



Smart Management
Equipment and Systems for
Charging Electric Vehicles

The electric vehicle, the smartest option for our future

The appearance of Electric Vehicles on the market has sparked off a wide-ranging media explosion regarding energy, technology, economic and environmental issues, creating great opportunities in each and every one of these fields; although at the same time it has raised a lot of questions, doubts and queries from future users and from society in general.

*One aspect that creates considerable concern among new users is that of the availability and types of charging points. **CIRCUTOR** has designed and developed a set of **Smart Management Equipment and Systems for Charging Electric Vehicles**.*



Contents

Smart Electric Vehicle Charging

*How, When and Where
to charge the batteries of an
electric car?.....* 5

Applications..... 6

Overview..... 7

Models

Single-family car parks..... 8

Multi-user car parks..... 8

Private car parks..... 8

*Car parks and
vehicle fleets.....* 10

*Urban car parks
on public roads.....* 12

Shopping Centres..... 12

Fast charging station..... 14

Solucions de
recàrrega intel·ligent
de vehicles elèctrics



Smart Electric Vehicle charging

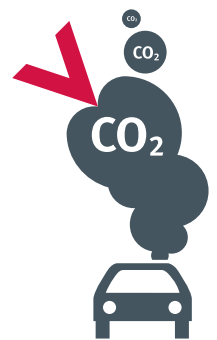
The electric car, the car of the future

We are at a time where many of the models created years ago need profound changes in order to adapt to the reality of the world today, and to the new paradigm of Sustainable Development. More specifically, one of the aspects that appears to have reached its turning point is transportation and the mobility sector.

There are two essential reasons why the transport sector needs to undergo important changes: increase its energy efficiency, reduce its dependence on petroleum and diminish its environmental impact. Our planet's energy needs are steadily growing, while the main energy sources used (fossil fuels and uranium) are limited. It is essential to convert modern energy systems into more efficient ones, and the most important challenge in this respect is the transport sector, which is highly energy inefficient. The emission

of large quantities of a huge number of contaminants (CO , CO_2 , CH_4 , NO_x , etc), the high noise levels in our cities and the expected impact of climate change caused by the greenhouse gases emitted by our vehicles, have led to the adoption of strict measures to reduce contamination levels and better protect our health and the environment.

In our society, transport makes up almost 40% of primary energy consumption, and so it is no exaggeration to say that the electric car is the car of the future because it offers substantial benefits for the challenges and problems of our times.



How, When and Where to charge the batteries of the electric car?

There are several models of Electric Vehicle on sale and on the streets of our cities, while a considerable increase is forecast in their number and variety over the next few years. The basic component of the EV is the new lithium ion battery, which has to be regularly charged.

For the new Electric Vehicle mobility model to develop effectively, it is essential to make great efforts to install adequate charging infrastructure.

Private parking (domestic)

Private parking (multi-user)

Urban parking

Shopping centres

Vehicle fleets

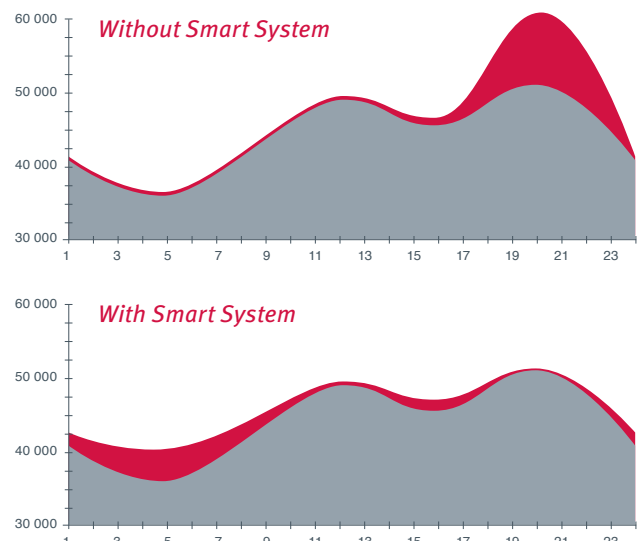
Interurban roads

Rapid recharging stations



Smart Charging Systems

In response to the challenges posed, **CIRCUTOR** is involved in R+D+i work, developing a smart system for charging electric vehicles that can charge batteries when energy is available and most economic (Load Shedding control), can identify the availability of charge credit at any point (RFID control), can distinguish between several charge points in the same car park (RS-485 / Ethernet / 3G communications), can charge in slow, semi-fast and fast mode (Fast Charge Control).



Applications



RVE in Norway (CHAdeMO Model (fast mode))



RVE in Formentera (Balearic Isles, Spain)



RVE in Parc Tecnològic, Barcelona (Barcelona, Spain)



RVE in Sabadell (Barcelona, Spain)

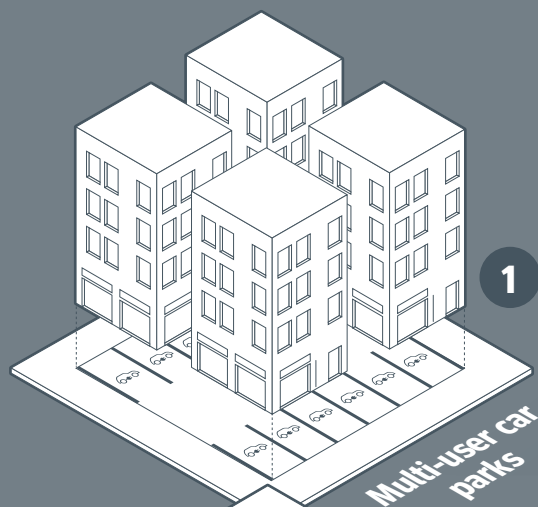


RVE in Andorra (Andorra)

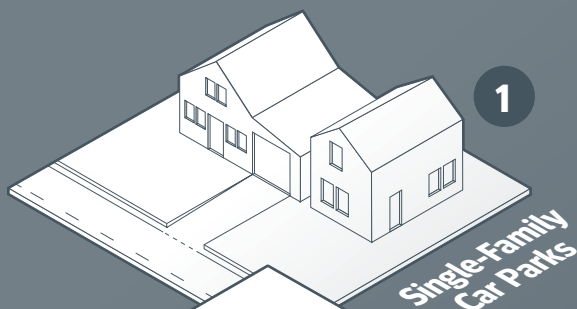


RVE in Parking Cánovas (Valencia, Spain)

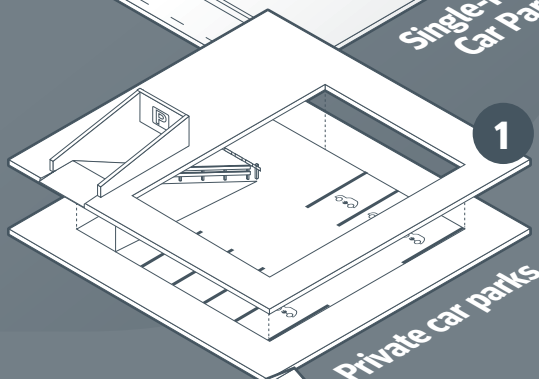
Overview



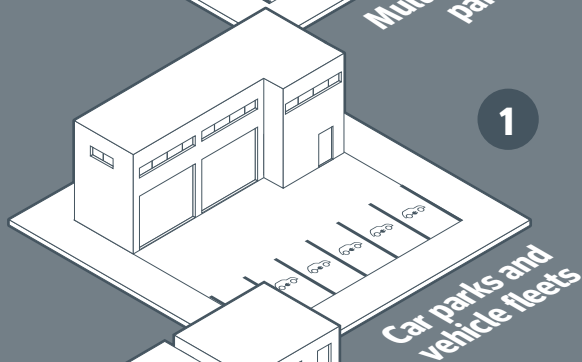
Multi-user car parks



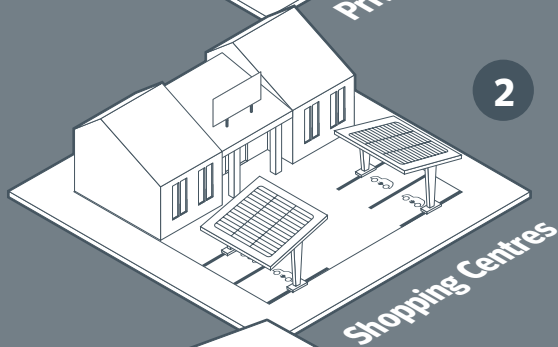
Single-Family Car Parks



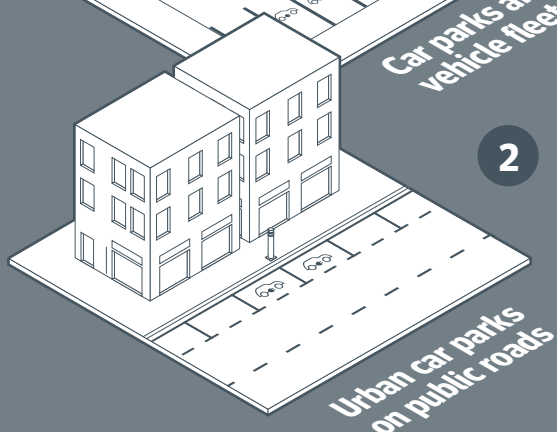
Private car parks



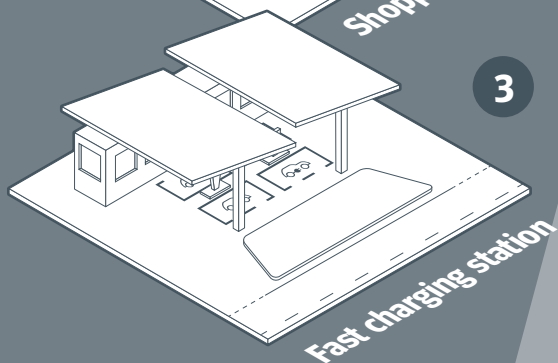
Car parks and vehicle fleets



Shopping Centres



Urban car parks on public roads



Fast charging station

A complete range of charging points

1

Charging cabinets

230 V single-phase outlet or 400 V three-phase outlet, depending on the charge mode

Identification and payment via RFID card. For interior points (car parks).

2

Charging posts

230 V single or double single-phase outlet, or 400 V three-phase outlet, depending on charging mode

User identification via RFID card. Ideal for urban environments.

3

Fast charging station

Ultra-fast direct current charging ($500 \text{ V}_{\text{DC}} - 125 \text{ A}_{\text{DC}}$)

Concept similar to that of a petrol station.

Several payment methods.

Single-Family car parks

CIRCUTOR offers different charging solutions for domestic environments:

- Different types of socket with cable option and connector for your vehicle (**SAE J1772**)
- Protection and metering
- Protection and metering with demand management

Our equipment can incorporate a smart management system that can connect to the charging system, ensuring that the contracted power is not exceeded (preventing disconnection).

Multi-user car parks

The charging process can now be done via the installation of individual charging cabinets or with a more sophisticated installation, based on a master unit, with multiple control points, that can manage up to 32 charging points connected to it. In any case, the equipment reads the energy consumed and can generate reports on consumption, incidents, etc.

The system also has other features such as:

- Connection impossible without a car in the parking space (optional).
- Control of demand so as not to exceed contracted power
- Control (optional) of disturbances in the network (Harmonics)
- Access control and Prepayment via RFID cards supplied by the car park owner or manager
- Equipment with Ethernet / 3G communications enable the display and management of electrical parameters from a PC.

Private car parks

Car parks, whether public or private, are the ideal place for the specific installation of charging points for electric vehicles, as users feel more secure if their vehicle is connected to an installation that is enabled and controlled around the clock for this type of application.

CIRCUTOR offers all types of solutions for charging electric vehicles with additional features such as:

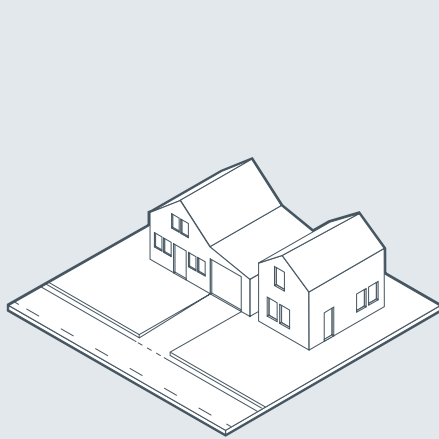
Card payment

With this system a device is installed with an RFID system card reader. The site administrator supplies them upon payment. The user can charge the vehicle by inserting the card.

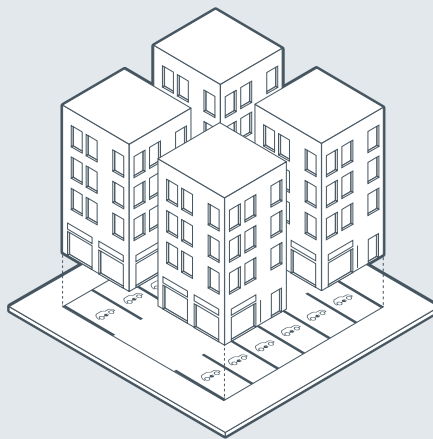
Charging equipment with communications systems

With this system, the manager can remotely control the charging process and collect for it according to requirements. It also allows for demand management and optional control of disturbances in the electrical network (harmonics).

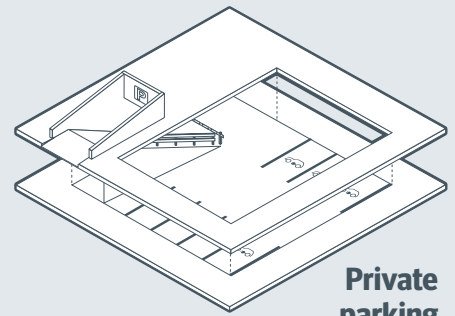




Single-Family Car Parks



Multi-user car parks

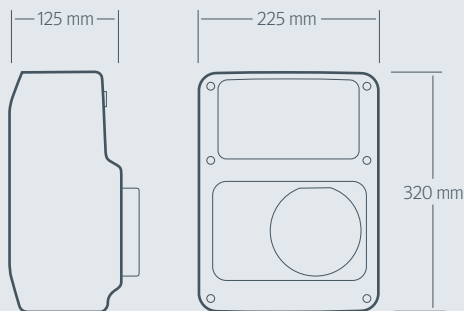


Private parking

Charging cabinets

The charging cabinets for private domestic car parks have the following features:

- Electrical safety
- Designed especially for interiors
- Robust (Identification via RFID)
- Access and prepayment control system via RFID (via display)
- Integrated energy metering
- Easy to install and use
- Anti-fraud protection
- Optional RS-485 Ethernet, GSM and GPRS/3G communications



Output Mode	Output 1	Others
Mode 1 / 2	230 V _{AC} 16 A Single-phase	Cabinet for private domestic car parks with Schuko socket. Possibility of communications, display and energy metering.
Mode3	400 V _{AC} 32 A Three-phase	Cabinet for private domestic car parks with Type 2 socket. Possibility of communications and display.
Mode 1 / 2	230 V _{AC} 16 A Single-phase	Cabinet for private multi-user car parks with Schuko socket. Optional identification/prepayment via RFID and communications.
Mode3	400 V _{AC} 32 A Three-phase	Cabinet for private multi-user car parks with Type 2 socket. Optional identification/prepayment via RFID and communications.
Mode3	230 V _{AC} 16 A Single-phase	Cabinet for private multi-user car parks with Type 1 socket. Optional external output cable and communications.

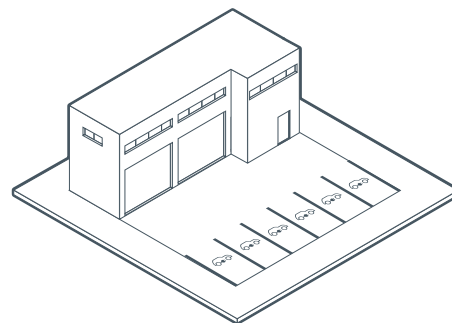
Car parks and vehicle fleets

One of the most important segments for implementing the electric vehicle are car parks with vehicle rotation as well as fixed spaces. A second important segment is the vehicle fleet, both in terms of maintenance, services and transport.

The vehicle fleets of service companies that habitually drive in urban or metropolitan environments is one of the most contaminating subsectors, and at the same time causes many problems for local administrations.

The possibility of changing this type of fleet to electric vehicles would help to reduce maintenance costs and the high level of urban contamination.

CIRCUTOR has developed a solution for vehicle fleets, where electric control of the installation is very important, as a large number of vehicles can be charging at the same time. For this reason optimal consumption management is necessary, with compensation of the charges between phases and harmonic filtering when required.



Multi-point charging system

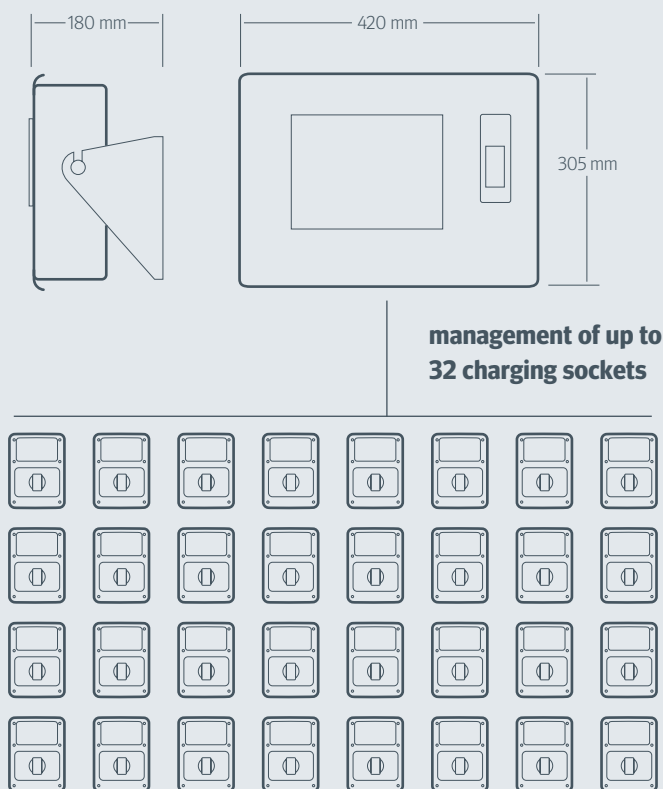
The multipoint system of the RVE family has been designed to offer smart charging for car parks with multiple sockets. Management of the multi-point charging system is very important, as the possibility may arise of several vehicles charging at the same time. Optimal management of consumption, balancing phases and the harmonics level are necessary for this type of system and installation.

This solution offers simultaneous smart charging of a large number of electric vehicles, control of different parameters of the electrical network and the vehicles connected to it, as well as user preferences for total parking space management.

The system also enables payment and billing systems, as well as the export and editing of electric data, such as total and partial consumption, the different problems and incidents in the electrical network, events, historical data, etc.

The main features of the master interface are:

- Selection of the **Schuko type 1** and **type 2** charging socket
- Possibility of logging and managing electrical parameters
- Power control over all slave equipment
- Possibility of external communications with metering equipment such as company electrical energy meters or harmonic filtering equipment.
- Possibility of communications with other car park elements such as payment systems that allow the car park manager to receive the information on a PC. Likewise, the communications enable the car park manager to control the status of the electric vehicles and their respective parking spaces.



Output Mode

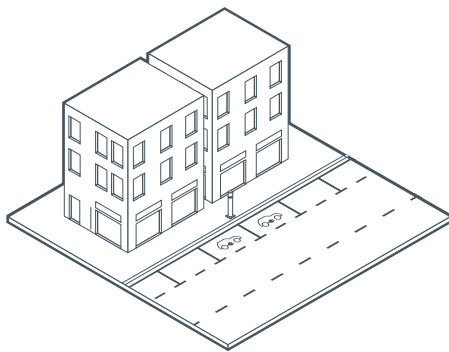


Others

User interface with touch screen and card reader
(Compatible with other charging systems of the same product family)

Urban car parks on public roads

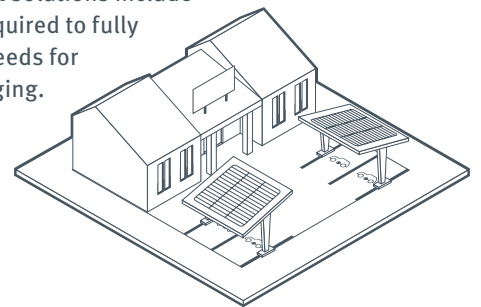
CIRCUTOR has various electric vehicle charging units for urban and inter-urban roads. While charging a vehicle in the street or on an inter-urban road, the driver must be able to choose between a slow charging post if he has to stop for a long period of time, or a semi-fast post for charging batteries in the shortest possible time. **CIRCUTOR** has developed various types of exterior posts that offer solutions to any user who needs to charge an electric vehicle.

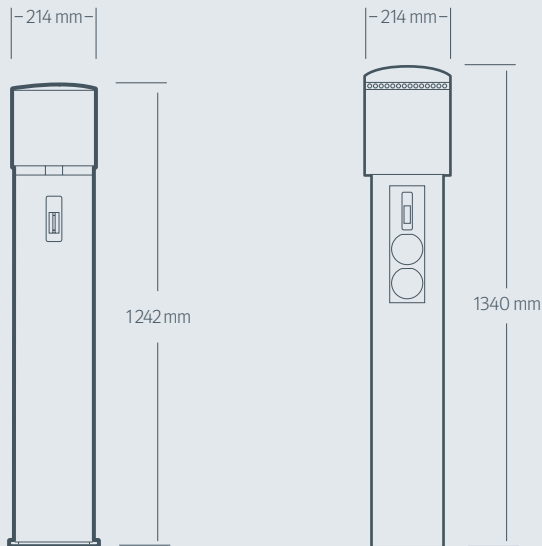


Shopping Centres

Many shopping centres (supermarkets, department stores, etc) are willing to offer their clients charging solutions for electric vehicles, either to manage a business line or with the intention of launching a fidelity program. Exterior posts are normally the units chosen for these needs, but any type of solution can be applied to satisfy the personalised needs of each centre.

For example, not charging for a given quantity based on the customer's total purchase in the shop, which can be used like fidelity programs. The car park owner can invoice remotely and even integrate the personalised needs of each centre. To sum up, **CIRCUTOR** solutions include all the equipment required to fully satisfy customers' needs for electric vehicle charging.







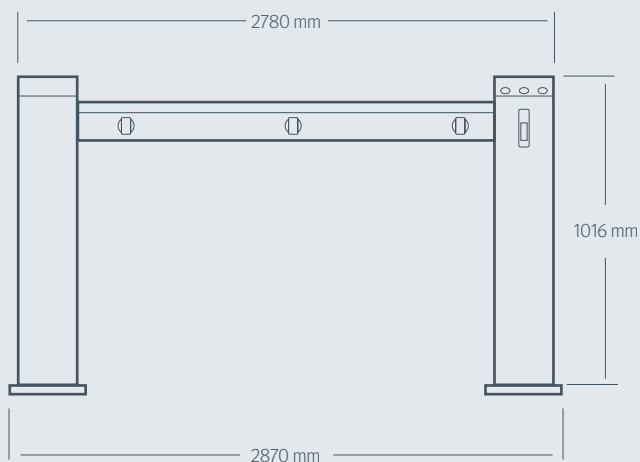


Exterior post

The charging posts in the **RVE** range have been designed to meet electric vehicle outdoor charging needs, and comply with all the electrical safety standards as well as standards for safety access, metering and consumption management. Robustness and anti-vandalism features are just some of those to be borne in mind when designing and developing this equipment.

The **RVE** range of products have been designed to provide the user with a simple method for charging an vehicle, wherever it may be. The charging posts have been equipped with a simple access system, energy payment methods via RFID cards and a very practical opening/closing system. Just a few steps are required for any user to conduct the charging process, and no technical know-how is required.

Output Mode	Output 1	Output 2	Others
	230 V _{AC} 16 A Single-phase	-	Schuko socket, charging in Mode 1 and 2 .
	230 V _{AC} 16 A Single-phase	230 V _{AC} 16 A Single-phase	Schuko socket, charging in Mode 1 and 2 .
	230 V _{AC} 16 A Single-phase	400 V _{AC} 32 A Three-phase	Type 2 (Mennekes) Mode 3 socket and Schuko Mode 1 socket and Mode 2
	400 V _{AC} 32 A Three-phase	400 V _{AC} 32 A Three-phase	Two type 2 sockets (Mennekes) Mode 3



Post for two-wheeled vehicles

This equipment has been designed to cover the needs of two-wheeled electric vehicles. It complies with electrical safety standards, access safety, metering and consumption management, etc. The controller directs the prepayment process via the RFID proximity cards. Allows for outlet selection and consumption management for each current socket.

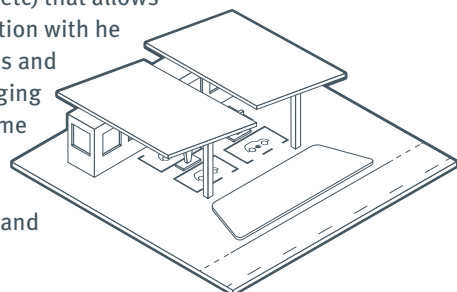
The two-wheeled vehicle stations are designed for exterior use and are compact, while at the same time robust and with anti-vandal features, and can also be adapted to any car park.

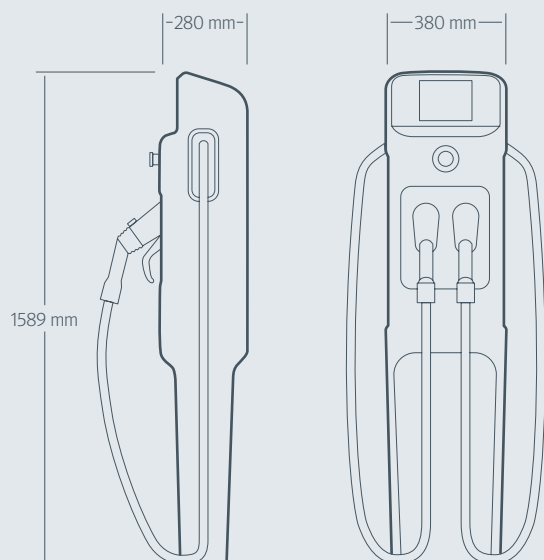
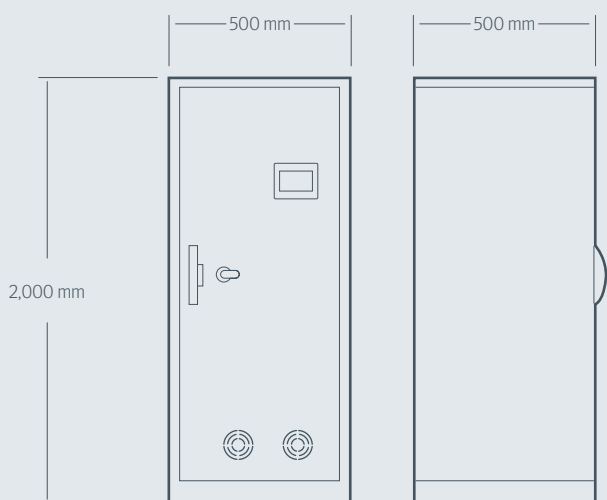
[illegible]

Fast charging station

The **CIRCUTOR** ultra-fast charging units are the fastest ones to be found in today's market. Their innovative, original design, offers a fast and easy way to charge a vehicle in accordance with the **CHAdemo** protocol for direct current charging. Special attention has been paid during the design of the equipment to ease of installation and electrical protection to increase user safety.

The **CIRCUTOR** ultra-fast charging stations, following the **CHAdemo** protocol, can charge electric vehicles in just a few minutes (15 ~ 30 min.), depending the capacity of the batteries and their discharge level. The unit has a communications system (Ethernet, 3G, etc) that allows for permanent connection with he remote control stations and logging of all the charging data along with real time control. The device can also be remotely controlled and simply and efficiently managed.





Fast charging station CHAdeMO


Electrical features of module:

- Power supply input: 3 phases, 400 V AC, 50/60 Hz
- Maximum consumption: 70 kV·A
- Maximum output voltage 500 V DC
- Maximum output current 125 AC
- Maximum curve: 1.5% load curve:
- 92% efficiency
- Electrical protection: 4 kV
- Measurement error in voltage and current: 1%
- Voltage and current sampling: 100 ms

Advantages

- Average charge in just a few minutes.
- Scalable modular system.
- Module isolated and separate from the power unit and with protection for the user.
- Compact, reduced size system.
- Integrated communications.
- Smart Charging.
- Mixed options for AC/DC with Mode 3 and Mode 4.
- Electrical safety.
- IP 55
- Control unit protection.
- Elegant aesthetic design.
- Simple, easy-to-use interface with touch screen.
- Operation status indicators via LEDs.

Output Mode	Output 1	Output 2	Others
Mode4	500 V _{DC} 120 A	-	CHAdeMO outlet. 50 kW _{DC}
Mode4 + Mode4	500 V _{DC} . 120 A	500 V _{DC} . 120 A	2 CHAdeMO outlets. 50 kW _{DC}
Mode4 + Mode3	500 V _{DC} 120 A	400 V _{AC} 32 A Three-phase	One CHAdeMO outlet and one type 2 outlet. MIX

Power module	Others
	POWER MODULES for CHAdeMO connection (500 V _{DC} 120 A outlet) *A module is required for each CHAdeMO socket.

Smart Management Equipment and Systems for **Electric Vehicle Charging**

+ information: central@circutor.es

www.circutor.com



CIRCUTOR, SA - Vial Sant Jordi, s/n
08232 Viladecavalls (Barcelona) Spain
Tel.: (+34) 93 745 29 00 - Fax: (+34) 93 745 29 14
central@circutor.es

