SL1300A Scienlab Test Case Library Charging Discover

Perform conformance and interoperability testing with test suites
Perform Conformance and Interoperability Testing with Test Suites

The Scienlab Charging Discovery System (CDS) from Keysight enables users to easily define, compile and execute custom test routines. In addition, Keysight provides complete test case libraries for all important charging conformance and interoperability standards. Each library is developed according to official specifications 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 a detailed description of test actions and the expected behavior.

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.

System prerequisites for the operating PC

The operating PC should fulfill the following requirements:

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Recommended Intel® Core™ i5processor or higher or equivalent</td>
</tr>
<tr>
<td>Memory (RAM)</td>
<td>Recommended at least 16 Gigabyte RAM</td>
</tr>
<tr>
<td>Hard disk</td>
<td>Recommended at least 512 Gigabyte or more (The amount of required disk space mainly depends on the test scope and duration and varies according to the customer requirements.)</td>
</tr>
<tr>
<td>Network card</td>
<td>Gigabit Ethernet</td>
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<tr>
<td>Operating system</td>
<td>Recommended Windows 10, 64 Bit</td>
</tr>
</tbody>
</table>

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.
Use Cases

It is important to mention, that the following test case packages have different test objectives. Some are focused entirely on protocol tests, others are designed to test electrical safety and performance. Thus, some test cases can be executed on simple hardware without restrictions, while other more system-related test cases require an extended hardware setup including power source/load. Perform the following main use cases covered by the Keysight Scienlab Test Case Library Charging Discover.

Use case 1: Component test of EVSE (SECC) or EV (EVCC)

In the case of testing the charging communication controller of an EVSE or EV only, all protocol test cases can be executed by using the minimum CDS configuration. Only the real-time computer plug-in unit and the according communication modules (for PLC or CAN interfaces) are required.

Figure 1. Component test of EVSE (SECC) with CDS (minimum configuration), SL1093A Charging Discover Software, and SL1300A Scienlab Test Case Library Charging Discover

Figure 2. Component test of EV (EVCC) with CDS (only real-time computer plug-in unit), SL1093A Charging Discover Software, and SL1300A Scienlab Test Case Library Charging Discover
Use case 2: Full system test of EVSE or EV

When testing the charging interface of the entire product, an extended setup with an HV module and EVSE plug-in adapter (for the EVSE test) or charging adapters (for the EV test) is required for contacting the Device under Test (DUT). In addition, a suitable AC or DC power load (for the EVSE test) or source (for the EV test) must be provided to run through the entire charging sequence and reach all desired test steps.

**Note:** For some safety-critical failure injection test cases, further HW modules may be required also.

**Figure 3.** Full system test of EVSE with CDS with RP79XXA (power load), SL1093A Charging Discover Software, and SL1300A Scienlab Test Case Library Charging Discover

**Figure 4.** Full system test of EV with CDS with RP79XXA (power source), SL1093A Charging Discover Software, and SL1300A Scienlab Test Case Library Charging Discover
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 (Tier 1 and Tier 3)

**Note:** This standard has been originally intended for simultaneous testing of EV and EVSE and using a breakout 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 0.9.1 (published January 2012), CHAdeMO 1.2 3rd Edition (published December 2017)

**Origin of test specification:** Protocol check sheet version 0.9.1 (published by CHAdeMO Assoc. in September 2017), Protocol check sheet Version 1.2 (published by CHAdeMO Assoc. 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 incompliant 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. 37 EVSE test cases according to the national Japanese standard CHAdeMO Version 0.9.1 and a 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


**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 CDV1

**Origin of test specification:** CharIN-TC IEC61851-1 -23 V1-0 CCS-Basic-V1.0.1

**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 a 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 require additional CDS hardware options. For example, insulation resistance test: This kind of 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 IEC61851-1 -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 an 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

Each software support subscription starts after the installation and is valid for the chosen duration. It includes updates for chosen test case packages ordered together with the maintenance contract.

**Note:** The maintenance contract is only valid for those test case packages that were purchased in the same order.

Choose your duration

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Duration</th>
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</thead>
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<tr>
<td>R-W6W-001-L</td>
<td>KeysightCare software support subscription, node-locked</td>
<td>12 months</td>
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<tr>
<td>R-W6W-001-X</td>
<td>KeysightCare software support subscription, node-locked</td>
<td>24 months</td>
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<tr>
<td>R-W6W-001-Y</td>
<td>KeysightCare software support subscription, node-locked</td>
<td>36 months</td>
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Extend the Capabilities of your Test Solution

Meet the Scienlab Charging Discovery System family of solutions

Accelerate your charging interface testing and validate charging behavior across EV and EVSE

Keysight’s Scienlab Charging Discovery System Series (CDS) supports the latest adapters and protocols used with EVs and EVSE. As use cases, standards, and protocols evolve, our modular, upgradeable portfolio will help you ensure conformance and interoperability today and tomorrow.

Figure 5. From left to right: SL1040A CDS – Portable Series, SL1047A CDS – High-Power Series, and SL1093A Charging Discover Software

- Configure the CDS to your specific needs and replace multiple real EV/EVSE with one test solution.
- Address R&D and type-approval applications with automated functional, conformance, interoperability, safety, and quality testing.
- Automate and accelerate conformance testing with pre-programmed test cases.
- Get a holistic view of current and voltage measurements as well as charging communication.

Find out more about SL1040A Scienlab CDS Series here.
Find out more about SL1047A Scienlab CDS – High-Power Series here.
Find out more about SL1093A Scienlab Charging Discover here.
Meet the SL1200A Series Scienlab Regenerative AC Emulator, 3-Phase

The SL1200A Series was designed to handle all your 3-phase AC test needs up to 1200 VAC, from 30 to 630 kVA without the need for a transformer. Two voltage ranges are available: 600 VAC and 1200 VAC. The 600 VAC models are ideal for low voltage inverter test as well as EV and EVSE charging test applications. The 1200 VAC models allow for (HVRT) testing at the IEC LV-AC limit without the need for a large, complex test setup.

- Covers AC test needs; up to 1200 VL-L; up to 130 A; up to 630 kVA
- Achieve 1200 VL-L at full specifications without extra equipment, such as a transformer
- Save energy with 100% regenerative (bidirectional) power solution with >85% efficiency
- Get up and running immediately with intuitive soft front panel (SFP)
- Feel confident with complete, one-vendor solution of hardware, software, consulting, and support services worldwide for many applications, such as EVSE/EV charging test.

Figure 6. SL1200A Series Scienlab Regenerative AC Emulator

Find out more about the SL1200A Series here.
Meet the SL1800A Scienlab Regenerative DC Emulator – High-Power Series

Keysight’s SL1800A Scienlab Regenerative DC Emulator – High-Power Series enables you to emulate the large batteries in electric vehicles. The bidirectional power flow allows emulation of both power sourcing applications, such as traction inverter test, as well as power-absorbing (sinking) applications, such as EV charging. Being regenerative, the power absorbed is delivered back to the grid, saving on energy and cooling costs. With bi-directionality, integrated DC voltage and current controllers, high dynamics, and its regenerative energy feedback capacity, the Scienlab Dynamic DC Emulator provides an all-in-one system for efficient and effective testing of the power electronic components in EV and EVSE.

- Fully integrated with SL1040A and SL1047A Scienlab Charging Discovery System.
- Available for high voltage, high-power applications. Extendable to meet future, increased power needs.
- Energy-efficient source and sink mode (96%).

![Figure 7. SL1800A Scienlab Regenerative DC Emulator - High-Power Series](image)

Find out more about the SL1800A Series [here](#).