Application Areas
The Smart Charging Solution is a key solution for developing and testing technologies involved in the electric vehicle charging process. The combination of hardware and software components offers comprehensive testing options. Thanks to its high flexibility, the Smart Charging Solution can complete a range of tasks, such as simulating charging stations and electric vehicles, and simulating, testing, and developing onboard chargers. As a result, it supports both manufacturers of electric vehicles and manufacturers of charging stations in developing and testing smart charging technologies.

Simulating Charging Stations
- Test real electric vehicles and onboard chargers by connecting them to simulated charging stations that support different standards
- Test various ECUs and power electronics components involved in the charging process

Simulating Onboard Chargers
- Test charging station controllers in early development stages thanks to the electric vehicle simulation included in the Smart Charging Interface Software
- Replace the vehicle ECU or the communication controller for testing vehicle prototypes

Key Benefits
- Standardized conformance tests to ensure conformance of electric vehicle communication controllers (EVCCs) with charging standards
- ISO 15118 and DIN 70121 powerline communication
- ChaoJi-2, CHAdeMO, and GB/T support
- Plug-and-charge standard support for secure TLS-encrypted communication
- Isolated interface between the HIL simulator and the ECU
- Interfaces for all common charging plugs (e.g., Type 1, Type 2, CCS1, CCS2, GB/T, CHAdeMO)
- Support for AC and DC charging
- CAN FD interface for easy integration into RCP and HIL environments
- Rapid control prototyping (RCP), software-in-the-loop (SIL) testing, and hardware-in-the-loop (HIL) simulation
- Monitoring and manipulation of power-line communication used, e.g., for pairing mechanism (Signal Level Attenuation Characterization, SLAC)
- Simulation of errors during communication

Hardware and Software
The Smart Charging Solution includes hardware and software and can be easily integrated into your test setup. For more information, visit www.dspace.com/go/smart-charging-solution

1) Available for CHAdeMO and GB/T communication. ISO 15118 and DIN SPEC 70121 communication will be available in a later release.
The basic hardware component of the Smart Charging Solution comes as an isolated interface between the hardware-in-the-loop (HIL) simulator and the electronic control unit (ECU). It provides a CAN FD interface for connecting to the HIL simulator as well as USB and Ethernet interfaces for protocol tracing and data logging.

**DS5366 Smart Charging Interface**

The basic hardware component of the Smart Charging Solution comes as an isolated interface between the hardware-in-the-loop (HIL) simulator and the electronic control unit (ECU). It provides a CAN FD interface for connecting to the HIL simulator as well as USB and Ethernet interfaces for protocol tracing and data logging.

**Smart Charging Plug Simulator**

For a comprehensive set of fault insertion options, the Smart Charging Plug Simulator can be added to the Smart Charging Solution. It supports all common charging standards, including the CharIN CCS Test System (CCTS) recommendation. The extension lets you emulate and manipulate the electrical networks related to connectors, cables, and communication signals.

**Smart Charging Interface Software**

The Smart Charging Interface Software includes a Simulink® model, ControlDesk layouts, and a DBC file that describes the CAN FD communication. The Simulink model supports all common charging communication standards. It includes a user interface for parametrization and allows for the connection and simulation of power electronics components. By using the ControlDesk layouts, you gain an overview of all the relevant electrical information, the messages involved in the charging communication, and the communication status. You can also use the layout for configuration purposes, for example, for parametrization as well as electrical and timing manipulation.

**Smart Charging PlugAndCharge Software Module**

This software module lets you test advanced features as described in the ISO 15118-2 charging communication standard, including plug-and-charge (PnC) and value-added services (VAS). These features require TLS encryption and certificate handling, which are both supported by the dSPACE test solution.

**Technical Details for the DS5366 Smart Charging Interface**

- Internal 4 GB SD card for customer settings
- Host interface
  - 1 Mbit/s CAN FD
  - USB logging on connected PC
  - Ethernet raw data
  - Input for custom PWM voltage
  - Input for custom PWM impedance resistor
- Target interface
  - Control pilot (CP), proximity pilot (PP), protective earth (PE)
  - 2 x relay outputs for power switching and user applications
- CAN FD interface
  - Monitoring of SLAC and vehicle-to-grid (V2G) messages via CAN
  - Dynamic access to control messages in the DS5366 Smart Charging Interface
- Power supply
  - 8 ... 30 V DC input voltage
  - ~ 6 W power consumption

**Functionality Overview for the Smart Charging Interface Software**

- Simulink model
  - Behavior model of a charging station
  - User interface for connecting and simulating power electronics components
- Open model for all communication standards that can be coded for different real-time systems
- Suitable interface for dSPACE ASM Electric Components
- ControlDesk layouts
  - Overview layout including electrical information as well as information on the communication status
  - Specific overview and configuration layout including timing manipulation for all standards
  - Status and device information
  - Plotting of charging curves with all relevant data
  - CAN monitoring for message exchange via the real-time system
  - Warnings and error counter
- Automatic Mode and Manipulation Mode
  - Logging of all request and response messages on CAN FD
  - Override mechanism for parameter manipulations
  - Possibility to connect power electronics components
  - V2G data manipulation
  - Timing manipulation by restraining V2G response messages on CAN FD