Handbook on Power Supply Systems for Signalling

Target Group: Trainee SSE/JE (Signal) & Signal Maintainers

November 2017
CAMTECH/S/PROJ/2017-18/SP5/1.0

Maharajpur, Gwalior (M.P.) - 474005
Handbook on Power Supply Systems for Signalling

कैमटेक/एस/प्रोज/2017-18/एसपी5/1.0

नवम्बर 2017

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November 2017
प्राककथन

रेल्वे सिग्नलिंग प्रणाली के कार्यान्वयन में पावर सप्लाई की प्रमुख भूमिका होती है। सिग्नल से संबंधित कई उपकरण होते हैं, तथा पावर सप्लाई में खराबी आने पर यह उपकरण कार्य करना बंद कर सकते हैं जिससे रेल यातायात में बाधा उत्पन्न हो सकती है। एकीकृत पावर सप्लाई (आईपीएस) जैसी व्यवस्थाओं के आगमन से सिग्नल ब्लैकआउट की घटनाओं में पर्याप्त रूप से कमी आई है। भारतीय रेल्वे के गैर-विद्युतीय एवं पहाड़ी क्षेत्रों में स्थिति सिग्नलिंग संस्थापनों हेतु गैर-परंपरागत ऊर्जा स्रोतों जैसे सौर ऊर्जा का दोहन भी किया जा रहा है।

केमटेक उन्नत तकनीकों से संबंधित सूचनाओं के अभिलेखों के प्रस्तुतीकरण एवं उन्नयन में प्रयत्नशील है। केमटेक ने इस हस्तपुस्तिका को सिग्नल कार्यकर्ताओं विशेषतः नए भर्तियों के लिए एसईजीउ तथा तकनीशियनों को भारतीय रेल्वे में सिग्नलिंग हेतु प्रयोग में लाये जाने वाली विभिन्न प्रकार पावर सप्लाई प्रणालियों से अवगत करने हेतु तैयार किया गया है।

मुझे आशा है कि इस हस्तपुस्तिका में दी गयी जानकारी संकेत विभाग के कार्यकर्ताओं के ज्ञान में वृद्धि करेगी तथा उन्हें पावर सप्लाई प्रणाली के अनुरक्षण में सहायक होगी।

केमटेक, ग्वालियर
टी. कृप्पन
दिनांक: 24.11.2017
वरिष्ठ कार्यकारी निदेशक
FOREWORD

Power supply has a vital role to play in the functioning of railway signalling system. There are a number of equipments which are associated with signals, and failure of power supply may lead to failures of these equipments which may cause heavy delays to traffic. With the advent of arrangements like Integrated Power Supply (IPS) systems cases of blanking of signals have been reduced considerably. The non-conventional energy sources like Solar energy is also being harnessed for signalling installations in non-electrified and hill areas of Indian Railways.

CAMTECH is continuously making efforts in documentation and upgradation of information on advanced technologies. CAMTECH has prepared this handbook to make the signal personnel especially the newly recruited SSEs/JEs and technicians familiar with the different power supply systems being used for signalling in Indian Railways.

I hope that the information given in this handbook will improve the knowledge of signal personnel and help them in maintaining the power supply system.

CAMTECH Gwalior
Date: 24.11.2017

T.Kuppan
Sr. Executive Director
भूमिका

सिग्नलिंग प्रणाली में कई प्रकार के उपकरण एवं गियर होते हैं जिनके कार्यान्वयन हेतु विभिन्न प्रकार की पावर सप्लाई की आवश्यकता होती हैं। पावर सप्लाई प्रणाली का अभिकल्पन कई बिन्दुओं पर निर्भर करता है, जैसे कि संस्थापन का प्रकार, सिग्नलिंग गियरों की संख्या, संबंधित पावर उपकरण एवं लोड की आवश्यकता इत्यादि।

इस हस्तस्पतिका को भारतीय रेलवे में सिग्नलिंग हेतु प्रयोग में लाया जाने वाली विभिन्न प्रकार पावर सप्लाई प्रणालियों की जानकारी देने हेतु तैयार किया गया है। अ.आ.आ.सं. के निर्देशितकरण के अनुसार सौर ऊर्जा एवं लेवल क्रासिंग गेट/इंटरमीडियेट ब्लॉक वर्किंग/ इंटर मीडियेट रिले हर हेतु पावर सप्लाई व्यवस्था की जानकारी से संबंधित अनुभागों को इस हस्तस्पतिका सम्मिलित किया गया है। मुझे आशा है कि यह हस्तस्पतिका न केवल नई भारतीय एसएसआई एवं इंटरमीडियेट रिले हेतु, प्रशिक्षु एसएसआई एवं सिग्नल अनुरक्षकों हेतु उपयोगी होगी, बल्कि कार्यरत सिग्नल कमियों के लिये भी उपयोगी होगी।

हम अ.आ.आ.सं. (आर.डी.एस.ओ.) लखनऊ, उत्तर मध्य रेलवे के झांसी मण्डल, अ.आ.आ.सं. द्वारा अनुमोदित फार्मा तथा भारतीय रेलवे के उन संकेत अभियंताओं एवं तकनीशियनों के अनुसार आवश्यक जिन्होंने इस हस्तस्पतिका को बनाने में हमारी सहायता की है।

चूंकि तकनीकी उन्नयन एवं शिक्षण एक क्रमिक प्रक्रिया है, अत: इस हस्तस्पतिका में आप कुछ जोड़ने या सुधारने की आवश्यकता महसूस कर सकते हैं। यदि ऐसा है तो कृपया अपने सुझाव हमें ईमेल dirsntcamtech@gmail.com पर भेजें तथा इस पते पर लिखिए: भारतीय रेल, उच्च अनुरक्षण प्रोद्योगिकी केंद्र, होटल आदित्याज के सामने, एयरपोर्ट मार्ग, महाराजपुर, ग्वालियर (म प्र ) 474005

केमटेक, ग्वालियर
dि.24.11.2017

दिनेश कुमार यादव
निदेशक (सिग्नल एवं दूरसंचार)
PREFACE

Signalling system consists of a variety of equipments and gears which require different types of power supply for their functioning. The design of a Power supply system depends upon various factors such as type of installation, number of signalling gears, associated power equipments and load requirement etc.

This handbook has been prepared to provide information on various types of power supply systems for signalling in use on Indian Railways. Sections containing information on Solar energy and Power Supply arrangement for Level crossing Gate/Intermediate Block Working/Intermediate Relay hut as per RDSO specifications has been added in the handbook. I hope that this handbook shall not only be useful for newly recruited trainee SSEs/JEs and Signal maintainers, but also for working signal personnel.

We are sincerely thankful to RDSO Lucknow, Jhansi division North Central Railway, RDSO approved firms and all those Signal Engineers and technicians of Indian Railways who helped us in preparation of this handbook.

Since technological upgradation and learning is a continuous process, you may feel the need for some addition/modification in this handbook. If so, please give your comments on email addressdirsntcamtech@gmail.com or write to us at Indian Railways Centre for Advanced Maintenance Technology, In front of Adityaz Hotel, Airport Road, Maharajpur, Gwalior (M.P.) 474005.

CAMTECH Gwalior

Date: 24.11.2017

D.K.M.Yadav

Director (S&T)
विषय सूची

<table>
<thead>
<tr>
<th>अनुभाग</th>
<th>विवरण</th>
<th>पृष्ठ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section</td>
<td>Description</td>
<td>Pages</td>
</tr>
<tr>
<td>प्राकथन</td>
<td>Foreword</td>
<td>i &amp; ii</td>
</tr>
<tr>
<td>भूमिका</td>
<td>Preface</td>
<td>iii &amp; iv</td>
</tr>
<tr>
<td>विषय सूची</td>
<td>Contents</td>
<td>vi</td>
</tr>
<tr>
<td>सुधार पर्ची</td>
<td>Correction Slip</td>
<td>vii</td>
</tr>
<tr>
<td>डिस्क्लेमर तथा हमारा उद्देश्य</td>
<td>Disclaimer &amp; Our objective</td>
<td>viii</td>
</tr>
<tr>
<td>कैमटेक प्रकाशन</td>
<td>CAMTECH publications</td>
<td>ix</td>
</tr>
<tr>
<td>1</td>
<td>परिचय</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>परम्परागत पावर सप्लाई प्रणाली</td>
<td>Conventional Power Supply System</td>
</tr>
<tr>
<td>3</td>
<td>एकीकृत पावर सप्लाई प्रणाली</td>
<td>Integrated Power Supply System</td>
</tr>
<tr>
<td>4</td>
<td>आर.आर.आई. हेतु लो टेन्शन (एल.टी.) पावर पैनल</td>
<td>Low Tension (LT) Power Panel for RRI</td>
</tr>
<tr>
<td>5</td>
<td>विशिष्ट सिग्नलिंग उपकरणों हेतु पावर सप्लाई की आवश्यकताएं</td>
<td>Power Supply requirements of specific Signalling gears</td>
</tr>
<tr>
<td>6</td>
<td>मैज. परम्परागत ऊर्जा के सोट - सौर ऊर्जा</td>
<td>Non-conventional energy sources-Solar Energy</td>
</tr>
<tr>
<td>7</td>
<td>लेवल क्रॉसिंग गेट/इंटरमिडिएट ब्लॉक वर्किंग/ इंटरमिडिएट रिले हेतु पावर सप्लाई व्यवस्था</td>
<td>Power Supply arrangement for Level crossing Gate/Intermediate Block Working/Intermediate Relay hut</td>
</tr>
<tr>
<td>अनुलग्नक 1</td>
<td>रेलवे बोर्ड पत्र क्र. 98/सिग/एसजीएफ/2 दिन. 21.09.2005</td>
<td>23</td>
</tr>
<tr>
<td>अनुलग्नक 2</td>
<td>आर.डी.एस.ओ. द्वारा अनुमोदित फर्मों की सूची</td>
<td>24</td>
</tr>
<tr>
<td>अनुलग्नक 1</td>
<td>रेलवे बोर्ड पत्र क्र. 98/सिग/एसजीएफ/2 दिन. 21.09.2005</td>
<td>23</td>
</tr>
<tr>
<td>अनुलग्नक 2</td>
<td>आर.डी.एस.ओ. द्वारा अनुमोदित फर्मों की सूची</td>
<td>24</td>
</tr>
</tbody>
</table>
The correction slips to be issued in future for this handbook will be numbered as follows:

केमटेक/एस/प्रोज/2017-18/एसपी 5/1.0 # XX दि ..................

CAMTECH/S/PROJ/2017-18/SP5/1.0# XX date ......................

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

### CORRECTION SLIPS ISSUED

<table>
<thead>
<tr>
<th>Sr. No. of Correction Slip</th>
<th>Date of Issue</th>
<th>Page no. and Item No. modified</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
डिस्क्लेमर

यह स्पष्ट किया जाता है कि इस हस्तपुस्तिका में दी गयी जानकारी सिग्नल इंजीनियरिंग मैन्युअल, रेलवे बोर्ड प्रकाशनों तथा आर डी एस ओ प्रकाशनों के किसी भी वर्तमान आलेखों को विश्वासित नहीं करती है। यह दस्तावेज वैधानिक नहीं है वरन इसमें दिए गए निर्देश केवल मार्ग दर्शन हेतु हैं। यदि किसी बिन्दु पर विरोधाभास होता है, तब सिग्नल इंजीनियरिंग मैन्युअल, रेलवे बोर्ड प्रकाशनों, आर डी एस ओ मार्गदर्शन अथवा जोनल रेलवे के निर्देशों का पालन करें।

DISCLAIMER

It is clarified that the information given in this handbook does not supersede any existing provisions laid down in the Signal Engineering Manual, Railway Board and RDSO publications. This document is not statutory and instructions given are for the purpose of guidance only. If at any point contradiction is observed, then Signal Engineering Manual, Railway Board/RDSO guidelines may be referred or prevalent Zonal Railways instructions may be followed.

हमारा उद्देश्य

अनुरक्षण प्रौद्योगिकी और कार्यप्रणाली का उन्नयन करना तथा उत्पादकता और रेलवे की परिसम्पत्ति एवं जनश्रुति के निष्पादन में सुधार करना जिससे अंतर्विषयों में विश्वसनीयता, उपयोगिता और दक्षता प्राप्त की जा सके।

OUR OBJECTIVE

To upgrade Maintenance Technologies and Methodologies and achieve improvement in Productivity and Performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability and Utilisation.

यदि आप इस सन्दर्भ में कोई विचार और सुझाव देना चाहते हैं तो कृपया हमें इस पते पर लिखिए:

संपर्क सूत्र : निदेशक (संकेत एवं दूरसंचार)
पत्राचार का पता : भारतीय रेल उच्च अनुरक्षण प्रौद्योगिकी केंद्र,
महाराजपुर, ग्वालियर (म. प्र.) पिन कोड 474005
टेलीफोन : 0751-2470185
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ई-मेल : dirsntcamtech@gmail.com

If you have any suggestion & any specific comments, please write to us:

Contact person : Director (Signal & Telecommunication)
Postal Address : Centre for Advanced Maintenance Technology, Maharajpur,
Gwalior (M.P.) Pin Code – 474 005
Phone : 0751 - 2470185
Fax : 0751 - 2470841
Email : dirsntcamtech@gmail.com
CAMTECH is continuing its efforts in the documentation and up-gradation of information on maintenance practices of Signalling & Telecom assets. Over the years a large number of publications on Signalling & Telecom subjects have been prepared in the form of handbooks, pocket books, pamphlets and video films. These publications have been uploaded on the internet as well as railnet.

For downloading these publications

On Internet:
Visit www.rdso.indianrailways.gov.in
Go to Directorates → CAMTECH → Publications for download → S&T Engineering

On Railnet:
Visit RDSO website at 10.100.2.19
Go to Directorates → CAMTECH → Publications → S&T Engineering

A limited number of publications in hard copy are also available in CAMTECH library which can be got issued by deputing staff with official letter from controlling officer. The letter should be addressed to Director (S&T), CAMTECH, Gwalior.

For any further information regarding publications please contact:

Director (S&T) – 0751-2470185 (O)(BSNL)
SSE/Signal - 7024141046 (CUG)

Or

Email at dirsntcamtech@gmail.com

Or

FAX to 0751-2470841 (BSNL)

Or

Write at
Director (S&T)
Indian Railways Centre for Advanced Maintenance Technology,
In front of Hotel Adityaz, Airport Road, Maharajpur,
Gwalior (M.P.) 474005
Power Supply Systems for Signalling

1. परिचय Introduction
Types of Signalling systems used on Indian Railways
- Electromechanical interlocking
- Panel interlocking
- Route Relay Interlocking
- Electronic Interlocking
- Block proving by Axle counters with Block panel
- Automatic Signalling
- Centralized traffic Control
- Intermediate Block signalling

In a signalling system, different power supplies are required depending upon the signalling system provided as mentioned above and signalling gears and associated equipments provided from the following list:
- LED Signals
- Track circuits
- Axle Counters
- Motor operated points
- Relays internal (Style Q/K-50)
- Relays External(Style Q/K-50)
- Data Logger
- Indication Panel
- Visual Display Unit (VDU)
- Block instrument
- Fire Alarm system

Types of power supply systems
1. Conventional power supply system
2. Integrated Power supply system
3. LT Power panel for Siemens RRI
4. Solar power

2. परम्परागत पावर सप्लाई प्रणाली Conventional power supply system
This system was earlier used in electromechanical installations in which power supply to Signal lamps, Electric Motor point operation, track circuit battery charger, relays, block instrument etc. is provided through various power supply equipments like Battery bank, battery chargers and transformers. The inputs and outputs of these power equipments are terminated on fuses on a board provided in power equipment room.
In AC electrified area, the main power is derived from the traction supply. In RE area the source of power supply to signalling system is through auxiliary transformers (UP and DN
AT) connected to OHE. In non-electrified area, the main supply is obtained from commercial power supply and the source of power supply is through a remote feeder.

**Drawbacks**

This system had certain drawbacks namely:

- In RE area the 230 V AC supply from OHE is very reliable but its occasional interruption/ low voltage cannot be ruled out leading to blank signals.
- In non-RE area the supply from remote feeder of State Electricity Board is quite unreliable in respect of its availability and voltage.
- The battery backup along with battery chargers is provided in all the DC circuit, which requires more maintenance.
- Due to frequent interruptions of supply, the signals become blank till the starting of Diesel Generators.
- On failure of equipment (Battery charger or transformer), the changeover to standby is manual leading to delay in restoration of required power supply.

3. एकीकृत पावर सप्लाई प्रणाली Integrated Power Supply system

To overcome the problems of frequent interruptions of supply 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 conform to RDSO specification No. RDSO/SPN/165/2012 version 3.0.

3.1 Advantages of IPS using switch mode technology

- 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 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 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.

### 3.2 Modules of IPS

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)

![Block diagram of Integrated Power Supply system](image)

**Fig. 1: Block diagram of Integrated Power Supply system**

(i) **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 230 VAC/110 V AC for Signals and Track Circuits.

Two inverters based on Pulse Width Modulation (PWM) technology are provided in ACDP and these are operated in Master/Slave configuration such that on failure of one inverter the other supplies to the load automatically within 500 milliseconds.
Ferro Resonant type Automatic Voltage Regulator (AVR)
Input voltage range 150 V to 270 V at 50 Hz mains supply.
The output voltage 230V+1%

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.

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 (100 V, 110 V, 120 V, 130 V) are provided at the secondary of each transformer.

Functioning 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 not 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 Inverter 1. On its failure Inverter 2 takes over immediately. When both inverters fail, the AVR1 finally runs the load.

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.

(ii) 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).

Distribution/Supervisory control/Alarm (DSA) unit
This is a microprocessor based module to control and monitor various parameters of FRBC/SMR.

Functioning 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.

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 a low voltage disconnect contactor.

(iii) DC Distribution Panel (DCDP)

This panel consists of
• 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:

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

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.

Functioning of DCDP

The 110V DC power supply taken from the SMPS panel is fed to DC-DC converters pertaining to Relay INT., Relay EXT., 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.
**Status Monitoring panel for ASM’s Room**
This panel consists of status indications and critical alarms of IPS to be provided in ASM’s room. The monitoring panel shall be of wall mounting type. DC-DC converters for Block Tele may also be accommodated in the Status Monitoring Panel.
Indications and alarms are provided on the panel to enable the ASM to prompt signalling staff as and when there is a fault condition and help him to switch ON Generator only when it is required.

**Battery bank**
IPS system is suitable for charging 110 V battery bank of Low maintenance cells as per as per IRS S88/2004 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.

**Standard Configurations**
RDSO has standardized various configurations for SMPS based IPS according to the type of station to cater for the power supply requirements of signalling gears as given below:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Configuration</th>
<th>Drawing no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IPS for upto 4 lines without AFTC Non-RE Area</td>
<td>SDO/IPS/PI-4L/NRE/001</td>
</tr>
<tr>
<td>2</td>
<td>IPS for upto 4 lines without AFTC RE Area</td>
<td>SDO/IPS/PI-4L/RE/002</td>
</tr>
<tr>
<td>3</td>
<td>IPS for upto 6 lines without AFTC Non-RE Area</td>
<td>SDO/IPS/PI-6L/NRE/003</td>
</tr>
<tr>
<td>4</td>
<td>IPS for upto 6 lines without AFTC RE Area</td>
<td>SDO/IPS/PI-6L/RE/004</td>
</tr>
<tr>
<td>5</td>
<td>IPS (INTERNAL) for medium size stations in RE/Non-RE area</td>
<td>SDO/IPS/PI-10L/005</td>
</tr>
<tr>
<td>6</td>
<td>IPS (EXTERNAL) for medium size stations in RE/Non-RE area</td>
<td>SDO/IPS/PI-10L/006</td>
</tr>
<tr>
<td>7</td>
<td>Power Supply arrangement with IPS for interlocked LC gate in RE/Non-RE Area</td>
<td>SDO/IPS/LC/007</td>
</tr>
<tr>
<td>8</td>
<td>IPS configuration for IBS in RE/Non-RE Area</td>
<td>SDO/IPS/IBS/008</td>
</tr>
</tbody>
</table>

Block diagram of Sub system of IPS for upto 4 lines without AFTC RE Area is as given on next page. (RDSO Drg. No.SDO/IPS/PI-4L/RE/002).
Fig. 2: Block diagram of IPS for upto 4 lines without AFTC RE Area (Drg. No. SDO/IPS/PI-4L/RE/002)

Note: 
(i) For 60V metal to metal relay circuit, the rating of DC-DC Converter for relay internal and external shall be 60-66V/5A.
(ii) Depending upon type of block instrument, the DC-DC converter for block line may be taken as 12-40/1A or 40-100V/1A or 100-150V/1A.
(iii) SMR shall be in n+1 configuration, DC-DC converter for internal circuit shall be in n+2 configuration & for other circuits in n+1 configuration.
4. आरआरआई. हेतु लो टेन्शन (एलटी) पावर पैनल LT Power Panel for RRI

Low Tension (LT) Power Panel is generally used in Siemens RRI installations for power supply distribution and control.

In AC electrified section, normally the mains single phase 230 V AC or 3 phase, 440 V AC 50Hz supply is made available from traction supply by stepping down through UP and DN Auxiliary transformers. Local commercial supply of state electricity board is also available as standby. The changeover of supplies is through automatic changeover panel provided in SM’s room. In addition to this, a standby diesel generator is also provided with automatic or manual changeover for emergencies. Stand by batteries are also provided to keep the circuit elements in their last operated position during the time of change over from main supply to the stand by supply.

Thus a continuous uninterrupted power supply is ensured.

To obtain different voltages required for different circuits various transformers, rectifiers/battery chargers are employed. Voltage stabilizers are employed to overcome the problem of supply fluctuations in power supply for signal aspect.

For example the following equipments are provided to cater for different power supplies used in RRI installation at Tughlakabad station of Northern Railway:

Mains supply
63 KVA Source I - 3 Phase 440 V AC 50 Hz
63 KVA Source II – AT Supply 1 Phase 230 V 50 Hz
63 KVA D.G. Supply - 3 Phase 440 V AC 50 Hz

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Circuit</th>
<th>Power supply required</th>
<th>Equipment provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Relay Internal</td>
<td>60 V DC</td>
<td>Battery Charger 230V AC/60 V DC 80 A with battery bank</td>
</tr>
<tr>
<td>2</td>
<td>Relay External -1 (W)</td>
<td>60 V DC</td>
<td>Battery Charger 230V AC/60 V DC 20A with battery bank</td>
</tr>
<tr>
<td>3</td>
<td>Relay External -2 (E)</td>
<td>60 V DC</td>
<td>Battery Charger 230V AC/60 V DC 25A with battery bank</td>
</tr>
<tr>
<td>4</td>
<td>Relay External -1</td>
<td>24V DC</td>
<td>Battery Charger 230V AC/24 V DC 15A with battery bank</td>
</tr>
<tr>
<td>5</td>
<td>Relay External -2</td>
<td>24V DC</td>
<td>Battery Charger 230V AC/24 V DC 15A with battery bank</td>
</tr>
<tr>
<td>6</td>
<td>Datalogger Supply</td>
<td>24 V DC</td>
<td>Battery Charger 230V AC/24 V DC 20A with battery bank</td>
</tr>
<tr>
<td>7</td>
<td>Signal Supply -1</td>
<td>110 V AC 50 Hz</td>
<td>Transformer 230 V/110 V AC 5KVA</td>
</tr>
<tr>
<td>8</td>
<td>Signal Supply-2</td>
<td>110 V AC 50 Hz</td>
<td>Transformer 230 V/110 V AC 5KVA</td>
</tr>
<tr>
<td>9</td>
<td>Signal Supply-3</td>
<td>110 V AC 50 Hz</td>
<td>Transformer 230 V/110 V AC 3KVA</td>
</tr>
<tr>
<td>10</td>
<td>Signal Supply-4</td>
<td>110 V AC 50 Hz</td>
<td>Transformer 230 V/110 V AC 3KVA</td>
</tr>
</tbody>
</table>
Sr. No. | Circuit | Power supply required | Equipment provided
---|---|---|---
11 | Track -1 (DC Track circuit) | 110V AC 50 Hz | Transformer 230 V /110 V AC 5 KVA
12 | Track -2 (DC Track circuit) | 110V AC 50 Hz | Transformer 230 V /110 V AC 3 KVA
13 | Panel Indication | 16-24V DC | Battery Charger 230 V/24 V DC 25 A with battery bank
14 | Point machine (DC Power Supply) | 110V DC | Battery Charger 230 V AC/120 V DC 50A
15 | Stabilizer-1 | 230 V AC | Voltage stabilizer 5 KVA
16 | Stabilizer-2 | 230 V AC | Voltage stabilizer 5 KVA
17 | Stabilizer-3 | 230 V AC | Voltage stabilizer 3 KVA
18 | Stabilizer-4 | 230 V AC | Voltage stabilizer 3 KVA

The power panel is installed in power supply room. The front panel consists of various controlling switches, supply indications, ammeters, voltmeters and frequency meters. Various fuses, Air circuit breakers, Power contactors, Over load/short circuit protecting device, Timers, Voltage sensing relays and Flasher relay are provided inside the panel. Automatic power supply change over facility from main to stand supply is also provided whenever the main supply fails. In addition, earth leakage detector sets for various circuits are also provided separately adjacent to the L.T. Panel.

For each power supply, two power equipments are provided, one as Normal and other as Standby. Programme switches are provided for manual changeover from normal to standby and vice-versa. A diagram showing Programme switch wiring for 24 V DC Battery bank and Battery Charger is given on next page.

Fig.3 : View of LT Power Panel installation
Fig.4: Programme switch wiring for 24 V DC Battery bank and Battery Charger
5. विशिष्ट सिग्नलिंग उपकरणों हेतु पावर सप्लाई की आवश्यकताएं

**Power supply requirements of specific signalling gears**

Apart from the power supplies required for various signalling equipments mentioned in earlier sections, some signalling gears are vendor specific or not commonly used and require different power supply. These types of equipments are mentioned below:

(i) **AC Track circuit**

**In DC Traction areas**

Power supply required - (i) 130V AC 3 Phase 50 Hz for track relay racks.
- (ii) 110 V AC 3 Phase 50 Hz for track circuit feeding in the yard.

Power equipment required - Transformer 440V/110-130V AC 3 Phase 50 Hz

**In AC traction areas**

Power supply required – (i) 110 V AC & 165V AC 3 Phase 83 1/3 Hz for track relay racks.
- (ii) 110 V AC 3 Phase 50 Hz for track circuit feeding in the yard.

Power equipment required – Frequency converter 440V 3 phase 50Hz/165V AC 3 Phase 83 1/3Hz

(ii) **380 V AC 3 Phase point machine**

Power supply required- 380V AC 50 Hz 3 Phase

Power equipment required - Converter 230 V AC 50 Hz single phase /380 V AC 50 Hz 3 phase 5 KVA.

(iii) **Audio Frequency Track Circuit**

The Audio Frequency Track Circuit system consists of a power supply unit to supply power to the transmitter and the receiver. Power supply unit to supply power to the transmitter and the receiver shall work from 230V/110V (nominal) 50 Hz ± 2.5 Hz single-phase AC or 24V DC. The specifications for different vendor specific AFTCs are as given below:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Model</th>
<th>Power Supply range</th>
<th>Input voltage</th>
<th>Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Siemens FTG-S FTG S 46 &amp; S 917</td>
<td>230V AC±10%, 50 Hz ±2% or 110V AC±10%, 50 Hz ±2%</td>
<td>+ 5 V DC, + 12 V DC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Alstom DIGICODE DTC 24 &amp; DTC 921</td>
<td>230V AC±10%, 50 Hz ±2% or 110V AC±10%, 50 Hz ±2%</td>
<td>50 V DC, 10 V DC &amp; 24 V DC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ABB Style T1-21</td>
<td>95-120 V AC, 50 Hz</td>
<td>22.5 to 30.5 V DC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AFTC-UM71</td>
<td>110VAC ± 25%</td>
<td>24VDC ± 1V</td>
<td></td>
</tr>
</tbody>
</table>
(iv) Digital Axle Counter

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Model</th>
<th>Power Supply range</th>
<th>Power equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DACF 710 A &amp; DACF 710 P CEL SSDAC</td>
<td>22 V to 30 V DC</td>
<td>Battery Bank 24V 40 AH, 24V 5A Battery charger or 24V 5A dedicated module of IPS</td>
</tr>
<tr>
<td>2</td>
<td>DACF 720P CEL HASSDAC</td>
<td>23 V to 28.8 V</td>
<td>Battery Bank 24V 40 AH, 24V 5A Battery charger or 24V 5A dedicated module of IPS</td>
</tr>
<tr>
<td>3</td>
<td>DACF 730P CEL MSDAC</td>
<td>22 V to 30 V DC</td>
<td>Battery Bank 24V 200AH, Battery Charger, 24V, 30A (Axle Counter Type Only)</td>
</tr>
<tr>
<td>4</td>
<td>AzLS Eldyne SSDAC</td>
<td>21.5 – 28.8VDC</td>
<td>Battery Bank 24V 200AH, Battery Charger, 24V, 30A (Axle Counter Type Only)</td>
</tr>
</tbody>
</table>
| 5      | AzLM Eldyne MSDAC      | 21.5 – 28.8VDC (At ACE) 54 – 72VDC (At DP) | Internal - Battery Bank 24 V 200AH, Battery Charger 230V/24 V DC 30 A.  
External - Battery Bank 60 V 200AH, Battery Charger 230V/60 V DC 20 A. |
| 6      | Siemens AzS350U MSDAC  | 24- 60 V DC to Evaluation Computer 70 V DC for counting heads | Internal - Battery Bank 60 V 200AH, Battery Charger 230V/60 V DC 40 A.  
External - Battery Bank 60 V 200AH, Battery Charger 230V/60 V DC 20 A. |
| 7      | Frauscher ACS 2000 MSDAC | Input 19 - 72 V DC | Battery Bank 60 V 200AH, Battery Charger 230V/60 V DC 40 A.                  |

Note: The given capacity of charger and battery bank are indicative, the actual values may differ as per load at a particular station. Where IPS is provided, DC-DC Converter of suitable rating modules can be used for giving power supply to Digital Axle Counter.
(a) Power feeding arrangement for MSDAC

Upto certain distance power to Detection Points (DPs) and communication between Evaluator and DP is on same ½ quad. Beyond that, it requires special arrangement and local power supply depending upon type of MSDAC used. Even with this there is a limit of distance of a DP from its Evaluator as given below in following paragraphs:

Siemens MSDAC

The SVK2150 power supply board in Evaluator generates the following operating voltages required by Az S 350 U:

- 5 V DC for internal operation
- 70 V DC for external operation of max. five counting heads

As an option, the counting heads can be supplied with power directly from an on-site voltage source via an additional band-pass filter board for external supply (in the ZP 43 wheel detection equipment).

DPs upto 4.5 Km can be fed directly from the Evaluator.

Power & Communication both are available at the same Evaluator port.

For DPs beyond 4.5 km, a BBT (Broad Band Transformer) is to be provided at less than 4.5 Km. In this case, DP cannot use the power fed from Evaluator, therefore local power supply will have to be provided for DP at site.

Eldyne MSDAC

Evaluator does not provide power for DPs.

PDCU is used to combine power from power source at central place and data from Evaluator to send them on a single ½ quad.

Beyond a certain limit separate local power supply will have to be provided to DP.

There is a limit of maximum distance of a DP from Evaluator even with local power supply which is given as below:

For AzLM

<table>
<thead>
<tr>
<th>Maximum communication distance between ACE &amp; DP</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 Km</td>
<td>60V centralized power supply &amp; cable of diameter 0.9mm.</td>
</tr>
<tr>
<td>4.2 Km</td>
<td>110V centralized power supply &amp; cable of diameter 0.9mm.</td>
</tr>
<tr>
<td>8 Km</td>
<td>60/110V local power supply &amp; cable of diameter 0.9mm.</td>
</tr>
</tbody>
</table>

For AzLS

<table>
<thead>
<tr>
<th>Maximum communication distance</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between DP &amp; DP -30 Km</td>
<td>24/60/110V power supply, cable of diameter 0.9mm and assuming loss of 1dB/Km</td>
</tr>
<tr>
<td>Between DP &amp; ACE of AzLM – 13 Km</td>
<td>24/60/110V power supply, cable of diameter 0.9mm and assuming loss of 2.6 dB/Km</td>
</tr>
</tbody>
</table>
Frauscher ACS 2000 MSDAC
The axle counting system ACS2000 requires stable power supply. It is recommended to derive the power from the IPS (Integrated Power Supply)/regulated power supply.
Voltage supply range +19 V to +72 V DC
Typically 24 V DC power supply is used for installations on Indian Railway.

(b) Power supply requirements for MSDAC

At stations
Existing IPS of station i.e 110V DC/60 V DC/24 V DC will only be used. Suitable supply to be taken for all the DACs.

Or
Existing power supply of station with a battery charger suitable for Axle Counter with battery backup may be provided to run the DAC system.

At Relay Huts
IPS having 110V DC/60 V DC/24 V DC will have to be used. Suitable supply to be taken as local supply for the DPs which are beyond normal range of operation.

Or
A battery charger suitable for Axle Counter with battery backup may be provided for local supply to DPs.

6. गैर- परंपरागत ऊर्जा के स्रोत
Non-conventional energy sources

सौर ऊर्जा Solar Power
On non-electrified areas of Indian Railways especially at remote or hilly places where grid supply is not available round the clock or not available at all, Solar energy can be used to power Signalling equipments.
Solar energy is obtained through use of solar cells. The solar cells convert sunlight into electrical energy on the principle of Photo Voltaic effect. When a number of solar cells are connected in series to get a specific voltage, the unit so formed is called Solar Module.
A Solar Panel consists of a number of modules, which are connected in series and parallel configuration to provide a specific voltage and current to charge a battery bank.

Utilization of Solar Power Supply System in the Indian Railways
The efficient running and control of Railway traffic in the country is sometimes seriously hampered by the irregular grid supply (by State Electricity Board) resulting in traffic congestion and other operational equipment failures also. The alternate D.G. sets pose considerable problem as it has a high maintenance cost and necessitates the use of additional D.G. sets as stand by. Again diesel oil is prone to pilferage, and moreover transportation and storage costs are involved. It also causes atmospheric pollution. Hence by harnessing the abundantly available and non-polluting by nature solar energy source for power requirements came into action after decades of research and field experience.
Application of Solar Powered System for Signalling & Telecommunications
Almost all signalling and Telecommunication gears can be run by solar power. In Indian Railway, Signalling system is Solar powered in phased manner. Priorities are given to those locations where there is no conventional power or power transmission through cables is cost effective. Some example of application of solar power for signalling and telecommunication gears are given below:

1. Semaphore signal lighting at night.
2. Charging battery to power Signal lighting and Point Machines.
3. Charging battery for Integrated Power Supply (IPS) system.
4. Charging battery for Optic Fibre Cable hut.
5. Solar powered Radio warning system/Gate Signal/HKT/TC.
6. Solar powered RRI/PI/relay operation (internal and external circuits)/ALR.
7. Charging secondary cells for Tokenless/Token block instruments.
8. Lighting Outer/ Warner Signals and Distant Signal with motor operation.

Advantages of Solar Powered System for Signalling
Following are the advantages of Solar powered system:
1. Totally Solid State design and highly desirable.
2. Power supply cabling from station building to the signal unit or cabin not needed, since the unit is a self contained power source. This saves cabling cost.
3. Minimum maintenance, which can be easily done by low skilled worker.
4. Long life of whole system and the system gives trouble free performance.
5. System design suited to monsoon and low light condition thus ensuring failure free operation of the signalling gears throughout the year.

Disadvantages
- Initial cost is high
- Dependent on sunlight
- Additional cost for storage battery.
- Climatic condition, location, latitude, longitude, altitude, tilt angle, ageing, dent, bird dropping, etc. affect the output.
- It has no self-storage capacity.
- Manufacturing is very complicated process.
- Large area is required to install solar panel for specific power supply requirements.

Main Components of Solar Photo Voltaic System
The solar power system consists of the following components:
- Solar array.
- Battery Bank
- Solar Charge Controller
- Field Junction Box
- Solar Module Mounting Structure
- Earthing kit
- Cables.
Solar array consists of series/parallel combination of modules, which are mounted on the metallic structure in sunny and shadow free area at a fixed angle as recommended by designer. The Sun is not always available and it is not regular. However, loads are to be fed any time of the day. Therefore power is stored in a battery bank. Low maintenance Lead acid battery of specified capacity and as per latest specification is to be provided.

Charge controller is the interface between Array and battery bank. It protects the battery from overcharging and moderate charging at finishing end of charge of battery bank. Therefore it enhances the life of the battery bank. It also indicates the charging status of batteries like battery undercharged, overcharged or deep discharged through LEDs indications. Some switches and MCBs are also provided for manual or accidental cut-off of charging. In some charge controllers load terminals are also provided through a low battery charge cut-off device so that it can protect the battery bank from deep discharge. Solar Charge Controller units for Indian Railways are manufactured as per RDSO Specification No.RDSO/SPN/187/2004.

Field Junction Box (FJB) is the interface between Solar panels and the Charge Controller. All the incoming/outgoing cables/wires from Solar panel to Charge Controller are terminated at FJB.

Fig.5: Block diagram of Solar Photo Voltaic System
**Solar Panel Requirement for IPS System at PI Station in Non-RE Area**

RDSO has standardized the Solar Panel requirements for IPS System at Panel Interlocked Station in Non-RE area based on the assumption that all three sources of supply i.e. solar power, AC commercial supply and DG set supply will be utilized everyday for running signalling system at a station. Battery capacity has already been specified as 300 AH for IPS system in non-RE area. These requirements are separately worked out for up to 3 line station, 4 line station and 6 line station and are tabulated in Table A below:

<p>| Table A |
|-----------------|-----------------|-----------------|
| Sr. No. | Description | Upto 3 line station | Upto 4 line station | Upto 6 line station |
| 1. | Approximate Signalling load (AC + DC) except track circuit at 110 V | 13A | 22A | 28A |
| 2. | Solar Power requirement (in Ampere Hour) |  |  |  |
| (a) | For 12 hrs. load per day | 12x13= 156 AH | 12x22= 264 AH | 12x28= 336 AH |
| (b) | For 10 hrs. load per day | 10x13= 130 AH | 10x22= 220 AH | 10x28= 280 AH |
| (c) | For 08 hrs. load per day | 08x13= 104 AH | 08x22= 176 AH | 08x28= 224 AH |
| (d) | For 06 hrs. load per day | 06x13= 78 AH | 06x22= 132 AH | 06x28= 168 AH |
| 3. | SPV requirement for 110 V system |  |  |  |
| (i) | Derating factor of Solar Panel | 10% (0.9) | 10% (0.9) | 10% (0.9) |
| (ii) | Derating factor of Battery efficiency | 10% (0.9) | 10% (0.9) | 10% (0.9) |
| (iii) | Sun availability assumed | 5 Hrs. | 5 Hrs. | 5 Hrs. |
| (iv) | Charging current of Solar panel | 4.2 A | 4.2 A | 4.2 A |
| (v) | No. of 12 V, 70 W Solar Panels required in parallel |  |  |  |
| (a) | For 12 hrs. load per day | 156/(0.9X0.9X5X4.2) =10 Nos. | 264/(0.9X0.9X5X4.2) =16 Nos | 336/(0.9X0.9X5X4.2) =20 Nos |
| (b) | For 10 hrs. load per day | 130/(0.9X0.9X5X4.2)=08 Nos. | 220/(0.9X0.9X5X4.2)=13Nos | 280/(0.9X0.9X5X4.2)=17 Nos |
| (c) | For 08 hrs. load per day | 104/(0.9X0.9X5X4.2)=07 Nos. | 176/(0.9X0.9X5X4.2)=11Nos | 224/(0.9X0.9X5X4.2)=14 Nos |
| (d) | For 06 hrs. load per day | 78/(0.9X0.9X5X4.2) =05 Nos. | 132/(0.9X0.9X5X4.2) =08 Nos | 168/(0.9X0.9X5X4.2) =10 Nos |
| (vi) | No. of 12V, 70W Solar panel required | 9 | 9 | 9 |</p>
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Upto 3 line station</th>
<th>Upto 4 line station</th>
<th>Upto 6 line station</th>
</tr>
</thead>
<tbody>
<tr>
<td>(vi)</td>
<td>Total solar panel required (nos.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>For 12 hrs. load per day</td>
<td>90</td>
<td>144</td>
<td>180</td>
</tr>
<tr>
<td>(b)</td>
<td>For 10 hrs. load per day</td>
<td>72</td>
<td>117</td>
<td>153</td>
</tr>
<tr>
<td>(c)</td>
<td>For 08 hrs. load per day</td>
<td>63</td>
<td>99</td>
<td>126</td>
</tr>
<tr>
<td>(d)</td>
<td>For 06 hrs. load per day</td>
<td>45</td>
<td>72</td>
<td>90</td>
</tr>
</tbody>
</table>

4. **Area requirement for fixing solar panels (size approx. 1.2 m x 0.55m per panel) in square meter**

| (a)    | For 12 hrs. load per day                         | 60                  | 95                  | 119                 |
| (b)    | For 10 hrs. load per day                         | 48                  | 78                  | 101                 |
| (c)    | For 08 hrs. load per day                         | 42                  | 66                  | 84                  |
| (d)    | For 06 hrs. load per day                         | 30                  | 48                  | 60                  |

**Note:** Actual solar panel requirement shall be carried out by the Railway as per the guidelines given above based on actual signalling load at a station with IPS system.
7. **Power Supply arrangement for Level Crossing Gate/Intermediate Block Working/Intermediate Relay hut.**

The above system shall conform to RDSO Specification No. RDSO SPN/215/2015 ver.1.0 effective from 26.03.2015. This power supply arrangement is provided for Level Crossing Gate and Intermediate Block Working with Solar backup (PSA/LC/IB) suitable for wayside signaling installations in RE and Non-RE areas. The PSA/LC/IB system is suitable to work with VRLA Maintenance free cells as per IRS:S93/96(A).

**General requirements**
The Power Supply arrangement for Level Crossing Gate and Intermediate Block Working (PSA/LC/IB) is meant to give continuous supply to both AC and DC Signalling circuits for wayside signaling installations in RE and Non-RE areas. This arrangement consists of the following:

**Bi-directional Inverter**
The design of Bi-directional inverter is such that it charges the battery in charger mode and it converts the battery energy to AC in inverter mode as in the systems with renewable energy source, where energy is stored in batteries.

**Distribution/Supervisory Control/Alarm (DSA) or Control Supervisory Unit (CSU)**
The system shall have a Distribution/Supervisory Control/Alarm (DSA) or Control Supervisory Unit (CSU) section, preferably in the upper portion of the rack for termination of battery, load and AC/DC inputs and outputs.

**Remote monitoring**
A GSM based system to send SMS alerts corresponding to the Mains Voltage, AC/DC output voltages and battery voltage in addition to the faults occurring. The system shall have facility for Automatic serial data transfer to a Central Monitoring Unit through data logger.

Note: The remote monitoring is possible only where networking of data loggers is done.

**Automatic Voltage Regulator (AVR)**
The Automatic Voltage Regulator (AVR) shall be designed in line with specification IRS:S:74/89 to cater for any load from no load to full load (from unit power factor to 0.8 lagging) of its rated capacity. The voltage regulator shall be capable of handling any load, without degrading total harmonic distortion and regulation.

**Solar Photo Voltaic Module (SPV)**
The Solar Photo Voltaic Module (SPV) shall be provided in non-RE areas and designed in line with specification IRS:S:84/92. Solar panels shall have theft protection arrangement by suitable mechanical/electrical arrangements using proximity switch for each SPV connected in series and SMS alerts shall be sent in the event of theft of solar panels.
Solar Charge Controller
The Solar Charge Controller shall be Maximum Power Point Tracking (MPPT) type. Its rating shall be 25A min. to cater combined load of both battery and inverter and the input voltage range shall be 70 V to 150 V minimum.

Transformer-Rectifier
Transformer-Rectifier set shall be designed in line with specification IRS:S:91/2014. The transformer rectifier shall be connected in following order:

(i) Relay Internal
(ii) Relay External
(iii) Track Circuit
(iv) LED Signal
(v) Electric Lifting Barrier
(vi) Panel Indication

Input voltage – 230 V AC single phase 50 Hz ± 2Hz
Nominal output voltage- 24V, 30V, 48V or 60V DC as per requirement with ratings 5A & 10A

Transformer
The Transformer shall be designed in line with specification IRS:S:72/88.
Input voltage 230 V + 2%, 50 Hz with ratings 500 VA & 1000 VA
Secondary tappings – 0, 100, 110, 120 & 130 volts at no load

Battery bank
VRLA* Maintenance Free cells/LMLA batteries 110 V/120AH** or 200AH as per IRS:S:93/96(A) shall be provided. Batteries may be housed on battery racks (MS) or alternatively in the lower compartment of IPS rack itself.

*In some railways cases of abrupt failure of VRLA batteries without any prior symptoms have occurred. At installations like LC Gate, Intermediate Block Working and Intermediate Relay hut which are situated in mid sections, maintainer goes there only on his routine visit as per prescribed maintenance schedule. At such installations, sudden failure of any VRLA cell cannot be detected and may lead to a prolonged failure.
As per Railway Board’s letter No.98/SIG/SGF/2 dated 21.09.2005, VRLA batteries should not to be used in Signalling applications. (Please refer Annexure).

**Most of the railways use battery bank not less than 200 AH capacity.

Typical configuration
Typical configuration of Power Supply arrangement for Level Crossing Gate and Intermediate Block working (PSA/LC/IB) is as per drawing no.SDO/RDSO/PS/LC/IB/002 (Annexure _I of RDSO/SPN/215/2015) (refer Fig.: 6)
During the daytime when Solar power is available along with grid supply, battery will be charged by both solar and grid supply. There shall be arrangement to supply load current to inverter and charge the battery to utilize the maximum solar power available at that time.

Power Supply Systems for Signalling  November 2017
Electrical requirements
Power Supply arrangement for Level Crossing Gate and Intermediate Block Working (PSA/LC/IB) shall be suitable for operation for a nominal input voltage of 230V AC, 50 Hz single phase power supply derived from Electricity Board or Railway Traction supply or 7.5/10/15 KVA Diesel Generator set with AMF control of appropriate quality. The system shall work satisfactorily with input voltage variation from 160 to 275 V AC and frequency variation from 48 Hz to 52 Hz.
Fig. 6: Block schematic drawing of LC Gate IPS with Solar backup
Ref. Drg. No.: SDO/RDSO/PS/LC/IB/002

Power Supply Systems for Signalling  November 2017
ANNEXURE I

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)

No. 98/SIG/SGF/2

New Delhi, dt. 21.09.2005

General Manager (S&T)
All Indian Railways.

Director General (Signal)
RDSO, Lucknow.

Sub:-Application of Valve Regulated Lead Acid Batteries (VRLA) for signaling systems.

Ref: i) This office letter No. 98/Sig/SGF/2 dated. 20/21-12-2004.
    ii) DG(Signal)/RDSO’s letter No. STS/E/Cel1s - Secondary VRLA dt. 3.2.2005.

The issue of use of VRLA batteries has been under consideration of the Board for quite some time. This item was also discussed during 10th MSG Meeting held on 14th and 15th May 2004. RDSO has given some recommendations on the use of VRLA batteries.

The recommendations have been examined in Board’s office and Board (ML) has decided that VRLA batteries should not be used in signaling applications.

For existing VRLA batteries, Board (ML) has approved the issue of special instruction No.SS/105-205 (Revision) by RDSO to Railways. The Railways which are already using IPS with VRLA batteries should submit feedback to Railway Board and RDSO.

- Sd-
  (Arun Saksena)
  Exec Director (Signal)
  Railway Board

Copy to: Sr. ED (Signal) RDSO may kindly arrange for issuance of maintenance instructions for existing VRLA batteries.

***

Power Supply Systems for Signalling

November 2017
Following is the list of some firms which are approved by RDSO for manufacture and supply of various power supply equipments used in signalling installations on Indian Railways:

(a) **Battery chargers for Railway S&T installations**  
(Spec No.: IRS:S-86/2000 (Amd. 4))

1. M/s Electric Industries, B-121, Okhla Industrial Area, Phase I, New Delhi-110020
3. M/s Ultra Electronics Pvt. Ltd., 32B, Ganesh Chandra Avenue, Ground Floor, Kolkata-700 013
4. M/s Electro Star, 22, Beleghata Main Road, Kolkata-700010
5. M/s Mani Electronics, 109/1, Beliaghata Main Road,
6. Shed No. 15, Kolkata-700010

(b) **DC-DC Converter for Railway S&T Installations**  
(Spec No.: IRS: S:96/2000)

1. M/s Digitech, 8- Industrial Area, Ram Nagar, Roorkee-247 667 (Uttaranchal)
2. M/s Surya Electronics, Plot No. 115- ALEAP, Industrial Area, Gajularamaram Village, Qutabullapur, Mandal, RR District, Hyderabad-500055
3. M/s Digital Communication & Control Pvt. Ltd., Webel Industrial Estate, Room no. 213/215/217, P-1, Taratala Road, Kolkata-700 088

(c) **Inverter for Railway signaling installations for ‘On-line’ applications**  
(Spec No.: IRS:S-82/92 (Amd.2))

1. M/s Apple Systems Pvt. Ltd., 62 A, Alipore Road, Kolkata- 700027

(d) **Low Maintenance Lead Acid Stationary Secondary Cells for S&T installations**  
(Spec No.: IRS: S-88/2004)

1. M/s Exide Industries Ltd., Exide House, 59-E, Chowranghee Road Kolkata – 020
2. M/s Southern Batteries Pvt Ltd, Plot No. 30, KIADB Indl. Area, Bommasandra, Bangalore Distt. .562158
3. M/s Lead Acid Battery Co. (P) Ltd., 61/3, B.T. Road, Kolkata-700002
4. M/s The Bharat Battery Manufacturing Co. Pvt. Ltd., 11 A & B Jamir Lane, Kolkata-700019
5. M/s Mysore Thermo Electric Pvt. Limited, 36 & 62, 4th Main, III Phase, Peenya Industrial Area, III Phase, Bangalore-560058
(e) Solar Photo Voltaic Module [Spec No.: IRS:S-84/92 (Amd. 2)]
1. M/s Central Electronics Ltd., 4, Industrial Area, Sahibabad-201 010
2. M/s Tata Power Solar Systems Ltd., Plot No. 78, Phase-I, Electronic City, Hosur Road, Bangalore-560100
3. M/s Rajasthan Electronics & Instruments Ltd., 2-Kanak Pura, Industrial Area, Jaipur-012
4. M/s Premier Solar System (P) Ltd., 3rd Floor, V.V. Tower Karkhana, Main Road, Secundrabad-500015

(f) Transformer 230/110 V [Spec No.: IRS:S-72/88 (Amd. 2)]
1. M/s Electro Star, 22, Beleghata Main Road, Kolkata-700010
3. M/s Sree Chand Elect, Industries (P) Limited, 23-A, Netaji Subhas Road, 4th Floor, Room No. 14, Kolkata-700001
4. M/s Mani Electronics, 109/1, Beliaghata Main Road, Shed No. 15, Kolkata-700010

(g) Transformer-Rectifier set for Railway S&T installations [Spec No.: IRS: S-91/93 (Amd. 1)]
1. M/s General Auto Electric Corporation, D-207, Ansa Industrial Estate, Saki Vihar Road, Sakinaka, Andheri (East) Mumbai-400 072

(h) Ferro Resonant type Automatic AC Voltage Regulator for Railway signalling installations [Spec No.: IRS: S-74/89 (Amd. 6)]
1. M/s Apple Systems Pvt. Ltd., 62 A, Alipore Road, Kolkata- 700027
2. M/s Sree Chand Elect, Industries (P) Limited, 23-A, Netaji Subhas Road, 4th Floor, Room No. 14, Kolkata-700001
3. M/s Electro Star, 22, Beleghata Main Road, Kolkata-700010

(i) SMPS Based Integrated Power Supply (IPS) [Spec No.: RDSO/SPN/165/2012 (Ver.3.0)]
1. M/s Statcon Power Controls Ltd., A-34 Sector 59 Noida, G.B.Nagar 201301
2. M/s Amara Raja power Systems Ltd., Renigunta, Cuddapah Road, Karakambadi, Tirupati-517 520
3. M/s HBL Power Systems Ltd. 8-2-601, Road No.10 ,Banjara Hills, Hyderabad-500034

### Power Supply Systems for Signalling

### November 2017
**Quality Policy**

To develop safe, modern and cost effective Railway technology complying with Statutory and Regulatory requirements, through excellence in Research, Designs & Standards and Continual improvements in Quality Management System to cater to growing demand of passenger and freight traffic on the Railways.
INDIAN RAILWAYS
Centre for Advanced Maintenance Technology
Maharajpur, Gwalior (M.P.) Pin Code – 474 005