POWER FACTOR CORRECTION

FUSECO

- No Capacitor Banks
- Wall Mounting Solutions
- Load Balancing
- Dynamic Step-less Compensation

Static VAr Generators (SVG)

The Sinexcel SVG represents the latest generation technology in the power factor correction field. It operates by detecting the load current on a real-time basis through an external CT (current transformer) and determining the reactive content of the load current. The data is analysed and the SVG's controller drives the internal IGBT's by using PWM signals to make the inverter produce the exact reverse reactive current of the corresponding load reactive content which is injected into the grid.

Key Features:

- **Excellent power factor correction performance**
  Can maintain a PF of 0.99 lagging or unity if required.
- **Compensates both inductive and capacitive loads**
  Corrects lagging and leading power factor.
- **Dynamic step-less compensation**
  Profiles the load and operates with a response speed of <15ms. No possibility of over-compensation or under-compensation, will only inject the kVAr that is needed in that moment.
- **Corrects load imbalance**
- **Not affected by resonance**
- **Wall-mount & Rack-mount versions available**
- **SPC outdoor units available with WiFi connectivity**
- **Can operate at low voltages**
- **Can be used with existing PFC systems**
- **Modular design**
- **Ease of installation and commissioning ('Plug and Play')**
- **User-friendly interface and monitoring**
- **Available in 690V**

Sinexcel Static VAr Generator (SVG)

50kVAr Solutions

▲ 50kVAr Rack-Mounted SVG
500W x 510D x 190H (mm)
Weight: 35kg

▲ 50kVAr Wall-Mounted SVG
500W x 192D x 560H (mm)
Weight: 35kg

100kVAr Solutions

▲ 100kVAr Rack-Mounted SVG
500W x 520D x 270H (mm)
Weight: 48kg

▲ 100kVAr Wall-Mounted SVG
505W x 286D x 557H (mm)
Weight: 48kg

Cabinet Solutions

▲ Standard Cabinet - up to
500kVAr capacity possible

Outdoor Applications

Sinexcel SPC

- **The SPC is a SVG designed for outdoor applications**
- **IP44 enclosure**
- **WiFi Connectivity**
  Access & control settings, performance parameters and real time information via WiFi interface.
- **Available in 50kVAr and 100kVAr versions**
- **Pole, wall or floor-mount versions available**
- **Can be parallel connected so larger capacities can be obtained**
- **Can be used with existing PFC systems**

▲ 50kVAr SPC unit
935W x 262D x 1081H (mm)
Weight: 72kg

▲ 100kVAr SPC unit
935W x 521D x 1120H (mm)
Weight: 135kg

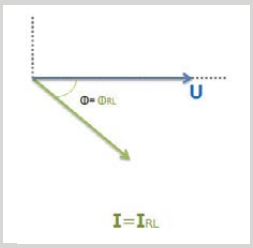
Comparing SVG with Switched Capacitor Systems

Comparison between a commonly used capacitor type system and the latest generation power factor correction technology from Sinexcel (SVG)

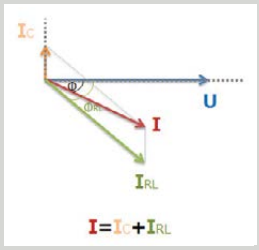
Switched Capacitor PFC systems

The system detects the load current on a real-time basis through an external CT and determines the reactive content of the load current. The data is analysed and the system's controller switches in the required amount of reactive current in steps, depending on the amount of reactive current available to it in that moment from the capacitor bank.

Before compensation



After compensation



Traditional PFC systems use capacitors in groups. Their output current is in fixed steps (50kVAr, 25kVAr, 12.5kVAr, 6.25kVAr) which usually leads to over or under-compensation.

Capacitor bank style PFC systems take at least 20ms – 40s to perform compensation depending upon whether the switching is done via a solid state switch or a contactor.

Traditional PFC systems are affected by resonance, which is detrimental to the capacitors. To lower the risk, de-tuning reactors are introduced into the circuit to lower the resonant frequency below that of the lowest harmonic in the circuit.

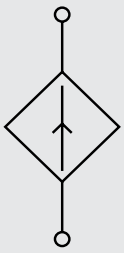
Capacitor bank style PFC systems can only compensate for inductive loads.

Capacitor output is subject to the voltage of the grid, so if the grid voltage is low the output of the capacitors will be low, resulting in a decline in available compensating capacity, under-compensation and possible fault conditions.

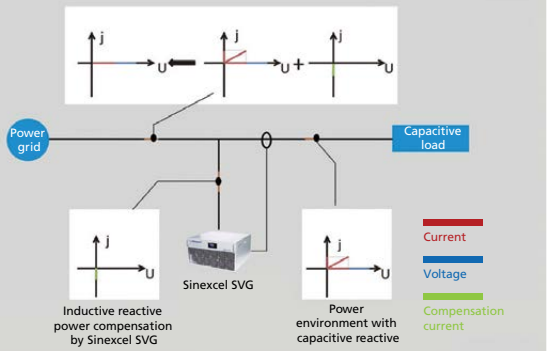
To better suit the changing dynamics of the load a traditional capacitor type PFC system needs to be oversized and to have a greater number of smaller steps to better suit the application. This increases the cost significantly.

SVG

The SVG detects the load current on a real-time basis through an external CT and determines the reactive content of the load current. The data is analysed and the SVG's controller drives the internal IGBT's by using PWM signals to make the inverter produce the exact reverse reactive current of the corresponding load reactive current.



Capacitive reactive power compensation by Sinexcel SVG (vector graph)
PF=0.99 after reactive power compensation by Sinexcel SVG



The SVG performs as a controlled current source, thus obtaining a power factor of 0.99 lagging whilst avoiding over-compensation and under-compensation.

The complete response time of the SVG is less than 15ms and the dynamic response time is less than 50µs. The SVG can track the dynamics of the load and compensate accordingly in almost real-time.

The capacitance of the SVG does not require the installation of a de-tuning reactor. Performing as a current source and an active compensation device the SVG has been designed to not be affected by resonance.

The SVG can correct both a lagging and a leading power factor, as well as work with a traditional capacitor type PFC system to eliminate over and under compensation.

Designed with an active compensation circuit. Therefore the voltage of the grid has little influence on the compensation capacity. The output of reactive current matches the working conditions even when the voltage of the power grid is low.

The compensation capacity of the SVG is the same as the installed capacity. Therefore for a given compensation effect, the capacity of the SVG may be 20% - 30% less than that of a standard capacitor type PFC System.

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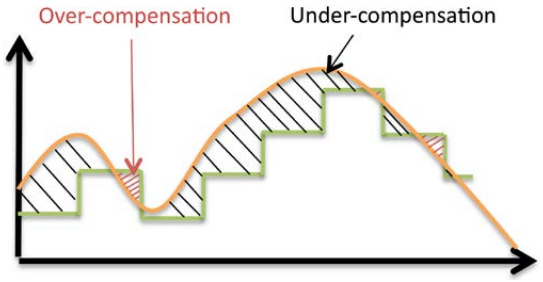
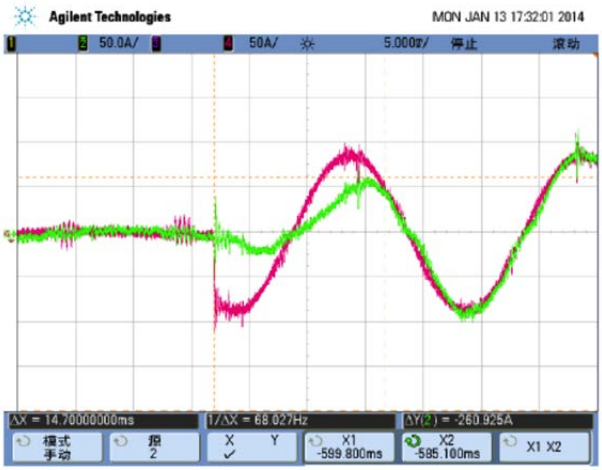
Advanced Performance

Dynamic Step-Less Compensation

- Profiles the load and operates with a response speed of <15ms
- Dynamic reaction time is less than 50µs
- No possibility of over-compensation or under-compensation
- Only injects the kVAr that is needed in that moment



Traditional capacitor type PFC systems take 20ms-40s to respond to a change in load. Their delay combined with the stepped response performance means that they are perpetually over or under compensating.

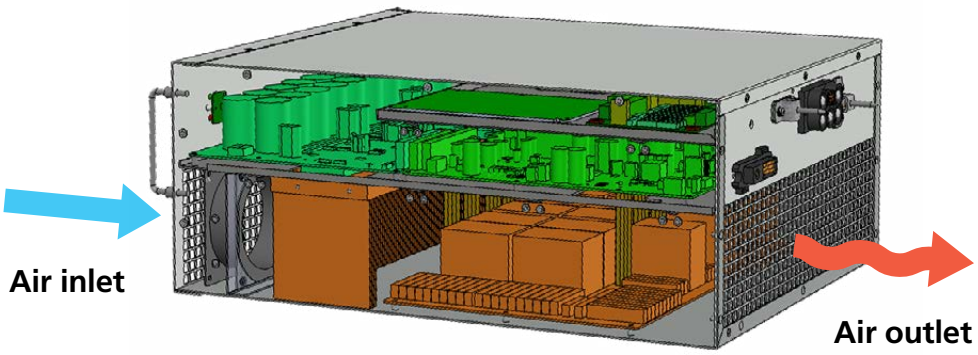


SVG Reaction Time <50µs, response time < 15ms

The Sinexcel recalculates the required load accurately and quickly. The IGBT technology switches with high speed, quickly matching the load requirement.

Designed for Efficiency & Minimal Maintenance

- Minimises dust ingress.
- Electronic components separated from heat producing components and housed in their own sealed compartment, resulting in greater protection from the effects of heat and dust ingress.
- Optimum heat dissipation.
- Heat sinks, IGBT's, inductors and other heat producing components housed in a separate compartment optimised for efficient ventilation and cooling.



Advanced Performance

Excellent Power Factor Correction Performance

- Can maintain a PF of 0.99 lagging or unity if required

Compensates both Inductive and Capacitive Loads

- Corrects lagging and leading power factor (-1 to +1)

Eliminating the Weakest Link – The Switched Capacitors

- The new method of PFC from Sinexcel takes away the most vulnerable and weakest link in a traditional PFC system – the switched capacitors. Various environmental conditions (eg. excessive temperature, over-voltage, harmonic distortion) may cause capacitors to rupture and ignite.
- The average life span of a switched capacitor is heavily dependent on the ambient temperature in which it is operated – requiring careful selection with respect to permissible operating temperature range. These temperature limits work well in colder climates but may not necessarily work well in Australia. The new generation technology in the SVG eliminates the operational limitations, safety concerns, space demands and life span issues of capacitor banks.

Operates in all 3 Phases

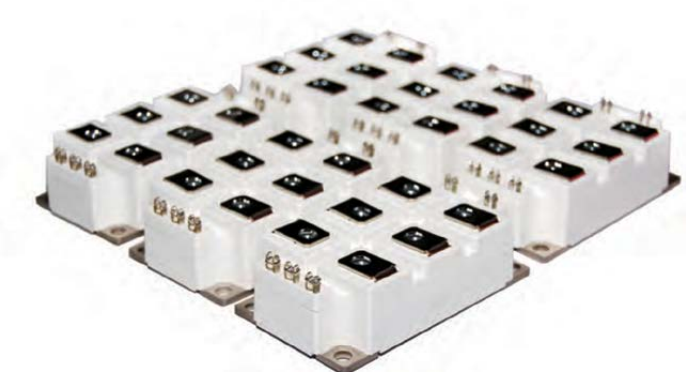
- A traditional switched capacitor type PFC system measures one phase and provides stepped kVAr compensation only to that phase, irrespective of what the other two phases need.
- The Sinexcel SVG measures and provides dynamic kVAr compensation throughout all three phases.

Greater Longevity

- With traditional capacitor systems, when smaller steps are needed for fine adjustment, the space required for either 6.25kVAr or 50kVAr steps is the same. The other disadvantage for having a small step for fine adjustment is that it gets over used (frequently switched). The PFC controller uses an algorithm that evenly distributes the work load amongst the available steps except when one or two of those steps are of a smaller capacity. This brings into play the actual useable lifetime of the components used, for example the life of the contactor!

Not Affected by Resonance

- The Sinexcel system is not susceptible to existing harmonics and therefore does not need a blocking reactor and is unaffected by resonance whereas for the traditional PFC system this is very much a problem.



Corrects Load Imbalance

Can Operate at Low Voltages