

We Build

Static Var Generator

Wall & Cabinet mount



"Scalable step-less digital Power Factor Correction(PFC) with optional harmonic compensation using IGBT based inverters"

Why use SVG for power factor correction?

- Always unity PF
- No over compensation or under compensation
- Individual correction on all three phases.
- Capacitive as well as Inductive compensation
- Full correction in less than 10ms (1/2 a cycle).
- RS485, CAN, RJ45 network port
- Modbus RTU, Modbus TCP/IP, PMBus protocols supported

LIVELINE ELECTRONICS
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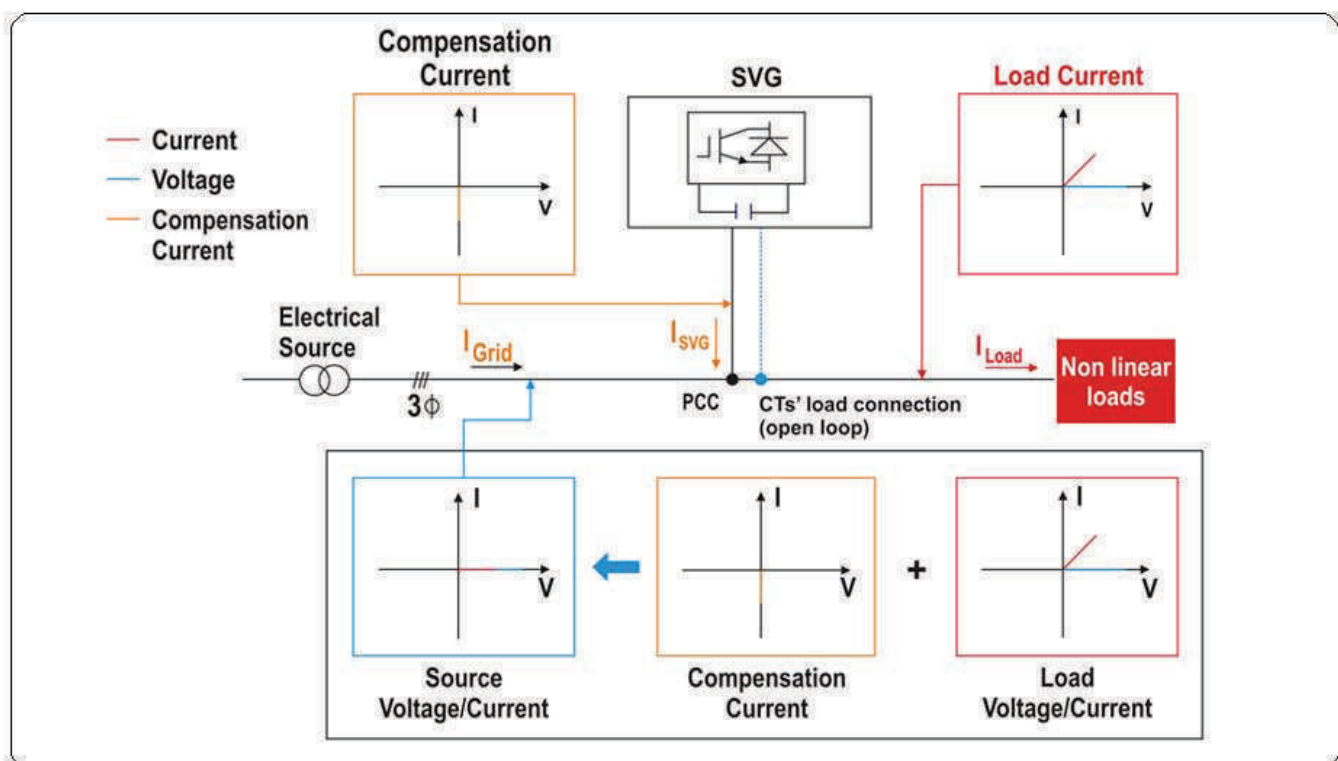
STATIC VAR GENERATOR [SVG]

AN INNOVATIVE WAY TO POWER FACTOR CORRECTION

Automatic power factor correction equipment is broadly applied in industry to ensure the electrical distribution system is utilised to its best capacity. Normally, such power factor correction is done by way of monitoring load PF and switching capacitor banks. But it's well known that such capacitor based automatic power factor correction are slow to react to load PF changes resulting into either over or under compensation. Also, due to today's harmonic rich environments, capacitors suffer from overloads, system resonance, capacitor leaks, contactor failures, reduced life expectancy and real fire risk.

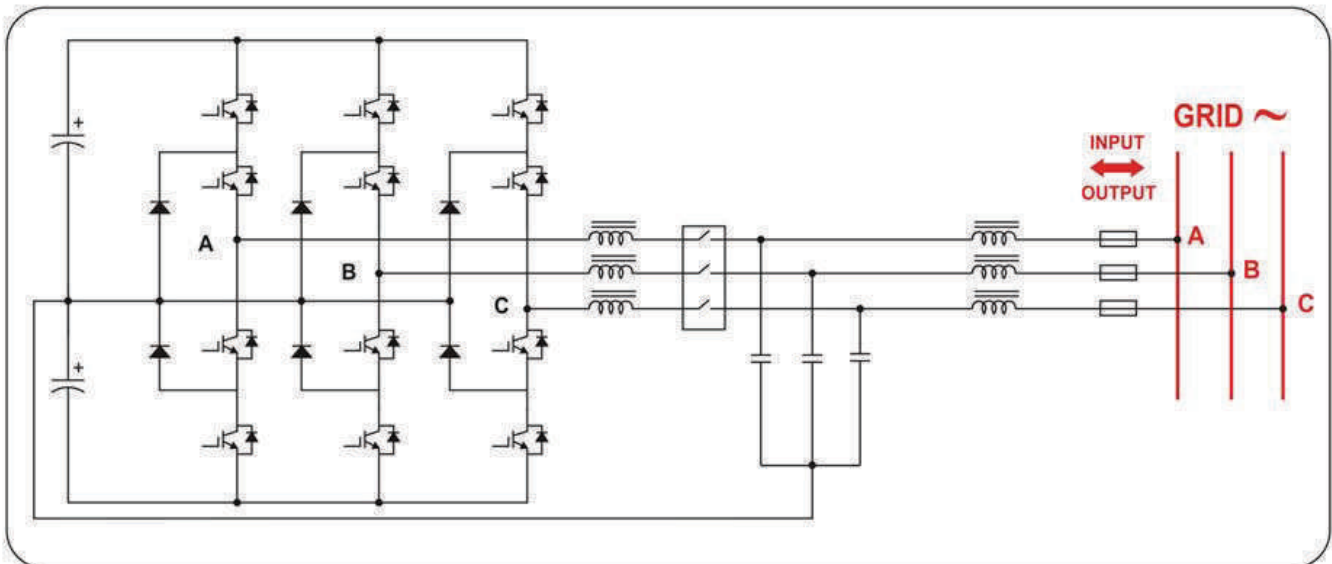
LIVELINE SVG is an entirely new approach to power factor correction. The SVG utilises a high speed three level inverter that reacts to changes in reactive power, exchanging corrective reactive power into the system. Full correction is made in 3/4 of a cycle. This rapid

response provides stable accurate real-time power factor correction without the drawbacks of traditional capacitor based systems. The SVG can continuously adjust reactive power dynamically and bi-directionally (leading or lagging). There is no chance of system resonance and even under low voltage conditions SVG will provide full reactive power compensation. Our SVG is 100% inverter based so there are no AC capacitors to fail.



SVG OPERATIONAL PHILOSOPHY

Any load current is detected through external CTs, sampled and fed to the internal semiconductor processors where immediately an Instantaneous Reactive Power algorithm identify n quantifies the active power from the reactive power. Also, compensating reactive power requirement is dynamically and accurately calculated at a sampling frequency of 160 kHz and sent to the IGBT control system where a PWM signal is generated at a equivalent switching frequency of 80 kHz. A compensating capacitive reactive power or inductive reactive power is controlled by the manipulating the DC bus voltage in comparison to the AC line voltage. Thus, causes a capacitive current or inductive current flow, creating a reactive power exchange with the network.



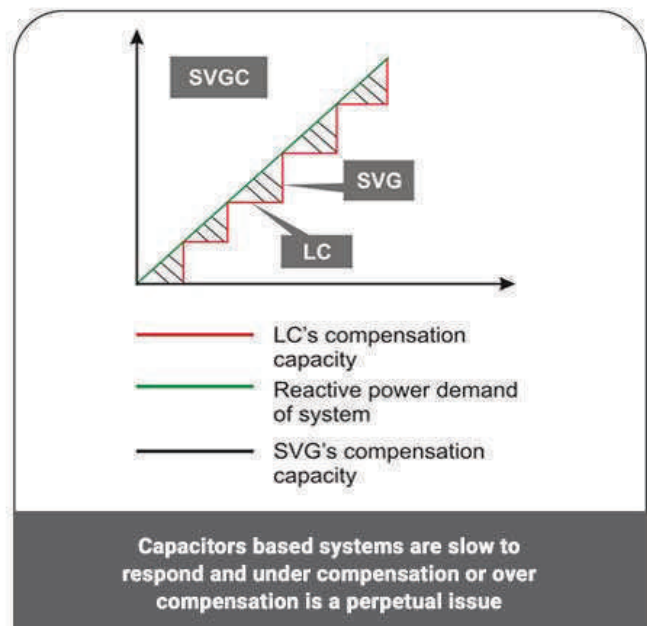
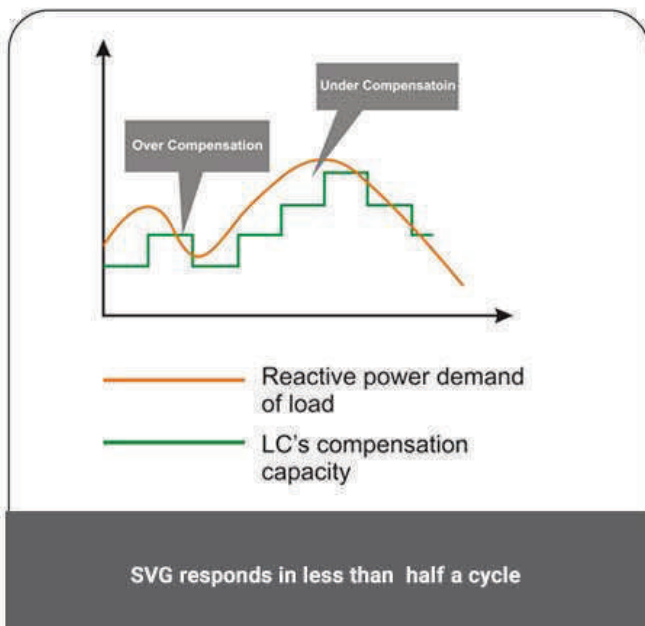
The innovative inverter design is at the heart of every SVG manufactured by **LIVELINE**. The modular inverter utilises IGBTs so reduces switching losses and permits higher switching speeds. The need for small filter components results in an ultra-compact design with an improved waveform resulting in very low harmonic distortion and low levels of electromagnetic interference. The ultra-compact design permits a modular construction.

MODULAR DESIGNS ALLOWS FOR EASY EXPANSION

OUTSTANDING PERFORMANCE

SVG provides real time response with constant correction to plant power factor. Transient free, virtually instantaneous response ensures high system stability.

- Reactive power compensation: $\text{Cos } F = 1.00$
- Continuous correction – step less control. SVG controls from 0 – rated kVAr as one continuous range.
- No over compensation or under compensation as experienced with capacitor switching systems.
- Individual correction on all three phases.
- Capacitive and Inductive compensation: -1 to +1. Something capacitor based systems can't do.
- Full correction in less than 10ms (1/2 a cycle). Suitable dynamic loads where the power factor fluctuates rapidly or in big steps e.g. saw mills, cranes, welders.
- Optimised sizing – installed capacity equals compensation capacity
- Simple wall mount for 50kVAr and 100kVAr sizes
- Rack mount options in 30/50/100kVAr sizes. One cabinet can accommodate up to 600kVAr utilising any combination of sizes.
- Increase your capacity as your plant grows. Simply add as many units in parallel as required. You can mix and match sizes to suit your application.



COMPARISON BETWEEN A CONVENTIONAL CAPACITOR BASED SYSTEM VERSUS SVG



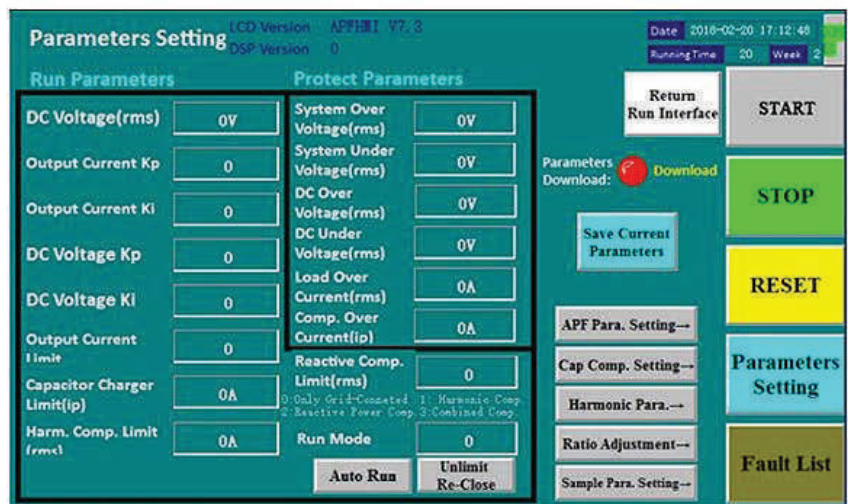
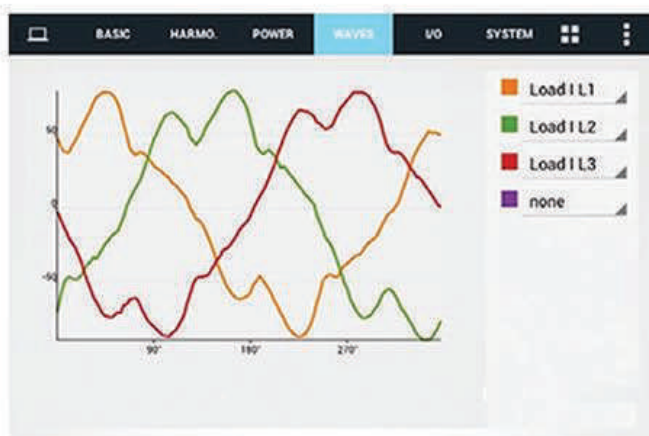
| | CAPACITOR APFC | SVG |
|------------|--|---|
| TECHNOLOGY | Capacitor based correcting systems employ switching IN and OUT fixed value capacitor banks and there by achieves the desired PF at the grid end of the supply. | SVG uses scalable IGBT based inverter to produce infinitely variable step less output to achieve the desired set point. |
| RESPONSE | Capacitor banks are generally slow to respond and are an electro mechanical system and may take considerable time to achieve the desired result. | SVG takes 15msec to completely respond to the need and only 50 microsec to dynamically respond. |
| RESONANCE | Capacitor based systems are most likely to encounter resonance. | The SVG, being a inverter based control technique, has no such possibilities. |

| | CAPACITOR APFC | SVG |
|--------------------------|--|---|
| ALL LOADS | Only corrects inductive load PF where it's lagging in nature. | The SVG can correct both an inductive (lagging) and capacitive (leading) load. |
| SIZE & SPACE | For conventional systems, generally sizes are big as it houses inductors, contactors and capacitors in one enclosure. | The inverter technology used in the SVG is very compact and typically requires less mounting area than a conventional system. |
| GRID VOLTAGE IMPACT | The performance of power factor correction capacitors is greatly impacted by the grid voltage level. Low voltage on the grid results in poorer compensation performance from the capacitors. | The SVG performance is virtually unaffected by low grid voltage levels. |
| ELECTRO -MECH FAILURES | Capacitor based systems require frequent switching of the stages to achieve correction for changing power factor and are subjected to frequent failures. | The SVG has low losses and needs little maintenance. The service life is expected to greater than 10 years. |
| SCALABILITY & MODULARITY | No such facility | It can be augmented in future by inserting additional modules |

FLEXIBLE CONTROL & MONITORING

Easy to use, with displays on every unit providing all system information including grid voltage, compensating current, grid current, load current, grid pf, load pf, alarm code and operating status.

- Cabinet based systems come complete with colour TFT touch screen so you can see exactly what is happening with your complete system. In addition to the information available on the standard unit display you can view individual module temperatures, THDv, THDi, voltage waveforms, harmonic spectrum.
- Optional alarm monitoring card allows SVG to be integrated into any plant control system
- RS485, CAN, RJ45 network port
- Modbus RTU, Modbus TCP/IP, PMBus protocols supported

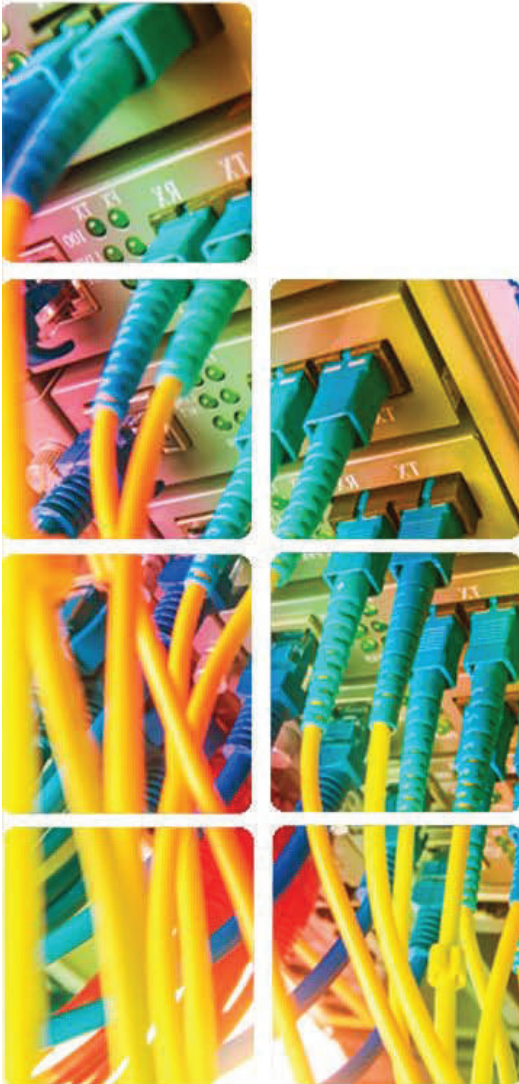



HMI ACTS AS A FULL POWER QUALITY METER

HIGHER RELIABILITY AND SAFETY OF ELECTRICAL SYSTEMS

Unlike traditional capacitor based systems, the SVG does not negatively interact with your electrical system. Today's harmonically rich environments are tough on capacitor based systems with increased risks of resonance and capacitor failures:

- Unaffected by harmonic distortion and free from harmonic resonance
- Three phase unbalance compensation
- Unaffected by grid voltage drop. Even under reduced grid voltage levels, full reactive current can be provided to meet working conditions. Operating voltage range of -40% to +20%
- No damaging transient voltage spikes caused by the switching of capacitors
- Overheating capacitors and harmonic reactors are a thing of the past.
- <3% THDi input harmonics won't pollute the users electrical distribution system



LONG LIFE WITH EXTREME DURABILITY

- 100% solid state with latest generation IGBTs
- Latest inverter technology provides efficiency of greater than 97%
- Output provides a better quality wave form with a lower harmonic content than traditional systems.
- Electronics free from contaminated air flow
- Long life cooling fans are simple to replace
- Capacitor free. No degradation of failures due to capacitors
- Low risk – no swollen or leaking capacitors. It reduces risk of fire.
- No contactors to replace
- Design service life of more than 100,000hrs, without maintenance. That's more than 10 years operation in a plant that operates 24/7. Capacitor based systems can last as little as three years.
- High power density means less precious switchboard room is used.



ADVANCED STATIC VAR GENERATOR – AHF

A Power Factor Correction Unit and Harmonic Filter in One

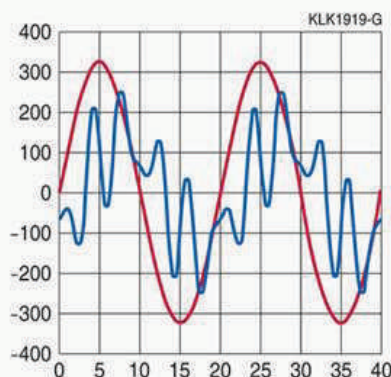
The Advanced Static Var Generator provides the same dynamic performance as the SVG with the added benefit of combining harmonic mitigation. Available in 50/100kVAR wall mount and 30/50/100 kVAR cabinet mount modules.

Extend Your Power Factor Correction Performance

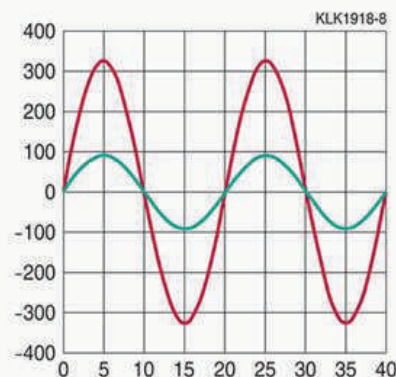
The requirement for power factor correction is the number one power quality issue faced by the vast majority of industrial and commercial installations. The second biggest power quality issue is harmonic mitigation.

- Commercial installations will often have elevated 3rd harmonics owing to single phase non-linear loads such as computer switch mode power supplies, LED lighting, electronics lighting ballasts, inverter heat pumps.
- And a computer data centre backed up by UPS containing a six pulse rectifier and 5th, 7th, 11th harmonics can be added into the mix
- Variable Speed Drives controlling air handler units within building HVAC systems can further elevate the 5th, 7th, 11th harmonics
- Industrial installations will often have high levels of variable speed drive loading as automation systems improve efficiencies and productivity. It is not uncommon to see very high levels of current

harmonics and voltage harmonic distortion resulting from six pulse VSDs drawing predominantly 5th, 7th 11th harmonics. Wouldn't it be great if you could address both power factor correction and harmonic mitigation in one cost effective unit. The Advanced Static Var Generator (ASVG) does just that.



— Voltage (V)
— Load current (A)



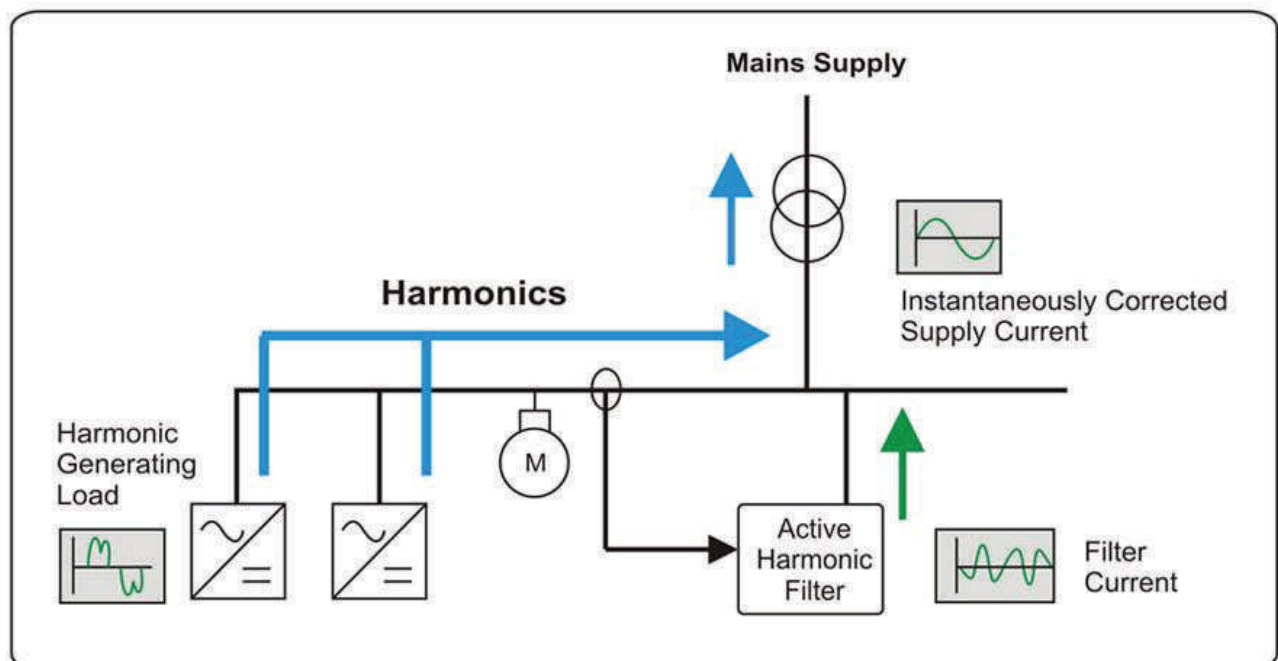
— Voltage (V)
— Line current (A)

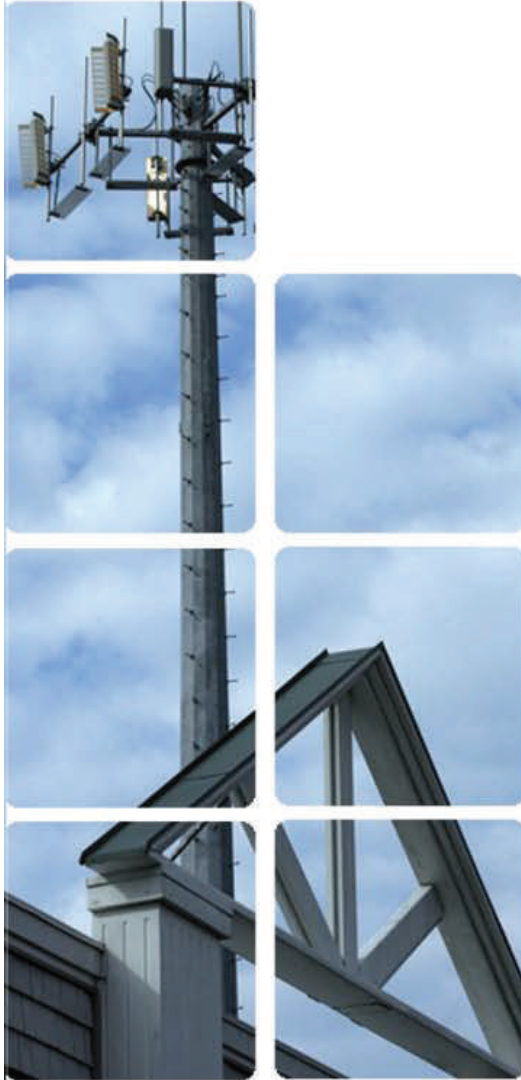
Typical waveform containing harmonics compared to a perfectly desired sine wave

POWER FACTOR CORRECTION AND HARMONICS MITIGATION IN ONE

With 3rd, 5th, 7th, 11th harmonic orders most prevalent in the majority of installations, a correctly sized ASVG can correct your displacement power factor to unity and also reduce your harmonics to <5% THDi. This results in a near unity true power factor. Form factor and dimensions are the same as the same rated SVG.

- Reactive power compensation: $\cos \phi = 1.00$
- Capacitive and Inductive compensation: -1 to +1
- All the features and benefits of the SVG
- Mitigation of 3rd, 5th, 7th, 11th harmonic orders
- Unit capacity can be shared 50/50 between power factor correction and harmonics correction
- Current unbalance correction can correct for load unbalance across all three phases





TECHNICAL SPECIFICATION

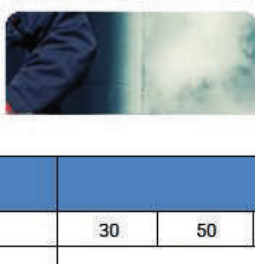
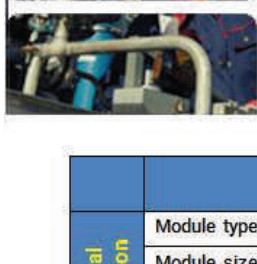
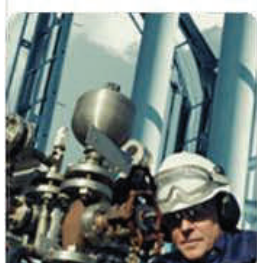
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|--------------|---------------------|------------------------|
| Input | Working voltage | 400V/690V (-40%, +20%) |
| | Working frequency | 50Hz (-10%, +10%) |
| | Current transformer | 100:5 - 10000:5 |

| | | AHF | SVG |
|------------------|--------------------------------|-----------------------------|-----------------------------|
| Functions | Harmonic compensation | 2-50 | 2-13 (50% of rated current) |
| | Harmonic filter rate | >97% | |
| | Reactive power compensation | -1 to +1 adjustable | |
| | 3 phase imbalance compensation | 100% imbalance compensation | |

| | | |
|-----------------------------|--------------------------------|---|
| Technical parameters | Total response time | <10ms |
| | Active power loss | <2.5% |
| | Heat dissipation | Intelligent air cooling |
| | Noise | <60dB |
| | Sampling/control frequency | 160kHz |
| | Equivalent switching frequency | 80kHz |
| Technical parameters | Current loop cut-off frequency | 4kHz |
| | Protections | Over voltage, under voltage, over heat, over current, short circuit etc. more than 20 protections |
| | CT installation place | Load side/grid side optional |

Continued to next page.....

TECHNICAL SPECIFICATION



| | | |
|-------------------------|-------------------------|--|
| Communication interface | Communication method | RS232, 485, Modbus protocol, TCP/IP optional |
| | Communication interface | RS485, internet interface |
| | Computer software | Yes, all parameters are set on computer |
| | Fault alarm | Yes, record 500 alarm information most |
| | Monitor | Support modules independent monitor or one cabinet central monitor |

| | | AHF(A) | SVG(kvar) |
|-----------------|-----------------|--------------|-----------------|
| Cabinet (W X D) | 600*600 cabinet | Power ≤ 150A | Power ≤ 100kvar |
| | 800*600 cabinet | Power ≤ 300A | Power ≤ 200kvar |
| | 600*800 cabinet | | |
| | 800*800 cabinet | Power ≤ 900A | Power ≤ 600kvar |

| | | AHF(A) | | | | | SVG(kvar) | | |
|--------------------------|---------------------|-------------|-------------|----|-----|-----|-------------|-------------|-----|
| Mechanical Specification | Module type | 30 | 50 | 75 | 100 | 150 | 30 | 50 | 100 |
| | Module size (W*H*D) | 480*200*530 | | | \ | | 480*200*530 | | |
| | | \ | 680*200*530 | | | | \ | 680*200*530 | |
| | Parallel quantity | 15 | | | | | | | |

| | | |
|-----------------------|--------------------|---|
| Mechanical parameters | Wall mounting size | Same as rack type |
| | Module weight | 25kg (<=75A/50kvar) 50kg (>=100A/100kvar) |
| | Color | RAL 7035 |

| | | |
|-------------------|---------------------|--|
| Working condition | Ambient temperature | -10°C ~ +45°C |
| | Altitude | <5000m (above 1000, every 100m more, capacity reduce 1%) |
| | Relative humidity | <95% no condensation |
| | Protection degree | IP20, custom design for higher level |

POWER QUALITY SURVEYS AND SVG ENGINEERING SERVICES

We regularly undertake power quality surveys to understand user specific problems. Using our specialised measuring equipment, our technical support team can carry out an onsite audit to engineer a solution for your power factor needs and harmonic mitigation needs. A report will be presented with recommendations on solutions.

Please call LIVELINE at 9830024138 or mail at info@livelineindia.com to discuss your requirements with our technical support team.

LIVELINE ELECTRONICS is an ISO 9000 & 14000 certified MSME and NSIC registered Kolkata based industrial power electronic products manufacturing company having sales and service network spread across the nation.

Our current product range also include industrial UPS Systems, Battery Charges, Inverters, Capacitor based Power Factor Correction (APFC) panels, Inverters, Electrical Control/Distribution Panels, Servo Stabilisers, Isolation Transformers, Power Quality Surveys n Site Audits etc.

Most of our products are technologically advanced and designed to deliver high quality performances with a focus on customer support and services.

LIVELINE reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on LIVELINE products previously or subsequently sold. LIVELINE does not guarantee the items of the accuracy and completeness.



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