



ibaPDA-Interface-IEC61850-Client

Data interface IEC 61850

Manual
Issue 1.7

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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 documentation

This documentation describes the function and application of the software interface *ibaPDA-Interface-IEC61850-Client*.

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 manual is aimed at qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded as professional if he/she is capable of assessing safety and recognizing possible consequences and 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 IEC 61850-compliant devices in the area of substation automation. For the handling of *ibaPDA-Interface-IEC61850-Client* the following basic knowledge is required and/or useful

- Windows operating system
- Basic knowledge of *ibaPDA*
- Knowledge of configuration and operation of the relevant target system/device

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

The following system requirements are necessary for the use of the IEC 61850 client:

- *ibaPDA* v8.2.0 or higher
- License for *ibaPDA-interface-IEC61850-Client*
- If you need more than 64 connections, you will require additional *one-step-up-Interface-IEC61850-Client* licenses for each additional 64 connections.

Requirement for the analysis of the data:

- *ibaAnalyzer* v8.0.2

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

License information

Order no.	Product name	Description
31.001090	ibaPDA-Interface-IEC61850-Client	Extension for an ibaPDA system to include an IEC 61850 client interface Number of connections: 64
31.101090	one-step-up-Interface-IEC61850-Client	Extension license for an existing interface ibaPDA-interface-IEC61850-Client for another 64 connections

One connection is required per configured IEC 61850 device.

Note



In order to use more than 64 data connections per interface, extension licenses one-step-up...are required. Up to 64 further connections to devices can be established on each one-step-up-license. These licenses can be purchased or released multiple times.

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

3 IEC 61850-Client

3.1 General Information

The standard IEC 61850 of the International Electrotechnical Commission (IEC) describes a general transmission protocol for protection and control technology in electrical switchgear of medium and high-voltage technology (station automation).

The data interface *ibaPDA-Interface-IEC61850-Client* is suitable for the measured data recording from an IEC 61850-compliant server via standard network cards.

The following protocols are supported:

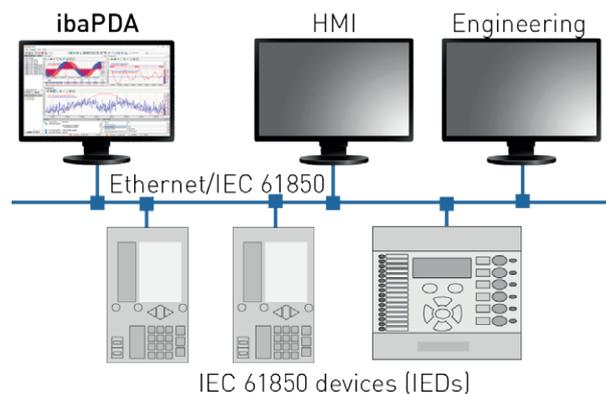
- Manufacturing Messaging Specification (MMS)
- Generic Object Oriented Substation Events (GOOSE)

The selection of the signals to be measured is hereby conveniently carried out by means of symbolic names supported by the IEC 61850 symbol browser. This makes it possible to access all measurable data attributes based on the imported server object list of the IEC 61850 device.

Furthermore, *ibaPDA* supports retrieval, transfer and renaming of COMTRADE files according to IEC 61850-7-2 by means of a so called file module, which can be configured for each IEC 61850 device.

3.2 System topologies

The connections to the data servers can be established via the computer's standard Ethernet interfaces. Topology example with protective relay:



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 for IEC 61850 server

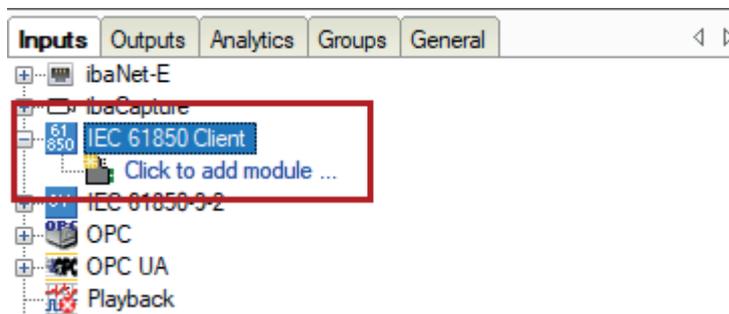
The configuration and engineering of the IEC 61850 server requires special tools from the device manufacturer and is not part of this data interface.

Some of the functions provided in the standard IEC 61850 are deliberately not used in the data interface. This ensures that unintentional changes to the server-side configuration will not disrupt the link to other devices. For example, it is not possible to generate dynamic data sets with GOOSE modules or to assign a different data set to a GOOSE control block.

3.4 Configuration and engineering for ibaPDA

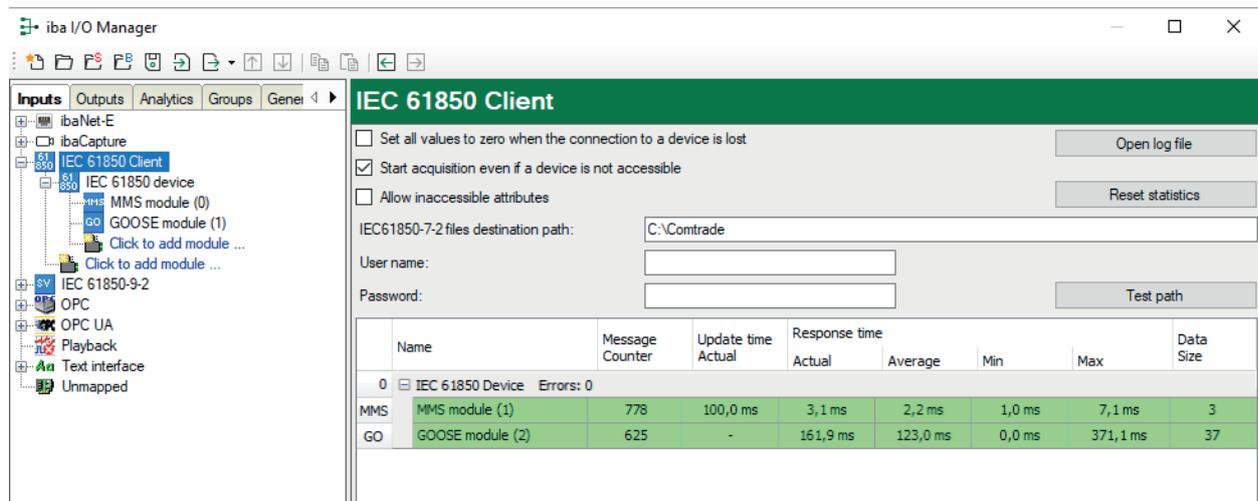
Open the I/O manager, e.g. from the toolbar .

If all system requirements are at hand (see chapter [↗ System requirements](#), page 7) the interface “IEC 61850 Client” is displayed in the signal tree.



3.4.1 Interface settings

The interface IEC 61850 client has the following functions and configuration possibilities:



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

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

Start acquisition even if a device is not accessible

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

Allow inaccessible attributes

Enable this option to start the acquisition, even if no attributes are accessible. The inaccessible symbols are issued as warnings in the validation dialog. This can only occur if the address book is not up-to-date!

If you do not enable this option, then the measurement will not start in the presence of inaccessible symbols.

IEC61850-7-2 files destination path

Enter here the path to the destination directory if you want to use the *File module* in order to transfer COMTRADE files from an IEC 61850 device. This directory will be the base directory to store the files. The path should be given from the *ibaPDA* server's point of view. A UNC-path is permitted. In order to access network shares add user name and password. Use the <Test path> button to check *ibaPDA*'s ability to access the path.

Connection table

The table shows different diagnostic values of the individual connections during data measurement. To reset the calculated times and error counters to zero, simply click on the <Reset counters> button. All modules of an IEC 61850 device use the same connection.

The telegram counter is a continuous counter that is incremented by one with each received telegram.

The update time is only shown for modules that automatically query data from the IEC server with the set update time. This is only the case with MMS modules without report control blocks. The currently measured update time indicates whether the desired set update time is reached. In the case of overload of the IEC server, the desired update time cannot be reached. The corresponding line in the connection table is then colored in yellow.

For MMS modules without a report control block, the response time describes the time that passes between the data query by *ibaPDA* and the receipt of the response.

For all other module types, the IEC server automatically sends data according to different criteria. In this case, the response time describes the duration between two received telegrams.

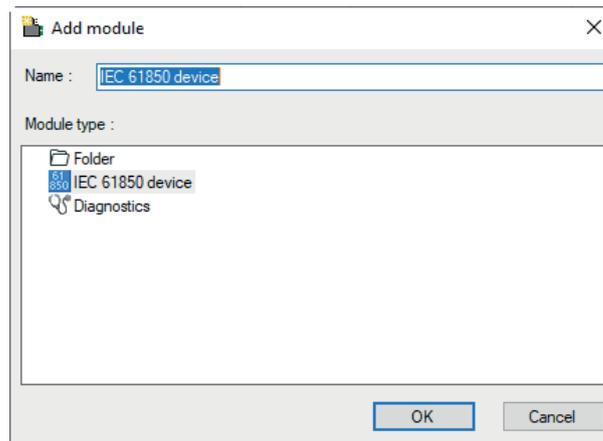
Also see the chapter ↗ *Connection table*, page 35

<Open log file> button

If connections to IEC 61850 devices have been established, then all connection specific actions are recorded in a text file. With this button, you can open and have a look at this file. In the file system on the hard drive, you will find the log files of this interface in the path `...\ProgramData\iba\ibaPDA\Log\`. The file name of the current log file is `lec61850Log.txt`, the name of the archived log files is `lec61850Log_yyyy_mm_dd_hh_mm_ss.txt`.

3.4.2 Add device module

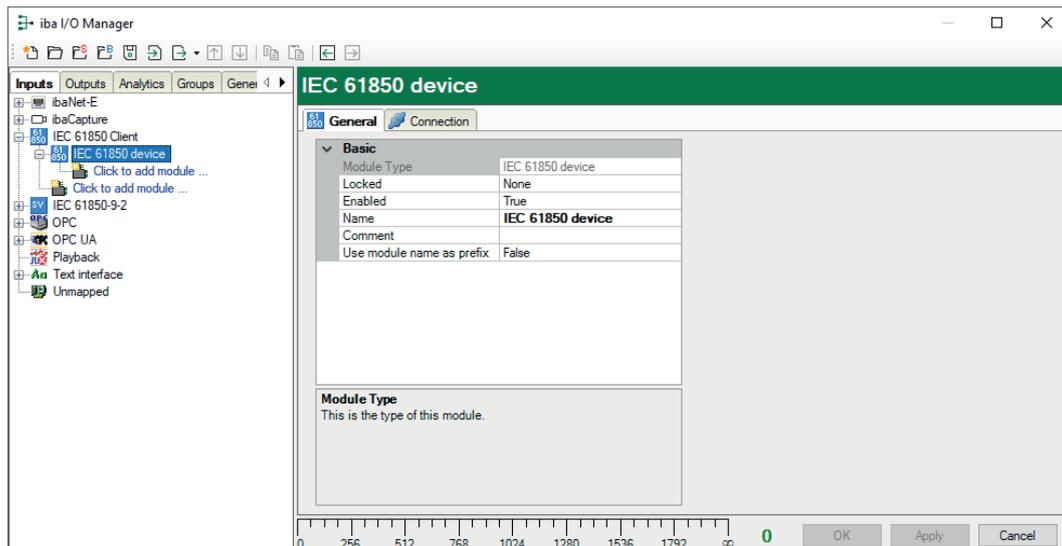
IEC 61850 devices are shown in *ibaPDA* as device modules.



Add a module by clicking below the interface. Select the module type “IEC 61850 device” and click on <OK>.

3.4.3 General device module settings

All devices have the following common setting possibilities.



Basic settings

Module Type (information only)

Display of the module type

Locked

A module can be locked to avoid unintentional or unauthorized changing of the module settings.

Enabled

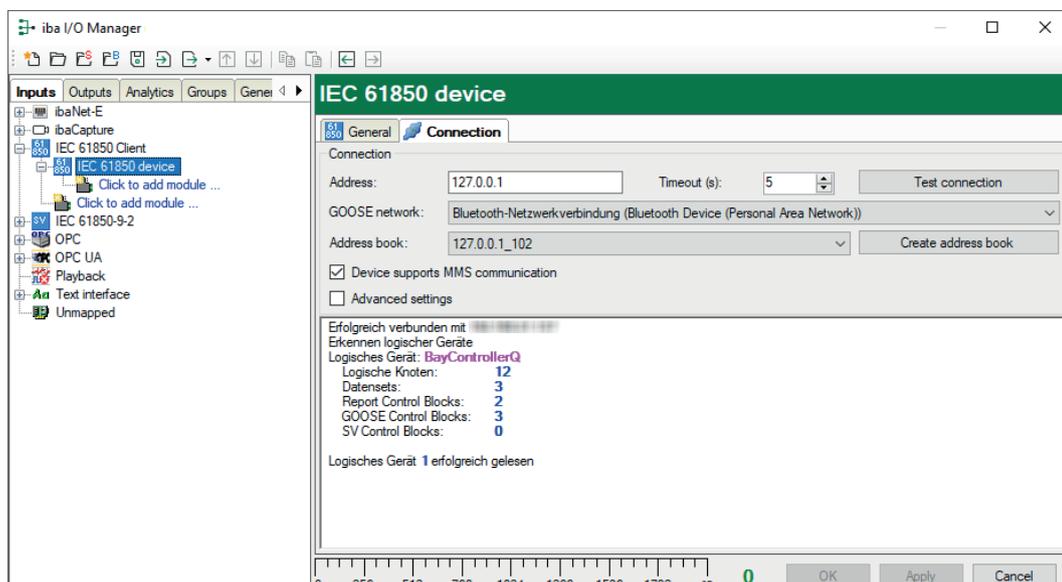
Disabled modules are excluded from signal acquisition.

Name

The plain text name should be entered here as the module designation.

3.4.4 Connection Settings

In the *Connection* tab, the corresponding connection of the device module is configured for the IEC 61850 device.



Connection Parameters

Address

The IP address of the IEC 61850 device is to be entered here to establish the connection.

Timeout

You can set the value for the timeout here in seconds for the connection establishment and read accesses. When the timeout is exceeded, the device is considered as inaccessible or unresponsive.

Button <Test connection>

With the set connection parameters, it is attempted to establish the connection to the IEC 61850 device. If successful, information about the device is shown, such as detected logical devices, nodes, data sets and control blocks.

GOOSE network

Network card to be used to receive GOOSE messages. Only relevant when using GOOSE telegrams.

Address book

Selection of the linked address book. If address books have already been created, they are offered for selection here. *ibaPDA* can also create address books.

<Create address book>

This button can be used to create an address book offline. The button opens the file browser and the SCL file can be selected, with which *ibaPDA* creates an address book.

When you click on the <Test connection> button, *ibaPDA* connects to the IEC 61850 device and loads the address book from the device itself. The name of the address book is then the IP address and port number of the device.

Address books are managed in I/O Manager, on the *General* tab, in the *Address books* node. See chapter [➤ Address books](#), page 32.

Device supports MMS communication

This option is enabled by default.

However, it is also possible that GOOSE messages are received without MMS communication to the IEC 61850 device.

This means that the *ibaPDA* server does not necessarily have to be located in the network of IEC 61850 devices, as long as the GOOSE messages are forwarded to the network where the *ibaPDA* server is located.

To make sure that the *ibaPDA* server does not support MMS communication anymore, disable the option *Device supports MMS communication*.

In this case, you must configure additional properties in the GOOSE module, such as the application ID and a source and/or destination MAC address. See chapter [➤ GOOSE module](#), page 18.

Advanced settings

The advanced settings can be shown in order to configure additional parameters.

- Port
Number of the port used on the server side

Note



Port 102 is used by default. If S7 communication based on RFC 1006 is present in the same network, this may lead to problems, since this also uses port 102 as the default port.

- Password
If access to the IEC server is password-protected, enter the password here.
- Maximum number of objects to read in a single command
If neither a data set nor a report control block is used for an MMS module, *ibaPDA* reads the configured signals with individual commands. Ensure here how many objects should be read in a command, since several signals are combined in an MMS message if this is possible. If the value is set to 1, a separate MMS message is in fact sent to the server for each value.

3.4.5 Add module

Click the blue command *Click to add module* under the device module. Select the desired module type, assign a name and click <OK>.

All modules together use the link defined in the superordinate IEC 61850 device.

There are 3 types of modules that you can add to the IEC 61850 device module:

- GOOSE module
Communication according to IEC 61850 Generic Object Oriented Substation Events (GOOSE) protocol.

- **MMS module**
Communication according to IEC 61850 Manufacturing Messaging Specification (MMS) protocol.
- **File module**
Download, rename and save a COMTRADE file from the IEC 61850 device (according to IEC 61850-7-2).

3.4.6 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 module to record signals.

Name

You can enter a name for the module here.

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 timebase.

Use module name as prefix

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

Module structure

Number of analog and digital signals

Presets the number of the configurable analog/digital signals in the signal tables. A maximum of 1000 signals is possible.

The description of the module type-specific IEC 61850 settings can be found in the chapters [↗ MMS module](#), page 16 and [↗ GOOSE module](#), page 18

3.4.6.1 MMS module

The MMS module offers communication as per IEC 61850 manufacturing messaging specification (MMS) protocol.

The module supports 3 services:

1. Cyclical reading of individual data attributes
2. Cyclical reading of data sets
Data sets are groups of data attributes that can be read together using a single command.
3. Receiving of reports when changing the value within a data set
This is the most efficient method of data transmission, since no cyclical data transmission occurs.

MMS module (6)	
MMS General Analog Digital	
▼ Basic	
Module Type	IEC 61850 device\MMS module
Locked	False
Enabled	True
Name	MMS module
Module No.	6
Timebase	10 ms
Use name as prefix	False
▼ IEC 61850	
Report Control Block	None
Data Set	Dynamic
Logical Device for Data Set	
Update time	100 ms
Use external timestamp	False
▼ Module Layout	
No. analog signals	32
No. digital signals	32
Name The name of the module.	
Select symbols	

Basic settings

See [General Module Settings](#), page 15

IEC 61850

Report Control Block

- None: No report control block is used. The data is queried cyclically (see above service 1 and 2).
- Preconfigured report control block (only visible with server connection): The server transmits data changes using the report control block. There is no need to poll the data. This is more efficient.

Data Set

Selection of the data sets to be used:

- None: In this case, no data set is used and the data attributes to which the signals refer are read individually (see above service 1), relatively slow.
- Dynamic: A new data set will be created, which contains all the data attributes referenced by the signals.
- Configured data set (only visible with server connection): The preconfigured data set will be read and the data attributes referenced by the signals will be extracted from it.

Logical Device for the Data Set

Select the logical device you want to create the dynamic data set in. Can only be selected with data set = dynamic.

Update time

The update time determines how fast ibaPDA tries to read data from the IEC 61850 device. The actual resulting update time can be higher depending on the load of the device. Please check the diagnostic overview for measured update rates as overload will result in lost samples.

Use external timestamp

By default the data is resampled by *ibaPDA*. This way equidistant data is generated that is synchronized to data coming from other sources. Alternatively you can use the external timestamp from the IEC 61850 device. In this case you will have to select the "As is" profile in the data storage to store the data as non-equidistant data with the external timestamp. When calculations are done with the data then it will be resampled.

3.4.6.2 GOOSE module

The GOOSE module offers communication as per IEC 61850 Generic Object Oriented Substation Events (GOOSE) protocol.

GOOSE module (7)															
<div style="display: flex; border-bottom: 1px solid gray;"> GO General Analog Digital </div>															
<div style="border: 1px solid gray; padding: 5px;"> <div style="background-color: #f0f0f0; padding: 2px;">Basic</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Module Type</td><td>IEC 61850 device\GOOSE module</td></tr> <tr><td>Locked</td><td>False</td></tr> <tr><td>Enabled</td><td>True</td></tr> <tr style="background-color: #e0f0ff;"><td>Name</td><td>GOOSE module</td></tr> <tr><td>Module No.</td><td>7</td></tr> <tr><td>Timebase</td><td>10 ms</td></tr> <tr><td>Use name as prefix</td><td>False</td></tr> </table> </div>		Module Type	IEC 61850 device\GOOSE module	Locked	False	Enabled	True	Name	GOOSE module	Module No.	7	Timebase	10 ms	Use name as prefix	False
Module Type	IEC 61850 device\GOOSE module														
Locked	False														
Enabled	True														
Name	GOOSE module														
Module No.	7														
Timebase	10 ms														
Use name as prefix	False														
<div style="border: 1px solid gray; padding: 5px;"> <div style="background-color: #f0f0f0; padding: 2px;">IEC 61850</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>GOOSE Control Block</td><td>None</td></tr> <tr><td>Data Set</td><td>None</td></tr> <tr><td>Use external timestamp</td><td>False</td></tr> </table> </div>		GOOSE Control Block	None	Data Set	None	Use external timestamp	False								
GOOSE Control Block	None														
Data Set	None														
Use external timestamp	False														
<div style="border: 1px solid gray; padding: 5px;"> <div style="background-color: #f0f0f0; padding: 2px;">Module Layout</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>No. analog signals</td><td>32</td></tr> <tr><td>No. digital signals</td><td>32</td></tr> </table> </div>		No. analog signals	32	No. digital signals	32										
No. analog signals	32														
No. digital signals	32														
<div style="border: 1px solid gray; padding: 5px; min-height: 100px;"> <p>Name</p> <p>The name of the module.</p> </div>															
Select symbols															

Basic settings

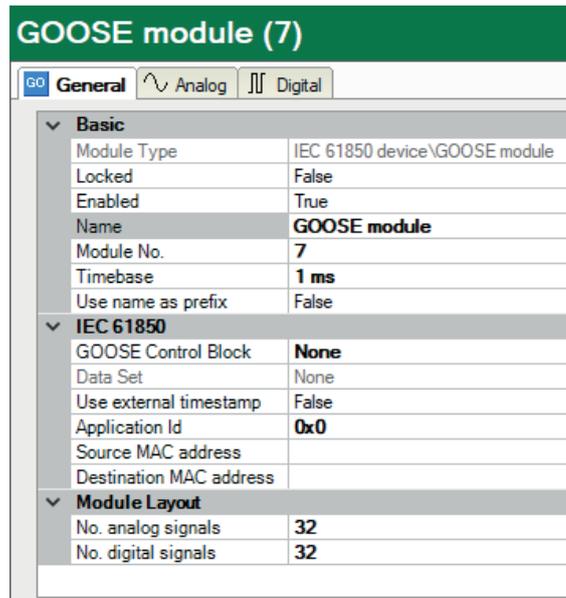
See [↗ General Module Settings, page 15](#)

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GOOSE Control Block

Selection of the GOOSE control block to be used that is preconfigured on the server. A GOOSE control block must always be selected. It is essential to select a GOOSE control block that is not already used by another client.

If the IEC 61850 device does not support MMS communication (see settings in the *Connection* tab), the fields Application ID, Source MAC address, Destination MAC address.



If you have an address book, you can select the GOOSE control block from the address book. The application ID is filled in automatically. If you do not have an address book, you must enter the GOOSE control block and the application ID. Optionally, you can also configure a source and/or destination MAC address to identify the correct GOOSE messages.

You can also leave the field blank if the GOOSE messages can be identified, for example, by the application ID, the source MAC address, or the destination MAC address.

Data set

The data set that is sent via GOOSE.

Use external timestamp

By default the data is resampled by *ibaPDA*. This way equidistant data is generated that is synchronized to data coming from other sources. Alternatively you can use the external timestamp from the IEC 61850 device. In this case you will have to select the "As is" profile in the data storage to store the data as non-equidistant data with the external timestamp. When calculations are done with the data then it will be resampled.

3.4.6.3 File module

According to standard IEC 61850-7-2, IEC 61850 devices can create COMTRADE files when a trigger occurs. The file module enables *ibaPDA* to download, rename and copy these files from an IEC 61850 device to a destination directory. You can configure the file module as sub module under an IEC 61850 device.

File module – Basic settings

See [↗ General Module Settings](#), page 15

File module – Files tab

On this tab, you can make the settings for the file handling.

File module (0)

Fi General
Files
^ Analog

Source

Check for new files: Every s
 On rising edge of ⚠ Unassigned

Directory to monitor:

Destination

Base directory:

Sub directory: Use module names as directory names
 Custom:

Actual directory:

File name: Use source file name
 Custom:

Source	Format
File time (local)	yyyyMMdd_HHmms

Test file name:

Actual file name:

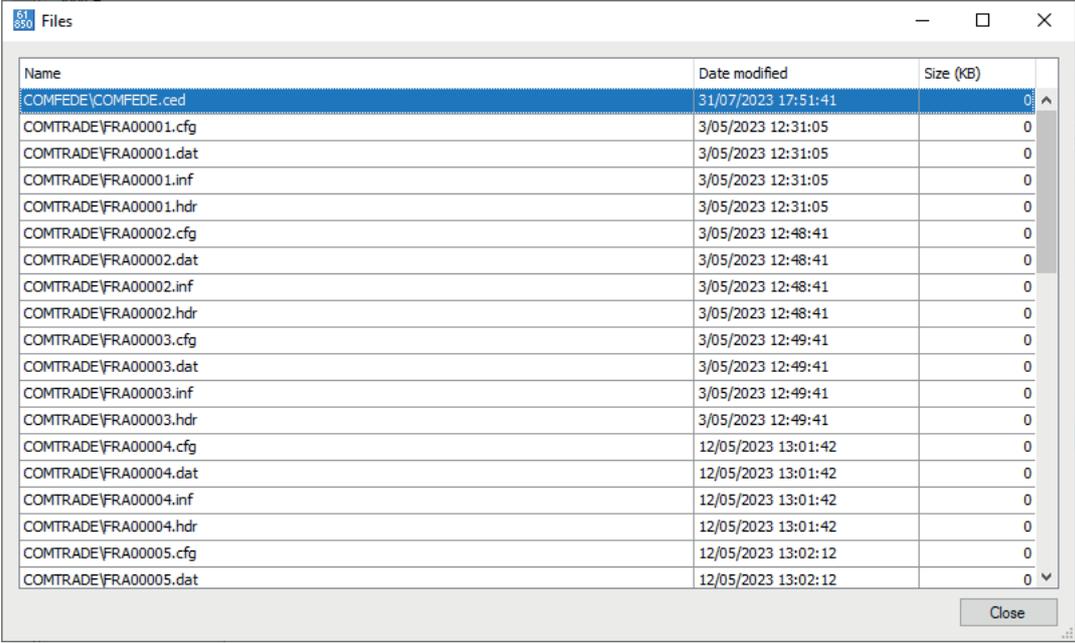
Source

Here you can set when a scan for new files should be performed. If you want to scan periodically, you can set the scan interval, given in seconds, here. Alternatively, you can trigger a scan by a rising edge of a trigger signal. The drop-down list offers all digital signals in the signal tree. Select the desired signal here. A reasonable choice is a signal which indicates when the file creation is finished on the IEC 61850 device, e.g. the *RcdMade.stVal* data attribute of the RDRE logical node.

Furthermore, enter the name of the directory to be monitored for new files on the IEC 61850 device.

<Browse files on device> button

Use this button to get an overview of the current files on the device. This might look as follows:



Name	Date modified	Size (kB)
COMFEDE\COMFEDE.ced	31/07/2023 17:51:41	0
COMTRADE\FRA00001.cfg	3/05/2023 12:31:05	0
COMTRADE\FRA00001.dat	3/05/2023 12:31:05	0
COMTRADE\FRA00001.inf	3/05/2023 12:31:05	0
COMTRADE\FRA00001.hdr	3/05/2023 12:31:05	0
COMTRADE\FRA00002.cfg	3/05/2023 12:48:41	0
COMTRADE\FRA00002.dat	3/05/2023 12:48:41	0
COMTRADE\FRA00002.inf	3/05/2023 12:48:41	0
COMTRADE\FRA00002.hdr	3/05/2023 12:48:41	0
COMTRADE\FRA00003.cfg	3/05/2023 12:49:41	0
COMTRADE\FRA00003.dat	3/05/2023 12:49:41	0
COMTRADE\FRA00003.inf	3/05/2023 12:49:41	0
COMTRADE\FRA00003.hdr	3/05/2023 12:49:41	0
COMTRADE\FRA00004.cfg	12/05/2023 13:01:42	0
COMTRADE\FRA00004.dat	12/05/2023 13:01:42	0
COMTRADE\FRA00004.inf	12/05/2023 13:01:42	0
COMTRADE\FRA00004.hdr	12/05/2023 13:01:42	0
COMTRADE\FRA00005.cfg	12/05/2023 13:02:12	0
COMTRADE\FRA00005.dat	12/05/2023 13:02:12	0

<Reprocess files> button

If you click on this button then all files, which are available on the IEC 61850 device, will be processed again. This may be useful if you have changed the destination settings.

Destination

In the *Destination* section you set the directory where the files should be transferred to and how they should be named.

The path of the destination directory consists of two parts:

- **Base directory**
The directory as it is configured in the settings of the interface *IEC 61850 Client*, in the field *IEC61850-7-2 files destination path*. Click on the <Edit> button to get there directly.
- **Sub directory**
The name of the sub directory can be created from the module name or manually. Select the desired option and enter a directory name if needed. If you enter a relative directory name (e.g. Test) in the *Custom* field, then this directory will be created relatively to the base directory. If you enter a full path (e.g. C:\Test), then the base directory will be ignored. UNC-path entries are permitted.

The line *Actual directory* shows the name according to the settings.

The name of the source file or a customized name can be used for the destination file. You can assemble the customized name from different parts.

Use the table below to configure the file name.

Next to the table, there are buttons with the following features:

	Add a new part to the file name. By clicking on this button you get a menu for selecting the desired information type (see below).
	Delete selected row.
	Move selected row up in sequence. The icon is not available (gray), if the operation is not possible.
	Move selected row down in sequence. The icon is not available (gray), if the operation is not possible.

The sequence of the parts in the table from top to bottom is transferred to the file name from left to right. A later change of sequence in the table will respectively change the file name.

You can insert the following information into the file name:

Information	Description
File time (local)	Inserts the local file time. Open the drop-down list in the <i>Format</i> column to select the preferred time format. File time (local) is set by default in the first row. After you have added more information you can shift file time (local) to another position or delete it.
File time (UTC)	Inserts the file time as UTC value. Open the drop-down list in the <i>Format</i> column to select the preferred time format.
Original file name	Inserts a part of or the complete file name of the source file. A little drop-down list in the <i>Format</i> column helps. For single characters enter a single number (index). "0" refers to the first character in the file name. For multiple consecutive characters enter a range. "0-2", for example, will use the first three characters of the file name. In order to use the complete file name select <i>Full</i> in the drop-down list.
Static text	Any text, which remains unchanged. Allowed are all characters, which can be used in file names.

In order to check how the final file name would look like, you can enter a file name as it would be on the IEC 61850 device, in the *Test file name* field. The line *Actual file name* then shows the result.

File module – Analog tab

The module has two diagnostic signals:

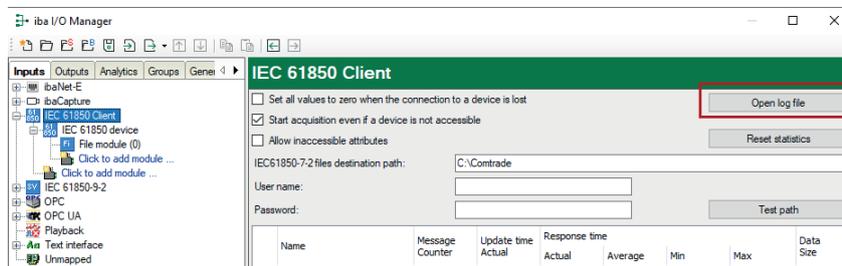
- Number of files downloaded
This is a 32 bit integer counter (DWORD), that is incremented with each downloaded file.
- Last retrieved file
This is a text signal (STRING) containing the full name of the last file, which was saved in the destination directory.

The signals and their actual values are shown in the *Analog* tab of the IEC 61850 device module.

Log file

The log file of the IEC 61850 client interface will contain entries for each file that is transferred and for any error that might have occurred.

Click on the <Open log file> button in the IEC 61850 client interface dialog to view the log file.



3.4.7 Signal configuration

In the *Analog* and *Digital* tabs, the variables to be measured are configured.

The length of the signal table or the number of signals per table is determined in the general settings of the modules, module structure (see ↗ *General Module Settings*, page 15).

Note



Observe the maximum permissible signal number based on your license.

Note



Take into consideration that the number of signals, which are read by a device, influences the minimum achievable read cycle. The more signals recorded, the slower the reachable reading cycle.

Selection of measuring signals

You have two options to select the measuring signals:

1. Click on the *Select symbols* hyperlink in the *General* tab of the module.

MMS module (6)	
<div style="display: flex; justify-content: space-between;"> MMS General Analog Digital </div>	
Basic	
Module Type	IEC 61850 device\MMS module
Locked	False
Enabled	True
Name	MMS module
Module No.	6
Timebase	10 ms
Use name as prefix	False
IEC 61850	
Report Control Block	None
Data Set	Dynamic
Logical Device for Data Set	
Update time	100 ms
Use external timestamp	False
Module Layout	
No. analog signals	32
No. digital signals	32
Name	The name of the module.
Select symbols	

Use the mouse to click on the link and open the symbol browser.

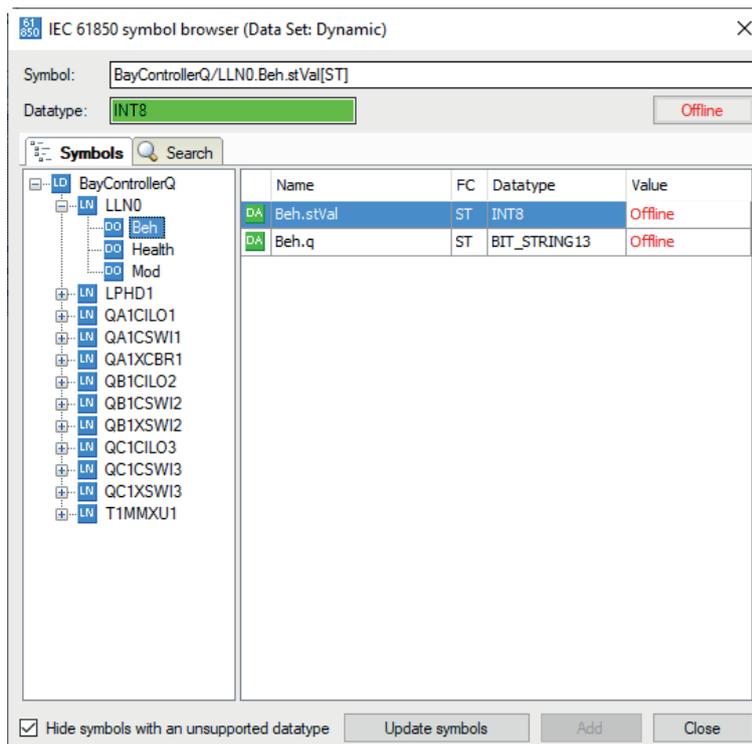
2. Click on a field in the “Symbol” column in the *Analog* or *Digital* tab.

The icon  will become visible. A click on the icon opens the symbol browser.

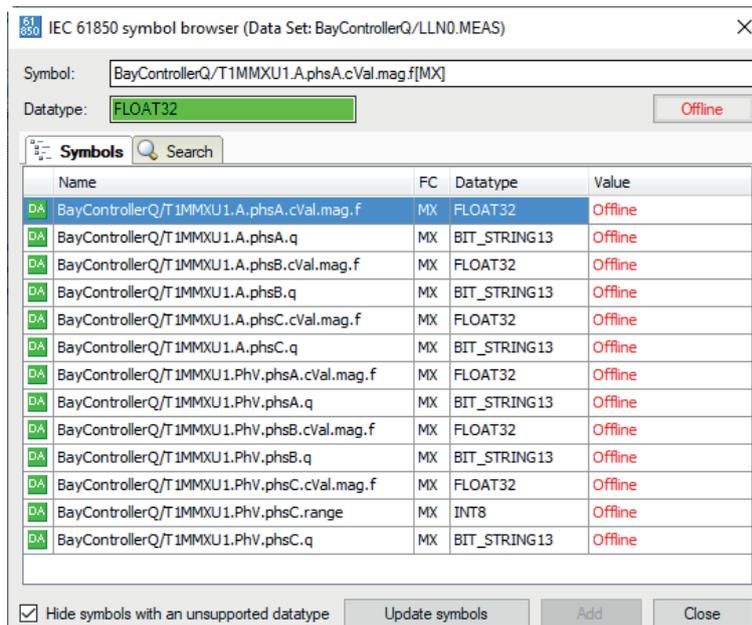
If you open the symbol browser via the hyperlink in the *General* tab, all available signals are contained there. Depending on whether you select an analog or digital signal in the browser’s signal tree, the *Analog* or *Digital* tab will be opened in the background. If you add a signal, it will be inserted in the next open line of the matching signal table.

If you have selected “None” or “Dynamic” under *Data Set* in the general module properties, you will be shown a tree in the symbol browser with all logical devices, nodes and data objects of the server.

The table view shows the data attributes of the selected object. Use the <Offline> button to switch the system <Online>. The current values can then be shown here. In the event of error indications, see chapter [➤ Error messages](#), page 36.



If you have selected a preconfigured data set in the general module properties under *Data Set* in the symbol browser you will see a flat view of all of the assigned data objects of the data set.



You can select individual or several signals in the signal tree.

Click on <Add> to add them to the corresponding analog or digital signal table. If you select an individual signal, then the next signal is marked after clicking on <Add>. In this way, you can add several successive signals by pressing <Add> several times. You can also add a signal to the signal table by double clicking on the signal.

You can also search by symbol name in the *Search* tab of the symbol browser. The signal tree of the search result can be operated like the complete signal tree.

Note

By means of the checkbox “Hide symbols with an unsupported datatype” you can hide all not supported data types.

Description of the tables

The analog signals to be measured must be entered in the signal tables with the complete name (symbol) and the data type. This is done automatically when selecting via the symbol browser. You can assign any signal name.

The screenshot shows the 'iba I/O Manager' window with the 'MMS module (6)' configuration. The 'Analog' tab is active. The table below shows the configuration for the analog inputs:

	Name	Symbol	DataType	Active
0	BayControllerQ/QA1CSWI1.Pos.origin.orCat[ST]	BayControllerQ/QA1CSWI1.Pos.origin.orCat[ST]	SINT	<input type="checkbox"/>
1	BayControllerQ/QA1CSWI1.Pos.stVal[ST]	BayControllerQ/QA1CSWI1.Pos.stVal[ST]	BYTE	<input type="checkbox"/>
2			FLOAT	<input type="checkbox"/>
3			FLOAT	<input type="checkbox"/>
4			FLOAT	<input type="checkbox"/>
5			FLOAT	<input type="checkbox"/>
6			FLOAT	<input type="checkbox"/>
7			FLOAT	<input type="checkbox"/>
8			FLOAT	<input type="checkbox"/>
9			FLOAT	<input type="checkbox"/>
10			FLOAT	<input type="checkbox"/>

The screenshot shows the 'iba I/O Manager' window with the 'MMS module (6)' configuration. The 'Digital' tab is active. The table below shows the configuration for the digital inputs:

	Name	Symbol	Act...
0	BayControllerQ/QA1CSWI1.Pos.stSeld[ST]	BayControllerQ/QA1CSWI1.Pos.stSeld[ST]	<input type="checkbox"/>
1	BayControllerQ/QA1CILO1.EnaOpn.stVal[ST]	BayControllerQ/QA1CILO1.EnaOpn.stVal[ST]	<input type="checkbox"/>
2			<input type="checkbox"/>
3			<input type="checkbox"/>
4			<input type="checkbox"/>
5			<input type="checkbox"/>
6			<input type="checkbox"/>
7			<input type="checkbox"/>
8			<input type="checkbox"/>
9			<input type="checkbox"/>
10			<input type="checkbox"/>

The following data types are supported:

- BOOLEAN
- Enums
- Coded Enums (e.g. Check, Dbpos)
- Int8
- Int8U
- Int16
- Int16U
- Int32
- Int32U
- Int64, see chapter ↗ *Int64*, page 27
- Float32
- Float64
- Quality, see chapter ↗ *Quality*, page 28
- Timestamp (UTC_Time, BINARY_TIME), see chapter ↗ *Timestamp*, page 29

Special note for GOOSE module without selected GOOSE control block

GOOSE module (57)						
GO General Analog Digital						
	Name	Unit	Gain	Offset	Index	DataTy... Active
0	TestLD1/GGIO0.DPCSO1.stVal[ST]		1	0	2,0	BYTE <input checked="" type="checkbox"/>
1			1	0	1	FLOAT <input type="checkbox"/>

If no GOOSE control block is used (MMS communication is not supported), then the signal is not assigned via the symbol, but via the index of the data in the telegram. The data type must also be selected manually.

Index 0 means the first element in the dataset, *index 1* the second element, If an element in the dataset is a structure, it is also necessary to define which element from the structure should be used. This is done via "Index,Subindex".

Example: Index 4,2 means the fifth element in the dataset. This is a structure, the third subelement of the structure is used.

3.4.7.1 Int64

Due to the internal data handling in *ibaPDA* conversion from Int64 to Double is done. Therefore, values at the end of the value range may cause a data deviation.

3.4.7.2 Quality

The data types *Quality* and *Coded Enums* are bit strings. Each bit or sometimes two bits describe a status.

Bit 0	00 -> good
Bit 1	01 -> invalid 10 -> none 11 -> questionable
Bit 2	Overflow
Bit 3	OutOfRange
Bit 4	BadReference
Bit 5	Oscillatory
Bit 6	Failure
Bit 7	OldData
Bit 8	Inconsistent
Bit 9	Inaccurate
Bit 10	Source (0 -> process, 1 -> substituted)
Bit 11	Test
Bit 12	OperatorBlocked

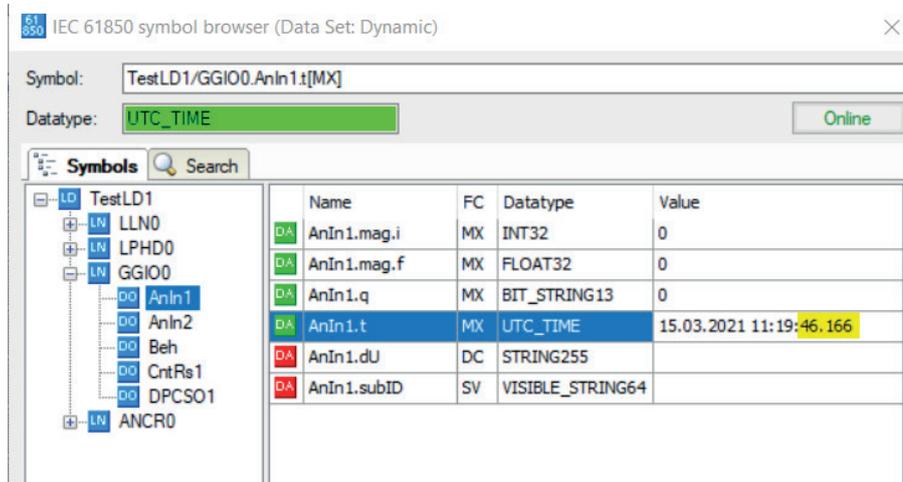
In *ibaPDA*, the values are displayed as decimal value in the trend graph, for example. For a better readability, a representation by means of 16 bit decoder, which represents the individual bits, is clearer.

16 bit decoder (8)	
Bit	Value
0	Validity (Good = 00, Invalid = 01, Reserved = 10, Questionable = 11)
1	Validity
2	Overflow
3	Out Of Range
4	Bad Reference
5	Oscillatory
6	Failure
7	Old Data
8	Inconsistent
9	Inaccurate
10	Source (Process= 0, Substitued = 1)
11	Test
12	Operator Blocked
13	na
14	na
15	na

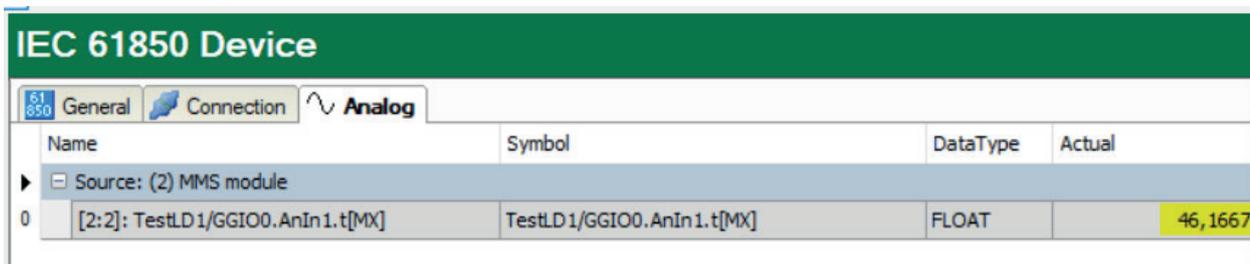
3.4.7.3 Timestamp

The IEC61850 data type *Timestamp* is an 8 byte value where the first 4 bytes indicate the seconds since 1/1/1970 00:00:00. The next 3 bytes represent the fraction of a second. The last byte contains various quality flags (including time accuracy).

The timestamp is displayed in the IEC 61850 Symbol Browser in the format "dd.mm.yyyy hh:m-m:ss.ms".



ibaPDA does not internally support a *Timestamp* data type. In order to still be able to measure time information, e.g. for checking the latency period and the jitter of IEC 61850 data, the seconds and milliseconds fraction is acquired from a *Timestamp* as a float value.

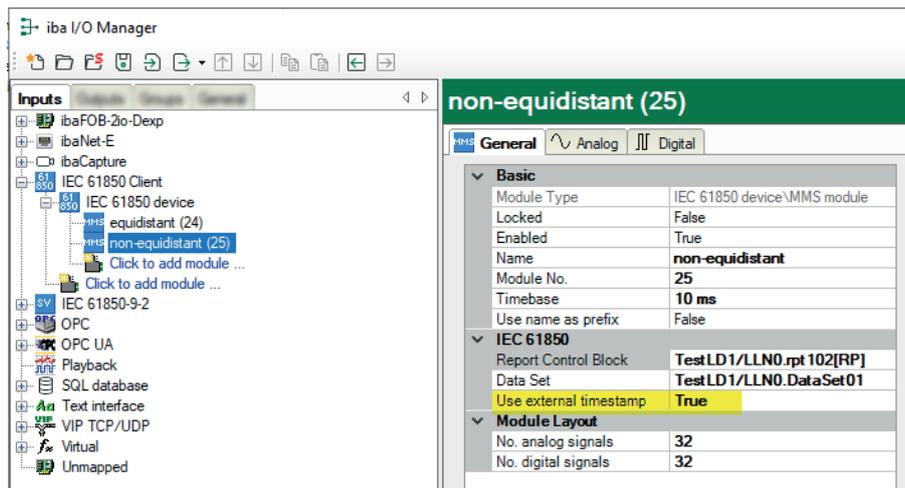


3.4.7.4 Recording of non-equidistant data

With the function of non-equidistant data acquisition, the signals in the data file are saved with the timestamp which is sent from the IEC 61850 server. This special function is particularly useful when it is important to know exactly when a new data point is received. For example, for cascaded circuit breakers to know which one triggered first.

For this purpose, IEC 61850 uses the possibility, that a measuring value or state value includes a quality value and a timestamp. This triple always belongs together. All other signals, like additional information, have no own timestamp and can only be recorded as equidistant data, according to the IEC 61850 standard.

To use non-equidistant data acquisition, the option *Use external timestamp* must be set to "True" in the MMS or GOOSE module.



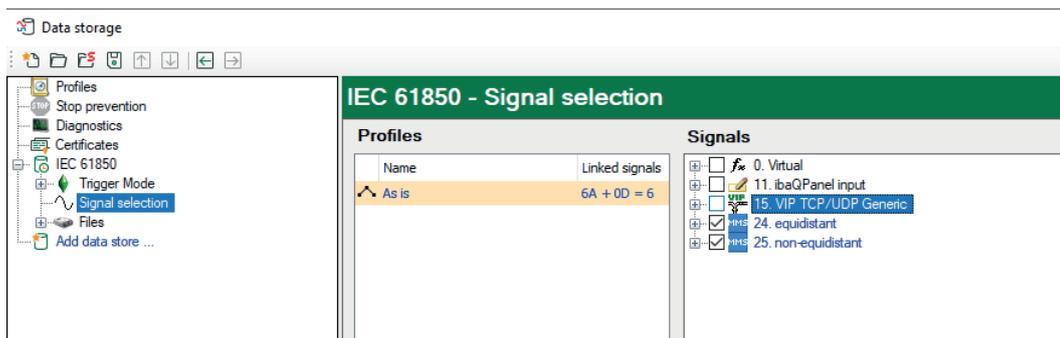
Display in the signal table

A new column *Time symbol* is added in the signal table. A time stamp can additionally be defined for the signals in this column. When selecting a symbol, it is checked whether an associated timestamp exists in the data model for the signal. If one is defined the timestamp is automatically added. If a time stamp is defined for the signal, it is sampled non-equidistantly. All other signals without an additional timestamp are recorded equidistantly.

Name	Unit	Gain	Offset	Symbol	Time symbol	DataType	Active
0 TestLD1/GGIO0.DPCSO1.stVal[ST]		1	0	TestLD1/GGIO0.DPCSO1.stVal[ST]	TestLD1/GGIO0.DPCSO1.t[ST]	BYTE	<input checked="" type="checkbox"/>
1		1	0			DOUBLE	<input checked="" type="checkbox"/>
2 TestLD1/GGIO0.AnIn2.mag.f[MV]		1	0	TestLD1/GGIO0.AnIn2.mag.f[MV]	TestLD1/GGIO0.AnIn2.t[MV]	DOUBLE	<input checked="" type="checkbox"/>
3		1	0			FLOAT	<input type="checkbox"/>
4		1	0			FLOAT	<input type="checkbox"/>
5		1	0			FLOAT	<input type="checkbox"/>

Data store configuration

Additionally, the signals must be added to a time-based data store. The “As is” and the “Time” profile can be used. A data storage can contain both equidistant and non-equidistant signals.

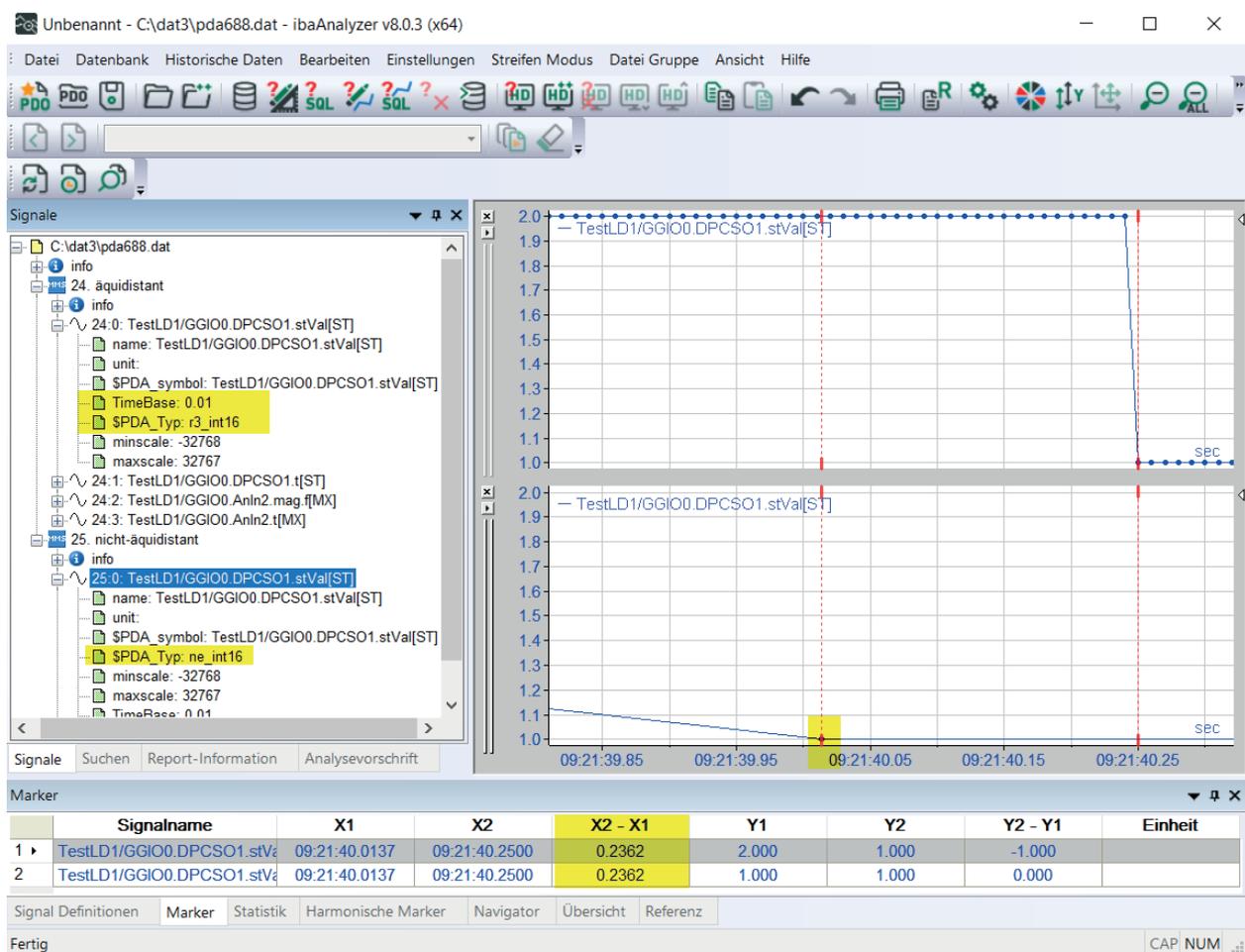


Display in ibaAnalyzer

The example in the figure below shows the difference between equidistant (module 24) and non-equidistant (modul 25) signals in *ibaAnalyzer*.

When recording non-equidistant data only one measuring value is written to the data file when a report or GOOSE message is received. This measuring value is written with the original time-stamp to the data file, which is sent from the IEC 61850 server.

Additional information is added for each signal in the data file, e.g. the signal type \$PDA_Typ. Based on the signal type, *ibaAnalyzer* detects whether the signal is equidistant (r3_...) or non-equidistant (ne_...).

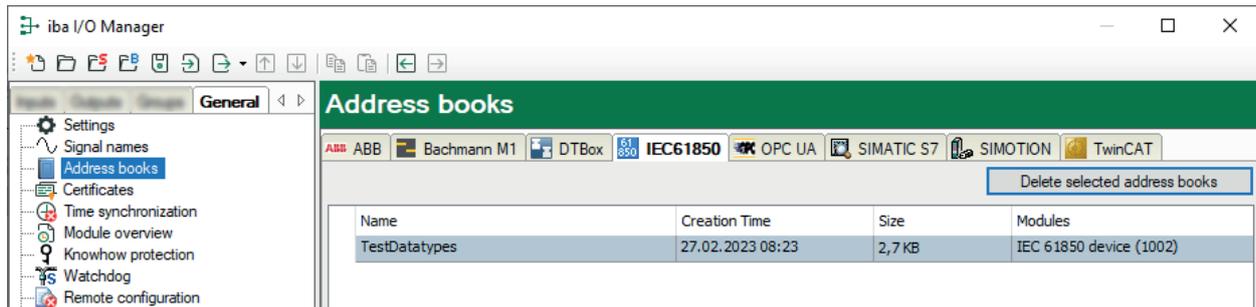


Special aspects when recording non-equidistant signals

1. The signals are only recorded in the data file as non-equidistant data. In all other places (e.g., in virtual signals, in trendgraphs) the signals are used equidistantly.
2. In order to record signals non-equidistantly, the dataset on server-side must be created with data objects (like XCBR.Pos) and not with data attributes (like XCBR.Pos.stVal). If data attributes are used in the dataset only the changed value is sent in the telegram and not the timestamp. This is also the case if dynamic datasets are used. The behaviour of the data objects and data attributes in a dataset is explained in the standard IEC 61850-7-2 chapter 17.2.3.2.2.9.
3. Not all signals have an associated timestamp and these signals must be sampled as equidistant signals. The standard IEC61850-7-3 describes, which signals have an associated timestamp.

3.4.8 Address books

The IEC 61850 address books are listed in the *General* tab of the *Address books* node.



The *Modules* column displays the modules that use a specific address book. You can double-click on it to jump to this module.

<Delete selected address books>

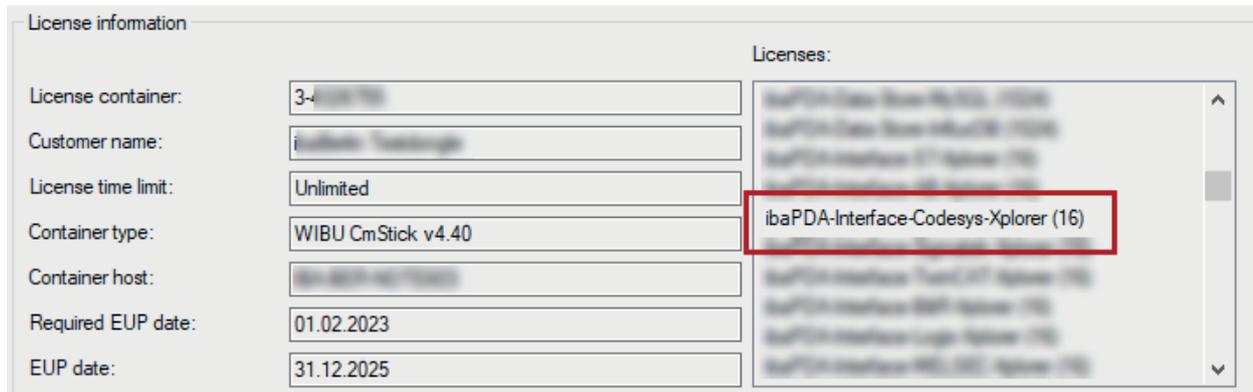
Selected address books are deleted from the directory of the *ibaPDA* server.

4 Diagnostics

4.1 License

If the interface is not displayed in the signal tree, you can either check in *ibaPDA* in the I/O Manager under *General – Settings* or in the *ibaPDA* service status application whether your license for this interface has been properly recognized. The number of licensed connections is shown in brackets.

The figure below shows the license for the *Codesys Xplorer* interface as an example.



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.

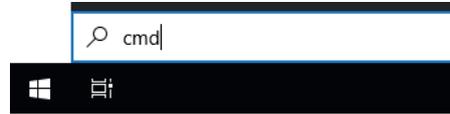
Examples:

- [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.

```
Administrator: Command Prompt
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 for192.168.1.10:
    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.

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>ping 192.168.1.10

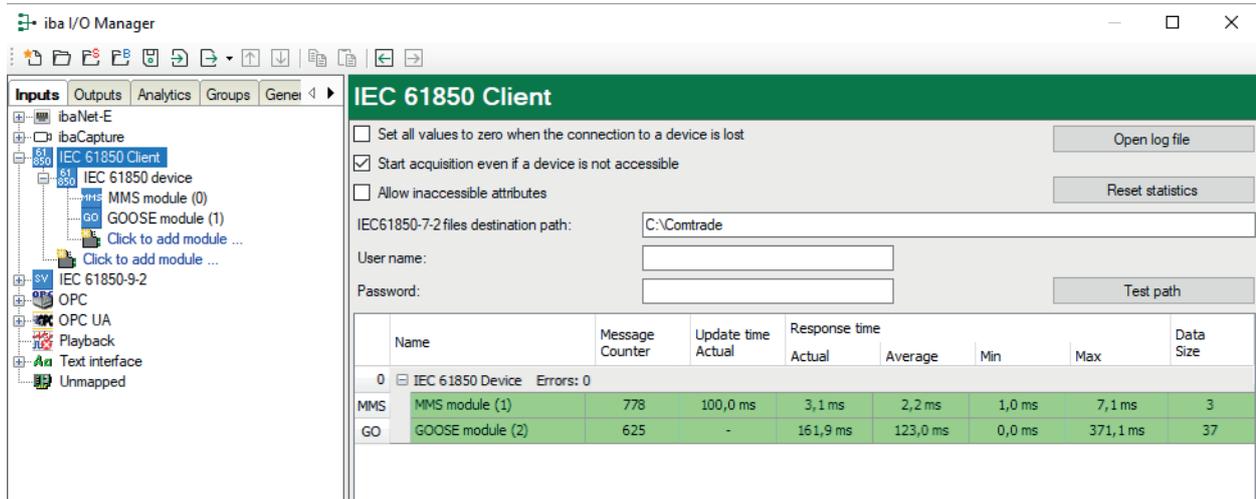
Pinging 192.168.1.10 with 32 bytes of data:
Reply from 192.168.1.10: Destination host unreachable.

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

C:\Windows\system32>
```

4.4 Connection table

All Ethernet-based interfaces have a table available in the I/O manager that shows the status of each connection. Each line represents one connection.



The modules for which the connections exist are identified by name in the first column (left) grouped by IEC 61850 devices.

The telegram counter is a continuous counter that is incremented by one with each received telegram. The response time is the time that a device requires to answer a data request. In the case of cyclical transmission, this corresponds to the time to read the data. In the case of MMS reports or GOOSE events, this corresponds to the time between events. The data size is the net data size of the transmitted telegrams.

Click the <Reset counters> 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 (only for MMS and no report control block).
Red	The connection has failed or was interrupted

Table 1: Meaning of background colors of the connection table

4.5 Error messages

The following error messages may be shown:

DATA_ACCESS_ERROR_NO_RESPONSE = -2, /* for server internal purposes only! */

DATA_ACCESS_ERROR_SUCCESS = -1

DATA_ACCESS_ERROR_OBJECT_INVALIDATED = 0

DATA_ACCESS_ERROR_HARDWARE_FAULT = 1

DATA_ACCESS_ERROR_TEMPORARILY_UNAVAILABLE = 2

DATA_ACCESS_ERROR_OBJECT_ACCESS_DENIED = 3

DATA_ACCESS_ERROR_OBJECT_UNDEFINED = 4

DATA_ACCESS_ERROR_INVALID_ADDRESS = 5

DATA_ACCESS_ERROR_TYPE_UNSUPPORTED = 6

DATA_ACCESS_ERROR_TYPE_INCONSISTENT = 7, /* A data type is inconsistent. Please check the data types to ensure they are correct.*/

DATA_ACCESS_ERROR_OBJECT_ATTRIBUTE_INCONSISTENT = 8

DATA_ACCESS_ERROR_OBJECT_ACCESS_UNSUPPORTED = 9

DATA_ACCESS_ERROR_OBJECT_NONE_EXISTENT = 10

DATA_ACCESS_ERROR_OBJECT_VALUE_INVALID = 11

DATA_ACCESS_ERROR_UNKNOWN = 12

5 Support and contact

Support

Phone: +49 911 97282-14

Email: support@iba-ag.com

Note



If you need support for software products, please state the number of the license container. For hardware products, please have the serial number of the device ready.

Contact

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