The BORDLINE® BC battery charger is a compact, lightweight unit designed to charge the batteries and supply DC loads. Up to 4 units can be installed in parallel to achieve the needed output power.

System overview
The battery charger is based on modern SiC power semiconductor technology. BORDLINE® BC_AC_72V is an assembly consisting of:
- 3 x AC/DC battery chargers
- 1 x Overvoltage Protection Box
- 1 x External Gateway.

Each single battery charger module is composed by:
- EMI filter and rectifier for AC inputs
- Simplified power factor correction (PFC) stage to adjust current and voltage phase
- Resonant DC/DC converter providing galvanic isolation
- Digital control based on microprocessor/DSP
- Customer Interface based on CAN
- Speed controlled ultra-long-life fans for cooling (inside BORDLINE BC power modules)
- Forced air cooling system including two fans and one air inlet filter

Functionality
The BORDLINE® BC battery charger is fed by a three phase AC input and generates a DC voltage to charge the vehicle batteries and/or supply DC loads. The device is configured to start up as soon as the AC input voltage is present (dead battery start). The converter operates at high switching frequencies allowing for low ripple voltage and compact build size. Overvoltage Protection box guarantees to protect the battery charger operation even in case of input overvoltage transients. Charging characteristic is battery temperature dependent thanks to the input signal provided by the external temperature sensor.

Characteristics
- High power density and compact design
- Built with silicon carbide (SiC) power semiconductors
- Three phase AC voltage input
- Integrated active output diode
- Machine room installation
- Efficiency > 95 %
- Full redundancy to increase output power and functionalities availability
- Air forced cooling

### Technical data BORDLINE® BC assembly

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>3 x 480 Vac 60 Hz</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>72 Vdc (77…137.5 Vdc)</td>
</tr>
<tr>
<td>18 kW</td>
<td></td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP20</td>
</tr>
<tr>
<td>Operating ambient temperature range</td>
<td>-25°C…+45°C</td>
</tr>
<tr>
<td>Communication Interface</td>
<td>CANopen/Ethernet TRDP</td>
</tr>
<tr>
<td>Dimension</td>
<td>625x600x245 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>40 kg</td>
</tr>
</tbody>
</table>
**Control and monitoring**
The battery charger is fully digital controlled by using a digital signal processor (DSP). The control unit monitors voltages, currents and internal temperatures to protect the device. External overload conditions such as short circuit, excessive ambient temperature, overvoltage are handled safely. The driver electronics supply the trigger signals for the power semiconductors and are also responsible for their protection. All outputs are short-circuit proof.

**Communication protocol**
BORDLINE® BC modules communicate between each other via an RS-485 interface. The battery charger control provides status and error messages on the CANopen bus to the external gateway that is in charge of TCMS communication and cybersecurity implementation. External gateway and TCMS information exchange are in place through an Ethernet TRDP communication protocol. HTTP protocol and Web Services are also integrated in the gateway SW.

**Cooling system**
Each BORDLINE BC module is cooled by forced air. Fan speed is controlled by the needs of the device (depending on load conditions and current ambient temperature).

**Overvoltage protection**
An OVP box guarantees an additional battery charger protection from overvoltage surges for an absolute minimum of 2.5kV. By installing the OVP board between the charger and the supplying grid/inverter, BORDLINE® BCs are protected against such high energy surges from the grid.

**Mechanical/Electrical design**
The battery charger is mounted on board the Electrical Multiple Unit using a mechanical frame fitting in the customer available space. All electrical interfaces are located from one side to guarantee an easy and fast module connection.

**Diagnostics and service**
Diagnostic information is provided through TRDP communication directly to TCMS, but it’s also possible connecting to each single BC module using a PTE through a CAN-USB cable. Each BORDLINE® BC is an LRU that can be easily removed and replaced. In this way repair time decreases, increasing the availability and operation time. Dedicated web pages improve the diagnostic accessibility giving to the user the chance to have customized diagnostic views.

**Application example**
BORDLINE® BC 72V has been installed in regional EMU trains running in North America.