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
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
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 system integration
- Project management, organisation and founding of the Competence Center

Organized by: evs27
Hosted by: Technische Universität Dortmund
In collaboration with: Fira Barcelona, AVERE, AVENA, EVAAP, EDTA
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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
Fault current with charging rectifiers
Fault currents with charging rectifiers

<table>
<thead>
<tr>
<th>RCD Type A</th>
<th>RCD Type B</th>
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<tbody>
<tr>
<td>• Cheap</td>
<td>• Expensive</td>
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<tr>
<td>• Cannot detect DC fault currents</td>
<td>• Ensures detection of DC components in the fault current</td>
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<tr>
<td>• Protection contains only the charging cable</td>
<td>• Protection includes rectifier</td>
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A simple, cheap, and reliable device for EV charging is needed
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
Alternative method for Residual Current Detection

State Diagram

C,D → B: stop charging → start charging, i_F > 30 mA
B → A: unplug → plug
A → E: unplug
E → C,D: i_F > 30 mA
Alternative method for Residual Current Detection

### 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

**Circuits**
Alternative method for Residual Current Detection

Measurement of a cut off in a fault case

![Graph showing change of state and fault current with marks indicating 17 ms duration and ca. 30 mA current.](image)
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
Alternative method for Residual Current Detection

Thank you for your attention!

Contact

Dr. Jan Fritz Rettberg
Competence Center E-Mobility, Infrastructure and Grids

TU Dortmund University
ie³ - Institute of Energy Systems, Energy Efficiency and Energy Economics
Phone: +49 231 9742 4131 | Mobile: +49 1578 59 19 279 | Fax: +49 231 9742 4139
eMail: Fritz.Rettberg@tu-dortmund.de | www.kompetenzzentrum-elektromobilitaet.de