

What to Expect in New Connectors

New Connectors are Coming

J1772-2010 (AC)

CHADEMO (sometimes spelled CH \wedge deMO)
Protocol with the

JARI Connector

Changes in Charging Philosophy

- Until now, chargers carried in car
- Use AC current to charge
- Charger in car would determine amps
- Driver responsible for setting limits
- Car is likely limiting factor
- New Direct DC charging will parallel the present charging system
- DC current used
- Voltage and amperage limits are supplied to charger, which responds.
- Vehicle must tell charger the max current it's batteries can handle.

CHADEMO is protocol from TEPCO

- TEPCO = Tokyo Electric Power Company
- JARI = Japan Automotive Research Institute (they defined the adapter plug)
- CHADEMO = A Charging Protocol for rapid DC charging
- Charger Specifications Level 3 (Direct DC)
 - Input 3 phase 200V in Japan
 - Max DC Output 50kW
 - Max DC Voltage 600V
 - Max DC Current 550A

Chicago Ramifications

- CHADEMO established by Toyota, Mitsubishi, Subaru, Nissan.
- Will likely become De-Facto standard for Level 3 charging
- Nissan Leafs, Mitsubishi i-MiEV, others will have JARI connectors and use CHADEMO protocols.
- CEVC initial build out including Level 3 had choice of connectors, but JARI was default.

KW

- $600V * 550A = \mathbf{330 KW}$ (max possible Level 3)
- $500V * 125A = \mathbf{62.5 KW}$ (max possible in CHADEMO protocol)
- $240V * 70 A = \mathbf{16.8 KW}$ (max possible in J1772 protocol)
- $240V * 32 A = \mathbf{7.7 KW}$ (max possible for many J1772 stations)
- $120V * 16 A = \mathbf{1.9 KW}$ (maximum at home)

Fast Charging limitations

- This **62.5 KW** (CHADEMO) is 33 times what power you would be able to use at home or opportunity charging
- If your home charger can charge your vehicle in 8 hours, the CHADEMO protocol can charge it in 15 minutes.
- (CHADEMO doesn't work for current battery chemistries to much over 90 % SOC)
- YMMV, may also be locale dependent

Fast Charging Definitions

- SAE, international agencies have not defined Fast Charging
- California Air Resources Board (CARB) states in their Zero Emissions Vehicle (ZEV) mandate program, lists a certification requirement for fast charging as a **ten-minute charge that enables the vehicle to travel 100 miles.**

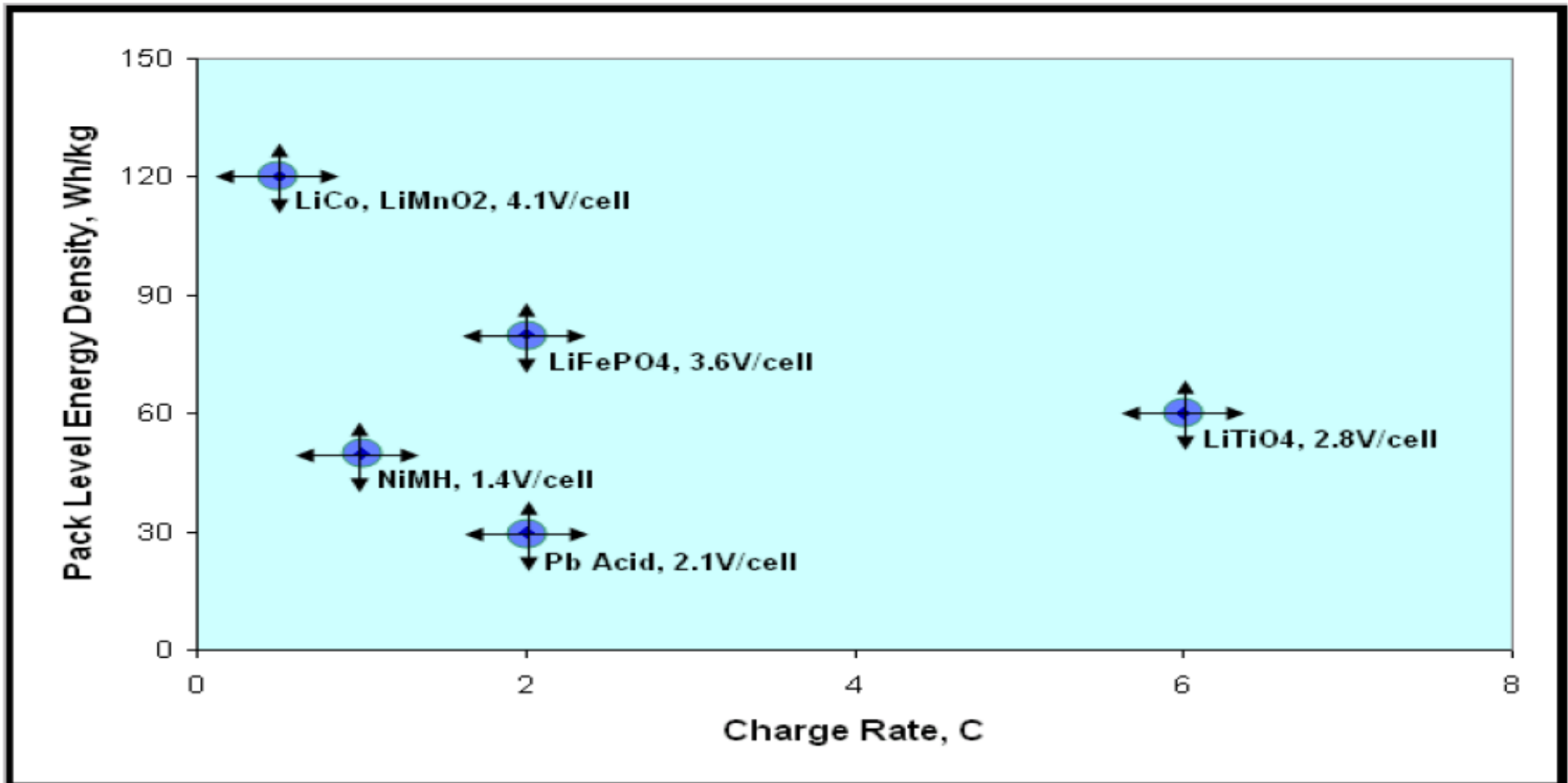
In US, we use SAE Standards

SAE J1772TM-2010 defines a standard.

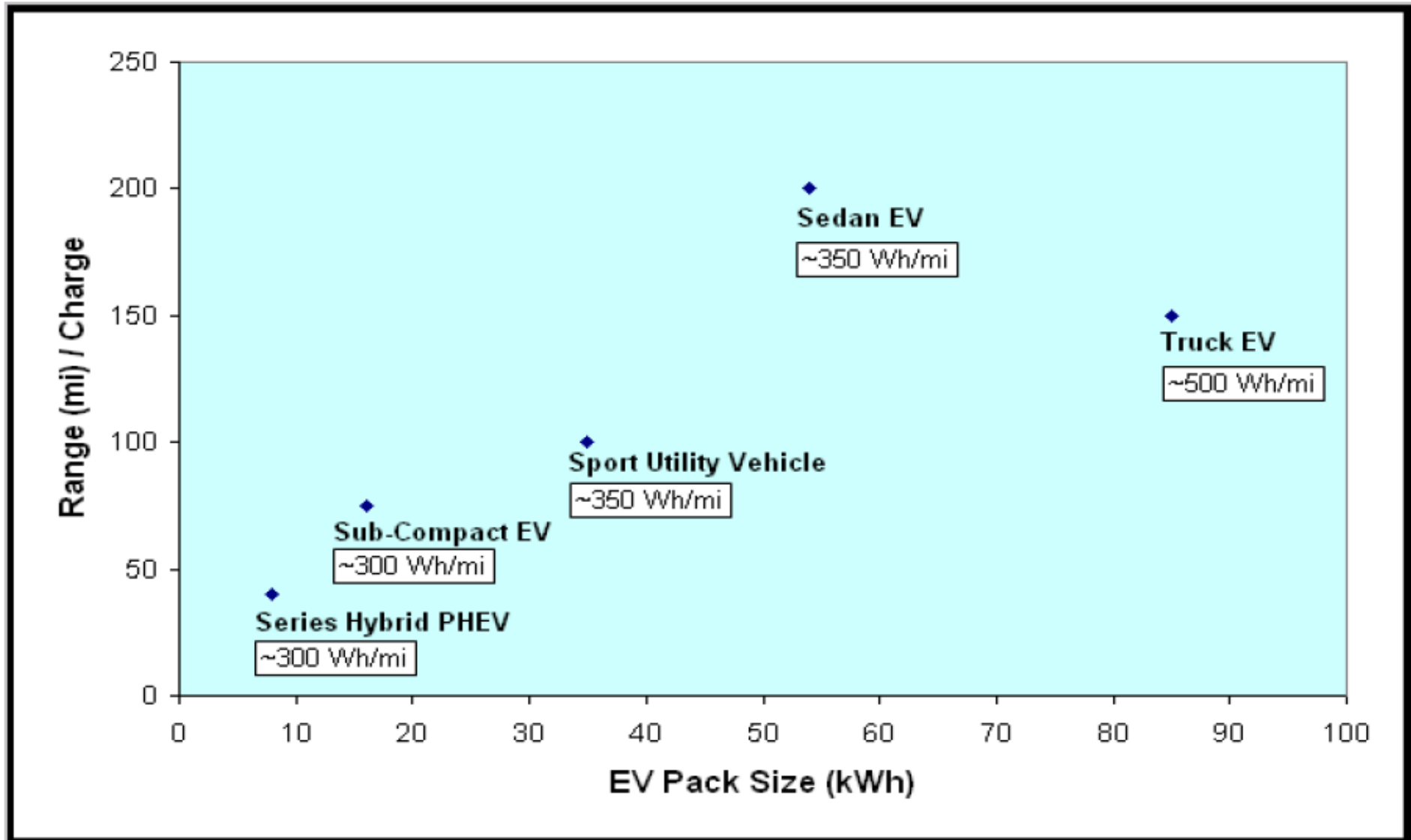
- AC Level 1 117V 16A Max
- AC Level 2 240V 32A or 70A
- DC Level 3 is not SAE Defined, but
- DC Level 3 will likely be CHADEMO protocol

Energy Density by Chemistry

Specific Energy versus Charge Rates for Different Battery Chemistries



Vehicle Range vs. Pack size



Level 2 Charging – How It Works

AC Level 2 Charging

- Charge plug not powered until plugged into and commanded by vehicle
- Supply equipment signals presence of AC input power
- Vehicle detects plug via proximity circuit (prevents drive away while connected)



Level 2 charging

Control Pilot functions begin

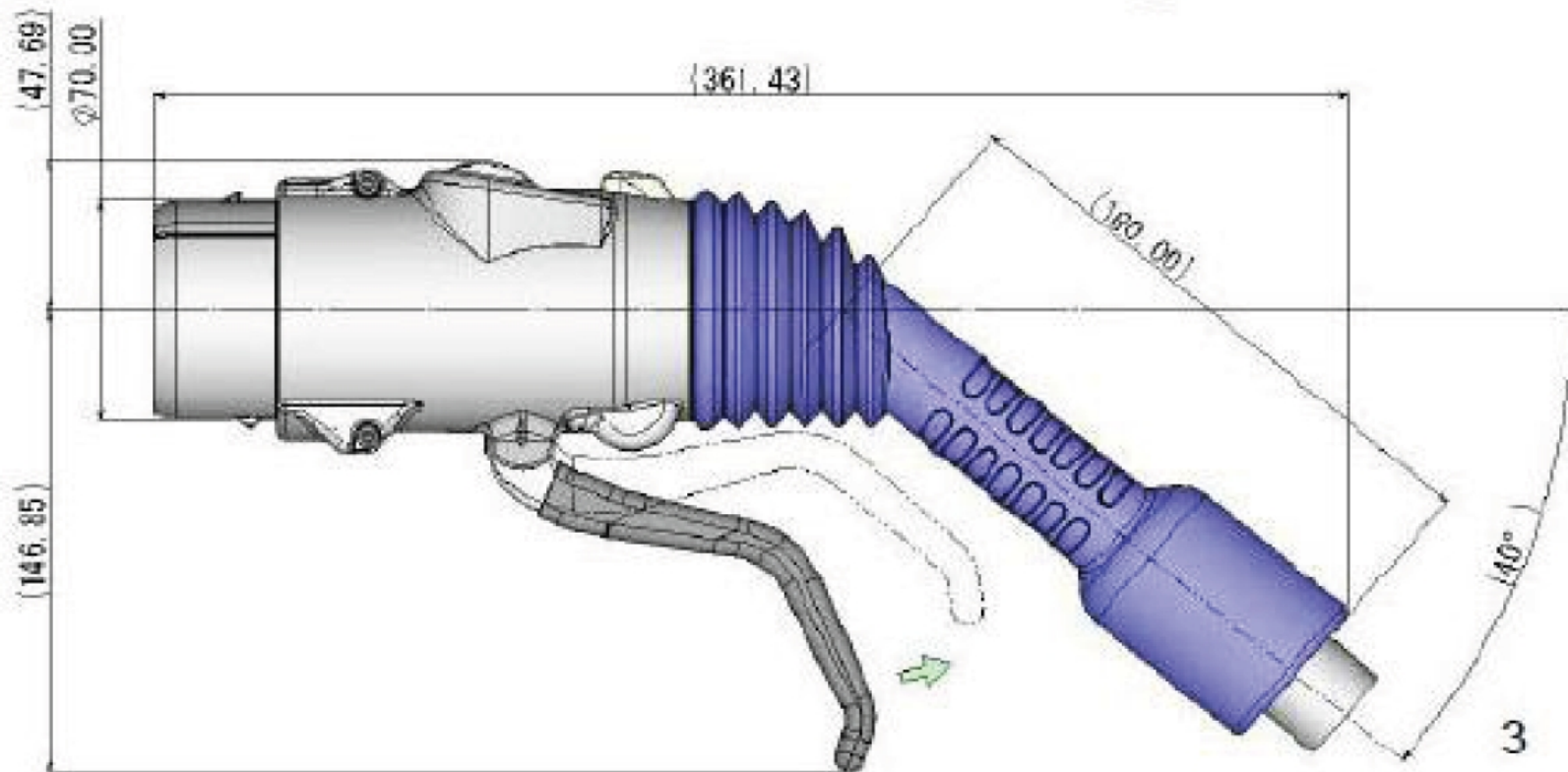
- Supply equipment detects PEV
- Supply equipment indicates to PEV readiness to supply energy
- PEV ventilation requirements are determined
- Supply equipment current capacity provided to PEV
- PEV commands energy flow
- PEV and supply equipment continuously monitor continuity of safety ground
- Charge continues as determined by PEV



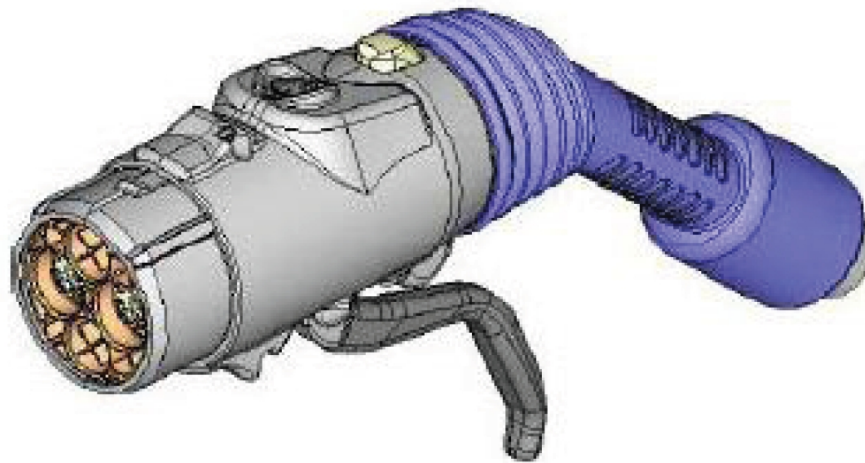
DC Quick Charge

Connector = JARI

- CHADEMO protocol



JARI Pictures

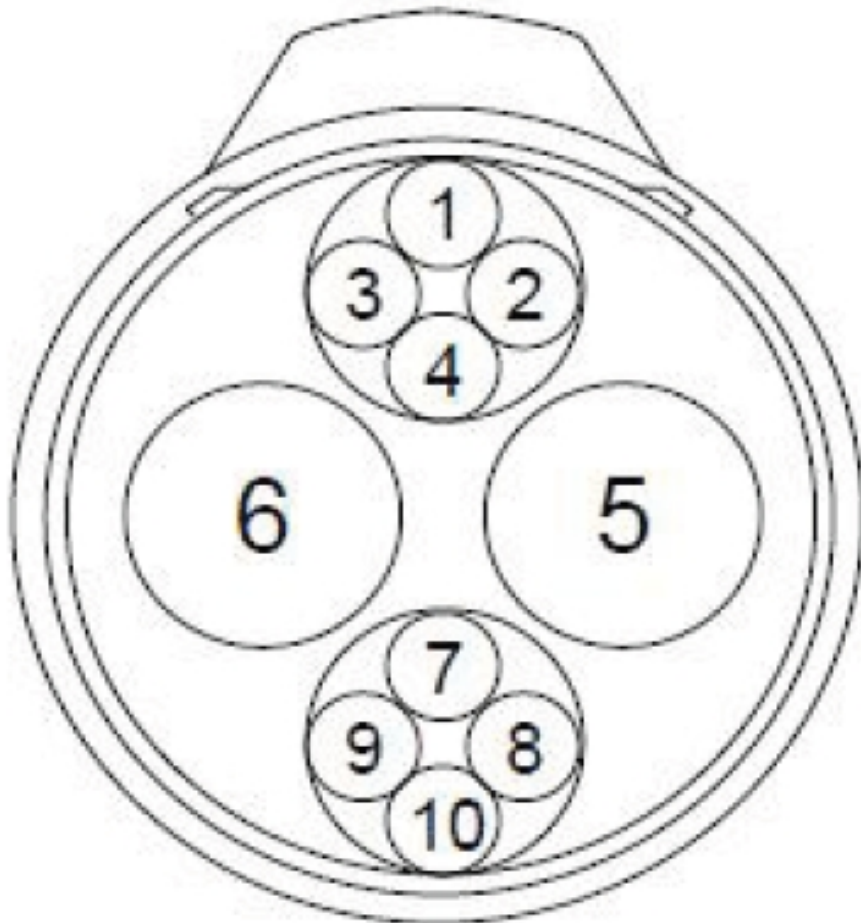


external diameter: 9 mm

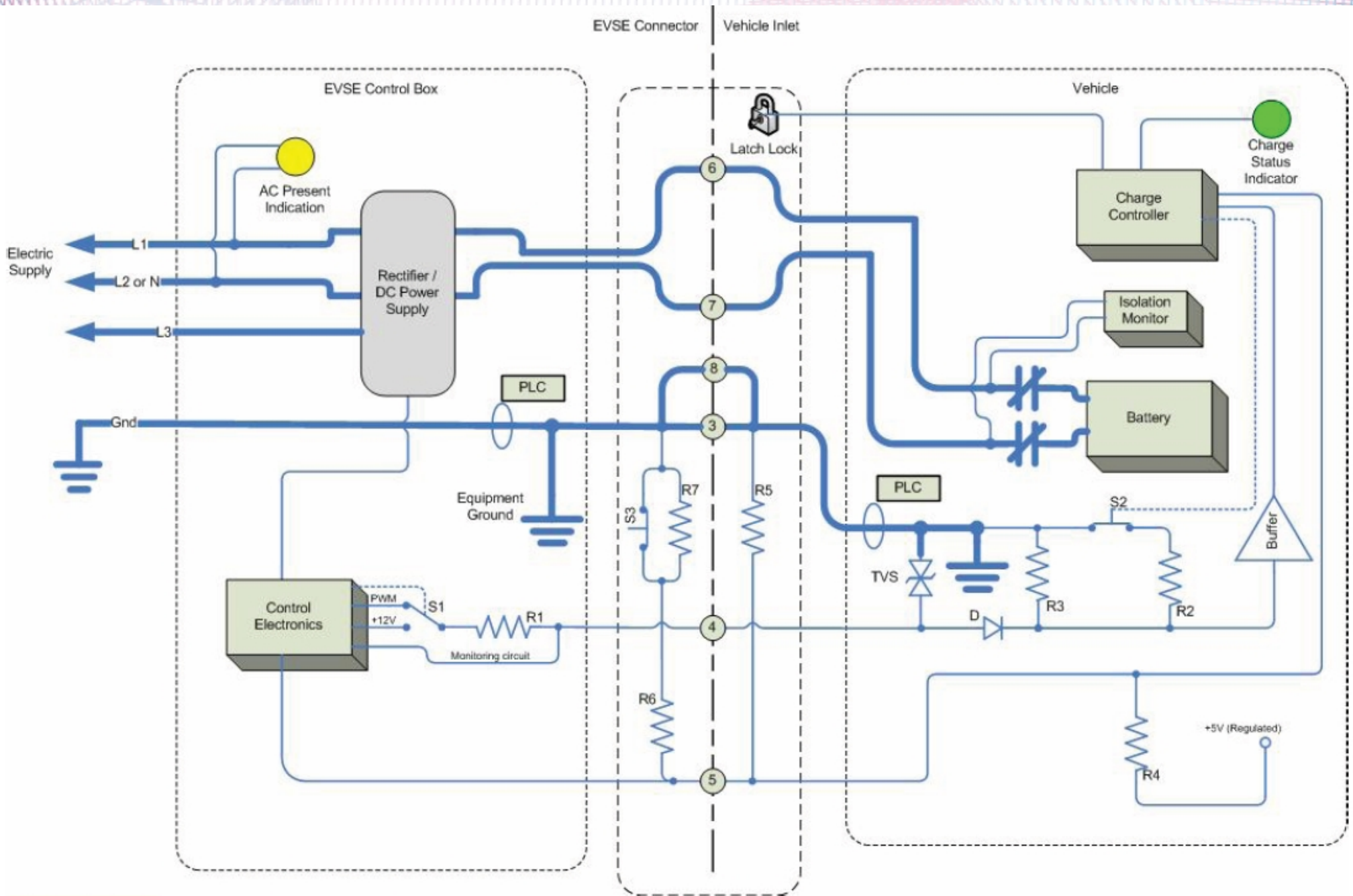
Signal terminal
external diameter: 1.6 mm



Pins on the JARI connector



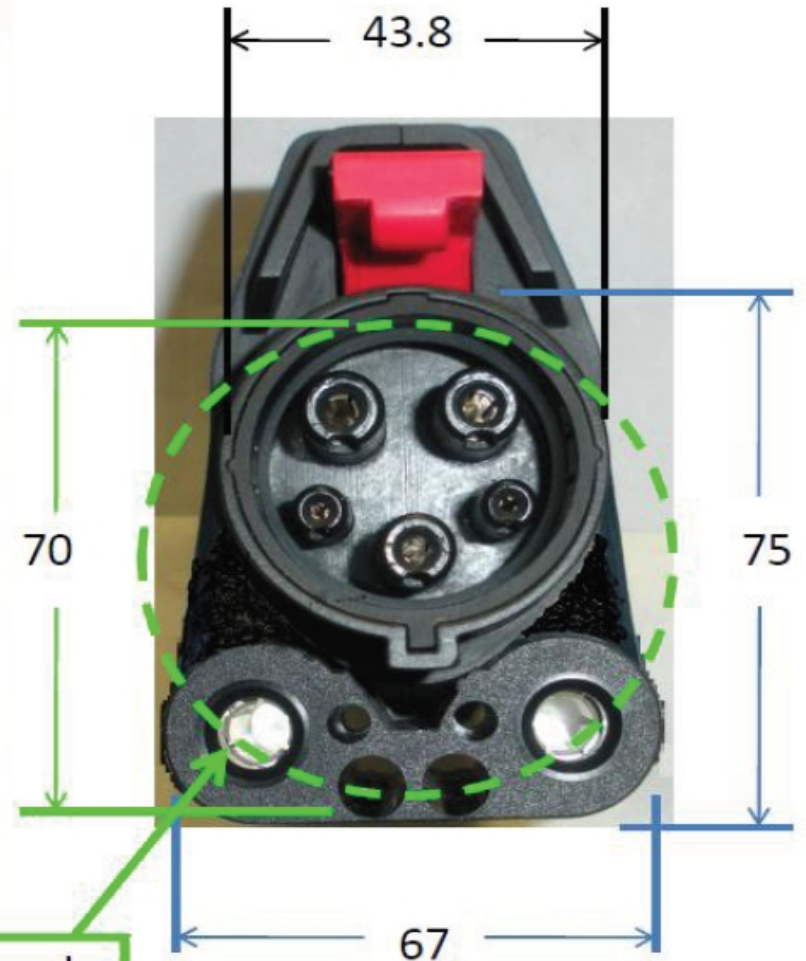
- Two Power pins
- Seven control/ communication pins
- Two communication pins usually CANbus
- Two pins for EV relay control
- One reference Ground for vehicle isolation monitor
- One proximity or mating detection pin
- One “ready to charge” pin.



Size Comparison JARI vs J1772

Preliminary Specifications

Voltage	600 VDC	
Current	200 A	
Contacts	DC Power	8.5 mm diameter
	Ground	2.8 mm diameter
	Signal	1.5 mm diameter
Cable Sizes	DC Power	AWG 1/0 (50 mm ²)
	Ground	AWG 14 (2.5 mm ²)
	Signal	AWG 18 (0.75 mm ²)
Ingress Protection	IPX5	
Weight Estimate	0.75 Kg (1.65 Lbs.)	
Insertion / Extraction Force	Est. 100 – 120 N	
Incremental cost	tbd	



JARI Proposal

Progression



**240V Home
Charge
Unit**

