POWER.S^3

Power Supply Safe Solutions

PRODUCT & APPLICATION OVERVIEW

2010

FCI MVL Division

Introduction

- **FCI has been launching several innovative high power connectors, named:**

POWER.S^3

Power Supply Safe Solutions

- These are developed **to meet the booming demand for high performance but cost effective high power interconnections** from virtually all automotive OEM worldwide starting with Electric Vehicle (EV) programs scheduled for launch in 2010/11

- Building on FCI Motorized Vehicles **in-depth experience and expertise in the automotive sector**, the new High power Interconnect and charge plugs incorporate a **serie of ground-breaking features** that reflect the unique challenges presented by EV and HEV applications, along with the **requirement to keep size, weight and cost to a minimum.**

Main electrification sub-systems

Electric Mobility

Networking of Chassis and Interior components

New HVAC

New Heating, ventilation and air conditioning concepts are needed.

New Brake System

New By-wire Brake System is needed for recuperation.

Simulator Brake Actuation

Vacuum Pump

Infrastructure

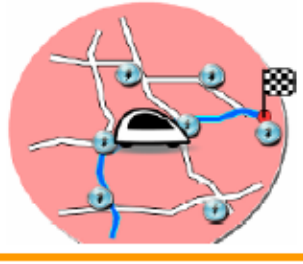
Intelligent connection to smart power grids

New Charging Stations

New Networking and Navigation

GPS guidance along EV infrastructure routes helps to prevent Range Anxiety.

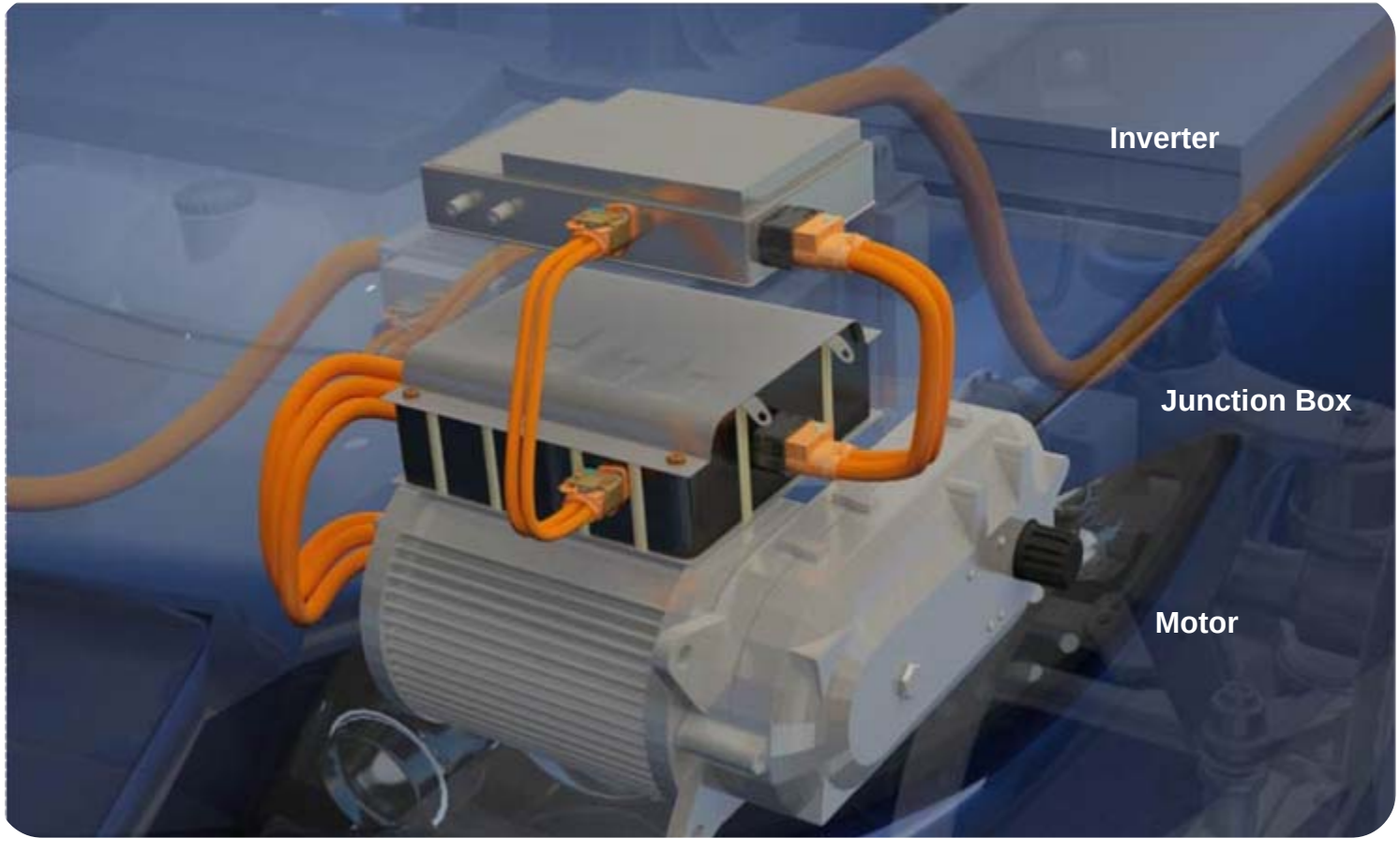
Information exchange between EV, Service Provider and Utilities (Smart Grid) is needed.



Source: Continental AG – 2009

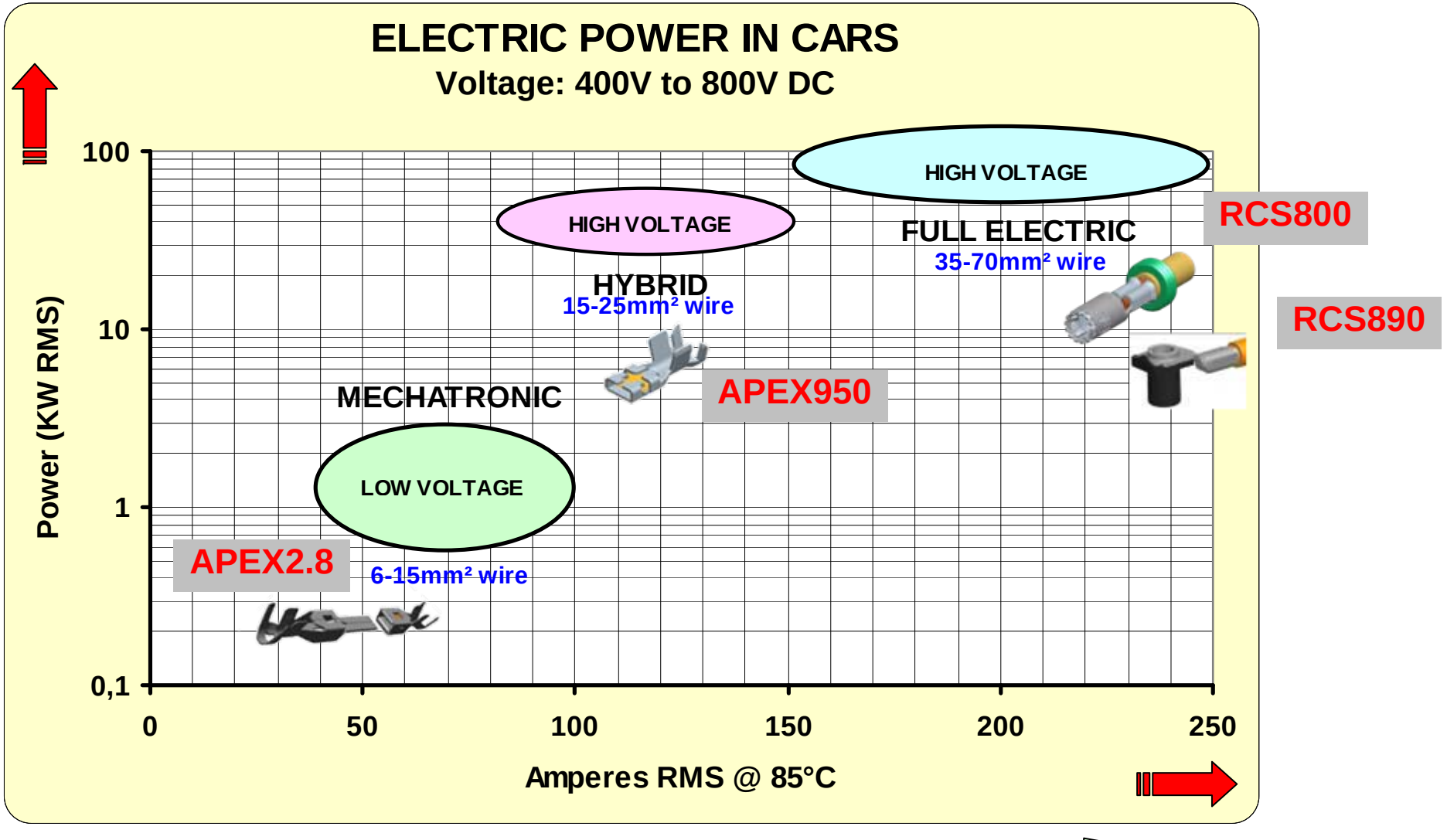
Main electrification sub-systems

Interconnection of powertain high voltage systems



Vehicle electrification operates under 400V or more and requires
High Power interconnection systems

What does High Power means in Automotive?



FCI's complete range of terminals to cover all applications

Existing product range at a glance

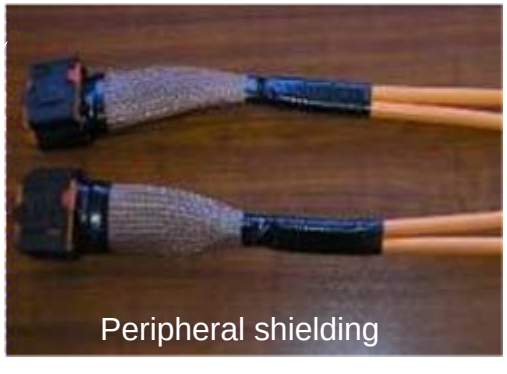
- APEX 280 female + header

APEX-2.8mm

[2.8mm rectangular pin]

35A @ 70˚ C

(4mm² cable)



- RCS 800 female + header

RCS-800 *[straight]*

[for 8mm round pin]

230A @ 70˚C

(50mm² cable)

Global shielding design

AVAILABLE

DEVELOPMENT

AVAILABLE

DEVELOPMENT

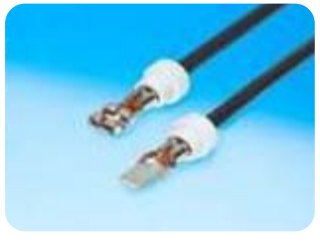
HOUSINGS

HIGH POWER TERMINALS

SHIELDED

APEX-2.8mm
[2.8mm rectangular pin]
35A @ 70° C
(5mm² cable)

UNSHIELDED



APEX-950
[for 9.5mm rectangular pin]
150A @ 70° C
(35mm² cable)

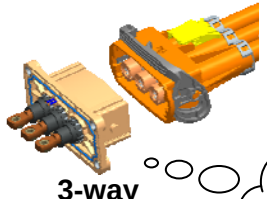
SHIELDED

RCS-800 ***[straight]***
[for 8mm round pin]
230A @ 70°C
(50mm² cable)

SHIELDED

2-way

1-way



3-way

1W + 3W AK spec versions

RCS-890 ***[90° angle]***
[for 8mm round pin]

Charge plug applications

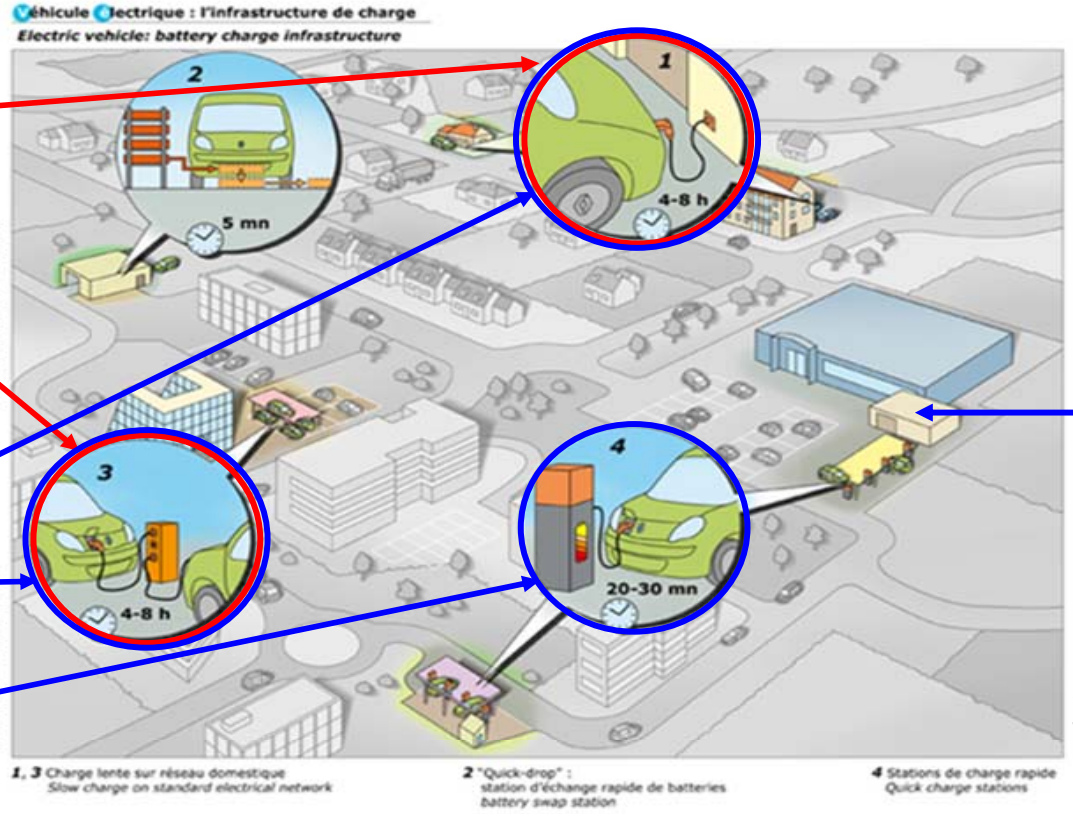
SAE J1772 – 16/32A

IEC 62196-2-1–16/32A

SLOW CHARGE
AC current

IEC 62196-2-2–16/32/63A

SLOW & FAST CHARGE
AC current

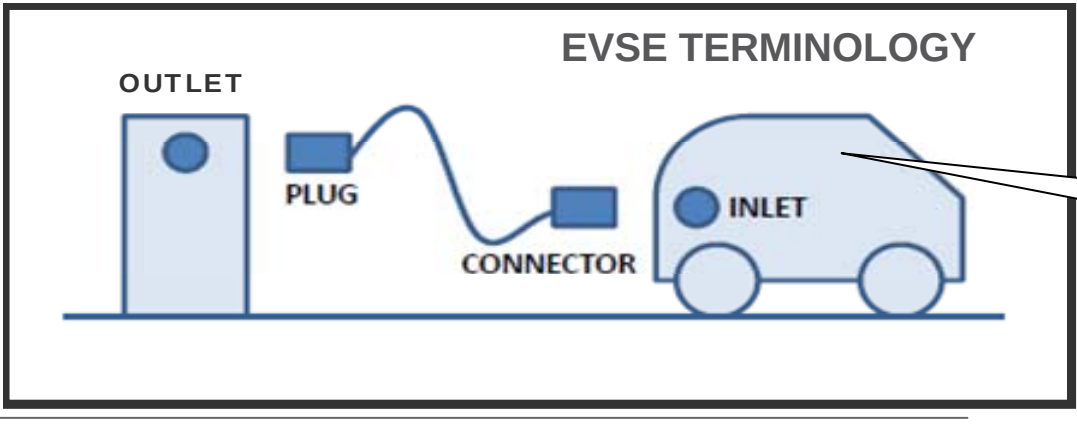


Renault ©

Example – CHAdeMO

VERY FAST CHARGE
Which standard in future?

Example only
AC/DC 'Combo'



EVSE = Electric Vehicle Supply Equipment

Since May 2010, standardization committees have agreed on these product designations. They will be used from now on by all parties involved in charge plug business

International standard IEC-62196 for connection devices

3 main interface definitions

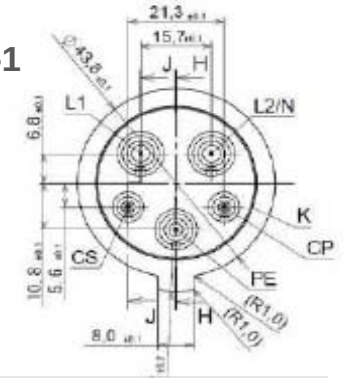
- **Specification**
  - IEC-62196-1 General specifications
  - IEC-62196-2 xEV charge plug interfaces

- **Type-1**
  - introduced by *YAZAKI*
  - described also in **SAE-J1772 standard**
  - **1-phase AC 250V - 32A**
    (up to 80A in USA)

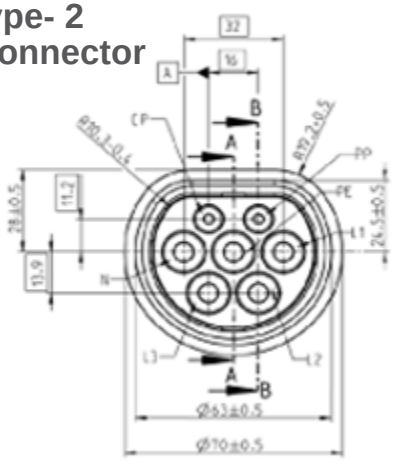
- **Type-2**
  - introduced by *MENNEKES*, modified by FCI-REMA
  - **3-phase AC up to 500V – 63A and 1-phase up to 70A**
  - **'Vehicle'**
    - **Connector → female terminals**
    - **Inlet → male terminals**
  - **'Wall':**
    - **Plug → male terminals**
    - **Outlet → female terminals**

- **Type-3**
  - introduced by *SCAME*, with Schneider and Legrand
  - **3 versions AC current**
    - **3-phase 500V - 32A (2 pilot contacts)**
    - **1-phase 250V – 32A (2 pilot contacts)**
    - **1-phase 250V-16A (1 pilot contact)**

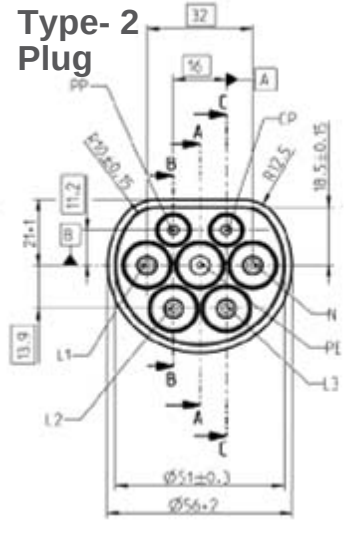
Type-1



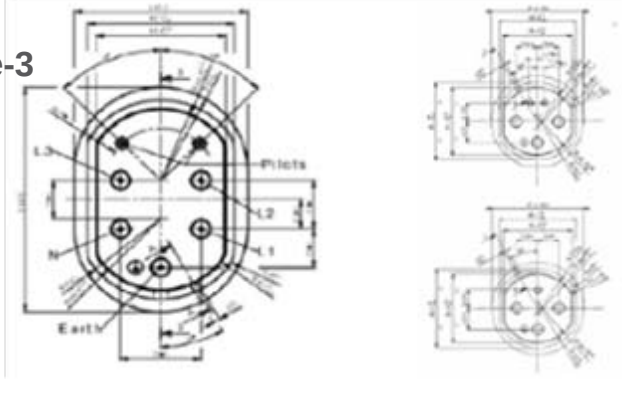
Type- 2 Connector



Type- 2 Plug



Type-3



FCI has joined the EV-PLUG-ALLIANCE in September 2010

- ***Created by Legrand-Schneider-Scame***
- ***16 members in September 2010***
- ***7 more have already agreed to join***
- ***<u>Membership target</u>:***
  40 members by mid-2011
- ***<u>Main objective</u> is to define an international charge plug interface standard for both home charging and public charging stations***
- ***Interface promoted is Type-3C plug interface with electrical line protection 'Mode-3'***

<u>16/32A AC with shutters</u>

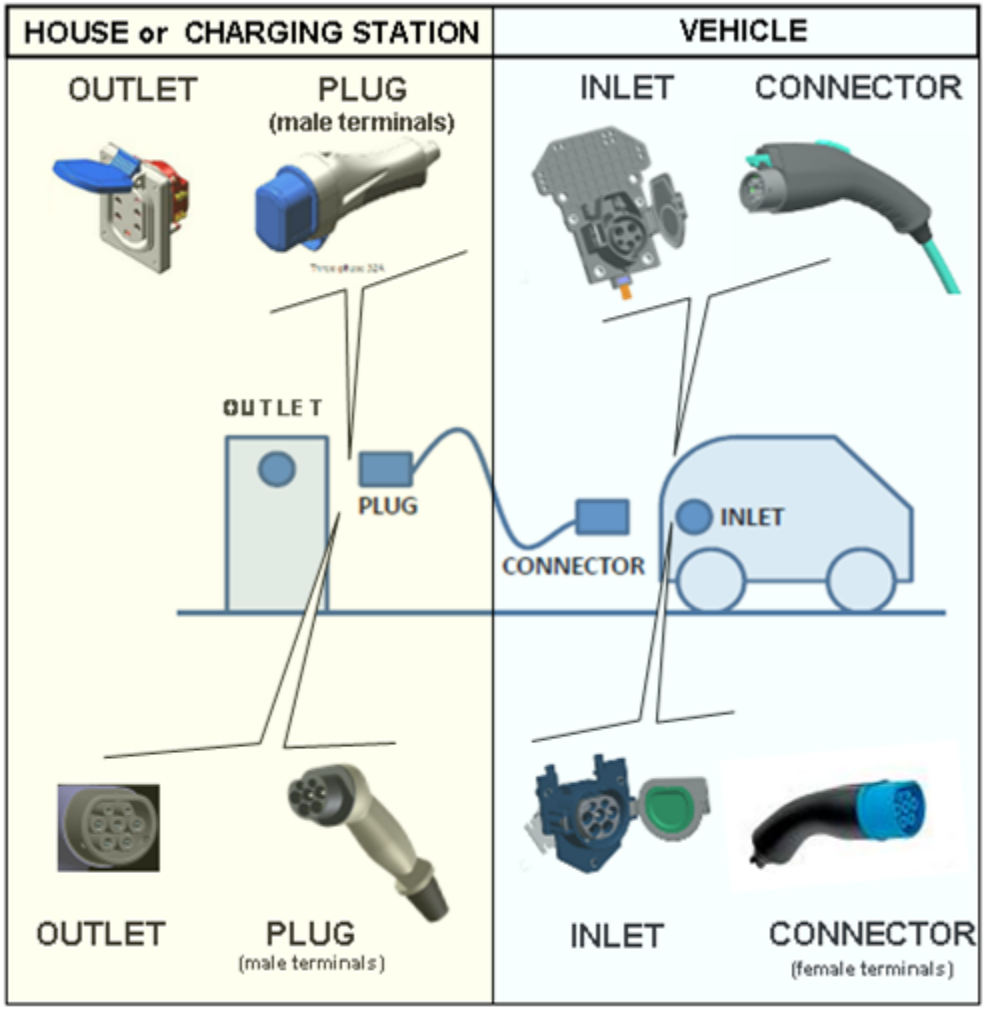
Charge plugs product descriptions

3 interfaces – 4 product types

- Type-3 (wall only)

Main advantage of Type-3 vs Type-2 is presence of shutters as a protection against accidental contact with live parts

- Type-2 (wall)



- Type-1 (vehicle only)
- Type-2 (vehicle)

Interface choices and their combinations will vary across regions

Charge plug devices main technical characteristics

IEC-62196-2-1 'Type-1' *(SAE-J1772)* 16/32A

- **Electrical**
  - 16 A or 32 A
  - 230 V single phase
  - maximum charge performance of 7.4 KW
  - High voltage insulation protection
  - Power cable 2,5 mm² (16A) or 4 mm² (32A)
  - Signal cable 0,75 mm²
- **Mechanical**
  - Mating and un-mating force 40N at initial
  - >10,000 mating cycles
    - Mating and un-mating force 80N after 10,000 cycles
  - Plug/socket pull out force 200N mini
- **Environmental**
  - Ambient temperature – 40°c + 85°c
  - IP67 sealing for the plug/socket connection and socket flap protection
  - Freezing protection
  - Drain system for fluids and dust egress
  - Salt spray protection

IEC-62196-2-2 'Type-2' 16/32/63A

- **Electrical**
  - 16, 32 or 63 A
  - 400 V - High voltage insulation protection
  - 1-phase, 2-phase, 3-phase possibilities (1-L3, N, PE)
  - additional 2x 30V/2A signal terminals (control pilot)
- **Mechanical**
  - 10 000 mating cycles
  - Can handle 5 hot disconnects
- **Environmental**
  - Ambient temperature – 40°c + 50°c
  - IP67 (mated)
  - IP67 (unmated inlet)
- **Specifications according to IEC 62196-2-2**

  … still not 100% frozen

Line protection modes 1-2-3

Domestic charging

- **Mode 1 (16A)**
  - **No line protection**

- **Mode 2 (16A)**
  - **Portable line protection**
    - **CCID or BCB ***
      ***** *(Battery Connection Box)***

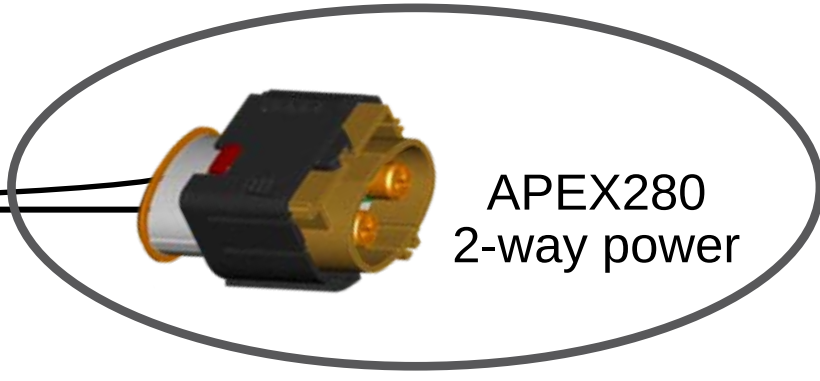
- **Mode 3 (16A/32A)**
  - **Connector to Plug jumper**
    - **Example here below Type 2 + Type-3**

wall Electric Management Box

FCI ‘Inlet’ connector solutions

Example of Type-1 (SAE-J1772) sub-assembly

Ground



APEX280
2-way power

2-way signal