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भारत सरकार GOVERNMENT OF INDIA  
रेल मंत्रालय MINISTRY OF RAILWAYS

## PAMPHLET

on

# SMPS POWER PLANT FOR TELECOM INSTALLATIONS

End User : Supervisory & Artisan Staff

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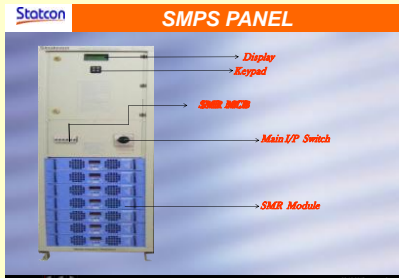
**Indian Railways**  
**Centre for Advanced Maintenance Technology**

महाराजपुर, ग्वालियर — 474 005

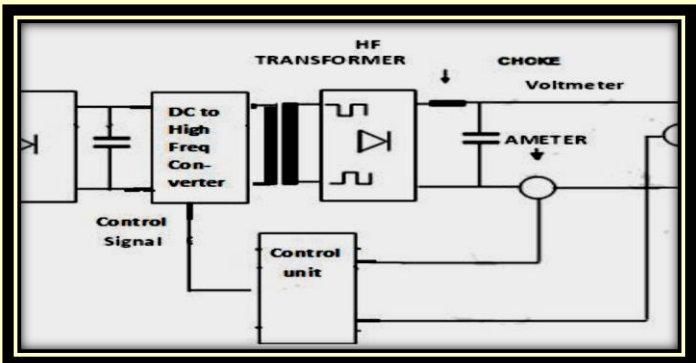
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## SMPS POWER PLANT FOR TELECOM INSTALLATION

This Pamphlet covers the specification, maintenance and adjustments of 48 V DC Power Plant based on High Frequency Switch Mode Techniques for Telecom Equipments i.e. Exchanges, Multiplexing Equipments, GSM-R Equipments, OFC Equipments etc. Power plant may be used for charging VRLA or Conventional batteries



A **switch mode power supply** is an electronic [power supply](#) that incorporates a switching regulator to [convert electrical power](#) efficiently. Unlike a [linear power supply](#), the pass transistor of a switching-mode supply continually switches between low-[dissipation](#), full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy.



### **i) First Stage conversion:**

Power factor correction along with H.F. filter and input AC voltage rectification and conversion in high voltage DC.

### **ii) Second Stage Conversion:**

- Rectified high voltage DC is stored in capacitors.
- High voltage DC is then converted in to a very high frequency AC (20 KHz and higher).
- Conversion of high voltage DC to high frequency AC is achieved by means of very powerful and ultra fast semi-conductor switching devices.
- High frequency AC is stepped down to the required level by means of a small high frequency transformer.
- Stepped down AC is rectified by ultra high speed diodes to DC of desired voltage and filtered by means of high frequency filters and pure DC voltage is stored in capacitors.
- This Pamphlet covers the specification, maintenance and adjustments of 48 V DC Power Plant based on High Frequency Switch Mode Techniques for Telecom Equipments i.e. Exchanges, Multiplexing Equipments, GSM-R Equipments, OFC Equipments etc.

## **SPECIFICATIONS OF SWITCH MODE RECTIFIER SYSTEM**

1	AC Input voltage	230 V AC rms, Single Phase, Variation 90V to 300V AC
2	AC Input Freq	50 Hz $\pm$ 2 Hz
3	DC output voltage Setting	Nominal : 48V DC Auto Float : 52.8 V DC (Float voltage) Auto Charge : 57.0V DC ( Boost Voltage)
4	Load Voltage Tolerance	44.4V(Under Voltage) to 60V DC (Over Voltage)

5	Output Current Limit	27.5 A for each Module
6	Output Voltage regulation	$\pm 1\%$ of set value over specified input voltage freq variation and load variation of 25% to 100%
7	Ripple (Peak to Peak)	300mV max. peak to peak without battery connected at full load
8	Psophometric noise	2 mV max. with battery connected or 4mV max without battery connected
9	Efficiency	a) Better than 85% at nominal Input, Output at 100% load b) Better than 80% for other specified input. Output condition and load between 25% to 100%
10	Power Factor	a) 0.95 lagging to 0.98 leading at nominal input & output voltages and load 75% to 100% b) 0.90 lagging to 0.90 leading at in any other working conditions and load 75% to 100%
11	Noise Level	60 dBA max under all operating conditions at an ambient noise level of 45 dBA
12	Dielectric level	1.5 KV rms at 50 Hz for 1 minute between AC input to Output, Input Output to Earth

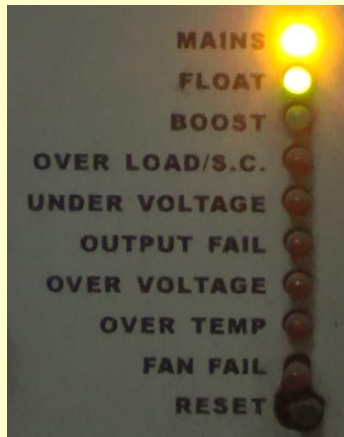
13	Insulation level	a) >2 M $\Omega$ between AC input & Earth b) >1 M $\Omega$ between DC output & Earth c) >5 M $\Omega$ between AC input & DC output
14	Switch Gear	MCB at Input and Output
15	Protection	DC Output high voltage Over Load/Short CKt Input Surge Protection Soft Start Facility Over temperature
16	Indications (LED)	Mains ON, Float, Boost
17	Alarms (Visual)	DC Output Over Voltage DC Output under Voltage DC Output Over Load Module Fail

### Power System Configuration:

SN	Basic SMR Module	Configuration	Permissible Ultimate Capacity
1	12.5 A	FR-FC (n+1)	50 Amp
2	25 A	FR-FC (n+1)	150 Amp
3	50 A	FR-FC (n+1)	800 Amp
4	12.5 A	FR-BC (n+2)	50 Amp
5	25 A	FR-BC (n+2)	150 Amp
6	50 A	FR-BC (n+2)	800 Amp

- The FR-FC or FR-BC modules shall be housed in (n+1) or (n+2) parallel configuration in a single rack where 'n' is the actual required number of FR-FC, FR-BC modules for meeting the particular load requirement.
- Power Plant shall consist of a Distribution-Switching-Control-Alarm Arrangement (DSCA) and Float Rectifier-cum-Chargers (FR-FCs) or Float Rectifier cum Boost Chargers (FR-BCs).
- The Power Plant shall be capable of meeting the load requirement (equipment and battery bank) for various telecom equipments. The system shall be expandable at rack level itself, using the basic modules of the same rating.
- To cater for higher load requirements, same type of FR-FCs or FR-BCs mounted in the same rack shall be capable of working in parallel load sharing arrangement.
- The Power Plant including FR-FC or FR-BC modules shall be suitable for operation from AC Mains or from a DG Set.

## **RECTIFIER MODULE STATUS AND ALARM INDICATION**



1	<b>Mains</b>	<b>It Indicates mains supply to the module is ON</b>
2	<b>Float</b>	It shows that Module is in Float mode of charging.
3	<b>Boost</b>	It shows that Module is in Boost mode of charging.
4	<b>Over load /SC</b>	It shows that the module is overloaded.
5	<b>Under Voltage</b>	It shows that the output DC voltage of the module is low.
6	<b>Output Fail</b>	It shows that the output DC voltage of the module is low.
7	<b>Over Voltage</b>	It shows that the output DC of the module have exceeded normal output operating range
8	<b>Over Temp</b>	It indicates that the temperature of the module inside is more than 75°C.

## SYSTEM ALARM

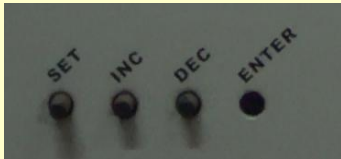
- When mains AC is within the specified limit and still battery is discharging then there is an alarm of “MOBD”.
- When the system current more than 105% of the number of modules present excluding redundancy then there is an alarm of “System Over Load”.
- Due to any reason if module is failed and on module there is an alarm “FR/FC FAIL” then there is an alarm of “FR/FC FAIL” on system.
- When Mains AC voltage is more than 300V or less than 90 V then there is an alarm of “AC O/R.
- If the system voltage increases beyond setting value (57.1V) then there is an alarm of “LOAD VOLT HIGH”.
- When battery is discharged below 44.4 V then there is an alarm of DC U/V.
- When battery is isolated manually with the help of isolation switches then an alarm of “BATT ISOLATED” generated.

## OPERATING PROCEDURE OF MICRO CONTROLLER BASED DSCA



The display shows:

- AC voltage shows at Left corner of the display at 1<sup>st</sup> line.
- DC load Voltage shows at Right corner of the display at 1<sup>st</sup> line.
- DC Voltage shows at Left corner of the display at 2<sup>nd</sup> line.
- System current shows at Right corner of the display at 2<sup>nd</sup> line
- Right corner of the display at 2<sup>nd</sup> line: battery current (to see the battery current press increase for 3 seconds. the system will display “battery current” with symbol “b” within 10 seconds.
- The system displayed “FC” in float mode and BC in boost mode.
- For any fault, the system will give alarm and display “FLT” with blinking effect till the fault goes. press “ENTER” to see the faults, the list of faults will display within 30 seconds and buzzer will stop ringing.
- There are four adjustment keys on front panel. set, increase, decrease & enter.

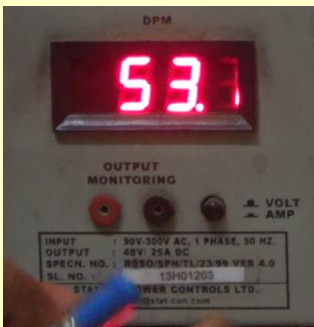


- To come to normal mode press “ENTER”.
- To see the parameters values, press “SET” for 3 seconds.
- System will play “login : User Set”.
- Press “SET” again to choose “Fact Set’.
- To choose the user set login mode press “ENTER”.



- To choose the fact set login mode. Enter 4 digit password.
- After entering by pressing “ENTER KEY” in user set, display will show “FLOAT VOLTAGE” the first parameter of the user set.
- Press “SET” button. Subsequent pressing of set button, the display shows all the parameter with its value one by one. these parameters are “FLOAT”, “BOOST”, “ACOV SET”, “ACUV SET”, “AC SPAN”, “DC OV SET”, “DC UV SET”, “SYS CRNT”, “BCL”, “Load Voltage High”, “TCS”, “F TO B Current”, “B TO F Current”, “RESTORE USER SET”.
- Except “FLOAT”, “BOOST” and “BCL” all are factory setting. Do not disturb these settings.
- To change the parameters values, first select the parameter.
- To increase the value of selected parameter, press “INCREASE”.
- To decrease the value of selected parameter, press “DECREASE”.
- To register (store) the set value press “ENTER”.
- To restore the default user setting first select the “RESTORE USER SET” of user set login mode then press “INCREASE” key and “DECREASE” key simultaneously for 4 seconds.

### MCB at Input and Output



Output Voltage and current of SMRs can also be measured separately with the help of multimeter by connecting on the ports as shown in the picture. Voltage and current can be selected by pressing the switch.

## **DO's and DON'ts**

- Keep the entire modules in ON position.
- Set equal voltage in all modules for proper current sharing.
- Set battery path current to AH/10.
- Set battery voltages for SMF battery, Float-2.25 V/cell & boost-2.3 V/cell. For LM battery, float-2.2V/cell & Boost-2.4V/cell.
- Replace fuse with a similar rating.
- Do not take out plugs of modules in working condition.
- Do not connect battery when modules are ON.
- Do not connect battery in reverse polarity.
- Never Add/remove battery in the bank when connected to charger.
- Never reduce numbers of cells in a battery bank, before that reduce charger output voltage to a appropriate level (for removing one cell reduced voltage by 2 volt).
- Never short circuit the fuse holder by a conductor.

## **MAINTENANCE AND CHECKS**

- Cleanliness and ventilation shall be maintained in equip. room.
- A logbook of battery current, load current, AC input voltage, AC input current and load voltage should be maintained.
- The batteries connected to the power plant should be monitored for proper voltages with the use of LCD Display on the front panel.
- Apply rust free jelly to the connections given from bus bar and to the points where the high current carrying cables are connected.
- The earth resistance to the power plant should be measured within every six months and should be maintained below 0.2 ohms. Never run earth wire near to current carrying conductor.
- Plant must checked once in a six months to check the value of electrolytic capacitors. Replace capacitor if found less than 20% of its rated value.

## TROUBLE SHOOTING

The following tables gives some common faults and remedies.

Sr	Equipment level fault	Probable Cause/Remedy
1	Mains AC MCB/Fuse blows intermittently	One of the rectifier modules is faulty
2	Voltage at load bus bar very low	Power plant is on battery backup for longer period or heavy load is connected
3	Improper change over of battery	Check battery connections at battery side & eqpt side or one of the battery cell is damaged
4	All the Modules not getting ON even AC input is within range	Input connectors might be loose connected or input relay might go faulty

## PROBABLE TROUBLE SHOOTING IN MODULE LEVEL

Sr	Equipment level fault	Probable Cause/Remedy
1	DC fail, LED glows continuously	DC output fuse of module may be in open condition
2	Over voltage LED glows continuously	Press over voltage reset switch, if it glows again, Module card got faulty
3	No display on module	Fuse may blown
4	Display appears but no output	Fuse may blown or MOSFET fails
5	Overload LED glows continuously	Connectors are loose connected

## BATTERY MAINTENANCE

- Cleaning of all cells near its terminals periodically.
- Reading of all cell's voltage with charger ON and charger OFF.
- Boosting of Sick cells using Sick Cell charger.
- Applying petroleum jelly over the terminals of Batteries.
- Periodically recording specific gravity of all cells.
- Periodically checking electrolytic level of cells.
- Battery room shall be properly ventilated.
- Battery connections shall be of correct polarity.
- Healthy condition of the cell must be checked individually putting on separate load (not less than 01 Amp). Battery voltage must not drop below 1.9 volt (for 2.2V/200AH cell)



### **Disclaimer:**

It is clarified that this pamphlet does not supersede any existing provisions laid down by RDSO, Railway Board or Zonal Railways. The pamphlet is for guidance only and it is not a statutory document.

*If you have any suggestion or comment, please write to:*

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