Clause 6 - Routing configurations: _____
	Annex H, BACnet Tunneling Router over IP
	BACnet/IP Broadcast Management Device (BBMD)

CHARACTER SETS SUPPORTED

X	ANSI X3.4
---	-----------

	IBM /Microsoft DBCS
	ISO 8859-1
	ISO 10646 (ICS-4)
	ISO 10646 (UCS2)
	JIS C 6226

OPTIONAL SERVICE-PARAMETERS SUPPORTED

ReadProperty, ReadPropertyMultiple, WriteProperty, WritePropertyMultiple, SubscribeCOV, COVNotification, Who-Is, I-Am, Who-Has, I-Have, TimeSynchronization, TimeUTCSynchronization