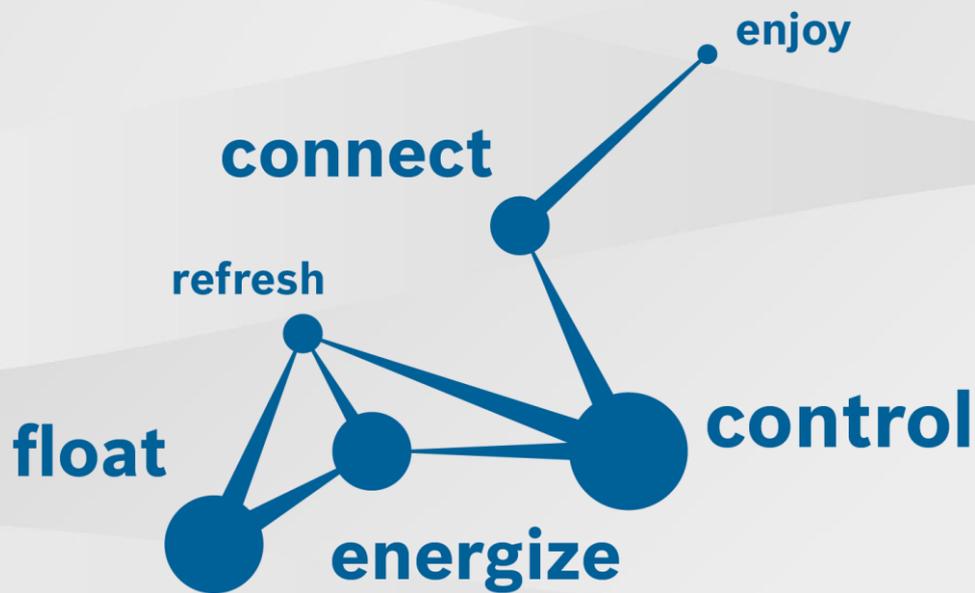


# 48 V Central Drive System

## FAQ catalog



## The urban code of mobility

# Table of contents

<b>1</b>	<b>Introducing the 48 V Central Drive System</b>	<b>3</b>
<b>2</b>	<b>System characteristics</b>	<b>4</b>
2.1	Components	4
2.2	Vehicles	6
<b>3</b>	<b>Powertrain system FAQ</b>	<b>6</b>
<b>4</b>	<b>uDrive Connect app FAQ</b>	<b>8</b>

**Note:** The following document is based on data available at the time of writing (07.2018) and is subject to revision in the event of changes.

# 1 Introducing the 48 V Central Drive System

## What problems arise with regard to urban mobility?

Crowded streets, fewer resources, chronic shortage of parking spaces – the traffic situation in large cities in particular is strained. The world's population is growing and there is less and less space in large cities. It's time for rethinking. The world needs flexible mobility solutions that are economical as well as efficient.

## How is Bosch contributing to resolving these problems?

For all power classes (4 – 20 kW): With the 48 V Central Drive System for light electric vehicles, Bosch offers the technological basis for sustainable driving pleasure. For this, Bosch is drawing on key components from the automotive field. Bosch has created a carefully harmonized system comprising drive unit, control unit, battery, charger, display and the uDrive Connect app. The system can be used flexibly in all classes of light electric vehicles and makes these whisperer-quiet vehicles into networked and powerful vehicles for safe and rapid travel.

## System highlights:

- ▶ Powerful low-voltage powertrain system for light electric vehicles based on 48 V
- ▶ Easy scalability between 4 kW and 20 kW
- ▶ Automotive key components
- ▶ Safe and unique driving experience

## Which market segment does Bosch serve?

With the 48 V Central Drive System all light electric vehicles in the classes L1e – L7e can be equipped.

	2 Wheeler		3 Wheeler			4 Wheeler	
	L1e 	L3e 	L2e 	L4e 	L5e 	L6e 	L7e 
Type	Two-wheel moped	Two-wheel motorcycle	Three-wheel moped	Two-wheel motorcycle w/ side-car	Powered tricycle	Light quadricycle	Heavy quadricycle
Max. Power [kW]	≤ 4 kW	L3e-A1 ≤ 11 kW L3e-A2 ≤ 35 kW L3e-A3 > 35 kW	≤ 4 kW	as L3e	> 4 kW	L6e-A ≤ 4 kW L6e-B ≤ 6 kW	≤ 15kW
Max. speed [km/h]		No speed limitation		No speed limitation	No speed limitation		No speed limitation
Weight	Technically permissible mass	L3e-A1 ≤ 0,1 kW/kg L3e-A2 ≤ 0,2 kW/kg L3e-A3 > 0,2 kW/kg	≤ 270 kg	Technically permissible mass	< 1000 kg	< 425 kg	L7e-CP ≤ 450 kg L7e-CU ≤ 600 kg

## 2 System characteristics

### 2.1 Components

#### **What components are used in the 48 V Central Drive System?**

The scalable powertrain system consists of six main components with the following characteristics:

#### **Controller:**

The control unit is the brain of the powertrain system. It converts the driver's request into intelligent commands for the system components and in this way ensures the perfect response at all times.

- ▶ Powerful Bosch control unit
- ▶ Compact housing
- ▶ Easy integration of vehicle safety systems such as ABS and ESP® (optional, additional hardware required)



#### **Drive Unit:**

The powerful 48 V drive converts the energy of the battery into maximum traction and recharges the battery when braking. This creates maximum driving pleasure.

- ▶ Powerful 48 V Bosch drive (10.5 kW)
- ▶ Light (9 kg), compact and air-cooled
- ▶ Integrated inverter



#### **On-Board Battery:**

The specially developed lithium-ion battery offers not only high energy density, but also high safety. Thanks to modularity, several battery packs can be operated in parallel.

- ▶ High energy density and long service life
- ▶ Integrated Battery-Management-System (BMS)
- ▶ Robust, powerful (2.4 kWh, 48 V) and safe
- ▶ Modular construction (up to max. 19.2 kWh) allows expansion of capacity and range
- ▶ Easy assembly & exchange (for OEMs/service technicians)

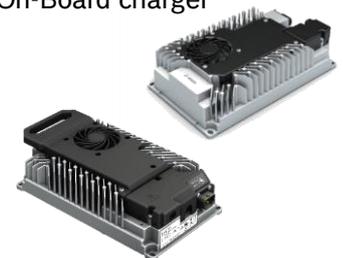


#### **On-Board & Off-Board Charger:**

The compact, actively cooled charger ensures fast charging when connected to common 230 V domestic power sockets. You can select from two different charging modes: Standard and Quick.

- ▶ High charging power (1.2 kW) and integrated air cooling
- ▶ Compact design, two charging modes (On-Board only) & high efficiency
- ▶ Charging possible from every 230 V domestic power socket
- ▶ **Off-Board Charger:** With carrying handle and Status LED + Charging of multiple batteries possible

On-Board charger



Off-Board charger

#### **Black & White Display:**

The high-quality display can be integrated into every vehicle quickly and easily. All system information is displayed clearly. You can select from four different driving modes: Go, Cruise, Boost, Crawl.

- ▶ Intuitive 4.4" liquid crystal display with LED status lights
- ▶ The ability to select the driving mode: Go, Cruise, Boost, Crawl
- ▶ Display of battery status, range & other driving data
- ▶ It can be easily integrated into any vehicle or used as a stand-alone solution



**Remote (uDrive Connect App):**

Thanks to the Bluetooth interface on the display and the Bosch uDrive Connect app, it is possible to retrieve vehicle data and make individual changes to settings.

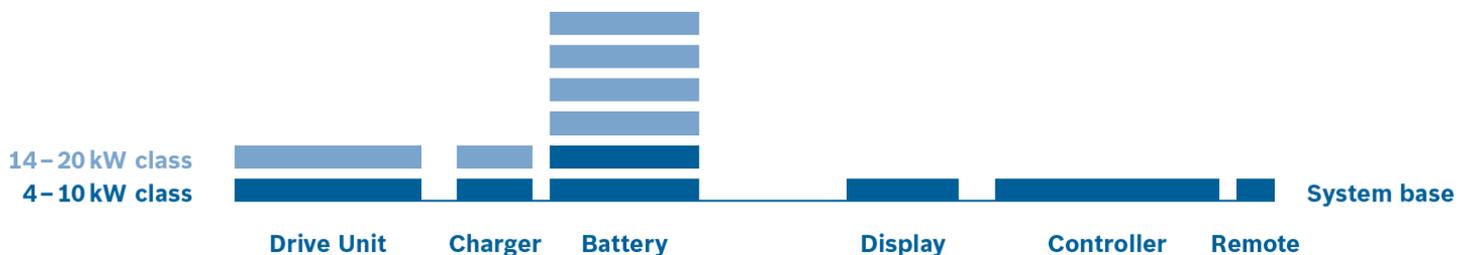
- ▶ Transmission of system data via Bluetooth (e.g. battery status)
- ▶ Charge warning, projected charging duration & range determination
- ▶ System personalisation & use of applications (apps) possible

**How do the different driving modes vary?**

- ▶ GO: „The comfortable no worry mode”– Aimed to reach maximum range.
- ▶ CRUISE: “The flow mode”– Higher power and acceleration compared to GO mode.
- ▶ BOOST: „The pure dynamic mode”– Highest acceleration and maximum power.
- ▶ CRAWL: „The support mode”– Low speed (< 3km/h) for maneuver assistance (push forward and backward).

**What does scalable powertrain system mean?**

The powertrain system can be used for all light electric vehicles between 4 – 20 kW. Thanks to easy scalability, the system components can be multiplied to suit the vehicle class and power requirement. If, for instance, a second battery pack is added, the range can be extended.

**What does "The Urban Code of Mobility" mean?**

Together with vehicle manufacturers (OEMs), Bosch creates new perspectives and mobility solutions for the urban environment, which results in an Urban Code of Mobility.

**What benefits does a vehicle manufacturer (OEM) have from the powertrain system?**

- ▶ Key components from the automotive field
- ▶ Benchmark in terms of safety and reliability of the battery
- ▶ System approach allows fast market entry & limited integration efforts for the OEM

**What benefits does a customer have from the powertrain system?**

- ▶ Unique driving experience: Immediate acceleration & high range
- ▶ High safety & benchmark performance
- ▶ Customization (display, driving modes) & connectivity

**What benefits do sharing providers and fleet operators have from the powertrain system?**

- ▶ Easy scalability and high flexibility allow modification for each use case
- ▶ Optimisation of efficiency & range through configurability of the driving modes
- ▶ High reliability and safety
- ▶ Powerful battery reduces change and charging frequency

## 2.2 Vehicles

### What vehicles can be equipped with the 48 V Central Drive System?

The powertrain system can be used for all light electric vehicles in the power range from 4 to 20 kW. This includes two-, three- and four-wheel vehicles.

### What are the characteristics of the vehicles?

The following characteristics are based on the reference vehicles that have been simulated/tested at Bosch. The data can vary depending on the vehicle type and equipment package.

PROPERTY	ESCOOTER L1E	ESCOOTER L3E	ECAR L7E
Max. speed	45 km/h	100 km/h	90 km/h
Max. output	4 kW	8 kW	15 kW
Battery capacity	4.8 kW	4.8 kW	14.4 kW
Consumption (driving cycle)	32 Wh/km (WMTC Part I)	35 Wh/km (WMTC Part I)	75 Wh/km (WLTC)
Range	135 km (WMTC Part I)	120 km (WMTC Part I)	170 km (WLTC)
Acceleration 0...45 km/h	Boost: 6.0 sec	n.a.	n.a.
Acceleration 0...50 km/h	n.a.	Boost: 3.8 sec	6.8 sec
Uphill driving (Boost mode)	45 km/h on 10% incline 29 km/h on 20% incline	70 km/h on 10% incline 52 km/h on 20% incline	53 km/h on 10% incline 31 km/h on 20% incline
<b>Charging times:</b>			
Standard 50%	Approx. 2 h (one or two batteries)		
Standard 100%	Approx. 5 h (one or two batteries)		
Quick 50%	Approx. 1 h (one battery), approx. 1.8 h (two batteries)		

eScooter L1e: 210 kg (incl. one driver, 2 batteries), gear ratio 7.6

eScooter L3e: 210 kg (incl. one driver, 2 batteries), gear ratio 7.6

eCar L7e: 735 kg (incl. one driver, 6 batteries, 2 Drive Units, 2 Chargers), gear ratio 12

Driving cycles:

- WMTC (World Motorcycle Test Cycle): Motorcycle test cycle to determine consumption and emissions.
- WLTC (World Harmonized Light-Duty Vehicle Test): Test cycle for small vehicles according to worldwide standards.

## 3 Powertrain system FAQ

### Why are the battery and charger installed permanently?

Because of the size and weight of a battery with an energy content of 2.4 kWh, we decided for the time being to install it permanently. To allow fast and easy connection of every vehicle to a 230 V socket, the charger is also installed in the vehicle.

### Can I also remove the battery and charge it at home in my apartment?

Until the end of 2017, charging took place directly at the vehicle. Starting in 2018, the battery can be also charged with the Off-Board Charger and from 2019 on Bosch will offer both the charger as well as the battery in a mobile version. Depending on the vehicle manufacturer and vehicle type, charging will then also be possible outside the vehicle.

### Is Bosch also planning to introduce a system for other power classes?

The Bosch 48 V Central Drive System can be used in any light electric vehicle between 4 and 20 kW. Those vehicles can be on two, three or four wheels. The first vehicle launched to the market in August 2017 was the electrified Schwalbe. In 2018 electrified motorcycles will be launched as well as three wheeler applications.

***Can I retrofit ("tune") my L1e eScooter to L3e?***

No. The vehicle class is permanently associated with the power of the motor and speed. Every vehicle has to be accepted by certification authorities, e.g. by TÜV or Dekra, in the type approval prior to receiving approval for road service. Likewise, the design of the vehicle components is based on the planned use. For this reason, changing between classes is not possible in the system.

***How can I service the components of the 48 V Central Drive System?***

Service and maintenance should always be performed by a knowledgeable service center or the vehicle manufacturer.

***Why are eScooters equipped with a black-and-white display?***

The display is the interface to the vehicle for the driver. It must be possible to read all important information quickly and easily here – and this under all weather and lighting conditions. Our 4.4" black-and-white display offers high contrast and ensures good readability.

***I want to use a connectivity control unit. What options does the system offer in this regard?***

It is possible to integrate a connectivity control unit via a CAN interface.

***What does recuperation mean?***

The drive unit can be used to convert braking energy into electrical energy and feed it into the battery. This process is called recuperation.

## 4 uDrive Connect app FAQ

### ***What app will be available at the launch of the eScooter?***

Since the launch of the first eScooters, the Android version of the Bosch "uDrive Connect app" is available in the Google Play-Store.

### ***When will the app be available for iOS?***

The iOS version of the app is already being planned. More detailed information shall be available at a later point in time.

### ***What can the app do?***

The uDrive app has three essential features:

- ▶ Presentation of system information about the vehicle for reliable notification of the remaining range and time needed for charging
- ▶ Configuration of display contents and the standard initial driving mode
- ▶ Diagnosis of the powertrain system & information (e.g. Charging temperature)

### ***How can I check, if my vehicle is connected with my Smartphone?***

- ▶ In the display of the vehicle you will see a Bluetooth symbol. When there are small arrows on each side, the vehicle is connected with some device.
- ▶ Once the app is connected with your vehicle, the app shows the connection status in the status bar. When the status shows a specific point of time, the Smartphone is currently not connected.

### ***What can I do, if there is no connection between my smartphone and the vehicle?***

- ▶ The vehicle can only be connected with one device at once. Please check, if the vehicle is connected with another device. De-connect the other device (or shut down the Bluetooth of the other device). The connecting process is also described in the app (refer to the small "i" in the top right corner).
- ▶ Normally the PIN entry for the connecting processes appears via a pop-up notification. Sometimes it only appears in the notification bar of your smartphone. Please check the notification bar and enter the PIN there.
- ▶ If the connection fails, please delete all data related to the Bluetooth connection in the vehicle, the app and your smartphone:
  1. Delete data in the vehicle: Start the vehicle, then go to the menu and choose "delete devices" (press "CONFIRM" for 2 seconds → settings → smartphones → delete devices). After that, turn the vehicle off for min. 20 seconds.
  2. Deleting the data in your smartphone: "Unpair" the vehicle and your smartphone in the Bluetooth smartphone settings.
  3. Delete data in the app: Please select "uDrive Connect" in the app smartphone settings → memory/storage → delete data (Remark: The specific naming for the setting may vary from depending your smartphone).

### ***What can I do, if the app/my smartphone does not receive any vehicle data?***

- ▶ Check, if the Bluetooth connection is active and the vehicle is connected.
- ▶ Deactivate the battery saving mode of your smartphone.
- ▶ Check, if you have received a request to re-enter a PIN (e.g. in the smartphone notification bar).
- ▶ Turn off the vehicle for min. 20 seconds. The transmission of the vehicle information can take up to 30 seconds.
- ▶ The vehicle can only store four different Bluetooth devices (smartphones). If your smartphone is not detected, please re-connect.

***What can I do, if the app/my smartphone does not identify the charging process?***

- ▶ It takes up to 30 seconds to re-establish the Bluetooth connection with your smartphone and submit the information, that the charger is plugged. Please stay within the Bluetooth connection range (roughly 10m) for the described period of time.
- ▶ The vehicle can only be connected with one device at once. Please check, if the vehicle is connected with another device.

***What are the next steps planned for the app?***

The app will be expanded continually through constant implementation of further features such as push notifications or searching for close-by charging stations.

A white-label concept for vehicle manufacturers is also envisioned ("OEM branding"). This way, vehicle manufacturers can individualize the Bosch-developed app using their corporate design.

***Will Bosch store any vehicle or personal data over the uDrive Connect app?***

The storage of vehicle and/or personal data is only allowed after the approval of the customer. The actual data protection policy can be downloaded here: [Data protection policy uDrive Connect app.](#)

**Robert Bosch GmbH**

Automotive Electronics

Postfach 10 60 50

70049 Stuttgart

Germany

Contact:

Andrea Grewe

[Andrea.Grewe@de.bosch.com](mailto:Andrea.Grewe@de.bosch.com)