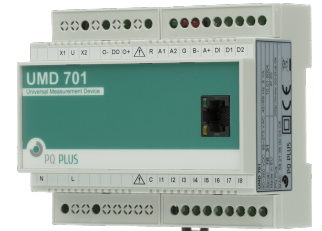
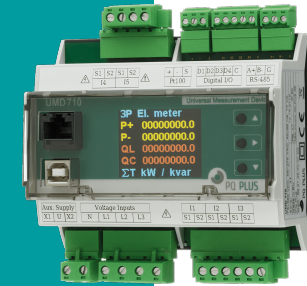
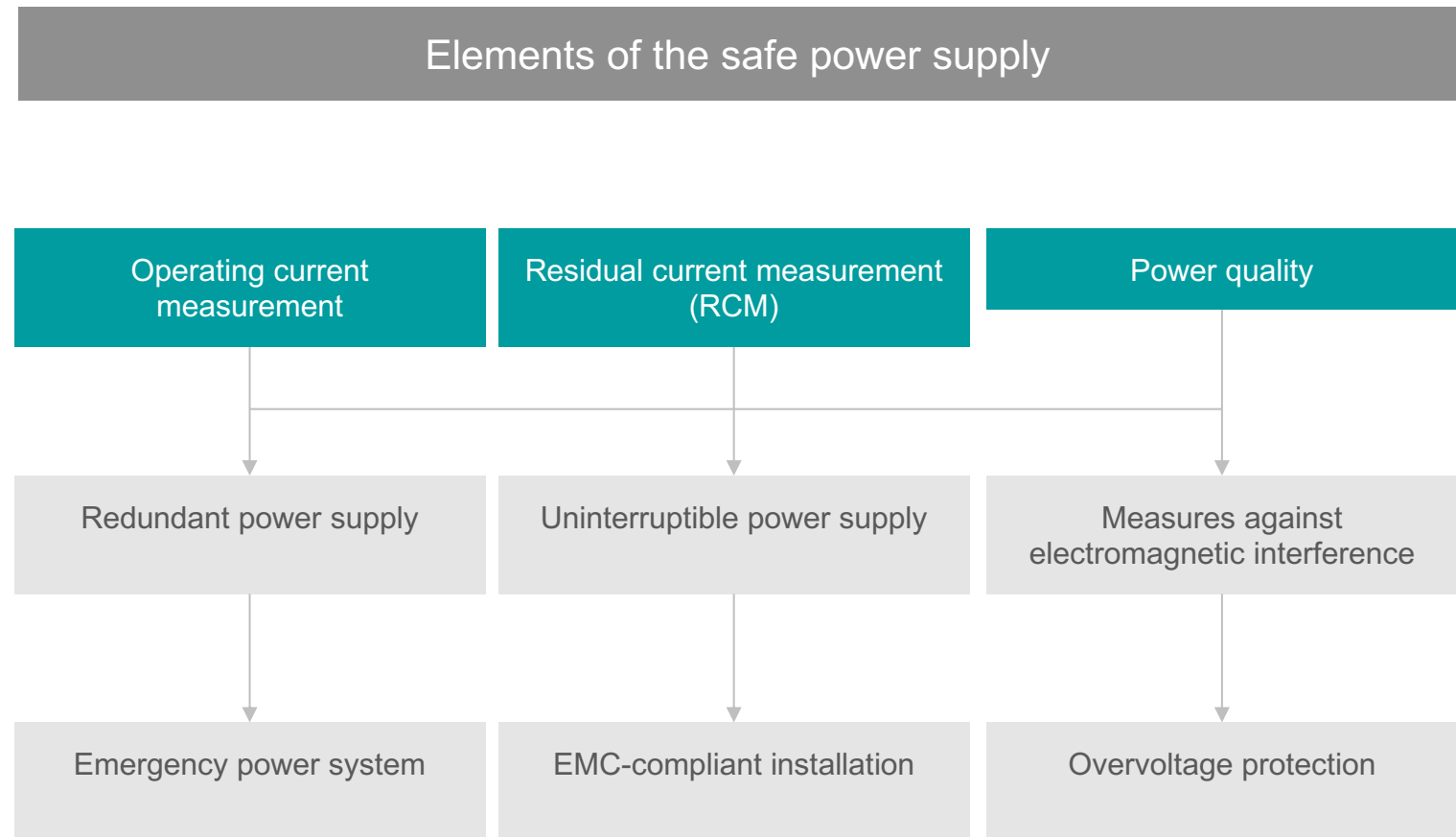


Energy meters are tools of maintenance

Detection and monitoring of overcurrents, leakage currents, voltage quality, operating hours and consumption peaks with alarm center.



Basics



Requirements

1. Security
2. Maximum availability
3. Trouble-free
4. Economic efficiency
5. Verifiability

Standards

What are the standards and guidelines

- **ArbschG**
- **DGUV**
- **EN 50600**
- **EnWG**
- **VdS-Grundschatz**
- **EN 61000-2-4**
- **KRITIS**
- **TRBS**
- **BetrSichV**
- **BSI-Grundschatz**

Problems

modern consumer

- Switching power supplies
- Frequency converter
- Inverter
- Lighting technology (LED)
- Elevators
- MRT



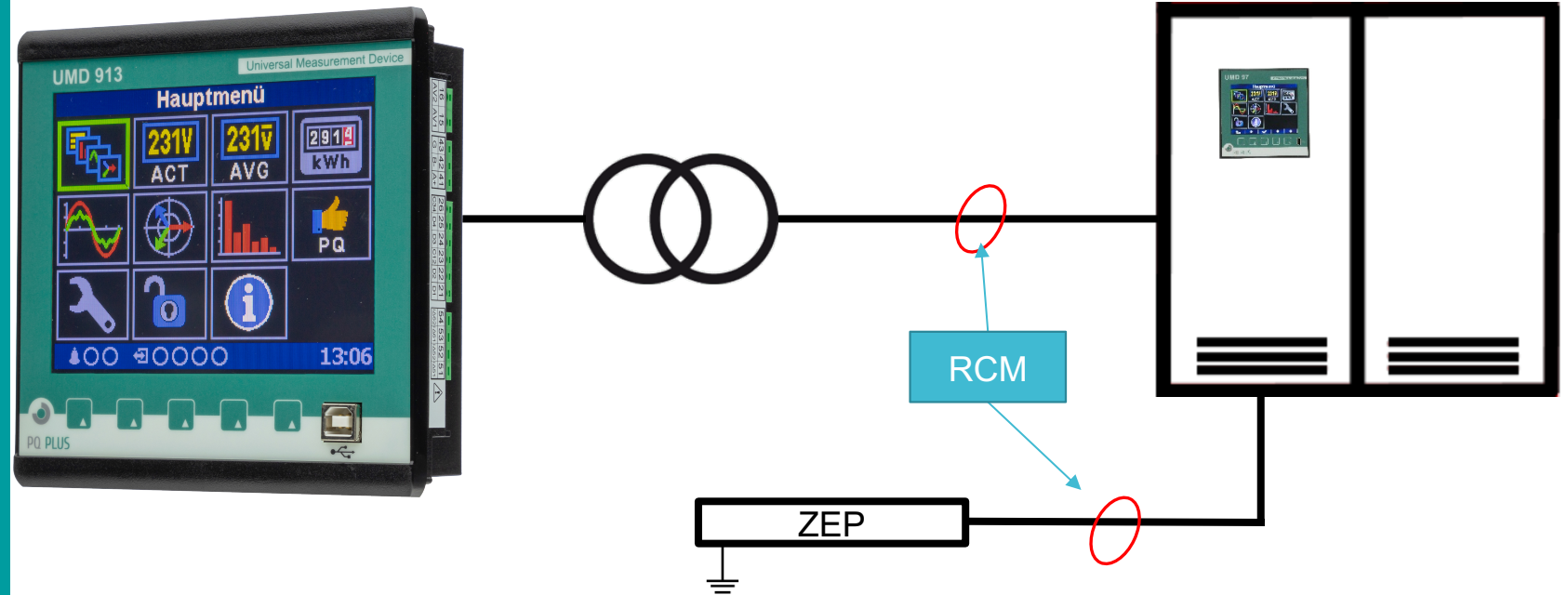
Targets

1. Ensure availability
2. Continuous monitoring
3. Measurement concept
4. Early detection
5. Histories
6. Compliance with standards
7. Avoid shutdowns
8. Ensuring periodic testing

Granularity level 1

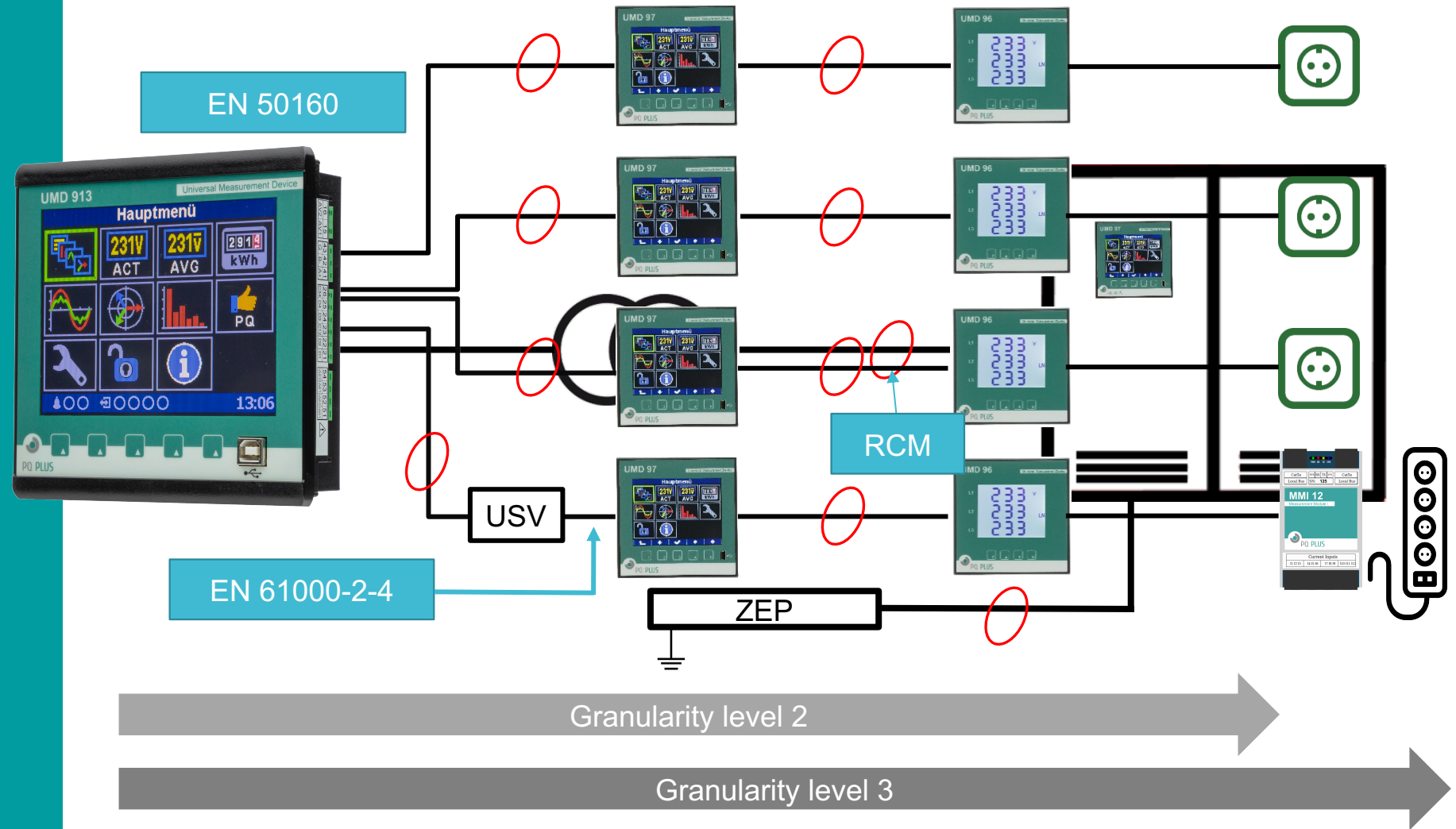
Primary / secondary care

EN 50160



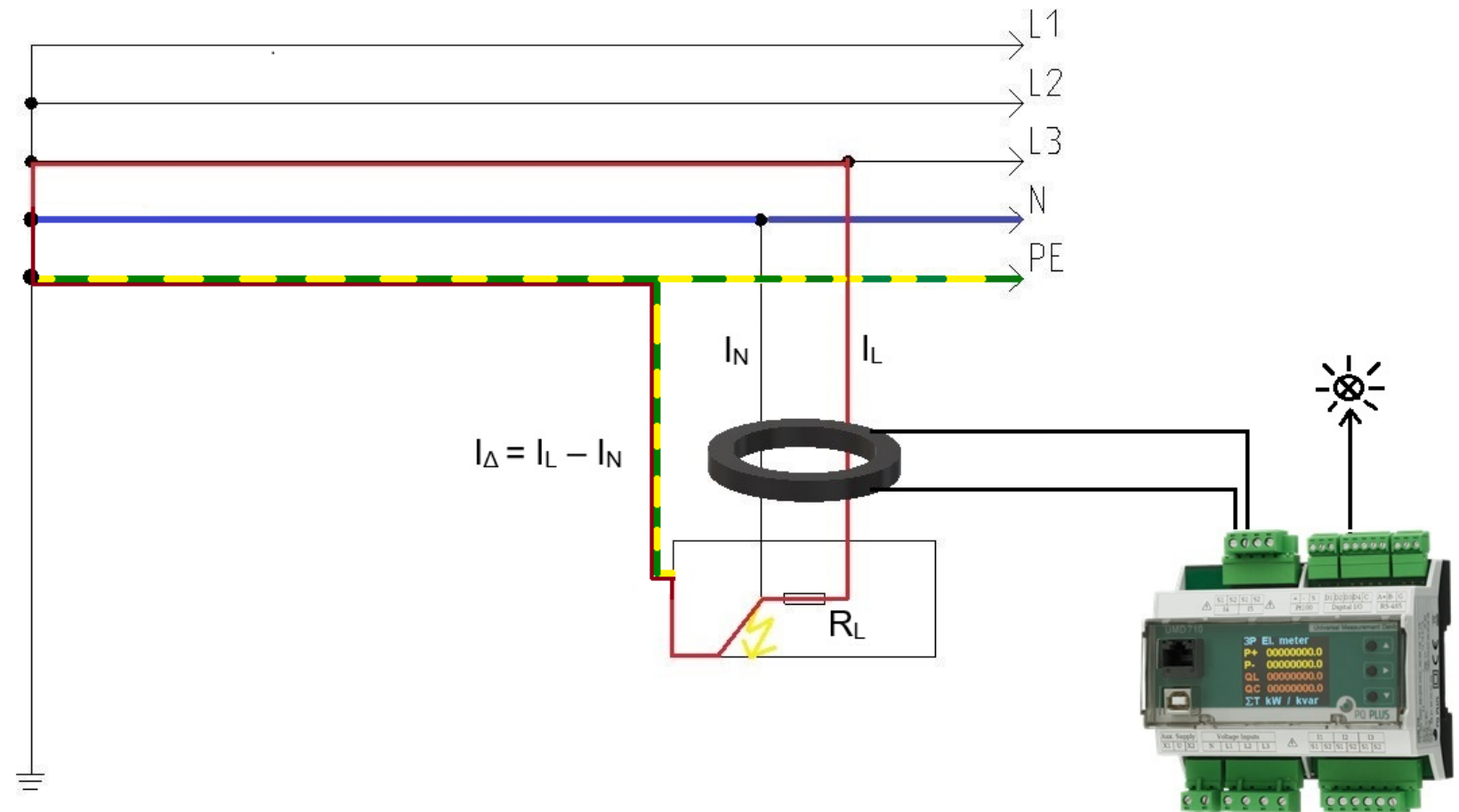
Granularity level 2 / 3

Secondary distribution device



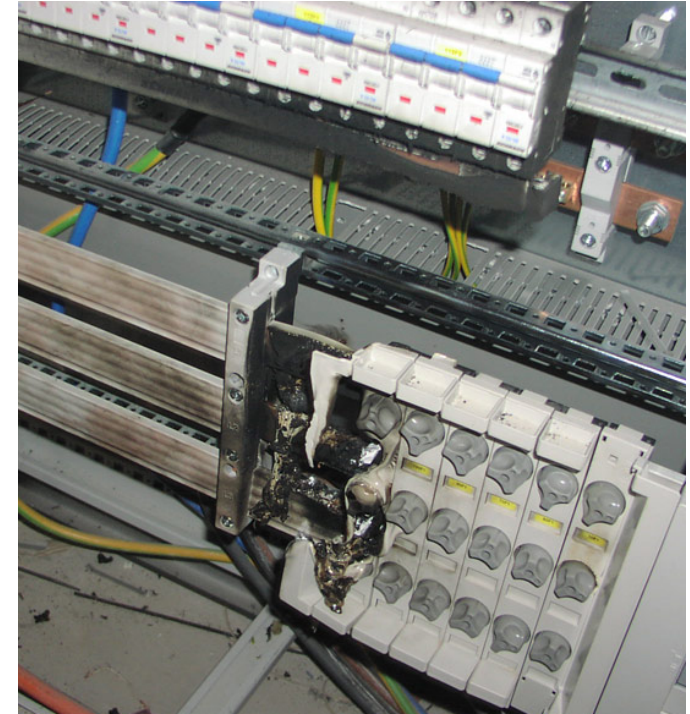
Principle RCM

„Differential current is the algebraic sum of the instantaneous values of the currents flowing at the same time in all active conductors (L, N) at a given point in a circuit in an electrical system.”
(DIN VDE 0100-200)



Effects of differential currents

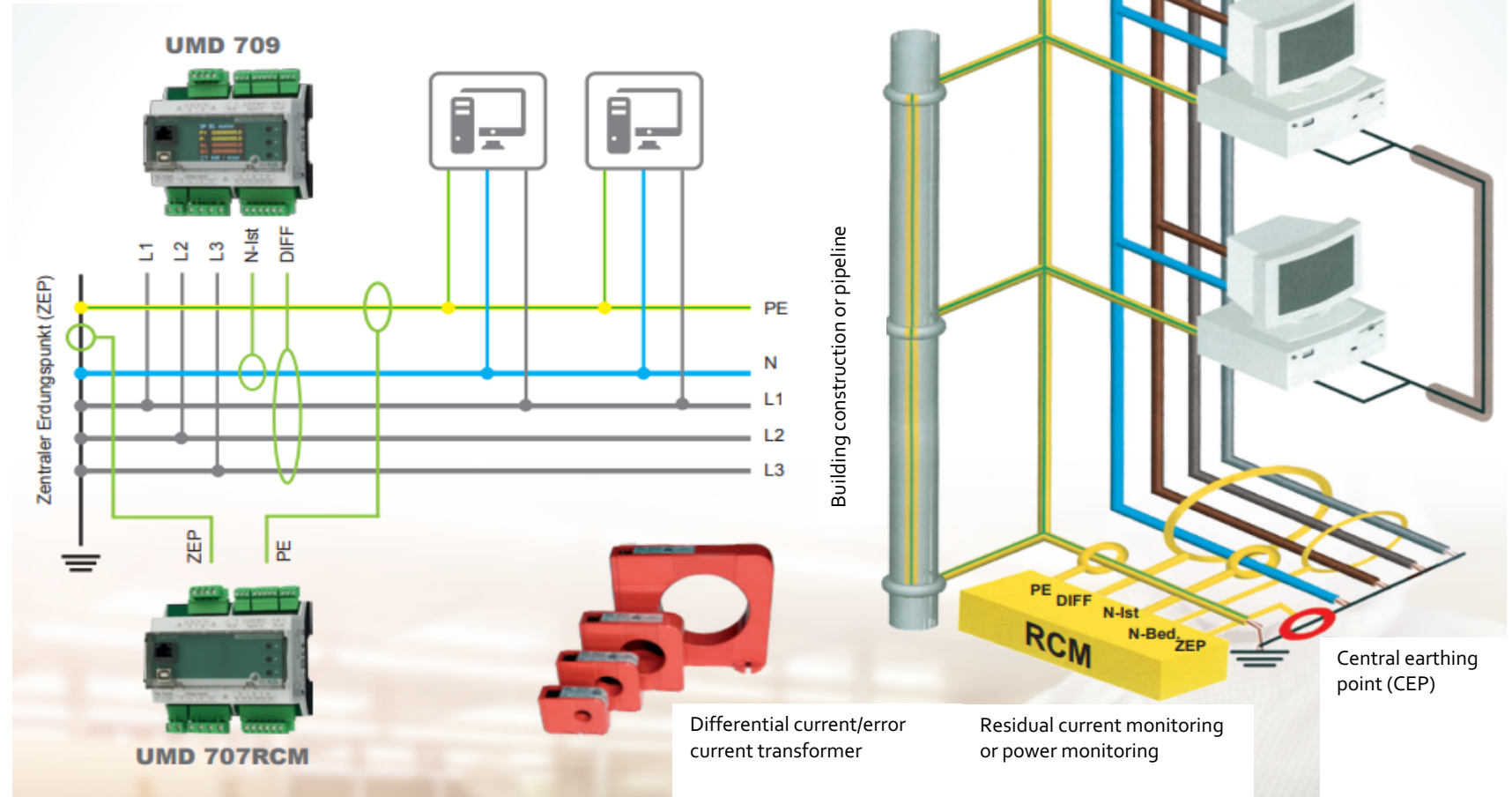
- Fire damage
- Electrical corrosion
- Unintentional interruptions of operation
- Malfunctions in equipment
- EDP crashes
- Interference with protective devices
- Interference with data transmissions
- Hum



Our solutions for residual current measurement

With our measuring instruments, we supply the tools for modern metrological equipment in power distribution at an interesting price/performance ratio. Transparency in the network and safeguard residual current monitoring at any time - with the UMD from PQ Plus.

Measure both the feed and all feeders continuously, as granularly as necessary. Alarm management and connection to telecontrol systems are a matter of course.

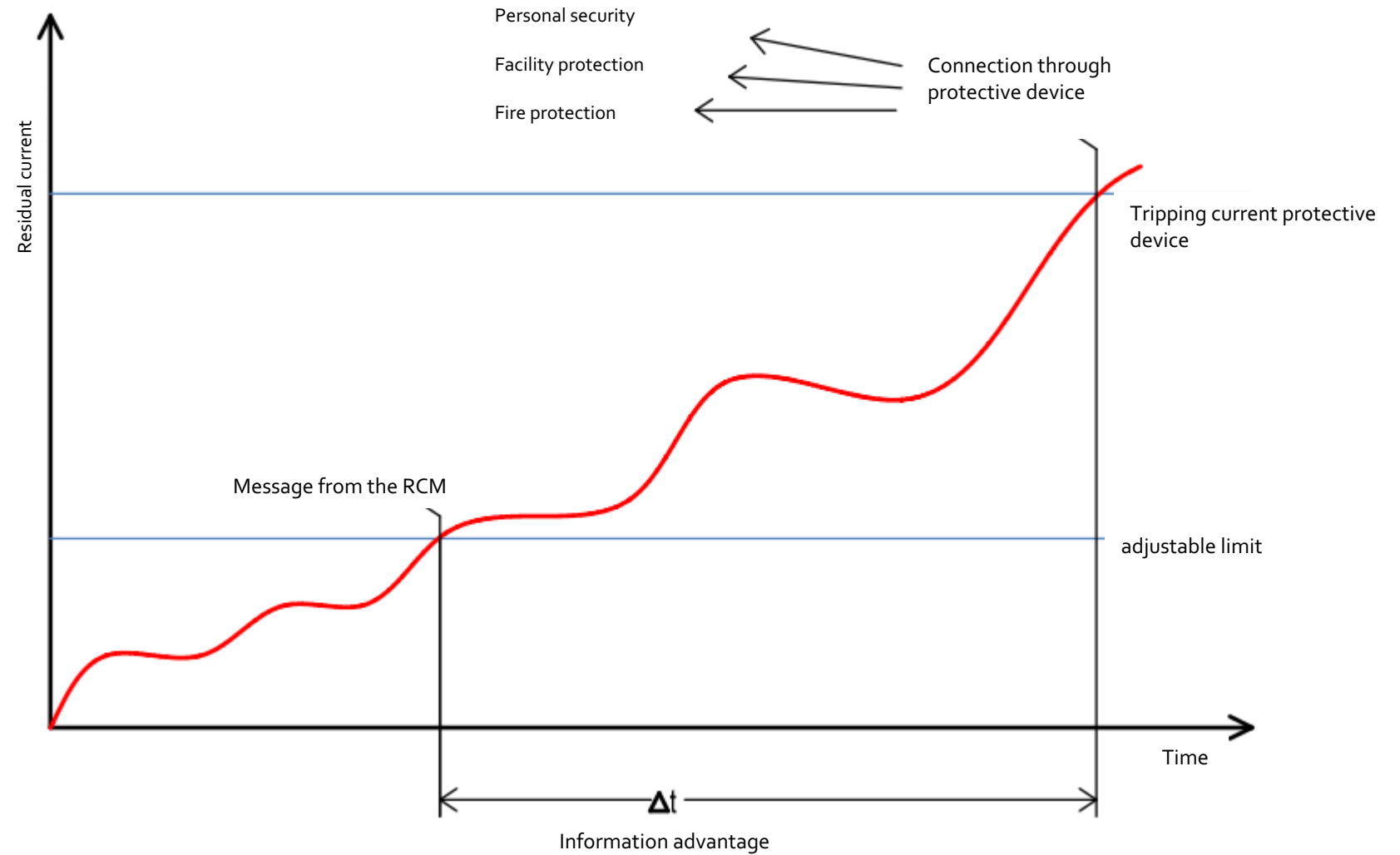


Yield

1. Cost saving
2. Efficiency
3. Resources
4. Personnel
5. Overview

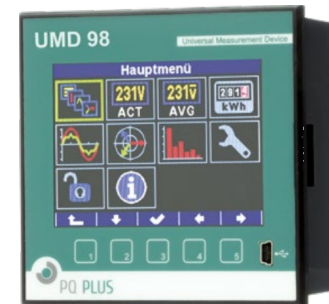
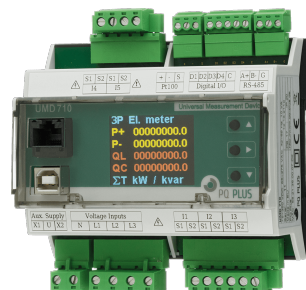
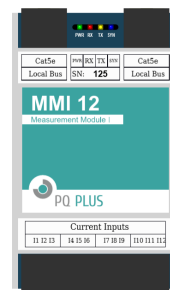
$$\blacktriangle \text{ Efficiency} = \frac{\blacktriangle \text{ Benefit}}{\blacktriangledown \text{ Effort}}$$

From reacting to acting



UMD- universal measurement device

- Door installation
- Top-hat rail
- Sampling rate up to 28.8 kHz
- 128. harmonics
- RCM measurement
- Large data memory



Differential current

Overview RCM units

	RCM channels	Type A	Type B	Max. Residual current
UMD 98	2 (1)	x	x	28.000 mA
UMD 913G	2	x	x	28.000 mA
UMD 701RCM	8	x	-	3.000 mA
UMD 707RCM	5	x	-	28.000 mA
UMD 709	1	x	-	28.000 mA
UMD 710	1	x	-	28.000 mA

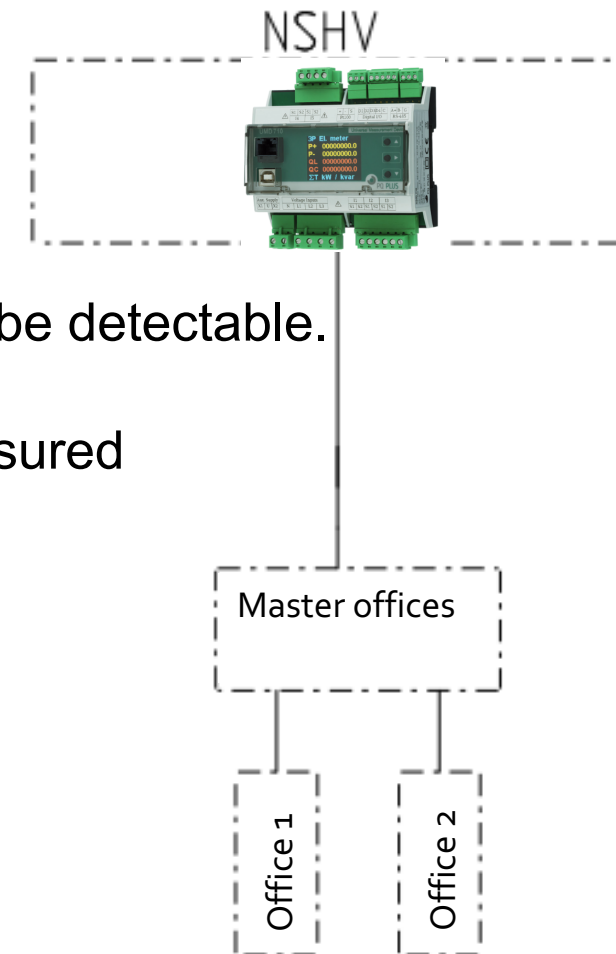
Targets are:

- Record energy data
- Increase fire protection
- Analyse power quality

Example storey distributor AV/SV:

In order to increase fire protection fault currents of up to 3000 mA should be detectable.

The actual fault current should be measured or estimated beforehand!



How high are leakage currents in the "normal state"?

Leakage currents are approx. 0.1 % - 0.5 % of the operating current.

They can be estimated or measured.

Example:

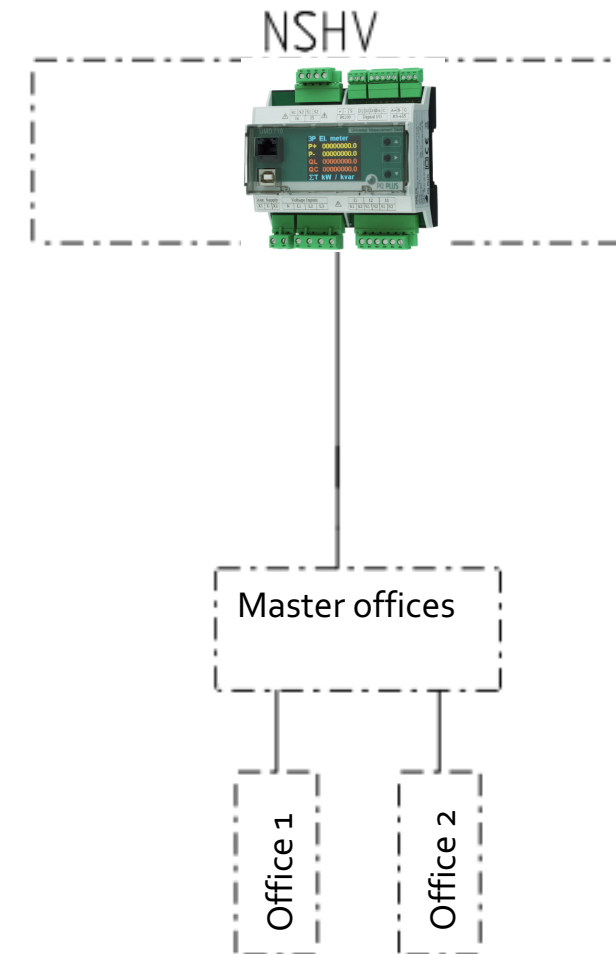
In the NSHV, the sub-distribution of the offices is fused with 63 A.

Calculation:

$63 \text{ A} \times 0.1\% = 63 \text{ mA}$ leakage current

Measurement:

120 mA

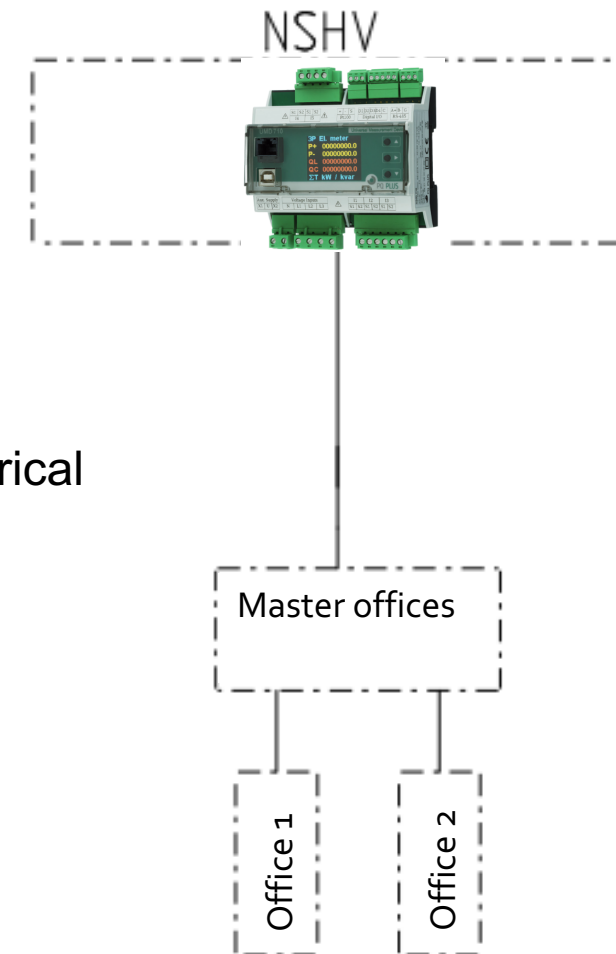


How high are leakage currents in the "normal state"?

Since the measured leakage current is 120 mA one measurement in the NSHV is sufficient.

Solution:

With the UMD 709/ 710, in addition to the leakage current as well as all common electrical and can be integrated into a control system via Ethernet.



Measurement in the outlets

Targets:

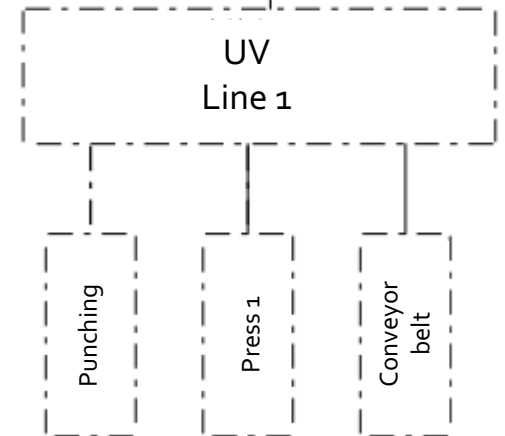
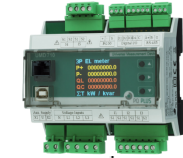
- Elimination of insulation resistance measurement
- Monitoring of power quality
- Recording of the total energy consumption

Estimation or measurement of the residual current

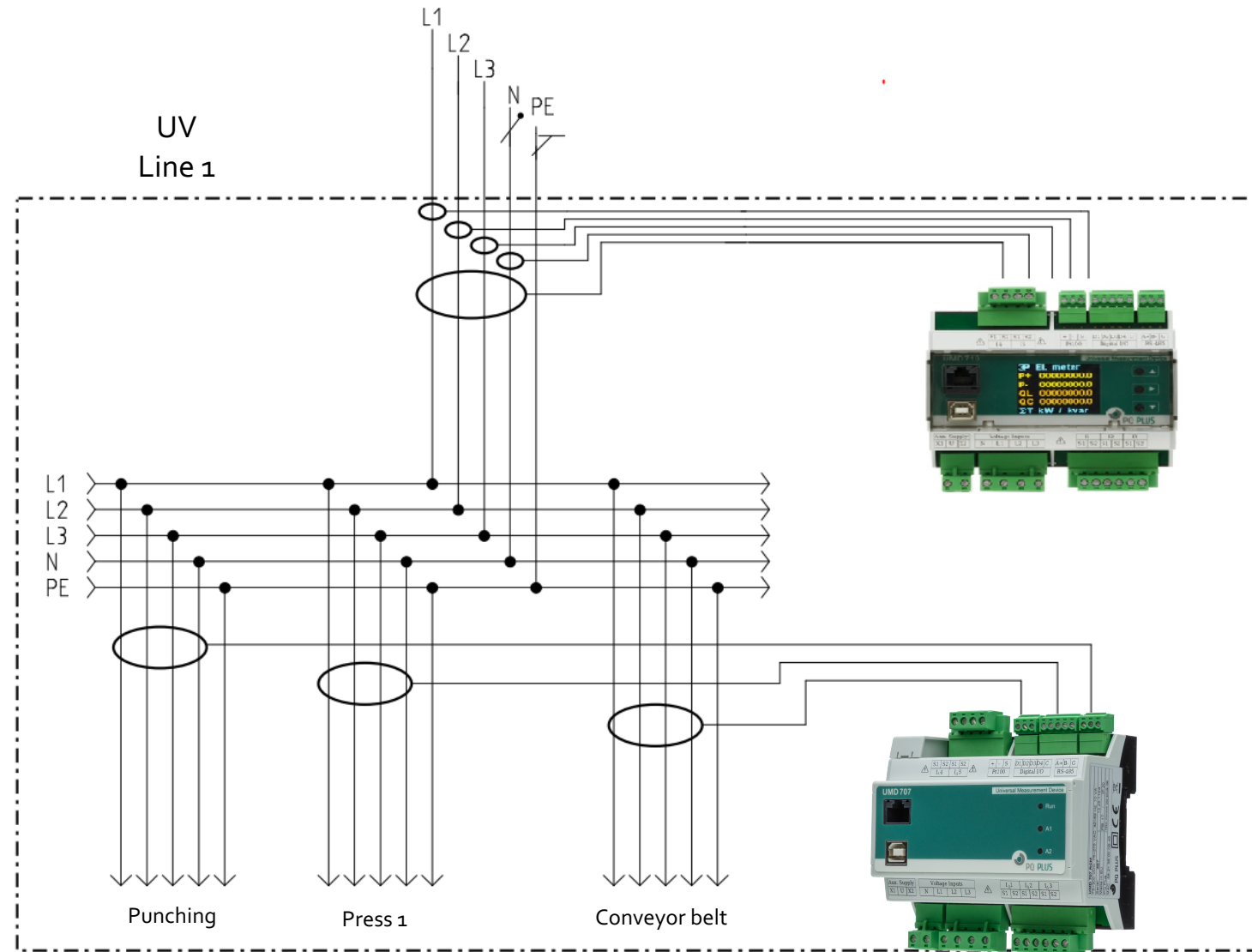
Sub-distribution line 1 is fused with 200 A.
At 0.1%, the differential current may be max. 200mA

Fault currents should be detectable in final circuits up should be detectable. In addition, a measuring accur of 5 mA is recommended.

In addition, the central earthing point should be be monitored.



Sub-distribution connection diagram



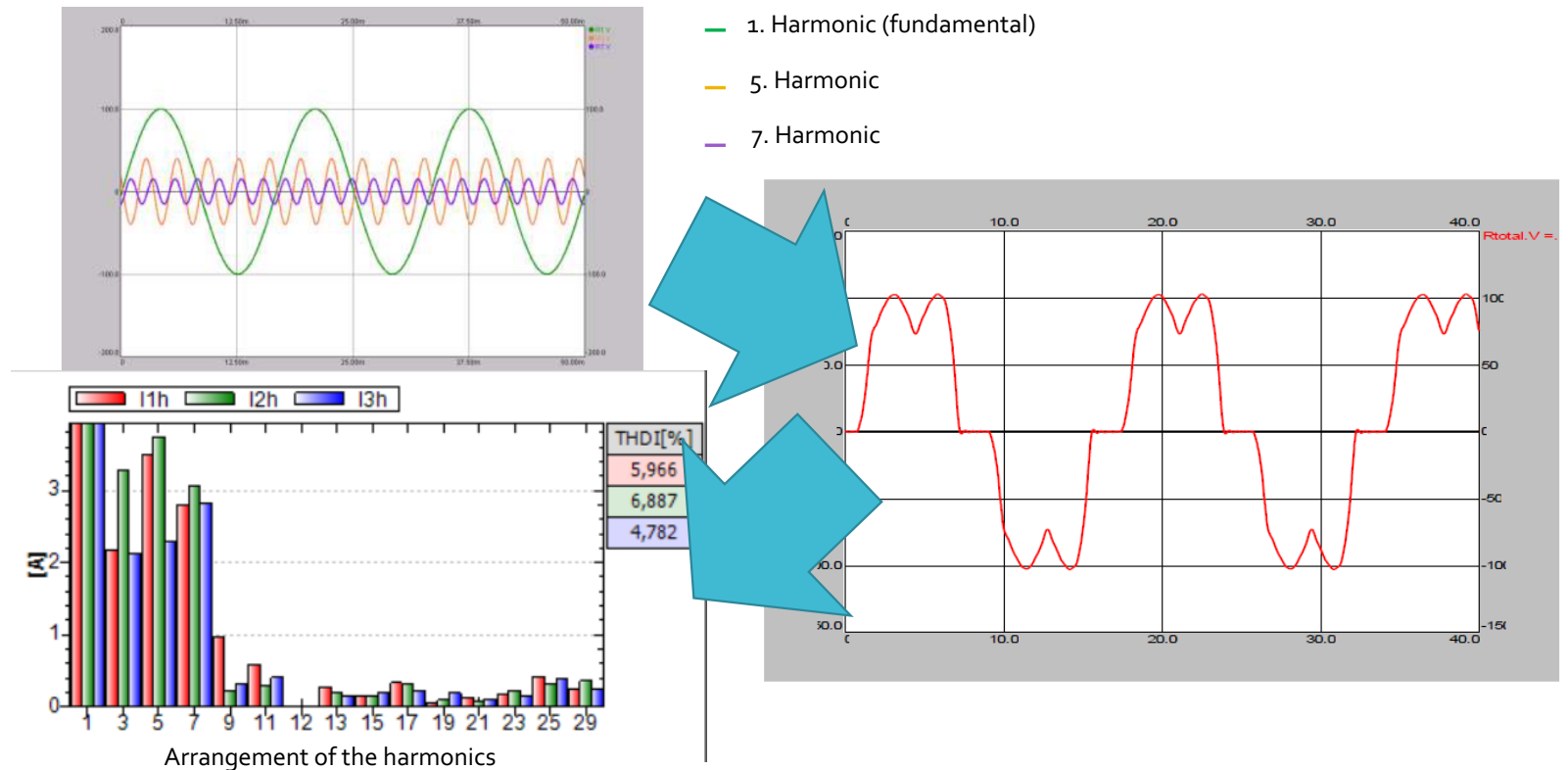
Harmonics

Harmonics Voltage THD(U) and current THD(I) occur in many devices/systems.

They can be subdivided into harmonics

They load the mains, fuses and transformers.

Components of a non-linear, periodic oscillation



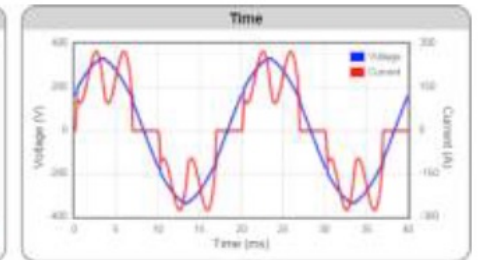
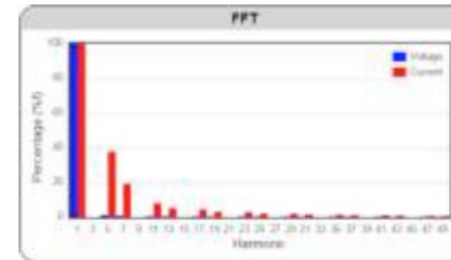
Source: PQ Plus, Schaffner GmbH

18.12.20

Causes of harmonics

Causes of harmonics different devices in the hospital environment:

- Refrigeration systems, MRT, ... (frequency converter)
- Electrical, controlled heat with phase control (thyristor controller)
- Switched-mode power supply in PCs, computers, UPS systems, ...
- Solar and wind power systems with electronic grid feed-in, ... (inverters)



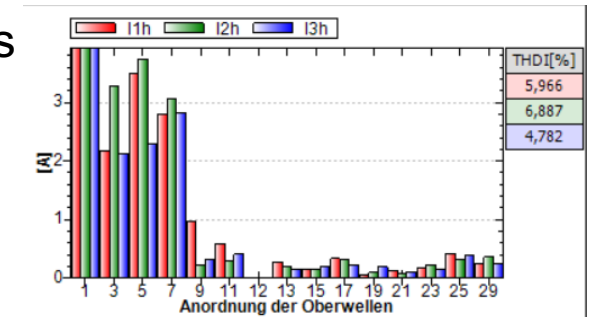
and many more

Harmonics are present in every power grid today
(public and own transformer)

Effects of harmonics

Effects:

- Higher load on transformers and emergency power generators
-> Increased costs
- Heating of cables and lines -> Increase in fire hazard
- High current on the N conductor (3 harmonics) -> Fire hazard
- Incorrect tripping of circuit breakers and fuses
-> Operational failures
- Malfunctions of devices and systems
-> Operational failures and possibly incorrect diagnoses



Harmonics reduce operational safety and increase maintenance and operating costs!

Important standards in the field of harmonics:

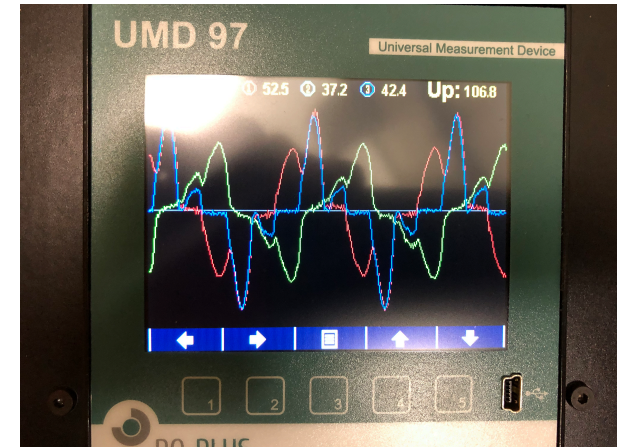
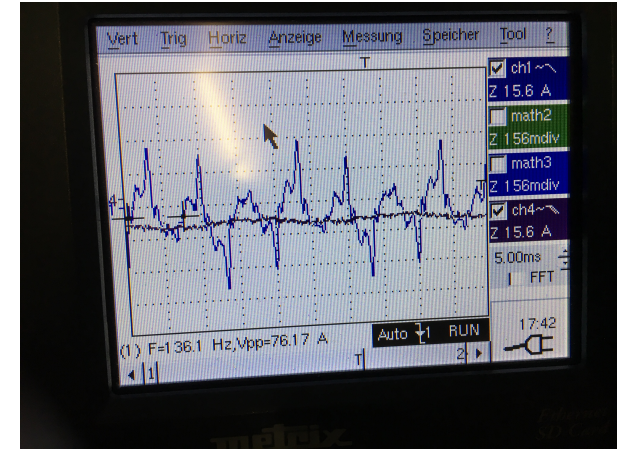
- Network operator EN50160
- Public network: EN61000-2-2, EN61000-3-2/12
- Non-public grid EN61000-2-4 – hospital class 1 - max. 6% THD(U)
- Different standards in the area of power supply such as AR-N-4110

Measures against harmonics

Filter measures against harmonics

- Passive filtering through choking:
 - > Reduction of current harmonics up to 5%
- Active filtration: "counterflow" to pollution
 - > *Reduction of current/voltage harmonics down to 0%*

Also effective against EMC and Cos phi



Filtering measures should be taken for THD(U) values higher 6%, 8%, 10% (EN61000-2-4 - own transformer and/or THD(I) values in the mains of 20% and higher.

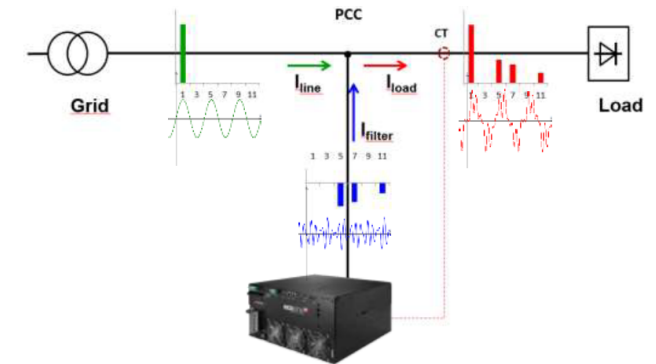
Measures against harmonics

Filter measures against harmonics

- Passive filtering through throttling:



- Active filtration: "counterflow" to pollution



Filter measures cost money but also bring money!
Important space requirement!

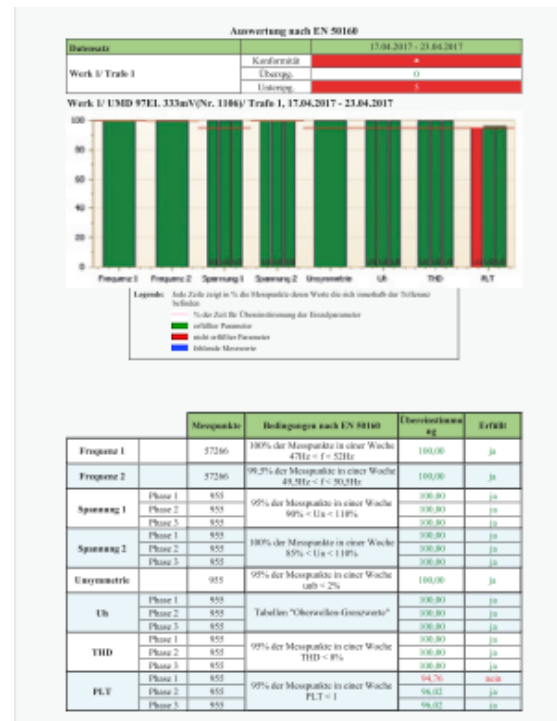
FW modules Power quality

PQ S / PQ A:

Acquisition and evaluation of measured values according to EN 50160 or EN 61000-2-2, EN 61000-2-4, EN 61000-2-12.

Flicker, voltage dips and harmonics

Weekly evaluation in a PQ archive



PQ - Spannungseinbrüche

U<%	0.2	0.5	1	5	60s
90					
80					
70					
40					
5					

U>%	0.5	5	60s	löschen
120	4			06.03.17
110	1			17:54:39

PQ - EN 50160 Woche

	Mo	Di	Mi	Do	Fr	Sa	So
03.04.	✓	✓	✓	✓			
27.03.	✓	✓	✓	✓	✓	✓	✓
20.03.					✓	✓	✓

PQ Hauptarchiv (alle abgespeicherten Reihen)

entspre...	Woche	f	U	Uns...	THD	Oberwellen	Flicker Pt
kein	06.04.2016	100	99,8	99,8	100	100	94,0
ja	11.04.2016	100	100	100	100	100	100
ja	18.04.2016	100	100	100	100	100	100
ja	25.04.2016	100	100	100	100	100	100
ja	02.05.2016	100	100	99,9	99,9	100	100
ja	09.05.2016	100	100	100	100	100	100
ja	17.05.2016	100	100	100	100	100	100

Spannungsereignisse (alle abgespeicherten Reihen)

spannung [%]	10ms<ts<200ms	200ms<ts<500ms	500ms<ts<1s	1s<ts<5s	5s<ts<60s	None
u<120	4	0	0	0	0	0
120<u<110	0	0	0	0	0	0
90<u<80	2	0	0	0	0	0
80<u<70	1	0	0	0	0	0
70<u<40	Letzte Ereignisse: 0 Samstag, 21. Mai 2016 20:21:08					
40<u<25	0 Dienstag, 10. Mai 2016 19:06:17					
5>u	0	0	0	0	0	0

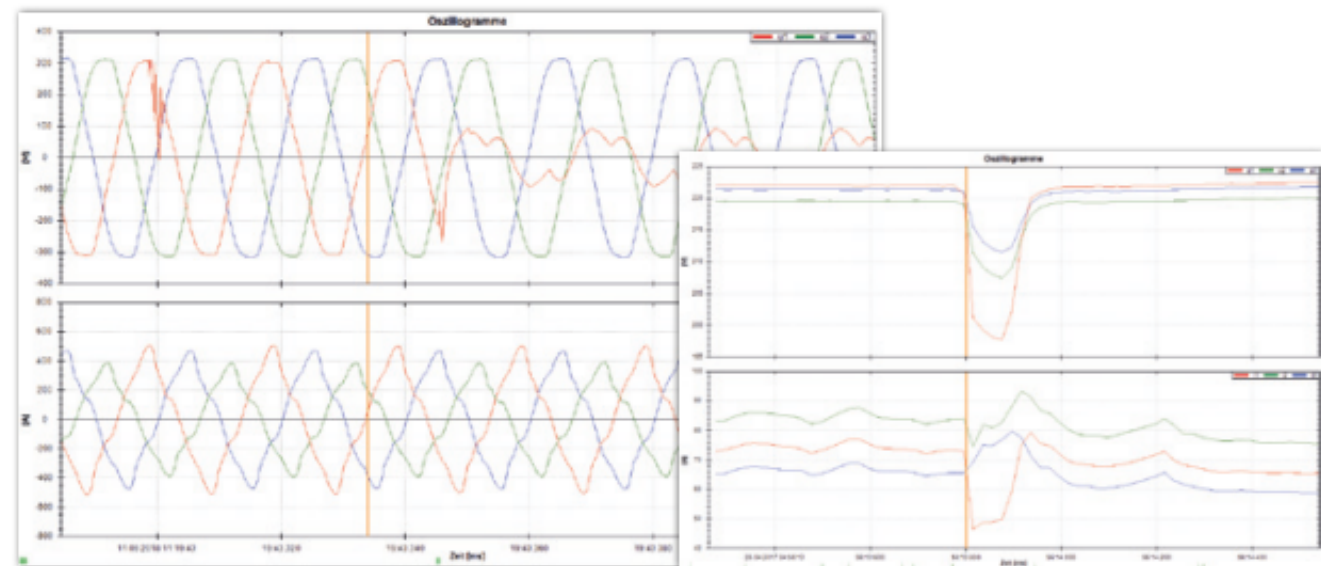
FW module GO (General Oscillogram)

GO:

Captures and accurately records various signal distortions and transient events

Records oscillograms of voltages and currents with extended details (up to 288 samples per period) and trigger options in high resolution in memory

Stored data is processed in ENVIS or provided in .xls or .csv files for processing in any software.



Communication

- Modbus TCP
- Modbus RTU
- SNMP
- SQL database
- M-Bus



Alarms

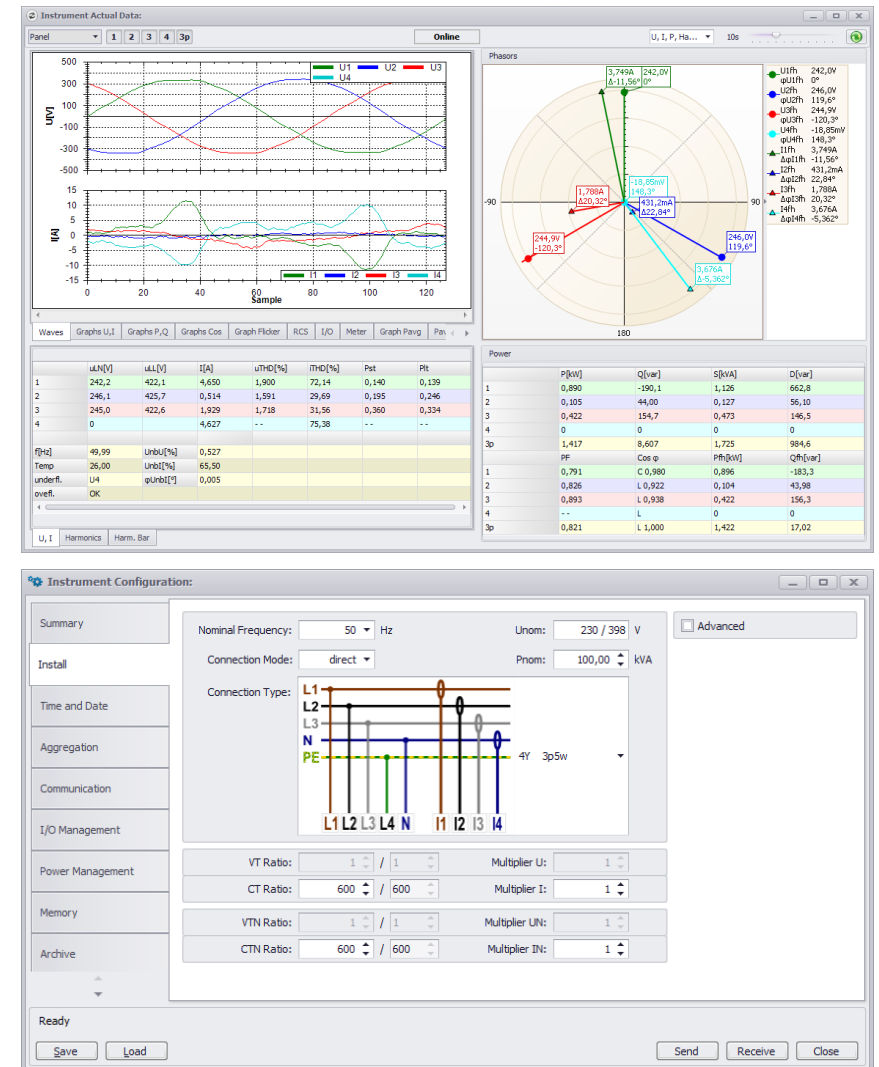
- Message from the device
- Message from the system
- E-mail
- Warning signals
- Collective message

ON	Ircm1	+	⇒	EMAIL	+
ON	Ircm2	+	⇒	EMAIL	+

ENVIS - Applications ENVIS.DAQ



- Configuration
- Live data
- Memory



ENVIS - Applications ENVIS



- Visualisation
- Evaluation
- Compare

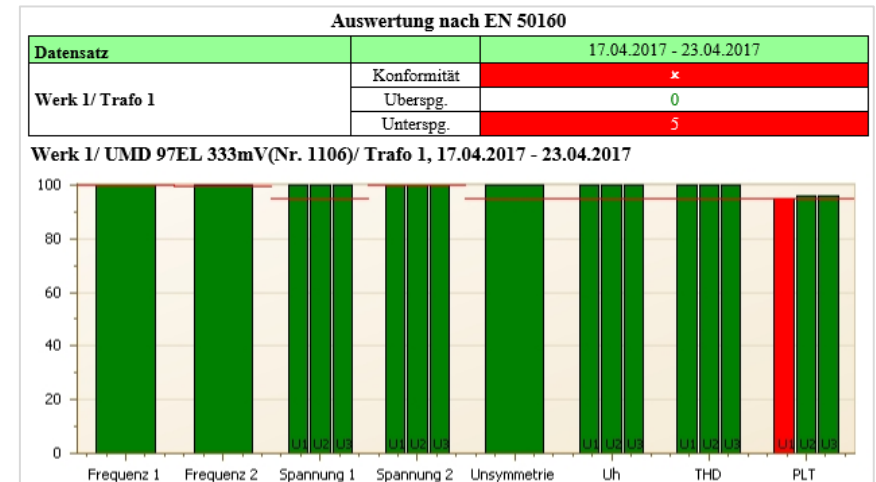
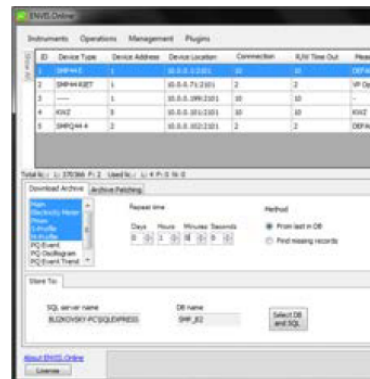


ENVIS - Applications

ENVIS.Online



- Automation
- Alerting
- Reporting



		Messbeispiele	Erfüllung der Bedingung aus EN 50160	Konformitätsgrad	Übereinstimmen
Frequenz 1		21544	100% of Beispiele in einem Woche 47Hz < f < 52Hz	100,00	ja
Frequenz 2		21544	99,5% of Beispiele in einem Woche 49,5Hz < f < 50,5Hz	100,00	ja
Spannung 1	Phase 1	361	95% of Beispiele in einem Woche 90% < Un < 110%	100,00	ja
	Phase 2	361		100,00	ja
	Phase 3	361		100,00	ja
Spannung 2	Phase 1	361	100% of Beispiele in einem Woche 85% < Un < 110%	100,00	ja
	Phase 2	361		100,00	ja
	Phase 3	361		100,00	ja
Unsymmetrie		361	95% of Beispiele in einem Woche unb < 2%	100,00	ja
Oberwellenspannung	Phase 1	361	Tabellen 'Individual harmonic limits'	100,00	ja
	Phase 2	361		100,00	ja
	Phase 3	361		100,00	ja
THD	Phase 1	361	95% of Beispiele in einem Woche THD < 8%	100,00	ja
	Phase 2	361		100,00	ja
	Phase 3	361		100,00	ja
PLT	Phase 1	361	95% of Beispiele in einem Woche PLT < 1	90,30	kein
	Phase 2	361		90,30	kein
	Phase 3	361		90,30	kein

ENVIS - Applications

ENVIS Web

- Eligible for 50001
- Update service
- Manufacturer-independent
- User management
- Data import/export
- Modbus / M-Bus
- KPI's



ENVIS - Applications

ENVIS Web

- Alarm management
- Reporting
- Sankey diagram
- Load profile analysis
- E-mail dispatch
- Consumption and cost overview
- Manual data collection



Accessories

MMD 97

- Mobile measuring case
- Rogowski coils
- IP 65
- < 2 kg
- EN 50160
- 512 MB memory



UKSH – Kiel- Lübeck



UKSH – Kiel-Lübeck



Topology

PV

110 kV

110 kV

20 kV

20 kV

WKA

0,4 kV

0,4 kV

Modbus
TCP

Modbus
TCP

Modbus
TCP

Modbus
TCP

Modbus RTU

Modbus RTU

Excursus: Measuring energy

Different measurement concepts:

- **Energy Fairs „Management“:**
No calibration/declaration of conformity of the electricity meter and the transformers necessary
- **Single calibrated measurement (billing):**
Electricity meter with MID and transformer according to declaration of conformity/calibrated (class 0.5 or better) Replacement obligation 8 years+
- **Measurement according to the Energy Collection Act (third party quantities):**
RLM meter (15-minute load profile measurement) - Transformer according to declaration of conformity/calibrated Replacement obligation 8 years+

It is essential to consult with the auditor in advance:
-> cf. presentation by ENOPLAN

QUESTIONS?

Thank you for your attention