Standardisation needs and testing methods for multiple-outlet chargers

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IDIADA company introduction

Automotive service provider for:

- Engineering
- Testing
- Homologation
EV technology demonstrators
Charging process: safe, fast and compatible

Charger tests with innovative EV simulator

Ensure safe charger operation will following concepts:
- Automatic test procedure, logging, analysis
- Testing with a battery simulator. Advantages:
  - Abnormal failures, different voltage levels
  - Continuous tests with battery simulator, never “full”
  - Repeated test under same conditions
- Experience from more than 120 charger tests realized

IDIADA is only European CHAdeMO certification body

Charger interface development

Consulting to automotive OEMs or suppliers in order to:
- Develop software, electronics or layout for
  - AC charging interfaces (type 1, type 2)
  - CHAdeMO 0.9 and 1.0
  - Combo 1 and Combo 2 (DIN70121)

for safe operation according IEC61851, ISO15118 and DIN70121
- Communication with BMS and integration into vehicle E/E
Summary

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04_ Conclusions
In Spain around 83% of the people might be willing to consider to buy an electric vehicle, but…

What is the **minimum range** that an electric vehicle would need before you would consider buying or leasing it?

➔ **Expectations and reality don’t match**
(Leaf, i3, e-Golf, e-up!, ZOE, iMiEV, smart ED)

Considering your expected vehicle use, what is the **longest time to fully recharge** the battery that you would consider acceptable when buying or leasing an electric vehicle?

➔ **fast charge infrastructure necessary**

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Source: Unplugged: Electric vehicle realities versus consumer expectations *(based on a data analysis of all 13,000 individual responses to the survey)*
Charging standards: installed charging stations in Europe:
- CHAdeMO: 1,181 (02.07.2014)
- CCS: (no reliable numbers, probably < 100)
  - Fastned has plans to install multi-outlet stations on 200 locations in Netherlands
  - SLAM project will install 400 CCS-only chargers in Germany up to 2017
  - supported by EU via CPT directive → CCS in all fast chargers in Europe!

But:
Tesla is following own charger specification: “superchargers”:
- closed specification, collaboration discussion with BMW
- 120kW max power → more range per hour of charge
- no user fee for Tesla owners
- so far 24 installed in Europe, many more announced for 2014 and 2015

Due to higher vehicle range higher area coverage with less chargers!
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• Developed upon market demand:
  - charging station operators need to serve all EV users
  - no big cost increment for MO charging stations (< 10%)

• Most new installations are multi-outlet

But: No regulations regarding safety, compatibility and usability
Multi-Outlet charging stations

- Standards
  - Safety
  - Compatibility
  - Easy usability

- Current charging stations use the same power unit for CCS and CHAdeMO charging
  - Ensure that DC-outlets which are not in use are de-energized
- During charge of DC outlet 1 a second user might want to initiate the payment and charge of outlet 2
  - Currently not possible due to details in CCS and CHAdeMO
- User experience should match the behaviour among different charging stations

Standardization necessary
Possible types of Multi-Outlet charging stations

- 1 DC and 1 AC outlet  → already on the market

- 2 different DC outlets,
  - only one can be used at the same time  → already on the market
  - both can be used at 50%  → not yet
  - both can be used according to demand  → not yet

- 2 different DC outlets + 1 AC,
  - 1 DC and 1 AC can be used in parallel  → already on the market

- More than 2 DC outlets of the same type,
  flexible power sharing between outlets  → not yet

- ...
Testing methods

- Detection of vehicle specific incompatibilities:
- Detection of unexpected behaviour in abuse operation.
- Charging current waveform from on-board charger.
- Real ripple waveform in DC charging

- Automatic testing procedure
  - repeatability, less manual operation
- Long time testing
  - durability and temperature test
- Simulation of different EV characteristics
  (timings, CAN messages, voltage levels, capacities)
- Multi-standard capability within one test machine
EV charging simulator – HW overview

- CAN buses
- DC power
- AC power
- Analog & PLC communication
- Analog signals
- Digital signals
- USB

→ Combo type 1
→ Combo type 2
→ CHAdeMO
Test requirements workflow for available standard

- Requirement is identified from the standard
- New test item is added in the checksheet
- New simulator test is configured in specific user-friendly language
- Logging data is generated for further analysis
- Requirement is tested with EV Simulator
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Specifications in place for any single charging standard

Definition of test specifications for CCS still ongoing

No specifications for multi-outlet charging stations
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