Fraunhofer Institute for Wind Energy and Energy System Technology

Department Network Technology and Integration

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- Infrastructure
  - Test Laboratories
Department Network Technology and Integration

Head: Dr. Thomas Degner

Power Quality and Grid Connection
- Dr. Gunter Arnold

Topics
- Grid Code and Grid Connection Requirements
- Conformance Tests
- Model Validation
- Measurements of Grid Characteristics
- Grid-Design, Grid Planning and Consulting

Power System Control and Dynamics
- Dominik Geibel

Topics
- Power System
  - Simulation
  - Stability Analysis
- Control development
  - Grid Control
  - Micro Grids
  - Hybrid Grids
  - DER units
- Hardware in the Loop
  - CHiL and PHiL

Protection and Controls for Power Distribution
- Dr. Thomas Degner (temporary)

Topics
- Network Protection
- Communication and Control Technologies for Power Systems
- Grid Operation

Rural Electrification and Hybrid systems
- Dr. Thomas Degner (temporary)

Topics
- Rural Electrification
- Hybrid Systems (Planning and Design)
- Pilot- and Demonstration-projects
Department Grid Technology and Integration: Experimental Infrastructure

- DeMoTec – Design-Center for modular system technology
- Accredited Test Laboratory for Electromagnetic Compatibility (EMC) according to IEC 17025
- European Network of DER Laboratories - DERlab
- SysTec – Test Centre for smart grids and electro-mobility
SysTec - Test Centre for Smart Grids

Testing Capacity

- Accredited for grid code compliance testing
- Measurements of static and dynamic properties of the grid interface of generation units and plants
  - Low Voltage up to 1.25 MVA
  - Medium Voltage up to 6 MVA
  - Bidirectional AC Supply up to 1 MVA
  - 100 – 900 V @ 650 A/ 100 – 450 V @ 1300 A, frequency range 45 – 65 Hz
  - Controllable DC source up to 1 MVA
  - 1000V@(5*150+1*250) A, interconnection up to 4 kV

Deutsche Akkreditierungsstelle GmbH


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Urkundeninhalt:
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. Fraunhofer IWES Institutsteil Kassel
Wilhelmshöher Allee 73, 34121 Kassel

Prüfungen in den Bereichen:
Elektromagnetische Verträglichkeit (EMV)
Messung der elektrischen Netzleistungen von Stromrichtern und Erzeugungsanlagen
Messung des Wirkungsgrades von photovoltaischen Systemen und Stromrichtern
SysTec - Testing Laboratory for Grid Integration (PNI)
Electrical Set-up

- Development- and Test Facility for quasi-stationary and dynamic testing of the grid interface of DER units and Systems (low- and medium voltage)

New: 1 MW
Testing Laboratory for Grid Integration (PNI)
Quasi-stationary Properties Low Voltage

- Control of voltage and frequency at LV level
  - Connection of single DER units
  - Connection of LV grid sections
  - Interfaces for integration in a HIL System

- Bidirectional High Power AC Supply from Gustav Klein
  - Power Range ≤ 1 MVA
    - 100 – 900 V @ 650 A
    - 100 – 450 V @ 1300 A
  - Range of frequency 45 – 65 Hz
Testing Laboratory for Grid Integration (PNI)
Quasi-stationary Properties Medium Voltage

- Utilization of signal generators
- Defined generation of signals given to the secondary technology of the developed and tested equipment
- No need for complex grid simulators to simulate quasi-stationary MV operating states
Testing Laboratory for Grid Integration (PNI)
Dynamic Properties LV and MV (1)

- Rating of the mobile test system
  - Power range: 0.25 MVA to 6 MVA
  - Voltage levels: 10 kV, 20 kV
  - Frequency: 50 Hz
  - Short circuit power range: 80 MVA to 350 MVA
  - Ambient Temperature: –25 to +60 °C
  - Operation temperature: 0 to +50 °C
  - 40-foot sea container

![Diagram of network and test bed](image-url)
Testing Laboratory for Grid Integration (PNI)
Dynamic Properties LV and MV (2)

- **Utilization of MV LVRT container also for testing of LV equipment**
  - Different tested LV equipment may have differing rated voltages
- **Tap transformer for coupling**

- **Rated power:** 1.25 MVA
- **Voltage tapings**
  - 7 voltage steps at secondary side and primary tappings of ± 5*1%
  - 230 V – 725 V
Testing Laboratory for Grid Integration (PNI)
Lab facilities – DC source for supply of EUT

- **DC supply for equipment under test (EUT)**
  - PV inverters
  - Batteries
  - Fuel cells

- **Controllable DC source**
  - Magna Power Electronics MT Series V
  - Modular set-up
    - 5 units of 150 kW (1000V @ 750 A)
    - 1 unit of 250 kW (1000V @ 250A)
  - Variable parallel and serial interconnection possible (up to 4 kV)
Testing Laboratory for Grid Integration (PNI)
Central Control and Data Acquisition

- Control of the Facility from a central room
  - Control of the MV switch gear via IEC 61850

- Central Data acquisition
  - Application of a new measurement module with extended power quality recording possibilities

- Interface for the Integration of Matlab / Simulink Applications e.g. for Online-Simulations
Department Grid Technology and Integration: Services (Selection)

- Accredited testing of generation units and certification of generation plants according to grid connection guidelines
- Metrological examination of performance (tripping characteristic) of protection devices for distribution grid components
- Measurements of power quality and analysis of performance
- Investigation of new network control systems
- Investigation of network control characteristics of photo-voltaic systems, grid-integrated storage systems, biogas plants, CHP plants etc.
- Generation of defined network conditions in low voltage electricity networks
- Test of devices and components in a system context (in combination with power hardware in the loop systems)
- Modeling and simulation of grid characteristics of generation units and generation plants