Stationary and mobile test rig applications

POWER CONVERTER AT A GLANCE

- For asynchronous and synchronous drives
- For a variety of high performance test applications such as trains, transformers and special motors
- Individually customized with scalable, modular performance levels
- Low-level electromagnetic emissions for sensitive test rig applications
- User-friendly service software and interface design
- Unmatched infrastructure including full laboratory to pretest multiple test systems prior to commissioning
- Over 600 systems in operation worldwide

References: AVL LIST, Deutsche Bahn, HIGHVOLT
PowerTech is THE specialist in high performance converter technology for high performance test rigs. With over 600 installations worldwide, PowerTech offers unmatched product performance, know how, service experience and testing infrastructure. PowerTech converters for test rig applications are used for:

- Product development and end of line testing
- Combustion motors, gears and hybrid drive trains
- High voltage transformer testing
- Rail testing of pantographs, propulsion and braking
- Electric motor and generator testing
- Component testing of diverse industries
- Testing of industrial machines, compressors and special motors

PowerTech converters enable the turnkey simulation of technological processes. This contributes to lower product development costs and faster development cycles. The use of intelligent power modules, compact design, minimal number of components and forced air and water cooling define PowerTech’s state of the art technology. This is why almost all Formula 1 racing teams now use the PowerTech family for their development.

TECHNICAL FEATURES

- IGBT-based four-quadrant technology
- With voltage link and pulsed mains converter
- AFE - active front end functionality
- Active harmonic compensation for best possible grid quality
- Reactive power management with adjustable cos phi
- Maximum output frequency of up to 2.500 Hz
- Maximum IGBT pulse frequency of up to 15 kHz
- Excellent field-oriented control properties
- Low losses and high immunity to electromagnetic interference
- Minimal electromagnetic emissions
- Single-phase/multi-phase solutions
- Modular, flexible design and construction
- Optimised air or water-cooling
- Support of common field bus systems and binary interfaces
- User-friendly service software and interface design

1 Control electronics
2 Power module with air cooling, water cooling as an option
EXTENSIVE TESTING FACILITIES IN-HOUSE

PowerTech has years of experience in testing with high power applications. Before delivery to the customer, each converter is tested with the original motor – only a fully tested package of power converter and motor is delivered to our customer. New motor types are "identified" with special load tests. That ensures a high accurate control of the torques – and in the end, best quality.

TESTING FEATURES

Load tests with air- and liquid-cooled equipment and machinery
- Test beds for in-house coupling of motor/converter drive sets
- Testing capabilities for determining vibration, velocities, torques and speeds
- Motors can be run with dynamic as well as stationary tests e.g. for thermal tests
- Workshop is capable of adapting customized shaft connections

In-house facilities for testing of grid faults
Realization of simulated grids for product tests
- Adjustable grid voltage 0 - 830 V
- Adjustable grid frequency 0 - 200 Hz
- 700 A continuous reactive current possible
- 2000 A peak current for LVRT tests possible
- Simulation of flicker effects, LVRT, HVRT, harmonics

FACILITY FEATURES

Feed-in possibilities
- Terminal areas with 400 V and a capacity of 1.3 MVA
- Terminal areas with 690 V and a capacity of 2.0 MVA
- Variable source 0 - 200 Hz, 0 - 690V

DC voltage source
- 0 - 1000 V DC 350A recovery-capable

Loading devices
- Dynamometer with 300 kW, 0 - 7 000 U/min
- Transformer / inductor combination for loop operation up to 2.0 MVA

Internal test rigs
- Air-suspended prestressed bed for motor testing
- Unsuspended prestressed bed for motor testing

Cooling equipment
- Water / water heat exchanger
- Additional equipment according to customer requirement
APPLICATION EXAMPLES

STATIONARY HIGH-VOLTAGE TRANSFORMER TEST FACILITY

PowerTech converters are used as a voltage supply for test facilities that test transformers according to IEC. These facilities are used for insulation tests and endurance tests.

Solution
- Very high output power and parallel converter operation are possible
- High level of EMC experience is required as test routines with partial discharge measurements during converter operation occur
- Short-circuit-proof, three-phase or single-phase operation, harmonics stabilization of THD and DC offset
- Also suitable for mobile high-voltage transformer testing facilities

TEST RIGS FOR RAILWAY INDUSTRY

Train component testing (e.g. train transformers, propulsion inverters and motors) used in different voltage levels.

Solution
- Modular designed frequency converter with DC bus and active front end
- Motor inverter as load for the unit under test
- Supply of the auxiliary voltages
- Control cabinet for the internal power supply and protection
- Advanced control functions, including safety circuit for safe stop
- Different I/O’s, including interface for different field bus versions (Profibus, Profinet, CAN)

TEST RIGS FOR MOTORS, GEARS AND HYBRID DRIVE TRAINS

PowerTech converters are deployed in test rigs for motors, gears and hybrid drive trains. Any configuration is possible: from a compact, reliable test bench for combustion engines to a test rig with maximum dynamics.

Solution
- Control of asynchronous and synchronous motors with up to 24 000 rpm
- High dynamic speed and torque control with a step response of < 1 ms
- Frequency limit of the drive system at 2.500 Hz with an IGBT pulse frequency of up to 15 kHz with large test systems
- Speed change gradient of the drive system: 100 000 rpm/s
- For Formula One applications with up to 1 000 000 rpm/s
- Battery simulation of 50 kW to 1 000 kW

The system of electric motor and PowerTech converter replace each of the mentioned components for simulating technological processes:
- W: Wheels
- E: Engine
- P: Primemover
- T: Transmission output
- D: Drive

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WORLD LEADER FOR HIGH DYNAMIC POWER CONVERTERS IN THE AUTOMOTIVE TESTING AREA

About 600 power converters delivered worldwide for

- Motor test benches for testing combustion engines, universal drives, electric drives
- Gear test benches as the most complex in the automotive testing industry
- Combustion shock simulation with power converter and electric motor
- Motorsport applications for highest dynamics, as required by Formula 1, IndyCar
- Hybrid drive test benches, AC and DC converters provide variable energy source, for e.g. battery simulation
- High voltage transformers test rigs, e.g. insulation tests, lifetime tests
- Train component test rigs for testing of train transformers, propulsion inverters and motors

QUALIFIED SYSTEM PARTNER

System solutions for converters and motors

- PowerTech closely works together with well-known, qualified motor suppliers like VEM, Schorch, Krebs und Aulich, LDW, Faunndau
- Coordinated solutions in electrical parameters, interpretation of the encoders and protection functions
- Preconfigured, proven and therefore reliable compilations of components of the electric drive train
TECHNICAL DATA

Converters for test rig applications

ELECTRICS

<table>
<thead>
<tr>
<th>Line voltage</th>
<th>Rate voltage 380 - 480 V, 380 - 690 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid frequency</td>
<td>50 / 60 Hz</td>
</tr>
</tbody>
</table>

AC output

<table>
<thead>
<tr>
<th>Nominal power</th>
<th>50 - 6 000 kW, expandable to 12 MW with parallel connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum frequency</td>
<td>2 500 Hz</td>
</tr>
</tbody>
</table>

Rated voltage 0 - 500 V AC, 0 - 700 V AC, 3 phase or single phase

DC output

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>0 - 800 V DC, 0 - 1 200 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal power</td>
<td>up to 4 MW expandable through parallel connections</td>
</tr>
</tbody>
</table>

MECHANICS

<table>
<thead>
<tr>
<th>Fieldbus systems</th>
<th>CAN, Profinbus, Ethercat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Standard industrial cabinets</td>
</tr>
<tr>
<td>Cooling</td>
<td>Air or water cooling</td>
</tr>
<tr>
<td>Protection</td>
<td>IP23, IP54</td>
</tr>
<tr>
<td>Temperature range</td>
<td>0 to +45 °C</td>
</tr>
</tbody>
</table>

BLOCK DIAGRAM

*Singles-phase or DC/DC solutions also available*