

EV ComboCS - The CCS Tester



Accelerate and make CCS developments more reliable

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Trialog is working on EV charge since more than 10 years and had several opportunities to develop a strong expertise on Electro-Mobility charge protocols like IEC 61851-1, DIN 70121, ISO 15118 and OCPP 1.6/2.0.

In this context, Trialog has developed several testing and validation tools.



ComboCS, the EV CCS Simulator is one of these tools. It aims to enable and simplify CCS developments by providing simulation and test means of DIN 70121 and ISO 15118 protocols without any power transfer. This tool allows to:

- Simulate the EV part of a CCS implementation in order to perform or simulation charging session following IEC 61851-1, DIN 70121 and/or ISO 15118;
- Follow in real-time the communication through the embedded UI;
- Change in real-time the EV behaviour;
- Launch different test case scenario to trigger nominal and non-nominal test cases.

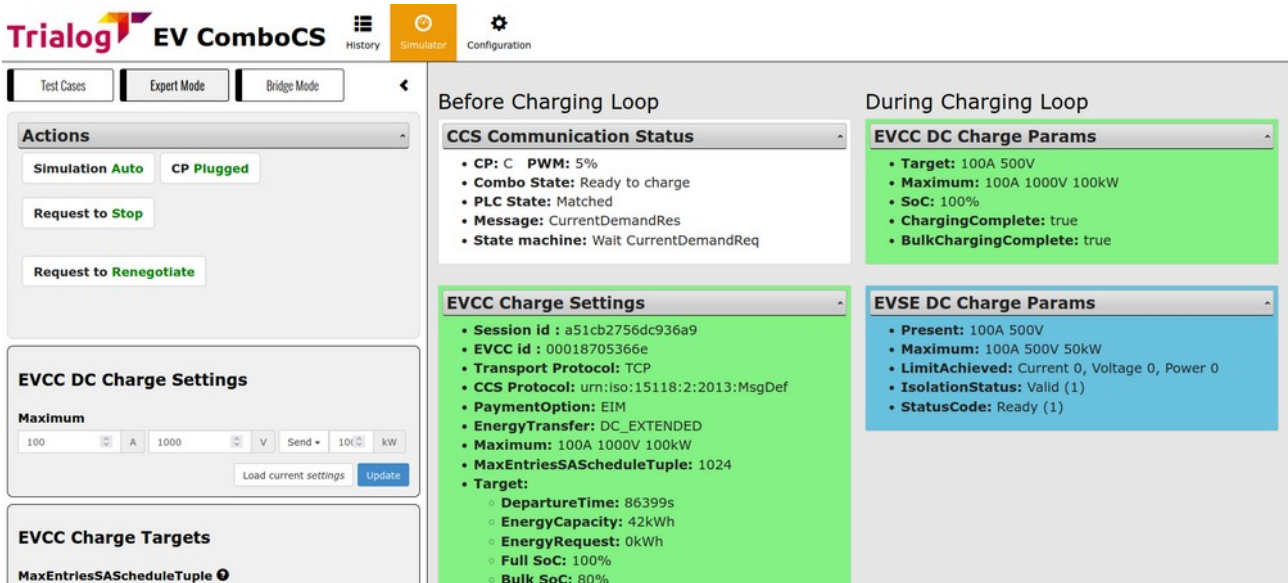


Figure 1: ComboCS User Interface

Technical Details

ComboCS is a box allowing to perform AC or DC, ISO 15118 or DIN 70121 communications, including the HPGP PLC and IEC 61851-1 communications.



Figure 2: ComboCS connectors - Face 1



Figure 3: ComboCS connectors - Face 2

- Size: 23x15x6 cm
- Power: +12V
- Connectors:
 - Control Pilot and Protective Earth: BNC
 - Ethernet: RJ45
 - CAN: DB9 (*reserved for future usage or specific development*)
 - 6 GPIO: AHW 10G-0202-T (*reserved for power transfer add-on or specific development*)
- Wires provided with the Simulator
 - AC/DC 230V/12V
 - Type 2 plug with BNC connector
 - Ethernet wire

Supported Features

ISO 15118 and DIN 70121 standards define several use cases and functions. ComboCS supports almost all functions and more specifically:

- ISO 15118-3 / DIN 70121 for PLC communication
 - SLAC
 - SLAC Validation with BCB-Toggle
- ISO 15118-2 / DIN 70121
 - SDP
 - Supported state machines: AC and DC
 - Supported payment options: EIM and Plug&Charge
 - Supported optional use cases:
 - Service Details
 - Plug&Charge Authorization
 - Plug&Charge Certificate Installation
 - Smart Charging
 - Renegotiation
 - Metering Receipt
 - Welding Detection (DC charge only)
 - Pause / Resume

For test purpose, the Simulator could also be used to perform ISO 15118-2 communication over Ethernet without the PLC ISO 15118-3 link.

ISO 15118-20 can be enabled as an option, not provided by default in ComboCS. It is available as a software update. Please see details in section SW UPGRADE TO ISO 15118-20 EXTENSION.

Implementation in progress

“Amplitude Map exchange” of ISO 15118-3 is still under validation and provided as developer preview into the ComboCS.

ComboCS Modes

SIMULATOR MODE

By default, the EV ComboCS can be plugged to a charging station and perform a standalone and nominal CCS charging session without any other inputs.

The default configuration is:

- ISO 15118 or DIN 70121
- DC Charge
- EIM payment option
- Charge Maximum Limits: 32A, 400V, 22kW
- Charge Minimum Limits: 6A, 0V
- CurrentRegTolerance: 1A, PeakCurrentRipple: 15A

This default behavior can be modified using the Configuration view, and adapted in live using the expert and test case modes defined below.

SUPERVISOR MODE

ComboCS is provided with a Web interface, compatible with Windows, Linux and Mac, accessible over Ethernet or Wifi. It provides access to real-time evolution of the ongoing CCS communication.

The screenshot displays the ComboCS web interface, divided into two main sections: "Before Charging Loop" and "During Charging Loop".

Before Charging Loop:

- CCS Communication Status:**
 - **CP:** C **PWM:** 5%
 - **Combo State:** Ready to charge
 - **PLC State:** Matched
 - **Message:** ChargingStatusRes
 - **State machine:** Wait ChargingStatusRes
- EVSE Charge Settings:**
 - **EVSE id:** FR*VED*E0004*01*22
 - **Transport Protocols:** ["TCP"]
 - **CCS Protocols:** ["urn:iso:15118:2:2013:MsgDef", "urn:din:70121:2012:MsgDef"]
 - **PaymentOptions:** ["EIM"]
 - **EnergyTransfers:** ["AC_1", "AC_3"]
 - **Maximum:** 32A 230V
 - **SA Schedules:**
 - SASchedule #1: Charge: #1(1)[0-86400s:22kW]

During Charging Loop:

- EVSE AC Charge Params:**
 - **Target:**
 - Active 0kW
- EVCC AC Charge Params:**

No EVCC AC Charge parameter in "urn:iso:15118:2:2013:MsgDef".
- Detailed Logs:**

```
[D][38:57.359] > Tx ChargingStatusRes Ed1 {0}{0} (21ms)
[D][38:57.342] < Rx ChargingStatusReq Ed1 [0] (0ms)
[D][38:57.058] > Tx ChargingStatusRes Ed1 {0}{0} (20ms)
[D][38:57.041] < Rx ChargingStatusReq Ed1 [0] (0ms)
[D][38:56.761] > Tx ChargingStatusRes Ed1 {0}{0} (22ms)
```

Figure 4: ComboCS interface - Example of ISO 15118 communication

All data exchanged between the EVSE of the EV is available through the user interface. The history of the whole decoded communication can be downloaded as a log file.

SESSION HISTORY MODE

An historic of all charging session is kept available on the ComboCS and can be downloaded in CSV format for Excel. It allows to quickly identify a session by a number, to know its status and the failure reason.

Current Charging Session 85%									
#	EVCCID	SessionId	Type	Result	Last message	Current stage	Error code	Actions	
39	00018705366e		Not Selected	Pending	None	Waiting PLC	No error	<input type="button" value="Stop"/>	<input type="button" value="Plugged"/>

Charging Sessions History											
#	Start	Duration	EV MAC	EVCCID	RunId	SessionId	Type	Result	Last message	Last stage	Error code
31	1645201929	17 s	00018705366d	00018705366e	72089631	9db48b9eaad9bf50	DIN DC EIM	Success	SessionStopRes	Finished <input type="button" value="PCAP"/>	No error
30	1645201223	292 s	00018705366d	00018705366e	1664540707	4f006905f72cb49f	DIN DC EIM	Success	SessionStopRes	Finished <input type="button" value="PCAP"/>	No error
29	1645201011	170 s	00018705366d	00018705366e	72089631			Failure	None	Ready to charge <input type="button" value="PCAP"/>	Remote host closed the communication - TCP error: The remote host closed the connection
28	1645200992	9 s	00018705366d	00018705366e	1664540707			Failure	None	Waiting Handshake <input type="button" value="PCAP"/>	Comm Incompatibility
27	1645199573	1274 s	00018705366d	00018705366e	72089631	f3dc4f1f3702661b	ISO-2 DC EIM	Success	SessionStopRes	Finished <input type="button" value="PCAP"/>	No error

Figure 5: Session history view

TEST CASE MODE

The Test Case Mode of ComboCS triggers CCS communication session for a list of nominal and non-nominal predefined cases.

The Test Case Mode proposes two types of test cases:

- **Conformance testing:** DIN 70122, ISO 15118-4 and ISO 15118-5 documents define test cases to validate conformance of the implementation to the normative documents. ComboCS is providing a subset of these test cases. The coverage is not yet complete, but increasing regularly.
- **Interoperability testing:** Because of existing ambiguities in the norms and the multiplicity of the implementations, ComboCS is providing several test cases with limit and non-nominal behaviour of the EV, and even invalid behaviour of the EV observed « in the street ». Thanks to the experience of Trialog in the field, this list is increasing regularly.
Interoperability tests allow to reproduce the behaviour of several existing vehicles, especially for the following list of vehicles: BMW i3, DS3, Ioniq, Jaguar i-pace, Kia e-Niro, Peugeot e208 and e2008, Porsche Taycan, Renault Zoé, Tesla Model S.

Additionally to the available test cases, an HTTP/REST and WebSocket API is provided with ComboCS, allowing to define its own test cases and integrate ComboCS to its own validation process (end of line test, non regression tests, ...).

These test cases provides a great overview of the implementation state of the Charging Station in several use cases.

Current Test Case

#12 PowerDeliveryRes FAILED_PowerDeliveryNotApplied

Description:
Just before the Charging Loop (AC or DC), the EVSE is sending a PowerDeliveryRes ResponseCode 'FAILED_PowerDeliveryNotApplied' to notify that it cannot delivery energy (as defined in [V2G2-480] and [V2G-DC-401]).

Expected Result:
The EVCC shall:

- Stop the TCP communication abruptly
- Notify errors to higher layers

State: Pending

Logs:
Start preamble: reset settings & simulate unplug
Waiting 7s...
Preamble finished
Start HLC-C: simulate plug
Waiting V2G communication session startup...
State: Pending

Figure 6: ComboCS Test Case Mode

Each test case is provided with a description of the test, explanation of the successive steps, and the expected results with links to the normative requirements. An indicative result is provided at the end of the scenario.

Possibility of custom developments

On demand, it is possible to update ComboCS in order to create test cases specific to your needs and projects.

EXPERT MODE

Using the expert mode, it is possible to modify at any time the nominal behavior of the EV ComboCS before or during the Charging Loop.

Expert mode allows to define precisely each values sent by the EV in a CCS communication. Some cases require synchronisation and timing that cannot be done manually. Therefore, such cases can be passed using the Test Case mode.

Expert mode allows to control the EV:

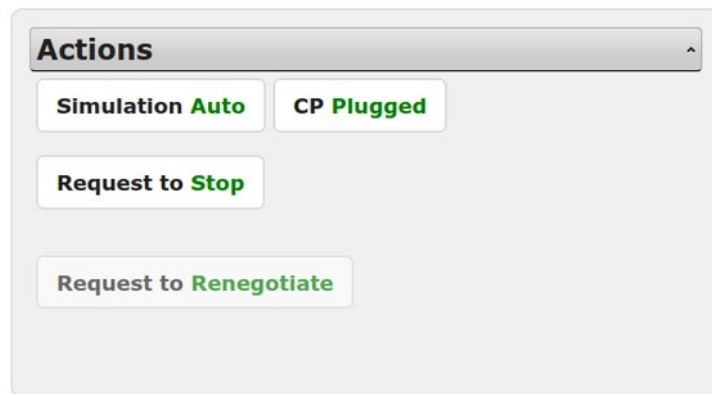


Figure 7: Start, stop, renegotiate, unplug

Expert mode allows to configure the EV charging settings:

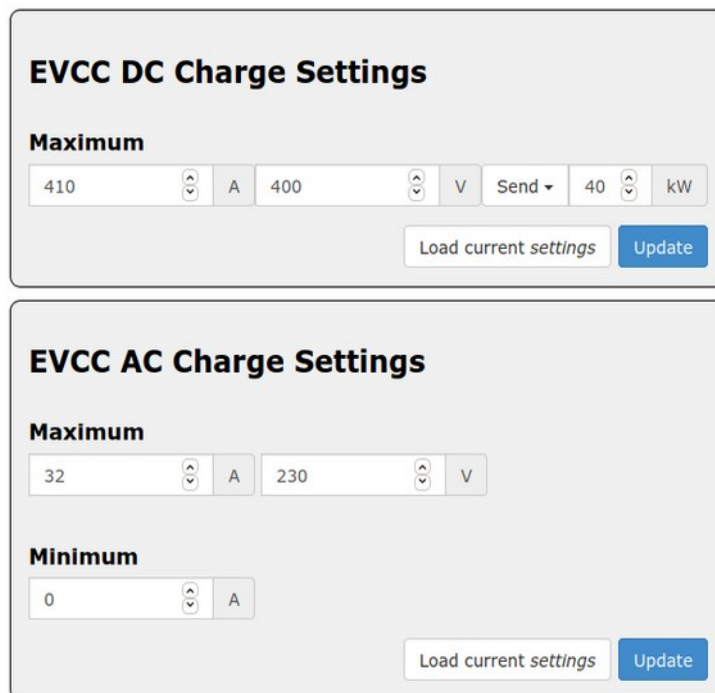


Figure 8: AC and DC charge settings

Expert mode allows to configure the EV charging request during the DC charging loop, especially the target current and voltage:

EVCC DC Charge Params

Target ?

16 A 430 V

EV Status ?

Auto EVReady ▾

Auto EVErrorCode ▾

Maximum ?

Send ▾ 0 A Send ▾ 0 V Send ▾ 0 kW

Current SoC ?

52 %

ChargingComplete

∅ BulkChargingComplete ▾

RemainingTimeToFullSoc ?

∅ RemainingTimeToFullSoc ▾

RemainingTimeToBulkSoc ?

∅ RemainingTimeToBulkSoc ▾

Load current *params* Update

Figure 9: Updating a request during the Charging Loop

INSPECTION MODE

When ComboCS Inspection mode is enabled, all PLC traffic is redirected to a Wireshark opened on the operator machine, providing access to the raw Ethernet traffic from SLAC to ISO 15118-2 or DIN 70121 for further analysis.

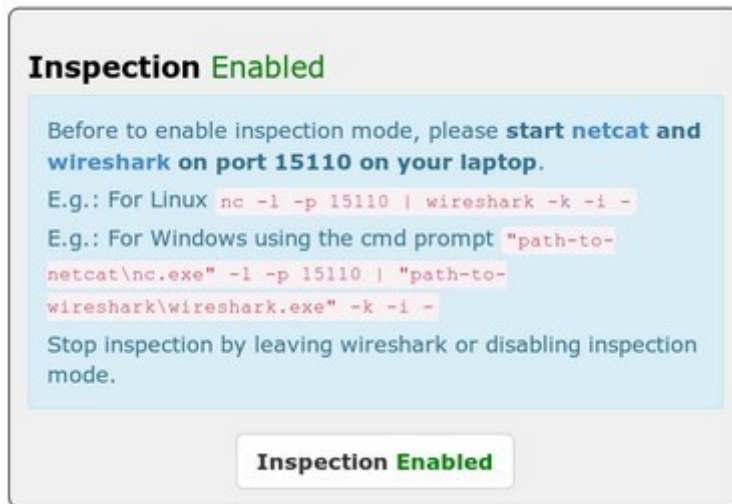


Figure 10: Bridge mode interface

Thanks to a Wireshark plugin developed by Trialog, provided with the tool, the Ethernet traffic is directly decoded in Wireshark and ready for analysis.

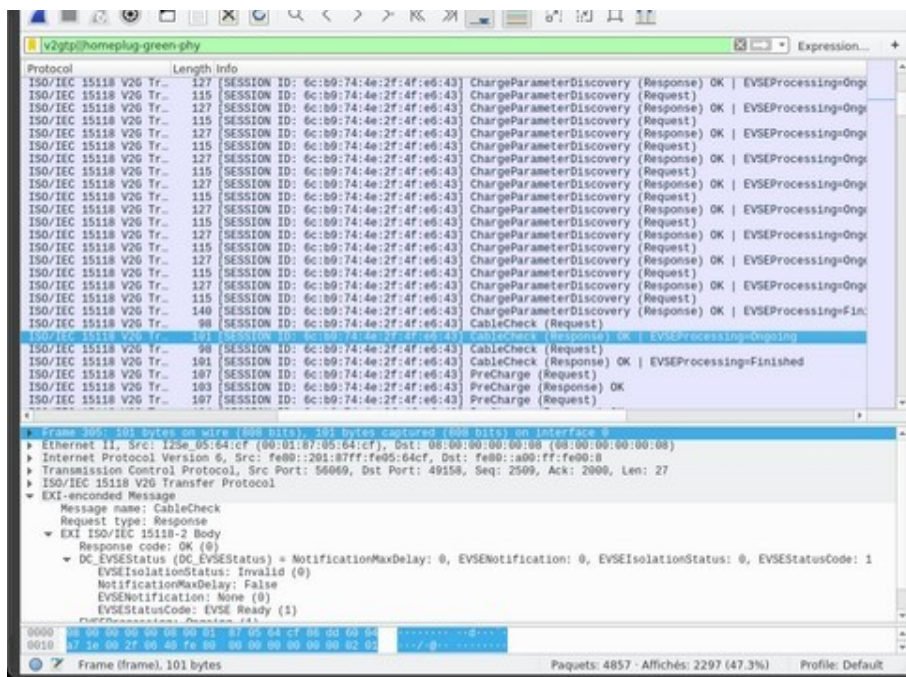


Figure 11: PLC traffic is available through Wireshark

This mode also allows to inject PLC traffic in an existing AVNL.

Please notice:

The CCS communication between the EV and the EVSE can sometime be encrypted with TLS, for example when using the Plug&Charge (PnC) feature.

In order to unencrypt a secured communication, Wireshark shall be configured with a premaster secret generated using the TLS credentials of the charging station or the vehicle. A premaster secret is unique for each charging session.

Another solution is to use the “EXI Decoder” software made by Trialog and fill it with ComboCS’ logs. The ComboCS log files contain the unencrypted EXI Plug&Charge data.

Implementation in progress

The TLS premaster key will soon be accessible from the ComboCS UI for each session: download the PCAP file, download the premaster key and configure them into Wireshark to access the data.

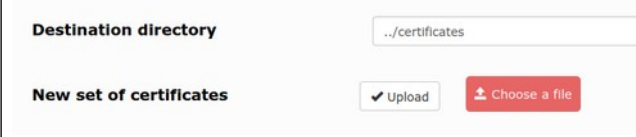

ComboCS for TLS and Plug&Charge

The ComboCS supports TLS and both Authorization and Certificate Installation use cases of Plug&Charge using ISO 15118-2.

As a test tool, the ComboCS provides error codes and detailed logs of the Plug&Charge exchanges. In particular, it provides access of the internal intermediate phases of the signature generation and verification, or Contract private key extraction, in order to facilitate analysis and debugging.

```
> Tx PaymentDetailsReq Ed1 (246ms)
  eMaid: "NLTNMC0586309X7"
< Rx PaymentDetailsRes Ed1 {0}[0](124ms)
  Challenge: "642238292bbb191bf076a0bd37f07a0"
> Prepare AuthorizeReq
  DER SignatureValue:
  "30440220020824ba40e4b1e5e0911655f2c241aac69349ca13f7a15393341ade79cb8cff022003ac211825056a019636a404383ce7139320abd1edc9eb1300cbc9ce5955d962"
  DER SignatureValue (Base64): "MEQCIAIILpA5LH14JEWVFLCQarGk0nKE/ehU5M0Gt55y4z/AiADrCEYJQVqAZY2pAQ4P0cTkyCr0e3J6xMAy8n0WVXZYg=="
  R: "020824ba40e4b1e5e0911655f2c241aac69349ca13f7a15393341ade79cb8cff"
  S: "03ac211825056a019636a404383ce7139320abd1edc9eb1300cbc9ce5955d962"
  Raw SignatureValue:
  "020824ba40e4b1e5e0911655f2c241aac69349ca13f7a15393341ade79cb8cff03ac211825056a019636a404383ce7139320abd1edc9eb1300cbc9ce5955d962"
  Raw SignatureValue (Base64): "AggkukDkseXgkRZV8sJBqsatScot96FTkzQa3nnLjP8DrCEYJQVqAZY2pAQ4P0cTkyCr0e3J6xMAy8n0WVXZYg=="
> Tx AuthorizeReq Ed1 (283ms)
< Rx AuthorizeRes Ongoing Ed1 {0}[0](1461ms)
```

Since Plug&Charge requires a PKI and since interoperability between PKIs is an important stage of testing, the ComboCS also allows to adapt to several environments:

<p>You are already using a PKI</p> <p>The ComboCS can be configured with your own PKI. Upload your PKI into the ComboCS and configure the credentials to be used.</p> <p>In case you are using the Hubject's or CharIN's PKI, the ComboCS is already embedding these 2 V2G root certificates. This will allow to setup the TLS communication. However, to perform Authorization or Contract installation, you will require to deploy a certificate chain signed by these roots.</p>	
<p>You do not have any PKI</p> <p>The ComboCS is provided with its own PKI. Download the test purpose PKI (certificates + private keys) on the ComboCS interface and install it on your EVSE.</p>	

The ComboCS Plug&Charge features has been tested in dozen of Testing Symposiums and CharIN Testivals, and tested with other test systems (Verisco, Vector, Comemso, Keysight). It is used since 2018 in all Plug&Charge international interoperability demonstrations made with ElaadNL, Vedecom, GIREVE, Hsubject, E-clearing.net, Trialog, Renault, Stellantis and others.



It is one of the few implementations used during the 2022 CharIN Festival in Poland to introduce the CharIN Plug&Charge logo.

ComboCS LEDs and GPIOs



Figure 12: Face 2 of the ComboCS

The ComboCS is provided with 6 LEDs indicating the progress of the charging session. At plugin LEDs are blinking and lighting one by one. If an error happen, LEDs are kept in their existing state to visualize quickly where it failed.

Meaning and behaviour of each LED is described below:

- **LED 1 : Control Pilot**
 - LED is off when unplugged (state A/E/F).
 - LED is blinking when plugged but not ready to charge (state B).
 - LED is on when plugged and ready to charge (state C/D). Therefore, for DC charge, it should become one at the beginning of the CableCheck process.
- **LED 2 : PLC Matched**
 - LED is blinking when the first SLAC message is received, until the end of the Matching process described in ISO 1511863 and DIN 70121.
 - LED is on when the SLAC process ifs finished with the succesful Matched state.
- **LED 3 : Cable Checked**
 - LED is blinking when the first SDP request is sent, just after the SLAC Matching process, until the end of the CableCheck process described in ISO 15118-2 and DIN 70121. A lot of steps are done in this stage (SDP, TCP/TLS connexion,

Handshake, SessionSetup, Authorization, ChargeParameterDiscovery and also CableCheck for DC charge).

- When CableCheck process is started, the LED 1 “Control Pilot” shall be on, since the EV is required to go to state C before CableCheck.
- LED is on when the end of the CableCheck mechanism is reached.
- **LED 4 : Charging**
 - LED is on when the Charging Loop is reached (PowerDeliveryReq Start in AC, end of PreCharge loop in DC, when TargetVoltage-MeasuredVoltage <20V)
 - This LED is always either on or off, it does not blink, in order to let the user use this GPIO as a a logical state to switch a charge relay.
- **LED 5 : End of charge**
 - LED is blinking when the end of the charge is requested by the EV or the EVSE
 - LED is on when the charging session is ended
- **LED 6 (red) : Test result**
 - LED is blinking when the session result is “Failure”
 - LED is on when the session result is “Success”

As a summary:

- A LED is off when the related state is not yet reached.
- A LED is blinking when the related state is in progress. With an exception for PreCharge: LED 4 is kept off until Charging Loop is reached in order to let the user use this GPIO as a a logical state to switch a relay.
- A LED is on when the related state is finished.

Therefore, all LEDs are going off when unplugged.

The GPIO connector of the ComboCS is a mirror of the LEDs. It allows the GPIO to be used to read the digital status of the LEDs, and therefore to know the status of the charging session.

The LED 4 “Charging” is always either on or off, it does not blink, in order to let the user use this GPIO as a a logical state to switch a charge relay.

The illustration below describes the pinouts of the GPIO connector:

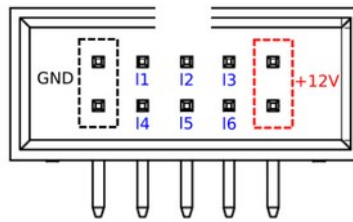


Figure 13: GPIO pinout

GPIO Voltage: 3,3V, Max current: 10mA.

Female connector is not provided with the tool. Search for HCSD-05-D-11.40-01-N-G-R reference (10 pins, 2 entries, 2.54mm space between pins).

ComboCS Options

The following options are not provided by default with the ComboCS and require a specific quotation line. They are available either as software update, or hardware update or both.

SW UPGRADE TO ISO 15118-20 **EXTENSION**

This feature is an option available as a software update.

Development in progress

A release is already available today and working. Interoperability has been tested during the first ISO 15118-20 vTestival hosted by Vector in 2022 July.

Complete implementation is still in progress. New releases with enhancements are expected every 2 months until 2022 June.

By default, the ComboCS only supports the original versions of the standard: DIN 70121 and ISO 15118-2. This SW upgrade enables the brand new ISO 15118-20 support on ComboCS.

This option provides the same feature basis as the default one but for ISO 15118-20. However, it does not provide any test case mode for ISO 15118-20 since conformance tests are not defined yet by the normative comitee.

In order to simplify validation of ISO 15118-20, the tool allows to disable TLS or to use the TLS 1.2 mechanism defined in Iso 15118-2.

The following table is listing the current status of the implementation:

Use Case	Status
SDP	Available
V2GTP	Available
Protocol selection with SupportedAppProtocol	Available
AC unidirectional and bidirectional state machines Dynamic mode	Available
DC unidirectional and bidirectional state machines Dynamic mode	Available
AC unidirectional and bidirectional state machines Schedule mode	To be scheduled

DC unidirectional and bidirectional state machines Schedule mode	To be scheduled
TLS 1.3 with Mutual Authentication	Implementation in progress
Service Renegotiation	Implementation in progress
User Mobility Needs exchange	First version already available Implementation in progress
Plug&Charge Authorization	To be scheduled
Plug&Charge Contract Installation	To be scheduled
Pause & Resume	To be scheduled

NON-INTRUSIVE SNIFFER OPTION

This feature is an option adding some measurement hardware.

In Sniffer mode, the ComboCS does not simulate anymore an EV or a Charging Station, but is plugged directly between an EV and a Charging Station communicating using CCS. ComboCS can then sniff passively the communication without interacting in any way with the PLC traffic. In such a mode, all PLC traffic is available on a dedicated RJ45 port, providing access to the raw Ethernet traffic from SLAC to ISO 15118-2 or DIN 70121. This traffic can be displayed on a Wireshark opened on the operator machine, for further analysis.

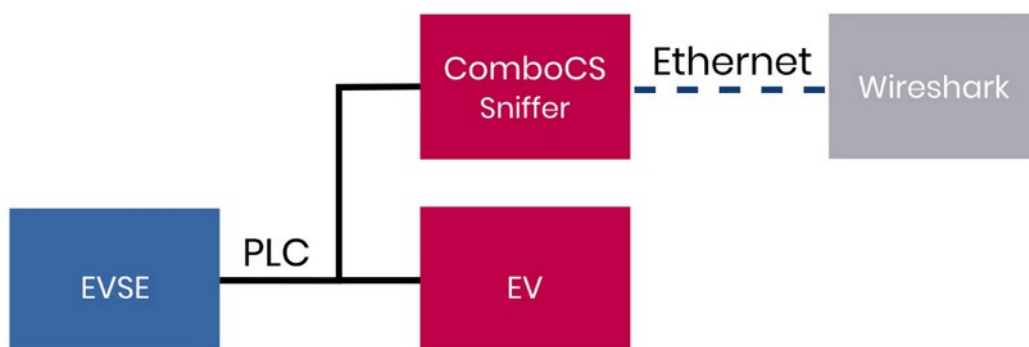


Figure 14: ComboCS + sniffer option

Thanks to a Wireshark plugin developed by Trialog, the same used in the Inspection mode described above, the Ethernet traffic is directly decoded in Wireshark and ready for analysis.

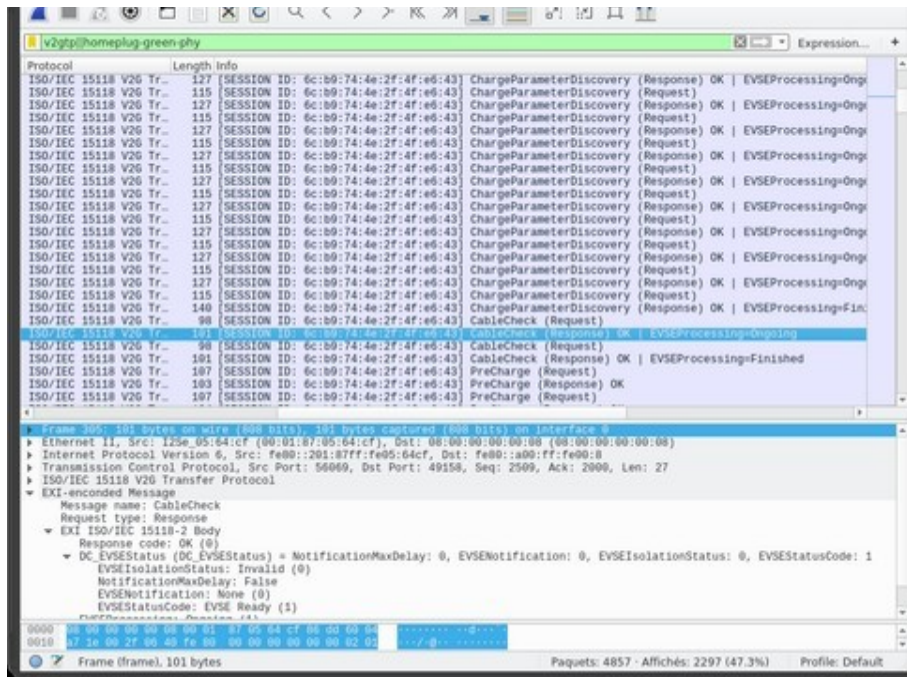


Figure 15: PLC traffic is available through Wireshark

Such a mode could have an impact on PLC power emission and shall not be used during PSD measurement.

PSD MEASUREMENT OPTION

This feature is an option available as a software update and delivery of new hardware parts.

Specific development required

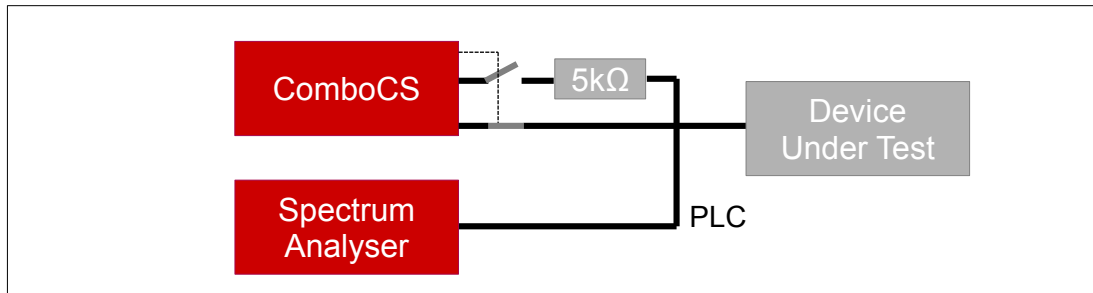
To fully automate the process, the CCS implementation shall be adapted to use the ComboCS interface, or a custom development is required on the ComboCS to put the CCS implementation in a dedicated measurement mode and change the PLC calibration.

In order to comply with ISO 15118 and DIN 70121, a CSS implementation shall emit a PLC level of -35dBm (i.e. -75dBm/Hz) for each PLC carrier between 1.8MHz and 30MHz. The measurement shall be done at the Charging Station DC plug or AC inlet, a calibration shall be done according the internal wiring of the Charging Station from the point of measurement to the PLC Modem.

The generic PSD Measurement option of the ComboCS facilitates the calibration of a CSS implementation. In this mode, the ComboCS shall be connected to a Charging Station that communicates permanently over PLC. A specific development is recommended on the

Charging Station to trigger such a communication¹. The ComboCS will then measure the PLC power emission on each carrier thanks to the setup defined in ISO 15118-3 and DIN 70121 summarized below.

The result is analysed and computed by the ComboCS in order to provide the delta to be applied on the Charging Station PLC Modem calibration.



PSD measurement add-on basic setup

The ComboCS also provides a generic communication interface over HTTP to:

- trigger the permanent PLC communication on the charging station
- retrieve the current PLC Modem calibration of the Charging Station
- apply the new PLC Modem calibration of the Charging Station

If the Charging Station is adapted to integrate this communication interface, the PSD measurement setup could be completely automated. Otherwise, it requires several manual steps.

A custom development can also be discussed with the Trialog team and added into the ComboCS in order to adapt the setup to your specific needs.

VDV261 OPTION

This feature is an option available as a software update.

With the VDV261 option, the EV will behave like buses connecting to a VDV261 backend for preconditioning and monitoring. The backend is not provided with this option.

¹ Some other solutions are available on the market, that do not require the implementation of this permanent communication over PLC on the Charging Station, but they are not compliant with ISO 15118-3 and DIN 70121.

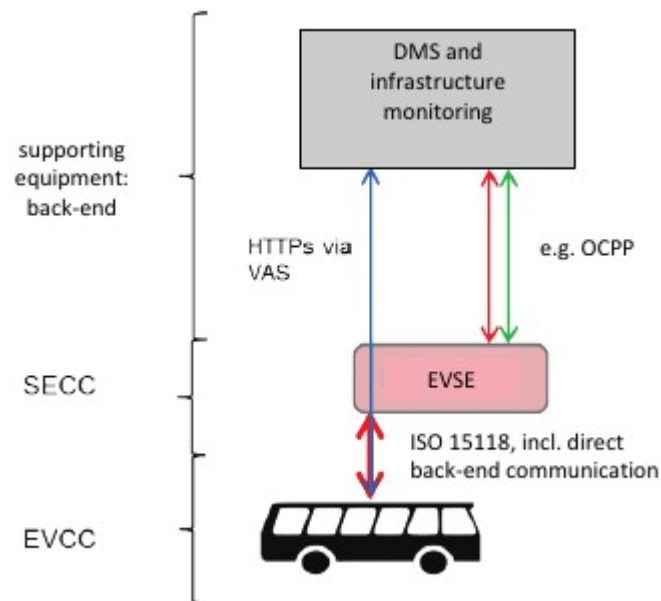


Figure 16: VDV261 typical flow

- The EV ComboCS can be configured to select VDV261 Value-Added-Service when proposed by the EVSE
- Once selected, the EV ComboCS will connect to the provided VDV261 back-end
- VDV261 data are displayed in the Supervision view of the EV ComboCS

OPPCharge **OPTION**

This feature will be an option available as a software upgrade.

Not available yet

Implementation of this specific module for buses and trucks is still under investigation. Delivery is not planned yet. For more information, please contact us.


ADDITIONAL ACCESORIES

Additional accessories are available.



Additional Type 2 / BNC plug

One is already provided with the tool.

	<p>External 12V battery</p> <p>An external battery allows to use the ComboCS tool even when no AC high power source is available.</p>
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Additional support

TRAINING AND EXPERTISE

To accelerate your learning curve of the tool and get sure your team is quickly up and running, Trialog can propose:

<p>ComboCS Training</p>	<p>Half a day or one day of training about the ComboCS usage for CCS testing and PSD measurement.</p> <p>Training can be done on site or using a remote conference tool.</p>
<p>CCS Training</p>	<p>2 days of training to master the CCS ecosystem</p> <p>Typical summary of the training:</p> <p>Workshop 1:</p> <ul style="list-style-type: none"> • Scope of ISO 15118 / DIN70121 • Role of Normative Working Groups • Actors and roles of electric mobility: EV, CS, CSO, eMSP, Aggregator, etc. • ISO 15118 Reference Use Case (ISO 15118-1) <p>Workshop 2:</p> <ul style="list-style-type: none"> • ISO 15118-2 Application Messaging + Cyber Concept • ISO 15118-3 PLC Concept <p>Workshop 3:</p> <ul style="list-style-type: none"> • What's new and what's different in ISO 15118-20 • ISO 15118-20 (V2G) Application Messaging • ISO 15118-20 Cybersecurity Aspects <p>Workshop 4:</p> <ul style="list-style-type: none"> • Implementation of ISO 15118: tools available on the market • Brainstorming

Expertise	<p>Hours of support per email, phone or on-site regarding CSS standards, OCPP, charge systems, PLC calibration and support for test and validation.</p> <p><i>Please notice Trialog is already providing a hotline with the ComboCS annual subscription for every questions you may have regarding the usage of the tool and potential issues. The purpose of this hotline is not to provide expertise.</i></p>
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POWER TRANSFER SUPPORT

In order to perform power transfer using DIN 70121 or ISO 15118 communication, you can connect your own power electronics to the ComboCS. The GPIO and HTTP API described in the User Manual of the ComboCS allow to connect most power setup to the ComboCS.

To accelerate and simplify the integration of the ComboCS into your power bench, depending of your needs, Trialog can:

- Provides hours of support
- Adapts the ComboCS software to fit your specific solution
 - Ex 1: Connect the ComboCS to a specific power supply using LXI
 - Ex 2: Implement a dedicated CAN interface

Example of solutions for AC charging:

- Add several consumers to simulate different level of power transfer.
- Or use current loop on Charging Station meter to simulate high power transfer with only a minimal real power transfer exchange.

Example of solutions for DC charging:

- Add several resistors to mimic different levels of power transfer.
- Control generative loads over CAN to test power transfer.

Annual Subscription

The ComboCS tool described in this document is ready to use. It has been tested and validated by the Trialog team, tested with several Charging Stations in the field and during 3 Testing Symposiums and 3 CharIN Testivals and is currently used by more than 50 companies around the world.

The ComboCS is also still actively maintained by Trialog to fix eventual remaining bugs, test with new Charging Stations, facilitate the usage of the tool, and ensure the correct behaviour of the Simulation mode regarding the current consensus of the normative groups and ISO 15118 User Group.

Access to releases

In order to provide such corrective and evolutive updates of the ComboCS, Trialog is proposing an annual subscription including:

- Access to corrective releases of the ComboCS
- Access to evolutive releases of the ComboCS

Trialog will deliver **at least one major release per year** to deploy new test cases, enhancement of existing features (same feature basis) and to fix remaining bugs that might have been detected.

Trialog can share its internal previsional roadmap but does not garanty any delivery planning in the scope of this annual subscription. A dedicated contract can be defined to adapt this roadmap to your company requirements.

Access to Trialog's hotline

In addition to the access of these releases, the subscription also offers access to Trialog's hotline through an online ticketing system. It can be used to ask questions about ComboCS usage and report issues encounter with the ComboCS.

Please notice, a dedicated expertise budget is required in case you need training or support for OCPP, CCS and EV charge system expertise. Contact us for details.

Activation of the subscription on a yearly basis

The subscription is done on a yearly basis. The first year of the ComboCS subscription is already included when buying the tool. Subscription for upcoming years is done on the conditions defined when buying the tool if done continuously. In case of interruption, paying for the not covered period is necessary to get the update.

This subscription is strongly recommended by Trialog but does not modify the licence rights that can be acquired from Trialog. Your company will be able to continue to fully use the ComboCS without this subscription. However, without subscription, your company will not get access to any release nor Trialog's ticketing system.

Contact us

For more information about **ComboCS**, please contact us: emobilitysales@trialog.com.

Do you know ComboCS for Maintenance?

Trialog has also developed a lighter version of ComboCS dedicated to Charging Station Maintenance: plug the ComboCS4M to your Charging Station in the street and get a quick result about the status of PLC and ISO 15118 status to know if the station is ready or not to be used.

Check below the differences between the 2 versions:

	ComboCS4M	ComboCS
Session History view List history of simulated charging sessions, logs and PCAP	✓	✓
Supervision view Real-time access to ISO 15118 and DIN 70121 communication data on the UI	✓	✓
Simulation mode Plug and start the ISO 15118 / DIN 70121 communication	✓	✓
Analogic output at charge startup Automatically connect your power bench	✓	✓
HTTP API Automate your own test cases Control the tool without any UI	✓	✓
PCAP per session Standard file format to access ISO 15118 and DIN 70121 communication data on Wireshark	✓	✓
Expert mode Complete control of the simulation Reproduce real car behaviors	Limited	✓
Test case mode ISO 15118-4 conformance + interoperability test cases		✓
Inspection mode Real-time access to ISO 15118 and DIN 70121 communication data on Wireshark		✓
SW upgrade to ComboCS option	Compatible	N/A
SW upgrade to ISO 15118-20 option	Compatible	Compatible
Sniffer option To be plugged between a car and a station Real-time access to ISO 15118 and DIN 70121 communication data on Wireshark	Compatible	Compatible
PSD measurement option	Compatible	Compatible
Custom development	Compatible	Compatible

ComboCS4M is the perfect tool for your technical team installing your stations or managing curative / preventive maintenance.

Interested? Please contact us!