Building a EU-spec EVSE

With the OpenEVSE project

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Introduction

In December 2011 I got my (our) new house in the Netherlands (Middelburg). It's a newly build house and during the construction I kept the installation of a EVSE on the driveway in the back of my mind.

In May 2010 I made a reservation for a Tesla Model S, so during the construction of the house I anticipated for the Model S to be on my driveway somewhere in 2013.

I'm co-owner of a dutch hosting company where my role is CTO. I love toying with electronics and building things myself. I just have something with eletronics and electricity!

While I could just have bought a EVSE and installed it on the outer wall of my shed I didn't want to. I found the Open EVSE project and I just wanted to make that work. It could be nicely integrated into my shed.

The goal

My goal was to build a 3-phase capable EVSE which would be able to deliver 3x32A at 400V. That is a total of 22kW.

The system would need to have a Type 2 (IEC 62196-2-2) socket where the car could plug in.

Basically: It should be a EVSE which uses the J1772 signaling and complies with the European regulations.

Preparations

Power supply house

When you don't request for anything special a new house in the Netherlands will be connected to a single phase with 40A.

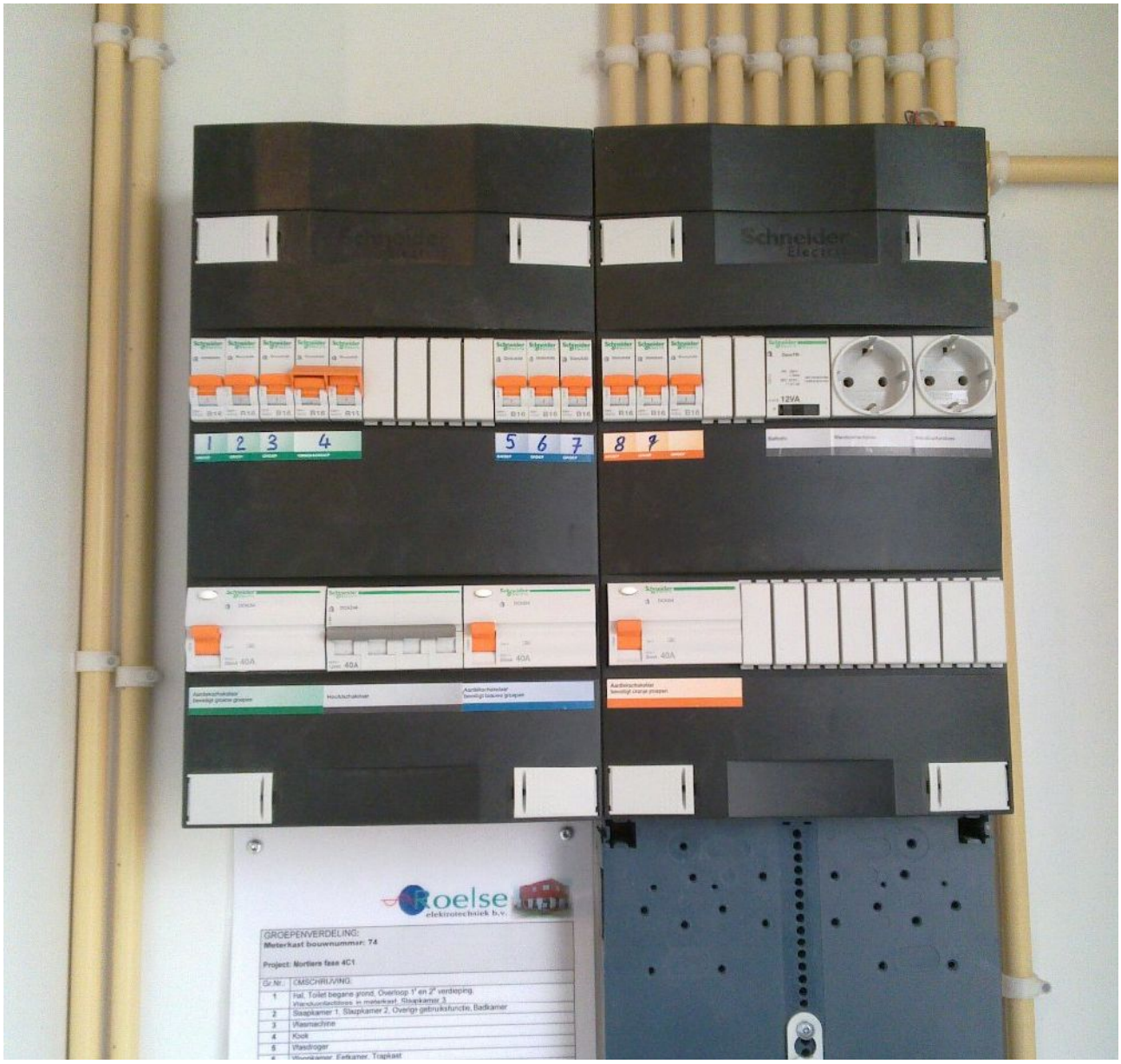
When requested you will be connected to all three phases with 25A per phase. Many people who use electric cooking (like I do) do this or when 40A is simply not enough.

So I requested my house to be connected on all three phases and requested 40A per phase.

Distribution panel

After I got the key I took a look at the electrical wiring in the distribution panel and they connected much of my appliances on the first phase (L1). L2 and L3 were barely used. I needed to get this balanced so that I wouldn't trip the breaker on L1 quickly.

This is how the panel looked when I got the house.



All the breakers you see on top are 16A single-phase breakers.

On the bottom row you can see:

- CFGI (Dutch: aardlekschakelaar)
- Main switch
- CFGI
- CFGI

I however needed to add this:

- Digital kWh meter for own readings (See http://energy.widodh.nl/)
- 32A 3-phase breaker for the shed / EVSE.

The result after my modifications:

This is a total overview with my network wiring in there as well. On the bottom row of the panel you'll see the kWh meter and on the right the 32A breaker (in off position). The grey cable on the top is the one towards my shed.

Cabling

The goal was 3x32A, to do that you need at least a 5G6 cable. That is a cable with 5 copper wires of 6mm^2 each.

I got a ground cable which I ran through a PVC pipe which was installed during construction on my request.

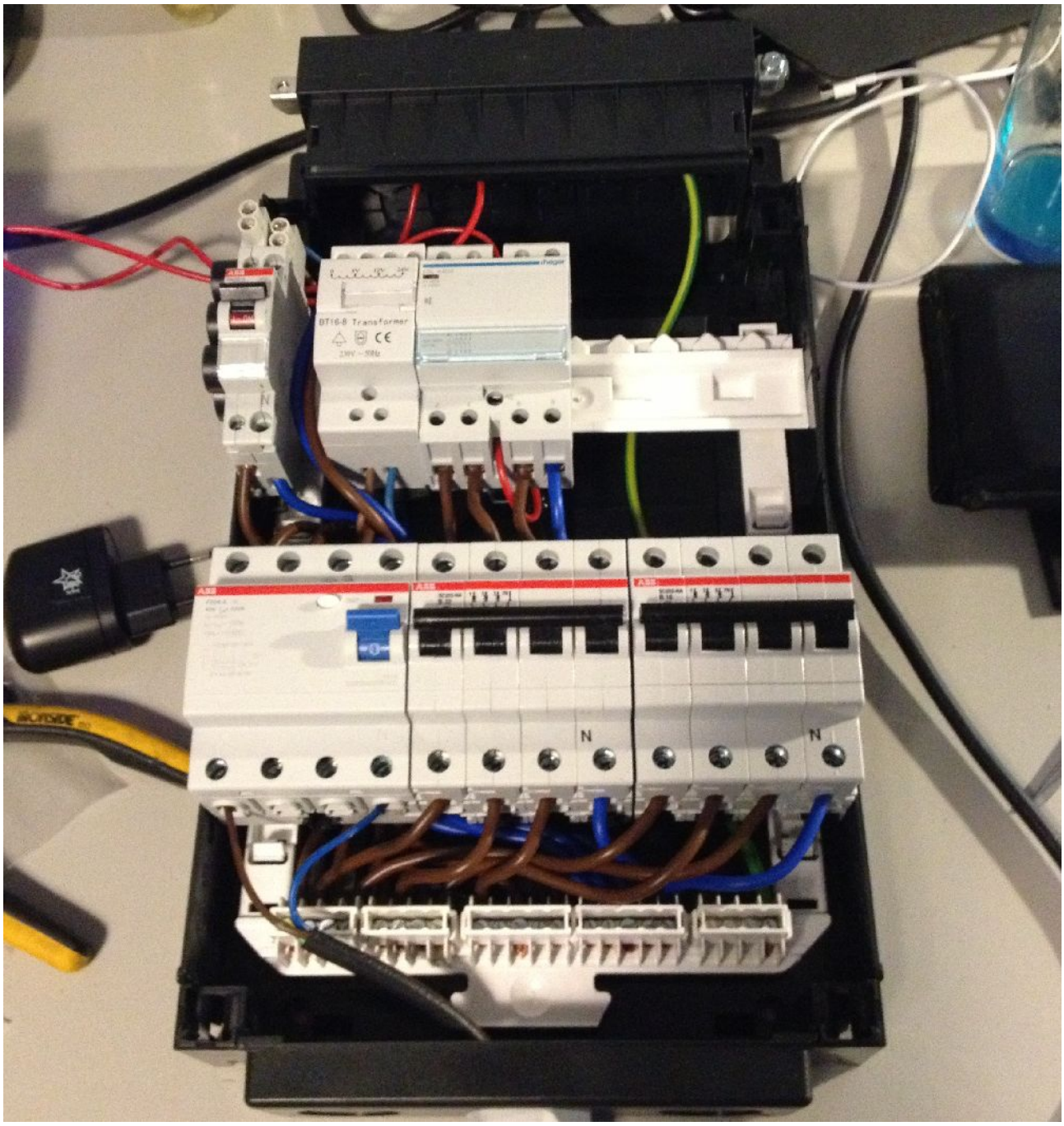
That is what I ended up buying. 40 meters of ground cable.

The shed

Power distribution

All these preparations were done at the beginning when I got my house, but it wasn't until September 2012 before my shed was actually build.

Inside the shed there would be a secondary distribution panel which would house most of the components for the EVSE.

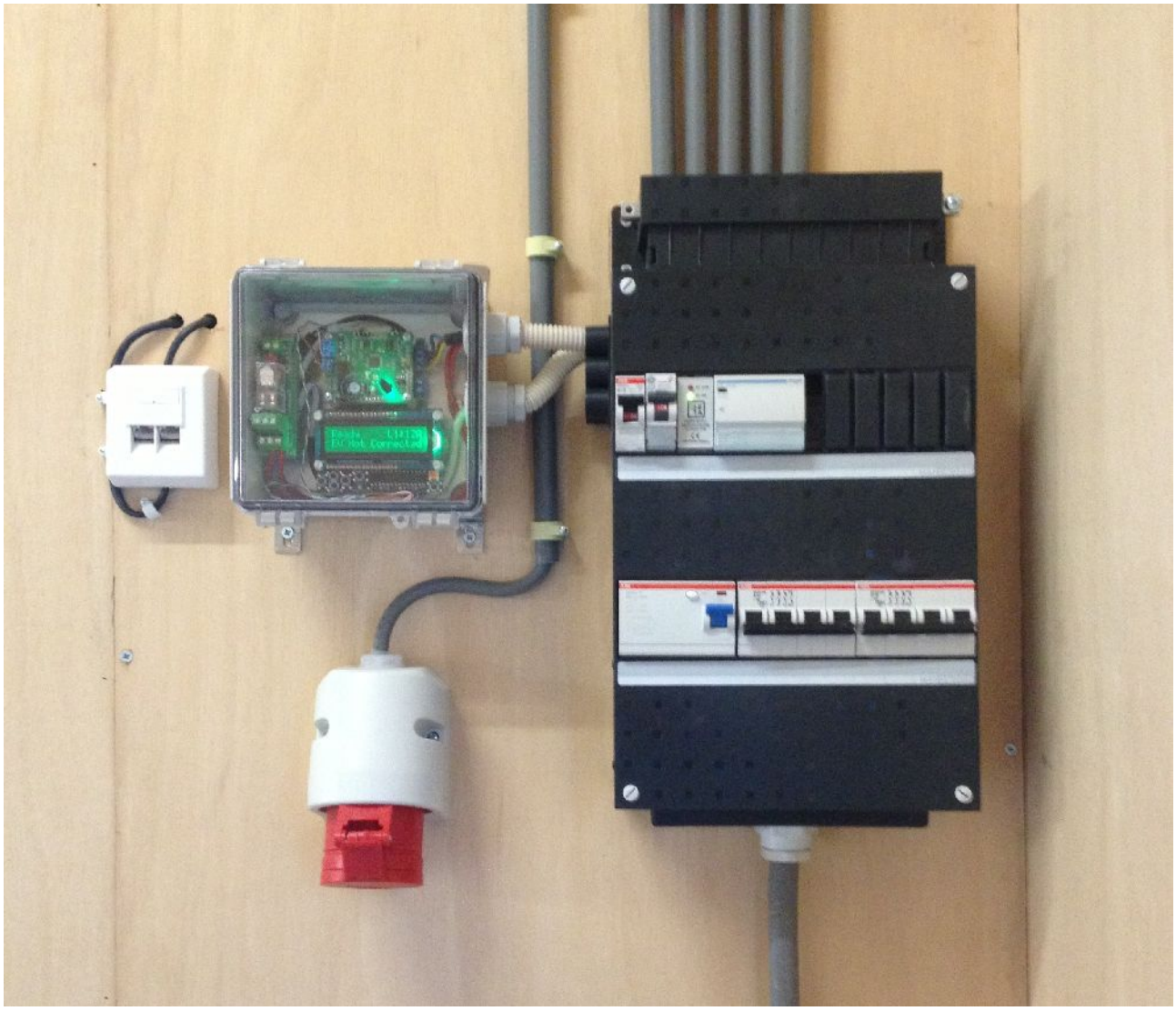


This is the panel after I build it up. The shed has it's own CFGI.

I'll list the components from the top to bottom left to right:

- 16A breaker for outlets and lighting in the shed
- 12V transformer for EVSE relais
- 40A relais (Hager ELS 440)
- CFGI
- 32A breaker for EVSE (directly connected to relais)
- 16A 3-phase breaker for an additional 3-phase outlet

After a couple of hours of work this is how the installed panel with EVSE looks like:



The red socket is the additional 16A 3-phase CEE socket I installed. It's not for the EVSE.
I added a second 16A breaker on the top in case you noticed.

The EVSE socket

The shed is build from wood and has a outer and inner wall. I wanted all the cabling to be in between them so you wouldn't notice anything when it was finished.

This is the Type 2 socket as I purchased it. There is also a interlocking actuator on top of the socket which isn't in this picture.

The interlocking actuator makes sure the connector can't be unplugged while the car is charging.

I haven't been able to get this working yet since Open EVSE doesn't have support for this.

This is the back of the socket installed on the outer wall. You can see the interlocking actuator installed on top of the socket.

The red leaver is for manual release of the socket in case it might be stuck due to whatever reason.

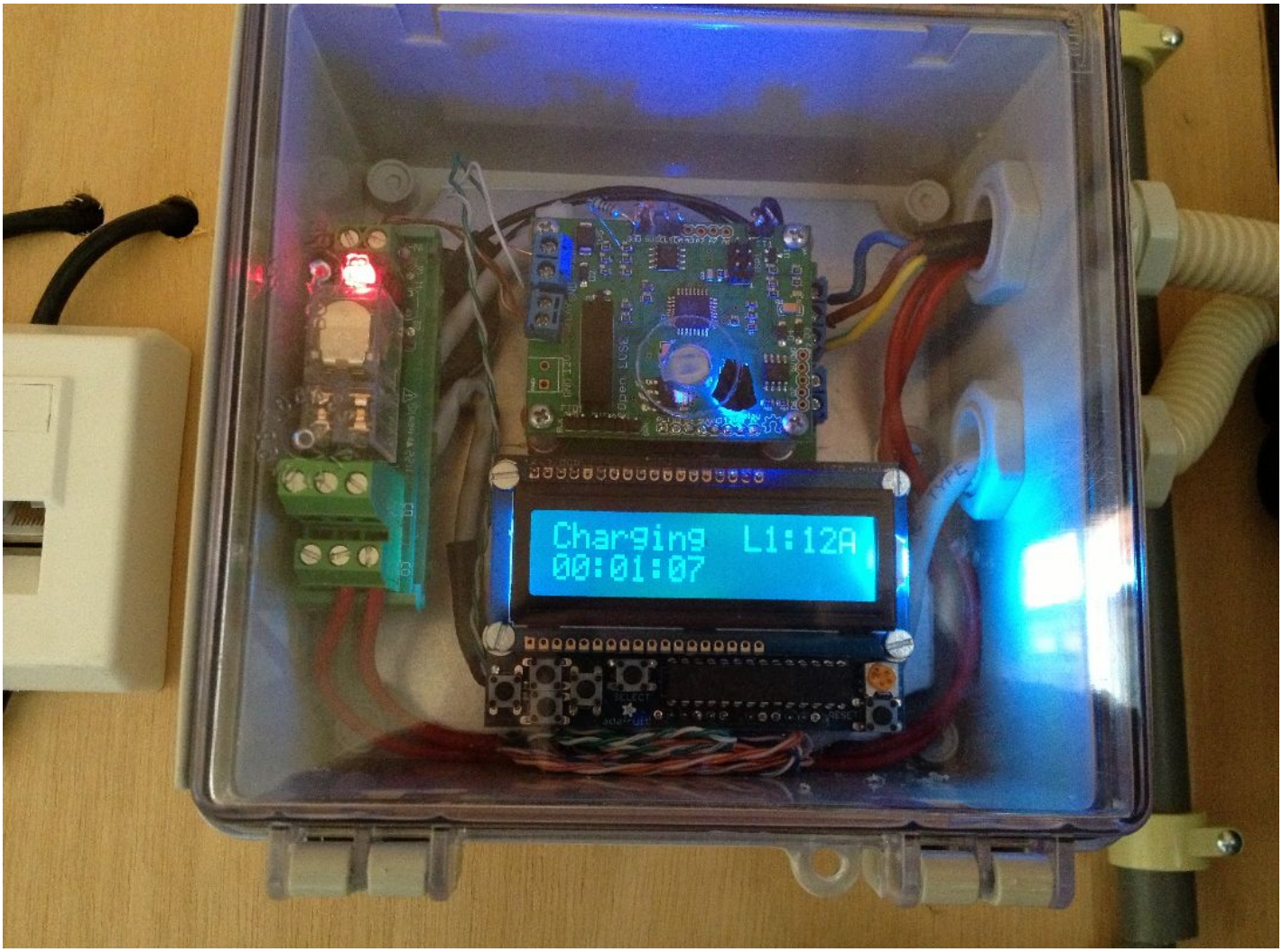
On the left you see a CAT6 cable which I use for the Control Pilot, Proximity Pilot and controlling the actuator (which doesn't work yet).

The cable on the right is de 5G6 cable coming from the 40A relais in the distribution panel in the shed.

On the bottom you see a PVC pipe which I use as a drain. The socket has been designed that any water entering the socket goes out through a drain, just another safety measure.

The end result is just this socket on my outer wall! No 'ugly' charging station on the wall, just a socket where you can *safely* plug in your EV.

The EV charging



This is what it shows when an EV is charging! On this picture the EVSE was running a firmware where I limited it to 12A just for testing purposes.

The expert eye might notice that I didn't wire the Advanced Power Supply of the Open EVSE. That is correct! At the time I took this picture I didn't.

I've done this afterwards and it now auto-senses Level 2 charging and supplies 30A on Level 2.

The result

In this case I think a picture says more then a thousand words.