

What are the differences and advantages to the various design technology used in PropSava Voltage Optimisers?

For the lay person, differentiating between the various technologies employed to deliver voltage stabilisation can often be a daunting task and it is not always clear as to which technology is best for a particular application.

What is the PropSava?

Background:

Vanguards Power (Hong Kong) Limited PropSava is based upon a design of a contactless voltage regulator from 10KVA to 600KVA and electro-servo voltage regulator from 60KVA – 3,000 KVA (*definition: A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level*)

We refer to the PropSava as a Power Optimisation System because the main purpose of the software we have designed that controls the voltage regulator is to optimise (*definition: [verb] modify to achieve maximum efficiency*) the output voltage from the main supply to electrical equipment.

Voltage regulation is not new. Devices for regulating voltage have existed since man started trying to harness the power of electricity. The basic principles of high current voltage regulators are also not new since all systems use various types of transformers to change the value of the voltage supply to the required output level. The main difference between different types of voltage regulators are:

1. They are able to regulate incoming voltage that is over and under the required output requirement – many transformer types only regulate over voltage and therefore do not provide stable voltage for those users who suffer from under voltage supply.
2. The control mechanism and systems used that measures and effects change of the incoming voltage to achieve the desired output voltage – mechanical, electro-mechanical and electronic
3. The speed of the control mechanism and system – response time in seconds.
4. The serviceability of the device – service and maintenance intervals.
5. The range of output voltage that can be maintained - + or – X Volts.
6. The length of service life – how many years the device is designed to operate.
7. Cost
8. Warranty.

PropSava Technology:

Contactless System - Control & Management:

The PropSava is a pure linear contactless system based upon electromagnetic induction principle. This system is used in our single and three phase systems. The contactless system is managed and controlled by our newly developed computer chip and software system. The computer chip controlled system and software is the key to the consistent efficiency of our contactless voltage regulator; making some 8 million calculations per second. This extremely fast measuring of all data allows the PropSava to rapidly identify, measure, and implement the necessary control changes to ensure that the outgoing voltage is maintained at the pre-set limits within 0.042 seconds – 42 milliseconds.

SCR:

To ensure that the PropSava voltage control system keeps up with the speed of the onboard computer chip system and software, we have used the latest German manufactured silicon controlled rectifiers (SCR). SCR's have no wear out mechanism related to number of switching operations so much higher switching rates can be used bringing higher speed, smoother power delivery and flexibility.

Electro-Servo System:

For most applications our Servo Electronic - Electro Mechanical Ranges have proved to be a very reliable and cost-efficient, being able to accommodate an input voltage swing of in excess of 40% whilst still delivering accuracy on the output. Comprising a transformer having its secondary winding connected between the mains supply and the load, the primary voltage is automatically controlled through a motor driven variable transformer.

Electronic Servo stabilisers do contain moving parts with only a low-level of ongoing maintenance required; being deliverable by universally readily available skill sets.

Comparison Table:

SCR Power Optimisation System

Advantages	Disadvantages
High speed of response to voltage changes – 0.042 seconds	Less price competitive when compared to Electronic Servo design
Output voltage accuracy 1.5 %.	Should not be used where large and unexpected loads are possible such as welding plants and large ovens.
No Moving parts – virtually Maintenance free	
Efficiency 96% at full load below 50KVA and 98% plus above 50KVA	
Not Frequency dependent	
Output voltage does not collapse on overload or severe input voltage drop	
Low output waveform distortion	
Unaffected by load or power factor changes	
Will attenuate voltage spikes if required	

Electro-Servo Power Optimisation System

Advantages	Disadvantages
Unaffected by load or power factor changes and more resilient to frequent large loads than SCR - such as welding etc.	Moving parts requiring maintenance such as annual inspection of servo-motor chain drive and 5 yearly replacements of carbon brushes.
Reasonable speed of response to voltage changes.	Lower speed of response (1 – 1.5 seconds compared to solid state designs such as Contactless Systems.
Competitively priced	Size & Weight larger than Contactless System.
Efficiency 96% at full load below 50KVA and 98% above 50KVA	
Negligible output waveform distortion	
Not Frequency dependent	
Will attenuate voltage spikes if required	
Endurable, with long life expectancy	

PropSava Single Phase Load Sizes:

The single phase systems are designed for 230V and 120V systems. The 230V units are available as 5, 12, 18, 23, 30, 40 and 60KVA; and the 120V units as 2, 5, 9 and 12KVA.

Voltage output on the 230V units are regulated to 220V +/- 1% with an 'optimum switch' that instantly changes the output voltage to 210V.

Voltage output on the 120V units are regulated to 110V +/- 1% with an 'optimum switch' that instantly changes the output voltage to 105V.

PropSava 3 Phase Load Sizes:

The 3 phase systems are designed for 400V input voltage +/-10% (360 – 440V) supplies with output across the phase of 380V (single Phase of 220V) and load sizes from 10KVA to 600KVA using our Contactless SCR System and 60KVA to 3,500KVA for our Electro-Servo system.

Benefits of the PropSava:

Both the single and 3 Phase PropSava provide the following benefits:

1. Reduce KWH electricity costs and carbon emissions by up to 17%, (depended on incoming voltage and equipment conditions)
2. Reduce reactive power, improve power factor and suppress harmful harmonics (subject to assessment of KVAR and installation of an additional harmonic filter).
3. Increase the lifecycle of the electrical equipment and reduce the maintenance costs.
4. Protect electrical equipment from transients (spikes and surges).
5. 10 year guarantee and a 25-40 year life cycle.
6. No maintenance on contactless system – 5 year, 1 hourly inspection on electro-servo systems.

General Specifications of PropSava 3 Phase SCR System:

Power Optimisation/Regulation:		Digital control contactless compensated regulation, three phase regulated separately
Input	Voltage:	400V (360 – 440V)
	Variance Range:	± 10%
	Frequency:	47Hz ~ 63Hz
	Power Factor:	0.95 ~ 1
Output	Voltage:	380V or customer specified
	Regulated range:	± 1.5%
	Frequency:	As input
	Range of Load PF:	0.8 ~ 1
Efficiency		≥98.8% (Full Load)
Waveform distortion:		≤0.1%
Response time:		≤40mS
Insulation Resistance:		≥2MΩ
Insulation strength:		No damage at 2000V 1 Minutes
Display:		Multifunctional LED display shows input/output Voltage, current. Protection state.
Protection function:		Auto/Manual Bypass, Over/under voltage, Over load, Short circuit, Phase Drop, Wrong Phase, Alarm/Silence at Bypass.
Surge Protection:		IEC class II surge protection. Nominal discharge surge current is 20KA
Overload ability:		150% for 10 second
Noise:		≤ 45dB
Cooling:		Fan
Size:		Manufactured to Load/size specification
Input/output Connection:		Terminal plate
Environment	Temperature	-10°C ~ 45°C
	Humidity	0~95% (No freezing point)

Surge Protection System:

All PropSava single and 3 Phase Power Optimisation Systems have a surge arrester fitted as standard. This is not a luxury but an absolute necessity to protect not only the PropSava but also the entire site/properties electrical equipment. Surges are short-duration peak voltages – i.e. transient voltages – existing for only milliseconds; but can measure thousands of volts.

These surges are caused by:

1. Direct lightning strikes
2. Indirect lightning strikes within a distance of some kilometres
3. Switching operations in the power supply system
4. Faults due to switching operations within the installation

In the commercial sector, lightning or power surges cause 45% of electrical equipment damage. Overall, 28 out of 100 cases of damage to electronic equipment are caused by surges. Surges are by far the most frequent cause of damage and that is why surge arrestors are fitted as standard.

Surge Protection System Specifications - Standard:

PropSava-3 phase Standard Surge Arrester installed V 20-C/3+NPE-385 technical data:

Surge Controller surge arrester Description	V 20-C/3+NPE-385
Maximum continuous operating voltage U_{cAC} (max. permitted operating voltage) U_{cDC}	385 V~ 505 V-
LPZ	1 → 2
Requirement class to VDE 0675, Part 6 (Draft 11.89) A1, A2 to IEC 61643-1	C, Class II
Tested to:	IEC 61643-1, pr EN 61643-1, E DIN VDE 0675-6:1989-11 and Part 6/A1
Nominal discharge current of the upper part I_n (8/20)	20kA
Max. Discharge current per block I_{max} (8/20) Surge Controller V 20-C/3...	110 kA
Maximum discharge current of the upper part I_{max} (8/20)	40 kA
Voltage protection level at 1 kA (8/20) Up at 5 kA (8/20) Up at I_n Up	≤1.2 kV ≤1.5 kV ≤1.8 kV
Response time t_A	<25 ns
Short-circuit withstand strength 25 kA with max. upstream fuse	125 A gL/gG
Connection cross-section	2.5-35 mm ² (single and multi stranded); 2.5-25 mm ² (fine-stranded with core end sleeves)
Mounting	Snap-fitting on 35 mm top-hat rail to DIN EN 50 022
IP Code	IP20
Temperature range ϑ	-40 °C to +80 °C

Surge Protection System Specifications - Optional:

PropSava-3 phase Optional Surge Arrestor type V 25-B+C/3+NPE-385 technical data:

Surge Controller surge arrester Description	V 25-B+C/3+NPE-385
Maximum continuous operating voltage U_{CAC} (max. permitted operating voltage) U_{CDC}	385 V~ 505 V-
LPZ	0 → 2
Requirement class to VDE 0675, Part 6 (Draft 11.89) A1, A2 to IEC 61643-1	B+C Class I+II
Tested to:	IEC 61643-1, pr EN 61643-1, E DIN VDE 0675-6:1989-11 and Part 6/A1
Nominal discharge current of the upper part I_n (8/20)	50kA
Max. discharge current per block I_{max} (8/20) Surge Controller V 20-C/3...	150 kA
Maximum discharge current of the upper part I_{max} (8/20)	100 kA
Voltage protection level at 1 kA (8/20) U_p at 5 kA (8/20) U_p at I_n U_p	≤ 1.0 kV ≤ 1.2 kV ≤ 1.5 kV
Response time t_A	<25 ns
Short-circuit withstand strength 25 kA with max. upstream fuse	160 A gl/gG
Connection cross-section	2.5-35 mm ² (single and multi-stranded); 2.5-25 mm ² (fine-stranded with core end sleeves)
Mounting	Snap-fitting on 35 mm top-hat rail to DIN EN 50 022
IP Code	IP20
Temperature range ϑ	-40 °C to +80 °C

Overall Build objectives of the PropSava:

- PropSava single and 3 Phase Voltage Optimisers:
- Fast response time.
- Maximum possible efficiency at full load.
- High efficiency, high standard and extensive safety range of industrial grade components.
- The ability to sustain severe temperature, humidity, vibration and dirty environments.
- Transformer windings are of high quality enamelled copper wire.
- Low output noise and extremely RFI radiated noise.
- Fast response to input and output changes.
- Inexpensive.
- No maintenance.
- Reliable.
- Manual bypass function
- Automatic bypass function
- Surge protection
- Input and output isolated