



ibaPDA-Interface-TwinCAT-Xplorer

PLC-Xplorer Data Interface to Beckhoff Systems

Manual
Issue 1.4

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The current version is available for download on our web site www.iba-ag.com.

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1 About this Manual

This document describes the function and application of the software interface

ibaPDA-Interface-TwinCAT-Xplorer

This documentation is a supplement to the *ibaPDA* manual. Information about all the other characteristics and functions of *ibaPDA* can be found in the *ibaPDA* manual or in the online help.

1.1 Target group and previous knowledge

This documentation addresses qualified professionals, who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded as a professional if he/she is capable of assessing the work assigned to him/her and recognizing possible risks on the basis of his/her specialist training, knowledge and experience and knowledge of the standard regulations.

This documentation in particular addresses persons, who are concerned with the configuration, test, commissioning or maintenance of Programmable Logic Controllers of the supported products. For the handling *ibaPDA-Interface-TwinCAT-Xplorer* the following basic knowledge is required and/or useful:

- Windows operating system
- Knowledge of configuration and operation of the relevant control system

1.2 Notations

In this manual, the following notations are used:

Action	Notation
Menu command	Menu <i>Logic diagram</i>
Calling the menu command	<i>Step 1 – Step 2 – Step 3 – Step x</i> Example: Select the menu <i>Logic diagram – Add – New function block</i> .
Keys	<Key name> Example: <Alt>; <F1>
Press the keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Key name> Example: <OK>; <Cancel>
Filenames, paths	<i>Filename, Path</i> Example: <i>Test.docx</i>

1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

Danger!



The non-observance of this safety information may result in an imminent risk of death or severe injury:

- Observe the specified measures.

Warning!



The non-observance of this safety information may result in a potential risk of death or severe injury!

- Observe the specified measures.

Caution!



The non-observance of this safety information may result in a potential risk of injury or material damage!

- Observe the specified measures

Note



A note specifies special requirements or actions to be observed.

Tip



Tip or example as a helpful note or insider tip to make the work a little bit easier.

Other documentation



Reference to additional documentation or further reading.

2 System requirements TwinCAT-Xplorer

The following system requirements are necessary for the use of the TwinCAT-Xplorer data interface:

- *ibaPDA* v8.1.0 or more recent
- License for *ibaPDA-Interface-PLC-Xplorer* or *ibaPDA-Interface-TwinCAT-Xplorer*
- With more than 16 connections you need additional *one-step-up-Interface-TwinCAT-Xplorer* licenses for each additional 16 connections.

Note



The *ibaPDA-Interface-PLC-Xplorer* license contains, among others, the license for the interface TwinCAT-Xplorer.

- The TwinCAT ADS communication library of Beckhoff must be installed on the *ibaPDA* computer. If TwinCAT v2 or v3 is installed on the computer where *ibaPDA* is running, then the library is usually available.
If TwinCAT is not installed on the *ibaPDA* computer, then you have to download the TwinCAT 3 ADS runtime from the Beckhoff website:
<https://www.beckhoff.com>.
There, navigate to *Download finder – Software and tools – TwinCAT 3 – TC1xxx – Runtime – TC1000 – TC3.1 ADS*.
Start the installer and select full install.
The TwinCAT 3 ADS runtime supports also TwinCAT 2.

For further requirements for the used computer hardware and the supported operating systems, please refer to the *ibaPDA* documentation.

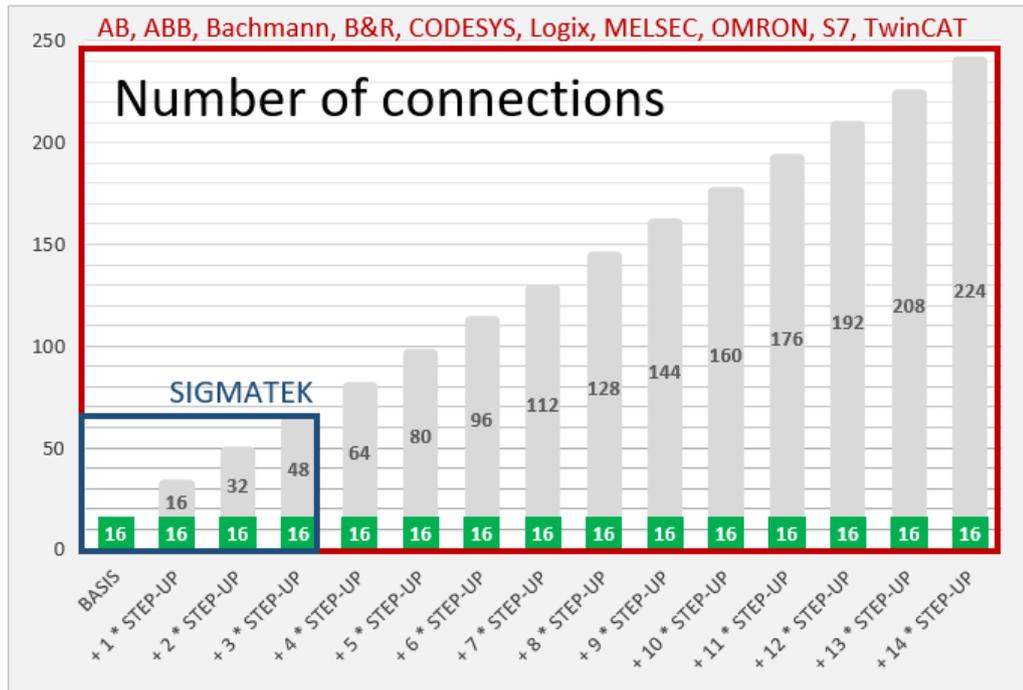
License information

Order no.	Product name	Designation
31.001042	ibaPDA-Interface-PLC-Xplorer	Extension license for an <i>ibaPDA</i> system adding all available Xplorer data interfaces. (Full specification under www.iba-ag.com)
31.000005	ibaPDA-Interface-TwinCAT-Xplorer	Extension license for an <i>ibaPDA</i> system adding the data interface TwinCAT-Xplorer (interface to TwinCAT)
31.100005	one-step-up-Interface-TwinCAT-Xplorer	Extension license for 16 further TwinCAT-Xplorer connections, a maximum of 14 extension licenses is permissible

Note



To use more than 16 data connections per interface, you can purchase the one-step-up-... extension licenses separately for each interface. Up to 16 further connections to PLCs can be established on each one-step-up-license. Up to 240 connections can be configured and used per data interface with the multiple purchase or multiple release of these licenses (up to 15 in total). Exception of SIGMATEK: Here, only up to 4 licenses (64 connections) can be activated.



Consider the limitation of the number of signals by the *ibaPDA* base license.

3 PLC-Xplorer data interface to TwinCAT PLCs

3.1 General information

The TwinCAT-Xplorer data interface is suitable for the recording of measured data on a Beckhoff PLC using the Beckhoff ADS protocol over standard network cards. Access is transparent for the controller. It is not necessary to configure or program the controller especially.

You can configure up to 16 connections with a TwinCAT-Xplorer interface on each license. By the additional purchase of up to 14 further one-step-up-TwinCAT-Xplorer licenses you can implement a total of a maximum of 240 connections. For each Beckhoff PLC you need one connection.

The interface supports TwinCAT versions 2 and 3 running on industrial PCs, embedded PCs (CX series) and bus controllers (BC/BX series).

The signals to be measured can be conveniently selected using their symbolic names with support from the *ibaPDA* Symbol Browser. This allows access to all measurable symbols, which are stored in the PLC itself or which are available in a symbol file (*.tpy).

3.2 System topologies

The connections to the controllers can be established via the computer's standard Ethernet ports.

No further software is necessary for operation.

Note



It is recommended carrying out the TCP/IP communication on a separate network segment to exclude a mutual influence by other network components.

3.3 Configuration and engineering TwinCAT

No particular configuration and programming is required on the controller side as a matter of principle. In particular, it is not necessary to call any program modules.

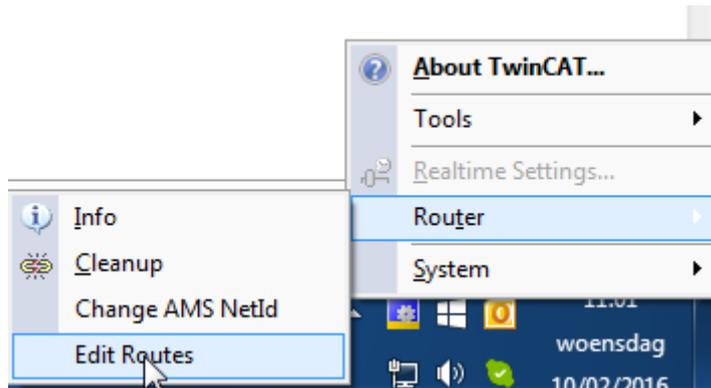
However, you should consider the following.

Edit routes

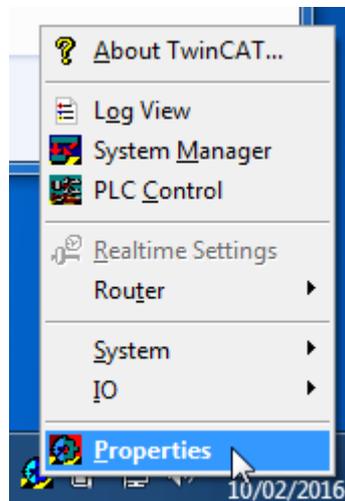
On the *ibaPDA* server computer there is also an ADS router installed when the TwinCAT ADS library is installed. An entry to the remote PLC needs to be entered in the routing table of this ADS router. Also an entry for the *ibaPDA* server computer's AMS Net ID needs to be entered in the routing table of the remote ADS router. This can be done by the ADS router configuration tool. If the TwinCAT software is installed on the *ibaPDA* computer, the routes may already be set because TwinCAT uses the same routes to the PLC.

There are different ways to open the configuration tool:

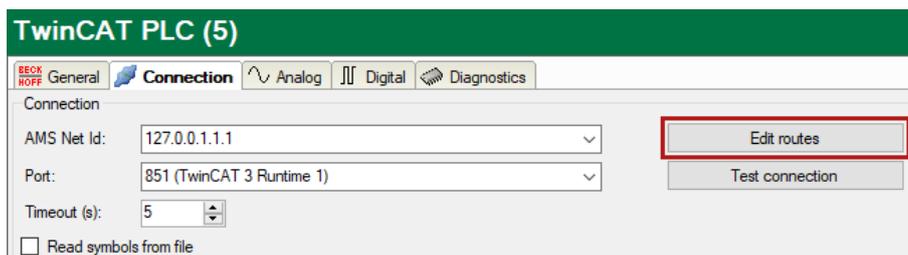
- Via the context menu on the TwinCAT system tray icon
Use the command *Router – Edit Routes*.



- Via the context menu on the TwinCAT system tray icon
Click on *Properties*.



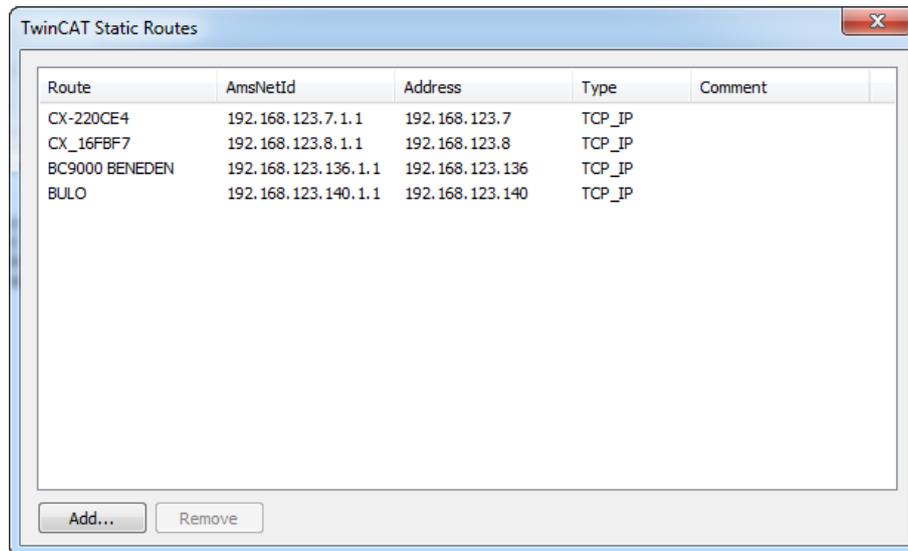
- In the I/O manager of *ibaPDA*
Click on the <Edit routes> button.



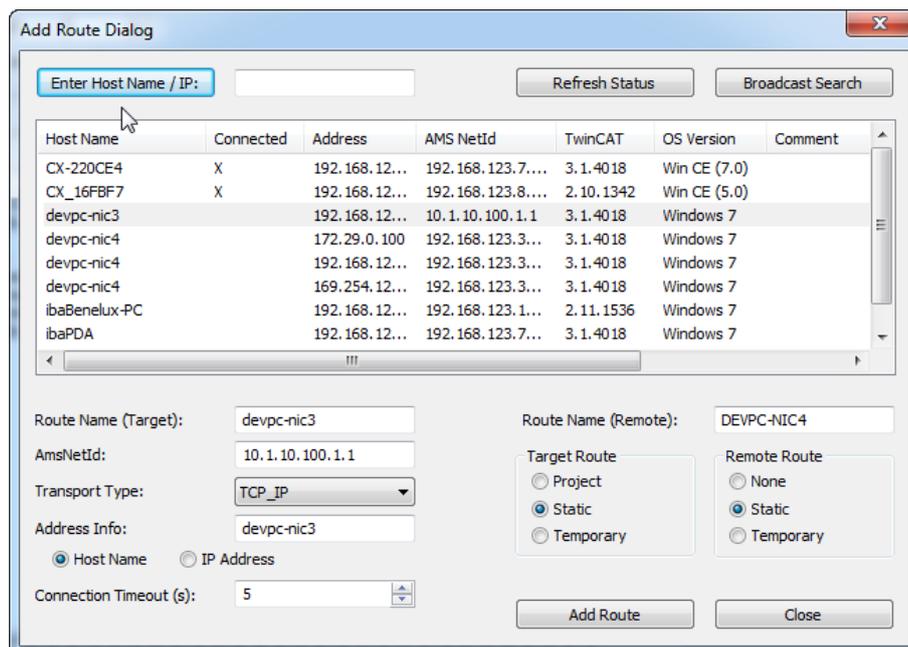
In order to configure the required routes follow these steps:

If TwinCAT 3 or the TwinCAT 3 ADS runtime is installed

After starting the tool, the following dialog opens.



1. Click the <Add...> button to add a new route.
2. Use the <Broadcast Search> button to look for compatible TwinCAT PLCs on the local network.



3. Then either select a found PLC or enter the *Route Name*, *AmsNetId* and *Address Info* manually.
4. Besides the broadcast search there is also the possibility to configure a connection directly by entering the IP address.

The screenshot shows the 'Add Route Dialog' window. At the top, there is a search field 'Enter Host Name / IP:' containing '192.168.1.1', a 'Refresh Status' button, and a 'Broadcast Search' button. Below this is a table with the following data:

Host Name	Connected	Address	AMS NetId	TwinCAT	OS Version	Comment
CX-220AA7		192.168.1.1	5.34.10.167.1.1	3.1.4018	Win CE (7.0)	

Below the table are configuration fields:

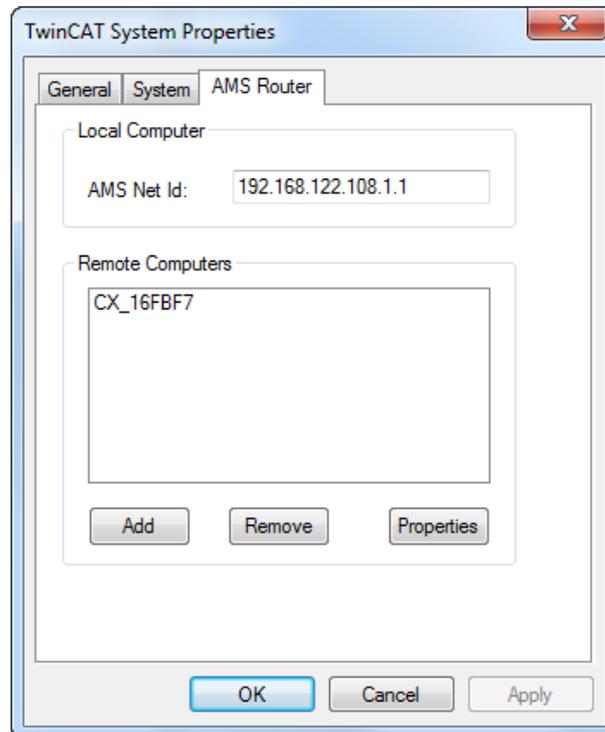
- Route Name (Target): CX-220AA7
- AmsNetId: 5.34.10.167.1.1
- Transport Type: TCP_IP
- Address Info: 192.168.1.1
- Radio buttons: Host Name, IP Address
- Route Name (Remote): IBA-FUE-WORKCELL
- Target Route: Project, Static, Temporary
- Remote Route: None, Static, Temporary

5. Select "Static" for *Target Route*.
6. Select "Static" for *Remote Route* when connecting to a TwinCAT PLC.
Select "None" for *Remote Route* when connecting to a bus controller.
7. Finally click the <Add Route> button to add the route into the routing table.

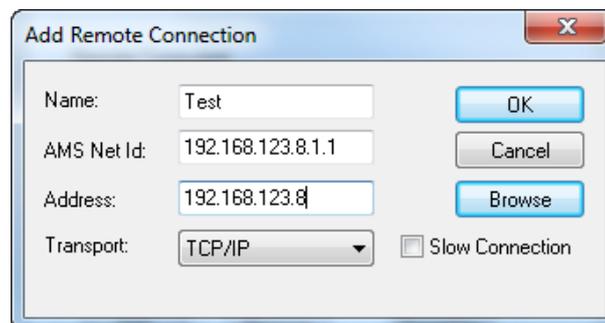
The router will try to connect to the remote ADS router and might require a user name and password. If the connection was successful, then an X appears in the *Connected* column.

If TwinCAT 2 is installed

After starting the tool, the following dialog opens.



1. Click the <Add> button to add a new route.



2. Enter manually the *Name*, *AMS Net Id*, *Address* fields.
3. Click the <OK> button to add the route into the routing table.

Once the routing tables are correct, you can connect to the PLC in *ibaPDA*.

Note



If "ADS Error 1796 (0x704): ADS ERROR: reading/writing not permitted" appears, be sure to enter username only without domain, hostname or IP address as prefix.

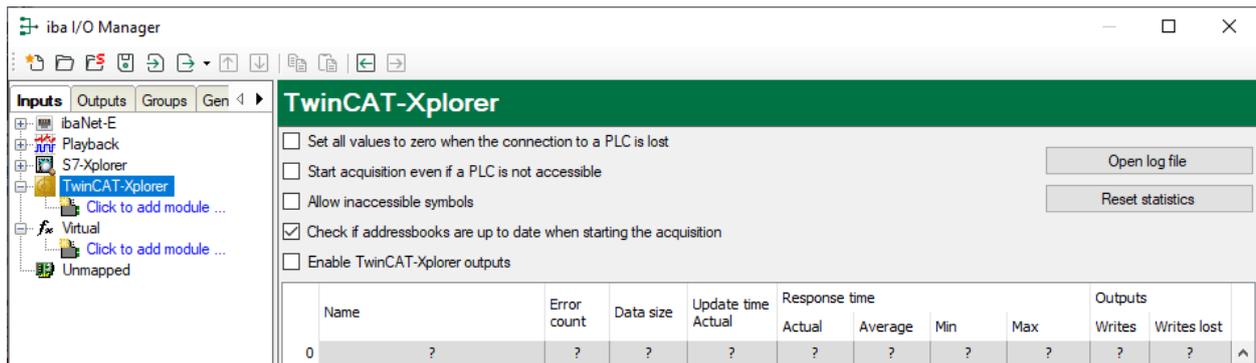
3.4 Configuration and engineering ibaPDA

Subsequently, the engineering for *ibaPDA* is described. If all system requirements are met, *ibaPDA* offers the *TwinCAT-Xplorer* interface in the signal tree of the I/O Manager.

3.4.1 General interface settings

If the Xplorer interface is selected in the tree, you can see an overview of diagnostics information on the configured connections between *ibaPDA* and the controllers.

The interface has the following features and configuration options.



Set all values to zero when the connection to a PLC is lost

If enabled, all measured values of the PLC are set to zero as soon as the connection is lost. If this option is disabled, *ibaPDA* will keep the last valid measured data in memory at the time the connection was lost.

Start acquisition even if a PLC is not accessible

If this option is enabled, the acquisition will start even if the controller is not accessible. In case of an error, a warning is indicated in the validation dialog. If the system has been started without a connection to the controller, *ibaPDA* will periodically try to connect to the PLC.

Allow inaccessible symbols

Enable this option if you wish to start acquisition even if symbols are not accessible. The inaccessible symbols are issued as warnings in the validation dialog box and not as errors.

This can only occur if the address book is not up-to-date.

Measurement will not start when inaccessible symbols are present if you do not enable this option.

Check if addressbooks are up to date when starting the acquisition

If this option is enabled, the system will check if the addressbook is up to date when the acquisition is started.

Enable TwinCAT-Xplorer outputs

Enable this option for activating the output modules. With the TwinCAT-Xplorer outputs you can write directly to TwinCAT controllers.

Caution

Please consider that writing data to the PLC might exert an influence on programs running on the PLC and can lead to adverse reactions and processes. Please make sure that no danger arises from the activation. Please take into consideration that the description of data in the controller has influence on the programs which run there and can result in unwanted reactions and processes. Therefore please make sure that activating the TwinCAT-Xplorer outputs does not involve any risks.

Connection table

The table shows the response time values (actual, average, minimum and maximum) and error counters for the individual connections during data measurement. To reset the calculated times and error counters to zero, simply click on the <Reset counters> button.

See chapter [↗ Connection table, page 27](#)

The data size column shows how much data is read. The number in brackets shows how many ADS commands are required to read the data. The higher the number of required ADS commands is, the slower the response time will be.

<Open log file>

If connections to TwinCAT controllers have been established, all connection-specific actions are logged in a text file. Using this button, you can open and see this file. In the file system on the harddisk, you will find the log file in the program path of the *ibaPDA* server (...\\Programs\\iba\\ibaPDA\\Server\\Log\\). The file name of the current log file is `TwinCATLog.txt`, the name of the archived log files is `TwinCATLog_yyyy_mm_dd_hh_mm_ss.txt`.

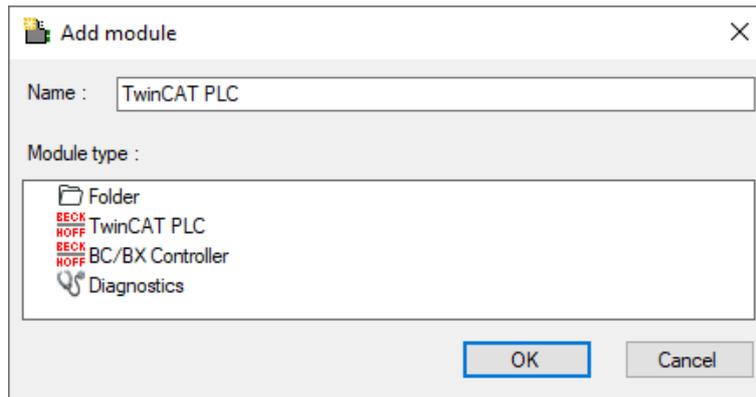
<Reset statistics>

Click this button to reset the calculated times and error counters in the table to 0.

3.4.2 Adding a module

Procedure

1. Click on the blue command *Click to add module...* located under each data interface in the *Inputs* or *Outputs* tab.
2. Select the desired module type in the dialog box and assign a name via the input field if required.
3. Confirm the selection with <OK>.



A connection is allocated for each module.

Module types

There are 2 types of modules available, which you can add to the *TwinCAT-Xplorer* interface:

TwinCAT PLC

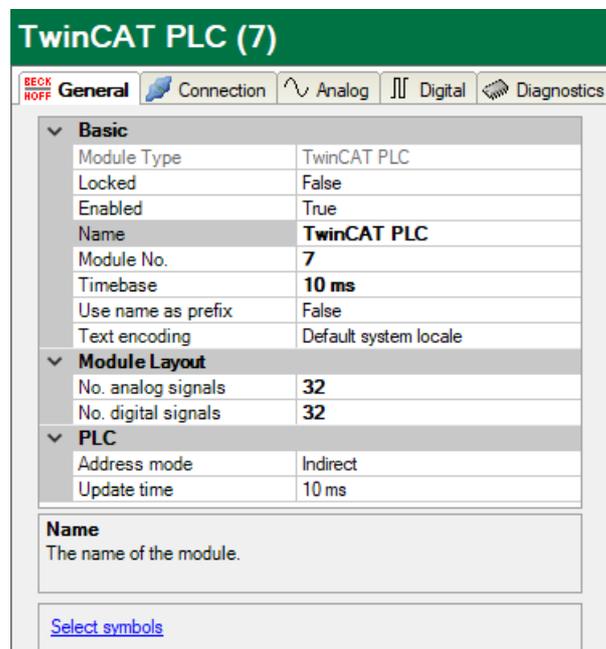
Use this when you want to measure from an industrial PC or embedded PC (CX series).

BC/BX Controller

Use this when you want to measure from a bus controller.

3.4.3 General module settings

All modules have the following common settings.



Basic settings

Module Type (information only)

Indicates the type of the current module.

Locked

You can lock a module to avoid unintentional or unauthorized changing of the module settings.

Enabled

Enable the modul to record signals.

Name

Here you can enter a name for the module.

Module No.

This internal reference number of the module determines the order of the modules in the signal tree of *ibaPDA* client and *ibaAnalyzer*.

Timebase

All signals of the module are sampled on this time base.

Use name as prefix

This option puts the module name in front of the signal names.

Module Layout**Number of analog and digital signals**

Defines the number of configurable analog and digital signals in the signal tables. The default value is 32 for each. You can change the number. The maximum value is 1000.

PLC**Address mode (type TwinCAT PLC only)**

This setting determines how the data for symbols is read from the PLC.

- Direct address mode

Data is read directly from the symbol address listed in the address book.

This mode is faster than the indirect mode. In case of online change or after loading a new configuration in the PLC which may cause a change of addresses, *ibaPDA* might read the wrong data.

- Indirect address mode

Data is read via a handle that is generated by the PLC from the symbol name. In indirect mode, *ibaPDA* will always read the correct data even when the symbol address has changed.

Indirect mode is not supported on BC/BX devices, which is why this setting is not available for BC/BX Controller modules.

Update time

Gives the reference update time in which the data is retrieved from the PLC. During measurement, the actual update time can be higher than the specified value if the PLC needs more time to transmit the data. You can check in the connection table how quickly the data is actually updated.

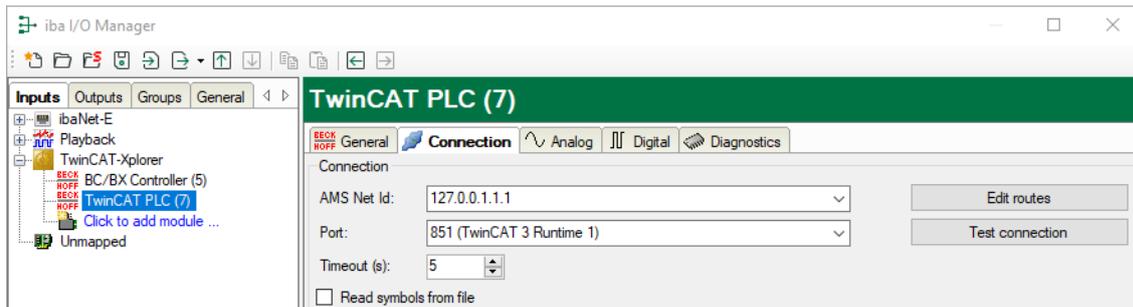
Link "Select symbols"

Click on this link after the connection has been successfully established in order to configure the signals to be measured.

For more information, see chapter [➤ Signal configuration](#), page 19.

3.4.4 Connection settings

The connection of the module to the controller is configured in the *Connection* tab. You should enter the required parameters.



AMS Net-ID

Enter the AMS Net Id here.

This is the address of an ADS router. It is an extension of the IP address. It consists of 6 bytes. Usually the first 4 bytes are the IP address and the last 2 bytes are 1.

Port

The port number determines the ADS device that is connected to the router. There are pre-defined port numbers for the TwinCAT runtimes.

- 800: für BC/BX bus controllers
- 801, 811, 821, 831: for the 4 possible TwinCAT 2 runtimes
- 851, 852, 853, 854: for the 4 possible TwinCAT 3 runtimes

Timeout

Here you can specify a value for the timeout in seconds for establishing the connection and for read accesses. Exceeding the time specified here can lead to the controller being declared not accessible or not responsive.

<Edit routes> button

Pressing this button will open the ADS router configuration tool provided TwinCAT ADS library is installed on the *ibaPDA* computer.

For more information, see chapter [➤ Configuration and engineering TwinCAT](#), page 8.

Once the routing tables are correct, you can connect to the PLC in *ibaPDA*. Use the <Test connection> button on the *Connection* tab.

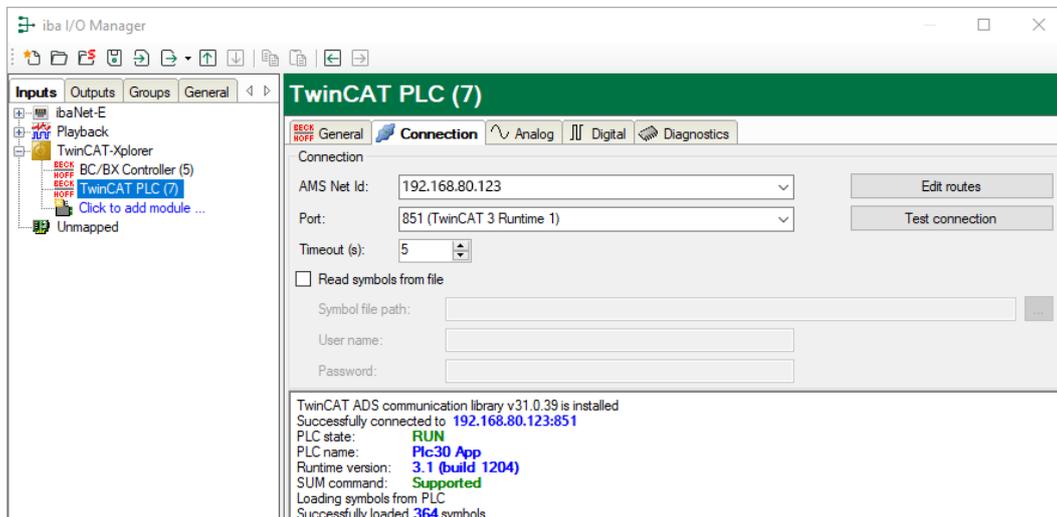
<Test connection> button

An attempt is made to establish a connection to the controller using the connection parameters specified. If successful, the information relating to the PLC will be displayed, such as status, name, runtime version and whether it supports the SUM command.

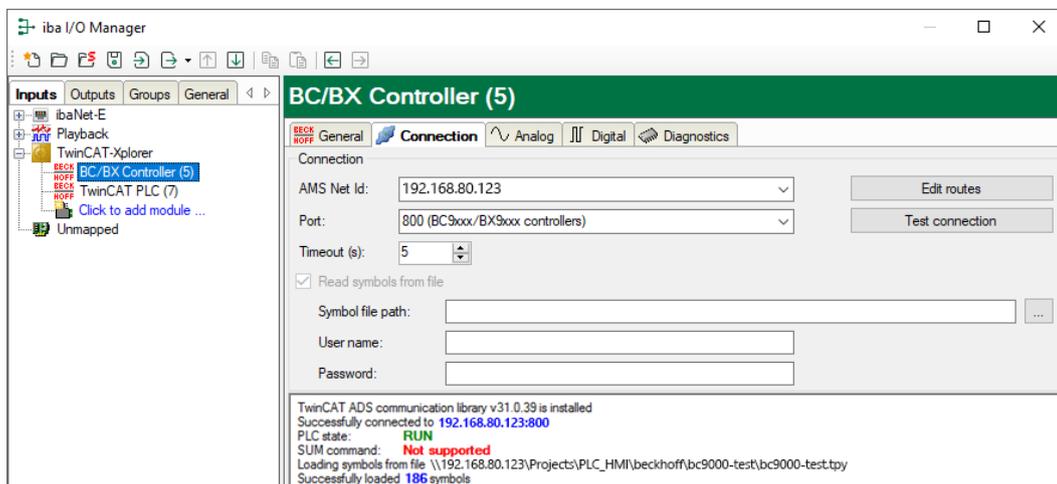
Note

The SUM command is used to send multiple ADS read commands inside of a single ADS SUM command. This speeds up the response time a lot.

On most TwinCAT PLCs the symbols are stored on the PLC itself. If this is the case, then *ibaPDA* will load the symbols from the PLC during the connection test.



If the symbols are not stored on the PLC, which is the case for bus controllers, then a symbol file needs to be specified. The symbol file is a TPY file that is generated by the TwinCAT compiler. It is normally located in the same directory as the project file. The *ibaPDA* service is going to access the symbol file. This means that if the symbol file is located on a network share then you need to specify the UNC path and proper user credentials for it.



3.4.5 Signal configuration

The variables to be measured are configured in the *Analog* and *Digital* tabs.

The length of the signal tables, i.e. the number of signals per table, is specified in the general module settings, module layout (see [General module settings](#), page 15).

Note



Observe the maximum number of signals permitted by your license!

Note

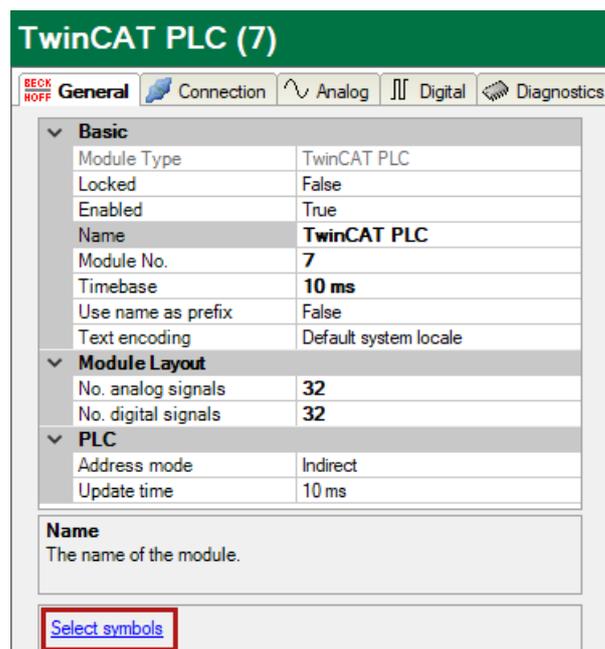


Take into consideration that the number of signals, which are read by a CPU, influences the minimum achievable update cycle. The more signals acquired, the longer the achievable update time.

Selection of the signals to be measured

You have two options to select the signals to be measured:

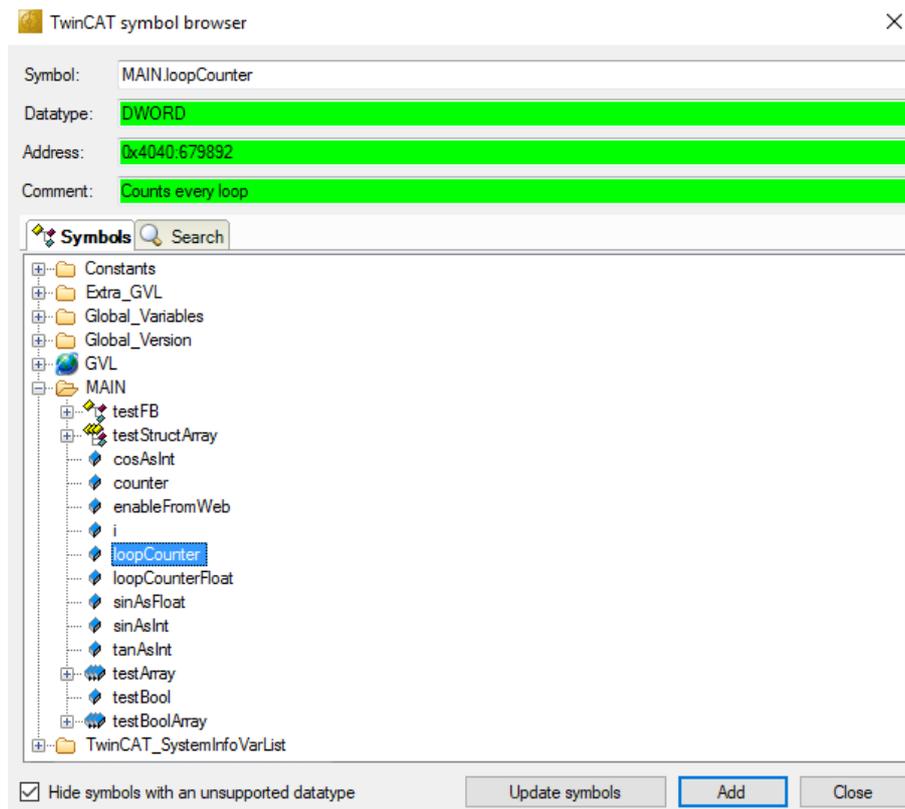
- Click on the *Select symbols* hyperlink in the module's *General* tab.



Clicking on the link opens the TwinCAT symbol browser.

- Clicking on a field in the *Symbol* column of the *Analog* or *Digital* tab.

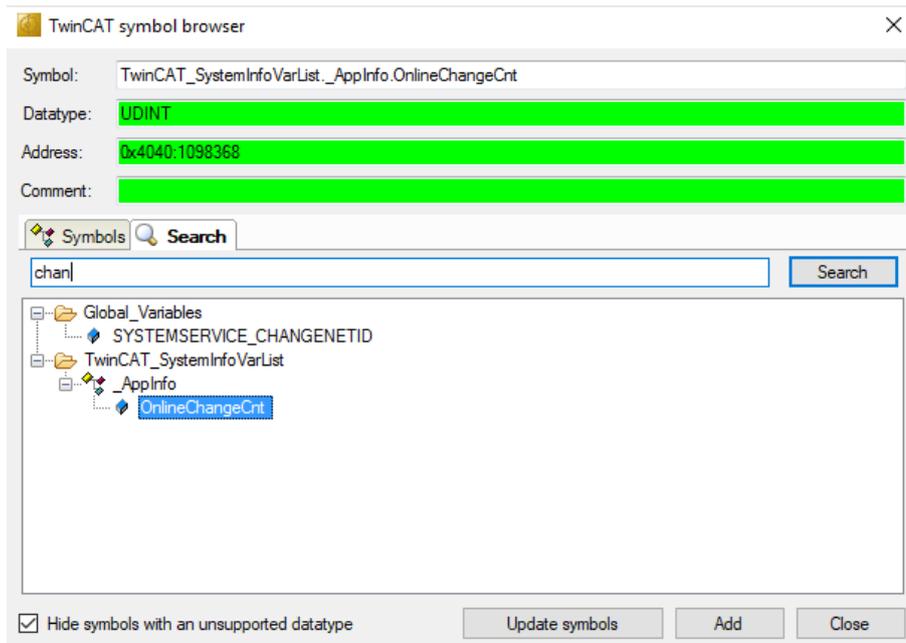
The button  is displayed. A click on the button opens the TwinCAT symbol browser.



The symbol browser shows all the symbols that were loaded from the PLC or imported from the symbol file. You can select single or multiple symbols in the tree.

Click the <Add> button to add them to the corresponding analog or digital signal table. If you selected a single symbol then the next symbol will be selected after you clicked the <Add> button. This allows you to hit <Add> multiple times in order to add consecutive symbols. You can also double click a symbol to add it to the signal table.

Use the <Update symbols> button to read the symbols again from the PLC or to read the symbol file again.



On the *Search* tab, you can search symbols by name. The search result tree works in the same way as the complete symbol tree.

Note



You can hide all unsupported datatypes by checking the "Hide symbols with an unsupported datatype" checkbox.

The data type, address and comment of the selected symbol are also shown in the browser. The address consists of an Index Group (in hex) followed by an Index Offset (in decimal). The address of a symbol can change when a project is recompiled or when the project is changed and extra symbols are added or symbols are removed.

Signal table

The selected signals are automatically entered in the correct *Analog* or *Digital* table. The *Analog* table displays the data type of the signal (read only). The plain text names of the signals can be assigned individually.

TwinCAT PLC (7)							
BECKHOFF General Connection Analog Digital Diagnostics							
Name	Unit	Gain	Offset	Symbol	DataType	Active	
0			1 0		FLOAT	<input type="checkbox"/>	
1			1 0		FLOAT	<input type="checkbox"/>	
2			1 0		FLOAT	<input type="checkbox"/>	
3			1 0		FLOAT	<input type="checkbox"/>	
4			1 0		FLOAT	<input type="checkbox"/>	
5			1 0		FLOAT	<input type="checkbox"/>	

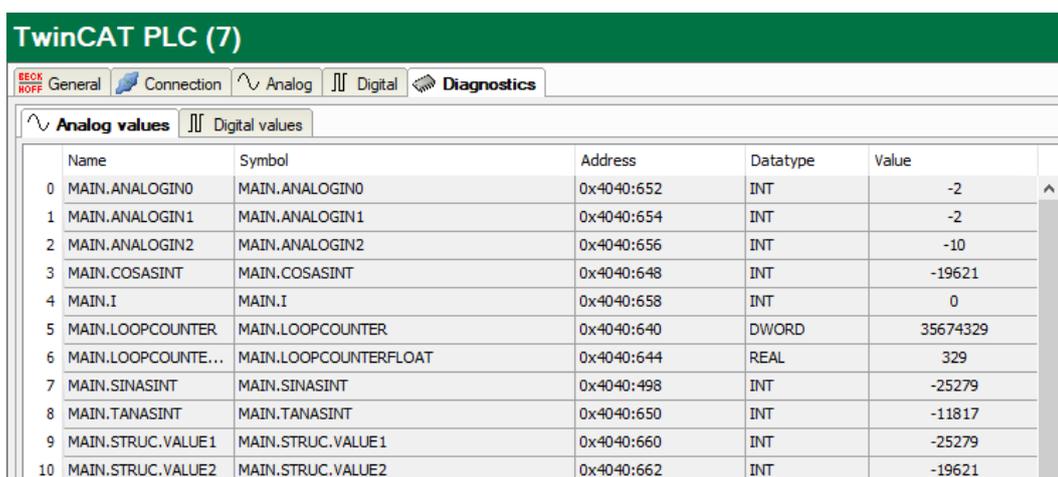
Remarks about symbols and addressing mode

ibaPDA can read the data for a symbol via the symbol address or via the symbol name. When *ibaPDA* reads via the symbol name then it first requests a handle to the symbol from the PLC. This handle then points to the actual address of the symbol. When a new version of the project is loaded on the PLC, then the PLC automatically updates the addresses that the handles point to. This way *ibaPDA* will always read the correct data for the symbol when it reads via the handle. This addressing mode is called *Indirect*.

The other addressing mode is called *Direct*. In direct mode *ibaPDA* uses the symbol address directly to read data for a symbol. In this case *ibaPDA* could read incorrect data after a project download to the PLC. You can configure the addressing mode that *ibaPDA* will use on the *General* tab of the module. It is recommended to use the *Indirect* address mode. Bus controllers do not have symbol information on them so they only support *Direct* address mode.

3.4.6 Modul diagnostics

After you have applied the configuration, all the configured signals are listed in tabular format with their datatype and current actual value in the *Diagnostics* tab of the TwinCAT-Xplorer module.



The screenshot shows the 'Diagnostics' tab of the TwinCAT PLC (7) interface. It displays a table with columns for Name, Symbol, Address, Datatype, and Value. The table lists 11 signals, with rows 0-10. Rows 0-10 are active (white background), while rows 11-15 are inactive (grey background).

Name	Symbol	Address	Datatype	Value
0 MAIN.ANALOGIN0	MAIN.ANALOGIN0	0x4040:652	INT	-2
1 MAIN.ANALOGIN1	MAIN.ANALOGIN1	0x4040:654	INT	-2
2 MAIN.ANALOGIN2	MAIN.ANALOGIN2	0x4040:656	INT	-10
3 MAIN.COSASINT	MAIN.COSASINT	0x4040:648	INT	-19621
4 MAIN.I	MAIN.I	0x4040:658	INT	0
5 MAIN.LOOPCOUNTER	MAIN.LOOPCOUNTER	0x4040:640	DWORD	35674329
6 MAIN.LOOPCOUNTER...	MAIN.LOOPCOUNTERFLOAT	0x4040:644	REAL	329
7 MAIN.SINASINT	MAIN.SINASINT	0x4040:498	INT	-25279
8 MAIN.TANASINT	MAIN.TANASINT	0x4040:650	INT	-11817
9 MAIN.STRUC.VALUE1	MAIN.STRUC.VALUE1	0x4040:660	INT	-25279
10 MAIN.STRUC.VALUE2	MAIN.STRUC.VALUE2	0x4040:662	INT	-19621
11				
12				
13				
14				
15				

Grey rows in table indicate inactive signals.

3.4.7 Module outputs

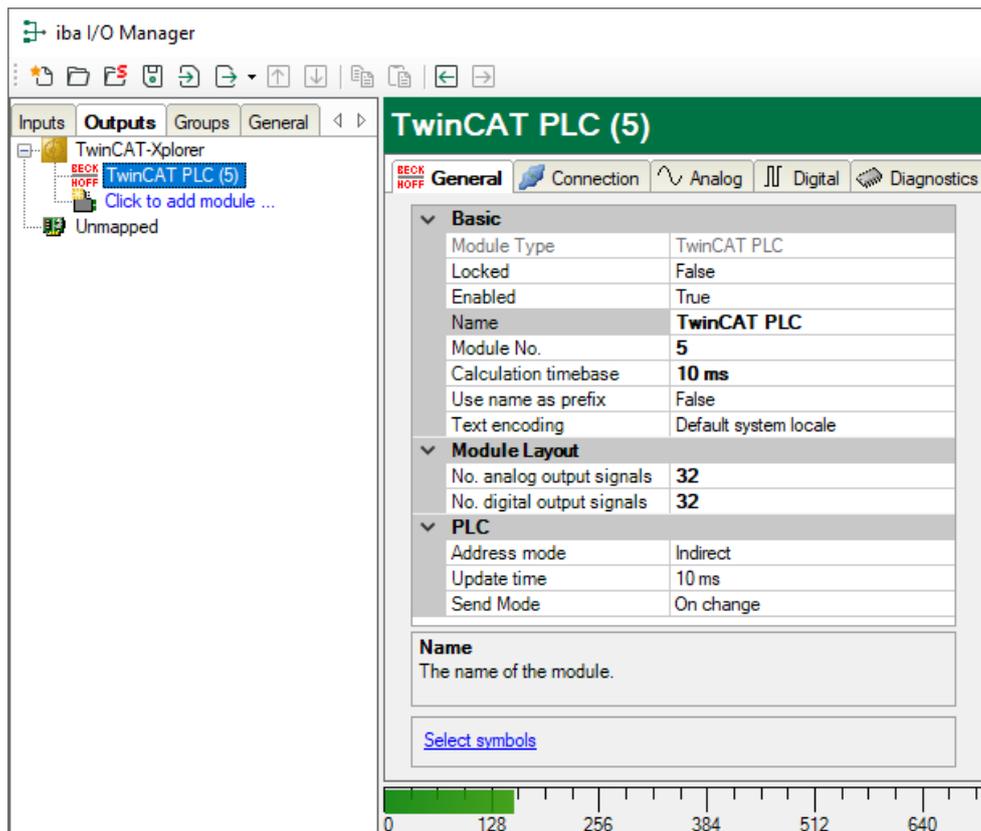
The output module is not an autonomous module, but an extension of the *TwinCAT-Xplorer* module. With the output module, you can write data from *ibaPDA* to a controller.

Note



Depending on the configured protection-level access of the TwinCAT controller, writing values to the controller may be not possible.

You can configure the module in the *Outputs* tab. You do not have to add it separately. The module is available as soon as a *TwinCAT-Xplorer* module is added.



Except from the module-specific settings, the settings correspond to the settings in the *Inputs* tab. The user can also define the settings in the *Inputs* tab. The connection settings also correspond to those in the *Inputs* tab.

For details concerning the module settings see [General module settings](#), page 15.

Module specific settings

No. analog / digital output signals

Defines the number of configurable analog signals/digital signals in the signal tables. The default setting is 32. You can change the number. Maximum value is 1000.

Send mode

Determines when new data is sent to the controller:

- Cyclic: Data is sent in the cycle of the update time
- On change: Data is sent each time the signal data is changed
- On trigger: Data is sent with every rising edge of the trigger signal

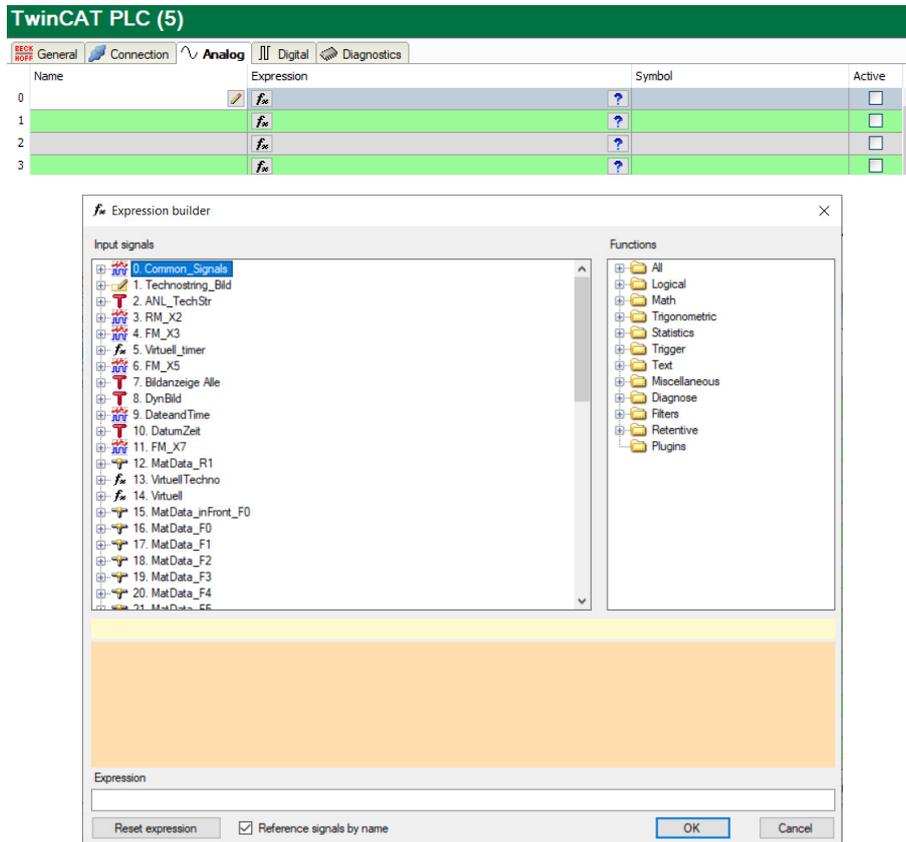
Always all signals of a module are sent, independently of the send mode.

Trigger signal

The signal values are sent to the PLC with the rising edge of this digital signal. You can only see this field if you have selected the "On trigger" send mode.

Signal configuration

The analog and digital signals to be output, are configured in the expression builder. The expression builder can be opened by the <fx> button from each signal row.



Other documentation



For more information about how to use the expression builder, see the *ibaPDA* manual.

Note

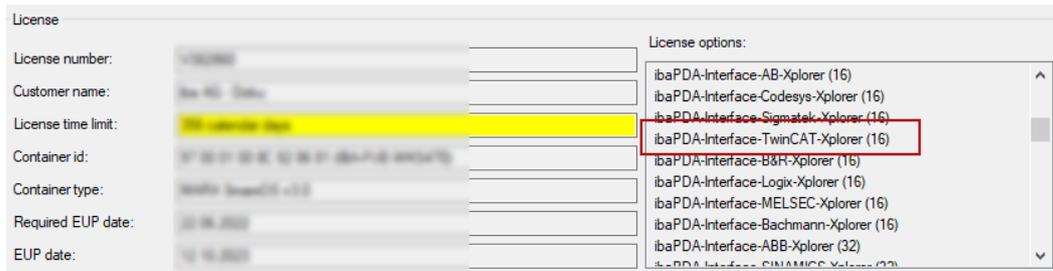


All signals of a TwinCAT-Xplorer module are read and written via a common connection. Therefore, the total number of configured signals has influence on the update time.

4 Diagnostics

4.1 License

If the "TwinCAT-Xplorer" interface is not displayed in the signal tree, you can either check in *ibaPDA* under *General - Settings - License* in the I/O manager or in the *ibaPDA* service status application, whether your license "Interface TwinCAT-Xplorer" has been properly recognised. The number of licensed connections is indicated in brackets.



4.2 Log files

If connections to target platforms or clients have been established, all connection-specific actions are logged in a text file. You can open this (current) file and, e.g., scan it for indications of possible connection problems.

You can open the log file via the button <Open log file>. The button is available in the I/O Manager:

- for many interfaces in the respective interface overview
- for integrated servers (e.g. OPC UA server) in the *Diagnostics* tab.

In the file system on the hard drive, you can find the log files of the *ibaPDA* server (... \ProgramData\iba\ibaPDA\Log). The file names of the log files include the name or abbreviation of the interface type.

Files named `interface.txt` are always the current log files. Files named `Interface_YYYY_MM_DD_HH_MM_SS.txt` are archived log files.

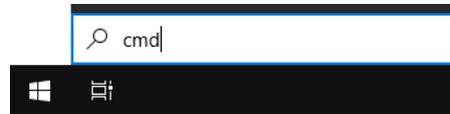
Examples:

- `ethernetipLog.txt` (log of EtherNet/IP connections)
- `AbEthLog.txt` (log of Allen-Bradley Ethernet connections)
- `OpcUAServerLog.txt` (log of OPC UA server connections)

4.3 Connection diagnostics with PING

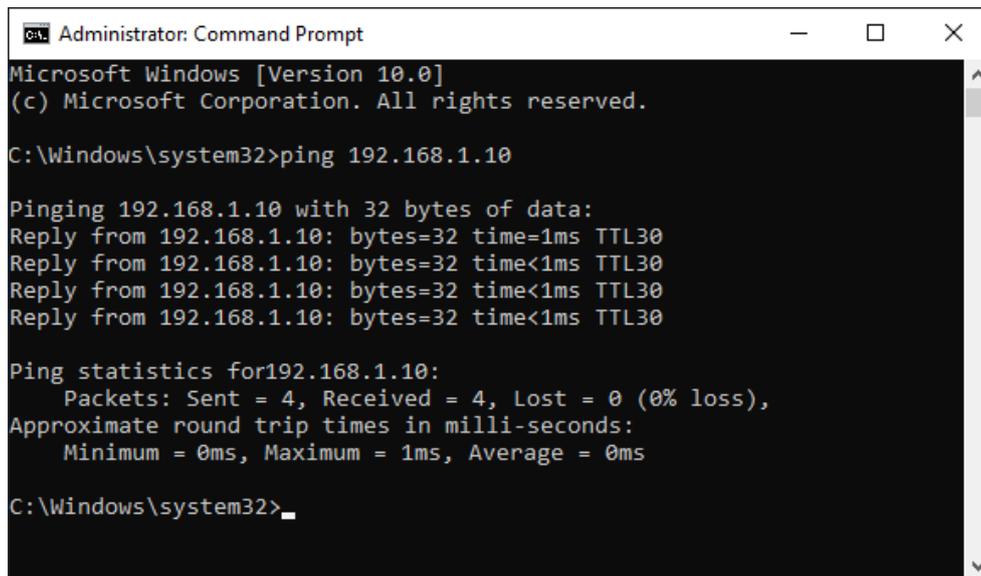
PING is a system command with which you can check if a certain communication partner can be reached in an IP network.

1. Open a Windows command prompt.



2. Enter the command "ping" followed by the IP address of the communication partner and press <ENTER>.

→ With an existing connection you receive several replies.

A screenshot of a Windows Command Prompt window titled 'Administrator: Command Prompt'. The window shows the following text:

```
Microsoft Windows [Version 10.0]
(c) Microsoft Corporation. All rights reserved.

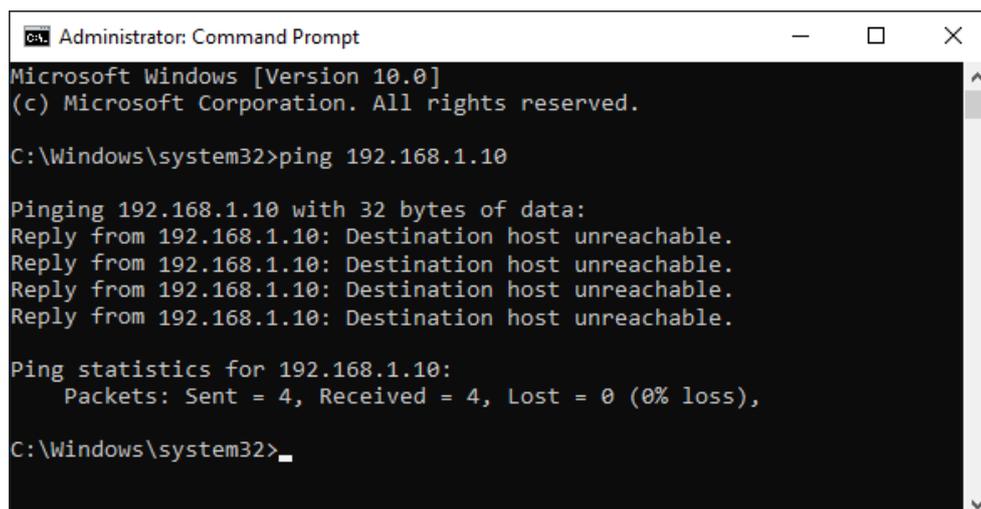
C:\Windows\system32>ping 192.168.1.10

Pinging 192.168.1.10 with 32 bytes of data:
Reply from 192.168.1.10: bytes=32 time=1ms TTL30
Reply from 192.168.1.10: bytes=32 time<1ms TTL30
Reply from 192.168.1.10: bytes=32 time<1ms TTL30
Reply from 192.168.1.10: bytes=32 time<1ms TTL30

Ping statistics for 192.168.1.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Windows\system32>_
```

→ With no existing connection you receive error messages.

A screenshot of a Windows Command Prompt window titled 'Administrator: Command Prompt'. The window shows the following text:

```
Microsoft Windows [Version 10.0]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>ping 192.168.1.10

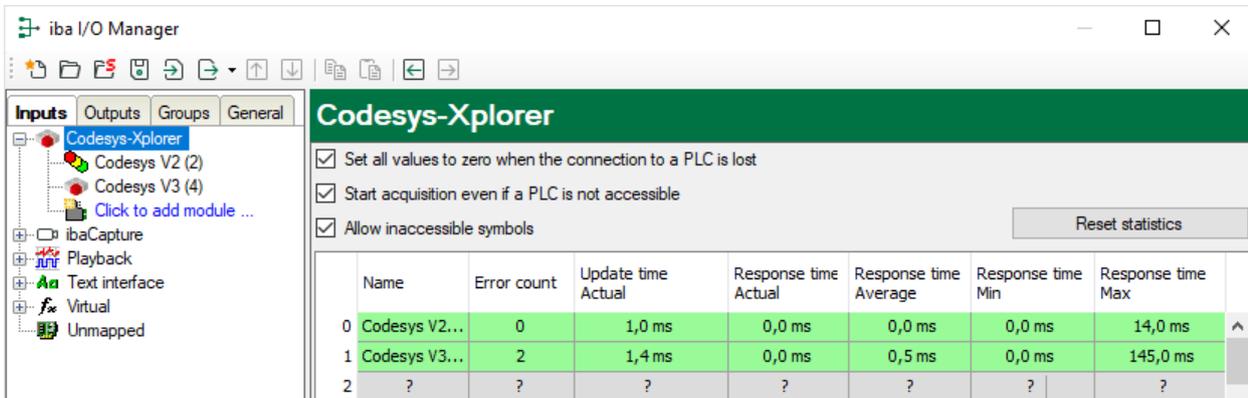
Pinging 192.168.1.10 with 32 bytes of data:
Reply from 192.168.1.10: Destination host unreachable.

Ping statistics for 192.168.1.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

C:\Windows\system32>_
```

4.4 Connection table

For every Ethernet-based interface, there is a table available in the I/O manager which shows the status of each connection. Each line represents one connection. The following figure shows, as an example, the connection table of the Codesys-Xplorer interface:



The connected target systems (controllers) are identified by their name or IP address in the first (left) column.

Depending on the interface type the table shows error counters, read counters and/or data sizes, as well as the cycle times, refresh times and/or update times of the different connections during the data acquisition. Click the <Reset statistics> button to reset the error counters and the calculation of the response times.

Additional information is provided by the background color of the table rows:

Color	Meaning
Green	The connection is OK and the data are read.
Yellow	The connection is OK, however the data update is slower than the configured update time.
Red	The connection has failed.
Gray	No connection configured.

4.5 Diagnostic modules

Diagnostic modules are available for most Ethernet based interfaces and Xplorer interfaces. Using a diagnostic module, information from the diagnostic displays (e. g. diagnostic tabs and connection tables of an interface) can be acquired as signals.

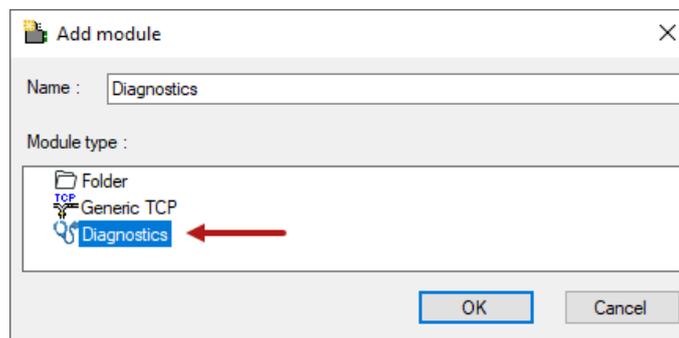
A diagnostic module is always assigned to a data acquisition module of the same interface and supplies its connection information. By using a diagnostic module you can record and analyze the diagnostic information continuously in the *ibaPDA* system.

Diagnostic modules do not consume any license connections, since they do not establish their own connection, but refer to another module.

Example for the use of diagnostic modules:

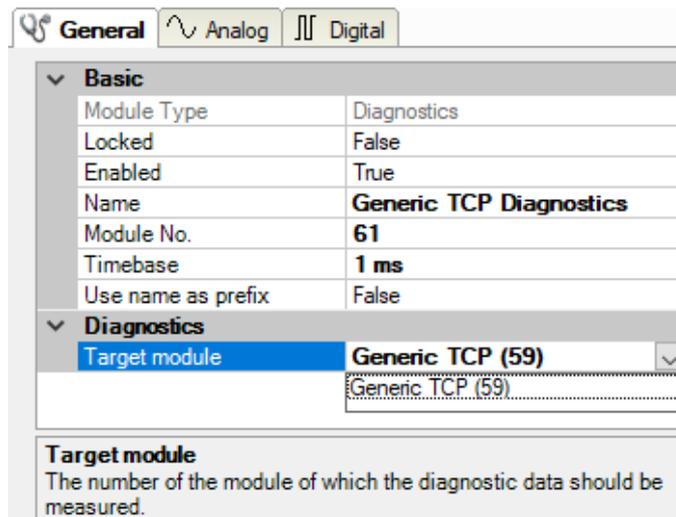
- A notification can be generated, whenever the error counter of a communication connection exceeds a certain value or the connection gets lost.
- In case of a disturbance, the current response times in the telegram traffic may be documented in an incident report.
- The connection status can be visualized in *ibaQPanel*.
- You can forward diagnostic information via the SNMP server integrated in *ibaPDA* or via OPC DA/UA server to superordinate monitoring systems like network management tools.

In case the diagnostic module is available for an interface, a "Diagnostics" module type is shown in the "Add module" dialog (example: Generic TCP).



Module settings diagnostic module

For a diagnostic module, you can make the following settings (example: Generic TCP):



The basic settings of a diagnostic module equal those of other modules.

There is only one setting which is specific for the diagnostic module: the target module.

By selecting the target module, you assign the diagnostic module to the module on which you want to acquire information about the connection. You can select the supported modules of this interface in the drop down list of the setting. You can assign exactly one data acquisition module to each diagnostic module. When having selected a module, the available diagnostic signals are immediately added to the *Analog* and *Digital* tabs. It depends on the type of interface, which signals exactly are added. The following example lists the analog values of a diagnostic module for a Generic TCP module.

General Analog Digital						
Name	Unit	Gain	Offset	Active	Actual	
0 IP address (part 1)		1	0	<input checked="" type="checkbox"/>		
1 IP address (part 2)		1	0	<input checked="" type="checkbox"/>		
2 IP address (part 3)		1	0	<input checked="" type="checkbox"/>		
3 IP address (part 4)		1	0	<input checked="" type="checkbox"/>		
4 Port		1	0	<input checked="" type="checkbox"/>		
5 Message counter		1	0	<input checked="" type="checkbox"/>		
6 Incomplete errors		1	0	<input checked="" type="checkbox"/>		
7 Packet size (actual)	bytes	1	0	<input checked="" type="checkbox"/>		
8 Packet size (max)	bytes	1	0	<input checked="" type="checkbox"/>		
9 Time between data (actual)	ms	1	0	<input checked="" type="checkbox"/>		
10 Time between data (min)	ms	1	0	<input checked="" type="checkbox"/>		

For example, the IP (v4) address of a Generic TCP module (see fig. above) will always be split into 4 parts derived from the dot-decimal notation, for better reading. Also other values are being determined, as there are port number, counters for telegrams and errors, data sizes and telegram cycle times. The following example lists the digital values of a diagnostic module for a Generic TCP module.

General Analog Digital			
Name	Active	Actual	
0 Active connection mode	<input checked="" type="checkbox"/>		
1 Invalid packet	<input checked="" type="checkbox"/>		
2 Connecting	<input checked="" type="checkbox"/>		
3 Connected	<input checked="" type="checkbox"/>		

Diagnostic signals

Depending on the interface type, the following signals are available:

Signal name	Description
Buffer file size (actual/avg/max)	Size of the file for buffering statements
Buffer memory size (actual/avg/max)	Size of the memory used by buffered statements
Buffered statements	Number of unprocessed statements in the buffer
Buffered statements lost	Number of buffered but unprocessed and lost statements
Connected	Connection is established
Connected (in)	A valid data connection for the reception (in) is available
Connected (out)	A valid data connection for sending (out) is available
Connecting	Connection being established
Connection attempts (in)	Number of attempts to establish the receive connection (in)
Connection attempts (out)	Number of attempts to establish the send connection (out)
Connection ID O->T	ID of the connection for output data (from the target system to <i>ibaPDA</i>). Corresponds to the assembly instance number
Connection ID T->O	ID of the connection for input data (from <i>ibaPDA</i> to target system). Corresponds to the assembly instance number
Connection phase (in)	Status of the ibaNet-E data connection for reception (in)
Connection phase (out)	Status of the ibaNet-E data connection for sending (out)
Connections established (in)	Number of currently valid data connections for reception (in)
Connections established (out)	Number of currently valid data connections for sending (out)
Data length	Length of the data message in bytes
Data length O->T	Size of the output message in byte
Data length T->O	Size of the input message in byte
Destination IP address (part 1-4) O->T	4 octets of the IP address of the target system Output data (from target system to <i>ibaPDA</i>)
Destination IP address (part 1-4) T->O	4 octets of the IP address of the target system Input data (from <i>ibaPDA</i> to target system)
Disconnects (in)	Number of currently interrupted data connections for reception (in)
Disconnects (out)	Number of currently interrupted data connections for sending (out)
Error counter	Communication error counter
Exchange ID	ID of the data exchange
Incomplete errors	Number of incomplete messages
Incorrect message type	Number of received messages with wrong message type
Input data length	Length of data messages with input signals in bytes (<i>ibaPDA</i> receives)
Invalid packet	Invalid data packet detected

Signal name	Description
IP address (part 1-4)	4 octets of the IP address of the target system
Keepalive counter	Number of KeepAlive messages received by the OPC UA Server
Lost images	Number of lost images (in) that were not received even after a retransmission
Lost Profiles	Number of incomplete/incorrect profiles
Message counter	Number of messages received
Messages per cycle	Number of messages in the cycle of the update time
Messages received since configuration	Number of received data telegrams (in) since start of acquisition
Messages received since connection start	Number of received data telegrams (in) since the start of the last connection setup. Reset with each connection loss.
Messages sent since configuration	Number of sent data telegrams (out) since start of acquisition
Messages sent since connection start	Number of sent data telegrams (out) since the start of the last connection setup. Reset with each connection loss.
Multicast join error	Number of multicast login errors
Number of request commands	Counter for request messages from <i>ibaPDA</i> to the PLC/CPU
Output data length	Length of the data messages with output signals in bytes (<i>ibaPDA</i> sends)
Packet size (actual)	Size of the currently received message
Packet size (max)	Size of the largest received message
Ping time (actual)	Response time for a ping telegram
Port	Port number for communication
Producer ID (part 1-4)	Producer ID as 4 byte unsigned integer
Profile Count	Number of completely recorded profiles
Read counter	Number of read accesses/data requests
Receive counter	Number of messages received
Response time (actual/average/max/min)	Response time is the time between measured value request from <i>ibaPDA</i> and response from the PLC or reception of the data. Actual: current value Average/max/min: static values of the update time since the last start of the acquisition or reset of the counters.
Retransmission requests	Number of data messages requested again if lost or delayed
Rows (last)	Number of resulting rows by the last SQL query (within the configured range of result rows)
Rows (maximum)	Maximum number of resulting rows by any SQL query since the last start of acquisition (possible maximum equals the configured number of result rows)

Signal name	Description
Send counter	Number of send messages
Sequence errors	Number of sequence errors
Source IP address (part 1-4) O->T	4 octets of the IP address of the target system Output data (from target system to <i>ibaPDA</i>)
Source IP address (part 1-4) T->O	4 octets of the IP address of the target system Input data (from <i>ibaPDA</i> to target system)
Statements processed	Number of executed statements since last start of acquisition
Synchronization	Device is synchronized for isochronous acquisition
Time between data (actual/ max/min)	Time between two correctly received messages Actual: between the last two messages Max/min: statistical values since start of acquisition or reset of counters
Time offset (actual)	Measured time difference of synchronicity between <i>ibaPDA</i> and the <i>ibaNet-E</i> device
Topics Defined	Number of defined topics
Topics Updated	Number of updated topics
Unknown sensor	Number of unknown sensors
Update time (actual/average/ configured/max/min)	Specifies the update time in which the data is to be retrieved from the PLC, the CPU or from the server (configured). Default is equal to the parameter "Timebase". During the measurement the real actual update time (actual) can be higher than the set value, if the PLC needs more time to transfer the data. How fast the data is really updated, you can check in the connection table. The minimum achievable update time is influenced by the number of signals. The more signals are acquired, the greater the update time becomes. Average/max/min: static values of the update time since the last start of the acquisition or reset of the counters.
Write counter	Number of successful write accesses
Write lost counter	Number of failed write accesses

5 Support and contact

Support

Phone: +49 911 97282-14
Fax: +49 911 97282-33
Email: support@iba-ag.com

Note



If you need support for software products, please state the license number or the CodeMeter container number (WIBU dongle). For hardware products, please have the serial number of the device ready.

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