EPCOS APFC Panels

Modular, partly compartmentalized design with rack modules

EPCOS offers wide range of low voltage automatic power factor correction systems. The cutting edge comes from combining the superior technical capability, application engineering knowledge and understanding of power system with world class power capacitors and capacitor accessories. Leader in power capacitors and capacitor accessories now offers custom built and standardized low voltage automatic power factor correction panels of various ratings, configurations and features to suit every application requirement.

The superiority of the panels are rooted on the world class power capacitors and capacitor's accessories combined with unmatched technical capability in application engineering, power system analysis and design. EPCOS offers a wide range of customized solution to meet every need. Wide choice of capacitors (MPP Resinol filled, MPP gas impregnated, APP – Oil impregnated), high quality Detuning / Antiresonance reactors with highest linearity (5.67%, 6%, 7% and 14%) with appropriate switching devices (capacitor duty contactors or thyristor switching modules),state-of-the-art controllers (4 steps to16 steps) with advanced control, monitoring and protection features, data logging and communication facilities including GSM, housed in well-engineered powder coated CRCA enclosure makes EPCOS APFC panels the preferred choice of power factor improvement solution for every need.

Some of the special features of our APFC Panels are:

- Superior technology combined with application know how.
- Compact and thermally validated design.
- Complete system type tested upto assembly level
- Ease of maintenance.
- Sophisticated integrated modules built in.
- Appropriate selection of components and capacitors.
- Modularity.

In order to meet specific customer requirement EPCOS offers wide selection of APFC configurations with high degree of customization.

- Panel Shell configuration – Standard
  Non Compartmentalized, Modular
  Partly compartmentalized, Fully compartmentalized.
- Painting – Powder Coating or Liquid coating.
- Installation – Indoor or Outdoor.
- Ingress Protection Class – IP2X … IP5X.

Contactor Switched Panels

Capacitor duty contactor

Standard panel, Switchgear compartment separated from Capacitor + reactor compartment.

Modular, partly compartmentalized design with rack modules, contactor switched

EPCOS contactor switched panels are built with special capacitor switching contactors. Capacitor duty contactors have additional auxiliary contacts with current limiting resistors (also called pre charging resistors) in series with it. The inrush current is limited by these auxiliary contacts coming on first and then the main contacts takes over the steady state current of the capacitors.

Use of capacitor duty contactors enhances the life of capacitors as well as that of the complete system and also limits the system transients thus improving power quality.

For special applications and for system voltages higher than 480V, we offer APFC Panels suitable for operation up to 690V.

Contactor switched APFC panels are more suited for slow varying load or intermittent constant loads. These are available with current limiting or detuned harmonic filter reactors. Apart from the controllers these are built with indicating panel meters as well as with step ON-OFF indications. With the given site conditions or load these can be made custom built as well.

The Range of Contactor switched APFC panels

- Voltage – 230V to 690V.
- KVAr – 7 KVAr to 1000 KVAr.
- Steps – 4 to 16 steps.
- Panel Type – Standard, Semi-compartmentalized and Modular.
- Other type of panels with special feature of GSM, remote control monitoring, special dust protection, chemical industry, humid atmosphere are also available on request.

Standard or non-compartmentalized design

Thyristor Switched Panels

Thyristor switched module

Modular, partly compartmentalized design with thyristor switched, front open view

EPCOS thyristor switched APFC panels are built with world class EPCOS thyristor switching modules (TSM). These modules are very effective in eliminating the inrush current of capacitors. They are controlled switching devices which can be made to switch on when the voltage across the thyristor is zero, thereby eliminating the inrush current. Additionally, thyristor switching is used when the load variation is rapid as in the case of cranes, lifts, spot welding, plastic extrusion etc. These static switches have a very high speed and thus are ideal for compensating dynamic loads. Since there are no moving parts, the switching life is very high compared to contactors.EPCOS offers high performance thyristor switching modules for system voltages from 380V to 690V. These modules are natural cooled and are highly reliable and are very compact. The power electronic devices used have a rated PIV of 2200V, one of the highest in its class, thus enhancing the reliability of the module. TSM is used with accessories such as 1% (di/dt limiting reactor) and EW22 (quick discharge resistor) to enhance the performance of the system.

Thyristor switched APFC panels are more suited for compensation of fast varying loads such as elevators, cranes, welding, rolling mill loads. These are available with current limiting or detuned harmonic filter reactors. The self diagnostic and natural cooled feature of TSM based panels makes it unique and suitable with very arduous conditions of the loads .

The range of thyristor switched APFC panels

- Voltage – 230V to 690V.
- Phase – 1Ph or 3 Ph.
- KVAr – 7KVAr to 1000 KVAr.
- Steps – 4 to 16 steps. •

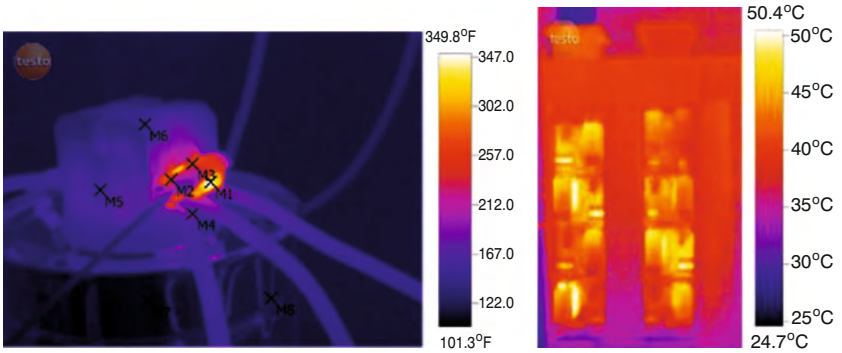
Panel Type – Standard, Semi-compartmentalized and Modular.

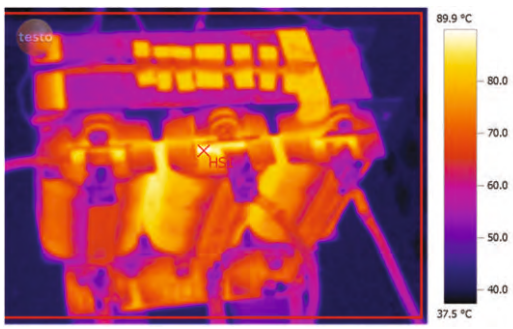
Other type of panels with special feature of GSM, remote control monitoring, special dust protection, chemical industry, humid atmosphere or individual phase corrections are also available on request.

Distinguishing Aspects of EPCOS APFC Panels

- Three Level Testing
  - Component level testing.
  - Sub-assembly level testing.
  - Complete Panel testing.
- Routine and Type tested Capacitor Units.
- Routine and Type tested Damping. and Detuning reactors.
- Routine and Type tested Capacitor Switching Contactors.
- Routine and Type tested Thyristor switching modules.
- Routine and Type tested Advanced APFC Controllers.
- Routine and Type tested Capacitor Rack Modules.
- Individual feeder sub-assembly in the form of Capacitor Rack modules is built with the appropriate choice of protection of properly sized and chosen high speed fuses / MCCB for protection of Thyristor Switched Module based on the i^2t characteristics of the Semiconductor Device.
- The Rack module is Type tested and Design Registered with Registration No.235974 dated 05/04/2011 and 235250 dated 15/03/2011.
- The Capacitor Rack Module is fitted with roller wheels which facilitates easy assembly and disassembly in the event of a need for Service.
- One could maintain minimal stock of the Standard Rack Module to ensure that there is no loss of PF improvement in the event of Service need for any particular feeder.
- Panels are well validated for an effective thermal design w.r.t. appropriate placement of heat generating components and to facilitate air flow in a manner in which heat evacuation is effective
- The complete APFC panel is also Type tested for some special tests beyond the stated requirements of IS 8623 and IEC 61921.
- Unique, unparalleled in-house test facility for full power testing of APFC Panel to a Rated Voltage up to and including 690V and Rated power up to and including 500 KVAr.
- Facility to inject harmonics, used for validating the performance of critical components viz., capacitors and reactors to almost site-like conditions.
- Facility to do thermal mapping, used for validating first designs over and above the theoretical validation.

Thermal Mapping





Active Harmonic Generator

List of Testing Facilities:

Unique, unparalleled in-house test facility for full power testing of APFC Panel to a Rated Voltage up to and including 690V and Rated power up to and including 500 KVAr

List of standard equipments:

- Autotransformer (0-440V) and 0-800Amps.
- Autotransformer (0-690V) and 0-500Amps.
- Power Analyser (Fluke and Hioki).
- 5 kV High voltage Testing.
- YOKOGOWA Digital Power meter for watt-loss.
- MEGGER Digital Insulation test meter.
- True RMS Clamp Meter.
- 32 Channel Temperature rise sensor and monitor.
- Digital Coating thickness meter.
- Active Harmonic generator and current injection.
- 500 KVAr APFC panel functional test facility.
- TESTO Thermal imaging Camera.
- TESTO Airflow meter.

List of standard routine tests:

- Visual and dimensional checks.
- Verification of BOM.
- Wiring and harnessing check.
- IR test (megger).
- HV test
- Functionality test in auto and manual mode.
- Output KVAr / Capacitance check.
- Verification of functioning of controller, meters and CT's.

First of its kind temperature chamber of 3m x 3m x 7m where APFC panels can be loaded and tested by maintaining required ambient temperature between 45° C to 55° C

Specifications for APFC Panels

Rated voltage	: 380 / 400 / 415 / 440 / 690 V*.
Rated frequency	: 50 / 60 Hz.
Rated output	: 8 - 1000 KVAr* (other ratings from 1000 - 2000 KVAr are available on request).
Configuration	: Delta / Star floating / Star grounded.
Number of steps	: 1 – 16.
Step distribution	: Equal / Binary / unequal.
Detuning reactor	: 0.2%, 1%, 5.67%, 6%, 7%, 14%.
Reactor winding	: Copper / Aluminum strip / Aluminum foil.
Switching device	: Thyristor switched modules / Capacitor duty contactor.
Panel type	: Standard / Modular – Partly compartmentalized / Compartmentalized.
Branch protection	: HRC fuse / High speed fuse for Semiconductor device (TSM) protection / SFU / MCCB.
Capacitors	: Resin filled / Gas impregnated / APP – Oil impregnated.
Protections	: OV / UV / SC / EF / OT.
Controller	: i) BR 4000 / BR 6000 series for single CT sensing application (balanced load). ii) BR 5000 / BR 7000 series for three CT sensing application with RS485 communication as a Standard feature (unbalanced load).
Measuring CT	: 1 for BR 4000 and BR 6000 series.
	: 3 for BR 5000 and BR 7000 series.
Data logging	: Through controller internal memory in BR 5000 series.
Ingress protection	: IP2X ... IP5X.
Power analyzer	: Optional.
Other unique optional features	: i) Facility of Master / Slave. ii) Facility of Fan failure monitoring. iii) Facility to operate the Panel on Utility supply and Generator supply with different 'target PF' settings. iv) Facility to send hourly Data by GSM to a designated Base station. v) Facility to program key data on the PF Controller through GSM. vi) Facility to receive SMS for designated fault situations. vii) Facility of incorporating a Smoke Detector in the Panel and tripping the main Supply in the event of Smoke detection. viii) Facility of operating Panels on either side of a bus-coupler independently or with the bus coupled. ix) APFC Panels for Outdoor application available. x) APFC Panels for highly corrosive environments available. xi) APFC Panels for Outdoor application used for Distribution Transformer compensation in Utilities with many unique features such as 100 days of Data logging, Neutral fault detection and other multiple fault detection and protection.

* Other Ratings available on request.

Type Test Reports

APFC Panels

Contactor switched APFC Panel


CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Thyristor Switched APFC panel


CENTRAL POWER RESEARCH INSTITUTE

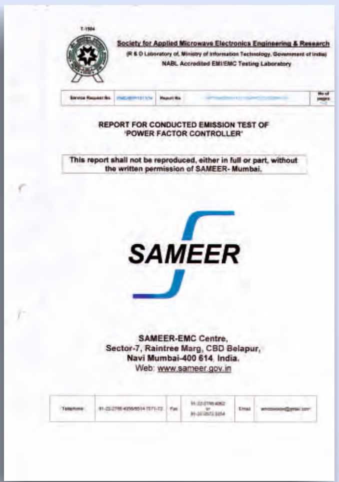
TEST REPORT

Capacitor Rack Module


ELECTRICAL RESEARCH AND DEVELOPMENT ASSOCIATION

TEST REPORT

Power Factor Controller – EMI and EMC


Society for Applied Microwave Electronics Engineering & Research

REPORT FOR CONDUCTED EMISSION TEST OF 'POWER FACTOR CONTROLLER'

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TEST REPORT FOR 'POWER FACTOR CONTROLLER'

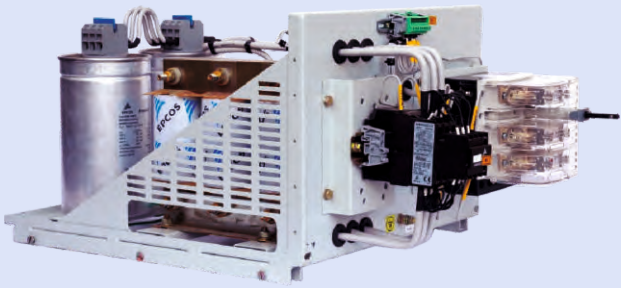
Types of Capacitor Rack Modules

We offer APFC Panels with PFC modules which are ready to assemble in a modular system with various options. These can be quickly assembled into APFC panels in a very short time thus offering a fast response and shortest delivery time.

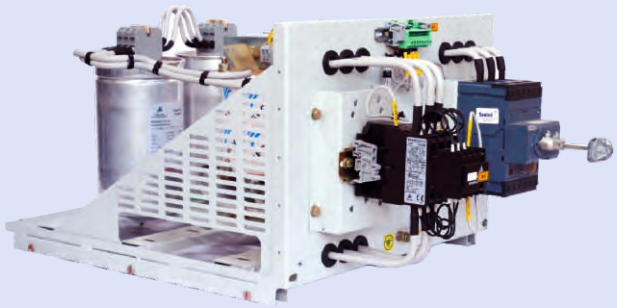
Range of capacitor rack modules include:

1. Rating : 5, 10, 12.5, 25, 50 KVAr.
2. Rated voltage : 415 or 440 V.
3. Capacitors : MPP (SH) resin filled or gas impregnated.
4. Switching device : Capacitor duty contactor or thyristor switched module
5. Series reactor : 0.2%, 1%, 5.67%, 7%.

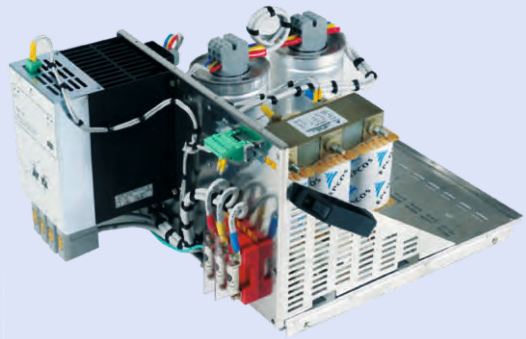
Rack Module with Contactor switching and SFU protection



Rack Module with Contactor switching and MCCB protection



Rack Module with Thyristor switching and High speed fuse protection



Rack Module with Thyristor switching and Isolator+High speed fuse protection