

Scienlab Test Case Library

Charging Discover

SL1300A



Software Overview

The Scienlab Charging Discovery System (CDS) from Keysight enables users to easily define, compile and execute custom test routines.¹ In addition, Keysight provides complete test case libraries for all important charging conformance and interoperability standards. Each library is developed according to official specification and carefully verified with all CDS hardware configurations and every software release version. Hence, it is the quickest and most simple way to get valid test results out of the box.

This datasheet gives an overview of all currently available test case bundles driven by Scienlab Charging Discover software and explains its content. Each library is based on a national or international standard that specifies a certain number of concrete test cases with detailed description of test actions and the expected behavior.

¹ See also item SL1040A-S01 Expert mode in data sheet SL1040A and SL1047A. Further see item SL1093A-FP Charging Discover (operating software) in data sheet SL1093A.

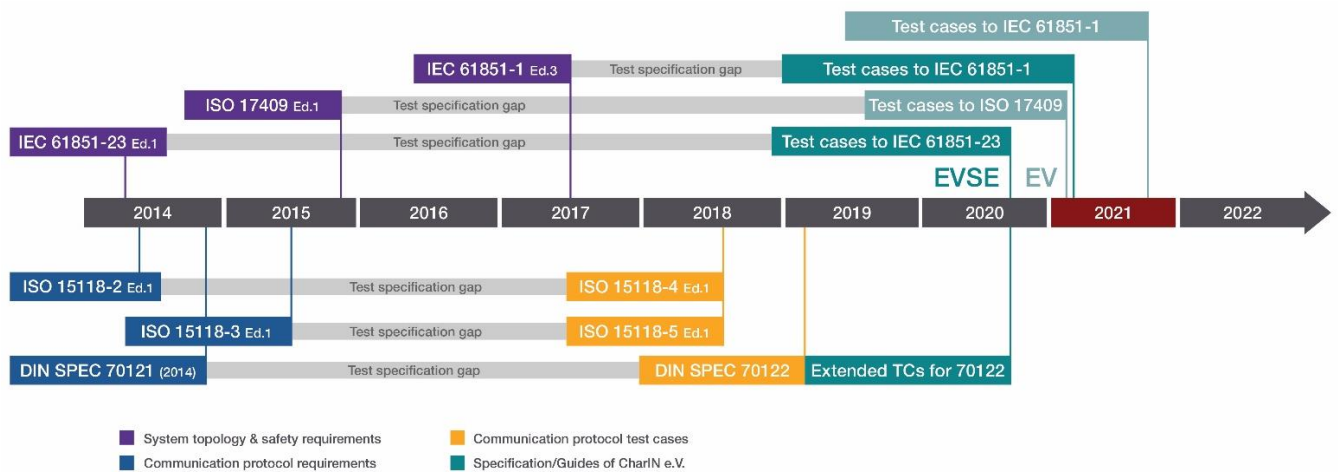


Figure 1. Overview of CCS interoperability related standards as timeline

In case of IEC 61851-1 and IEC 61851-23, the given items refer to the according test specifications provided by CharIN e.V., which are not released at the time of publication of this data sheet (expected for EVSE Q2 2021 and EV Q4 2021).

Furthermore, this datasheet also contains KeysightCare Software support subscription options (see items R-W6W-001-x) which are recommended, because frequent updates of all test case packages are expected due to partially incomplete/immature specifications.

It is important to mention, that the following test case packages have different test objectives. Some are focusing entirely on protocol test, others are designed to test electrical safety and performance. Thus, some test cases can be executed on a simple hardware without restrictions, while other more system-related test cases require an extended hardware setup including power source/load. The following overview illustrates four examples:

Component test EVSE	
<p>In case of testing the charging communication controller of an EVSE only, all protocol test cases can be executed by using the minimum CDS configuration. Only the Realtime computer plug-in unit and the according communication modules (for PLC or CAN interfaces) are required.</p>	
Component test EV	
<p>In case of testing the charging communication controller of an electric vehicle only, all protocol test cases can be executed on the same hardware setup as in the previous case.</p>	
Full system test EVSE	
<p>When testing the entire product, an extended setup with HV module and EVSE plug-in adapter are required for contacting the Device under Test (DUT) (see SL1040A datasheet). In addition, a suitable AC or DC power load must be provided to run through the entire charging sequence and reach all desired test steps.</p>	
<p>Note: For some safety critical failure injection test cases, further HW modules may be required also.</p>	<p>Note: Example shows Regenerative Power Source/load of type RP79xx from Keysight</p>
Full system test EV	
<p>When testing the charging interface of an entire electric vehicle, a full CDS configuration with HV module, charging adapters a suitable AC or DC power source is required.</p>	
	<p>Note: Example shows Regenerative Power Source/load of type RP79xx from Keysight</p>

Option Class EVSE Test Cases

SL1301A Test case EVSE – SAE J2953/2

Origin of requirements: SAE J2953/1 (October 2013), SAE J1772 (October 2012)

Origin of test specification: SAE J2953/2 (published January 2014)

Test scope: AC charging only; interoperability and functional safety

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, frequency, duty cycle).
- Check for correct detection of safety related events and correct DUT reaction (e.g. termination of charging session when pressing the latch button of the charging adapter).
- Test of capability for scheduled charging sessions (e.g. user-initiated delay of charging session, user-initiated interrupt of and automatic resume to charging session).

Quantity: 28 AC test cases

Note: This standard has been originally intended for simultaneous testing of EV and EVSE and using a break-out box fixture for data logging. Keysight implementation contains individual EV or EVSE test cases instead. Only this way interdependencies between two DUTs can be eliminated and the verdict becomes traceable.

SL1302A Test case EVSE – GB/T 34657.1

Origin of requirements: GB/T 18487.1-2015, GB/T 27930-2015

Origin of test specification: GB/T 34657.1 (published October 2017)

Test scope: AC and DC charging; interoperability

- Test of “Charging phase and charging end phase”.
- Test of “Charge control pilot circuit”.
- Test of “Abnormal charging states”, such as communication interruptions.
- Charging output control tests.

Quantity: 30 AC test cases and 47 DC test cases

Note: For successful execution of the included AC test cases, an AC sink (e.g. AC resistive load or AC Emulator) is required. For included DC test cases, a DC sink (e.g. DC Emulator) is required. For some DC test cases it is recommended to use a resistive load or a DC source for battery voltage simulation. Therefore, the DC Emulator must cover at least the power range of the SUT. All insulation test cases require the CDS option “Insulation Resistance Emulator (SL1040A-IRE)”.

SL1303A Test case EVSE – GB/T 34658

Origin of requirements: GB/T 27930 (published 2015)

Origin of test specification: GB/T 34658 (published October 2017)

Test scope: DC charging only; conformance test of protocol

- Test of “Low-voltage auxiliary power-on” and “Charging handshake process”.
- Test of “Charging parameter configuration phase”.
- Test of “Charging phase and charging end phase”.

Quantity: 67 DC test cases

SL1304A Test case EVSE – CHAdeMO

Origin of requirements: CHAdeMO 1.2 3rd Edition (published December 2017)

Origin of test specification: Protocol check sheet Version 1.2 (published by CHAdeMO Association in September 2017)

Test scope: DC charging only; conformance test of protocol

- Test of charger reaction due to charging stop events (e.g. stop button pressed, communication of EV battery under- or overvoltage, etc.) in the different charging stages.
- Test of charger reaction due to in-compliant timing behavior of the EV in the different charging stages.
- Test of logical failures in charging session (e.g. switch k is active before switch d1 is turned on).
- Test of normal stop signal and error conditions during charging.

Quantity: Total of approx. 117 EVSE test cases according to the national Japanese standard CHAdeMO Version 1.2.

SL1305A Test case EVSE – DIN SPEC 70122

Origin of requirements: DIN SPEC 70121 (published December 2014), CharIN Implementation Guide to DIN SPEC 70121:2014

Origin of test specification: DIN SPEC 70122 (published November 2018), CharIN Test Cases for DIN SPEC 70121:2014 Implementation Guide (Version: 1.1.1 January 2021)

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all V2G Messages (Charging setup, charging loop and termination of charging)
- Test of “SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging

Quantity: Total of approx. 201 EVSE test cases according to DIN SPEC 70122 and 122 EVSE test cases according to CharIN e.V.

SL1306A Test case EVSE – IEC 61851-23 (System C, CCS)

Origin of requirements: IEC 61851-23 Ed.2, draft version MT5-198

Origin of test specification: CharIN-TC IEC 61851-1 -23 V1-0 CCS-Basic-V1.0

Test scope: DC charging (only system C, CCS); conformance test for safety, interoperability

- Test of measurement and control accuracy of EVSE DC output in CCC and CVC.
- Conformance check of Cable Check output voltage.
- Test of safety behavior of DUT (e.g. error/emergency shutdown in case of short circuit or PE loss in HV circuit).
- Test of correct insulation monitoring before and during charging session.
- Test for detection and reaction in fault conditions (e.g. Short circuit in DC output).

Quantity: 58 DC test cases

Note: This test case package contains some test cases, which requires additional CDS hardware options. For example, insulation resistance test: This kind of particular safety-relevant fault injection test cases may only be performed in a special laboratory environment. All insulation test cases require the CDS option “Insulation Resistance Emulator (SL1040A-IRE)”.

SL1308A Test case EVSE – IEC 61851-1

Origin of requirements: IEC 61851-1 Ed.3 (published February 2017)

Origin of test specification: AC test cases: Conformance test cases for Golden Test Device, version: 6.0 (2017), DC test cases: CharIN-TC IEC 61851-1 -23 V1-0 CCS-Basic-V1.0

Test scope: AC and DC charging; system requirements and basic signaling

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, frequency, duty cycle, etc.).
- Test of robustness and interoperability through systematic variation of all CP parameters during ongoing charging session.
- Check for correct detection of safety error events, and correct DUT reaction (e.g. Emergency shutdown in case of CP state E/F).
- Check for correct proximity pilot detection.

Quantity: 15 AC test cases and 18 DC test cases

Note: The AC test case package is not included in upcoming specification updates or maintenance. As soon as the official AC specifications from CharIN e.V. are available, the AC test cases from Golden Test Device will be replaced.

Option Class EV Test Cases

SL1309A Test case EV – SAE J2953/2

Origin of requirements: SAE J2953/1 (October 2013), SAE J1772 (October 2012)

Origin of test specification: SAE J2953/2 (published January 2014)

Test scope: AC charging only; conformance test of protocol

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, rise/fall times during CP state changes, etc.).
- Check for correct detection of safety related events and correct DUT reaction (e.g. termination of charging session when pressing the latch button of the charging adapter).
- Test of capability for scheduled charging sessions (e.g. user-initiated delay of charging session, user-initiated interrupt of and automatic resume to charging session).
- Test of continuation of the charging session in case of dynamic grid events (e.g. frequency variation, voltage swell/sag, voltage outages).

Quantity: 24 AC test cases

Note 1: This standard has been originally intended for simultaneous testing of EV and EVSE and using a break-out box fixture for data logging. Keysight implementation contains individual EV or EVSE test cases instead. Only this way interdependencies between two DUTs can be eliminated and the verdict becomes traceable.

Note 2: For successful execution of the included AC test cases, an AC source (e.g. AC grid or AC Emulator) is required. All tier 2 test cases require an AC source (e.g. AC Emulator).

SL1310A Test case EV – GB/T 34657.2

Origin of requirements: GB/T 27930 (published 2015)

Origin of test specification: GB/T 34657.2 (published October 2017)

Test scope: AC and DC charging; interoperability

- Test of “Charging phase and charging end phase”.
- Test of “Charge control pilot circuit”.
- Test of “Abnormal charging states”.
- Charging output control tests.

Quantity: 19 AC test cases and 17 DC test cases

Note: For successful execution of the included AC test cases, an AC source (e.g. AC grid or AC Emulator) is required. For included DC test cases, a DC source (e.g. DC Emulator) is required. All insulation test cases require the CDS option “Insulation Resistance Emulator (SL1040A-IRE)”

SL1311A Test case EV – GB/T 34658

Origin of requirements: GB/T 27930 (published 2015)

Origin of test specification: GB/T 34658 (published October 2017)

Test scope: DC charging only; conformance test of protocol

- Test of “Low-voltage auxiliary power-on” and “Charging handshake process”.
- Test of “Charging parameter configuration phase”.
- Test of “Charging phase and charging end phase”.

Quantity: 105 DC test cases

SL1313A Test case EV – DIN SPEC 70122

Origin of requirements: DIN SPEC 70121 (published December 2014)

Origin of test specification: DIN SPEC 70122 (published November 2018)

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121 and IEC 61851-1:2017 (PWM signal).
- Good and error case tests through all V2G messages (Charging setup, Charging loop and termination of charging).
- Test of “SECC Discovery Protocol” and TCP/IPV6 binding process.
- Test of “V2GTP” message encapsulation.
- Test of “Supported Application Protocol Handshake” process and messaging.

Quantity: 236 DC test cases

SL1315A Test case EV – IEC 61851-1

Origin of requirements: IEC 61851-1 Ed.3 (published February 2017)

Origin of test specification: Conformance test cases for Golden Test Device, version: 6.0 (2017)

Test scope: AC and DC charging; system requirements and basic signaling

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, frequency, duty cycle, etc.).
- Test of robustness and interoperability through systematic variation of all CP parameters during ongoing charging session.
- Check for correct detection of safety error events, and correct DUT reaction (e.g. Emergency shutdown in case of CP state E/F).
- Check for correct proximity pilot detection.

Quantity: 39 AC test cases and 10 DC test cases

Note 1: The test case package is based on yet unavailable test case specifications by CharIN e.V. All upcoming (hardware compatible) specification releases, updates and extensions are covered by the software maintenance contract for this test case package.

Note 2: The test case package is not included in upcoming specification updates or maintenance. As soon as the official specifications from CharIN e.V. are available, the test cases from Golden Test Device will be replaced.

KeysightCare Software Support Subscription for Test Cases

KeysightCare software support subscription	
Each software support subscription starts after the installation and is valid for chosen duration. It includes updates for chosen test case packages ordered together with maintenance contract. Note: Maintenance contract is only valid for those test case packages that were purchased in the same order.	
Choose your duration	
R-W6W-001-L KeysightCare software support subscription, node-locked	12 months
R-W6W-001-X KeysightCare software support subscription, node-locked	24 months
R-W6W-001-Y KeysightCare software support subscription, node-locked	36 months

Extend the Capabilities of your Test Case Library

Keysight's Scienlab Charging Discovery System Series (CDS) is a breakthrough solution for holistic test of all AC and DC charging interfaces of electric vehicles (EV) and electric vehicle supply equipment (EVSE).

You can get further information to the Scienlab Charging Test Solutions below.



From left to right: SL1040A CDS – EMC Series, SL1040A CDS – Portable Series and SL1047A CDS – High-Power Series

Meet the SL1040A Scienlab Charging Discovery System Series

The Scienlab Charging Discovery System Series from Keysight enables you to test charging interfaces of electric vehicles (EVs) and EV supply equipment (EVSE). Thanks to its modular and innovative design, you can configure the CDS to customers' specific needs and replace multiple real EV/EVSE with one test solution to ensure an optimal price-performance ratio.

- Automated functional, conformance, interoperability and quality testing for R&D, end-of-line (EOL) and Electromagnetic Compatibility (EMC) applications.
- Time synchronous measurement and decoding of communication and power signals.
- Scalable and futureproof hardware design according to CharIN e.V. CCS Test System.
- CE, UL and KC-Mark conformance certified by CSA Group.
- Extensive Test Case Library for automated conformance testing of CCS, CHAdeMO and GB/T standard.

Find out more about the [SL1040A Scienlab CDS Series](#).

Meet the SL1047A Scienlab Charging Discovery System – High-Power Series

The Scienlab Charging Discovery System – High-Power Series (CDS HP Series) from Keysight enables you to test charging interfaces of electric vehicles (EVs) and EV supply equipment (EVSE) during high-power charging up to 1,500 V DC and ± 600 A DC. With the CDS can perform all necessary conformance and interoperability tests according to worldwide charging standards. Our new solution, which features the separate Scienlab Cooling Unit with interchangeable liquid-cooled charging adapters, also enables a high-power upgrade of the SL1040A Scienlab Charging Discovery System – Portable Series.

- Automated functional, conformance, interoperability and quality testing for R&D and EOL applications.
- Time synchronous measurement and decoding of communication and power signals.
- Scalable and future-proof hardware design according to CharIN e. V. CCS Test System.
- CE, UL, and KC-mark conformance.
- Extensive Test Case Library for automated conformance testing of CCS, CHAdeMO, and GB/T standard.

Find out more about the [SL1047A Scienlab CDS HP Series](#).

Meet the SL1093A Scienlab Charging Discover Test Software

The Scienlab Charging Discover Test Software controls the Scienlab Charging Discovery System. With this up-to-date, user-friendly software, you can operate the system, visualize measured values, record test sequences, and generate reports for trusted insights.

- Live and synchronized views of recorded measurements.
- Test editor for creating individual test cases.
- Powerful graph view for analyzing recorded traces.
- Export of measured values (for example, MDF).
- Remote functionality for hardware in the loop test benches.

Find out more about the [SL1093A Scienlab Charging Discover Test Software](#).

Learn more at: 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

