A. Eberle GmbH & Co. KG

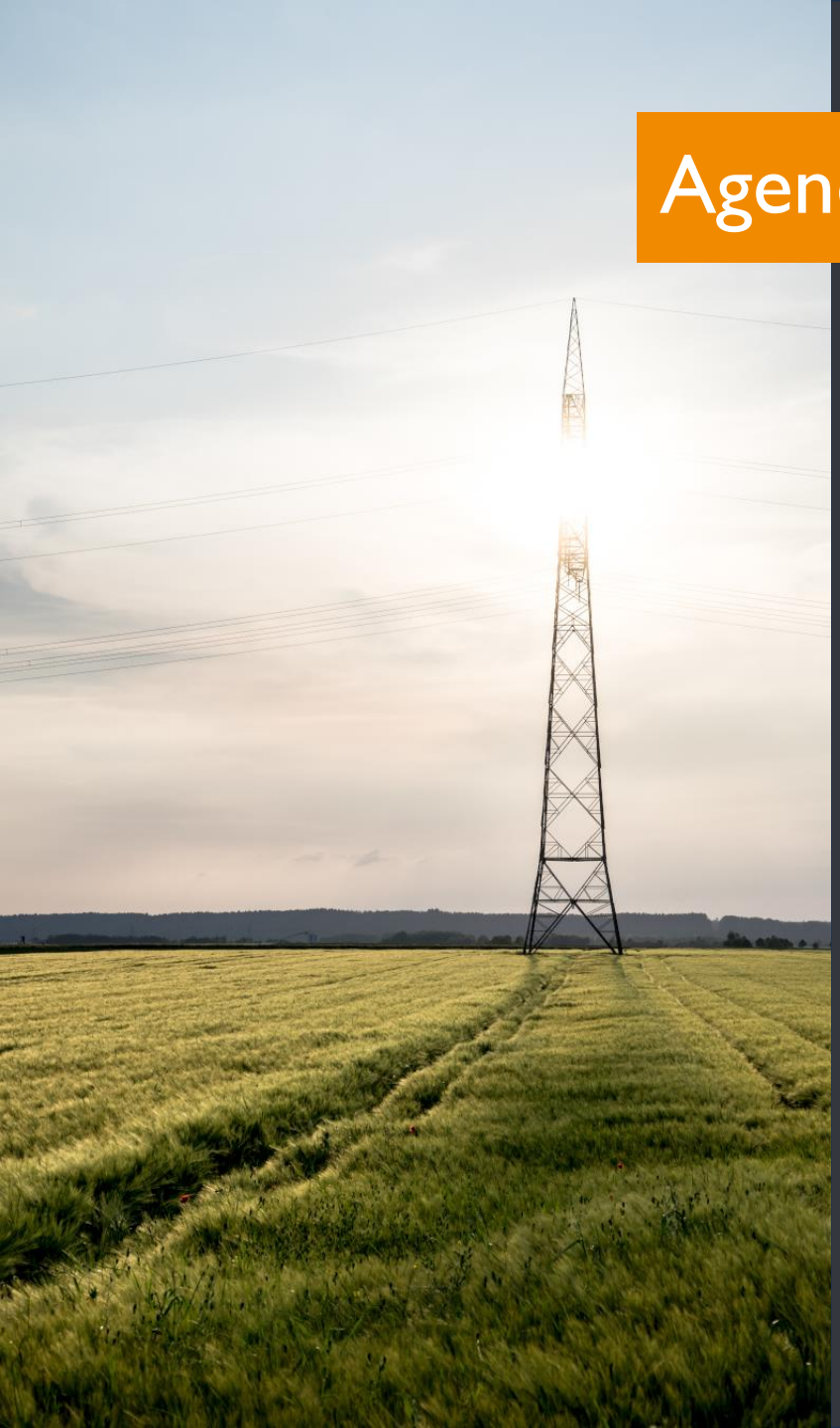
40 Years of experience in the field of measurement and control technology

Founded in 1980
located at „FrankenCampus“
in Nuremberg

100 employees
all dedicated to our corporate mission:
Clarity, Openness & Fairness

Active at all voltage levels
in generation, transport and distribution of electrical energy

Operating internationally
in approx. 65 countries



Agenda

01	General Information – A. Eberle Africa and A. Eberle Germany
02	Automatic Voltage Regulation REGSys™
03	Transformer On Line Monitoring
04	Mobile Power Quality and Power Quality Systems PQSys
05	Low Voltage Regulation LVRSys™

Measure. Regulate. Across all Grids.

Change form A. Eberle GmbH & Co. KG Germany to A. Eberle Africa (Pty) Ltd.

Our company, A. Eberle GmbH & Co. KG, Frankenstraße 160, D-90461 Nuremberg/Germany has been
an approved supplier for voltage regulation - REG-D and REG-DA - for more than 22 years.
The relays have been supplied directly from Germany to various clients and systems integrators in South Africa,
e.g. ESKOM, IST (eThekwini), JHB City Power, Cape Town Electricity, Siemens, ABB / HITACHI Energy, CONCO, ACTOM etc..
We, A. Eberle Germany have a distributor of our main product portfolio in Southern Africa – Magnet Electrical Supplies - to support our products not only in sales, but especially in after sales service and in marketing for new business opportunities.
The current CEO, Mr. Till Sybel, has decided to invest in South Africa and establish together with Magnet a new business called A. Eberle Africa (Pty) Ltd.. This investment aims to support South Africa and the rest of Africa with the A. Eberle products, especially to guarantee and continuously improve the security of supply and availability of energy networks.

The new company has been registered, A.Eberle Africa Pty Ltd (registration number 2022 /251346/07). We are finalizing our SARS registration for VAT, all other SARS registrations have been completed.
The new company, seated in Durban, also has an established base in Johannesburg and will employ more South African citizens. The initial staff will be three South Africans. The plan is to grow the business into Africa to employ eight citizens soon.

From High-Voltage to Low-Voltage …

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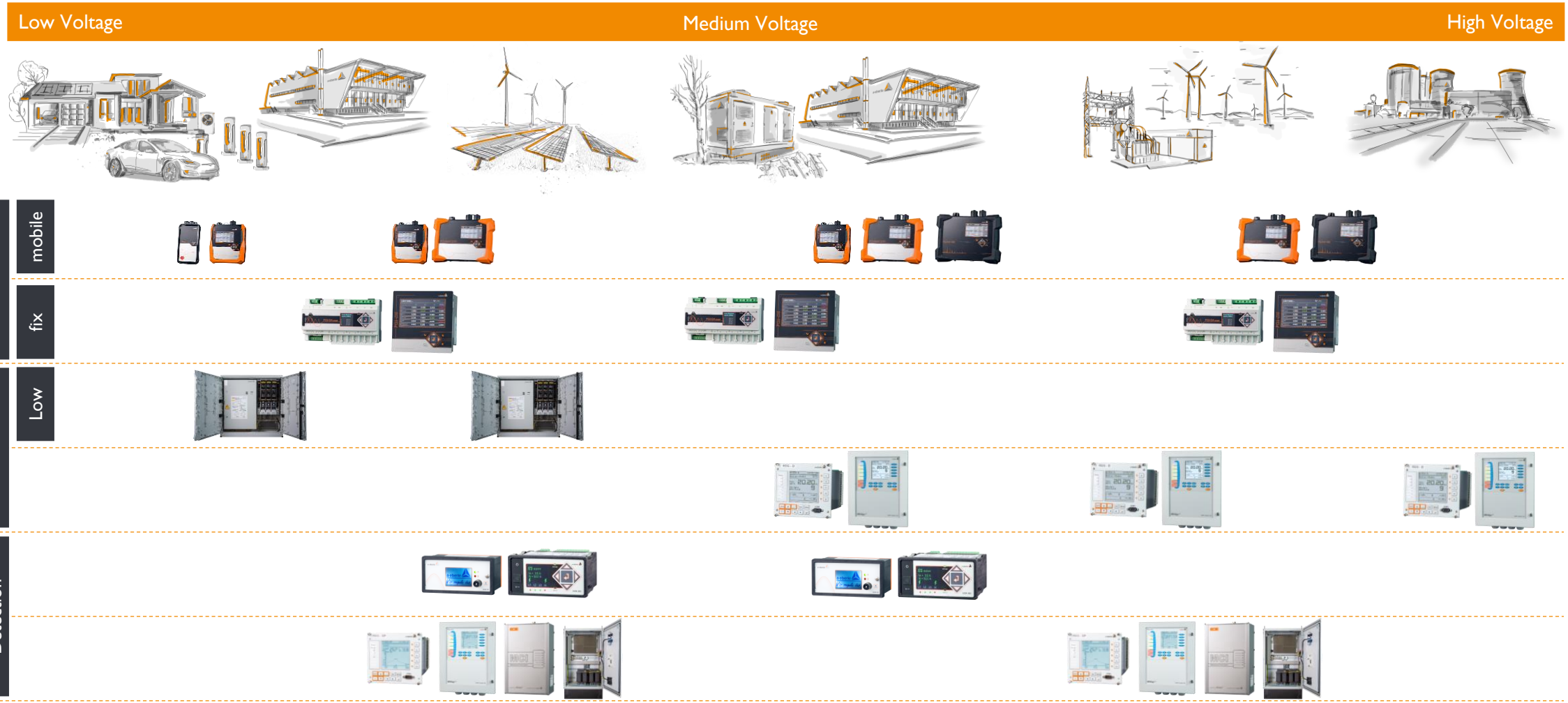
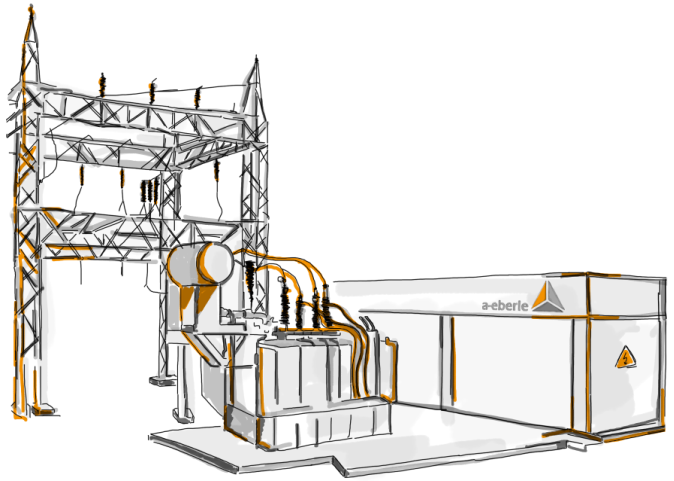




Power Utilities

Generation, Transmission and Distribution

01	Voltage Regulation of Transformers with tap-changer
02	Fault Recorder and Monitoring of the Voltage Quality
03	Petersen-coil Regulation with option of Current Injection
04	Earth Fault Detection
05	Engineering & Services

Voltage Regulation
REG-D + Monitoring + SCADA

Regulation of P-Coils
REG-DP + EOR-D + SCADA

PQ-Monitoring
PQI-DA smart + PQI-DE

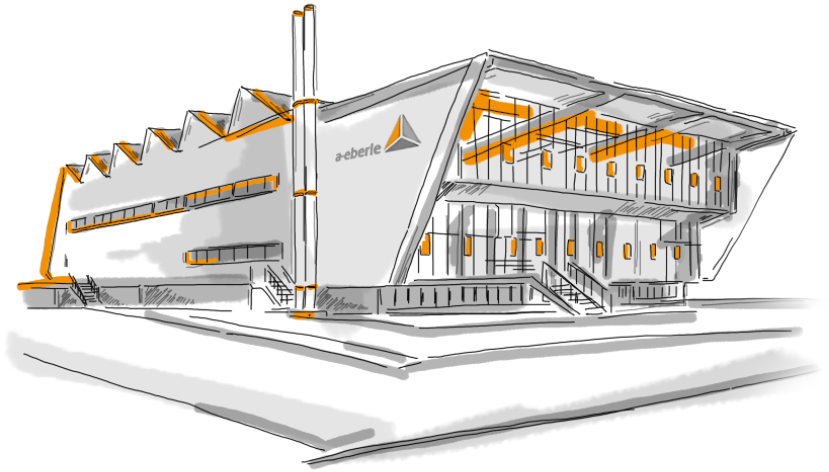
Industry
Industrial Plants

01	Monitoring at the “Transfer Point” in direction of endcustomers
02	Monitoring of Voltage Quality with Fault Recorder functionality
03	Mobile Power Quality Measurements and PQ-Services
04	Short-circuit Indication and Earth Fault Detection

Power Quality
System

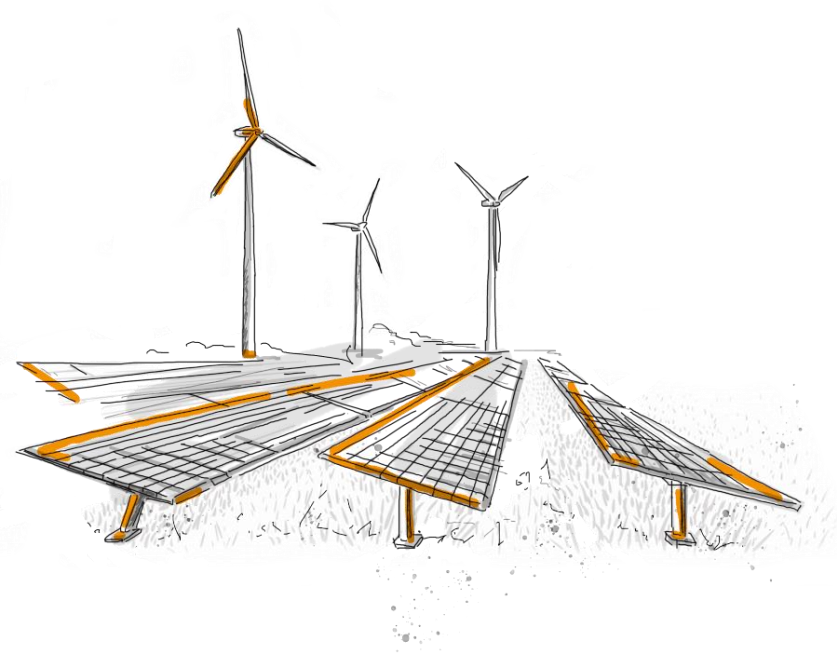
Power Quality
Mobile

Earth Fault Detection



Renewable Energies

Decentralized generation plants



01	Photovoltaics, wind farms and combined heat / power units
02	Monitoring of Retroactivity and Energy Management
03	Mobile and fix-installed Power Quality and PQ-Services
04	Voltage Regulation of Transformers with tap-changer

Power Quality
System

Power Quality
Mobile

Voltage Regulation

Low Voltage Grid

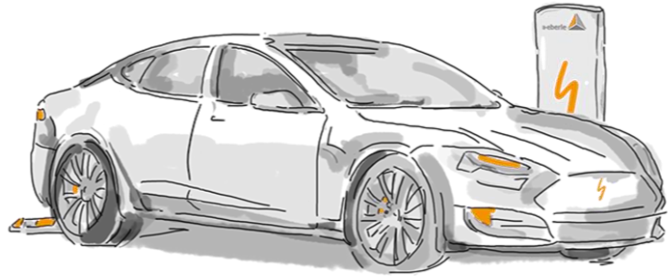
„Intelligent" Distribution Substations

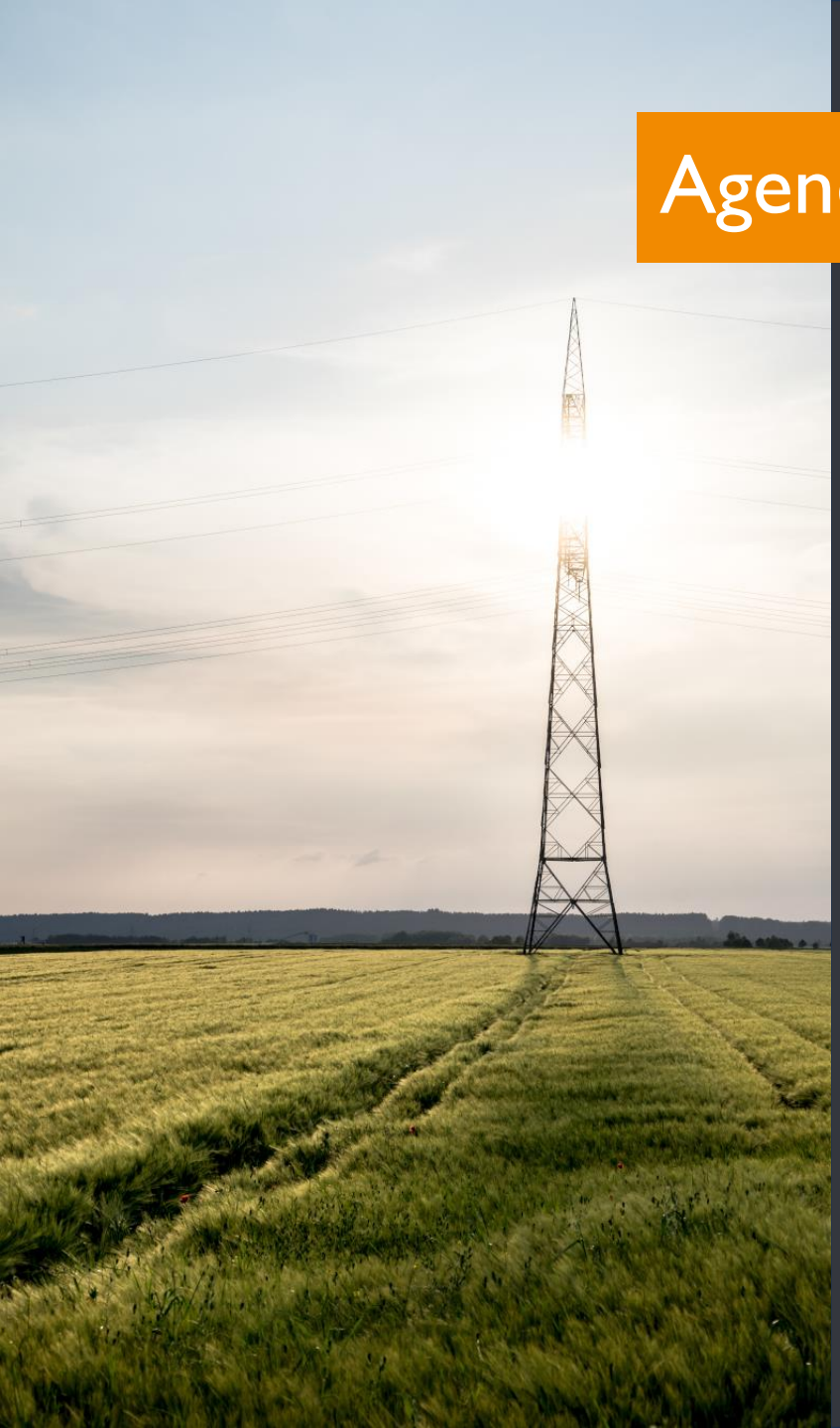
01	Retroactivity of Prosumers and Power Quality-Monitoring
02	Low Voltage Regulation (Feeder Control)
03	Monitoring of charging infrastructures (e-mobility)
04	Mobile- and fix-installed Power Quality and PQ-Services

Power Quality
System

Power Quality
Mobile

Low Voltage Regulation





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International Norms

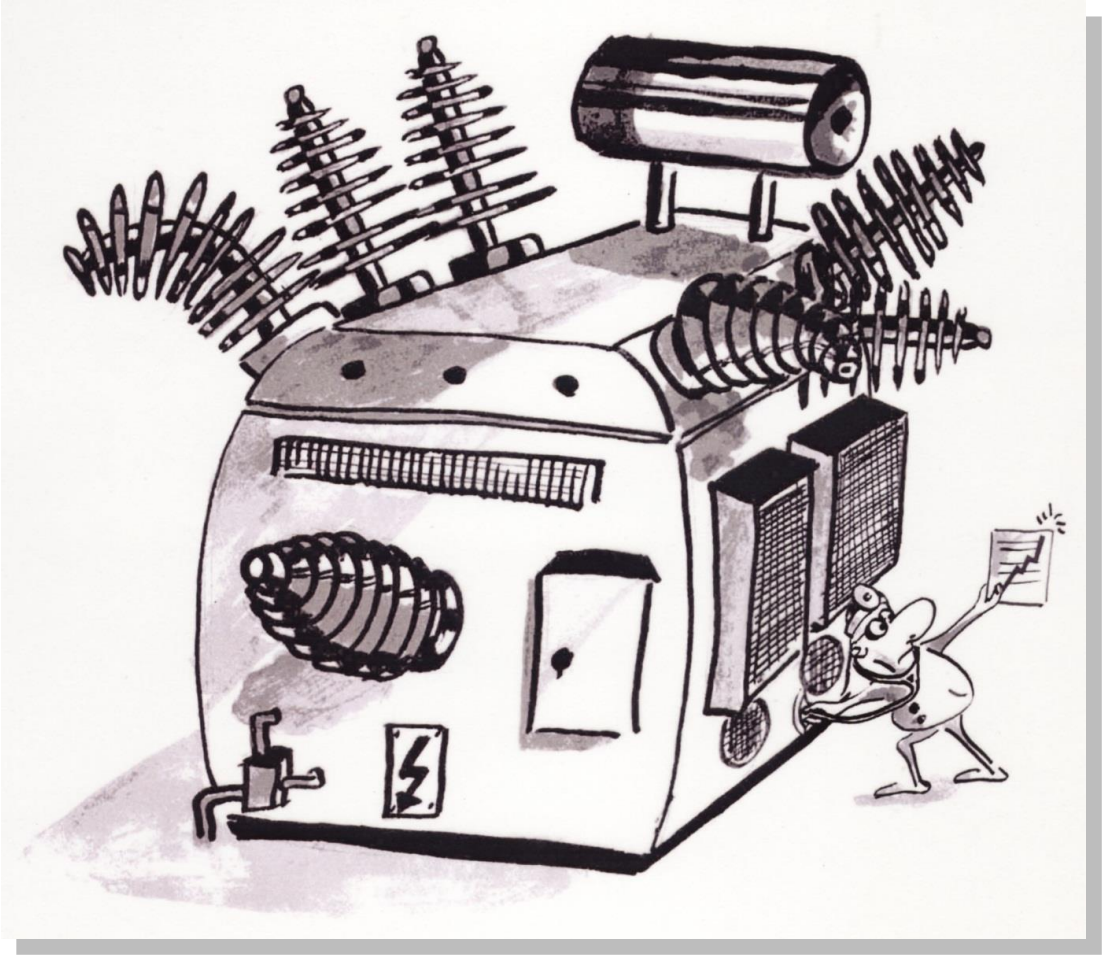
IEC 60038 (DIN EN 60038)	EN 50160 (DIN EN 50160) IEC 61000-2-12
Definition of different nominal voltages for electrical power grids, railways (AC/DC) and electrical devices (AC/DC) generally.	Definition of the minimum quality of the nominal voltages with view on frequency, amplitude, wave form and symmetry of the voltages at the transfer point to the enduser in the low- and medium voltage grid

Overview REGSys / REG-DA

Totally flexible Automatic Voltage Regulator (Systems)

REG-DN™ - The new member of our REGSys™ family is coming soon!

Transformer Monitoring



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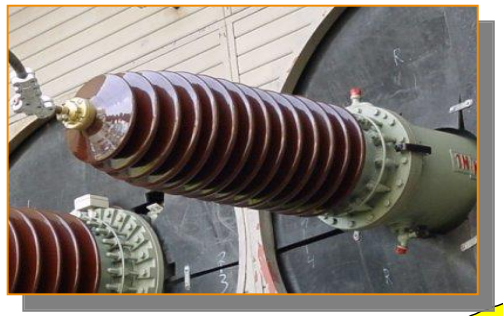
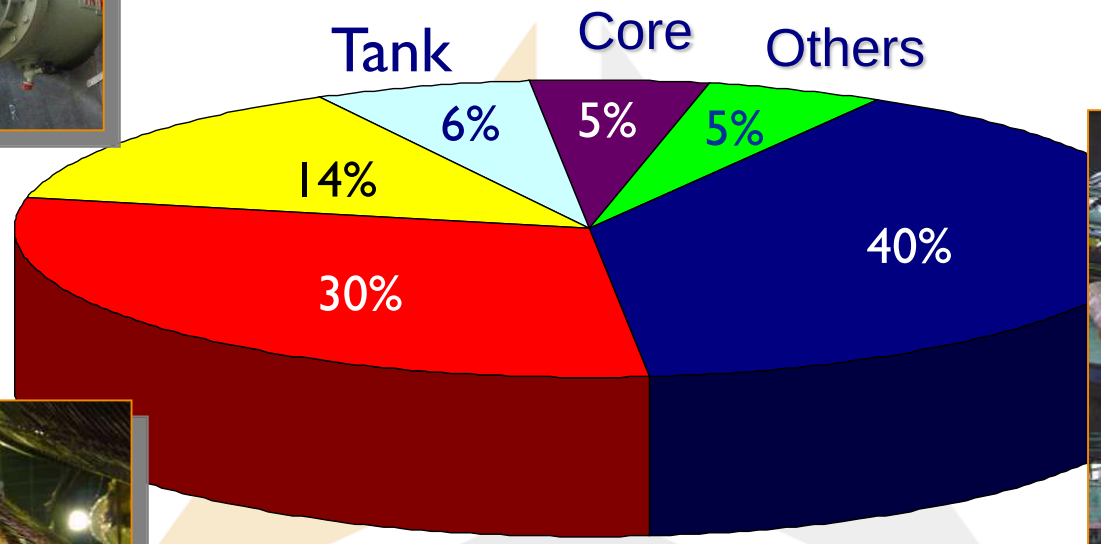
Causes for failure in Power Transformers

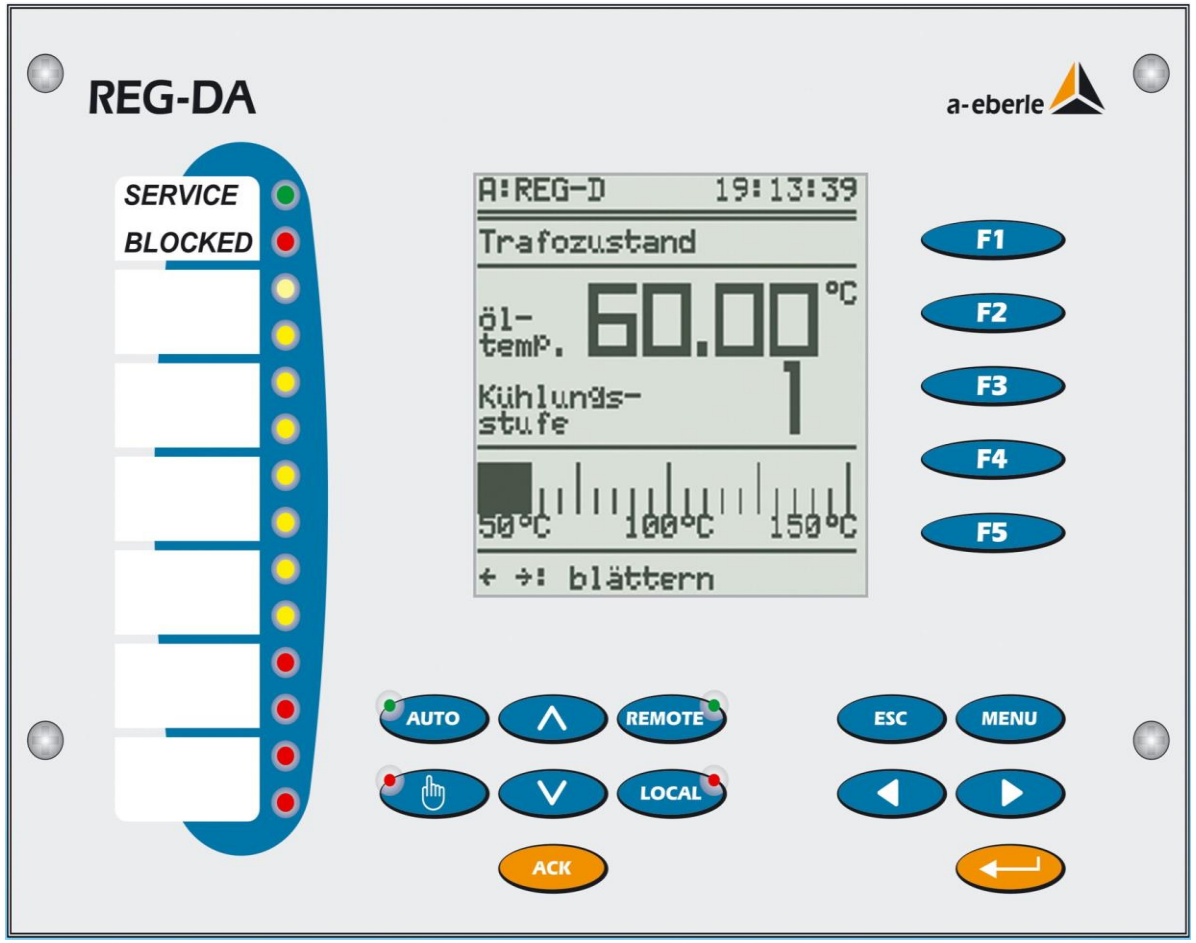


Bushing

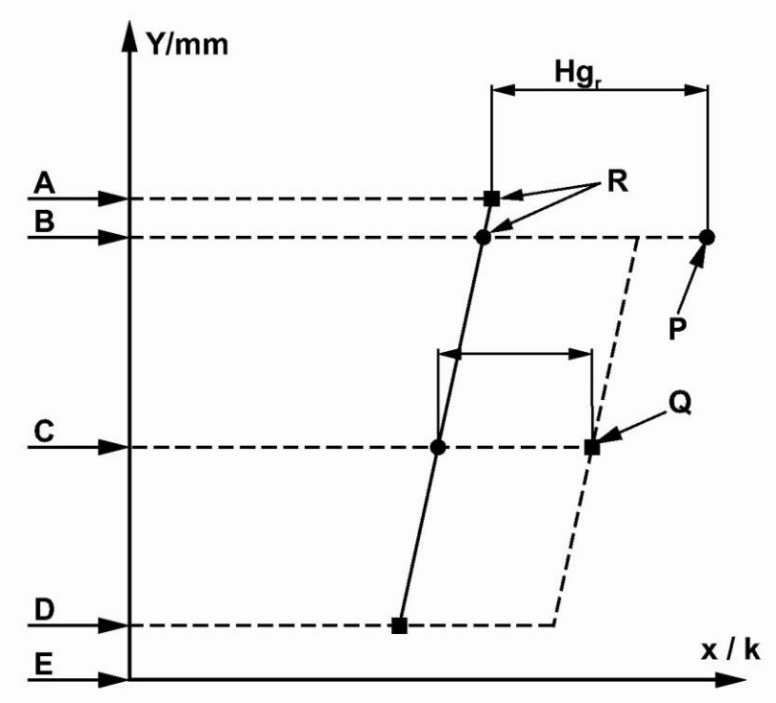
Cigre SC 12 WG 12.05
Electra, No.88, 1983



Voltage Regulator REG-DA with Transformer Monitoring Module (TMM)

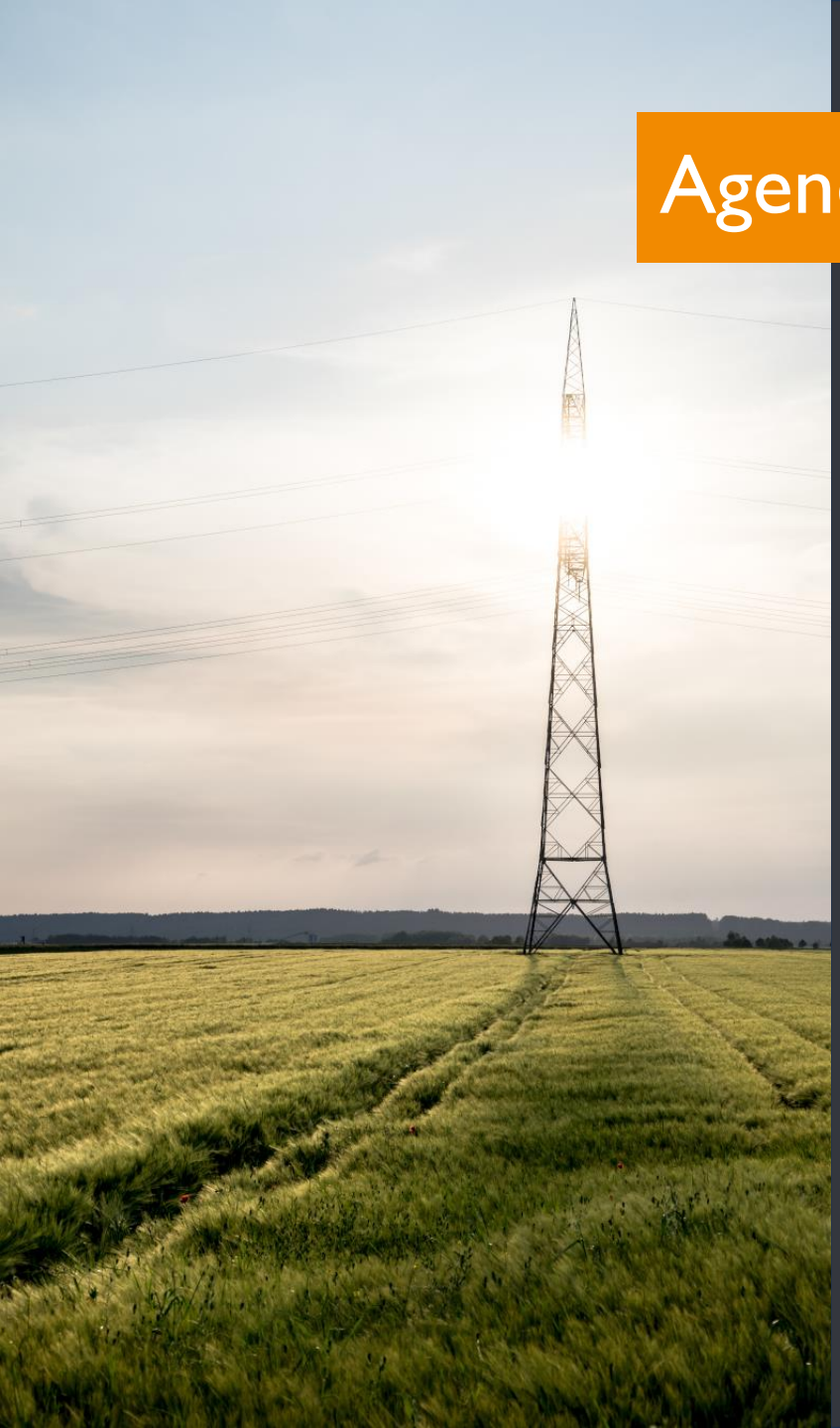


Thermal model of the transformer (TMM)



A: Temperature of the upper oil-layer
B: Temperature inside the transformer tank
at the top of the winding
C: Average temperature of the oil-filling in the tank
D: Temperature at the lower end of the winding
E: Represents the bottom of the tank
P: Hot Spot or Hot Spot Temperature
Q: Average winding temperature
R: points of the same temperature (assumption)

X: X axis of the diagram - temperature
Y: Y-axis of the diagram - relative altitude of the individual points



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TrafoStick


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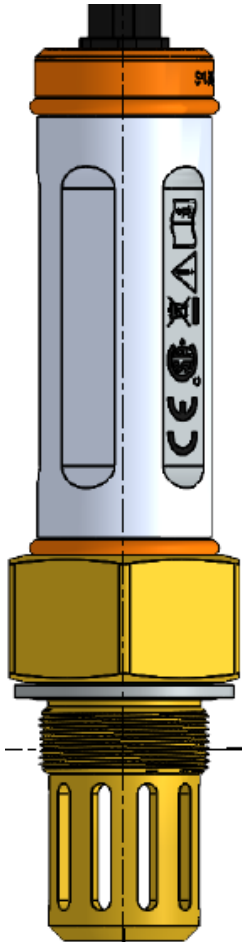
Made in Germany
a-eberle
Made in Germany

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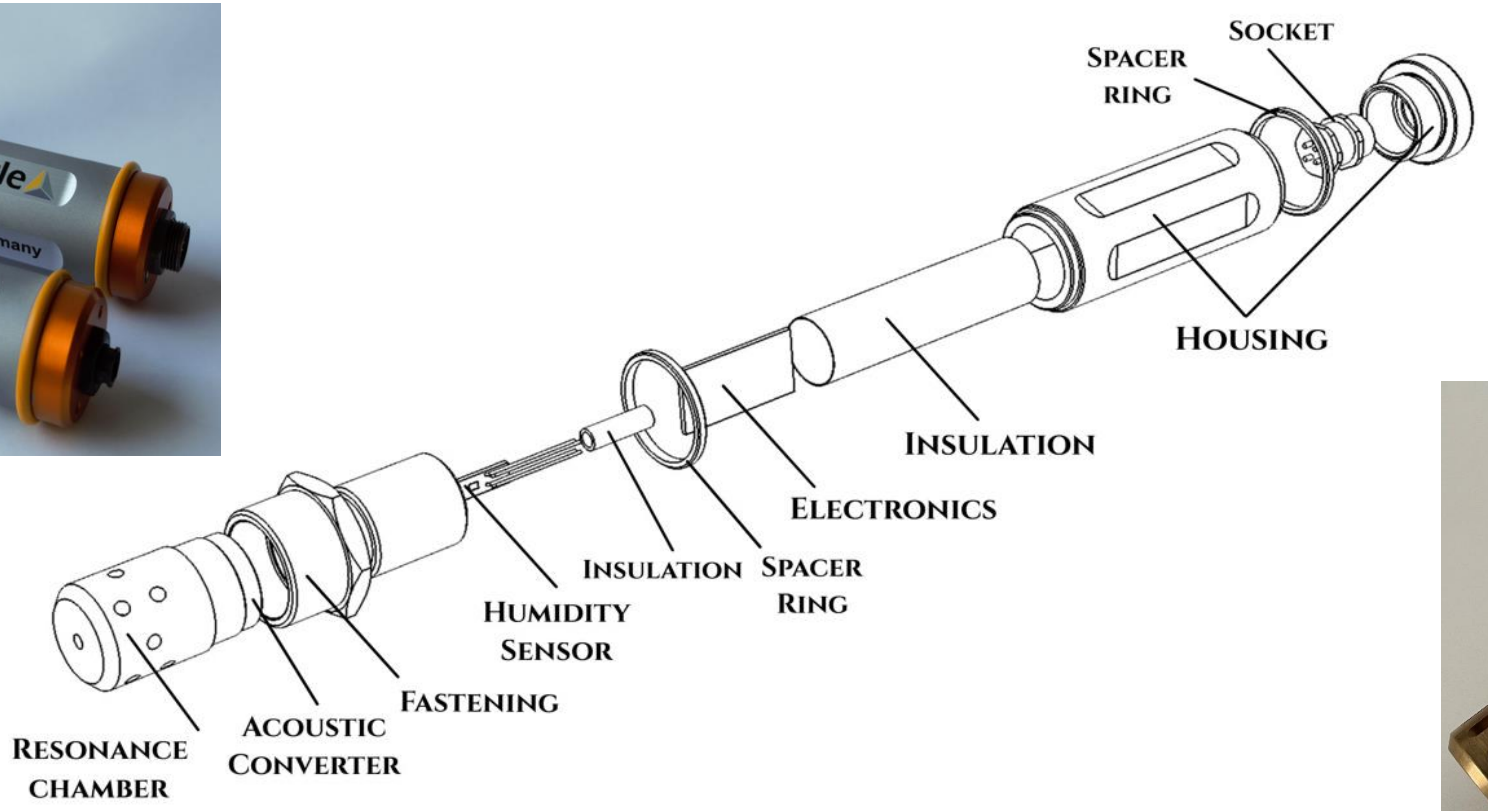
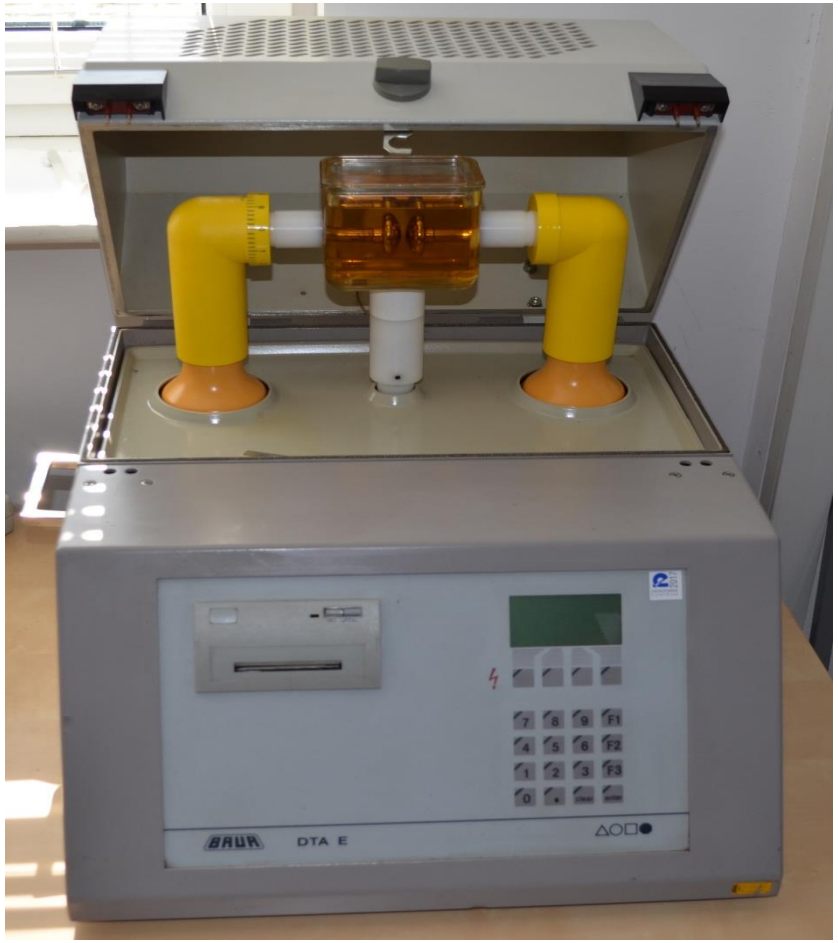
Made in Germany

„Paradigm Shift“

- Acoustic Hybrid Sensor / TrafoSticks TS 4A(dvanced) and TS 5G(as)



Standard offline-measurement according to ISO (laboratory)



Really up-to-date? - BDV-standard according to IEC 60156, especially with view on efficiency, costs and accuracy.

```
Messprotokoll
BAUR DTA 100C                    1.12
Version                         14:48
08.05.2017
-------------------------------------
Seriennummer:
0901804031
Probennummer:
0805171448

Normmessung:
IEC 60156:1995

Elektrodenform:
IEC60156 Fig. II

Abstand:                      2.50 mm

Prüffrequenz:                   60 Hz

Dauerrühren
-------------------------------------
Temperatur                    28 °C

Messung 1                     31.4 kV
Messung 2                     21.2 kV
Messung 3                     35.2 kV
Messung 4                     36.8 kV
Messung 5                     40.8 kV
Messung 6                     37.4 kV

Mittelwert                    33.8 kV
Stand. abw.                    6.9 kV
S/M                           20.4  %

Prüfung beendet!

-------------------------------------
Prüfung durchgeführt
von:

.........................
```

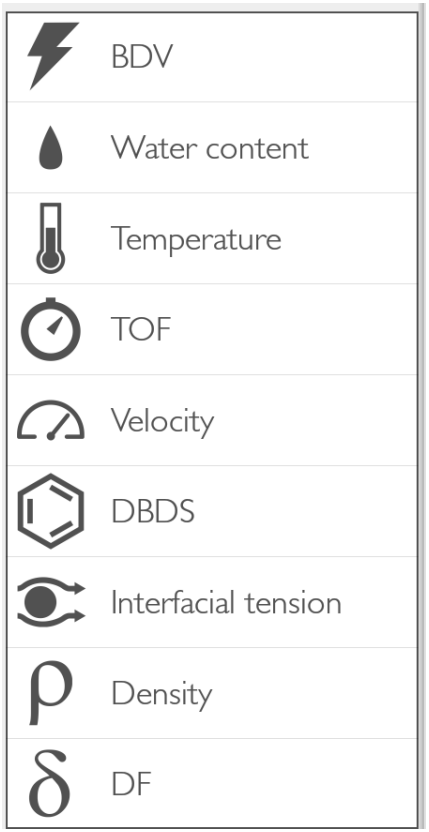
Measured parameters

The following transformer-oil parameters are determined with both TrafoSticks:

BDV @20°C	Breakdown voltage [kV]	1-5%
BDV TM	Breakdown voltage [kV]	; 1-5%
Wc	Water content [ppm]	; 2.0%
Temp	Temperature [°C]	; 0,1%
RS	Relative saturation [%]	; 1-5%
AVG_Wc (S, M, L) ;AVG_BDV (S, M, L) ;AVR_BDV-TM (S, M, L)		; 1-5%

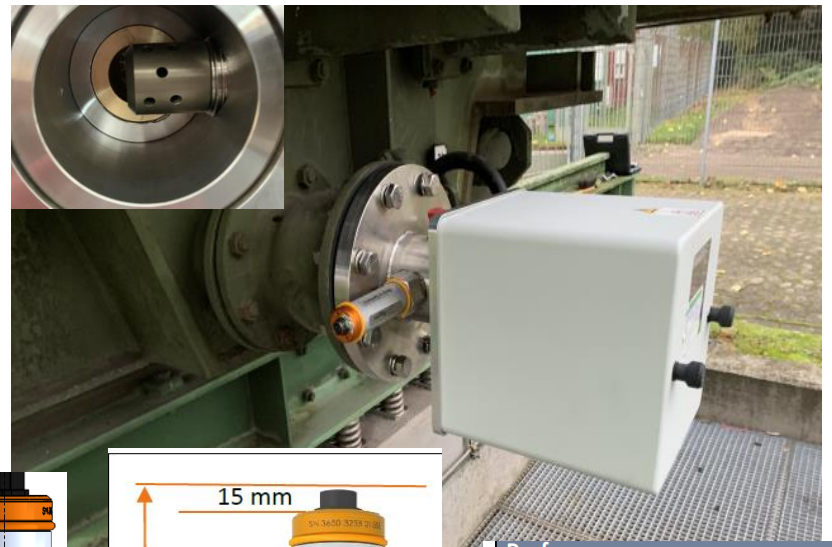
AND

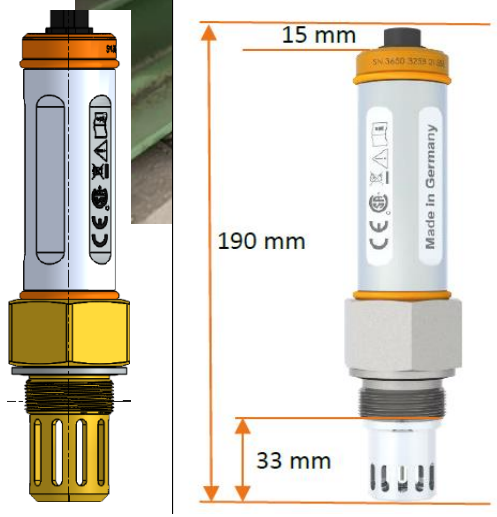
with TrafoStick TS5G two gases additionally - H2 & CO!
(Hydrogen & Carbon Monoxide continously
- 1 value/sec., via MODBUS TCP/IP)



Transformer Monitoring

Installations of TrafoStick TSG4/TSG5 – measurement of BDV *ONLINE!*

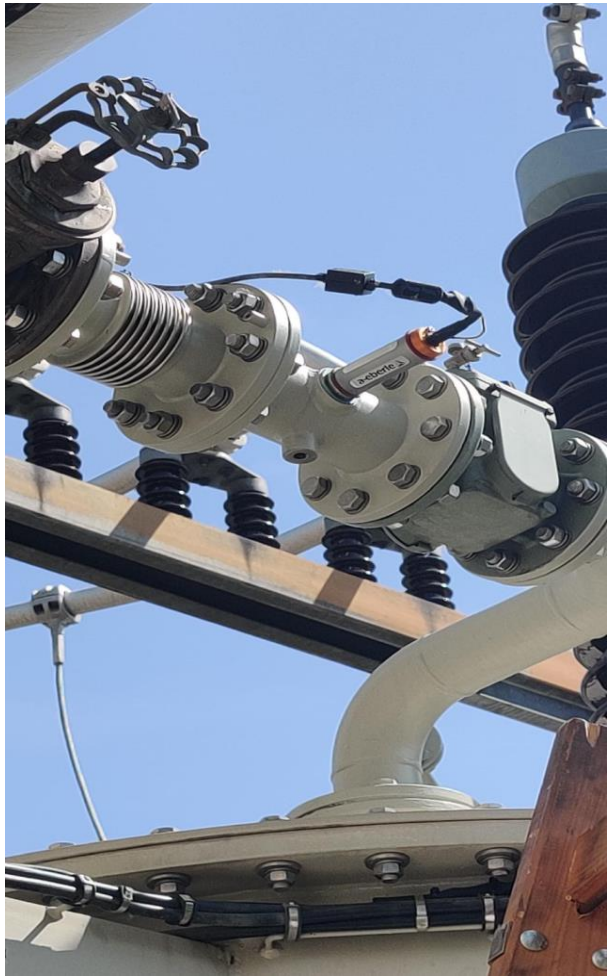


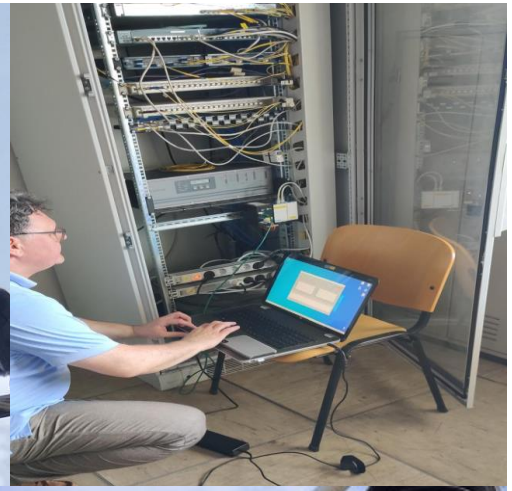


Performance	
Breakdown voltage (BDV)	10kV to 120kV (± 2.5%)
Water Content (W_C)	2 ppm – 80 ppm (± 2%)
Temperature measurement range	-40°C to 120°C (±0,2°C typical)
Hydrogen (H2)	0 ppm – 5000 ppm (± 10%)*
Carbon Monoxide (CO)	0 ppm – 5000 ppm (± 15%)* (* on the measured value)
Measurement interval (selectable)	0.1s (via MODBUS)

Transformer Monitoring

Installations of TrafoStick (TSG4) – measurement of BDV *ONLINE!*





Transformer Monitoring

Transformer Monitoring

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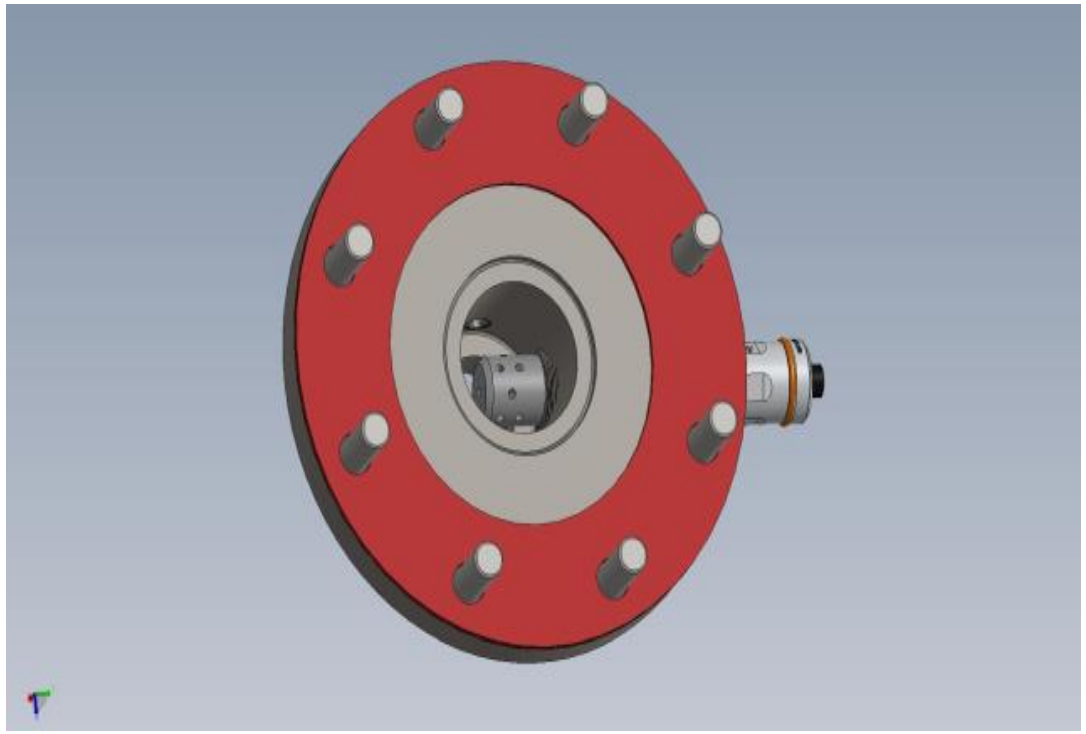
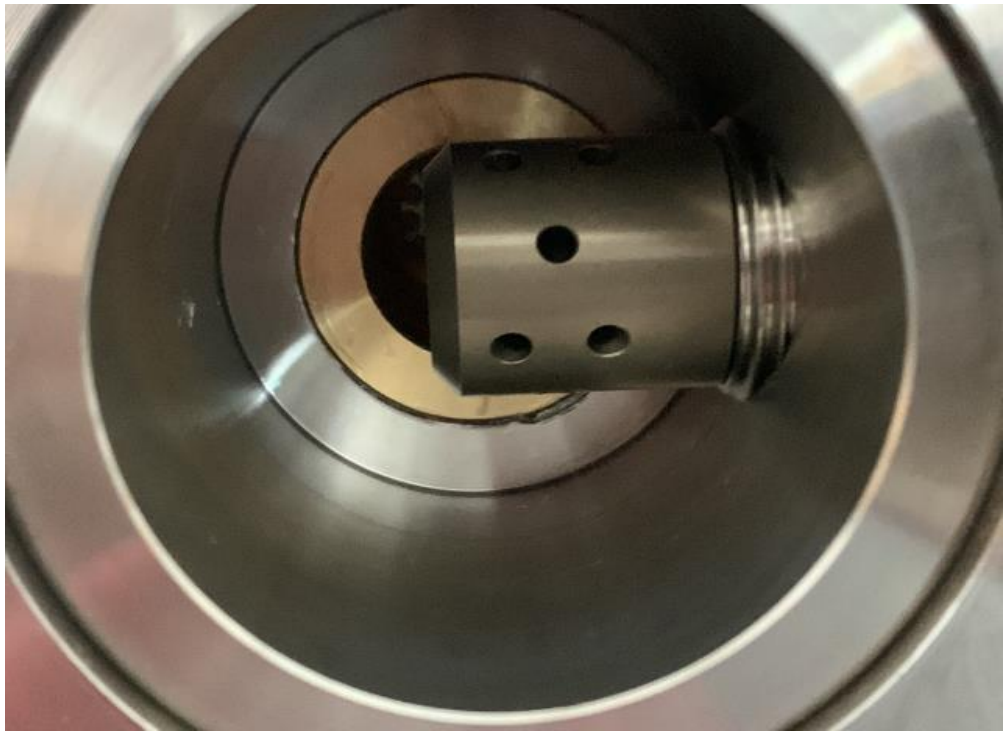
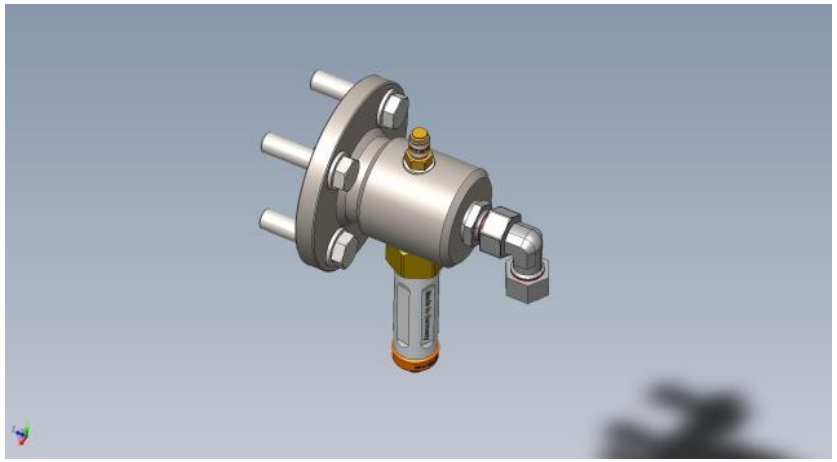
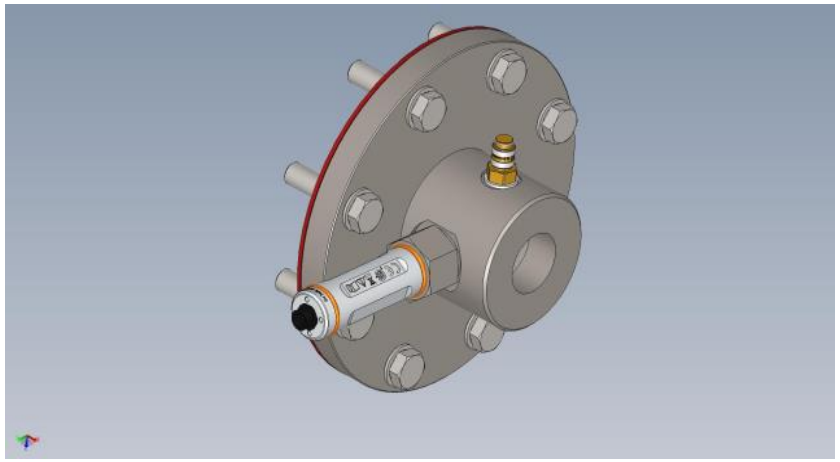
TrafoStick TSG4 (TSG5) - Installation details

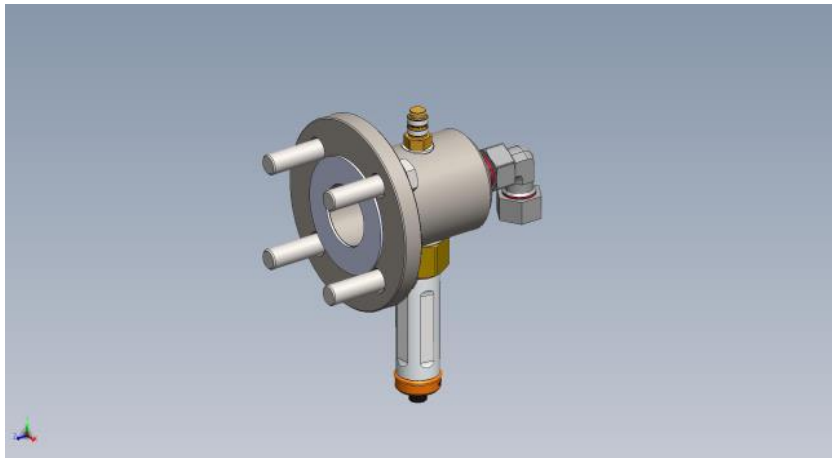


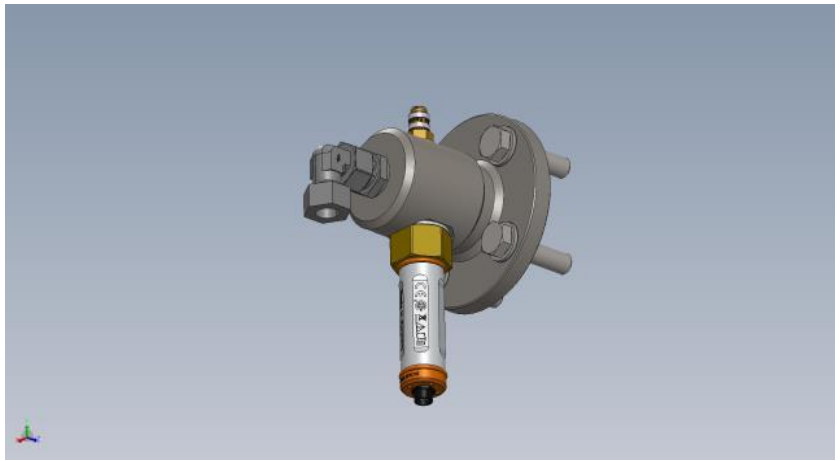


TrafoStick TSG4 (TSG5) - Installation details

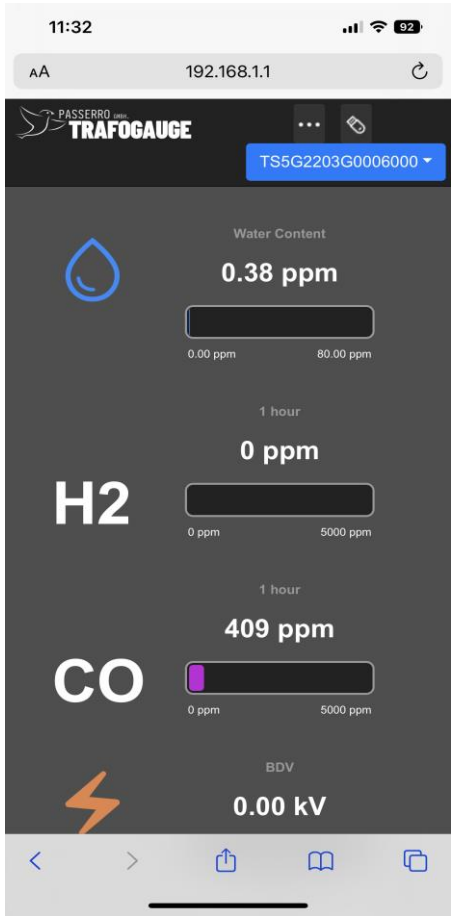


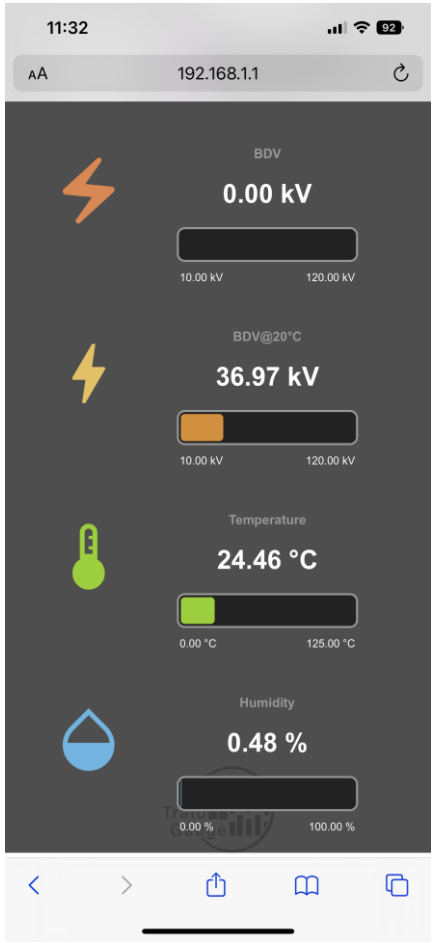


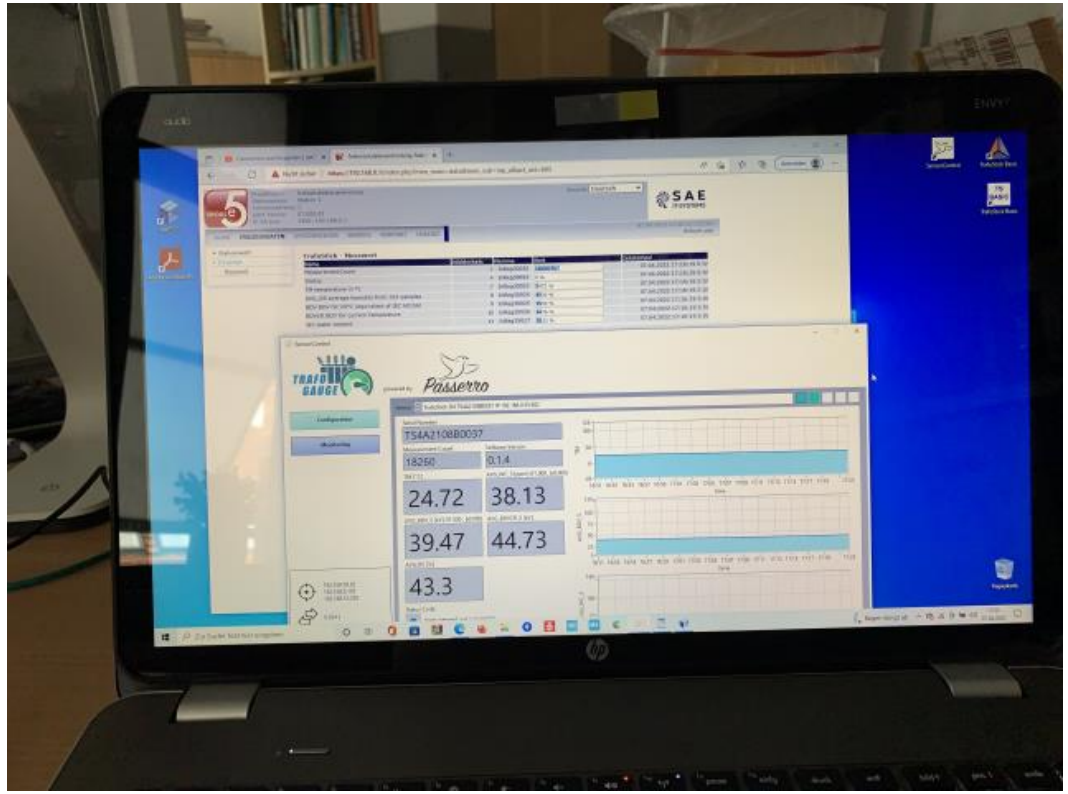


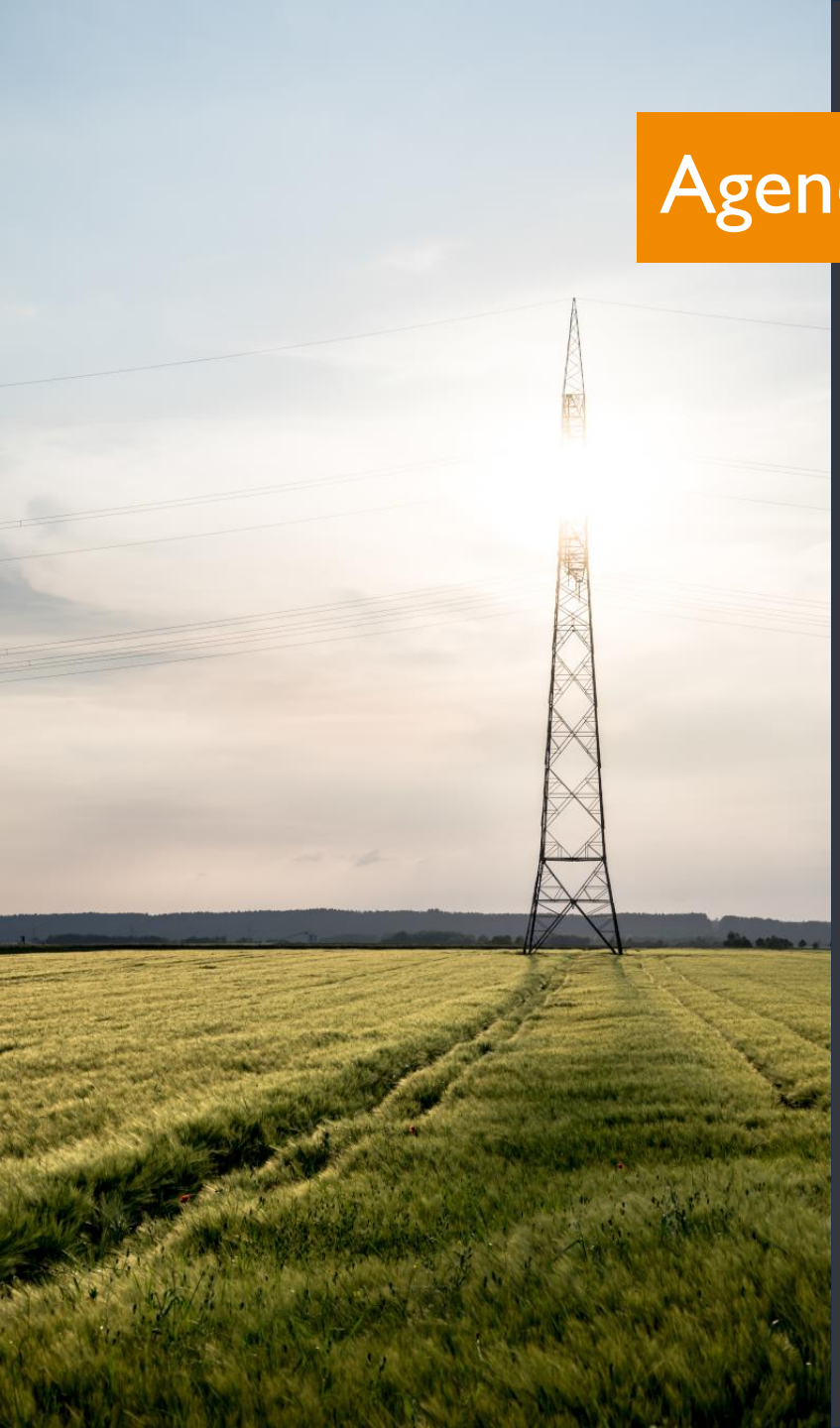


TrafoStick TSG5 – City Municipality in Germany









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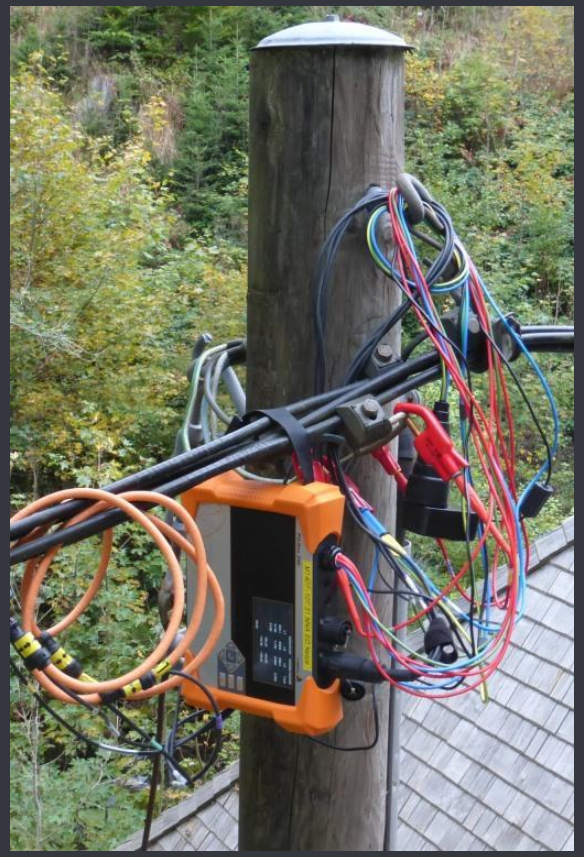
Power Quality Services

Expert knowledge, tailored to your requirements



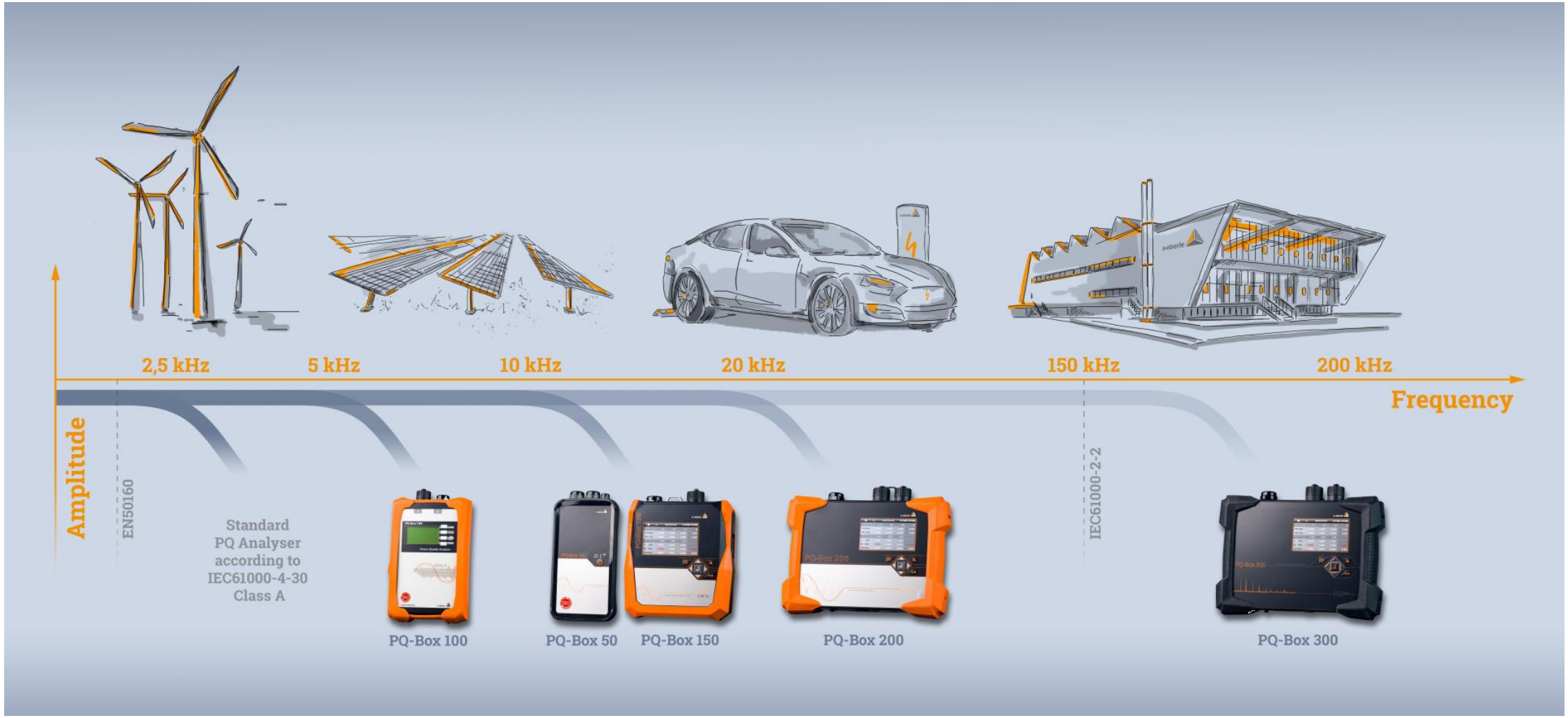
Discover the causes of grid problems

Our experts' extensive experience in the sector

Use of our high-grade Power Quality Analysers

Problem-focused assessment for every application

Frequency Range of mobile Network Analyzers



Power Quality - Boxes

PQ-Box 50

The most compact Class A device

Fits in anywhere	• Pocket size (220 x 110 x 40 mm) • Light weight (500 g) • WiFi + App for Handy and Tablet
Flexible use	• Basic (Power measurement) • Light (PQ Analysis incl. Flicker + Harmonics to 2.5 kHz) • Expert (Oszilloskopic Recorder 20,48 kHz + Halfcycle TRMS Recorder)

PQ-Box 150
The Allrounder

The Allrounder	• 24 Bit resolution • Memory card up to 32 GB • Frequency analysis up to 9 kHz of voltage/current according to IEC 61000-4-7
Flexible use	• Basic (Power measurement) • Basic+ (PQ Analysis incl. Flicker + Harmonics to 2.5 kHz) • Light (Oszilloskopic Recorder 20,48 kHz + Halfcycle TRMS Recorder) • Expert (Frequency analysis 2-9 kHz)

PQ-Box 200

For the Expert

Additional Features	• Free analogue input for e.g. residual current measurement • Binary input trigger • Oscilloscopic recorder with 40,96 kHz sampling rate
Transient Board	• 4 MHz Sampling • 5000 V range

PQ-Box 300

Measurement in a New Dimension

Additional Features	• Free analogue input for e.g. residual current measurement • Binary input trigger • HF Oscilloskope Recorder with 409,6 kHz Sampling
Supraharmonic Measurement	• Measurement of frequency bands up to 170 kHz • Gapless HF analysis in 200 Hz / 2 kHz bands according to IEC 61000-4-7

Fix-Installed Power Quality Devices

Multiple applications

Substations and switchgear

Factory feeds in the industry

Decentralized utilities, PV and wind power plants

Loading facilities / E- Mobility

PQI-DA smart
The all-rounder

01 Data acquisition for PQ applications according to **IEC61000-4-30 - Class A Ed. 3** with highest accuracy of < 0.1%.

02 **Powerful disturbance** recording with detection of transients up to 24 µs and a duration of up to 6 minutes

03 **Easy installation** Plug & Play thanks to guided wizard without knowledge of standards

04 **Free** evaluation software WinPQ lite

05 **Security** by Design according to BDEW Whitepaper

PQI-DA smart
Details

01 1.7-inch OLED color display

02 Frequency measurement of voltage and current from 2 kHz to 9 kHz (option)

03 Certified **according to IEC 62586-1** and **-2** as class **PQI-A-FI-H** device

04 Voltage and current oscilloscope
Sampling frequency: 40.96kHz / 10.24kHz

05 1GB internal non-volatile memory
(Equivalent to 144 weeks of continuous recording; memory expansion up to 32GB via SD card possible)

06 Highly accurate time synchronization via GPS (NMEA + PPS), NTP, IRIG-B (IEEE-1344) & DCF77

07 4 voltage inputs, full scale: 690V L-L 480V L-N, accuracy < 0.1% with input channel bandwidth DC to 20 kHz

08 Wall-mounting, top-hat rail, panel-mounting enclosures

09 4 current inputs
5 A rated current, load capacity: 100 x In pulse 1 sec

10 High installation category
CAT IV / 300V and CAT III / 600V

PQI-DE -

The tool for the power quality expert

01 **High-precision** measured value acquisition according to IEC61000-4-30 - Class A Ed. 3. 144 weeks - without gaps!

02 **Residual current measurement** (RCM) up to 40.96 kHz according to IEC 62020 and usable as 5 current channels

03 On-site display and evaluations directly on the large 5" **display**

04 **Sensor inputs** for current and voltage measurement

05 Optimal device for **monitoring the VDE connection guidelines** (VDE- AR4105..4120 - Appendix F)

PQI-DE -
Details

01 5 inch colour display

02 1GB internal non-volatile memory = 144 weeks of recording
(memory expansion up to 32GB via SD card possible)

03 4 voltage inputs, measuring range end value:
690V L-L
480V L-N, accuracy < 0.1%

04 4 current inputs
5 A rated current, load capacity: 100 x In pulse 1 sec

05 Frequency measurement of voltage and current from 2 kHz to 9 kHz (option)

06 Voltage and current oscilloscope
Sampling frequency: 40.96kHz / 10.24kHz

07 Residual current measurement input with 40.96kHz sampling

08 Highly accurate time synchronization via GPS (NMEA +PPS), NTP, IRIG-B (IEEE-1344)& DCF77

09 Wall-mounting, top-hat rail, panel-mounting housings via accessories

10 High installation category: CAT IV / 300V and CAT III / 600V

Differences Between the PQI-DA smart and PQI-DE

Feature		
Measurement 4x Voltage, 4x Current, 40.96 kHz	✓	✓
IEC61000-4-30 Edition 3 Class A	✓	✓
Display	1,7 Inches	5 Inches
Communication Ethernet, SCADA, time sync.	✓	✓
Memory 1 GB internal, up to 32 GB SD card	✓	✓
IT-Security On Board (SSH Encryption 256 Bit Encryption)	✓	✓
Digital inputs/outputs (Triggers and Alarms)	2 / 2	8 / 4
Residual current measurement RCM (from FW V. 2.2)	-	✓
Temperature input PT100 / PT1000 / KTY	-	✓

PV park monitoring according to VDE-AR 4110

Example: Sensor application

Size: 81 hectares
Connected load: 24.1 MW

Simple, highly accurate and direct measurement via coils (600V CAT4)

Compact design, low integration costs and high storage density = 140 weeks without gaps - guaranteed!

Accessories Current measurement with Senosorik

a-eberle

Rogowski
600V CAT IV
100Hz..20kHz
C40

Diameter 12cm
500A
111.7087.01

Diameter 19cm
3000A
111.7087

Diameter 30cm
4000A
111.7087.02

Diameter 60 cm,
3000A
111.7087.03

Current clamps
600V CAT IV
C44

5A
Measuring
transformer
111.7095

50A
Protection
transformer
111.7096

Current clamps
C45

Hall Sensors
+/- 4V Uout
On request

Accessories for the installation

PQI-DA *smart*

Metal frame for panel-mount inst. 564.0435

Din-rail for wall-mount installation 564.0433

PQI-DE

Adapter for wall-mount or DIN-rail
564.0440

19"-front plate for 2x DIN housing 144x144mm + cable duct on the backside, aluminium black
564.0144.03

1 9" mounting frame - 6 HE, 483x267mm with two cut-outs (138 x 138 mm) for two PQI-DE
564.0144.02

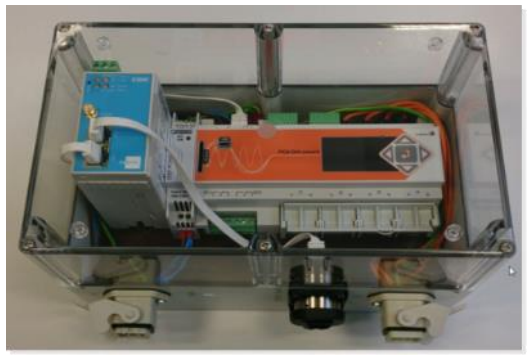
Blind plate for 144x144mm, plastic/black
564.0144.04

Customized solutions

a-eberle

Customer-specific
by A-Eberle GmbH & Co KG

PQI-DA smart installed in Macrolon housing IP 65 incl. back-up fuse and wiring
150.0070.001



PQI-DA smart installed in IP 67 housing incl. modem, back-up fuse and cabling
150.0106.00

19" solutions with free choice of terminals
100.0070.072

PQSys – City of Tshwane

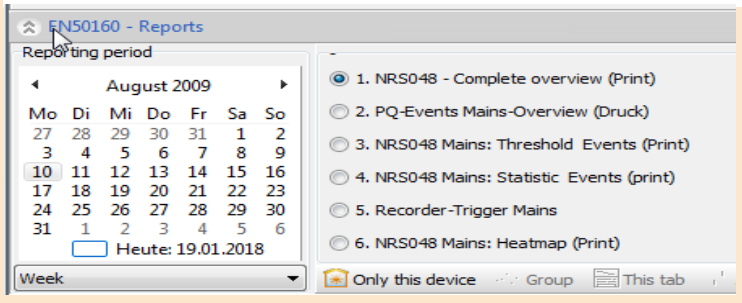
Customer

The **City of Tshwane Metropolitan Municipality** (also known as the **City of Tshwane**) s the metropolitan municipality that forms the local government of northern Gauteng Province, South Africa. The Metropolitan area is centred on the city of Pretoria with surrounding towns and localities included in the local government area.

Application

Sum: -

Depth of the slump [%]	Residual voltage in [%]	Duration		
		20 <= t < 150	150 <= t < 600	600 <= t < 3000
10 < u <= 15	90 > u >= 85			
15 < u <= 20	85 > u >= 80		24	0
20 < u <= 30	80 > u >= 70			
30 < u <= 40	70 > u >= 60	4	7	1
40 < u <= 60	60 > u >= 40	0		
60 < u <= 100	40 > u >= 0	37		



Technical Solution A. Eberle

Feedback Customer

All installations of PQI-DA smart are working probably. The software WinPQ is used for visualizations, especially with view on dips/swells to find out the source of an event (Eskom or …) and to create typical NRS048/PQ-events –overviews/reports, In parallel to analyze disturbance records.

André Kachelhoffer

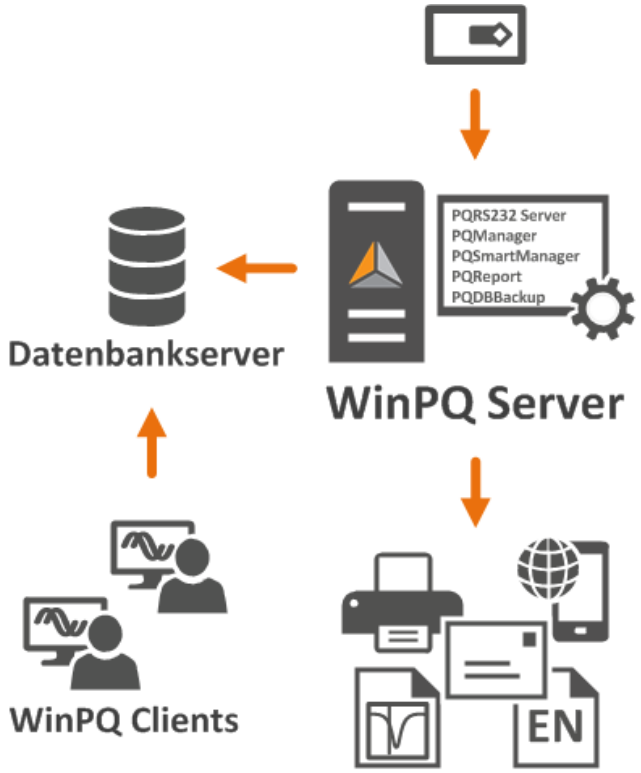
B Tech (Elec)

Engineering Technician/Snr: Quality of Supply

Energy and Electricity Department | 1st Floor | Room 102| Network Control Centre Capital Park | Cnr Behrens and Flower Street | Pretoria | PO Box 423 | 0002 | www.tshwane.gov.za

Tel: 012 358 2409 | Cell: 083 263 9982 | | Email: Andrek@tshwane.gov.za

Installation:	**ca. 250 measurement points**
Kunde:	**City Municipality**
Land:	**South Africa**
	Till Sybel, 07/2022



WinPQ:

Voltage quality immediately and safe at a glance

TOP / DOWN evaluation method

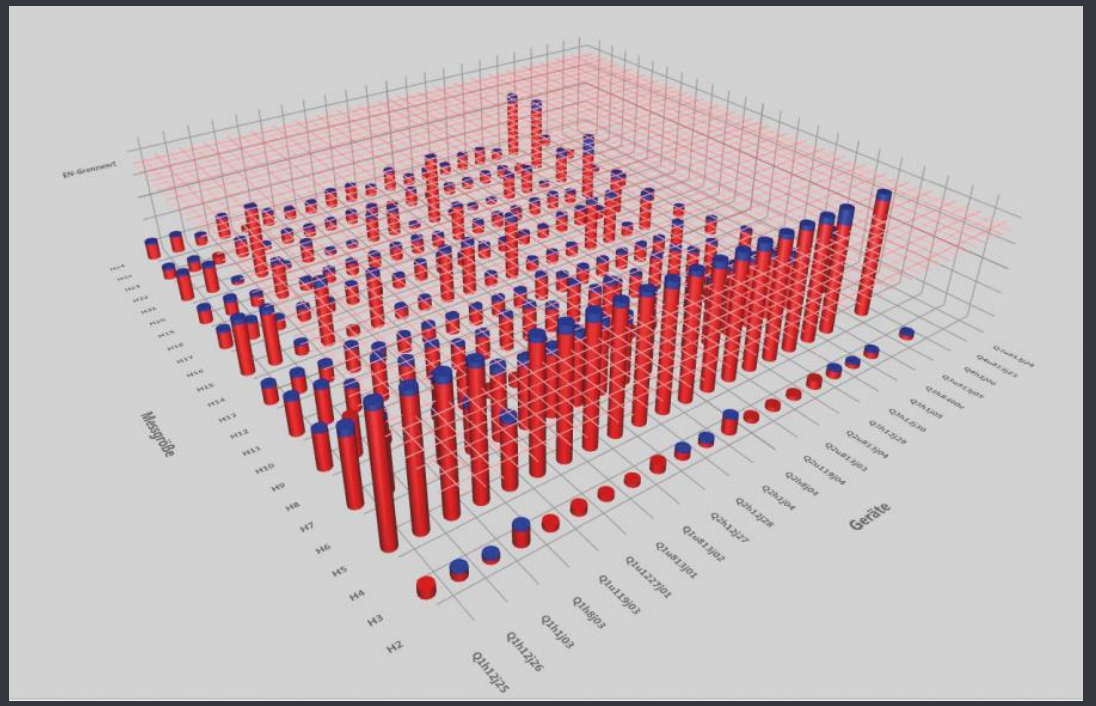
Extremely wide range of power quality-reports and statistics

Easy installation Plug&Play thanks to guided wizards

Autoreporting per measuring point

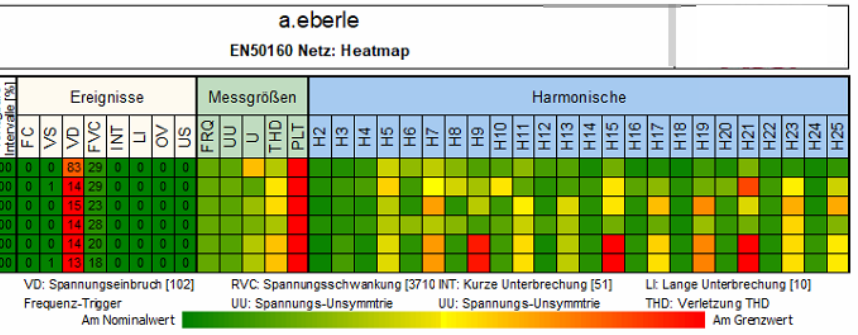
IT-Security by design according to BDEW-standard

Separate schedule for each measuring point

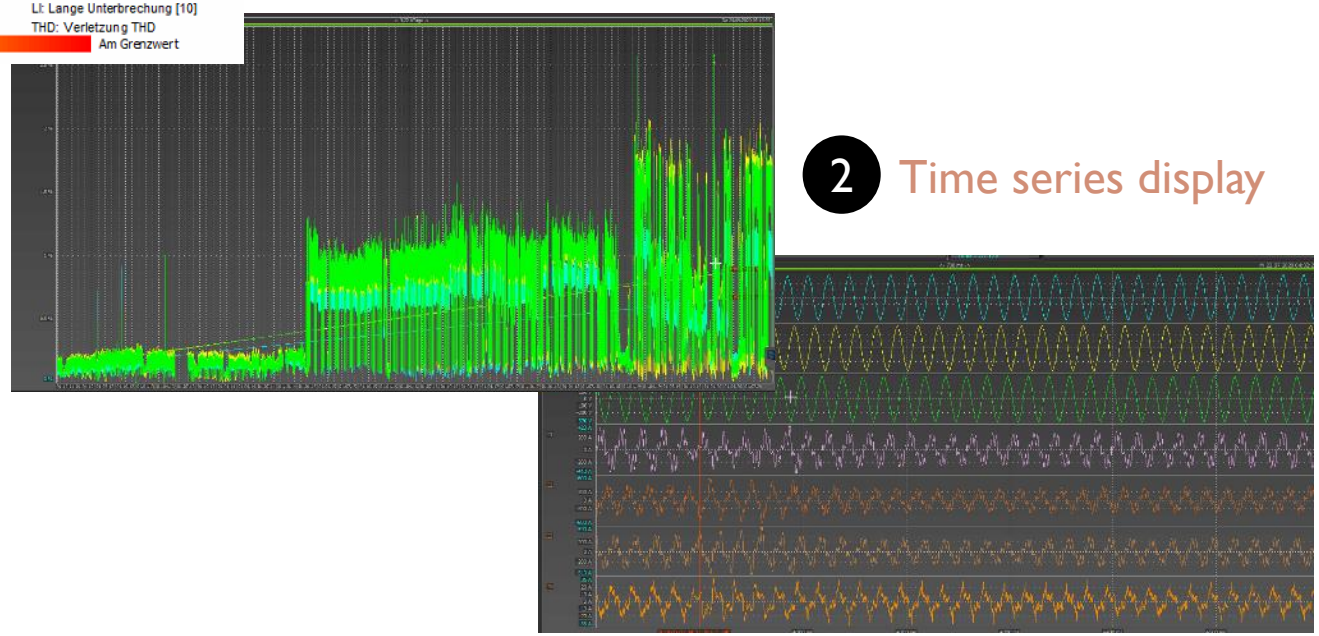


The monitoring concept helps to identify trends at an early stage

Application examples for reporting for understanding



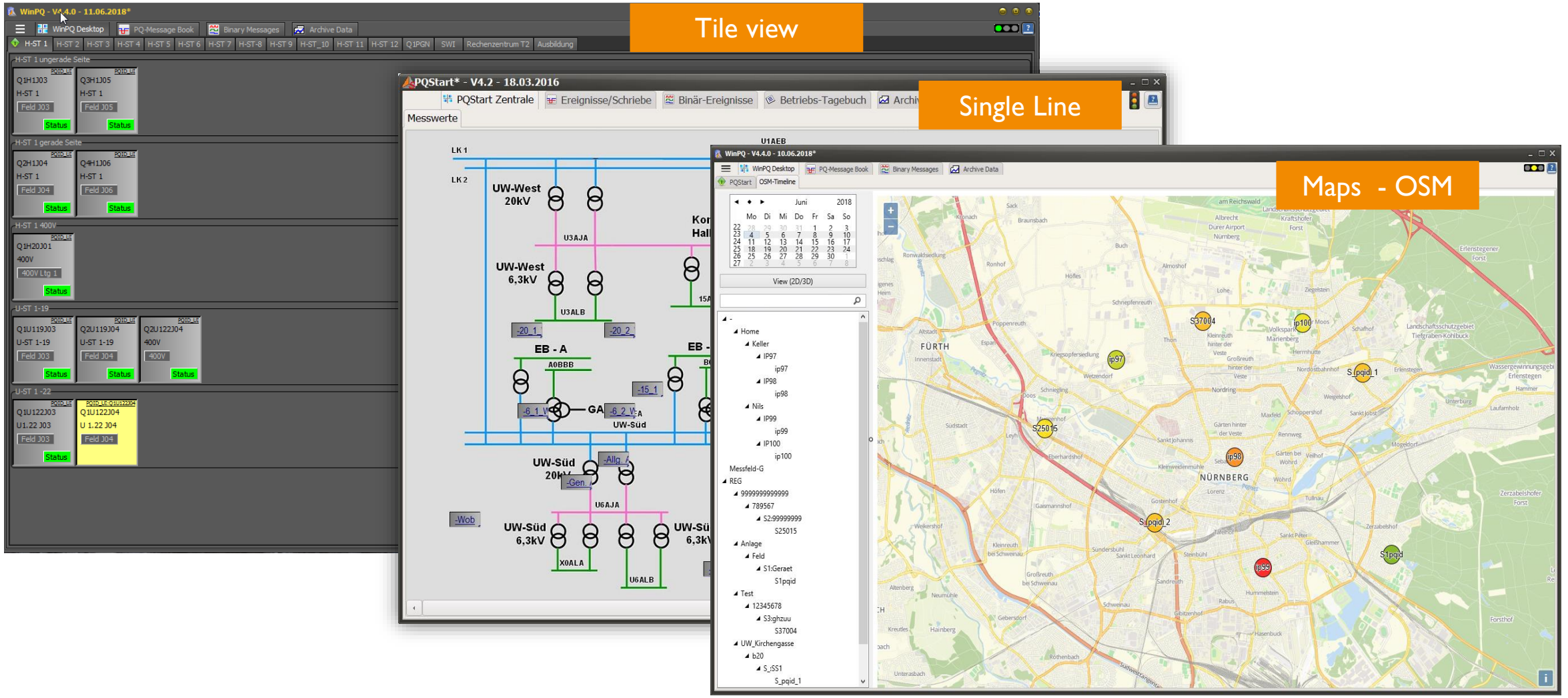
1 Heatmap



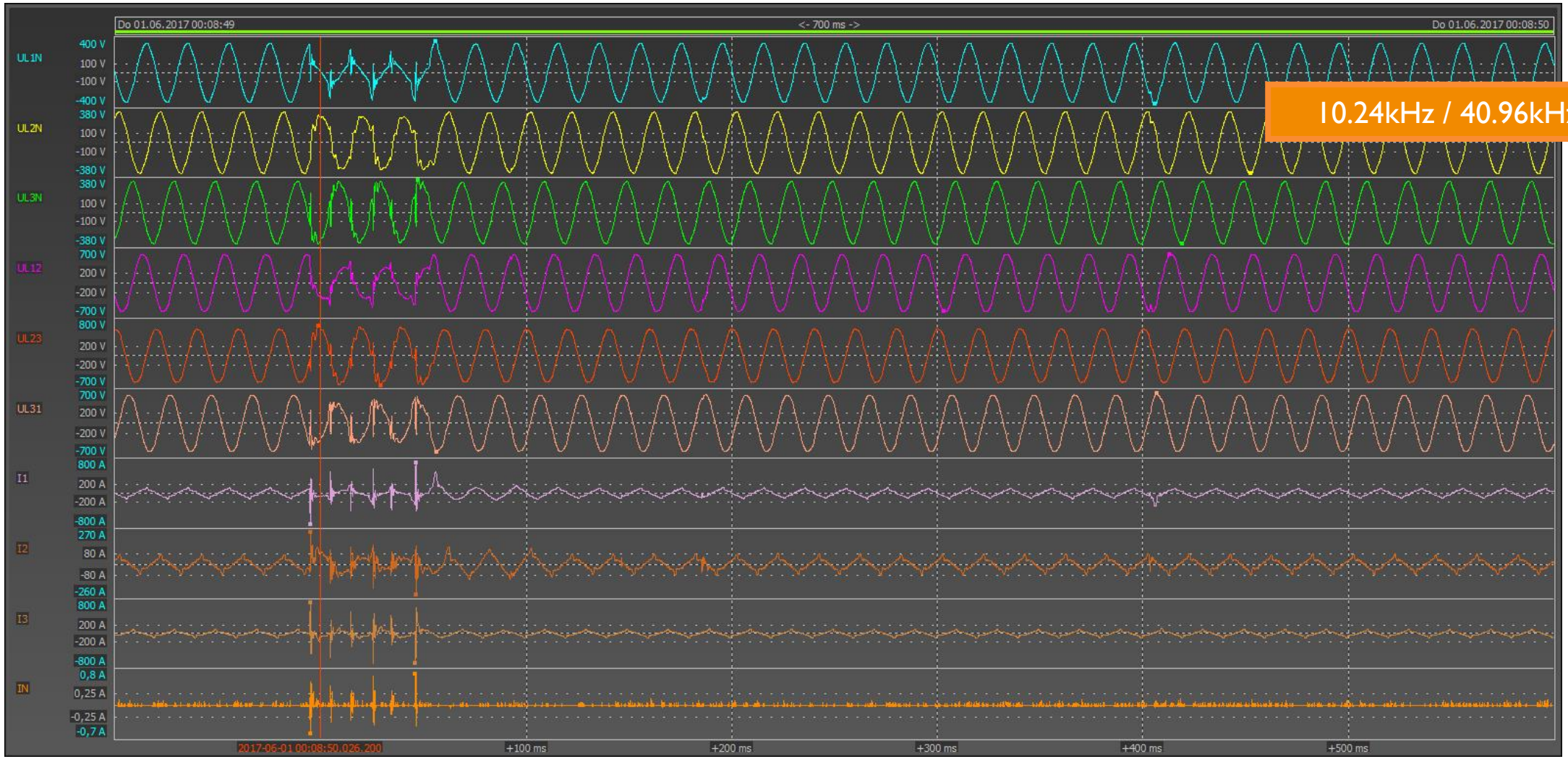
2 Time series display

3 High-resolution disturbance writing with up to 40 kHz

Overview opportunities



Oscilloscope recorder



Possible triggering criteria for fast digital output signals, recordings and IEC 61850 PLCs

Triggers

Voltage lower & upper	Sequence positive & negative	Envelope voltage trigger/ Transient trigger
Phase Jump	Voltage/current jump	Frequency change
Current lower & upper	Binary inputs	Frequency lower & upper

All trigger events can be set to the beginning of the event or to the end of the event (active/passive trigger).

The Cloud is coming…

WinPQ System

Professional Power Quality Software

powerquality cloud

sense

Cloud-native Plattform for measurement data acquisition and processing

Product Launch

Analyze power quality & disturbances in a new dimension
- at any time, at any place, with any device

The first fully responsive & web-based user interface for your Power Quality data!

- Grid Overview Dashboard – detect disturbances in the grid at first sight!
- Analysis Section – clarify the root cause of disturbances in detail.
- Configurable REST API – designed for flexible data exchange within your organization.
- 100% Secure!
  Supports full user rights management.

Only from 08.11.2022 to 31.01.2023: Special offer with up to 750 € savings! Contact us now by e-mail!

Advantages of the WebPQ Visualizer

FACTS #1

Simple and fast visualisation and evaluation of your PQ-measurement data and fault records in the browser, without installation on your PC, tablet or other terminal device.

Platform-independent solution that can be installed on-site in your company network.

Use of highly secure interfaces (HTTPS) and own certificate management with full User Rights Management System (URM).

Freely configurable and customisable dashboards - get to the bottom of faults individually and share your analyses quickly and easily with colleagues.

Advantages of the WebPQ Visualizer

FACTS #2

Integration into third-party systems thanks to I-frame capability and fixed hyperlinks.

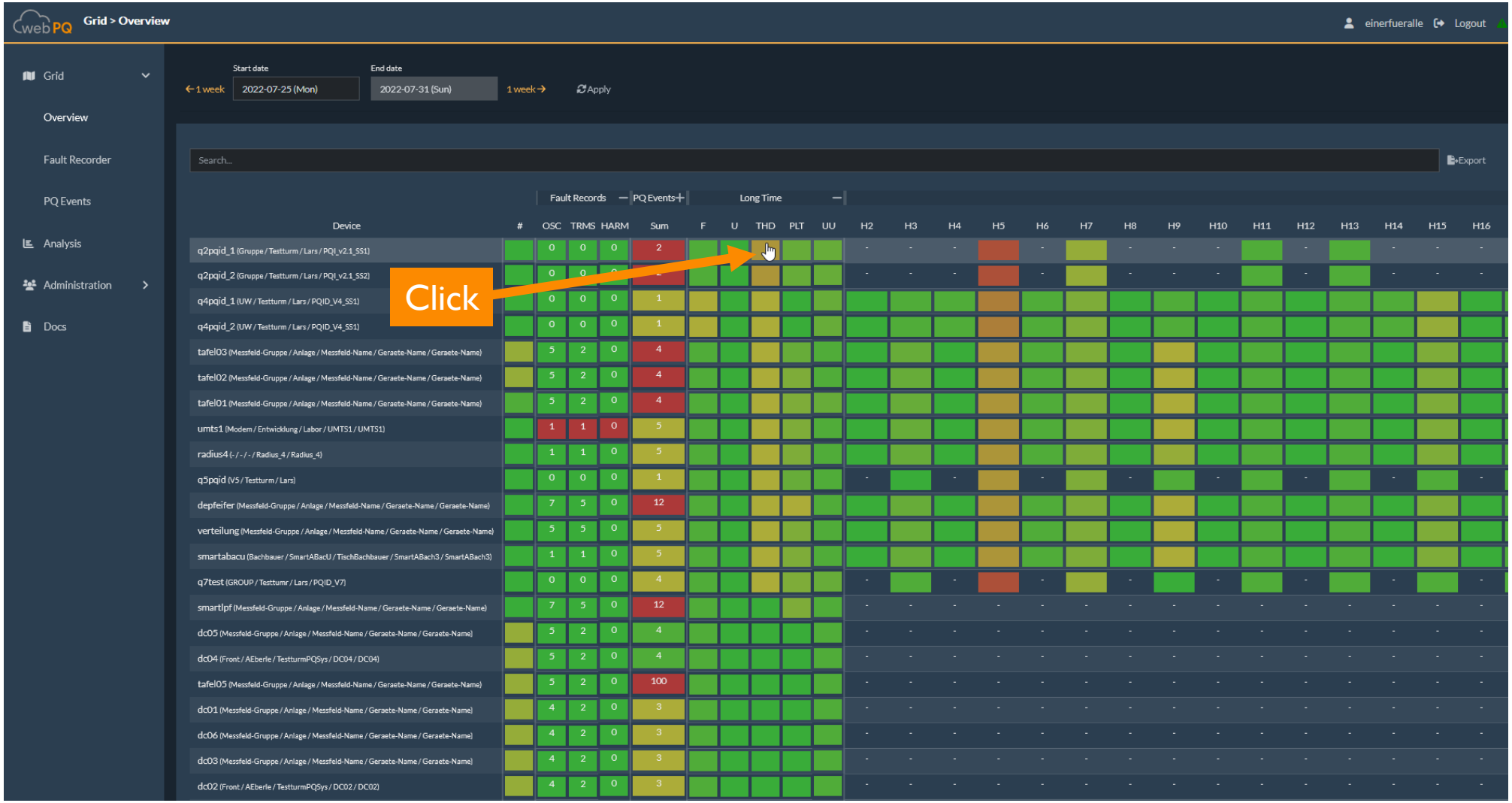
Fully documented REST API (Swagger) for data exchange within your company or with third party products (network calculation tools).

Downward compatible to existing measurement data of WinPQ.
All PQI-D's, PQI-DE & PQI-DA smart versions are supported!

Complete and flexible integration into the customer's IT.

Network > Overview

- Interactive heatmap overview of **all** power parameters
  - Fault Records
  - PQ events
  - Statistics of the measured values such as harmonics, voltage, flicker, unbalance, etc.
- Measured values are just a **click** away via **analysis**
- Fully searchable, exportable, scalable!



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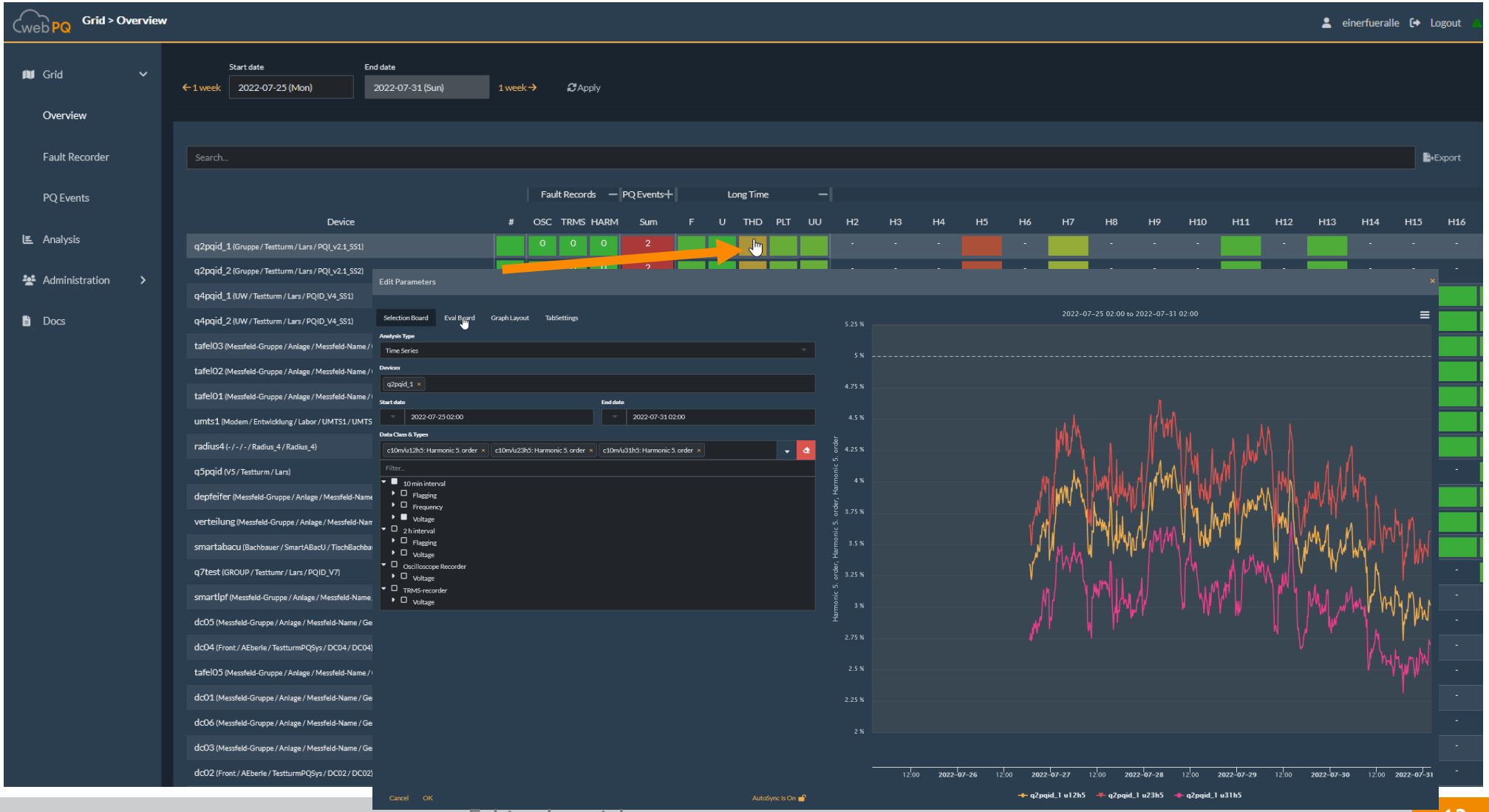
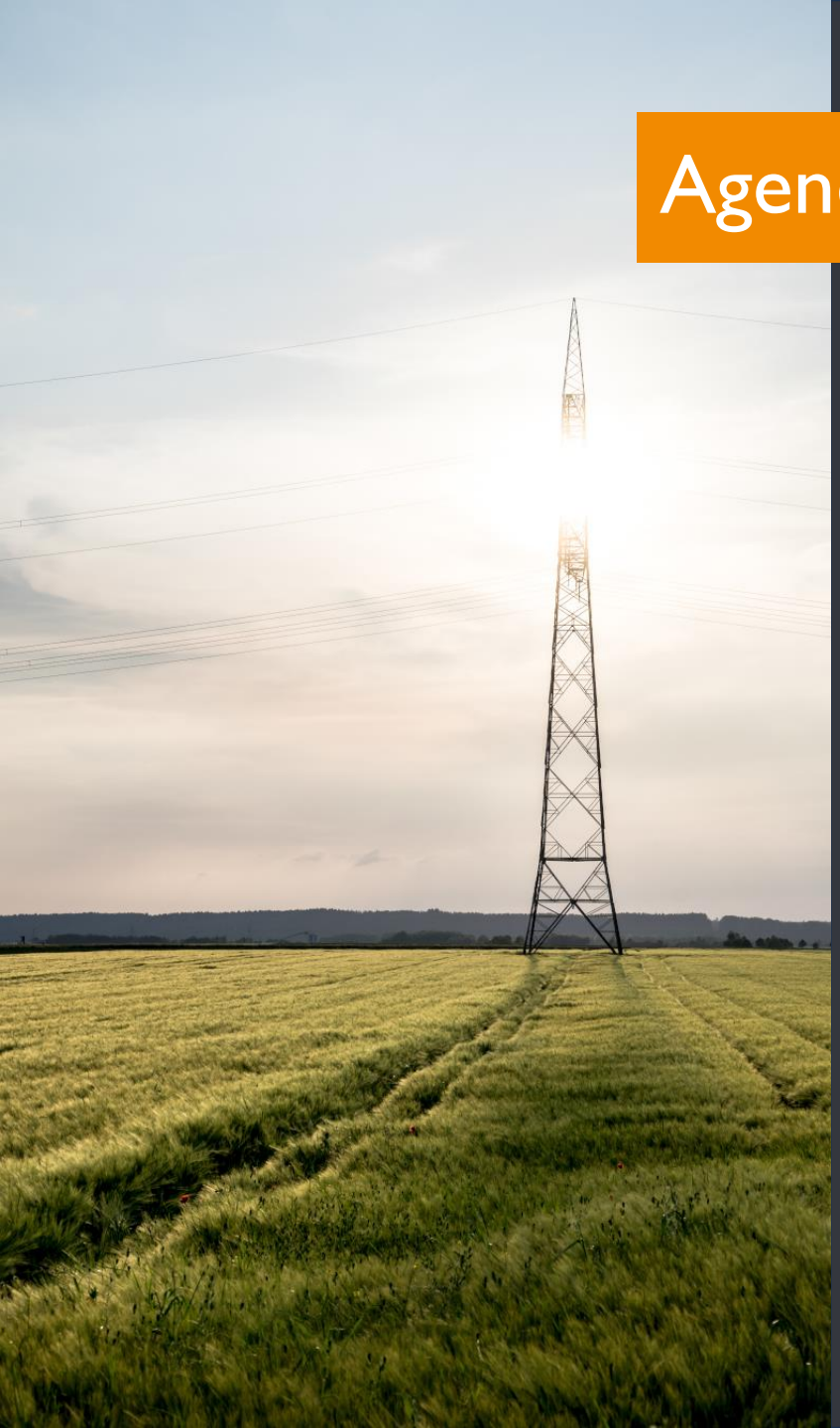
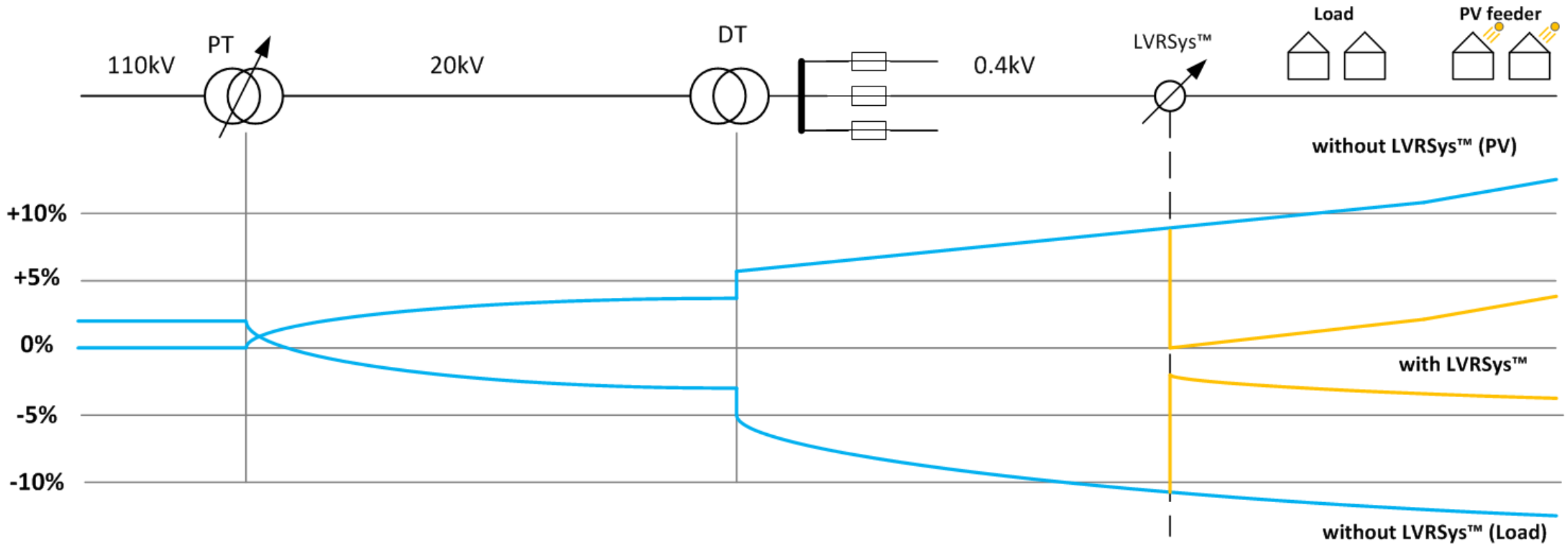




Agenda

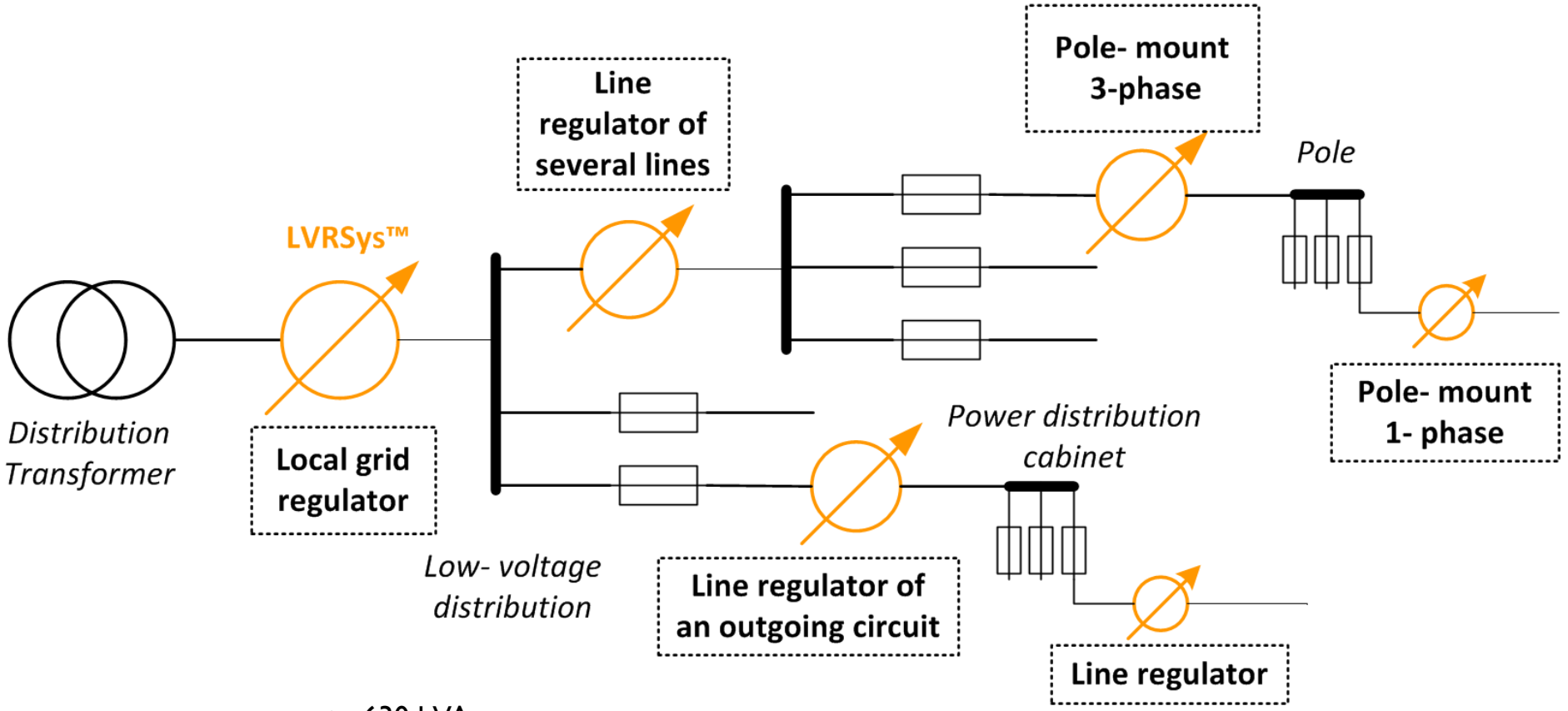
01	General Information – A. Eberle Africa and A. Eberle Germany
02	Automatic Voltage Regulation REGSys™
03	Transformer On Line Monitoring
04	Mobile Power Quality and Power Quality Systems PQSys
05	Low Voltage Regulation LVRSys™

Optimum Utilization of the Stress Band



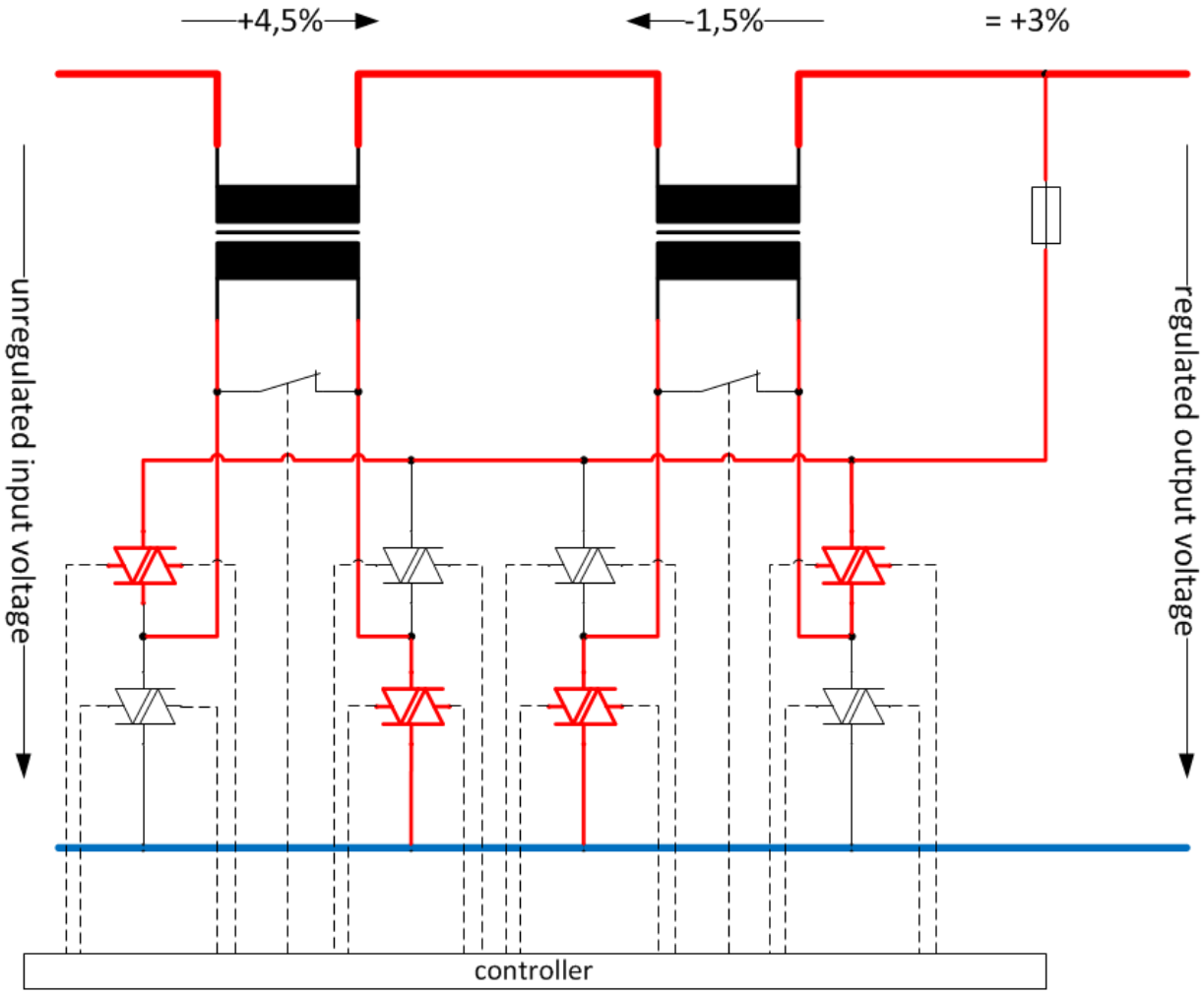
LVRSys™ Modular System: Power & Control Ranges

Three- and single-phase / Power utilities



- Power: up to 630 kVA
- Control range: ±6% / ±8% / ±10%
- Control range special application: up to ±24%

LVRSys™: Technical Principle



Raise voltage 4.5% by activating the 4.5% transformer

Lower the voltage by activating the 1.5% transformer but inverse

Result: total voltage is +3%

Contactors close in the event of failure, local grid continues to operate, but without control.

LVRSys™- Outdoor

Cabinet size 1:

W/H/D: 114 cm / 32 cm / 105 cm (up to 110 kVA)

Cabinet size 2:

W/H/D: 146 cm / 32 cm / 105 cm (up to 250 kVA)

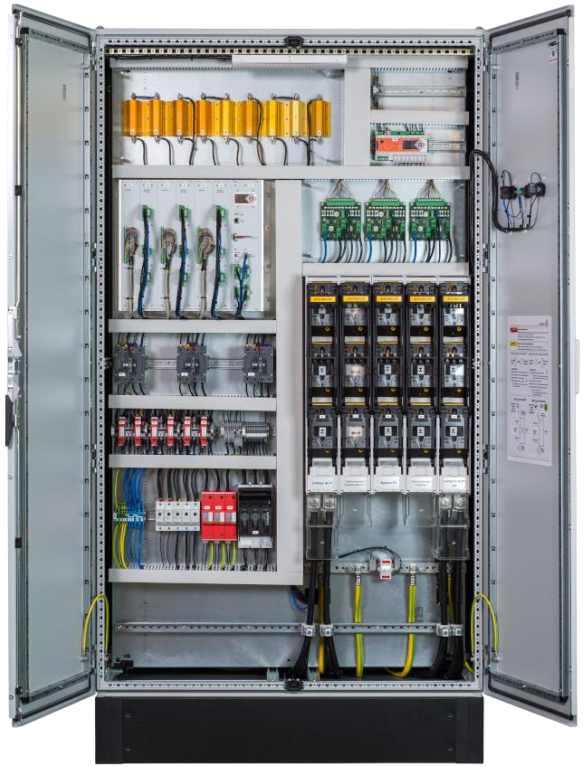
LVRSys™ - Indoor

Cabinet size 1:

W/H/D: 60 cm / 60 cm / 180 cm
(up to 110 kVA)

Cabinet size 2:

W/H/D: 80 cm / 60 cm / 200 cm
(up to 250 kVA)



Cabinet size 3:

W/H/D: 120 cm / 60 cm / 220 cm
(up to 630 kVA)

Thank you!

Let‘s stay in contact.

www.a-eberle.de

Register now for our newsletter!

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XING