ibaPDA-Interface-Raw Ethernet

Data Acquisition Interface for ibaPDA-V6

Manual

Issue 1.0

Measurement and Automation Systems

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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, deviations cannot be excluded completely so that the full compliance is not guaranteed. However, the information 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 http://www.iba-ag.com.

Protection note

Windows® is a label and registered trademark of the Microsoft Corporation. Other product and company names mentioned in this manual can be labels or registered trademarks of the corresponding owners.

Certification

The device is certified according to the European standards and directives. This device corresponds to the general safety and health requirements. Further international customary standards and directives have been observed.

Issue	Date	Revision – section / page	Author	Version SW
1.0	08-27-2012	First edition	rm	6.27.5

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1 About this manual

This manual describes the use of the software ibaPDA-Interface-Raw Ethernet.

1.1 Target group

This manual addresses in particular the qualified professionals who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded to 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.

1.2 Basic knowledge

The following knowledge is required for the operation of the software ibaPDA-Interface-Raw Ethernet.

- Basic knowledge of Windows operating system
- Basic knowledge of operating web browsers
- Basic knowledge of ibaPDA-V6

1.3 Designations

The following designations are used in this manual:

Action	Designations
Menu command	Menu „Logic diagram“
Call of menu command	„Step 1 – Step 2 – Step 3 – Step x” Example: Select menu „Logic diagram – Add – New logic diagram”
Keys	<Key name> Example: <Alt>; <F1>
Press keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Button name> Example: <OK>; <Cancel>
File names, Paths	„File name“, „Path” Example: „Test.doc“

1.4 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:

- By an electric shock!
- Due to the improper handling of software products which are coupled to input and output procedures with control function!

⚠ WARNING

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

⚠ CAUTION

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

Note

A note specifies special requirements or actions to be observed.

Important note

Note if some special features must be observed, for example exceptions from the rule.

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 Introduction

Description

The Raw Ethernet communication uses IEEE 802.3 multicast frames. Up to 4 links are supported for data acquisition. Each link can be defined on a different NIC (network interface card). On each link the data sent must have a fixed layout.

If 2 links are defined on the same NIC the multicast address must be different.

Up to 1024 modules are supported per interface.

The Raw ethernet interface is visible in the tree of the I/O manager when a dongle with the corresponding license enabled is attached.

Product name

ibaPDA-Interface-Raw-Ethernet

3 ibaPDA-V6 setup

3.1 Raw Ethernet interface settings

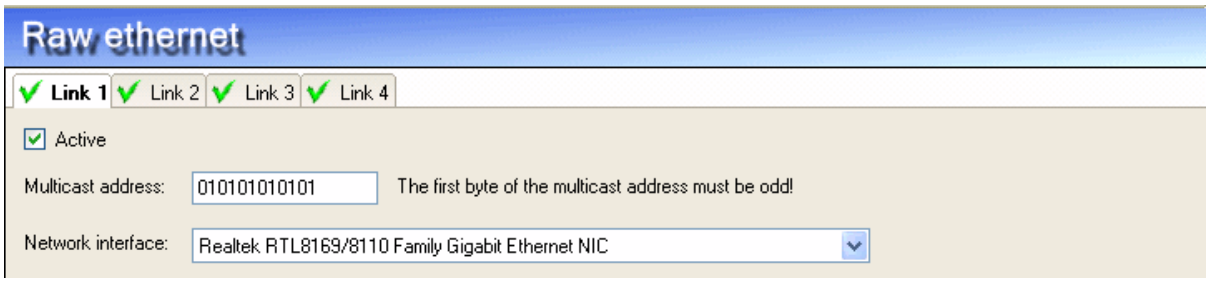


Fig. 1: Raw ethernet interface settings

Interface settings

- Multicast address
  Enter different Multicast addresses for different links if they use the same NIC.
- Network interface
  Select for each link the network interface card (NIC) which is used for Raw Ethernet communication.

Available modules

- Raw ethernet

3.2 Module type Raw ethernet

The Raw ethernet module is a generic ethernet module which can be freely configured by the user.

Select the link of the Raw ethernet interface you'd like to use in the tree and add a Raw ethernet module.

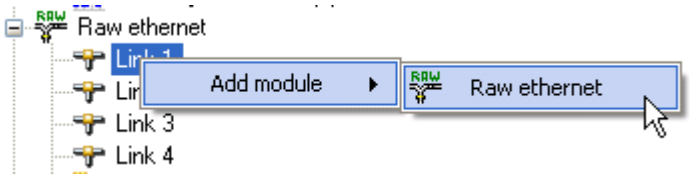


Fig. 2: Adding a module

3.2.1 Raw ethernet - General tab

Basic

❑ Locked

A module can be locked in order to prevent change of module settings by accident or unauthorized users. The lock-function is linked to the user management in ibaPDA-V6. A module can be locked (true) or unlocked (false) only by users who have the required right, provided the user management is activated.

- If False, any user can change the module settings.
- If True, no change of module settings possible. Module must first be unlocked by authorized users in order to change the settings.

❑ Enabled

With selection of one of the options in the drop-down list in the field next to *Enabled* you decide whether this module is to be enabled (True) or disabled (False). If a module is disabled then its signals are excluded from acquisition. Thus, they are available neither for display nor for recording. Furthermore, the number of signals from a disabled module will not be taken into account in the signal statistics (signal-o-meter).

❑ Name

In the field next to "Name" enter a comprehensive name for the module.

It is recommended to use an application-specific naming rule for a better clearness and comprehension, particularly with a vast number of modules. The name may refer to a technological purpose or a special location in the plant, where the module is used or installed.

The number of characters in the name is unlimited. The name of the module is stored in the data file and visible in ibaAnalyzer.

❑ Module No.

In the field next to "Module No." you may enter a module number. When adding modules to the configuration the system gives numbers automatically in a chronological order. However, you may prefer a different order later in the data file for analysis. Feel free to change the module number according to your needs. The module number determines the order in the signal tree in ibaAnalyzer.

❑ Timebase

In the field next to “Timebase” you may enter a time value, given in ms, which is an integer multiple of the general timebase as configured in the *General* branch of the I/O manager tree. All signals of the module will then be sampled on this timebase. The ratio between max. and min. timebase for all modules is limited to 1000. The timebase value is limited to 1000 ms.

Advanced

❑ Swap mode

Set the swap mode according to the signal source.
You can choose between 4 options:

Mode	16 bit	32 bit
No swap	AB	ABCD
Depending on datatype	BA	DCBA
Swap 16 bit	AB	CDAB
Swap 8 bit	BA	BADC

Table 1: Swap modes

Which swap mode is the correct one depends on the swap mode of the signal source.

❑ Measurex floats

If this option is enabled (TRUE) floating point values will be considered as Measurex floats instead of IEEE floats.

Module Layout

❑ No. of analog and digital signals

Here, you may increase or decrease the number of signals in the module. Default is 32 signals. You can enter any value between 0 and 1000. The signal tables will be adjusted accordingly.

3.2.2 Raw ethernet - Analog tab

❑ Name

In the "Name" column enter a comprehensive name for each signal.

It is recommended to use an application-specific naming rule for a better clearness and comprehension, particularly with a vast number of signals. The name may refer to a technological purpose, the module name or a special location in the plant, where the signal comes from.

The number of characters in the name is unlimited. The names of the signals are stored in the data file and visible in ibaAnalyzer.

❑ Comment 1 and Comment 2

Each signal can be assigned up to 2 comments. Comments can be used to provide additional information about a signal. This could be an extended signal description or information in another language.

The comments can be entered in the signal tables in different ways:

- Enter the comment directly in the cell if the comment column is visible
- Click in the signal name cell and then on the little button in its right corner and enter the comments in the comment dialog. Then click <OK>.
- When using Request modules for selected PLC systems the comments are loaded together with the signals, if comments are supported by the PLC system.

Tip

Comments are real added value because:

- ❑ They are stored in the data file and available in ibaAnalyzer.
- ❑ They can be used as alternative signal names.
- ❑ They are subject to the search function (optionally) and can be displayed in the search results.
- ❑ They are shown as tooltips on signals in signal tree, legend, marker table and digital meter.

❑ Visual min and Visual max

These settings can be used to limit the Y-scale of a trend graph to a minimum and a maximum value. The settings are only applied to the trend graph if the corresponding Y-axis property is set to “Visual scale configured on signal”.

This helps to determine the Y-scale already in the projection phase, provided the final signal range is known.

Moreover, if you set up the Y-axes property in the trend graph preferences to “Visual scale configured on signal” the Y-scale will adjust automatically to the Visual min and max values as soon as you open a trend graph with such a signal. The Y-scale then immediately shows the expected range.

The visual scale is also written to the data file and can be used by ibaAnalyzer as well.

❑ Unit

Assignment of an engineering unit (such as Ampere, Volt, m/s, tons etc.) for the signal. This entry can be up to 11 characters long and is regarded as a comment field only. It is always displayed in conjunction with a numerical display of the values.

❑ Gain and Offset

The values for gain and offset describe a linear characteristic curve for scaling. If incoming values are given in physical units, gain and offset can be ignored, i.e. set gain = 1 and offset = 0.

However, control applications in the automation systems which supply the signals often use normalized values for analog signals, ranging between 0.0 and 1.0 or -1.0 and +1.0. In order to get a correct scale for display in terms of physical units, ibaPDA must use a normalize factor. This factor can be evaluated by means of gain and offset parameters.

Gain and offset can be entered directly in the corresponding fields or by means of the two-point-scaling dialog with two pairs of applicable values.

You can open the two-point-scaling dialog with a click on the little tool button in the fields gain or offset. (Cursor must be on the fields to see the button.)

Two-point-scaling dialog

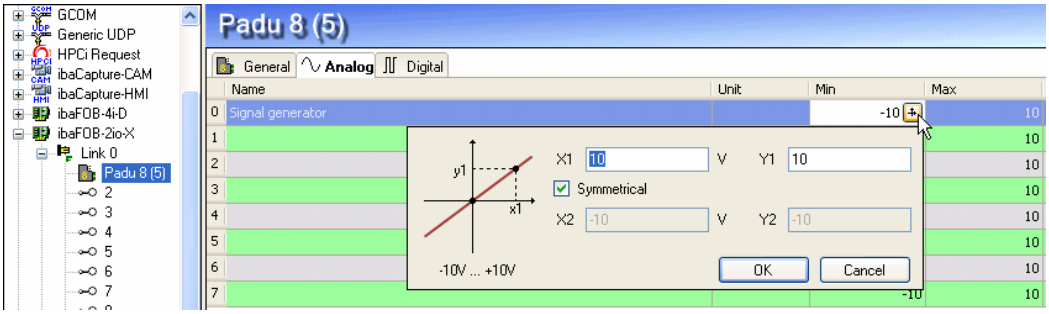


Fig. 3: Two-point-scaling dialog

The two-point-scaling dialog can be used to provide a scaling factor for analog signals by entering 2 points (X1/Y1 and X2/Y2) of a straight line. This dialog helps to scale the physical input quantity (e. g. voltage on ibaPADU-8) in order to get a value in physical units of the measured quantity (e. g. pressure, speed, temperature, etc.)

If you know that one point is 0/0 you can check the “Symmetrical” checkbox and enter only one point (X1/Y1).

If the connected module has a physical input range then this range is shown in the dialog (e. g. from -10 V to +10 V).

❑ Address

In this column you should specify the offset of the first byte of the value within the raw data stream. The offset can be entered as hexadecimal or decimal values by selecting the desired setting in the context menu. In order to get some default values just click on the column header. The offset values are filled in automatically starting with the value in the first row, respectively in the field the cursor is currently in, downwards in address steps according to the selected data types.

❑ DataType

In the fields of this column you can select the data type of each signal. Just click in the corresponding field and select the data type from the drop-down list. The address space is depending on the data type. Hence, an adjustment of address entries may be necessary after change of data types.

Available data types:

Data type	Description	Value range
BYTE	8 Bit without positive or negative sign	0 … 255
INT	16 Bit with positive or negative sign	-32768 … 32767
WORD	16 Bit without positive or negative sign	0 … 65535
DINT	32 Bit with positive or negative sign	-2147483648 … 2147483647
DWORD	32 Bit without positive or negative sign	0 … 4294967295
FLOAT	IEEE754; Single Precision; 32 Bit floating point	$1.175 \cdot 10^{-38}$ …$3.403 \cdot 10^{38}$

Table 2: Data types

❑ Active

Activation of signals

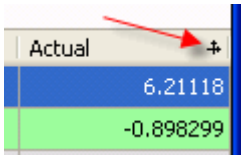
A click on the column heading "Active" enables (checkmark) and disables (no checkmark) all the signals at the same time. Individual signals can be activated in the signal-specific activation box. No acquisition takes place for channels which are not activated, so that such channels are available neither for display nor for storage.

Furthermore, disabled signals will not be taken into account in the signal statistics.

Entries - such as names or engineering units - remain, however. They are available again right after reactivation of a signal.

❑ Actual (Value)

The fields in this column show the actual value of the signals. Even if the acquisition is not running yet the actual value may be displayed if the hardware is already connected and working (diagnostic feature). You can switch the value display between scaled and raw values. Click on the column header to toggle the values. If scaled values are on display the header shows a little icon:



Alternatively you can use the context menu anywhere in the signal table to enable/disable scaled values display.

In some cases there might be a display of “NaN” (= **N**ot **a** **N**umber) instead of a number.

For digital signals only the values 0 and 1 are permitted.

3.2.3 Raw ethernet - Digital tab

↗ For description of columns “Name”, “Comment 1”, “Comment 2”, “Active” and “Actual” see description of “Analog tab” above.

For digital signals you have the possibility to get 32 single bits out of a DINT or DWORD.

❑ Address

In this column you should specify the offset of the first byte of the value carrying binary signals within the raw data stream. The offset can be entered as hexadecimal or decimal values by selecting the desired setting in the context menu. In order to get some default values just click on the column header. The offset values are filled in automatically starting with the value in the first row, respectively in the field the cursor is currently in, downwards in address steps according to the selected data types.

❑ Bit no.

The number 0...31, specifies the position of the digital signal in a 32-bit block in the data stream with reference to the address entry (offset). Increment of bit no. by 1 up to 31, then increase address by 4.

3.3 Diagnose

For each link there is a diagnostic hex view, providing information about network card, Ndis name, Multicast address, adapter status and counters.

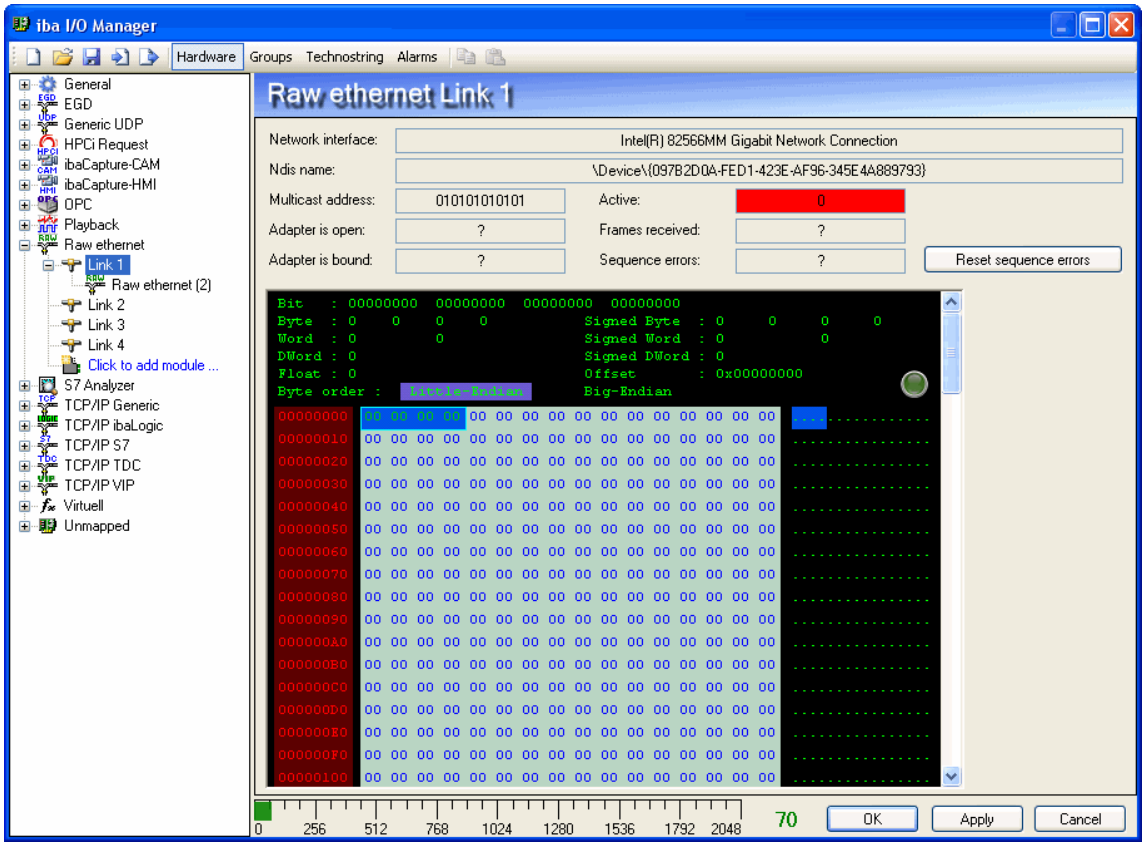


Fig. 4: Raw Ethernet link, diagnostic hex view

4 IEEE 802.3

This chapter gives a short overview of the IEEE 802.3 Ethernet frame.

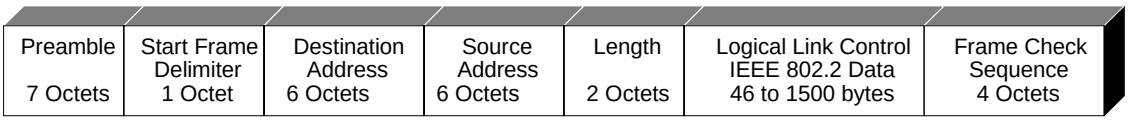
Following OSI Model Conceptual View shows that the IEEE 802.3 frames are situated on the datalink layer (layer 2).

LAYER	USER APPLICATION			DATA FORMAT	ENABLING TECHNOLOGY	
7 APPLICATION	Provides common services to user applications. ➡X.400 E-MAIL interoperability specification ➡X.500 E-MAIL directory synchronization specification ➡Strictly speaking, does not include user applications	Higher layer protocols - independant of underlying communications network				SOFTWARE
6 PRESENTATION	Provides presentation services for network communications. ➡Encryption ➡Code translation (ASCII to EBCDIC) ➡Text compression ***Not to be confused with*** ➡Graphical User Interfaces(GUIs)		Node-to-node sessions			
5 SESSION	Establishes, maintains, terminates node-to-node interactive sessions.			sessions Interactive, real-time dialogue between 2 user nodes	Distributed applications, middleware, or network operating systems.	
4 TRANSPORT	Assures reliability of end-to-end network connections.		End-to-end user network connection.	messages Asembles packets into messages.	Network Operating Systems	
3 NETWORK	Establishes, maintains, and terminates end-to-end network connections.	Network		packets Embedded within frames.	Network Operating Systems.	
HARDWARE/SOFTWARE INTERFACE					**NIC DRIVERS**	
2 DATA LINK	Logical Link control sub-layer. Media access control sub-layer. Specified by 802.X protocols. ➡Assures reliability of point-to-point data links.	Communications	Point-to-point data link	frames Recognizable as data.	Network Interface Cards.	HARDWARE
1 PHYSICAL	Establishes, maintains, and terminates point-to-point data links.			bits Unrecognizable as data	Media	

Fig. 5: OSI Model Conceptual View of IEEE 802.3 frame

Following picture gives the layout of the IEEE802.3 frame:

IEEE 802.3 Frame Layout



The overall frame length varies from 64 to 1518 Octets

NOTE: 1 Octet = 8 bits

Fig. 6: IEEE 802.3 frame layout

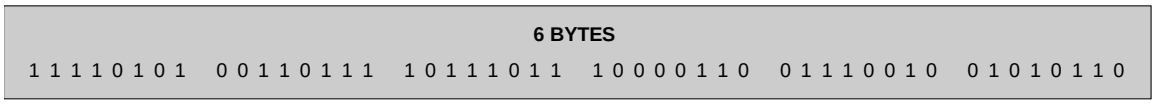
The data received in ibaPDA includes the destination address, source address, length and the IEEE 802.2 data. The length field is ignored in ibaPDA. The first 2 bytes of the IEEE 802.2 data have to be a 16 bit sequence counter.

5 Multicast Frames

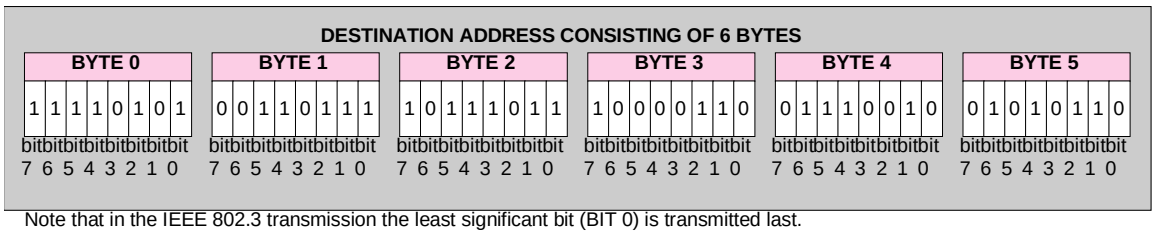
Multicast Ethernet frames are distinguished from directed packets by having the Individual/Group (I/G) bit of the destination address set to 1 (Group).

Multicast is like broadcast, but you have to listen to specific multicast addresses to receive it. Multicast Ethernet addresses have bit 0 in byte 0 set (i.e. it is odd): for instance, Windows network software uses multicast address `03:00:00:00:00:01` to send and receive "find name" packets; without it, network browsing does not work.
As following picture illustrates, the byte 0 is transmitted first over the network.

Original Data Stream of 6 bytes



IEEE 802.3 Transmission



Note that in the IEEE 802.3 transmission the least significant bit (BIT 0) is transmitted last.

Fig. 7: Resolution of data stream

Multicasting refers to networking in which one computer sends a single copy of the data over the network and many computers receive that data.
When streaming frames over the network, the advantage to unicast is that only a single copy of the data is sent across the network, which preserves network bandwidth.
In large companies the bandwidth savings can be substantial. The disadvantage is that it is connectionless; clients have no control over the streams they receive, so cannot pause or skip backward or forward in the frame stream.

6 Support and Contact

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Note

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