



Motor drive applications

energy efficiency and reliability

Increase the productivity with clean power
Comply with EMC /Harmonics standards and
increase motor life time



Schaffner Group

The Schaffner Group is the international leader in development and production of solutions which ensure efficient and reliable operation of electronic systems. The Group's broad range of product and services includes EMC/EMI components, harmonic filters and magnetic components as well as development and implementation of customized solutions. Schaffner components are deployed in energy-efficient drive systems and electronic motor controls, in wind and photovoltaic systems, rail technology, machine tools and robotics as well as power supplies for numerous electronic devices in sectors such as medical technology or telecommunications. Schaffner provides on-site service to customers around the world through an efficient, global organization and makes ongoing investments in research, development, production and sales to systematically expand its position as leader on the international market.

A global one-stop shop

- EMC/EMI filters**
- PCB filters
 - IEC inlet filters / Power entry modules
 - DC filters
 - Single-phase filters
 - Three-phase filters
 - Three-phase + neutral line filters
 - Open frame filters

- EMC/EMI chokes**
- Feedthrough filters and capacitors**
- Automotive components**
- Customized solutions**

Power Quality products

- Line reactors
- dv/dt reactors and filters
- Sine wave filters
- Harmonic filters
- Regen reactors and filters
- Transformers

Customized solutions

<ul style="list-style-type: none"> - Motor protection chokes - dv/dt filters - Sinusoidal output filters - Sinus Plus filters - LC and LCL filter - Low leakage current RFI filter 	<ul style="list-style-type: none"> - Motor bearing currents - Additional pulse loads on the inverter - Acoustic motor noise - EMC problems
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Total solutions for motor drive systems

Frequency inverters, also called variable frequency drives (VFDs), are among the most widely used pieces of equipment for AC motor control. Nowadays, they are used in virtually every area of industrial and domestic installations; in applications as diverse as pumps, air conditioning systems, elevators and cranes, conveyors, machine tools, alternative energy production and in a vast array of other energy saving applications.

VFD semiconductor power structures can be made in different AC-AC, DC-AC or AC-DC topologies and therefore can be applied as PV-, Wind-, UPS- or other converter creating similar interference issues as within motor drive systems.

Problems associated with modern drives

In the quest for ultra-compact, efficient power conversion, inverter and converter manufacturers employ high speed semiconductor switches and pulse width modulation (PWM) techniques to generate fast risetime voltage pulses.

Unfortunately, this creates a considerable number of problems from purely functional difficulties to most severe motor damage. Following, a brief summary of the most significant problems and phenomena:

- Inrush and peak currents
- Low frequency interference phenomena
- Grid problems with regenerative drives
- Motor bearing currents
- Additional pulse loads on the inverter
- Acoustic motor noise
- EMC problems
- Displacement currents
- DC link capacitor stress
- Harmonics
- DC link overvoltage and other problems
- Inverter input
- EMC and EMI problems
- Harmonics
- Commutation notches
- Inverter output
- Excessive dv/dt
- Peak and overvoltages
- Parasitic earth currents
- Eddy current losses in the motor
- Whole system
- Low efficiency
- Low power factor
- Unacceptable interference emissions

Solutions from Schaffner

In most cases, several phenomena occur in the same system, a fact which underlines the importance of combining filter components to a total solution.

In order to reduce the overall suppression and mitigation effort and costs associated with, a careful investigation of the equipment can be provided and be solved by Schaffner with following cost efficient solutions:

- EMI/RFI input filters
- RFI suppression chokes
- Harmonics filters/chokes
- Line reactors
- Commutation reactors
- Special components for energy regeneration
- Motor protection chokes
- dv/dt filters
- Sinusoidal output filters
- Sinus Plus filters
- LC and LCL filter
- Low leakage current RFI filter
- Uncertain system immunity
- Increased leakage currents
- Uncertain service security and reliability

The decision to favor a certain solution above another depends entirely on the system requirements and should always be backed by a technical and economic analysis.

Advanced testing capabilities

To ensure that our components work properly in the final equipment, Schaffner operates a full load test setup for motor drives.

With the unique ability to test every drive with various loads and cable lengths, switching frequencies and environmental conditions, we are able to serve our customers with the most reliable and cost-effective solutions.

Benefit from more than 50 years of experience

Schaffner can help you to ensure:

- EMC and harmonics compliance
- System reliability and efficiency
- Operation and production improvements
- Functional security and sustainability

To obtain more detailed information please contact your local Schaffner sales office, distributor or www.schaffner.com.

Note: motor drives are used as a typical example; Schaffner is also active in numerous other areas, such as PV inverter, wind converter and other power electronic devices.

To find your local partner within Schaffner's global network, please go to www.schaffner.com

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Clean and efficient power – harmonic mitigation

Active Harmonic Filter



- Compensation current: 0 to 300 A
- Frequency: 47 to 63 Hz
- Harmonic mitigation: THID < 5%, THID adjustable
- Voltage: up to 690 VAC

- Global or selective compensation of harmonic currents up to the 50th order
- Compensation of displacement power factor
- Load balancing capability
- Response time of less than 300 microseconds
- 3-level topology with 20–30% lower losses (690 V)

Passive Harmonic Filter



- Rated power: 4 to 400 kW (50 Hz) / 5 to 500 HP (60 Hz)
- Frequency: 50 Hz / 60 Hz
- Harmonic mitigation: THID < 5%, < 10%, < 15%
- Voltage: up to 690 VAC

- The industry standard for 6-pulse rectifiers and motor drives
- The most compact 5% THID filter available
- Excellent behavior under partial load conditions
- Filters for diode rectifiers

Standard fulfillment – EMC suitable filtering

3-Phase EMC/EMI Line Filter



- Attenuation performance: standard, high, very high
- Motor power: 4 to 2000 kW
- Operating frequency: up to 60 Hz
- Rated current: 5 to 2500 A
- Voltage: up to 690 VAC

- For industry standard EMC filter solutions
- Off-the-shelf low to high power filter
- Slim space-saving book-style housing
- Solid safety connector blocks or optional wire output connections
- From standard to excellent attenuation performance
- Versions for IT distribution networks
- Versions with low leakage current

3-Phase + Neutral EMC/EMI Line Filter



- Attenuation performance: standard, high, very high
- Motor power: 2.2 to 315 kW
- Operating frequency: up to 60 Hz
- Rated current: 3 to 600 A
- Voltage: up to 520 VAC

- Compact filter for mains input of cabinets and control equipment
- Designed for applications like machine tools to sensitive medical installations
- Combines excellent attenuation with very low operating leakage current < 1 mA
- Solid touch-save terminal blocks up to 200 A

Maximize production – protect motors and reduce disturbance

Sine Wave Output Filter



- Motor power: 7.5 to 1200 kW
- Motor frequency: up to 600 Hz
- Motor cable length: up to 2000 m
- Rated current: 13 to 1320 A
- Switching frequency: 2 to 16 kHz
- Voltage: 0 to 690 VAC

- Smooth sine wave without voltage peaks
- Protects motor winding insulation against over- and dv/dt voltage stress
- Reduces motor heating, magnetic and eddy current losses
- Improvement of system reliability
- Reduces bearing currents
- Applied when multiple motors are controlled by one VSD
- Ideal for retrofit and long motor cable installations
- Versions with common-mode interference reduction

Maximize production – protect motors and reduce disturbance

3-Phase Load Reactor



- Motor power: 1.5 to 630 kW
- Rated current: 4 to 1100 A
- Switching frequency: 2 to 16 kHz
- Voltage: up to 500 VAC

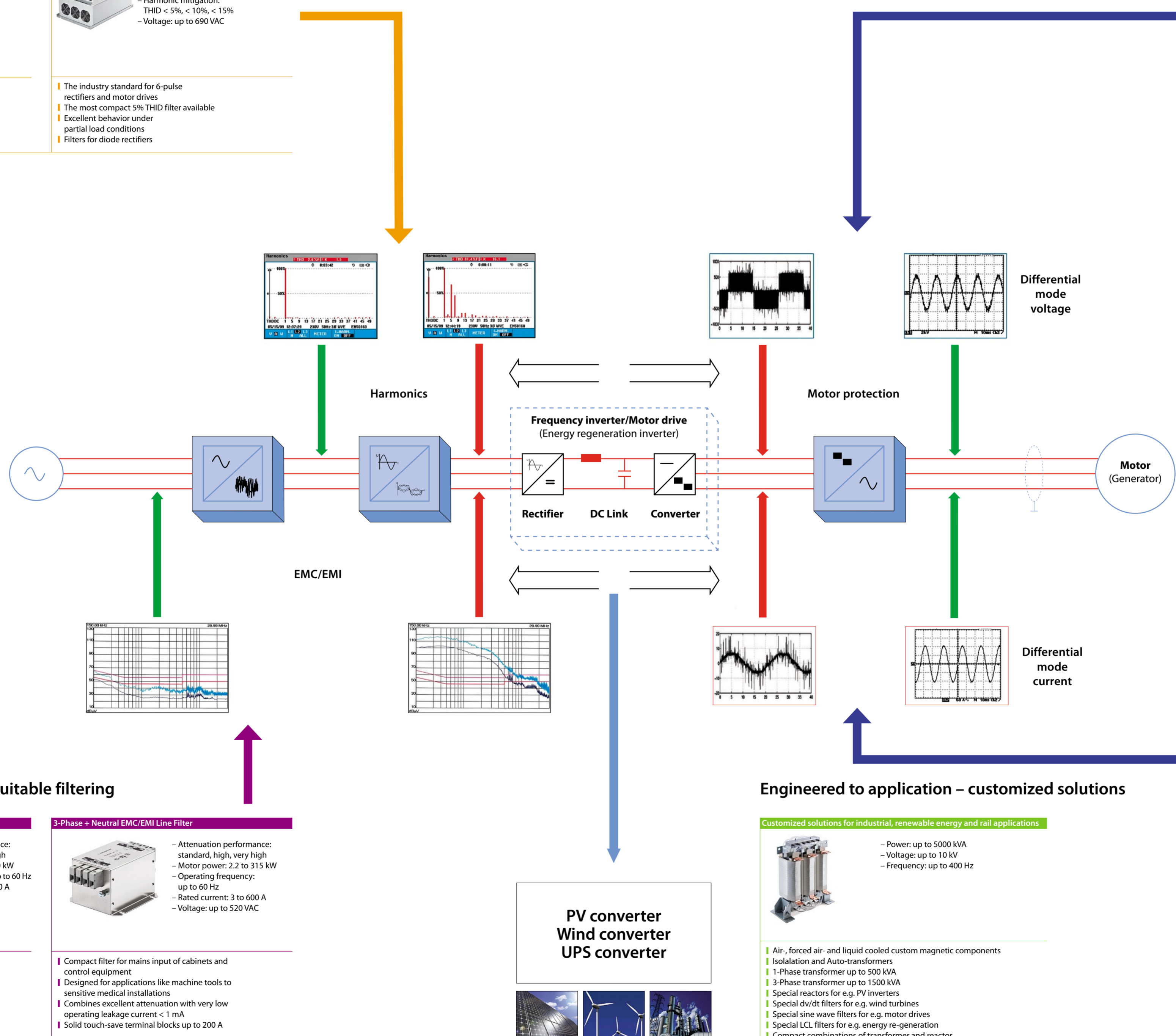
- dv/dt voltage suppression
- Reduces motor winding insulation stress when short motor cables are used

dv/dt Filter



- Motor power: 1.5 to 30 kW
- Motor frequency: up to 400 Hz
- Rated current: 4 to 66 A
- Switching frequency: 2 to 16 kHz
- Voltage: up to 500 VAC
- Protection degree: IP20

- Protects motor winding insulation against over- and dv/dt voltage stress
- Reduces disturbance of neighboring equipment and cables
- Improvement of system reliability



Engineered to application – customized solutions

Customized solutions for industrial, renewable energy and rail applications



- Power: up to 5000 kVA
- Voltage: up to 10 kV
- Frequency: up to 400 Hz

- Air-, forced air- and liquid cooled custom magnetic components
- Isolation and Auto-transformers
- 1-Phase transformer up to 500 kVA
- 3-Phase transformer up to 1500 kVA
- Special reactors for e.g. PV inverters
- Special dv/dt filters for e.g. wind turbines
- Special sine wave filters for e.g. motor drives
- Special LCL filters for e.g. energy re-generation
- Compact combinations of transformer and reactor

**PV converter
Wind converter
UPS converter**

