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1 About this Manual

This document 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  
avtomation. 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:

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

ℹ️ 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 V6.34.0 or higher
- Basic license for ibaPDA + 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.

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

License information

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.001090</td>
<td>ibaPDA-Interface-IEC61850-Client</td>
<td>Extension for an ibaPDA system to include an IEC 61850 client interface Number of connections: 64</td>
</tr>
<tr>
<td>31.101090</td>
<td>one-step-up-Interface-IEC61850-Client</td>
<td>Extension license for an existing interface ibaPDA-interface-IEC61850-Client for another 64 connections, maximum of 3 extension licenses permissible</td>
</tr>
</tbody>
</table>

Table 1: Available IEC 61850 interface licenses

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. Up to 256 connections can be configured and used per data interface with the multiple purchase or multiple release of these licenses (up to 3 in total).

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.

3.2 System topologies

The connections to the data servers can be established via the computer's standard Ethernet interfaces.

![Diagram](image)

Fig. 1: General 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 6) the interface “IEC 61850 Client” is displayed in the signal tree.

![Fig. 2: Interface in the I/O manager](image-url)
3.4.1 Interface settings

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

![General interface settings](image)

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.

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 25

**<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 in the program path of the *ibaPDA server* (\Programs(x86)\iba\ibaPDA\Server\Log\). The file name of the current log file is *Iec61850Log.txt*, the name of the archived log files is *Iec61850Log_yyyy_mm_dd_hh_mm_ss.txt*.

### 3.4.2 Add device module

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

![Add module dialog]

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.

![General device module settings](image)

**Fig. 5: General device module settings**

**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 Settings](image)

**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>**
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.

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

![Advanced settings](image)

- **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
Add a module by clicking below the device module. Select the desired module type and click <OK>.

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

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
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.

Module No.
Internal reference number of the module. This number determines the order of the modules in the signal tree of ibaPDA client and ibaAnalyzer.

Time base
All signals of the module will be sampled on this time base.

Use name as prefix
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 20 and GOOSE module, page 22

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 14).

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.
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 26.
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.

---

**Fig. 9:** Symbol browser tree view

**Fig. 10:** Symbol browser data set view
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.

![Signal table example](image)

Fig. 11: Examples of signal table analog
Fig. 12: Examples of signal table digital
### 3.4.8 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 settings](image)

**Basic settings**

See ![General Module Settings](image), page 14
**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. No cyclical querying of data is required (see above service 3). You have to choose a report control block instance that is not already used by another client.

**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 temporary data set is generated in the node “LLN0” of the server, which contains all data attributes to which the signals refer (see above service 2). This data set is deleted again when the data recording on the server is over.
- Configured data set (only visible with server connection): The data set preconfigured on the server is read and the contained data attributes can be accessed (see above service 2 and 3).

**Logical Device for the Data Set**
Logical device that the data set accesses. Can only be selected with data set = dynamic.

**Update time**
Indicates the target update time when the data will be requested from device.
3.4.9 GOOSE module

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

![GOOSE module settings](image)

**Fig. 14: GOOSE module settings**

**Basic settings**
See ![General Module Settings](image), page 14

**IEC 61850**

**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.

**Data set**
Display of the data set belonging to the GOOSE control block.
4 Diagnostics

4.1 License

If the "IEC 61850-Client" interface is not displayed in the signal tree, you can either check in ibaPDA under General - Settings - License info in the I/O manager or in the ibaPDA service status application to see whether your license "Interface IEC 61850 Client" has been properly recognized. The number of licensed connections is indicated in brackets.

![License display in the ibaPDA I/O manager](image)

Fig. 15: License display in the ibaPDA I/O manager

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.

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)
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. 16: PING successful](image)

With no existing connection you receive error messages.

![Fig. 17: PING unsuccessful](image)
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:

<table>
<thead>
<tr>
<th>Color</th>
<th>Meaning</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>The connection is OK and the data are read.</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>The connection is OK, however the data update is slower than the configured update time (only for MMS and no report control block).</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>The connection has failed or was interrupted</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: 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

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

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