V2G Simulator

Quick Start Guide

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Inhalt

1 Revision history

Date	Version	Author	Change description
2021-07-19	1.0	jpo	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

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

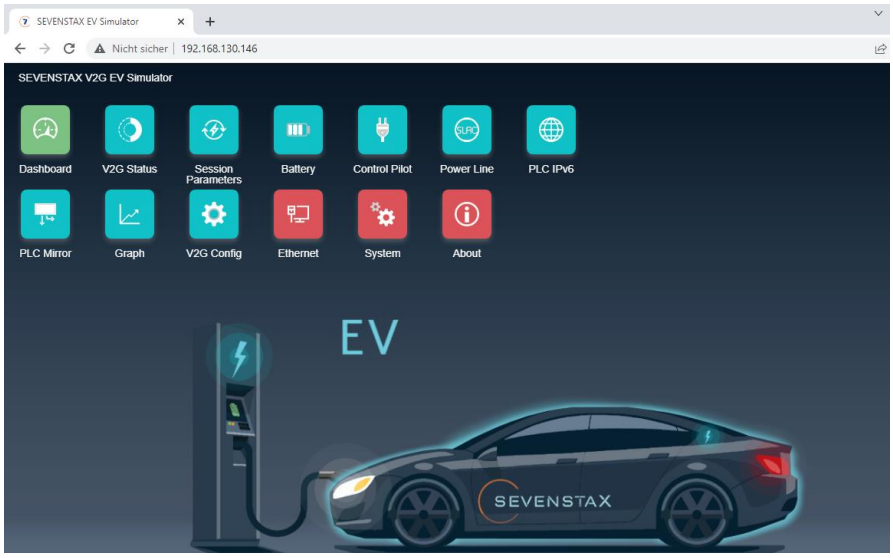
- Conforms to the following charging protocols
  - ISO/IEC 15118-2:2014 EIM
  - DIN 70121-2:2012
- Energy Transfer Modes
  - AC single phase / three phase
  - DC core / extended
- Voltage and current simulation
  - Min./Max. Parameters
  - PID Controller

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:

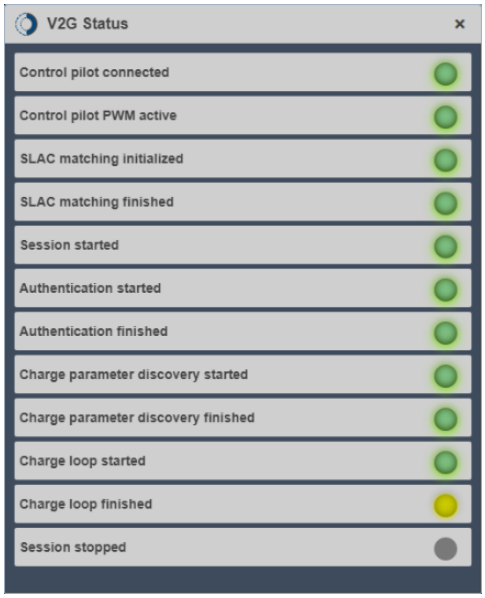
1. Power the first V2G Simulator and ensure that the other simulators are not powered
2. Open the website of the V2G simulator, navigate to the module “Ethernet Interface” and switch to the section “Name”
3. Change the Device Name and confirm it with a click on ”Apply”
4. You can access this V2G Simulator 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

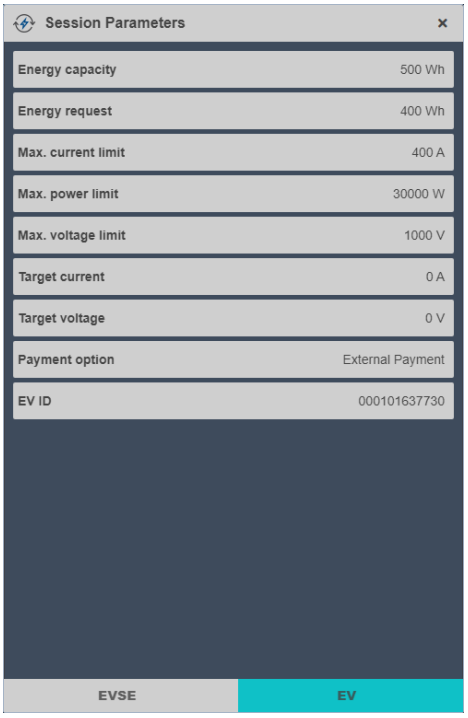
4.1.1 V2G Status



Status: shows status of the V2G communication stack

- : step was finished successfully
- : step is in progress
- : an error occurred in this step
- : step has not been executed yet

4.1.2 Session Parameters



The module Session Parameters shows the parameters of the simulator and the parameters of the remote system if it is connected.

4.1.3 Control Pilot

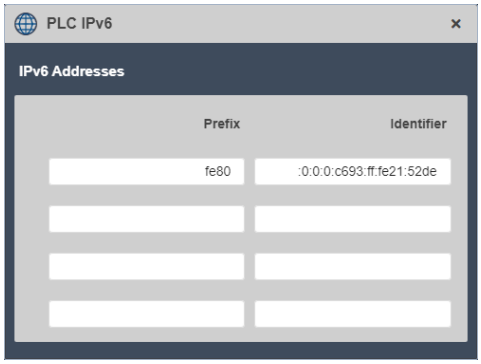
State: shows the state of charge according to the IEC

A: not connected
B: connected
C: charging
D: charging with ventilation
E/F: error

Duty Cycle: shows if a high-level communication or a basic charging is executed

high-level: 4%-6%
basic charging: 10% -86%

4.1.4 PLC IPv6



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

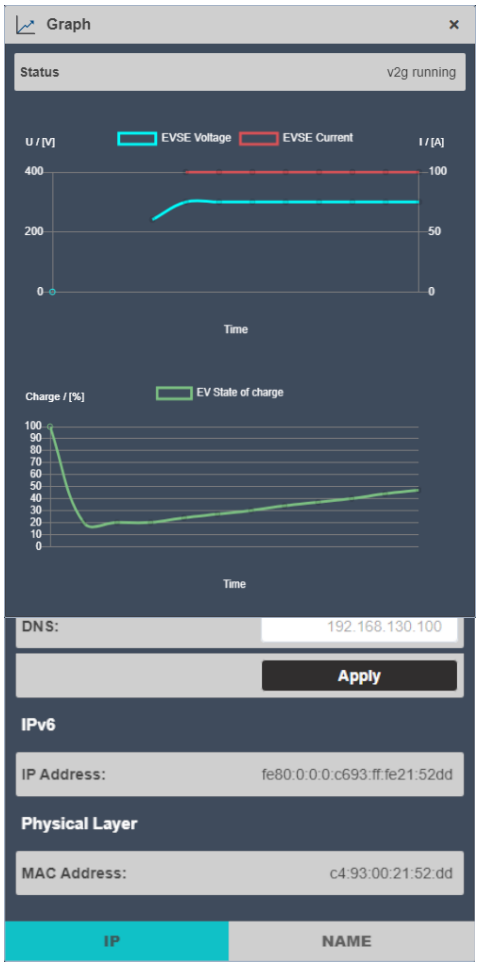
4.1.5 PLC Mirror

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:



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

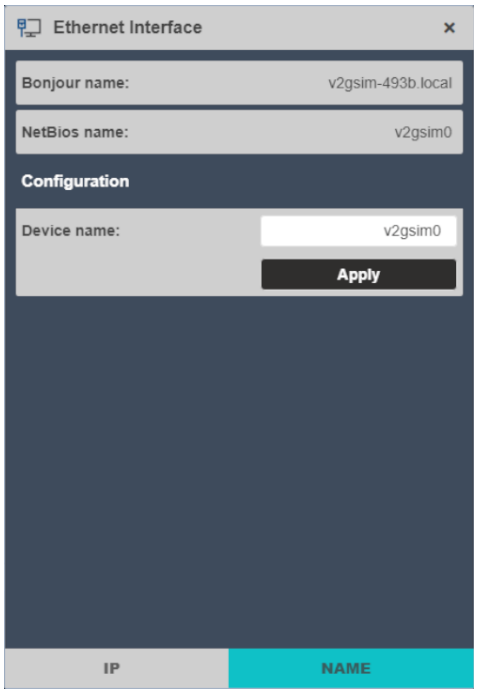
Second graph: shows the value for the state of charge over time

4.1.7 Ethernet Interface

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

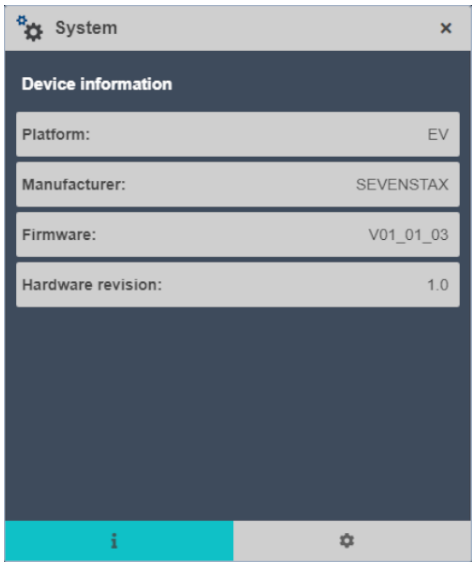


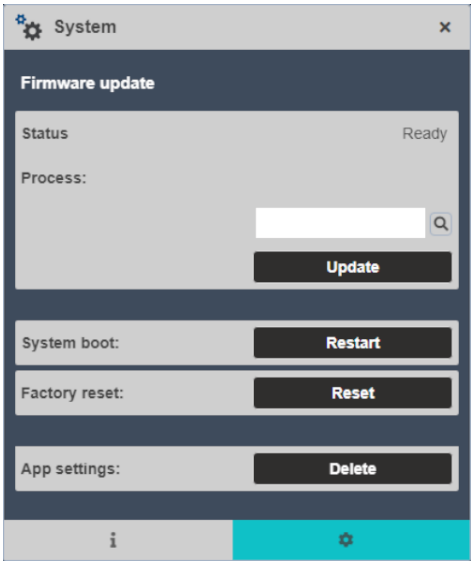
Bonjour name: name of the V2G Simulator for ZeroConfig

NetBios name: name of the V2G Simulator for http

Configuration: 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)

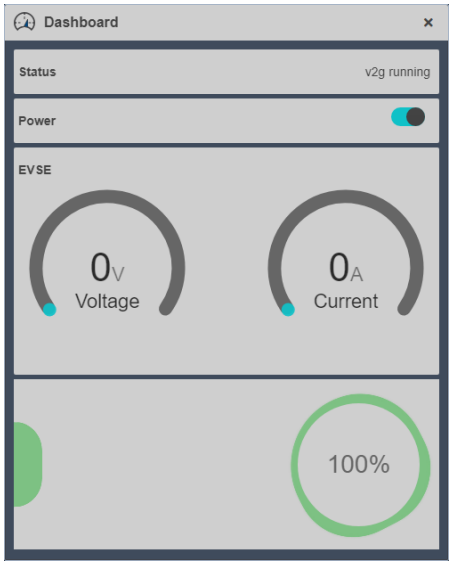
System boot: restarts V2G Simulator

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



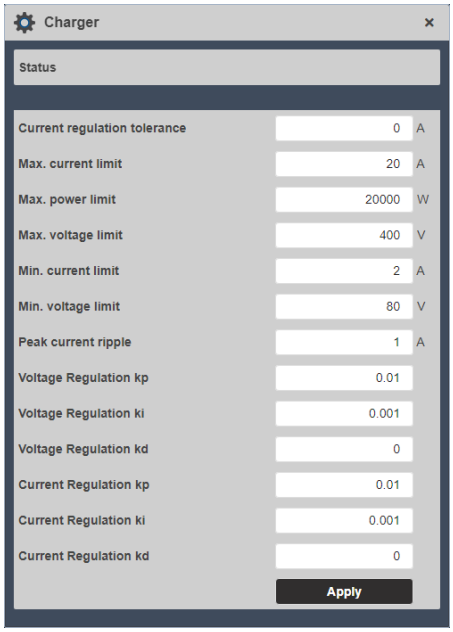
Status: shows the current status of the V2G Stack (e.g. slac running, v2g start, v2g running)

Power: possibility to stop and restart a charging session

EVSE: shows the value for current voltage and current from the EVSE

Battery: shows the current battery status in per cent

4.2.2 Charger



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	A
Max. power limit	0	20,000	W
Max voltage limit	1	1,000	V
Min. current limit	0	399	A
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	

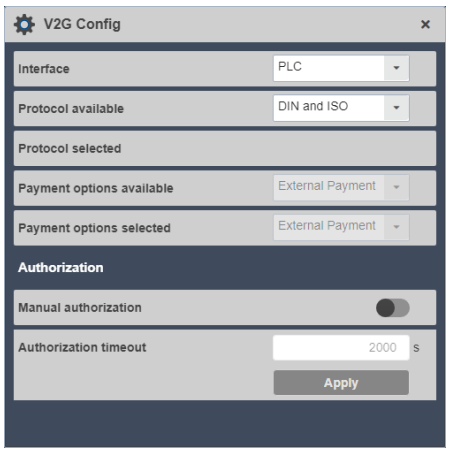
The parameters Min. current limit and Max. current limit are dependent (e.g. Min. current limit cannot be set higher than Max. current limit)

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

4.2.3 Power Line

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



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

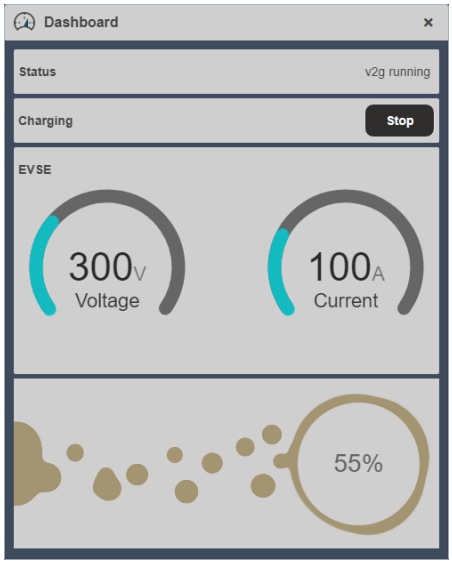
Payment options selected: shows the used payment option

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



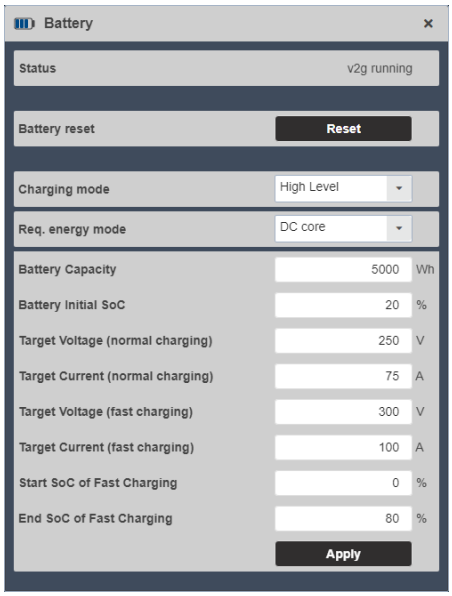
Status: shows the current status of the V2G Stack (e.g. slac running, v2g start, v2g running)

Charging: possibility to stop and restart a charging session if CP manual mode in the module Power Line is activated

EVSE: shows the value for current voltage and current from the EVSE

Battery: shows the current battery status in per cent

4.3.2 Battery



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	Max	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	A
Target Voltage (fast charging)	0	1,000	V
Target Current (fast charging)	0	400	A
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

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

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

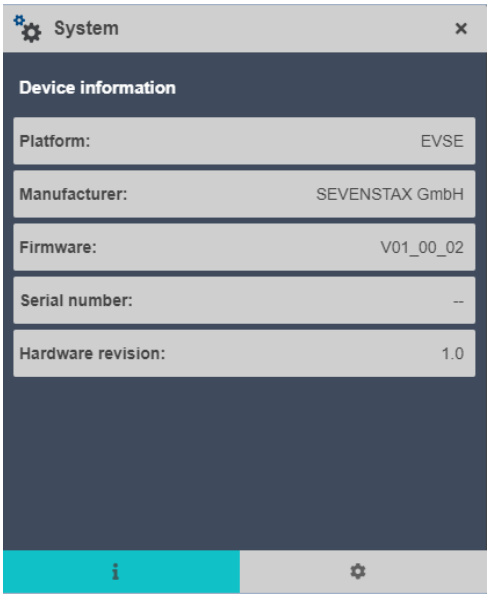
5 Execute a charging session

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).

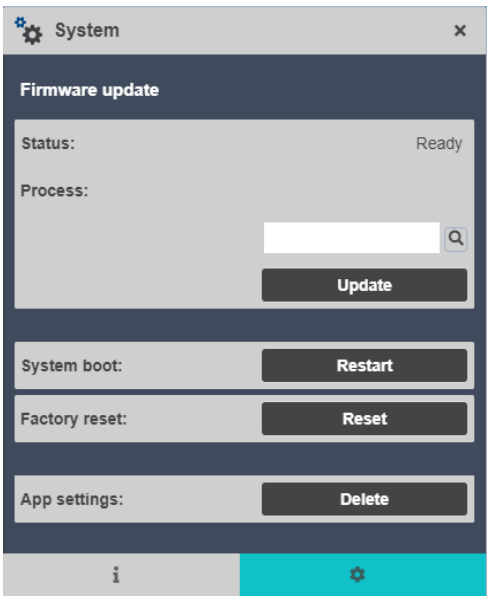
7. After the PLC-driver connection was established the V2G communication and the charging session start automatically and can be monitored in the modules Dashboard and V2G Status

6 Firmware Update

1. Open the ‘System’ app on the webpage.

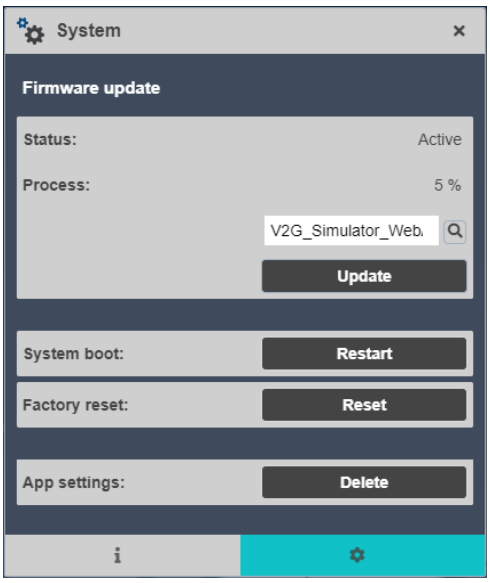


2. Click on the icon to switch to the Firmware Update view.

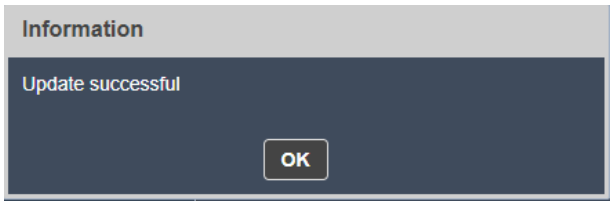


3. Click on the icon to open a window for selecting the FWU file with the ending “.fwu” for upload.

4. Click on Update to start the firmware update



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

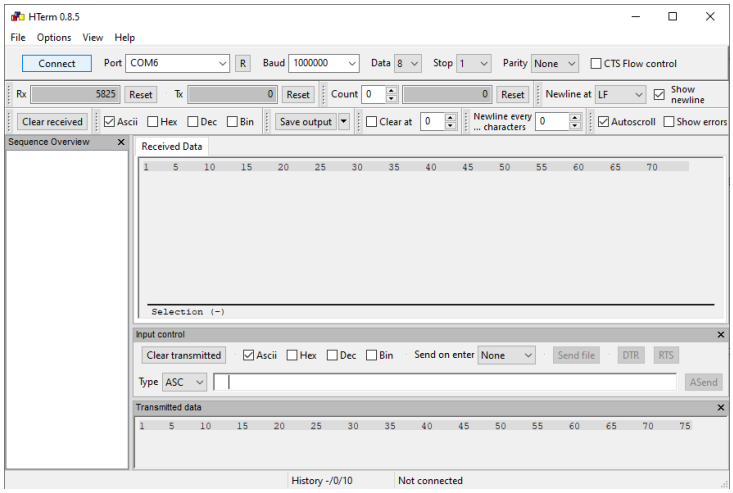


7 UART interface

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.



Configurations:

Baud:	1,000,000
Data:	8 bit
Parity:	None
Stop:	1 bit
Flow Control:	none
Newline at:	LF

3. In the picture below an example HTerm output can be seen. The output shows the current IPv4-address of the V2G Simulator.