DEWETRON Power Applications

Test & Measurement Solutions

worldwide

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Test & Measurement Solutions

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From our founding in 1989, DEWETRON has become a market-leading provider of test and measurement systems. Our 200+ employees are located at our headquarters in Graz, Austria - and also in more than 25 countries around the world.

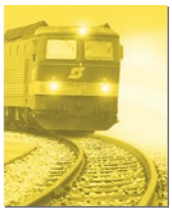
DEWETRON is with Augusta Technology AG and their new major shareholder TKH group, part of an international industry group with 1,1 billion Euro turnover and more than 4.700 people.

We provide highest quality Test & Measurement Solutions for


Automotive


Power & Energy


Aerospace


Transportation


General T&M

Reference Customers

NASA, Airbus, OMV, Lockheed Martin, Lufthansa, Honda, Harley Davidson, Johnson & Johnson, Renault, Rolls Royce, Windtest, Verbund Hydro, Rockwell Collins, Schindler, Trumpf, Technical University Vienna, Pirelli, Kawasaki, Bell Helicopter, Boeing Commercial Airplanes, Bombardier, New York Subway, Trenitalia, Continental, and many more ...

We have the expertise & we go the extra mile for our customers

Since 25 years data acquisition is all we do. As we are producing instruments each new development is based on huge experience in making data acquisition systems.

Customization is one of our biggest strengths - we love the challenge and we like to go the extra step for our customers to enable highest quality test and measurement data in shortest time.

There is a whole team of application engineers with 10+ years of experience to support challenging applications.

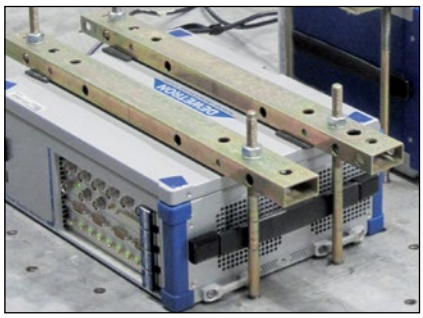
Quality

Our commitment to Total Quality Management is based on the understanding of what is important for the success of our customers. It starts with the definition of the technical specification, covers the development, production, quality control, shipment, and ends with support and service of our systems during operation.

DEWETRON is ISO 9001:2008 and ISO 14001:2009 certified. Environmental and quality management is more than just a compliance issue for us; it is an integral part of our business operations.

We take quality very seriously! That is why we have our own environmental test facilities in our building in Austria, where all DEWETRON products are tested..

Extensive temperature tests (-40 to +70 °C)



Shaketest procedure


ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

CERTIFICATE

The Certification Body
of TÜV SÜD Landesgesellschaft Österreich GmbH
certifies that

Dewetron Elektronische Meßgeräte Ges.m.b.H.
Parkring 4
A-8074 Graz-Grambach

has established and applies
a Quality and an Environmental Management System for

Design, Production, Trade and System-Integration
of Data Acquisition Systems and Instruments

An audit was performed, Report No. 153110
Proof has been furnished that the requirements
according to

ISO 9001:2008 and ISO 14001:2009

are fulfilled. The certificate is valid until September 2014
Certificate Registration No. QU1530003

Vienna, 2011-12-07

Certification Body
of TÜV SÜD Landesgesellschaft Österreich GmbH
Campus 21 Europaring A04301, A-2345 Businesspark Wien Süd, Austria

ISO certificate

DEWE-ACADEMY

In the DEWE-ACADEMY single or multi-day events are offered. Professionals teach the practical application of our measurement systems, based on the relevant theory.

DEWETRON ACADEMY

Calibration

DEWETRON maintains two top-notch calibration facilities with the same equipment: one at our worldwide headquarters in Austria, and another one at DEWETRON USA in Rhode Island. Our cal lab is based on the Fluke 5500 series calibrator, and we run the METCAL calibration system, which allows us to automate nearly every process.

APPLICATIONS (page 5)

Applications

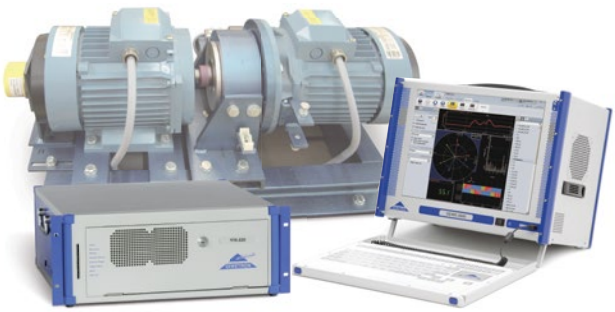
- *Power Measurement (PM)* 7
- *E-Mobility (EM)* 15
- *Power Network Analysis (PNA)* 25
- *Power Fault Recording (PFR)* 37

SOFTWARE (page 49)

Software

- *Marlin Power Measurement* 49
- *DEWESoft™* 55
- *PMT Process Monitoring Tool* 62

HARDWARE (page 67)



Hardware

- *E-Mobile Instruments* 69
- *Power Measurement Instruments* 70
- *Power Network Analysis Instruments* 72
- *Power Fault Recording Instruments* 74
- *Amplifier Modules* 76
- *Current Transducers* 78
- *Current Clamps & Ampflex* 80

CALCULATION EXAMPLES (page 85)

APPLICATIONS

APPLICATIONS

Suitable for
PM EM PNA PFR

PM - Power Measurement - Power Analyzer 7

- Hardware 8
- Software 9
- Inverter Measurement 13
- Photovoltaic test bench 14

EM - E-Mobility 15

- Hardware 16
- Software 17
- Measurement on the test bench 20
- Measurement under real driving conditions 21
- Battery testing 23

PNA - Power Network Analysis 25

- Power quality measurements and analyses 28
- Energy consumption measurements and load curve analyses 31
- Measuring wind power and other renewable energy sources 33

PFR - Power Fault Recording 37

- Power fault recording and power monitoring in energy transmission grids 40
- Monitoring power supply of electrical railway systems 43
- Harmonic monitoring of high-voltage DC power lines (HVDC) 45

Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

Suitable for PM

Power Measurement - Power Analyzer

DEWE-PM

In times of power electronics, power measurement is not only a multiplication of current and voltage, but primarily an analysis of interfering high-frequency and broadband signals. Sinusoidal qualities, as once electric current and voltage, are displaced by pulse packages; power ratings do not have only 50 or 60 Hz any longer.

Beside the calculation of power for the fundamental oscillation and all signals, questions of harmonics, symmetries, flickers and start-up processes arise.

Switching frequencies of drive mechanisms having several kHz require sampling rates of several hundred kHz and analogical bandwidths of input amplifiers. The demand of preciseness is far below 0.1 % and this should preferably be the case in the entire frequency spectrum and amplification range.

Key Features Software

- *Measurement of DC, 1-, 2-, 3-, 6- and 7-phase AC systems*
- *16.7 Hz, 50 Hz, 60 Hz, 400 Hz, 800 Hz, variable frequencies (1.5 Hz up to 10 kHz)*
- *Multiple power measurements with one device*
- *Math-library for efficiency, energy consumption, recuperation calculation*
- *Power quality library for FFT, harmonics, higher frequencies, flicker, flicker emission, symmetrical components etc. and automatic report generations*
- *Calibration in frequency domain*

Key Features Hardware

- *High bandwidth up to 6 MHz*
- *High accuracy 0.02 %*
- *High sampling rate up to 10 MS/s*
- *Continuous data storing in full sample rate*
- *Flexiblity in number and type of input channels*

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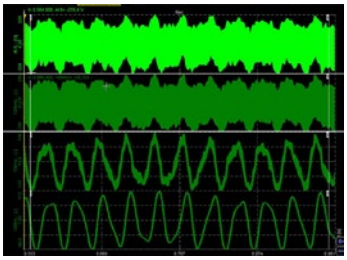
High bandwidth of whole measurement chain and high sampling rate



Modern frequency converters for electric vehicles work with a pulse frequency up to 100 kHz. To acquire these signals for precise power measuring, it is necessary to choose a high sampling rate. With DEWETRON systems a sampling rate of ***up to 10 MS/s*** *is possible. This allows exact analysis of the pulse packages of frequency inverters.*

Furthermore an analog bandwidth of up to 1 MHz should be guaranteed. DEWETRON galvanic isolated amplifiers with a bandwidth up to 2 MHz ensure this.

Current input – direct, low-voltage or flexcoil

Due to modular system it's possible to connect all types of current transducers to the system. So you whether can measure the current directly via a shunt-amplifier module (30 A peak), or via external sensors (shunt, clamp, etc.) with low-voltage module or you can connect simple flexcoils (integrator is located in the device itself). All modules are galvanic isolated with an accuracy of 0.02 %.

Modular system – Flexible number & type of channels

The hardware offers different signal inputs like analog, digital, counter/encoder, video, GPS and various bus systems like CAN which all are recorded perfectly synchronized. Almost every sensor (voltage, current, rpm, force, torque, noise, vibration, emission data, temperature, pressure, etc.) can be connected to the DEWETRON system. Furthermore the system can be expanded to any number of input channels.

Voltage input up to 1600 V_{DC}

To ensure voltage and current measurement at every point of the electrical powertrain (also in the intermediate circuit) a wide voltage input range and high accuracy for both, current and voltage measurement, is necessary. The galvanic isolated (4 kV) high-voltage amplifiers allows to measure voltages up to 1600 V_{DC} with an accuracy of 0.02 %.

Mobile measurement system

Mobile measurements require measurement systems with small form factor.

DEWETRON measurement systems can be equipped with battery packs which enable measurements under real driving conditions. The battery packs are hot-swapable which ensures arbitrary length of the measurements (e.g. measuring energy consumption at an empty run of a vehicle).

Resolution

Standard resolution is 16 bit for up to 10 MS/s sampling rate. For special applications also an A/D converter with a resolution of 24 bit and a maximum sampling rate of 200 kS/s can be reached.

Data storing

The concept of the whole measurement system allows a continuous storage of data in the full sampling rate. The possible storage duration depends only on the used hard disk and can be easily enlarged.

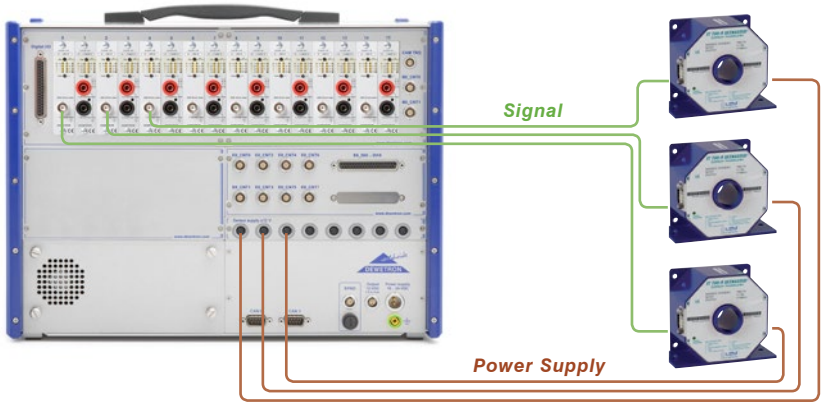
Hardware Synchronization

It's possible to synchronize a number of different DEWETRON measurement systems with each other via direct connection or via GPS. The synchronization will be done in the full sampling rate.

Power supply for sensors

The measurement system can also provide the power supply for different sensors (±9 V, ±15 V). So for example the power supply for current transducers (current clamps or a zero-flux transducer system) can be directly provided from the measurement system.

Further sensors, such as GPS or video, can be connected to the system.



Software

The software is user-friendly and easy to use. It is always the same, for measurement and analysis, so you do not have to switch between different software tools.

Power calculation

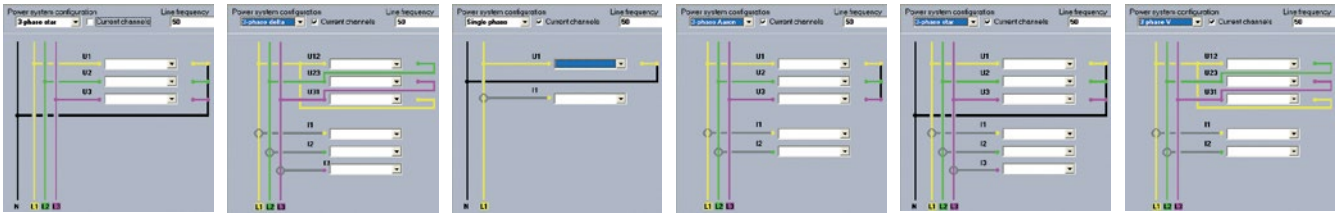
- *Active power (P), reactive power (Q), apparent power (S), distortion power (D)*
- *Cos φ, power factor*
- *P, Q, cos φ for each harmonic*
- *Symmetrical components (positive, negative and zero sequence components); U, I, P, Q, cos φ; from 10 period values and period values*
- *Period values (½ cycle, cycle, overlapping, 1 ms sliding, ...)*
- *Synchronized calculation intervall over 5 to 60 periods (normally used 10 periods in 50 Hz and 12 periods in 60 Hz systems)*

Power system configurations (wiring schematics)

In the software it's possible to define any power system configuration, starting from one-phase AC systems up to 7-phase systems (6- and 7-phase configuration is a combination of 3 and 1-phase systems)

- *DC*
- *1-, 2-, 3-, 6-, and 7-phase AC systems*

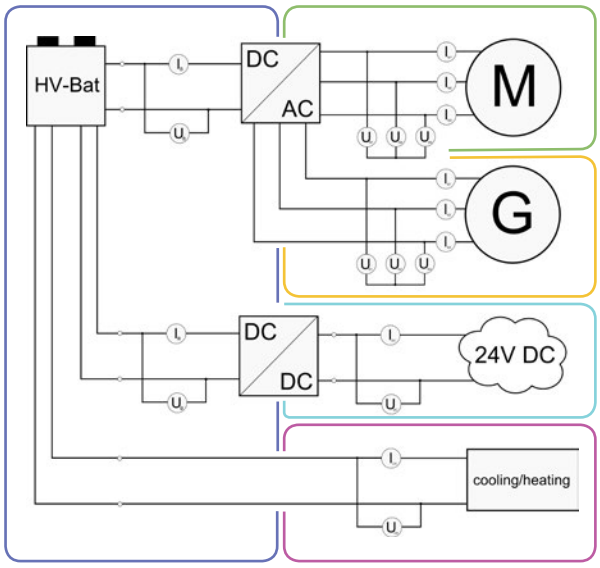
Different wiring schematics allow all possible connections. These are single phase, star connection, delta connection, V connection, Aron connection and a combined star / delta connection. All of course with or without currents.



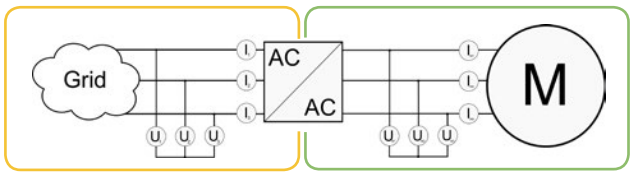
For three-phase systems it is possible to calculate out of a star connection the delta waveform and rms values and vice versa.

Multiple power measurements

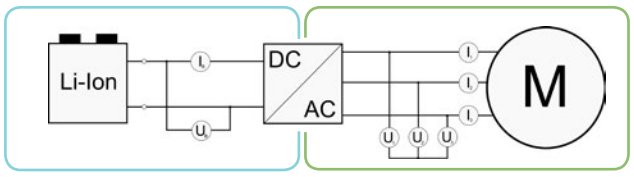
It's possible to do multiple power measurements within the same device and also with different system configurations and system frequencies. This is especially for the determination of efficiency factors indispensable.



2 x 3-phase AC measurement and 3x DC measurement



2x 3-phase AC measurement



DC and 3-phase AC measurement

Power system frequencies & frequency calculation

The software PLL guarantees a very accurate frequency estimation (mHz). The resampling functionality ensures even for very fast frequency changes (inverter with variable frequency) right results without gap and time-delay.

It's also possible to use different power system frequencies for different power measurements within one device.

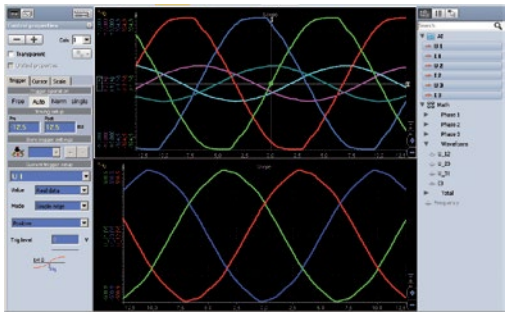
Possible system frequencies:

- *16.7 Hz (railway applications)*
- *50 Hz, 60 Hz (electrical grid)*
- *400 Hz, 800 Hz, (motors, generators on ships, airplanes etc.)*
- *Variable from 1.5 Hz up to 10 kHz (e.g. variable drives)*

Calibration in frequency domain

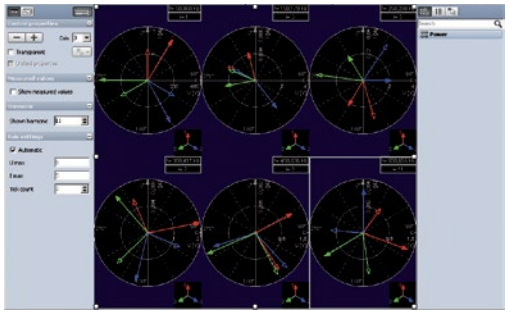
Any part (module, clamp, sensor) has a frequency depending transmission curve for amplitude and phase: A(f), Phi(f). In the software it is possible to calibrate all sensors in the frequency domain. With this unique technology the basic accuracy of different sensors can be highly improved and ensures highest accuracy for power measurement.

Scope



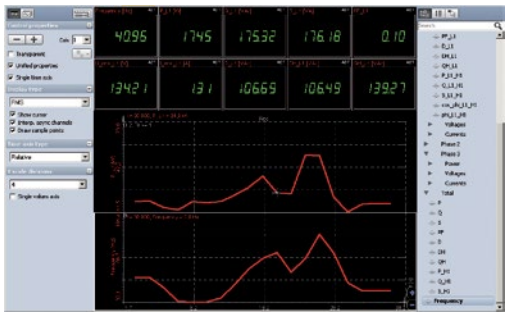
- *Selectable graphs*
- *U1, U2, U3, U12, U23, U31: line to line and line to earth voltages are supported*
- *Up to 8 graphs in one diagram*
- *Zoom in and out are supported online*
- *Waveforms can be stored*
- *Flexible trigger options*

Vector scope

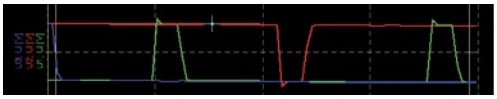


- *Vector scope for 3 phase systems*
- *Each individual harmonic can be shown*
- *More vector scopes can be displayed on one screen*
- *Different power systems can be shown on one screen*
- *With the "transparent" function direct comparisons of phasors are possible*

Recorder



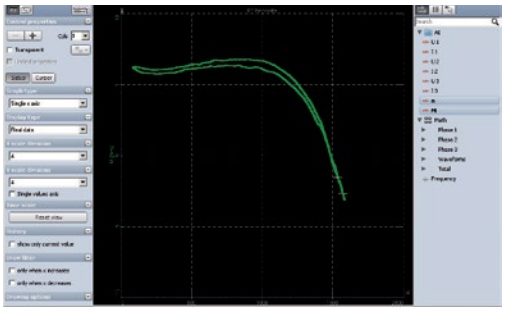
- *Display synch and asynchronous parameters in the same screen*
- *Individual screens can be defined*
- *Zoom in and out*
- *Storing fast (full sampling rate) or reduced (e.g. 600 sec.)*
- *Detailed zoom-in to pulse width*



X/Y recorder

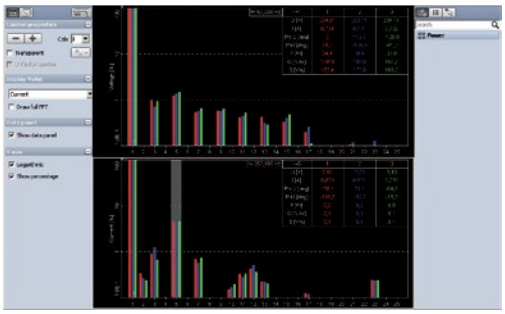
- *Orbitals can be generated online*

  P over Q as example for this function



FFT - harmonics analysis

- *U, I, P and Q up to the 1000st order*
- *Individual setup of the number of harmonics including DC-component*
  (example: 20 kHz sampling rate = 100 harmonics @ 50 Hz)
- *Harmonic smoothing filter (according to IEC 61000-4-7)*
- *Full- and half weighted sidebands (according to IEC 61000-4-7)*
- *Calculation corrected to the actual real frequency*
- *Higher frequencies: grouping in 200 Hz bands (according to IEC 61000-4-7)...*
- *Full FFT spectrum available with each FFT line of synchronized signal*
- *Background harmonics substractable*
- *Optionally definable group-mode for harmonics and interharmonics.*
  Selectable number of bins and frequency groups - "200 Hz" according to EN 61000-4-7 (OPT-DB required)



FFT - frequency analysis

- *In addition to the harmonics FFT a full frequency based FFT is available (with selectable window size)*
- *All frequencies can be analyzed with this function*
- *Trigger on FFT patterns*
- *Definable filters (hanning, haming, flat top, rectangle, ...)*
- *Analysis up to the half sampling rate possible*

Flicker

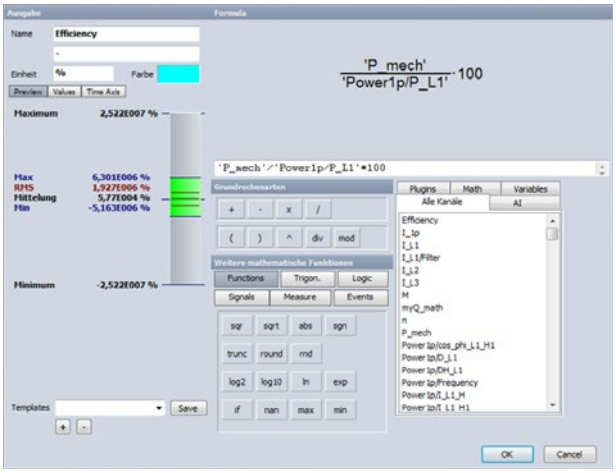
- *According to EN 61000-4-15*
- *P_{ST} and P_{LT} with flexible intervals*
- *Individual recalculation intervals*
- *Flicker emission (current flicker)*
- *Rapid voltage changes: dt (duration of voltage drop), dc (peak of voltage drop) , du (steady deviation of voltage)*

Flicker emission

The flicker emission (also called current flicker) is the amount of flicker, which is added to the grid of a producer or consumer. The determination of these factors is important for the analysis of wind power plants. With the grid impedance and the measured current the voltage drop of an ideal voltage source is calculated and estimated with the flicker algorithm the Flicker emission co-efficients are calculated (according to IEC 61400-21).

Math functions

With the additional MATH function of DEWESoft™ calculations of for example efficiency, difference of input, output and phase angle differences can be implemented easily. Use all POWER parameters as input value.



- *Arithmetic functions*
- *Trigonometric functions*
- *Logic function*
- *Signal generator*
- *Event functions*
- *d/dt, integration*
- *Highpass, lowpass and bandpass filters*
- *Transfer curve function*
- *Statistics*

Analysis & report generation according to different standards

Within the software or via additional plugins it is possible to do analysis according to different standards and partially also with automatic report generation.

Here is a list of covered standards:

- *61000-4-30*
- *61000-4-7*
- *61000-4-15*
- *61000-3-2*
- *61000-3-3*
- *EN50160*
- *IEEE 1159*
- *IEC 61400-12-1*
- *IEC 61400-21*
- *VDE AR4105*
- *FGW-TR3*
- *EN160001*
- *TOR D2*
- *BDEW*
- *61000-2-4*
- *EN 61000-3-11*
- *EN 61000-3-12*

etc.

Recording options

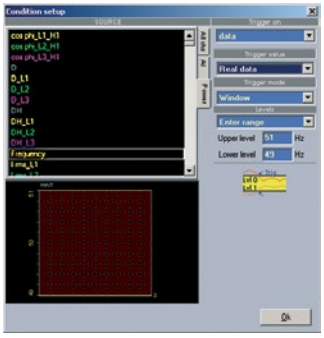
Edge, filtered edge and window trigger

Setting the trigger on rising edge when the threshold has been crossed

Setting the trigger on falling edge when the threshold has been crossed

Setting the trigger when signal enters the range between two definable threshold levels

Setting the trigger when signal leaves the range between two definable threshold levels



Further trigger functions: pulse width, window and pulse width, slope, FFT and time

Inverter Measurement

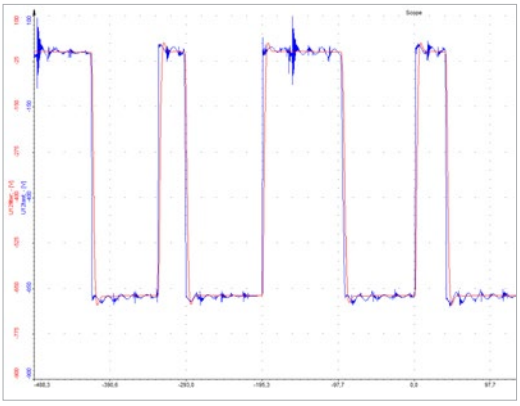
Application Example for Power Measurement

The customer is manufacturer of power inverters mainly for urban trolley busses and rail public transport services. At the test bench, they do detailed analyses at the power inverters, the motors and the whole powertrain.

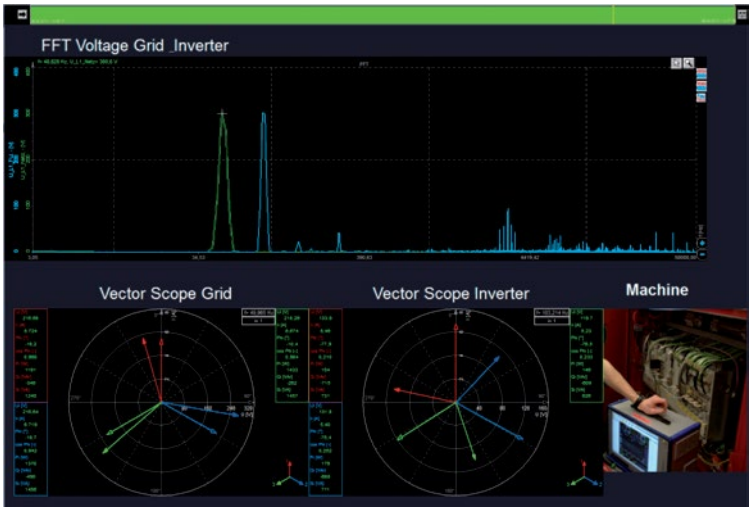
On the one hand, they analyze the PWM generation in detail and need therefore highest sampling rates, high bandwidth and highest accuracy for the whole measurement chain. On the other hand, they do also efficiency measurements and need therefore power measurement at multiple points (3-phase star and delta, 2-phase, 1-phase and DC) and also with different frequencies (variable, 50 Hz, 60 Hz, 16.7 Hz, 400 Hz, 800 Hz). Additional measurement channels for mechanical parameters (torque, speed, etc.) and ambient parameters (temperature, humidity, etc.) are required. All in all there are 24 channels which have to be measured completely synchronous (with 2 MS/s sampling rate).

Further requirements are the online efficiency determination of the inverter and a number of further calculations via the Math library and the power plugin. For detailed analysis, they use the post-processing function provided by the software.

Simultanous measurement on the grid and inverter



PWM signal of the inverter



FFT and vector scope of the inverter and the grid

DEWE-2600 measurement instrument

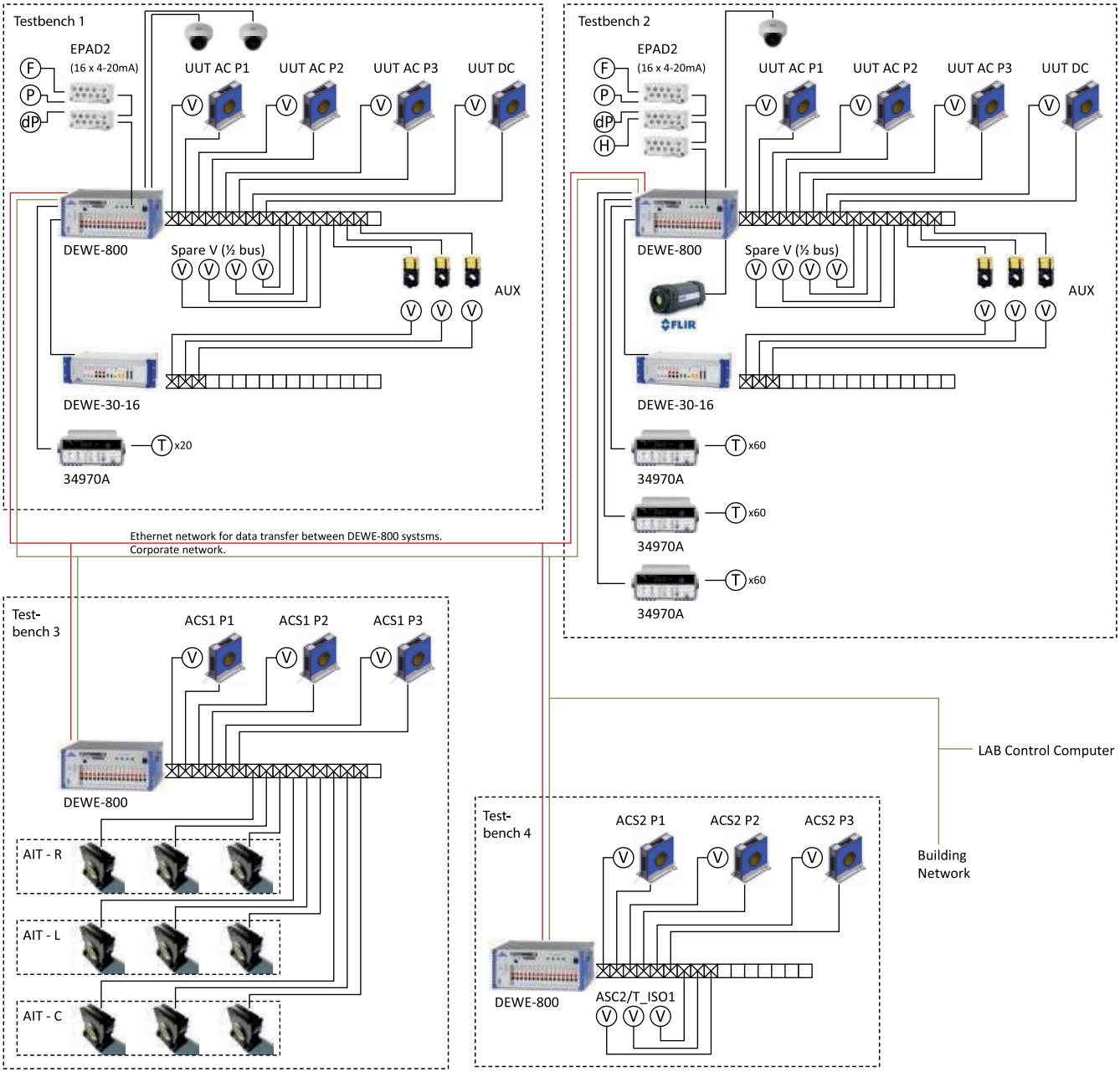
Test bench for photovoltaic systems

Application Example for Power Measurement

The customer is manufacturer of electrical equipment mainly for the energy sector. In the division of solar they provide complete solutions for photovoltaic integration. They have several test bays for analysis of the photovoltaic systems, starting from the DC output of the solar panel up to the grid connection.

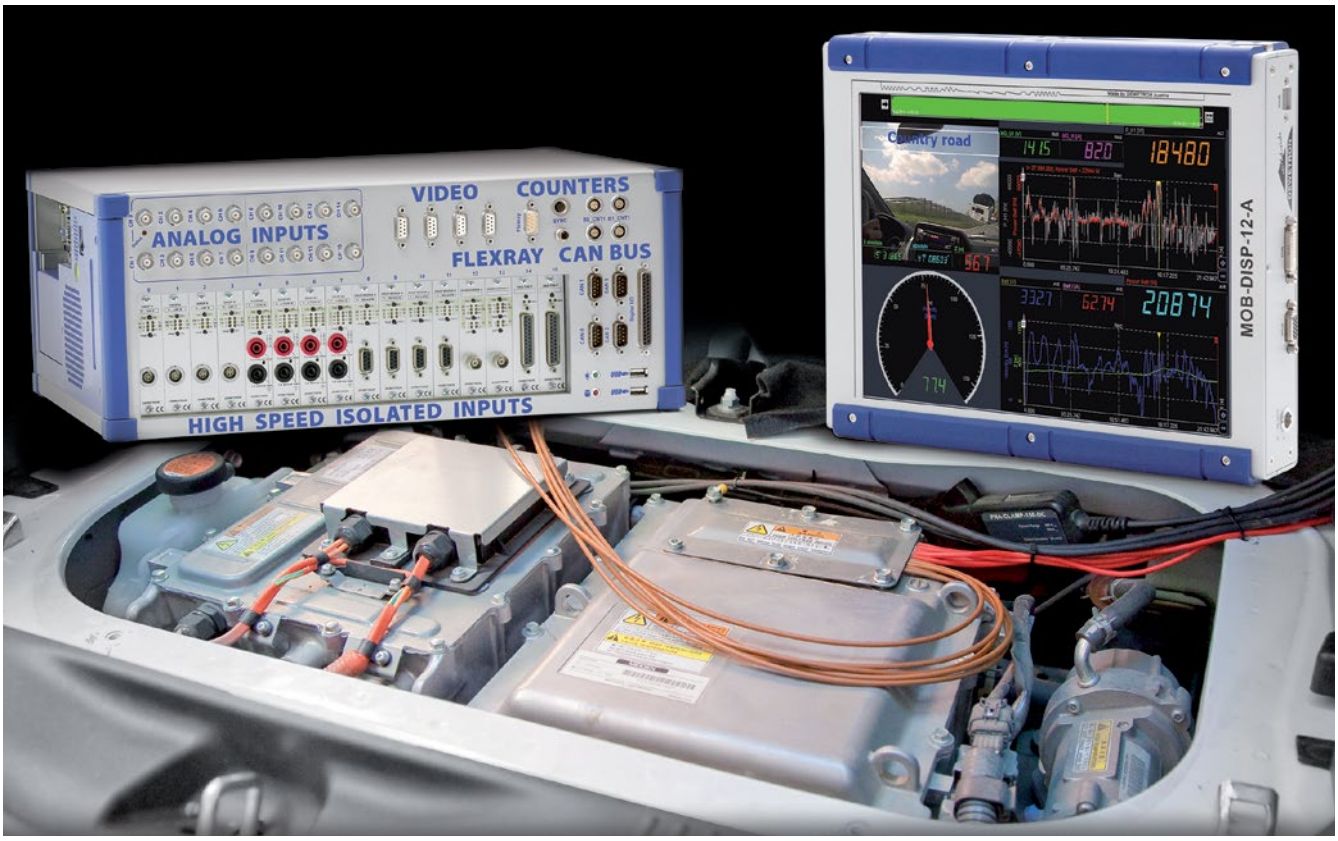
They want to do a number of analysis at the test-bench like efficiency determination, harmonics analysis, energy generation, profiles of the power generation etc. at different ambient conditions and different operation situations. Beside the data acquisition of voltage and currents they also want to connect video and infrared cameras, temperature-, humidity- and pressure sensors to the measurement device. There are all in all more than 130 sensors connected to the different measurement devices at all five test-bays. It is possible to do the data acquisition of all signals at all test-bays completely synchronous with the full sampling rate.

They need to do the calculation of the electrical power for different wirings like one phase, three phases, DC and also for different frequencies during measurement. Furthermore they want to do a lot of mathematical operations (filter, statistics, correlation, classification, arithmetical- and trigonometrically functions) already during the measurements.



Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

Suitable for EM



E-Mobility

DEWE-E-MOBILE

The shift from the conventional vehicle towards the various hybrid technologies and purely electrically driven vehicles has already began. The range of micro, mild, full and plug-in hybrids already available or posed for launch is a clear indicator that e-mobility is regarded as our biggest short-to-medium-term hope for environmentally-friendly mobility.

In the race to produce an electric vehicle with a range for everyday use, the development of energy efficient components is an important focus for automotive research centres all over the globe. Consequently there is an enormous need for test and measurement systems to monitor the energy flow and storage through vehicle activity such as charging, startup, driving, parking and potential misuse of the vehicle. DEWE-E-Mobile systems can do so much more than just capture voltage and current signals.

An extra library for power measurement (POWER module) makes the calculation of, for example, power flow, losses, harmonics and voltage fluctuations possible. With the help of this functionality the user can - beside the DC measurement on batteries - make synchronized analysis of the other components like converters and motors.

Adding transducers such as accelerometers, rpm sensors or thermocouples can be handled through flexible and isolated signal conditioning, recorded in a synchronized way by hundreds of channels of vehicle CAN bus data. Add a GPS sensor to give information about position, distance, velocity and direction, along with video cameras to monitor road or environmental conditions - then you have a very clear view of the "e-vehicles'" performance characteristics.

Key Features

- *ALL-IN-ONE Power Analyzer, Combustion Analyzer, recorder and scope on a single machine*
- *Synchronized analog & digital signals, counter, CAN bus and video inputs – to simplify analysis*
- *Flexible number of channels*
- *High isolation and high accuracy*
- *High bandwidth up to 2 MHz*
- *High sampling rate up to 10 MS/s*
- *Online or offline efficiency, energy and recuperation calculation*
- *Measurements in real driving conditions or at the test bench*

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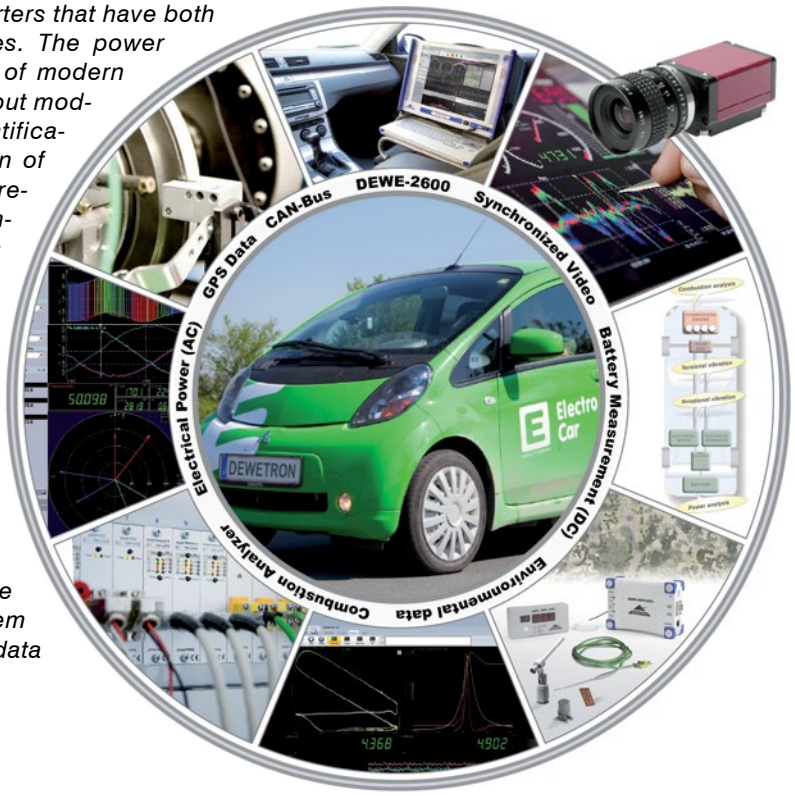
Suitable for
EM

Modern drive systems work with very fast converters that have both high pulse frequencies and steep rising edges. The power measurement is thus confronted with all tasks of modern power measurement instruments: broadband input modules, high sampling rates, highly accurate identification of reactive and active power, determination of rotation speed and torque. Beside the measurements of motors (3~, permanently energized synchronization instruments), also measurements of battery circuits and intermediate circuits are of interest – and this absolutely synchronous (DC, single-phase).

Further interesting parameters could be temperature, oscillation, acoustics, sound emission, torsion and rotation oscillation and analysis of combustion engines, in case that they are used in parallel. On the one hand, such systems should be as portable as maximally possible for mobile applications. On the other hand, it should be possible to integrate them in engine test benches. This requires adequate data interfaces.



DEWETRON hardware

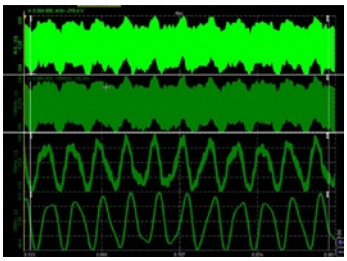
Broadband, isolated measuring inputs, high sampling rates and robust design combined with high flexibility – this unifies DEWETRON in its instruments of DEWE-E-Mobile series; be it the DEWE-510 as engine test bench solution or integrated in the car, respectively the DEWE-2600 that is battery-powered. They all have the modular construction in common that allows an arbitrary number of current and voltage input channels. Temperature, charge or bridge amplifiers can also be used as can CAN bus adapters or counter interface for e.g. tachometers.

Hardware key features

Modular system – Flexible number & type of channels

The hardware offers different signal inputs like analog, digital, counter/encoder, video, GPS and various bus systems like CAN which all are recorded perfectly synchronized. Almost every sensor (voltage, current, rpm, force, torque, noise, vibration, emission data, temperature, pressure, etc.) can be connected to the DEWETRON system. Furthermore the system can be expanded to any number of input channels.

High bandwidth of whole measurement chain and high sampling rate



Modern frequency converters for electric vehicles work with a pulse frequency up to 100 kHz. To acquire these signals for precise power measuring, it is necessary to choose a high sampling rate. With DEWETRON systems a sampling rate of up to 10 MS/s is possible. This allows exact analysis of the pulse packages of frequency inverters.

Furthermore an analog bandwidth of up to 1 MHz should be guaranteed. DEWETRON galvanic isolated amplifiers with a bandwidth up to 2 MHz ensure this.

Wide voltage and current input range with high accuracy

To ensure voltage and current measurement at every point of the electrical power train (also in the intermediate circuit) a wide voltage input range and high accuracy for both, current and voltage measurement, is necessary. The galvanic isolated high-voltage amplifiers allow to measure voltages up to 1600 V_{DC} at an accuracy of 0.02%.

For highly accurate current measurement zero flux transducers are used that not only feature high dynamics (startup current versus idle current with an accuracy of 0.05%) but also high bandwidth (>300 kHz).

Calibration in frequency domain

Any part (module, clamp, sensor) has a frequency depending transmission curve for amplitude and phase: A(f), Phi(f). In DEWETRON software it is possible to calibrate all sensors in the frequency domain. So the basic accuracy of different sensors can be additively improved and ensures highest accuracy for power measurement.

Mobile measurement system

Mobile measurements require measurement systems with small form factor.

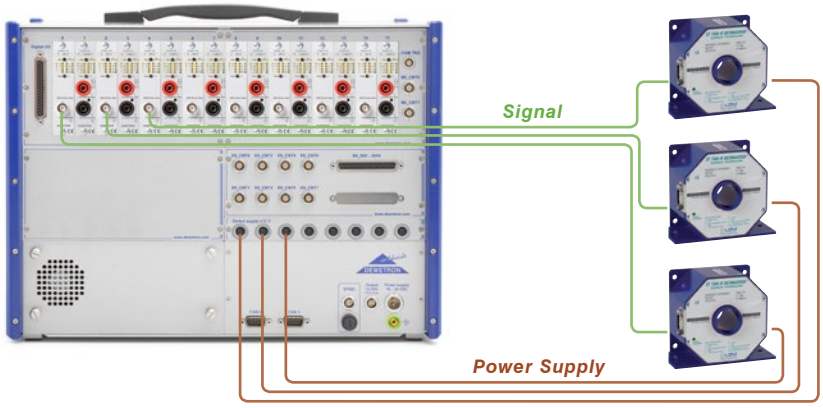
The DEWETRON measurement system can be equipped with battery packs which enable measurements under real driving conditions. The battery packs are hot-swapable which ensures arbitrary length of the measurements (e.g. measuring energy consumption at an empty run of a vehicle).

Software key features

Power supply for sensors

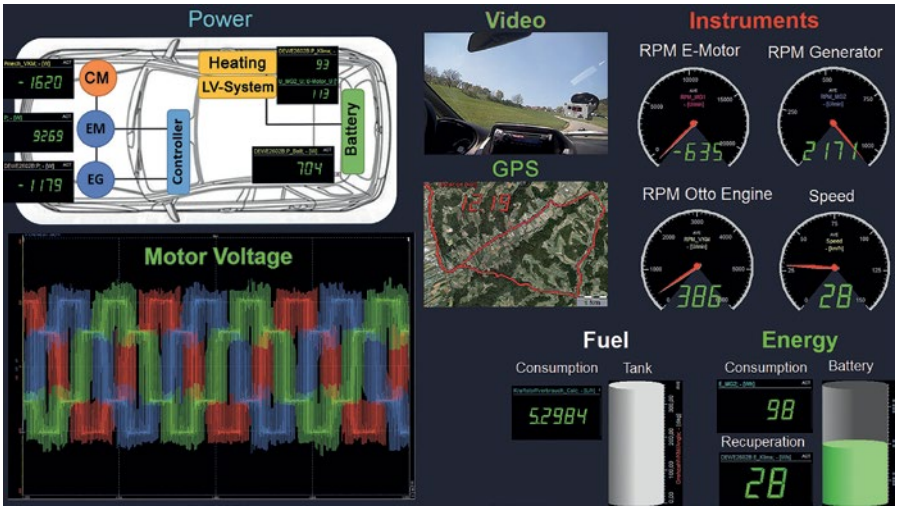
The measurement system can also provide the power supply for different sensors (±9V, ±12V, ±15V). So for example the power supply for current transducers (current clamps or a zero-flux transducer system) can be directly provided from the measurement system.

Further sensors, such as GPS or video, can be connected to the system.



DEWETRON software

The identification of dynamic processes, the calculation of power and the measurement of harmonics are only a few of the numerous functions of the measurement software DEWESoft™ with its option POWER. Unbalances, frequencies and revolution per minute are some more that are nowadays necessary for the power analysis. Besides, it is very important to reach high sampling rates that can be processed by the software: 500 kHz for the calculation of power are a must-have for controlled drive systems.

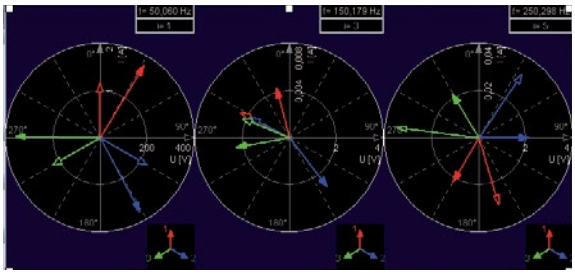


The software option POWER was especially developed for the electric power measurement. It includes the conventional and approved DEWESoft™ functions and moreover provides all parameters that are necessary for electric drives:

- *P, Q, S, PF*
- *U, I, cos φ*
- *Harmonics*
- *FFT up to 500 kHz*
- *M, n*
- *X/Y recorder*
- *Sound*
- *Rotational and torsional vibration*

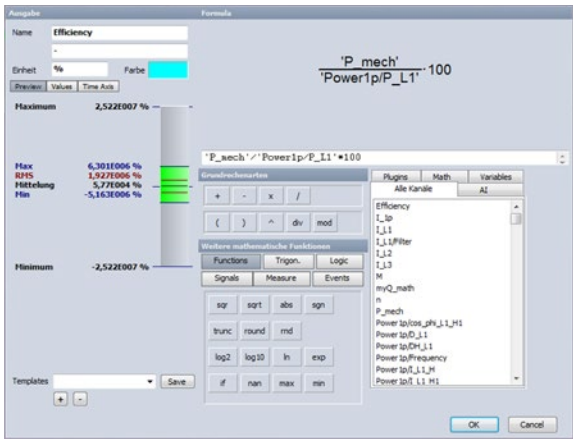
Several power modules at same time

With the software, a number of power modules can be calculated for different system configurations (1-phase, 2-phase, 3-phase star or delta, DC) and for different frequencies (16.7 Hz, 50 Hz, 60 Hz, 400 Hz, 800 Hz or variable frequency). This enables synchronous power measurements at every point in the electrical power train.



Math library

A comprehensive mathematic library for processing the input signals is included in the measurement software and is easy to operate. The library includes functions such as filters, counters, mathematical and logical operations, spectrum analyses and statistical reports that enable it to work with different signals and signal forms. So for example, the energy consumption, the efficiency or the recuperation can be calculated already during the tests.



Post processing

The software allows also doing all analysis after the measurement. You just have to stream all input signals to the hard disk and you can do all calculations (Power, Math, etc.) via post processing.

Video

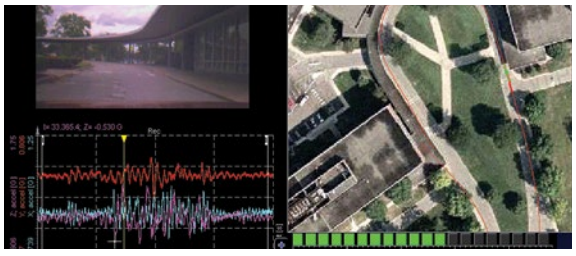
The use of synchronous DEWESoft™ video functions allows the parallel storing of video data and measurement values and opens a wide range of application possibilities – whenever optical information is needed.

For the application under real-driving conditions this functionality allows to analyze the behavior of electric vehicles also for different driving situations. Together with GPS you have a very clear view of the vehicles performance.

It is also possible to connect infrared cameras (e.g. analyzing temperature distribution of battery packs) or high-speed cameras (e.g. with 120 fps) to the system.

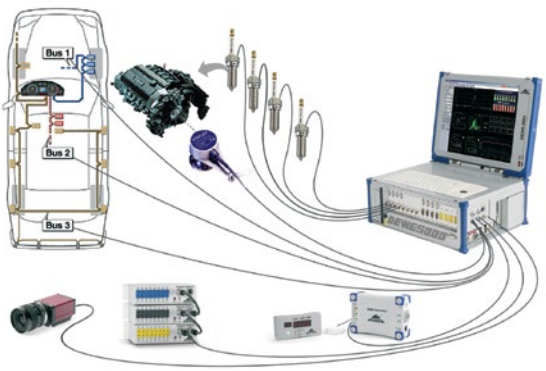
GPS

A GPS sensor can be connected to the system, which provides information about position, distance, velocity, time and direction.



CAN-bus

In addition to a number of sensors, also direct CAN-bus systems can be provided. CAN-bus data is used in the software as own measurement channel. The synchronous recording of CAN-bus data from battery management systems and control units is just one of several possibilities provided.

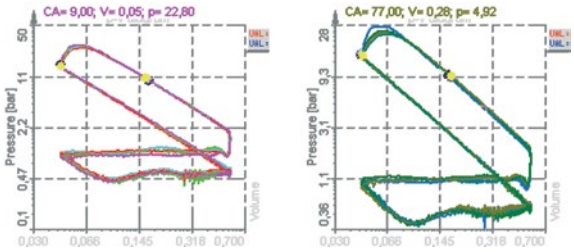


Sound and vibration

Exact and high-resolution noise level measurement according to EN 60651, 60804, 61672. With its user-friendly operator interface, the software brings the sophisticated noise/acoustics analysis to the user.

Analyses on combustion engines CA-option

As it is the case with classical hybrid vehicles, combustion engines can also be in use besides electrical drive systems, then these engines can simultaneously be analyzed with the CA option in the software.



Rotational and torsional vibrations

With this module you can easily measure rotational vibrations, bearing damages, unbalances, etc. and can record - in parallel to the power data discussed so far - as well as evaluate them.

Temperature measurement

Batteries have a limited temperature frame in which they work efficiently. You would like to fix some sensors such as thermal elements by yourself or some hundred temperatures should be recorded? Our systems can record asynchronous input channels with different time resolutions SYNCHRONOUSLY (one clock for all channels!)

Remote control

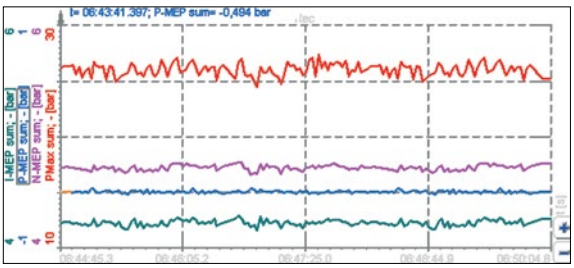
With the remote control system, the instruments can be configured and the data can be evaluated from afar – for example while being in your office. The transmission of data from vehicle to vehicle via WLAN is also a special feature.

Export

Additionally, the software offers an export function for the most common data formats, such as Excel, MATLAB, FlexPro and Famos and a lot more.

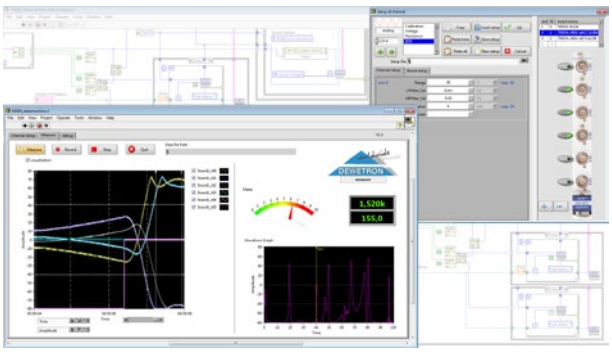
Open interface (DCOM)

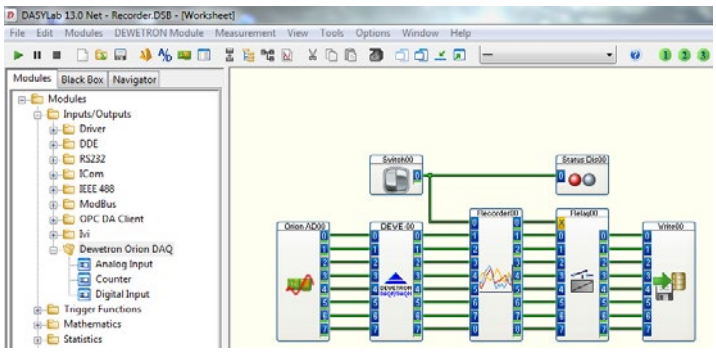
The programming interface DCOM offers every user the possibility to arrange one's individual integration into test bench systems. Several protocols already generated are available (OPC, Modbus, ...) – just contact us and we are pleased to find your individual solution for your applications.



LabVIEW, DASYLab and OPC interface

All measurement data can be embedded in test beds again, with drivers for LabVIEW and DASYLab.

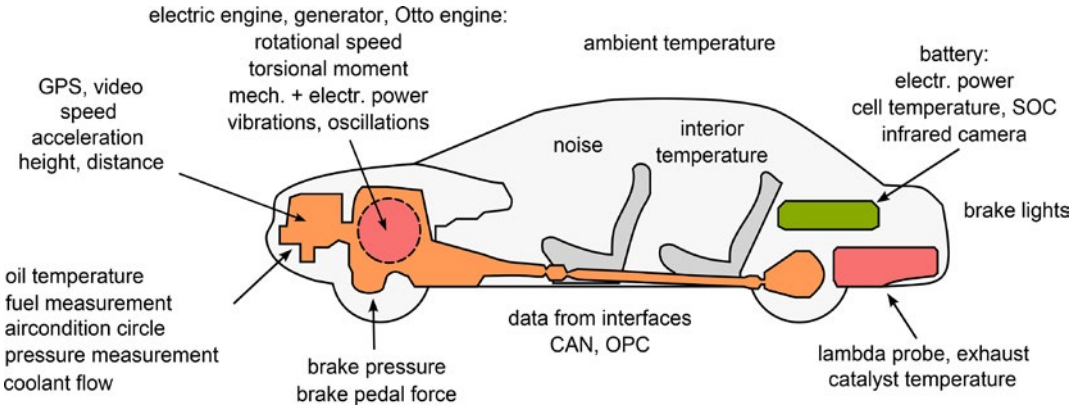




Measurement on the Test Bench

Application Example for E-Mobility

The customer is an institute for powertrain and automotive technology at a Technical University. They have a test bench for analysis of the longitudinal dynamics of hybrid and electric vehicles. The heart of the test bed consists of two DEWE-2600-E-Mobile measurement systems. Together, they are able to measure and store synchronously more than 100 signals with different sampling rates. The input signals comprise, among others, voltage, current, SOC, rpm, torque as well as noise, vibration and consumption and emissions data. Additional data of the test bed and the control unit of the vehicle can be imported into the software via a special interface.



- *>100 signal inputs*
- *>100 calculations in math*
- *E-motor, generator, otto engine*

Inverter measurement

One of the university's objectives was to determine the efficiency of the electrical powertrain. With DEWETRON's measurement software, it is possible to create several power modules to calculate the power at different frequencies for several direct, alternating and three-phase current systems at the same time.

In this way, it is possible to acquire currents and voltages at 14 different measuring points at the test bed synchronously. They acquire engine, generator, heating, air-conditioning and low-voltage systems to create an entire power balance. Modern frequency converters for electric vehicles work with a pulse frequency up to 30 kHz. To acquire these signals for precise power measuring, it is necessary to choose a high sampling rate to guarantee an analog bandwidth up to 600 kHz. DEWETRON's galvanic isolated amplifiers with a bandwidth up to 2 MHz ensure this.

Battery measurement

The battery is the central element in the electrical powertrain and strongly influences the performance and range of electric vehicles. As such, the lifetime of the battery is a problem. Therefore, the university also analyzed the cell characteristics, aging, as well as warming and temperature dispersion to evaluate the long-term performance of the battery. More than 40 measuring points in the battery system are analyzed. The performance balance of the entire powertrain is determined directly in the measurement software. Hence, it is possible to identify the recuperation energy, energy consumption, efficiency factor, and so on, during the tests. The analysis can also be performed in the post-processing phase.

Mobile measurement system

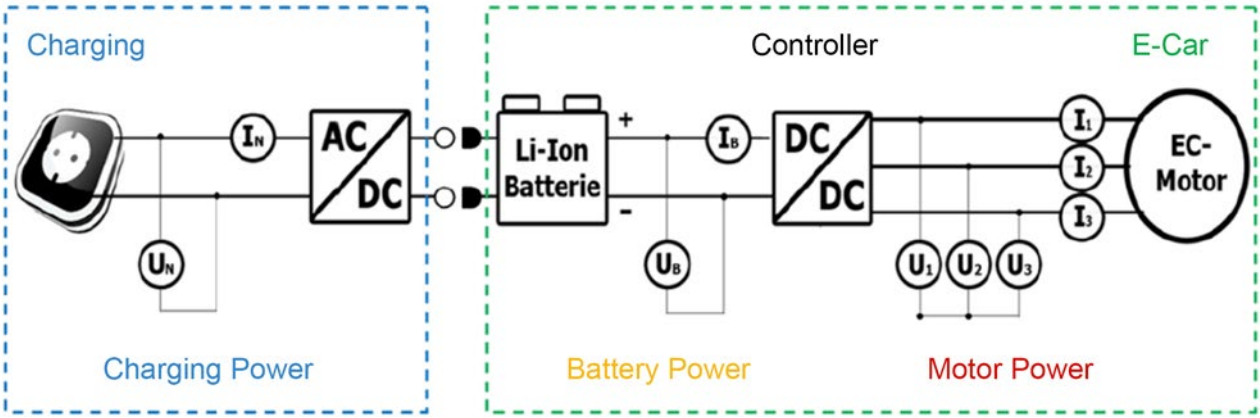
Using the same DEWETRON measurement system, it is even possible to measure during real driving conditions. The DEWE-2600-E-Mobile measurement system has two battery packs that supply the sensors as well as the system with enough power to guarantee a reliable measurement. For measurements during driving, further sensors such as GPS or video can be connected to the system.

Measurement under Real Driving Conditions

Application Example for E-Mobility

Standardized driving cycles are used to measure the energy consumption of different vehicles. However, actual driving cycles are not suitable to measure the energy consumption of electric vehicles. The aim of two master theses at a University of Applied Science was to determine the energy balance under real driving conditions of electric vehicle - one for an electric car and the other one for an electric two-wheeler.

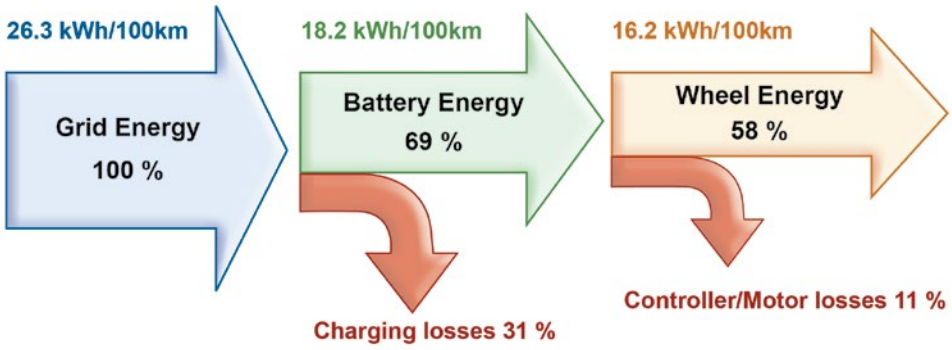
The field test consists of several road tests (city, freeway, uphill, downhill, etc...) under different conditions. Additional tests with different drivers accounts for the impact of personal driving behavior and ensures objective and significant results. The analysis of the charging cycle completes the measurements. Finally, the energy balance and the operational behavior of the e-scooter are outlined. As a final point, some characteristic values are calculated and compared to other vehicles.



Results for the E-Scooter

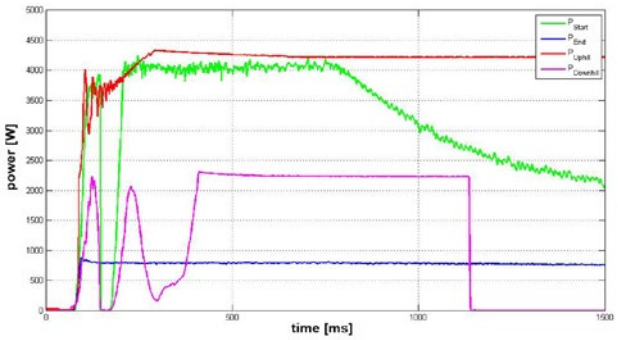
Energy balance

This chart shows a Sankey diagram for the energy flow.



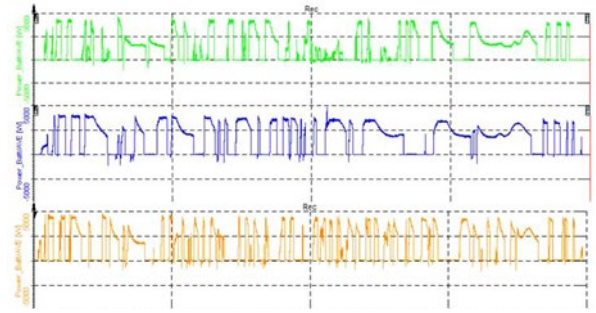
Acceleration behavior at different driving situations

This chart shows the acceleration of the scooter at different driving situations. The green chart is the acceleration with full-charged battery, the blue one when the battery was nearly empty, the red one for uphill and the magenta one for downhill driving.



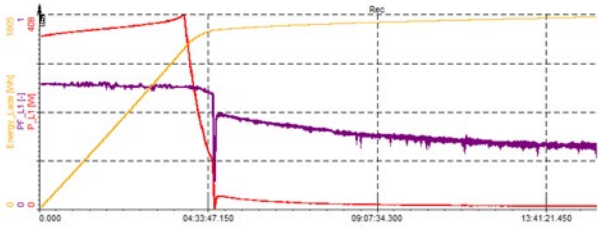
Acceleration behavior of different drivers

This chart shows the acceleration behavior of different test drivers on the same test-track. The acceleration behavior can influence the energy consumption of up to 10 %.



Charging profile, time and efficiency

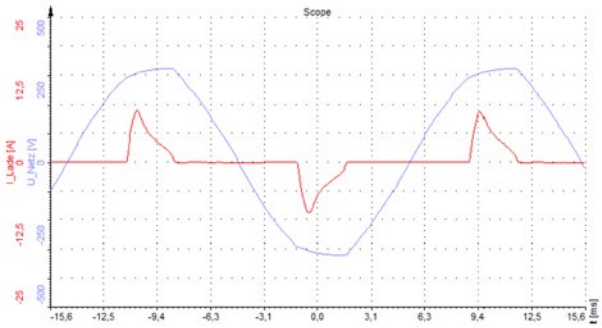
In the table, you see the energy consumption and efficiency for full charging and a short charge process. In the chart, you see the charging profile.

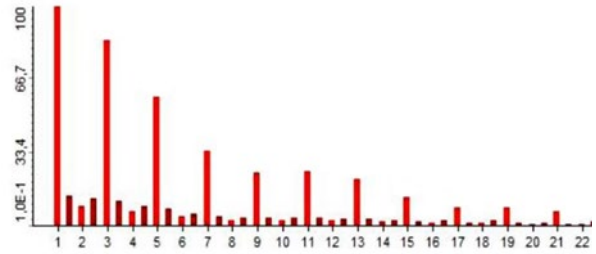


Charging device - EMC tests according to EN61000-3-2

This chart describes the harmonics emission of the charging device. The table shows the values as well as the max-imum value, and the charts the profile of the harmonics as well as the harmonics in time and frequency domain.

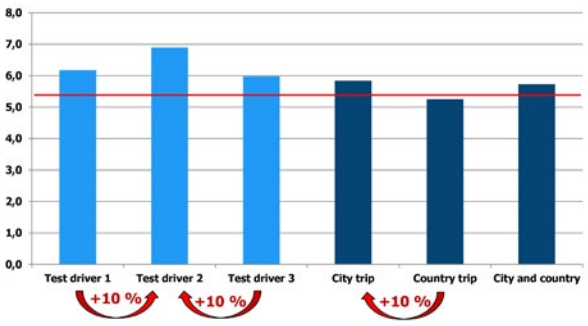
Harmonic number	Frequency [Hz]	Current [A]	Max. current [A]
1	50	1,82	-
3	150	1,42	2,3
5	250	0,95	1,14
7	350	0,58	0,77
9	450	0,45	0,4
11	550	0,44	0,33
13	650	0,36	0,21
15	750	0,22	0,15





Energy consumption of different drivers test tracks

This chart describes the energy consumption of different test drivers and different test tracks.

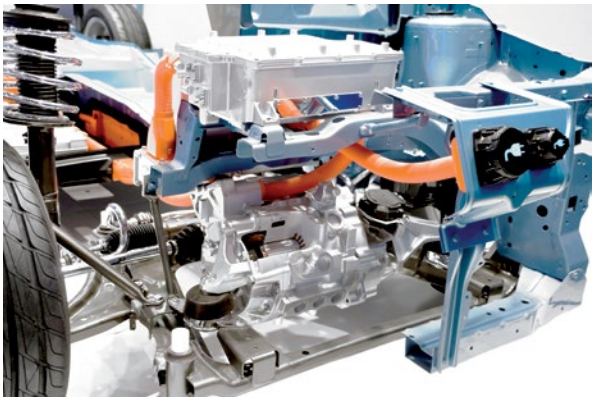


Battery Testing

Application Example for E-Mobility

Energy storage systems are becoming more and more important. Especially the trend towards E-Mobility, micro-grids, renewable energy sources etc. increase the importance of battery systems.

Manufactures efforts are focused on improving the energy efficiency, power performance, reducing the dimensions, reducing the costs and at the same time ensure safety, reliability and durability over the whole lifecycle of batteries.



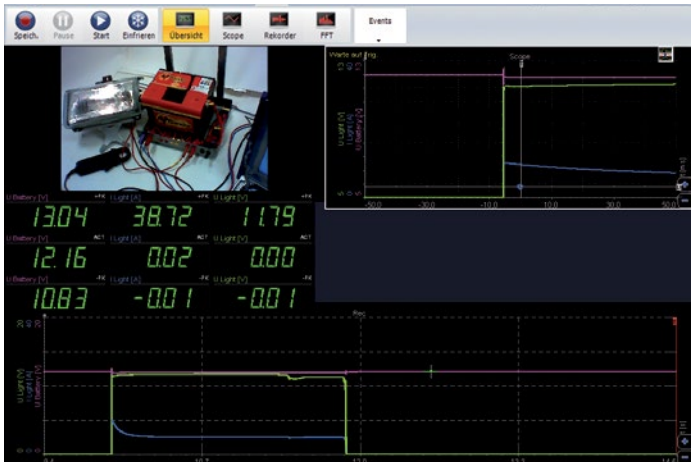
To tap the full potential and to guarantee long-term and high-level operation of the batteries, intelligent and elaborate testing is absolutely necessary. Due to the strong interactions within a battery system, testing different parameters like temperature, voltage, current, force, video etc. at the same time and completely synchronous are required for continuously optimizing the whole system.

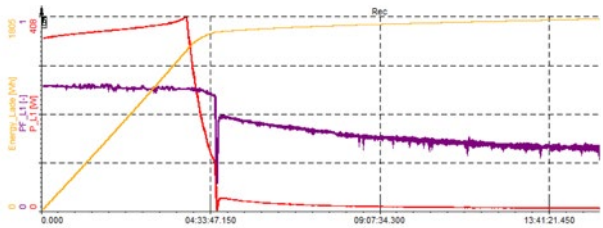
Challenges and requirements

- *High-dynamic range for voltage and currents*
- *Synchronous acquisition of multiple channels (voltage, current, force, vibration, temperature, pressure, humidity etc.)*
- *Transients measurement (up to 10 MS/s) and long term measurements (hours, days, weeks, months)*
- *Thermal imaging camera*
- *Camera 300 fps*
- *Post-processing and export functionality for detailed analysis*

Measurements

- *Cell characterization*
- *Charge-discharge cycles, efficiency, losses*
- *Misuse tests: behaviour under extreme electrical, mechanical and thermal loads (crash test, short-circuit, overheating, overloading)*
- *Endurance tests (ageing tests for different environmental conditions)*
- *Transient analysis*





	Energy consumption [Wh]	Charged Energy [Wh]	Efficiency [%]	Duration
Full charging	1211	1805	67,1	14 hours
Short-charging	203	301	67,4	55 minutes

Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

Suitable for PNA

Power Network Analysis

DEWE-PNA

DEWE-PNA systems are energy net analyzers which perform power quality analysis following exact standards and a lot more beyond that. The combination of high-capacity measurement software and flexible report generators enables the user to solve nearly every task in the field of energy measurement.

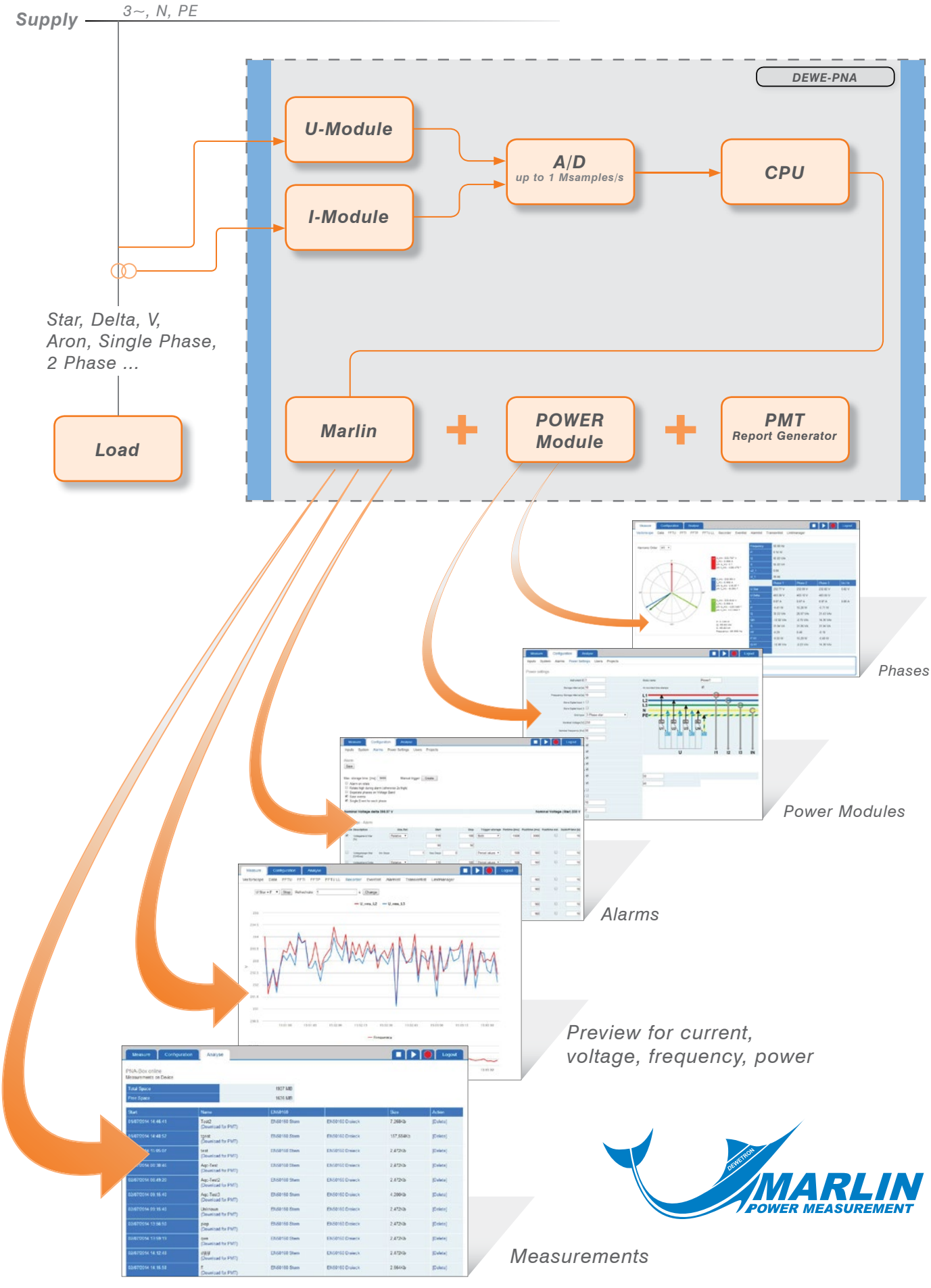
Another advantage is the configuration of the instruments. On the one side, we have the type DEWE-571 developed for the technician on site - stable, isolated and easy to operate. On the other side, there is the DEWE-module-based instrument such as the DEWE-2600-PNA. Its perfect flexibility of the hardware also allows complex applications in the fields of engineering and development.

These instruments are designed to fulfill the requirements of IEC-61000-4-30 class A, the power quality measurement standard.

Key Facts

- EN50160, IEEE 1159
- IEC61000-4-30 Class A
- Power rating
- Higher frequencies up to 150 kHz
- Interharmonics
- Flicker
- Symmetrical components
- Frequency
- DISDIP/Unipede statistics
- CBEMA/ITIC curve
- Load curve
- Energy efficiency

worldwide DEWETRON


Supply
3~, N, PE
DEWE-PNA
U-Module
I-Module
A/D
up to 1 Msamples/s
CPU
Star, Delta, V,
Aron, Single Phase,
2 Phase ...
Load
Marlin
POWER
Module
PMT
Report Generator
Phases
Power Modules
Alarms
Preview for current,
voltage, frequency, power
Measurements
MARLIN
POWER MEASUREMENT

DEWETRON Power Quality Analyzers

EN50160, IEEE 1159 and other Norms

Due to the changing market power quality analyzes are getting more and more important. On the one side, the increasing use of electronic consumers causes system perturbations. On the other side, the number of blackouts has grown recently. Early detection of shortages is therefore necessary and trend analyzes of various parameters can be helpful to beware of outages. Additionally, the obligation to prove the quality of the power supply system has changed and commercial aspects are also getting more and more important.

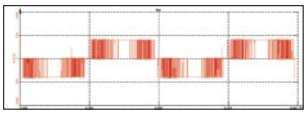
Disturbance Analysis

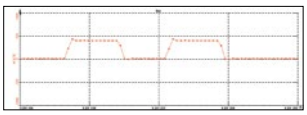
Simple recordings of voltage are source for the interpretation of power supply. In order to be able to be more precise and find solutions, it is not sufficient to calculate the voltage by means of average values of 10 minutes. Transient recorders with acquisition rates of MS/s even detect fastest disturbance peaks and are essential for the exact analysis.

Flicker and More

The standard software package includes flicker, unbalance, calculation of power and frequency etc. as well as a report generator with which one can print pre-defined reports (e.g. EN50160, IEEE 1159) on the one side and create individual reports on the other side.

Harmonics Analysis





The topic harmonics also becomes a new important aspect. If you have done the analysis up to the 25th or even 50th harmonics, you can now go far beyond that. The frequency spectrum of 2-9 kHz (or up to 150 kHz) is analyzed in 200 Hz bands. The combination of this new standard and the formerly used harmonics standards is the main task of up-to-date power quality analyzers. DEWETRON has worked on this subject by creating the very latest generation of software and covering the whole spectrum of harmonics, interharmonics, frequency bands and grouping methods. Standard measurements with pre-defined and standardised setups are included or individual settings can be done by the users themselves.

Energy Analysis

The consumption of energy as well as the energy costs are rising. The reduction of energy costs is everyone's topic of interest. Treaties and prices are relevant – the effective consumption as well. In order to be able to reduce the consumption, one has to know the exact energy consumption and the internal power flow.

In order to be able to measure this, multi-channel measurement instruments are necessary. Using these instruments one can measure the consumption on several lines at the same time. This can also be done in parallel ways in different distribution boxes or even buildings.

With the help of the report generator one can create simple reports on power flow and distribution of energy consumption. The export interfaces support a quick exchange of data with other analysis software packages.

Suitable for PNA

Power Quality Analysis - Power Quality Measurements

Application Example for Power Network Analysis

Introduction

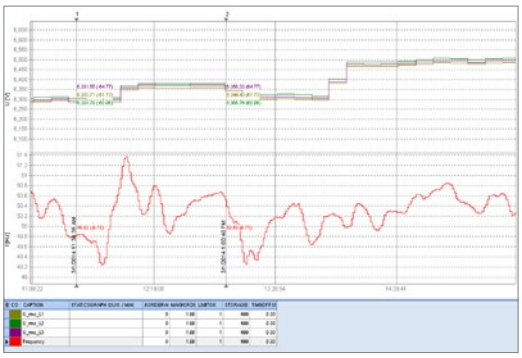
Power quality, also known as keywords like grid quality, grid voltage quality and service reliability, is a topic that is directly linked to energy supply and is certainly a highly topical issue in this field.

Due to the liberalization of power markets, grid-bound energy sources, such as electrical current, became freely tradable products and thus have to obey product liability law such as other tradable products. The corresponding parameters were constituted in the product standard EN 50160 in Europe with major parameters:

- *U_{rms}*
- *Wave form*
- *Frequency*
- *3~ phases; symmetry / 2 ~ phase*
- *Availability*

Additionally, there are many other tasks: e.g. special harmonics evaluations, long-term measurements, and the identification of fastest transient processes or only power flow measurements in four quadrants.

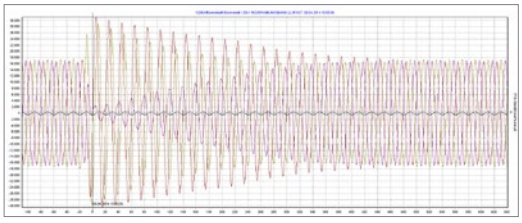
Power quality also becomes a mayor topic in other countries like India, China, Bangladesch and many more aspiring countries in the world. The picture on the right shows the frequency of Bangladesch´s national grid. According to EN50160 the frequency limits are 49.5 Hz and 50.5 Hz. In Bangladesch these limits would be exceeded.



Task

The identification of limit values that are constituted in the EN 50160 or in another power quality standard is nowadays not a big challenge anymore. Several millimeters can measure these, compare their values with limit values and reflect them in well-formatted reports.

The task becomes more specialized when you want to find the reasons for off-limit conditions; that is when you want to make exact analyses of the public grid.

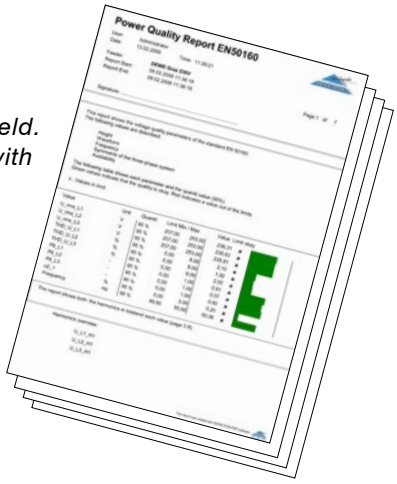


The analysis of harmonics up to the 25th is sufficient for the EN 50160 but other standards demand 50 or even 100. Latest standards even proceed to the range of 9 kHz in order to identify disturbances of electrical instruments.

- *Harmonics up to 50 / 100 or higher*
- *2 to 9 kHz (up to 150 kHz) @ 200 Hz bands*
- *Flexible grouping method for interharmonics and harmonics*
- *Determination of power flow direction of the individual power harmonics*

Flicker as the impact of voltage fluctuation is widely known. But what about the sources of flicker (identification of flicker emission)? What about adjustment of filters (faster re-calculation periods and sliding flicker windows)?

- *Flicker 10 min Pst, Plt*
- *Identification of flicker emission (current flicker)*
- *Shorter re-calculation periods, sliding flicker windows*



Beside the EN 50160, there exist many other standards and regulations in this field. Only some may be listed that imply exact measurement and can be analyzed with DEWETRON-instruments:

- *EN 50160*
- *EN 61000-3-x; EN 61000-2-2; EN 61000-2-4; ...*
- *EN 62040*
- *ITI / CBEMA curve*
- *DISDIP statistics (Unipede)*
- *TOR D2 (D A CH CZ regulation)*
- *etc.*

For medium-voltage power grids analyses are not only necessary for line voltage/earth potential but also for line/line voltage. Short circuits display differently compared to earth faults. Flicker and harmonics should be evaluated for the line/line voltage, the voltage transformers are mostly installed between line and earth. Flexible connection possibilities and internal conversions may remedy.

- *3 ~ star (e.g. low voltage)*
- *3 ~ star with conversion to delta (e.g. mean and high voltage)*
- *Delta connection (e.g. industrial grids)*
- *Aron- und V-connection*
- *2 ~ (e.g. traction supply systems)*
- *1 ~ (e.g. household)*

Conventional instruments for power quality analysis obviously prove to be at the end of their possibilities. With a concept for measurement instruments that are as flexible as possible and that complies with official standards we provide the perfect solution.

Solution

Hardware

The DEWE-571-PNA was especially designed and developed for measurements in distributors and central control rooms. Completely isolated, highest EMC protection and a stable case characterize this instrument. If more channels are needed then the ELOG model can help. 4 voltages and 12 currents at the same time are its specific feature.

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the PQ Standard EN50160 or IEEE 1159 and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments.

Different storing options allow a quick and simple report generation directly online, with SQL server databases or the new offline file format. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

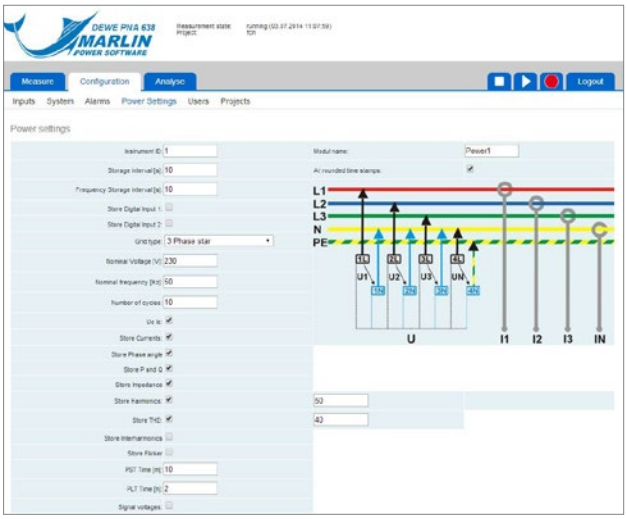
Software

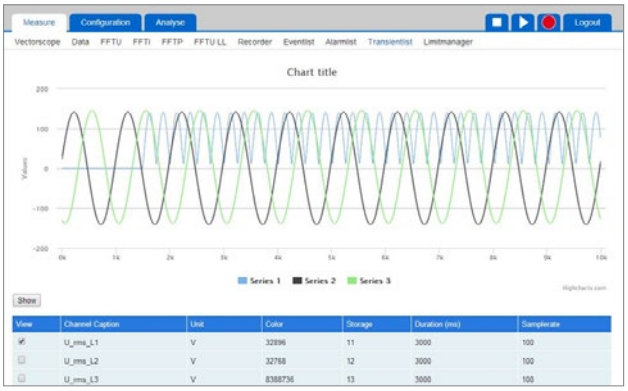
Marlin

Marlin is a web-based power measurement software with full functionality for Power Quality Measurement, Power Network Analysis and Power Fault Recording.

The special feature of Marlin is the web based user interface. It is possible to work with Linux and Windows based measurement instruments. This means any DEWETRON system can be controlled with any browser on any device.

Marlin is available as single-power-module (Linux based) and multi-power-module (Windows based) measurement solution. Due to the multi-power functionality it is possible to calculate different power modules (DC, Single Line, STAR, DELTA, ARON, V and 2-Phase) with any frequency on one DEWETRON instrument at the same time.





- *Web based technologies with easy web access*
- *Multi-power-module calculation*
- *DC and AC power calculation with any frequency*
- *Single Line, 3Phase-STAR, 3Phase-DELTA, ARON, V and 2-phase power calculation*
- *Flicker IEC61000-4-15*
- *Online report generator for EN50160, IEEE 1159*
- *Integration in permanent monitoring systems*

Fast online reporting

Marlin offers the possibility to generate EN50160 or IEEE 1159 reports only using the web interface. The reports include the quantile values of frequency, unbalance, voltage, THD, flicker and FFTU. If the limit is exceeded the value is highlighted automatically. A table of voltage dips and voltage swells is available too. The report is completed by a set of diagrams and a harmonics chart.

Using free pdf creator, the report can be saved as pdf using the save or print function of the web browser. Access is possible with all common web browsers. Aa wide range of tools to generate individual reports is offered.

Storing options

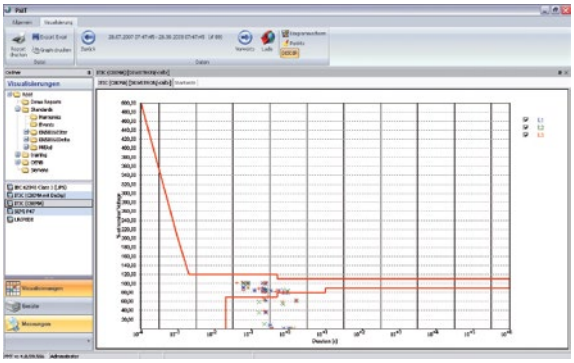
DEWETRON offers different storage options. On the one hand it is possible to store measurements on the device and to analyze these data offline, on the other hand it is possible to stream the data to a SQL database. The database solution offers the possibility to store data from more than one device at the same place.

Online transient view

Marlin is not only able to store transients by date, time, duration and remaining voltage. It also can visualize the whole transient in full resolution. With Marlin, DEWETRON devices become all-in-one solutions.

DEWESoft™

The software with its options POWER and DB (report generator PMT) was especially designed for exact normative analyses and, among other features, offers the following functions for analysis:



- *Voltage curve, voltage jumps, voltage fluctuations*
- *Disturbance statistics (Unipede, CBEMA, ITI, ...)*
- *Flicker (EN 61000-4-15)*
- *Flexibility of configuration of measurement*
- *Flexible screen settings*

Customers

- *Energy supply companies*
- *Grid operators*
- *Service technicians*
- *Energy consultants*
- *Facility management*
- *Constructors of electrical plants*

Energy Consumption Measurements - Load Curve Analyses

Application Example for Power Network Analysis

Introduction

Energy consumption, its trend, the proportion of active and reactive power and the subsequent costs are a big issue nowadays. Of great interest are on the one hand saving capacities both for the consumption and the electricity bill and on the other hand, the greenhouse gas emissions in combination with the energy consumption. Furthermore, the load curve is interesting as regards the reduction of peak power and load management systems.

Task

Load curve analyses are typically carried out in the main distributors in business enterprises and industrial plants. Substations and the circuits behind them can also be added as typical measurement locations. Of great interest are currents, voltages, active and reactive power – not only the instantaneous value but also as regards their chronological sequence with adjustable averaging interval. Such an analysis usually takes 1 week to 1 month.

In order to be able to configure load management systems efficiently, it is not only obligatory to know the total load curve but also the individual branches. Multi-phase measurements on several consumers, in parallel and if possible with only one instrument is therefore the challenge for measurement technology.

In transformer stations it is important to identify the distribution of energy on the different circuits in order to optimally adjust the operation and identify shortages.

Solution

The product DEWE-571-PNA was especially designed and developed for measurements in distributors and central control rooms. Completely isolated, highest EMC protection and a stable case characterize this instrument.

If more channels are needed then the ELOG model can help. 4 voltages and 12 currents at the same time are its specific feature. Besides, also other products in a conventional DEWETRON box and completely installed systems are available.

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the PQ Standard EN50160 or IEEE 1159 and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments.

Different storing options allow a quick and simple report generation directly online, with SQL server databases or the new offline file format. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

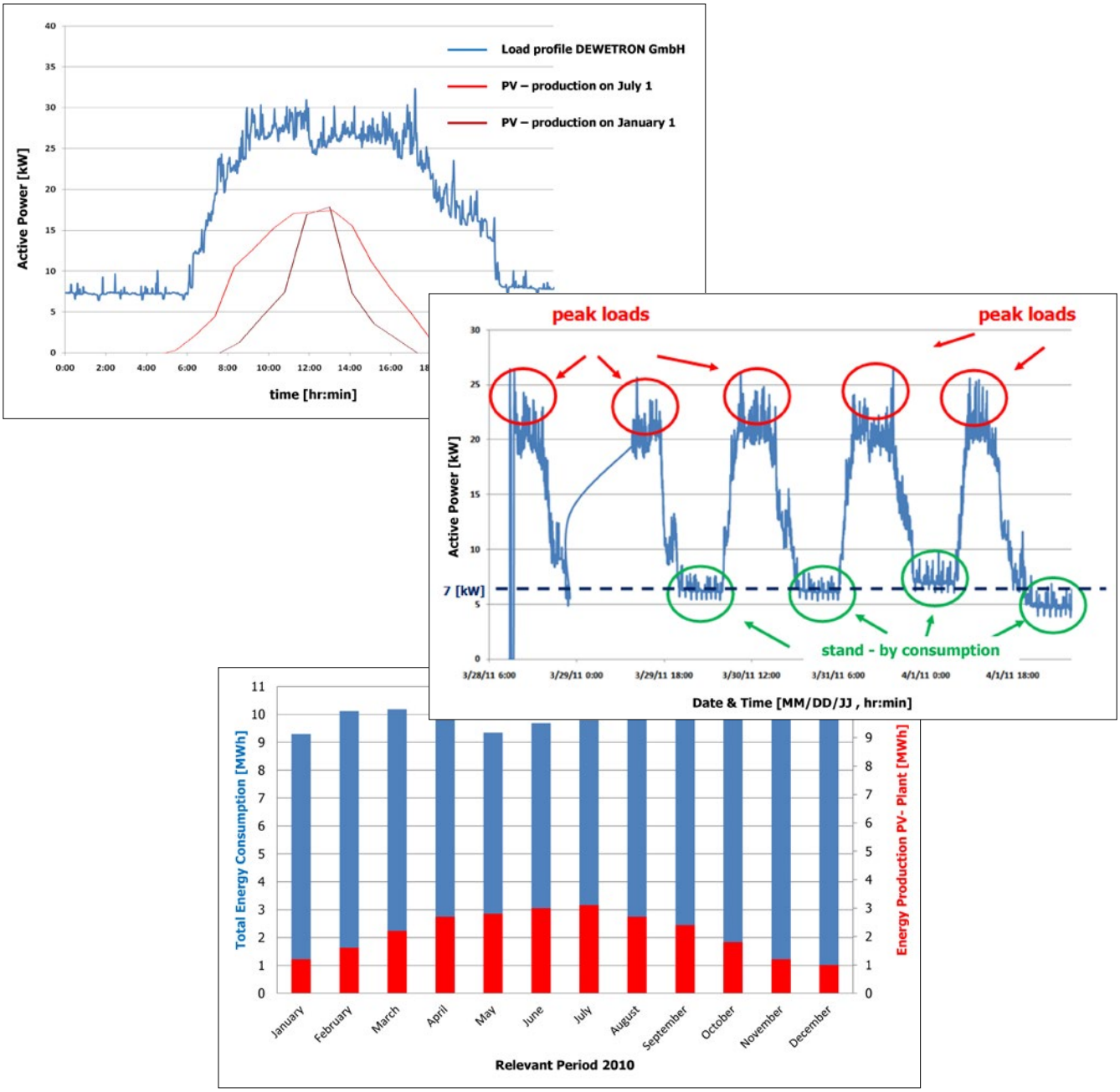
Software Functions

PQ Parameter

Beside the energy data, all power quality parameters such as harmonics, flicker, unbalances, frequencies and disturbances can be measured.

Mathematics Library

In DEWESoft™ it is possible to use own designed formulas and mathematical expressions and integrate them in the measurement setup. The results will be included in the measurement interface by doing only one click. This gives the customer the ability to meet nearly any measurement challenge.



Customers

- *Service technician and facility managers*
- *Constructors of electrical systems or load management systems*
- *Research institutions and energy consultants*
- *ISO 16001 certifier*

Measuring Wind Power and other Renewable Energy Sources

Application Example for Power Network Analysis

Introduction

Renewable energy sources are already integrated in power grids and the amount of energy is becoming more and more. Wind power plants are mostly operated in wind power plants or as single plants. Photovoltaic systems with a total power of some Megawatts are already a part of the townscape in some countries and bio gas plants are no longer the hobby of some farmers anymore. Each of these plants acts as an independent power plant and must have special features concerning stabilised voltage and electromatgnetic influences respectively.

On the one hand, these electrical characteristics have to be verified and carried out as individual tests or sample testing.

On the other hand, the behaviour of large renewable plants has to be monitored according to the actual power quality standards (for example IEC 61400-12, IEC 61400-21)[1)] as there is a provider/customer relationship on the connection point to the power grid.

Task

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Power plants with renewable sources are thus independent power plants within the grid which they can positively or negatively influence as much as any other supplier or consumer. These influencing parameters (voltage fluctuation, harmonics, frequency, etc.) underlie certain limit values. They have to be especially evaluated according to certain basic requirements such as e.g. wind speed for wind turbines and short-circuit power (IEC 61400-21). If the limit values are kept, then all parties of the energy supply system (customer, supplier, plant operator) can expect to have the maximal operation reliability.

Today, the amount of energy generated by wind power plants is so high in some regions that plant operators themselves would not be able to switch off wind power plants in case of grid disturbances. Therefore, wind power plants must support the voltage in case of a voltage drop triggered off by e.g. an error in the pre-located power grid, in order to avoid an area-wide switch-off. In open air test sites the entire wind power plant can be tested with the DEWE-PNA/PFR as regards its capacity to detect a disturbance and support the voltage. Other renewables are a subject to similar regulations and have to be tested according the same standard.

Policy has reached a further step in thinking about the energy future of Europe and the whole world. One idea is to generate energy in energy-intensive regions like coastlines or desert areas (like the project called DESERTEC-EUMENA in the picture above). The challenge of such innovative projects is still the integration of power plants into a widespread distribution grid.

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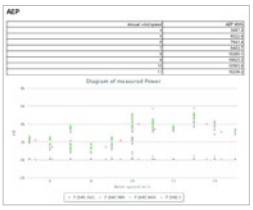
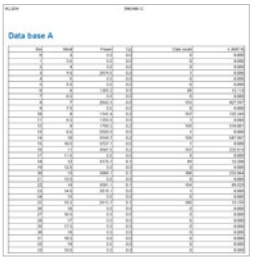
1) *IEC 61400-12: Power performance testing, windspeed, CP-diagram, ...*

IEC 61400-21: Measurement and assesment of power quality characteristics of grid connected wind turbines (harmonics, flicker, IH, HF, ...)

Solution





Besides the standard functions of fault recorders and power quality monitors, several additional measurements are necessary to perform a complete analysis of a renewable energy plant:

- *Fault recorders and transient recorders (PFR, DFR)*
- *Power quality monitor and voltage recorders (PQM, VR)*
- *Power curve and automatic controller action*
- *Electrical features such as harmonics, flicker, reactive power, switching frequencies, identification of voltage drops*
- *Sampling rate up to 10 MS/s*
- *DC-measurements in the frequency converter*
- *Analysis on the side of the grid and the generator*
- *Voltages up to 1400 Vpeak directly measurable (DAQP-HV and HSI-HV modules)*
- *Long-term analysis with data base storage system and evaluation according to norms of wind energy plants and grids with automated reporting system (IEC 61400-12, IEC 61400-21)*
- *Measuring wind power (wind speed, wind direction, altitude profile, turbulences, etc.)*
- *Mechanical parameters such as rotation and oscillation of the rotor*
- *Forces and impacts (rotors, blades, turbine towers, power train, etc.)*
- *Acoustic emission (sound power level, frequency spectrum)*
- *Luminance, temperature*

Hardware

Only one DEWETRON measurement instrument is necessary to perform all these measurements. Based on the new DEWE-PM/PFT-series it is quite easy to define the appropriate hardware solution for you. Several power modules (three-phase systems) with up to 16 input channels supplied by the basic instrument (and 16 extra channels as an upgrade) can be used in order to, e.g., measure the low and mean voltage at the same time.

Additionally, wind speed, temperature and acoustic/noise level can be measured as well. Great emphasis was placed on stability and interference resistance when developing this instrument. The frequency converter benefits the strong common-mode rejection voltage.

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the standards and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments.

Different storing options allow a quick and simple report generation directly online, with SQL server databases or the new offline file format. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

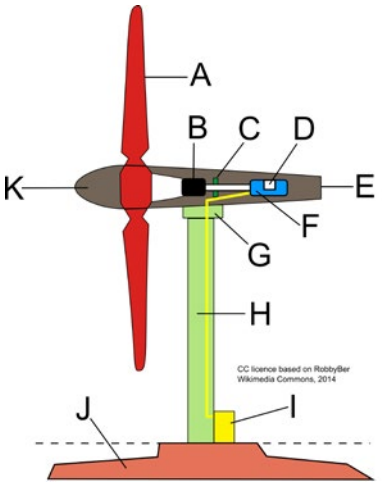
Software

In addition to the common power quality functions (flicker, harmonics, voltage fluctuation, imbalance), the evaluation of wind power plants requires some special measurement methods. Beside the flicker emission values (current flicker) these are primarily the evaluation of power and harmonics at different wind speed. Especially when evaluating the frequency not only the harmonics and interharmonics are required but also the 200 Hz groups between 2 and 9 kHz. A comprehensive reporting function makes the software perfect (Plugin Wind).

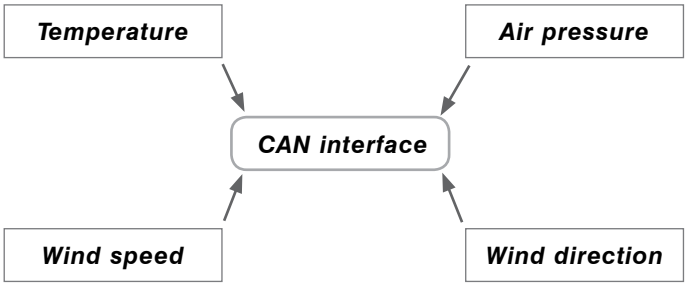
DEWETRON's software packages Marlin, PMT, DEWESoft™ POWER meet all the requirements and thus offer a comprehensive solution for measurement, evaluation, reporting and completely automised measuring and test procedure.

Wind power monitoring using DEWE-x38 instruments and CAN

Using a CAN interface it is possible to use Dewetron´s x38 instrument series to acquire environmental data such as air pressure, wind speed, temperature or wind direction. Within this data and power values it is possible to calculate IEC 61400 wind reports using only the web interface of the Marlin software. The environmental data is used to count power bins according to the wind speed. To generate the wind report it is possible to remove several wind sectors from the calculation. The report includes dataset A/B and several charts like the CP-curve. Beware that no external analysis software is needed. Using the Marlin web interface the customer can look at the running measurement and is able to control the instrument from anywhere.



A rotor blades
B gearing
C brake
D switchgear and control system
E wind nacelle
F generator
G wind direction guide
H tower
I grid connection
J base
K rotor hub and blade adjustment



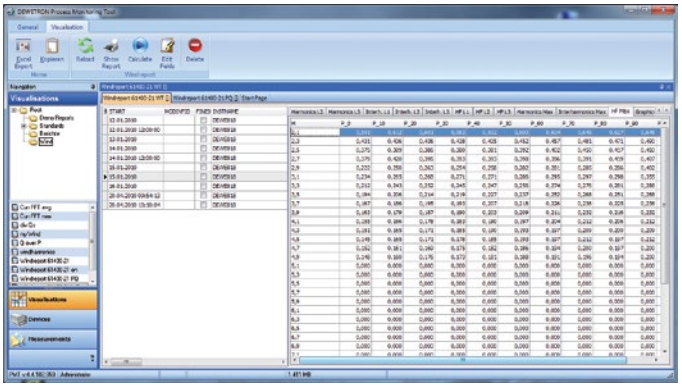
Some Details

Various Power Modules

With the DEWESoft™ power module an arbitrary number of power lines can be measured simultaneously. E.g. wind energy plant: U_{NV} / U_{MV} / U_{HV} / U_{DC}

FFT– Harmonics Analysis

- *U, U_{Line}, I, P, cos φ and Q*
- *Individual setup of the number of harmonics including DC (Example: sampling rate 20 kHz = max. 200 harmonics @ 50 Hz)*
- *Values adjusted to the actual power frequency*
- *Evaluation of 2-9 kHz (up to 40 kHz) in 200 Hz bands*



EN 61400-21 Plugin (Plugin-Wind)

- *According to EN 61400-21 (PQ measurement)*
- *Automatic report generation*
- *Flicker coefficient factors*
- *Harmonics, interharmonics and higher harmonics up to 9 kHz @ 200 Hz*

Flicker

- *According to EN 61000-4-15*
- *PST and PLT with adjustable intervals*
- *Individual recalculation intervals*
- *Flicker emission (current flicker) according to EN 61400-21*

Remote Control

By using the remote control, instruments can be configured and data evaluated without being on site. You can do this when being in the office for example.

Acoustic/Noise Level Measurement

The residents in whose surroundings these wind power plants have been constructed must not be affected by any noise of the power plants exceeding the legally accepted limit values – noise level measurement is also made possible with the help of the DEWE-PNA/PFR: Accurate and high-resolution noise level measurements following EN 60651, 60804, 61672. DEWESoft™ and its user-friendly interface convince and bring the sophisticated noise-/acoustic analysis to the customer.

GPS Sync

With the help of the GPS function several measuring instruments, that are a few kilometers away from each other (e.g. off-shore wind park and on-shore substation), can be synchronized. The highly accurate clock (100 ns) is even available in case of interference with reception. Phase measurements and angle comparisons are a typical application for this function.

Customers

- *Producers of wind energy plants*
- *Non-productive industries in the field of wind power plants*
- *Companies responsible for maintenance and energy supply*
- *Operators of wind power plants*

Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement

Suitable for PFR

Power Fault Recording

DEWE-PFR Power Fault Recorder and Quality-Monitor

The DEWE-PFR power fault recorders are network analyzers for low, medium and high voltage systems. Because of the flexibility of the software, many activities can be done in a single box - from fault recording to RMS monitoring. The instrument provides up to 16 (48) analog voltage or current channels. Along with its main task of monitoring and recording RMS values, PFR-8xx identifies and stores faults as waveforms for detailed analysis. A unique capability of this system is that it can also use calculated line-to-line channels for these events.

Data can be stored both locally on the PFR's internal hard drive, or to a central SQL database. Our flexible system architecture means that multiple databases are supported for one or more PFR systems as well as other DEWETRON instruments. This system-wide interoperability is a feature also unique to DEWETRON.

Key Facts

- Monitoring of power supply systems
- Power plant testing and monitoring
- High-, medium- and low voltage systems
- Fault recording
- Harmonics, Flicker
- Power flow
- EN 61000 conformity
- DIP measurements
- Database storing
- GPS synchronisation
- Remote control
- EN50160, IEEE 1159
- ITIC (CBEMA)
- UNIPEDE

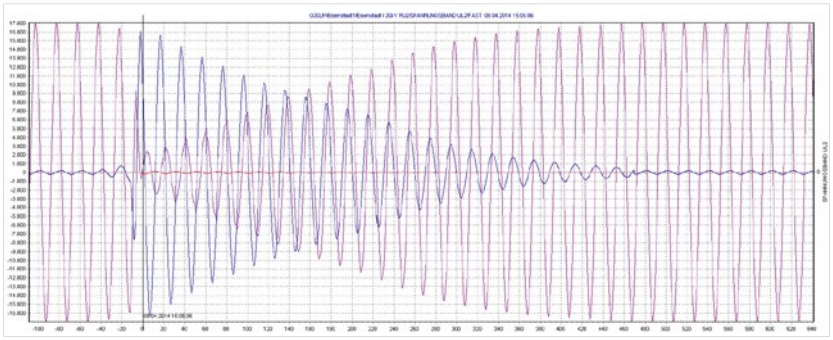
worldwide DEWETRON

DEWE-8xx-PFR Power Fault Recorder and Quality Monitor

DEWETRON Power Fault Recorder and Power Quality Monitors can handle many different tasks at the same time in the same box – and this is why DEWETERON PFRs are different: Full flexibility in Hardware and Software is our main advantage.

With ONE BOX you can do for example all this at the same time:

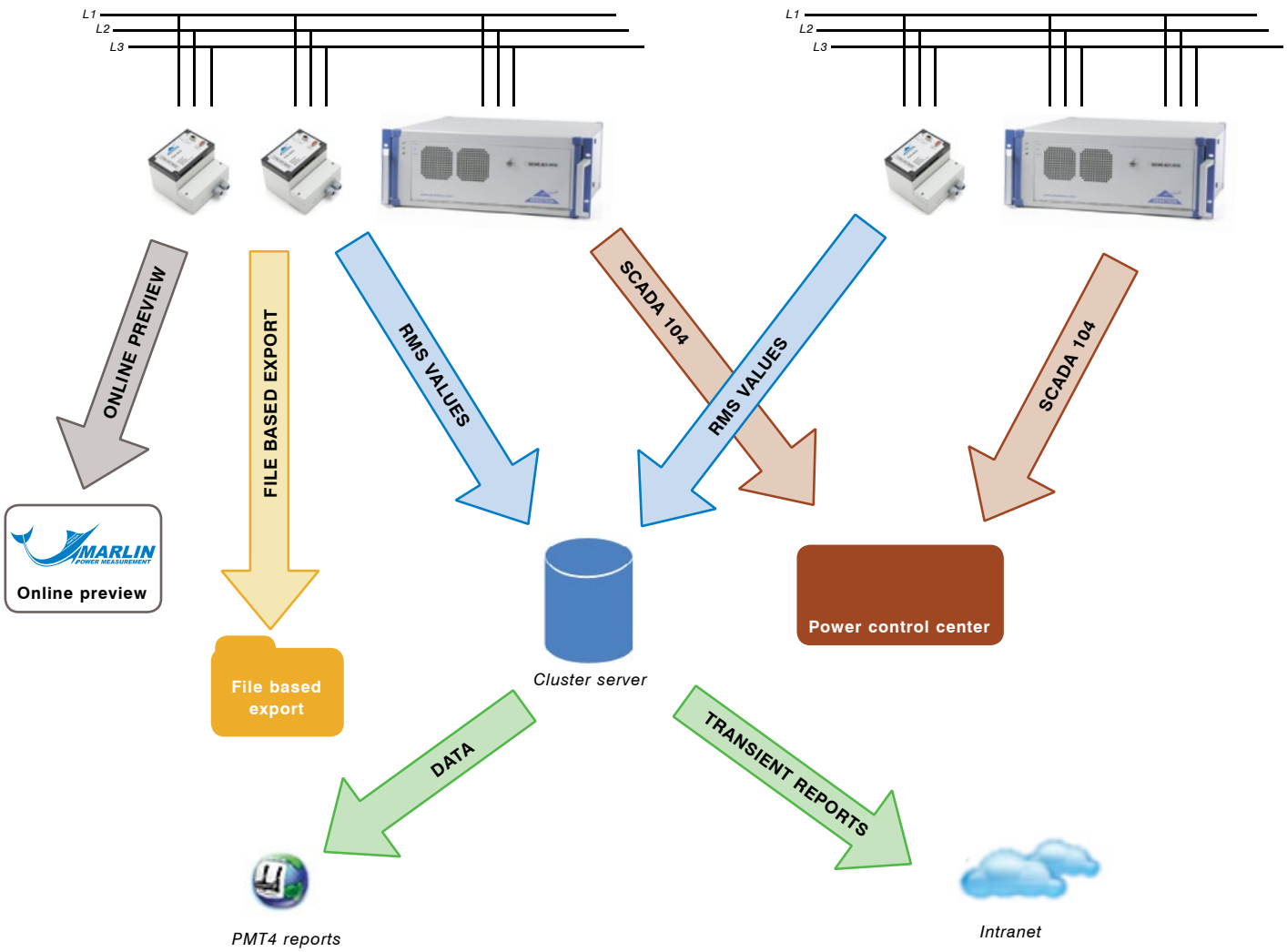
- *Transient Fault Recorder (TFR)*
- *Disturbance Fault Recorder (DFR)*
- *Voltage Recorder (replacement of paper recorders)*
- *Power Quality Monitor (PQM)*
- *Power Measurement (PM)*



Single earth fault, violet: affected phase, blue: neutral phase

Monitoring Systems with Central Server Technology

Because of technical needs and market rules it comes up more and more that power network companies are building up monitoring systems for power fault recording and quality monitoring. Those networks can be made based on PFR technology with standard internet interfaces and central SQL Servers. The Data evaluation is made with the help of the strong Software PMT on multiple client computers. Email based automatic reports are just one feature of those large Systems.



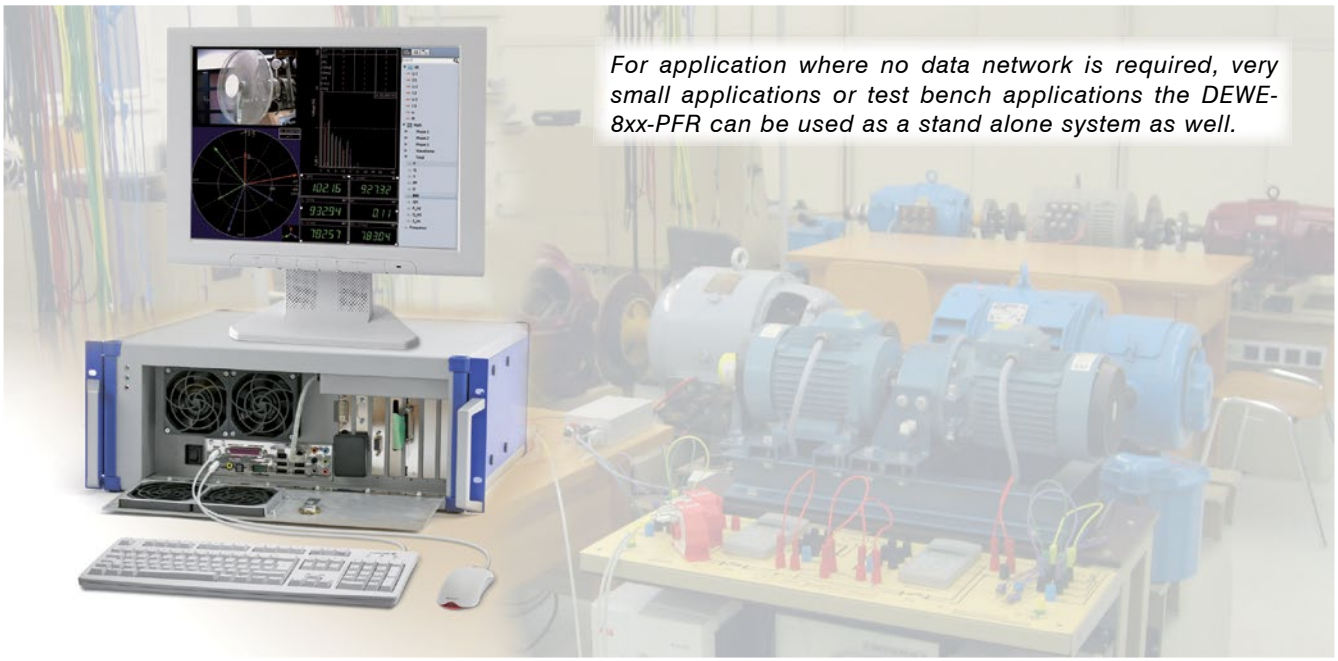
DEWE-818-PFR – Large Substations and Maximum Flexibility

The DEWE-818-PFR as the most flexible system in Hard and Software is the right instrument for large substations in all voltage levels. Beside voltage and current even all other physical parameters can be monitored as well.

DEWE-821-PFR – Small Substations

The typical application for the DEWE-821-PFR are medium voltage substations with a small number of feeder lines.

DEWE-8xx-PFR – Stand alone Systems

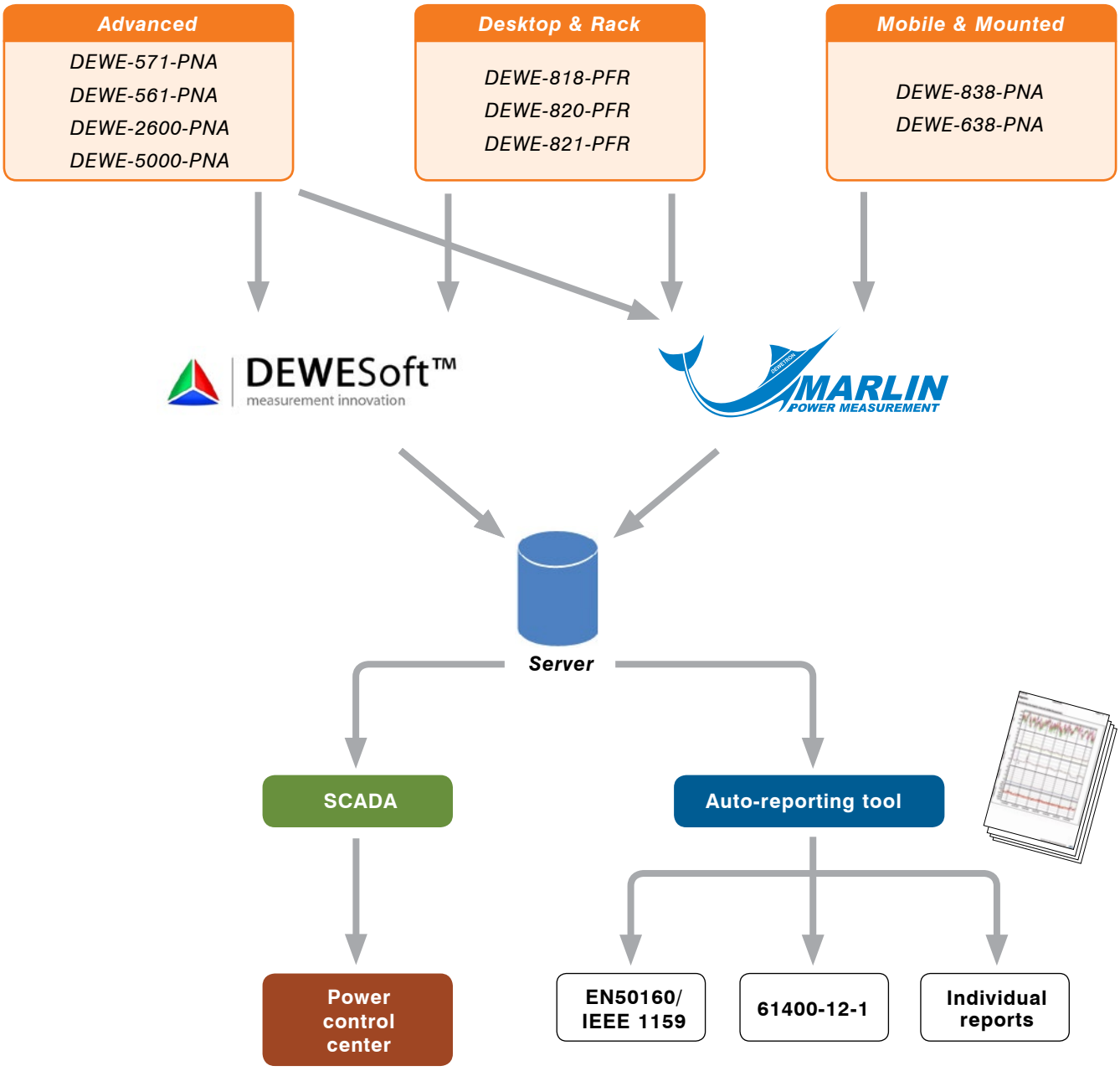


For application where no data network is required, very small applications or test bench applications the DEWE-8xx-PFR can be used as a stand alone system as well.

SCADA and Auto-reporting

SCADA stands for supervisory control and data acquisition. Using DEWETRON´s data acquisition instruments it is possible to include a datastream into a SCADA system.

Individual report generation can be done using DEWETRON´s PMT. To archive monthly or weekly reports, we offer a system called auto-reporting. The customer decide how often any report is needed should be generated and the system stores reports as PDF on any local or network location.



Power Fault Recording and Power Monitoring in Energy Transmission Grids

Application Example for Power Fault Recording

Introduction

The changing energy market and consumer technologies have also influenced the requirements for the power fault recorders. When formerly it was sufficient to know the voltage value and curve progression, nowadays we want to know the reason for disturbances but also anomalousness to the normal operation in detail. Power quality issues are always a part of it and power flows in all four quadrants are daily work.

Task

Such modern fault recorders are meant to take over the functions of several instruments and should additionally be of perfect use to up-to-date communication systems in order to centrally provide the data to several user groups.

- *Digital fault recorders fast (wave form, a few seconds)*
- *Digital fault recorders slow (periodic values, several minutes)*
- *Voltage monitoring*
- *Paper recorder replacement*
- *Power quality monitors*
- *Load curve monitoring*

One central data base solution should not only be able to centrally store the data but rather support an automated reporting system. E-mail notification in case of an error, automatically updated recorder feature and the integration in existing SCADA systems are among the required functions. Report generator and on-screen reports are standard.

Hardware Solution

DEWETRON's reaction to this is the fault recorder concept DEWE-PFR. Due to the very different requirements of individual transformer stations a very simple and flexible hardware system is obligatory. Based on the DEWE-PFR systems these requirements can be met. Arbitrary number of channels, easy change of voltage and current input channels, user-friendly maintenance and cascading possibility characterize this instrument group. Moreover, highest EMV (electromagnetic compatibility) requirements are necessary. Differential input channels, isolated circuits and secure current paths are guaranteed by the DAQP-HV and DAQP–LA modules.

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the PQ Standard EN50160 or IEEE 1159 and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments.

Different storing options allow a quick and simple report generation directly online, with SQL server databases or the new offline file format. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

Special Features

Time Synchronization

The chronological synchronization of the fault recorders can either be done via the LAN or externally via GPS or DCF77 clocks. Using the LAN way it does not even matter which protocol is available: SNTP or NTP via TCP or UDP.

Crosstrigger

Fault recording is the main feature of these instruments. It is also possible to send the trigger reason for the fault record to other fault recorders in the net and thus obtain global recordings. The synchronization is reached by sending the exact time stamp. At the same time, the data from the circular buffer are stored and evaluated.

E-Mail, SNMP

Another very useful function is the e-mail support. Triggers of fault records, the reaching of limit values, instrument errors or also communication problems are sent to personally defined user groups via e-mail. Similar possibilities are offered by SNMP. Reports such as e.g. weekly analyses can also be automatically generated and sent.

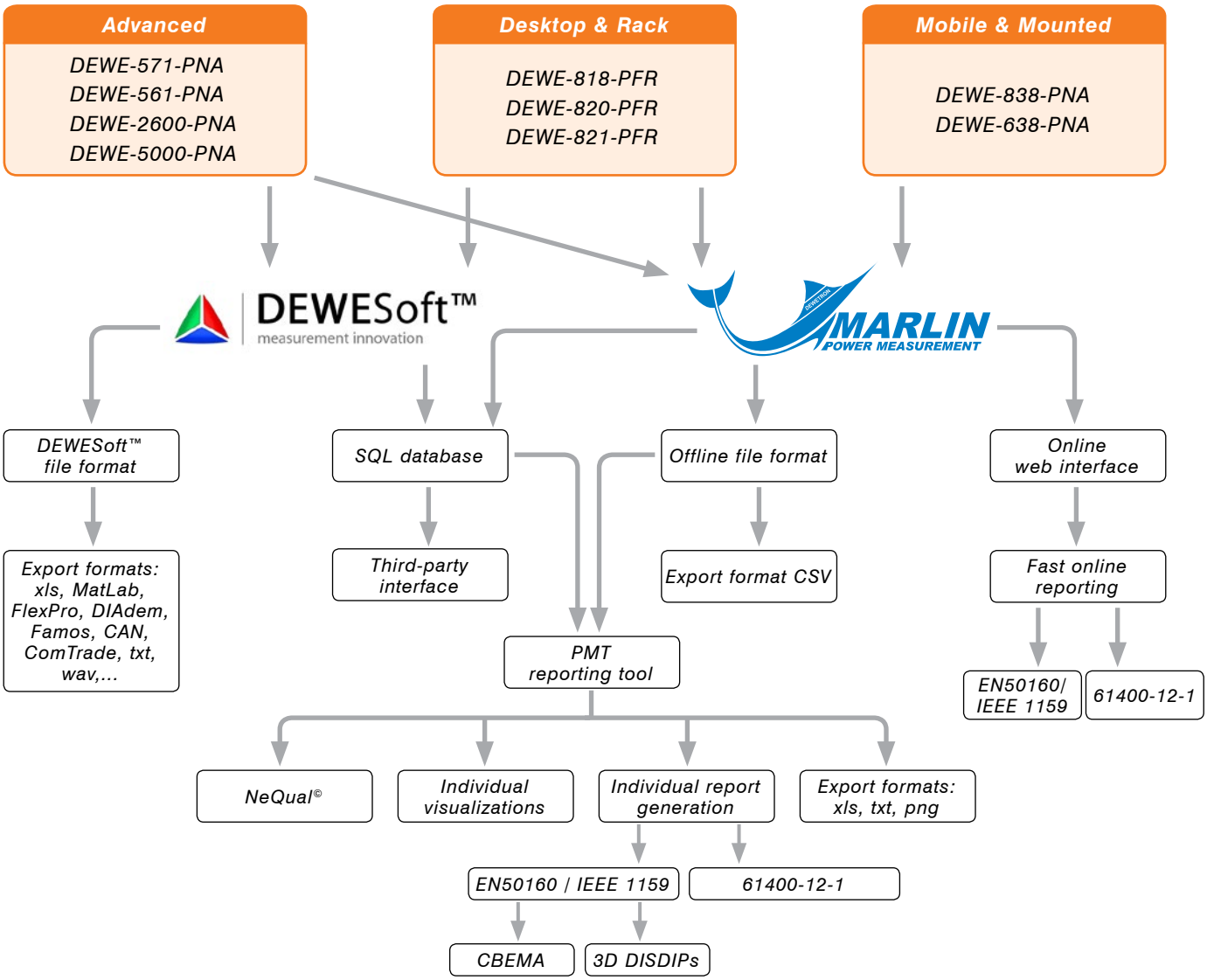
Online Monitoring

Direct access to the fault recorders provides authentic online monitoring. Additionally, saved data can be automatically updated as diagrams and fault records automatically show the latest entries.

Open Data Base Structure

The structure of the data base is open for the user. Individual reports, websites or special analyses can easily be added to the data. We are also pleased to offer user-specific solutions.

Overview Storing Options

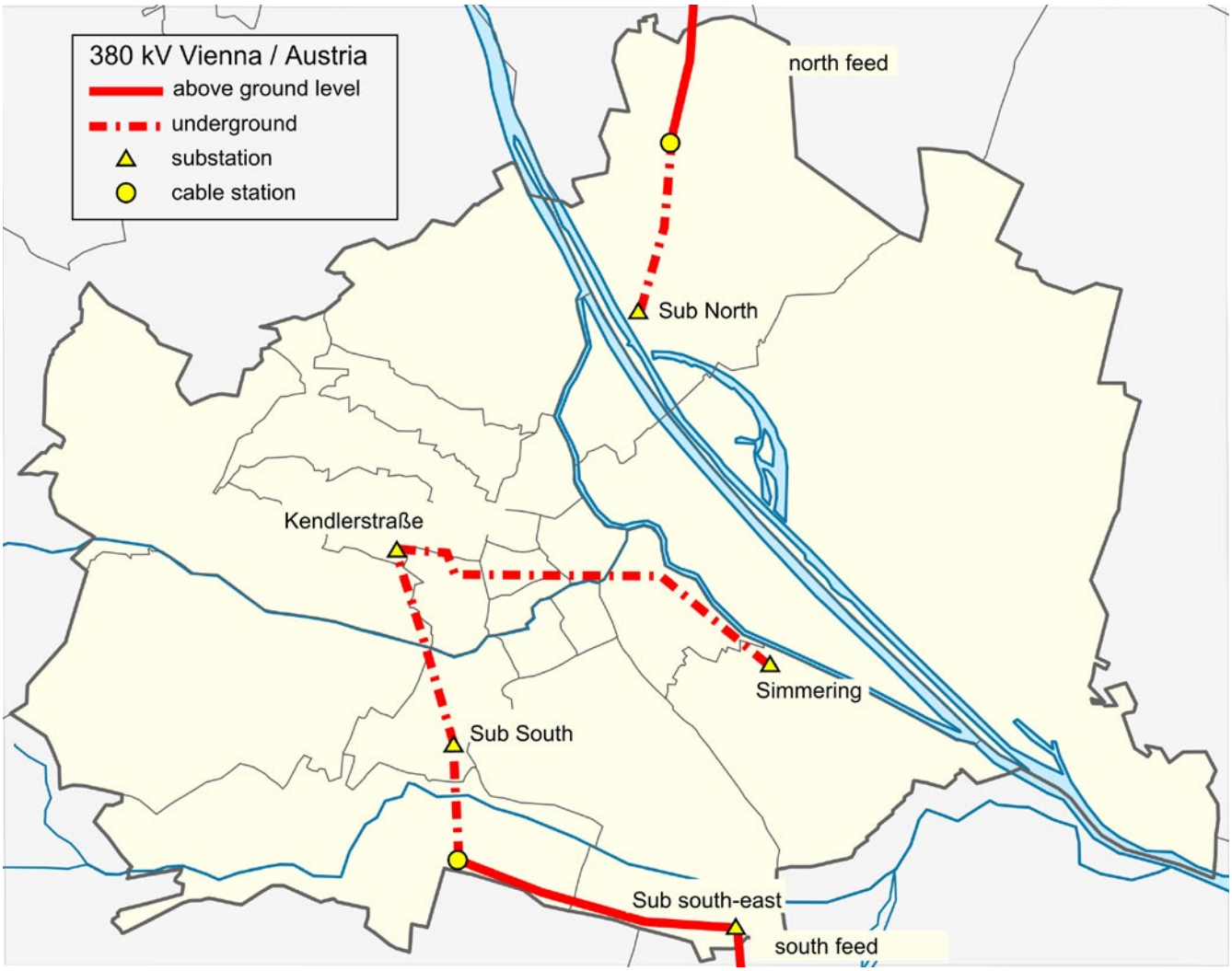


NeQual©

Power Quality Interface designed in Switzerland

DEWETRON offers the ability to react fast on market demands and we also lend an ear to customer's special needs. NeQual© is a server application developed by VSE (association of Swiss electricity companies) which provides the possibility to compare a large dataset of different country regions.

DEWE instruments are class A instruments, which means that all used measurement methods depends on an international standard (IEC 61000-4-30) and so the results which the customer gets are comparable with each class A instrument. Every EN50160 or IEEE 1159 dataset generated by DEWETRON´s instruments can be exported into NeQual© format and then used to upload it into a NeQual© server environment.



Picture: 380 kV transmission system of Vienna, Austria License: CC0

Suitable for PFR

Monitoring Power Supply of Electrical Railway Systems

Application Example for Power Fault Recording

Introduction

Nowadays, the electrical energy supply of railways is in many places autonomic and disconnected from the classical railway business. Mostly, these are individual companies, sometimes they belong to the railway company. As is the case in modern energy service companies we do also have a clear separation of electrical energy supply and transmission in this case. These transmission companies work the same way as all grid companies and are subject to similar market regulations.

The railroad network is often used by other locomotive operators. These compete against each other and against the railway companies. A free market has developed with defined regulations.

For energy supply this means that these companies have recently become service providers in the field of energy supply, have customers, distribute and transmit current and have to obey similar product liability law as do conventional energy service providers. Power quality has also become a keyword in this field.

Task

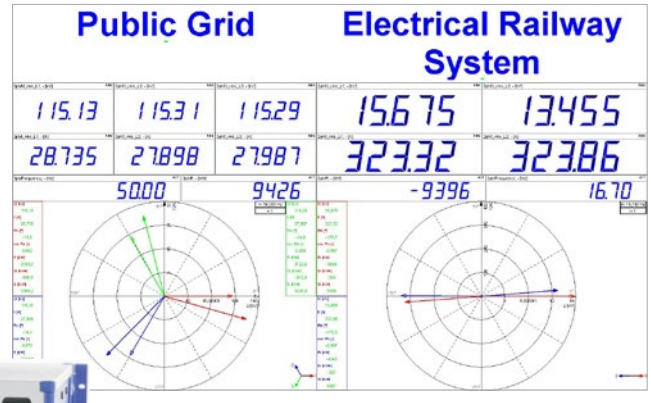
On the one hand, transformer stations in railroad networks provide transformation and transmission of electric energy from customer generation to other sub-plants. On the other hand, they are often connection points between the original railroad networks (overhead traction line) and a pre-located public power supply.

Thus, there are explicit property lines of electric energy and the supplier must assure power quality (service reliability). Monitoring systems for power supply of electric railroads can provide clear information on the voltage waveform. Railroad networks often have other frequencies than public networks (16.7 Hz, 25 Hz, DC etc.) and are furthermore not synchronous.

On the one hand, the network operator is interested in voltage quantity, harmonics, power flow direction, reactive power flow and on the other hand, in conventional disturbance records. A system that unifies all this, that can observe differently frequent power grids at the same time and that can take use of modern communication systems is required in this case.

Solution

Due to very different requirements of individual transformer stations a very flexible and basic hardware system is necessary. Based on the DEWE-818-PFR systems these requirements can be fulfilled. Arbitrary numbers of channels, easy change of voltage and current input channels, user-friendly maintenance and cascading possibilities characterize this instrument group. Moreover, highest EMC standards are necessary. Differential input channels, isolated circuits and secure current paths are guaranteed by the DAQP-HV and DAQP-LA module.



For portable applications we offer module based DEWETRON instruments among which the DEWE-2600-PM is the most qualified and applicable one.

Harmonic Monitoring of High-Voltage DC Power Lines (HVDC)

Application Example for Power Fault Recording

Introduction

High-voltage DC lines are used for the transport of energy over long distances, sometimes for submarine cables or also for the connection of grids with different frequencies. Typically, we talk about 1 million volt and some thousand amperes.

The latest project in which we were involved had a transmission rate of 3 GVA. The picture shows such a transformer station at the end of a 1.000 km long DC line.

Task

When we talk about HVDC then we mean semiconductors and converters. These converters are electronic switches that cannot utilize the whole sinus of the alternating voltage and thus produce harmonics. Some of these harmonics are also measurable on the side of the direct current of the converters. All harmonics must be limited and, if necessary, also filtered. Several coils and capacitors are necessary for this. When these filters are detuned it is important to receive an alarm message. Some parameters such as THD, THFF and EDC have to be monitored as well. All in all we talk of more than 200 measurement points. On each point 50 harmonics including DC values must be calculated every 200 milliseconds. As the measuring transformers are on various locations, the measuring systems have to be distributed and set up on various places as well. The measurement of the DC values requires a special solution as well. An interesting detail is the measuring of harmonics on the direct current side as in this case the fundamental oscillation is naturally not existent.

Solution

Based on the DEWE-PFR series the hardware solution can easily be designed. The 19" rack systems are perfect for the whole equipment and the use of DAQP-HV, DAQP-LV and DAQP-LA modules respectively and allow any input configuration for such large-scale projects.

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the PQ Standard EN50160 or IEEE 1159 and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

Measuring AC Parameters on the DC Line

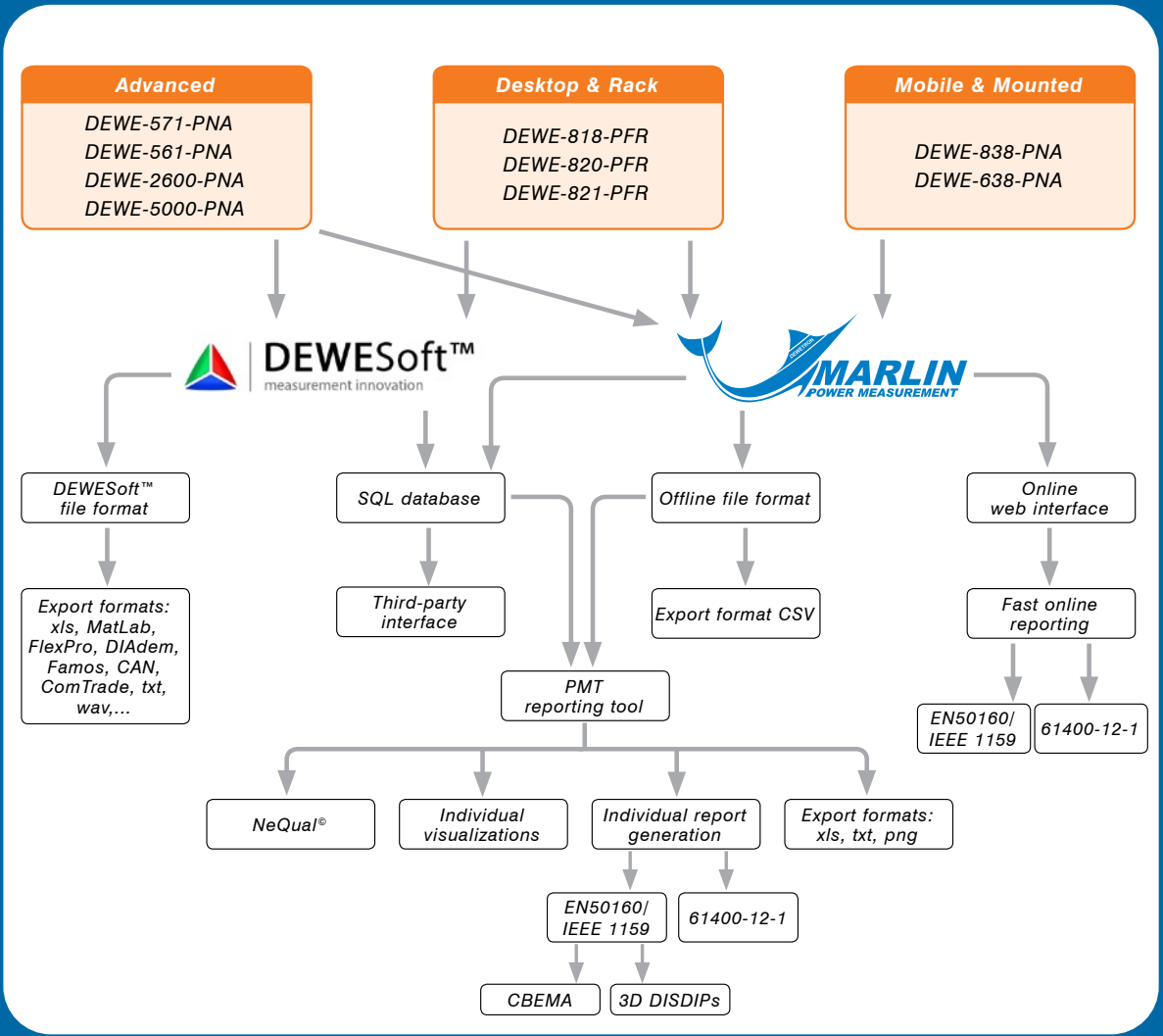
In order to be able to measure harmonics on DC lines, you have to know the exact frequency on the AC side. For that purpose, an AC instrument measures the frequency and provides this information as measuring channel to all other instruments via the LAN. This frequency channel serves as a basis for the calculation of the harmonics in DEWESoft™ POWER. The measurement of direct current is an interesting detail as well and is solved by a Rogowsky coil and fiber optic conductors for signal transmission. Due to these fiber optic conductors the galvanic isolation can be solved efficiently.


60 %
10:21
AT
83.64.182.166
Logout
System settings
Power settings
Inputs
Setups
Files
Record
Running
Stop
3 Phase
Live view I UL12=397.994 V UL23=399.833 V UL31=402.284 V
1 Phase
Live view I UL1=230.448 V
Aron
Live view I UL1=230.448 V UL2=230.51 V UL3=231.979 V
3 Phase
Live view I UL1=230.448 V UL2=230.51 V UL3=231.979 V
2 Phase
Live view I UL1=230.448 V UL2=230.51 V
Aron +
Live view I UL12=397.994 V UL23=399.833 V UL31=402.284 V
marlin measurement software - Instrument SN: 666
State: | Version: 1.1.8 | Current setup: Sternmessung

SOFTWARE

SOFTWARE

- Marlin 49
- DEWESoft™ 55
- Plugins 60
- PMT - Process Monitoring Tool 62



MARLIN POWER MEASUREMENT

worldwide DEWETRON

Marlin is DEWETRON's solution for electrical power engineering

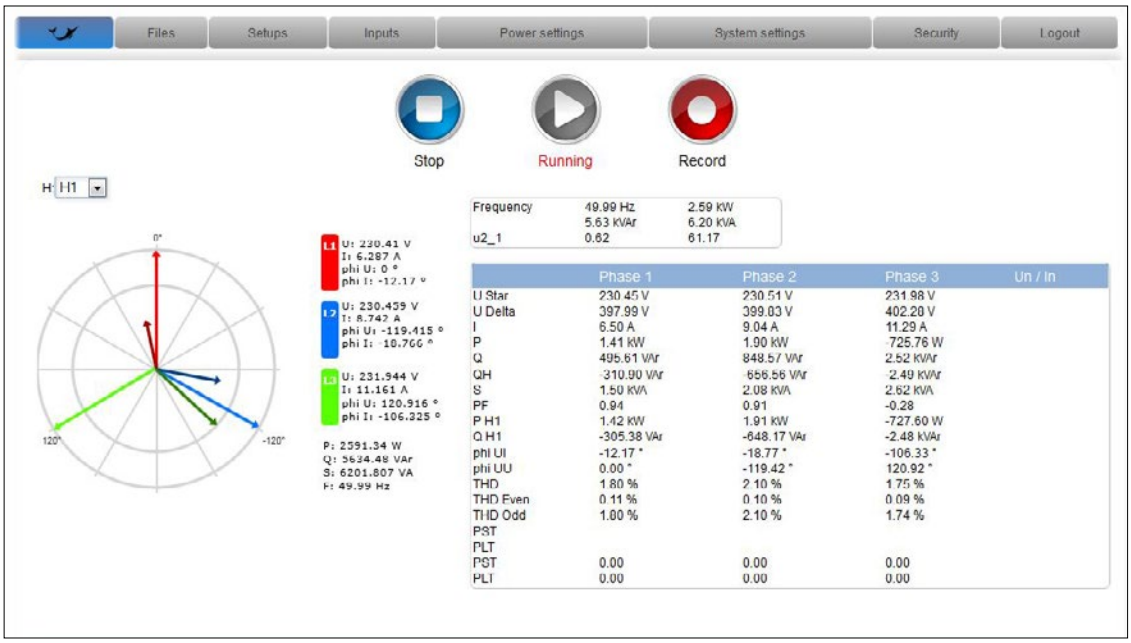
The recording of disturbances in power networks, the calculation of all power quality parameters and the measurement of performance and energy flows are the main tasks that Marlin performs.

The software can be run as a native Windows service in the background. Unauthorized access to the instruments without user credentials is not allowed. On small DEWETRON devices, such as the DEWE-638 and DEWE-838 series, Marlin runs as a Linux service.

User Interface

Would you like to control your measurement instrument and run your measurement from any place at any time?

With Marlin now it is possible to run your power measurement with any browser. There is no need for any app or remote software. Just type in the IP-address of your DEWETRON instrument!



Marlin power measuring software for fault analysis, PQ and energy monitoring

Feel free to use any browser

Works on every hardware. No matter if Linux, Windows, Android or etc. operating system.

Measurement and evaluation at the same time - Access from multiple workstations simultaneously

The user interface is a pure web application and therefore allows the control and evaluation of each workstation in the network. Access via a browser independent operating system is possible from all devices such as tablet computers, smart phones, and any computer workstation. Therefore, the data can be viewed by multiple users simultaneously, from any location.

Integration into your control and monitoring system

Marlin also provides an easy and simple way to transfer RMS-Values directly to a control center. Due to this feature SCADA 104 is used to transfer data from a DEWETRON-Instrument to the control center of a power station.

Measurement parameters

In addition to all aspects of 3-phase current and voltage, parameters that can be measured include harmonics, flicker, frequency and symmetrical components.

High-precision calibration

Since the calibration related calculations are performed in the frequency domain, a high-precision adjustment of the input channels, including conversion circuit, is possible. This is done for phase angle / amplitudes. The calibration can therefore be guaranteed for the highest accuracy class (class A according to EN 61000-4-30). There is also an available database-driven calibration solution for "on-site" calibration.

Delta, star, and combined networks

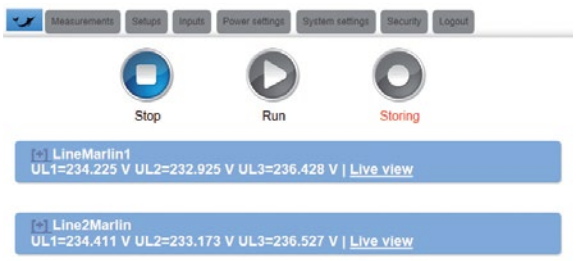
Disturbance recorders can be used in all network levels. Besides the classic star circuit with neutral, a measurement in a delta or a calculation of the line-to-line parameters is possible. A proper measurement strictly according to the EN50160 or IEEE 1159 standard in medium and high voltage networks, in which the transducers are connected in star, the assessment must be made line to line. For two-phase systems and frequencies other than 50/60 Hz, there are also available settings.

Several power modules at once

Recording of the above parameters can be performed in parallel by multiple virtual devices. It can simultaneously measure current and voltages from summed feeders, as well as a 3-phase configuration.

Data storing and data transfer

There are different ways to store data with Marlin. Due to the flexibility of data storing it is possible to store data in a SQL-Database, and in an Offline-File-Format.



Offline File Format

The data will be stored directly on your DEWETRON instrument. With this option it is possible to evaluate your measurement directly with PMT4-Offline on the DEWETRON instrument or any device with a PMT4 installation. There is no need for an SQL server or SQL database.

Stream to database

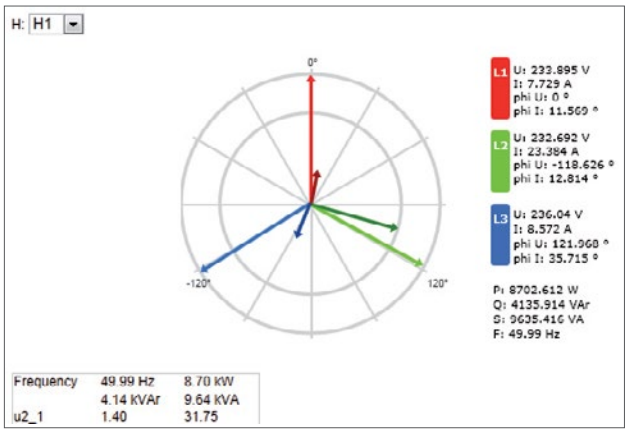
The data will be transmitted directly to the data server (SQL server). In this mode it is not relevant whether the data base is directly stored on the measurement instrument or on a data server in your company network.

Marlin provides also the possibility to transfer data to the power control center. Therefore the SCADA 104 protocol is used to transfer RMS values directly through your network to your control center.

Also the web based technology of Marlin allows you to select a RMS value directly with a hyperlink.

Vector diagram at the start screen

- *Vector Scope for 3-phase systems*
- *Every harmonic can be shown*
- *Display of multiple vector scopes on the same screen via web browser technology*



Recorder

- *Recording of all parameters in adjustable intervals*
- *Zoom in and zoom back during the measurement!*

FFT - Harmonic analysis

- *FFT for U and I according to EN 61000-4-7*
- *FFT for P - power direction determination*
- *Adjustable number of harmonics*
- *THD calculation*
- *Limit manager (.e.g., EN 61000-2-4, EN 50160...)*

Performance and PQ analysis (EN 61000-4-30 Class A)

- *Diagram: Star, with triangular rating, delta, 3 ~, 1 ~*
- *Phase 4 as earth voltage / star power*
- *Frequency measurement, fundamental frequency selectable*
- *P, Q, S, PF, P1, Q1, cos φ (each 3 ~ and phase values)*
- *Harmonics, THD (EN 61000-4-7)*
- *Flicker (EN 61000-4-15)*
- *Symmetrical components*
- *Signal voltage level*

Online fault list

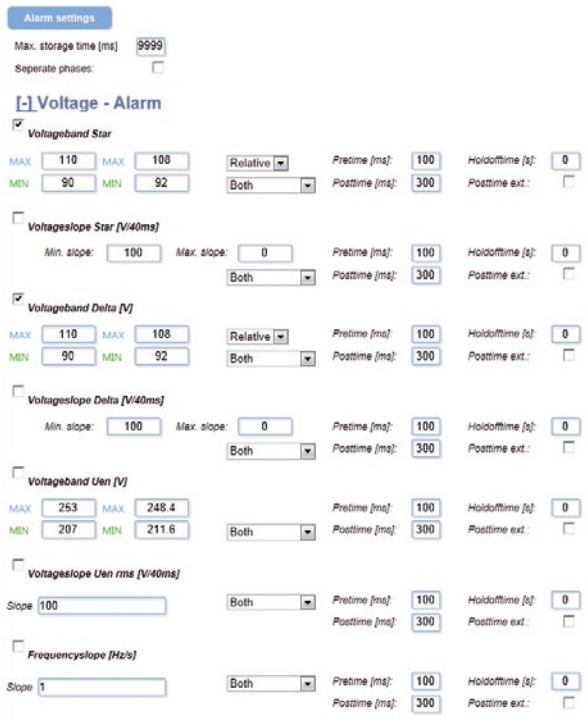
- *Reporting of the nature and time of the fault*

Online fault statistics

- *Duration, altitude and time of the fault*
- *List form*
- *Statistics by DISDIP online*

Trigger settings

- *U, I, f, P*
- *Power band: star, delta, earth voltage*
- *Regulation: star, delta, earth voltage*
- *Frequency hopping*
- *Power band: phase center*
- *Change in current: phase center*
- *Active and reactive power change 1 ~ and 3 ~*
- *Power factor changes 1 ~ and 3 ~*



Alarm list

- *Device messages*
- *Error messages*
- *Trigger settings*

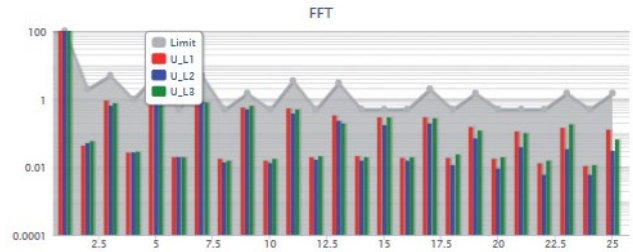
EN50160 (or IEEE 1159) online analysis

- *Star or delta*

95 % Quantile

Name	Wert	Limits	Ergebnis
Frequenz 99.5 %	50.02 Hz	49.5 to 50.5	Ok
Unsymmetrie	0.23 %	0.0 to 2.0	Ok
U RMS L1	234.12 V	207.8 to 254.0	Ok
U RMS L2	234.07 V	207.8 to 254.0	Ok
U RMS L3	234.56 V	207.8 to 254.0	Ok
THD L1	2.26 %	0.0 to 8.0	Ok
THD L2	1.90 %	0.0 to 8.0	Ok
THD L3	2.01 %	0.0 to 8.0	Ok
Pst L1	NAN		
Pst L2	NAN		
Pst L3	NAN		
plt L1	NAN		
plt L2	NAN		
plt L3	NAN		

Charts



FFT Spec 95 % Quantilwerte Ok

EN50160 (or IEEE 1159) online reporting

- *Providing a powerful short overview about the status of the grid*
- *Online report calculation in star and delta configuration*
- *95 % quantile and 100 % values*
- *Charts of voltage, harmonics and frequency*

100 % Values

Name	Value	Limits	Result
Frequency 100 %	Hz		
U RMS L1	235.41 V	195.5 to 253.0	Ok
U RMS L2	234.89 V	195.5 to 253.0	Ok
U RMS L3	234.27 V	195.5 to 253.0	Ok

Disdip

> 120%	0	0	0	0
110% - 120%	0	0	0	0
80% - 90%	0	0	0	0
70% - 80%	0	0	0	0
40% - 70%	0	0	0	0
5% - 40%	1	0	0	4
	10 - 200 ms	200ms - 500ms	500ms - 1s	1s - 5s	5s - 60s

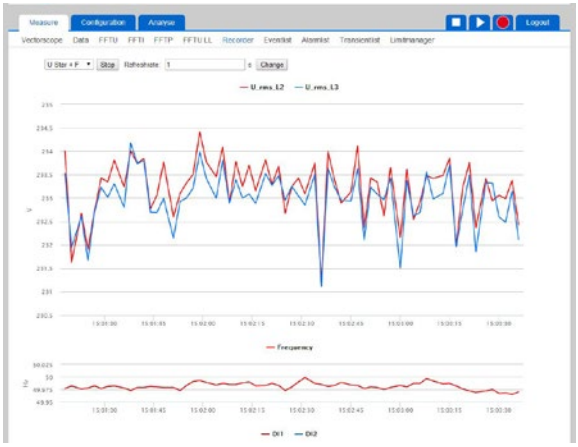
Marlin for x38 series (638 and 838)

The software is a web application which you can access with any browser (e.g. Microsoft Internet Explorer, Apple Safari, Mozilla Firefox,...)

The DEWETRON x38 series are small single power module instruments with full Power Network Analysis and Power Fault Recorder functionality. Evaluating according to the PQ Standard EN50160 or IEEE 1159 and fulfilling the measurement requirements of IEC6100-4-30 Class A are two of the key features of these small powerful measurement instruments. The DEWETRON x38 series is perfect to build up a large scaled monitoring system to maintain a complex power grid.

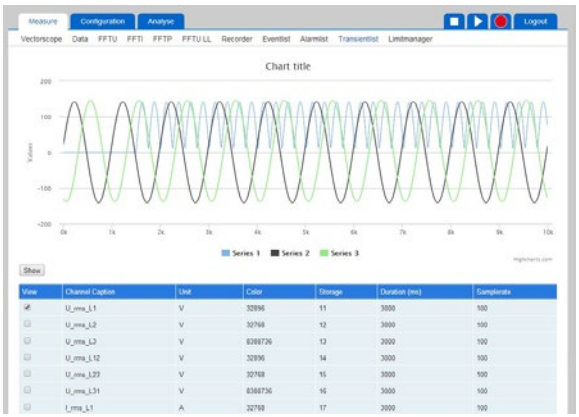
Online data

- *U, I of phases, lines and neutral*
- *f*
- *Power of phases and total*
- *P, Q, S, PF*
- *Fundamental values of power*
- *Flicker (EN 610004-15)*
- *THD*



Harmonics screen (EN 61000-4-7)

- *U, I, P, Q, U_{Line}*

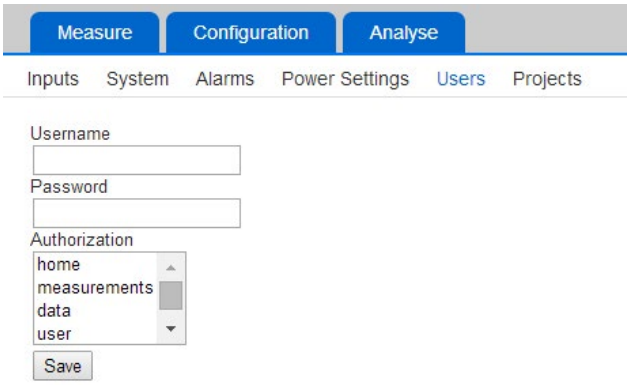


Vector scope

- *U, I*
- *Selectable order of harmonic*

Fault recording

- *Transient-view with selectable channels and zoom function*
- *Export to CSV directly via online interface*

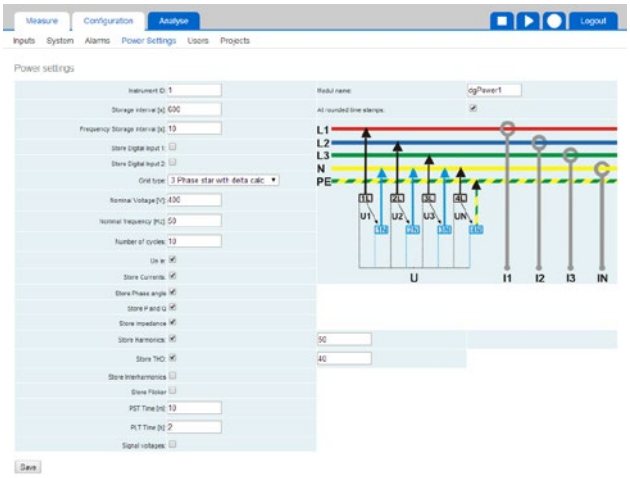


Access to the instrument

Different users have different access to the instrument.

Basic access:

- *Viewer (only data can be shown)*
- *Admin (administrator access to the instrument)*
- *Rightsmanager (access to power settings, analog settings, system, alarms, etc...)*



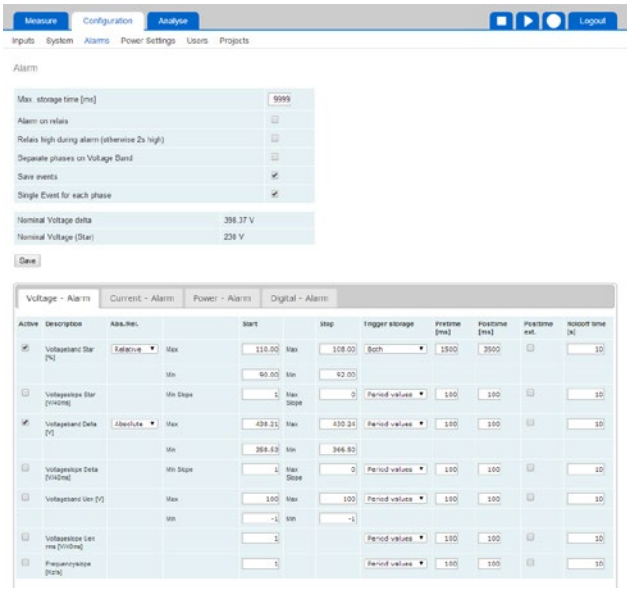
PQ and POWER monitor

Configure the storing options for the PQ recorder:

- *Harmonics, flicker, voltage, THD,...*

Configure the POWER meter:

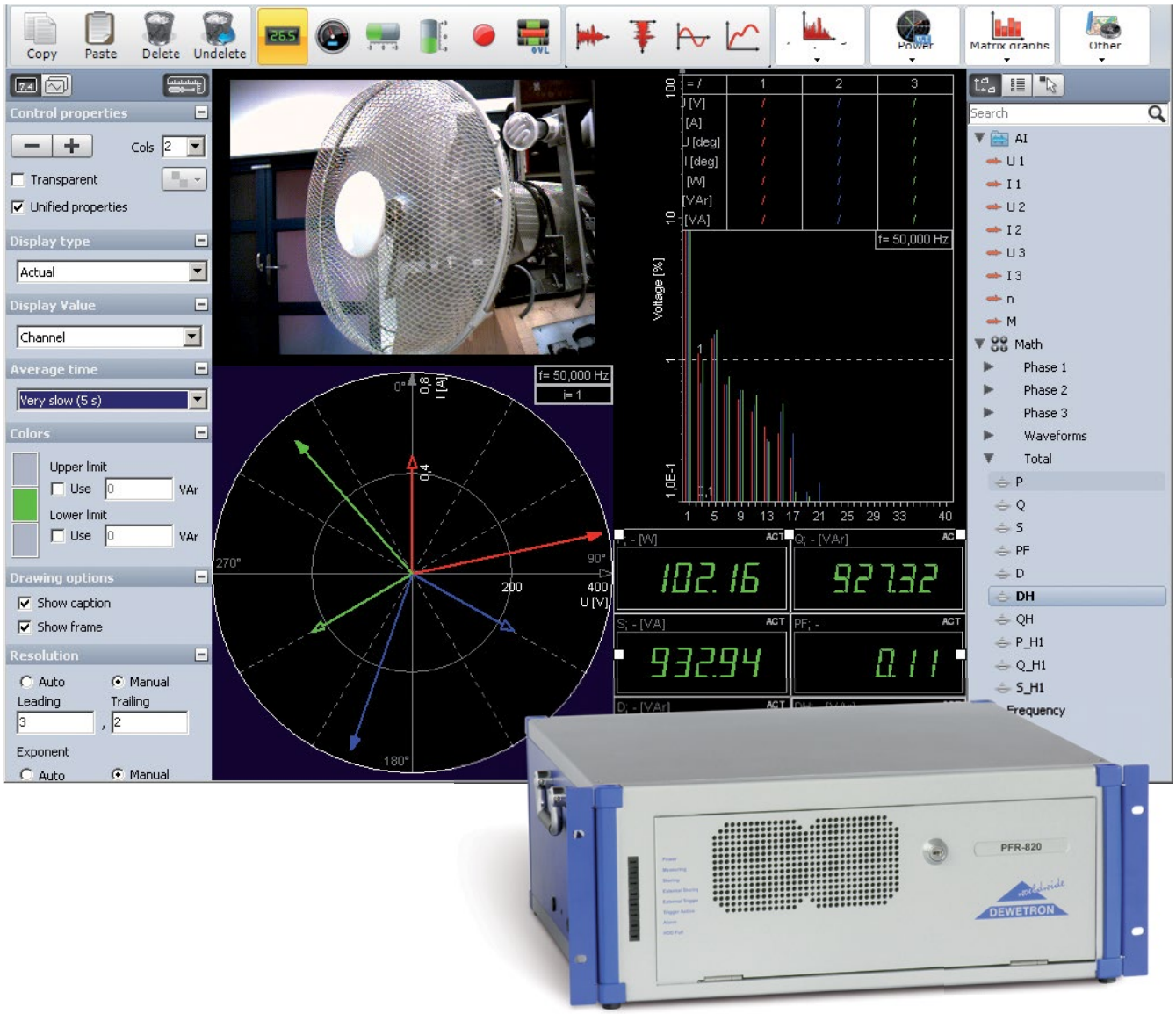
- *P, Q, S, PF, cos φ, I, f,...*



Fault recorder

Trigger options for:

- *External (DIOs)*
- *Voltage (level, rate of change, line + phase and neutral)*
- *Current (level, rate of change)*
- *Power (level, rate of change)*
- *Frequency (level, rate of change)*



DEWESoft™

(All Models except DEWE-638 and DEWE-838)

The option POWER (DEWESoft™-OPT-POWER) is an absolutely high-performance tool for the calculation of power and other similar parameter – the capacity to multiply current and voltage is not the only feature it has. This toolbox is an excellent combination of many features and nearly all applications can be realised by using DEWETRON equipment.

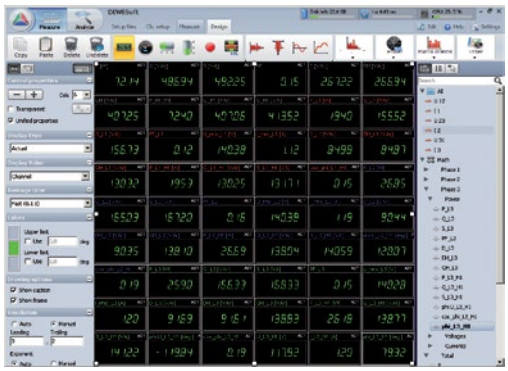
Beside the exact calibration the frequency calculation is a central feature of this software. 50 Hz and 60 Hz are a must – for us also 16.7, 400 and 800 Hz as well as DC and variable frequencies (driver) are a necessity. Due to the high acquisition rate (mainly dependent on the AD card in use, up to 1 MS/s) and for the DAQP-HV-S3 and HSI-HV modules is no limitation of the acquisition of PWM drivers (2 MHz electrical bandwidth) and the calculation of active and reactive power, power factor etc ...

The toolbox with power quality parameters such as harmonics, interharmonics, THD, symmetric components, flicker and its combination with numerous trigger possibilities make the equipment a power analyser with nearly no limitations. Several screen elements such as vectorscopes, harmonics monitor, oscilloscope and diagrams allow a perfect online visualisation of the data.

The integration of counter inputs, video and CAN-bus offers additional data sources. The mathematical library additionally offers the possibility to calculate parameters such as torque and angular velocity, or even determine the efficiencies online.

Power Calculation

- *P, Q, S, D*
- *Cos φ, power factor*
- *P, Q, cos φ for each harmonic*
- *Symmetrical components (positive, negative and zero sequence components); U, I, P, Q, cos φ; from 10 period values and period values*
- *Period values (½ cycle, cycle, overlapping, 1 ms sliding, ...)*

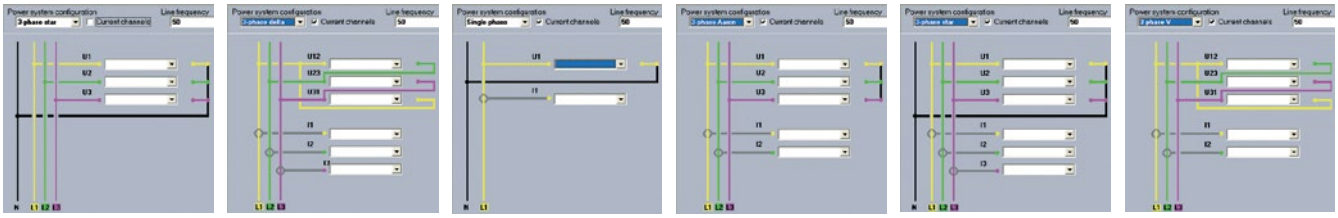


Frequency Calculation

The software PLL guarantees a very accurate frequency calculation (mHz). On one system multiple power systems can be measured and each can have its own frequency. With the use of the different instruments from DEWESoft™ the values can be shown in several ways.

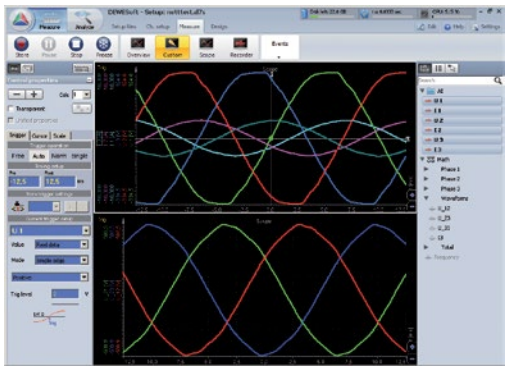
Wiring Schematics

Different wiring schematics allow all possible connections. These are single phase, star connection, delta connection, V connection, Aron connection and a combined star / delta connection. All of course with or without currents.



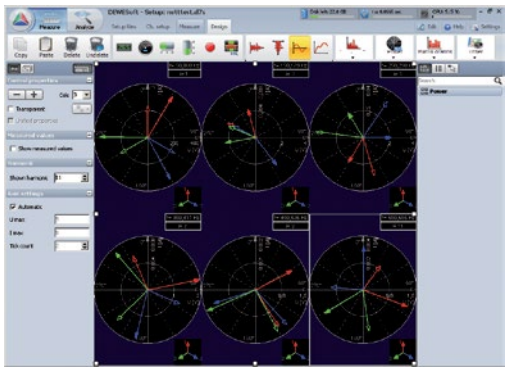
Scope

- *Selectable graphs*
- *U1, U2, U3, U12, U23, U31: Line to line and line to earth voltages are supported*
- *Up to 8 graphs in one diagram*
- *Zoom in and out are supported online*
- *Waveforms can be stored*



Vector Scope

- *Vector scope for 3 phase systems*
- *Each individual harmonic can be shown*
- *More vector scopes can be displayed on one screen*
- *Different power systems can be shown on one screen*
- *With the "transparent" function direct comparisons of phasors are possible*

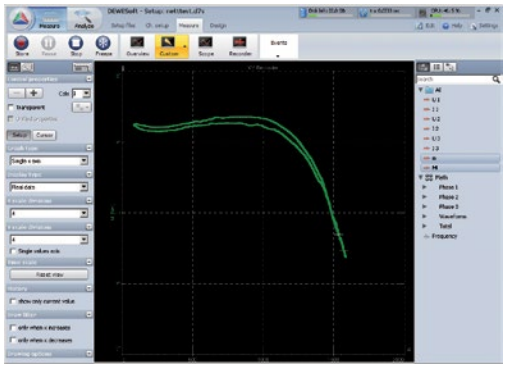


Recorder

- Recording of all parameters in individual intervals
- Individual screens can be defined
- Zoom in and out
- Storing fast (full sampling rate) or reduced (e.g. 600 sec.)
- Detailed zoom-in to pulse width!

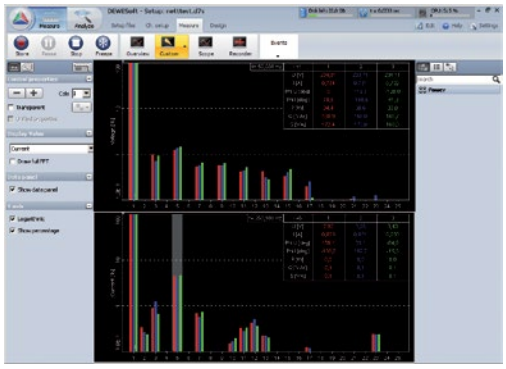
X/Y Recorder

- Orbitals can be generated online
- P over Q as example for this function



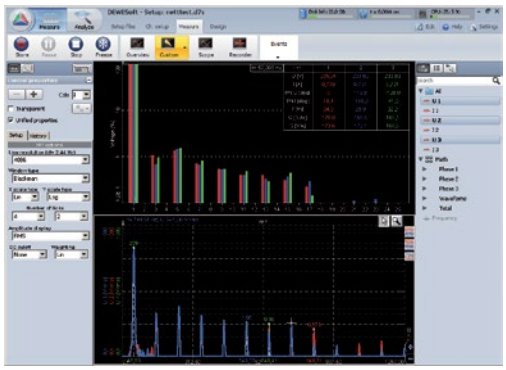
FFT - Harmonics Analysis

- U, I, P and Q
- Individual setup of the number of harmonics including DC-component
  (Example: 20 kHz sampling rate = 200 harmonics @ 50 Hz)
- Interharmonics, groups or single values
- According to EN 61000-4-7
- Calculation corrected to the actual real frequency
- THD, THD even, THD odd
- Trigger on each parameter
- Background harmonics substractable
- Optionally definable group-mode for harmonics and interharmonics.
  Selectable number of bins and frequency groups - “200 Hz“ according to EN 61000-4-7 (OPT-DB required)



Full FFT - Frequency Analysis

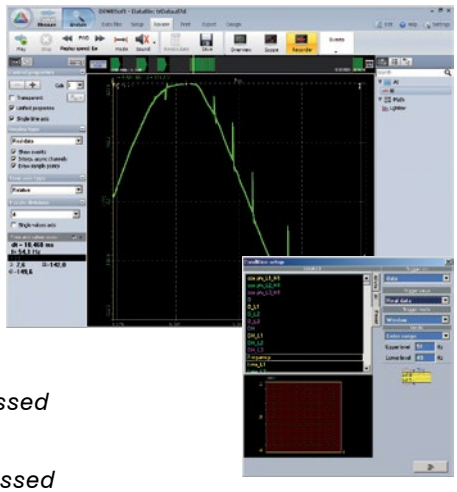
- In addition to the harmonics FFT a full frequency based FFT is available.
- All frequencies can be analyzed with this function
- Trigger on FFT patterns
- Definable filters (hanning, haming, flat top, rectangle, ...)



Flicker

- According to EN 61000-4-15
- P_{ST} and P_{LT} with flexible intervals
- Individual recalculation intervals
- P_{inst}, du, du_{max}, $du_{duration}$
- Flicker emission (current flicker)

Fault Recorder



- *Setting a trigger on all parameters of the power module!*
- *U, I, P, Q, S, D, cos φ, power factor, ...*
- *Each harmonic!*
- *Pos-, neg-, zero-sequence systems*
- *Very fast glitch detection (up to MS/s)*
- *Math. channels (rpm, torque, efficiency,...)*

Edge-, filtered edge- and window-trigger

Setting the trigger on rising edge when the threshold has been crossed

Setting the trigger on falling edge when the threshold has been crossed

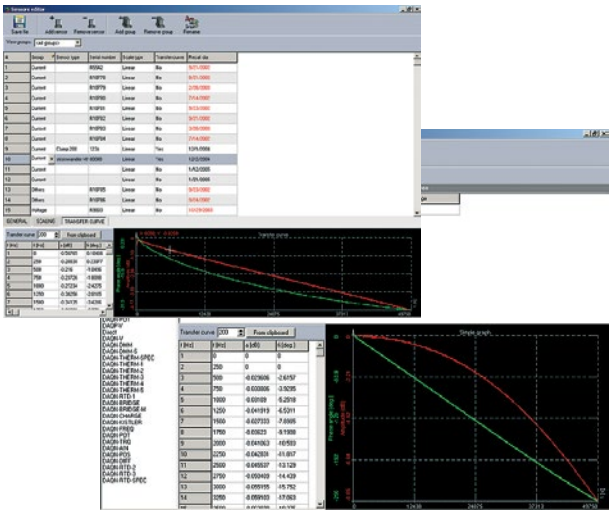
Setting the trigger when signal enters the range between two definable threshold levels

Setting the trigger when signal leaves the range between two definable threshold levels

Further trigger functions: pulse width, window and pulse width, slope, FFT and time

Calibration/Accuracy

The high accuracy of the calculation can be reached because of the calibration function in the frequency domain. With this unique technology amplitude and phase can be corrected for the full frequency range from DC up to whatever the hardware can sample (kilosamples up to megasamples per second). All internal curves like filter response or multiplexer shift are corrected inside the software and the sensor database includes correction curves for each clamp, rogowski coil, transformer or which sensor ever is used.



Rotational and Torsional Vibration Measurement

Torsional vibration is an oscillation of angular motion (twist) which occurs on rotating parts - such as gear trains, crankshafts or clutches. High torsional forces and vibrations result in material fatigue, abnormal abrasion etc. and can be destructive in the long run. In many cases, torsional vibration is not noticed until the affected part is damaged. Often only vibration noise is the only indication of torsional vibration.

Report Generator and Database Storing (DEWESoft™-OPT-DB)

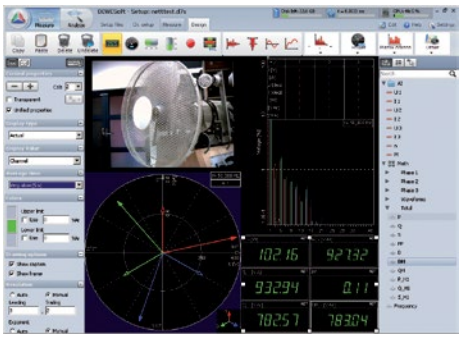
In several applications, especially when it is necessary to evaluate data over long periods, with different sampling rates or in parallel to their acquisition, it might be necessary to use a really strong database tool. Therefore DEWETRON has developed the DATABASE OPTION as an add-on to DEWESoft™.

Beside data storing there is also a strong reporting tool available. Diagrams, FFT spectra, Fault reportings and statistic functions are the basic functions and additional reports can be added by using the plug in Technology. Nice visual elements can be used to get a good overview about the full measurement system.

Reports like EN50160, IEEE 1159 or EN 61000-2-4 can be easily generated as well as large customized reports on the user's needs.

Video

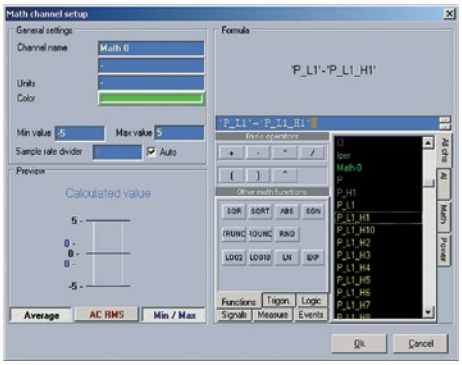
The parallel usage of the synchronous DEWESoft™ VIDEO function allows the user to store videos in parallel with the data recording and opens a wide range of applications – whenever optical information is needed!



Math Functions

With the additional MATH function of DEWESoft™ calculations of for example efficiency, difference of input, output and phase angle differences can be implemented easily. Use all POWER parameters as input value!

- *Arithmetic functions*
- *Trigonometric functions*
- *Logic function*
- *Signal generator*
- *Event functions*
- *d/dt, integration*
- *Highpass-, lowpass- and bandpass-filters*
- *Transfer curve function*

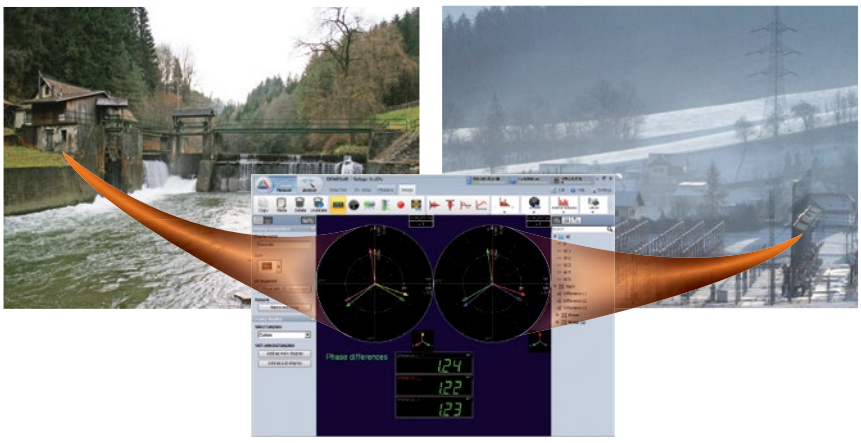


Remote Control

With the remote control ability the instrument can be configured and the data can be evaluated from your office or wherever you are.

GPS and NET

With the use of the GPS function a comparison of different units on different locations is possible. Phasor measurement and angle comparisons are a typical application of this function.



Reporting Function

- *Direct report printout*
- *Data export for enhanced post analysis in other applications*
- *PMT as reporting and analysis tool*

Notification (for permanent installed systems)

- *E-Mail*
- *SNMP*

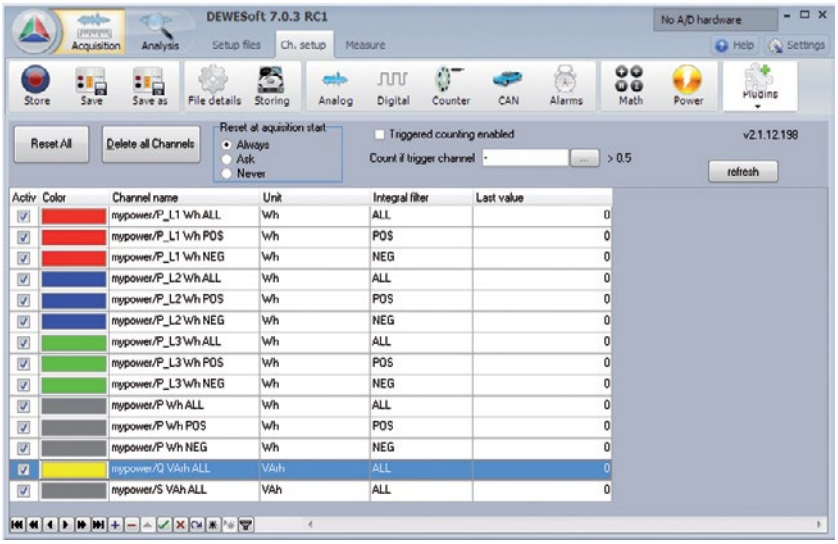
Plugins for DEWESoft™

PLUGIN-ENERGY

Suitable for PM EM PNA PFR

The energy counter inside DEWESoft™

- *Calculates the energy out of any power value*
- *Ingoing / outgoing and total active power*
- *Inductive / capacitive reactive energy*
- *Remembers the counter value also during stopped DEWESoft™*
- *Digital input to suppress counting*
- *Also mechanical values can be used as power channels (Example: mechnical energy on a shaft)*

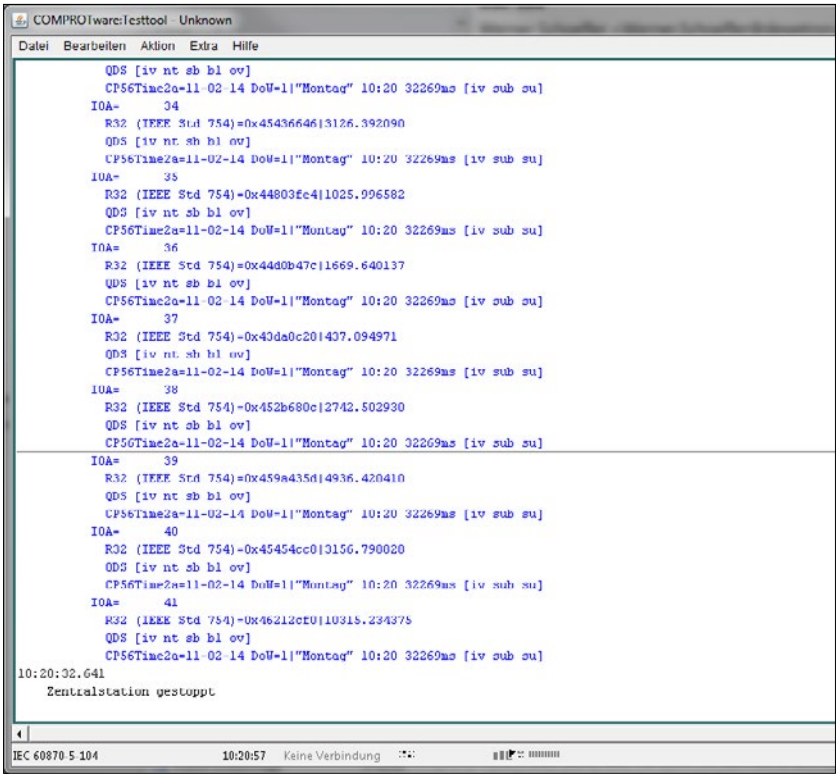


PLUGIN-SCADA-104

Suitable for PM EM PNA PFR

Read and write data to EN 60870-5-104

- *Supports the EN 60870-5-104 protocol*
- *Each read variable is an asynchronous DEWESoft™ channel*
- *Send data continuously or after adjustable rates of change*
- *For instruments with DEWESoft™ or DEWE-838/638 systems*

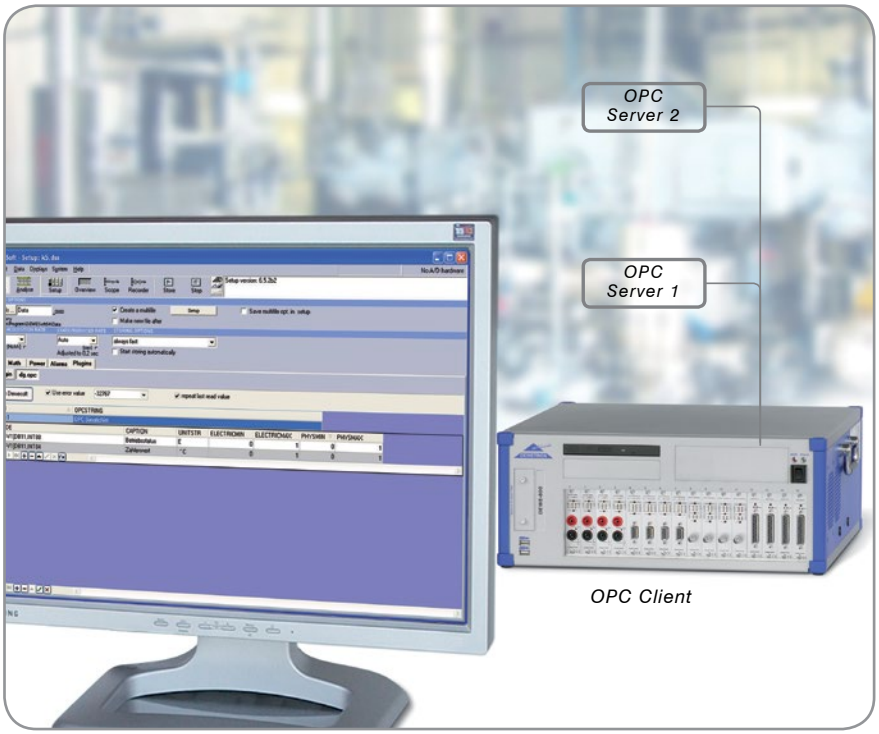


PLUGIN-OPC-CLIENT

Suitable for PNA

Use OPC data as DEWESoft™ channels

- *OPC server support*
- *More OPC servers addressable*
- *Data polling*
- *Numeric data*
- *Boolean data*
- *Each parameter is an asynchronous DEWESoft™ channel*



PLUGIN-OPC-SERVER

Provide DEWESoft™ channels to OPC clients

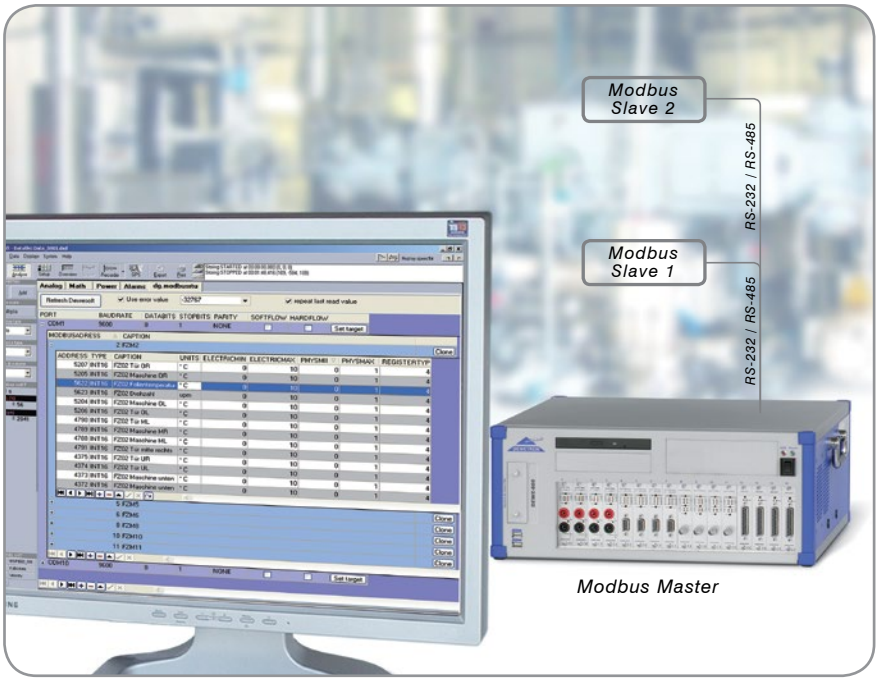
- *OPC server for DEWESoft™*
- *Any DEWESoft™ channel can be used*
- *Export data to .txt files*
- *OPC data access 3.0 (and earlier)*

PLUGIN-Modbus

Suitable for PNA PFR

Use serial Modbus devices inside DEWESoft™

- *RS-485 support*
- *More serial interfaces addressable*
- *RTU protocol*
- *INT16, INT32, FLOAT32 (IEEE 32 bit floating point)*
- *Each variable is an asynchronous DEWESoft™ channel*



PMT - The Process Monitoring Tool

Power Data Base Storing and Report Generation

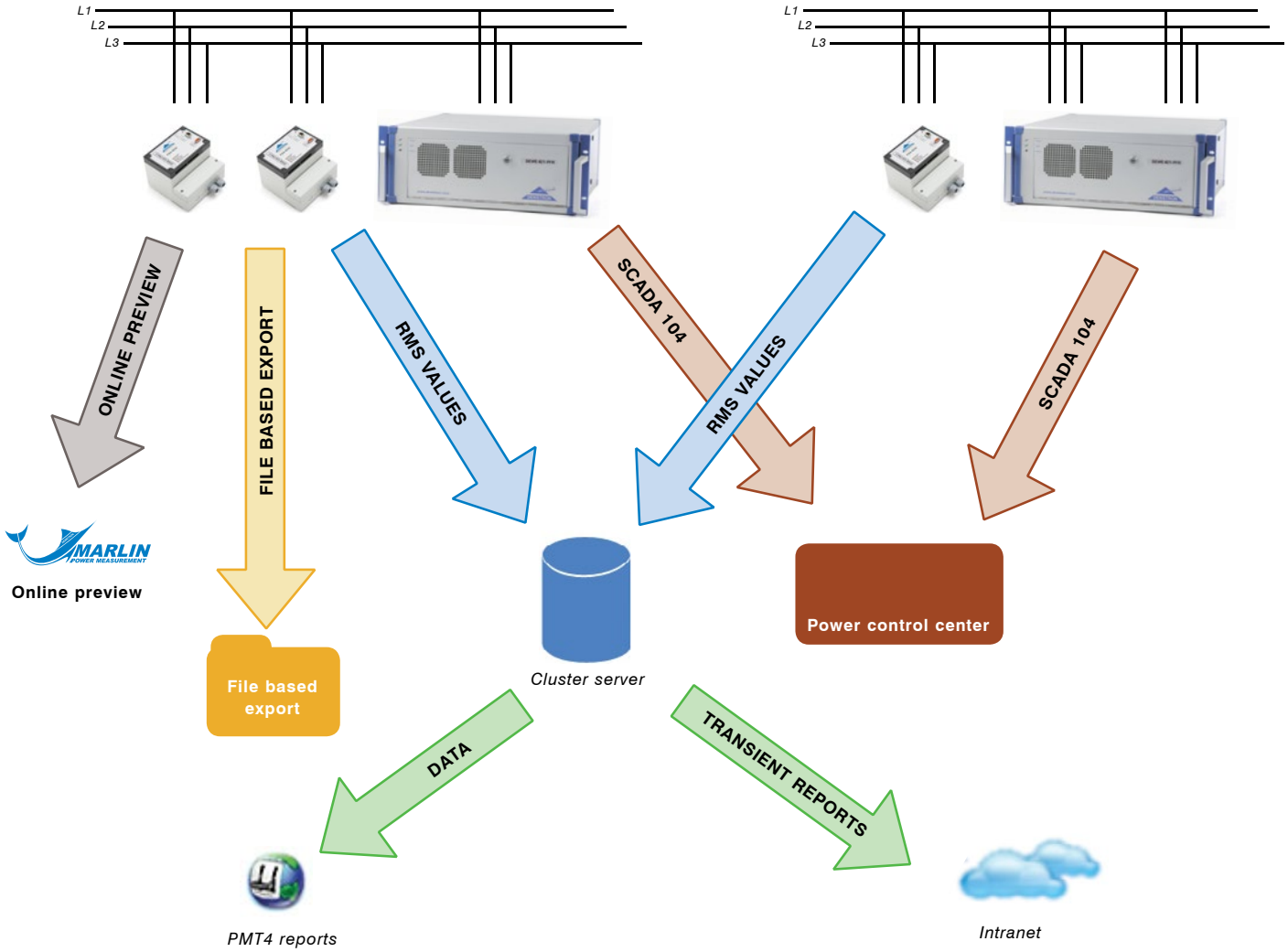
In several applications, especially when it is necessary to evaluate data over long periods, with different sampling rates or in parallel to their aquisition, it might be necessary to use a really strong database tool. Therefore DEWETRON has developed the database OPTION as an add-on to DEWESoft™.

Beside data storing there is also a strong reporting tool available. Diagrams, FFT spectras, Fault reportings and statistic functions are the basic functions and additional reports can be added by using the plug in Technology. Nice Visual Elements can be used to get a good overview about the full measurement system.

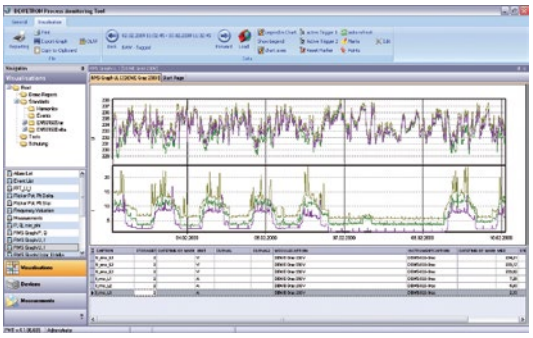
Reports like EN50160, IEEE 1159 or EN 61000-2-4 can be easily generated as well as large customised reports on the users needs.

- *Long time data acquisition*
- *For instruments*
- *For PFR systems*
- *Storing of logged data*
- *Different storing intervals*
- *Waveform data as fault records*
- *RMS shapes as disturbance faults*
- *Cross trigger*
- *Diagrams*
- *Histograms*
- *FFT spectra*
- *Fault lists*
- *Fault diagrams*
- *Alarm lists*
- *Topological overview*
- *DIS DIP statistics*
- *CBEMA / ITIC curve*
- *Large Report Generator*
- *Sum reports*
- *User levels*
- *Auto update*
- *SQL database with defined tables*
- *Plugin interface*
- *Email support*
- *PDF support*
- *SNMP support*

Database Storing

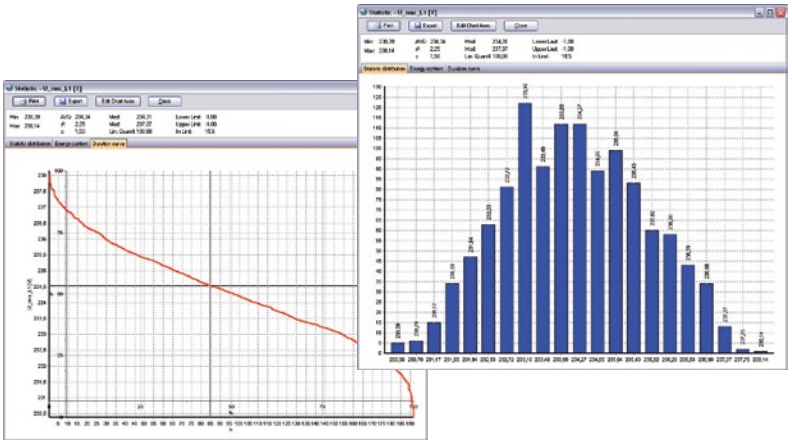


Diagrams



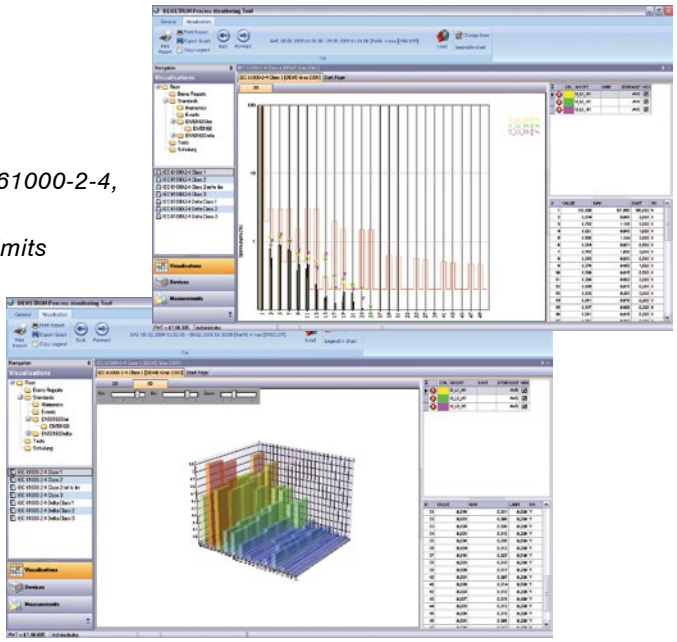
- Single Diagrams or multiple Diagrams on one page
- Individual number of channels per diagram
- Graphical view or statistical view in a table
- Table individual configurable
- Min / Max / Avg Calculation
- Up to 5 Percentage Calculations (eg 95% value) per channel
- Direct comparison of different locations/days
- Zoom In / Zoom Out Function
- Report Printing function
- Math channels

Histograms



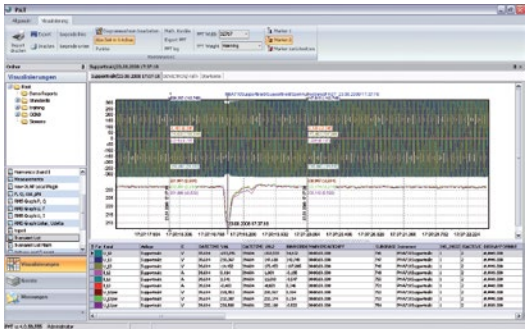
- Histogram calculation
- Med / Stddev / Var / Mod calculation
- Individual definition of sidebands
- Report printing function
- Energy line

FFT Spectra



- Individual number of harmonics (25, 50, ...)
- Voltage, current, active power, reactive power, phase angle, impedance
- Limits according standards (EN50160, IEEE 1159, IEC61000-2-4, individual definition)
- Max / Avg / 95% calculation and comparison against limits
- Timestamp or intervals of data presentation
- More subgraphs per page possible
- More datalines in one graph
- Direct comparison of different locations
- Zoom In / Zoom Out Function
- Report Printing function
- 3D graph

Fault Diagrams



- Waveform presentation of faults
- RMS shape calculation
- Different setups for different faults
- Report Printing function
- FFT
- Math channels

Fault Lists

- Listings of faults
- Filters like time, channel, type etc..
- Automatic update function
- Confirmation support
- Report Printing function

Alarm Lists

- Alarm list definition
- Automatic update function
- Confirmation support
- Report Printing function

Topological Overview

- Topological online view of instruments
- Status
- Faults
- Combination with different diagrams
- Start of different setups

DIS DIP Statistics

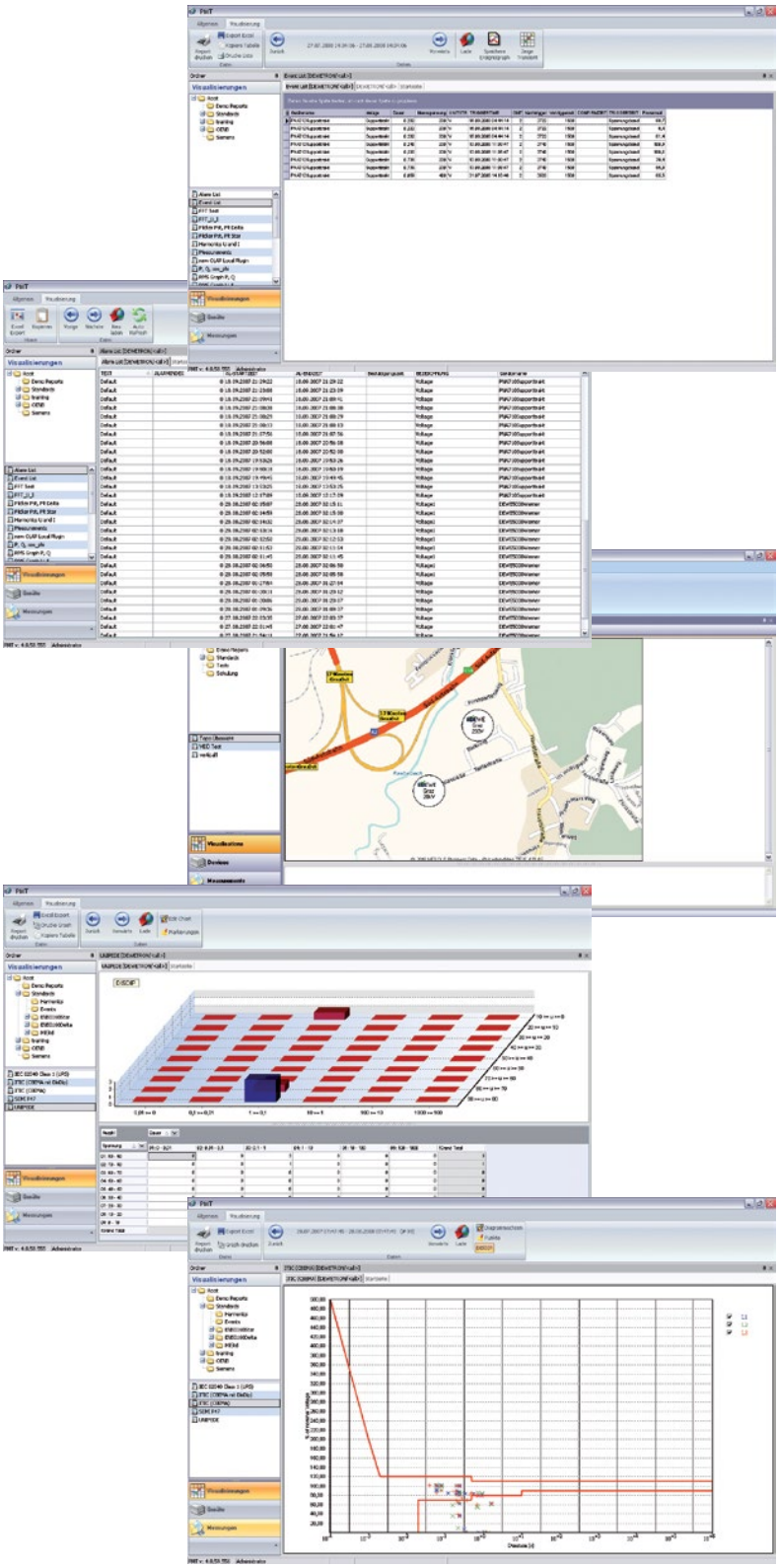
- Statistics like DISDIP/Unipede etc.
- Individual limits
- Individual time settings
- Graphical or table element
- Report printing function

CBEMA / ITIC curve

- Statistics like CBEMA, SEMI F47 etc..
- Individual limits
- Individual time settings
- Combination with DISDIP possible
- Graphical view
- Report printing function

Flicker

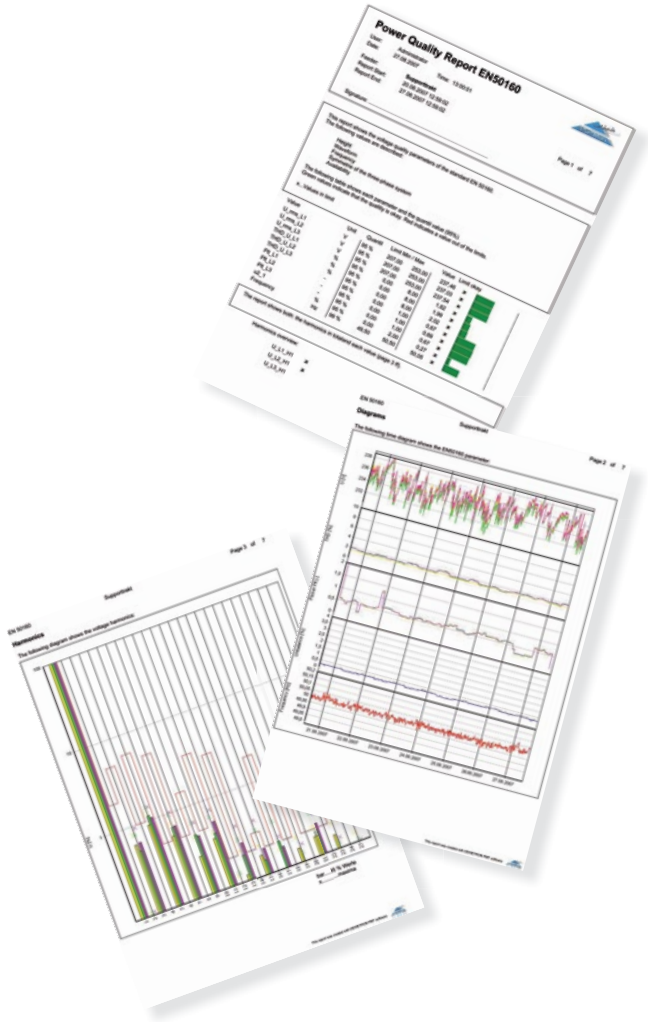
- According to EN 61000-4-15
- P_{ST} and P_{LT} with flexible intervals
- Individual recalculation intervals
- P_{F5}, du, du_{max}
- Flicker emission (current flicker)



Analysis according to Standards

Measure

- *Setups according to certain standards*
- *prepared or user-definable*
- *PQ according to EN501610*
- *Harmonics according to EN 61000-4-7*
- *Flicker according to EN 61000-4-15*
- *Measurement according to EN 61000-4-30 class A*



Analyze

- *EN-50160*
- *EN 61000-2-4 class 1, 2, 3*
- *EN 61400-21*
- *Harmonics freely adjustable (for example: EN 61000-3-x)*
- *Built in report generator for flexible reports*
- *Combination of certain diagrams in one report*
- *Tables*
- *FFT spectra*
- *Fault statistics*
- *CBEMA curve*
- *All other visualization-elements are supported*
- *Summary report for more instruments*
- *Automated report generation and print support*

Reports

- *Built-in report generator for flexible reports*
- *Combination of different diagrams in one report*
- *Tables*
- *FFT spectras*
- *Disdip statistics*
- *CBEMA curves*
- *All other view elements supported*
- *Sum reports over multiple stations*
- *Auto generation and print support*


Files
Setups
Inputs
Power settings
System settings
Security
Logout
Stop
Running
Record
Frequency
Phase 1
Phase 2
Phase 3
Un / In
DEWETRON
DEWE-571
Made in EC

HARDWARE

HARDWARE

E-Mobile Instruments 69

- DEWE-2600-E-Mobile-1000 69
- DEWE-510-E-Mobile-1000 69

Power Measurement Instruments 70

- DEWE-820-PM-100 70
- DEWE-2600-PM-100 70
- DEWE-5000-PM-100 70
- DEWE-820-PM-1000 71
- DEWE-2600-PM-1000 71
- DEWE-5000-PM-1000 71

Power Network Analysis Instruments 72

- DEWE-571-PNA / -1MS 72
- DEWE-561-PNA / -1MS 72
- DEWE-561-PNA-4U12I / -1MS 72
- DEWE-571-PNA-4U12I / -1MS 72
- DEWE-561-PNA-4U28I / -1MS 72
- DEWE-638-PNA 73
- DEWE-3020-PNA 73
- DEWE-2600-PNA 73
- DEWE-5000-PNA 73
- DEWE-838-PNA-V (opt. -Ph) 75
- DEWE-838-PNA-P (opt. -Ph) 75
- DEWE-838-PNA-W 75

Power Fault Recording Instruments 74

- DEWE-818-PFR 74
- DEWE-821-PFR 74
- DEWE-820-PFR 74
- DEWE-838-PNA-V (opt. -Ph) 75
- DEWE-838-PNA-P (opt. -Ph) 75
- DEWE-838-PNA-W 75

Amplifiers & Sensors 76

- High Voltage Modules 76
- Low Voltage Modules 77
- High Precision Current Transducers 78
- Current Clamps & Shunts 80
- Ampflex 82

Calculation Examples 83

- Power Accuracy 83
- MCTS 200 Accuracy 84
- DAQP-LA Accuracy 85
- Instrument Inputs Accuracy 86

E-Mobile Instruments

Nothing is required to complete these instruments.

		DEWE-2600-E-Mobile-1000	DEWE-510-E-Mobile-1000
Dynamic analog input channels		7 voltage, 7 current, 2 additional channels possible	
Included DAQP modules for DC circuit		1 x HSI-HV and 1 x HSI-LV-D	
Included DAQP modules for two E-Drive		6 x HSI-HV and 6 x HSI-LV-D	
External quasi-static channel expansion		EPAD interface, up to 16 EPAD2 modules = 128 channels	
A/D conversion			
Sampling method		Simultaneous sampling	
Sampling rate / channel		1 MS/s (optional 5 or 10 MS/s)	1 MS/s
Resolution		16 bit	
Digital I/O and counters			
Digital I/O, TTL level		8	
Counters or digital inputs, TTL level (1 counter equals 4 digital inputs)		2 included / 8 optional	
Options			
UP-CNT8-TTL adds 8 synchronous counter / encoder or 32 digital inputs, TTL level		optional	
UP-CNT8-DIFF adds 8 sync. counter / encoder or 24 digital inputs with programmable threshold levels (0..40 V), input voltage range -35 to 60 V, AC/DC coupling, and 8 sync. digital inputs protected up to 25 V_{DC}, TTL level		optional	
CAN bus option			
UP-CAN-2 2 highspeed CAN bus interfaces		included	
Video input option			
UP-DEWE-CAM-01 adds synchronized video picture acquisition of up to 200 fps (frames per second) up to 70 fps at 640 x 480 pixel up to 200 fps at 640 x 120 pixel		optional	
Combustion Analyzer option			
DEWE-CA		optional	
Speed and distance sensors			
DEWE-VGPS-200C with 20 Hz engine and interpolated 200 Hz output		optional	
Current sensors			
PNA-Clamp-150-DC (DC…100 kHz) - TEDS detection		300 A DC or AC_{peak}	
EMC			
EMC		EN 61000-6-2 / EN 61000-6-4	
Voltage inputs (amplifier)	Surge	EN 61000-4-5	4 kV
	Burst	EN 61000-4-4	4 kV
Current inputs (amplifier)	Surge	EN 61000-4-5	4 kV
	Burst	EN 61000-4-4	4 kV
Shock and vibration			
Shock		EN 60068-2-27	
Vibration		EN 60068-2-6, EN 60721-3-2 class 2M2	
Environmental			
Operating temperature		0 to +50 °C (0 to +45 °C with batteries)	
Storage temperature		-20 to +70 °C	
Humidity		10 to 80 % non cond., 5 to 95 % rel. humidity	
Data storage			
Technology		Hard disk	
Capacity		1000 GB	
Max. gap free storing to disk		Typical 80 MB/s	Typical 70 MB/s
Typical duration of recording (16 ch. / 10 kS/s/ch. / 16 bit)		20 days	35 days
Power supply			
Standard		Battery powered, 3 battery slots [2], 3 batteries for ~2 hours operation incl., incl. external AC power supply	510-DC-12V Power supply 9 to 18 V_{DC} (no internal battery), incl. external AC adaptor
Optional		100 to 240 V_{AC} or 135 to 340 V_{DC}	
Main system [1]			
Display		15,4" TFT (1280 x 800)	Optional MOB-DISP-12
Processor		Intel® Core™ i5 / i7	
RAM		3 GB	
Current transducer power supply 15 V		8x Lemo sockets for 9 V and ±15 V	
Interfaces		4x USB, 2x Ethernet, 1x RS-232	
Dimensions			
Housing		Portable instrument	
Dimensions (W x D x H)		417 x 246 x 303 mm (16.4 x 9.6 x 11.9 in.)	439 x 308 x 181 mm (17.2 x 12.1 x 7.1 in.)
Weight without batteries		Typ. 14 kg (31 lb.)	Typ. 8 kg (17.6 lb.)

[1] Please find current specifications in the latest price list

[2] Weight of one battery: 660 g (1.45 lb.)

PM Instruments

Nothing is required to complete these instruments.

		DEWE-820-PM-100	DEWE-2600-PM-100	DEWE-5000-PM-100
Dynamic analog input channels		DEWE-820-PM-100-8: 8 DEWE-820-PM-100-16: 16	DEWE-2600-PM-100-8: 8 DEWE-2600-PM-100-16: 16	DEWE-5000-PM-100-8: 8 DEWE-5000-PM-100-16: 16
Included DAQP or HSI modules at 8 channel units		4x DAQP-HV and 4x DAQP-LV-D		
Included DAQP or HSI modules at 16 channel units		8x DAQP-HV and 8x DAQP-LV-D		
External quasi-static channel expansion		EPAD interface, up to 16 EPAD2 modules = 128 ch		
A/D conversion				
Sampling method		Simultaneous sampling		
Sampling rate / channel		**100 kS/s**		
Resolution		16 bit		
Digital I/O and counters				
Digital I/O, TTL level		8		
Counters or digital inputs, TTL level (1 counter equals 4 digital inputs)		2 / 8		
Options				
UP-CNT8-TTL adds 8 synchronous counter / encoder or 32 digital inputs, TTL level		✓	✓	✓ via external box ORION-CB-CNT8
UP-CNT8-DIFF adds 8 sync. counter / encoder or 24 digital inputs with programmable threshold levels (0..40 V), input voltage range -35 to 60 V, AC/DC coupling, and 8 sync. digital inputs protected up to 25 V_{DC}, TTL level		✓	✓	✓ via external box ORION-CB-CNT8
CAN bus option				
UP-CAN-2 optional 2 high-speed CAN bus interfaces		✓	✓	✓
Video input option				
UP-DEWE-CAM-01 adds synchronized video picture acquisition, up to 70 fps at 640 x 480 pixel		✓	✓	✓
Optional sensors				
Current / Shunt		5 A / 0.1 Ohm Shunt		
Current / Transducers		60, 200, 400, 700, 1000, 2000, 5000 A		
Current / Clamps		Various models, e.g.: 150 A_{DC} / 1400 A_{AC}		
EMC				
EMC		EN 61000-6-2 / EN 61000-6-4		
Voltage inputs	Surge	EN 61000-4-5: 4 kV		
	Burst	EN 61000-4-4: 4 kV		
Current inputs	Isolation SUB-D	350 V_{DC}		
	Option banana connectors	EN 61000-4-5/-4: 4 kV		
Shock and vibration				
Shock		Desktop or rack mount installation only	EN 60068-2-27	MIL-STD 810F 516.5, procedure I
Vibration		Desktop or rack mount installation only	EN 60068-2-6, EN 60721-3-2 class 2M2	MIL-STD 810F 514.5, procedure I
Environmental				
Operating temperature		0 to +50 °C	0 to +50 °C (0 to +45 with batteries)	0 to +50 °C
Storage temperature		-20 to +70 °C		
Humidity		10 to 80 % non cond., 5 to 95 % rel. humidity		
Data storage [1]				
Technology		Hard disk		
Capacity		1000 GB		
Max. gap free storing to disk		Typ. 70 MB/s	Typ. 80 MB/s	Typ. 70 MB/s
Typ. duration of recording (16 ch. / 10 kS/s/ch. / 16 bit)		35 days	20 days	35 days
Main system [1]				
Display		-	15,4" TFT (1280 x 800)	17" TFT (1280 x 1024)
Processor		Intel® Core™ i5 / i 7		
RAM		3 GB		
Current transducer power supply 9 V / ±15 V		8 x lemo sockets		
Interfaces		4x USB, 2x Ethernet, 1x RS-232		
Power supply				
Standard		100 to 240 V_{AC} 135 to 340 V_{DC}	Battery powered, 3 battery slots [2], 3 batt. for ~2 hrs. operation incl., incl. external AC power supply	100 to 240 V_{AC} 135 to 340 V_{DC}
Optional		-	100 bis 240 V_{AC} 135 bis 340 V_{DC}	-
Dimensions				
Housing		19" rack-mount, 4U	Portable instrument	Portable instrument
Dimensions (W x D x H)		437 x 443 x 181 mm (17.2 x 17.4 x 7.1 in.)	417 x 246 x 303 mm (16.4 x 9.6 x 11.9 in.)	460 x 351 x 192 mm (18.1 x 13.8 x 7.7 in.)
Weight without batteries		Typ. 12 kg (26.4 lb.)	Typ. 14 kg (31 lb.)	Typ. 17 kg (37.4 lb.)

[1] Please find current specifications in the latest price list

[2] Weight of one battery: 660 g (1.45 lb.)



DEWE-820-PM-1000	DEWE-2600-PM-1000	DEWE-5000-PM-1000
DEWE-820-PM-1000-8: 8 DEWE-820-PM-1000-16: 16	DEWE-2600-PM-1000-8: 8 DEWE-2600-PM-1000-16: 16	DEWE-5000-PM-1000-8: 8 DEWE-5000-PM-1000-16: 16
4x HSI-HV and 4x HSI-LV-D		
8x HSI-HV and 8x HSI-LV-D		
EPAD interface, up to 16 EPAD2 modules = 128 ch		
Simultaneous sampling		
1 MS/s (optional 5 or 10 MS/s)	**1 MS/s**	1 MS/s (optional 5 or 10 MS/s)
16 bit		
8	8	8
2 / 8	2 / 8	2 / 8
✓	✓	
✓	✓	✓ via external box ORION-CB-CNT8
✓	✓	✓
✓	✓	✓
5 A / 0.1 Ohm Shunt		
60, 200, 400, 700, 1000, 2000, 5000 A		
Various models, e.g.: 150 A_{DC} / 1400 A_{AC}		
EN 61000-6-2 / EN 61000-6-4		
EN 61000-4-5: 4 kV		
EN 61000-4-4: 4 kV		
350 V_{DC}		
EN 61000-4-5/-4: 4 kV		
Desktop or rack mount installation only	EN 60068-2-27	MIL-STD 810F 516.5, procedure I
Desktop or rack mount installation only	EN 60068-2-6, EN 60721-3-2 class 2M2	MIL-STD 810F 514.5, procedure I
0 to +50 °C	0 to +50 °C (0 to +45 with batteries)	0 to +50 °C
-20 to +70 °C		
10 to 80 % non cond., 5 to 95 % rel. humidity		
Hard disk		
1000 GB		
Typ. 70 MB/s	Typ. 80 MB/s	Typ. 70 MB/s
35 days	20 days	35 days
-	15,4" TFT (1280 x 800)	17" TFT (1280 x 1024)
Intel® Core™ i5 / i7		
3 GB		
8 x lemo sockets		
4x USB, 2x Ethernet, 1x RS-232		
100 to 240 V_{AC} 135 to 340 V_{DC}	Battery powered, 3 battery slots [2], 3 batt. for ~2 hrs. operation incl., incl. external AC power supply	100 to 240 V_{AC} 135 to 340 V_{DC}
-	100 bis 240 V_{AC} 135 bis 340 V_{DC}	-
19" rack-mount, 4U	Portable instrument	Portable instrument
437 x 443 x 181 mm (17.2 x 17.4 x 7.1 in.)	417 x 246 x 303 mm (16.4 x 9.6 x 11.9 in.)	460 x 351 x 192 mm (18.1 x 13.8 x 7.7 in.)
Typ. 12 kg (26.4 lb.)	Typ. 14 kg (31 lb.)	Typ. 17 kg (37.4 lb.)

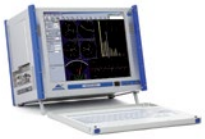
PNA Instruments

Nothing is required to complete these instruments.

		DEWE-571-PNA / 571-PNA-1MS DEWE-561-PNA / 561-PNA-1MS	DEWE-561-PNA-4U12I / -1MS DEWE-571-PNA-4U12I / -1 MS	DEWE-561-PNA-4U28I / -1MS
Dynamic analog input channels		4 voltage 4 current	4 voltage 12 current	4 voltage 28 current
Signal conditioning		Internal		
Current clamps / coils included		4x PNA-FLEX-300-45	-	-
External quasi-static channel expansion		Option PAD-BOX		
Input specifications				
Voltage range		±1400 V peak		
Bandwidth of input amplifiers		DC to 300 kHz		
Direct current input		5 A	-	5 A
Maximum input current via clamps		Depending on clamps		
Maximum input current via flexible coils		10000 A		
A/D conversion				
Sampling rate		250 kS/s aggregate **-1MS:** 1 MS/s/ch		
Resolution		16 bit		
Digital I/O				
Digital I/O, TTL level		2x DIN (24 V max.) and 1x DOUT (Relais, normal open, 60 V / 1 A AC max.)		
Counters		-		
Functions				
Multiple 3 phase systems		✓		
Voltage, current		✓		
Power, frequency, symmetrical components		✓		
Harmonics, Interharmonics, THD		✓		
Period values, disturbance rec.		✓		
Fast transient recorder		✓		
Report generator & Flicker		✓		
Network Monitoring		✓		
EN50160, IEEE 1159		With Marlin or PMT reporting tool (DEWESoft™-OPT-DB included)		
Wide band power analysis		1 MS/s/ch required		
EMC				
EMC		EN 61000-6-2 / EN 61000-6-4		
Voltage inputs	Surge	EN 61000-4-5: 4 kV		
	Burst	EN 61000-4-4: 4 kV		
Direct current inputs	Surge	EN 61000-4-5: 4 kV		
	Burst	EN 61000-4-4: 4 kV		
Shock and vibration				
Shock		EN 60068-2-27		
Vibration		EN 60068-2-6, EN 60721-3-2 class 2M2		
Environmental				
Operating temperature		0 to +50 °C (0 to +45 with batteries)		
Storage temperature		-20 to +70 °C		
Humidity		10 to 80 % non cond., 5 to 95 % rel. humidity		
Data storage [1]				
Technology		Solid State Disk		
Capacity		120 GB		
RAM		3 GB		
Main system [1]				
Display		12“ TFT (1280 x 800)	12“ TFT (1280 x 800)	-
Processor		Intel® Core™ i5 / i7		
Current transducer power supply 9V		-		
Interfaces		2x USB, 1x Ethernet, 1x RS-232		
Power supply				
Standard		**Version 571-PNA:** Battery powered, 2 battery slots [2], 2 batteries for ~2 hrs. operation incl., incl. external AC power supply **Version 561-PNA:** 100 to 240 V_{AC}		
Optional		-		
Dimensions				
Housing		Portable instrument		
Dimensions (W x D x H)		360 x 300 x 150 mm (14.2 x 11.8 x 5.9 in.)		
Weight without batteries		Typ. 5 kg (11 lb.)		

[1] Please find current specifications in the latest price list

[2] Weight of one battery: 660 g (1.45 lb.)


DEWE-638-PNA	DEWE-2600-PNA	DEWE-5000-PNA
4 voltage 4 current	16 slots for DAQP modules	16 slots for DAQP modules
Internal	Modular, 4x DAQP-HV and 4x DAQP-LV-B included	
-	3x CLAMP-20-B	
-	EPAD interface, up to 16 EPAD2 modules = 128 ch	
±1400 V peak		
DC to 300 kHz		
5 A	-	
Depending on clamps		
10000 A	3000 A (10000 A)	
10 kS/s	250 kS/s (up to 1 MS/s)	
16 bit		
2 x DI for alarm in	8	
-	2	
✓		
✓		
✓		
✓		
✓		
✓		
✓		
✓		
✓	With Marlin or PMT reporting tool (DEWESoft™-OPT-DB included)	
-	With DEWE-ORION series boards	
EN 61000-6-2 / EN 61000-6-4		
EN 61000-4-5: 4 kV		
EN 61000-4-4: 4 kV		
-	n.a.	
-	n.a.	
EN 60068-2-27	EN 60068-2-27	MIL-STD 810F 516.5, procedure I
EN 60068-2-6, EN 60721-3-2 class 2M2	EN 60068-2-6, EN 60721-3-2 class 2M2	MIL-STD 810F 514.5, procedure I
-20 to +50 °C	0 to +50 °C (0 to +45 with batteries)	0 to +50 °C
-20 to +70 °C		
10 to 80 % non cond., 5 to 95 % rel. humidity		
SD Card	Hard disk	
2 GB	1000 GB	
3 GB		
-	15,4“ TFT (1280 x 800)	17“ TFT (1280 x 1024)
Low power CPU	Intel® Core™ i5 / i7	
-	4x Binder 712 socket	
2x USB, 1x Ethernet, 1x RS-232	4x USB, 2x Ethernet, 1x RS-232	
95 to 260 V_{AC} internal 10 - 36 V_{DC}	Battery powered, 3 battery slots [2], 2 batteries for ~2 hrs. operation incl., incl. external AC power supply	100 to 240 V_{AC} 135 to 340 V_{DC}
-	100 to 240 V_{AC} 135 to 340 V_{DC}	-
Portable instrument		
200 x 150 x 75 mm (7.9 x 5.9 x 3 in.)	417 x 246 x 303 mm (16.4 x 9.6 x 11.9 in.)	460 x 351 x 192 mm (18.1 x 13.8 x 7.7 in.)
Typ. 2.5 kg (5.5 lb.)	Typ. 14 kg (31 lb.)	Typ. 17 kg (37.4 lb.)

PFR Instruments

Only your choice of input amplifiers is required to complete some of these instruments

		DEWE-818-PFR	DEWE-821-PFR	DEWE-820-PFR-16
Dynamic analog input channels		Up to 48 voltage or current with DEWE-30-16-PFR	Up to 12 voltage and 12 current	16 slots for DAQP modules
External quasi-static channel expansion		EPAD interface, up to 16 EPAD2 modules = 128 ch		
Software		DEWESoft™ Power + PMT		
Input specifications				
Voltage range		± 1400 V peak		
Bandwidth of input amplifiers		DC to 300 kHz		
Direct current input		5 A		
Maximum input current via clamps		Depending on clamps		
Maximum input current via flexible coils		3000 A		
Extra inputs		-		
A/D conversion				
Sampling rate		250 kS/s aggregate		
Resolution		16 bit		
Digital I/O and counters				
Digital I/O, TTL level		8 / 16 / 24		
Digital I/O, full isolated (250 V)		up to 32		
Status		8 up to 96 relais; 8 up to 96 LED		
Safety				
Safety test		EN -61010-1		
EMC				
EMC		EN 61000-6-2 / EN 61000-6-4		
Voltage inputs	Surge	EN 61000-4-5: 4 kV		
	Burst	EN 61000-4-4: 4 kV		
Current inputs	Surge	EN 61000-4-5: 2 kV	EN 61000-4-5: 4 kV	EN 61000-4-5: 2 kV
	Burst	EN 61000-4-4: 2 kV	EN 61000-4-4: 4 kV	EN 61000-4-4: 2 kV
Shock and vibration				
Shock		Desktop or rack mount installation only		
Vibration		Desktop or rack mount installation only		
Environmental				
Operating temperature		0 to +50 °C		
Storage temperature		-20 to +70 °C		
Humidity		10 to 80 % non cond., 5 to 95 % rel. humidity		
Data storage [1]				
Technology		Hard disk		
Capacity		1000 GB		
Main system [1]				
Processor		Intel® Core™ i5 / i7		
Interfaces		4x USB, 2x Ethernet, 1x RS-232		
System timing		External clock, NTP, external antenna		
Power supply				
Standard		100 to 240 V_{AC} or 135 to 340 V_{DC}		
Optional		48 / 110 V		
Dimensions				
Housing		**DEWE-818-PFR:** 19” rack-mount, 4U	19” rack-mount, 4U	19” rack-mount, 4U
		DEWE-30-16-PFR: 19” rack-mount, 3U		
Dimensions (W x D x H)		**DEWE-818-PFR:** 437 x 304 x 181 mm (17.2 x 12 x 7.1 in.)	437 x 443 x 181 mm (17.2 x 17.4 x 7.1 in.)	437 x 443 x 181 mm (17.2 x 17.4 x 7.1 in.)
		DEWE-30-16-PFR: 437 x 133 x 245 mm (17.2 x 17.4 x 7.1 in.)		
Weight		**DEWE-818-PFR:** Typ. 12 kg (26.4 lb.)	Typ. 12 kg (26.4 lb.)	Typ. 12 kg (26.4 lb.)
		DEWE-30-16-PFR: Typ. 6 kg (13.2 lb.)		

[1] Please find current specifications in the latest price list

PNA and PFR Instruments



DEWE-838-PNA-V (opt. -Ph)	DEWE-838-PNA-P (opt. -Ph)	DEWE-838-PNA-W
4 voltage	4 voltage 4 current	3 voltage, 3 current 1 wind speed, 1 wind direction
	-	
	PNA-Browser Application + PMT	
	± 1400 V peak	
	DC to 300 kHz	
-	5 A	± 5 V
	-	
	-	
-	-	± 5 V wind speed ± 5 V wind direction
	10 kS/s	
	16 bit	
For option -Ph (phoenix connectors) 2 x DI for alarm in		-
-		-
For option -Ph (phoenix connectors) 2 x relais		-
	EN -61010-1	
	EN 61000-6-2 / EN 61000-6-4	
	EN 61000-4-5: 4 kV	
	EN 61000-4-4: 4 kV	
	EN 61000-4-5: 4 kV	
	EN 61000-4-4: 4 kV	
	Fixed installation only	
	Fixed installation only	
	-20 to +50 °C	
	-20 to +70 °C	
	10 to 80 % non cond., 5 to 95 % rel. humidity	
	SD Card	
	2 GB	
	Low power CPU	
	1x Ethernet, 1x RS-232	
	External clock, NTP	
	95 to 260 V_{AC} (internal 10 to 36 V_{DC})	
	-	
	Counter panel mount chassis Wall mount DIN rail	
	160 x 166 x 125 mm (6.2 x 6.5 x 4.9 in.)	
	Typ. 2 kg (4.4 lb.)	

HV Modules

for high voltages

Suitable for PM EM PNA PFR

Suitable for PNA PFR

	HSI-HV	DAQP-HV
Input ranges unipolar and bipolar	±20 V[1], ±50 V[1], ±100 V, ±200 V, ±400 V, ±800 V, ±1400 V	
DC accuracy 20 V and 50 V 100 V to 1400 V	±0.05 % of reading ±40 mV ±0.05 % of reading ±0.05 % of range	
Gain linearity	0.05 %	0.03 %
Gain drift range	Typically 20 ppm/°K (max. 50 ppm/°K)	
Offset drift 20 V to 100 V 200 V to 1400 V	typical 1.5 mV/°C of range max. 4 mV/°C typical 5 ppm/°C max. 20 ppm of range/°C	
Long term stability	100 ppm/sqrt (1000 hrs)	
Input resistance	10 MΩ || 2.2 pF	10 MOhm
Bandwidth (-3dB)	2 MHz	300 kHz
Filter selection	Push button or software	
Filter (lowpass)	100, 300, 1k, 3k, 10k, 30k, 100k, 300 kHz, 1 MHz, 2 MHz[2]	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz[3]
Filter type	Bessel or Butterworth 40 dB/decade	
Filter characteristics	Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f_0) Butterworth 60 dB/dec (3rd order; 0 to -3 dB @ 2 MHz)	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)

Typical SFDR and SNR [dB]	10kHz		100kHz		1MHz		2 MHz		300 kHz		100 kHz		10 kHz	
	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR	SFDR	SNR
50 V	110	91	110	82	94	76	84	73	98	76	101	81	108	90
200 V	110	95	110	92	94	82	84	77	98	84	101	89	108	91
1400 V	110	95	110	95	94	82	84	77	98	86	102	91	107	92

Typical CMRR	>80 dB @ 50 Hz 70 dB @ 400 Hz	60 dB @ 1 kHz 48 dB @ 10 kHz
Isolation voltage	Line to Ground 1.4 kVrms Line to Line 1.8 kVrms	
Protection Surge (1.2/50) Burst (5 kHz)	CAT III 600 CAT IV 300 ±4000 V ±4000 V	
Output voltage	±5 V	
Output resistance	<10 Ohm	
Output current	max. 35 mA (CAUTION: do not exceed maximum output current!)	5 mA
Output protection	Short to ground for 10 sec.	
Power supply	±9 V_{DC} ± 1%	
Power consumption	1.2 W	0.7 W
Power On default settings	Software programable	
Connector	-B -SC	
Interface	RS-485	

[1] only for HSI module: 20 V and 50 V bandwidth limited to 1 MHz
[2] 2 MHz exclusively for Bessel filter characteristic
[3] 300 kHz exclusively for Bessel filter characteristic

LV Modules

for low voltages

Suitable for PM EM PNA PFR

Suitable for PNA PFR

	HSI-LV	DAQP-LV
Input ranges unipolar and bipolar	10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2.5 V, 5 V, 10 V, 25 V, 50 V	
DC accuracy bibolar	Range / Accuracy 10 mV to 100 mV: ±0.02 % of reading ±60 µV 2.5 V: ±0.02 % of reading ±0.1 % of range 200 mV to 50 V: ±0.02 % of reading ±0.05 % of range	Range / Accuracy 10 mV to 50 mV: ±0.02 % of reading ±40 µV 100 mV to 50 V: ±0.02 % of reading ±0.05 % of range
Input coupling	DC or AC software selectable (1.5 Hz standard, custom on request down to 0.01 Hz)	
Gain linearity	Typ. 0.01 %; max. 0.04 % of full scale	0.01 % of full scale
Gain drift range	Typ. 10 ppm/°C (max. 30 ppm/°C)	Typ. 10 ppm/°K (max. 20 ppm/°K)
Offset drift 10 mV to 200 mV 500 mV to 50 V	Uni- and bipolar Typ. 3 µV/°C Typ. 10 ppm of range/°C	
Long term stability	100 ppm/sqrt (1000 hrs)	
Input resistance	1 MOhm	1 MOhm
Input overvoltage protection	350 V_{DC}	
Bandwidth (-3dB)	2 MHz	300 kHz
Filter selection	Push button or software	
Filter (lowpass)	100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 2 MHz[1]	10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz[2]
Filter type	Bessel or Butterworth 40 dB/dec	
Filter characteristics	100 Hz to 1 MHz: Butterworth or Bessel 40 dB/dec (2^{nd} order; ±1.5 dB @ f_0) 2 MHz: Butterworth 60 dB/dec (3^{rd} order; 0 to -3 dB @ 2 MHz)	10 Hz to 100 kHz: Butterworth or Bessel 40 dB/dec (2nd order; ±1.5 dB @ f0) 300 kHz: Bessel 60 dB/dec (3rd order; 0 to -3 dB @ 300kHz)
Typical SFDR and SNR [dB]	10 kHz: 20 mV 88/78, 1 V 110/98, 50 V 110/98 100 kHz: 20 mV 88/71, 1 V 110/95, 50 V 110/95 1 MHz: 20 mV 77/60, 1 V 93/82, 50 V 94/82 2 MHz: 20 mV 76/56, 1 V 84/75, 50 V 85/75	300 kHz: 20 mV 100/72, 1 V 102/82, 50 V 102/82 100 kHz: 20 mV 98/76, 1 V 99/93, 50 V 99/93 10 kHz: 20 mV 97/84, 1 V 97/96, 50 V 97/96
Typical CMRR	10 mV to 1 V range: 130 dB @ 50 Hz, 120 dB @ 1 kHz, 95 dB @ 10 kHz, 75 dB @ 100 kHz 2.5 V to 50 V range: 100 dB @ 50 Hz, 75 dB @ 1 kHz, 55 dB @ 10 kHz, 25 dB @ 100 kHz	10 mV to 1 V range: >100 dB @ 50 Hz, >100 dB @ 1 kHz, 83 dB @ 10 kHz 2.5 V to 50 V range: 90 dB @ 50 Hz, 65 dB @ 1 kHz, 55 dB @ 10 kHz
Isolation voltage	350 V_{DC} (1 kV_{RMS} with banana connector)	
Sensor supply	±9 V (±1 %), 12 V (±5 %), 200 mA resettable fuse protected	
Output voltage	±5 V	
Output resistance	<10 Ohm	
Output current	max. 5 mA	
Output protection	Short to ground for 10 sec.	
Power supply	±9 V_{DC} ±1 %	
Power consumption	1.1 W without sensor supply	0.8 W without sensor supply
Power On default settings	Software programable	
Connector	-B -SC -SUBD -LEMO -BNC	
Interface	RS-485	
TEDS	Hardware support for TEDS (Transducer Electronic Data Sheet)	
Supported TEDS chips	DS2406, DS2430A, DS2432, DS2433, DS2431	
Supported MSI (Modular Smart Interface)	MSI-V-ACC, MSI-V-RTD	MSI-V-ACC; MSI-V-RTD, MSI-V-CH-50

[1] 2 MHz exclusively for Bessel filter characteristic
[2] 300 kHz exclusively for Bessel filter characteristic

High Precision Current Transducers

- *3 to 6 channels*
- *Models from 200 A_{pk} to 1000 A_{pk}*
- *High linearity*
- *Low offset*
- *High bandwidth*
- *Low phase error*

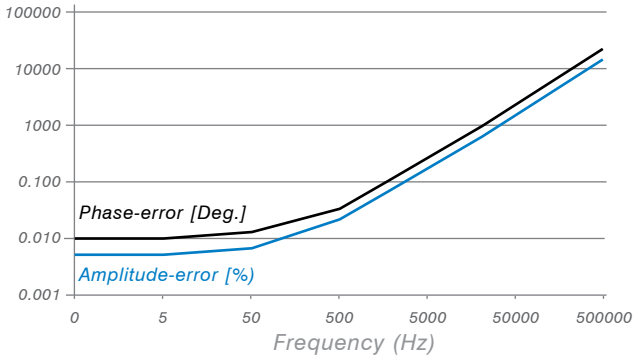
Power supply PM-MCTS

Model overview 60 A - 1000 A

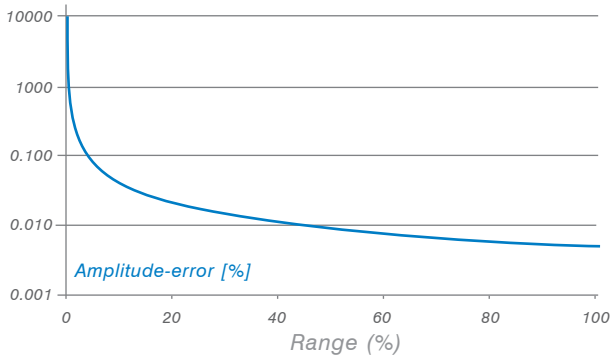
Specifications						
Model	**PM-MCTS 60**	**PM-MCTS 200**	**PM-MCTS 400**	**PM-MCTS 700**	**PM-MCTS 700 U[1)]**	**PM-MCTS 1000**
Transducer	PM-867-60I	PM-867-200I	PM-867-400I	PM-867-700I	PM-867-700U	PM-867-1000IHF
DC, Peak	60 A	200 A	400 A	700 A	700 A	1000 A
RMS Sinus	42 A	141 A	282 A	495 A	495 A	707 A
Overload Ability						
Normal Operation	110 % (66 A_{pk})	110 % (220 A_{pk})	110 % (440 A_{pk})	110 % (770 A_{pk})	110 % (1100 A_{pk})	110 % (1100 A_{pk})
Short Time (100 ms)	500 % (300 A_{pk})	500 % (1000 A_{pk})	500 % (2000 A_{pk})	500 % (3500 A_{pk})	500 % (3500 A_{pk})	400 % (4000 A_{pk})
Accuracy						
Linearity	0.002 %	< 0.001 %	< 0.001 %	< 0.001 %	< 0.001 %	< 0.001 %
Offset	0.025 %	0.008 %	0.004 %	0.005 %	0.005 %	0.005 %
Temperature Influence	2.5 ppm/K	2 ppm/K	1 ppm/K	1 ppm/K	4 ppm/K	1 ppm/K
Frequency Influence	0.04 %/kHz	0.06 %/kHz	0.06 %/kHz	0.12 %/kHz	0.06 %/kHz	0.06 %/kHz
Phase error	0.025°+0.06°/kHz	0.025°+0.05°/kHz	0.025°+0.09°/kHz	0.025°+0.18°/kHz	0.025°+0.09°/kHz	0.025°+0.09°/kHz
General						
Bandwidth	DC … 800 kHz	DC … 500 kHz	DC … 500 kHz	DC … 250 kHz	DC … 100 kHz	DC … 500 kHz
Output Ratio	100 mA_{pk} at 60 A_{pk}	200 mA_{pk} at 200 A_{pk}	200m A_{pk} at 400 A_{pk}	400 mA_{pk} at 700 A_{pk}	10 V at 700 A_{pk}	1 A_{pk} at 1000 A_{pk}
Shunt	PM-MCTS-BR5	PM-MCTS-BR5	PM-MCTS-BR5	PM-MCTS-BR2.5	-	PM-MCTS-BR1

[1)] 700-U can be directly supplied from measurement device for mobile solutions

Amplitude-/ phase-error depending on frequency



Amplitude-error depending on range (DC)

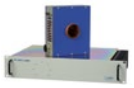
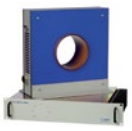
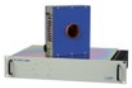
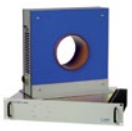


Nominal Current Range	Basic Three Channel System	Additional Current Channel	Optional Shunt
60 A (Transducer PM-867-60I)	PM-MCTS-60	PM-CM-60	PM-MCTS-BR5
200 A (Transducer PM-867-200I)	PM-MCTS-200	PM-CM-200	PM-MCTS-BR5
400 A (Transducer PM-867-400I)	PM-MCTS-400	PM-CM-400	PM-MCTS-BR5
700 A (Transducer PM-867-700I)	PM-MCTS-700	PM-CM-700	PM-MCTS-BR5
1000 A (Transducer PM-867-1000IHF)	PM-MCTS-1000	PM-CM-1000	PM-MCTS-BR1
	- MCTS Rack - 3 internal Power Supplies - 3 Transducer Heads - 3 Connection Cables 10 m - Power Cord	- 1 internal Power Supply - 1 Transducer Head - 1 Connection Cable	- 1 Plug-On Shunt

Optional Shunts	PM-MCTS-BR1	PM-MCTS-BR2.5	PM-MCTS-BR5
	1 A / 1 Ω / 1 W Shunt for MCTS 1000	800 mA / 2,5 Ω / 1 W Shunt for MCTS 700	400 mA / 5 Ω / 1 W Shunt for MCTS 200/400
Amplitude Accuracy	0.05 %	0.05 %	0.05 %
Angular Accuracy	1° at 100 kHz	1° at 100 kHz	1° at 100 kHz
Frequency Range	300 kHz / 0.5 dB	300 kHz / 0.5 dB	300 kHz / 0.5 dB

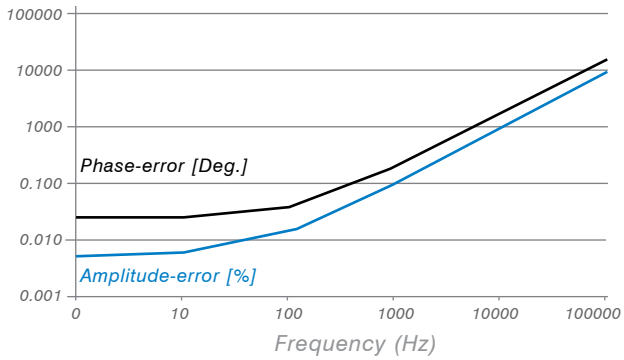
2000 A - 5000 A

Suitable for PM EM PNA PFR

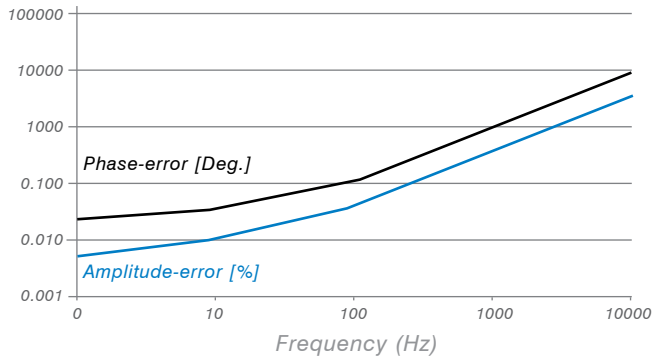





ULTRASTAB CTS	Current Output		Voltage Output	
	PM-CTS-2000IHF	PM-CTS-5000I-140	PM-CTS-2000U	PM-CTS-5000U-140
Primary Nominal current (Ipn) Programmable in steps of	2000 A 125 A	5000 A 250 A	2000 A 125 A	5000 A 250 A
Polarity	Bipolar		Bipolar	
Nom. output range	± 2 A	± 2 A	±10 V	±10 V
Primary current range DC, RMS sinus Peak	 2000 A_{rms} 2828 A_{pk}	 5000 A_{rms} 7071 A_{pk}	 2000 A_{rms} 2828 A_{pk}	 5000 A_{rms} 7071 A_{pk}
Overload ability - short time (100 mS)	10000 A_{pk}	25000 A_{pk}	10000 A_{pk}	25000 A_{pk}
Overload capacity (fault)	10000 A (0.1 s)	25000 A (0.1 s)	10000 Apk (0.1 s)	25000 Apk (0.1 s)
Bandwidth	DC 300 kHz	DC 80 kHz	DC 300 kHz	DC 80 kHz
Temperature influence	1 ppm/K	1 ppm/K	1 ppm/K	1 ppm/K
Output ratio	2 A_{rms} at 2000 A_{rms}	2 A_{rms} at 5000 A_{rms}	10 V at 2000 A_{rms}	10 V at 5000 A_{rms}
Linearity	0.001 %	0.001 %	0.001 %	0.001 %
Offset	0.004 %	0.004 %	0.004 %	0.004 %
Frequency influence	0.1 %/kHz	0.5 %/kHz	0.1 %/kHz	0.5 %/kHz
Phase error	0.02° + 0.15°/kHz	0.02° + 0.9°/kHz	0.02° + 0.15°/kHz	0.02° + 0.9°/kHz
Cable length Standard Optional	 2.5 m 30 m	 2.5 m 30 m	 2.5 m 30 m	 2.5 m 30 m
Electronics Dimension Weight	Rack mount 482 x 88 x 381 mm (19 x 3.5 x 15 in.) 9 kg (19.8 lb.)		Rack mount 482 x 88 x 381 mm (19 x 3.5 x 15 in.) 9 kg (19.8 lb.)	
Transducer heads Dimension Weight	With ø50 hole 165 x 200 x 50 mm (6.5 x 7.9 x 2 in.) 3.3 kg (7.28 lb.)	With ø150 hole 350 x 350 x 92 mm (13.8 x 13.8 x 3.6 in.) 17 kg (30.86 lb.)	With ø50 hole 165 x 200 x 50 mm (6.5 x 7.9 x 2 in.) 3.3 kg (7.72 lb.)	With ø150 hole 350 x 350 x 92 mm (13.8 x 13.8 x 3.6 in.) 17 kg (30.86 lb.)

Amplitude-/ phase-error vs. frequency (PM-CTS-2000)

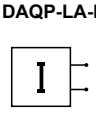
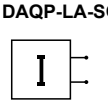


Amplitude-/ phase-error vs. frequency (PM-CTS-5000)



Current Modules

Suitable for PNA PFR

Current module for DEWE-8xx-PFR	Accuracy	Continuous current	Input ranges	Input resistance (Shunt)	Bandwidth (BW), Filters (LP = lowpass), HP = highpass)	Isolation (ISO), Overvoltage protection (OP)
DAQP-LA-B  	±0.05 % of range	max. 0.6 A_{RMS}	2 mA, 6 mA, 20 mA, 60 mA, 200 mA, 0.6 A	5 Ohm	BW: 300 kHz LP: 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz	ISO: 1.4 kV_{RMS}
DAQP-LA-SC  	±0.05 % of range	max. 5 A_{RMS}	0.1 A, 0.3 A, 1 A, 3 A, 10 A_{pk}, 30 A_{pk}	0.1 Ohm	BW: 300 kHz LP: 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz	ISO: 1.4 kV_{RMS}

Current Clamps

PNA-CLAMP-150-DC

Suitable for PM EM PNA PFR

Current range	300 A_{DC} or AC_{peak}	Power supply OPTION for	±15 V ±10 %, external
Cont. current measurement	150 A_{DC} or AC_{RMS}		
Overload capability	500 A_{DC} (for 1 min)	* DEWE-2600/2602: * For others:	0.5U-CLAMP-DC-POWER-4/-8 CLAMP-DC-POWER-4/-8
Output sensitivity	20 mV/A	Connector	SUB $D_{(TED)}$; (SUBD modules required for TEDS support) Supply (LEMO; incl. jaws status); Adapter SUB D-banana included
Accuracy (+ 25 °C)	±0.3 % of reading ±2 mA		
Frequency Range	DC to 100 kHz (-1 dB)	Max. conductor size	32 mm diameter
Jaw status	0 V (Lo) / +15 V (Hi)	Relative zero correction	Auto zero at switch on

PNA-CLAMP-1800-DC

Suitable for PM EM PNA PFR

Current range	1800 A_{DC} or AC_{peak}	Power supply OPTION for	+9 V ±5 %, external
Output sensitivity	1 mV/A		
Accuracy (+ 25 °C)		* DEWE-2600/2602: * For others:	0.5U-CLAMP-DC-POWER-4/-8 CLAMP-DC-POWER-4/-8
DC Accuracy (0-1000A)	±0.8 % of reading ±0.5 A		
DC Accuracy (1000-1500A)	±1.8 % of reading ±0.5 A	Connector	SUB $D_{(TED)}$; (SUBD modules required for TEDS support) Supply (LEMO); Adapter SUB D-banana included
Overall Accuracy (0-1000A)	±2.5 % of reading ±0.5 A		
Overall Accuracy (1000-1500A)	±3.5 % of reading		
Overall Accuracy (1500-1800A)	±5 % of reading		
Resolution	±20 mA	Max. conductor size	32 mm diameter
Frequency Range	DC to 20 kHz (-1 dB)	Relative zero correction	Push button

PNA-CLAMP-5

Suitable for PNA PFR

AC input range	0.04 to 6 A				
Output	60 mV/A				
% accuracy	0.04 to 6 A	≤ 0.5 %	Phase error	0.04 to 6 A	≤ 0.5°
Bandwidth	40 Hz ... 10 kHz				
Working temperature	-10° to +55°C		Temperature drift	≤ 0.2 % of output signal per 10K	
Connector type	C16-1, 6+PE				
Fits to following systems	DEWE-5xx-PNA				

PNA-CLAMP-10

Suitable for PNA PFR

AC input range	0.01 to 12 A				
Output	100 mV/A				
% accuracy	0.01 to 0.1 A	≤ 3 % +0.1 mV	Phase error	0.01 to 0.1 A	not specified
	0.1 to 1 A	≤ 2.5 %		0.1 to 1 A	≤ 5°
	1 to 5 A	≤ 1 %		1 to 5 A	≤ 3°
	5 to 12 A	≤ 1 %		5 to 12 A	≤ 3°
Bandwidth	40 Hz ... 10 kHz				
Working temperature	-10° to +55°C		Temperature drift	≤ 0.2 % of output signal per 10K	
Connector type	C16-1, 6+PE				
Fits to following systems	DEWE-5xx-PNA				

PNA-CLAMP-20 / PNA-CLAMP-20-B

Suitable for PNA PFR

AC input range	0.1 to 24 A		selectable	0.5 to 240 A	
Output	100 mV/A			10 mV/A	
% accuracy	0.1 to 20 A	≤ 1 % +50 mV		0.5 to 10 A	≤ 3 % +5 mV
				10 to 40 A	≤ 2.5 % +5mV
				40 to 100 A	≤ 2 % +5mV
				100 to 240 A	≤ 1 % +5mV
Bandwidth	40 Hz ... 10 kHz				
Phase error	0.1 to 20 A	not specified		0.5 to 10 A	not specified
				10 to 40 A	≤ 5°
				40 to 100 A	≤ 3°
				100 to 240 A	≤ 2.5°
Working temperature	-10° to +55°C		Temperature drift	≤ 0.15 % of output signal per 10K	
Connector type	C16-1, 6+PE for PNA-CLAMP-20		Safety banana jacks (4 mm) for CLAMP-20-B		
Fits to following systems	DEWE-5xx-PNA, DEWE-5xx-PNA-1MS for PNA-CLAMP-20				
	All systems with DAQ and HSI series amplifiers for PNA-CLAMP-20-B				

PNA-CLAMP-1000						
Suitable for PNA PFR 	AC input range	0.001 to 1200 A				
	Output	1 mA/A				
	% accuracy	1 to 100 mA	≤ 3 % +5 µA	Phase error	1 to 100 mA	not specified
		0.1 to 1 A	≤ 2 % +3 µA		0.1 to 1 A	not specified
		1 to 10 A	≤ 1 %		1 to 10 A	≤ 2°
		10 to 100 A	≤ 0.5 %		10 to 100 A	≤ 1°
		100 to 1200 A	≤ 0.3 %		100 to 1200 A	≤ 0.7°
	Bandwidth	30 Hz ... 5 kHz				
	Working temperature	-10° to +50°C		Temperature drift	≤ 0.2 % of output signal per 10K	
	Connector type	C16-1, 6+PE				
	Fits to following systems	DEWE-5xx-PNA				

PNA-CLAMP-1000-DC						
Suitable for PNA PFR 	AC input range	0.2 to 100 A		selectable	0.5 to 1000 A	
	DC input range	0.4 to 150 A		selectable	0.5 to 1400 A	
	Output	10 mV/A			1 mV/A	
	% accuracy	0.5 to 20 A	1.5 % ±5 mV		0.5 to 100 A	1.5 % +1 mV
		20 to 100 A	1.5 %		100 to 800 A	2.5 %
		100 to 150 A_{DC}	2.5 %		800 to 1000 A	4 %
					1000 to 1400 A	4 %
	Bandwidth	DC to 10 kHz at -3 dB				
	Phase error	10 to 20 A	< 3°		10 to 200 A	< 2°
		20 to 100 A	< 2°		20 to 1000 A	< 1.5°
	Working temperature	-10° to +55°C		Temperature drift	≤ 0.3 % of output signal per 10K	
	Connector type	Safty banana sockets (4 mm)				
	Fits to following systems	All system with DAQ and HSI series amplifiers				

Shunts

Shunts		Shunt 5 A	Shunt 20 A
Suitable for PM 	Type of current	AC + DC	AC + DC
	Impedance	0.1 Ohm	0.005 Ohm
	Max. Current	5 A	20 A
	Accuracy	0.1 %	0.1 %
	Temperature drift	<±10 ppm/K (20 °C to 60 °C)	<±10 ppm/K (20 °C to 60 °C)
	Connectors	DAQ-SHUNT-3 Input: 2 m cable with banana plugs Output: 30 cm cable with banana plugs DAQ-SHUNT-4 Input: built-in banana jacks Output: 30 cm cable with banana plugs DAQ-SHUNT-5 Input: built-in banana jacks Output: built-in banana jacks	DAQ-SHUNT-6 Input: built-in banana jacks Output: built-in banana jacks

Current transducer adaptor box

ADAP-CUR-20A		
	Type of current	AC + DC
	Continuous current	±25 A_{RMS}
	Max. current (1 s)	85 A_{PEAK}
	Accuracy	0.5 %
	Sensitivity	50 mV/A
	Bandwidth (-3dB)	300 kHz
	Isolation voltage	600 V CAT III (according to EN 50178) 300 V CAT III (according to EN 61010)
	Temperature drift	<±50 ppm/K (typical 5 ppm/K)
	Connector input	built-in banana jacks
	Connector output	SUB-D (TED) (SUB-D modules required for TEDS support)

Ampflex

PNA-A100-200-45 / PNA-A100-200-80						
Suitable for PNA PFR	AC input range	0.5 to 200 A		selectable	0.5 to 2000 A	
	Output	10 mV/A			1 mV/A	
	% accuracy	0.5 to 5 A	not specified		0.5 to 5 A	not specified
		5 to 200 A	≤ 1 %		5 to 2000 A	≤ 1 %
	Bandwidth	10 Hz ... 20 kHz				
	Phase error	0.5 to 5 A	≤ 0.7°		0.5 to 5 A	≤ 0.7°
		5 to 200 A	≤ 0.7°		5 to 2000 A	≤ 0.7°
	Working temperature	-10° to +55°C (maximum temperature for sensor is 90°C)				
	Temperature drift	≤ 0.5 % of output signal per 10K				
	Connector type	Safty banana jacks (4 mm)		Length of coil	45 cm for PNA-A100-200-45	
	Fits to following systems	All systems with DAQ and HSI series amplifiers			80 cm for PNA-A100-200-80	

PNA-A100-300-45 / PNA-A100-300-80						
Suitable for PNA PFR	AC input range	0.5 to 300 A		selectable	0.5 to 3000 A	
	Output	10 mV/A			1 mV/A	
	% accuracy	0.5 to 5 A	not specified		0.5 to 5 A	not specified
		5 to 300 A	≤ 1 %		5 to 3000 A	≤ 1 %
	Bandwidth	10 Hz ... 20 kHz				
	Phase error	0.5 to 5 A	≤ 0.7°		0.5 to 5 A	≤ 0.7°
		5 to 300 A	≤ 0.7°		5 to 3000 A	≤ 0.7°
	Working temperature	-10° to +55°C (maximum temperature for sensor is 90°C)				
	Temperature drift	≤ 0.5 % of output signal per 10K				
	Connector type	Safty banana jacks (4mm)		Length of coil	45 cm for PNA-A100-300-45	
	Fits to following systems	All systems with DAQ and HSI series amplifiers			80 cm for PNA-A100-300-80	

PNA-A100-1000-120						
Suitable for PNA PFR	AC input range	0.5 to 1000 A		selectable	0.5 to 10000 A	
	Output	1 mV/A			0.1 mV/A	
	% accuracy	0.5 to 5 A	not specified		0.5 to 50 A	not specified
		5 to 1000 A	≤1 %		50 to10000 A	≤ 1 %
	Bandwidth	10 Hz ... [45 ... 65] ... 20 kHz				
	Phase error	0.5 to 5 A	≤ 0,5°		0.5 to 5 A	≤ 0,5°
		5 to 1000 A	≤ 0,5°		5 to10000 A	≤ 0,5°
	Working temperature	-10° to +55°C (maximum temperature for sensor is 90°C)				
	Temperature drift	≤ 0.5 % of output signal per 10K				
	Connector type	Safty banana jacks (4 mm)		Length of coil	120 cm	
	Fits to following systems	All systems with DAQ and HSI series amplifiers				

PNA-FLEX-300-45 / PNA-FLEX-300-80						
Suitable for PNA PFR	AC input range	0.5 to 10000 A				
	% accuracy	0.5 to 5 A	not specified			
		5 to 10000 A	≤ 1 %			
	Bandwidth	10 Hz ..300 kHz				
	Phase error	0.5 to 5 A	≤ 0.7°			
		5 to 10000 A	≤ 0.7°			
	Working temperature	-10° to +55°C (maximum temperature for sensor is 90°C)				
	Temperature drift	≤ 0.5 % of output signal per 10K				
	Connector type	C16-1, 6+PE		Length of coil	45 cm for PNA-FLEX-300-45	
	Fits to following systems	DEWE-5xx-PNA, DEWE-638-PNA			80 cm for PNA-FLEX-300-80	
		DEWE-5xx-PNA-1MS				

Calculation Examples

Power Errors

Voltage Error	E_V [%]	$E_V = \sqrt[3]{(E_{V\ DC\ fix} + E_{V\ DC\ range} + E_{V\ AC})^3 + (E_{VT\ DC\ fix} + E_{VT\ DC\ range} + E_{VT\ AC})^3}$
Current Error	E_C [%]	$E_C = \sqrt[3]{(E_{C\ DC\ fix} + E_{C\ DC\ range} + E_{C\ AC})^3 + (E_{CT\ DC\ fix} + E_{CT\ DC\ range} + E_{CT\ AC})^3 + E_{Shunt}{}^3}$
Phase Error	E_{Phi} [°]	$E_{Phi} = \sqrt[3]{(E_{Phi\ U\ AC} + E_{Phi\ C\ AC})^3 + (E_{Phi\ VT\ fix} + E_{Phi\ VT\ AC})^3 + (E_{Phi\ CT\ fix} + E_{Phi\ CT\ AC})^3 + E_{Phi\ Shunt}{}^3}$
Cos Error	E_{cosPhi} [%]	$E_{cosPhi} = \left(1 - \frac{\cos(phi + E_{Phi})}{\cos(phi)}\right) * 100$
Sin Error	E_{sinPhi} [%]	$E_{cosPhi} = \left(1 - \frac{\sin(phi + E_{Phi})}{\sin(phi)}\right) * 100$
Power	E_S [%]	$E_S = \sqrt{E_V{}^2 + E_C{}^2}$
Active Power	E_P [%]	$E_P = \sqrt{E_V{}^2 + E_C{}^2 + E_{cosPhi}{}^2}$
Reactive Power	E_Q [%]	$E_Q = \sqrt{E_V{}^2 + E_C{}^2 + E_{sinPhi}{}^2}$

Example:

U=100 V; voltage range=200 V; no voltage transducer (VT)

I=10 A; current range=40 A; current transducer=PM-MCTS-200; shunt=PM-BR5

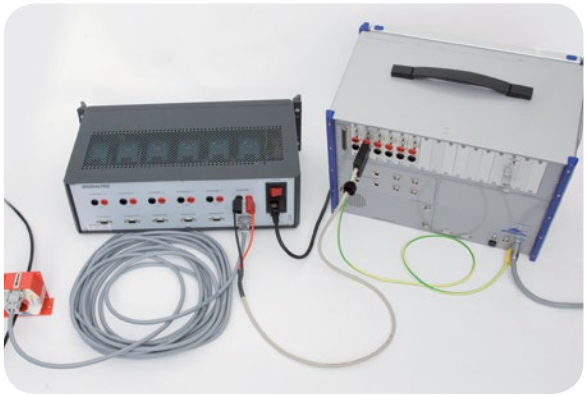
f=50 Hz, filter=300000 Hz

Phi=30°

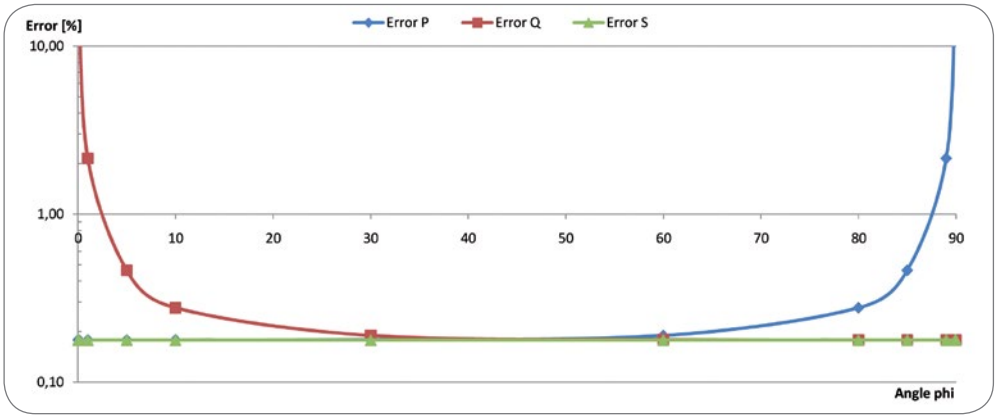
Voltage Error	E_V [%]	$E_V = \sqrt[3]{\left(0{,}05\ \% + 0{,}05\ \% * \frac{200\ V}{100\ V} + 0\right)^3 + (0+0+0)^3} = 0{,}15\ \%$
Current Error	E_C [%]	$E_C = \sqrt[3]{\left(0{,}02\ \% + 0{,}05\% * \frac{40\ A}{10\ A} + 0\right)^3 + \left(0{,}005\ \% * \frac{200\ A}{10\ A} + 0{,}03\ \% * \frac{50\ Hz}{1000\ Hz}\right)^3 + 0{,}05\ \%^3} = 0{,}228\ \%$
Phase Error	E_{Phi} [°]	$E_{Phi} = \sqrt[3]{(0{,}01° + 0{,}01°)^3 + (0+0)^3 + \left(0{,}01° + 0{,}045° * \frac{50\ Hz}{1000\ Hz}\right)^3 + 0{,}0005^3} = 0{,}021°$
Cos Error	E_{cosPhi} [%]	$E_{cosPhi} = \left(1 - \frac{\cos(30° + 0{,}021°)}{\cos(30°)}\right) * 100 = 0{,}0216\ \%$
Sin Error	E_{sinPhi} [%]	$E_{cosPhi} = \left(1 - \frac{\sin(30° + 0{,}021°)}{\sin(30°)}\right) * 100 = -0{,}065\ \%$
Power	E_S [%]	$E_S = \sqrt{0{,}15\ \%^2 + 0{,}228\ \%^2} = \pm 0{,}273\ \%$
Active Power	E_P [%]	$E_P = \sqrt{0{,}15\ \%^2 + 0{,}228\ \%^2 + 0{,}0216^2} = \pm 0{,}274\ \%$
Reactive Power	E_Q [%]	$E_Q = \sqrt{0{,}15\ \%^2 + 0{,}228\ \%^2 + (-0{,}065)^2} = \pm 0{,}28\ \%$

Accuracy Example MCTS 200

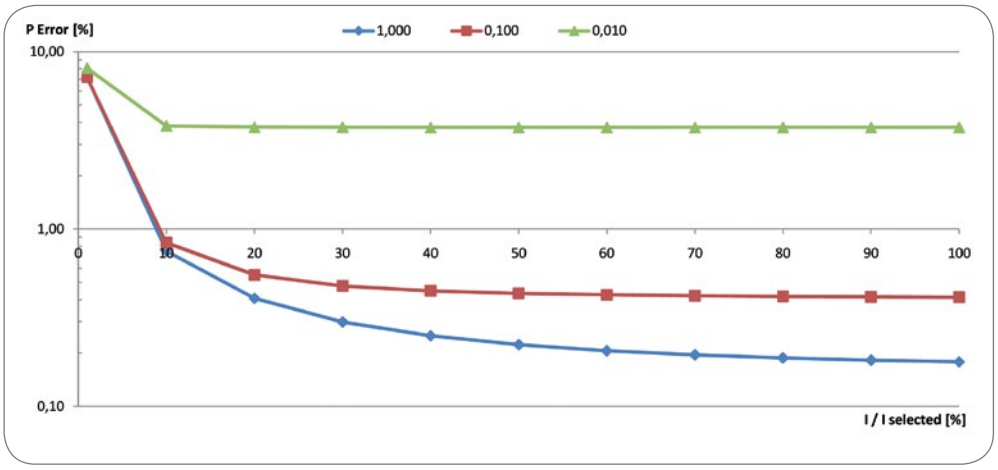
Voltage [V]:	*100*	*Current module:*	*DAQP-LV*
Current [A]:	*140 A*	*Range:*	*1 V*
Frequency [Hz]:	*50*	*Filter:*	*300 kHz*
Phi [°]:	*30*	*Shunt:*	*PM-BR5*
		Current Transducer:	*PM-MCTS-200*
		Voltage module:	*DAQP-HV-S3*
		Range:	*200 V*
		Filter:	*700 kHz*



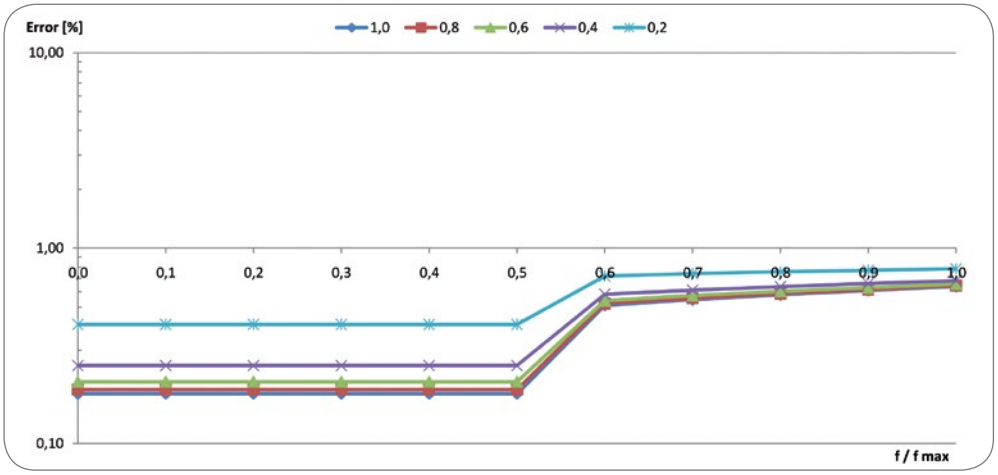
Maximum P-error and Q, S as function of Phi



Maximum P-error as function of current for different cosPhi

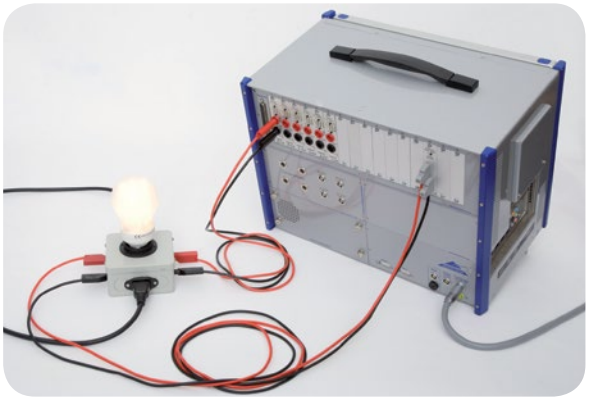


Maximum P-error as function of frequency with cariable current/max current (f_{max} = 50 000 Hz)

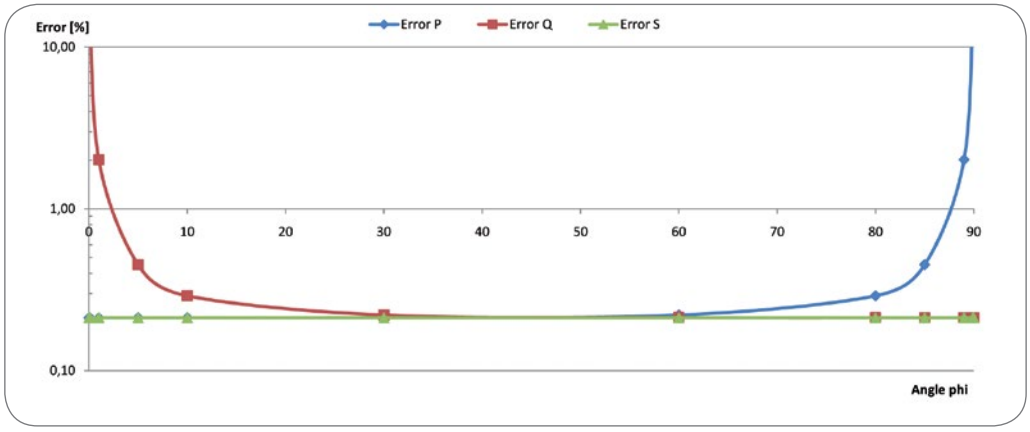


Accuracy Example DAQP-LA

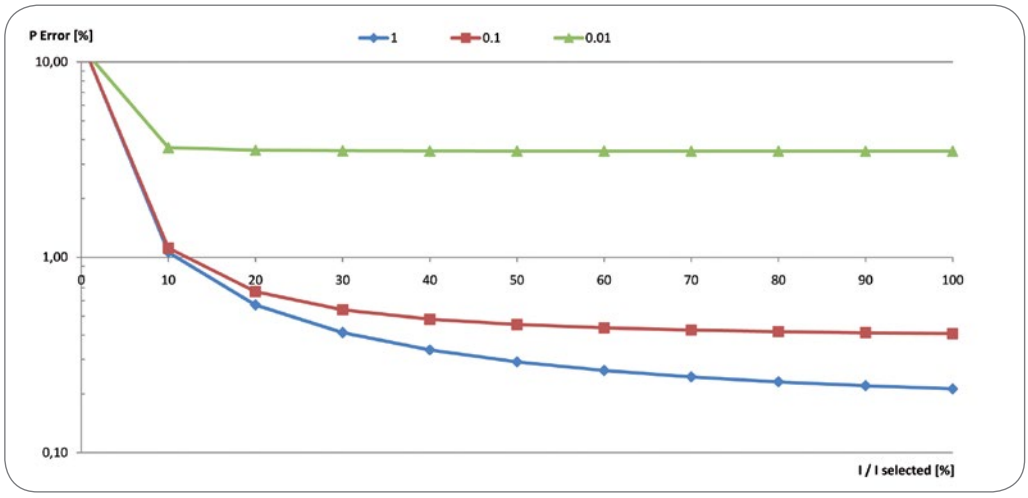
Voltage [V]:	*100*	*Current module:*	*DAQP-LA*
Current [A]:	*5 A*	*Range:*	*10 A*
Frequency [Hz]:	*50*	*Filter:*	*300 kHz*
Phi [°]:	*30*		
		Voltage module:	*DAQP-HV-S3*
		Range:	*200 V*
		Filter:	*700 kHz*



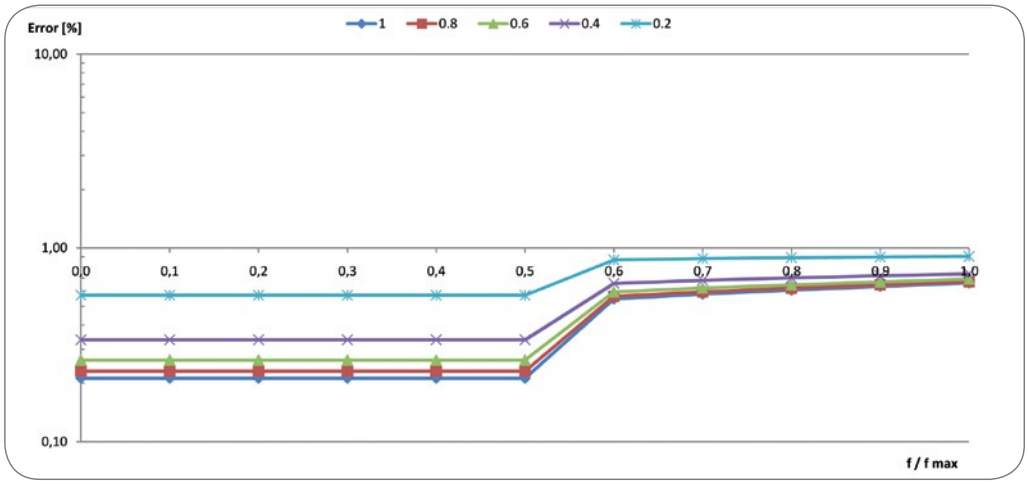
Maximum P-error and Q, S as function of Phi



Maximum P-error as function of current for different cosPhi



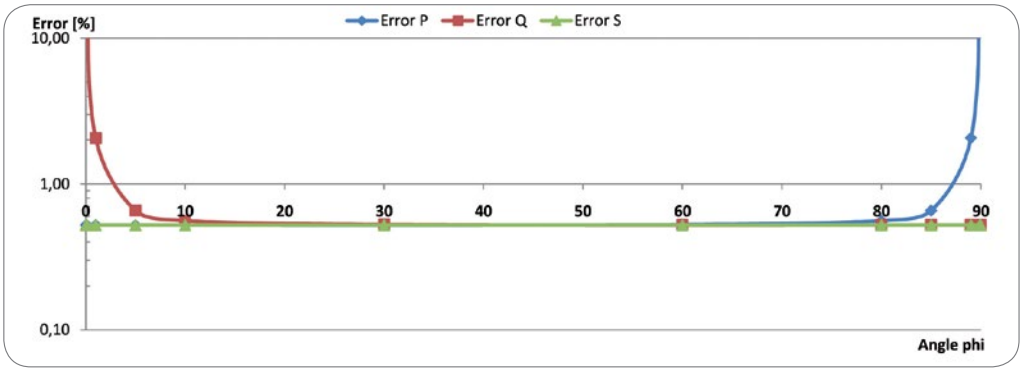
Maximum P-error as function of frequency with cariable current/max current (f_{max} = 50 000 Hz)



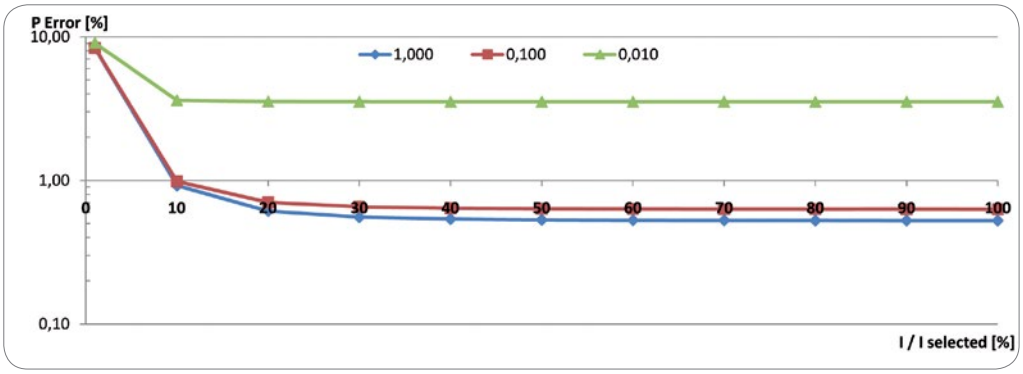
Accuracy Example for Instrument Inputs

Voltage [V]:	*400 V*	*Current module:*	*DAQP-LV*	*Voltage module:*	*DAQP-HV-S3*
Current [A]:	*30 A*	*Range:*	*1 V*	*Range:*	*800 V*
Frequency [Hz]:	*50*	*Filter:*	*300 kHz*	*Filter:*	*700 kHz*
Phi [°]:	*30*				

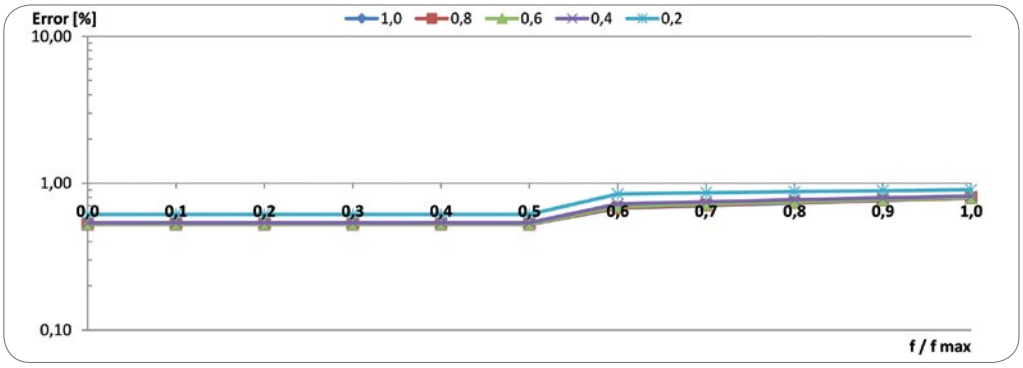
Maximum P-error and Q, S as function of Phi



Maximum P-error as function of current for different cosPhi



Maximum P-error as function of frequency with cariable current/max current (f_{max} = 50 000 Hz)



Why DEWETRON?

SYNC-CLOCK™ Technology

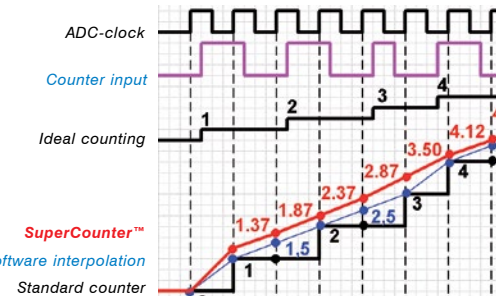
The quality of synchronized measurement data has top priority at DEWETRON which is guaranteed by the SYNC-CLOCK™ technology. Analog, digital, GPS, counter, CAN-bus, ARINC and video as well as major sensor systems like Kistler RoaDyn® 2000 wheel or GeneSys ADMA INS/GPS system etc. are already recorded synchronously during the measurement.

Highest Precision

TRION™ series modules easily take it on with all similar products on the market.

SuperCounter™

Counter/encoder inputs of TRION™ modules are phase synchronized. Refering to the diagram, you can see that a standard counter is always a sample behind. With software interpolation you can get closer, but only DEWETRONs advanced technology is both, fully phase AND amplitude corrected.



Scalable and Modular

The ability to scale from a few channels to many and to split in several housings without compromising the simultaneous data sampling of all channels is unique.

User Exchangeable Modules

All TRION™ amplifier modules can be changed within a few seconds. Modules in different sampling speed and resolution can be used in one chassis. Use isolated and differential inputs at the same time.

Global Support

Our engineers are in 25 countries around the world to support you with their knowledge and expertise. We offer maintenance, upgrades, ISO certified system calibrations and also customer trainings!

DEWETRON Offices Worldwide

Sales offices in 25 countries • Service centers in Europe, USA, Middle East and Asia

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