OpenEVSE

OpenEVSE - 40A Charging Station

P50 Advanced

P50 Standard

IMPORTANT SAFETY INSTRUCTIONS

Read and save these instructions prior to installing and operating your Charging Station. Retain this installation guide for maintenance and troubleshooting information. If you have further questions, contact Customer Service at support@openevse.com.

WARNING: To reduce the risk of fire, electric shock, and serious bodily injury, observe the following:
 • Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards.
 • When cutting or drilling into structure, do not damage electrical wiring and other hidden utilities.
 • Use this device only in the manner intended.

CAUTION: The installation of this charging Station must be in accordance with all national and local electrical codes.

CAUTION: Exercise caution and common sense when powering the device. Do not connect to a damaged power source.

WARNING: Power must be disconnected before installation and servicing, cleaning, and other user-maintenance. Failure to disconnect power creates risk of fire, electric shock, and serious bodily injury.

CAUTION: The product warranty will not cover equipment damage or failure that is caused by improper installation or operation.

WARNING: Do not install in an environment that is excessively dusty, conductive, corrosive, or gas-filled, is exposed to open flames (e.g., gas-burning stoves), is near strong chemicals or solvents, or where there is excessive heat, shock, or vibration.

CAUTION: This charging station is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning the use of the charging station by a person responsible for their safety. Children should be supervised to ensure that they do not play with the charging station.

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Introduction

About

OpenEVSE started in February 2011 with a simple experiment to try to generate the SAE J1772 pilot signal on an Arduino Board. One experiment lead to another to another until a prototype J1772 compatible controller was born. With lots of feedback and interest from the great folks on the "My Nissan LEAF" Forum a few boards were offered to other hardware hackers (6 were built in the first batch) 6 turned into more and more... Boards and now complete kits have been built all over the world and are reliably charging many EVs all over the globe.

OpenEVSE was released as an Open Source hardware and software project in October 2011.

For more information:

OpenEVSE Information
info@openevse.com

OpenEVSE Support
support@openevse.com

License

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OpenEVSE is a truly open project with all source materials freely shared. The licenses are clearly defined and there are zero additional restrictions. OpenEVSE may be used for Commercial purposes as defined in the licenses

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The OpenEVSE Project and Source code has been evaluated by the Open Source Hardware Foundation and meets the requirements for Open Hardware. The registration number for OpenEVSE is US000028.

US000028

Technical Specifications

The OpenEVSE P50A Advanced is compatible with **Level 1 and Level 2** can be powered by a single phase AC power from 90 – 264V 50 or 60hz including the following common configurations:

- 120V - 240V AC single-phase Line, Neutral and safety ground
- 240V AC split-phase: The two phases must both measure 120V AC to ground.
- 208V AC single-phase Any 2 phases and safety ground

The OpenEVSE P50S Standard is compatible with **Level 2 ONLY** can be powered by a single phase AC power from 208 – 264V 50 or 60hz including the following common configurations:

- 240V AC split-phase: The two phases must both measure 120V AC to ground.
- 208V AC single-phase Any 2 phases and safety ground
- 230V AC single-phase Line, Neutral and safety ground

Specifications		Model: P50A	
AC Input			
Operating Voltage		90 - 264 VAC, 1-Ph	
AC Frequency		50 or 60Hz	
AC Output			
Current	50A Circuit	6A - 40A	
	40A Circuit	6A - 32A	
	30A Circuit	6A - 24A	
	20A Circuit	6A - 16A	
Output Power	120 VAC	720 W - 2880 W	
	240VAC	1440 W - 9600 W	
Features			
Display	Type	LCD 16 Character 2 Lines	
	Backlight	Color	
Temperature	Sensor	Yes	
	Type	DS3231	
Real Time Clock		Yes	
Station Based Timers		Yes	
Current Measurement		Yes	
Display - kWh added		Yes	
Display - kWh total		Yes	
Session Options	Add x kWh	Yes	
	Charge x min	Yes	
Safety			
Power Interlock		Yes	
Pilot Signal		Yes	
Ground Monitoring		Yes	
Ground Fault Interrupt with self test		15ma - 20ma	
Welded Contact Detection		Yes	
Self test		Power-on and before energizing	
Temperature Throttling	50%	65°C - 150°F	
	25%	68°C - 155°F	
	Shutdown	71°C - 160°F	
	Resume 100%	62°C - 145°F	
Electric Vehicle ID		Yes	
Ventilation Check		Yes	
Warranty			
Standard		3 Year	
Enclosure		**P50A-18**	**P50A-24**
Weight		4.2kg - 9.3 lbs	4.4kg 9.7lbs
Dimensions (H x W x D)	mm	260 x 135 x 70	
	Inches	10.3 x 5.3 x 2.8	

Specifications		Model: P50S	
AC Input			
Operating Voltage		208 - 264 VAC, 1-Ph	
AC Frequency		50 or 60Hz	
AC Output			
Current	50A Circuit	6A - 40A	
	40A Circuit	6A - 32A	
	30A Circuit	6A - 24A	
	20A Circuit	6A - 16A	
Output Power	120 VAC	720 W - 2880 W	
	240VAC	1440 W - 9600 W	
Features			
Display	Type	LCD 16 Character 2 Lines	
	Backlight	Monochrome (White on Blue)	
Temperature	Sensor	Yes	
	Type	MCP9808	
Real Time Clock		No	
Station Based Timers		No	
Current Measurement		Yes	
Display - kWh added		Yes	
Display - kWh total		Yes	
Session Options	Add x kWh	Yes	
	Charge x min	Yes	
Safety			
Power Interlock		Yes	
Pilot Signal		Yes	
Ground Monitoring		Yes	
Ground Fault Interrupt with self test		15ma - 20ma	
Welded Contact Detection		Yes	
Self test		Power-on and before energizing	
Temperature Throttling	50%	65°C - 150°F	
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	Shutdown	71°C - 160°F	
	Resume 100%	62°C - 145°F	
Electric Vehicle ID		Yes	
Ventilation Check		Yes	
Warranty			
Standard		3 Year	
Enclosure		**P50S-18**	**P50S-24**
Weight		4.2kg - 9.3 lbs	4.4kg 9.7lbs
Dimensions (H x W x D)	mm	260 x 135 x 70	
	Inches	10.3 x 5.3 x 2.8	

Safety

OpenEVSE was designed to comply with safety features required by standards documents for Electric Vehicle Charging from SAE J1772, NEC and UL.

Note: The OpenEVSE P50 Charging Station has not been tested or certified by a Nationally Recognized Testing Laboratory.

- UL2251 Standard for Plugs, Receptacles and Couplers for Electric Vehicles
- UL2231 Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits
- SAE J1772™ Electric Vehicle Conductive Charge Coupler Standard
- NEC Article 625 Electric Vehicle Charging System Equipment

Power interlock

OpenEVSE includes an interlock that de-energizes the electric vehicle connector and cable whenever the electrical connector is uncoupled from the electric vehicle **(NEC 625.18)**

Pilot Signal

OpenEVSE supports the SAE J1772 pilot signal which provides an automatic means to de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in either cable rupture or separation of the cable from the electric connector and exposure of live parts **(NEC 625.19) (SAE J1772)**

Self Check

OpenEVSE performs a Self-Testing sequence during start up to ensure unit is working properly and safely upon power-up OpenEVSE checks for:

- GFCI--Ability to respond to a 20mA ground fault
- Missing Ground
- Welded Relay Contact Monitor
- Pilot line status

Ground Monitoring

OpenEVSE checks ground during power-up and constantly monitors for presence of proper safety ground during operation. If ground is lost charging is discontinued. **(SAE J1772)**

Ground Fault Interrupt

OpenEVSE includes mandatory Ground Fault Interruption.

- Fault sensitivity of 20ma trip for protection against electric shock of personnel. **(NEC 625.22) (SAE J1772) (UL 2231)**
- After each GFCI event OpenEVSE will retry charging up to 4 times after a 15 minute delay per event. **(UL 2231)**
- Ground Fault circuit tested during Power on Self-test.

Stuck Relay detection

OpenEVSE checks relay contacts on power up to ensure relays are functioning properly and providing proper power interlock.

Electric Vehicle Identification

OpenEVSE verify the pilot signal integrity by checking the Electric Vehicle Diode. The pilot signal must BOTH be at the correct resistance AND pass the "diode check" to activate the circuit. **(SAE J1772)**

Ventilation Required

OpenEVSE checks for the "Ventilation Required" request from Electric Vehicles with lead acid batteries (not common). By default OpenEVSE will deny charging if ventilation is not available. With additional hardware and firmware update OpenEVSE can allow "Ventilation Required" charging if the charging station is equipped to activate ventilation. **(SAE J1772)**

Internal Temperature

OpenEVSE Continuously monitors the internal temperature of the Charging Station and will shutdown if the internal temperature exceeds 71°C (160°F).

Temperature Throttling

OpenEVSE Actively reduces charging current during high temperature events in several steps beginning at 65°C (150°F). If temperature drops full current is restored. Charging will be halted if temperature exceeds a critical level.

Installation

Step 1 — Introduction
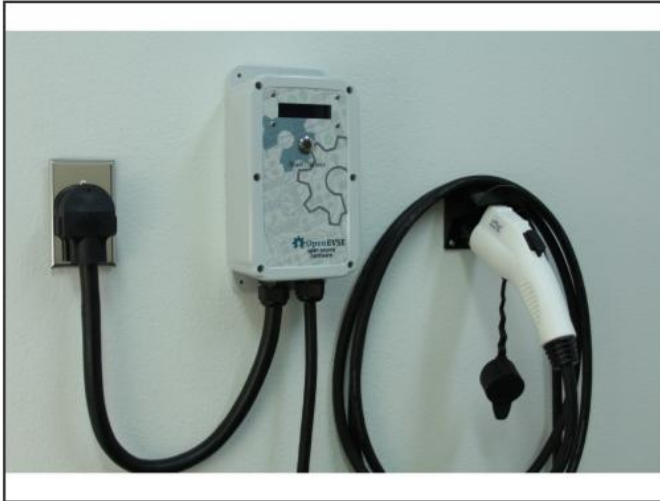
(i) Tools Required

- Drill with 1/4" bit (drywall) or 1/8 bit (wood)

- # 2 Phillips screwdriver

- (Optional) Level

Step 2 — Location

- Your Charging Station should be mounted on a flat surface in close proximity to your plug.

📌 **Note. Why is the power cord so short...?** J1772 and UL standards require a short input cord for enhanced safety. The EV cord is protected with several safety checks and cutoff but the input cord can not be protected. Keeping the input cord short reduces the risk of damage.

⚠️ Turn off power at the circuit breaker.

- Plug in to the socket (with power off) and mark a location that allows a gentle bend of the input cord.

  - **Option - Portable** Mark 2 center holes top and bottom if you plan to use your Charging station on the road. It will be very easy to remove.

  - **Option - Static** For more static install, mark the 4 corner holes.

Step 3 — Drill holes

- Drywall - Drill your holes with a 1/4" drill bit.
  - Insert the drywall anchor and screw in until flush with the wall

- Wood - Drill through the wood or stud with a 1/8" drill bit.

- Center mount - Screw in the screws leaving the head extended by 1/2".

Step 4 — Mount Charging Station

- **Center Mount (Portable)** - Slide screws through the large opening. Shift the station either to the left or right. Tighten the screws as necessary to keep the station in place.

- **Corner Mount (Stationary)** Screw in the 4 screws.

Step 5 — Mount Holster

- Use the Holster as a template and mark the holes.

- Drywall - Drill your holes with a 1/4" drill bit.
  - Insert the drywall anchor and screw in until flush with the wall

- Wood - Drill through the wood or stud with a 1/8" drill bit.

- (i) Tip - Screw in the top screws first and tilt the holster up for easier access to the top holes.

Operation

Display

The OpenEVSE P50 Advanced displays various colors based on state if equipped with a Red - Green - Blue (RGB) Liquid Crystal Display (LCD).

The colors are:

Color	OpenEVSE State	EV State	J1772 State
White	Booting	N/A	N/A
Green	Ready	Not Connected	State A
Yellow	Ready	Connected	State B
Blue	Charging	Charging	State C
Red	Error	N/A	Error

LCD Text

The Standard LCD used on OpenEVSE P50 has 2 lines and 16 Characters per line.

Top Line Left Side

Ready	OpenEVSE is ready
Charging	OpenEVSE is ready to Charge
Error	OpenEVSE has detected an Error
Stopped	OpenEVSE has been stopped
Waiting	OpenEVSE is waiting for a timer
Sleeping	OpenEVSE is sleeping

Top Line Right Side The Right side displays information about the Service level and Current setting of the Pilot. In the "Ready" States the LCD displays the Service Level L1 - 120V or L2 - 240V and the Maximum current allowed by the Charging Station.

Bottom Line The Bottom line displays information about the state of the Electric Vehicle and the current charging session.

EV Not Connected	OpenEVSE does not detect an EV
EV Connected	OpenEVSE detected an EV

While in the Charging state the LCD will display the watt hours added for the current session on the left and the Total Life time in kWh on the right.

Real Time Clock

The P50 Advanced includes a Real Time Clock which allows charging station based timers. See the Button Menu section to set the current time, Start and Stop times. These timers are independent of timers set on the vehicle.

Battery - The P50 Advanced includes a CR1220 coin cell battery installed on the back side of the LCD. This battery can be replaced with a CR1216, CR1220 or CR1225 at the end of its life. Note the battery is not required for normal operations, it serves to keep time after a power failure.

Button Menu

Menu options can be accessed with the button. The menu operates on Long press and short press.

All options are available in the "Ready" State. If a vehicle is connected only session options are available.

Long Press - Press and hold down

Short Press - Press and release

- To access the menu press the button and hold it down until the menu displays.
- Scroll through the options with a short press the button.
- Change the value of an option Press and hold.
- Scroll through the available values for that particular option short press.
- Select the desired value Press and hold.

Button Menu Options

- LCD Type (Monochrome, RGB)
    - Monochrome - Single Color LCDs
    - RGB - Red, Green, Blue LCDs
- Service Level (L1, L2, Auto)
    - L1 - Level 1 Charging Only (120v)
    - L2 - Level 2 charging Only (200 - 240v) Recommended for International Users
    - Auto - Auto Detect L1 or L2
- Default Current (Max 40A. Do not exceed 80% of Circuit/Breaker Rating)
- Set Time (Day, Month, Year, Hour, Minute)
- Start Time (Hour, Minute)
- Stop Time (Hour, Minute)
- Session Options
    - Charge Limit (add xxx kwh)
    - Time Limit (charge for xx minutes)

For Advanced users only with specific need. The following safety features are enabled by default. Do not disable under normal circumstances. Any disabled Safety Features will be displayed on every boot.

- Vent Required (Enabled, Disabled)
- Stuck Relay Check (Enabled, DIsabled)
- Ground Check (Enabled, Disabled)
- GFCI Self Test (Enabled, Disabled)
- Temperature Check (Enabled, Disabled)

Power on Self Test

Self Check

OpenEVSE performs a Self-Testing sequence during start up and every time before beginning to charge to ensure all safety features are working properly including:

- GFCI--Ability to respond to a 20mA ground fault
- Missing Ground
- Welded Relay Contact Monitor
- Pilot line status with Vehicle Identification
- Internal Temperature

Possible errors returned during the self test are:

GFCI Self Test Failed	OpenEVSE did not detect a GFCI Fault during test	Check GFCI CT and Self test coil
Earth Ground Test Failed	OpenEVSE could not detect a Ground	Check Ground Connections and AC_Test lines
Stuck Relay Test Failed	OpenEVSE read AC voltage before Relays were closed	Check Relay and AC_Test Lines

Errors

GFCI FAULT	OpenEVSE detected a ground leakage of > 20ma	OpenEVSE will rerun GFCI self-test and retry charging. If Ground fault indicates immediate failure. Charging is suspended. If GFCI continues regularly Contact Support
NO GROUND	OpenEVSE lost connection to ground	Check Electrical Ground, Contact Support
STUCK RELAY	Power was detected when line should be open.	Contact Support
VENT REQUIRED	OpenEVSE read a pilot signal at 3V	Ventilation requested by the Electric Vehicle.
DIODE CHECK	OpenEVSE did not detect a Vehicle	Ensure Charge handle is dry and clean. Contact Support.
OVER TEMPERATURE	Temperature over 72C detected	If outside air temperature is very hot, keep station out of direct sunlight and charge at lower current otherwise Contact Support.

Additional Resources

Online Solutions, Forums and Trouble Tickets
http://support.openevse.com
E-mail support@openevse.com

Online Guides
http://guides.openevse.com

Store
http://store.openevse.com

Website
http://www.openevse.com

Source Code - Firmware - Schematics, etc.

https://github.com/openevse