Horizon Mechanical Systems

Plumbing * Heating * Air Conditioning

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May 28, 2014

From: Duane Zachman
To: Brice Gordon
Subj: Whole House Protection from Electrical "Brownouts" and "Spikes"

Brice,

This is to summarize the information and budgets we have researched to find a solution to the problem that is occurring at the main house with electrical faults. These faults are "Brownouts" and "Spikes" from the electric utility provider and cause equipment and electronics to be damaged. Since the problem is from the utility, we have explored options that protect the entire house electrical. Because the electrical service for the house is large and single phase, it makes equipment difficult to find availability and price. The following are 3 options we obtained information on.

Option 1 – Two Voltage conditioners 240 volt, 200 KVA Estimated Price $103,000.00

Voltage Conditioners 2 x $28,000.00 =	$56,000.00
Freight	$ 2,000.00
Engineering	$ 5,000.00
Wire, Conduit, Crane	$10,000.00
Labor Installation	$30,000.00

Option 2 – Two Voltage Regulators 240 Volt, 200 KVA Estimated Price $117,000.00

Voltage Regulators 2 x 35,000.00 =	$70,000.00
Freight	$ 2,000.00
Engineering	$ 5,000.00
Wire, Conduit, Crane	$10,000.00
Labor Installation	$30,000.00

Option 3 – Two UPS 240 Volt, 200 KVA Estimated Price $450,000.00

UPS 2 x 200,000.00 =	$400,000.00
Freight	$ 2,000.00
Engineering	$ 5,000.00
Wire, Conduit, Crane	$10,000.00
Labor Installation	$33,000.00

Please note that these prices are budget numbers and not a fixed quote. Pricing was obtained from a local supplier in the research of this equipment. I hope this information is helpful. I am also attaching a brochure and a simple riser diagram to help explain this information.

Thank You
Duane Zachman

Staco AVR

Automatic Voltage Regulator

Modular Power Conditioning System

The Toughest Power Conditioner on the Market Today

The Staco Energy Products Company Automatic Voltage Regulator is based on a series regulation transformer controlled by variable transformers (VTs). It offers tight output regulation, robust design and easy customization.

In today's world, the cost of electrical power and its quality have become major operating concerns. The continuing increase in the cost of electrical power has heightened interest in energy savings, and poor power quality has been identified as a cause of expensive malfunctions and shutdowns in new high technology equipment.

Voltage regulation problems account for more than 90% of the power problems seen at most sites. The Staco Energy's base Automatic Voltage Regulator (AVR) provides protection against all but the most extreme voltage swings. When additional non-voltage issues occur, Staco Energy offers a series of options that address such issues as high voltage transients, high harmonic content and site load balance. This integrated and targeted approach provides site-specific power correction in a one-box solution.

Warranty

The industry leading three-year warranty is our guarantee that Staco Energy offers the toughest, most robust Voltage Regulation System on the market today.

Advantages:

- Modular construction for easy customization
- Options offer more features and functionality
- Extremely high overload/inrush rating
- Very low cost of ownership due to efficiency and virtually maintenance-free operation
- Trouble-free operation with no active devices in power path
- 1% or better output voltage regulation
- Continuous voltage regulation—not crude step regulation
- Redundant, manual regulation control (raise/lower switch)
- Individual coil protection—avoid catastrophic cascade failures
- Gold plated contacts on all coils
- Nickel plated copper bus bar
- Easy, front panel access for service/installation
- No waveform distortion—no harmonics added
- Small footprint
- Able to withstand the continuous vibration of mobile applications

STACO ENERGY® PRODUCTS CO.

Automatic Voltage Regulator

The Staco Energy Automatic Voltage Regulator's unique construction blends precise regulation, high availability, and ruggedness into a highly customizable package.

Base Regulator System

Technology	Motorized Variable Transformer controlled, series regulation transformer (buck-boost transformer with secondary wired in series with the load)			
kVA rating (single-phase)	2.5, 5, 7.5, 10, 15, 25, 37.5 (up to 500 kVA, contact factory)			
Voltage (single-phase)	120, 208, 230, 240, 277, 380, 400, 480			
kVA rating (three-phase)	9, 15, 30, 45, 75, 112.5, 150, 225, 300, 400, 500 (up to 1,000 kVA., contact factory.)			
Voltage (three-phase)	120, 208, 240, 380, 400, 420, 440, 480			
Input Regulation (±1% output)	+10% / -20%			
Input Regulation (+1% -5% output)	+10% / -25%			
Response Time	< 2 cycles			
Correction Time	29 V/sec. at 480 Vac 3 phase, 48 V/sec. 240 Vac single phase. Contact factory for other times.			
Efficiency	Typical 97% for PLC units and 99% for AVR units			
Mean Time Between Failure	Greater than 200,000 hours			
Harmonic Distortion	None added			
Harmonic Content	None added			
Overload Rating	33% - 2 hours	50% -1 hour	100% -15 minutes	1,000% - 30 cycles
Output impedance	Less than 1% (maintains tight regulation with 100% load step)			
Load Power Factor (pf)	0 lagging to 0 leading			
Altitude (operating)	10,000 feet without derating			
Temperature (operating)	0° to 40° C			
Heat Dissipation	Voltage Regulator Typical 38 BTU/Hr/kVA; Power Conditioner Typical 95 BTU/Hr/kVA			
Audible Noise	Less than 45 dBA			
Wiring	Hardwired			
Enclosure	NEMA 1 100% front accessible standard with NEMA 3R and others upon request.			

Power Conditioning Options

Power Problem	Base Unit Voltage Regulator	Optional Isolation Transformer	Optional Surge Protection	Optional Advanced MP Controller	Optional Individual Phase Control
Brownout	X				
Under Voltage / Sag	X				
Over Voltage / Surge	X				
High Voltage Transient			X		
Lightning Protection			X		
Unbalanced Load					X
3rd Harmonic Reduction		X			
Line Noise		X			
Establish a Neutral on Output		X			
Front Panel LCD Display				X	
Remote Communications & Control				X	
Output Regulation	±1% (5%)	±1% (5%)	±1% (5%)	±0.5 Vac	±0.5 Vac

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Applications for Voltage Regulation

- **BROADCAST:** Regulation for broadcast transmitter sites and studios.
- **COMMERCIAL:** High-rise building whole floor regulation or power conditioning, input voltage regulation for elevator control, large A/C chillers, lighting, and other sensitive non-critical systems.
- **INDUSTRIAL:** Industrial automation, process control, CNC, factory robotics, facility level of point-of-use, heavy load machinery regulation.
- **MARINE:** Dockside or shipboard voltage regulation and power conditioning.
- **MEDICAL:** Medical Imaging: X-ray, CAT Scan, and MRI power conditioning; building or whole floor regulation.
- **MOBILE:** Commercial broadcast and military mobile communication trucks, trailers and shelters.

Points to Consider for Sizing and Configuration

- **OUTPUT:**

Voltage?	_____	Vac
Phase?	Single	Three
Neutral Available?	Yes	No
Frequency?	50 Hz	60 Hz

- **INPUT:**

Voltage?	———	No
Neutral Required?	Yes	No
kVA Required	———	No

Surge Suppression?	Yes	No
Individual Phase Control?	Yes	No
Advanced MP Controller?	Yes	No
Isolation Transformer?	Yes	No
External Bypass?	Yes	No
Other?	Yes	No

Optional Components

Surge Protection

General use surge suppressor designed for small service entrance panels or individual equipment protection. Provides against high voltage transients generated both internally (such as motors, environmental control equipment, manufacturing, and office equipment) and externally (substation switching transient, system faults, and severe weather such as lightning strikes).

- 25 year free replacement warranty on surge protector
- Parallel configuration provides 40kA (40,000 amps) per phase peak surge current protection
- Response time <= 1 nanosecond
- Protection: all modes: L-N, L-L, N-G, L-G
- ANSI/IEEE C62.41/62.45 Categories C, B and A with susceptibility up to medium exposure levels. Designed to protect against externally generated impulse transients and internally generated switching/ring wave transients.
- UL 1449 latest edition, CUL, UL 1283 listed

Advanced Communications & Control (MP Controller)

- Increases output regulation to ± 0.5 Vac from standard ±1%
- LCD display with numeric/special function keypad
- Monitor and manage output voltage and set points
- Three form "C" contact closures and eight logic level output signals
- Multiple set points may be programmed for variable speed, ramping, and dwell for dynamic voltage control
- User programmed to accept peak-to-peak, average or RMS measurements
- Optional RS232 and RS422 communications for remote monitoring and control
- MP controller standard on three-phase systems with Individual Phase Controlled (IPC)

Individual Phase Control

Provides ± 0.5 Vac regulation (w/MP Controller) on each phase, independently. Provides load balancing for applications with unbalanced, single-phase loads or unbalanced and fluctuating utility power.

Double Shielded Isolation Transformer (Wye-Wye)

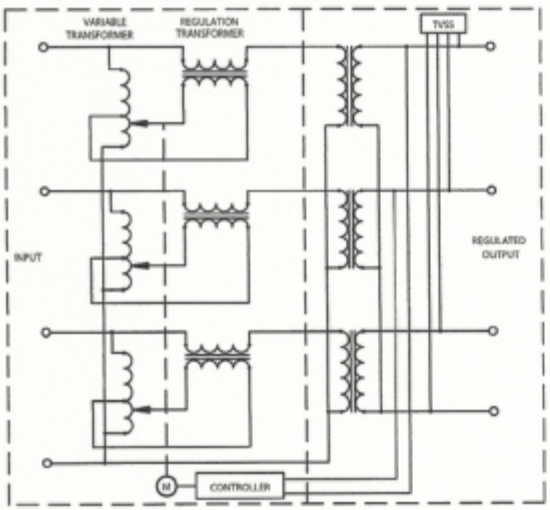
- Provides extra protection & isolation between the utility and the load
- Noise attenuation
- 120 dB common mode
- 60 dB transverse mode
- All copper construction
- Traps 3rd harmonic and triple harmonics
- Removes electrical ground noise/interference
- Creates a bonded neutral (newly derived source)
- 97% or greater efficiency
- Required where input & output voltages differ

Additional Options

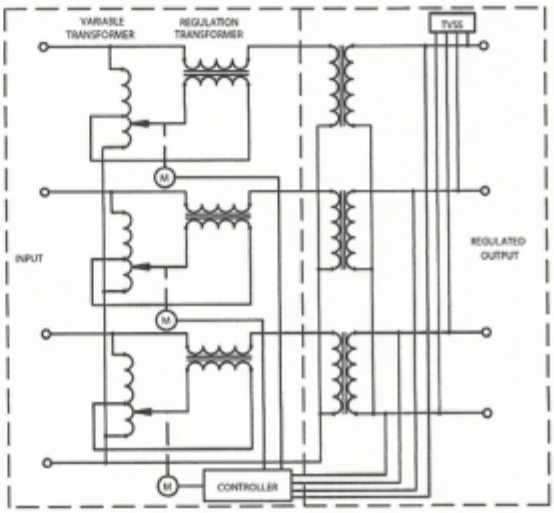
- Electrically and mechanically isolated external maintenance bypass in a free-standing or wall-mount cabinet
- Input and output circuit breakers
- Additional / custom power meters
- Custom enclosures for harsh /outdoor environments

Circuit Diagrams

Three Phase, Single Line Control



Three Phase, Individual Line Control



About Staco Energy Products

Since 1937, customers worldwide have been relying on Staco Energy Products Company to deliver voltage control and power quality solutions tailored to their needs.

As a leading power quality resource, we offer our customers world-class support; from our thorough applications assessment, to our ability to design and deliver a solution that is tailored to the specific needs of our customers; through delivery and commissioning.

Our professional, factory trained service team is in place to ensure that our customers' revenues are protected, and their investment provides them with many years of trouble free operation.

Staco develops total power solutions for OEM and end user applications.

In addition to the Automatic Voltage Regulator we offer a wide array of power quality products, including:

- ***Uninterruptible Power Supplies***
- ***Power Conditioners***
- ***Voltage Regulators***
- ***Power Factor Correction and Harmonic Mitigation***
- ***Active Harmonic Filters***
- ***Variable Transformers***
- ***Custom Engineered Test Sets***

Represented locally by:

STACO ENERGY® PRODUCTS CO.

Your tailored power solutions provider

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