REMA GROUP®

Electrotechnical Specialist Manufacturer

Charger Connectors for Electricle Vehicles (EV's)

Bonn - Germany

The Mission

Worldwide emphasis is on the effects of Global Warming and the need to reduce Carbon Emissions.

The future use of fossil fuels for transportation is under close scrutiny and electric propulsion now has the focus of attention.

Internationally, Governments are looking closely at and co-operating with all the Motor manufacturers. This is evident when viewing the prototype and post prototype vehicles presented in ever increasing numbers, to name a few Mercedes, Renault, Toyota, Nissan and Ford.

At a recent International Standard's meeting one forecast put forward, where the member's group is active at several international Government levels on "Green Issues", expected all car manufacture would be electric by the year 2020. This forecast is supported by independent sources worldwide.

The REMA Challenge

The Rema company are ideally structured to keep in step with the future mass acceptance of EV's. We are already represented on International Committees, where future standards of plugs and sockets for charging electric vehicles are decided.

The Rema forward programme includes new connectors made for this specific charging application, that encompasses many innovations.

The REV-1 Connector (32 A 1-phase)

Type REV-1:

- **32 A; 1-phase („SAE Connector“)**
- **According SAE J 1772 and IEC 62196**

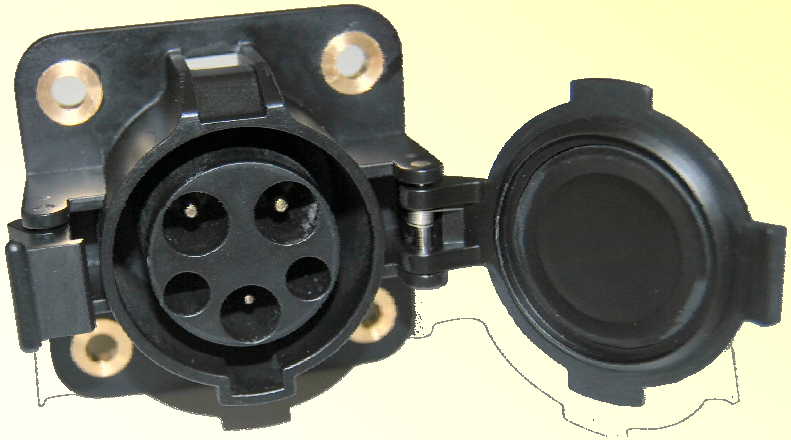
  - ✓ **Prototypes existing**
  - ✓ **Serial production parts expected Q4 / 2009**
  - ✓ **Testing acc. SAE, UL, ... Expected to be finalized in Q1 / 2010**

The REV-1 Connector (32 A 1-phase)

- **For max. 32 A single-phase 230 V**
- **Male contacts in vehicle socket; Female Contacts in Mobile part**
- **Insulated power pins 3,6 mm (bidirectional use grid to vehicle and vice versa)**
- **Plug latched while charging**
- **Switch indicating latching status**
- **Last mate first break „Proximity Pin“ for immobilizer and cable capability detection**
- **First mate last break „Control Pilot“ for communication**
- **Max. Charging performance: 7,4 kW**

The REV-1 Connector (32 A 1-phase)

- The Vehicle Inlet



The Plug

The REV-1 Connector (32 A 1-phase)

- Summary

Voltage / Amperage Rating	230 V / 32 A AC
Male / Female Assignment	Male contacts: Vehicle Inlet Female contacts: Plug
No. of Phases	1-phase
No. of contacts	1 ph + N + Gnd + 2 aux contacts = 5
Diameter of main contact pins	3,6 mm
Auxiliary Contacts	1 premate control pin; 1 post mate proximity pin
Contact Material	Electrolyte copper
Mating Force Determination	External spring on female contact tip
Cable Size	4 sqmm
Charger	onboard
No. of mating Cycles	10,000
Mating Force	< 80 N
Ambient Temperature	- 30 °C … + 50 °C
US Standard	SAE J 1772
International Standard	IEC 62196
Cable size coding	Resistors identifying different cable sizes
Option	Temperature Sensor / LED in vehicle Socket

The REV-3 Connector (63 A 3-phase)

Type REV-3:

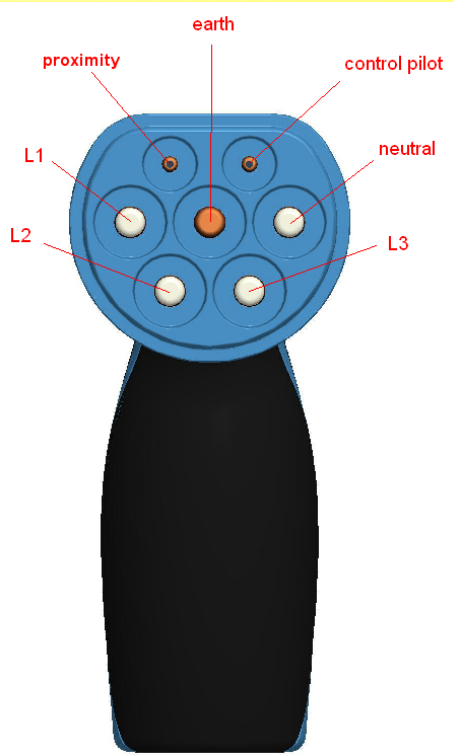
- **63 A; 3-phase („OEM Connector“)**
- **According German Proposal for IEC 62196-2**

  - ✓ **Prototypes existing**
  - ✓ **Finalisation of IEC 62196-2 expected in Q2 / 2010**
  - ✓ **Serial production parts expected Q3 / 2010**
  - ✓ **Testing acc. VDE, ... expected to be finalized in Q3 / 2010**

The REV-3 Connector (63 A 3-phase)

- **For single-phase 230 V and three-phase 400 V use (insulation voltage 500 V)**
- **Male contacts in hand-held plug to increase robustness of connection system**
- **Insulated 6 mm diameter power pins (bidirectional use grid to vehicle and vice versa)**
- **Plug locked while charging (Protection against unattended removal)**
- **Plug free of mechanical parts (Latching)**
- **Charging current up to 80 A single phase (63 A three phase)**
- **„Proximity Pin“ for immobilizer and cable capability detection**
- **„Control Pilot“ for communication**
- **Charging performance:**

	230 V	400 V
16 A	3,7 kW	11,0 kW
32 A	7,4 kW	22,0 kW
63 A	14,5 kW	43,5 kW



The REV-3 Connector (63 A 3-phase)

Replacement:

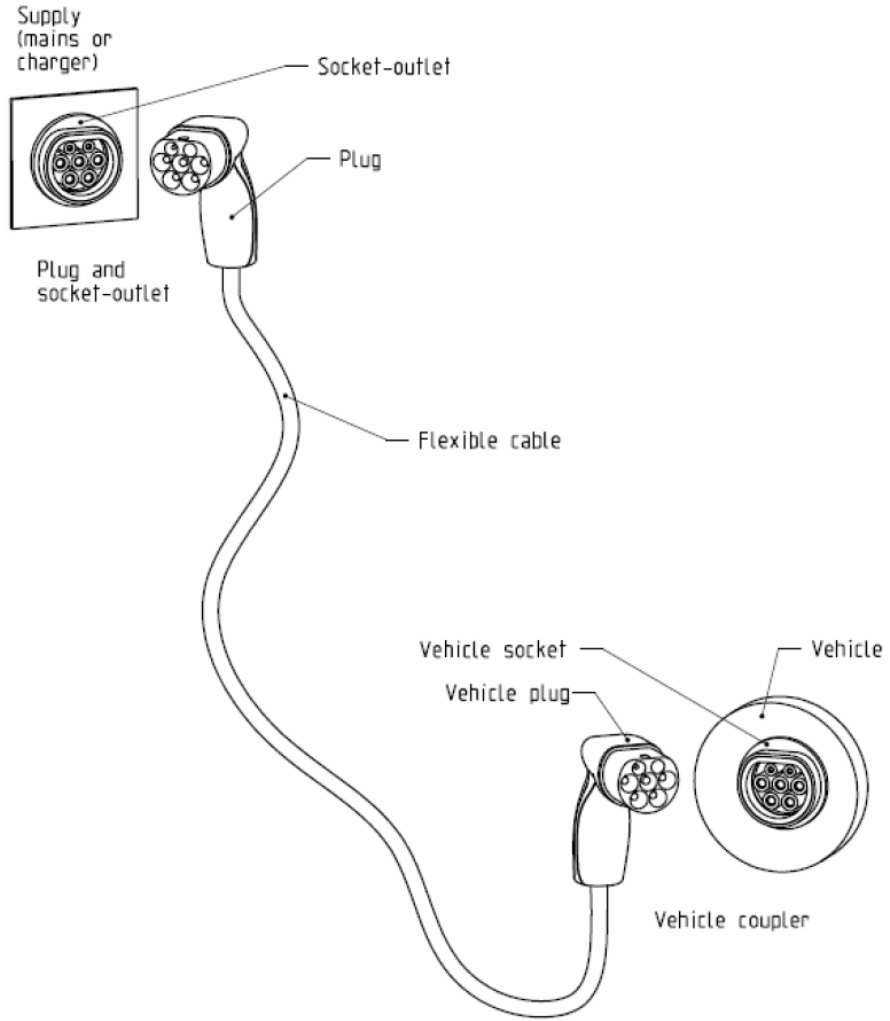


Figure 1 – Diagram showing the use of the accessories

The REV-3 Connector (63 A 3-phase)

Contacts

Different Cable bushings for different Amperage classes:

- Crimp 10-16 mm² cable
- Crimp 10-6 mm² cable
- Crimp 2,5 mm² cable

Contacts needds to be optimized with regards to dirt sensitivity and mating / extraction force:

- Slot w/o spring
- Slot with springs
- Lamella Contacts

The REV-3 Connector (63 A 3-phase)

Resistor coding

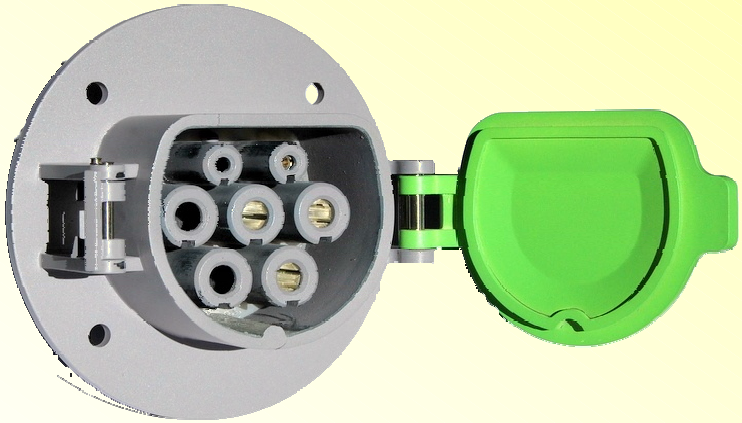
- Cord set can be rated to lower Currents as 63 A
- Cable size can be reduced (e.g. 3 x 2,5 mm^2 instead of 3 x 16 mm^2)
- Introduction of “Current Capability Coding”
- Different Resistors between Proximity and GND Pin

Possible Resistor Values are:

Current Capability	Resistor
16 / 20 A	680 Ω
32 / 30 A	220 Ω
63 / 60 A (80 A 1ph)	100 Ω

The REV-3 Connector (63 A 3-phase)

- The Vehicle Inlet



The Plug

The REV-3 Connector (63 A 3-phase)

- Summary

Voltage / Amperage Rating	500 V / 63 A AC
Male / Female Assignment	Male contacts: Plug Female contacts: Vehicle Inlet
No. of Phases	3-phase
No. of contacts	3 ph + N + Gnd + 2 aux contacts = 7
Diameter of main contact pins	6 mm
Auxiliary Contacts	1 premate control pin; 1 post mate proximity pin
Contact Material	Electrolyte copper
Mating Force Determination	External spring on female contact tip
Cable Size	Max.: 16 sqmm
Charger	onboard
No. of mating Cycles	10,000
Mating Force	< 80 N
Ambient Temperature	- 30 °C … + 50 °C
International Standard	IEC 62196
Cable size coding	Resistors identifying different cable sizes
Option	Switch / Temperature Sensor / LED in vehicle Socket

The REV Connectors

Engineering, manufacturing and sales:

A cooperation of FCI and REMA

- **Vehicle Plug (Mobile Part)**
- **Infrastructure Plug**
- **Infrastructure Socket**
- **Charger cord**

Sales Window to Automotive: www.fciconnect.com