Power Quality solutions – more than just products
Overview Power Quality product portfolio
Reactors, Ecosine active and passive harmonic filters, Output filters

Solution provider
Line reactors

Solution provider
Ecosine active and passive filters, Output filters

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We care for clean energy

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Overview Power Quality product portfolio

Reactor

Line and load reactors are the most economical harmonic filter solution, with proven performance to reduce distortion created from variable frequency drives. Reactors are available for either line site, to reduce harmonic distortion; or load side, to minimize long lead effects and help to extend motor life.

Features and benefits
- Economical, compact, wide ratings selection
- Reduction of mains harmonics and commutation notches
- Help to meet international Power Quality standards such as IEEE-519 or EN 61000-3-2
- Protection of motor drive electronics and DC link capacitors against mains transients
- Reduction of inrush and peak currents
- Prevention from nuisance tripping caused by power line voltage spikes
- Improvement of true power factor

Ecosine passive harmonic filter

Schaffner ecosine harmonic filters represent an economical solution to the challenge of load-applied harmonics mitigation in 3-phase power systems. With a plug-and-play approach and more compact dimensions than comparable products, they can be quickly installed and easily commissioned. They increase the reliability and service life of electric installations.

Features and benefits
- The industry standard for 6-pulse rectifier and motor drives
- Help to comply with international Power Quality standards, e.g. IEEE519
- Economical, effective and reliable harmonic mitigation
- Filters for diode rectifier (with or without DC-link choke) and thyristor rectifier
- Best-in-class partial load performance
- Most compact design
- Plug and play, ready to use
- Available from 1.5HP to 500HP; parallel filters for larger ratings
- Open type and enclosed protection
Ecosine active harmonic filter

Active harmonic filters are intelligent power quality devices that continuously monitor the 3-phase line current and dynamically provide a precisely controlled current spectrum for real-time suppression of harmonic distortions created by non-linear loads. Operating at the Point of Common Coupling (PCC), they facilitate compliance with all international Power Quality standards, e.g. IEEE 519 or EN 61000-3-12 and local regulations.

Features and benefits
- Most effective harmonic mitigation up to the 50th order, parameter setting for even and odd harmonics
- Compact active harmonic filter for 3-phase loads with and without neutral wire
- THDi < 5%, achievable even on most complex mixed loads and at changing load profiles
- New modular design with intelligent system approach - to offer tailored solutions for different applications and customers
- 3-Level IGBT inverter topology for reduced power losses
- Extended temperature range of modules up to 50°C
- Ultra-fast and dynamic reactive power compensation (inductive and capacitive)
- Load balancing and unloading of neutral wires
- Available in 60A modules, up to 300A enclosed, with parallel capability for higher ratings

Output Filter

Whenever electricity is used to drive an equipment, in particular when a motor drive is controlling the speed of an electric motor, special attention for the noises generated by the motor drives need to be taken into considerations. Schaffner output filters help avoiding problems that can result in functional difficulties to very severe motor damage.

Features and benefits
- Converts the rectangular PWM output voltage of motor drives into a smooth sine wave with low residual ripple
- Eliminates premature motor damage caused by high dv/dt, overvoltage, cable ringing, motor overheating, and eddy current losses
- Motor frequency up to 200 Hz
- Extended motor cable length capability
- Complies with IEC 60034-17* and NEMA-MG1 requirements for general purpose motors
- Both sine wave and dv/dt filters offered up to 690 VAC
Power Quality solutions – more than just products
Schaffner is a unique market player, offering the whole power quality solution portfolio including line reactors, passive and active harmonic filters and output filters. This one-stop shop approach incorporates great opportunities for finding solutions with the best cost-benefit ratio for customers. A good example is the area of hybrid solutions applying 3-phase reactors or passive harmonic filters in combination with active harmonic filters.

Line Reactors

Line Reactors, operated on the line side of power drive systems, efficiently protect inverter electronics and DC link capacitors from inrush, peak and short-circuit currents. Additionally, low-frequency interference and harmonics are reduced significantly. In many cases, combining line reactors together with passive harmonic filters or active harmonic filters, we are able to provide a very optimized solution, technically and commercially.
Output components are used for motor protection and the improvement of system reliability, availability and functionality. Deployed at the output side of frequency inverters, these filters ensure reliable operation by avoiding expensive downtimes of installations, manufacturing plants, machinery and a vast array of other industrial and domestic motor drive applications due to premature motor damage. An appropriate output solution will even allow the deployment of unshielded motor cables, the use of multiple motors in parallel on the same drive or the retrofit of modern drives in existing installations with old motors and unshielded cabling.

Schaffner Power Quality products can be easily combined in one installation as customer tailored solution with best technical and economical fit, providing the most efficient harmonic mitigation and system reliability.
The challenges for consumers of electricity

Reliability and efficiency are assessed as being important to business operation. This includes reliable operation of machines, manufacturing systems and office equipment. In practice, this is often not the case, despite the use of UPS and back-up generators.

- Distribution lines and networks cannot be fully utilized
- High percentage of energy losses in the power lines
- Increased wear and limited system availability
- Downtime for equipment and systems

Power quality problems in the internal power network are often the reason. Measurements and network analysis can detect the root cause of the problem.

Whether for machinery, welding equipment, variable-frequency drives, or electric motors: Almost all non-linear consumers today can cause substantial voltage distortion.

Non-linear loads like three-phase diode bridge rectifiers cause harmonic distortion of the electricity supply system. This distortion results in currents in the systems, which are of higher magnitude than expected and contain harmonic frequency components. The amplitude of the resulting current is often under-estimated and can reach a level up to 140%, which tremendously loads the installed conductor. Furthermore, overcurrent protections which are typically rated close to the nominal current are prone to so-called nuisance tripping.
The cost of poor power quality

The benefit of investing in harmonic mitigation by installing Schaffner ecosine harmonic filters and reactors is more than just reducing harmonics. Current and voltage harmonics affect the correct operation of equipments sharing the same supply. This is only one – probably the most evident – of the many issues which harm the whole electric installation system.

- Quality has its cost, but poor quality has definitely a higher cost. If no measures against current harmonics are taken in a power system, the total power factor and system’s efficiency decrease, and the transformer and generator capacity are dramatically reduced.

- Financial consequences: Harmonics mitigation is considered to be expensive. The decision to ignore such issues in an early stage can potentially lead to a much more substantial cost impact and troubles such as: the capacity of electric installations may need to be upgraded; equipment fails prematurely; disturbances cause production downtime; Utility companies issue power quality violation penalties.

It is estimated* that power quality problems are causing costs of about 10 billion Euro per annum for industry and commerce in the EU while expenditure on preventive measures is less than 5% of this. Similar figures can be derived for other countries like the US and China.

(*European Copper Institute "The Cost of Poor Power Quality", available online)
Most electrical loads are non-linear

Harmonics are not generated by the utility
Electric utilities have to constantly deal with customer applications having problems due to harmonics. However, disturbances like electromagnetic interferences or harmonics are not attributable to the utility company, but to the users and the non-linear nature of their loads.

Most electrical loads do not behave like resistors
This means that a sinusoidal applied voltage, which is typically provided by the utility through the distribution transformers, does not yield to a resulting sinusoidal current. Only for resistive components, for instance resistive heating systems or incandescent-type illumination devices, voltage and current have proportional sinusoidal waveforms.

Non-linear loads as source of harmonic currents and voltages
Modern consumers of power, such as variable speed motor drives, switched-mode power supplies in home appliances or ballasts in fluorescent lamps contribute significantly to energy savings and to a more efficient use of electricity. However, they cause non-sinusoidal currents to be drawn from the grid.

Harmonic voltages
Harmonic currents which flow through the system impedances of transformers and reactors give rise to harmonic voltages. The distorted voltage will cause interferences and decrease the equipment lifetime, performance and reliability of other loads connected to the same grid.

Harmonics have a serious impact
Harmonics reduce the efficiency of a system. Harmonic currents overload electric installations, distribution transformers, breakers, fuses, conductors, etc. They cause overheating and premature system aging or make the increase of the electric system capacity necessary. Harmonics overload capacitor banks in reactive compensation systems and cause malfunctions of electronic controllers, disturbances in sensitive medical devices or crashes in communication networks.

No risk of system resonance through a patented solution
The impedance of the filter can theoretically resonate with the system’s natural inductance or the capacitance of an EMI filter (if installed). Schaffner ecosine filters are designed such that their first natural frequency is below that of any predominant harmonic. Furthermore, for ecosine passive harmonic filters a damper module reduces the amplitude of possible resonance, thus ensuring the system’s reliability and availability.
Schaffner’s broad product portfolio, along with its global infrastructure of sales and engineering offices, ensures the best power quality solutions for a wide range of applications. With our leading brand of ecosine active and passive harmonic filters as well as our line reactors and output filters, we offer the best fitted solutions to our partners and customers at point of connection, up- and downstream of variable speed drives.

“Wherever an inverter or motor drive is in use, Schaffner products are in use nearby.”
Compliance with IEEE-519 and other benefits

International power quality standards such as IEEE 519-2014, EN 61000-3-12, EN 50160, EN 12015, G5/4, AS 2279 or D.A.CH.CZ provide, among other requirements, distortion limits and recommend harmonics mitigation practices. IEEE 519-2014 is a widely recognized set of recommendations which include the maximum permissible current and voltage distortion values at the point of common coupling (PCC).

The distortion limit is given as function of the system loading, i.e. the relation between the maximum short circuit current (ISC) and the maximum demand load current (IL) at the PCC.

Ecosine harmonic filters (passive and active) and reactors once installed in the electric system will reduce the harmonics such that the requirements of most common international standards are met.

Schaffner ecosine filters and reactors unload lines and transformer upstream of the nonlinear load, e.g. a 3-phase diode bridge rectifier, hence reducing the system overall losses and operating temperature.

The problem of harmonics is properly solved by the use of Schaffner ecosine filters and reactors with the following benefits:

- Efficient mitigation of harmonic currents
- Compliance with IEEE 519 and other power quality standards
- Increased equipment operating lifetime, system reliability and availability in mission-critical applications
- Enhanced utilization of electric system capacity
- Power factor correction
- Load balancing and reactive power compensation
- Long-term savings in system operation and maintenance costs
- Fast and simple plug-and-play operation for new and existing installations
- Very compact, modular and light-weight filter concept; high power density
- Seamless integration with previously installed DC-link chokes or EMC/EMI filters

«Efficient energy usage and loss mitigation.»
Schaffer Power Quality Simulatur PQS is a Power Quality tool for planners, consultants and application engineers which allows the accurate modelling and simulation of low voltage 3-phase network topologies.

Its main features include:

- Simulation of power, current and voltage at all network nodes
- Support for the proper selection of harmonics mitigation technologies
- Sharing of projects with colleagues/partners by simply copying the URL link
- Verifying of compliance with selected power quality standards
- Simple and easy to use reporting features
- Particularly suitable for systems with variable speed drives
- Most accurate active and passive harmonic filter simulation models
- Generator model included
- Customer specific AC line chokes functionality
- Schaffner 18-pulse autotransformer – «Mitigator» included

Free download «Do not hesitate to log in and try»
http://pqs.schaffner.com/
Services and after-sales products

**Schaffner – more than just filters**

Schaffner ecosine standard filters are available for different supply networks throughout the world. They are UL listed, CE marked, and fulfill the requirements of the low voltage directive.

A broad selection of power, current, voltage and frequency ratings gives the user a flexible choice of filters and solutions.

**Schaffner is in the unique position of being able to support you with problem analysis, engineering advice, testing and measurement support and a worldwide customer service organization. Our goal is to ensure that you obtain the level of harmonics mitigation you actually need – guaranteed.**

**After-sales products and services**

In addition to the wide and flexible portfolio of Schaffner Power Quality products, Schaffner provides a variety of services and after-sales products and support. This goes from manufacturer’s warranty to extended warranty offers, health check and maintenance contracts.

Please contact your local Schaffner partner for comprehensive support. More information can also be obtained from the Schaffner website: [schaffner.com/service](http://schaffner.com/service)
Reliability and quality of power is a major concern for all industries, utilities and any kind of infrastructure segments including modern building technologies. Low equipment performance and premature aging along with breakdowns and poor power factor result in severe issues and wasted energy. As the leading experts for good power quality, Schaffner offers more than just products. We are partners to our valued customers and aim to improve power quality issues, while optimizing the energy usage and enabling compliance with local and international power quality standards. Our international teams of dedicated and well experienced engineers will support you to find the best fitted solution, based on a unique broad products portfolio. Solid application know-how goes along with leading simulation abilities, ensuring best functionality and customer satisfaction.

As we care for clean energy, we are your partner for a future with better shaped power.
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