Optimized power supplies for a variety of applications

Grid compatibility for industry and renewable energy

Optimized grid voltage quality

Reactive power, harmonics and flicker compensation

Individually adaptable with scalable modular output stages

Easy to integrate in existing systems and configurations

Testing of grid faults in own test facility

References: Suzlon, FEST, VEM Group
OPTIMALLY TAILORED COMPONENTS FOR MAXIMUM EFFICIENCY

Power supply solutions for industrial consumers and processes require the most diverse range of voltages and frequencies. For instance, processing machines are often bound by special grid conditions, while test equipment requires operation within special voltage or frequency limits. PowerTech converters are used to optimize each individual power supply meeting the need for flexibility and high reliability at the same time.

PowerTech converters provide adjustable AC and DC voltages with a wide power range. The AC voltages generated can be both single-phase and three-phase. Also hybrid versions with both AC and DC supplies as well as other customer-specific requirements can be provided. Knorr-Bremse PowerTech combines mass-produced components and tailored solutions to offer customers cost-optimized products made from proven components.

TECHNICAL FEATURES

- AFE – active front end functionality
- Highly dynamic control properties
- Highly dynamic and adjustable
- Individually adaptable and scalable output stages
- Easy to integrate in existing systems
- Simple operation and user-friendly interface design
- Supports common fieldbus systems (CAN, PROFIBUS, ETHERCAT etc.), but binary interfaces are also available
- Extensive product tests performed in own test facilities
- Implementation of simulated grids for product tests in own test facility

FIRST-CLASS POWER SUPPLY:
PowerTech converters for reliable, flexible and high-availability power supplies in industrial environments

PowerTech converters for power supply and grid compensation
SAMPLE APPLICATION: VOLTAGE SUPPLY CONVERTER

- Generation of 60 Hz in an original 50 Hz grid or vice versa
- Voltage supplies for test facilities (motor testing, transformer testing, railway equipment testing)
- Supply of 16.7 Hz or DC voltages for testing equipment e.g. for railway equipment
- Voltage supplies for special grid properties in industry or for renewable energies
- Compensation of predefined voltage levels, even with variable loads
PowerTech converters improve quality in electric energy distribution grids. At the same time, they fulfill a number of grid requirements including optimizing the line voltage quality and compensating for reactive power, harmonics and voltage flicker.

Increased energy quality, reduced energy costs and grid stabilization are just a few of the latest requirements for energy users. Industrial applications require a stable grid for safe operation. In particular, high-precision work must be protected against fluctuations in the power supply or power failures. At the same time, these processes must not strain the grid, e.g. with excessive reactive power requirements. Using controlled PowerTech compensation systems allows for proper compliance with the grid connection requirements of grid operators. At the same time, it ensures the efficient and reliable operation of machines and systems.

COMPENSATION CONVERTERS ARE IDEAL FOR
- Applications in the automotive industry
- Power generation from regenerative energy sources
- Energy storage
- Energy-intensive processing industries (paper, chemicals, steel, etc.)
- Research center equipment

CUSTOMER BENEFITS
- Optimized grid quality and reduced load on equipment thanks to customer-specific active compensation systems
- Stabilization and support for public or industrial grids through active harmonics management
- Compliance with contractually specified power factor leads to reduced energy costs
- Reduced losses in transmission grids and distribution grids, as well as in industrial systems
- Ability to test symmetrical low voltage ride through in the PowerTech test facility
SAMPLE APPLICATION: GRID COMPENSATION CONVERTER

- For controlling the negative effects of poor grid quality on production processes
- For controlling the negative effects of poor grid quality for existing private or industrial consumers
- For use in variable processes with changing reactive power or harmonics that require dynamic compensation responses
Converters today need to ensure the reliable operation of energy generation systems even if the grids are exposed to strongly fluctuating frequencies or voltages. Due to the increasingly stricter international guidelines for grid supply and grid compatibility (grid codes), wind turbines, for instance, can no longer disconnect from the grid in the event of a grid breakdown. This means that primarily old systems and specific generator concepts are technically overwhelmed. With that in mind, the PowerTech converter series offers custom product solutions for grid stability in energy generation systems.

The PowerTech reactive current converter keeps the system on the grid during temporary symmetric voltage drops of up to 15% or asymmetric drops of up to 0%. If a two-phase asymmetric short circuit occurs in the medium-voltage range, the reactive current is supplied using the remaining phase. The reactive current converter consists of a pulsed IGBT power converter with a voltage link. If the grid is operating under nominal conditions, the converter operates in stand-by mode. If the voltage on the grid drops, the converter is activated and supplies the required reactive current for up to six seconds.

IDEAL FOR WIND TURBINES
The power converter is connected via fieldbus. To avoid any grid resonance, the individual pulse frequencies can be set in a range from 2 kHz to 7 kHz. Stochastic pulse frequencies can also be set to prevent unwanted resonance and beat frequency during the parallel operation of multiple PowerTech converters or parallel operation with converters from other manufacturers.

COMPLIANCE WITH GRID CODES:
PowerTech reactive current converters for renewable energies

CUSTOMER BENEFITS
- Compliance with international grid codes
- Power classes of 850 A to 2500 A
- Automatic recognition of grid faults and grid codes that can be preset
- Highly dynamic and adjustable reactive current response
- Easily integrated into new or existing wind turbines
- Customisable due to modular design
- Highly dynamic and adjustable reactive current response
- Simple user interface and user-friendly interface design
- “Zero voltage ride through” (ZVRT) capability/“high voltage ride through” (HVRT) capability
- Natural convection is sufficient for cooling

Phase module with power segment and proprietary PowerTech control – the currently valid grid code can be pre-set
SAMPLE APPLICATION:
REACTIVE CURRENT CONVERTER

- Integration of the power converter into the wind turbine via fieldbus
- Avoid grid resonance by variable pulse frequency adjustment in range from 2 kHz to 7 kHz
- Preventing resonance and beat frequency during parallel operation of multiple reactive current converters or parallel operation converters from other manufacturers by individually adjustable stochastic pulse frequencies
## TECHNICAL DATA

Converters for power supply and grid compensation

### ELECTRICS

<table>
<thead>
<tr>
<th>Line voltage</th>
<th>Rated voltage 380 - 480 V, 380 - 690 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid frequency</td>
<td>50 / 60 Hz</td>
</tr>
<tr>
<td>AC output</td>
<td>Nominal power 50 - 6000 kW, expandable to 12 MW with parallel connection</td>
</tr>
<tr>
<td>Maximum frequency</td>
<td>2500 Hz</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>0 - 500 V AC, 0 - 700 V AC</td>
</tr>
<tr>
<td>DC output</td>
<td>Rated voltage 0 - 800 V DC, 0 - 1200 V DC</td>
</tr>
<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, Profibus, Ethercat, USB interface, digital in/out, signal contacts, potential-free</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

GRID COMPENSATION

![Diagram of grid compensation](attachment:image.png)