

# Powering India

Since 1998



**RS** Power  
**Power+**



## GROW UNINTERRUPTED

Quality, uninterrupted power is the backbone of every industry. Incepted in 1998, RS Power paces with the evolving need of various sectors to develop Industrial Power Supply Solutions.

From developing power systems to back air traffic control systems, to contributing to inventions & innovation by supplying pure power in laboratories, RS Power has won trust of more than 30 sectors for providing conventional & unconventional power solutions & services.

The constant efforts of RS Power to provide value-added services & consultation has earned it multiple national awards and ISO certifications.





## COMMITTED TO DELIVER QUALITY

RS Power, which was founded in 1998, is a technically competent business capable of designing, developing, and delivering efficient solutions to meet the needs of customers that require complete power conditioning solutions. Our products have earned a reputation for excellent quality, performance, and dependability.

Sales, service, distribution, and warehousing operations are dispersed across India, including manufacturing sites in both Jaipur and Pune.

Production, R&D, QC & Testing, Service & Maintenance, Sales & Marketing, Store & Purchase, Accounts, HR, and General Administration are among our numerous departments.

## QUALITY ASSURED

All products are tested for quality and standard by the Central Govt. NABL Laboratory. The two main test laboratories include the

- Electronic TEST & Development Centre Standardisation Testing and Quality Certification ETDC (STQC)
- National Test House (NTH)

## CERTIFICATIONS (PROFICIENT POWER)



## RECOGNITIONS

RS Power has been recognized for quality and durability by renowned companies Indian Railways, Indian Army, Indian Air Force, Reliance, Tata and numerous others.

- National Award for outstanding Performance from Govt. of India
- SAHARA Award for Quality Product



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**CLIENTS**



## ONLINE UPS 1-10 KVA UPS (PP 11 Series)

### On-Line UPS

On-Line UPS deliver pure sine wave power and the highest level of power protection available to sensitive servers and network equipment. Double-conversion technology continually converts incoming AC power into filtered DC power, and then re-synthesizes it back into AC power with a pure sine wave. Constant on-line operation completely isolates sensitive equipment from every power problem on the AC line, plus reliable battery backup keeps network running even in the case of a blackout.



### Power Packed Features

- IGBT based high frequency PWM Inverter
- Wide input voltage range
- Protection from spike, surges, RFI, EMI
- Constant voltage and frequency
- EPROM/Micro controller design
- Reliable double conversation technology
- Float cum boost charger
- Soft start facility
- Clean computer grade power to critical load
- Generator compatible
- High crest factor
- Less harmonic distortion
- Static bypass switch

### Reliable Double Conversation Technology

The double conversion technology is proven, efficient, reliable and provides clean computer grade power to critical load. The load is completely protected against spikes, surges, brownouts and power failures.

### High Frequency PWM Inverter Using IGBT

High frequency PWM technology using IGBT provides high efficiency, low noise and faster transient response.

### Application & Users

- Local Area Network (LAN)
- Data Centers/Offices
- Work Stations
- Telecommunication Systems
- Medical Equipment
- Air Traffic Control Systems
- Satellite Systems
- Industrial Equipment & Automation
- General Laboratory Equipment
- Studio, Printing and Media Equipment

## TECHNICAL SPECIFICATIONS

Capacity	1 KVA	2 KVA	3 KVA	5 KVA	6 KVA	7.5 KVA	10 KVA
Model No.	1000 OL	2000 OL	3000 OL	5000 OL-3	6 KOL	7.5 KOL	10 KOL
General	(i) UPSs are free from workmanship defects, sharp edges, nicks, scratches, burs etc. All fasteners fixed properly. The equipment shall be complete with all parts and all parts shall be functional. (ii) UPS enclosure's degree of protection shall be IP20/IP21 as per appendix C of IS 13947 (part 1)/1993 (reaffirmed 2004) (iii) Provision of manual By-pass facility for maintenance of UPS (iv) UPS shall supply output power and charging current at the same time.						
Technology and capability	True online Sine wave double conversion DSP controlled UPS with advanced IGBT/PWM technology at both rectifier and inverter.						
Switching Device	MOSFET/ IGBT						
Switching Frequency	> 10 KHz						
Input Voltage	160 V – 270V, 50 ± 3% Hz, Single phase AC (or any Voltage range as per requirement)						
Input Power factor	>0.95 (lagging)						
Output	230 V/ 220 V ± 1%, 50 ± 0.5 Hz, single phase						
KW rating of the UPS	0.8/0.9 to unity at full load						
Isolation Transformer	Inbuilt Isolation Transformer (optional)						
Crest Factor	3:01						
Facility for operation in synchronous mode	Provided i.e. Output frequency shall be same as that of mains frequency						
Harmonic Distortion	2% Max. for UPS upto 5 KVA , 3% max. for UPS above 5 KVA						
Efficiency	At rated output KVA rating, rated power factor, rated voltage and frequency (overall efficiency): ≥90%						
Overload Capacity	120% for 10 min. & 150% for 1 Minute						
Display (LCD)	Input & Output Voltage, Input & Output Frequency, Temperature, Load percentage, Battery Charging, Battery Level Indicator, Charging Status						
Protections	· Over Temperature · Short Circuits at output of UPS · Overload at output terminal · Over and under voltage at battery terminal						
Indicators	· Mains presence · Battery Charging & discharging · Output overload · Low battery voltage · Over Temperature						
Meters	Provision of Digital Meter for monitoring the following parameters: · Input AC voltage · Output AC voltage, current and frequency · Battery voltage & current · Power Load Meter						
Battery Bank	· Type : SMF VRLA batteries as per JISC : 8702 standard/Tubular/Lithium Ion · Battery Stand : Provided						
Noise (dB), Temperature and RH	< 45 dB (1 meter), 0-40 OC, 0-95 % (No condensation)						
Protection	IP20/IP21						
Alarm	Battery low voltage, abnormal power supply, UPS failure						
Other Features Optional)							
Communication & Interface	Suitable Interface (RS232/RS485) Port and software enable to user to supervise while working on platform such as XP/Windows/Linux/VISTA etc. SNMP communication offers so that critical parameters of UPS can be monitored from remote position.						
Parallel Redundancy	Parallel Redundancy/Hot standby modes						
Bypass	Static Bypass system for Automatic Transfer						
STANDARD							
Certification	ISO 9001, ISO 14001, ISO 27001, ISO 45001, RoHS, & BIS certified						
Safety Standard	IEC/EN-62040-1						
EMC Standard	IEC/EN-62040-2; IEC/EN-62040 -3, Complying to CE						



## ONLINE UPS 10-30 kVA UPS (PP 313 Series)

### On-Line UPS

On-Line UPS deliver pure sine wave power and the highest level of power protection available to sensitive servers and network equipment. Double-conversion technology continually converts incoming AC power into filtered DC power, and then re-synthesizes it back into AC power with a pure sine wave. Constant on-line operation completely isolates sensitive equipment from every power problem on the AC line, plus reliable battery backup keeps network running even in the case of a blackout.



### Power Packed Features

- IGBT based high frequency PWM Inverter
- Wide input voltage range
- Protection from spike, surges, RFI, EMI
- Constant voltage and frequency
- EPROM/Micro controller design
- Reliable double conversation technology
- Float cum boost charger
- Soft start facility
- Clean computer grade power to critical load
- Generator compatible
- High crest factor
- Less harmonic distortion
- Static bypass switch

### Reliable Double Conversation Technology

The double conversion technology is proven, efficient, reliable and provides clean computer grade power to critical load. The load is completely protected against spikes, surges, brownouts and power failures.

### High Frequency PWM Inverter Using IGBT

High frequency PWM technology using IGBT provides high efficiency, low noise and faster transient response.

### Application & Users

- Local Area Network (LAN)
- Data Centers/Offices
- Work Stations
- Telecommunication Systems
- Medical Equipment
- Air Traffic Control Systems
- Satellite Systems
- Industrial Equipment &Automation
- General Laboratory Equipment
- Studio, Printing and Media Equipment

## TECHNICAL SPECIFICATIONS

Rating	10 KVA	10 KVA	15 KVA	15 KVA	20 KVA	20 KVA	25 KVA	25 KVA	30 KVA	30 KVA
	(3-1)	(3-3)	(3-1)	(3-3)	(3-1)	(3-3)	(3-1)	(3-3)	(3-1)	(3-3)
General	(i) UPSs should be free from workmanship defects, sharp edges, nicks, scratches, burs etc. All fasteners fixed properly. The equipment shall be complete with all parts and all parts shall be functional. (ii) UPS enclosure's degree of protection shall be IP20/IP21 (iii) Provision of manual By- pass facility for maintenance of UPS (iv) UPS shall supply output power and charging current at the same time. (v) DC disconnect Switch with Protection (vi) Static Transfer switch (External/Internal)- Automatic Bidirectional and take care of 100% uninterrupted load transfer. Transfer Time: <4m sec. (vii) UPS shall have cold start facility (viii) Provision of Phase Sequence Corrector for Phase reversal protection.									
Technology	True Online Double conversion DSP controlled UPS with advanced IGBT/PWM technology and digital microprocessor controls in all aspect as per IEC/other international standards.									
<b>INPUT</b>										
Voltage Range	380/400/415 VAC±15% for 3 Phase +N + Earth						(or any Voltage range as per requirement)			
Line Low/high cutoff	350 VAC – 480 VAC									
Dual Input	Provision of separate supply for mains and bypass									
Input Frequency	45 to 65 Hz or better									
Power Factor	≥0.90(Full Load)									
THDi	<5% at 100% Load									
<b>OUTPUT</b>										
Inverter Design	IGBT based PWM with Digital control									
Voltage Range	<ul style="list-style-type: none"> <li>• 220/230/240 VAC ±1% for Single phase</li> <li>• 380/400/415 VAC ± 1% for Three Phase +N</li> </ul>									
Voltage Regulation	<ul style="list-style-type: none"> <li>• ±1% for balanced load</li> <li>• ±2% for 100% unbalanced load</li> </ul>									
Output Power Factor	≥0.90									
Voltage Distortion	Linear Load<3% , Non-Linear Load <5%									
Overload capacity	100 -125% for 10 min., 125-150% for 60 Sec. then shift to bypass									
Crest Factor	3:1									
Efficiency	≥ 90%									
Output Frequency	50 Hz ± 0.1%									
Waveform	Pure Sine Wave									
Isolation Transformer	Inbuilt/External Isolation transformer (Optional)									
Response Recovery Time	40ms(max.)									
Bypass	<ul style="list-style-type: none"> <li>• Provision of Automatic and Manual bypass control</li> <li>• Manual Maintenance bypass</li> </ul>									
Battery Type	SMF(VRLA) confirming to JISC : 8702-1:2003/Tubular/Lithium Ion									
<b>ENVIRONMENT</b>										
Operating Temperature	0 – 40°C									
Humidity	95° C % Non – condensing									
Storage Temperature	-20°C to 55°C									
Noise	<60 dB (1meter)									
Protection	IP20/IP21									
<b>GENERAL</b>										
Display & Control	LED/LCD									
Protection	<ul style="list-style-type: none"> <li>• Output Overload Protection</li> <li>• Short circuit protection at output of UPS</li> <li>• Output AC Over and under voltage at battery terminals.</li> <li>• Over temperature.</li> <li>• Input Over/Under voltage protection.</li> <li>• Battery low/over charge protection.</li> <li>• Inbuilt/external Surge Suppressor (Input &amp; Output)</li> </ul>									
Indications	<ul style="list-style-type: none"> <li>• Charger ON/ Mains ON.</li> </ul>									



## ONLINE UPS 40-300 KVA UPS (PP 33 Series)

### On-Line UPS

On-Line UPS deliver pure sine wave power and the highest level of power protection available to sensitive servers and network equipment. Double-conversion technology continually converts incoming AC power into filtered DC power, and then re-synthesizes it back into AC power with a pure sine wave. Constant on-line operation completely isolates sensitive equipment from every power problem on the AC line, plus reliable battery backup keeps network running even in the case of a blackout.

	<ul style="list-style-type: none"> <li>• Mains Normal/ Abnormal.</li> <li>• Battery on Charge.</li> <li>• Load on bypass.</li> <li>• UPS ON.</li> <li>• Inverter ON.</li> <li>• Audible alarm for mains failure, battery low pre- alarm, battery low trip and inverter trip.</li> </ul>
Meters	Provision of Digital Meter for monitoring the following parameters: <ul style="list-style-type: none"> <li>• Input/output AC voltage</li> <li>• Input/output AC current</li> <li>• Input/output AC frequency</li> <li>• Battery Bus voltage</li> </ul>
LCD	Display Input/ Output voltage, Frequency, Power, Power Factor, Battery voltage, Current , battery Status, Load Percentage, UPS status, History record, Set parameters.
Alarm	<ul style="list-style-type: none"> <li>• Mains over/under voltage</li> <li>• UPS is on battery/Bypass Operation</li> <li>• System fault</li> <li>• Battery charging failure</li> <li>• Inverter Overload</li> </ul>
Communication	Suitable Interface (RS232/RS485) Port and software enable to user to supervise while working on platform such as XP/Windows/Linux/VISTA etc. SNMP communication offers so that critical parameters of UPS can be monitored from remote position.
Certification	ISO 9001, ISO 14001, ISO 27001, OHSAS, RoHS, CE Compliant
Safety Standard	IEC/EN- 62040-1, IEC/EN- 62040-2 & IEC/EN62040-3:2011
System Configuration	Load Sharing Configuration/ Standalone Configuration with external switch/Hot Standby

\*In the interest of continuous product improvement, all specifications are subject to change without notice.



## Power Packed Features

- Advanced operation mode
- DSP controlled, double CPU controlled
- Manual maintenance bypass
- Wide input voltage range
- High output power factor
- Strong environmental adaptability
- Advanced Battery Management
- N+X parallel redundancy up to 6 units
- Compatible with generator
- Strong shock resistance ability
- High MTBF (>2,00,000 h)
- Low MTTR (<0.5 h)
- Full protection against over-discharge, overcharge, overload.
- 12 Pulse rectifier (optional)
- Inbuilt Isolation Transformer for unbalanced load (Copper Winding)
- High reliability: True On-Line static bypass technology to provide strong overload and fault protection device. Internal manual maintenance bypass, further improve the

reliability of continuous operation of the load.

## Applications & Users

- Large/Medium Data Centers/Offices
- Telecommunication Systems
- Medical Equipment
- Air Traffic Control Systems
- Satellite Systems
- Industrial Process Equipment/Machines and Automation
- General Laboratory Equipment
- Studio, Printing and Media Equipment
- Optimized battery performance:
- Advanced battery management System (ABMS)
- Automatically convert to constant current constant voltage charging technology.
- Parallel redundancy:

## TECHNICAL SPECIFICATIONS

1. RATING	40 KVA	60 KVA	80 KVA	100 KVA	120 KVA	160 KVA	200 KVA	250 KVA	300 KVA
Isolation Transformer	Inbuilt/External Isolation transformer (Optional)								
<b>2. INPUT</b>									
Topology	Double conversion, Fully DSP Controlled, IGBT Three level PWM Design								
Voltage Range	(380 VAC/400VAC /415 VAC) ±15% 3 phase 4 wire(3-ph+N+PE) (or any Voltage range as per requirement)								
Frequency Range	50/60 Hz ±10%								
Power Factor	≥0.9/0.99								
THDi	≤3% on full load								
Rectifier delay start	0-60 Sec								
Input Current-limiting	0.1- 1.1times of rated current (Settable)								
Bypass Voltage Range	± 20%								
<b>3. OUTPUT</b>									
Inverter Design	Advanced 3 level T-NPC topology								
Inverter Components	IGBT								
Voltage Range	380/400/415 VAC 3 Phase + Neutral+ Ground								
Voltage Regulation	±1% , No load to full load : ≤3%								
Frequency	50/60 Hz ±0.1%								
Power Factor	0.8/0.9 to unity								
Total Harmonic Distortion (THD)	Linear Load <3% , Non-Linear Load <5%								

Overload capacity	<ul style="list-style-type: none"> <li>• 105 -110% for 1Hour</li> <li>• 110 -125% for 10 min.</li> </ul>		
Crest Factor	3:1		
Efficiency	<: 90%		
Waveform	True Sine Wave		
<b>4. BYPASS</b>			
Rated Voltage	380/400/415 VAC		
Bypass Voltage Range	Upper limit: +10%, +15%, +20% can be set. Lower limit: -10% ,-20% ,-30%, -40% can be set.		
Rated Frequency	50/60 Hz (auto sensing)		
Bypass Frequency Range	±2% (±10% ,±20% can be set)		
Transfer time to Bypass	>5 ms		
Overload Capacity	15 times the rated current (10 ms), 5 times the rated current (5s)		
<b>5. Protections, Indicators and Meters</b>			
Protection	<ul style="list-style-type: none"> <li>• Overload</li> <li>• Short circuit</li> <li>• Over and under voltage.</li> <li>• Manual and bypass facilities</li> <li>• Battery Low voltage</li> <li>• Over temperature</li> <li>• Fan failure</li> </ul>		
Indicators	<ul style="list-style-type: none"> <li>• Charger On/ Mains presence.</li> <li>• Mains Normal/ Abnormal.</li> <li>• Load on bypass.</li> <li>• UPS On, UPS Trip.</li> <li>• Audible alarm for mains failure, battery low pre- alarm, battery low trip and inverter trip.</li> </ul>		
Meters	<ul style="list-style-type: none"> <li>• AC Input/ Output voltage</li> <li>• AC Output current</li> <li>• Battery voltage</li> <li>• Battery charging &amp; discharging current</li> <li>• Output frequency</li> </ul>		
Degree of protection	IP20/IP21		
<b>6. ENVIRONMENT</b>			
Operating Temperature	0 - 40°C		
Humidity	0 - 95° C % Non - condensing		
Storage Temperature	-25°C to 55°C		
Altitude	1000 m		
Noise	<55 dB (1m away from the Unit)	<60 dB (1m away from the Unit)	<65 dB (1m away from the Unit)
<b>7. PANEL DISPLAY</b>			
LED	Indicate the status of Input, Inverter, bypass, battery, output.		
LCD	Display Input/ Output voltage, Frequency , Power , Power Factor, Battery voltage, Current, battery Status, Load Percentage, UPS status, History record, Set parameters. (Minimum 5 Inch LCD touch screen)		
<b>8. COMMUNICATION</b>			
Interface	Dry contact RS 232, RS485, SNMP Card(Optional)		
Options	Harmonic filter, SNMP adapter, LBS cable, Battery Temperature Sensor, Battery Ground Fault Detection, Bypass current sharing inductor.		
<b>9. Certifications</b>			
ISO	ISO 9001:2015, ISO 14001:2015, ISO 27001:2013		
Health & Safety	OHSAS 45001, RoHS Compliant		
Standards	IEC 62040-1, IEC 62040-2 & IEC 62040-3 : 2011 and CE Compliant		

## BATTERY CHARGER

# SMPS Battery Charger

### Constant Voltage Constant Current Type

A Battery Charger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol depends on the size and type of the battery being charged. SMPS Battery Charger (CVCC type) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. In SMPS switching is done at very high frequency of several KHz using Pulse Width Modulation technique which is reliable, efficient, noiseless and compact.



### Working Principle

The design is based on the fly back topology. High switching frequency makes the components sizes to decrease and hence reduction in the size. The efficiency of the unit is greater than 75%. The input voltage is applied to the transformer primary which is switched at high frequency using opto-isolators. The output of the transformer is rectified using proper rectifier diodes. The output is further smoothed with the use of smoothing inductors to reduce the ripple to the desire level. The Battery Chargers provide both constant voltage (CV) charging below the rated current and constant current (CC) charging if the battery tries to draw more than the rated current. In CV mode, the output voltage is well regulated against line and load variations. The input voltage range is 160 V to 270 V which is a wide range of effective working of the charger with higher variation in input voltage.

### Users

- Paramilitary Forces (CRPF, ITBP, CISF, BSF, BRO, DGAR etc.)
- State Govt. Police Wireless and Radio/Telecommunication Deptt.
- State Govt. Fire Services
- State Govt. Road Transport Services
- Indian Railways (Electrical and S& T)
- Battery Manufacturing Industries
- Process Industries

### Features

- Due to the wide input range of 160 V to 280 V, the charger is suitable to work in regions with high voltage fluctuations.
- Due to compact structure and user friendly functions, carrying and installation of the charger is easy.
- Batteries ranging from 35 AH to 120 AH can be charged.
- Rugged design of the charger that makes it able to work in harsh environmental conditions.
- Military grade components are used in designing the charger for prolonged life and better tolerance.
- SMF and non SMF both type of batteries can be charged.

### Applications

- Signal & Telecom/Infocom Power Supply
- Railway utilities
- Substation Batteries
- DG set Batteries
- Process Industries
- Power Generating Plants
- All types of battery operated material handling equipments like Fork-lift Trucks, Platform Trucks, Pallets, Triggers and Stockers etc

## TECHNICAL SPECIFICATIONS

Rating	12V/5Amp.	12V/12Amp.	12V/5Amp.	12V/12Amp.	12V/5Amp.	12V/12Amp.
Model No.	PPSBC 55	PPSBC 125	PPSBC 53	PPSBC 123	PPSBC 51	PPSBC 121
No. of station	5	5	3	3	1	1
Battery Charging Capacity	7AH to 40 AH	35 AH to 120AH	7AH to 40 AH	35 AH to 120AH	7AH to 40 AH	35 AH to 120AH
Current Setting (Max.)	0.5 A to 5 A	3.5 A to 12 A	0.5 A to 5 A	3.5 A to 12 A	0.5 A to 5 A	3.5 A to 12 A
Technology	SMPS Type					
Charging Mode	Automatic					
Charging cut off voltage	14.5V ±0.2V					
Input Voltage Range	160 to 270 Volts					
Protections	(a) Reverse polarity protection.					
	(b) Short circuit protection.					
	(c) Over current protection.					
	(d) AC Surge protection at Input with MOV					
	(e) Soft start and soft stop feature without inrush current.					
	(f) Over Voltage protection at 280V at input and automatic recovery at 270 V when the voltage is reduced from 280V.					
	(g) Not to charge battery in case one or more cells are internally short					
Output Voltage	As per battery condition					
Operation	Continuous Duty					
Efficiency	>75% for SMPS at 230V					
Ripple	<100mV peak to peak at full load					
Display per station display	Digital Volt/Amp meter selectable or continuous duty					
LED Indication	(a) Charging Status (b) Charged condition status and (c) Reverse polarity					
Cabinet	CRCA sheet Min 1.2 mm thick					
Terminals	Suitable capacity (Red and Black pair per station)					
Charging Cable	Flexible Copper Cable, red for (+) ve terminal and Black/blue for (-) ve terminal per station					
Cable Size	6 Sq. mm for 12 A & 2.5 Sq. mm for 5 A					
Cable Length	1.5 m					

\*In the interest of continuous product improvement, all specifications and Images are subject to change without notice.



## BATTERY CHARGER FCBC Battery Charger (SMPS/Transformer Based)

### Power+ Battery Charger

POWER+ Battery Charger provides quiet, reliable and adjustable DC power to battery/load. The Battery Charger gives DC output, the input source being Single/Three Phase AC supply only. The load is isolated from any spikes, surges or dips.

Battery Charger is simply a rectifier, which converts AC to DC. To effect rectification, one of the following method must be selected:

- By rotating a converter, i.e. an AC motor driving a DC generator

- By thermionic tube rectifier
- By semiconductor rectifier
- Rectification by semiconductor devices offers several advantages over Rotating and Thermoionic Devices. There are two types of semiconductor rectifiers:

- Diode Version Battery Charger
- SCR Version Battery Charger



## SCR VERSION CHARGERS V/S DIODE VERSION CHARGERS

### Diode Version Battery Charger

These chargers use diode as the rectifying device

### SCR Version Battery Charger

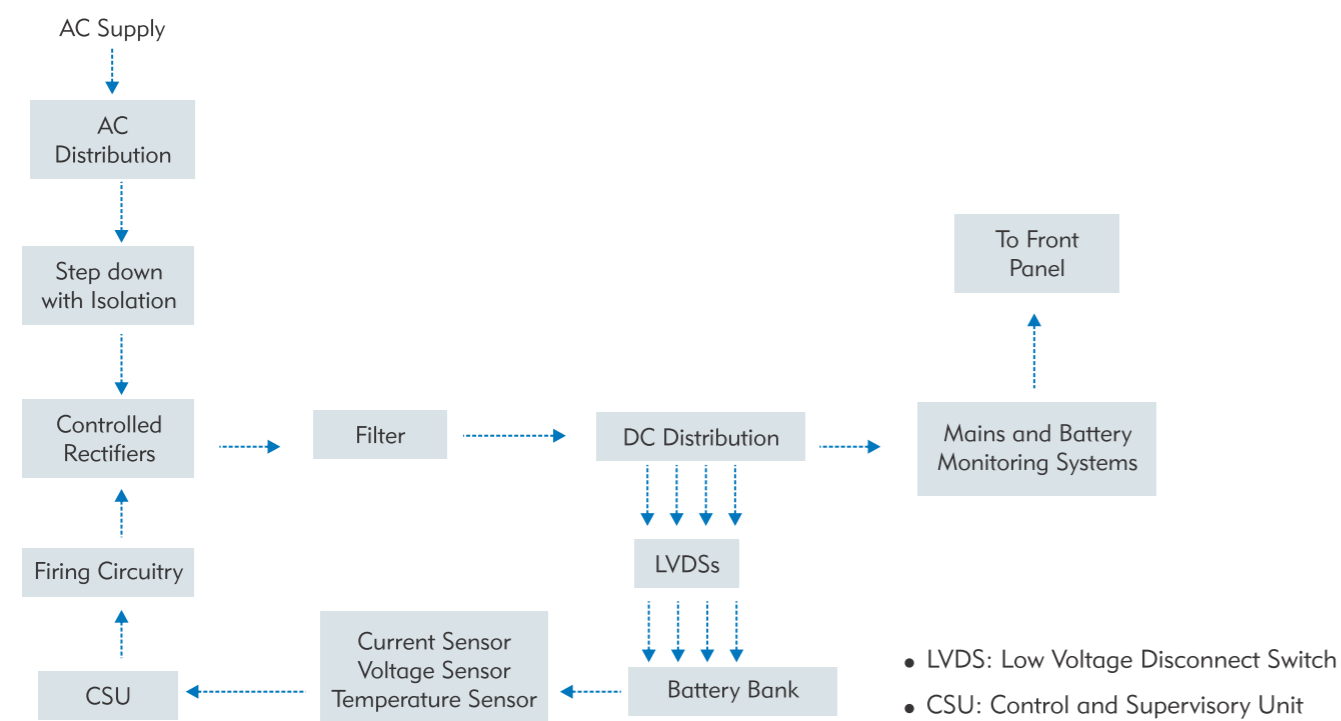
Chargers using SCR are known as Phase Controlled Rectifiers. Its basic function is to convert AC input into controlled DC output. The basic principle of the Phase Controlled Rectifier is to control the point at which SCR are allowed to conduct during each AC cycle. Single/Three Phase fully controlled rectifiers give best utility factor, less ripple factor and more efficiency.

- a) AC Distribution: It consists of a HRC Fuse, AC MCCB and a Single Phase Preventor.
- b) Isolation and Step down: This unit consists

of simple step down transformer.

- c) Controlled Rectifier: Fully controlled rectifier circuit consists of six thyristors that convert AC power to controlled DC power.
- d) Filter: This network suppresses (choke) AC component from the DC power.
- e) DC Distribution: It consists of
  - DC MCCB (optional)
  - HRC Fuses
  - Bus bar
- f) Sensors: This block converts 4-20 mA and 0-5 VDC to actual voltage, current and temperature and then feeds to CSU.
- g) Control and Supervisory Unit (CSU): This unit consists of electronic circuitry which generates firing angle accordingly

### INTERNAL BLOCK DIAGRAM



S.No.	Description	SCR Version	Diode Version
1.	Technology	Thyristor-based phase controlled technique	Simple uncontrolled rectifier using diode
2.	Regulation	± 1%	Poor regulation (± 1.0-12%)
3.	Settings	By using simple potentiometer for phase control	Using heavy duty rotary switch for ON load tap changer
4.	Reactor	Electronic current limit	Heavy duty reactor required for current limit
5.	Transformer	Mains transformer without any taps required	Mains transformer required with different taps to control voltage and current
6.	Over charge	Batteries are charged till the max. limit	Often battery gets over charged
7.	Soft start facility	Easy, as when charger is ON, DC voltage is built up softly (not immediately)	Critical
8.	Battery current limit	Provided by controlling the firing angle	Not provided
9.	Constant Voltage	DC voltage constant	Through rotary switch but not exact DC value
10.	Efficiency	Comparatively high	Low
11.	Weight	Light Weight	More weight than SCR version

### Configurations

- Float Charger (FC)
- Float cum Boost Charger with voltage dropping diodes/voltage regulator (FCBC)
- Float and Boost Charger (FC & BC)
- Dual Float cum Boost Charger (DFCBC)
- Redundant float or float cum boost charger
- Application/customer specification configuration
- Rating
  - Voltage: 12 V, 24 V, 48 V, 110 V, 220 V or any custom made
  - Current: Up to 2000 A for 24 VDC/up to 1000 A for 48 VDC/up to 700 A for 110 VDC/up to 500 A for 220 VDC

### Salient Features

- Fully automatic electronic SCR controlled
- Soft start feature to minimize inrush current to battery
- when charger is re-energized
- Dropper diode regulator in load path for specific applications.
- In general, the system conforms to IEC 146 and IS-
- 4540 standards.
- Battery path current limiting
- Output short circuit proof
- Automatic float boost change over
- Operation under reverse input phase sequence

- Built-in digitally controlled automatic regulation circuit
- Insulation class for magnetic as per IS standard
- 7 tank-processed powder-coated painting shades
- Powder coated paint as per IS Standards
- Telecom/Infocom power supply
- Power generating plants
- Railway utilities
- Process industries
- Switchgear protection
- Substation batteries
- DG set batteries
- Traction chargers for all types of battery-operated
- material handling equipments like fork-lift trucks,
- platform trucks, pallets, triggers, stackers, etc.

### Applications

### TECHNICAL SPECIFICATIONS

AC Input Volatge	As specified by customer with $\pm 10\%$ tolerance (1 Ph or 3 Ph 3 wire/4 wire, 50 Hz $\pm$ )		
DC Output Voltage	12V	24V	48 V or as per customer requirement
DC Output Current	5-20 Amp	5-20 Amp	5-100 Amp
Model	PPFCBC 12	PPFCBC 24	PPFCBC 48
Regulation	$\pm 1\%$ , digitally controlled		
Current Limit	105% continuous of rated load, digitally controlled		
Ripple content	<2% rms (standard), 1% optional		
Charger efficiency	>85% for Three Phase input >75% for Single Phase input		
Protections	Battery U/V & O/V   Battery over charger & over load   Short circuit Bridge protection fast acting fuses   Surge suppresser   AC & DC circuit protections Filter capacitor fuse   Battery Input fuses		
Cooling	Natural (or) Forced		
Ambient temperature of operation	0-50°C or as per customer requirement		
Cabinet	Free standing steel cabinet 1.6/2.0 mm Gauge sheet steel or as per customer requirement IP protection as per customer requirement		
** Provided as per requirement			



## BATTERY CHARGER Thyristor based CVCC Charger

Battery Charger provides quiet, reliable and adjustable DC power to battery/load. The Battery Charger gives DC output, the input source being Single/Three Phase AC supply only. The load is isolated from any spikes, surges or dips.

Thyristor controlled Battery Chargers are known as Phase controlled rectifiers. It's basic function is to convert AC input into controlled DC output. The basic principal of the Phase controlled rectifier is to control the point at which SCR are allowed to conduct during each AC cycle. Single/Three Phase fully controlled rectifier gives best utility factor, less ripple factor, better regulation and more efficiency. Thyristor controlled Battery Chargers suitable

for sealed maintenance free Batteries of 1100AH/ 120AH capacity fitted on AC and TL Coaches for giving normal charging/discharging/freshening charge in constant voltage and constant current mode. The Battery Chargers covered by this specification (RDSO/PE/SPEC/AC/08/Rev.1/Aug./04 or latest) shall be natural air cooled suitable for an ambient temperature varying form 9 to 55°C with maximum humidity of 98% in altitudes upto 1200 meters above sea level and in dusty atmospheric conditions to be used for charging and discharging sealed maintenance free batteries either fitted on Ac and TL Coaches in rake formation or in Depots/workshops.



## POWER SOLUTIONS PCU-SVR

Power Conditioning Unit (PCU) / Static Voltage Regulator (SVR) is a Microprocessor based IGBT electronic device with PWM technology, having an RFI / EMI filters. It regulates fluctuating voltage in a precise manner & constitutes a high-level spike suppression system which protects the equipment by virtually eliminating any transients, surges and EMI/RFI noises in the distribution network. Power Conditioning Unit / Static Voltage Regulator is most suitable for 24-hour continuous process operations where break downs due to fluctuations result in heavy financial losses and damage of expensive equipments.



Type	Constant Voltage/current with current limiting		
Input Volatge	Nominal Voltage : 415 VAC Operating Voltage Range : 380 – 480 VAC, 50 Hz		
Type of Battery charger	Constant Voltage/current with current limiting		
DC output voltage	110- 155 V DC		
Output Currunt	0-200 A/0-300 A / 1 X 220 A / 2 X 100 A or as per requirement		
Operating modes	(i) Charging in constant voltage (CV) or in constant current (CC) mode at a constant preset current and (ii) Discharging in constant current (CC) mode		
Output Regulation	The charger shall give a DC output Voltage adjustable over range of 2.0 V to 2.75 per cell by means of a voltage control potentiometer. The value of output Voltage shall be maintained within $\pm 0.05$ V per cell of the set Value over the entire range of the input AC supply variation and the output load variation from 10% to 100% of rated capacity.		
Constant Voltage:			
Constant Current:	The charger shall be capable of delivering an output current whose magnitude shall be selected be means of current control potentiometer. The current shall be maintained constant within $\pm 2$ A of the set value at 10% to 100% load, with the input voltage varying between 380 V to 480 V AC.		
Ripple content	The charger shall be equipped with suitable filter circuit on the output to reduce the voltage/current ripple factor to less than or equal to 5% rms at full load when measured across a resistive load.		
Auto mode charging	The charger shall be provided with a suitable circuitry to charge the battery either in float or boost mode automatically. It shall go to boost mode whenever the charging current exceeds 5-6% of voltage capacity and boost to float when the charging current reduces in 3-4% of Voltage capacity.		
Protections	<ul style="list-style-type: none"> <li>Over Voltage</li> <li>Bridge protection fast acting fuses</li> </ul>	<ul style="list-style-type: none"> <li>Current Limit</li> </ul>	<ul style="list-style-type: none"> <li>Short circuit Protection</li> <li>AC Input Fuse</li> <li>AC Over/Under Voltage Protection</li> </ul>
Controls	<ul style="list-style-type: none"> <li>Unit ON/OFF Control Rotary Switch</li> <li>Charger /OFF Selector Switch</li> <li>Current Variable Potentiometer</li> </ul>	<ul style="list-style-type: none"> <li>Battery input circuit breaker</li> <li>Constant Voltage/Constant Current Selector Switch</li> <li>Voltage Variable Potentiometer</li> </ul>	
Indicating Instruments	<ul style="list-style-type: none"> <li>DC digital Voltmeter</li> <li>AC digital Ammeter</li> <li>Unit ON in CC Mode phase/bridge fuse)</li> </ul>	<ul style="list-style-type: none"> <li>DC digital Ammeter</li> <li>Mains Unit ON</li> <li>Charger Over Voltage</li> <li>AC under Voltage</li> </ul>	<ul style="list-style-type: none"> <li>AC digital Voltmeter</li> <li>Unit ON in CV Mode</li> <li>Unit fault (for failure of input</li> <li>AC Over Voltage</li> <li>Charger Failure</li> </ul>
Enclosure	The charger shall be housed in a robust sheet metal, naturally ventilated cubicle (Powder coated with gray) suitable for mounting on the shop floor and provided with easily accessible screwed covered for facility of connections/replacement.		
Insulation Resistance	>5 Mega Ohms		

## Applications

- Refineries & their distribution outlets
- Petrol/Diesel Retail Outlets
- Hospitals, Diagnostic labs & imaging equipments
- General laboratory equipments
- Broadcast communications & Telecommunication equipment
- Machine tools / CNC equipments & Industrial Automation applications
- Building / Shopping mall automation
- Data Centers / Call Centers
- Process industries & Chemical plants
- UPS bypass & Power distribution

## Technology

PCU/SVR regulates the voltage by IGBT driven PWM Inverter at 20 KHz switching frequency with voltage correction rate of 5000V/Sec., so that the output voltage complies with the requirements of ITIC Curve for regulated minimum voltage supply to electronic devices, machinery and IT equipments. Voltage regulation achieved by superimposition of PWM wave on incoming wave, without any brake in the power path. The micro processor-based control circuitry along with IGBT results in high correction speed and higher efficiency. There is no moving part inside PCU/SVR and it is a fully electronic & automatic unit.

### Comparison Between Power Conditioning Unit (PCU)/static Voltage Regulator (SVR) & Servo Voltage Stabilizer

Power Conditioning Unit /Static Voltage Regulator	Servo Voltage Stabilizer
Output voltage is regulated by using Buck Boost transformer	Output voltage is regulated by using double wound dimmer
Switching devices are IGBT which improves the reliability of the system.	Switching devices are Relay which is a Electro-mechanical device & is less reliable.
No moving part inside and is a fully electronic unit	Carbon brushes generate sparks and Gear assembly makes noises. It is prone to frequent wear and tear that requires regular maintenance.
Correction speed is very fast, almost 5000V/Sec. (Min.)	Rate of correction is slow, almost 30V/Sec.
Response time is higher	Poor Response time
Over Shoot and Under Shoot exists for less duration	Over Shoot and Under Shoot exists for long duration
No cooling oil required	Oil cooling is messy & is required to be changed periodically

## TECHNICAL SPECIFICATIONS

GENERAL	Voltage regulation shall be performed by IGBT driven PWM inverter operating at around 20 KHz switching frequency with typical voltage correction time of 20 ms (one AC cycle for 50Hz Supply), so that the output voltage complies with the requirements of ITIC curve for regulated voltage supply to electronic machinery. Voltage regulation shall be achieved by superimposition of PWM wave on incoming wave, without any brake in the power path. Power Conditioning Unit (PCU) / Static Voltage regulator (SVR) shall use only static parts for real-time voltage correction. It shall not use any such moving part like relay or brush, which limits the rate of voltage regulation. There shall be no switching in the power path, current interruption, transitions or step changes during voltage regulation. The output voltage shall be duly free of harmful surges, spikes and EMI/ RFI noises.
Type	Single / Three phase, Unbalanced load
Rating	5 KVA - 200 KVA
Frequency	47 - 63 Hz
Full Regulation Range	Input Voltage Range: 160 - 280 V AC (P-N), 275 - 480VAC(P-P) Output Voltage: 230 V $\pm$ 1 % - P-N (Adjustable) 400 V $\pm$ 1%- P-P (Adjustable)
Relaxed Regulation Range	Input Voltage Range: 140 - 300 V AC (P-N), 240 - 520VAC(P-P) Output Voltage Functional Range: of 200 - 250V P-N
Duty cycle	Continuous
Waveform distortion	NIL
Speed of correction	5000 V/sec, the said voltage regulator shall sense as well as correct any voltage Sag / Surge / Fluctuation in 20 ms, i.e. 1 waveform
Response time	10 mS
Overload capacity	125% for 60 mins.
Efficiency	> 96% in worst conditions i.e. at 100% and lowest voltage.
Cooling	Naturally Air cooled / Forced Air Cooled
Protections	MCB / MCCB at Input for overload & short circuit protection. Contractor at output for auto-resumption of supply in event of High Voltage / Low voltage / Single Phase prevention. Input Low Voltage cutoff: - 140 V Input High voltage cutoff: - 300 V



## POWER SOLUTIONS Isolation Transformer

Isolation Transformer provides complete electronics & electromagnetic shielding. The presence of spikes and transient or noise in the supply line leads to the erratic behavior. The electrostatic and electromagnetic shielding provided by Isolation Transformer eliminates line disturbance and prevents faulty and erratic operation of critical and sensitive instruments & equipments.



Automatic Bypass for surge load	
Manual Bypass Switch to bypass the full equipment	
Heavy-duty, three-stage AC input surge protection circuits shall be of class 2, consisting of inductor, capacitor and MOV (Metal Oxide Varistor). All 3 phases shall be protected by separate surge protectors. Noise filters shall be provided on input as well as output to protect against high frequency EMI / RFI noises. MOVs shall be provided between Phase to Neutral and also between Neutral to Ground.	
Additional, type 2 surge protection device shall be provided with provision of shunt trip in event of failure of surge device. Also, provision for by passing the surge protection device for running the outlet when SPD is not in service.	
Indications /Annunciation	LED display is provided for each phase showing input voltage, output voltage, load & fault condition due to over voltage, under voltage, over load, short circuit, excess temperature with counter.
Environmental Protection	IP 20
Class of insulation	Class H
Cabinet shall be heavy duty PVC / PU wheel mounted with at least 2 lockable wheels & Internal parts shall be readily accessible and replaceable (by opening the cabinet cover).	
Buck Boost Transformer used shall be designed at 1.2 Tesla Flux density maximum, +/- 2%.	
Control Card used shall have 100% RoHS components plus shall be conformal coated	
Surge Card used shall have Fire Retardant Capacitors	
Equipment shall have service life of at least 10 years	
Remote monitoring through RS-485 interface to observe parameter of PCU/SVR RS-485 to VSB convertor (optional)	

\*In the Interest of continuous product improvement, all specifications are subject to change without notice.

## Electrical Noises are Generated due to

- Switching of electrical utilities like Capacitors, MCCBs, ACBs, etc.
- The inductive loads like Motors, Elevators, Compressors, Overhead Cranes and Presses.
- Switching equipments like Inverters, UPSs, SMPS, etc. generate electrical noises due to switching of Thyristors, Relays, Transistors, etc.
- Welding systems pollute earthing systems, adds notches and high frequency noises in the wave form.
- Lightening, precipitation of static charges and electrical discharges in the atmosphere are the natural cause of generation of various electrical noises.

## Effects

- Electrical noises are observed to occur over a wide band of frequency ranging from 1 KHz to 100 MHz and above. Magnitude is observed to be as high as 4000 to 6000 Volts in 3 phase supply system.
- The high frequency noise can interface with digital electronic equipments causing untraceable data errors, change of programme, loss of memory, erratic behavior, etc.
- The high voltage spikes can cause the failure of Thyristors or Transistor, Micro Processors and other sensitive devices.
- The radiated noise can interface in operation of remote control equipment like Cranes, Digital Controls or Telecom Equipments.

Isolation Transformer isolates primary and secondary, or separates neutral-to-ground bond on the secondary side. It can be used to create separately derived source to combat current loops.

The Ultra Isolation Transformers are available in different levels of noise attenuation capabilities, the most commonly used are 100 & 120 dB. The coupling capacitance between primary and secondary is direct 1 : 1 relationship with dB levels.

## Applications & Uses

- Machine tools/CNC equipments & Industrial Automation applications
- Broadcast communications & Telecommunication equipment
- General laboratory equipment
- Refineries & their distribution outlets
- Hospitals, Diagnostic labs & Imaging equipments
- Building/Shopping mall automation
- Data centers/Call centers
- Process industries & Chemical plants
- UPS bypass & Power distribution

## Special Features

- Complete electrostatic shielding
- Isolates sensitive & critical equipments from noise power lines
- Filters power line noise, spikes & transients
- Minimizing common mode noise by 85 dB

## Technology

Isolation Transformer is constructed with a primary and secondary winding closely wrapped about the same ferrous core. A single faraday shield is used between the primary and secondary winding to divert noise, which would normally be electrically coupled between the primary and secondary winding to ground.

## TECHNICAL SPECIFICATIONS

Item	Isolation Transformer
Capacity	1 KVA to 50 KVA (Single Phase), 1 KVA to 500 KVA (Three Phase)
Cooling	Air Cooled
Connection	Delta/Star for 3 Phase Supply
Regulation	2-4 % for 100 % changes in current unity P.F.
Di-Electric Strength	2500 V for 60 seconds
Ratio	1 :1 and 2:1
Insulation Resistance	Better than 500 Mega Ohms
Common Mode Attenuation	20 dB/40 dB
Coupling Capacitance	1 Micro farads
Leakage Current	< 5 mAmps
Ambient	0-45° c

\*In the interest of continuous product improvement, all specifications are subject to change without notice.

## POWER SOLUTIONS

# Servo Voltage Stabilizer

Central/State Govt. buildings, Corporate Offices, Commercial Buildings, Hotels, Big Hospitals, Industrial Units, Data Centers, Printing Presses, Petrol/Diesel dispensing machines, Laboratories etc. running round-the-clock and frequently face the problem of low and high voltage. Most of the load is of Computers, IT Peripherals, Electrical Utilities, Air Conditioners, Medical Equipments, Motors, Laboratory Equipments, Telecommunication Equipments, Machine Tools and CNC Equipments. Servo Voltage Stabilizer is an equipment that helps obtain constant voltage from fluctuating supply system and most suitable for 24 hrs. continuous operations,

where breakdowns owing to fluctuation result in heavy financial losses and damage of expensive equipments and utilities.

Servo Voltage Stabilizer, copper wound indoor type, continuous duty, conforming to IS: 9815 (Pt. I)/1994 (Reaffirmed 2004) suitable for phase voltage of 120-280 Volts/160-260 Volts. Three phase Servo Voltage Stabilizer comprises of three single phase Servo Voltage Stabilizer conforming to IS: 9815 (Pt. I)/1994 (Reaffirmed 2004), connected in star and enclosed in a single enclosure with common control panel and shall be suitable for unbalance input voltage. Rated output shall be 240V for single phase and 415V for three phase Servo Voltage Stabilizer respectively.



100 KVA-2000 KVA



10 KVA-100 KVA

### Features

- Integrated circuits control without relays
- Auto-manual operation facilities from front panel
- Step less voltage correction at high speed without overshoot
- Zero waveform distortion and unaffected by load power factor
- Output voltage sensing circuits that use solid state switching circuits
- High efficiency and unaffected by line frequency variation (between 48 Hz to 52 Hz)

minutes to protect against intermittent failures of power supply

### Applications & Users

- Central/State Govt. Buildings
- Corporate Offices, Commercial Buildings & Hotels
- Medical Equipments/Big Hospitals
- Industrial Units (Machine Tools/CNC Equipments/Automation)
- Data Centers
- Printing Presses
- Air Conditioners & Electrical Utilities
- Petrol/Diesel dispensing machines
- Laboratories
- Signal, Telecommunication and Broadcasting Equipments

### Optional Features

- Overload protection
- Filters for line interferences
- Single phasing preventer in three phase
- Automatic switch-off against over/under voltage
- Time delay: Starts equipment after 2-3

Item	Servo Controlled Voltage Stabilizer
Capacity	1.0 KVA to 2000 KVA
Cooling	Air and Oil Cooled in two separate modules
Type	Indoor, Floor Mounting (Balanced/Unbalanced)
Input Voltage Range	<ul style="list-style-type: none"> <li>• 300-460 V/ 320-460 V/340-460 V/360-460 V in 3-phase, 4 wires AC system</li> <li>• 170-270 VAC/ 140-270 VAC, Single Phase or any voltage range as per requirement for both Single and Three Phase</li> </ul>
Output Voltage	<ul style="list-style-type: none"> <li>• 380 VAC/ 400 VAC/ 415 VAC <math>\pm</math> 1%, 3 phase, 50 Hz</li> <li>• 220 VAC/ 230 VAC <math>\pm</math> 1%, Single Phase or any voltage as per requirement for both Single and Three Phase</li> </ul>
Output Voltage Adjustment	$\pm$ 5%
Frequency Range of Operation	47-53 Hz
Correction Speed	35 volts/sec.
Control Circuit	Solid-state electronic plug-in PCB circuits
Efficiency	<ul style="list-style-type: none"> <li>• Above 98% at full load</li> <li>• Above 95% at half load</li> </ul>
Adjustment	Output voltage level and correction sensitivity to be adjustable

No load loss at minimum rated input voltage	Less than 3% of the rated capacity
No load loss at maximum rate input voltage	Less than 3% of the rated capacity
Full load loss at minimum rate input voltage	Less than 5% of the rated capacity
Full load loss at maximum rate input voltage	Less than 5% of the rated capacity
Maximum load loss and input voltage at which it occurs	At minimum input
Duty Cycle	Continuous
Short Time Overload Capacity	<ul style="list-style-type: none"> <li>• Not less than 110% for 5 minutes</li> </ul>
Alarms and Tripping*	<ul style="list-style-type: none"> <li>• Output voltage HI/LOW alarm and tripping through to be adjustable</li> <li>• Input single phasing alarm and tripping through input MCCB</li> <li>• Input phase reversal alarm and tripping through input MCCB</li> <li>• Over temperature sensing and alarm</li> </ul>
Metering	<ul style="list-style-type: none"> <li>• Input voltmeter with selector switch (Ph-Ph &amp; Ph-N)</li> <li>• Output voltmeter with selector switch (Ph-Ph &amp; Ph-N)</li> <li>• Ammeter for R, Y, B input currents with selector switch</li> <li>• Oil temperature by digital meter</li> </ul>
Indications (using LED type lamps)	<ul style="list-style-type: none"> <li>• Input ON (after MCCB) on lamp</li> <li>• Output R, Y, B separate lamps (after MCCB)</li> <li>• Input phase reversal</li> <li>• Input single phasing</li> <li>• Unit over temperature</li> <li>• Input MCCB Trip</li> </ul>
Protection*	<ul style="list-style-type: none"> <li>• Input MCCB for OL &amp; SC protection</li> <li>• Output MCCB for OL &amp; SC protection</li> <li>• Input phase reversal</li> </ul>
Bypass Arrangement*	Suitable bypass arrangement for bypassing the input supply to output and Isolating the Servo Stabilizer for maintenance/ repair
Power Circuit Diagram on Panel (Mimic Panel)*	Power and control circuit diagram with above indication to be screen printed (Mimic panel) on the front panel of the Servo Stabilizer
Operating Temperature	Up to 50°C
Operating Humidity	Up to 95% RH
Confirming to	IS: 9815 (Pt.1)/1994 (Reaffirmed 2004) with latest amendments
Oil	Transformer grade oil confirming to IS: 335/IEC 296
General	Painting using 7 tank process system, Earthing bolts, lifting hooks
*Optional	

\* In the interest of continuous product improvement, all specifications are subject to change without notice.



## SOLAR ENERGY SOLUTIONS

# Grid-connected Solar PV Systems

### Introduction

The Sun is the source of energy and life for us. Most of the energy we use has undergoes various transformations before it is finally utilized, but it is also possible to tap this source of Solar Energy as it arrives on the Earth's surface. There are many applications for the direct use of Solar Thermal and Photovoltaic Energy. It is a technology which is well understood and widely used in many countries throughout the world. The most common use for Solar Photovoltaic technology is generating power for lighting (Appliances, Computers and Televisions, etc.), pumping water, generating grid quality power, etc. As world oil prices vary, it is a technology which is rapidly gaining acceptance as it results in an energy saving measure in both domestic and commercial sector.

Solar energy is the energy that is in sunlight. It has been used for thousands of years in many different ways by people all over the world. As well as its traditional human uses in heating, cooking, and drying, it is used today to make electricity where other power supplies are absent, such as in remote places. It is becoming cheaper to make electricity from solar energy and in many situations it is now competitive with energy from coal or oil.



## There are basically two types of Solar PV systems namely Off-grid and Grid-connected

1. Off-grid Solar PV Systems: Off-grid Solar PV system works with batteries. The solar energy is stored in the battery and used to feed building loads after conversion from DC to AC power with a stand-alone inverter. These systems are generally used in remote areas without grid supply or with unreliable grid supply.
2. Grid-connected Solar PV Systems: Grid-connected Solar PV systems feed solar energy directly into the building loads without battery storage. Surplus energy, if any, is exported to Discoms Grid and shortfall, if any, is imported from the Grid. These guidelines apply to Grid-connected Rooftop Solar PV systems only.

## Grid-connected solar PV Systems

Grid-connected Solar PV systems is a photovoltaic system that has its electricity-generating solar panels mounted on the rooftop of a residential or commercial building or structure.

Solar Rooftop System is an arrangement of interconnected components installed on the roof of a building or work-shed with the purpose of converting sunlight into electricity. The installed solar panels absorb and convert solar energy directly into electricity. The DC electric current generated is converted into AC with the inverter.

Solar Rooftop PV systems have been widely accepted worldwide. Major Indian cities, such as Kolkata, Chennai, Delhi, Mumbai, Bangalore, Jaipur, Ahmedabad and Hyderabad have introduced Grid-connected Rooftop Systems. Rooftop Systems are being installed in various Educational, Medical, Residential, Commercial, Government and Community Institutions for reaping benefits of electricity saving.

## Working principle of Solar PV System

Solar Photovoltaic technology (SPV) enables direct conversion of sunlight into electricity. Photovoltaic cells, commonly known as solar cells, are used to convert light into electricity. A number of solar cells joined together make a Solar Photovoltaic module. The electrical output of a PV module is rated in terms of peak watt, which is the maximum power output that the PV module could deliver under standard test conditions of incident solar radiation of 1000 watts per square meter area, air mass 1.5 and ambient temperature 25°C. A combination of few solar modules makes a solar array.

Solar modules made of solar cells produce direct current electricity from sunlight, which can be used to power equipment or to recharge a battery. An inverter is required to convert a direct current (DC) into an alternating current (AC).

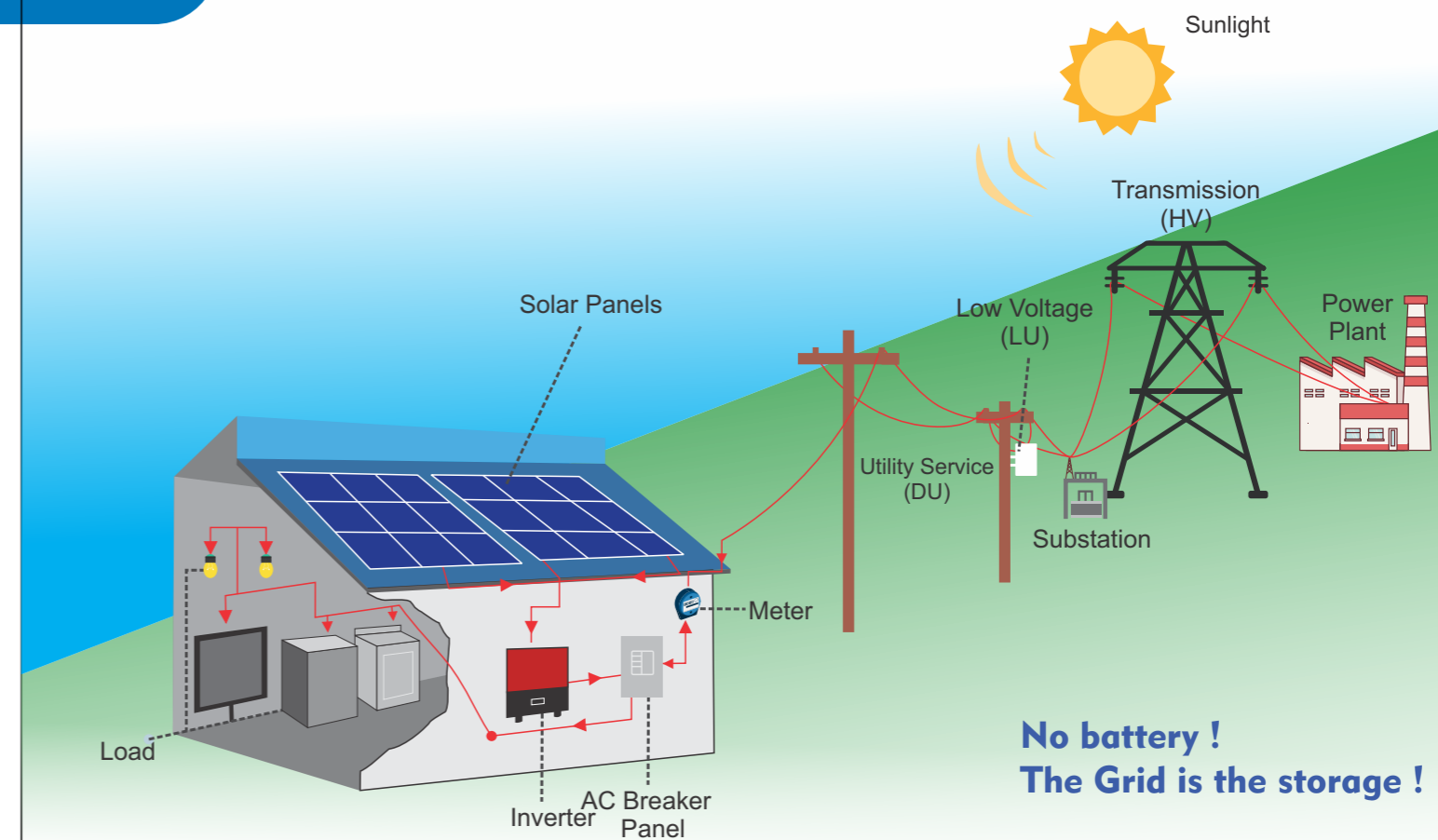
Most parts of India have about 285 sunny days. Average Solar radiation incident over the land is in the range of 4 -7 KWh per square meter per day. Solar Photovoltaic power plant can be installed in land, on rooftops or even in water as a floating body.

In Grid-connected plant, power generated from the plant is exported to the grid through inverter and export-import meter. Power generated from solar module is DC power which is converted to AC power using inverter before feeding it to the grid.

## Requirements for installation of SPV Plant on rooftop

- A minimum vacant roof area of 10 -12 sq mtr or 100-120 sq ft is required for installation of 1 kWp SPV System.
- The Consumer shall have 3 Phase/ 1 Phase supply service connection.
- Mandatory safety precautions/ features shall have to be followed to install a SPV System as

## Grid-tied Solar Rooftop with Netmetering (Industrial/Commercial/Residential)



per the norms.

- A single bi-directional meter shall be installed for export and import of energy.
- The standard equipments as per the norms of MNRE shall only be installed.

## System Components

The Grid-connected SPV power plant consists mainly of the following components, but might not be restricted to the same:

- Solar Photovoltaic Modules (which are connected to an inverter).
- Module Mounting Structures
- Inverters (which converts the system's direct current (DC) electricity to alternating current (AC))
- Batteries (optional) to provide energy storage or backup power in case of a power

interruption or outage on the grid.

- Grid Connect arrangements (Net Energy Meter)
- Cables and Connectors
- Lightning Protection and other protection devices
- Earthing
- Monitoring Systems

## Benefits (Features) from the Grid-connected Rooftop Solar System

- Reduce your electricity bills
- Earn benefits on electricity generation
- Surplus power is supplied to the Grid
- Reduction in electricity bill as the bill is prepared after adjusting import and export

of power.

- MNRE, Govt provides 30% subsidy on installation of rooftop solar power plants in domestic sector and non-profit making institutions.
- Reduction in payback period after availing Generation Based Incentive (GBI).
- Contribute to the environment by reducing harmful emissions
- Natural cooling of the top floor
- Power from the Sun is clean, silent, limitless and free
- Photovoltaic process releases no CO<sub>2</sub>, SO<sub>2</sub> or NO<sub>2</sub> gases which are normally associated with burning finite fossil fuel reserves and do not contribute to global warming.
- Photovoltaic are now a proven technology which is inherently safe as opposed to other fossil fuel based electricity generating technologies which reduces or avoids the necessity to build new transmission/distribution lines or upgrade existing ones
- Solar Powered Grid-connected Plants can act as tail-end energizers, which in turn reduces the transmission and distribution losses
- Provides a potential revenue source in a diverse energy portfolio
- Guaranteed performance

### Application

Large utility-scale solar parks or farms are power stations and capable of providing an energy supply to large number of consumers. Generated electricity is fed into the transmission grid powered by central generation plants (Grid-connected or Grid-tied Plant), or combined with one, or many, domestic

electricity generators to feed into a small electrical grid (hybrid plant). In rare cases generated electricity is stored or used directly by island/standalone plant. PV systems are generally designed in order to ensure the highest energy yield for a given investment. Some large photovoltaic power stations such as Solar Star, Waldpolenz Solar Park and Topaz Solar Farm cover tens or hundreds of hectares and have power outputs up to hundreds of megawatts.

A small PV system is capable of providing enough AC electricity to power a single home, or even an isolated device in the form of AC or DC electric. For example, military and civilian earth observation satellites, street lights, construction and traffic signs, electric cars, solar-powered tents and electric aircraft may contain integrated photovoltaic systems to provide a primary or auxiliary power source in the form of AC or DC power, depending on the design and power demands. In 2013, rooftop systems accounted for 60 percent of worldwide installations. However, there is a trend away from rooftop and towards utility-scale PV systems, as the focus of new PV installations is also shifting from Europe to countries in the Sunbelt region of the planet where opposition to ground-mounted solar farms is less accentuated.

### Building-integrated

In urban and suburban areas, photovoltaic arrays are commonly used on rooftops to supplement power use; often the building will have a connection to the power grid, in which case the energy produced by the PV array can be sold back to the utility in some sort of net metering agreement.

## TECHNICAL SPECIFICATIONS

S.No.	Specification	Parameters
1.	Solar PV System Capacity Sizing	The size of a Solar PV System depends on the 90% energy consumption of the building and the shade-free rooftop (or other) area available.
2.	Solar PV modules	
a)	Type	Crystalline silicon
b)	Origin	Manufactured in India
c)	Efficiency	>= 13%
d)	Fill factor	>= 70%
e)	Degradation warranty	Panel output (Wp) capacity to be >=90% of design nominal power after 10 years and >=80% of design nominal power after 25 years.
f)	Module frame	Non-corrosive and electrolytically compatible with the mounting structure material.
g)	Termination box	Thermo-plastic, IP 65, UV resistant
h)	Blocking diodes	Schottky type
i)	Module minimum rated power	The nominal power of a single PV module shall not be less than 300Wp.
j)	RF identification tag for each solar module	Shall be provided inside the module and must be able to withstand environmental conditions and last the lifetime of the solar module.
k)	RF identification tag data	<ul style="list-style-type: none"> <li>a. Name of the manufacturer of PV module</li> <li>b. Name of the Manufacturer of solar cells</li> <li>c. Month and year of manufacture (separately for solar cells and module)</li> <li>d. Country of origin (separately for solar cells and module)</li> <li>e. I-V curve for the module</li> <li>f. Wm, Im, Vm and FF for the module</li> <li>g. Unique Serial No and Model No. of the module</li> <li>h. Date and year of obtaining IEC PV module qualification certificate</li> <li>i. Name of the test lab issuing IEC certificate</li> <li>j. Other relevant information on traceability of solar cells and module as per ISO 9000 standard</li> </ul>
l)	Power output rating	To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted.
m)	Compliance with standards and codes	IEC 61215 / IS 14286 IEC 61730 Part 1 and 2
n)	Salt Mist Corrosion Testing	As per IEC 61701
3.	Solar PV Modules Mounting Structure	
a)	Wind velocity withstanding capacity	150 km / hour
b)	Structure material	Hot dip galvanised steel with a minimum galvanisation thickness of 120 microns or aluminium alloy.
c)	Bolts, nuts, fasteners, panel mounting clamps	Stainless steel SS 304
d)	Mounting arrangement for RCC-flat roofs	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15

S.No.	Specification	Parameters
e)	Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability and wind with standing capacity, or penetrating the sheet metal and fixing to the substructure, ensuring that the roof remains waterproof and ensuring stability and wind withstanding capacity.
f)	Mounting arrangement for elevated structures	The elevated structure has to be securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC surfaces.
g)	Mounting arrangement for ground installations	With removable concrete ballast made of pre-fabricated PCC (1:2:4), M15; assuring enough ground clearance to prevent damage of the module through water, animals and other environmental factors.
h)	Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.
i)	Minimum distance between roof edge and mounting structure	0.6m
j)	Access for panel cleaning and maintenance	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box.
4.	<b>Solar Array Fuse</b>	The cables from the array strings to the solar grid inverters shall be provided with DC fuse protection. Fuses shall have a voltage rating and current rating as required. The fuse shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.
5.	<b>Solar Grid Inverter</b>	The solar grid inverter converts the DC power of the Solar PV modules to grid-compatible AC power. The recommended solar grid inverter capacity in kW shall be in the range of 95% - 110% of the Solar PV array capacity.
a)	Total Input power (AC)	To match Solar PV plant capacity while achieving optimum system efficiency
b)	Input DC voltage range	As required for the Solar Grid-tied inverter DC input.
c)	Maximum power point (MPPT) tracking	Shall be incorporated
d)	Number of independent MPPT inputs	1 or more
e)	Operation AC Voltage	Single phase 230V or Three phase 415 V (+ 12.5%, -20%)
f)	Operating Frequency range	47.5 – 52.5 Hz
g)	Nominal frequency	50 Hz
h)	Power factor of the inverter	>0.98 at nominal power
l)	Total harmonic distortion	Less than 3%
j)	Built-in Protection	AC high / low voltage; AC high /low Frequency
k)	Anti-islanding protection	As per VDE 0126-1-1, IEC 60255.5 / IEC 60255.27
l)	Operating ambient temperature range	-10 oC - +60 oC
m)	Humidity	0 – 95% Rh
n)	Inverter efficiency	>=95%
o)	Inverter weighted efficiency	>=94%
p)	Protection degree	IP 65 for outdoor mounting, IP 54 for indoor mounting

S.No.	Specification	Parameters
q)	Communication interface	RS 485 / RS 232 / RJ45
r)	Safety compliance	IEC 62109-1, IEC 62109-2
s)	Environmental Testing	IEC 60068-2 (1,2,14,30)
t)	Efficiency Measurement Procedure	IS/IEC 61683
u)	Cooling	Convection
v)	Display type	LCD for data display. LCD / LED for status display
w)	Display parameters to include	Output power (W), cumulative energy (Wh), DC voltage (V), DC current (A), AC voltage (V), AC frequency (Hz), AC current (A), cumulative hours of operation (h).
6.	DC Combiner Box	A DC combiner box shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC distribution box.
7.	DC Distribution Box	A DC distribution box shall be mounted close to the solar grid inverter. The DC distribution box shall be of the thermo-plastic IP65 DIN-rail mounting type and shall comprise the following components and cable terminations: <ul style="list-style-type: none"> <li>• Incoming positive and negative DC cables from the DC combiner box</li> <li>• DC circuit breaker, 2 pole (the cables from the DC combiner box will be connected to this circuit breaker on the incoming side)</li> <li>• DC Surge Protection Device (SPD), class 2 as per IEC 60364-5-53</li> <li>• Outgoing positive and negative DC cables to the solar grid inverter.</li> </ul> As an alternative to the DC circuit breaker a DC isolator may be used inside the DC distribution box or in a separate external thermoplastic IP 65 enclosure adjacent to the DC distribution box. If a DC isolator is used instead of a DC circuit breaker, a DC fuse shall be installed inside the DC distribution box to protect the DC cable that runs from the DC distribution box to the solar grid inverter.



## SOLAR ENERGY SOLUTIONS

### Solar Tree

#### Introduction

The sun is the source of energy and life for us. most of the energy we use has undergone various transformations before it is finally utilized, but is also possible to tap this source of solar energy as it arrives on the earth's surface. there are many applications for the direct use of solar thermal and photovoltaic energy. it is a technology which is well understood and widely used in many countries throughout the world. the most common use for solar photovoltaic technology is generating power for lighting (our lights, appliances, computers and televisions etc.), pumping water, generating grid quality power etc. as world oil prices vary, it is a technology which is rapidly gaining acceptance as it results in an energy saving measure in both domestic and commercial sector.

Solar energy is the energy that is in sunlight. it has been used for thousands of years in many different ways by people all over the world. as well as its traditional human uses in heating, cooking, and drying, it is used today to make electricity where other power supplies are absent, such as in remote places. it is becoming cheaper to make electricity from solar energy and in many situations it is now competitive with energy from coal or oil.



#### Smart Infrastructure

TREE Stands For:

T -Tree generating

R -Renewable

E -Energy and

E -Electricity

RS Power Systems Pvt. Ltd. provides feasible design solutions for environment. At locations where free wireless internet is available it enables the people for free access of energy for charging their mobile and portable lap top devices. Information like important city locations, phone numbers, institutions and addresses which could be accessed by everyone can be provided by several interactive info panels.

Tree is capable of producing roughly 800 kilowatts of power per day, can provide electricity day and night. The Solar Tree can be used for uplifting the public opinion of citizens for renewable resources of energy.

Applicable in:

- Urban and Rural Areas
- Parks, Gardens
- Airports, Coastlines
- Highways
- Deserts
- New Housing Estates
- De-forested Areas
- Petrol Pumps

RS Power Systems offers a strong, deliberate aesthetic, recalling heavy industry and railroads. Among our products, it provides the most shade and sense of place, making it great for courtyards and seating areas. Its 18 solar panels also produce 10.5 kW, enough to power 2 residential homes with less space compared to rooftop solar ground.

S.No.	Specification	Parameters
8.	AC Distribution Box	An AC distribution box shall be mounted close to the solar grid inverter. The AC distribution box shall be of the thermo plastic IP65 DIN rail mounting type and shall comprise the following components and cable terminations: <ul style="list-style-type: none"> <li>• Incoming 3-core / 5-core (single-phase/three-phase) cable from the solar grid inverter</li> <li>• AC circuit breaker, 2-pole / 4-pole</li> <li>• AC surge protection device (SPD), class 2 as per IEC 60364-5-53</li> <li>• Outgoing cable to the building electrical distribution board</li> </ul>
9.	Connection to the Building Electrical System	The AC output of the solar grid-tie inverter shall be connected to the building's electrical system after the Discom service connection meter and main switch on the load side. The solar grid-tie inverter output shall be connected to a dedicated module in the Main Distribution Board (MDB) of the building. It shall not be connected to a nearby load or socket point of the building. For buildings or loads with diesel generator backup, the wiring of the solar grid-tie inverter shall be such that the solar grid inverter cannot run in parallel with the diesel generator.
10.	Cables	All cables shall be supplied conforming to IS specifications
11.	Earthing	<ul style="list-style-type: none"> <li>• The PV module structure components shall be electrically interconnected and shall be grounded.</li> <li>• Earthing shall be done in accordance with IS 3043-1986, provided that Earthing conductors shall have a minimum size of 6.0 mm<sup>2</sup> copper, 10 mm<sup>2</sup> aluminum or 70 mm<sup>2</sup> hot dip galvanized steel. Unprotected aluminum or copper-clad aluminum conductors shall not be used for final underground connections to earth electrodes.</li> <li>• A minimum of two separate dedicated and interconnected earth electrodes must be used for the Earthing of the solar PV system support structure with a total earth resistance not exceeding 5 Ohm.</li> <li>• The earth electrodes shall have a precast concrete enclosure with a removable lid for inspection and maintenance. The entire Earthing system shall comprise non-corrosive components.</li> </ul>
12.	Combiner Box	Wires from individual PV modules or strings are run to the combiner box, typically located on the roof. These wires may be single conductor pigtails with connectors that are pre-wired onto the PV modules. The output of the combiner box is one larger two wire conductor in conduit. A combiner box typically includes a safety fuse or breaker for each string and may include a surge protector.
13.	Surge Protection	Surge protectors help to protect your system from power surges that may occur if the PV system or nearby power lines are struck by lightning. A power surge is an increase in voltage significantly above the design voltage.
14.	Metering	An energy meter (Kilowatt-hour Meter) shall be installed in between the solar grid tie inverter and the building distribution board to measure gross Solar AC energy production (the "Solar Generation Meter").



## POWER SOLUTIONS

# EV Charger For Tricycle

A Battery Charger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol depends on the size and type of the battery being charged.

SMPS Battery Charger (CVCC type) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. In SMPS switching is done at very high frequency of several KHz using Pulse Width Modulation (PWM) technique which is reliable, efficient, noiseless and compact.



### Working Principle

The design is based on the fly back topology. High switching frequency makes the components sizes to decrease and hence reduction in the size. The efficiency of the unit is greater than 75%. The input voltage is applied to the transformer primary which is switched at high frequency using opto-isolators. The output of the transformer is rectified using proper rectifier diodes. The output is further smoothed with the use of smoothing inductors to reduce the ripple to the desire level.

The Battery Chargers provide both constant voltage (CV) charging below the rated current and constant current (CC) charging if the battery tries to draw more than the rated current. In CV mode, the output voltage is well regulated against line and load variations. The input voltage range is 160 V to 270 V which is a wide range of effective working of the charger with higher variation in input voltage.

### Features

- Due to the wide input range, the charger is suitable to work in regions with high voltage fluctuations.
- Due to compact structure and user friendly functions, carrying and installation of the charger is easy.
- Rugged design of the charger that makes it able to work in harsh environmental conditions.
- Military grade components are used in designing the charger for prolonged life and better tolerance.
- SMF and non SMF both type of batteries can be charged.

## TECHNICAL SPECIFICATIONS

Input Specification	
Capacity	24 V / 5 Amp (SMPS based)
Nominal Voltage	230V AC, 1-Ph, 50Hz
Operating Voltage Range	140 to 275 V AC, 1-Ph, 50 Hz & charger shall be able to sustain continuous variation in Input Voltage from 140 V to 275 V AC
Frequency	50±3Hz
Efficiency	>80%
Isolation	I/P to O/P : 1.5 KV DC for 1minute I/P to earth : 1.5 KV DC for 1minute
Input Protection	i) Fuse Protection ii) Variation in I/P Voltage below 140 V & above 275 (up to 280 V AC)
Transient Surge Protection	Yes, (Varistor) or any other component
Output Specification	
Purpose	Suitable for charging of 24V 50 AH SMF Batteries (12V 50 AH SMF Batteries - 2 Nos. of Batteries connected in series)

## Our Nationwide Service Network

Charging Voltage	28±0.5 V DC
Output Current	5.0 Amp DC (Max)
Ripple	< 3% PK - PK Maximum Output Voltage
Line Regulation	< +/- 1.2%
Load Regulation	< +/- 5%
Protection	(i) O/P Over Voltage (ii) Over Load (120% of Rated 5 Amp) (iii) Short Circuit (iv) Battery Blocking (v) Battery Reverse
Indication	(i) Battery Charging (ii) Battery full charge
Environmental Specifications	
Operating Ambient Temperature range	-10 to 55°C Duration min 6 Hrs. as per following standards : (i) IS:9000 (Part II)-1977 (reaffirmed on 2016) (ii) IS:9000(Part-III) -1977 (reaffirmed on 2016)
Operating Relative Humidity requirement	At Least 90% RH (Non condensing) At 25°C Duration 12 Hrs. As per following standard: IS:9000 (Part IV)-1979 (reaffirmed on 2016)
Cooling	Natural/Forced Air cooling
Mechanical Requirement	
Mechanical Shock & Vibration Test	Upto 2G. as per following standard {1}IS:9000 (Part VIII)-1981 (i) IS:9000(Part 7/Sec1) : 2006
Cable and Connector Specification	
Input Side	3-Pin Plug Top of 6 Amp rating with 3 core copper cable length of 2 Meter
Output Side	3 Pin, IEC C14 Male connector of 6 Amp current rating with 1 meter length cable (excluding connector) of cross sectional are 1.5 SQ. mm, ISI marked, IS:694
General Requirement	(i) Current & Voltage rating safety factor shall be 1.5 times for Power Semiconductor devices. (ii) Cycle by cycle primary current protection is included to prevent potential damage. (iii) Enclosure shall be non conducting coated of non-breakable material & all the live part shall be covered to provide protection against Electric shock.



Scan the QR code to register a complaint



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