Safety and Quality in Energy Grids

ibaPQU-S
Modular Power Quality Monitoring System

ibaNet750-BM-D/ibaW-750
Power measurement with WAGO power terminals

ibaPDA-Interface-IEC61850-Client /-9-2
Integration of IEC 61850 compatible protection devices

Measurement Systems for Industry and Energy
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Monitor and optimize power quality

Measuring and monitoring the electric power quality (EPQ) is a crucial tool for energy producers, grid operators and consumers alike to document supply reliability and voltage quality on the one hand and to prove compliance with emission limits on the other hand. But also to analyze and thus avoid downtimes and failures.

Your benefits at a glance

- Characteristics according to the standard IEC 61000-4-30 class A
- Reducing energy costs
- Assuring supply
- Documenting voltage quality
- Observing emission limits
- Analyzing faults
- Meeting quality requirements
- Avoiding fines

Energy producers in the burden of proof

Distributed energy generation and the associated fluctuating provision of electrical power from renewable sources influences the stability of the power grid. Energy suppliers have to assure at all times that the energy fed into the public grid meets the quality criteria of the European standard EN 50160. This not only affects the „big“ energy producers, but also companies operating their own power plants that feed energy into the public grid.

High energy quality requires optimized facilities

Grid operators, too, have to comply with EN 50160. The requirements for transmission grids increase with the distributed structure and the use of power electronics, e.g. to control power flows or operating HVDC systems where direct current is transmitted over very long distances.

In this context, not only monitoring of electrical power is important, but also monitoring of the controllers of electrical equipment such as converters in converter stations.

With the modular ibaPQU-S system, it is possible to record data from the plant together with the calculated quality characteristics and measured raw values centrally in ibaPDA. This enables users to thoroughly evaluate all data, recognize contexts and thereby determine the root-causes of faults or quality variations. Moreover, the data provide important information about the dimensioning of the plant and its optimal operation.

Consumers are obliged to quality

Electricity consumers influence the grid quality for example by power electronic devices, e. g. for frequency-regulated drives. Grid reactances and the harmonic part of the currents create repercussions in the grid that impair the power quality in the supply grid. Examples include high surge-like loads caused by the start-up and operation of large machines such as the main drives of rolling mills or arc furnaces.

Both energy producers and large-scale consumers must observe the „D-A-CH-CZ Technical rules for the assessment of power system disturbances" that specify limit values for the emission of "power system faults" for generating and consumer systems. The ibaPQU-S system is also capable of determining the characteristics required in this technical rules and of monitoring compliance with the limit values. The characteristic values can be calculated both on the basis of the voltage and current measured values.

Moreover, power suppliers agree by contract with each large consumer the extent of disturbances they are allowed to inject into the grid. A violation of the limit values may be punished with fines. Monitoring the electric power quality at the transfer point provides information about whether and what disturbances are fed into the grid.

„We monitor power quality in accordance with binding standards.“

Dries Boone, Power Quality Expert

Your benefits at a glance:

- Efficiently analyze faults
- Document power quality in accordance with applicable standards
- Avoid fines

Solutions for all fields - Connect energy and process data

The iba system provides a wide range of functions to monitor and optimize electrical power facilities: continuous monitoring of the power quality in energy grids, use as digital fault recorder (transient fault recorder) and integration of the protocol standard IEC 61850. The possible applications complement each other and can be operated in parallel.

Proving electric power quality in line with standards

Electrical power quality (EPQ) is defined by characteristics such as frequency, height, curve profiles and symmetry of the supply voltage. It is adversely affected to an ever greater extent by the power grid itself, which is increasingly being fed from distributed sources, but also by the consumers.

The modular ibaPQU-S system allows the quality in energy grids to be monitored continuously. ibaPQU-S measures raw values such as current and voltage in sync with the grid and internally calculates the characteristics relevant for power quality according to the standard IEC 61000-4-30 Class A and is hence suitable for evaluations according to EN 50160.

Analysis of the characteristic values, especially when combined with other plant and process data, is a major basis for improving the quality and availability of power grids.

Power Quality Unit ibaPQU-S, see page 7

Cost-efficient measurement of load outputs

If the power characteristics of a network are to be measured and standard-compliant measurement with high resolution is not required, then using WAGO power measurement terminals together with the devices ibaW-750 or ibaNet750-BM-D offers a cost-effective alternative to ibaPQU-S.

Use of WAGO power measurement terminals, see page 12

Standard for energy automation

The transmission protocol IEC61850 has become the protocol standard for protection and control of electrical medium and high voltage switchgear. IEC61850 further increases the application spectrum of ibaPDA.

ibaPDA-Interface-IEC61850, see page 14

High-speed acquisition of dynamic processes

The scalable iba system allows tailoring the fault recorder function to the needs of customers in a flexible and individual way. Fast transient signal changes can be detected in the range between 1 kHz and 100 kHz using suitable acquisition hardware and recorded in high resolution. Since the fault recorder only records the measured data when a fault occurs, ibaPDA first buffers the data internally. When a fault condition occurs, recording of the data is triggered.

When several thousand signals have to be measured synchronously with a high sampling rate in complex plants, multiple ibaPDA systems are interconnected using optical fiber and the data is recorded with sample precision (multistation functionality).

The use as digital fault recorder, see page 16

Power Quality Unit ibaPQU-S

The Power Quality Unit ibaPQU-S can be used for high-accuracy monitoring of the power quality in energy grids. For this purpose, characteristics of electric power quality are calculated according to the standard and are acquired and recorded by ibaPDA.

At a glance

- Modular power quality monitoring system with highest accuracy
- Measurement in sync with the grid
- Internal calculation of grid quality parameters according to IEC 61000-4-30, class A
- Power and energy values
- Data acquisition and calculation of statistical and long-term power quality parameters using ibaPDA (FO connection required)
- Raw values for drill-down are available in ibaPDA
- All calculated values are available as single values in ibaPDA and can be monitored
- Can be used as fault recorder

Measurement with ibaPQU-S in sync with the grid

ibaPQU-S is an intelligent and modular system for power quality monitoring that implements all relevant measuring tasks. The system measures raw values such as current and voltage in sync with the grid and internally calculates the frequency and other relevant characteristic values, see table on page 9. The system is suitable for DC grids and for the common AC grids with 50 Hz and 60 Hz. For special applications, the frequency can be freely adjusted between 10 Hz and 80 Hz, e.g. for the railway grid at 16.7 Hz.

Calculating characteristic values according to standard

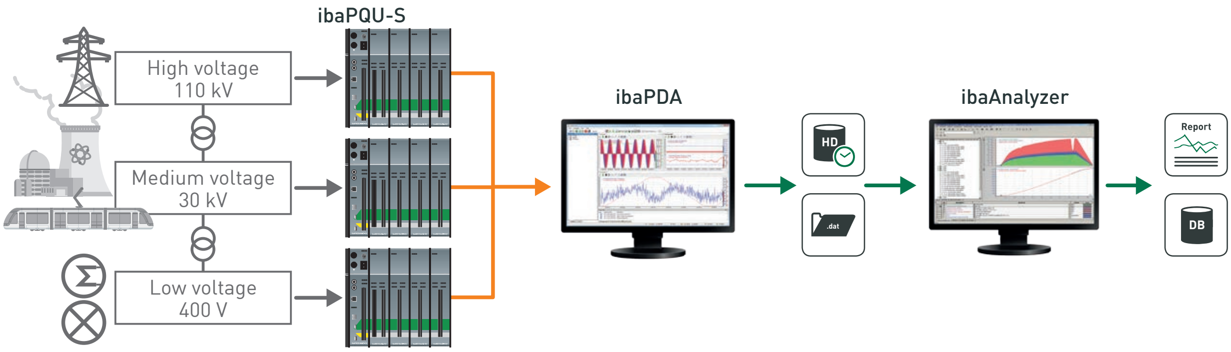
ibaPQU-S determines all characteristic values required in the standard EN 50160. Calculation of these values is performed as specified in the standard IEC 61000-4-30, class A, the highest quality class. ibaPQU-S thus meets the requirements of contract-relevant measurements and can be used for billing purposes. Moreover, the harmonics are measured according to IEC 61000-4-7, the flicker measurement method complies with IEC 61000-4-15.

In ibaPDA, the calculation and acquisition of all characteristic values specified in EN 50160 including the calculation periods defined in the standard can be activated at a mouse click.

Measurements beyond the standard

The standard specifies a time interval of 10 minutes for the acquisition of the RMS value, for example. In order to observe in detail how the system behaves after a change or analyze faults, ibaPQU-S also allows performing faster measurements. The possible calculation periods for the corresponding characteristic values are listed in the table on page 9. The trend of the characteristic values can be tracked online in ibaPDA.

The characteristic values calculated for the standard EN 50160 are based on voltage measurements. Additionally, ibaPQU-S is capable of calculating all characteristic values based on the measured current values, which is interesting e.g. for compensation facilities.



Example of monitoring of the power quality using ibaPQU-S in the iba system

Analyzing fault causes

The process data acquisition system ibaPDA connects ibaPQU-S into the overall plant and process monitoring. Thanks to ibaPDA's broad connectivity, it is possible to acquire the measured values from various sources and sample them synchronously. Using special mechanisms, the grid synchronous measured energy values are harmonized with the time synchronous process values. So the electric power quality parameters can be correlated with the plant's operating mode.

The synchronous measurement of the power quality parameters on the one hand and of the process values on the other allows plant operators e. g. to prove how and to what extent their plant has adversely affected the power grid. The causes of the grid fluctuations triggered by the process can thus be analyzed at any time.

In the reverse direction, this allows determining whether the system is impaired by grid disturbances from the outside.

Integration into the iba system

ibaPQU-S is the central unit of a modular system and can be expanded by up to 4 input modules. The modules supported by ibaPQU-S are listed on page 19.

The calculated power quality values are transmitted - together with raw values and other system and process values – to the acquisition system ibaPDA through a bidirectional optical fiber connection. There, the values are stored in measurement files, or if measurements extend over longer periods of time such as months or years, in an HD storage. In ibaPDA, all data from the different sources are combined and analyzed centrally. This allows both determining long-term trends and detailed analyses of faults with a resolution of up to 10 µs.

Faults can also be displayed through an alarm function and logged as event in ibaHD-Server.

Proving compliance with the standard

Finally, ibaAnalyzer allows storing the values in databases, calculating KPIs or creating clearly structured reports that can be used e. g. to prove compliance with the EN 50160 standard. When analysis rules and the report have been created, an analysis can be filled again and again with new data and reports for different periods or for fixed time intervals (e.g. weekly report) can be created automatically at the push of a button.

Overview of the characteristic values calculated with ibaPQU-S

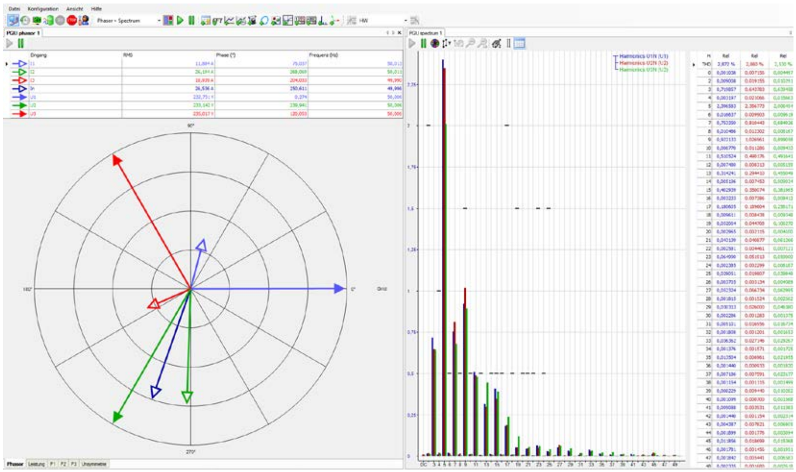
Calculation	Calculation period						Grid type		
	Half period	10/12[1]	150/180[2]	10 s	10 min	2 h	1	3	3+N
RMS	•	•	•	•	•	•	•	•	•
Peak	•	•	•	•	•	•	•	•	•
Rectified	•	•	•	•	•	•	•	•	•
Form factor	-	•	•	•	•	•	•	•	•
Crest factor	-	•	•	•	•	•	•	•	•
Frequency	•	•	•	•	•	•	•	•	•
Phase	-	•	•	•	•	•	•	•	•
Harmonics	-	•	•	•	•	•	•	•	•
Interharmonics	-	•	•	•	•	•	•	•	•
THD	-	•	•	•	•	•	•	•	•
Power	-	•	•	•	•	•	•	•	•
Energy	-	•	•	•	•	•	•	•	•
Power / Energy VA	-	•	•	•	•	•	•	•	•
Power / Energy VAr	-	•	•	•	•	•	•	•	•
Power factor	-	•	•	•	•	•	•	•	•
Cos φ	-	•	•	•	•	•	•	•	•
3 phase positive	-	•	•	•	•	•	-	-	•
3 phase negative	-	•	•	•	•	•	-	-	•
3 phase zero	-	•	•	•	•	•	-	-	•
Grid symmetric	-	•	•	•	•	•	-	•	•
Flicker (Pst, Plt)	-	-	-	-	•	•	•	•	•

[1] time interval of 10 periods in 50 Hz grids or 12 periods in 60 Hz grids (approx. 200 ms)

[2] time interval of 150 periods in 50 Hz grids or 180 periods in 60 Hz grids (approx. 3 s)

Examples for measurement and display with ibaPQU-S

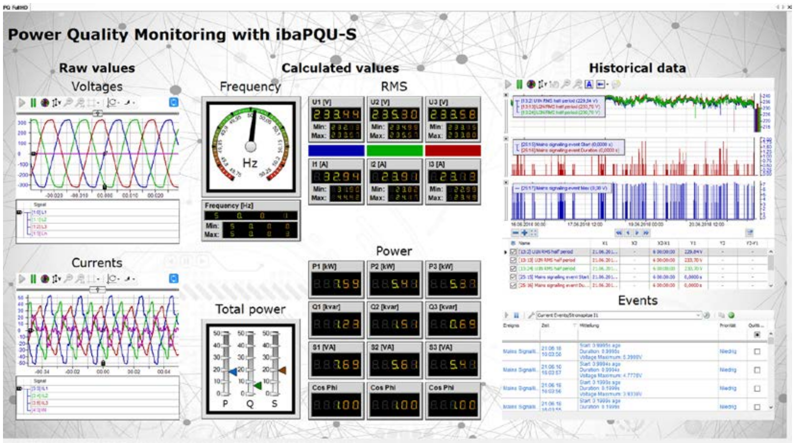
The following examples show measurements with ibaPQU-S. The display of the characteristic values in ibaPDA allows to draw conclusions about certain events or a possible failure and its cause.



Phasor and Spectrum View

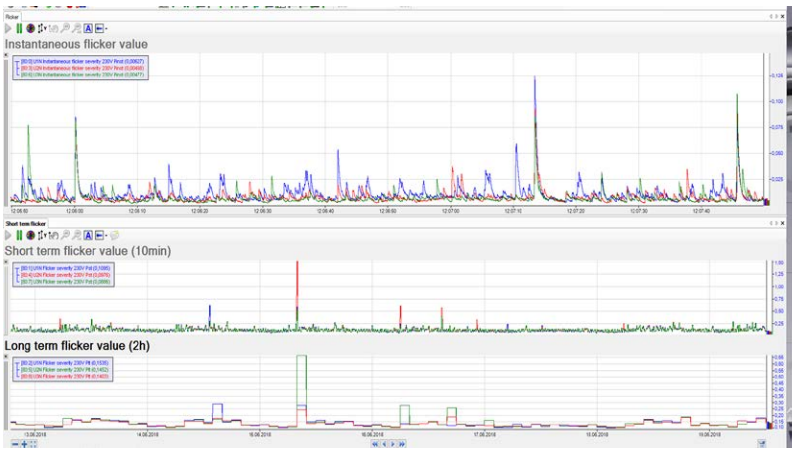
In the phasor view, voltages and currents are displayed according to magnitude and phase position. So the user recognizes the current load situation.

The spectrum diagram shows how much the consumers are burdened with harmonics. Both diagrams allow conclusions on the consumer structure.



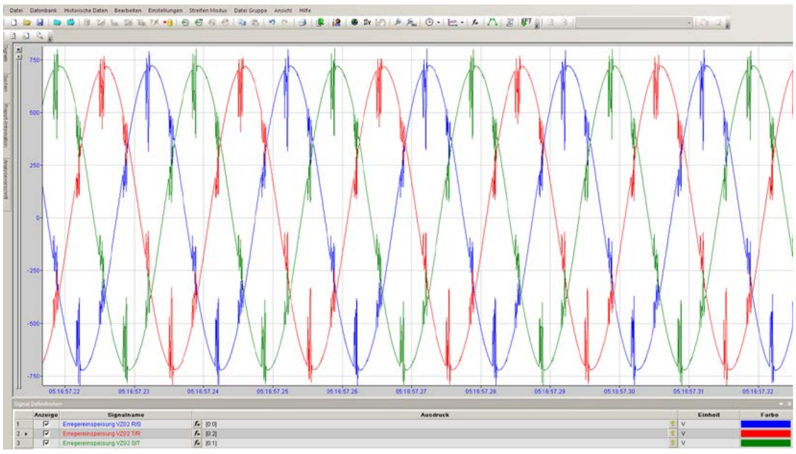
Example for a control room view for Power Quality Monitoring

ibaQPanel allows the live display of process and quality data, states and events, etc. With ibaQPanel, entire grid topologies can be displayed including corresponding measurement and process data. So control room staff is provided with the most important information and therefore can react quickly on system changes.



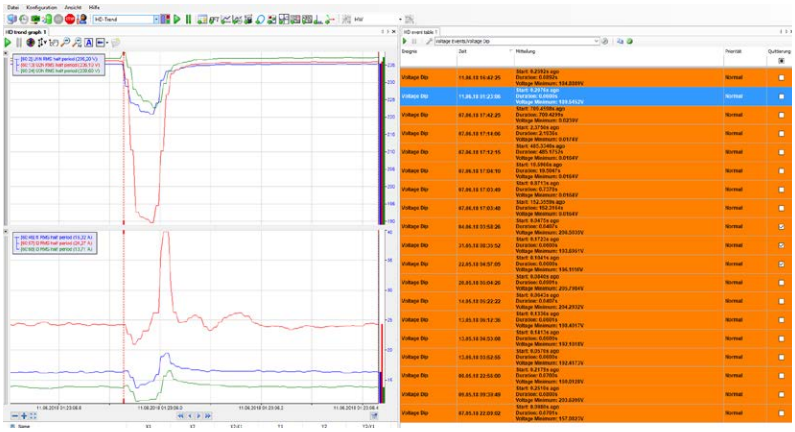
Example: flicker

The flicker value is an important measure to evaluate the power quality. Conclusions on grid topologies and consumer properties can be drawn with the help of the flicker value. In general, the long-term flicker value Plt must not exceed the limit value 1.



Example: commutation notches

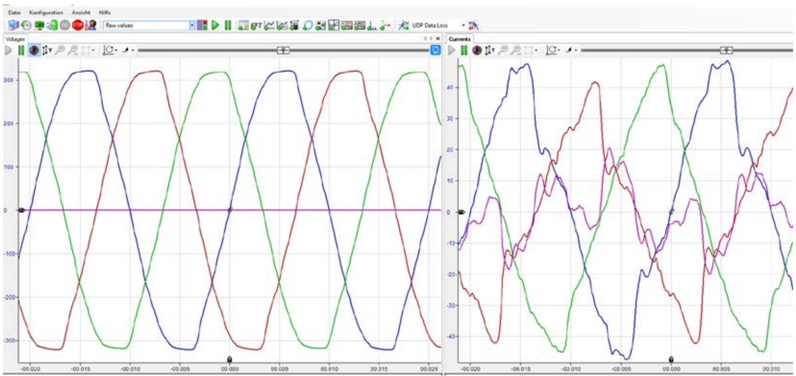
Commutation notches are caused, for example, by power converters. For the peaks being very steep but in fact also very brief, the effective value is only marginally changed. But nonetheless, other consumers can be interfered in their function by this effect. Thanks to the high-resolution (raw) values, this event is also recognized as an error and recorded by ibaPQU-S.



Example: voltage drop

The signal trend shows a voltage dip and the reaction of the effective values of the conductor currents to this event.

Further analysis allows to derive statements on the cause of the error and on the consumer structure. Preconfigured events can easily and quickly be found in the created event list and displayed in the trend graph by double-clicking.



Example: distorted currents

Nonlinear consumers, such as power electronic components, burden the supply grid with distorted, non-sinusoidal currents. As a result of the grid impedance, the voltage at the connection point is also subject to harmonics.

The flattening of the voltage (left figure) results from the overlay of the basic oscillation (50 Hz) and the harmonics (higher frequency components).

Power measurement with I/O modules of the 750 series from WAGO/Beckhoff

I/O modules of the 750 series from WAGO offer a cost-effective alternative for power measurement. Connection to the iba system is optionally via standard Ethernet or fiber optics.

At a glance

- Ideal applications: power flow analysis, internal energy management, calculation of energy costs and consumption
- Integration into the iba system:
  - with ibaW-750 via a standard Ethernet connection
  - with ibaNet750-BM-D via optical fiber with ibaFOB card
- Measurement in the low voltage range directly at consumers
- Cost-effective alternative to an ibaPQU-S system if no standard-compliant measurement is required

Ideal supplement

The iba system can be easily and cost-effectively expanded with 750 Series I/O modules from WAGO and K-bus modules from Beckhoff. There are different possibilities to integrate the I/O modules into the iba system: on the one hand via a standard Ethernet connection with the device ibaW-750, on the other hand via optical fiber with ibaNet750-BM-D.

In addition to analog and digital input and output terminals and complex terminals, the device also supports various terminals for power measurement of the 750-494 and 750-495 series.

Measure power, calculate characteristics

The terminals measure current and associated voltages in the three-phase power grid and calculate characteristic values, e.g.

- effective/reactive/apparent power
- effective/reactive/apparent energy
- power factor
- phase angle
- frequency

The power measurement terminals are particularly suitable for acquiring power characteristics in the low-voltage range directly at consumers. In addition, simple, but not standard-compliant grid analyses can be carried out on consumers.

For a standard-compliant measurement of the power quality, the Power Quality Unit ibaPQU-S is available.

Cost-effective solution

The use of power terminals is a simple, cost-effective solution for obtaining an overview of the most important power quality parameters when standard-compliant measurement is not required. Therefore, power flow analysis, internal energy management and the calculation of energy costs and consumption are among the ideal applications.

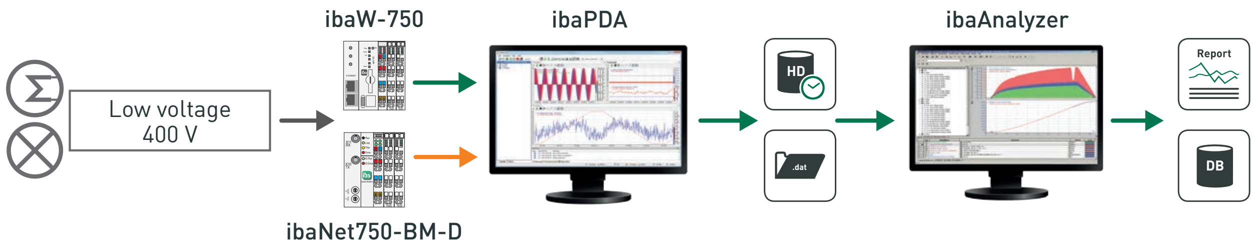
Convenient configuration, automatic detection

Both central processing units can be configured easily in ibaPDA as usual. The devices including connected I/O modules are automatically detected in ibaPDA.

In addition, a large number of diagnostic signals are available, which can trigger an alarm in ibaPDA if, for example, a preset limit value is exceeded or not reached.

Coupling to K-bus

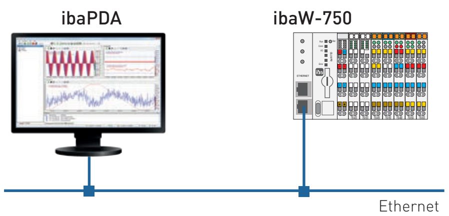
A maximum data volume of 2048 bytes can be transferred via the K-bus. The sampling rate depends on the cycle time on the K-bus.



Measurement of power characteristics in the low voltage range with WAGO power terminals

Acquisition of measured values via Ethernet with ibaW-750

ibaW-750 connects the K-bus I/O system to the ibaPDA data acquisition system via Ethernet. The signals are converted in the device and are available via the Ethernet interface. The ibaPDA system can be connected via a standard Ethernet card. ibaW-750 works with the new ibaNet-E protocol.



Measured data acquisition via Ethernet

Advantages of ibaNet-E

- Use of (existing) Ethernet cables and infrastructure
- Plant-wide connection
- Higher bandwidth than with fiber optics (ibaNet 32Mbit / 3 Mbit)
- Cycle times can be up to 1 second (e.g. for measured temperature values), up to now max. 1.4 ms possible with the FO connection

The two 10/100 Mbit Ethernet interfaces offer a switch function. So the network can be expanded easily via the ibaW-750 device.

By using the Ethernet transmission protocol ibaNet-E and a standard Ethernet connection, both the integration into the ibaPDA system and the device configuration for network/IT integration of ibaW-750 are extremely convenient.

A new function for device search ensures automatic detection if ibaW-750 is in the same LAN as the ibaPDA computer.

Isochronous measurement

ibaPDA synchronizes all ibaW-750 systems connected to it, enabling isochronous measurement of several distributed I/O systems via Ethernet.

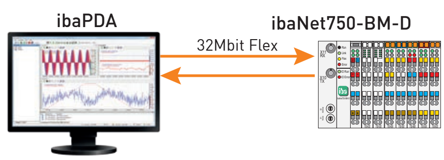
The sampling rate can be freely set up to 1 kHz. The maximum amount of data that can be transferred depends on the selected sampling rate. The following applies: The higher the sampling rate, the smaller the data volume.

Connection via fiber optics with ibaNet750-BM-D

The connection of ibaNet750-BM-D to ibaPDA is established via a bidirectional fiber optic connection with the iba protocol 32Mbit Flex. Here, too, ibaPDA automatically detects the I/O modules used and the signals can be selected and configured simply by mouse click.

With the ibaNet protocol 32Mbit Flex, the sampling rate can be flexibly set up to 40 kHz. The maximum data volume to be transmitted depends on the adjusted sampling rate: The higher the sampling rate, the lower the data volume. The ibaPDA application automatically determines the maximum sampling rate, which depends on the type and number of the I/O modules.

With 32Mbit Flex, it is possible to connect up to 15 devices to a ring topology. The signal limitation applies to the entire ring. Other 32Mbit Flex-enabled iba devices can be integrated into the ring as well.



Measured data acquisition via FO

Integration of IEC 61850 compatible protection devices in ibaPDA

The standard IEC 61850 (Edition 2) describes a transmission protocol for control and protection technology in electrical medium and high voltage switchgear. ibaPDA-Interface-IEC61850 /-9-2 allows integrating IEC 61850 compatible protection devices into the iba system.

At a glance

- IEC 61850 support in ibaPDA
- Event acquisition via GOOSE (Generic Object Oriented Substation Events)
- Measurement value acquisition via MMS (Manufacturing Messaging Specification)
- Acquisition of single attributes or whole data sets
- Comfortable selection of the signals to be measured using a symbol browser
- Acquisition of measured values via IEC 61850-9-2 (Sampled Values)

Communication according to standard

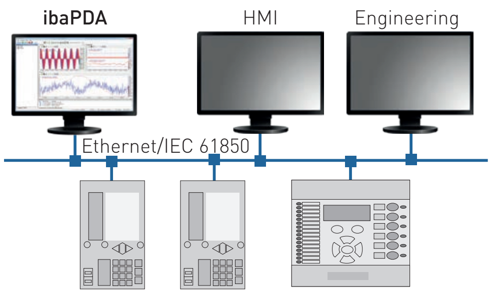
The standard IEC 61850 describes a general transport protocol for the protection, control and instrumentation technology in electrical switchgears of the medium und high voltage technology. The standard defines communication structures and an object-related data model. With this, the devices used, so called IEDs (Intelligent Electronic Device) can transmit their characteristics and can communicate with each other.

ibaPDA-Interface-IEC61850 enables the acquisition and recording of information from IEC 61850 compatible protection devices using ibaPDA.

Different communication types

The IEC 61850 protocol is based on TCP/IP and basically distinguishes between the following communication types:

- Manufacturing Messaging Specification (MMS)
- Generic Object Oriented Substation Events (GOOSE)
- Sampled Values according to IEC 61850-9-2



MMS

The MMS communication is a classic client-server-communication, where a device, e. g. a protection relay, will provide its data as a server. These data include e. g. characteristics and parameters of the device as well as measurement values and status reports.

GOOSE

GOOSE communication is based on the peer-to-peer principle and allows IEC 61850 devices to exchange data. This type of communication will be processed in real time directly on the Ethernet layer and therefore is likely used for safety relevant information and controlling data.

Sampled Values

Sampled Values is also based on the peer-to-peer principle and is used for the fast and cyclic transmission of digitized measured variables.

Sampled Values communication is described in the IEC 61850-9-2 standard. Currents and voltages are measured in real time and sent via Ethernet frames.

Data acquisition as IEC 61850 client

ibaPDA works as IEC 61850 client and supports both MMS and GOOSE communication. The corresponding modules are provided in the I/O Manager. After the connection is established between ibaPDA and the device, the data model can be downloaded from the device into the ibaPDA system.

With the interface ibaPDA-Interface-IEC61850-9-2, the acquisition of sampled values is possible.

Signal selection with the symbol browser

The signals to be measured can be selected comfortably based on the symbolic names supported by the IEC 61850 symbol browser. It gives access to all measurable symbols based on the imported server object list of the IEC 61850 device.

In the MMS module, the user can acquire individual data attributes or entire data sets. Additionally, it is possible to receive a report only when values change in a data set.

Accurate fault analysis using the high-speed fault recorder

The iba system is frequently used as a digital fault recorder in energy management applications. The facilities are continuously monitored for signal disturbances, but data recording is only triggered by a fault event.

- Fast fault and disturbance analysis
- High-resolution acquisition
- Cost savings through targeted troubleshooting

For this purpose, possible fault conditions are defined as different triggers. The iba system first saves the data to a buffer. When a fault condition occurs, recording of the signals is triggered in high resolution. This allows grid disturbances and other events to be analyzed accurately.

Trigger conditions for all events

In ibaPDA users can configure customizable trigger conditions that trigger precise recording. With the corresponding pre- and post-times for the trigger event, the history of a fault can be reconstructed exactly.

Trigger conditions can be configured with all analog and digital signals, combinations of multiple signals or using virtual signals. The trigger editor is an easy and fast way to define trigger conditions.

Moreover, event and status messages according to the IEC 61850 (Edition 2) protocol, e. g. GOOSE messages, can also be used as triggers. When using the Power Quality Unit ibaPQU-S, triggers can also act on the calculated characteristic values to monitor the power quality. The RMS value, for example, is suitable for analyzing the events that accompany voltage dips in more detail.

Customized recordings

Different measurement and monitoring modules allow different data recordings to be defined. Each recording can be controlled with its own triggers; specific signals can be selected and a dedicated sampling rate can be assigned. All data recording functions configured in an ibaPDA system are capable of recording in parallel.

The perfect hardware for all applications

Thanks to the modular hardware, the number of available channels increases with the requirements. The iba modular system can be used with different central units and it can be complemented with up to 4 additional I/O modules. The central unit ibaPADU-S-CM is a pure communication unit that samples signals synchronously and transmits them to the ibaPDA system via FO cables. The ibaPQU-S central unit additional enables the calculation and acquisition of power quality parameters. As I/O modules, there are different acquisition modules for current and voltage measurements. In this context it is worth mentioning the current acquisition modules with an overload factor of 1:100 at full resolution that were developed specifically for power engineering requirements. All modules in the iba modular system use sampling rates of up to 40 kHz to operate fully synchronous. If a higher resolution is required, the analog-to-digital converter ibaPADU-4AI allows acquiring signals with up to 100 kHz. Moreover, the entire iba connectivity can be used to couple signals as needed.

Multistation operation

Especially in complex energy measurement systems, several thousand signals are frequently measured and recorded synchronously. If the slots for input cards in one ibaPDA are no longer sufficient for all measuring channels, multiple ibaPDA systems can be synchronized in multistation mode.

An ibaPDA system then operates as the multistation master that can synchronize up to 4 ibaPDA systems as multistation slaves. In multistation mode, all ibaPDA systems work together as one system. They start and end a measurement at exactly the same moment and record synchronously to the exact sample.

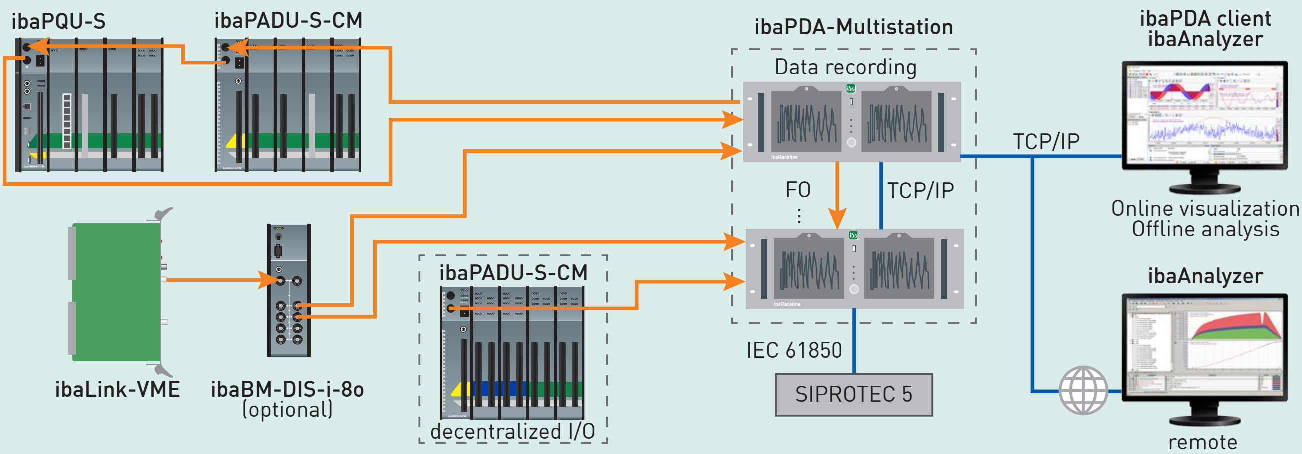
The ibaPDA systems in a multistation complex are able to exchange trigger events to trigger the recordings on all systems involved. The trigger signals are transmitted with the same high accuracy so that e. g. recording on ibaPDA system A can be started quasi simultaneously with the occurrence of a trigger event on ibaPDA system B.

The multistation mode requires an FO link from the master to each slave to transmit the sampling cycle and a network connection to exchange trigger events between master and slave.

Analysis

The recorded data can be analyzed in detail with ibaAnalyzer, allowing the cause of faults to be determined and short-term countermeasures to be introduced if necessary.

Application example: Fault recording in HVDC systems



Example of a configuration for using the iba system as a fault recorder in a HVDC system.

iba delivers several TFR systems (Transient Fault Recorder) worldwide for a number of high voltage DC transmission systems (HVDC).

The fault recorder function was implemented in addition to industrial computers and the data acquisition software ibaPDA with the iba modular system (ibaPADU-S-CM and/or ibaPQU-S) which is equipped with acquisition modules for current and voltage measurement.

The interface module ibaLink-VME is used in this application both to connect the system to SIMATIC TDC for measurement acquisition and for frame coupling of two SIMATIC TDC systems.

Undisturbed operation due to voltage monitoring

In a steel mill, energy and process data are collected simultaneously in accordance with EN61000-4-30 Class A (Ed.3). Thanks to the fast reaction to events, the required quality can be ensured and downtimes reduced.

Immediate detection of deviations

Real-time monitoring

The project

In steel works and metallurgical plants, downtime and repair costs due to the power quality disturbances become an increasing challenge. In addition, certain contractually defined quality features must be met when extracting electrical energy from the public grid. Continuous monitoring of the power grid parameters together with the process data forms the basis for faultless operation and the detection of possible failure.

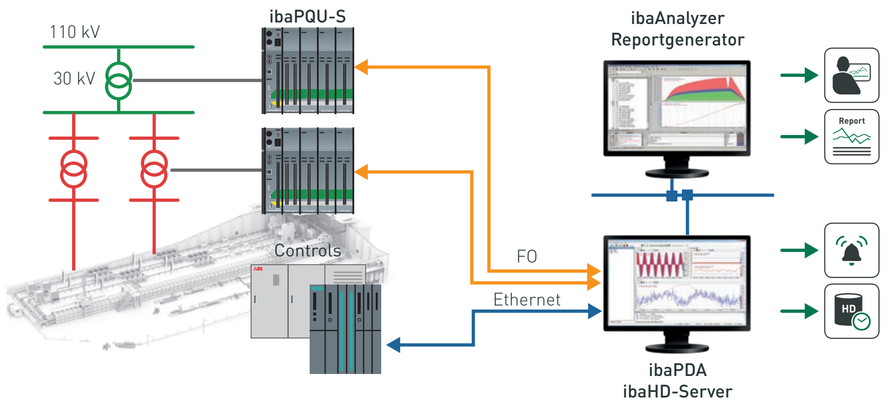
For this reason, a leading steel producer monitors, among other things, the power quality parameters at several transformer stations (from 110 KV to 30 KV) in order to demonstrate compliance with contractually defined limit values according to EN 50160 standard. In addition, power flows and system perturbations are systematically recorded to optimize the workload of the transformers. In addition, process states from the automation systems were used for the evaluation.

The technology

Due to the measurement with ibaPQU-S and further analysis of the measured values with ibaAnalyzer, excessive values of the individual harmonics were detected as well as unbalanced phase load. These parameters could be reduced by optimizing the workload of existing transformers and lines. Since then, the grid has been permanently monitored, which allows an early intervention in the grid dynamics.

By combining them with data from PLCs, you are able to react quickly to changes in process chain. Thus, the required product quality is guaranteed and high downtime and repair costs as a result of poor power grid quality could be reduced.

A weekly report with appropriate certification information is generated for the documentation backup.



Power quality monitoring and fault analysis in a steel mill

Order information

Software

Order no.	Name	Description
30.770064	ibaPDA-64	Basic package server/client bundle for 64 signals
30.770128	ibaPDA-128	Basic package server/client bundle for 128 signals
30.770256	ibaPDA-256	Basic package server/client bundle for 256 signals
30.770512	ibaPDA-512	Basic package server/client bundle for 512 signals
30.771024	ibaPDA-1024	Basic package server/client bundle for 1024 signals
30.772048	ibaPDA-2048	Basic package server/client bundle for 2048 signals
30.774096	ibaPDA-4096	Basic package server/client bundle for 4096 signals
30.778192	ibaPDA-8192	Basic package server/client bundle for 8192 signals
30.779999	ibaPDA-unlimited	Basic package server/client bundle for an unlimited number of signals
30.001930	ibaPDA Multistation	Expanded license for multistation operation
31.001090	ibaPDA-Interface-IEC61850-Client	IEC61850 communication interface for 64 connections
31.001400	ibaPDA-Interface-IEC61850-9-2	IEC 61850-9-2 interface for 2 streams
30.800064	ibaHD-Server-V2-T-64	Basic license ibaHD-Server-V2 for 64 tags (signals)
30.800256	ibaHD-Server-V2-T-256	Basic license ibaHD-Server-V2 for 256 tags
30.801024	ibaHD-Server-V2-T-1024	Basic license ibaHD-Server-V2 for 1024 tags
30.802048	ibaHD-Server-V2-T-2048	Basic license ibaHD-Server-V2 for 2048 tags
30.806666	ibaHD-Server-V2-T-unlimited	Basic license ibaHD-Server-V2 for unlimited tags

Additionally, license expansions are available for ibaPDA and ibaHD server to increase the number of signals, clients and data stores.

ibaPQU-S and I/O modules

Order no.	Name	Description
10.150000	ibaPQU-S	Power Quality Unit
10.124600	ibaMS3xAI-1A	Input module with 3 analog current inputs ± 3.0 A
10.124610	ibaMS3xAI-5A	Input module with 3 analog current inputs ± 15.0 A
10.124620	ibaMS3xAI-1A/100A	Input module with 3 analog current inputs ± 6.25 A (± 100 A for 1 s)
10.124521	ibaMS4xAI-380VAC	Input module with 4 analog voltage inputs, 380 V AC
10.124500	ibaMS8xAI-110VAC	Input module with 8 analog voltage inputs, 110 V AC
10.124100	ibaMS16xAI-10V	Input module with 16 analog voltage inputs ± 10 V
10.124101	ibaMS16xAI-10V-HI	Input module with 16 analog voltage inputs ± 10 V, high impedance
10.124102	ibaMS16xAI-24V	Input module with 16 analog voltage inputs ± 24 V
10.124103	ibaMS16xAI-24V-HI	Input module with 16 analog voltage inputs ± 24 V, high impedance
10.124110	ibaMS16xAI-20mA	Input module with 16 analog voltage inputs ± 20 mA
10.124200	ibaMS16xDI-220V*	Input module with 16 digital inputs ± 220 V
10.124201	ibaMS16xDI-24V*	Input module with 16 digital inputs ± 24 V
10.124210	ibaMS32xDI-24V*	Input module with 32 digital inputs ± 24 V
10.124000	ibaPADU-S-B4S	Subrack for a central unit and 4 modules

* The module can be used, but the signals are transmitted as raw values only.

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Technical changes and errors excepted.

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