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The 27th INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION.

Barcelona, Spain
17th-20th November 2013

Having a Cutting Point

Testing and Development Environment at TU Dortmund University

Dr. Jan Fritz Rettberg

Competence Center E-Mobility, Infrastructure & Grids
TU Dortmund University

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NRW Competence Center E-Mobility, Infrastructure & Grids

Technology- and Testing-Platform for…

- Charging stations
- Charging systems
- Accounting systems
- Communication devices

One-stop-shop for all aspects of system technology in e-mobility

- Power grid
- Power electronics
- Communication
- EMC
- Environmental effects

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NRW Competence Center E-Mobility, Infrastructure & Grids

TU Dortmund University

- ie³ - Institute of Energy Systems, Energy Efficiency and Energy Economics
  - Prof. Dr.-Ing. Christian Rehtanz
  - Prof. Dr.-Ing. Johanna Myrzik
- Insitute of Control Theory and Systems Engineering
  - Prof. Dr. Ing. Prof. h. c. Torsten Bertram
- Chair of Electrical Drives and Mechatronics
  - Prof. Dr.-Ing. Dr.-Ing. Stefan Kulig
- Communication Networks Institute
  - Prof. Dr.-Ing. Christian Wietfeld
- On-board Systems Lab
  - Prof. Dr.-Ing. Stephan Frei

Industrial partners

- AKUVIB Engineering und Testing GmbH
- EMC Test NRW GmbH
- LTi DRiVES GmbH
- RWE AG
- Technologiezentrum Dortmund
- TÜV Informationstechnik GmbH

AKUVIB Engineering and Testing GmbH

EMC TEST NRW

LTi

VORWEG GEHEN

TechnologieZentrumDortmund

TÜVIT

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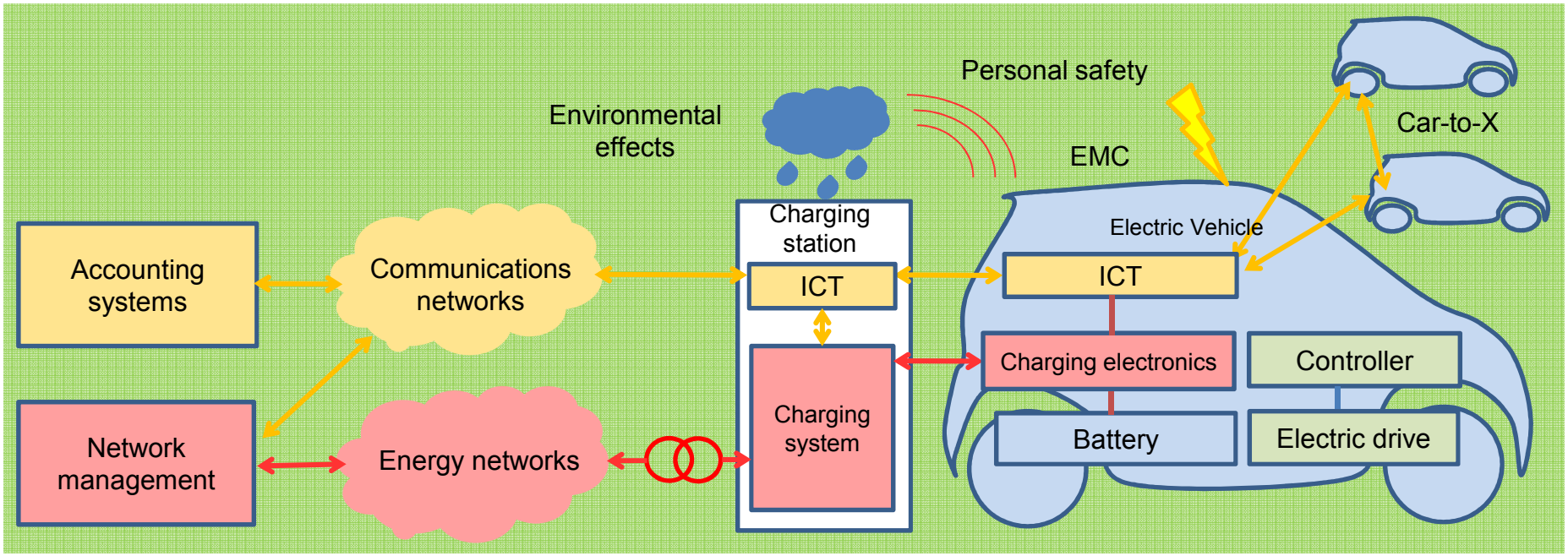
Testing and Development Environment



Testing and development environment for electrical components

Testing and development environment for communication

Protective and safety devices

EMC testing and simulation

Model-based systemintegration

Project management, organisation and founding of the Competence Center

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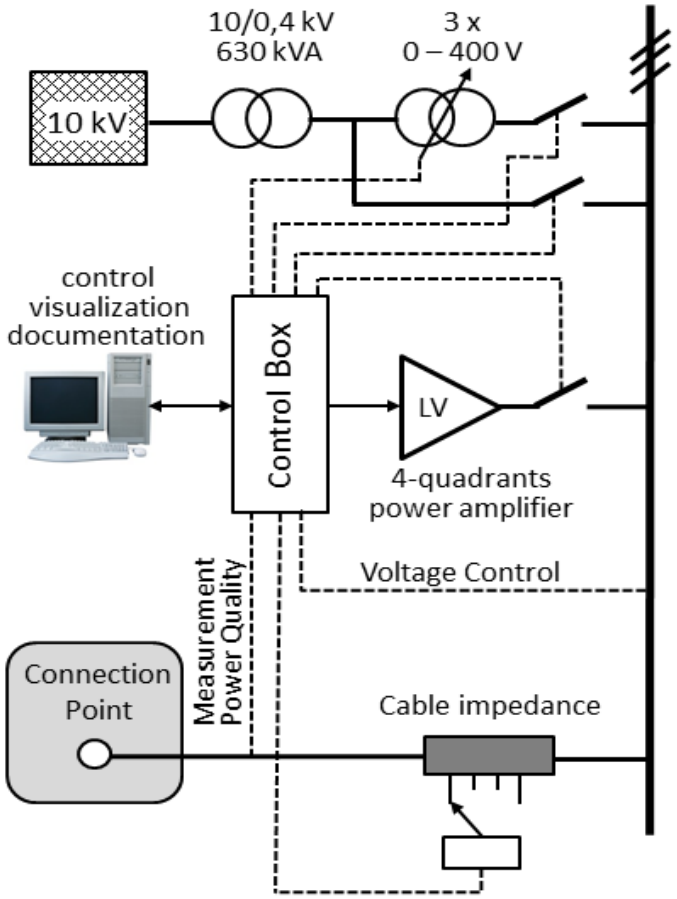
Testing and Development Environment



- Simulates several power grid states
- Analyses behaviour of charging station and EV regarding to electrical and ICT aspects
- All test results controlled, visualized and logged via central processing unit
- Terminal block as main control device that allows hardware interconnection according to requirements
- Real time hardware connects central processing unit and main control device

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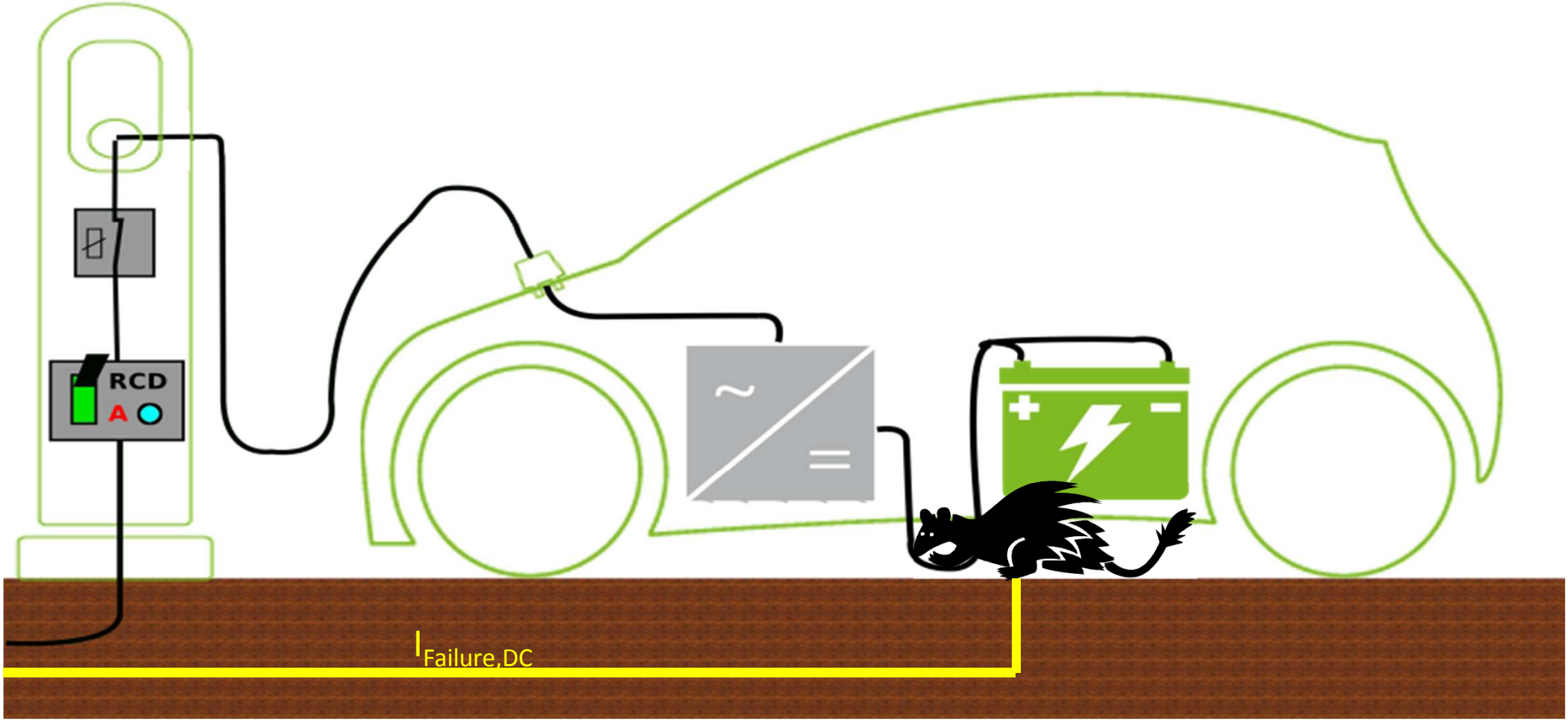
Fault current with charging rectifiers



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Fault currents with charging rectifiers

RCD Type A

- Cheap
- Cannot detect DC fault currents
- Protection contains only the chargin cable

RCD Type B

- Expensive
- Ensures detection of DC components in the fault current
- Protection includes rectifier

A simple, cheap, and reliable device for EV charging is needed

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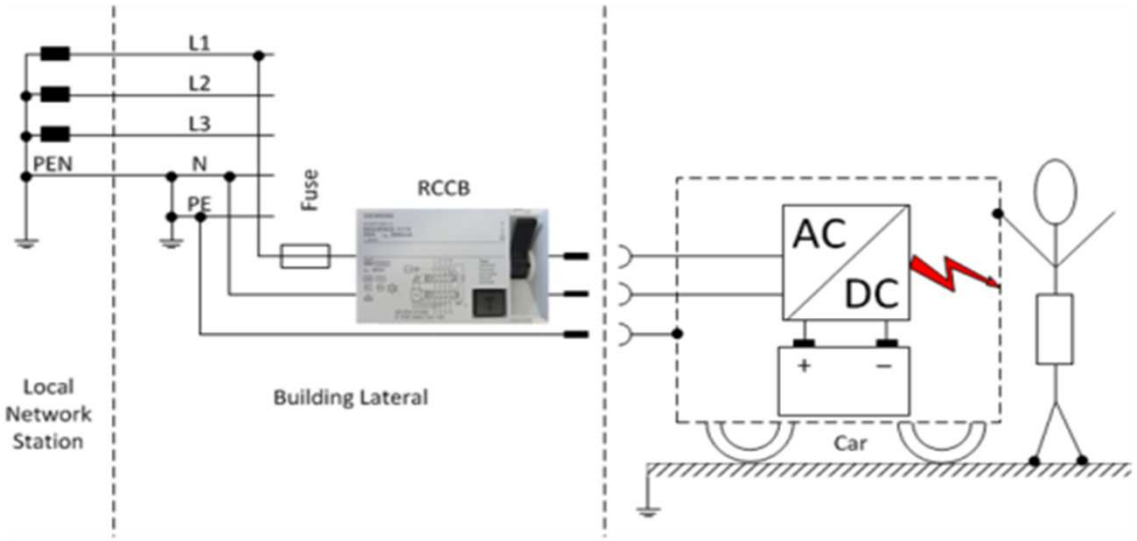
Alternative method for Residual Current Detection

Which topologies of charging rectifiers do really need an enhanced fault current protection?



- Analysation of all relevant standards and usable fault current protection devices
- General standards concerning electric strike protection and e-mobility
- Norms and standards for photovoltaics
- Examination and validation of possible charging rectifier set-ups by simulation

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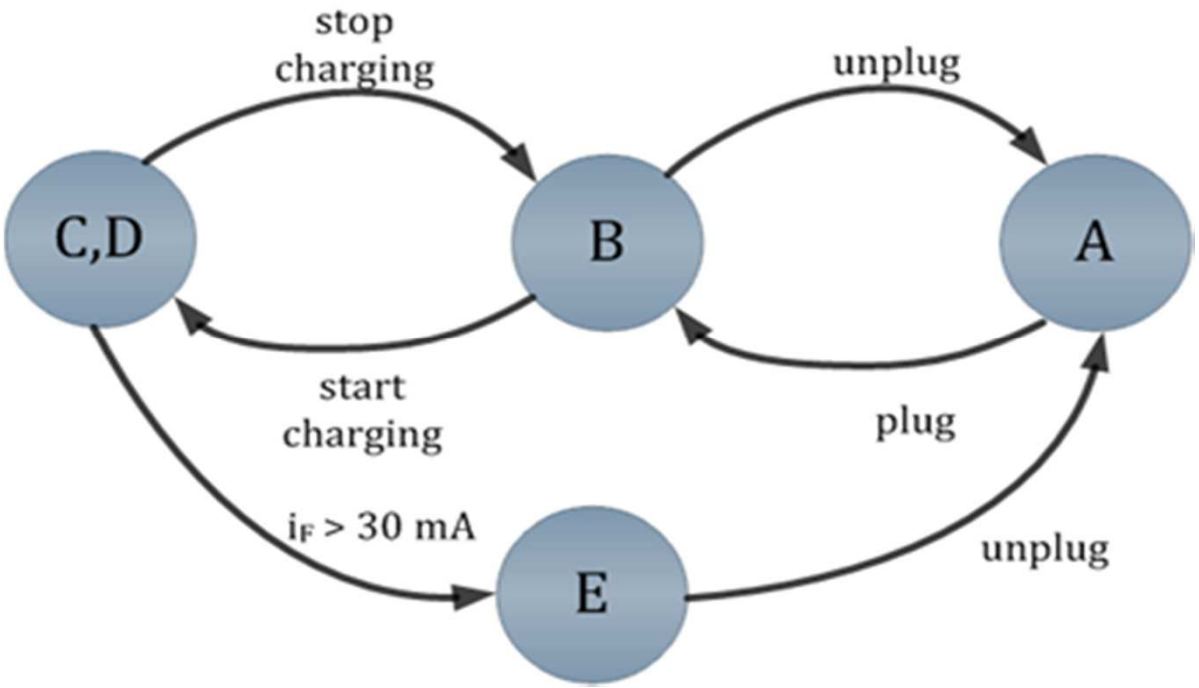
Alternative method for Residual Current Detection

State Diagram



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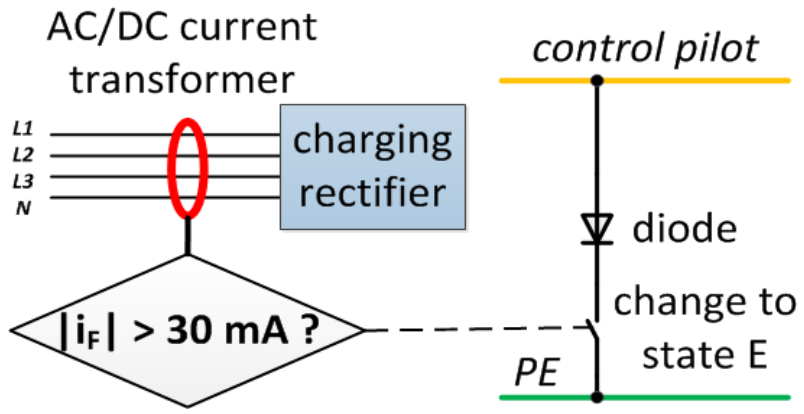
Alternative method for Residual Current Detection

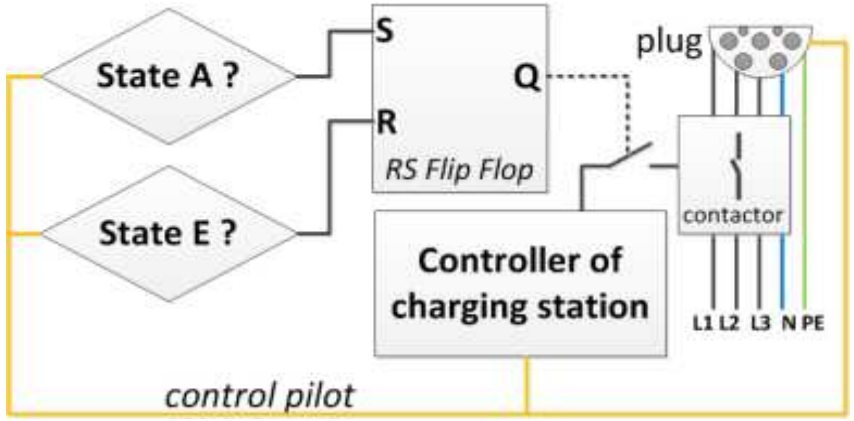
Circuits

Electric vehicle



- Detection of fault current (AC and DC)
- In case of failure:
  Change to error state

Charging station



- Detection of error state on control pilot
- In case of error state:
  Disconnection of main contactor

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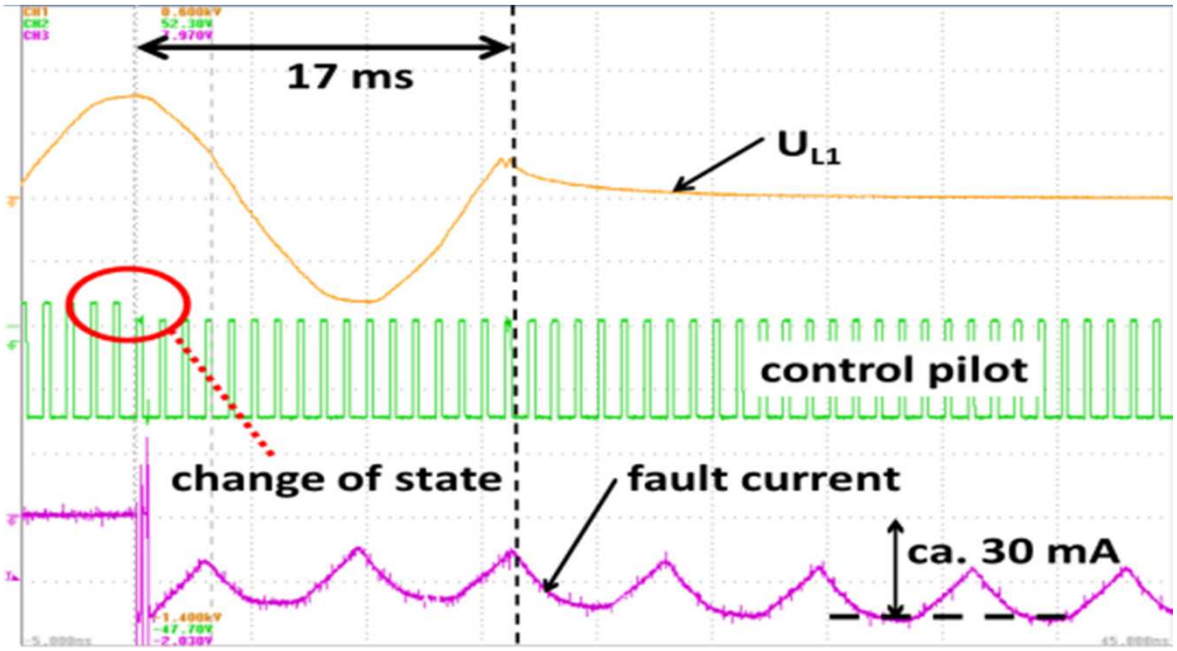
Alternative method for Residual Current Detection

Measurement of a cut off in a fault case



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Alternative method for Residual Current Detection

Conclusions

Characteristics

- Automatic cut off in case of an interrupt in power supply
- Automatic reset after a fault trip
- Completely hardware based circuit
- not yet conformed to standards
- Contactors must have a standardized opening time

Advantages

- Easy implementation
- Detection of AC and DC fault currents possible
- Complete charging system including the charging wire is deenergized in case of fault
- cheap: cost saving by a factor up to 20-50 compared with RCD type B
- extensible and sustainable: e.g. isolation monitoring

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Alternative method for Residual Current Detection

Thank you for your attention!

Contact

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