

Keysight Technologies

# Scienlab Charging Discovery System

## EV & EVSE Test

SL1040A



## Table of Contents

Introduction .....	3
SL1040A-STD Charging Discovery System (Real-time Computer in 19" plug-in unit) .....	6
SL1040A-STD HV Module.....	10
SL1040A-301 Communication Module PLC.....	12
SL1040A-302 Communication Module GB/T .....	13
SL1040A-303 Communication Module CHAdEMO .....	14
EV Charging Adapter .....	15
SL1040A-201 EV charging adapter AC Type 1.....	15
SL1040A-202 EV charging adapter AC Type 2.....	15
SL1040A-205 EV charging adapter GB/T AC .....	15
SL1040A-203 EV charging adapter CCS Type 1 .....	15
SL1040A-204 EV charging adapter CCS Type 2 .....	15
SL1040A-206 EV charging adapter GB/T DC .....	15
SL1040A-207 EV charging adapter CHAdEMO .....	15
EVSE Plug-In Adapter.....	17
SL1040A-101 EVSE plug-in adapter CCS Type 1 .....	17
SL1040A-102 EVSE plug-in adapter CCS Type 2 .....	17
SL1040A-103 EVSE plug-in adapter GB/T AC .....	17
SL1040A-104 EVSE plug-in adapter GB/T DC .....	17
SL1040A-105 EVSE plug-in adapter CHAdEMO .....	17
Advanced Hardware Options .....	18
SL1040A-106 EVSE Plug-in adapter for connection of an Emulator .....	18
SL1040A-209 Adapter cable for connection of an AC-power-source .....	18
SL1040A-210 Adapter cable for connection of a DC-power-source up to 125 A.....	18
SL1040A-211 Adapter cable for connection of a DC-power-source up to 300 A.....	18
SL1040A-107 Plug-in adapter CEE.....	18
SL1040A-IRE Insulation Resistance Emulator.....	19
SL1040A-TC1 Transport Case .....	20
Licenses .....	21
SL1040A-S01 Expert Mode.....	21
SL1040A-S02 Developer Mode.....	23
Service Options .....	24

## Introduction

The Scienlab Charging Discovery System (CDS) from Keysight is a modular solution for conformance and interoperability testing of EV/EVSE charging interfaces. Thanks to its modular design, the CDS can be configured to customers' specific needs for testing and validating the charging interface of electric vehicles and charging infrastructures.

Figure 1 shows the standard portable 19" CDS. For further CDS variants (e.g. EMC shielding or liquid cooled cable options) refer to other datasheets.



Figure 1: Portable 19" CDS

Three main use cases for the Charging Discovery System:

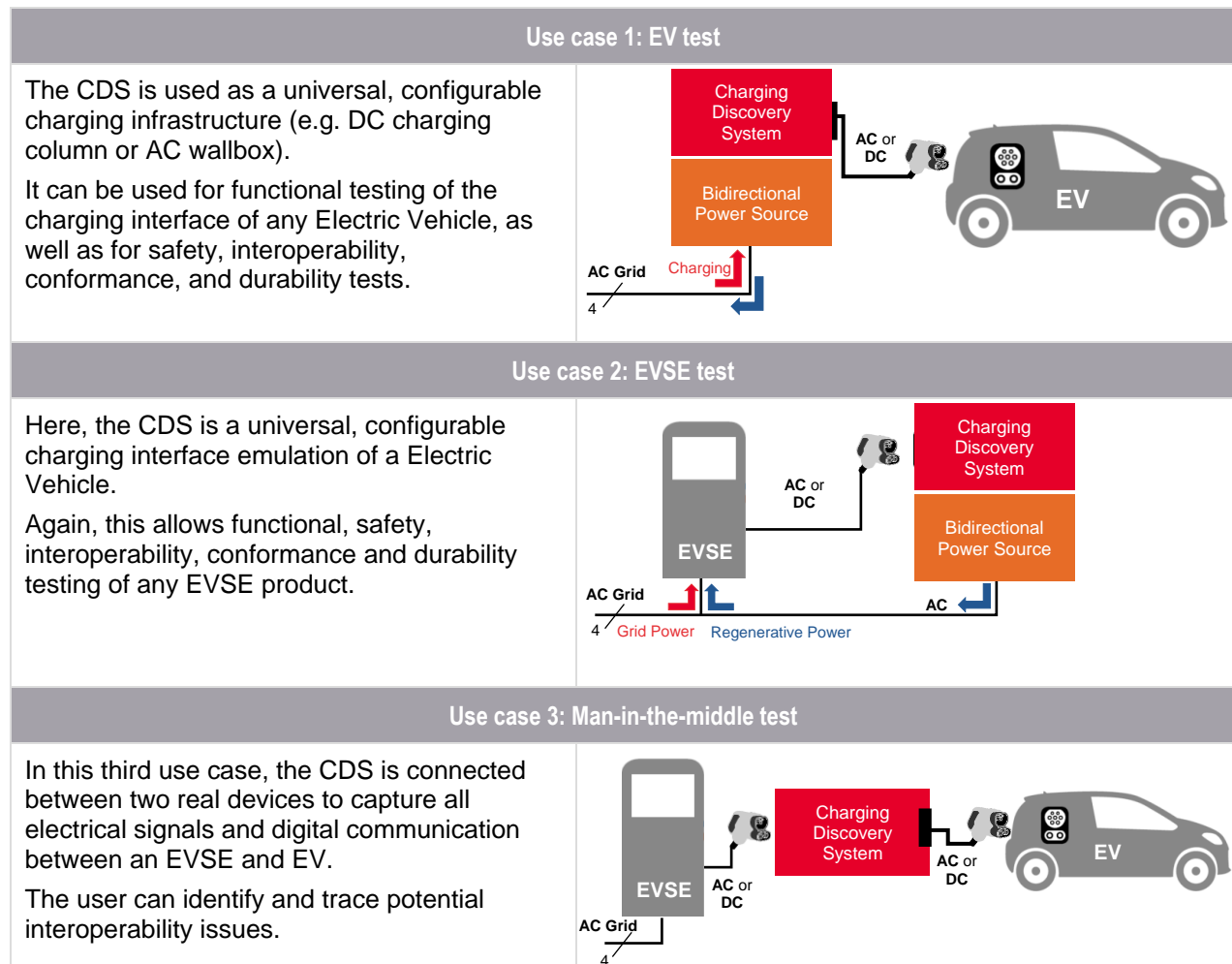


Figure 2 shows the modularity of the Charging Discovery System. This data sheet describes components in the red boxes. The components in the dark gray boxes are described in separate data sheets and clarify the extensibility of the test system.

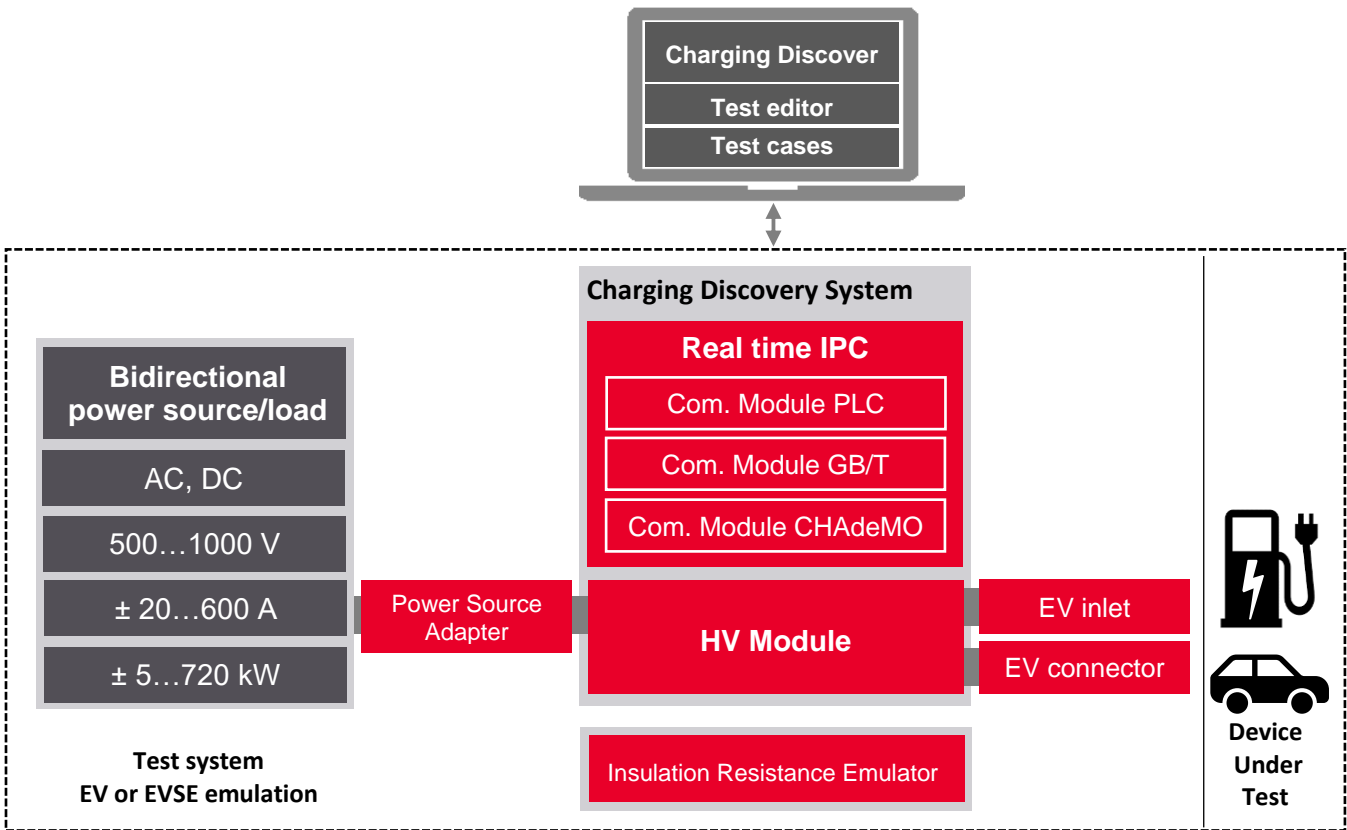
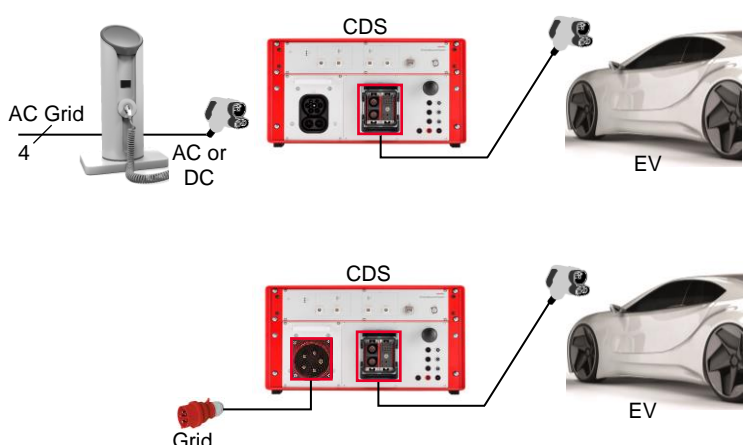
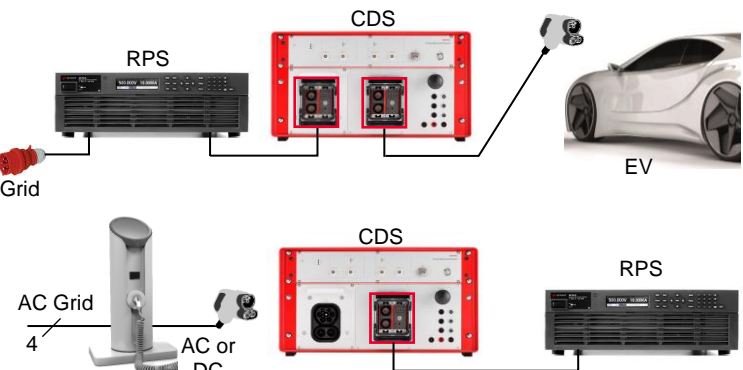
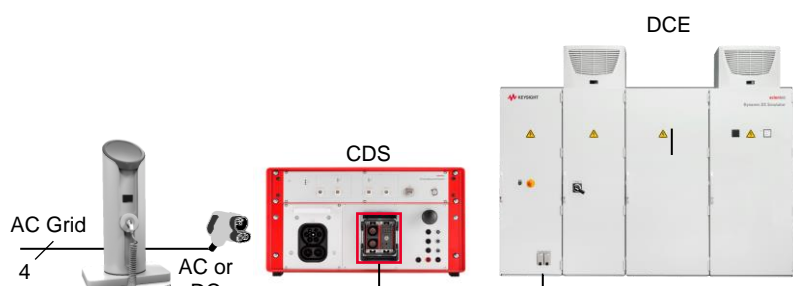


Figure 2: Modularity of the Charging Discovery System

Note, that options SL1040A-STD, SL1040A-301, -302, and 303 must be selected when ordering the SL1040A. Post-shipment upgrades are not possible. All other options may be ordered individually at any time.

Consider the targeted use case and test scope when ordering CDS hardware. For some applications, such as conformance testing of the charging communication protocols, the CDS alone may suffice. This is suitable when testing individual components of a charging system (e.g. SECC or EVCC) rather than the entire product. Full conformance tests require a power source (or load) in addition to the CDS.

The following table shows three examples of CDS configurations:

Example #1: Stand-Alone CDS	
<p>In some cases, a stand-alone CDS configuration is adequate. It allows AC man-in-the-middle analysis, as well as AC charging tests of an EV when used together with the CEE plug-in adapter (see SL1040A-107).</p> <p>Adding high level communication modules (see SL1040A-301...303) allows DC man-in-the-middle analysis and also V2G/CAN communication protocol testing.</p>	
Example #2: CDS + Low Power DC Supply	
<p>Adding a DC power source or load, even with low power, enables most DC conformance and interoperability testing.</p> <p>Keysight RP79xx(*) Regenerative Power System provides a scalable solution (5 to 150 kW) which is seamlessly integrated with CDS. It can be used as source or load, thus allowing EV and EVSE testing with one setup.</p>	
Example #3: CDS + High Power DC Supply	
<p>For high power DC charging, the CDS can be attached to larger DC emulators of 180 kW, 360 kW or more. EV and EVSE testing at full power range becomes possible.</p> <p>Note, for HPC EV testing a different CDS variant with liquid cooled cables may be required.</p>	

\* For subsequent orders of Keysight RP79xx, note that any RPS module must be commissioned by a CDS service engineer before first use. Contact your local Keysight field engineer for all service options.

SL1040A-STD Charging Discovery System (Real-time Computer in 19" plug-in unit)

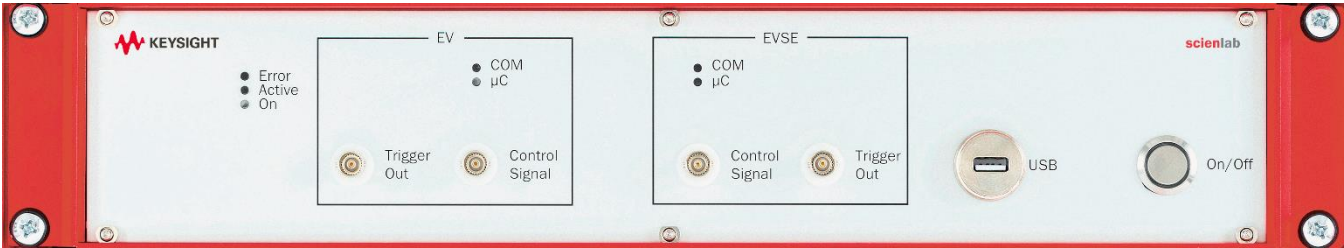


Figure 3: CDS real-time computer in 19" plug-in unit

General functions

- Real-time computing control unit with high system performance and low dead times
- Standard-compliant emulation of the EV or EVSE charging communication controller (CC); programmable using documented interfaces
- Built-in control of up to two charging sockets with locking actuator and temperature monitoring
- Fault injection at the control and proximity pilot (idle and short circuit)
- Man-in-the-Middle mode for analyzing the charging communication interface between EV and EVSE
- Included drivers allow easy integration of Scienlab power sources and sinks
- Included Windows *Charging Discover* software (see separate data sheet 5992-3496EN)

System Characteristics

Dimension	2 U (rack units) in a 19-inch open frame rack
Weight	6 kg
Protection class	IP00

Standards and Directives

The CDS supports the following charging communication standards:

The basic function includes:

- AC charging mode according to IEC 61851-1 (PWM)
- AC charging mode according to SAE J1772 (PWM)
- AC charging mode according to GB/T 18487.1 (PWM)

The following are also available as additional options (see following items):

- DC fast charging mode according to DIN SPEC 70121
- DC fast charging mode according to ISO 15118
- AC charging mode according to ISO 15118
- DC fast charging mode according to GB/T 27930
- DC fast charging mode according to CHAdeMO

## PWM functionality

- Measurement of the PWM level on the EVSE and EV sides
- Emulation of the EVSE signal generator with adjustable positive or negative amplitude, frequency, and duty cycle.
- Testing of the PWM signal with respect to level, noise component, edge steepness, frequency, and duty cycle.
- Variation of the control pilot's line impedance with switchable parallel resistors and capacitors
- Emulation of the vehicle side with freely programmable resistance emulation at the CP
- Fault injection: control pilot line break, short circuit to PE

## Proximity pilot

- Measurement and interpretation of the resistance of the Proximity Pilot (PP) for coding the current rating of the charging cable.
- Emulation of the PP resistance (during EVSE emulation)
- Fault injection: Line break, short circuit to PE

## System architecture

The CDS consists of several internal electronic functional groups to meet EV and EVSE requirements. The following block diagram shows the system architecture:

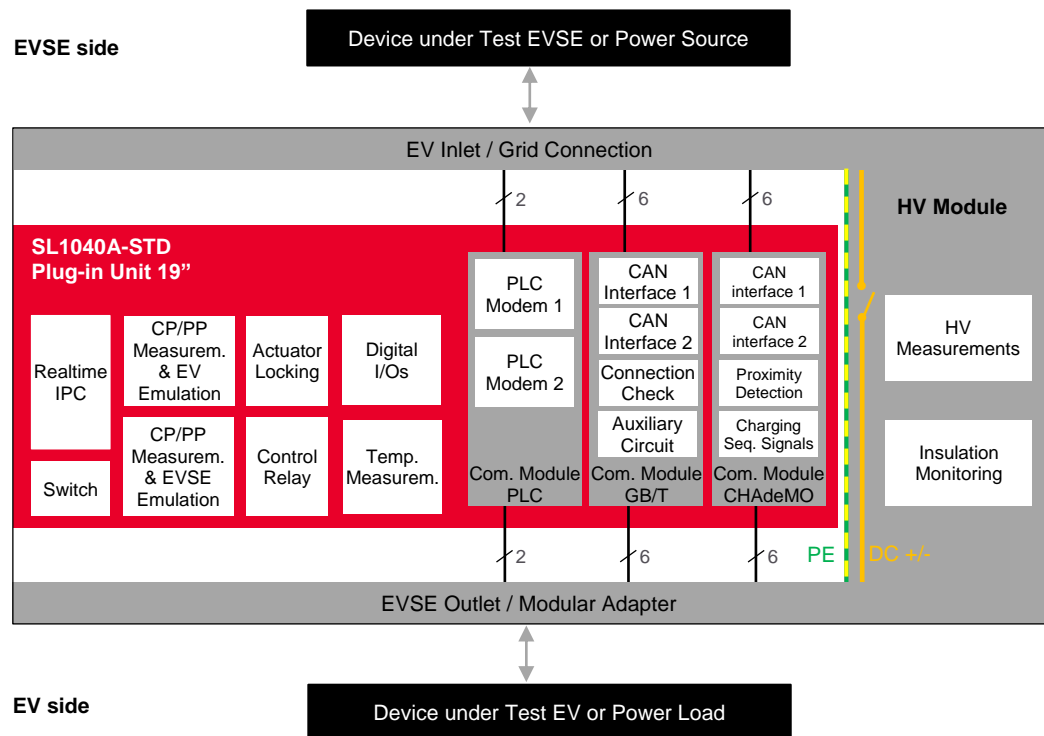


Figure 4: Block Diagram of CDS Architecture (Note: only red function blocks are included in this item)



## Technical data

EV/EVSE	Function/electric parameter		Range	Tolerance
EVSE	PWM generator	Fundamental frequency	900 – 1,100 Hz	± 0.1 Hz
		Open circuit voltage (adjustable, positive & negative)	± 0 to 15 V	± 0.02 V
		Pulse width	0 to 100 %	± 0.05 %
		Maximum rise time	2 µs at Cc = 0 pF	
		Maximum fall time	2 µs at Cc = 0 pF	
		Minimum settling time to 95% of steady state	3 µs at Cc = 0 pF	
		Input resistance R1	1,000 Ω ± 30 Ω	± 0.1 %
		Capacity Cs	300 pF	
		Capacitance Cc for emulating the max. line capacitance	switchable: 0, 1,300, 1,500, or 2,800 pF	± 5 %
EVSE and EV	Control pilot measurement	Voltage measurement	Measuring range: -15 V to +15 V 14 bit AD converter, 20 MS/s	± 10 mV
		Frequency measurement	900 to 1,100 Hz	± 0.1 Hz
		Pulse width	0 to 100 %	± 0.5 %
		Rise/fall time	1 to 100 µs	± 1 µs
		Input impedance	1 MΩ + 100 pF	
EV	Control pilot manipulation	EV resistance CP-PE (R2  R3)	1 to 20,000 Ω	0.5 %
		Capacitance Cc for emulating the max. line capacitances	switchable: 1,500, 2,400, or 3,900 pF	± 5 %
	Proximity pilot measurement	EV resistance PP-PE	50 to 3,250 Ω	± 0.3 %
	Proximity pilot emulation	Charging plug EV resistance PP-PE	fixed: 120, 1400, 4500, 8500 Ω variable: 0 to 1,000 Ω (Resolution 3 Ω)	± 0.3 % ± 0.5 %



## Interfaces

Description	
Self-supply	24 V DC (connection via terminal) Note: Desktop power supply unit not included.
<b>Measuring taps</b>	
Control pilot EV	BNC socket
Control pilot EVSE	BNC socket
<b>Digital interfaces</b>	
Interface to operating PC	1,000 MBit/s Ethernet
Remote interface (e.g. HiL)*	1,000 MBit/s Ethernet
Power source/sink	1,000 MBit/s Ethernet
External data media	USB
<b>Status LEDs</b>	
System status	3 LEDs (monochrome)
EV	Status of EVCC (RGB) and PLC modem
EVSE	Status of EVCC (RGB) and PLC modem

\* Support and remote interface license are optional available

## SL1040A-STD HV Module



Figure 5: Front side of HV module

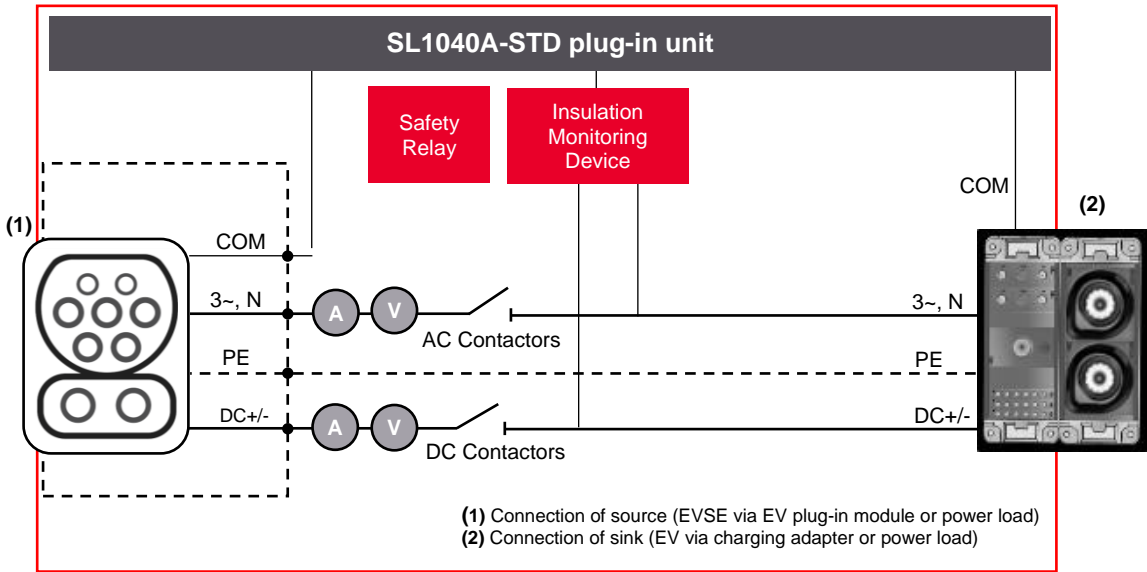
The HV module connects the control unit and the communication modules to the DUT, i.e. vehicle and/or charging infrastructure. Several variants are available to fulfill different worldwide standards. In addition to country and standard-dependent DUT contacting, the HV module includes a 19" housing, current transducers, safety components, and power contactors for AC and DC.

### Included in the scope of delivery:

- 19" compact aluminum housing
- Power supply to the 24 V supply of the device via 100-230 V AC. 50/60 Hz mains
- Integration of an insulation monitoring device (Bender ISOMETER®)
- Integration of a safety relay for interlock control (Pilz PNOZ X)
- DSUB15 mating plug for stand-alone operation
- Operating instructions, CE declaration of conformity, CSA declaration of conformity (CSA C22.2 No. 61010-1-12 & 61010-2-030-12)

Note: If the HV module is ordered without a plug-in adapter (see further items within this document), the EVSE/source port at the left side of the front panel will be covered by a blank front plate.

Measurement Specification		
	Range	Accuracy
Voltage AC (L1-N, L2-N, L3-N)	0 to 300 V rms	± 0.5 %
Voltage AC (L1-L2, L2-L3, L3-L1)	0 to 500 V rms	± 0.5 %
Current AC (L1, L2, L3)	0 to 50 A rms	± 0.5 %
Voltage DC±	0 to 1000 V	± 0.5 %
Current DC+	-500 to 500 A	± 0.5 %
Residual current PE	-100 to 100 mA	± 0.5 mA

System Description	
Dimensions (HxWxD)	330 x 520 x 600 mm
Weight including control computer + Com. module	36 kg (without adapters)
Protection class	IP40 (with connected plugs)
 <p>(1) Connection of source (EVSE via EV plug-in module or power load)  (2) Connection of sink (EV via charging adapter or power load)</p>	
Interfaces	
Operating buttons	Fast stop (safety shutdown)
Connection EVSE/external source or EV/external load	Via EVSE plug-in adapter Via EV charging adapter
AC	3~ 400 V AC / 32 A
DC	1000 V DC 400 A
HV measuring	Non-touchable banana plug

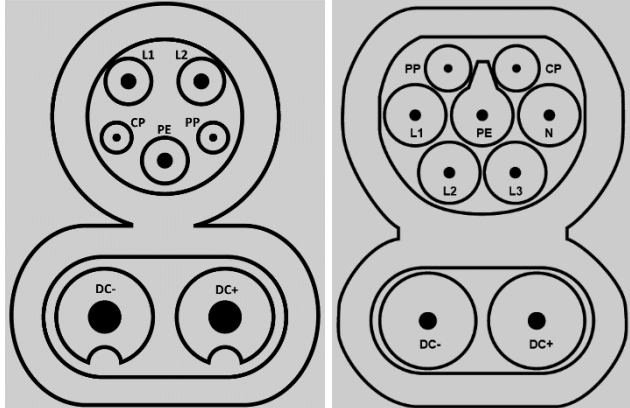
**Note:**

- The voltage and current carrying capacity rating may be limited by the attached EV connector or inlet. Higher currents (up to 600 A) can be realized with a different CDS variant and liquid cooled charging cables (see CDS – High Power series datasheet).
- This item can only be ordered in combination with “SL1040A-STD Charging Discovery System (Real-time Computer in 19” plug-in unit)”. The Real-time computer is not included here.
- DC charging according to the relevant standard is only possible with the associated communication module (see item SL1040A-301...303).

## SL1040A-301 Communication Module PLC

Adding two additional PLC modules to the Charging Discovery System supports the following additional functions:

- Emulation of the electrical interface on the EV and EVSE side
- EV emulation according to the standards DIN SPEC 70121 (2014) and ISO 15118 Ed. 1 (EIM only\*)
- EVSE emulation according to the standards DIN SPEC 70121 (2014) and ISO 15118 Ed. 1 (EIM only\*)
- Man-in-the-Middle measurement between EVSE and EV with low latency (<1ms)
- Recording of all EV or EVSE V2G messages and display of the information contained therein in plain text
- Recording and visualization of QCA attenuation statistic when charging with PLC communication
- Access to the most important PWM, V2G and SLAC parameters from Test-Editor for creation of sophisticated test cases. For example, inserting fault conditions by manipulating the application data (e.g. "EVTargetVoltage") and delay single response/request messages.

Pin	Designation	Function	Charging interface
CP	Control Pilot	PWM control line plus digital communication via PLC	
PP	Proximity Pilot	EV testing of the charging cable connection	

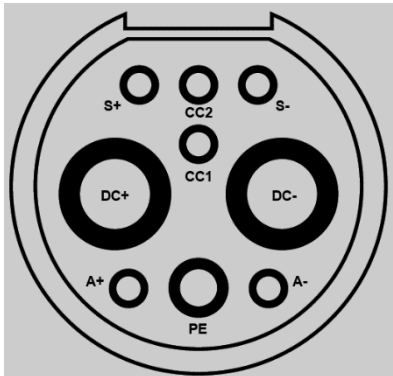
**Note:** This option does not include electromechanical contacting (connector/inlet). See the following EV charging and EVSE plug-in module adapter options for further details.

**\*Note:** Plug and Charge (PnC) will be available with future software update (included in SW maintenance contract)

## SL1040A-302 Communication Module GB/T

Adding two communication modules to the Charging Discovery System support the following additional functions:

- Emulation of the electrical interface of EV and EVSE
- EV emulation according to GB/T 27930-2011 and 2015 (DC)
- EVSE emulation according to GB/T 27930-2011 and 2015 (DC)
- Man-in-the-Middle measurement between EVSE and EV with low latency
- Recording of all EV or EVSE CAN messages and display of the information contained therein in plain text
- Access to the most important CAN parameters from Test-Editor for creation of sophisticated test cases, for example by inserting fault conditions by manipulating the application data (e.g. "Voltage demand") and/or delay single response/request messages.

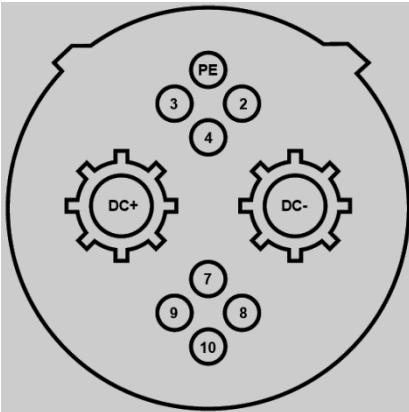
Pin	Designation	Function	Charging Interface
S+	CAN-High	CAN Bus: High level communication	
S-	CAN-Low		
CC1	Connection Check 1	EV testing of the charging cable connection	
CC2	Connection Check 2	EVSE testing of the charging cable connection	
A+	Auxiliary Circuit +	EVSE voltage supply* for EVCC	
A-	Auxiliary Circuit-	EVSE voltage supply* for EVCC	

**Note:** This option does not include electromechanical contacting (connector/inlet). See following EV charging and EVSE plug-in module adapter options for further details.


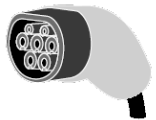
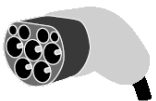




## SL1040A-303 Communication Module CHAdeMO

Adding two communication modules to the Charging Discovery System support the following additional functions:

- Emulation of the electrical interface on the EV and EVSE side
- EV emulation according to the CHAdeMO specification
- EVSE emulation according to the CHAdeMO specification
- Man-in-the-Middle measurement between EVSE and EV with low latency [*under development*]
- Recording of all EV or EVSE CAN messages and display of the information contained therein in plain text
- Access to the most important CAN parameters from Test Editor for creation of sophisticated test cases, for example by inserting fault conditions by manipulating the application data (e.g. "Charging current request") and/or delay single response/request messages.
- Supported CHAdeMO protocols: 0.9; 0.9.1; 1.0.0; 1.0.1; 1.1; 1.2; 2.0

Pin	Designation	Function	Charging interface
8	CAN-High	CAN Bus: High level communication	
9	CAN-Low		
7	Connector proximity detection	EV testing of the charging cable connection	
4	Vehicle charge permission	EV opening for charging process	
2	Charging sequence signal 1	EVSE “start” charging	
10	Charging sequence signal 2	EVSE releasing the charging process	
<b>Note:</b> This option does not include electromechanical contacting (connector/inlet). See following EV charging and EVSE plug-in module adapter options for further details.			

## EV Charging Adapter

Charging Standard	Adapter	Rated Voltage	Rated Current	Cable Cross-Section	Weight	Standard
<b>Adapter for AC charging</b>						
SL1040A-201 EV charging adapter AC Type 1		250 V	32 A	3x 10 AWG (6 mm <sup>2</sup> ) L1, N; PE 2x 21 AWG (0,5 mm <sup>2</sup> ) CP, PP	approx. 3 kg	IEC 62196-2 / SAE J1772
SL1040A-202 EV charging adapter AC Type 2		480 V	32 A	4x 6 mm <sup>2</sup> L1, L2, L3, N 1x 6 mm <sup>2</sup> PE 2x 0,5 mm <sup>2</sup> CP, PP	approx. 3 kg	IEC 62196-2
SL1040A-205 EV charging adapter GB/T AC		440 V	32 A	4x 6 mm <sup>2</sup> L1, L2, L3, N, PE 2x 0,5 mm <sup>2</sup> CP, CC	approx. 3 kg	GB/T 20234.2
<b>Adapter for DC charging</b>						
SL1040A-203 EV charging adapter CCS Type 1		1000 V	125 A	2x AWG 1 (50 mm <sup>2</sup> ) DC ± 1x AWG 3 (30 mm <sup>2</sup> ) PE 4x AWG 18 (1 mm <sup>2</sup> ) CP, PP, PTC	approx. 9 kg	IEC 62196-3 / SAE J1772
SL1040A-204 EV charging adapter CCS Type 2		1000 V	200 A	2x 70 mm <sup>2</sup> DC ± 1x 35 mm <sup>2</sup> PE 6x 0.75 mm <sup>2</sup> CP, PP, PTC	approx. 11 kg	IEC 62196-3
SL1040A-206 EV charging adapter GB/T DC		1000 V	250 A	2x 70 mm <sup>2</sup> DC ± 1x 25 mm <sup>2</sup> PE 6x 0,5 mm <sup>2</sup> S ±, CC1/2, PTC 2x 2,5mm <sup>2</sup> A ±	approx. 16 kg	GB/T 20234.3
SL1040A-207 EV charging adapter CHAdeMO		500 V	125 A	2x 35 mm <sup>2</sup> DC ± 5x 0.75 mm <sup>2</sup> Signal + PE 2x 0.75 mm <sup>2</sup> communication lines	approx. 11 kg	CHAdeMO association

\* Limited by EV plug manufacturer's certification

\*\* All charging adapters have a standard length of 5 m. Other lengths available on request.



On secondary side, all EV charging adapter are equipped with a compatible connector, as shown in the following photos:



Figure 6: Example of EV charging adapter (CCS Type 2)

## EVSE Plug-In Adapter

Charging Standard	Plug-In Adapter	Rated Voltage	Rated Current*	Standard
SL1040A-101 EVSE plug-in adapter CCS Type 1		AC: 250 V	AC: 32 A	IEC 62196-2 / SAE J1772
		DC: 600 V	DC: 125 A	IEC 62196-3 / SAE J1772
SL1040A-102 EVSE plug-in adapter CCS Type 2		AC: 480 V	AC: 32 A	IEC 62196-2
		DC: 1000 V	DC: 200 A	IEC 62196-3
SL1040A-103 EVSE plug-in adapter GB/T AC		440 V	32 A	GB/T 20234.2
SL1040A-104 EVSE plug-in adapter GB/T DC		1000 V	250 A	GB/T 20234.3
SL1040A-105 EVSE plug-in adapter CHAdeMO		600 V	125 A	CHAdeMO association

\*Maximum current values are limited by the available EV inlet itself. Higher ampacity will be available as soon as inlet availability improves. CDS HV module limitation is 400 A DC, see specification in chapter 2.

Note: The weight of the plug-in adapters is between 3.3 and 4.5 kg.


The following exemplary photo shows the side- and reverse view of a plug-in adapter:



Figure 7: Side view (left) and of the reverse side (right) of a plug-in adapter


## Advanced Hardware Options

### Plug-in adapter to connect a power source to the CDS (EVSE emulation)

Charging Standard	Plug-In Adapter	Rated Voltage	Rated Current	Max. Wire Cross-Section	Weight
SL1040A-106 EVSE Plug-in adapter for connection of an Emulator		AC: 250 V	AC: 32 A	AC: 6 mm <sup>2</sup>	5.7 kg
		DC: 1000 V	DC: 400 A	DC: 120 mm <sup>2</sup>	


Note: RCD type B protection included. For EVSE emulation a power source has to be connected with the CDS. For that a relevant adapter cable is required:

### Adapter cable to connect a power source/load to the CDS (EV and EVSE emulation)

Charging Standard	Plug-In Adapter	Rated Voltage	Rated Current	Max. Wire Cross-Section	Cable length	Weight
SL1040A-209 Adapter cable for connection of an AC-power-source		250 V	32 A	6 mm <sup>2</sup> PE: 6 mm <sup>2</sup>	5 m	4 kg
SL1040A-210 Adapter cable for connection of a DC-power-source up to 125 A		1000 V	125 A	50 mm <sup>2</sup> PE: 25 mm <sup>2</sup>		7 kg
SL1040A-211 Adapter cable for connection of a DC-power-source up to 300 A		1000 V	300 A	95 mm <sup>2</sup> PE: 50 mm <sup>2</sup>		9 kg

Note: For EVSE emulation a power source has to be connected with the CDS. For that a relevant plug-in-adapter (SL1040A-106) is required.

### Plug-in adapter to connect the CDS to the low-voltage grid

Charging Standard	Plug-In Adapter	Rated Voltage	Rated Current	Standard	Weight
SL1040A-107 Plug-in adapter CEE		AC: 250 V	AC: 32 A	IEC60309	3,8 kg

Note: RCD type B protection included.

## SL1040A-IRE Insulation Resistance Emulator

For testing the insulation monitoring function of vehicle or charging station, a variable resistance between DC+ and PE and DC- and PE is connected to the Charging Discovery System (CDS). The Insulation Resistance Emulator (IRE) can be used in this way to emulate an insulation fault systematically. The IRE may only be used in combination with the CDS and is shipped with an example test case for EVSE testing.

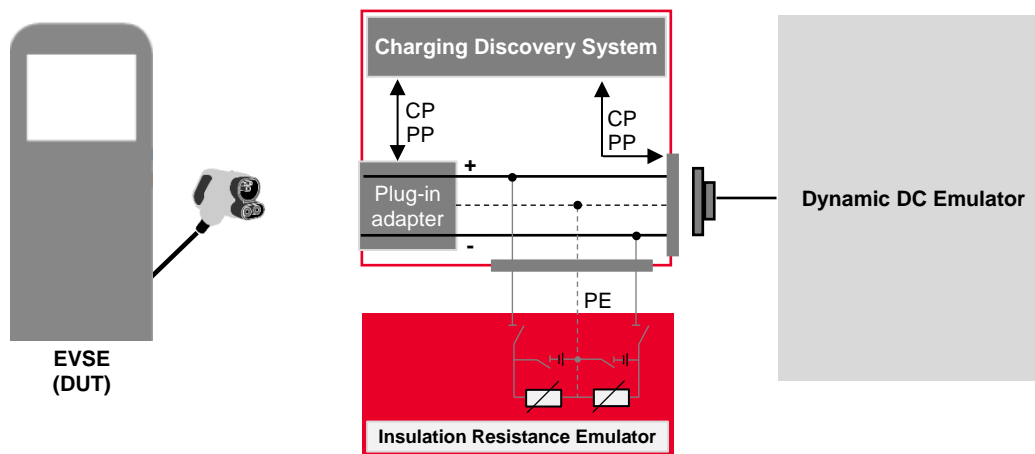


Figure 8: System topology including Isolation Resistance Emulator

Technical data	
Dimension (H x W x D)	300 x 520 x 600 mm
Weight	Approximately 15 kg
Protection class	IP20
Adjusting range per R-cascade	500 $\Omega$ - 2 M $\Omega$
Adjusting range Y-Capacitance	0; 0.5; 1.0; 1.5; 2.0 $\mu\text{F} \pm 5 \%$
Resolution	17 Bit
Max. adjustment deviation at 1 k $\Omega$ to 1 M $\Omega$	1 % of adjustment value
Electric strength	1000 V
Self-protection	Minimum total resistance DC+ to DC- limited by software
	32 mA fuse

## SL1040A-TC1 Transport Case

Case to transport a CDS or an external passive HV load. A fitted plastic foam casing guarantees a safe transport free from vibrations.

Technical data	
Dimension (H x W x D)	approx. 640 x 690 x 430 mm
Weight	approx. 7 kg
Material	Aluminum
Lock	2x quick release on one side
Included accessories	ABUS three-digit combination lock
	Removable trolley

The following photos show the CDS inside the transport case:



Figure 9: Exemplary photos of the transport case

## Licenses

### SL1040A-S01 Expert Mode

The Expert Mode option includes two independent features: Remote Interface and Test Editor System Key.

#### Remote Interface

The Expert Mode enables users to connect the Charging Discovery System with a third-party test automation through Ethernet (TCP/UDP). This interface allows users to parametrize EV/EVSE emulation or test case mode and execute tests remotely. The Keysight Windows application software, Charging Discover, captures traces in this mode when automatically connected, but the software tool is not required during test execution anymore (Note: it is still required for test case and test project definition).

Remote access supports the following functions:

- Configure use-case, charging standard, and operation mode (AC or DC) or select and run test projects/cases.
- Start, stop and reset the system
- Read charging state (PWM and high-level communication)
- Read all electrical measurements of CDS (signal and power)

Note: For complete access to all functions of remote interface see the chapter “SL1040A-S02 Developer Mode”. Later upgrade to Expert Mode, and from Expert to Developer Mode is possible at any time.

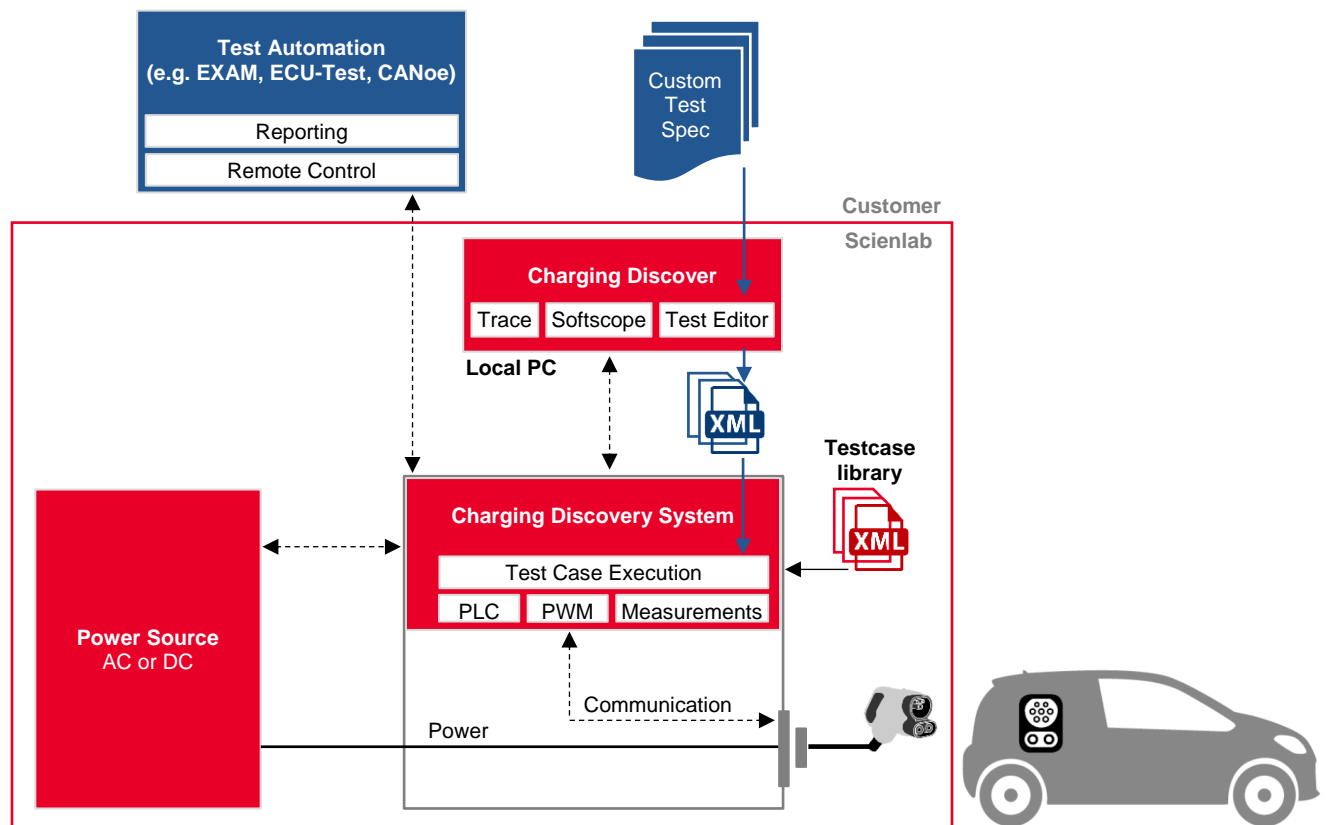


Figure 10: Interface topology of CDS with expert mode

## Test Editor System Key

The Test Editor allows users to conveniently define their own test cases directly within the Charging Discover graphical user interface. With the Test Editor System Key, test cases can easily transfer to and executed by the CDS.

Test case programming is performed using functions based on common high-level language elements. Loops, test cases, and subroutines can be combined. Available system functions and parameters are automatically suggested and explained through tooltips while typing (intelligent code completion).

- Simple and intuitive programming language (proprietary, but C-like) and clear tabular representation
- Use of chronological value tables or real charging profiles
- Dynamic source/sink parametrization: modification of setpoint parameters while the source/sink is active
- Independent creation of test sequences using variables for different device under test profiles
- Use of "print commands" for documenting dynamic results in the Charging Discover trace

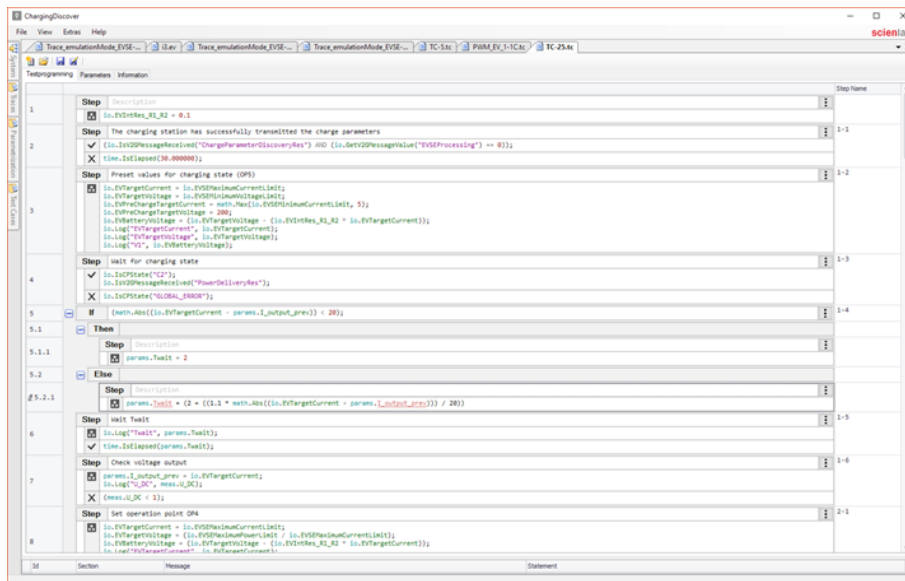


Figure 11: Test Editor screenshot

Note: If the CDS is ordered without a power source or an EVSE load, only test cases on signal level can be executed.

Contents of this option:

- Remote interface and Test Editor System Key
- Remote interface documentation, consisting of:
  - 1: Specification of Scienlab Ethernet Protocol (SLEP, intermediate protocol layer between UDP/TCP and application)
  - 2: Software Interface Specification CDS (application layer describing all signals and functions accessible through remote interface)

Note: Test Editor documentation is part of the Charging Discover operating manual.

Note: Price is valid until 1 year after test acceptance.



## SL1040A-S02 Developer Mode

The “Developer Mode” contains all expert mode features but adds additional functionality to the remote interface. (Note: it is never required to get both options – Expert and Developer Mode. Either is required for remote operation)

Extended remote access adds the following functions:

- Manual control of CP and PP output in EVSE emulation (e.g. PWM amplitude, frequency or duty cycle)
- Manual control of CP in EV emulation (e.g. setting R2/R3 resistance and cable capacitance)
- Remote variation of all charging communication parameters (before and during charging)
- Remote injection of fault states in Control- and ProximityPilot (e.g. short circuit)
- Manual control of attached power sources/loads: voltage/current setpoints, power-switch off limits.
- Access all charging state related high level parameters of EV and EVSE (V2G or CAN) as decoded values (e.g. TargetCurrent, PresentVoltage, SOC)
- Direct access to EV and EVSE PLC modem of CDS (GreenPHY QCA7000).

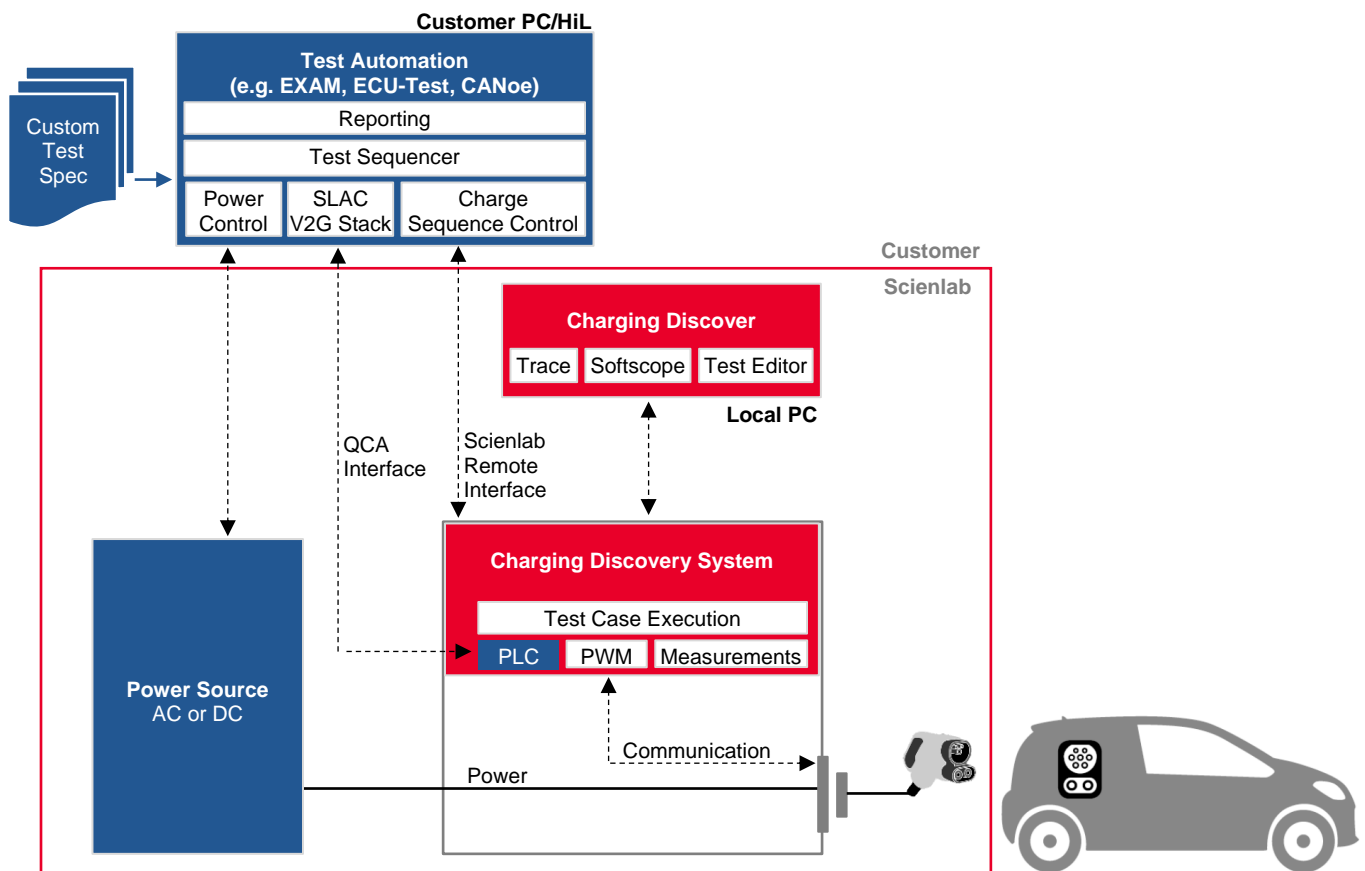


Figure 12: Interface topology of CDS with developer mode

Because of the direct access to all internal CDS components, users can integrate the CDS in their own test bench, automation software, or hardware-in-the-loop systems and therefore combine the CDS with other third-party power sources/loads. Note: When doing so, the CDS is neither controlling the charging sequence, nor the third-party power sources and loads. Since this control is managed by the customer's software and operator, Keysight is not responsible for technical integration issues. Technical support can be received through productivity support service.

## Service Options

Service demand depends on the chosen hardware configuration, the installation location and its facilities, and the scope of testing. For that reason, it is difficult to estimate the exact amount of service required prior to identifying all relevant customer requirements. Keysight offers a wide spectrum of services to guarantee a successful project and reduce the ramp-up time for our customers.

### **HS0003A-100 Project Management and Technical Consulting Service**

Project Management and Technical Consulting Service is mandatory for every project including a construction, integration or customization part. Keysight recommends this additional service in every Charging Discovery System project, in particular with the first order. By ordering the Project Management Service, an experienced project manager or system specialist is dedicated to your project and acts as direct communication interface from Keysight to the customer's project team.

The project manager has the following responsibilities:

- Consult the customer with in-depth technical knowledge about the test solution, its application and relevant test standards.
- Learn about the customer's objectives and give guidance how to use the ordered solution best in order to gain maximum benefits.
- Evaluation of post-order requirements and change management
- Coordinating and tracking project progress from day one until system handover
- To provide complete and accurate project documentation to the customer.

### **R9001A-201 Installation Service**

The scope of Keysight's Installation Service depends on the customer's facility. Keysight can provide full installation options for all products. To get a quote, share all relevant information and requirements with regards to test bench components that require media installation such as grid interface and cooling water supply with your local field engineer.

Note: Installation can also be executed by the customer.

### **R9002A-202 Commissioning Test**

The Commissioning Test Service guides customers during first usage of the test bench after installation. Commissioning Test Service is recommended for each test bench project and includes:

- Support in commissioning the test system and instructions on how to use it.
- Local presence of experienced test bench engineer during first usage of the test bench.
- Consulting of customer personnel with regards to intended usage of the test bench (e.g. initial test with customer specimen, evaluation of test results)
- Inspection of hardware/laboratory installation
- Initial installation and configuration to the control software Charging Discover as well as hand-on instructions how to use it.
- Travel expenses

Note: Commissioning Test Service is offered on a daily basis. Keysight recommends at least two days of Commissioning Test Service for each test system.

## HS0002A-100 Productivity Support Service

The Productivity Assistance Support Service is offered to support, consult and train the customers operation personnel to reduce the ramp-up time during the initial usage of a new test system, and on the other hand with regards to any unexpected system behavior during the test bench life cycle. Productivity Support Service is carried out remotely (phone/ internet) or on site (on request). It includes:

- Direct access to an experienced system specialist via phone/internet.
- Trouble-shooting support
- Software and programming support & consulting (e.g. how to use, modify or create conformance/interoperability test cases)

Note: Keysight recommends at least three days of Productivity Support Service for each test bench project.

Learn more at: [www.keysight.com](http://www.keysight.com)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

