See the Big Picture

ibaPDA-IEC61850-Server

IEC 61850 Server for Measurement Data

Manual

Issue 1.0

Measurement Systems for Industry and Energy

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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, discrepancies cannot be ruled out, and we do not provide guarantee for complete conformity. However, the information furnished in this publication is updated regularly. Required corrections are contained in the following regulations or can be downloaded on the Internet.

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

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1.0	08/2019	First edition	St	7.0

Content

1 About this manual

This document describes the function and application of the IEC 61850 server in *ibaPDA*.

1.1 Target group and previous knowledge

This documentation is aimed at qualified professionals, who are familiar with handling electric 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.

In particular, this documentation is intended for personnel involved in the engineering, testing, commissioning or maintenance of the respective programmable logic controllers and communication systems as well as protection and control technology in electric switchgear. For handling the IEC 61850 server in *ibaPDA,* the following previous knowledge is required and/or useful:

- Windows operating system
- Basic knowledge of *ibaPDA*
- Knowledge of IEC 61850 communication

1.2 Notations

In this manual, the following notations are used:

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

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 required to use the function IEC 61850 server:

- *ibaPDA v7.0.0* or higher
- License *ibaPDA-IEC61850-Server*
- Network connection to one or more IEC61850 clients

Other documentation

Further requirements for the respective computer hardware and the supported operating systems can be found in *ibaPDA* documentation.

Note

It is advisable to place the IEC 61850 communications for data acquisition on a separate network to avoid interference from the Ethernet data traffic between *ibaPDA* and other network nodes (file servers, data file requirements, etc.), which may affect the IEC 61850 data telegrams.

License information

Order no.	Product name	Description
30.670052	ibaPDA-IEC61850-Server	Extension license for an *ibaPDA* system which adds the function: IEC 61850 server

Table 1: Available IEC61850 server licenses

3 IEC 61850 server

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 switchgears of medium and high-voltage technology. The standard defines communication structures and an object-related data model. The devices used, so-called IED (Intelligent Electronic Device), can thus transmit their properties and communicate with each other.

ibaPDA offers an integrated IEC 61850 server, which can publish signals from *ibaPDA*. Signals in *ibaPDA* are mapped on attributes in the data model. The data structure described in IEC 61850 generally consists of 5 hierarchy levels:

- Server
- Logical Device, (LD)
- Logical Node, (LN)
- Data Object, (DO)
- Data Attribute, (DA)

It is possible to create an own data model from logical nodes, data sets and report control blocks. *ibaPDA* supports the following logical node types:

- GGIO (Generic Process I/O)
- IARC (Archiving)
- LCCH (Physical Communication Channel Supervision)
- LPHD (Physical Device Information)
- LTMS (Time Master Supervision)
- RDRE (Disturbance Recorder Function)

The IEC 61850 server supports MMS communication, either through polling, buffered and unbuffered report control blocks.

Up to 16 client connections are permissible at the same time.

3.2 System topology

The following drawing gives an overview of a possible configuration.

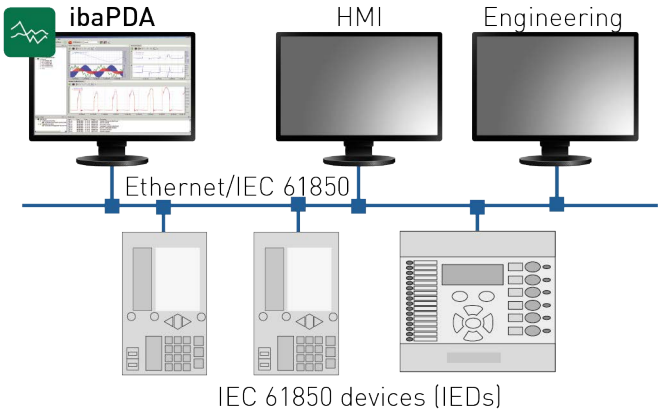

Fig. 1: Possible IEC 61850 network topology

3.3 Configuration and engineering ibaPDA

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

You will see the *IEC 61850 server* node in the signal tree under *General*.

Fig. 2: IEC 61850 server in the I/O manager

Select the node and then select the *Configuration* tab on the right.

3.3.1 Configuration tab

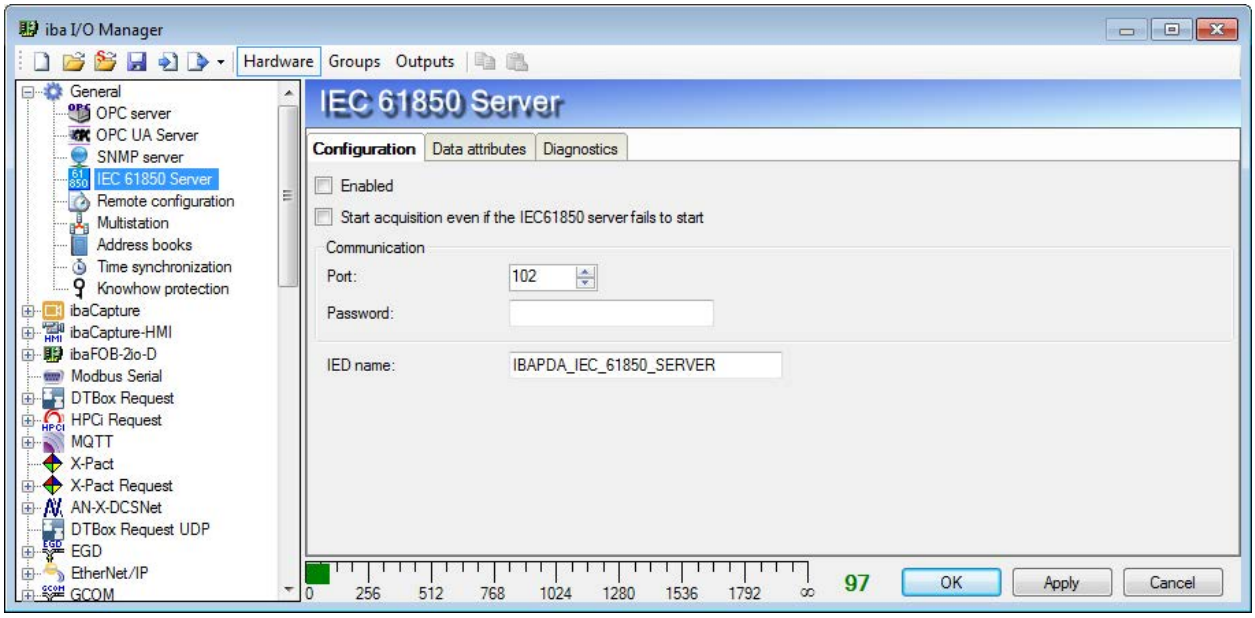

Fig. 3: IEC 61850 server, Configuration tab

Make the following settings in the *Configuration* tab:

Enabled
Check this box to enable the IEC 61850 server function.

Start acquisition even if the IEC 61850 server fails to start
If this option is enabled, the acquisition will start even if the IEC 61850 server cannot be started. A warning is issued in the validation dialog. If the system has been started without an IEC 61850 server, *ibaPDA* will periodically try to start the IEC 61850 server. If the IEC 61850 server has not been started, no signals will be published and *ibaPDA* will not be visible as an IEC 61850 server in the network.

Port
The port the IEC 61850 server uses to communicate. The default value is 102.

Note

The default IEC 61850 port 102 is simultaneously the default port for the S7 communication. If Siemens software, such as Step7, is installed on the *ibaPDA* PC, the user will likely have problems, because the port is already being used by some Siemens software components. In this case, either use a different port for the IEC 61850 server or uninstall the Siemens software from the *ibaPDA* PC.

Password
You can assign a password here.

IED Name
The default name is IBAPDA_IEC_61850_SERVER. The IED name can be changed, however. This may be important if several *ibaPDA* IEC 61850 servers are configured in one IEC client so that

they can be differentiated. Otherwise the *ibaPDA* IEC 61850 servers all appear there with the same name.

3.3.2 Data attributes tab

The actual content published by the IEC 61850 server is configured in the *Data attributes* tab.

The LLN0 node is available by default and contains general information. The data objects *Mod*, *Beh*, *Health* and *NamPlt* of this node are read-only and contain default values.

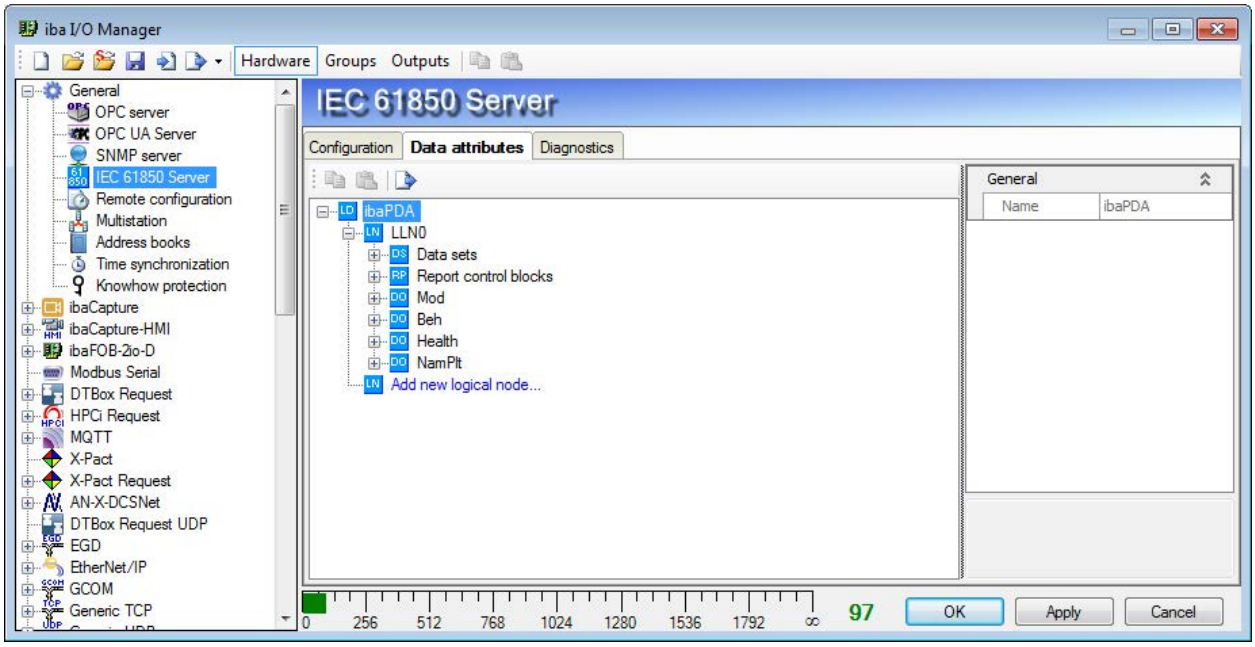

Fig. 4: Logical node LLNO

To publish data, you can create a separate data model using logical nodes. To do this, click on the link *Add new logical node...*. A dialog opens with the node types available in *ibaPDA*.

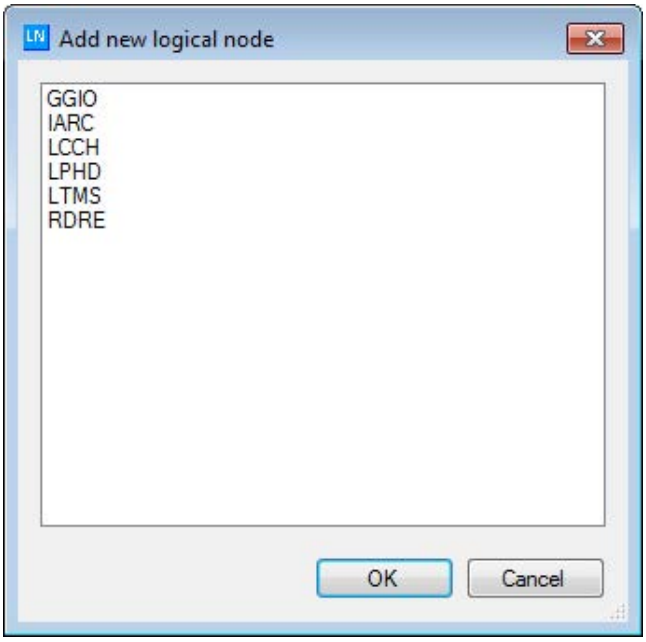

Fig. 5: Select node type

Select a node and confirm by pressing <OK>. The new logical node is added in the configuration tree. It contains the mandatory data objects and the mandatory attributes.

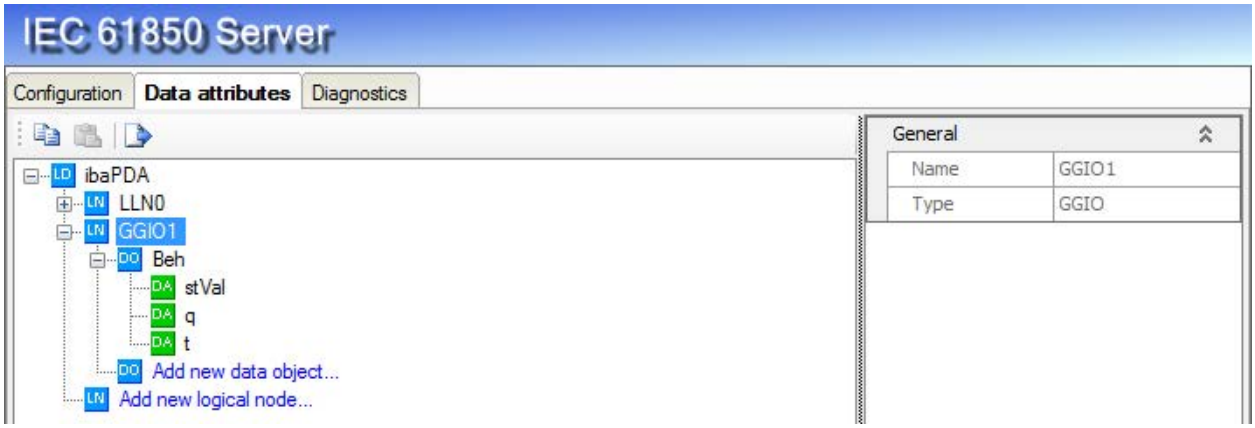

Fig. 6: New node in the configuration tree

For node types with optional data objects, these can be manually added by clicking on the link *Add new data object...*. The respective available data object type is available for selection.

In the example, the node type *GGIO* (Generic Process I/O) has been selected. For this node type, only the data object *AnIn* (Analog Input) is available in *ibaPDA*

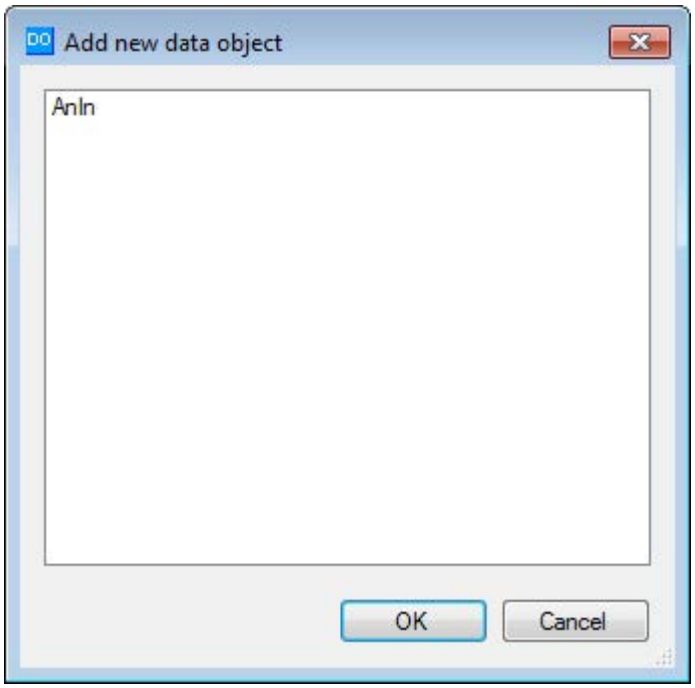

Fig. 7: Example of adding data object to GGIO node

In the example here, you still have to add an attribute to the data object *AnIn*. Click on the link *Add new attribute...*.

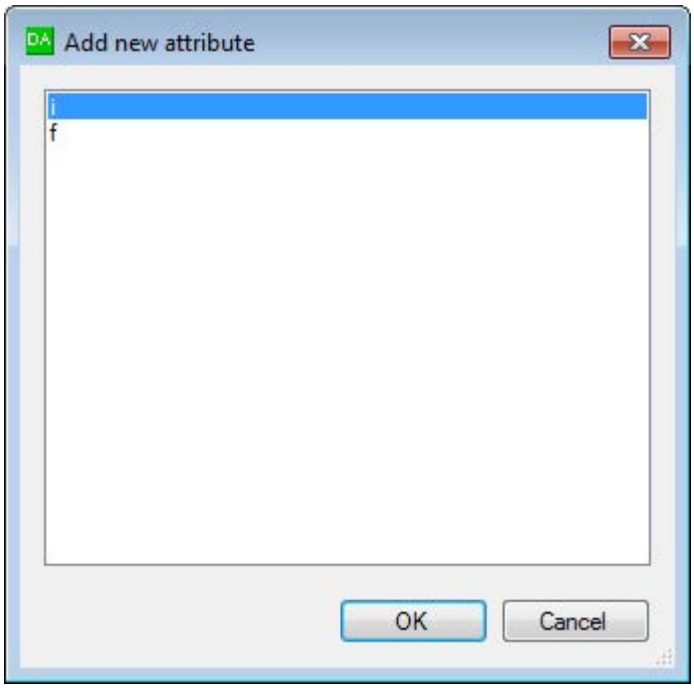

Fig. 8: Add attribute

The following attributes are available for selection for the data object *AnIn*:

- i: Data type integer 32
- f: Data type float 32

Select the attribute for which you would like to configure the value and edit this value in the table to the right. Open the dropdown menu in the *Source* field and either select a signal or enter a static value.

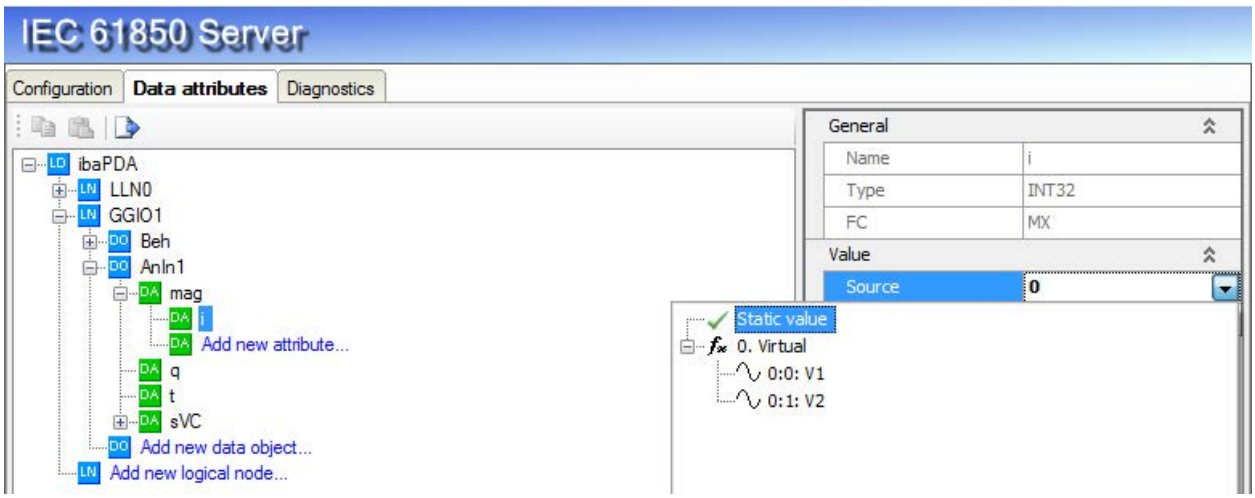

Fig. 9: Assign attribute

Note that the value of the attributes *q* and *t* cannot be set. For other attributes, you can select a data source in the same way as the example above.

You will find a list of possible data objects and attributes and their meaning in chapter
↗ *Overview of data objects and attributes*, page 18.

3.3.2.1 Create data sets

It is possible in the LLN0 node to configure data sets and report control blocks. Data attributes that are to be published in a report are combined in a data set. A data set can contain multiple attributes.

The transmission of report and measured values is configured with a report control block. Both properties of the transmission as well as the content, such as additional information and data sets, are defined here. See chapter ↗ *Report Control Block*, page 14.

In order to create a data set, expand the node *data sets* and click on the link *Add new data set...*. Or open the context menu and select *Add new data set*.

Fig. 10: Add new data set

Highlight the newly created data set in the configuration tree, then you can assign an unambiguous name in the table on the right side.

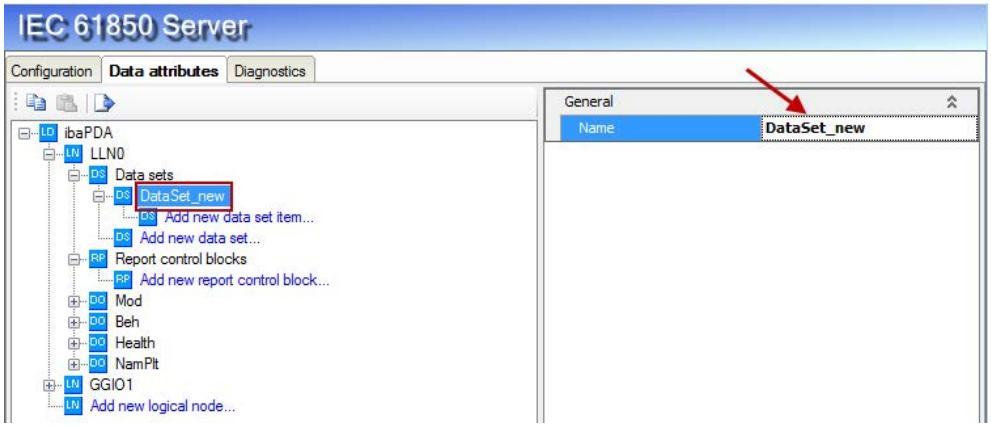

Fig. 11: Change the name of the data set

You can now add data set elements to the newly created data set. For this purpose, click on the link *Add new data set element...*. A dialog opens in which all available data attributes are listed.

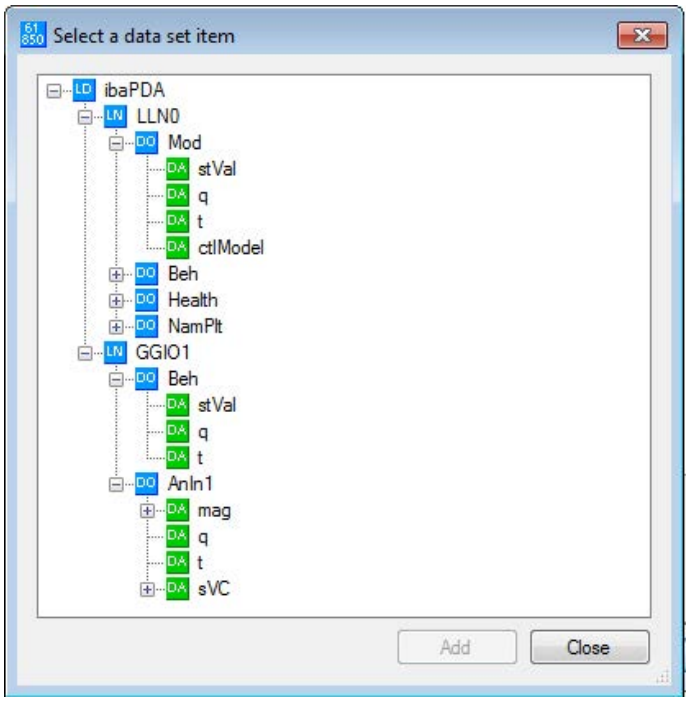

Fig. 12: Select data set elements

Select the attributes that you would like to add to the data set and click on <Add>. Once you are done adding data attributes, click on <Exit>.

3.3.2.2 Report Control Block

The transmission of report and measured values is configured with a report control block. A data set is used to reference which data objects should be reported.

A report control block can only be used by a client. If the user requires more instances of a report control block, he must create copies of the report control block. See chapter ↗ *Copy items*, page 17.

Expand the *Report control blocks* node and click on the link *Add new report control block.....*. Highlight the newly created report control block in the configuration tree to configure its properties in the table on the right side.

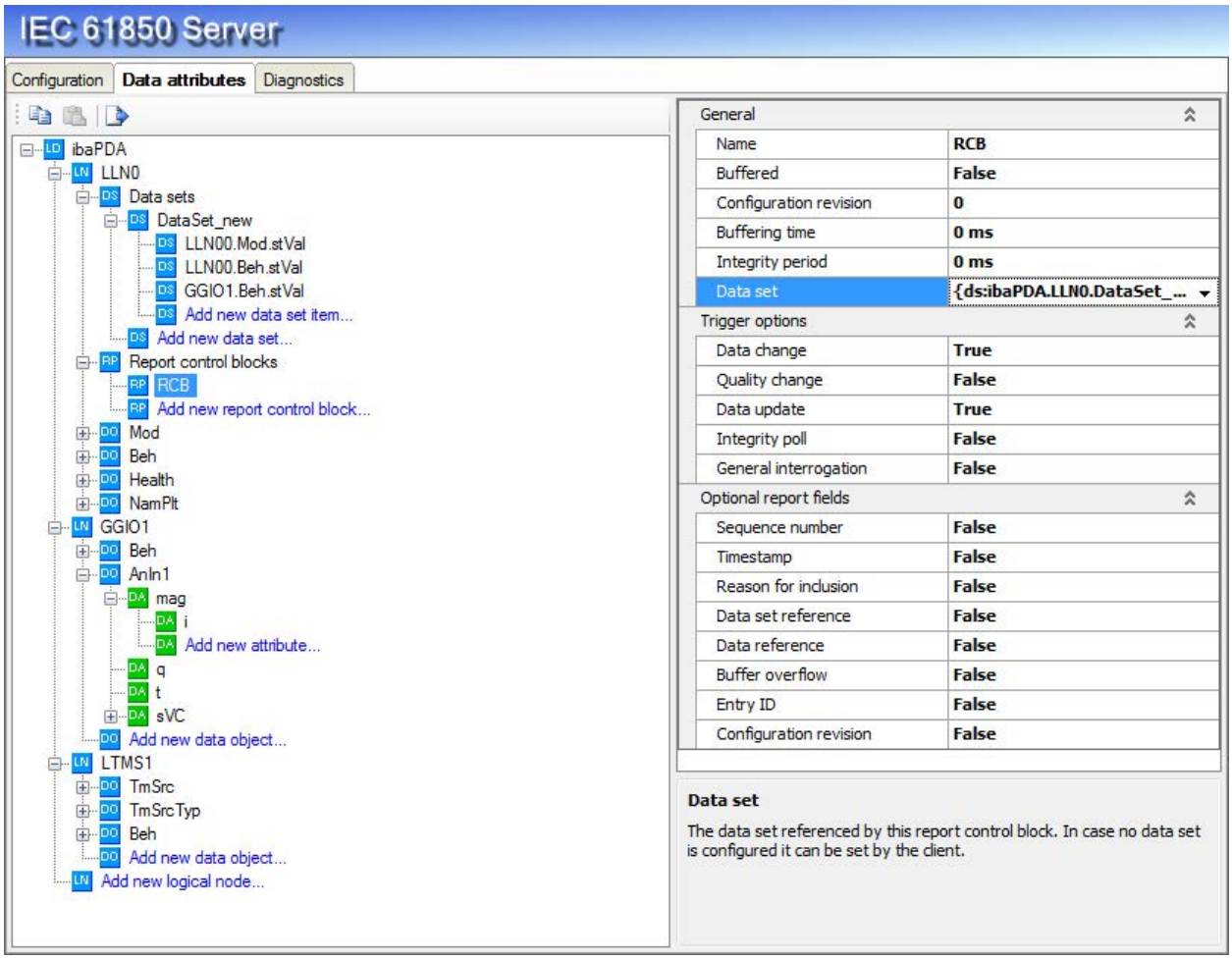

Fig. 13: Properties of the report control block

General

Name
Enter an unambiguous name here.

Buffered
- *False*: In the unbuffered mode, no reports are created if the client is not connected.
- *True*: In buffered mode, reports are stored on the server until the client connects.

Configuration revision
The configuration revision of this report control block

Buffering time
If an event triggers the creation of a report, then the server packs any other events in this time period (in ms) into a single report.

Integrity period
The time period in ms between two periodic reports.

Data set
The data set referenced by this report control block. Select a data set from the dropdown menu.

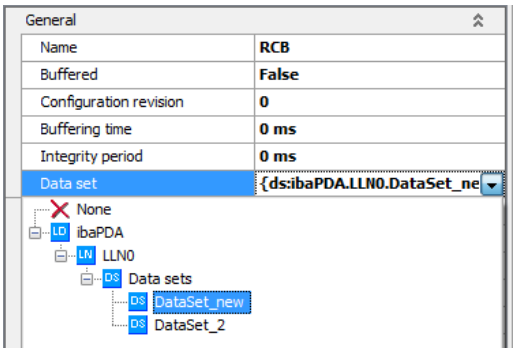

Fig. 14: Select a data set

Trigger options

Data change
The report is triggered if the data changes.

Quality change
The report is triggered if the quality changes.

Data update
The report is triggered if the data has been updated.

Integrity poll
The report is periodically triggered.

General interrogation
The report is triggered by a general interrogation request.

Optional report fields

Sequence number
The report contains a sequence number.

Timestamp
The report contains a timestamp.

Reason for inclusion
The reason for the creation of the report is included in the report.

Data set reference
The report includes the reference of the data set whose data is sent.

Data reference
The report includes the references to the data set element shown.

Buffer overflow
Include the buffer overflow in the report. The flag is only set in the buffered mode and in case that entries are lost due to a buffer overflow.

Entry ID
The report contains an entry ID

Configuration revision
The report includes the revision number of the configuration.

3.3.2.3 Copy items

Configuring logical nodes, data sets and report control blocks can be very time-consuming. To make it easier, it is therefore possible to copy logical nodes, data sets and report control blocks. You can access the copy and paste command in the context menu (right mouse click) of the respective item.

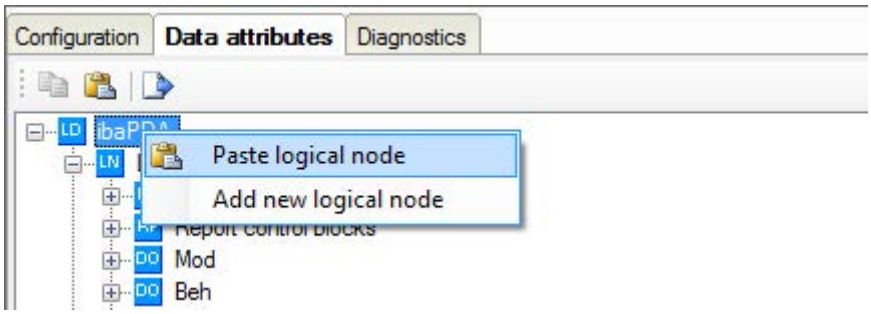

Fig. 15: Paste logical node

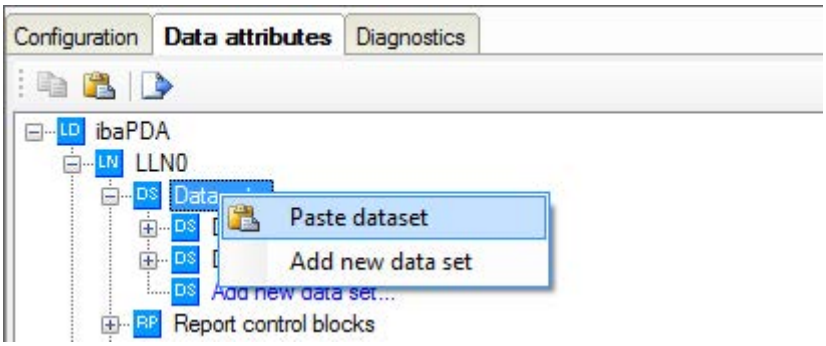

Fig. 16: Paste data set

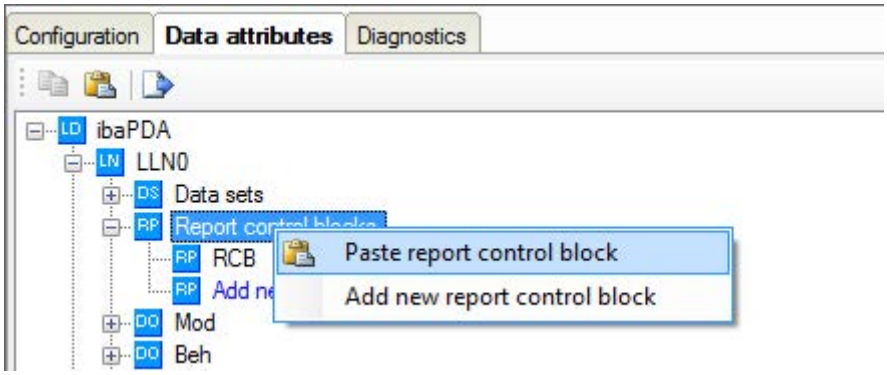

Fig. 17: Paste report control block

3.3.2.4 CID Export

The data model configuration of the IEC 61850 server can be exported into a CID file (Configured IED Description). Since the IP address of the server is contained in the CID file, a dialog appears in which you must select the network card, which you would like to use for the IEC 61850 communication.

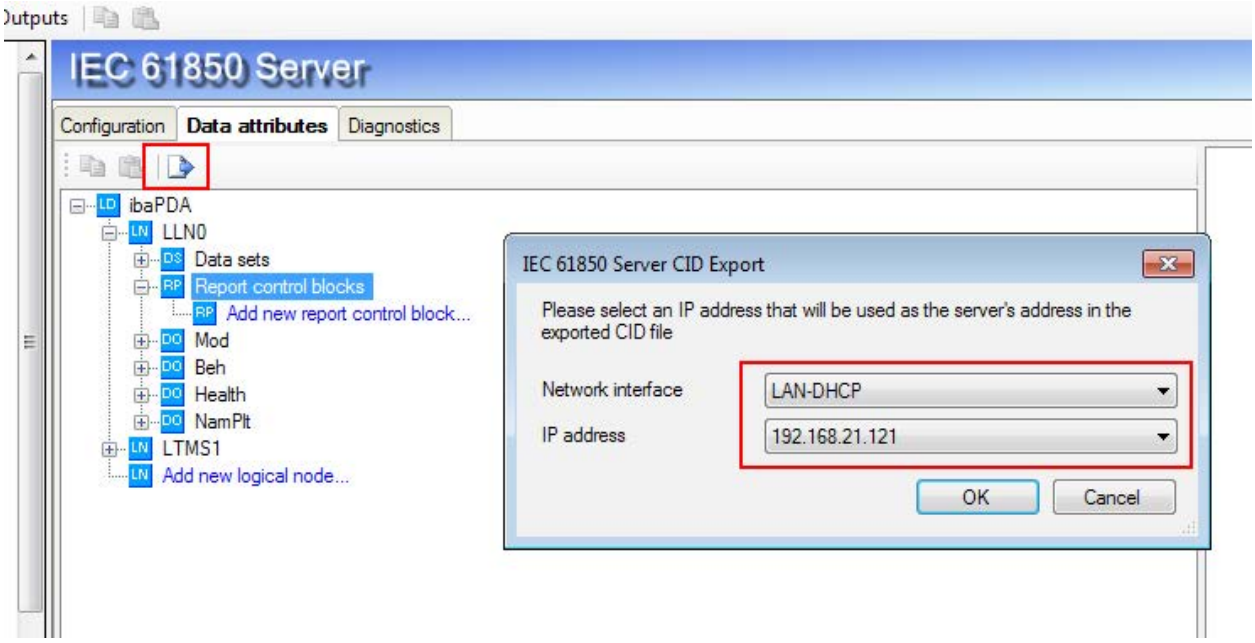

Fig. 18: Export of the configuration into a CID file

3.3.2.5 Overview of data objects and attributes

This chapter provides an overview of which data objects are available with which attributes in the respective logical node in *ibaPDA*. Mandatory data objects exist in the respective logical node by default. Optional data objects can be manually added.

In the individual data objects, a value can usually be set for the stVal (status value) attribute. No value can be entered for the attributes q (quantity) and t (time, time stamp of a status change).

In general, an IEC61850 client can only read data from the IEC61850 server in *ibaPDA*. Writing data or executing control commands is not supported.

GGIO (generic modeling of devices)

Data objects	Attributes	Values	Explanation
Beh			Behavior, mandatory object
	stVal	**Static**: On (1) Blocked (2) Test (3) Test-blocked (4) Off (5) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	
AnIn			Analog input, optional object
	mag.i	**Dynamic**: Allocation of an ibaPDA signal	Integer 32
	mag.f	**Dynamic**: Allocation of an ibaPDA signal	Float 32
	q, t	-	

IARC (archiving) interface to the archive system

Data objects	Attributes	Values	Explanation
MemOv			Memory overflow; if true, a memory overflow occurred; obligatory object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	
Beh			Behavior, mandatory object
	stVal	**Static**: On (1) Blocked (2) Test (3) Test-blocked (4) Off (5) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

LCCH (Physical Communication Channel Supervision) models common problems for physical communication channels

Data objects	Attributes	Values	Explanation
ChLiv			Physical channel status; if true, the channel receives telegrams within a certain time interval, mandatory object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	
Beh			Behavior, mandatory object
	stVal	**Static**: On (1) Blocked (2) Test (3) Test-blocked (4) Off (5) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

LPHD (Physical Device Information) receives general information about the physical devices

Data objects	Attributes	Values	Explanation
PhyNam			Physical device name plate, mandatory object
	vendor	Text input	
PhyHealth			Device state, mandatory object
	stVal	**Static**: OK (1) Warning (2) Alarm (3) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

Data objects	Attributes	Values	Explanation
Proxy			If true, the physical device is a proxy; mandatory object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

LTMS (Time Master Supervision) configuration and monitoring of the time synchronization function in an IED

Data objects	Attributes	Values	Explanation
TmSrc			Time source, mandatory object
	stVal	Not manually adjustable. Automatically set depending on the time synchronization used in ibaPDA.	
	q, t	-	
TmSrcTyp			Type of the clock source, mandatory object
	stVal	Not manually adjustable. Automatically set depending on the time synchronization used in ibaPDA.	
	q, t	-	
Beh			Behavior, mandatory object
	stVal	**Static**: On (1) Blocked (2) Test (3) Test-blocked (4) Off (5) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

Data objects	Attributes	Values	Explanation
Health			Status, optional object
	stVal	**Static**: OK (1) Warning (2) Alarm (3) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

RDRE (Disturbance Recorder Function)

Data objects	Attributes	Values	Explanation
RcdMade			Recording made; if true, the new fault recording has been completed and a corresponding file is available; mandatory object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	
Beh			Behavior, mandatory object
	stVal	**Static**: On (1) Blocked (2) Test (3) Test-blocked (4) Off (5) **Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	
FltNum			Fault number, mandatory object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

Data objects	Attributes	Values	Explanation
RcdStr			Recording started; if true, a fault recording is carried out, otherwise the recording was not started; optional object
	stVal	**Dynamic**: Allocation of an ibaPDA signal	
	q, t	-	

4 Diagnosis

4.1 License

If you cannot publish the configured signals as IEC 61850 variables, check whether your “ibaPDA IEC 61850 server” license is detected correctly in the *ibaPDA* I/O manager under *General – Settings – License options* or in the *ibaPDA* service status application.

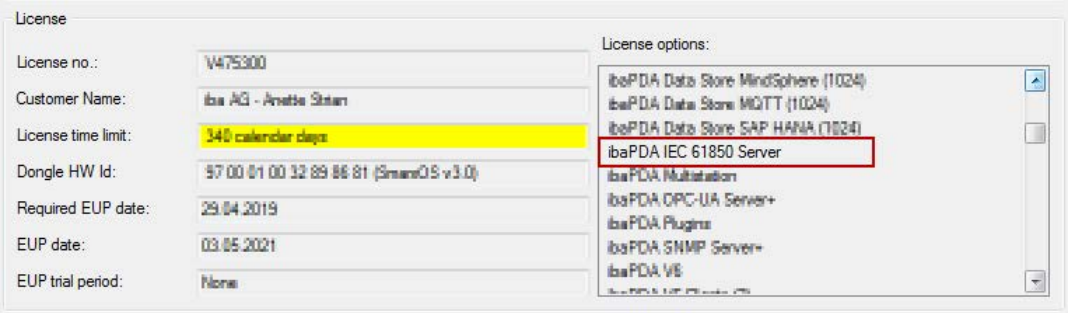

Fig. 19: Display of the license in the ibaPDA I/O manager

4.2 Diagnostics tab

The status of the IEC 61850 server is shown in the *Diagnostics* tab. In addition, the connected clients are listed in a table.

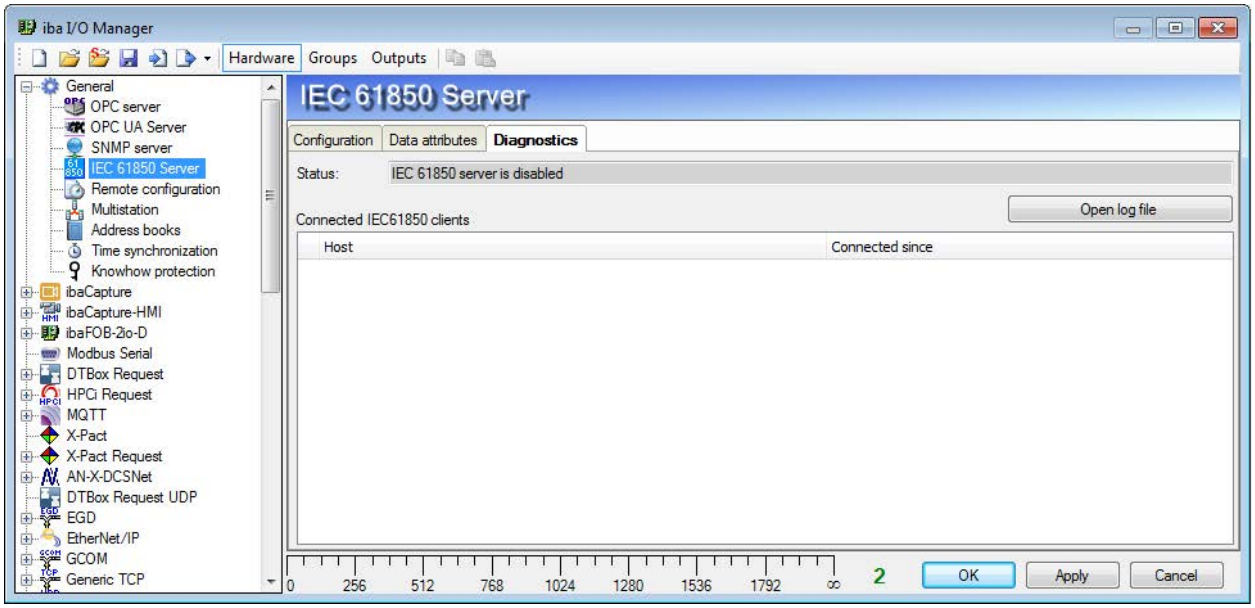

Fig. 20: Diagnostics tab

For each client, the time it has been connected to the server is displayed. The number of rows corresponds to the number of licensed 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.

Open a Windows command prompt.

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

With an existing connection you receive several replies.

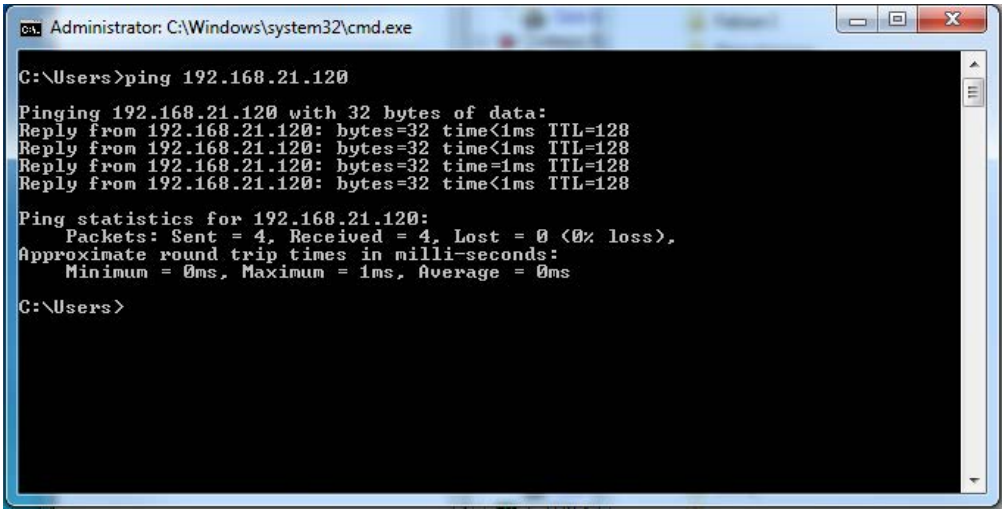

Fig. 21: PING successful

With no existing connection you receive error messages.

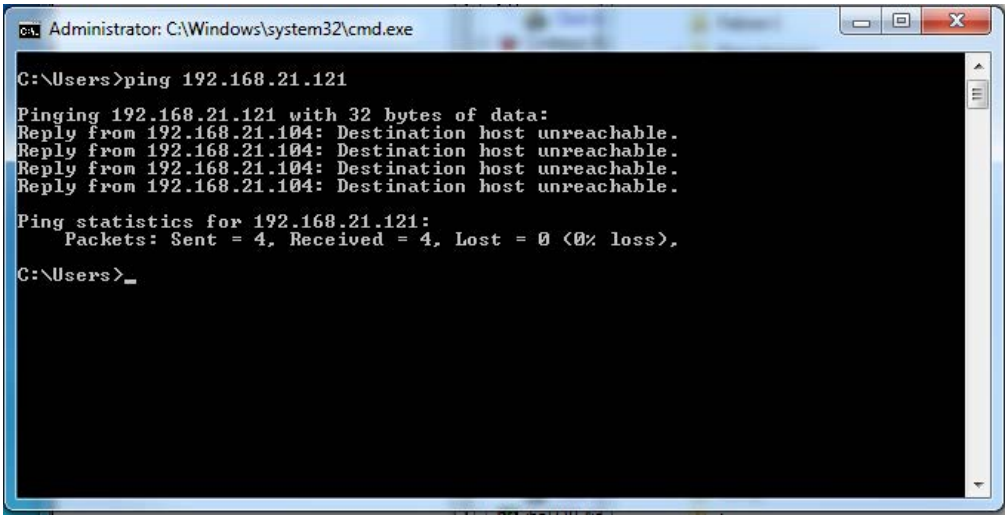

Fig. 22: PING unsuccessful

4.4 Log files

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

The log file can be opened 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 will find the log files in the program path of the *ibaPDA* server (...\Programs\iba\ibaPDA\Server\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)

5 Support and contact

Support

Phone: +49 911 97282-14

Fax: +49 911 97282-33

Email: support@iba-ag.com

Note

If you require support, indicate the serial number (iba-S/N) of the product and the license number.

Contact

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