



Power Quality Solutions
Fast Switching Capacitor System
– A German-based technology



MH Fast Switching Capacitor System

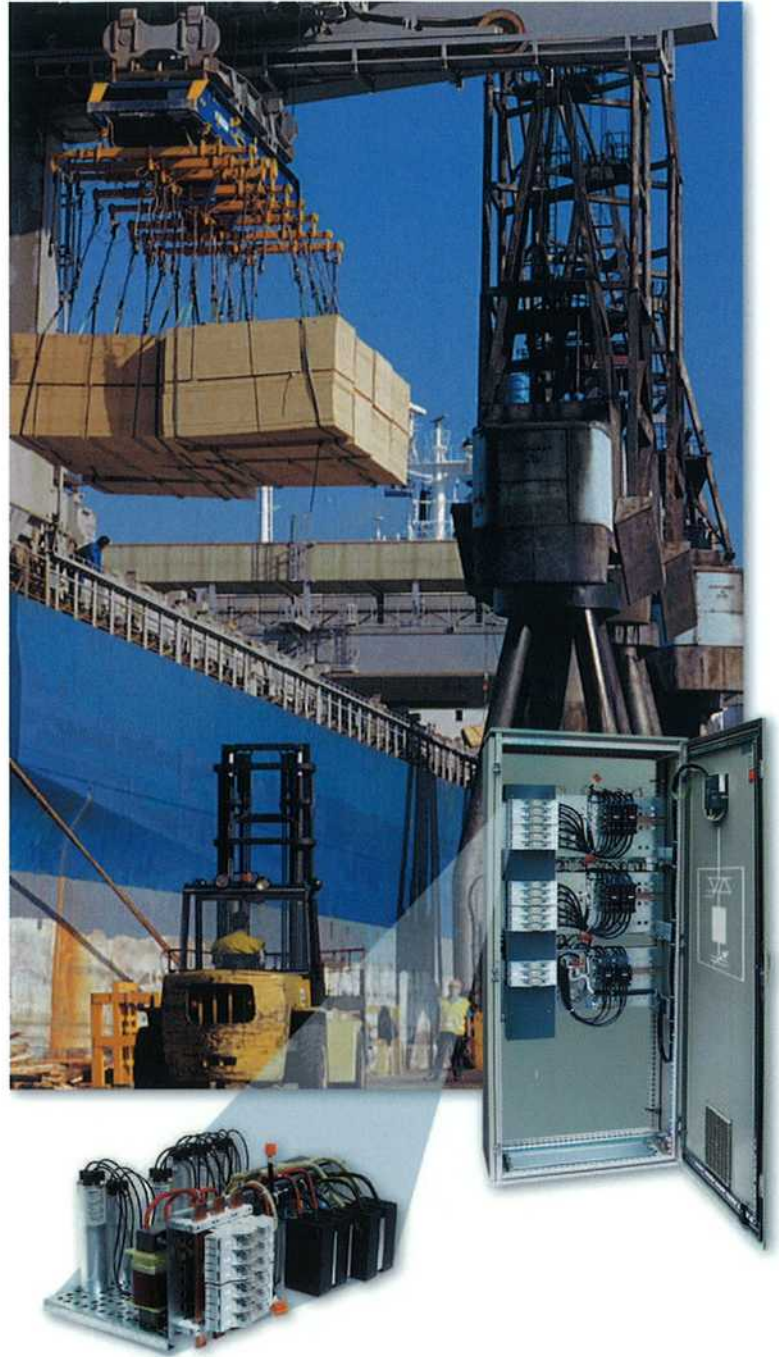
Conventional PFC systems are used to optimize the power factor, consequently improving the efficiency of the electrical networks. However, such solution based on electromechanically-switched capacitors may not be suitable for every application.

MH Fast Switching capacitor systems are used in applications with frequent high load fluctuations such as automotive systems, welding machines, wind turbines, presses, cranes, etc. In such cases, the conventional PFC systems are not fast enough to follow the load dynamics. The electromechanical contactors are also not designed for extensive switching cycles being susceptible to wear out thus raising concerns of safety risks.

The fast switching capacitor system overcomes these issues by replacing the slow-acting electromechanical contactors with electronic switches (thyristor modules). These switches do not deteriorate during the switching process and the capacitors are not adversely affected by transients, thereby increasing the life expectancy as compared to the electromechanical switched PFC systems.

The key features of **MH** Fast Switching Capacitor System include:

- Improved power quality, i.e. inrush currents of shunt capacitors are eliminated and harmful voltage transients are avoided
- Significant extension of PFC system life expectancy
- Enhanced safety
- Ultra fast control of power factor. This in turn avoids penalties and reduces system losses
- Voltage stabilization
- Maximized utilization of electrical distribution facilities (transformers, cables, switchgears, etc) due to peak load elimination

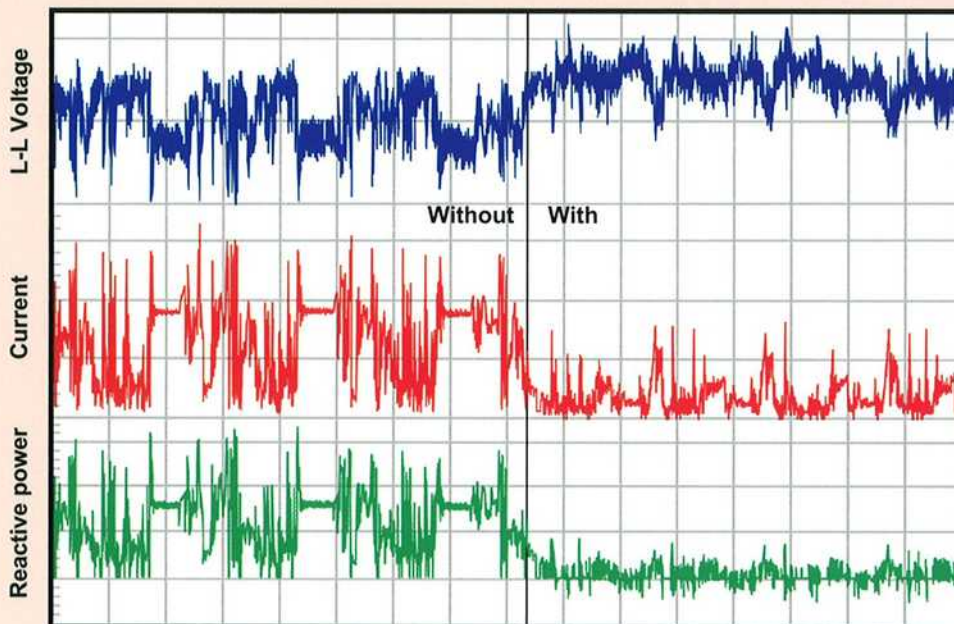
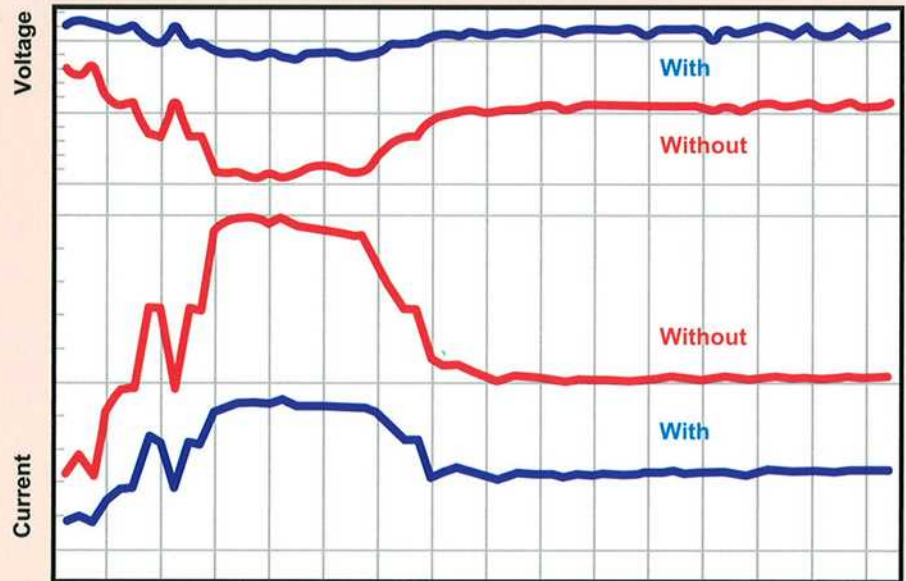


Applications

Motor Start-up

The high reactive power demand or very high current consumed during a motor start can lead to substantial voltage drops on both the low and high voltage sides of the transformer, which interfere with other loads, reducing initial torque and increasing start-up period.

MH Fast Switching tracks and fully compensates the reactive current, offering protection against voltage drops in the networks, eliminating load peaks and higher utilization of equipment through obtaining maximum torque during start-ups.



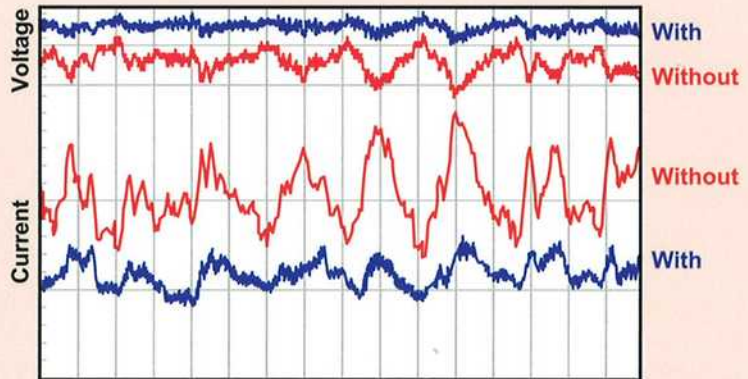
Harbour Crane

A typical complete cycle of crane operation is approximately one minute. During its period, the crane requires variable amounts of reactive power, fluctuating rapidly throughout its operating cycle.

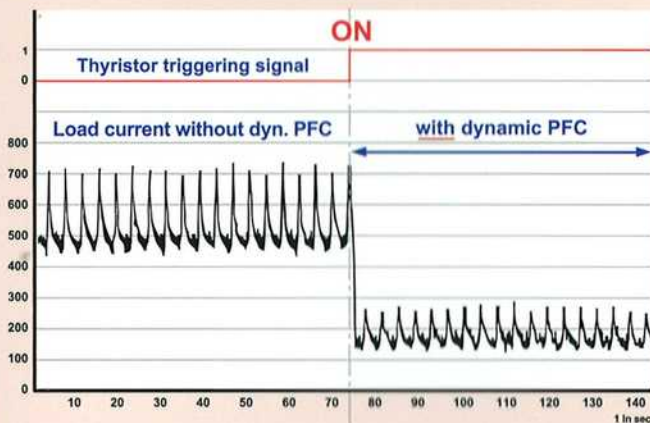
MH Fast Switching enhances the utilization of the distribution equipment through stabilizing the voltage levels, reducing the current and system losses and a lower investment cost due to reduced sizing of distribution equipment.

High-rise and Commercial Buildings (Lifts, Air-conditioning equipment and other rapid changing loads)

Lifts, air-conditioning equipment and other rapidly fluctuating loads in most high-rise and commercial buildings can create substantial load variations. This would require the application of fast switching systems with a fast reactive compensation and transient-free switching to eliminate spikes that are typically associated with conventional electromechanical switching.



MH Fast Switching improves the overall power quality through stabilizing the facility loads and enhances the life expectancy of sensitive equipment as well as to eliminate peak demand, which in turn translates to cost savings for customers.



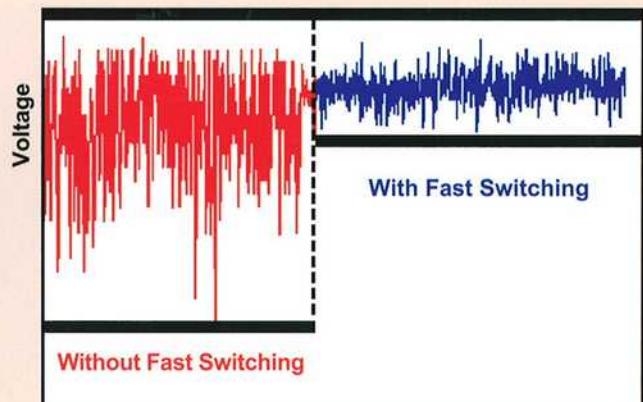
Electric Trains

Electric rail lines encompass long power distribution systems and extremely rapid load variations, creating substantial voltage drops and flicker. With **MH** Fast Switching, the network load capacities can be increased, minimizes system losses and maintenance costs as well as to stabilize the network power.

Welding Machines

Spot welders are extremely rapid fluctuating loads which draw large amounts of reactive power and very high currents. As a consequence, large voltage drops and voltage flickering are produced and these sags reduce weld quality and productivity due to longer process times.

MH Fast Switching tracks the reactive current and fully compensates it, thereby improving the weld quality and increase output yield. The existing power infrastructure can also be better utilized, thus reducing maintenance costs.



System Structure

MH Fast Switching system consists of capacitors, dynamic PFC controller, reactors and thyristor switching modules whereby the components are assembled in a cubicle with auxiliary apparatus, customized in accordance with the clients' requirements.



Low Voltage PFC Capacitors

MH Fast Switching system features VISHAY ESTA Low Voltage PFC capacitors that are designed to withstand 300 times the rated current, with a low loss of 0.25W/kVAR and a narrow capacitance tolerance of $\pm 5\%$. Tested and approved by UL and ULc, the capacitor incorporates a true 3-phase overpressure tear-off fuse to prevent the capacitor from bursting at the end of service life or inadmissible electrical or thermal overloads.



Dynamic PFC Controller

A 3-in-1 (PF controller-Multifunction Meter-Power Analyzer) dynamic PFC controller is suitable for use in both conventional and fast switching systems, and a hybrid operation is possible as well, i.e. 6 steps with contactors and 6 steps with thyristor modules. The controller incorporates relay outputs for ventilation control by means of programmable upper-lower limit as well as indication of a wide ranging system parameters. Equipped with a RS485 interface, the controller can be easily integrated into SCADA systems, power distribution communication network or programmable logic controller (PLC).



Thyristor Switching Module TSM-Series

With the thyristor module series TSM-LC and TSM-HV, we incorporate the key component – the state-of-the-art electronic switches for the fast switching system, which is capable of switching PFC capacitors within a few milliseconds, up to a capacity of 200kVar. The thyristor switches offer not only a fast response but also increases the life expectancy as they are not subject to mechanical wear. The module is also equipped with its own optimized cooling device, ensuring an adequate operating temperature.



Harmonic Filter Reactors

In applications whereby harmonics are present on the network, detuned filter circuit can be incorporated to the fast switching system. The detuned circuit of a serial connection of a capacitor and a reactor based on a designed resonant frequency, provides protection of the capacitors against high frequency currents and filtering properties.

The iron core reactors are manufactured under narrow tolerances. The reactors are constructed with a laminated low hysteresis losses iron core, precision controlled air gaps and copper windings, and have Class H insulation (180°C). Reactor design based on varying detuning factor is available upon request.





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