

V2G Simulator

Quick Start Guide

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1 Revision history

Date	Ver- sion	Author	Change description
2021-07-19	1.0	јро	Base version
2021-08-17	1.1	bbr	Added chapter for firmware update
2023-06-12	2.0	nni	Revise whole document and add module description
2023-09-21	2.1	nni	Add description for the use of various V2G Simulators

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2 **Product definition**

SEVENSTAX V2G Simulator is the perfect sparring partner for the development, test and analysis of Electric Vehicles and Electric Chargers supporting V2G charging communication by providing an opposing station conforming to the DIN 70121 and ISO/IEC 15118 standard. The simulator takes charge of all protocol layers and creates a standard-compliant and most importantly reliable remote station. The V2G simulator further conforms to the norms by supporting Powerline Communication (HPGP including SLAC) and IEC 61851 Control Pilot (CP) handling (pulse width modulation, voltage reading/control).

User guidance takes place via a convenient Web Application on your browser. During operation, the PLC communication can be mirrored to an Ethernet interface and analysed using SEVENSTAX GreenShark (optionally available). It is furthermore possible to integrate the V2G simulator into an automated test system via the HTTP/JSON interface.

The Web GUI of SEVENSTAX V2G Simulator delivers a comprehensive overview about the entire charging process. All necessary steps are of the charging sequence can be monitored. That e.g.allows the user to easily identify in which phase errors occur.

Furthermore, the user gets full control about the simulated charging process. All relevant parameters can be configured via the Web Application. An integrated PID-controller controls current and voltage of the simulated charging process and its parameters can also be configured via the Web Application (EVSE version).

Additionally, the integrated Dashboard and the Graph Window summarize the most relevant real-time data of the charging sequence and visualize them ideally for a perfect overview.

2.1 Features

- Conforms to the following charging protocols
 - ISO/IEC 15118-2:2014 EIM
 - DIN 70121-2:2012
- Energy Transfer Modes
 - AC single phase / three phase
 - DC core / extended
- Voltage and current simulation
 - Min./Max. Parameters
 - PID Controller



3 Get started

3.1 How to start the V2G Simulator

1. Connect a USB-C cable to USB 2 of the simulator. This will power up the device. The USB port is only used for power supply of the device.



2. Connect an ethernet cable to the LAN port of the simulator. You can either connect the simulator to an existing network or connect it directly to your PC. The device will first try DHCP if available, otherwise it will assign an Auto-IP address derived from the MAC address.





3. To open the web application, it is necessary to insert the name of the Simulator like this "http://v2gsim.local" or the IP-address in your browser. The default device name of the V2G Simulator is "v2gsim".



3.2 Use of various V2G Simulators

Only if a customer has ordered more than one V2G Simulator the following instructions must be performed to ensure a properly use of the Simulators:

- 1. Power the first V2G Simulator and ensure that the other simulators are not powered
- 2. Open the website of the V2G simulator, navigate to the module "Ethernet Interface" and switch to the section "Name"
- 3. Change the Device Name and confirm it with a click on "Apply"
- 4. You can access this V2G Simulator over http://inserted_name.local
- 5. Now power the second V2G Simulator and repeat the instruction for 1 to 5 if you have another V2G Simulator



4 **Overview of functionalities**

The web application provides several modules. In the modules it is possible to adjust different parameters of the V2G Simulator and to see information and settings. In the following the modules are described in detail.

4.1 Common modules

4.1.1 V2G Status

V2G Status	×	Sta
Control pilot connected	0	
Control pilot PWM active	0	
SLAC matching initialized	0	
SLAC matching finished	0	
Session started	0	
Authentication started	0	
Authentication finished	0	
Charge parameter discovery started	0	
Charge parameter discovery finished	0	
Charge loop started	0	
Charge loop finished	0	
Session stopped		

 Status:
 shows status of the V2G communication stack

 Image:
 step was finished successfully

 Image:
 step is in progress

 Image:
 an error occurred in this step

 Image:
 step has not been executed yet



4.1.2 **Session Parameters**



4.1.4 PLC IPv6

PLC IPv6		×
IPv6 Addresses		
	Prefix	ldentifier
	fe80	:0:0:0:c693:ff.fe21:52de
	_	
	_	

The module PLC IPv6 shows the IPv6 addresses of the PLC interface



4.1.5 PLC Mirror

PLC Mirror	×
PLC mirror	
Source MAC replacement	
Source address	Ehternet MAC
Destination address	Original

PLC mirror:	if it is activated the network traffic is mirrored from PLC to ETH	
Mac replacement:	if it is activated the MAC address from the PLC is replaced with the MAC address from the ETH NIC	
Source address:	shows which MAC address is used	
Destination address:		

🔁 Graph		×
Status	v2g ru	inning
U /[V] EVSE Volta	age EVSE Current	/[A] _100
200		-50
0.	Time	-0
Charge / [%] EV :	State of charge	
	Time	
DNS:	192.168.130.1	00
	Apply	
IPv6		
IP Address:	fe80:0:0:0:c693:ff.fe21:	52dd
Physical Layer		
MAC Address:	c4:93:00:21:5	2:dd
IP	NAME	

4.1.6 Graph

Status:	shows the current status of the V2G Stack (e.g., slac running, v2g start, v2g running)		
First graph:	shows the values for Voltage and Current over time		
Second graph: shows the value for the state of charge over time			



Mode:	Possibility to change the IPv4 address manually, if Manual is activated the disabled part below can be changed and applied
IP Address:	shows the current IPv6 address of the V2G Simulator
Mac Address:	shows the current Mac address of the V2G Simulator

V2G Simulator





Bonjour name: NetBios name: Configuration: name of the V2G Simulator for ZeroConfig name of the V2G Simulator for http opportunity to change the NetBios and Bonjour name

4.1.8 System



The module System shows device information.

The second view provides following functions:

Firmware update: opportunity to upload a firmware update (More information in chapter 5)

System boot: restarts V2G Simulator

Factory reset: resets all set parameters

App settings:

resets all settings made in the web application (e.g. window size)



4.2 EVSE simulator modules

4.2.1 Dashboard



4.2.2 Charger

🗱 Charger		×
Status		
Current regulation tolerance	0	Α
Max. current limit	20	Α
Max. power limit	20000	w
Max. voltage limit	400	v
Min. current limit	2	А
Min. voltage limit	80	v
Peak current ripple	1	А
Voltage Regulation kp	0.01	
Voltage Regulation ki	0.001	
Voltage Regulation kd	0	
Current Regulation kp	0.01	
Current Regulation ki	0.001	
Current Regulation kd	0	
	Apply	

The module Charger shows the current set parameters and provides the opportunity to change them. Each parameter has an individual range. It is not possible to set a value outside of the range.

The ranges are defined as follows:

Parameter name	Min	Max	Unit
Current regulation tolerance	0	400	A
Max. current limit	1	400	Α
Max. power limit	0	20,000	W
Max voltage limit	1	1,000	V
Min. current limit	0	399	Α
Min. voltage limit	0	1,000	V
Peak current ripple	0	400	A
Voltage Regulation kp	0	1	
Voltage Regulation ki	0	1	
Voltage Regulation kd	0	1	
Current Regulation kp	0	1	
Current Regulation ki	0	1	
Current Regulation kd	0	1	

The parameters Min. current limit and Max. current limit are dependent (e.g. Min. current limit cannot be set higher than Max. current limit)

Same applies to the parameters Min. voltage limit and Max. voltage limit.



4.2.3 Power Line

ready
*

CP state detection:

choose if the control pilot should be monitored (active) or if the system should presume, that the control pilot is always connected (always connected)

4.2.4 V2G Config

V2G Config	×	Interfac
Interface	PLC 🔹	_
Protocol available	DIN and ISO 🗸	Protoc
Protocol selected		
Payment options available	External Payment 👻	Protoc
Payment options selected	External Payment 👻	Boymo
Authorization		Fayine
Manual authorization		Manua
Authorization timeout	2000 s	
	Apply	

Interface:	choose the interface for the V2G communication (PLC or Ethernet)
Protocol available:	choose the protocol for the V2G communication (DIN 70121-2, ISO 15118-2 or both)
Protocol selected:	shows the used protocol
Payment options selected:	shows the used payment option
Manual authorization:	if it is activated the simulator shows a message when it reached the step authentication, where the authentication can be confirmed or rejected
Authorization timeout:	when the message to confirm the authentication is shown, the authentication will be rejected automatically after the set timeout



4.3 EV simulator modules

4.3.1 Dashboard

Dashboard × Status v2g running	Status:	shows the current status of the V2G Stack (e.g. slac running, v2g start, v2g running)
Charging Stop	Charging:	possibility to stop and restart a charging session if CP manual mode in the module Power Line is activated
300v 100A	EVSE:	shows the value for current voltage and current from the EVSE
Voltage Current	Battery:	shows the current battery status in per cent
55%		

4.3.2 Battery

III) Battery		×
Status	v2g running	,
Battery reset	Reset	
Charging mode	High Level 🔹	
Req. energy mode	DC core 🗸	
Battery Capacity	5000	Wh
Battery Initial SoC	20	%
Target Voltage (normal charging)	250	v
Target Current (normal charging)	75	А
Target Voltage (fast charging)	300	v
Target Current (fast charging)	100	А
Start SoC of Fast Charging	0	%
End SoC of Fast Charging	80	%
	Apply	

The module Battery shows the current set parameters and provides the opportunity to change them. Each parameter has an individual range. It is not possible to set a value outside of the range.

The ranges are defined as follows:

Parameter name	Min	Мах	Unit
Battery Capacity	0	50,000	Wh
Battery initial SoC	0	100	%
Target Voltage (normal charging)	0	1,000	V
Target Current (normal charging)	0	400	Α
Target Voltage (fast charging)	0	1,000	V
Target Current (fast charging)	0	400	Α
Start SoC of Fast Charging	0	100	%
End SoC of Fast Charging	0	100	%

The parameters Start SoC of Fast Charging and End SoC of Fast Charging are dependent (e.g. Start SoC of Fast Charging cannot be set higher than End SoC of Fast Charging)



4.3.3 Power Line

Power Line	×
PLC state	ready
CP manual mode	
SLAC skip	

CP manual mode:	if it is activated it provides the opportunity to control the charging session manually by pressing the start or stop button in the module Dashboard
SLAC skip:	if it is activated the step SLAC will be skipped in a charging session

4.3.4 V2G Config

✿ Inter Prot

🏠 V2G Config		×	Interface:	choose the interface for the V2G	
Interface	PLC	-		communication (PLC or Ethemet,	
Protocol available	DIN and ISO	-	Protocol available:	choose the protocol for the V2G	
Protocol selected	ISO 15118-2			15118-2 or both)	
Payment options available	External Payment	*	Protocol selected:	shows the used protocol	
			Payment options selected:	shows the used payment option	



5 Execute a charging session

6. On the backside of the V2G Simulator the PLC-port can be found. For a charging session the PLC-driver must be connected to the V2G Simulator and the DUT (device under test).



7. After the PLC-driver connection was established the V2G communication and the charging session start automatically and can be monitored in the modules Dashboard and V2G Status



6 Firmware Update

1. Open the 'System' app on the webpage.

System	×
Device information	
Platform:	EVSE
Manufacturer:	SEVENSTAX GmbH
Firmware:	V01_00_02
Serial number:	-
Hardware revision:	1.0
i	٥

2. Click on the icon to switch to the Firmware Update view.



3. Click on the icon <a>Click on the icon to open a window for selecting the FWU file with the ending ".fwu" for upload.



4. Click on Update to start the firmware update



5. After a successful firmware update, the following window is shown.

Information	
Update successful	
	ок



7 UART interface

This chapter describes how to read data from, the UART interface with the program HTerm as example.

1. Connect the USB1 Port with your PC.



2. Open a program which can read data from the UART interface. The following shows HTerm as an example. Setup the configurations, which are shown next to the HTerm image. The Port should be selected automatically, if no other UART-Ports are connected. Otherwise make sure to select the correct one. Click on Connect.

👫 HTerm 0.8.5	- 🗆 X	Configurations:	
File Options View Hel	p	Baud:	1.000.000
Connect Port	COM6 V R Baud 1000000 V Data 8 V Stop 1 V Parity None V CTS Flow control	Data	8 hit
Rx 5825	Reset Tx 0 Reset Count 0 - Newline at LF V Show newline	Data.	Nama
Clear received As	cii 🛛 Hex 🗋 Dec 🗋 Bin Save output 🔻 🗍 Clear at 🖉 🔹 Newline every 0 💽 🗸 Autoscroll 🗋 Show errors	Parity:	None
Sequence Overview X	Received Data	Stop:	1 bit
	1 5 10 15 20 25 30 35 40 45 50 55 60 65 70	Flow Control:	none
		Nowlino at:	
		Newline at.	LI
	Selection (-)		
	Input control ×		
	Clear transmitted Ascii Hex Dec Bin Send on enter None Send file DTR RTS		
	Type ASC V ASend		
	Transmitted data ×		
	1 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75		
	History -/0/10 Not connected		

3. In the picture below an example HTerm output can be seen. The output shows the current IPv4address of the V2G Simulator.

5	10	15 20	25 30 35 40 45 50 55 6	0 65	70	75
	3.479]	[NOTICE]	V2GAPP: # V2GCPS INFOTYPE CP DUTY CYCL	Ew		
	3.480]	[NOTICE]	V2GAPP: Duty Cycle changed to 56 permi	11,		
	3.480]	[NOTICE]	Q7KCOM: Reset QCA700x _v			
	3.539]	[NOTICE]	V2GAPP: # V2GCPS_INFOTYPE_CP_DUTY_CYCL	E ya		
	3.540]	[NOTICE]	V2GAPP: Duty Cycle changed to 57 permi	11 \n		
	3.541]	[NOTICE]	APL-MAIN: va			
	3.542]	[NOTICE]	APL-MAIN: ====================================	= \n		
	3.542]	[NOTICE]	APL-MAIN: NEW LAN CONFIGURATION (IPv4)	: \n		
	3.543]	[NOTICE]	APL-MAIN: for IP Config handle [fe02]	\n		
	3.544]	[NOTICE]	APL-MAIN: IPV4: _{V0}			
	3.544]	[NOTICE]	APL-MAIN: LOCALIP: 192.168.130.14	6 va		
	3.545]	INOTICE	APL-MAIN: SUBNEIMASK: 255.255.255.	0 %		
	3.546]	INOTICE	APL-MAIN: GAILWAI: 192.168.130.10	0 \n		
	3.340]	INOTICE	APL-MAIN: DNSI: 192.100.130.10	0.		
	3 5/81	INOTICE	AFL-MAIN: DN52: 0. 0. 0.			
	3 5491	INOTICE	APL-MAIN.	- 41		
	3.5821	[NOTICE]	Q7K:		= \n	