

PHiL Test Bench for EV and EVSE Charging Systems

Power Hardware-in-the-Loop Test Bench for Tests and Verification of EV and EVSE Charging Systems

State of the Art Charging Technology

Many stakeholders

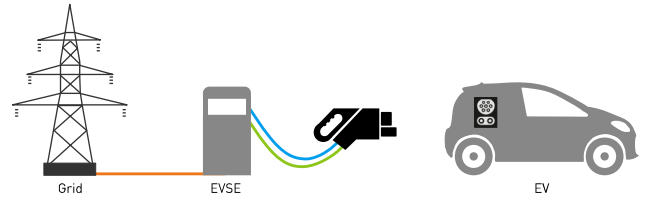
- Policy makers and regulating organizations (IEC, SAE, IEEE, DIN, ..)
- Customers, OEMs, end-point suppliers, energy sector

Various Technologies

- Conductive/inductive charging
- AC/DC charging
- Basic signaling/high-level communication

Challenges

- Interoperability between EV and EVSE
- World-wide support (different norms, grids, quality of electric installations)
- Simultaneous support of AC and DC charging



Testing of Electric Vehicles (EV)

Verification of functionality and norm compliance of EVs

DC charging

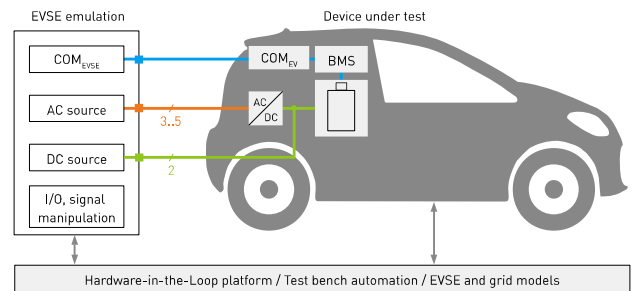
- Parametrizable dynamic DC voltage and current source
- Bidirectional energy flow; voltage 0..600 V; current ±300 A

AC charging

- Parametrizable 1,2,3-phase voltage source, with N and PE
- Variable voltage (0..270 V,rms) and frequency (50,60 Hz), harmonics
- Bidirectional energy flow for vehicle to grid tests (10..120 kVA)

Signaling

- Support of all charging modes (IEC 61851) and protocols (ISO 15118)
- Configurable EVSE state machine; parametrizable PWM generator



Testing of EV Supply Equipment (EVSE)

Testing of EVSE during development and in the field (with portable solution)

AC source

- Same as for AC charging by Testing of EV

AC load

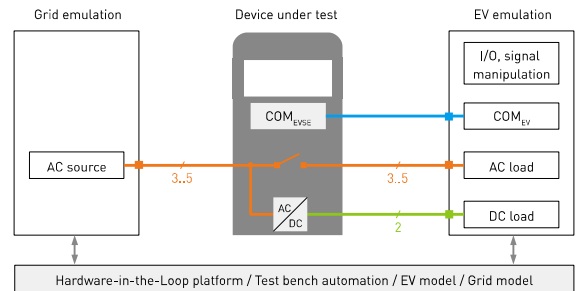
- Parametrizable, 1,2,3-Phase load with(out) N and PE
- Potential separation; bidirectional operation (10..120 kVA)

DC load

- Parametrizable DC voltage/current load; potential separation
- Bidirectional energy flow; voltage 0..600 V; current ±300 A

Signaling (besides support for IEC 61851 and ISO 15118)

- Variable resistance (PP and CP) and capacitance; temperature sensor
- Configurable EV state machine



Test Bench for EV and EVSE

- Quality assurance of the charging technology required for the global market
- Reproducible tests across product life cycle phases needed
- Comprehensive tests of EV / EVSE components with variable focus and depth

Application specific test environment and equipment

- Two types of power-emulators required AC and DC emulators (ACE, DCE)
- Scalable power rating dependent on application; energy efficiency
- Emulated EV and EVSE communication interfaces; bridge mode, analysis and manipulation of signals; support of IEC, ISO, DIN and GB/T standards;
- DUT protection and user safety concept
- Time-synchronous measurement and recording
- Hardware-in-the-Loop system and visualization; automated test cycles

