Smart management systems for electric vehicles recharge
The emission of a high number of many different contaminating substances, the high levels of noise in our cities and the forecasted impact of the climate change associated to greenhouse gases (CO$_2$, CH$_4$, etc.) produced by our vehicles have resulted in the adoption of strict measures to reduce contamination levels.

Transport already accounts for 40% of primary energy consumption, and, therefore, it can be actually assured that the electric car is clearly the car of the future, because it offers substantial improvements to the main challenges and problems of our time.

The charging boxes of the RVE charge system have been designed to fit all needs for indoor single car parks, compliant with all electrical security regulations as well as access security, metering and consumption management.

The robustness of the whole equipment guarantees protection against vandalism. Installation and ease of use are aspects that have been taken into consideration when designing and developing this equipment, resulting in a compact design with advanced technological features integrated.

Our premise for the RVE product range is to give the user a simple and effective way to charge his electric vehicle, no matter where he is located. This is the reason why our charging boxes can be equipped with a simple access system and energy payment process - done through RVE-Cards that work as identification and prepaid RFID cards - which makes the whole process to be fulfilled in only a few simple steps by any user, no matter his technological knowledge.

RFID Cards and Mobile Phone payment for Cars and Motorcycles are also part of the range of solutions available, while RS485, Ethernet, GSM and GPRS/3G communication systems can also be built-in. To fully manage all the charging process, an Energy Management Software (PowerStudio ©) is provided to keep track of all charging parameters.
Scenario overview

Charge point models

Simple outlet boxes
- Single 1-phase 230 V or three-phase 400 V outlet, depending on charge mode
- RFID card and Mobile Phone identification/payment system

Street pole
- Single or dual 1-phase 230 V or three-phase 400 V outlet, depending on charge mode
- User identification through mobile
- Mounted in the street

Fast charging station
- Ultra high current DC charging (500 Vdc - 125 A)
- Similar concept as gas station
- Payment system with credit card or "gas station" card
CIRCUTOR offers many solutions for single-family homes:

- Different outlets / integrating cable and connector to your vehicle
- Protection and Measurement
- Protection and Measurement with management of the demand

Earth leakage protection and measurement of the electrical parameters of the home. In addition, management of the demand allows the connection of the vehicle recharge system, making sure that it does not exceed the contracted power limit (preventing circuit breaker trips).

The charging process can be done by installing individual charging boxes or by a more sophisticated, based on a multi-point Master Control Unit which can manage up to 32 outlets connected to it. In any case, the equipment reads the electricity-meters and bills the electricity consumption accordingly.

In addition, the utility can bill to the user both home consumptions and charging consumptions in the same invoice.

There are several features that are also included such as:
- Without a car in the parking slot the device cannot be connected.
- RCD protection
- Control to avoid exceeding the contracted power limit.
- Optional control of disturbances in the network (Harmonics)
- Access Control or Pre-paid RFID cards supplied by the Parking Owner
- Charging Equipment included with Ethernet communications, enabling visualization and management of all charging parameters through a PC.

CIRCUTOR’s offers all kind of electric vehicle charging solutions and extra value-added features such as:

Card Payment
A RFID card and a card-reader are integrated in the equipment. The parking service price can be added to the electric energy consumption price in the case of public parking lots. But customized actions are also viable.

Charging equipment with communication systems
With this system, the owner can manage the charging process remotely and charge for it in accordance with his needs. It also allows the management of the demand and optional control of disturbance in the electrical network (harmonics).
Charging boxes

The indoor car park charging boxes have the following features:
- One outlet model with and without electrical protections
- Designed to be installed indoor
- Robust (RFID identification)
- Electrical security (MCB, RCD)
- RFID access control and prepayment system (through display)
- Integrated energy metering
- Easy of use and install
- Protected against fraud
- RS485, Ethernet, GSM and GPRS/3G communication available

<table>
<thead>
<tr>
<th>Outlets mode</th>
<th>Outlet 1</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode1</td>
<td>230 V&lt;sub&gt;a.c.&lt;/sub&gt; 16 A Single phase</td>
<td>Single-dwelling Schuko with optional communications and optional output cable</td>
</tr>
<tr>
<td>Mode3</td>
<td>400 V&lt;sub&gt;a.c.&lt;/sub&gt; 32 A Three phase</td>
<td>Single-dwelling Mennekes with optional communications and optional output cable</td>
</tr>
<tr>
<td>Mode1</td>
<td>230 V&lt;sub&gt;a.c.&lt;/sub&gt; 16 A Single phase</td>
<td>Multi-dwelling and Parking houses Schuko with RFID cards identification/payment and optional communications</td>
</tr>
<tr>
<td>Mode3</td>
<td>400 V&lt;sub&gt;a.c.&lt;/sub&gt; 32 A Three phase</td>
<td>Multi-dwelling and Parking houses Mennekes with RFID cards identification/payment and optional communications</td>
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Vehicle fleets

Currently, one of the most important markets for the electric vehicle is the one related to maintenance, service and transport fleets. With no doubt many firms will in short have the need of charging their electric vehicle fleets through an efficient and reliable system. Examples of these customers could be ports, airports, public services, gardening, cleaning, municipal services, post offices, etc.

Service companies usually have their fleets moving around the urban or metropolitan areas, which are the ones with higher contamination levels, resulting in many problems for public administrations, private companies and citizens in general. Being able to convert this type of fuel propelled fleets to electric vehicles will help the environment in the specific location where it is most needed (big urban areas) and will also help reduce the maintenance costs.

CIRCUTOR has developed a solution for electric vehicle fleets charging, where the electric control of the installation is very important since many different vehicles can be charged at the same time. Therefore, the optimum management of consumption is a must, compensating the charges between phases and having harmonic filtering if required.
Multipoint charging system

The multipoint system of the RVE family has been designed to offer a smart electric vehicle charging solution to car parks with multiple outlets. A multipoint management system is very important, since several cars can be charging at the same time. Optimum Management of consumption, balance between phases and harmonic filtering is required.

This solution allows an intelligent electric vehicle charging for a high number of electric vehicles, controlling different parameters of the electric network and the vehicles connected to it, as well as user and car park management preferences.

The system also allows payment systems as well as the exportation and edition of accurate electrical data such as total consumption, partial consumption, different problems on the electrical network, events, historical data, etc.

The main features of the master controller are:

• Selection of the electricity outlet
• Energy recording and management
• Power control of all devices
• Communication with external energy metering equipments such as electric company’s counters or harmonic filters equipments.
• Communication with other car park elements like payment systems, in order to be able to send consumption data information or other data to the PC of the car park manager. In the same way it can also communicate with the car park guidance system to know the status and location of the electric vehicle.

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<tr>
<td><img src="image" alt="Outlets mode" /></td>
<td>User interface with touch screen and card readers (Will work with in conjunction with any other product from this family of changing stations)</td>
</tr>
</tbody>
</table>
Many different electric vehicle charging applications are available for outdoor charging, be it in urban streets or interurban roads. While charging a vehicle on a street or an interurban road, the driver should be able to either choose a slow-charging pole - if he wants to make a long stop - or a quick charging pole that could fill the batteries in the shortest time as possible. CIRCUTOR has developed all type of outdoor poles to provide charging solutions to any user in need of charging his electric vehicle.

Many Retail Stores (supermarkets, big retail stores, etc) are willing to provide their customers with charging solutions for their electric vehicles, be it to manage a different business line or with the aim of putting in place a loyalty programme. Outdoor Poles are normally the equipment chosen to serve these needs, but all different kind of solutions are available in order to satisfy customized needs.

For instance, loyalty programmes can be implemented such as charging a certain amount for free based on total purchase of the customer in the retail store. The Parking Owner can bill remotely and even customized needs can be integrated. In summary, CIRCUTOR’s solutions include all equipment needed to fully satisfy customers needs related to charging electric vehicles.
### Street pole

The vehicle charging posts of the RVE range of products have been designed to fulfill electric vehicle charging needs on the street, compliant with all electrical security regulations as well as access security, metering and consumption management. The robustness for its use and features against vandalism are some of the aspects taken into consideration when designing and developing this equipment.

All the RVE range of products has been thought to give the electrical vehicle user a simple method for charging his vehicle no matter where it’s parked. Thus, the recharging posts have been equipped with a simple access system and energy payment method through RFID cards, as well as a handy and easy opening and closing system. The charging process can be completed in only a few steps by any user even without any technical knowledge.

### Two wheels street pole

This equipment has been designed to cover up the needs of 2 wheel electric vehicles, compliant with all electrical security regulations, access security, metering and consumption management. The controller manages the prepayment process through RFID proximity cards or SMS. It allows the outlet selection and the management of the consumption of each outlet.

The charging stations for two-wheelers are designed for outdoor use with compact design, although robust and protected against vandalism, and are adaptable to any 2 wheel vehicle park.
Fast charging station

CIRCUTOR’s ultra-fast charging stations are the quickest way of charging today’s electric vehicles. Their innovative, original design offers a quick, easy to use charging solution in line with CHAdeMO’s current standards for the direct current charging of electric vehicles. The equipment’s design has paid close attention to ease of installation and electrical protections to increase user safety.

CIRCUTOR’s ultra-fast charging stations, following CHAdeMO standards, can charge 80% of the batteries of an electric car in less than 15 minutes. The equipment has communications (Ethernet, 3G…) that allow permanent connection with remote control stations from which all charging data can be monitored in real time. Thus, the equipment can be operated remotely and managed in a simple, efficient way.
Fast charging station  CHAdeMO

Power Module Features
- Input power supply: 3 phases, 400 Vac, 50/60 Hz
- Maximum consumption: 70 kVA
- Maximum output voltage: 500 V dc
- Maximum output current: 125 A dc
- Maximum wave: 1.5% load current
- Efficiency up to 92%
- Isolation: 4 kV
- Voltage and current measuring error: 1%
- Voltage and current sampling: 100 ms

Advantages
- Average charging time less than 15 minutes.
- Modular, scalable system.
- User protected and isolated power module.
- Compact, reduced size system.
- Integrated communications.
- Intelligent charging.
- Option of mixed AC/DC systems Mode 3 and Mode 4.
- Electrical safety.
- IP54 Protection.
- Elegant aesthetic design.
- User-friendly interface with easy-to-use touch screen.
- Light indication.

<table>
<thead>
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<th>Outlets mode</th>
<th>Outlet 1</th>
<th>Outlet 2</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 4</td>
<td>500 Vdc</td>
<td>-</td>
<td>CHAdeMO outlet.</td>
</tr>
<tr>
<td>Mode 4 + Mode 4</td>
<td>500 Vdc</td>
<td>500 Vdc</td>
<td>Two CHAdeMO outlets.</td>
</tr>
<tr>
<td>Mode 4 + Mode 3</td>
<td>500 Vdc</td>
<td>400 Vac</td>
<td>Three phase</td>
</tr>
</tbody>
</table>

Power module

POWER MODULE for CHAdeMO connection (500 Vdc, 120 A Output)
*One power module required per each charging CHAdeMO type hose.
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