SmartVAR™ is the right choice for:

- Wind Power
- Spot Welding
- Laser Cutting & Welding
- Elevators
- Induction Heating
- Shredders / Crushers
- Arc Furnaces
- Injection Molding
- Cranes & Hoists
- Electric Trains
- Amusement Rides
- HVAC, Chillers

And for many other dynamic processes.
What is Dynamic VAR Compensation?
Dynamic VAR Compensation uses rapid switching techniques to insert and remove capacitive reactance as demanded by dynamic loads. Many electrical loads have very rapid requirements for reactance that cannot be satisfied with traditional automatic (contactor) switching methods. These highly dynamic requirements for reactive power can only be satisfied with the most rapid switching techniques that match reactive compensation to load demand. ARTECHE PQ offers a complete range of rapid-switching products to provide reactive power compensation, harmonic filtering and voltage support. Choose from standard products or we’ll customize a system to meet your precise needs.

SmartVAR™, by ARTECHE PQ, offers the fastest VAR switching capability available. Using thyristor (SCR) soft-switching techniques, SmartVAR™ adds capacitance to power systems at zero cross points to prevent switching transients. SmartVAR™ inserts capacitance onto a system within 8-10 msecs of sensing a need for reactive compensation. That’s only 1/2 to 2/3 of a cycle!

Benefits of Dynamic VAR Compensation
- VAR compensation is directly matched to dynamic load requirements
- Facility voltage is stabilized
- Facility voltage drops are reduced
- System electrical efficiency is improved
- Harmonic distortion can be minimized
- Power factor can be maximized
- Flicker can be reduced substantially
- Release system capacity

ARTECHE PQ SmartVAR™ solutions utilize low voltage power electronics with conventional cooling methods, reducing complexity, minimizing cost and for easy maintenance.

SmartVAR™ is available in Medium & Low Voltage Ratings!
ARTECHE PQ SmartVAR™ systems may be ordered for and installed on either low voltage (600 volts or less) or medium voltage (up to 11kV) power systems. Low voltage systems are designed for direct connection to the power system, whereas medium voltage systems utilizes an interposing step up transformer.

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**SmartVAR™ - the economical solution for dynamic VAR compensation**

Solving complex reactive power compensation problems does not have to be complicated. ARTECHE PQ adapts time proven technology and components to the sophisticated needs of the most rigorous applications. Using reliable high performance low voltage controls, switches and capacitor cells, ARTECHE PQ is able to provide the most economical solution to dynamic VAR compensation. Then we adapt these same components to medium voltage system by the simple introduction of a step up transformer. When it is rapid capacitor switching you need, SmartVAR™ is the most eco-

**Performance & Reliability Assured by Use of Best Components**

**Long Life Capacitors**
The heart of our SmartVAR™ system is our proprietary capacitor cell. Designed specifically for rigorous applications including harmonic rich environments, our 85 °C rated capacitors offer more than 1,000,000 hours of life expectancy in a 40°C ambient. Their physical construction minimizes element heating resulting in the industry's longest life expectancy.

**SmartVAR™ Switch**
Fast acting thyristor switches insert and remove capacitance in as little as 5–8 milli-seconds to respond to rapid load changes. Better yet, the RSS uses soft-switching technology to provide transient free switching of capacitors.

**SmartVAR™ Controller**
The brains behind the SmartVAR™ is our rapid sensing and rapid acting controller. The SmartVAR™ Controller makes 10,000 calculations per second to determine the reactive power demand and can control up to 24 capacitor steps.

**Reactors for tuned or detuned systems**
When there are harmonics present on your power system we can supply either reactors to detune the capacitor network to block harmonics and to avoid power system resonance. Reactors utilize PolyGap™ core construction to minimize losses, audible noise and stray magnetic fields.

**K-Rated Transformers for Medium Voltage Systems**
We use high performance, K-rated transformers that are specially constructed for our rapid switching systems. Depending on service voltage and application needs, we can use either liquid cooled or air cooled transformers.
**VAR Compensation**

SmartVAR™ supplies leading VARs when they are needed, by inserting and removing capacitive reactance from the system as demanded by dynamic loads. SmartVAR™ uses rapid switching devices and soft switching technology to rapidly insert or remove capacitive reactance from your system, and to do so without any switching transients. VAR compensation enables users to add more loads to existing power sources saving the costs associated with downtime and equipment for power source upgrades.

By using SmartVAR™ to control VARs, you’ll reduce energy flows between the source and the SmartVAR™ equipment resulting in higher energy efficiency and voltage stability. In cases where energy costs increase with lower power factor, you’ll be able to reduce your energy costs.

SmartVAR™ can sense a need for reactive VAR in and complete the switching of capacitive elements within 2/3 cycle. Our proprietary controller will calculate the VAR requirements and switch the appropriate steps of capacitance to maintain your target power factor.

**SmartVAR™ Provides the VARs Needed by Your Inductive Loads**

Local Injection of VARs eliminates dependence on VARs from utility or generator. SmartVAR™ reduces you VAR demand, energy consumption and peak demand. SmartVAR™ can eliminate power factor penalties. SmartVAR™ can increase KVA available from your existing power sources.

**Inductive Loads Demand Reactive VARs**

- VARs are non-productive and waste energy
- VAR demand fluctuates with various load conditions
- VARs are in addition to KW supplied by utility
- VARs increase total KVA demanded from power source
- VARs increase energy consumption
- VAR consumption may increase your energy costs
- VARs may increase
Power Factor Improvement

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, they will pay a rebate to the customer if PF is higher than a certain level. Many customers are paying for low power factor without even knowing it! Utilities 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 may disguise the fact that the customer is actually paying higher prices due to their actual power factor. Utility customers may simply pay the energy bill without knowledge of lower price availability if they improved their power factor.

Energy cost savings await many customers who choose to improve their facility power factor. Additionally, this will reduce their KVA, and current demand, reduce system losses, improve facility voltage, and enable them to add more equipment (loads) to their existing transformers. Those facilities knowledgeable about power factor can reap rewards in terms of energy cost savings and electrical equipment longevity improvement. Often, PF improvement products will realize a full payback in less than one year.

PF charges may be based upon peak demand. Normally, large motors experience their peak demand during inrush—when their PF is lowest. A hybrid SmartVAR™ system consisting of both fixed and rapid switching capacitors, can satisfy the short term VAR requirement for PF improvement at inrush, and allow the fixed capacitors to compensated for steady state VAR requirements.

10 reasons why is it important to improve your Power Factor?

- PF improvement reduces the current demanded by inductive loads and supplied by transformers or generators.
- Your electrical equipment will run cooler.
- Your electrical equipment will dissipate less heat in your building and reduce air conditioning costs.
- Your electrical equipment will last longer and operate more efficiently.
- Your peak demand will be reduced.
- Your total energy consumption will be reduced.
- Your system voltage drops will be reduced.
- Your will release capacity in your existing power sources.
- You will improve your electrical system reliability.
- Your energy bill may be reduced
Solves both harmonics and power factor for dynamic loads!

When dynamic loads are controlled by thyristors, diodes or SCRs, the input current waveforms (voltage and current) may become highly distorted and in addition to having high reactive demand, the rectifiers may cause significant harmonic distortion of the electrical power system. SmartVAR™ provides both reactive compensation and harmonic filtering to pacify these offending type loads.

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 also give false signals to equipment that is zero cross sensitive. Harmonic voltage distortion affects the entire power supply bus and may cause malfunctions, over-heating, failure, mis-operation of other equipment and can result in lower productivity.

When a power system is distorted, it becomes a voltage source at multiple frequencies (i.e.: 180hz, 300Hz, 420Hz, etc). Now each connected load will draw current at each of the harmonic frequencies resulting in higher copper and iron losses.

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.

Hidden Costs of Harmonic Distortion
- Increases system & equipment power losses
- Increases equipment operating temperature
- Reduces Total Power Factor
- Reduces equipment life
- May cause equipment failures
- May cause equipment interference and/or malfunctions

DVC+ is the right choice when solving harmonic problems for dynamic loads OR when you need to provide dynamic reactive VARs and also mitigate harmonics.

SmartVAR™ can be configured in a hybrid form to provide a combination of steady state and dynamic 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.

DVC+ is the right choice when solving harmonic problems for dynamic loads OR when you need to provide dynamic reactive VARs and also mitigate harmonics.
Voltage Support & Flicker

Large inductive loads, harmonic producing loads, switching of large loads, arcing loads, and high inertia loads can all pace additional stress on an electrical system and especially on the power sources (transformer, generators). Some loads have steady state requirements for VARs while others have VAR demands that change rapidly during their operating cycle.

Either large individual loads, or the combination of many loads on a power system can cause unique fluctuations in the system voltage. Arcing, inrush current harmonics, etc, can all increase the demand for peak current and attempt to draw higher magnitudes of current from a fixed capacity power source. When the 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.

SmartVAR™ can solve voltage support and flicker problems by using our rapid switching technology 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 virtually eliminated.

SmartVAR™ provides rapid detection of VAR demand and rapidly switch the proper amount of capacitance to achieve and maintain desired system performance.

Certain loads such as spot welders and arc furnaces, cause rapid excursions in current demand. These loads can actually cause momentary short circuits resulting in repetitive voltage notching. These rapid changes in voltage may cause an effect known as "flicker" which is a noticeable effect experienced in lighting equipment, and may cause instrumentation and timing circuit errors. Besides the visible problems, flicker can also cause process automation errors, equipment interference and UPS cycling resulting in reduced equipment life.

Use Arteche PQ SmartVAR™ where ever for dynamic performance is required for power factor compensation or harmonic mitigation.
SmartVAR™

Product Specifications:

**Power Systems:** 3-phase, 3 or 4 wire

**Frequency:** 60Hz or 50Hz

**System Voltage:**
- **LOW Voltage:** 208, 240, 380, 400, 415, 480 or 600 volts
- **MEDIUM Voltage:** 2400, 4160, 7200, (any from 601 to 34,500 volts)

**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 100 kVARs per switch

**Response time:** 10 to 12 milli seconds typical (6.67 msec best)

**Switch Rate:** 1 operation per cycle maximum

**Switch legs:** 2 (switches 2 out of 3 phases, no neutral connections)

**Enclosures:** Nema 1, Nema 3R, Nema 12 (others upon request)

**Temperature:**
- **Storage:** -30C to 60C
- **Operating:** 0C to 40C

**Altitude:** 1000 meters

**Standards:** Complies with NEMA, ANSI, UL, IEC, EIA, IEEE, NFPA requirements

**Capacitor Specifications**

- **Temperature capability:** -40C minimum to +85C maximum
- **Capacitor Life:** >1,000,000 hours at 40C operating temperature
- **Agency Approval:** UL File #E71645

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Low Voltage SmartVAR™ with & without harmonic filter reactor or capacitor protection reactor.

Medium Voltage SmartVAR™ with & without harmonic filter reactor or capacitor protection reactor.