Comparison of Advanced Phase Control (APC) & Variable Sine-wave Technology (VST) Dimmers	**A - 28/10/2008**

The extensive range of dimming technologies used in our Solution range of cabinets caters for all our customer requirements. From the simple Relay module up to the industry leading Variable Sine-wave Technology (VST) State Automation has a solution for the most demanding installation.

The two dimmer types that we are frequently asked about are our Advanced Phase Control (APC) and Variable Sine-wave Technology (VST).
One of the most often asked question is “how do these two technologies fit into a market place that is increasingly interested in a more environmentally-conscious world?”

This paper will compare the relative merits of our popular dimmer modules and their ‘Green’ credentials.

For this comparison we will look at a 3kW Dimmer from each technology type – APC & VST.

The APC is an evolutionary step in the life of the traditional Phase Control dimmer. The dimmer operates with a higher overall efficiency which means it generates less heat during operation. This helps keep HVAC cost down.
RCBO protection provides a higher level of electrical safety for the people working in the venue.
The APC still presents all the harmonics issues usually associated with Phase Control technology. Consideration needs to be made on de-rating the supply transformers and using larger neutral cables for the connection to the dimmer cabinets.

The VST is a revolutionary step in the life of dimming products. It provides the precise dimming control needed in today’s entertainment & architectural environment without the production of harmonics back into the supply.
The trade off that needs to be considered is the relatively higher heat generation.
The complexity of the VST module gives it a higher manufacturing cost but its reduced impact on the wider electrical supply network is becoming more & more attractive to the designers and builders looking to make a ‘Greener’ community.

Purchase Cost

The first thing you notice about the two technologies would be their cost difference.

Module 2-ch APC 3kW 16A with 32A RCBO 801-147-00/APC16/RP	€ 515.00 List
Module 2-ch VST 3kW 16A with 32A RCBO 801-152-00/V16	€1,700.00 List

The APC is the simpler technology and is therefore cheaper to manufacture. The resultant savings are passed on to our customers.
The VST is a more complex technology and uses more components. Testing is more rigorous which adds more time to the manufacturing process.

Comparison of APC & VST Dimmer technologies

The following table highlights some of the features shared by the two technologies and their comparative merits;

Feature	APC	VST
Purchase cost	100%	300%
Efficiency	High (>96.9%)	High (>95.9%)
Heat generation	Low	High
Reliability due to reduced heat stress of components	High	Medium
Lamp filament noise	Medium	Low
Production of 'Harmonics' back into Mains power supply	High	Low
Costs for 'de-rated' Mains power supply equipment	High	Low
Costs of Mains power cabling [Increased Neutral current]	High	Normal
Operating costs – HVAC of dimmer room	Low	Medium
Affect on supply 'Power-factor' for capacitive & inductive loads	High	Low
'Apparent' power usage due to poor 'Power-factor'	High	Low
Transport Costs associated with # of components in each module	Low	High
Manufacturing costs	Low	High
Delivery Costs due to weight of finished module	Low	Medium

APC ADVANTAGES

Some phase control dimmers may offer effective 'harmonic' filtering but they do so at the expense of energy efficiency and build cost. State Automation has revisited phase control technology to provide our customers with a far more efficient method of dimming lights.

SA calls this new technique 'Advanced Phase Control' (APC). While APC may not be revolutionary, it is evolutionary — it creates a new generation of dimmers with exceedingly high rise time (which means extremely good filtering) but with low heat loss compared with other dimmers of a similar capacity.

The test results show APC technology provides significant advantages.

- High efficiency—less wasted power, lower running costs.
- Dramatically cooler running, especially when the output level is close to 100%.
- Reduced ventilation and air conditioning requirements in large installations.
- Reduced weight and volume of the dimmer for similar performance.
- Less voltage drop at full output.
- The possibility of using the dimmer as a replacement for a relay or contactor since no inductance is in series with the load when the dimmer is at full output.
- Improved reliability because of reduced heat-stress on components.
- Reduced operating cost.

VST ADVANTAGES

Variable Sine-wave Technology electronically varies the amplitude of the AC input power and provides this as dimmed output.
There is no change to the frequency or waveform and therefore harmonic distortion is not introduced into the mains power lines. This in turn provides a favourable power factor rating.

VST is able to dim any type of load - resistive, capacitive and inductive - without requiring any changes to the dimmer components.

The VST dimmer provides the following features;

- Sinusoidal output effectively eliminates lamp filament singing
- Total harmonics distortion typically <1% (load & fade level dependent)
- Sinusoidal output essentially eliminates all harmonics
  - No odd harmonics means minimum neutral currents
  - Minimises RF harmonics and associated interference
- Sinusoidal output independent of load type, including reactive loads
- Substantially improved Power Factor for linear loads
- Compatible with most lamp types
- High efficiency (>96%)
- Operates with temporary generators that may have distorted sinusoidal outputs
- Input frequency & waveform independent
- Smooth intelligent fades with 660 steps internal resolution
- Electronic short-circuit and overload protection
- Electronic current limit
- Low harmonic content supports sensitive upstream and downstream RCDs (ELCB / GFI)

Further reading;

White Paper – Why Sinewave Dimming?
White Paper – Advanced Phase Control

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