

# SGVF Series

## Linear and Switched Mode (PWM) Electronics Power Sources



5500kVA 10kV PWM IGBT Power Source ( Three Phase) for ABB

**Samgor** designs and manufactures both **linear and switched mode (PWM) Electronics Power Sources**. We provide technically advanced, reliable, and cost effective standard and custom precision programmable AC Power Solutions that feature fast transient response, tight regulation, high peak current capability, no switching noise (linear) and low switching noise (PWM switching) models and low output impedance.

The **SGVF series linear electronics power sources** produce low-distortion and high fidelity output waveforms with **low partial discharge (<2pC)**. The advantage of linear amplification is its ability to faithfully reproduce oscillator waveforms with very high small signal bandwidth and low output distortion. The capacity of the linear AC power sources are up to **1000kVA single phase/each unit, it can combination to three phase (Delta or Star) or parallel using for single phase**.

The **SGVF series PWM electronics Power Sources** offer very good power density, high efficiency, and perform well into low power factor loads. They use a combination of both linear and non-linear methods to achieve high efficiency conversion in lighter and smaller packages. Using additional power filter, the partial discharge also can be **less than 30pC typically**. The capacity of the PWM AC power sources are up to **3000kVA three phase (Delta**

**or Star), 2000kVA single phase**.

Both **linear and switched mode (PWM) Electronics Power Sources** can adjust voltage and frequency separately . Also it can used as the pure power supply even using at very bad power quality place, the output voltage, frequency and waveform will be special stability.

### Applications:

- ◆ Distribution / Power Transformer Testing (200Hz)
- ◆ Instrument Transformer Testing (150Hz-400Hz)
- ◆ AC Resonant Withstanding Voltage Testing (Tunable Frequency Type, 20Hz-300Hz)
- ◆ Motor Testing (50Hz/60Hz/120Hz/etc.)
- ◆ Pump Testing(50Hz/60Hz/120Hz/etc.)
- ◆ TRIAC / SCR Testing
- ◆ Aircraft / Airport (400Hz)
- ◆ Port Shore Power Supply (60Hz)
- ◆ Research Department
- ◆ Army (400Hz)
- ◆ etc.



300kVA PWM IGBT Power Source ( Single Phase)

## Benefit and Advantage of Linear Amplifiers

### Power Sources:

- ◆ High Crest Factor, Low Distortion, High Fidelity Output, **waveform deviation factor is less than 0.5%**.
- ◆ Free partial discharge, **less than 2pC (40-500kHz)**.
- ◆ **Single / Three Phase output**, also can be parallel connection use.
- ◆ Light and Compact, it can **instead of most of MG Set and voltage regulator**.
- ◆ Ability to faithfully reproduce oscillator waveforms with very high small signal bandwidth and low output distortion.
- ◆ No space radiation when working..
- ◆ Used as pure power source, insulated power noise and anti-grid fluctuations.

### Linear Amplifiers Power Sources Feature:

- ◆ 0-400V output voltage.
- ◆ 15Hz-5000Hz frequency adjust range.
- ◆ Sampling and display output voltage, output current, output frequency, phase angel, working temperature, running time, and fault warning.
- ◆ Automatic search the resonant point when start.

### Linear Amplifiers Power Sources Safety Feature:

- ◆ "Zero Start" Interlock
- ◆ On/Off Push-button Control
- ◆ Emergency Off Mushroom Switch
- ◆ Breakdown and flashover protection: the system can automatically stop when the HV winding has flashover the ground.
- ◆ Short circuit protection: automatically stop when the output is short circuited in the cabinet.
- ◆ Power failure protection: the system will use the rest power within the circuit to switch off the signals to ensure the system's safety if the input power failed suddenly.
- ◆ Mistuning Protection: the control box will switch off the output if the testing system is mistuned due to the defects of test object.

- ◆ Bridge arm protection: the control box will automatically make alarm or stop the operating when the DC voltage from 4 bridge arms is not balanced.
- ◆ Efficiency protection: to ensure the safety of the system, it will measure the voltage, current, the load impedance and phase, limiting the active or reactive load. Meanwhile, the system will automatically notify the engineer to adjust the output of exciter transformer to match the relevant impedance.
- ◆ Cooling fan linkage protection: If the power of cooling fan is with the wrong phase sequence, the system will automatically adjust the phase sequence to ensure the direction of air outlet can be automatically adjusted. If the cooling fan cannot work, the system will not start or switch off automatically.
- ◆ Output voltage limitation protection: pre-setting the HV voltage value to ensure the output value will not bigger than the pre-set value due to wrong operating or other abnormal situation occurs.
- ◆ Seismic protection: the disc spring is installed on the bottom of cabinet to buffer the vibration due to the unevenness of road.
- ◆ Protection of phase lacking: the system will indicate if the input power supply has phase lacking and the system will switch off immediately.
- ◆ Protection on control box and optical fiber: if there is the fault upon the control box and optical fiber. The protection device of the system will work automatically and switch off the input power to ensure the safety of engineer and test object.



80kVA Linear Amplifiers Power Source

## Linear Amplifiers Power Sources Reliable Feature:

### Seismic Protection

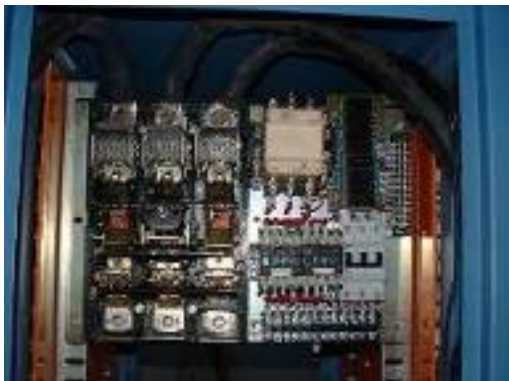
- ◆ There are six feet on the bottom of the power supply cabinet with disc spring to buffer the vibration during the transportation while they are enough to support the weight of the whole system.
- ◆ The system is equipped with anti-seismic terminals (Brand Phoenix) with imported plastic screw.
- ◆ The system is packed in the specialized case and with 4 lifting points on the top of the cabinet in order to ensure the safety during the lifting and transporting.

### Radiation

- ◆ The system use straight duct to improve the space and is equipped with 24 sets of imported EMPAST low-noise cooling fans. The temperature difference between inlet and outlet is less than 25k. there is moveable door for dust proof in the duct.

### Used Components

Material	Supplier	Remark
Capacitor	EPCOS	400V 4700uF to absorb the interference of high frequency, more stable
Transistor	SANYO 2SC3997	With the largest power in linear transistor, withstanding 150 celsius degree, 1600V DC breakdown, and output 250w
Contactora	ABB Italy	IRF580
Switch	ABB Italy	S800N
Cooling Fan	EMPAST German	250mm, 2600/min 35 m3/min 68dB, automatic dust cleaning
Connector	PHINEX	Made in German, high reliability
Screen	WINSTAR WG320240B	Clear display, big screen -175 to 175 degree
Button	DECA	High quality
Photoelectric converter	Agilent IRF1414	High stable
Photoelectric plug	ODU	Made in German
Voltage Sensor	LEM LV28—P	Good reputation, reflect the system status accurately



### Power Margin and Filtering

- ◆ There are switch on/off and emergency switch. It can automatically pre-switch-on and when the capacitor is charged inside the cabinet then the circuit is on.
- ◆ The power amplifying circuit use the Sanyo 250w 2SC3997 transistor, holding the more than 2 times of power margin and experiencing the 3 tests of outlet to ground short circuit (more than 120% over load during the short circuit test)
- ◆ The amplifier tubes are experiencing filtering by the situation : 2 times of working voltage and 1.5 current upon them, the difference is within 2%. There is current circuit to ensure that the current difference is less than 5% between different transistors.



**300kVA Linear Power Source**



**550kV Power Transformer Onsite Induce Voltage Test**

## Benefit and Advantage of Switched Mode (PWM) IGBT Power Sources:

- ◆ Very good power density, high efficiency, **waveform deviation factor is less than 2%**.
- ◆ Maximum system reliability
- ◆ Low partial discharge, **less than 20pC (40-500kHz), it can satisfy for destruction and power transformer testing.**
- ◆ **Single / Three Phase output**, up to 3000kVA capacity.
- ◆ Light and Compact, it can **instead of most of MG Set and voltage regulator.**
- ◆ **Easy commissioning and maintenance.**
- ◆ **R/C/L** all can be load, quality factor can be 0.05-0.95.
- ◆ Used as pure power source, insulated power noise and anti-grid fluctuations.
- ◆ Unmatched performance/price ratio.
- ◆ At the same output capacity, 2 output voltage select taps can be choose, it widely increase the totally capacity. (eg: 100kVA, tap 1: 0.5kV, 200A, tap 2: 0.25kV, 400A.)
- ◆ Super Heavy Duty.

## Switched Mode (PWM) IGBT Power Sources Feature:

- ◆ 0-600V output voltage, output voltage also can be special ordered.
- ◆ 20Hz-4000Hz frequency adjust range.
- ◆ Sampling and display output voltage, output current, output frequency, phase angel, working temperature, running time, and fault warning.
- ◆ Automatic search the resonant point when start.
- ◆ Fast response time for select the voltage and frequency.

## Switched Mode (PWM) IGBT Power Sources Feature:

- ◆ "Zero Start" Interlock
- ◆ On/Off Push-button Control
- ◆ Emergency Off Mushroom Switch
- ◆ Breakdown and flashover protection: the system can automatically stop when the HV winding has

flashover the ground.

- ◆ Short circuit protection: automatically stop when the output is short circuited in the cabinet.
- ◆ Power failure protection: the system will use the rest power within the circuit to switch off the signals to ensure the system's safety if the input power failed suddenly.
- ◆ Mistuning Protection: the control box will switch off the output if the testing system is mistuned due to the defects of test object.
- ◆ Cooling fan linkage protection: If the power of cooling fan is with the wrong phase sequence, the system will automatically adjust the phase sequence to ensure the direction of air outlet can be automatically adjusted. If the cooling fan cannot work, the system will not start or switch off automatically.
- ◆ Output voltage limitation protection: pre-setting the HV voltage value to ensure the output value will not bigger than the pre-set value due to wrong operating or other abnormal situation occurs.
- ◆ Seismic protection: the disc spring is installed on the bottom of cabinet to buffer the vibration due to the unevenness of road.
- ◆ Protection of phase lacking: the system will indicate if the input power supply has phase lacking and the system will switch off immediately.
- ◆ Protection on control box and optical fiber: if there is the fault upon the control box and optical fiber. The protection device of the system will work automatically and switch off the input power to ensure the safety of engineer and test object.



600kVA PWM IGBT Power Source (3 phase)

## Comparison of Linear / Switched Mode Electronics Power Sources with MG Sets

The following tables describes generally a comparison of traditional motor-generator set and new electronic power sources in transformer test fields. It shows the advantages and draw-backs of each system.

Earlier as power electronics were not such developed as nowadays, the motor-generator set was the most common voltage and frequency supply. The biggest issue to go in new fields with electronic power and fast switching IGBT-technology or linear amplifier the fact to reduce or eliminate the high frequency noise which is produced by the pulse-width-modulation of two-level converters. Further the outfitter design has to be also well developed to reduce the common mode voltage which can disturb the partial discharge measurements after IEC60076-1. Especially for dry-transformer laborites is this a very high challenge.

	<b>Motor Generator Set</b>	<b>IGBT Electronics Power Sources</b>	<b>Linear Electronics Power Sources</b>	<b>Remarks</b>
<b>Maintenance</b>	Once a year or more maintenance required for bearing, winding, couplings, cooling and etc.	No maintenance, only replacing electronics components after 10000 hours running;	No maintenance, only replacing electronics components after 10000 hours running;	
<b>Flexibility of Frequency Values</b>	Fixed frequency or changed in small range;	Max 20-600Hz can be set, 0.01Hz step;	Max 20-2000Hz can be set, 0.01Hz step;	
<b>Accuracy of Frequency Value</b>	Usually exact, but if windings in generator are not exact than slight frequency variations.	Max 0.01Hz Exact Frequency Control by fast microprocessor;	Max 0.01Hz Exact Frequency Control by fast microprocessor;	3rd,7th Harmonics is big for MG set.
<b>Stability of Frequency Value ( Very Important for Compensating)</b>	Usually slight frequency changed by input frequency slight changed;	No influence by Input power source, very stable;	Small influence by Input power source, very stable;	MG Set need to use VFD and synchronous motor to make frequency stable.
<b>Injection of Harmonics for Test Transformer (Thermal Test)</b>	Not possible	For the most used harmonics up 8 harmonics possible	Amplifier software set only;	Important for the dry type transformer.
<b>Capacity Upgrading Future</b>	Not possible	Easy to parallel more module;	Easy to parallel more module;	

<b>Investment</b>	Total Investment and maintenance fee is high;	Total Investment and maintenance fee is Low;	Total Investment and maintenance fee is Middle;	
<b>Working Quality Factor</b>	Typical 0-0.5 or less;	0-0.98, it can load capacitive, reactive, resistive;	0 -0.95, it can load capacitive, reactive, resistive;	IGBT can be used at max current in any voltage.
<b>Reliability</b>	Good if maintenance is well;	Very Good, Life cycle is 15-20 year, easy maintenance;	Good if maintenance well for electronics components;	
<b>Partial Discharge for Induce Voltage Test</b>	Big PD, no IEC standard has PD requirement for MG Set;	Typically <50pC by filter;	Typically <5pC	
<b>Start Time</b>	Depend on size of transformer, it need 5-30 minutes	10 seconds	10 seconds	
<b>Size of Location</b>	Very Big, normally for big MG set need a individual room;	Very small	Small	EPS can reduce the room investment;
<b>Flashover and Other Protection</b>	Good but not sensitive;	Good and very sensitive;	Good and very sensitive;	



1000kVA PWM IGBT Power Source (3 phase)



50kVA PWM IGBT Power Source (3 phase) for Induce Voltage Test

equipments for a wide range of electrical applications.

Test systems for laboratory, factory and field use are available.

**Welcome to send us your requirement spec and test object details, the professional engineers from Samgor will provide you a most suitable solution.**



**3000kVA 60Hz Port Shore Power Source**



**750kV Power Transformer Onsite Induce Voltage Test**



**600kVA PWM IGBT Power Source (3 phase)**

### **Company Profile:**

Over 20 years professional supplier in the high voltage test equipment business make the high voltage test department become most important branch of SAMGOR group, SAMGOR has a reputation for quality and reliability based on extensive products and vast experience. SAMGOR provides test, measurement and diagnostic

**For further information please contact:**

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