smARTvar®
Dynamic VAR Compensator
THE CHALLENGE: MATCHING REACTIVE COMPENSATION TO LOAD DEMAND

Dynamic VAR compensation uses ultra-fast switching techniques to insert and remove capacitive reactance (the internal resistance of a capacitor) as demanded by highly dynamic loads. Many electrical loads have very rapid requirements for reactance that can't be satisfied with traditional automatic (electro-mechanical contactor) switching methods. These highly dynamic requirements for reactive power can only be satisfied with rapid switching technologies that match VAR compensation to load demand.

THE SMARTVAR® SOLUTION:

DYNAMIC VAR COMPENSATION

Arteche offers a complete range of state-of-the-art switching products to provide rapid power compensation, harmonic filtering, and voltage support. In addition to our broad line of standard products, we can customize a system to meet your precise needs.

THE FASTEST VAR SWITCHING CAPABILITY

Using power switching modules, smARTvar® adds capacitance to power systems at zero voltage cross points to prevent switching transients. Use smARTvar® to insert capacitance into a system in less than 16 or 80ms (60Hz) of sensing the need for reactive compensation.

ACHIEVE DYNAMIC VAR COMPENSATION

Through the use of power electronic techniques, smARTvar® adds capacitance to power systems within sub-cycle times to prevent switching transients and:

- Stabilize your facility’s voltage
- Reduce your facility’s voltage drops
- Improve the efficiency of your electrical system
- Minimize harmonic distortion
- Maximize your power factor
- Substantially reduce flicker
- Release capacity within your facility’s system

CUSTOMIZED smARTvar® SOLUTIONS FOR YOUR FACILITY

INCREASE ENERGY POTENTIAL

When reactive power compensation is needed, in other words Power Factor correction is needed, the fastest possible VAR switching capability is offered by smARTvar® from Arteche PQ. Adequate VAR compensation enables users to free capacity from existing power sources, saving the costs associated with downtime and investment in new power sources.

Sub-Cycle Switching

Insert capacitance onto a system in less than 16 or 80ms (60Hz) of sensing the need for reactive compensation.

AVAILABLE IN MEDIUM AND LOW VOLTAGE RATINGS

Systems may be ordered and installed on either low voltage (690 volts or less) or medium voltage (up to 69 kV Class) power systems. Low voltage systems are designed for direct connection to the power system, whereas medium voltage systems utilize an interposing step-up transformer.

REDUCE COST AND COMPLEXITY

Medium voltage smARTvar® solutions utilize low voltage power electronics with conventional cooling methods to reduce complexity, minimize costs, and ensure easy installation and maintenance.

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THE smARTvar® SYSTEM

RELIABLE PERFORMANCE WITH INDUSTRY PROVEN COMPONENTRY

Rapid switching devices act upon a switching command given by our smARTvar® controller. It rapidly switches VARs into or out of the system... as demanded by your loads.

The smARTvar® controller
The Brain Behind smARTvar®
• Fully adjustable from 100 ms to sub-cycle reaction speeds.
• Rapid sensing and rapid acting controller with LCD graphic display.
• Makes 7,600 calculations per second to determine reactive power demand.
• Can control up to 12 capacitor banks.

The smARTvar® Switch
Our Rapid Responder
• Responds to rapid load changes.
• Power switching modules provide transient-free switching of capacitors.
• Fast acting power switching-modules insert and remove capacitance in as little as 16 or 80ms (60Hz).

The smARTvar® controller
The Heart of the smARTvar® System
• Designed for rigorous applications, including harmonic rich environments.
• Industry’s longest life expectancy; physical construction minimizes element heating.
• 85°C C-rated capacitors offer more than 1,000,000 hours of life expectancy in a 40°C ambient.

Note: Specifications for 3ph Capacitors may vary.

Reactors
For Tuned and Detuned Systems
• Detuning the capacitor network to block harmonics.
• Tuning to avoid power system resonance.

K-Rated Transformers
For Medium Voltage Systems
• High performance dry-type transformers specially constructed for rapidly switching system applications.
• Liquid-cooled or air-cooled depending on service voltage and application needs.

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Application Specifications
Product Specifications

Power Systems: 3-phase, 3 wire
Frequency: 60Hz or 50Hz
System Voltage: LOW Voltage: 208, 240, 380, 400, 415, 480, 600 or 690VAC
MEDIUM Voltage: 2.4, 4.16, 7.2, 13.8, 23, 38, and up to 69kV Class
Auxiliary Power: 110 to 230VAC, 50/60Hz (consumes less than 50 watts)
Connection: LOW Voltage: Direct connection to system
MEDIUM Voltage: Interposing step up transformer
VAR Capacity: Unlimited
VARS / switch: 25 to 150 kVARs per switch
Response time: 100 m-sec to sub-cycle (adjustable)
Switch legs: 2 (switches 2 out of 3 phases, no neutral connections)
Enclosures: Type 1, Type 3R, Type 12 (others upon request)
Temperature: Storage: -30°C to 60°C
Operating: 0°C to 40°C
Altitude: 2000 meters
Standards: Complies with NEMA, ANSI, UL, CUL, IEC.

Capacitor Specifications
Temp. capability: -40°C min to +85°C Cmax
Capacitor Life: >1,000,000 hours at 40°C C operating temp
Agency Approval: Meets or exceeds UL, CE standards

Note: Specifications for 3ph Capacitors may vary.

APPLICATIONS
The Arteche smARTvar® can be used in a wide range of applications where either ultra-fast reactive power compensation is required or where capacitor switching transients need to be eliminated due to the installation of sensitive equipment. The combination of ultra-fast response and transient-free switching offers a unique solution to improve voltage regulation and possibly reduce flicker.

Wind Power
Industrial Manufacturing
Energy/Oil/Gas
Spot Welding
Medical Centers
Shipyard Cranes & Hoists
Data Centers
Mining
Shredders & Crushers
Inductive Heating
Amusement & Theme Parks

Arc Furnaces
Injection Molding & Extruders
Transit & Traction, and Elevators
Laser Cutting
Commercial High Rise Buildings
Large Induction Motors (In-rush)
VAR COMPENSATION
THE MOST COST-EFFECTIVE SOLUTION TO DYNAMIC VAR COMPENSATION

Time proven technology and components help you adapt to the specific needs of your demanding applications:
- High performance low voltage controls, switches, and capacitor cells
- Easily adapts to medium voltage applications with step up transformers

MORE LOADS WITH LESS COST AND LESS DOWNTIME
By inserting and removing capacitive reactance from the system (as demanded by dynamic loads), smARTvar® supplies leading VARs exactly when needed. Rapid switching devices and soft switching technology rapidly insert or remove capacitive reactance from your system, and does so without switching transients. VAR compensation enables users to add more loads to existing power sources... saving the costs and reducing downtime associated with equipment and power source upgrades.

HIGHER ENERGY EFFICIENCY AND VOLTAGE STABILITY
By using smARTvar® to control VARs, you can reduce energy flows between the source and the smARTvar® connection point, resulting in higher energy efficiency and voltage stability. In cases where energy charges increase with lower power factor, you can reduce electricity costs.

MAINTAINS TARGETED POWER FACTOR
Using smARTvar® helps sense a need for reactive VARs in an application and completes the switching of capacitive elements in sub-cycle times. The controller calculates the VAR requirements and switches the appropriate steps of capacitance to maintain the targeted power factor.

PROVIDE THE VARS NEEDED BY INDUCTIVE LOADS WITH smARTvar®
- Local injection of VARs eliminates dependence on VARs from utility or generator
- Reduces your VAR demand, energy consumption, and peak demand
- Eliminate power factor penalties
- Increase KVA available from your existing power sources

INDUCTIVE LOADS DEMAND REACTIVE VARs
- Inductive VARs are non-productive and waste energy
- Inductive VAR demand can fluctuate with various load conditions
- VARs are in addition to KW supplied by utility
- Inductive VARs increase total KVA demanded from power source
- VARs increase energy consumption
- Inductive VAR consumption may increase your electricity costs

HARMONIC MITIGATION
REACTIVE COMPENSATION AND HARMONIC FILTERING TO PACIFY OFFENDING TYPE LOADS.

When dynamic loads are controlled by thyristors, diodes, or SCRs (Silicone Controlled Rectifiers), the input current waveforms (voltage and current) may become highly distorted. In addition to having high reactive demand, the rectifiers may cause significant harmonic distortion of the electrical power system.

The natural operation of a thyristor or SCR causes voltage notching, which often results in multiple zero crossings of the voltage waveform. Voltage notching represents voltage distortion and can give false signals to equipment that is zero cross sensitive.

Harmonic voltage distortion affects the entire power supply bus. It can cause:
- malfunctions
- premature or catastrophic equipment failure
- overheating
- mis-operation of other equipment
- lower productivity and increased downtime

Loads that generate distortion in multiple frequencies (e.g., 180Hz, 300 Hz, 420Hz, etc.), turn the system into a voltage source at each of those frequencies for any other linear load. Current in harmonic frequencies results in higher copper and iron losses.

A smARTvar® SOLUTION CUSTOMIZED FOR YOU
You can configure smARTvar® into a hybrid form to provide a combination of fixed and switched compensation. This is especially useful for large motors where steady state power factor needs to be corrected and additional leading VARs are required during inrush. The smARTvar® can also be configured to include active filters.

Copper losses increase when harmonic currents flow through electrical systems and equipment. Certain iron losses will also increase based on the square of the frequency.
POWER FACTOR IMPROVEMENT
Are you paying for low power factor without knowing it?

Many electric utilities throughout the world charge premium prices to customers whose facility power factor drops below a specified threshold (often 0.95, 0.90, or 0.85 PF). In some cases, power companies pay rebates to customers if PF is higher than a specified level.

Utility invoices don’t always itemize the charges for power factor but may bill on an adjusted KW, adjusted KVA, or on a total KVA basis. These and other methods disguise the fact that customers are actually paying higher prices due to their actual power factor. Customers pay the electric bill without the knowledge that, if they improve their power factor, a lower price may be available.

IMPROVE YOUR FACILITIES
POWER FACTOR FOR LOWER ENERGY COSTS
When you improve your power factor, your facility:
• reduces KVA and current demand
• reduces system losses
• improves voltage
• allows the addition of more equipment (loads) to your existing transformers

Proper consideration of power factor issues can lead to energy cost savings and improved life cycles of installed electrical equipment. Power factor improvement products may realize a full payback in less than one year.

A smARTVar® SOLUTION
CUSTOMIZED FOR YOU
PF charges may be based on peak demand. Normally, large motors experience peak demand during inrush when PF is at its lowest. A hybrid smARTVar® system, consisting of fixed and rapid switching capacitors, does two things:
1. Satisfies the short term VAR requirement for PF improvement at inrush.
2. Allows the fixed capacitors to compensate for steady state VAR requirements.

VOLTAGE SUPPORT AND FLICKER
Maintain desired system performance

Each of the following places additional stress on an electrical system... especially on its power sources (transformer, generators):
• large inductive loads
• arcing loads
• harmonic producing loads
• high inertia loads
• switching of large loads

Some loads have steady state requirements for VARs while others have VAR demands that change rapidly during their operating cycle. Use smARTVar® to provide rapid detection of VAR demand and rapidly switch the proper amount of capacitance to achieve and maintain the desired performance of your system.

Large individual loads, or the combination of many loads on a power system, can cause unique fluctuations in a system’s voltage. Arcing, inrush, and current harmonics can all increase the demand for peak current and attempt to draw higher magnitudes of current from a fixed capacity power source. When peak current demand exceeds the capacity of the power source, a voltage dip is experienced. In some cases, all three phases may rise/fall together, but in other cases, individual phases may behave differently.

When voltage dips, sensitive loads may shut down or malfunction, reducing productivity while increasing downtime, scrap, and tool or equipment failures. This may also increase the cost of maintenance and repairs.

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Solve voltage support and flicker problems by using the rapid switching technology of smARTVar® to compensate for extremely fast changes in reactive VAR demand. By inserting the proper steps of capacitance, system voltage can be supported and maintained within acceptable limits... and the effects of flicker can be eliminated.
EXTENSIVE VOLTAGE RANGES

Systems are available from 200 to 690 volts at both 50 and 60 Hz and can be modified for medium voltage projects. Tuned filters targeting your problematic harmonic frequencies are available to meet your unique application requirements. If your desired option is not listed, please consult the factory for additional assistance.

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STANDARD CURRENT TRANSFORMERS

A current transformer (CT) must be rated for the amp rating of the equipment it will measure.

• For example: a 2000A switchgear installation would require an AC20-2 or AC20-4, which is a 2000 amp CT.

In order to properly size a CT for a smARTvar® system, multiply the nominal ampere rating by three (3).

• For example: a 200kVAR SMV has a nominal current rating of 325 amps. 325 amps multiplied by 3 = 975 amps

- The CT for this application must be rated at 1000 amps

THE smARTvar® DYNAMIC VAR COMPENSATOR PART NUMBER SYSTEM