

EVSE EV Charger Test & Repair Secrets

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Contact us - info@evdoctor.net or 760 683-9436

EVSE Test - Equipment Needed (Purchase information is on the last page of this document)

1. MultiMeter (ohms/Volts) **and small paper clip**
2. EVDoctor Pocket Go NoGo EVSE Tester
<https://bit.ly/EVSE-Go-NoGo-Tester>
3. Security Torx bit set - (T10 or T15 Typical) see appendix
4. Optional - 'Tap Drill' bits #53 (0.0595), #36 (0.1065), ~#28 (0.1405) - To measure J1772 pin diameter
5. Optional - DSO Digital OscilloScope - Recommended to measure Pilot (CP) Signal.



Appendix - Additional reference Information worth reading

- A. EVSE History, Specification and Terms - Wikipedia
- B. EVSE & J1772 Simplified Theory of Operation - Worth reading
- C. J1772 Handle and Cable Repair**
- D. EVSE Handle Types - J1772, TESLA, CSS, Type 2
- E. Pocket Go NoGo EVSE Tester/Simulator
- F. EVDoctor Pin Gauge - Worn pin tester
- G. Low Cost Tools to help you repair your EV Charger.
- H. Extension Cord Wire Size Guide
- I. Outlet Wiring for 120V and 240V EVSE AC Power Plugs. Includes images of all NEMA Outlets
- J. Security and Tamper Proof Screws
- K. Gauges to measure pins - Numbered Drills Sizes
- L. Charger Specific Error Codes

Videos

<http://bit.ly/QuickFixEvWontCharge-Video> <http://bit.ly/QuickFixEvWontCharge-Slides>
<http://bit.ly/StopEVChargerCordDamage-Video> <http://bit.ly/StopChargerCordDamage-Slides>
<https://bit.ly/EVWontChargeWithTeslaAdapter-Slides>

Other Documents -

<https://bit.ly/EVSE-Repair-Pilot-Prox-Switch> - This is a short version of the 'Repair Secrets Document'
Also see Appendix C "J1772 Handle and Cable Repair" This has lots of good information.

Worn or Acing Pins

Many older EVSE EV Charger exhibit charging that stops before the charge is complete. This can be caused by worn or arc pins in the J1772 handle. Inspect the pins with a Otto Scope and measure the pin diameter. (see tools at the end of this document. If a pin is burned or heat damaged the J plug handle will have to be replaced which can cost >\$100 plus labor. In some cases the pin can be tightened by opening the handle and gently center punching the side of the pin. Call us and we will help you.



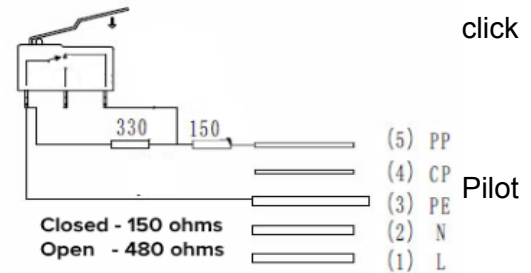
J1772 Release Latch

The Release Latch prevents the J1772 handle from being accidentally removed from the EV until the lever is pressed. Pressing the lever (open) signals the EVSE Charger to stop current flow (and prevent arcs). When the latch is open the Proximity Signal is 480 Ohms and when it is closed the signal is 150 Ohms. Sometimes the latch does not close when plugged into the EV and that prevents the EVSE from charging. Plug the J1772 handle into the EV and confirm that the latch closes. Press down on the latch and see if it clicks shut. If not, the tip of the latch needs to be filed off ~ 1/32" on the inside edge. This is easier to do if you take the handle apart. [Alternate - J1772 DOSTAR Plug - Release Lever Fixes by Enelx](#)

Proximity Signal (Plug Present) - PP -

The EV will not charge if the Proximity signal is not 150 ohms when the J1772 handle is plugged into the EV. Open the J1772 handle, Look for broken wires and listen for a click when the lever is activated. Replace microswitch if needed. Most microswitches are similar. Just get one that looks close. . NOTE: You should hear an audible click when the switch opens. The transition from closed to open should occur when the 'Beak' of the latch is open a gap of 0.20 - 0.325". NOTE: Some Proximity switches are Hall effect and require +12V. Make sure that the testing was performed with the EV Charger plugged in and verify that the signal is +12V. Also note some handles are sealed and cannot be opened. These handles must be replaced.

J1772 Proximity Switch



Control Pilot Signal - CP

Plug in the charger and check the Pilot Signal for +12V or use the Go NoGo tester. If it is any other voltage the problem is likely in the charger body. If it is an open circuit it is likely a broken wire between the charger body and the J1772 handle. Open the charger body case and use an Ohm meter to check continuity on the pilot signal. If the wire is broken it is usually near the J1772 handle (or the case). Try to guess where the break is and carefully cut open the wire jacket. Probe through the pilot wire insulation until you find the break. Generally you do not need to seal the poke holes in the Pilot signal because it is a low voltage signal. Wrap/seal the jacket with E Z Fuse Silicon sealing tape which is much better than electrical tape.

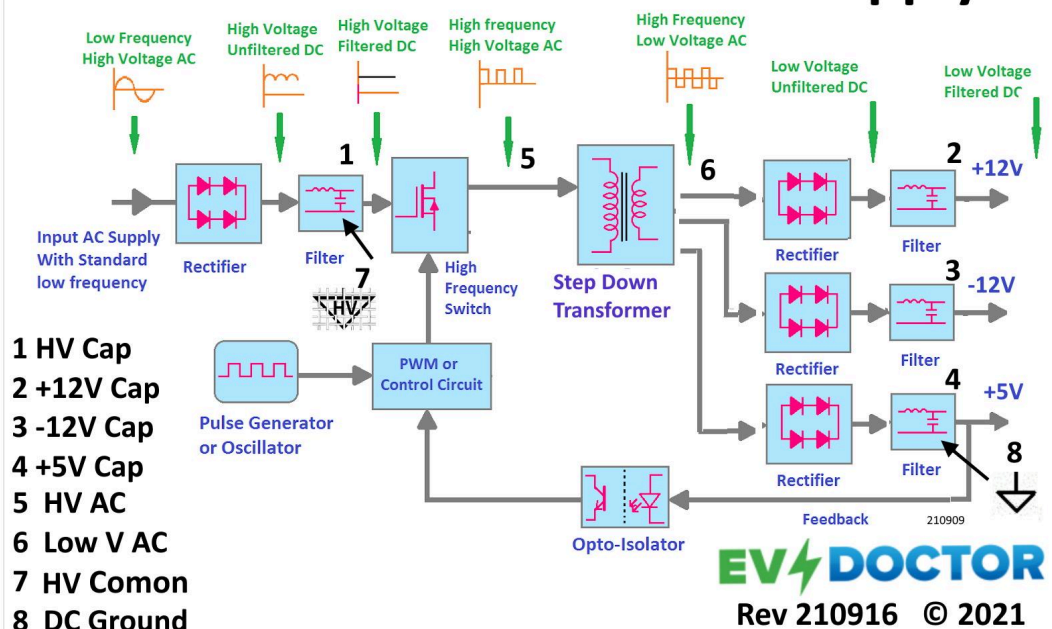
<https://www.homedepot.com/p/Super-Glue-1-in-x-10-ft-Black-E-Z-Fuse-Silicone-Tape-15408-6/204237144>

DC Power Supplies

Many EV Charger problems are caused by the DC Power Supplies. The DC power supply generates +5V, +12V and -12V for operation of the internal electronics. Most modern chargers use a 120/240V 'switching' design. To troubleshoot the DC power supplies review the diagram below and check the following:

- A. HV cap voltage ~385VDC ref #7 (HV Ground), B.. HV AC #5 ref #7 (HV ground) If none check HF switch , C. Check 5V cap #4, 4. +-12 voltage caps #3 & #4 (ref #8 DC Ground)

EVSE Switch Mode Power Supply



Stuck Main Contactor Relay - Red Flashing Error Signal

A common cause of EV Charger failures is the main contactor relay. This is the switch that closes to allow high voltage to connect to the electric vehicle. This puts 120V/240V on the J1772 handle power pins. Often there are 2 contactor relays one for each power pin on the J1772 handle.

Many EV Chargers check to see if the main contactor relay is open when the EV Charger is powered up and closed when the EV is ready to charge. An error will display if the contactor is closed at power up. This error should also cause the main contactors to open

Check for continuity between the AC power and J1772 power pins. If there is continuity the main contactor relay is stuck closed.

GFI or Open ground faults

These problems are quite difficult to fix as they are generally caused by failure in the analog amplifier circuits. Email us and we will try to help you.

Appendix - Reference Information

- A. EVSE History, Specification and Terms - Wikipedia
- B. EVSE & J1772 Simplified Theory of Operation - Worth reading
- C. J1772 Handle and Cable Repair, Other suppliers
- D. EVSE Handle Types - J1772, TESLA, CSS, Type 2
- E. Pocket Go NoGo EVSE Tester/Simulator
- F. EVDoctor Pin Gauge - Worn pin tester
- G. Low Cost Tools to help you repair your EV Charger.
- H. Extension Cord Guide - Amperage vs Length & Short Wire Guide
- I. Outlet Wiring for 120V and 240V EVSE AC Power Plugs
- J. Gauges to measure pins - Numbered Drills Sizes
- K. Charger Specific error codes

A. EVSE History, Specification and Terms <https://bit.ly/Wikipedia-EVSE-Specification>

Common Terms

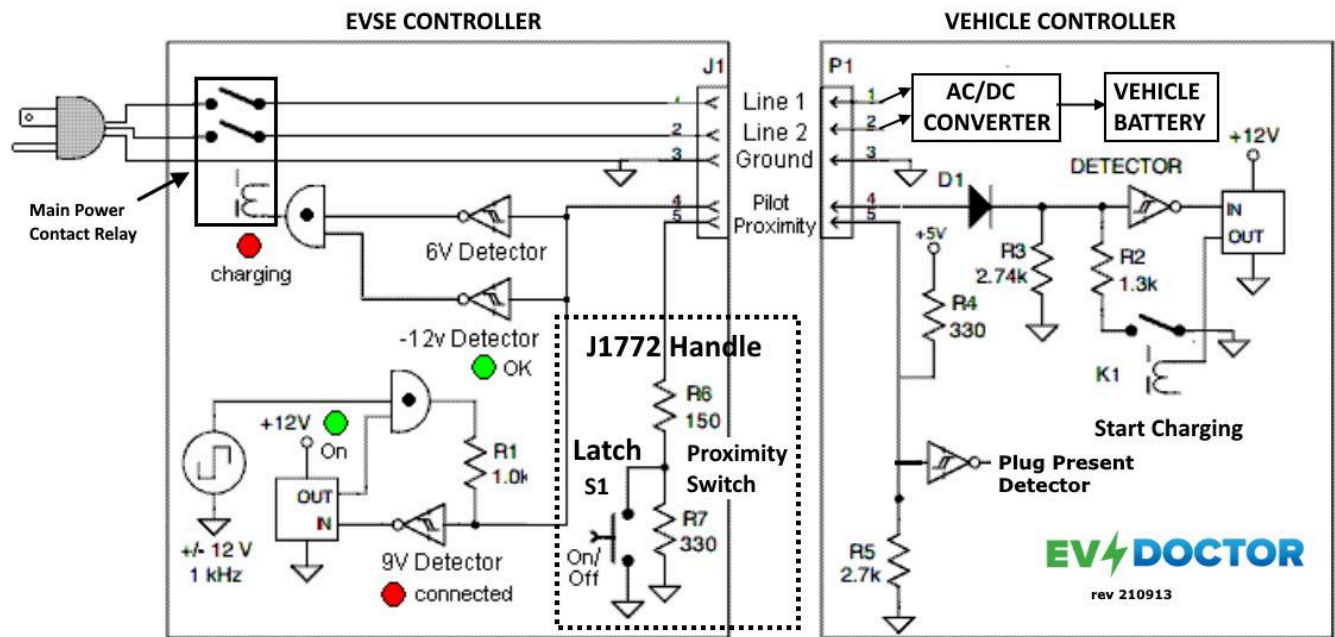
EVSE Electric Vehicle Supply Equipment
GMI Ground Monitor Interrupter
CCID Charge Circuit Interrupting Device CCID 20 = 20 ma, CCID 5 = 5 ma
Other resources

[Proximity Pilot and Control Pilot overview](#)

B. EVSE & J1772 Simplified Theory of Operation

EVSE AND VEHICLE CONTROLLER OVERVIEW

1. When the J1772 handle is plugged in the CP Signal is pulled down to 9V by R3. This starts the 1 kHz Pilot signal (PWM - Pulse Width Modulated). The pulse width tells the vehicle the amperage capacity of the EVSE. (See chart) The vehicle sets the actual charging rate.
2. If the proximity switch is closed (150 ohms - pin 5), the vehicle closes K1.
3. The EVSE controller then closes the main power relay which provides 120/240 AC volts to the vehicle.
4. When you press the latch the S1 proximity switch opens (480 ohms) and the vehicle stops charging. If the vehicle opens K1 the EVSE Controller turns off the AC power (Main Contact Relay)



C. J1772 Handle and Cable Repair, Other suppliers

This is a collection of J1772 handle and cable repair tips.

<http://bit.ly/J1772-Cable-Repair> - Good for Cable only repair

<https://bit.ly/J1772HandleCableRepair> - Short version good for installing used J1772

Handle with Cable

<http://bit.ly/J1772-Handle-Repair> - Long version, Very good video on J1772 replacement

For complete handle replacement we recommend these YouTube Videos by [Mayfield](#)

[Marine](#). <https://bit.ly/J1772-Handle-Replacement>

ByMitkus <https://bit.ly/J1772-Handle-Replace-Mitkus>

By Fast & Quiet [Replacing a J1772 Plug/Charging Nozzle](#)

EVSE AMP CAPACITY	
Amps	PWM
8	13.3%
12	20.0%
16	26.7%
20	33.3%
30	50.0%
40	66.7%
50	83.3%

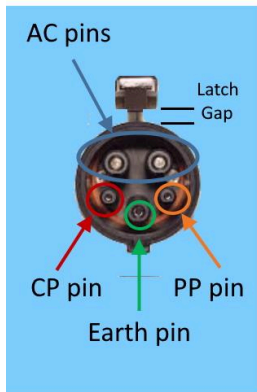
Other component suppliers

Parts & equipment <http://modularevpower.com/index.htm>

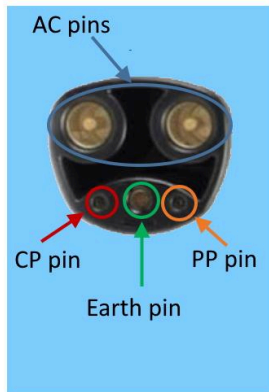
J1772 Handles <https://www.fastandquiet.com/charger-accessories>

D. EVSE Handle Types - The J1772 (J plug), Tesla, CCS2 and Type 2 plugs/chargers all work the same with respect to the Pilot signal and Proximity switch.

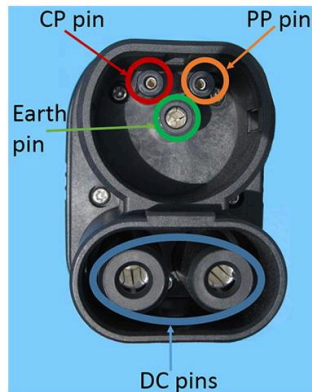
EVSE Electric Vehicle Pin Outs



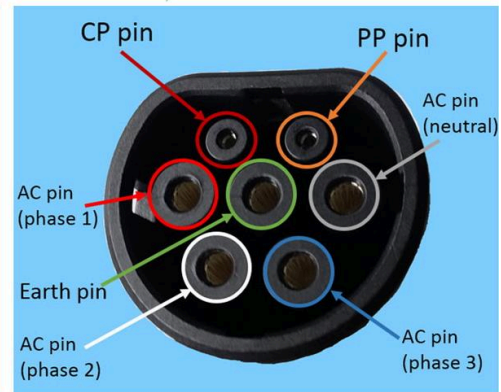
J1772 pin layout



TESLA pin layout



CCS2 pin layout



Type 2 plug pin layout

[Click here for full connector type details](#)

E. Pocket Go NoGo EVSE Tester/Simulator - See additional details here

<https://bit.ly/EVSE-Go-NoGo-Tester>

The EVDoctor Go NoGo Tester is designed for repair and verification of all types of EVSE (Electrical Vehicle Service Equipment) including - The J1772 (J plug, Type1), Tesla, CCS2 and Type 2 plugs/chargers

The EVSE Tester is self contained and does not require any additional equipment for basic testing. The EVSE Charger Status is displayed on 2 LED's - Pilot (green) and Pilot 1 kHz active (blue).

OPERATION: Insert the EVSE Tester leads into the Ground and Pilot pins of the J1772 handle and turn the Connect and Charge switches Off (Left). Follow the chart below.

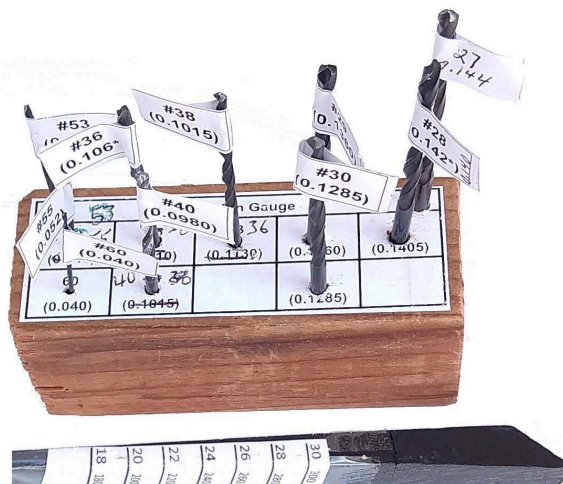
- 1) Plug in the EVSE to AC power. Observe the Pilot LED On.
- 2) Set Connect to On (right). The Pilot LED (green) and the Pilot 1 kHz LED (blue) On).
- 3) Set Charge to On. Observe the EVSE audible click (power on) and the Pilot Green LED dims slightly.

CAUTION: When the EVSE power is on there is 240V on the output pins. Your EVSE is working! *



F. EVDoctor Pin Gauge - For Testing for worn pins in the EVSE Handle

EVDOCTOR EVSE Pin Gauge				
Pin	Description	Pin Diameter - Nearest Tap Drill #/ (Decimal), *actual pin diameter		
		Min Dia.	Avg. Dia.	Max Dia.*
1, 2	L1 and L2 AC Power	#30 (0.1285)	#29 (0.1360)	#28 (0.142*)
3	Power Ground	#40 (0.0980)	#38 (0.1015)	#36 (0.106*)
4, 5	Control Pilot, Proximity	#60 (0.040)	#55 (0.052)	#53 (0.059*)
Note: The #28 Tap Drill is actually 0.1405"				
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J1772 Pin Sizes

#36
0.106 in
2.7 mm

Ground

#53
0.059 in
1.5 mm

Signal

#28
0.142 in
3.6 mm

AC Power

EVDOCTOR

J1772 Pin Set Male & Female

EVDOCTOR

G. Low Cost Tools to help you repair your EV Charger.

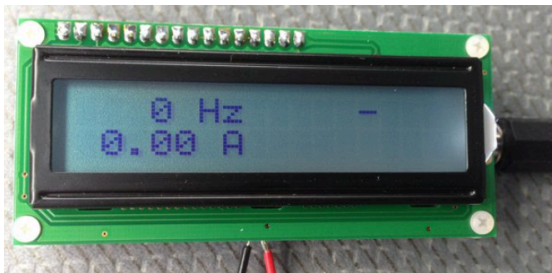
- EVDoctor Go NoGo EVSE Tester - <https://bit.ly/EVSE-Go-NoGo-Tester>
- Micro Power Buzz Box - This is an absolute must for circuit tracing \$25 www.ebay.com/itm/124862211925
- WeePro Digital Voltmeter Ammeter Ohmmeter Multimeter \$12 www.ebay.com/itm/271496690158 <https://www.amazon.com/dp/B01LY6EEKW>
- DSO150 Digital Oscilloscope 2.4 inch LCD Display \$32 www.ebay.com/itm/263783701694 www.amazon.com/dp/B07SZPY9R9
- 100MHz Oscilloscope 10x Scope Probe (needed for 240V AC Testing) \$14 www.ebay.com/itm/151894560636 www.amazon.com/dp/B00XJH2M02
- Mini LED Oscope. Great for viewing inside pins. \$9 www.amazon.com/dp/B088RHWH6H
- Numbered tap drill set - 1-60 www.amazon.com/gp/product/B07SW836NQ/
- Security Torx bit set - 11 piece (need T10 or T15 Typical) www.amazon.com/dp/B07ZH1RBMG/ \$8
- J1772 EVSE Simulator with display \$40 Geppetto Electronics <https://hackaday.io/project/9051-j1772-ev-simulator> <https://www.tindie.com/products/nsayer/evse-tester/#product-description>



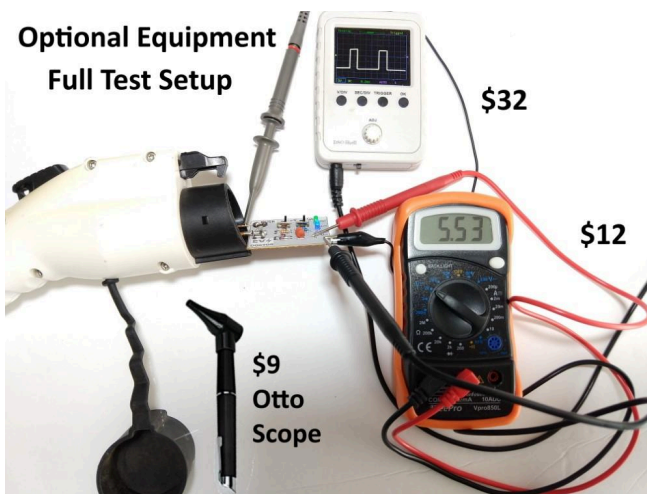
PCB



\$24



EVDoctor Tester w Display



H. Extension Cord & Wire Size Guide - Amperage vs Length

Check here for updated information - <https://bit.ly/EV-ExtensionCordGuide>

Can you use an Extension cord with an EV Charger (EVSE)? **Yes BUT you have to check for overheating. Lighted extension cords are notorious for weak plugs. Often wall outlets are weak. This can cause severe heating.**

CAUTION - The current limit of an extension cord is controlled by the heating during use. Check your plugs, outlets and cables for heating after one hour of charging. Warm is OK, Hot like coffee is not. The danger is when the plug or insulation melts. Then bad things happen

Extension Cord Types - 25' (Typical Current is limited to 20A by the outlet)

AWG 16	12A	Light Duty
AWG 14	16A	Medium Duty
AWG 12	25A	Heavy Duty
AWG 10	32A	X Heavy Duty

Extension Cord Guide - Amperage vs Length

Amps	25'	50'	100'
12A	AWG 16	AWG 14	AWG 12
16A	AWG 14	AWG 12	AWG 10
25A	AWG 12	AWG 10	
32A	AWG 10		

J1772 Max Charger

Cord 25'	mm2	Amps	Loss (W)
AWG 18	0.823	12A	46.08
AWG 16	1.31	16A	51.2
AWG 14	2.08	25A	78.13
AWG 12	3.31	32A	81.92

Short wire guide - When the wire is short you can use a much smaller wire. See Max Amps below

See https://www.powerstream.com/Wire_Size.htm

For Adapters Up to 3' long

20A	AWG 14
30A	AWG 12
40A	AWG 10
50A	AWG 10

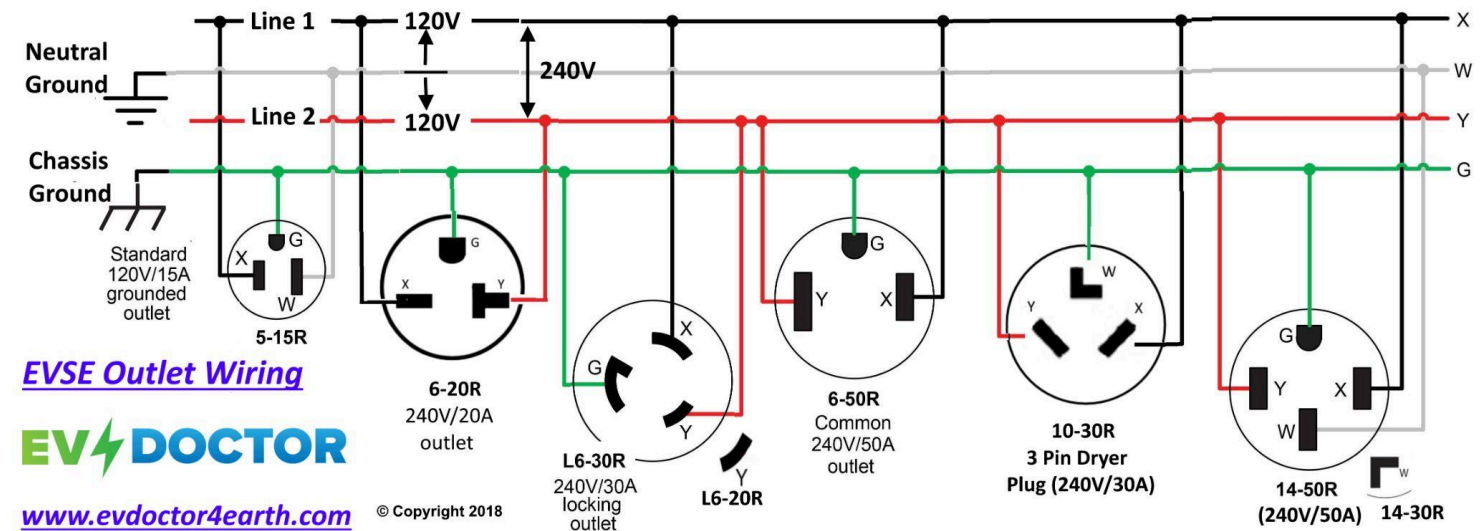
AWG gauge	Max amps for chassis wiring
8	73
10	55
12	41
14	32
16	22
18	16

I. Outlet Wiring for 120V and 240V EVSE AC Power Plugs - See images of all

Here is a list of common 120 & 240V outlets - <http://bit.ly/Common-Plugs-Outlets>

Here is a list of all NEMA plugs & outlets: Non-Locking <https://bit.ly/NEMA-OutletsAllNonLocking>

Locking <https://bit.ly/NEMA-OutletsAll-Locking>



J. Security and Tamper Proof Screws

You can buy a complete 1/4" hex drive set

<https://www.amazon.com/Mangocore-Security-Electric-Screwdriver-Magnetic/dp/B01I64IYJ0/> \$9

Security 6 point TORX are common in EV Chargers and J1772 handles. Here 3" long 1/4" drive security Torx

<https://www.amazon.com/Messee-Magnetic-Screwdriver-Screwdrivers-Accessory/dp/B08LPVY5Z4/> \$9

Look carefully, some chargers need a [5 Point Star Tamper Proof Bit Set, 10 Piece](#)

Tri point (type Y) are common in some products made in Japan, Sometimes mistakenly called tri wing

<https://www.amazon.com/Silverhill-Tools-ABSTW1-Starting-Tri-Point/dp/B0747Z1XJT/> \$12

Here is a list of all screw drives

https://en.wikipedia.org/wiki/List_of_screw_drives#

<https://en.wikipedia.org/wiki/Torx#Variants>

K. Gauges to measure pins - Numbered Drills Sizes

Number Drills				Number Drills			
DRILL	DECIMAL	DRILL	DECIMAL	DRILL	DECIMAL	DRILL	DECIMAL
80	.0135	40	.0980	60	.0400	20	.1610
79	.0145	39	.0995	59	.0410	19	.1660
78	.0160	38	.1015	58	.0420	18	.1695
77	.0180	37	.1040	57	.0430	17	.1730
76	.0200	36	.1065	56	.0465	16	.1770
75	.0210	35	.1100	55	.0520	15	.1800
74	.0225	34	.1110	54	.0550	14	.1820
73	.0240	33	.1130	53	.0595	13	.1850
72	.0250	32	.1160	52	.0635	12	.1890
71	.0260	31	.1200	51	.0670	11	.1910
70	.0280	30	.1285	50	.0700	10	.1935
69	.0292	29	.1360	49	.0730	9	.1960
68	.0310	28	.1405	48	.0760	8	.1990
67	.0320	27	.1440	47	.0785	7	.2010
66	.0330	26	.1470	46	.0810	6	.2040
65	.0350	25	.1495	45	.0820	5	.2055
64	.0360	24	.1520	44	.0860	4	.2090
63	.0370	23	.1540	43	.0890	3	.2130
62	.0380	22	.1570	42	.0935	2	.2210
61	.0390	21	.1590	41	.0960	1	.2280
				40	.0980		

L. Charger specific Information

JuiceBox

<https://bit.ly/JuiceBoxErrorCodes>

Error Codes Notes

Long beep error can be a tad ambiguous - is it a repeating, punctuated beep (beeeeeeeep ~~ beeeeeeeep ~~ etc), or is it continuous unbroken beep (except for some chattering, like beeeeeee eeeee eeeeeeeee.... while the LEDs flash rapidly together? You know, when we created those codes, thought they would be easy to describe ;) Internally known as "no ground" and 1-beep, but hard to discern from descriptions that have only ever known one beep :) A 1-beep is actually a generic internal fault and can cover many different issues - all related to self-tests.

JuiceBox LED codes

<https://www.effortlesselectric.com/docs/juicebox-led-indicator/>