

# Open Source Firmware for EV chargers

using the ESP32 chip



# Motivation

## **liberate and add features**

- liberate from the cloud      (the original was either dumb or cloud)
- add more features like
  - PV excess charging
  - load management
  - mesh networking

# Project start in April 2021

Idea to use the software from TinkerForge on the EN+ hardware

warp-charger.com



tinkerforge.com



The image shows the WARP charger from two angles: the front view (Vorderseite) and the web interface (Statusübersicht). The front view is a sleek, silver rectangular device with a circular logo in the center. The web interface shows various status parameters like battery level, current, and power consumption, along with a graph of power usage over time.



# Project start in April 2021

Idea to use the **software from TinkerForge** on the EN+ hardware

mikrocontroller.net

Forum: Mikrocontroller und Digitale Elektronik

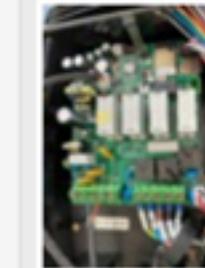
## Reverse engineering Autoaid / EN-Plus AC011K-AE-25 Wallbox mit ESP32

Forenliste | Threadliste | Neuer Beitrag | Suchen | Anmelden | Benutzerliste | Bildergalerie | Hilfe | Login

Reverse engineering Autoaid / EN-Plus AC011K-AE-25 Wallbox mit ESP32

von Birger S. ([birger\\_s](#)) 10.04.2021 12:43

Angehängte Dateien:



[Autoaid\\_en\\_11kw\\_charger.jpg](#)  
1,4 MB

Hallo,

mit Hilfe der Bilder (mehr Detailfotos hier: <https://mail.netgaroo.com/img/AC011K-AE-25/>) kann mir hoffentlich einer von euch weiterhelfen und mir sagen was man da sieht und was die vermutliche Funktion ist. Siehe Liste unten.

Letztlich suche ich Mitstreiter um eine open source firmware für die AC011K-AE-25 zu entwickeln.

Ich habe zwei Wallboxen.  
Zum einen den TinkerForge WARP Charger (<https://www.warp-charger.com/>). Der ist komplett open source - Hardware und Software - alles super. Zum anderen den Chinakracher AC011K-AE-25 von EN+ der in Deutschland von Autoaid (<https://www.autoaid.de/wallbox/>) verkauft wird.

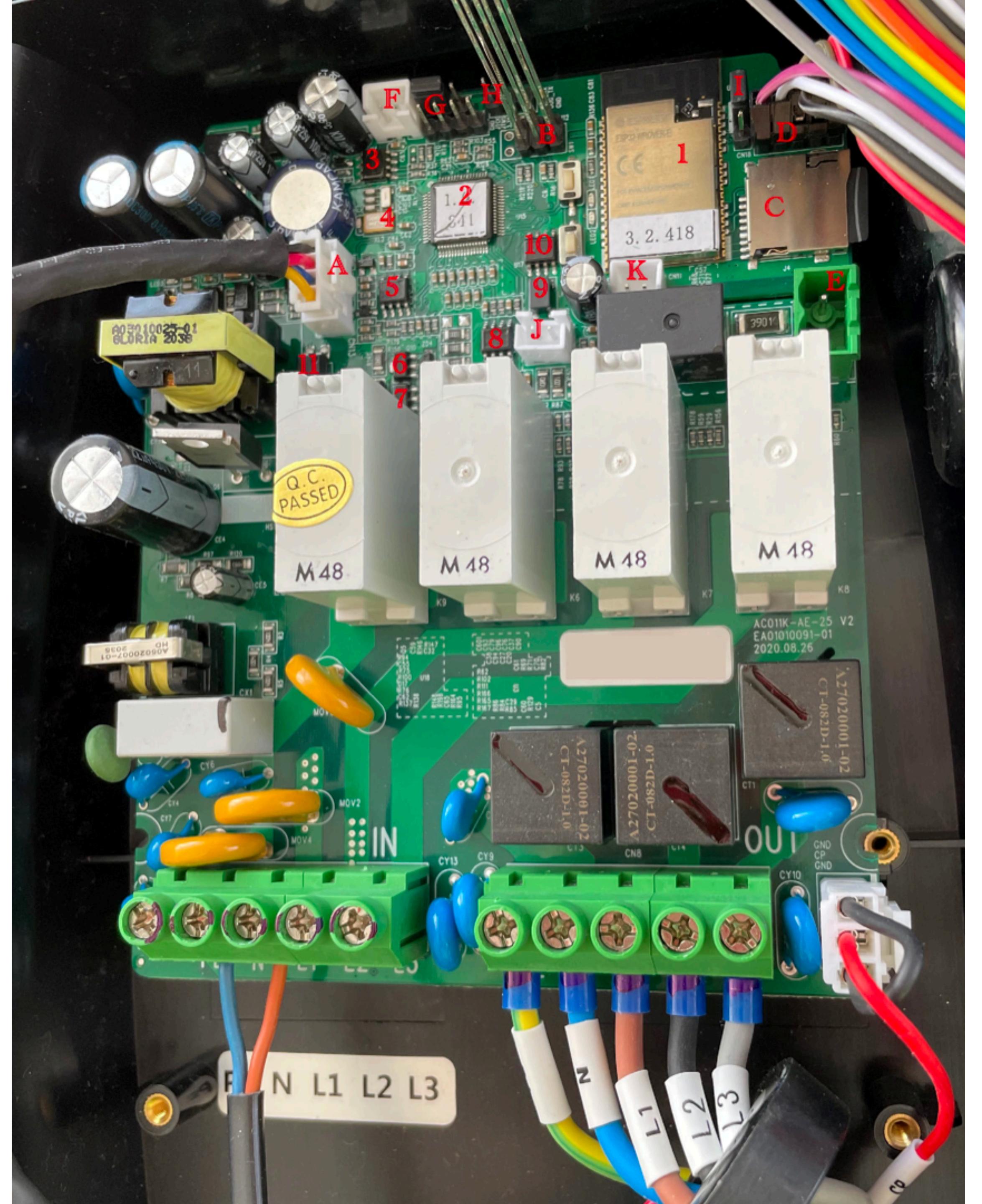
Ich hätte gerne eine open source firmware für die Box von EN+ / Autoaid. Am besten einen Fork der WARP Charger Software (<https://github.com/Tinkerforge/warp-charger/> und <https://github.com/Tinkerforge/evse-bricklet>).

Ich hoffe das sich daraus sowas wie OpenWRT bzw. Tasmota für Wallboxen entwickelt.

# during 2021

Idea to use the open source  
software from TinkerForge  
on the EN+ hardware

leads to  
some reverse engineering



# during 2021

# Idea to use the open source software from TinkerForge on the EN+ hardware

**leads to  
some reverse engineering**

19 12:21:46

ERON\_RESET),boot:0x17 (SPI\_FAST\_FLASH\_BOOT)  
, SPIWP:0xee  
,q\_drv:0x00,d\_drv:0x00,cs0\_drv:0x00,hd\_drv:0x00,wp\_drv:0x00  
ock div:2  
018,len:4  
01c,len:976  
room 4  
000,len:10124  
400,len:5828  
06a8 0,038 \*\*\*\* TINKERFORGE WARP CHARGER FOR AC011K V1.2.99-62bda6bb \*\*\*\*  
0,039 314K RAM SYSTEM 262132 HEAP BYTES FREE  
0,049 READY.  
0,096 Mounted data partition. 53248 of 655360 bytes (8.1 %) used  
0,228 WARP Charger for AC011K config version: 1.0.0  
0,243 Set timezone to Europe/Berlin  
0,384 Starting scan to select unoccupied channel for soft AP.  
0,397 Set up PrivComm: 115200, SERIAL\_8N1, RX 26, TX 27  
0,398 000: FA 03 00 00 AC 01 05 00 11 08 01 00 00 CA D3  
0,409 Tx cmd\_AC seq:01 len:15 crc:D3CA  
0,409 000: FA 03 00 00 AC 02 05 00 11 09 01 00 01 4A BE  
0,420 Tx cmd\_AC seq:02 len:15 crc:BE4A  
0,420 000: FA 03 00 00 AC 03 05 00 11 0A 01 00 00 4A F6  
0,430 Tx cmd\_AC seq:03 len:15 crc:F64A  
0,441 000: FA 03 00 00 AC 04 05 00 11 0C 01 00 00 0B 98  
0,441 Tx cmd\_AC seq:04 len:15 crc:980B  
0,452 000: FA 03 00 00 AA 05 08 00 18 3E 04 00 00 00 00 00 54 F0  
0,462 Tx cmd\_AA seq:05 len:18 crc:F054  
0,462 000: FA 03 00 00 AC 06 08 00 11 00 04 00 B8 08 00 00 CS 87  
0,473 Tx cmd\_AC seq:06 len:18 crc:B7C5  
0,473 000: FA 03 00 00 AA 07 08 00 18 3F 04 00 1E 00 00 00 49 A0  
0,483 Tx cmd\_AA seq:07 len:18 crc:A049  
0,494 000: FA 03 00 00 AA 08 12 00 18 25 0E 00 05 00 00 00 05 00 00 00  
020: 00 03 00 00 00 02 EC 31  
0,504 Tx cmd\_AA seq:08 len:28 crc:31EC  
0,505 000: FA 03 00 00 AA 09 07 00 18 12 01 00 03 78 89 19 60  
0,515 Tx cmd\_AA seq:09 len:17 crc:6019  
0,526 000: FA 03 00 00 AA 0A 07 00 18 12 01 00 03 3B 9C 19 60  
0,526 Tx cmd\_AA seq:0A len:17 crc:6019  
0,536 000: FA 03 00 00 AA 0B 05 00 18 12 01 00 03 FA 50  
0,547 Tx cmd\_AA seq:0B len:15 crc:50FA  
0,547 000: FA 03 00 00 AA 0B 06 00 18 08 02 00 78 00 EB 20  
0,557 Tx cmd\_AA seq:0B, len:6, crc:20EB  
0,558 000: FA 03 00 00 AA 0C 0A 00 18 02 06 00 78 00 EB 20 60 00 4C 04  
0,568 Tx cmd\_AA seq:0C, len:10, crc:044C  
0,579 000: FA 03 00 00 AA 0D 05 00 18 09 01 00 00 3C 9F  
0,579 Tx cmd\_AA seq:0D len:15 crc:9F3C  
0,589 000: FA 03 00 00 AA 0E 04 00 18 2A 00 00 17 76  
0,600 Tx cmd\_AA seq:0E len:14 crc:7617  
0,606 EVSE error, could not restore persistent storage config  
0,608 No RS485 Bricklet found. Disabling energy meter support.  
0,631 No NFC Bricklet found. Disabling NFC support.  
vfs\_api.cpp:102] open(): /spiffs/charge-records/charge-record-1.bin does not exist, no permits for  
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0,718 mDNS responder started  
1,020 000: FA 03 00 00 0A 05 04 00 14 3E 00 00 E4 9A  
1,021 EN+ GD EVSE found. Enabling EVSE support.  
1,032 Rx cmd\_0A seq:05 len:4 crc:9AE4 - I don't know what 3E means.  
1,044 WiFi connecting to adrion.netgaroo.com

```

1,047          000: FA 03 00 00 0A 07 04 00 14 3F 00 00 96 9A
1,047 Rx cmd_0A seq:07 len:4 crc:9A96 - I don't know what 3F means.
1,060          000: FA 03 00 00 0A 08 12 00 14 25 0E 00 05 00 00 05 00 00 00
          020: 00 03 00 00 00 02 85 10
1,071 Rx cmd_0A seq:08 len:18 crc:1085 - I don't know what 25 means.
1,084          000: FA 03 00 00 0A 09 05 00 14 12 01 00 00 D3 8E
1,084 Rx cmd_0A seq:09 len:5 crc:8ED3 - ctrl.cmd set ack done, type:0
1,096          000: FA 03 00 00 0A 0A 05 00 14 12 01 00 00 93 9B
1,107 Rx cmd_0A seq:0A len:5 crc:9B93 - ctrl.cmd set ack done, type:0
1,108 This is AC011K- (AC011K-), a WARP Charger for AC011K
1,119          000: FA 03 00 00 0A 0B 05 00 14 12 01 00 00 52 57
1,129 Rx cmd_0A seq:0B len:5 crc:5752 - ctrl.cmd set ack done, type:0
1,131          000: FA 03 00 00 0A 0B 06 00 14 08 02 00 78 00 ED 6E
1,142 Rx cmd_0A seq:0B len:6 crc:6EED - Heartbeat Timeout:120s
1,154          000: FA 03 00 00 0A 0C 04 00 14 02 00 00 BD 96
1,154 Rx cmd_0A seq:0C len:4 crc:96BD - Set Time done
1,166 Selecting channel 1 for softAP
1,168 Had to configure soft AP IP address 1 times.
1,168 Wifi soft AP started
1,179          SSID: AC011K-
1,182          MAC address: 1C:9D:C2:57:43:F9
1,182          IP address: 10.0.0.1
1,193          000: FA 03 00 00 0A 0D 05 00 14 09 01 00 00 D4 99
1,194 Rx cmd_0A seq:0D len:5 crc:99D4 - ctrl.cmd set start power mode done
1,206          000: FA 03 00 00 0A 0E 04 00 14 2A 00 00 1E 5E
1,216 Rx cmd_0A seq:0E len:4 crc:5E1E - cmdAACtrlcantestsetAck test cancom...111 done
3,304          000: FA 03 00 00 02 04 7D 00 53 4E 31 30 30 35 32 31 30 39 32 35
          020: 34 32 31 36 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          040: 25 11 00 41 43 30 31 31 48 2D 41 45 2D 32 35 00 00 00 00 00 00 00 00 00
          060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          080: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 2E 31 2E 32 31 32 00 00
          100: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 00 00 00
          120: 00 5A 00 78 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
3,356 Rx cmd_02 seq:04 len:125 crc:782A - Serial number and version.
3,357 EVSE serial: SN10052109254216 hw: AC011K-AE-25 fw: 1.1.212
3,367 EN+ GD EVSE initialized.
3,368          000: FA 03 00 00 A2 04 01 00 00 93 9B
3,378 Tx cmd_A2 seq:04, crc:9893
6,306 Wifi connected to adriion.netgaroo.com
6,324 Wifi MAC address: 1C:9D:C2:57:43:F8
6,325 Wifi got IP address: 192.168.188.179. Connected to BSSID 10:9A:DD:8B:01:4B
7,304          000: FA 03 00 00 02 05 7D 00 53 4E 31 30 30 35 32 31 30 39 32 35
          020: 34 32 31 36 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          040: 25 11 00 41 43 30 31 31 48 2D 41 45 2D 32 35 00 00 00 00 00 00 00 00 00
          060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          080: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 2E 31 2E 32 31 32 00 00
          100: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 00 00 00
          120: 00 5A 00 78 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
7,356 Rx cmd_02 seq:05 len:125 crc:E42B - Serial number and version.
7,357 EVSE serial: SN10052109254216 hw: AC011K-AE-25 fw: 1.1.212
7,367          000: FA 03 00 00 A2 05 01 00 00 92 64
7,377 Tx cmd_A2 seq:05, crc:6492
11,304         000: FA 03 00 00 02 06 7D 00 53 4E 31 30 30 35 32 31 30 39 32 35
          020: 34 32 31 36 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          040: 25 11 00 41 43 30 31 31 48 2D 41 45 2D 32 35 00 00 00 00 00 00 00 00 00
          060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          080: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 31 2E 31 2E 32 31 32 00 00
          100: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 00 00 00
          120: 00 5A 00 78 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
11,356 Rx cmd_02 seq:06 len:125 crc:002B - Serial number and version.
11,356 EVSE serial: SN10052109254216 hw: AC011K-AE-25 fw: 1.1.212
11,367          000: FA 03 00 00 A2 06 01 00 00 92 20
11,377 Tx cmd_A2 seq:06, crc:2092
30,613 Got no managed current update for more than 30 seconds. Setting managed current to 0
NTP synchronized at 33,1941

```

# BETA release Feb 2022

## software from TinkerForge on the AC011K (EN+ hardware)

The screenshot shows a GitHub repository page for [bs-github / esp32-firmware](#). The repository is public and forked from [Tinkerforge/esp32-firmware](#). The main navigation bar includes links for Code, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. Below the navigation, there are tabs for Releases (selected) and Tags. A button to "Draft a new release" and a search bar to "Find a release" are also present.

A specific release is highlighted:

- Date: 27 Feb 2022
- Author: bs-github
- Tag: warp8enplus...
- Commit: 2fc7e37
- Compare link

The release title is "first BETA warp firmware for EN+ chargers" and it is marked as a "Pre-release". The description states "First BETA!" and "See [Wiki](#) for features, limitations and instructions".

The "Assets" section lists three items:

Asset Type	Name	Size	Last Updated
Binary	warp8enplus_firmware_1_2_99_621b9375_merged.bin	1.6 MB	27 Feb 2022
Zip	Source code (zip)		27 Feb 2022
Tar.gz	Source code (tar.gz)		27 Feb 2022

# SUSE Hack Week 21

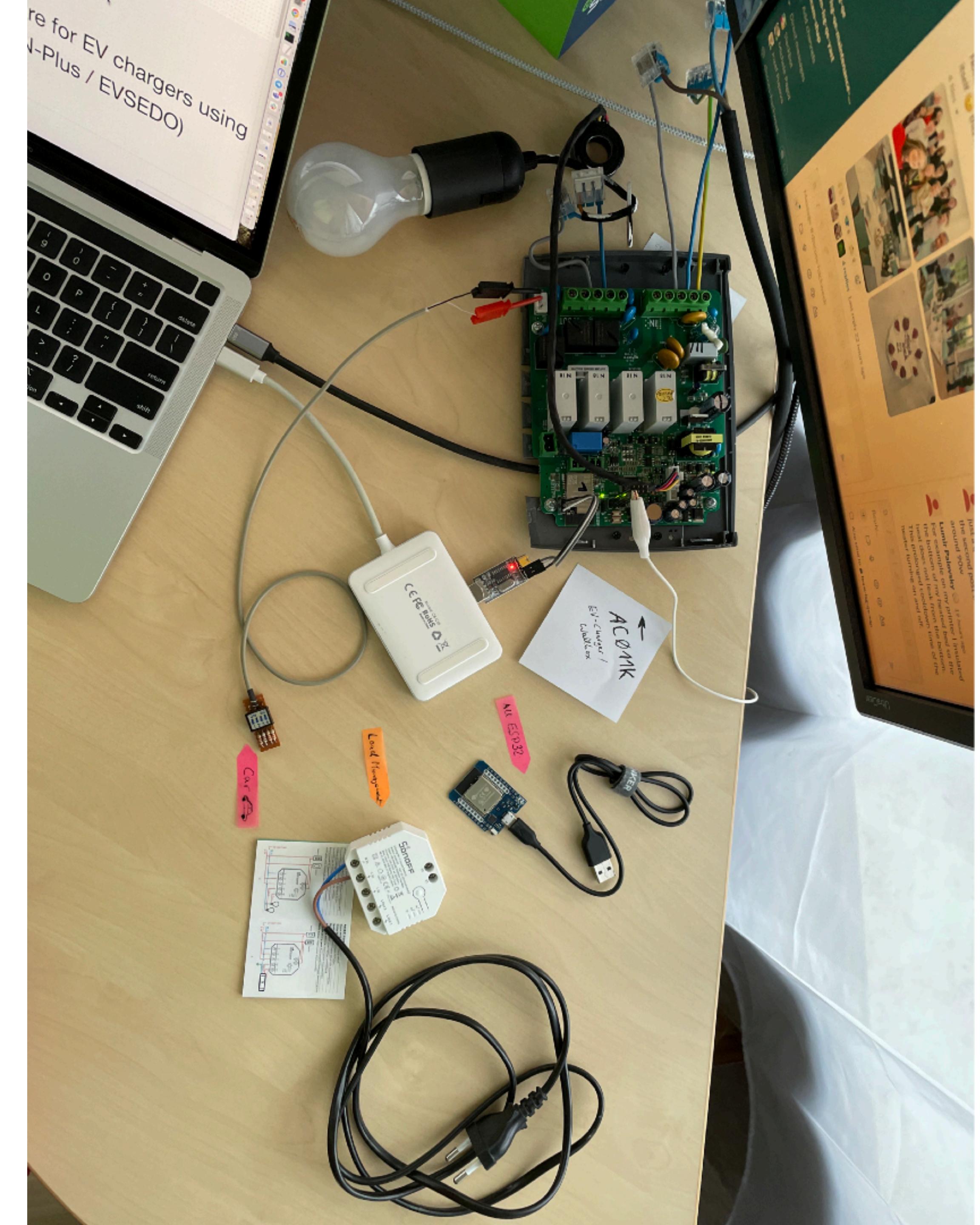
more hacking to get version 2 running

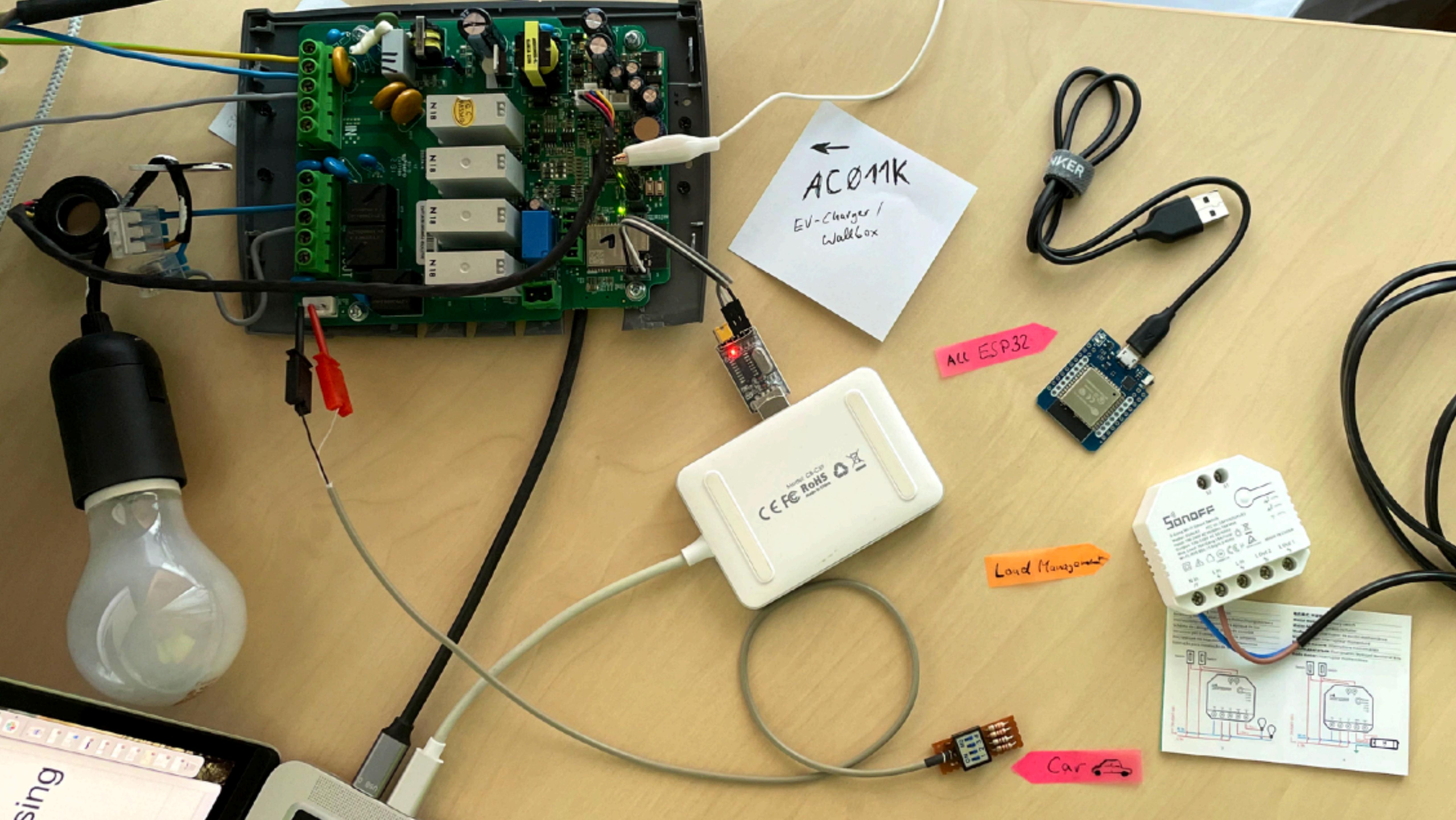


# mid 2022 port TinkerForge WARP2 Charger

version 2  
**software from TinkerForge**  
needs to be ported to the  
**EN+ hardware**

as well as to the  
**Sonoff DUAL R3**

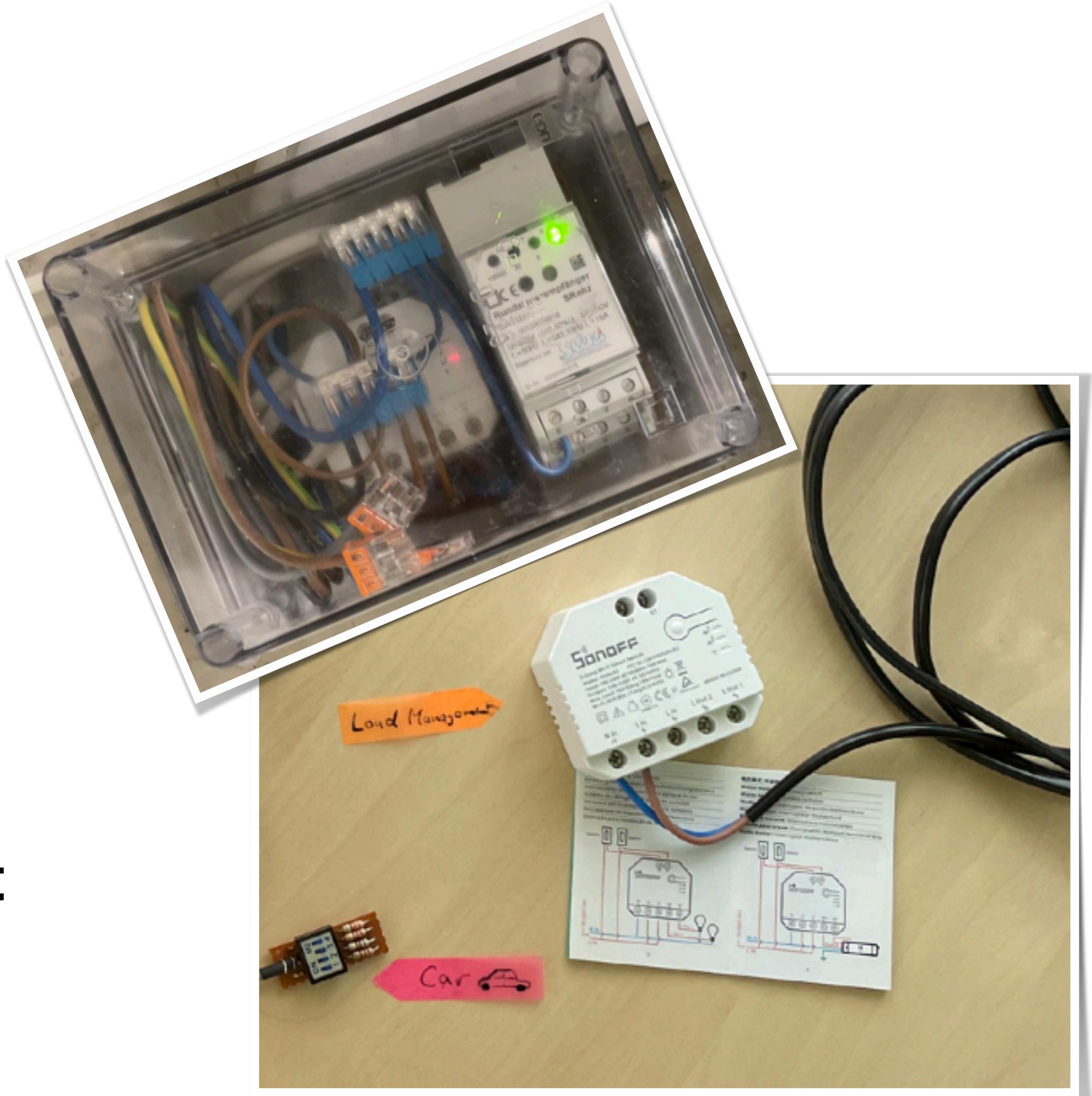




# Why the Sonoff?

Sonoff DUAL R3 is  
based on the ESP32 as well

energy provider requires that  
they can switch off the load



# Repeat success!

## Remember the **WRT54G**?

That's where the **OpenWrt**  
project came from

I'd like to have something similar  
for EV charging

many wallboxes are using the **ESP32**

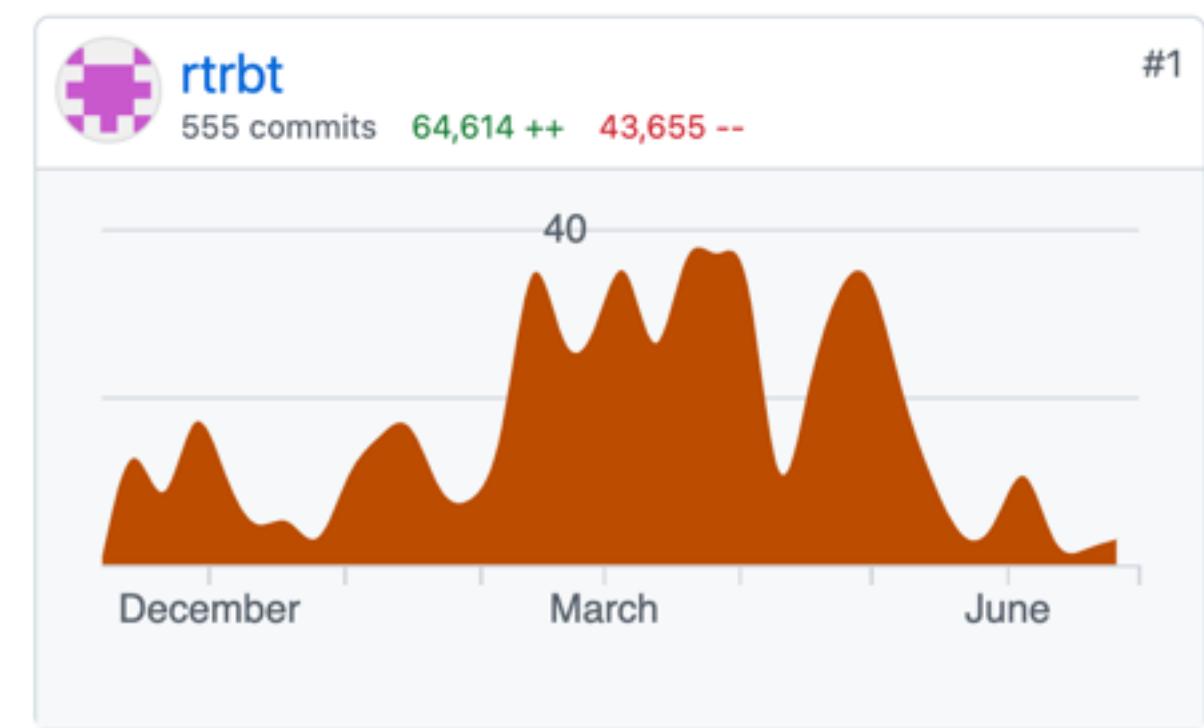
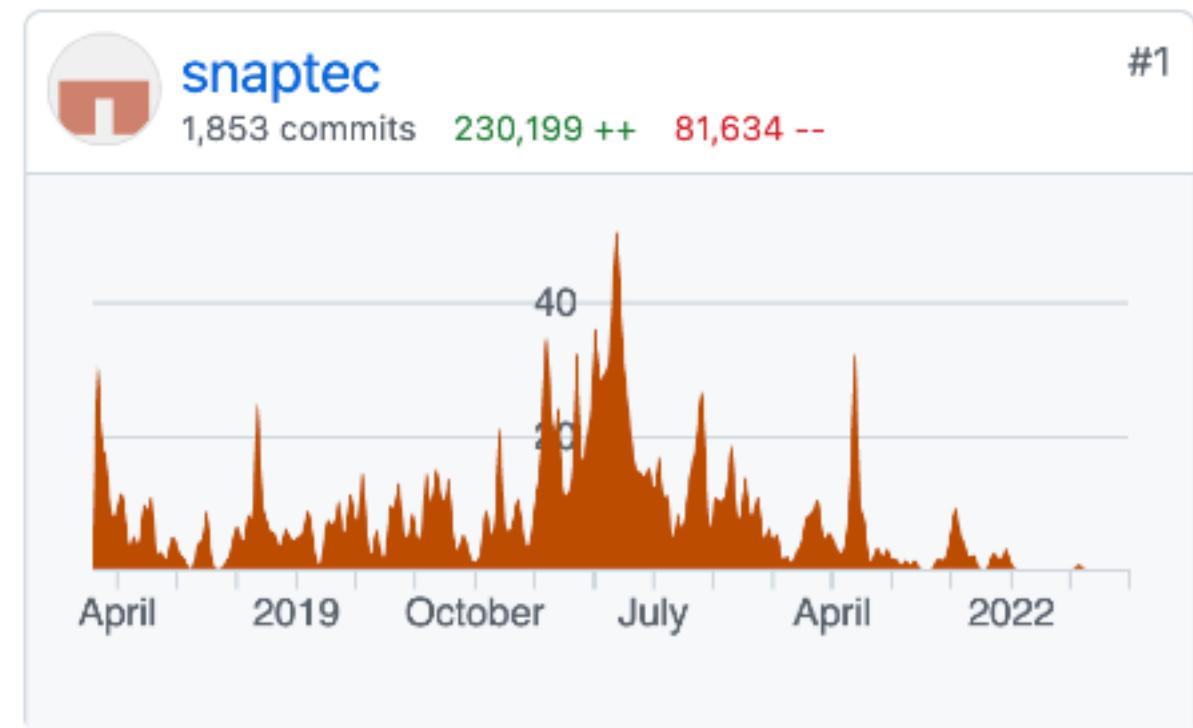


# OpenWB vs. TinkerForge and EN+

## Why not OpenWB?

sorry to say, but

**software too bloated (x10)**  
**hardware too expensive (x4)**



openWB series2 standard

1.199,00 €

**WALLBOX**  
Plug & Play mit 11 kW

autoaid

11 kW Ladeleistung  
DC Fehlerstromschutz  
Typ 2 Ladekabel integriert  
(4 Meter, optional 7 Meter)

449,00 € **349,00 €**

# To collaborate you only need the **ESP32**

to get **mesh networking** going would be  
really great,  
because the **ESP32** can only have max 10  
**WIFI clients**, but unlimited mesh is possible

and I'd really like to have someone help me  
clean up my very bad and messy C++ code



To collaborate you  
only need the  
**ESP32**

<https://github.com/bst-github/esp32-firmware/wiki>





# Reactions

<https://github.com/bst-github/esp32-firmware/wiki>

A dark-themed screenshot of a social media interface showing three reactions to a post.

- Ancor Gonzalez Sosa** 17:56  
impressive, very cool project
- Tobi Lehman** 17:58  
I love OpenWRT!
- Markus Noga** 17:59  
Very cool. Anyone remember  
Unslung for NSLU2?