vPOWER – CONTACTLESS POWER SUPPLY
140 kHz TECHNOLOGY
vPOWER - KEY HIGHLIGHTS
AGV SOLUTION

MODULAR DESIGN
Due to the modular structure of the vPOWER system, many diverse combinations of power ranges can be assembled. The primary side consists of 10kW elements for a modular equipment. The secondary side uses 1.5kW, 2.5kW and 3.3kW elements. Additionally, it is possible to parallel the outputs from multiple secondaries to obtain higher power per vehicle. The top can switch from regulated DC output voltage to a DC-Bus that allows up to 10kW.

SPAC-SAVING COMPACT DESIGN
The extreme compact design of the vPOWER components means a contactless power system can be implemented on vehicles with minimum space availability. New compensation boxes can be laid underground to minimize hazards and space needed. This is possible, in part, due to the separation of Pickup and Regulator electronics. The Pickup needs to be mounted directly interfacing the primary track while the Regulator electronics can be mounted anywhere on the vehicle allowing for easier access and maintenance. The connection between Pickup and Regulator is by coaxial cable which minimizes any radiated interference.

SIMPLE SERVICE AND DIAGNOSTIC TESTING
vPOWER’s primary-sided service and diagnostic module allow for whole-system performance control and monitoring. Fieldbus partnered with offered protocols PROFINET-Io, EtherNet-Ip, and CC-Link IE, enable worldwide operational capabilities. Important system vitals such as current, voltage, phase angle, and more can be read via an integrated LCD display of a vPOWER system. Failures and interferences are recorded internally and can be transmitted via a selectable interface allowing fast diagnostics and solutions in case of an event.
GUIDANCE
The main function of the track power cables in the floor is to transfer power to the Pickup(s) on AGVs. However, these cables can also be tracked, using a guidance sensor, to provide a guidance signal to the AGV controller.

The VAHLE Guidance sensor can navigate straight and curved pathways, as well as switches, crossing and power loops. RS485, CAN, PROFINET-IQ, EtherNet-IP and CC Link interfaces are available, to provide range of communication options AGV controllers.

REDUCED IRON-FREE ZONE
By increasing the frequency by a factor of 7, the primary current compared to the former VAHLE inductive technology was reduced. This reduction has a great advantage — the distance to ferromagnetic metals can be reduced during power transfer significantly. When there is an aluminum plate within a distance of 20mm to the primary field, the power loss in the plate will be reduced by 56% compared to former VAHLE 124A 20kHz products, allowing a greater degree of autonomy in the laying of the primary cable.

LARGE LATERAL TOLERANCE
The goal during development was to increase the vertical and lateral displacement tolerances to a world class level never achieved before in the industry.

When the tolerances are exceeded only a small derating occurs. Even when the specified tolerance range is exceeding closely to the specified, only a small derating will occur. This makes it possible, to drive through most of the trajectory reliable.
vPOWER– SYSTEM OVERVIEW
1 PPU20: 2 x 10 kW Primary Power Unit
2 PPS: Primary Power Synchronization
3 PPC: Primary Power Controller
4 PPGCM: Primary Power Gyrator Compensation Master
5 PPGCS: Primary Power Gyrator Compensation Slave
6 CX45: Track Power Coaxial Cable (optional, only required for track feeds longer than 10 meters)
7 TPFB: Track Power Feed Box (optional, only required when Track Power Coaxial Cable is being used)
8 PX45: Track Power Litz Cable
9 TPCB: Track Power Compensation Box
10 F-PU: Flat Pickup
11 CX12: Mobile Power Coaxial Cable
12 RE: Regulator electronic
PRIMARY EQUIPMENT – OVERVIEW

PPU10 M
PRIMARY POWER UNIT 10 KW MASTER

PPU10 S
PRIMARY POWER UNIT 10 KW SLAVE
PRIMARY POWER UNIT – PPU10

TECHNICAL DATA

Power Specification
- Power (nominal/peak): 10 kW
- Supply voltage: 400 ... 480 VAC ±10%
- Supply frequency: 50 ... 60 Hz
- Supply net system: TT, TN (grounded neutral)
- Output current/frequency: 45 A/140 kHz
- Efficiency PPU: 95%
- Auxiliary (required): 24 VDC ±10%, 4 A/5 A/7 A

Control Interface
- Interface: Profinet-Io, EtherNet/IP, CC-Link IE
- Data rate: 500 kBit/s
- Status information: Enable 140 kHz, Fieldbus Reset, Fieldbus Error, System Error, Warning

Mechanical Specification
- Dimensions: 1030 x 445 x 240 mm (10 kW unit)
- Ambient temperature: 0 ... + 40 °C non-condensing
- Operation: 3M4, 7M2
- Environment: General industrial
- Cooling: Convection
- Protection rating: IP20
- Connection power: Cage clamp 4 mm²
- Connection auxiliary: Cage clamp 1.5 mm²
- Connection fieldbus: RJ45

PRIMARY EQUIPMENT CONFIGURATION
Based on the 10 kW primary units, it is possible to configure primary units with a higher performance. A 40 kW base consists of a 10 kW primary unit master and three 10 kW primary units slave.

RANGE OF PRODUCTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
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</thead>
<tbody>
<tr>
<td>vPOW_PPU10k.1-140-045-M-PN</td>
<td>10017414</td>
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<tr>
<td>Primary Power Unit 10kW / 140kHz / 45A / Master / Profinet IO</td>
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<td>vPOW_PPU10k.1-140-045-M-EI</td>
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<tr>
<td>Primary Power Unit 10kW / 140kHz / 45A / Master / EtherNet/IP</td>
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<td>vPOW_PPU10k.1-140-045-M-IO</td>
<td>10017417</td>
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<td>vPOW_PPU10k.1-140-045-S-NI</td>
<td>10017420</td>
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<tr>
<td>Primary Power Unit 10kW / 140kHz / 45A / Slave / No Interface To extend the Primary Power up to 20kW or 40kW</td>
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</table>

* Further status information will be available at soonest: Temperature, voltage, current, phase angle, real POWER.
**TRACK EQUIPMENT**

**RANGE OF PRODUCTS**

<table>
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<tr>
<th>Description</th>
<th>Order No.</th>
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<tbody>
<tr>
<td>vPOW_CX45</td>
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<tr>
<td>vPOW_PX45</td>
<td>10018430</td>
</tr>
<tr>
<td>vPOW_TPCB.1-45-140-F</td>
<td>10017421</td>
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<tr>
<td>vPOW_TPFB.1-45-140-1</td>
<td>10017422</td>
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</tbody>
</table>

**VEHICLE EQUIPMENT**

**OVERVIEW CONFIGURATION PICKUP UND REGULATOR**

<table>
<thead>
<tr>
<th>Pickup FXXX</th>
<th>Regulator REXXX</th>
<th>vPOW_RE330.1 10017430</th>
<th>vPOW_RE250.1 10018452</th>
<th>vPOW_RE150.1 10018453</th>
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<tbody>
<tr>
<td>vPOW_F330.1_140 10017429</td>
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<tr>
<td>vPOW_F250.1_140 10018442</td>
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<td>vPOW_F150.1_140 10018443</td>
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<td>✓</td>
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VEHICLE EQUIPMENT - GUIDANCE

TECHNICAL DATA

Mechanical Data
Dimension ..................................... 239.45 x 155 x 48.50 mm
Mounting holes ............................. 140 x 141 mm
Weight ........................................... 1 kg
Protecting rating ............................. IP54
Ambient temperature ..................... 0 ... 40 °C non-condensing
Environment ................................. General industrial

BLOCK DIAGRAM

RANGE OF PRODUCTS

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>vPOW_Pilot.x-45-140-PN</td>
<td>10018392</td>
</tr>
<tr>
<td>Guidance Sensor / 140kHz /45A Profinet IO</td>
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</tr>
<tr>
<td>vPOW_Pilot.x-45-140-EI</td>
<td>10018394</td>
</tr>
<tr>
<td>Guidance Sensor / 140kHz /45A EtherNet/IP</td>
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</tbody>
</table>

Mechanical Data
Dimension .....................................239.45 x 155 x 48.50 mm
Mounting holes .............................140 x 141 mm
Weight ...........................................1 kg
Protecting rating .............................IP54
Ambient temperature .....................0 ... 40 °C non-condensing
Environment .................................General industrial
VEHICLE EQUIPMENT FOR 560 VDC
PICK-UP FXXX-140 AND REGULATOR REXXX

POWER CURVE

RANGE OF PRODUCTS

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>vPOW_F330.1-140 F-Pickup / 3.3kW / 140kHz / 45A / Duty 40% / Linear / 235…362VAC Nominal Power 1.3kW, Peak Power 3.3kW, Duty Cycle 40% at 10min cycle</td>
<td>10017429</td>
</tr>
<tr>
<td>vPOW_F250.1-140 F-Pickup / 2.5kW / 140kHz / 45A / Duty 40% / Linear / 235…362VAC Nominal Power 1kW, Peak Power 2.5kW, Duty Cycle 40% at 10min cycle</td>
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</tr>
<tr>
<td>vPOW_F150.1-140 F-Pickup / 1.5kW / 140kHz / 45A / Duty 40% / Linear / 235…362VAC Nominal Power 0.6W, Peak Power 1.5kW, Duty Cycle 40% at 10min cycle</td>
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<tr>
<td>vPOW_RE330.1 Regulator / 3.3kW / 560V / Duty 40% / No thermal monitoring / Standard / Relay contact / No Auxiliary / DC-Output 560VDC ±5% / Peak power 3.3kW / Duty cycle 40% / No battery charging, parallelizable output</td>
<td>10017430</td>
</tr>
<tr>
<td>vPOW_RE250.1 Regulator / 2.5kW / 560V / Duty 40% / No thermal monitoring / Standard / Relay contact / No Auxiliary / DC-Output 560VDC ±5% / Peak power 2.5kW / Duty cycle 40% / No battery charging, parallelizable output</td>
<td>10018452</td>
</tr>
<tr>
<td>vPOW_RE150.1 Regulator / 1.5kW / 560V / Duty 40% / No thermal monitoring / Standard / Relay contact / No Auxiliary / DC-Output 560VDC ±5% / Peak power 1.5kW / Duty cycle 40% / No battery charging, parallelizable output</td>
<td>10018453</td>
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<tr>
<td>vPOW_CX12-1 Mobile Power Coaxial Cable between Pickup and Regulator / 140kHz / 12A / 1 Meter</td>
<td>10018432</td>
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<td>vPOW_CX12-2 Mobile Power Coaxial Cable between Pickup and Regulator / 140kHz / 12A / 2 Meter</td>
<td>10018433</td>
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<td>vPOW_CX12-4 Mobile Power Coaxial Cable between Pickup and Regulator / 140kHz / 12A / 4 Meter</td>
<td>10018434</td>
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<tr>
<td>vPOW_CX12-6 Mobile Power Coaxial Cable between Pickup and Regulator / 140kHz / 12A / 6 Meter</td>
<td>10018435</td>
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</table>
**TECHNICAL DATA**

**Electrical Data System**
- Peak power: 3.3 kW / 2.5 kW / 1.5 kW
- Duty cycle: 40% ED @ 10 min cycle
- Nominal power: 1.3 kW / 1.0 kW / 0.6 kW
- Track current: 45 A
- Track frequency: 140 kHz
- Track conductor spacing: 110 mm
- Output voltage: 560 VDC ± 5%
- Output current: 6.5 A

**Protection**
- Output over voltage: Yes
- Over temperature: Yes
- Max. reverse voltage: 750 VDC

**Regulator Mechanical Data**
- Dimensions: 190 x 120 x 85 mm
- Mounting holes: 180.5 x 80 mm
- Weight: 1 kg
- Protection rating: IP20
- Ambient temperature: 0 ... +40 °C non-condensing
- Environment: General industrial

**Pickup Connection Cable Data**
- Length: 1/2/4/6 m
- Outer diameter: 11 mm
- Connections: Pre-terminated
- Flexibility: Flexible
- Min. bending radius: 90 mm

**Pickup Mechanical Data**
- Dimensions: 415 x 255 x 39.5 mm
- Mounting holes: 385 x 225 mm
- Weight: 10 kg
- Nominal air gap (from top of track cable toottom of Pick-Up): 15 mm
- Vertical displacement: ± 5 mm
- Lateral displacement: ± 20 mm
- Protection rating: IP54
- Color: RAL 5002
- Ambient temperature: 0 ... +40°C non-condensing
- Environment: General industrial
- Cooling: Natural convection