CLASS 5820

ReactiVar™ AccuSine® PCS Power Correction System

Square D® AccuSine® PCS stabilizes electrical systems:

- Dynamic current injection for harmonic cancellation and power factor correction
- Reduces harmonics for IEEE 519 (1992) standard compliance
- Decreases harmonic related overheating of cables, switchgear and transformers
- Reduces downtime caused by nuisance thermal tripping of protective devices
- Increases electrical network reliability and reduces operating costs
- Compensates each phase independently
- UL and CSA approved
- Parallel connection allows for easy retrofit and installation of multiple units for large networks
- Filters to the 50th harmonic
- Filters entire network or specific loads depending on installation point
- Response to load fluctuations begins in 40 microseconds with 8 milliseconds for full response to step load changes
- IGBT based power electronic technology
- 50, 100 and 300A models for 208 to 480V, 50/60 Hz three phase networks

Square D AccuSine Power Correction System (PCS) reduces problematic harmonic levels and provides instantaneous power factor correction. Cost savings result from reduced downtime and maintenance. In addition, over-sizing of distribution equipment to provide for harmonics and poor power factor can be avoided. Square D AccuSine PCS dynamically corrects power quality by providing:

- Active Harmonic Filtration
- Resonance Prevention
- Power Factor Correction
- Dynamic VAR Compensation

Federal Pioneer
Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric

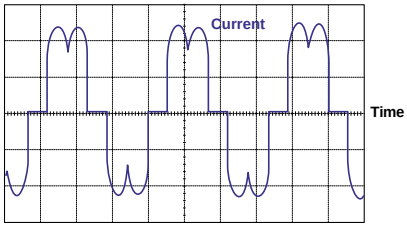
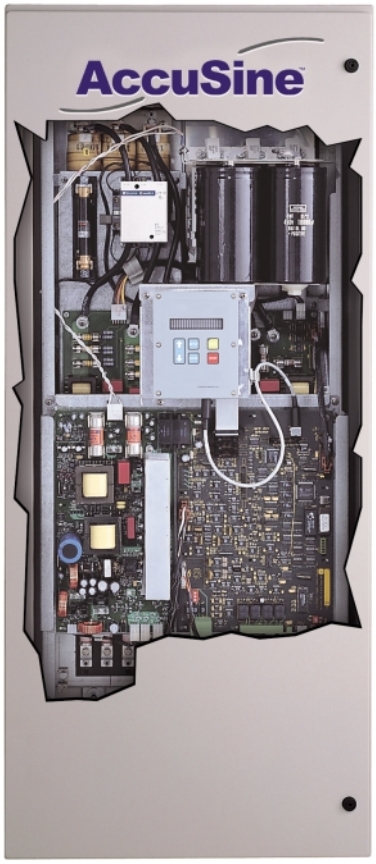


Fig. 1: Non-Linear Current Waveform



50A AccuSine PCS

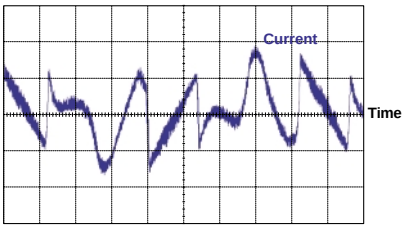


Fig. 2: AccuSine PCS Injection Current

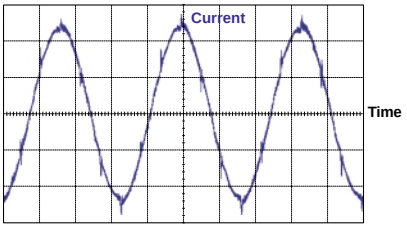


Fig. 3: Corrected Current Waveform

The Harmonic Problem

Although power electronic loads and devices which have rapid and frequent load variations have become abundant due to their many process control related benefits, they have one major drawback in common: they produce harmonics. Harmonics may disrupt other loads and increase operating costs and lower the reliability of the electrical network. The current waveform required by power electronic loads is quite different than the sinusoidal voltage delivered by the utility. This 'non-linear' current draw (Figure 1) results in the creation of harmonics.

Symptoms of problematic harmonic levels include overheating of motors, drives, cables, thermal tripping of protective devices and logic faults of digital devices all of which can result in downtime. In addition the life span of many devices may be reduced by overheating. Furthermore, by reducing harmonic levels, the need to oversize transformers and cables to account for harmonic heating effects is lessened.

With this in mind, the IEEE 519-1992 recommended practice establishes limits on current distortion that individual facilities can feed back on to the utility grid. Many utilities enforce these limits and with the decrease in capital spending due to deregulation of the industry, many more utilities are expected to start to enforce these limits.

Active Harmonic Filtering with AccuSine® PCS

The Square D AccuSine PCS cancels harmonics by dynamically injecting out of phase harmonic current. AccuSine PCS installation will allow for compliance with IEEE 519 – 1992 recommended harmonic limits. Reduced harmonic levels results in improved electrical network reliability and reduced operating costs. Nuisance tripping of protective devices and nuisance clearing of fuses due to harmonic heating effects is greatly reduced. Overheating of motors, transformers, switchgear and cables is also reduced which increases their life expectancy and reduces maintenance costs. For new installations, over-sizing of distribution equipment to reduce harmonic susceptibility can be reconsidered.

AccuSine PCS reduces current distortion that, in turn, reduces voltage distortion. Unlike passive devices, AccuSine PCS is easy to install and cannot be overloaded. When required harmonic compensation exceeds PCS capacity, AccuSine PCS will simply supply its maximum continuously. Multiple AccuSine PCS units can be connected in parallel to increase compensation.

Closed-loop control allows for high accuracy and self-adaptive harmonic control. AccuSine PCS determines the harmonic compensation required by using current transformers to measure the network current. The AccuSine PCS control logic removes the fundamental frequency component (50 or 60 Hz) from this waveform. The remaining waveform is then inverted and AccuSine PCS fires its IGBTs to inject this waveform (Figure 2) on to the network to compensate for the harmonics. The result is a waveform with greatly reduced harmonic content as seen by the upstream electrical system (Figure 3).

The Resonance Problem

The interconnection of a large variety of devices on today's electrical networks can create resonant conditions which magnify harmonic currents (Figure 4). Resonance can cause serious problems such as excessive voltage distortion, nuisance fuse and circuit breaker operation, overvoltage tripping of drives, premature capacitor breakdown and insulation breakdown within motors, transformers and conductors.

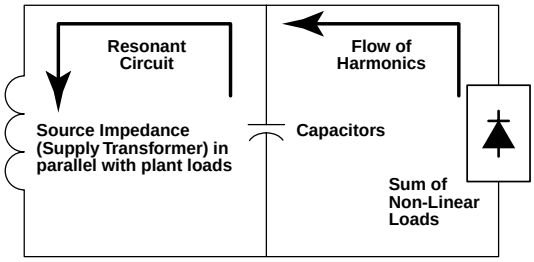


Fig. 4: Resonant Circuit Formed from Capacitor in Parallel with Source Impedance (Supply Transformer)

AccuSine® PCS Eliminates Resonance

Square D AccuSine PCS cancels harmonic current on the network to eliminate resonance conditions. By dynamically removing harmonics from the network no energy is present at the resonant frequency. The point of installation of AccuSine PCS on the electrical network determines where the harmonic cancellation takes place.

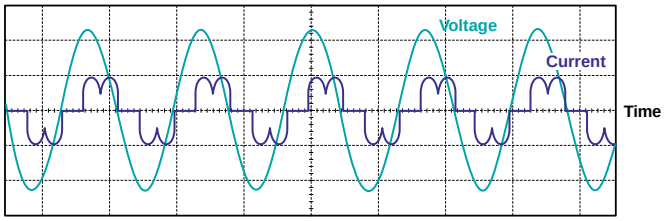


Fig. 5: Non-linear current waveform with poor power factor

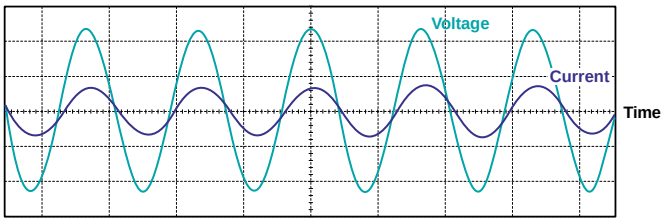


Fig. 6: Corrected Current waveform with improved power factor and reduced harmonic content after AccuSine PCS Installation

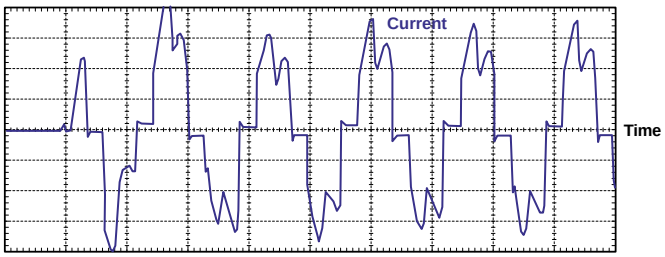


Fig. 7: Inrush Current without AccuSine PCS

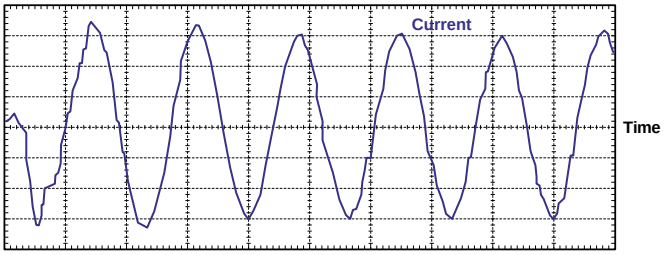


Fig. 8: Inrush Current with AccuSine PCS

Power Factor Correction with AccuSine® PCS

Poor power factor results in increased peak currents that reduce system capacity and, in most cases, cause a utility imposed penalty. AccuSine PCS is able to solely correct power factor, or, operate in a dual mode whereby current is injected to reduce harmonics and any excess current capacity is used to improve the power factor. Power factor correction is achieved by injecting current at the fundamental frequency (60/50 Hz). AccuSine PCS is able to correct for either a leading or lagging power factor. The result is a reduction in peak currents which frees system capacity and eliminates utility imposed power factor penalties.

Dynamic VAR Compensation by AccuSine® PCS

Large inductive inrush currents typically cause voltage sags that result in reduced productivity, poor process quality and possible downtime due to undervoltage tripping of devices.

The Square D AccuSine PCS is able to inject peak current at two and a half times its rms current rating for one cycle. For many applications this level of compensation eliminates visible flicker and improves voltage regulation resulting in better productivity and quality.

AccuSine® PCS Sizing

A harmonic study is not required to select the size of the AccuSine PCS installation. This is because when AccuSine PCS is installed it becomes a lower impedance path for harmonics than the existing power supply. For sizing, please contact the Square D Power Quality Correction Group at (905) 459-8805. To expedite the product selection process, please have a single line diagram and/or details of the application including sizes of transformers, non-linear and linear loads, and any existing filters and capacitors.

Product Selection

AccuSine® PCS, 208-480 V Three Phase ●, 50/60 Hz Models⁜

Total Current (A_{rms})	Enclosure Protection Rating	Catalog Number	Maximum Reactive Power (kVAR) @208V	@480V	Enclosure Type	Cable Entry	Exterior Dimensions* (HxWxD inches)	Weight* (lbs)
50	NEMA 1◆	PCS050D5N1	18.0	41.6	Wall Mount	Bottom	52x21x19	250
50	NEMA 12	PCS050D5N12	18.0	41.6	Floor Standing	Top	90x38x24	675
50	NEMA 3R	PCS050D5N3R	18.0	41.6	Wall Mount	Top	54x36x24	365
50	Chassis✘	PCS050D5CH	18.0	41.6			43x18x19	180
100	NEMA 1◆	PCS100D5N1	36.0	83.1	Wall Mount	Bottom	69x21x19	350
100	NEMA 12	PCS100D5N12	36.0	83.1	Floor Standing	Top	90x38x24	775
100	NEMA 3R	PCS100D5N3R	36.0	83.1	Floor Standing	Top	72x24x24	590
100	Chassis✘	PCS100D5CH	36.0	83.1			58x18x19	275
300	NEMA 1	PCS300D5N1	108.0	249.4	Floor Standing	Top	75x33x20	775
300	NEMA 12	PCS300D5N12	108.0	249.4	Floor Standing	Top	90x65x30	1450
300	NEMA 3R	PCS300D5N3R	108.0	249.4	Floor Standing	Top	96x36x30	1225
300	Chassis✘	PCS300D5CH	108.0	249.4			71x32x20	650

● Other voltages available. Contact your local Square D/Schneider Electric office. Multiple units can be connected in parallel. Specifications subject to change without notice.

⁜ Two remote 400Hz current transformers required for three phase loads. Three remote 400Hz CTs required when single phase loads are present. Select 500, 1000, 3000, or 5000A size, 5A secondary.

* Dimensions and weights are approximate. Do not use for construction. For actual dimensions, contact your local Square D/Schneider Electric office.

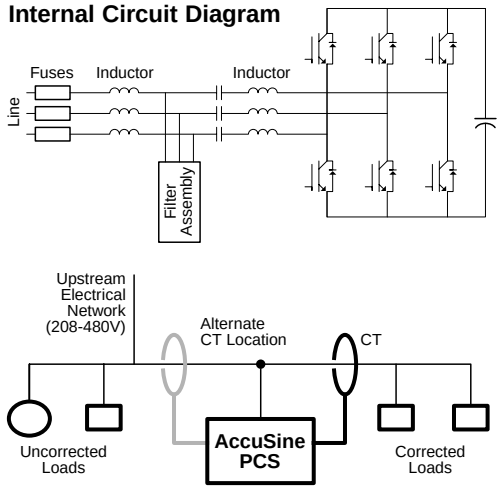
✘ Open Chassis Models require a Remote Digital Interface Module for operation. Specify 3, 5 or 10 meter cable length. For cooling purposes, maximum losses at 480V are 1.8, 3.0 and 8.0 kW for 50, 100 and 300A models respectively.

◆ All units except 50/100A NEMA1 and Chassis Models include door-interlocked disconnect. 600V, 200 kA IC, Class T fuses standard.

Other Reactivar™ products and services:

- Hybrid Filters with Active and Passive Elements
- Electronic Sag Protector for Voltage Sag Compensation
- AV9000 LV Real-Time Reactive Compensation Systems
- AT7000 Filtered LV Transient-Free Reactive Compensation Systems
- AT6000 Anti-Resonant LV Transient-Free Reactive Compensation Systems
- AT5000 Standard LV Transient-Free Reactive Compensation Systems
- AV7000 LV Passive Harmonic Filters
- AV6000 LV Anti-Resonant Capacitor Banks
- AV4000 and AV5000 Standard Automatic Capacitor Banks
- Low Voltage Fixed Capacitors
- Medium Voltage Real-Time and Transient-Free Reactive Compensation Systems up to 15kV
- Medium Voltage Metal-Enclosed Standard, Anti-Resonant and Filtered systems up to 15kV
- Medium Voltage Fixed Capacitors
- Zero-Threshold Surge Suppressor for global protection against utility generated transients
- Engineering Services Available:
  - Sizing and Rating Assistance
  - Harmonic Analysis
  - Computer Simulations
  - Commissioning
  - Service Contracts

Internal Circuit Diagram



Typical Installation

Consult your nearest Square D / Schneider Electric office for pricing.

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