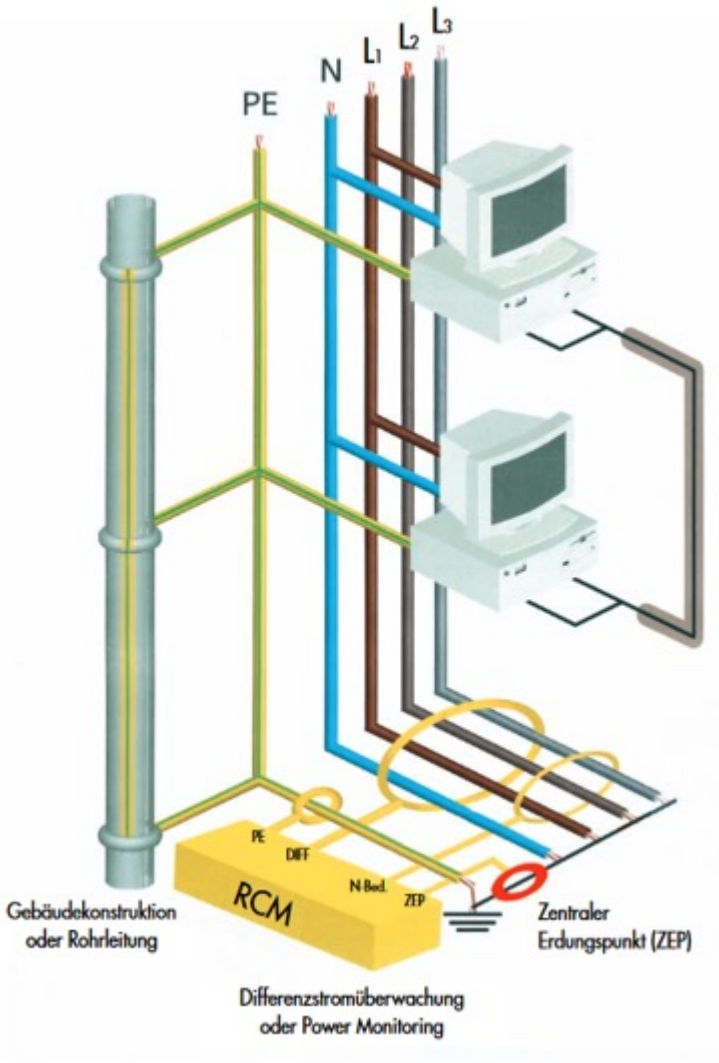
Universal measuring devices

Preventive maintenance tools

UMD measuring instruments measure and log

- Energy consumption in 1-phase or 3-phase operation in 4 quadrant operation
- Voltage quality according to EN 50160; EN 61000 -2-2; EN 61000-2-4;EN 61000-2-12
- for e.g. transients, flicker, harmonics up to the 128th harmonic
- RCM fault currents type A ; A+; B

Residual Current Monitoring



DGUV Regulation 3

§ 5 Examinations

(1) The entrepreneur shall ensure that the electrical installations and equipment are checked for their proper condition

1. before initial commissioning and after modification or repair before recommissioning by a qualified electrician or under the direction and supervision of a qualified electrician and

2. at certain intervals.

DGUV Regulation 3

Table 1A

Anlage / Betriebsmittel	Prüffrist	Art der Prüfung	Prüfer
Elektrische Anlagen und ortsfeste elektrische Betriebsmittel	4 Jahre	auf ordnungs-gemäßen Zu-stand	Elektrofachkraft
Schutzmaßnahmen mit Fehlerstrom-Schutzein-richtungen in nicht statio-nären Anlagen	1 Monat	auf Wirksamkeit	Elektrofachkraft oder elektro-technisch unter-wiesene Person bei Verwendung geeigneter Mess- und Prüfgeräte
Fehlerstrom-, Differenzstrom- und Fehlerspannungs-Schutz-schalter – in stationären Anlagen – in nicht stationären Anlagen	 6 Monate arbeitstäglich	auf einwandfreie Funktion durch Betätigen der Prüfeinrichtung	Benutzer

Testing of electrical systems

Visit

- Protective measures against electric shock
- Selection of operating resources taking into account environmental influences
- …

Testing

- Low impedance of the protective conductor
- Measuring the isola-tion resistance
- …

Trade fairs

- Function of emergency stop devices
- Function of the test button of RCDs
- …

Testing of electrical systems

Trade fairs

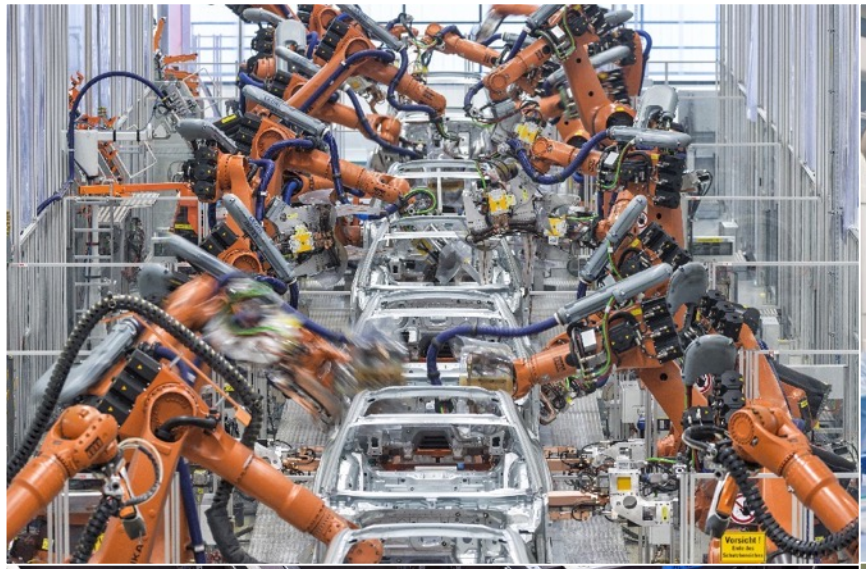
1. Continuity of the protective conductor and equipotential bonding conductor
2. Measuring the insulation resistance

Switch off!!!

3. Mains voltage measurement
4. Checking the phase sequence clockwise rotating field
5. Measurement of loop impedance/ mains impedance
6. Measurement of the residual current device

Testing of electrical systems

Switching off to test the insulation resistance is often very difficult because systems are in operation around the clock!



The solution

DGUV Regulation 3

§ 5 Examinations

The requirements are also fulfilled for stationary electrical systems and equipment, for example, if they are constantly monitored by a qualified electrician.

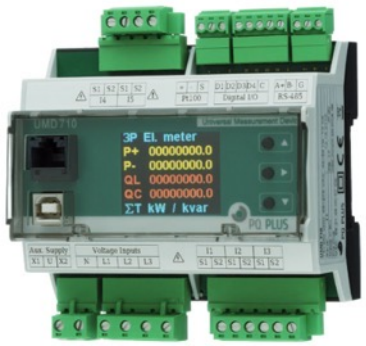
Stationary electrical installations and equipment are considered to be permanently monitored if they are continuously

- maintained by qualified electricians and
- be checked by metrological measures during operation (e.g. monitoring the insulation resistance).

VDE 0105-100/ A1:2017-06

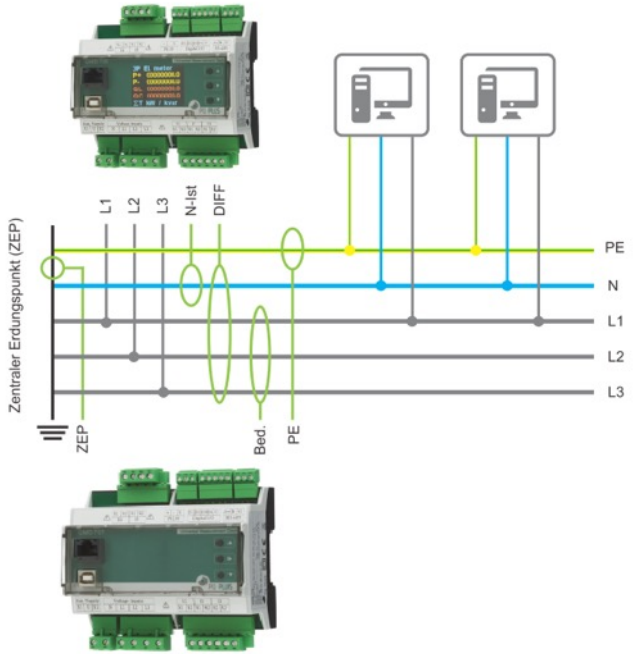
Paragraph 5.3.3.101.0.2:

"If a circuit is constantly monitored by a residual current measuring device according to DIN EN 62020 (VDE 0663)...and this monitoring device functions properly, the measurement of the insulation resistance can be dispensed with."



Continuous residual current measurement

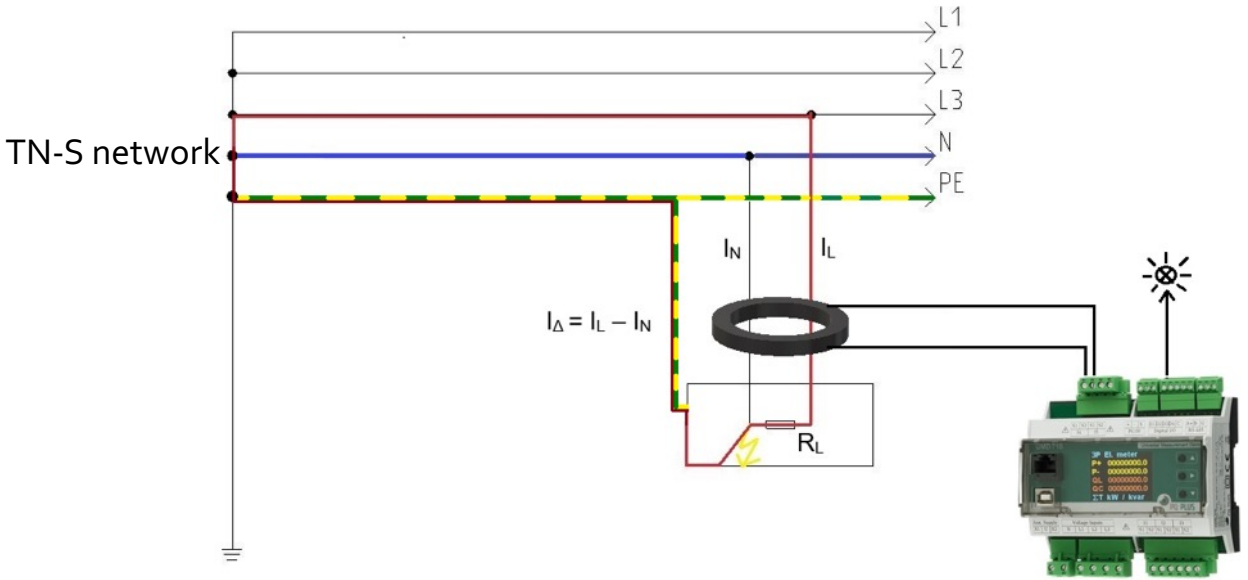
Current standards have also recognised that a "classic" insulation resistance measurement is no longer appropriate in this day and age. Therefore, continuous residual current measurements have changed all relevant standards in such a way that the insulation resistance measurement is permitted as a substitute!



RCM principle

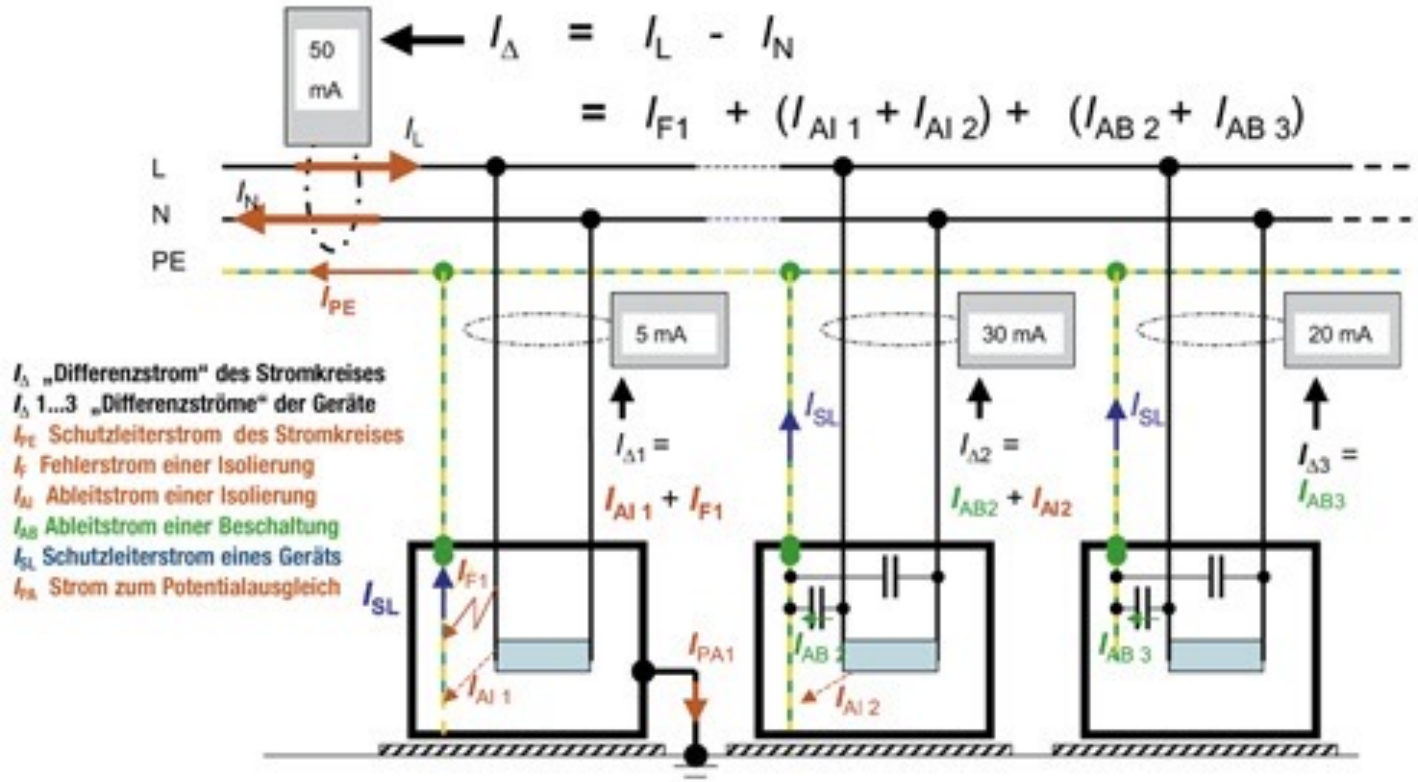
Definition differential current

"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 of a circuit in an electrical installation." (DIN VDE 0100-200).



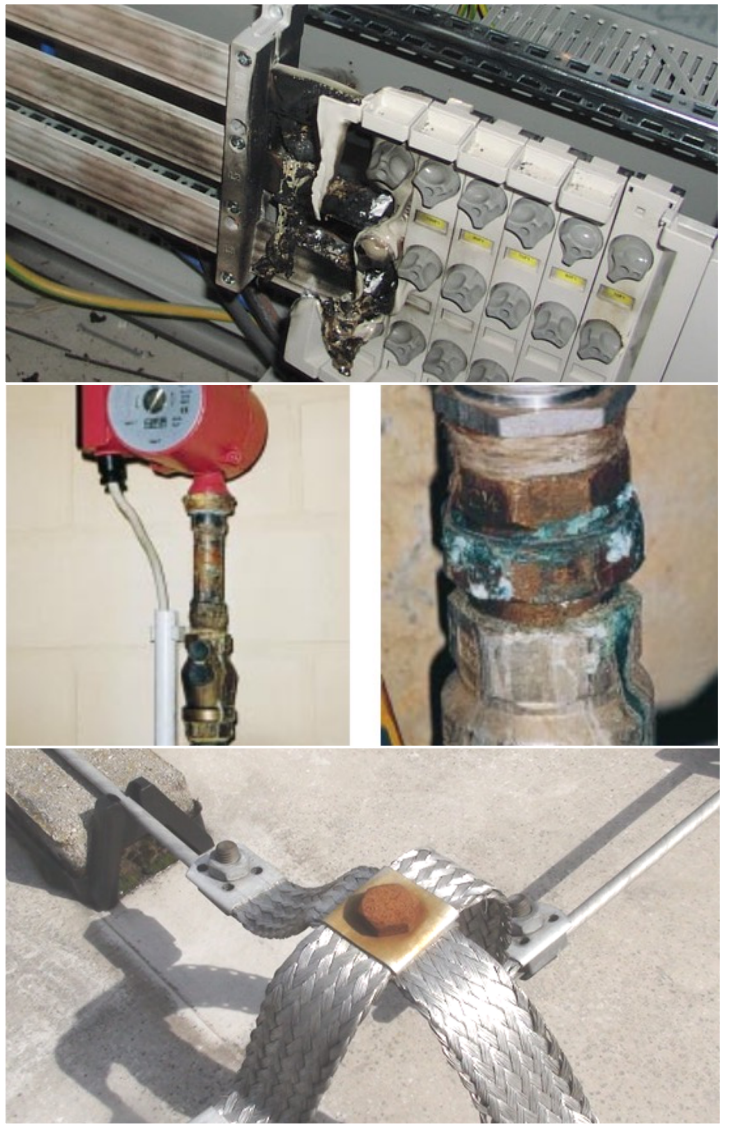
Origin of fault current

Internal circuits of electrical equipment cause leakage currents.



Effects of differential currents

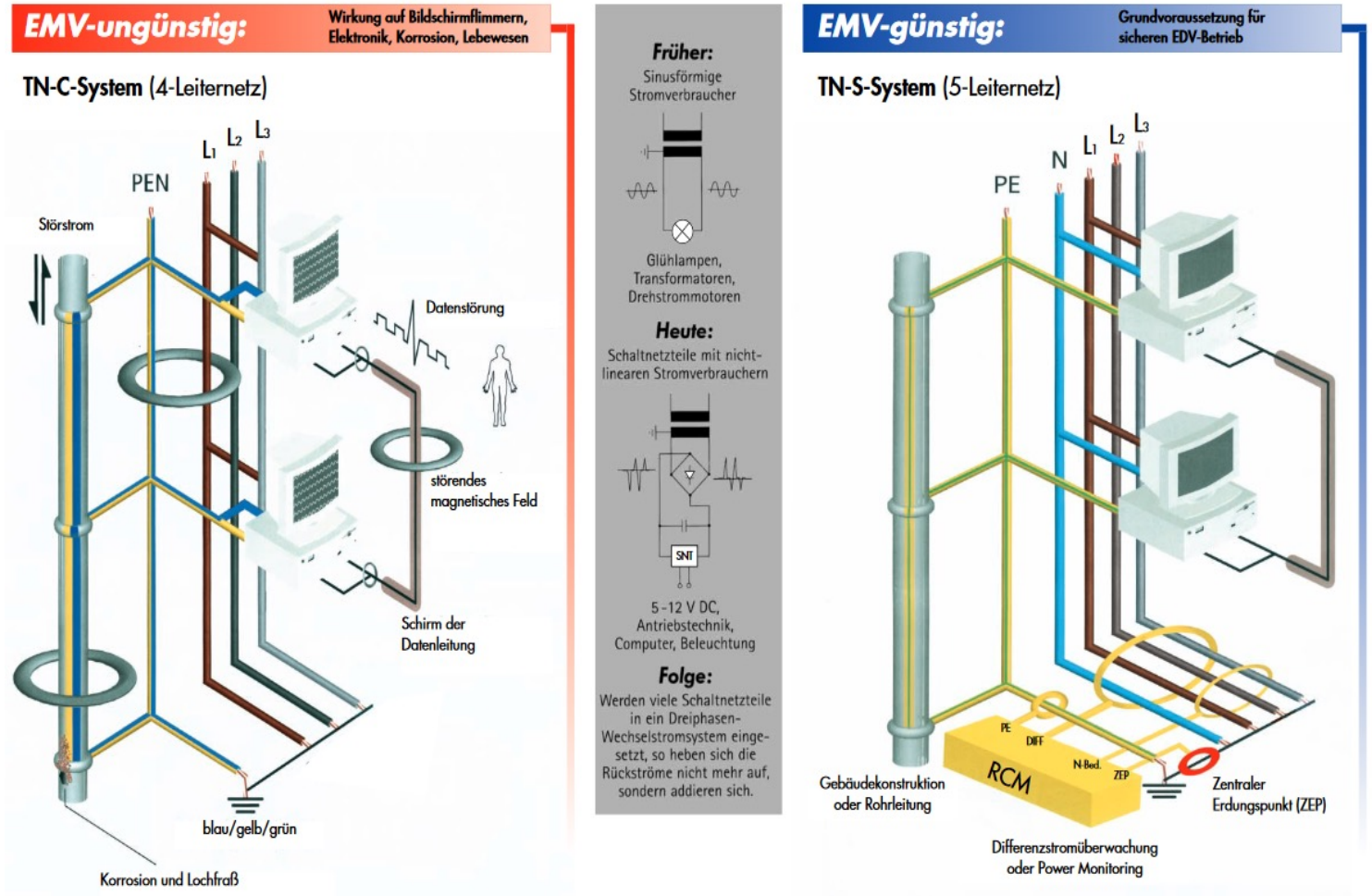
- Fire damage
- Electrocorrosion
- Unintentional service interruptions
- Malfunctions in plants
- EDP crashes
- Influencing protective devices
- Interference with data transmissions
- Hum



Precondition RCM

A TNS system is absolutely necessary for residual current measurement!

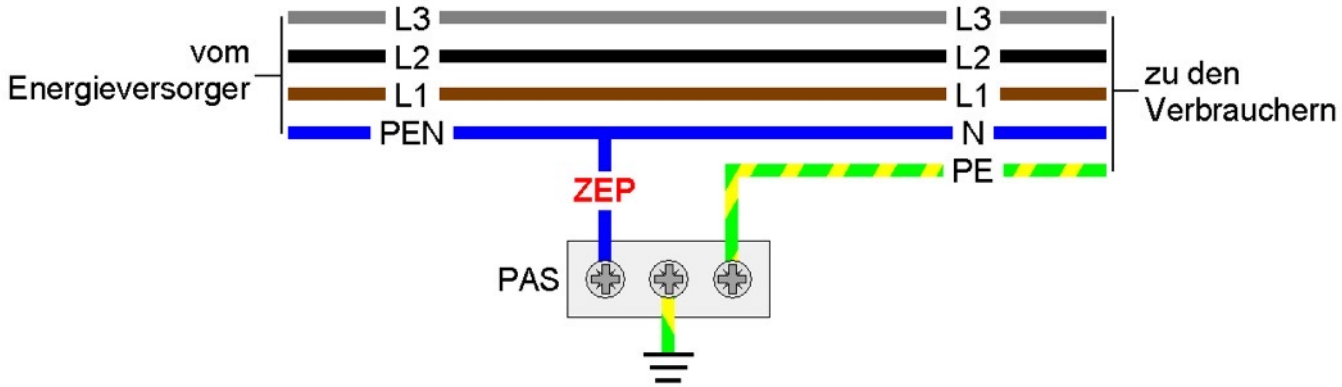
This means separating the neutral conductor from the protective conductor!



TNS network

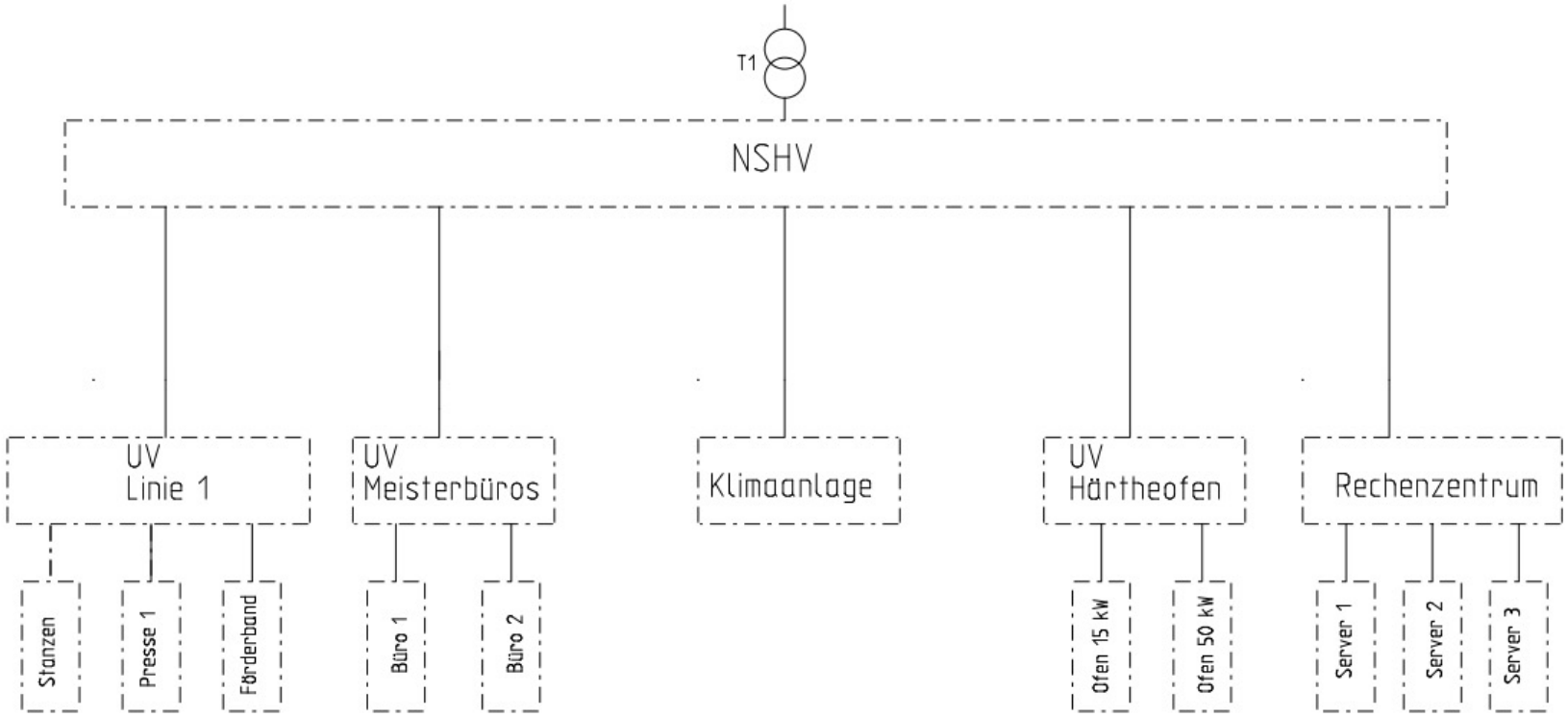
VDE 0100-444 part 444.4.3.2 also prescribes the following:

"Installations in newly constructed buildings must be erected as a TN-S system from the feed-in. In existing buildings that contain or are likely to contain significant information technology equipment and that are supplied from a public low-voltage network, a TN-S system should be erected from the start of the installation system."



Creation of a measurement concept

Analysis
The plant



Objective

The desired objectives should be defined before a measuring point concept is drawn up.

Possible targets are:

- Increased fire protection
- Increase plant availability
- Replacement of insulation resistance measurement by residual current measurement
- Energy data collection (ISO 50001)
- Power quality analysis
- Increase personal protection

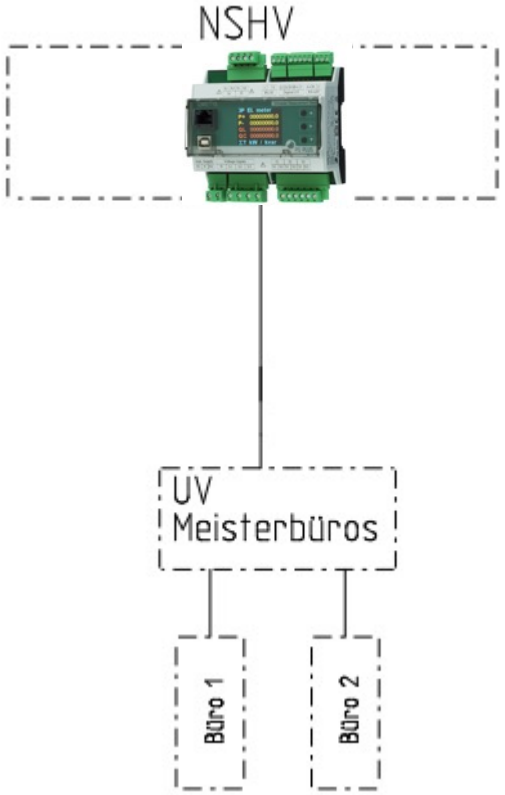
Example UV Master Office

Goals are:

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

To increase fire protection, fault currents of up to 300 mA are to be detectable.

The actual fault current should be measured or estimated beforehand!



Correct assessment of leakage currents

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

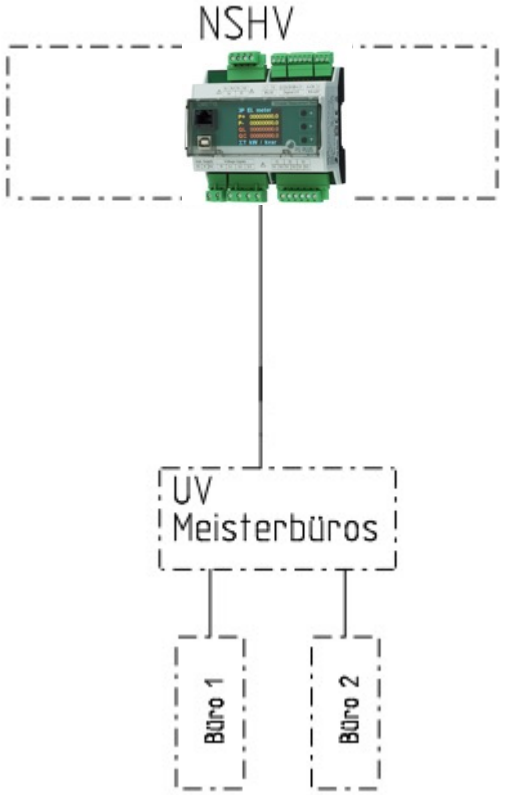
Leakage currents are approx. 0.1 % - 0.5 % of the operating current.

They can be estimated or measured.

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

Calculation:
63 A x 0.1% = 63 mA leakage current

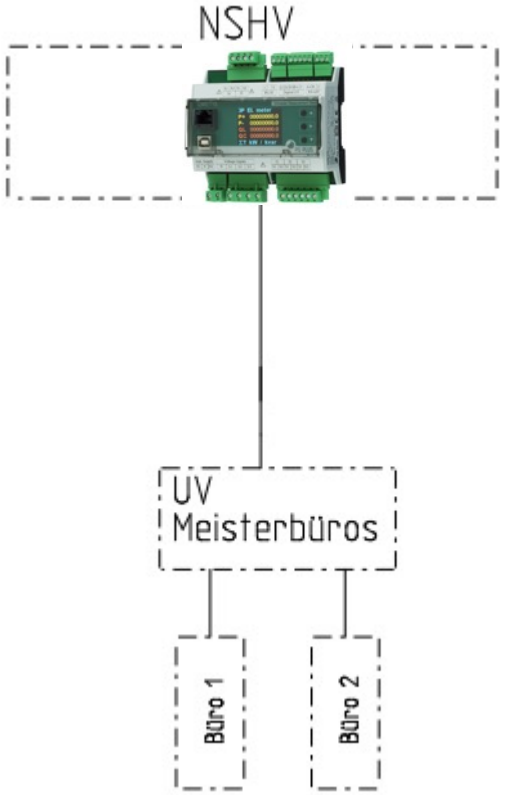
Measurement:
120 mA



Solution

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

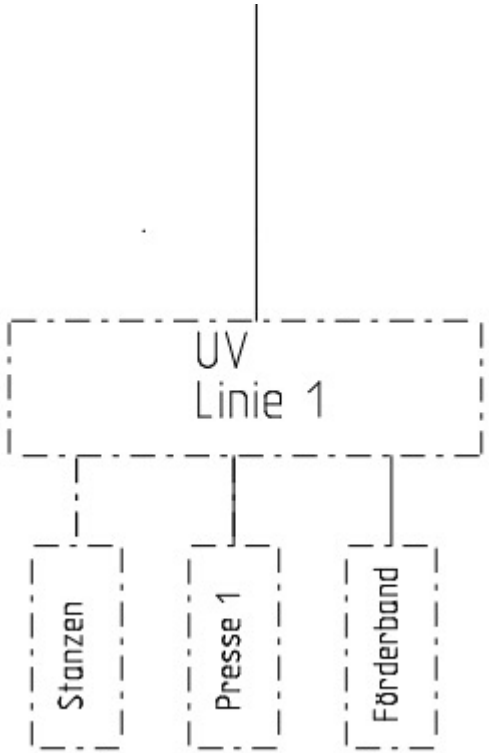
In addition to leakage current, the UMD 709/ 710 can also be used to record all common electrical variables and integrate them into a control system via Ethernet!



Measurement production lines

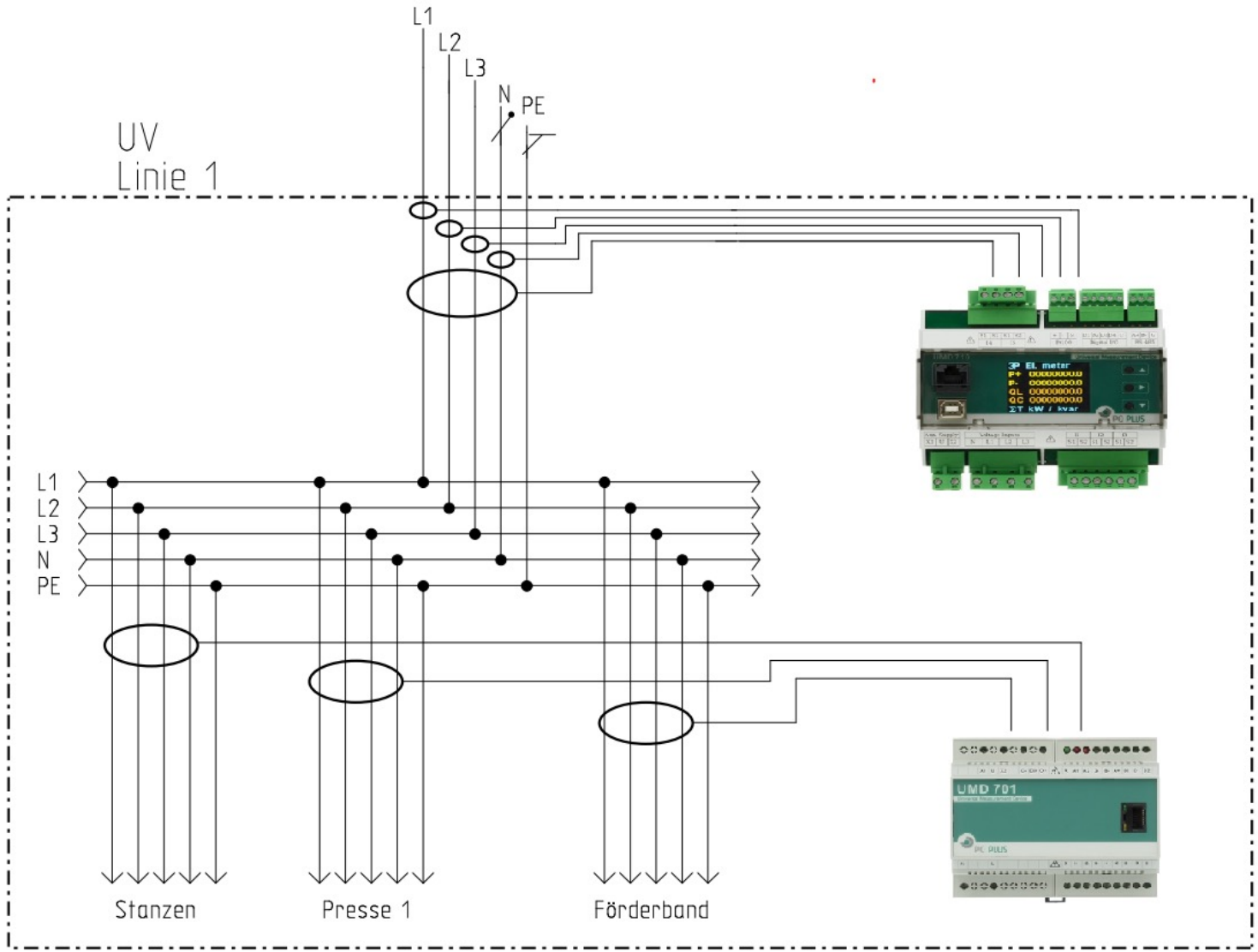
1. The aim is to eliminate the insulation resistance measurement and to record the total energy consumption.
2. Estimation or measurement of the differential current

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



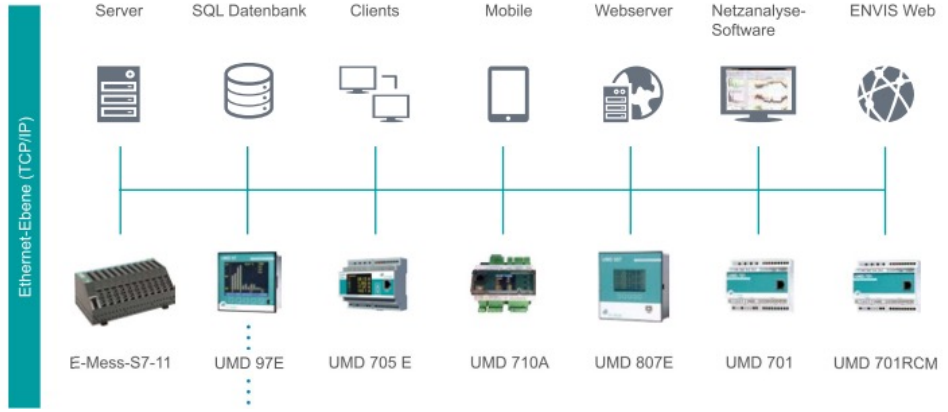
- Fault currents in end circuits should be be detectable up to 30 mA. In addition, a measuring accuracy of 5 mA is recommended.
- In addition, the central earthing point should also be monitored.

Measurement production lines

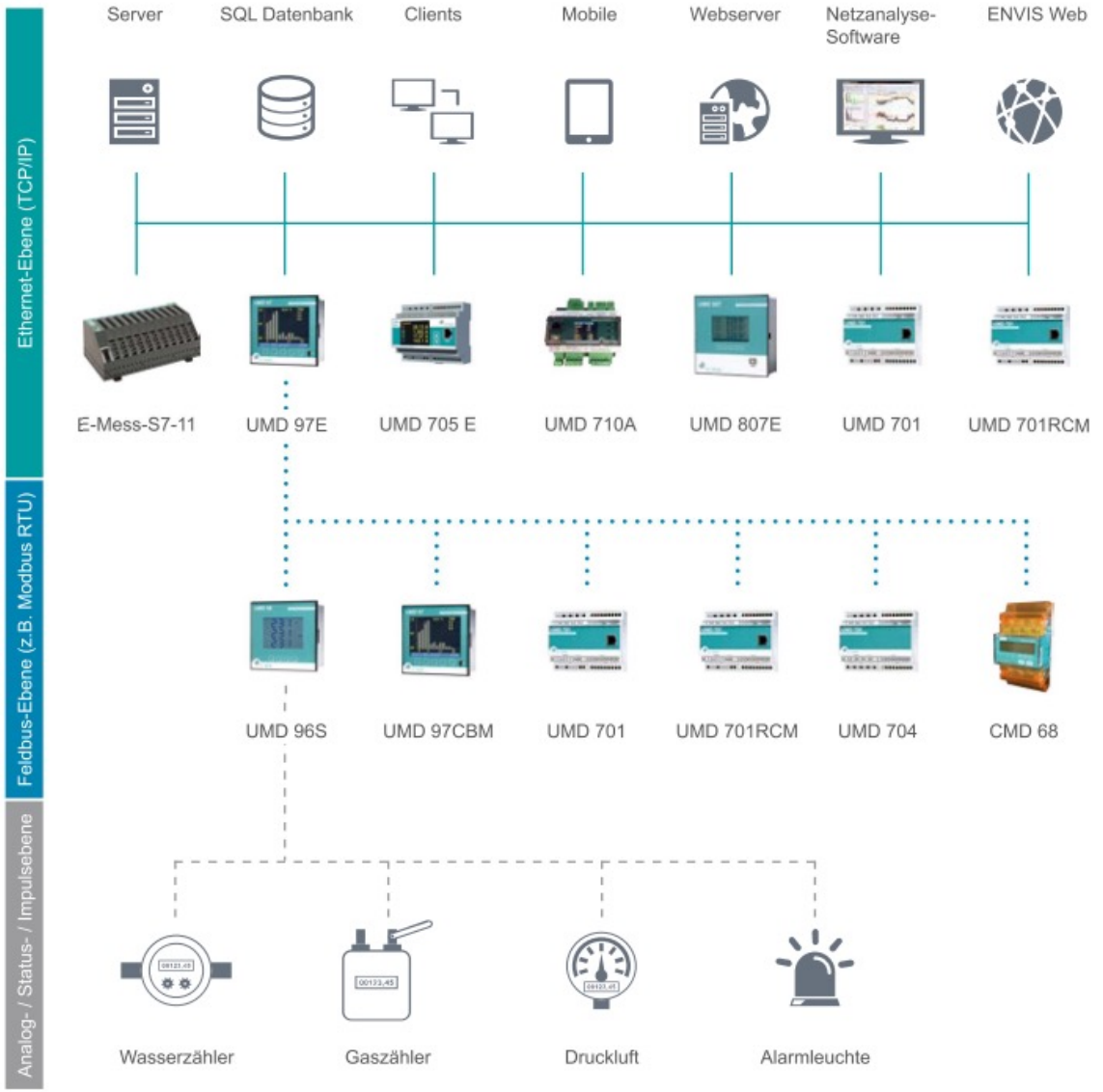


Documentation

- The measurement data can be integrated into an existing control system via Ethernet or archived and evaluated with the free ENVIS software and an SQL database.
- It is also possible to create reports with all desired data (energy data, fault currents, power quality) and to receive them automatically by e-mail.
- In addition, the I/O management of the measuring devices can be used to monitor limit values and states.
- In the event of an exceedance, for example, an e-mail can be sent as an alarm and an indicator light can be activated via the outputs of the units.

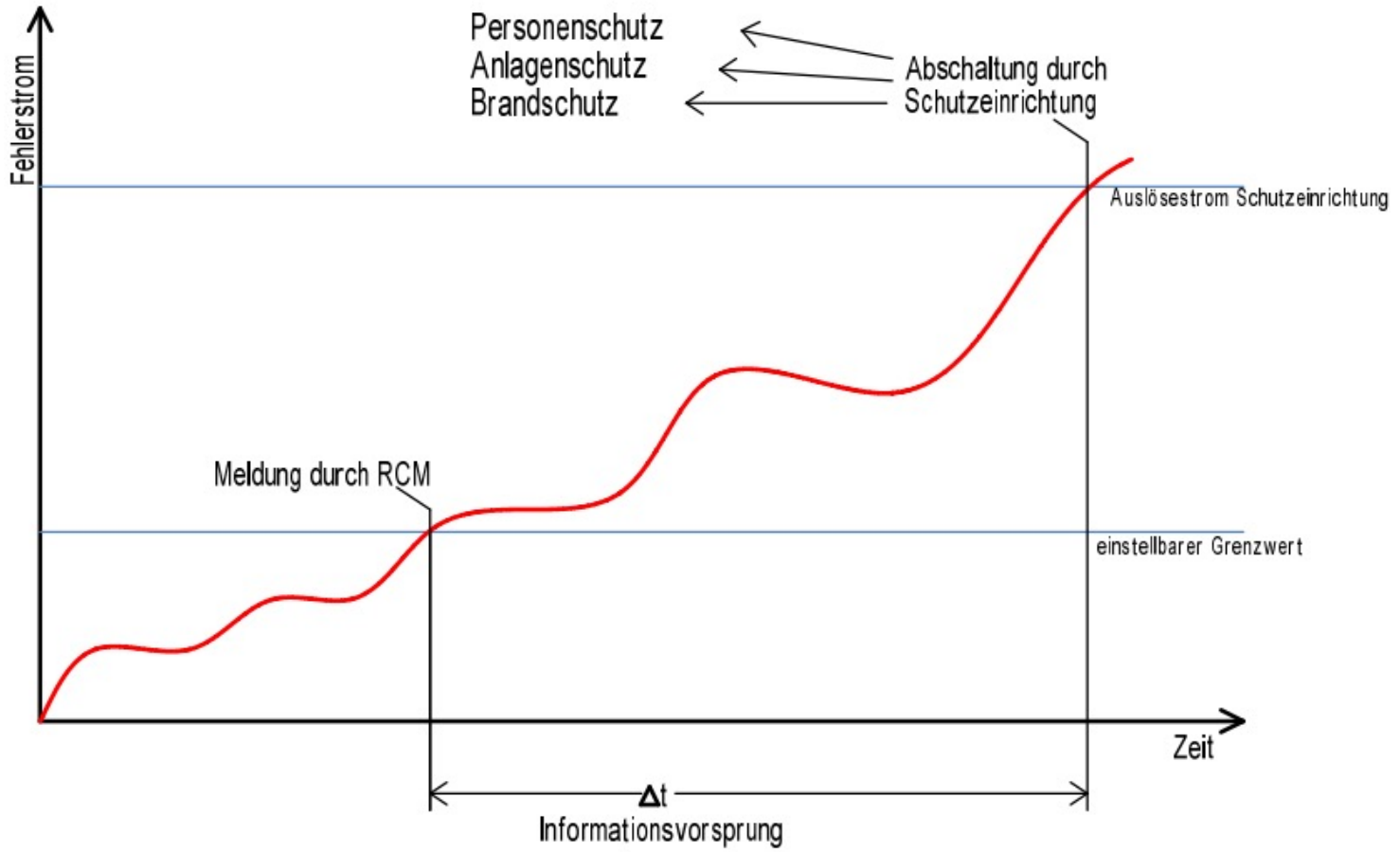


Documentation



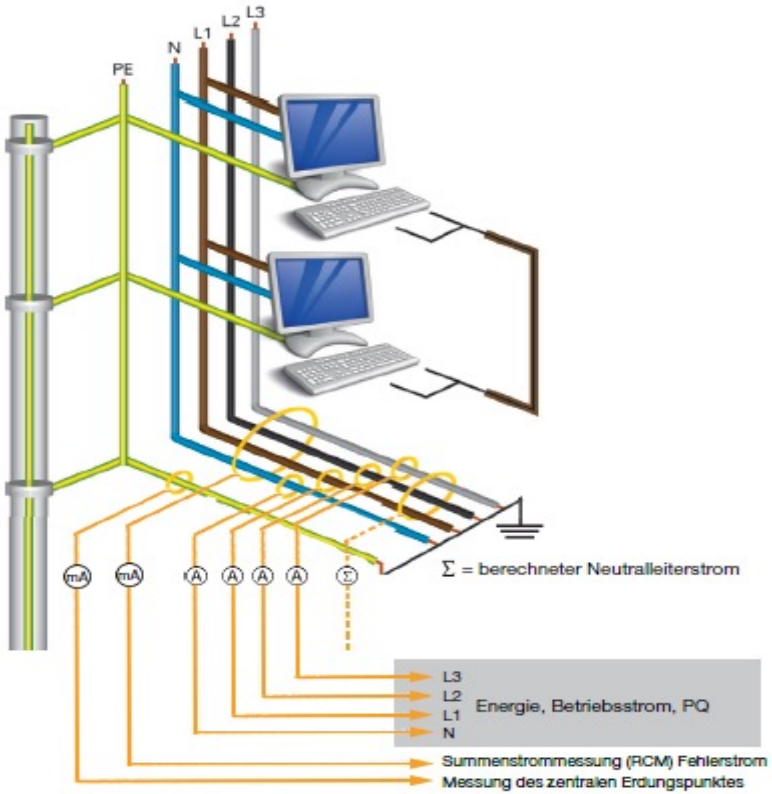
The advantages

The advantages



The advantages

- Detect faults (e.g. of the insulation) at an early stage
- Increase plant availability
- Capture energy data (ISO 50001)
- Preventive maintenance tool
- Elimination of disconnection for insulation resistance measurement
- Information advantage
- Cost saving
- Time saving
- Continuous measurement
- Increasing personal protection



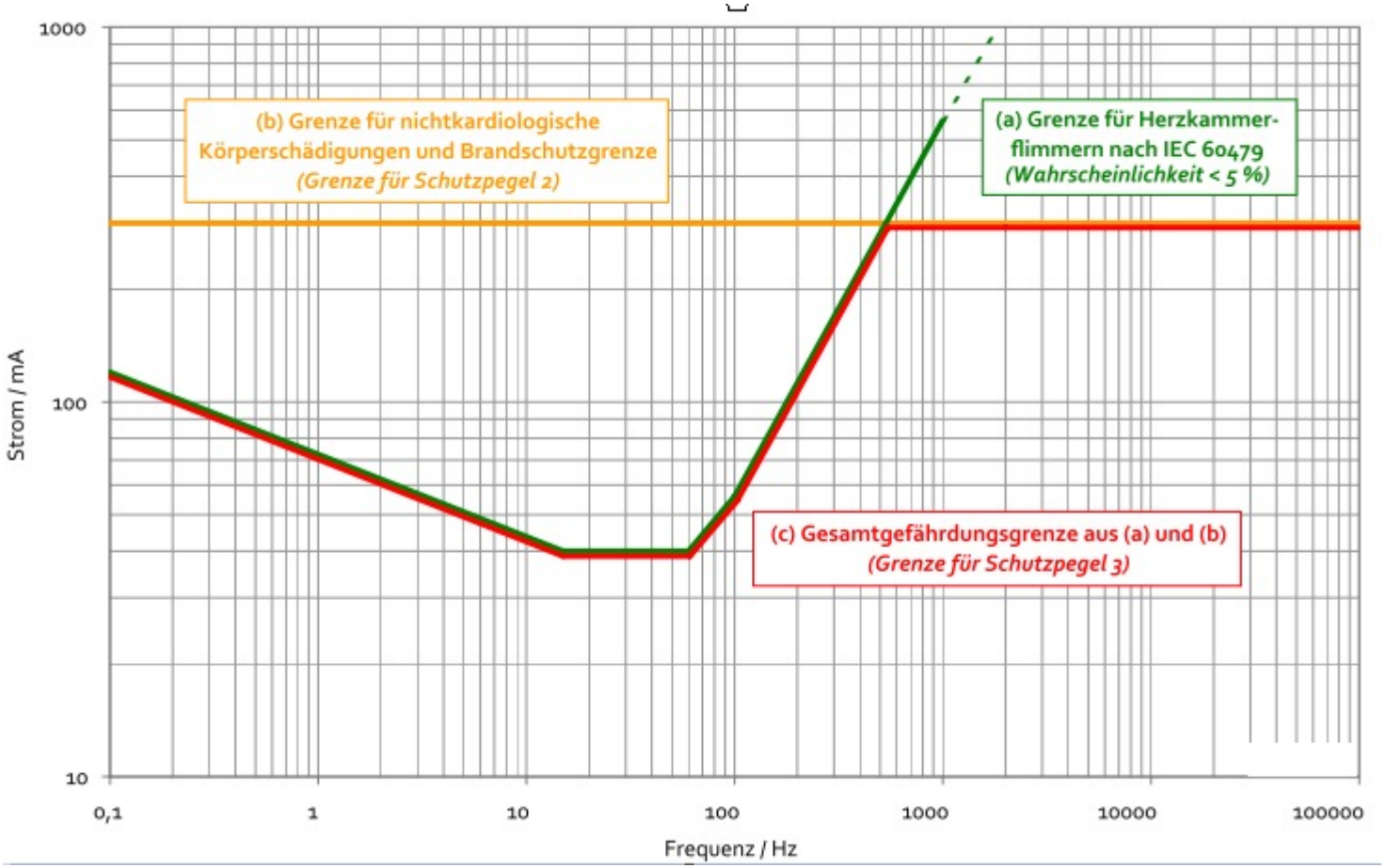
...and what about DC fault currents?

"All-current sensitive measurement type B/B+"

DC fault currents?

- In the rarest of cases, 100 % "smooth" DC residual currents occur.
- Fault currents generated by frequency converters are usually rather high-frequency and can be detected with measurement technology from PQ Plus.
- DC residual currents have hardly any effect on machines and systems
- The current tolerance of direct current is higher for people than for alternating current
- **DC currents type B are measured with the UMD98 RCM-T and UMD 701 or UMD707 and the matching transformer RCM-CT-B.**

DC fault currents?



QUESTIONS?

Thank you for your attention