GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(For Official Use)

A Pocket book on

INTEGRATED POWER SUPPLY

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Centre for Advanced Maintenance Technology

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FOREWORD

The Integrated Power Supply (IPS) provides stable and reliable power supply.

This Pocket Book on Integrated Power Supply has been prepared for dissemination of knowledge to the maintenance personnel of signaling department of Indian Railways to maintain the Integrated Power Supply in better way to avoid signal failures and maintain punctuality of trains.

This pocket size book covers installation maintenance instructions, adjustment of parameters, commissioning, do's and don'ts etc.

I hope that this pocket size book will be useful to the signaling personnel of Indian Railways.

CAMTECH ***A.R.TUPE***
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24.11.2014

PREFACE

Integrated Power Supply is the heart of Signalling System. On Indian Railways failures of IPS affect the punctuality of trains.

This pocket size book has been prepared to disseminate knowledge to maintenance staff to maintain the IPS in better way to avoid signal failures.

It is clarified that this Pocket size book does not supersede any existing provisions laid down in "Signaling Engineering Manual", Railway Board publications and RDSO publications. This book is not statutory and instructions given in it are for the purpose of guidance only.

We are sincerely thankful to Shri A.K. Pathak D.S.T.E./MGS/ECR, Shri Basantu D.S.T.E./BSB/NR and field personnel who helped us to prepare this book.

CAMTECH ***D.K.M.YADAV***
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24.11.2014

Content

INTEGRATED POWER SUPPLY

1. Introduction:

Power supply arrangement is the heart of signalling system. For a reliable signalling system installation, reliable power supply system is most important.

1.1. Power supply system in RE Area

In AC electrified area, the main power is derived from the traction supply.

n RE area the source of power supply to signalling system is through auxiliary transformer connected to OHE. This supply is very reliable but its occasional interruption/ low voltage can not be ruled out leading to blank signals.

1.2. Power supply system in Non-RE Area.

In non-electrified area, the main supply is obtained from commercial power supply.

The source of power supply is through a remote feeder, which is quite unreliable in respect of its availability and voltage. The battery backup is provided in all the DC circuit, which requires more maintenance. Due to frequent interruptions of supply, the signals are becoming blank till the starting of Diesel Generators.

1.3. **Integrated Power Supply system**

To overcome these problems a comprehensive power supply scheme known as Integrated Power Supply system has been developed by RDSO.

The function of Integrated Power Supply system is to provide a stable and reliable AC and DC power supply to the Railway signalling installations against all AC mains variations or even interruptions.

This is very essential for proper movement of trains. As the name indicates, it is designed and developed with a view to provide complete power solutions from single system to all signalling

circuits. The IPS for Railway Signalling circuits shall be manufactured as per Latest RDSO specification no.
RDSO/SPN/165/2012,Version3.0

1.4. Advantage of IPS using switch mode technology over thyristor based

The main advantages of SMPS based IPS are as follows:

- Integration of various power supply equipments i.e. Battery charger, Transformer, DC-DC Converter, Inverter and Voltage Regulator in one equipment.
- Only one battery set of 110 V of capacity 200/300 AH is used.
- Based on high efficiency more than 90% SMPS based latest technology with phase correction.
- Hence power factor (PF) achieved is better than 0.9.
- Modular in design with modules working in n+1 hot standby mode to provide redundancy and future expansion at any time later on even in working installation by adding more modules.
- Enhances safety in train operation by preventing blanking of signals in case of 230 V AC mains failure by provision of built-in on line inverter in hot standby.

- Provision of one set Class B and C Lightning and Surge protection at 230 V AC input supply is in-built.
- Provision of continuous battery health monitoring with indication and alarms on Status Monitoring panel with Station Master.
- Remote monitoring of failures of modules is possible through Data logger as potential free contacts for such failures are provided in the equipment.
- Economy is achieved by reducing hours of DG set running in Non-RE area as approx. 6 hours backup time provided.
- Standard configurations adopted for small and medium size stations to increase reliability, availability and maintainability.
- Reduce maintenance efforts due to centralized maintenance.
- Higher reliability due to in-built redundancy and integrated factory wiring.

Scope:

- This Pocket size handbook covers the technical and maintenance requirements of SMPS based integrated power supply system (IPS) suitable for Signalling Installations in RE and Non-RE areas as

per RDSO/SPN/2012 Version 3.0. Although effort has been made to cover all the technical aspects related to IPS, manufacturer's instruction manual may be referred for detailed study.

- The IPS system is suitable to work with either VRLA Maintenance free cells as per IRS: S 93/96(A) or low maintenance cells as per IRS:S 88/93.

RDSO approved Firms:

At present following are the RDSO approved firms for supply and installation of IPS system on Indian Railways:

1. M/s Amara Raja Power Systems Pvt. Ltd., Tirupati.(A.P.)
2. M/s Statcon Power Controls Ltd., Noida (U.P.)
3. M/s HBL Nife Power System Ltd. Hyderabad (A.P.)

2. Modules of IPS System

The SMPS based Integrated Power Supply (IPS) system is modular in design. It consists of the following modules:

- AC Distribution Panel (ACDP)
- SMPS based Float cum Boost Charger (FRBC) Panel
- DC Distribution Panel (DCDP)

2.1. SMPS based Float cum Boost Charger (FRBC) Panel:

This panel consists of

- FRBC (Float Rectifier cum Boost Charger) module.
- Distribution/Supervisory control/Alarm (DSA) unit.

FRBC or SMR Module:

The FRBC module is of 110 V/20 A rating.

The module is capable of operating in "Auto Float cum Boost Charger" mode. It is programmed to operate as a float rectifier or a Boost charger depending on the condition of the battery being sensed by the switching/control unit. Sometimes it is also called as Switch Mode Rectifier (SMR) Module. The module comprises of a number of SMRs in (n+1) configuration where n is the load at 110 V DC including battery charging in boost mode (C/10).

Auto Float Mode:

The float voltage of each rectifier module shall be set as given in the following table:

Nos. of cells	Auto Float mode voltage	
	VRLA Cells	Conv. LA Cells
55	123.8 V	118.25 V

Normal Float voltage for VRLA battery is 2.25 V/Cell and for conventional battery it shall be 2.15 V/Cell.

Auto Boost Mode

The Boost voltage of each rectifier module shall be set as given in the following table:

No. of Cells	Auto Boost mode Voltage	
	VRLA Cells	Conv. Cells
55	126.5 V	133.5 V

Normal Boost voltage for VRLA battery is 2.3 V/Cell and for conventional battery it shall be 2.42 V/Cell

Distribution/Supervisory Control /Alarm (DSA) unit:

This is a microprocessor based module to control and monitor various parameters of FRBC/SMR.

Alarms and Indication of DSA unit Status Indication:

Description	Nomenclature	Indication
(a) Mains available	MAINS	Amber
(b) Mains fail	MAINS FAIL	Red

All the above indications can be displayed on an LED or LCD type alphanumeric display through microprocessor based control and supervisory unit.

Functions of DSA unit:

Battery health monitoring in Auto mode:

On restoration of AC mains after an interruption, changeover from float charging to boost and vice-versa depending upon the battery condition.

Battery Current limiting circuit:

The battery charging current limit is settable (5-15% of battery AH capacity) for the safety of the battery.

Battery under voltage isolation

The system has provision for battery isolation which shall be effective at

(i) For VRLA battery: 1.8 V/cell ($\pm$0.012 V/cell)

(ii) For low maintenance lead acid battery : 1.85 V/cell ($\pm$0.012 V/cell)

Battery under voltage adjustment is provided inside the switching control unit and it is adjustable from 1.80 to 2.0 V/cell. Battery shall get reconnected after restoration of mains.

Battery reverse polarity protection:

Protection for battery reverse polarity is provided in the system. The battery reverse polarity indication is provided near the battery terminal.

This panel also has following facilities:

- Local and remote (via modem) monitoring of any alarm condition of each of the rectifier.
- Local and remote (via modem) monitoring of the output current of each rectifier.
- Setting of parameters of all the rectifiers using front panel or an optional remote PC.
- Monitoring of DC Load current and voltage.
- Facility to send fail signals of modules, provided in AC and DC panels to remote indication panel provided in ASM room.

Function of FRBC Panel:

A static switch is mounted in the SMPS panel. It protects the IPS system from AC under voltage or over voltage.

The operating voltage of the static switch is 150±5V to 275±5V. it automatically cuts-off if the AC input supply goes out of above limit.
It reconnects the AC supply to system automatically with a time delay of 10-15 seconds as soon as AC supply falls within the limit.

Control and Supervisory Unit (CSU):
CSU is the heart of SMPS panel. All the indications, monitoring and adjustments can be done through CSU with push buttons. It is a micro controller based menu driven by control unit with LCD display. For the operator convenience all the function done by CSU are categorized in to three groups:

- SMR menu
- CSU menu
- BATTERY menu

General

- Pre-commissioning checklist as per firm manual should be ensured jointly by railways and firms before commissioning of IPS.
  Good quality, maintenance free earth with earth resistance less than 1 ohm should be provided as

per the Code of practice for earthing and bonding system for signaling equipments RDSO/SPN/197/2008.

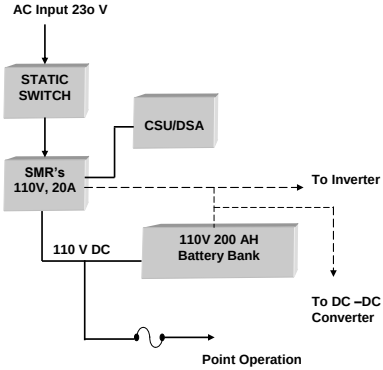

Fig.:1 Block Diagram for functioning of FRBC panel

The AC incoming supply of 150-275V AC is fed to SMPS panel. This voltage is further fed to SMRs Modules individually. Outputs of all SMRs are paralleled and fed to DC-DC Converters, Point operation through a fuse and Inverters. Battery is connected to SMRs through a fuse and alow voltage disconnect contactor.

2.2. AC Distribution Panel (ACDP):

This cabinet consists of:

- Inverters 110 V DC/230 V AC.
- Ferro resonant based Automatic Voltage Regulator (AVR) or Bypass AVR 230 V /230 V AC.
- Transformers 230VAC/110 V AC for Signals and Track Circuits.

Inverters:

Two inverters based on Pulse Width Modulation (PWM) technology are provided in ACDP.

The Inverters are designed for continuous operation for an input voltage of 98 V to 138 V DC at a nominal voltage of 110 V DC and shall be rated for an output of 230 V.

The two inverters are operated in Master/Slave configuration such that on failure of one inverter the other supplies to the load automatically within 500 milliseconds.

The following LED indications are provided on front panel:

Description	Nomenclature	Indication
(a) Mains ON	MAINS	Amber
(b) Output OK	OUTPUT	Green
(c) Inverter	INVERTER FAIL	Red

Fail		
(d) Inverter 'On load'	ON LOAD	Green
(e) Fan fail indication (in case of forced cooling)	FAN FAIL	Red

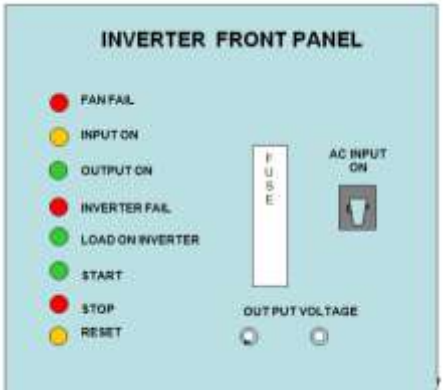

Fig.:2 Front Panel of Inverter

Ferro Resonant type Automatic Voltage Regulator (AVR)

The AVR works satisfactorily within a range of 150 V to 270 V input at 50 Hz mains supply. The output voltage shall be maintained within 230V±1% when the unit is connected to rated load. There are two AVRs provided in the ACDP:

- AVR1 Regulator for Signals
- AVR2 Regulator for Track Circuits

The output of AVR1 and AVR2 are fed to step down transformers of Signal and Track Circuits respectively.

A two pole ON/OFF rotary switch is provided for input to the regulator. A red neon lamp to indicate that the unit is 'ON' is provided on the front panel.

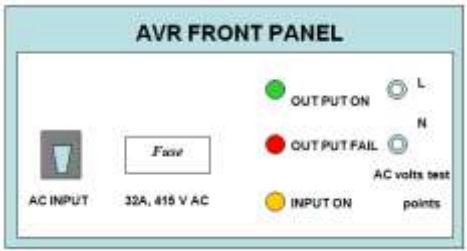

Fig.:3 AVR Front Panel

Transformer:

The supply from AC Bus (either from Inverter or from Bypass AVR) is fed to each Transformer through an AC Changeover Contactor. Necessary tapings (100V, 110 V, 120V, 130V) are provided at the secondary of each transformer.

The following LED indications are provided on the front panel:

Description	Nomenclature	Indication
(a) Input ON	INPUT	Amber
(b) Output ON	OUTPUT	Green
(c) Tx Fail	FAIL	Red

A rotary switch of 10 Aor above is provided for switching ON/OFF the transformer.

Fig.:4Transformer front Panel

Function of ACDP:

The incoming Mains of 150-275V is fed to both the AVRs pertaining to signals and Track circuits.

Track AVR is always kept in ON condition while signal AVR is made ON only when there is no Inverters output.

It is also ensured to cut off the AC input of Signal AVR to avoid no load losses of AVR, when output is available from any of the inverters.

SMRs/Battery voltage is fed to Inverter 1 and Inverter 2 through respective input MCBs.

Normally the AC load of signals is run on Inverter1. On its failure Inverter 2 takes over immediately.

When both inverters fail, the AVR1 finally runs the load.

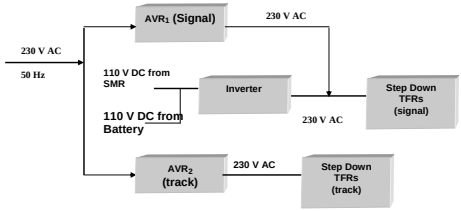

Fig.:5 Block Diagram for functioning of ACDP

2.3. DC Distribution Panel (DCDP)

This panel consists of the following

- DC-DC converters.
- Common Digital Voltmeter for measurement.

DC-DC Converters:

DC-DC Converters provide different DC voltage from input DC voltage range of 98 V to 138 V.

DC-DC Converters are connected in the following order:

Sr. No.	Equipment	Rating
1.	Relay Internal	24-32V, 5/10A OR 60-66V,5A
2.	Relay External	24-40V, 5/10A OR 60-66V,5A
3.	Axle Counter	24-32V, 5/10A
4.	Block Local UP	12-40V, 1 A
5.	Block Local DN	12-40V, 1A
6.	Panel Indication	12-28 V,5/10A
7.	Block Line UP	12-40V, 1 A
8.	Block Line DN	12-40V, 1A
9.	Block Tele UP	3-6V, 0.1A

Sr. No.	Equipment	Rating
10.	Block Tele DN	3-6V, 0.1A

DC-DC Converter of 12-40V, 1A is suitable for double line block instrument. For other type of block instruments any of the following ranges can be selected:

- 40-60V
- 60-100V
- 100-150V

Whenever block proving by axle counter is used, the DC-DC Converter of 24V/5A (2 Nos.) is used in place of block line DC-DC Converters.

Digital Voltmeter:

A DC voltmeter of 3 1/2 digit with LCD/LED display is provided on the front panel with extendable cords for measurements of output voltages of DC-DC converters.

Fig.:6 Measurement of output voltage of DC-DC converter

Each converter is provided with a proper plug in arrangement for DC input and output. A toggle switch is provided for switching ON/OFF the unit.

Following visual indications are provided on the front panel of DC-DC Converter.

Description	Nomenclature	Indication
(a) Input power ON	INPUT	Amber
(b) DC-DC Converter Output OK	OUTPUT	Green
(c) DC-DC Converter Fail	FAIL	Red

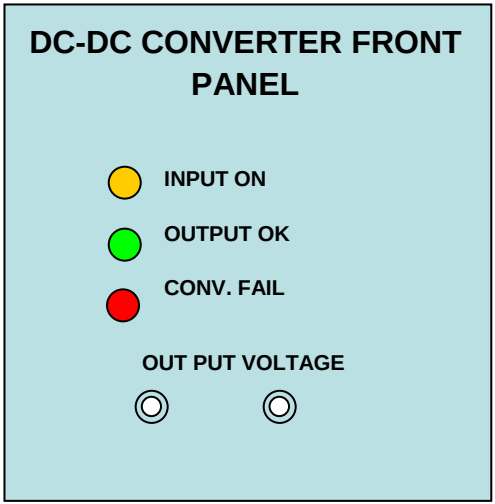

Fig.: 7 DC-DC Converter Front Panel

Functioning of DCDP:

The 110V DC power supply taken from the SMPS panel is fed to DC-DC converters pertaining to Relay Internal., Relay External., Axle Counter, Block Line Up & Dn, Block Tele**,** Panel Indication and HKT etc. DC-DC converters in n+1 configuration is paralleled for each application so that in case of failure of one converter, the other shall takeover immediately without delay.

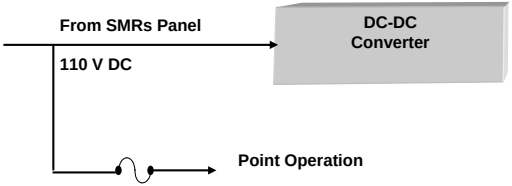

Fig.:8 Block Diagram for functioning of DCDP panel

2.4. Battery Bank:

IPS system is suitable for charging 110 V battery bank of Low maintenance cells as per as per IRS S88/93 or VRLA Maintenance free cells as per IRS:S-93/96A. Purchaser shall specify about type of batteries to be used. The battery is to be installed in a separate room.

Fig.:9 VRLA battery bank

3. Installation and Commissioning:

3.1. General

- Pre-commissioning checklist shall be ensured jointly by railways and firms before commissioning of IPS.
- Good quality, maintenance free earth with earth resistance less than 1 ohm should be provided as per the Code of practice for earthing and bonding system for signaling equipments RDSO/SPN/197/2008.

3.2. Installation:

- The system should be installed with sufficient space at rear and front for easy maintenance and servicing.
- The location selected for placing the system should be away from dropping or falling substances as well as heat generating equipment.
- Keep the cabinets side by side leaving a gap of about one foot in between.
- Grout the cabinets to floor using the holes provided in U-channels.
- Keep the entire front panel switches in DC-DC Converters, Step Down Transformers, AVRs and

MCBs of SMRs in OFF position. Remove Battery Input Fuse and Point Operation Fuse.

- Make the Input, Output and interconnections, except the loads connected to DC-DC Converters, and step down transformers as per the installation diagram.
- Refer the interconnection drawings for connectivity details.
- Insert the Rectifier Modules (SMRs) in their respective slots in SMPS panel.
- Follow the procedure for SMR as given in instruction manual.
- Insert the DC-DC converters in their respective slots in DCDP.
- Keep the voltage adjustment potentiometer fully anti clock wise so as to keep the output voltage minimum.
- This potentiometer is located on the front panel.
- Follow the procedure mentioned in the instruction manual.
- Place the Battery temperature sensing probe on Batteries and connect the other end of the probe connector to respective socket in SMPS panel.
- Mount the Status monitoring panel in ASM chamber at appropriate place.

- Connect the multi core cable, one end to Status monitoring panel first and then to SMPS panel.
- Connect Generator Output Supply to SMPS panel at appropriate terminal with 1 sq. mm.
- Separate earth is to be provided for IPS as per RDSO guide lines.
-

3.3. Adjustments of output parameters:

3.3.1. SMR/FRBC Module:

Float and boost voltage adjustment:

Available range of adjustment	Voltage to be set to	
	For VRLA battery	For Conventional Lead Acid battery
Float 98 – 138 V	Float 2.25 x 55 = 123.8 V	Float 2.15 x 55 =118.25 V
Boost 98 – 138 V	Boost 2.3 x 55 = 126.5 V	Boost 2.42 x 55 = 133.1 V

- To set the DC output voltage of SMR/FRBC, disconnect the battery and switch on one SMR at a time.
- Turn the potentiometer anti-clockwise for reducing the values and clock-wise for increasing.
- Set voltage as per above table. Increase voltage in all the modules by 1.0 volt above the settings for blocking diodes voltage drop.

  Note: All modules must be set at same voltage preferably by monitoring voltage at voltage monitoring jack through multimeter.

  Float and boost current adjustment:

  Available range of adjustment

  Float - 9 A – 22A

  Boost - 9 A – 22A
- Turn the potentiometer anti-clockwise for reducing the values and clock- wise for increasing.
- The current settings shall have to be same for all SMR modules

4. **MAINTENANCE**

4.1. Maintenance Check Points for DC-DC Converters

Sr.	Check Point	Action Required	Frequency
1.	Converter O/P voltage	Check if the O/P voltages are set as per requirement. If not, correct them	Once in 15 days
2.	Paralleling of Converters	Switch OFF main Converter and observe if the stand-by is taking the load.	Once in a month
3.	Paralleling of Converters	Switch OFF Stand-	Once in a month

Sr.	Check Point	Action Required	Frequency
		by Converter and observe if the main is taking the load.	
4.	Converter Mechanical Alignment	Check if all the converters are inserted properly	Once in 3 months
5.	Converter Cleaning	Remove one by one and clean the converter using a soft cloth . Gently blow some	Once in 3 months

Sr.	Check Point	Action Required	Frequency
		air from top or Bottom to remove the dust inside.	
6.	Converter failure	Check for failure Signal	Once in 3 months

Adjustment during system working (without disturbing loads)

- Pull DC-DC Converter from front for adjustment.
- Connect the Converter to the rack with both I/P and O/P card extenders.
- Connect the test points to Digital Voltmeter.
- Adjust the potentiometer to get the desired output.
- Check all the converters voltages pertaining to individual applications will be equal.

4.2. Maintenance Check Points for ACDP:

Sr.	Check Point	Action Required	Frequency
1.	O/P voltages of Inverters, AVRs , Step-Down Transformers as per requirement	Check if the O/P voltages are set as per requirement. If not, check for fuse contactors.	Once in 15 days
2.	Inverter O/P current	Check if the DPM is showing the signal current as per original settings.	Once in 15 days
3.	Auto changeover between Inverters and Bypass CVT	Check for this changeover operation as described in instruction manual	Once in a month

Sr.	Check Point	Action Required	Frequency
4.	Connector Mechanical Alignment	Check if all the connectors of various sub systems are inserted properly	Once in a month
5.	Sub System Cleaning	Remove one by one and clean them using a soft cloth . Gently blow some air to remove the dust inside.	Once in 3 months

4.3. SMR Maintenance

SMRs are fully alarmed and operate in an active loop sharing arrangement. However, some regular checks can be an early warning of problems waiting to happen. Check for failure signal by switching off one SMR at a time once in a month.

Current sharing (when number of modules is more then one number):

Under normal conditions the currents contributed by every rectifier should be within +/-2 Amps of each other.

4.4. Battery maintenance:

For maintenance of Battery, manufacturer's maintenance manual and instructions of Zonal Railways to be followed.

Some important points for battery maintenance are given below:

VRLA battery

- Cleaning of all cells near its terminals.
- Reading of all cell's voltage with Charger ON.
- Reading of all cell's voltage with Charger switched OFF.
- Boosting of Sick cell using Sick cell Charger.
- Replacement of the faulty cell with new cell.

Low Maintenance Battery:

Clean all cells around top cover and terminals periodically.

- Apply petroleum jelly over the terminals.

- Periodically record all cell voltages and their specific gravity.
- Periodically checking of electrolytic level of cells.
- Periodically recording of all cell voltages with Battery Charger switched OFF.
- Boosting of Sick cell using Sick cell Charger.
- Replacement of non-reparable cell in a bank by fresh charged cell.

4.5. Cleanliness:

Apart from these instructions regular cleaning of IPS and battery room should be done. Cleaning of dust collected inside the IPS panels (SMPS, DCDP & ACDP) should be done with the help of blower once in a month.

4.6. **Checking of earth resistance**

Check earth resistance every 3 months with earth resistance meter. it should be less than 2 Ohm.

4.7. Do's & Don'ts

4.7.1. SMR Module

Do's

- Keep all the modules in ON position.
- Set equal voltage for float and boost in all modules for proper current sharing.
- Set battery path current to AH/10.

- Set battery voltages according to type of battery.
- For SMF battery float voltage is 2.25 V/cell and boost voltage is 2.3 V/cell.
- For low maintenance battery float voltage is 2.15 V/cell and boost voltage is 2.5 V/cell.

Don'ts

- Do not take out plugs of modules when working.
- Do not connect battery when modules are ON.
- Do not connect battery in reverse polarity.
- Do not disturb battery under-cut setting.

4.7.2. Inverters

Do's

- Keep the Inverter Input MCBs always ON.
- Ensure correct DC polarity to inverter input.

Don'ts

Do not switch OFF the MCBs of both or any one since both inverters are working in master-slave configuration.

- Do not remove the Inverter input/output connectors with Inverter Input MCB ON.
- Do not switch OFF the incoming of CVT.

- Do not remove input/output connectors when unit is ON.
- Always keep manual mode selector to Auto position.

4.7.3. Step Down Transformers

Do's

- Keep the AC Input switches always ON in Step Down Transformers.
- Always ensure 230V supply to transformer.
- Always load only up to rated current.

Don'ts

- Do not short output of transformer.

4.7.4. DC-DC Converters

Do's

- Always connect connectors and then switch on DC-DC converters.
- Keep the DC Input switches always ON in Converters.
- Ensure input DC voltage is within the range of 98-138V.
- Always set voltage for modules working in parallel.

Don'ts

- Do not put connectors of different circuits in one paralleling group of connectors on a paralleling card.
- Do not disturb voltage of Converter when working beyond 0.5 V.

4.7.5. Automatic Voltage Regulators (AVRs)

Do's

- Keep the AC Input switches always ON in Track AVR.
- Ensure proper input supply.

4.7.6. Miscellaneous

Do's

- Keep all input MCBs in ON position.
- In case of emergency or any problem, switch OFF all the MCBs
- Remove control cable connector accessible from backside, before pulling out inverters/ step Down Transformers / Bypass AVRs.
- Whenever any module is removed and inserted again, ensure that it is properly inserted and fixed on to the rack.
- Whenever any PCB is replaced, connect the wires as per schematic drawing only. Else a severe damage to PCBs may occur.

- In case of emergency or any problem, switch OFF all the switches
- Check the healthiness of SPD periodically and whenever you feel surge is occurred.
- Do check temperature of Room/Shelter regularly. It should be less than 50 deg. C.
- Keep Maintenance record.

Don'ts

- Do not connect the Battery Bank to the IPS without removing the battery fuse.
- Do not disturb the potentiometers used in PCBs. They have to be adjusted at factory only.
- Do not restart the system without knowing the basic cause.
- Do not use wire fuses.
- Do not install the equipment in a poor ventilated site.
- Do not remove any fuse from panel in IPS.
- Check all incoming and outgoing connections, they should be tightened properly once in six months.
- Check for function of exhaust fan once in 15 days.
- Check for function of Spare Modules once in a month.
- Ensure frequency of supply is within 50 Hz $\pm$2.

5. SURGE PROTECTION AND EARTHING

5.1. Lightning and Surge protection

Lightning and Surge protection for IPS shall be as per Sr.ED/Sig./RDSO letter No. STS/E/SPD dated 22.06.2004 and Amendment 5 to RDSO/SPN/165/2012 for IPS.

IPS system shall be provided with Class B and Class C type two stage protection.

5.1.1. Stage1 Protection (Power line protection at Distribution level)

The protection of Class B type, against Lightning Electromagnetic Pulse (LEMP) and other high surges shall be provided at the power distribution panel. Wherever available, the modules shall have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed Surge Protection Devices (SPDs).

5.1.2. Stage2 Protection (Power line protection at Equipment level)

The protection of Class C type against low voltage surges shall be provided at the equipment level connected between line and neutral. This shall

have an indication function to indicate the prospective life and failure mode to facilitate the replacement of failed SPDs. This shall be thermal disconnecting type and equipped with potential free contact for remote monitoring.

Note: Co-ordinated type Class B and C arrestor shall be provided in a separate enclosure in IPS room adjacent to each other. This enclosure should be wall mounting type.

5.2. Earthing:

The IPS systems and its individual modules have earth terminals and these should be properly earthed to the IPS cabinet.

Zonal Railways shall provide earthing arrangement as per IS:S 3043. The earth resistance shall not be more than 2 ohm. Earth provided shall preferably be maintenance free using earth resistance improvement material.

No earth shall be connected to the system. The system earth shall be connected to Class B protection module and Class B module only shall be connected to earth.

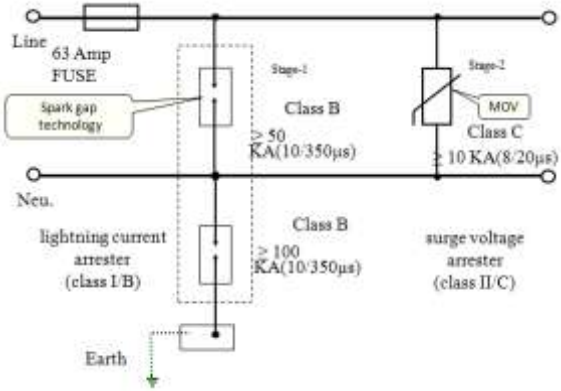

Fig.: 10 Functional Block diagram of LPD & SPD

1. Class B & C SPDs shall be provided as per the guidelines of RDSO and from RDSO recommended sources.
2. All the armoring of the cables shall be connected to SEBB
3. MEBB stands for Main Equipotential Earth Bus Bar
4. SEBB stands for Sub Equipotential Earth Bus Bar

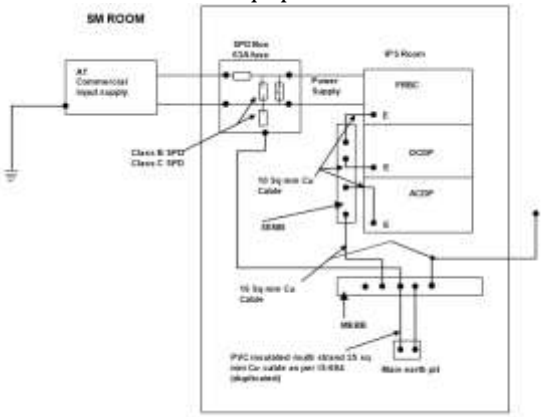

Fig.:11 Typical bonding and earthing connections for signalling equipments (IPS). Ref.: RDSO Drg. No. SDO/RDSO/E&B/002

ANNEXURE-I

BLOCK DIAGRAMS FOR STANDARD CONFIGURATIONS OF SMPS BASED IPS

IPS for up to 4 lines without AFTC Nom - RE area
(SDO/IPS/SMPS/PI/NRE/001)

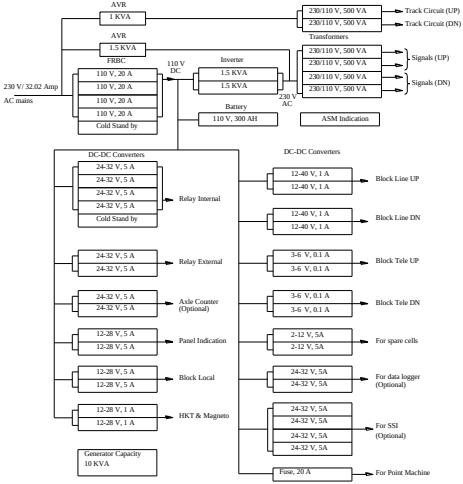

Fig.:12

IPS for up to 4 lines without AFTC RE area
(SDO/IPS/SMPS/PI/RE/002)

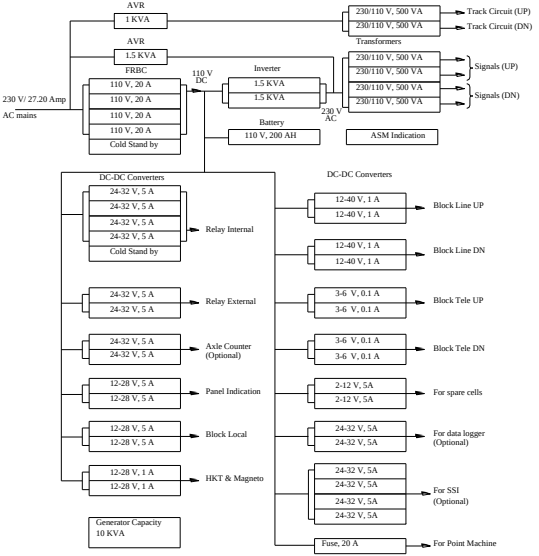

Fig.:13

IPS for up to 6 lines without AFTC Non RE area
(SDO/IPS/SMPS/PI/RE/003)

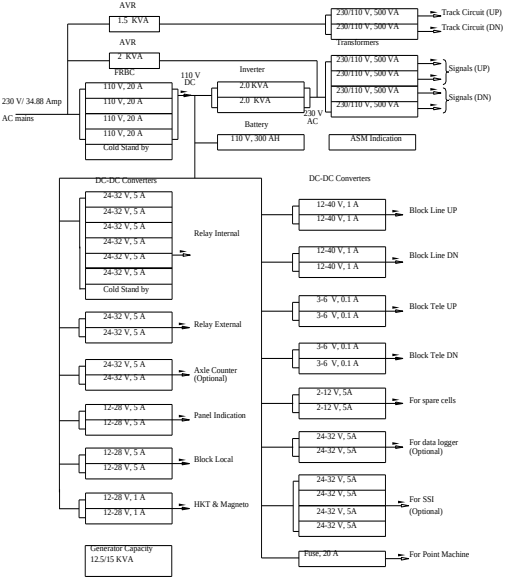

Fig.:14

IPS for up to 6 lines without AFTC RE area
(SDO/IPS/SMPS/PI/RE/004)

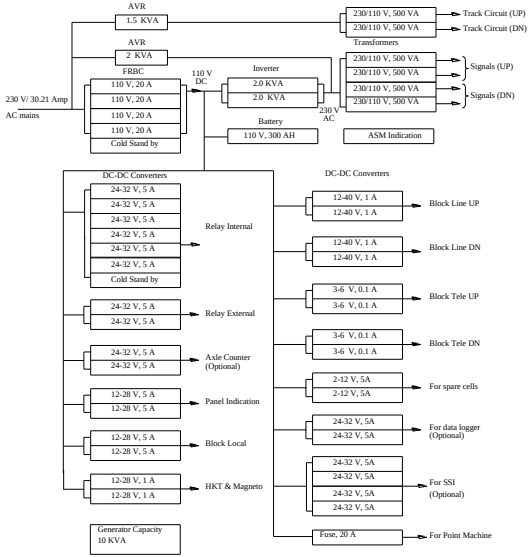

Fig.:15

IPS for up to 4 lines RE/Non-RE area with DC lit LED Signal
(SDO/IPS/SMPS/PI/RENon RE/005)

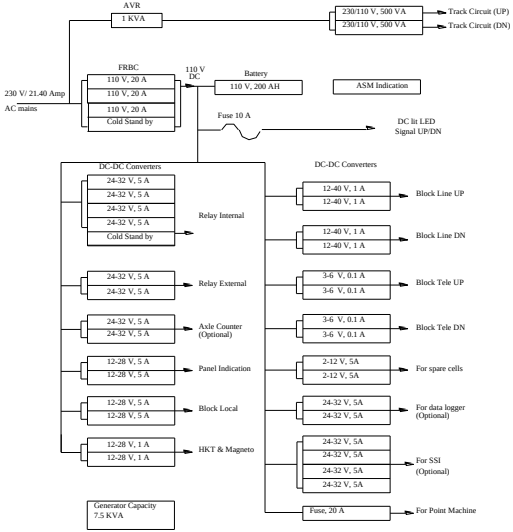

Fig.:16

DISCLAIMER

The information given in this pocket book does not supersede any existing provisions laid down in S.E.M., Rly. Board and RDSO publications. This document is not statutory and instructions given in it are for the purpose of guidance only. If at any point contradiction is observed, then S.E.M., Rly. Board/RDSO guidelines or Zonal Rly. instructions may be followed.

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