INDIAN RAILWAYS

SCHEDULE OF TECHNICAL REQUIREMENT
FOR SUPPLY, INSTALLATION, COMMISSIONING & MAINTENANCE OF THE MICROPROCESSOR BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS FOR IR BG COACHES

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Month/Year of issue</th>
<th>Revision / Amendment</th>
<th>Page No.</th>
<th>Reason for Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Feb 2009</td>
<td>Nil</td>
<td>N A</td>
<td>First Issue</td>
</tr>
<tr>
<td>2.</td>
<td>March 2009</td>
<td>Corrigendum 1</td>
<td>26</td>
<td>Figure replaced</td>
</tr>
<tr>
<td>3.</td>
<td>Feb, 2010</td>
<td>Rev - 01</td>
<td>3,4,6,10,11,13,22,26</td>
<td>Clause no.'s 1, 2, 2.2, 4.1, 8, 17.1, 17.2, 17.3.3, 18.2.12, 18.2.13, 19 modified, Annexure 2 replaced and Annexure 3 added</td>
</tr>
<tr>
<td>4.</td>
<td>May, 2010</td>
<td>Amendment 1</td>
<td>5</td>
<td>Clause 6 modified, Annexure 4 added.</td>
</tr>
<tr>
<td>5.</td>
<td>March , 2011</td>
<td>Rev -02</td>
<td>All</td>
<td></td>
</tr>
</tbody>
</table>

Issued By:
Carriage Directorate
Research Designs and Standards Organization
Manak Nagar, Lucknow - 226011.
## INDEX

<table>
<thead>
<tr>
<th>Clause No.</th>
<th>DESCRIPTION</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PART-I: GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Introduction</td>
<td>03</td>
</tr>
<tr>
<td>2</td>
<td>Definition &amp; Explanation</td>
<td>03</td>
</tr>
<tr>
<td>3</td>
<td>Scope</td>
<td>04</td>
</tr>
<tr>
<td>4</td>
<td>Scope of Supply</td>
<td>04</td>
</tr>
<tr>
<td>5</td>
<td>Eligibility Criterion</td>
<td>05</td>
</tr>
<tr>
<td>6</td>
<td>Prototype Approval</td>
<td>06</td>
</tr>
<tr>
<td>7</td>
<td>Annual Maintenance</td>
<td>06</td>
</tr>
<tr>
<td>8</td>
<td>Supplier’s Responsibility</td>
<td>06</td>
</tr>
<tr>
<td>9</td>
<td>Infringement of IPR</td>
<td>07</td>
</tr>
<tr>
<td>10</td>
<td>Cartel formation</td>
<td>07</td>
</tr>
<tr>
<td>11</td>
<td>On Site Replacement Warranty</td>
<td>07</td>
</tr>
<tr>
<td>12</td>
<td>Spare Parts, Reserve Apparatus &amp; Wearing pieces</td>
<td>07</td>
</tr>
<tr>
<td>13</td>
<td>Prices</td>
<td>08</td>
</tr>
<tr>
<td>14</td>
<td>After Sales Service</td>
<td>08</td>
</tr>
<tr>
<td>15</td>
<td>Training</td>
<td>09</td>
</tr>
<tr>
<td>16</td>
<td>Packing</td>
<td>09</td>
</tr>
<tr>
<td><strong>PART-II: FUNCTIONAL &amp; DESIGN REQUIREMENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Functional Requirements</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>Design Requirements</td>
<td>10</td>
</tr>
<tr>
<td>19</td>
<td>Description of Equipments</td>
<td>17</td>
</tr>
<tr>
<td>20</td>
<td>Data Base</td>
<td>22</td>
</tr>
<tr>
<td>21</td>
<td>Inspection &amp; Tests</td>
<td>23</td>
</tr>
<tr>
<td>22</td>
<td>Annexure 1</td>
<td>28</td>
</tr>
<tr>
<td>23</td>
<td>Annexure 2</td>
<td>29</td>
</tr>
<tr>
<td>24</td>
<td>Annexure 3</td>
<td>33</td>
</tr>
<tr>
<td>25</td>
<td>Annexure 4</td>
<td>65</td>
</tr>
<tr>
<td>26</td>
<td>Annexure 5</td>
<td>66</td>
</tr>
</tbody>
</table>
PART-I: GENERAL

SCHEDULE OF TECHNICAL REQUIREMENT
FOR MICROPROCESSOR BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS FOR IR BG COACHES

1. INTRODUCTION:
This specification is for the microprocessor based destination board display system using Global Positioning System (GPS), LED technology for display boards and VHF for communication and remote control. This system uses GPS technology for locating the coach and calculating kilometer run by the coach on per day basis. The information such as train number, train name, destination and starting station along with direction of journey and coach commercial abbreviation are displayed on the destination board which are important for passengers boarding at the stations. This specification covers the general, functional and design requirements of such destination board display system for Indian Railway coaches.

1.1 This specification requires the reference to the following specifications:

<table>
<thead>
<tr>
<th>IRS: S23</th>
<th>Electrical signaling and interlocking equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDSO/SPN/144</td>
<td>The Safety and reliability requirement of electronic signaling equipment</td>
</tr>
<tr>
<td>IS: 9000</td>
<td>Basic environmental testing procedures for electronic and electrical items</td>
</tr>
</tbody>
</table>

1.2 Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

1.3 For the purpose of this specification, the terminology given in IRS: S23 and RDSO/SPN/144 shall apply.

2. DEFINITION & EXPLANATION:

2.1 ‘DESTINATION BOARD DISPLAY SYSTEM’ means ”VHF REMOTE CONTROLLED µP BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS” including all related equipments, such as, CPU, LED display units for outside the coach, VHF Radio Modem, Mechanical Casing (Frame), Remote Unit, GPS system, suitable power supply unit etc.

2.2 Following terms are used in specification for their relevant meaning like µP means microprocessor, LED means light emitting diode, GPS means global positioning system, VHF means very high frequency, and CPU means central processing unit.

2.3 `Supplier` means the firm/company on whom the order for the manufacture & supply of the Destination Board Display System is placed/will be placed.

2.4 ‘PURCHASER’ means the Indian Railways on behalf of the President of the Republic of India who is Purchasing the Destination Board Display System system.

<table>
<thead>
<tr>
<th>Signature</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name &amp; Designation</td>
<td>Prepared By</td>
<td>Checked By</td>
</tr>
</tbody>
</table>
2.5 ‘INSPECTING AUTHORITY’ means the Organisation or its representative nominated by the Purchaser to inspect the destination board display system on his behalf.

2.6 The Research Designs and Standards Organisation, Manak Nagar, Lucknow-226011 is hereafter referred to as RDSO.

2.7 Indian Railways is hereafter referred to as I.R.

2.8 In case of Tenderer needs any clarification in respect of any clause of this specification or regarding the drawings the Tenderer shall obtain the same from purchaser/DG (Carriage), RDSO.

3. **SCOPE:**
This specification for VHF remote controlled microprocessor based Destination Board Display System with GPS for IR coaches covers requirements of system design, manufacturing, supply, installation, commissioning and after sales services.

4. **SCOPE OF SUPPLY:**
The scope of supply includes the following subsystems:

4.1 **VHF REMOTE CONTROLLED CPU**
Each Coach Shall be equipped with following separate units along with required connectors and wiring for communication & power supply as per wiring scheme attached at Annexure 2.

   a) **VHF REMOTE CONTROLLED CPU** referred hereinafter as COACH CONTROL UNIT shall be as master unit (Outside Coach) with built in GPS receiver, auto brightness control Module, VHF radio Modem, Microcontroller unit, 16X128 LED Display Module, RS232 Interface Module, RS485 Interface Module, IP65 protected mechanical enclosure with 3 mm polycarbonate sheet with silicon hard coating having more than 85% light transmission, properties similar to RDSO specification C-K404 rev-1 and DC-DC converter Module.
   
   - One unit per coach.

   b) The slave Destination Display Board (Outside Coach) of 16X128 LED Display Module, RS485 Interface Module, IP65 protected mechanical enclosure with 3 mm polycarbonate sheet with silicon hard coating having more than 85% light transmission, properties similar to RDSO specification C-K404 rev-1 and DC-DC Converter Module.
   
   - One unit per Coach.

   c) Two separate Power Supply unit (DC-DC Converter module 110V AC or DC to 12V DC) enclosed in a single boxed enclosure with automatic changeover/ changeover switch including required MCB, terminal board, short circuit protection fuse etc
   
   - One Unit per coach

4.2 **VHF BASED HANDHELD REMOTE CONTROL UNIT.**
VHF based Wireless programmable remote control unit, referred hereinafter as Remote Unit, to be used by C&W staff as the main controller for all entry and management of destination board related data on coach control unit, including a password-protection facility for changing the identity of the coach control unit itself, thus enabling its use universally over Indian Railways.

- Two unit per rake

4.3 The scope of the supply includes acceptance testing, installation and commissioning on the coaches, On-Site Replacement Warranty for one year and commitment to undertake Comprehensive Annual Maintenance Contract after warranty period.

Scope of supply includes PC software for preparation of train routes, uploading and downloading of route data and other information to remote unite and master control unit in wire mode with USB and RS232 port.

4.4 The source of power supply for remote control unit shall be independent 12V rechargeable battery, which shall be integrated with it.

4.5 The purchaser should specify the quantities of subsystems to be purchased based on the requirements.

5. ELIGIBILITY CRITERIA:
The quality aesthetics, design & overall workmanship of the ‘DESTINATION BOARD DISPLAY SYSTEM’ as a whole shall be of international standards.

5.1 Firm shall have adequate experience of design, development and manufacturing of ‘DESTINATION BOARD DISPLAY SYSTEM’ or similar system and shall be capable of developing material to the required quality and standards. Such systems installed by firm in past should have completed minimum two years satisfactory service. The list of supplies made along with contact details of the customers and performance certificate should be submitted along with the application form as documentary evidence.

5.2 Firm shall have necessary infrastructure consisting of automatic wave soldering machine or automatic SMD pick & place machine with Reflow oven, In Circuit tester, Burn in test chamber/ Dry heat chamber, Insulation tester, Ultrasonic PCB Cleaning Machine, LCR meter, universal IC tester, Regulated DC power supplies, Variac, temperature controlled soldering and desoldering work stations, LED illumination test fixture along with Dark Enclosure for measurement of various parameters. etc. Beside this firm should have micro computer based CAD work stations and developmental workstations for hardware and software for destination board.

5.3 Firm should have valid ISO 9000 certification.

5.4 All vendors shall be required to be approved by RDSO for necessary infrastructure and capabilities required for manufacturing, installation and commissioning of DESTINATION BOARD DISPLAY SYSTEM.
6. PROTOTYPE APPROVAL AND FIELD TRIAL PERFORMANCE MONITORING:
   6.1 The prototype approval by RDSO shall be mandatory in all cases including any design change / new vendor followed by field trial performance monitoring. Parameters for the performance field trial are specified at Annexure ‘4’.
   6.2 For field trial performance monitoring of the system, newly approved firm can participate in tenders of any railway. Such firm shall initially supply (if eligible in tender process) only 10 coach sets to any one railway for field trial of 3 months and balance quantity shall be accepted only after successful field trial. Concerned railways should satisfy the requirement of successful field trial of 3 months on 10 coach sets (if not done).

7. COMPREHENSIVE ANNUAL MAINTENANCE CONTRACT:
   The SUPPLIER shall be liable for Comprehensive Annual Maintenance Contract. Comprehensive Annual maintenance shall be required for the ‘DESTINATION BOARD DISPLAY SYSTEM’ for maintaining the system. The Comprehensive annual maintenance shall include the following items:

   A) TRIP Maintenance:
      a. Checking the entire system for its mechanical fixing thoroughly every trip at base PM depot.
      b. Checking the entire system for water-tight sealing arrangement and any visual defect.
      c. Monitoring the power supply, voltage, wiring etc. periodically.

   B) Three monthly Maintenance:
      a. Monitoring the antenna connectors.
      b. Monitoring the remote record feedings.
      c. Checking the remote operation for all the coach control units.
      d. Checking the battery/charging performance in the remote controller unit.
      e. Checking the data modem TX/RX power readings in the remote controller.
      f. The maintenance shall cover the free replacement of entire components including VHF Radio DATA MODEM, EDS, SMPS, ANTENNA etc. if found faulty/defective.

Note:
   1. Any fault/defect shall be rectified within period as agreed between supplier and purchaser.
   2. The maintenance shall also cover the updating of route data / customized messages in all coach units installed as per latest time table of I.R.as and when required by the purchaser. After updating route data a soft copy of updated route data shall be submitted to the purchaser.
   3. Supplier shall also update /change the system software as and when required by the purchaser.
   4. The railways authorities shall provide arrangements for the LADDER/ WELDING for checking the DISPLAY BOARDS and ensure that the checking is carried under safe conditions.
   5. The supplier shall ensure the 12 V D.C supply provided to the display boards, if any problem in the source the railways shall ensure that the problem is solved, and supplier shall ensure the functioning of the battery for remote unit. The batteries may be charged / changed during primary maintenance as per requirement.

8. SUPPLIER’S RESPONSIBILITY
   8.1 The supplier shall be responsible for the execution of the contract strictly in accordance with the terms of this specification and the conditions of contract, not withstanding any approval which purchaser or the Inspecting Officer may have given for the following:

<table>
<thead>
<tr>
<th>Signature</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name &amp; Designation</td>
<td>Prepared By</td>
<td>Checked By</td>
</tr>
</tbody>
</table>
a) The detailed drawings prepared by the supplier.
b) His sub contractor for materials.

8.2 The test carried out either by the supplier and/or by the purchaser and/or the Inspecting Officer.

9. INFRINGEMENT OF IPR
undertaking to be signed by Vendors on “INFRINGEMENT OF PATENT RIGHTS”. The undertaking can be as under

“Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design & development of this item and any other factor not mentioned herein which may cause such a dispute. The entire responsibility to settle any such disputes/matters lies with the manufacturer/supplier. Details/design/documents given by them are not infringing any IPR and they are responsible in absolute and full measure instead of railways for any such violations. Data, specifications and other IP as generated out of interaction with railways shall not be unilaterally used without the consent of RDSO and right of Railways/RDSO on such IP is acceptable to them.”

10. CARTEL FORMATION

Manufacturer and supplier shall have to submit the affidavit as per Annexure 5 attached in specification.

11. ON-SITE REPLACEMENT WARRANTY:
The time period of On-Site replacement warranty shall be one year for destination board display system. The supplier shall replace all products rejected on final acceptance due to their non-compliance with the requirements. The supplier shall also replace those products which show deficiencies during the time period of warranty by products complying with the requirements within a period of four weeks for the purpose of warranty support. The supplier will provide two e-mail addresses of different domains and time of four weeks will be considered from the date on which an e-mail has been sent. A fax or other mode of communication will also have same sanctity for counting number of days. Adequate penalty clause may be incorporated in the tender document by the purchaser.

12. SPARE PARTS, RESERVE APPARATUS & WEARING PIECES
12.1 The offer shall include recommended list of spare parts required for day to day maintenance of the destination display board equipments and spares in the form of kit for the various sub assemblies for the maintenance at the time of POH. The list shall give the batch no. / Part number, quantity and price of each components.

12.2 Tenderer shall ensure availability of all spares for a period of at least 10 years. This shall be irrespective of the fact whether the tenderer or his sub supplier(s) have stopped manufacturing of the equipment to the design supplied to IR

12.3 In order to ensure the availability and utilization of destination display board, a certain number of standby units of principal assemblies are required. In addition, it is proposed to stock sufficient minor components and spares to meet renewal and replacement on account of wear-tear or occasional failure, for a period of 6 years of service. Tenderer shall, therefore, submit a classified list of spares,
(unit exchange, spares & stage/normal maintenance) for each type of equipment used in destination display board, which he recommended for stocking.

13. **PRICES**

13.1 The Supplier shall give price of total destination board display system per coach set and shall also submit the prices of various items of the equipment giving break-up prices of all the components of the various items.

13.2 The Purchaser reserves the right to either buy the complete equipment as offered or any part thereof based on items wise break-up of cost indicated by the Supplier.

14. **AFTER SALES SERVICE**

14.1 Supplier is required to send his technical staff during the installation and commissioning of their equipment on coach/coaches.

14.2 Supplier shall arrange for adequate service engineers at his own cost to ensure that the equipment supplied performs satisfactorily.

14.3 Supplier shall also depute his staff on request by the Purchaser / RDSO, to investigate and attend to specific problems that may come up during actual operation of destination board display system.

14.4 Supplier shall associate with Indian Railways during the trials of destination board display system. He shall also undertake to modify the equipment supplied, if required as a result of trials.

14.5 The Supplier shall arrange to supply at least 5 hard & soft copies of the Operation & Maintenance Manuals and servicing Instructions for proper maintenance of his own proprietary equipment. The number of manuals to be supplied shall be 5 against first Contract and 2 at every contract and shall be supplied free of cost.

14.6 Manuals shall be illustrated, containing information pertaining to the principle of operation, maintenance schedule of all the proprietary items of equipment being supplied. The Manual shall also contain information on the following:

14.6.1 Details of attention required during IOH / POH or any other schedule.

14.6.2 Test procedure and standards for various destination board display system equipments on test bench as well as single unit/ coach/rake testing.

14.6.3 Details of gauges, jigs & fixture, tools, machinery and plant for maintenance of destination board display system.

14.6.4 Typical defects and their remedial measures.

14.6.5 List of spares for day-to-day maintenance and for POH in the form of periodic overhaul kit.

14.6.6 Identification codes for main equipment and their component parts to avoid mixing of different applications by mistake.

<table>
<thead>
<tr>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name &amp; Designation</th>
<th>Prepared By</th>
<th>Checked By</th>
<th>Approved By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14.6.7 Tenderer shall submit the frequency and detailed work content of various inspection/maintenance schedule necessary for maintenance of destination board display system offered by him. Whether these requirements are time based or distance traveled based shall be indicated for each schedule.

14.6.8 The Supplier shall also arrange to supply along with equipment Wall Charts of all equipment being supplied by them for display in maintenance depots. These shall be supplied @ 5 sets against first contract and 2 sets against every contract and shall be supplied free of cost. These charts shall be pictorial, showing all components along with their part Nos. for each item of equipment.

14.6.9 The Supplier shall supply revised Maintenance Manuals and Wall Charts incorporating necessary changes in the Manuals and Wall Charts already supplied by them for earlier contracts. The copies of maintenance manuals and wall charts are meant for wider circulation on Railway and fresh copies shall be furnished as stipulated even if there are no changes in the manuals & wall charts furnished against earlier contract.

15. TRAINING
The Supplier shall undertake to train the following Indian Railway personnel free of cost.

15.1 Railway Technicians-
Minimum 4 persons per depot for 6 working days training shall be trained on site / in depot to cover maintenance and testing of the complete destination board display system.

15.2 Officers and Engineers-
One officer and 2 Engineers shall be trained at the works of the principles for a minimum period of one week. This training shall cover all the aspects of destination board display system like design, manufacture, quality control, maintenance and testing.

16. PACKING
16.1 Supplier shall ensure that all outer and exposed portions of the various items of destination board display system are covered with suitable protection/packing material to prevent ingress of foreign matter/damage during handling, storage and stone throwing on it etc.

16.2 Supplier shall also ensure that all items of destination board display system in an assembled condition are adequately packed before dispatch to prevent damage in transporting, handling and storage.
PART-II: FUNCTIONAL & DESIGN REQUIREMENTS

17. FUNCTIONAL REQUIREMENTS:

17.1 Ambient conditions:
The display unit shall perform satisfactorily under the following climatic conditions:

i) Ambient temperature : -10°C to 50°C
ii) Max. Sunlight temperature : 70°C
iii) Altitude : Sea level to 2500 m
iv) Relative humidity : 40% to 100%
v) The rainfall is fairly heavy.
vi) During dry weather, the atmosphere is likely to be full of dirt & dust.
vii) Temperature variation may be quite high in the same journey or short period of time.
viii) Coaches operate in coastal areas with continued exposure to salt laden air.
ix) Airborne contaminants like smoke and chemical vapors.
x) Conducting particles like metal clips and filings.
xi) Accidental short circuit by dropped tools, fasteners etc.
xii) Stones may be thrown on the system by the ant-social elements during procession or strikes etc.
xiii) Abrasion damage and
xiv) Vibration and shock

17.2 Maintenance conditions:
The coach exteriors are cleaned with mildly acidic cleaning agents and using brushes with non-metallic bristles or automatic car washing plants. The system should not be affected by this cleaning either in performance, reliability or aesthetic.

17.3 Power Supply Availability:
17.3.1 110 V AC or DC supply is available from the coach circuits. This supply varies from 50V to 200V with 15% ripple.

17.4 Car-body dynamics:
±100 mm vertically
±55 mm laterally
±10 mm longitudinally
±4° bogie rotation about center pivot

18. DESIGN REQUIREMENTS:
18.1 The “VHF REMOTE CONTROLLED µP BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS”, including all sub-systems and equipment shall be of proven design.
18.2 Entire system can be understand by following block diagrams which elaborates the system working / requirements

1. Coach Control Unit Shall have following features:

- Each trains entire route shall be preprogrammed for the desired station/language region along with GPS coordinates.
- Capable to store and handle the data base of at least 100 up & down train routes with capability to display all the regional languages recognized and listed in the Eighth Schedule of the Constitution of India. Data base of train routes shall be prepared on PC/Laptop and uploaded to coach control unit either by RS232 port or remote unite.
- Train route selection on coach control units shall be done using remote unit.
- Capable to address 2 programmable display units for outside the coach which shall be used for train destination board in multiple regional languages.
- Provision of mapping of Unique identification No. of coach control unit with coach no. Like NR001234,(number of digits up to 12). If no. of digits are less than 12, suffix (trailing spaces) should be filled with blank spaces. To ensure unique id. of each CCU, each following prefix vendor code in the numeric serial no. of CCUs produced by them eg. Saranya000001. Vendor code will be approved by RDSO.
- Provision of recording up to 100 preprogrammed self explaining messages for common problems in the coaches along with coach ID using remote unit during journey. Recorded messages can be retrieved by any responsible person at originating/terminating stations.
- Kilometerage earned by coach shall be computed & logged on the basis of GPS information. So that maintenance schedules can be easily planned.
- It should be possible to down load date-wise data of kilometer run by the coach through VHF remote unit for last 36 months. It should also be possible to down load this data on PC software.
through VHF remote. Month wise summary of kilometer run should also be computed through PC software.

- Provision of wireless communication for data upload / retrieval with effective range of transmitter 1 km (in line of sight) in railway yards and depots.
- Provision of USB/COM port in master destination board for fast data upload/ retrieval in the coach control through handheld device or note book PC.

2 Remote Control Unit will have following design features:

**BLOCK DIAGRAM OF REMOTE CONTROL UNIT**

- Train rake composition data shall be entered at originating station by TXR staff in remote unit. Using rake composition data it shall be possible to select the train route for entire rake in one command.
- Capable to retrieve recorded messages of coach health from coach control unit required for maintenance staff.
- Capable to record preprogrammed self explaining messages for common problems in the coaches using coach ID, which can be easily keyed in during journey.
- Capable to store and handle the data base of at least 100 up & down train routes with up to 4 language support.
- Data base of train routes shall be prepared on PC/ Laptop and uploaded to remote unit.
- Whenever it is required to replace/edit the existing data base on coach control unit, it shall be possible using remote unit either by wireless or wire mode.
- Provision of keyboard to program /modify the data on board.
- Provision of wireless communication for data upload/ retrieval with effective range of transmitter 1 km (in line of sight) in railway yards and depots.
- Provision of USB/COM port for fast data upload/ retrieval in the remote unit through note book PC.
18.3 **Display units for outside coach:**

18.3.1 The LED destination display unit shall be wall mounted with 1.6 mm thickness of robust MS casing to IS:2062 grade Fe410WC of 1220mm X 220mm X 75mm size (with 5 mm round amber colour Diffused LED display of 16x128 matrix) and 8 mm pitch. Maximum allowed thickness of the enclosure unit is 75 mm, it may be in the range of 50 mm to 75 mm. The Display unit MS casing is tailor-made to suit the existing destination board brackets available on the coach with IP65 protection as per latest IS: 60947-1. Additional holding brackets required to be provided duly welded to coach body to support the Display unit from bottom. The mechanical and electrical installation, Complete with wiring shall be done in accordance with the governing specifications for the coaches. There should not be any projection beyond MMD after mounting.

18.3.2 **Mechanical Enclosure:**

<table>
<thead>
<tr>
<th>Physical dimensions</th>
<th>1220mm X 220mm X 75mm max (all dimensions in mm), (variation +/- 0.5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Provision</td>
<td>As per location given in the drawing no. CG-K7168 at Annexure '1'</td>
</tr>
<tr>
<td>Color</td>
<td>Silver</td>
</tr>
<tr>
<td>Finish</td>
<td>Anti corrosion epoxy coating to RDSO specification M&amp;C PCN/123-2006</td>
</tr>
</tbody>
</table>

Above enclosure shall be of minimum rating of protection IP65 as per latest IS: 60947-1

18.3.3 The Display unit shall be used to display the following information:

- The Train No., Coach commercial abbreviation in left right corner as shown in figure below
- Train Name - [train name]
- Destination of the train - [source station] to [destination station]
- Train route (via) - Via [list of important station in route]

All above messages shall be required in four languages (Hindi, English, regional languages of the train originating & terminating stations in case these or any of these, are different from Hindi) shall be displayed in timed sequence, with presentation schemes defined below. The whole Destination Display Board system may display only two languages (i.e. Hindi & English) in the region where ‘Hindi’ is recognized as a regional language.

Details of information to be displayed will be as per following schemes:

<table>
<thead>
<tr>
<th>16x32 column</th>
<th>16x96 column</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A-1</strong></td>
<td>LUCKNOW TO NEW DELHI</td>
</tr>
<tr>
<td>Frame 1</td>
<td></td>
</tr>
<tr>
<td><strong>2003</strong></td>
<td>NEW DELHI SHATABDI EXPRESS</td>
</tr>
<tr>
<td>Frame 2</td>
<td></td>
</tr>
<tr>
<td><strong>A-1</strong></td>
<td>LUCKNOW TO NEW DELHI</td>
</tr>
<tr>
<td>Frame 3</td>
<td></td>
</tr>
<tr>
<td><strong>2003</strong></td>
<td>VIA KANPUR, ALIGARH, GHAZIABAD</td>
</tr>
<tr>
<td>Frame 4</td>
<td></td>
</tr>
</tbody>
</table>
Note:
1. Each frame data shall be displayed in horizontal scrolling (crawling text) mode only. Normal scrolling speed shall be 50 column per second.
2. For Hindi and regional languages same cycle of presentation shall also be used in same sequential order.
3. Scroll speed shall be adjustable through remote unit, it should be possible to change scroll speed at any time.

18.3.4 Super bright amber colour LEDs of uniform intensity shall be used for longer visibility in various type display boards. The intensity of the illumination should be such that it shall be possible to read the information clearly from a distance of minimum 21 meters visibility in day time. This should be checked and ensured for that part / spot of indicator which has maximum intensity of ambient light. The LEDs shall be procured from NICHIA/AVAGO/OSRAM or any other brand approved by RDSO. The Absolute Maximum Rating of the LEDs are given as below:

### Electrical properties

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>LIMIT</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Voltage</td>
<td>Vr</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>DC forward current</td>
<td>If</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>DC Power dissipation</td>
<td>Ptot</td>
<td>100</td>
<td>mW</td>
</tr>
<tr>
<td>Peak forward Current (1/10 Duty cycle same pulse width)</td>
<td>Ifs</td>
<td>120</td>
<td>mA *</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Top</td>
<td>-20 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>Tstg</td>
<td>-30 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature (2 mm from body, Max 5 Sec)</td>
<td></td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

### Optical properties

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Parameters</th>
<th>Amber LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Size</td>
<td>5 mm round</td>
</tr>
<tr>
<td>2</td>
<td>LED Type</td>
<td>Diffused/Colorless Clear</td>
</tr>
<tr>
<td>3</td>
<td>Color</td>
<td>Amber</td>
</tr>
<tr>
<td>4</td>
<td>Wave Length</td>
<td>590 +/-10nm</td>
</tr>
<tr>
<td>5</td>
<td>Viewing Angle (50% Iv in mcd)</td>
<td>25°(Min.)</td>
</tr>
<tr>
<td>6</td>
<td>Luminous Intensity @ 20mA biased current</td>
<td>2200 mcd</td>
</tr>
<tr>
<td>7</td>
<td>Operating Temperature</td>
<td>-30°C to +85°C</td>
</tr>
<tr>
<td>8</td>
<td>Make</td>
<td>Avago/ Nichia/ OSRAM</td>
</tr>
</tbody>
</table>

18.4 The duration and information on display units shall be programmable as per user Railway's requirement.

18.5 The system should be so designed to take care of any planned attachment /detachment enroute including slip coaches, partial rake bifurcation / attachment etc.

18.6 Each coach control unit shall be identified digitally with an alphanumeric character (up to 12 characters) of the coach number like, "SC 00245" or "NCR 00245". Where first two/three digits are Zonal Railway Code, next two digits are year of manufacture and the last three digits are running serial number of the coach. Using digital identification it can be ensured that only the target rake or set of coaches receives the command while programming through Remote control unit. The coach control unit shall also have
Hardware ID code of the unit with date and year of manufacture in the embedded memory that can be retrieved by the user at any point of time through REMOTE UNIT.

18.7 In the coach control unit each train's entire route data shall be preprogrammed for the desired location / station / language region along with GPS coordinates using remote or notebook PC. This module shall have capability to handle the data base of at least 100 up & down train routes with up to 4 language support. The display data available in the memory can be replaced to any required new train data by transferring fresh data from the Remote unit with a minimum baud rate of 1200 bits/second; (the old data is overwritten automatically in such a case). Provision of RS 232 port shall be made for data transfer with a minimum data speed of 19.2 kb/second. This would facilitate fast loading of the required data initially through wire using RS 232 port.

18.8 The Remote control unit shall be effective in a range of 1 km (in line of sight) in railway yards and depots. The radio transceiver built in the coach control unit would receive & acknowledges receipt of the radio signals to the Remote Unit after selecting required train route & updating the display. Thus status of all coach units shall be known from the Remote unit itself. Remote unite to be provided with Mont/GP/ Omni directional Antenna at roof top in specific cases to cover one km range.

18.9 When the train passes through programmed train route, GPS receiver receives co-ordinates information of the current location from the geostationary satellites. Based on co-ordinates coach control unite shall calculate and log the distance covered in kilometers on daily basis.

18.10 When the coach control unit is changed/ replaced from one coach to the other, the identity of the board can be changed using the Remote unit or RS232 / RS 485 ports with data speed of minimum 19.2 k bits / second in wired mode or 1200 bits/sec in wireless mode.

18.11 It should be possible to upgrade/ extend the system. There shall be provision to add extra display units without any change in electronics.

18.12 Complete system must be properly shielded and earthed to overcome the effect of 25 KV traction line or electromagnetic induction or any other electro-static induction etc.

18.13 LEDs with equal fringe and uniform intensity are to be used to ensure that the information to be displayed is with excellent contrast so that no black patches are visible on the display screen and display on the board should be flicker free.

18.14 The construction of the whole unit should be modular, such that any module (i.e. radio modem, CPU, power supply unit etc.) can be easily removed when defective and a fresh module is fixed to make the system functional again. Wiring between different modules should be done with the help of male/female type of connectors. There should not be any requirement of rewiring, re-soldering/de-soldering or opening and reconnections of wiring etc. during the maintenance, unless there is damage to the wiring.

18.15 Material for the printed circuit board (PCB) shall be copper clad glass epoxy of grade FR-4 or equivalent. The display PCB thickness shall be 1.6 mm. Following description shall be etched on the component side of the PCB:
   a) Component outline in the proximity of the component
   b) Manufacturer's name.
18.16 CONFORMAL COATINGS: Assembled and tested printed boards should be given a conformal coating to enable them for functioning under adverse environmental conditions. The coating material should be properly chosen to protect the assembly from the following hazards.
   a) Humidity;
   b) Dust and dirt;
   c) Airborne contaminants like smoke and chemical vapors;
   d) Conducting particles like metal clips and filings;
   e) Accidental short circuit by dropped tools, fasteners etc.;
   f) Abrasion damage and
   g) Vibration and shock

18.17 The solder masks shall be applied on the solder side and component side of the PCB.

18.18 The coach control unit and display unit shall display Home Railway name /default railway safety messages in case of any communication fault when power is on.

18.19 The display boards should not display any garbage until the required information is placed on the system. All the embedded boards should have watchdog circuit, which should reset the processor in case the processor goes haywire due to any external disturbance caused by high voltage traction etc.

18.20 The coach control units should have facility to work on standby mode in case if it is required to be stopped. This should be controllable through a remote/manual operation on board itself. Each board should be provided with a power switch to switch on or switch off the display unit. The system should be so designed as to take care of technical snags, which may cause crashed display/hung display.
18.21 Complete electronics should confirm to specification for reliability and electronics used in rolling stock application shall be as per RDSO specifications RDSO/SPN/144 & ELRS/SPEC/SI/0015. In case of any conflict between RDSO specifications RDSO/SPN/144 & ELRS/SPEC/SI/0015, Specification no. RDSO/SPN/144 will prevail.

19. DESCRIPTION OF EQUIPMENTS

19.1 Coach Control Unit

The Coach set equipment consists of one master unit, one destination board slave unit and power supply unit:

a) Master unit shall be equipped with following equipments

<table>
<thead>
<tr>
<th>Description</th>
<th>No. off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Modem with VHF DATA TRANCEIVER (With RS-232/RS-485/TTL interface selection switch capability to programme various Railway required frequencies with minimum data speed of 1200 bits / second).</td>
<td>1 set</td>
</tr>
<tr>
<td>DC-DC converter (12V DC to required voltages, Adjustable)</td>
<td>1 set</td>
</tr>
<tr>
<td>IP 65 protected 1.6 mm thickness enclosure unit.</td>
<td>1 set</td>
</tr>
<tr>
<td>GPS receiver unit with GPS antenna and associate cables and connectors</td>
<td>1 set</td>
</tr>
<tr>
<td>Control unit (Micro controller based)</td>
<td>1 set</td>
</tr>
<tr>
<td>Display unit of 16x128LED with auto brightness control module for outside coach</td>
<td>1 set</td>
</tr>
<tr>
<td>1 Sq mm multi stand copper wire with Teflon sleeve</td>
<td>10mtrs (approx)</td>
</tr>
</tbody>
</table>

b) Slave destination display unit shall be equipped with following equipments

<table>
<thead>
<tr>
<th>Description</th>
<th>No. off</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC-DC converter (12 V DC to required voltages, Adjustable)</td>
<td>1 set</td>
</tr>
<tr>
<td>IP 65 protected 1.6 mm thickness enclosure unit.</td>
<td>1 set</td>
</tr>
<tr>
<td>Control unit (Micro controller based)</td>
<td>1 set</td>
</tr>
<tr>
<td>RS485 Interface Module</td>
<td>1 set</td>
</tr>
<tr>
<td>Display unit of 16x128 LED with auto brightness control module for outside coach</td>
<td>1 set</td>
</tr>
<tr>
<td>1 Sq mm multi stand copper wire with Teflon sleeve</td>
<td>10mtrs (approx)</td>
</tr>
</tbody>
</table>

c) Power supply unit

<table>
<thead>
<tr>
<th>Description</th>
<th>No. off</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC-DC converter (110V DC to 12 V, Adjustable)</td>
<td>1 no.</td>
</tr>
<tr>
<td>IP 65 protected 1.6 mm thickness enclosure unit.</td>
<td>1 no.</td>
</tr>
<tr>
<td>Terminal board of require capacity</td>
<td>1 set</td>
</tr>
<tr>
<td>MCB panel of required capacity</td>
<td>1 set</td>
</tr>
</tbody>
</table>

Signature

Name & Designation

Prepared By

Checked By

Approved By
19.1.1 Specification of some major sub units like radio modem, GPS are as below

A. **VHF TRANSCEIVER GENERAL SPECIFICATION:**
   a) Power Source     + 12V D.C Nominal (±1.2V MAX.)
   b) Temperature Range Storage  80° C maximum - 40°C min. 25° C
   c) Operating          60° C maximum - 20°C min.
   d) Antenna Impedance   50 ohm
   e) Frequency Control    PLL SYNTHESISER
   f) Frequency Tolerance and Stability  1.5 PPM
   g) High Humidity        90%
   h) Channel Capability   1
   i) Nominal Dimensions   134mm (L) X 60mm (W) X 20mm (H)
   j) Weight              190g
   k) Freq range          146 to 174 Mhz. or 136 to 150 MHz.
   l) Channel spacing     12.5 kHz
   m) Emission            8k50f3e.
   n) Frequency spread    28 MHz.
   o) Frequency stability 1.5 ppm
   p) Type of operation    Simplex
   q) Operating temperature range   -20°C to +70°C
   r) Type of antenna      helical antenna.

B. **Radio Data Modem (Data Transceiver) Normal Performance Specifications:**

<table>
<thead>
<tr>
<th></th>
<th>Performance Specifications ETSI300-113</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>RF OUTPUT Power 5W /1 W Programmable</td>
</tr>
<tr>
<td>b.</td>
<td>Modulation Type FM</td>
</tr>
<tr>
<td>c.</td>
<td>Intermediate Frequencies 45 MHZ, 455 KHZ</td>
</tr>
<tr>
<td>d.</td>
<td>Channel Spacing 12.5 KHZ, 25 KHZ(Programming)</td>
</tr>
<tr>
<td>e.</td>
<td>Transmit Attack Time &lt; 25mS</td>
</tr>
<tr>
<td>f.</td>
<td>Current Consumption Transmit 1500mA @ 5W, 800mA @ 1 W</td>
</tr>
<tr>
<td>g.</td>
<td>Receive 100mA (max)</td>
</tr>
<tr>
<td>a)</td>
<td>Receiver:</td>
</tr>
<tr>
<td>i.</td>
<td>Sensitivity 0.3 micro volts / - 118 dbm at 12 db SINAD.</td>
</tr>
<tr>
<td>ii.</td>
<td>Selectivity Better than 60 db.</td>
</tr>
<tr>
<td>iii.</td>
<td>Image and spurious rejection Better than 65 db.</td>
</tr>
<tr>
<td>iv.</td>
<td>AF distortion Better than 5%.</td>
</tr>
</tbody>
</table>
vi. AF response  With in + 1, -3 db of 6 db/octave.
vii. Impedance  50 ohms

b) Transmitter:
i. RF power output  1 watt / 5 watt programmable
ii. Frequency deviation  +/-5 kHz or +/-2.5kHz type
iii. Modulation sensitivity  Better than 10 mv at 1 khz at mic input for 1.5 khz and +/- 3khz standard deviation
iv. Modulation distortion  Better than 5%.
v. Modulation fidelity  With in + 1, -3 db of 6db/octave
vi. Spurious and harmonics  Better than 60 db.
vii. Output impedance  50 ohms

C. Connection and Operation:
a) External Connections:
1 – 50Ω BNC Socket
2 – 9 Pin D Connector

b) D-Type Interconnections:

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>TYPE</th>
<th>RANGE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>J 501-1</td>
<td>DATA-IN</td>
<td>ANALOGUE</td>
<td>100Mv - 2.5VP-P</td>
<td>External Modulation Input</td>
</tr>
<tr>
<td>J501-2</td>
<td>DATA-OUT</td>
<td>ANALOGUE</td>
<td>1 VP-P</td>
<td>Receiver AF Output</td>
</tr>
</tbody>
</table>

Signature

Name & Designation
Prepared By  Checked By  Approved By
19.1.2 Technical Parameters for GPS:

i. L1 frequency, C-A code (SPS) with 12 (or higher) independent tracking channels.

ii. NMEA-0183 compatible output.

iii. Update rate 1Hz

iv. Reacquisition time 250m sec.

v. Cold start better than 35 seconds.

vi. Hot start better than 5 seconds.

vii. Antenna- external, active passive with built in antenna bias circuitry.

viii. Antenna short circuit protection.

ix. Built in Antenna supervisory circuit for determination of active antenna open or short state.

x. Should be provided with magnetically mounted active antenna powered directly through GPS receiver.

xi. Operating temperature -4°C to +85°C.

xii. Autonomous positional accuracy shall be better than 10 meter.

19.1.3 Connectors:
The 110V & 12V DC, 2 way WAGO/ phoenix Germany/ weidmuller Germany connectors to be used to connect the power cable to the display unit.

19.1.4 Power Supply:

110 V AC or DC power supply available in the coach used by drawing a line from Direct battery input terminal to the Power supply unit (110V AC or DC to 12V DC Converter) with short circuit protection & properly rated fuse at its input The IS specified cable to be used to connect power supply unit output terminal to display unit through suitable MCBs and HRC fuses. High voltage protection is to be provided. Connection diagram of power supply unit shall be as per Annexure ‘2’

19.1.5 EMI Filter Assembly:

EMI FILTER ASSEMBLY is to be used to suppress any unwanted spikes and surges generated from the power lines or from the coach battery.

19.1.6 Wiring Assembly:

Wiring assembly shall be neat and clean with suitable cable markers on every wire and proper sleeving. The wiring standard shall be as per RDSO/2006/SPN-144 specification.
19.2 REMOTE UNIT:

19.2.1. Train rake composition data shall be entered at originating station by TXR staff in remote unit. Using rake composition data it shall be possible to select the train route for entire rake in one command.

19.2.2. Data base of train routes shall be prepared on PC/ Laptop and uploaded to remote unit. Remote unit shall be able to handle the data base of at least 100 up/down train routes with up to 4 language support. Any font (English / Hindi / Vernacular) generated in PC can be downloaded to the Remote unit and thereby same font is displayed on the coach control units.

19.2.3. Whenever it is required to replace/edit the existing data base on coach control unit, it shall be possible using remote unit either by wireless or wire mode.

19.2.4. Capable to retrieve recorded messages of coach health from coach control unit required for maintenance staff.

19.2.5. Capable to record preprogrammed self explaining messages for common problems in the coaches using coach ID, which can be easily keyed in during journey as per problem code list provided with remote manual.

19.2.6. The display data of the trains can be transmitted from the remote unit to the target coach control units either by wire mode or wireless mode. The rate of transfer of data from remote unit to the Display unit with radio trans- receiver modem is at the baud rate of 1200 bits / second and with wire mode, using RS 232 interface is 19.2 K bits / second.

19.2.7. Remote unit shall have provision of USB/COM port for fast data upload/ retrieval in the remote unit through note book PC.

19.2.8. The remote unit shall have built in rechargeable battery of 12V.

19.2.9. The remote should have following indications:
   a) TX (Transmit) INDICATION
   b) RX (Receive) INDICATION
   c) POWER ON INDICATION
   d) LOW BATTERY INDICATION
   e) BATTERY CHARGE INDICATION

19.2.10 Four lines LCD should be provided to display complete rake information /edit rakes /new rake details / fault conditions of coach control units etc. Remote unit Graphic user interface should be divided into category wise menus and sub menus and should cover all the requirement of specification and functions defined in the communication protocol at Annexure 3. User interface of remote unite shall be made automatic for selection of wireless / wire mode of communication.

19.2.11 The REMOTE unit shall be able to charge from 110 Volts A.C / 230 Volts A.C directly.
19.2.12 Physical features:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Radio Data Modem (with RS-232/485/TTL interface)</td>
<td>01 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Micro controller unit (with sufficient memory of complete data for 100 trains)</td>
<td>01 No.</td>
</tr>
<tr>
<td>3.</td>
<td>Rechargeable battery (12V, 4.5 AH)</td>
<td>01 No.</td>
</tr>
<tr>
<td>4.</td>
<td>LCD Display unit 20x4</td>
<td>01 No.</td>
</tr>
<tr>
<td>5.</td>
<td>Key pad assembly</td>
<td>01 No.</td>
</tr>
<tr>
<td>6.</td>
<td>IP 65 protected 1.6 mm thickness enclosure unit.</td>
<td>1 no.</td>
</tr>
<tr>
<td>7.</td>
<td>Weight</td>
<td>&lt; 3 Kg</td>
</tr>
</tbody>
</table>

19.2.13 Communication Protocol:
For wireless/wired communication between coach control unit and VHF remote, communication protocol as placed at Annexure-3 will be adopted to ensure inter-operability of VHF remote with coach control units of different vendors. This will be demonstrated during prototype testing or whenever required, at RDSO. Protocol for PC interface shall be same as in case of remote and master unite and synchronization in slave units shall have also same protocol.

20.0 DATA BASE:
System will have capability to store 100 train route up & down data along with GPS location co-ordinates. However this data shall be provided by coaching depot, conforming to clause no. 18.3.3 as per their requirement in the following format in Hindi, English, regional languages.

<table>
<thead>
<tr>
<th>Route No.</th>
<th>Train No.</th>
<th>Train Name</th>
<th>Starting Station, Regional Language</th>
<th>Destination Station, Regional Language</th>
<th>Via (list of important stations)</th>
</tr>
</thead>
</table>

Software (as elaborated below) for feeding and editing data in Hindi, English and all Regional language as per 8th schedule of constitution of India and article 344(1) and 351 shall be provided by the supplier. Supplier will do the necessary training and hand-holding support for making and editing database for first 3 months.

Software for destination board
- setup files of computer software on a CD.
- Control flow chart and algorithm for the control logic.
- Operating manual of the software.
- Facility to modify the display program through handheld unit/PC.

The system shall be user friendly to the maximum extent so that addition and alterations can be done by the Railway Engineer without the help of suppliers and programmer.
21.0 **INSPECTION & TESTS BY MANUFACTURER / SUPPLIER:**

21.1 Unless otherwise specified all tests shall be carried out at ambient atmospheric conditions. For inspection of material, relevant clauses of IRS: S 23 and RDSO/SPN/144 shall apply. Inspection and testing shall be carried out to the effect that all requirements of this specification are complied with.

21.2 Inspection shall be carried out for various types of boards, Modem, VHF Transceiver for all its parameters, and software. PC for Control Console Unit, UPS etc. shall be checked during inspection for their functional performance required proper working of complete system as per specification.

21.3 **Test Equipments:**
   i) Dual Beam Oscilloscope of 20 MHz bandwidth
   ii) Chromo Meter or Spectrometer
   iii) Digital Multimeters – 3.1/2 digit display with facility of diode & transistor testing with 1% accuracy
   iv) Megger (500Volt)
   v) PC
   vi) Test Jig
   vii) Radio Communication Test set with 1% accuracy
   viii) VHF Power Meter
   ix) Suitable VHF attenuators
   x) Any other test equipment considered necessary

21.4 **Batch Testing of LEDs:**
   A **Viewing Angle of LED:** Typical setup diagram is shown below.
- Place and connect the LED under test in the desired direction (Horizontal or Vertical) based on the LED type (Leaded or SMD) as shown in the above set up in a dark room atmosphere.

- Bias the LED such that the rated current flows in the LED under test.

- Place the Chromo meter or Spectrometer to measure the intensity in Lux in the position indicated in the setup. Adjust the distance between the tip of the LED and Chromo meter or Spectrometer diffuser to 10cm exactly.

- Rotate the LED so that the chromo meter or Spectrometer records maximum Lux. Record this value and treat the angle as 0° (degrees).

- Rotate the LED in Horizontal (X) direction to a point, at which the Lux reading is half of the value that was observed. Record the position of LED in degrees. Calculate the degrees the LED was rotated from the maximum intensity value to half intensity value. Record this value as θa (Theta). Similarly rotate the LED in opposite direction from the maximum intensity value and mark the point where the Lux value observed is half the value to the one observed in the center. Calculate the rotation in degrees from maximum Lux value and record this value as θb.

- The viewing angle (or Directivity) is the sum of θa and θb, which shall be greater than or equal to specification given in the respective LED specifications.

B Intensity of LED in ‘mcd’:

- Connect the LED under test as shown in the above set up in a dark room atmosphere.

- Adjust the distance between the tip of the LED and chromo meter (or Spectrometer) diffuser to 30cm exactly.

- Bias the LED such that the rated current flows in the LED under test.

- Record the intensity in ‘Lux’ shown in the chromo meter (or spectrometer).

- Intensity of LED (mcd) = 92.9*Lux value observed.

21.4.1 At least 1% of the LEDs of every procured lot shall be tested before use to the dispersion angle test procedure. Lot wise test record shall be maintained which may be verified by the inspecting officials.

21.4.2 Manufacturer shall maintain proper account of LEDs being used. The record shall include various details like source of supply, procurement invoice no. and date, quantity, incoming rejection, lot-wise consumption etc. which may be verified by the inspecting officials.

21.4.3 LEDs used in LED display units shall be of high performance quality and from reputed manufacturers as stipulated by RDSO. The maximum junction temperature of a LED shall not be less than 100°C and epoxy used in the PCB shall have UV inhibitors.

21.4.4 Number of LEDs and their part number shall not be changed without prior approval of RDSO.
21.5 Routine Tests:
21.5.1 The following shall comprise the routine tests and shall be conducted by manufacturer on every equipment and the test results will be submitted to the inspection authority before inspection. The application software in proper format shall also be submitted to the inspection authority in advance.
   a) Visual inspection of complete system
   b) Insulation Resistance Tests
   c) Performance test
   d) Card-level functional tests on all the cards.
   e) System level functional tests.

21.5.2 Any other tests shall be carried out as considered necessary by the purchaser.

21.6 INSPECTION OF FINISHED PRODUCT BY INSPECTING AUTHORITY
The inspecting authority should satisfy himself in respect of the following tests at the premises of the manufacturer.

21.6.1 General requirements
The manufacturer/supplier shall have a well documented 'internal quality assurance system' to ensure sustained quality of product being manufactured. The quality assurance system shall generally cover the following:

- System to ensure that correct raw material is being used
- System to ensure that components having manufacturing defects getting identified and destroyed so that such components are not used during assembly.
- System to ensure that bought out items are strictly as per norms specified in the specification.
- System to maintain strict control of dimensions and workmanship of components and assembled product.
- System to test and establish that complete system manufactured by the firm meets all the requirements specified in the specification.
- System of periodical calibration of equipments to ensure accuracy of the product.
- System to ensure traceability

21.6.2 Type Tests:
For type test, one complete system consisting of all type of display boards shall be subjected to following tests as applicable:

   a) Visual inspection
   b) Insulation Resistance Test
   c) Applied High Voltage Test
   d) Environmental/ Climate Tests  (As per guidelines in spec RDSO/SPN/144)
   e) Performance Test
   f) Endurance test
   g) Card-level functional tests on all the cards.
   h) System level functional tests.

21.6.3 Testing of Display unit casing for IP 65 to be certified by one of the Government accredited testing laboratories.

21.6.4 Vibration testing of the Display unit casing to be done to the standard of IS 60571/1 by one of the Government accredited testing laboratories.
21.7 Acceptance Tests:
21.7.1 One complete system shall be tested for this purpose. The system shall successfully pass all the type tests except environmental and climatic test for proving conformity with this specification. If any one of the equipment fails in any of the type tests, the purchaser or his nominee at his discretion, may call for another equipment/card(s) of the same type and subject it to all tests or the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s).

21.7.2 Constitute the acceptance tests, which shall be carried out by the inspecting authority for the purpose of acceptance on 20% of the lots (minimum 2 each type of system) offered for inspection by the supplier:
   a) Visual inspection of complete system
   b) Insulation Resistance Test
   c) Performance Test
   d) System level functional tests.

21.7.3 Any other tests shall be carried out as considered necessary by the purchaser.

21.8 Visual Inspection:
Each equipment of the system shall be visually inspected to ensure compliance with the requirement of clause 3 to 6 of this specification. The visual inspection shall broadly include:

   a) System Level Checking:
      • Constructional details.
      • Dimensional check.
      • General workmanship.
      • Configuration.
      • Mechanical polarization on cards.

   b) Card Level Checking:
      • General track layout.
      • Quality of soldering and component mounting.
      • Conformal Coating.
      • Legend printing.
      • Green masking.

   c) Module Level Checking:
      • Indications and displays.
      • Mounting and clamping of connectors.
      • Proper housing of cards.

21.9 Insulation Resistance Test:
Insulation Resistance Test shall be conducted as per RDSO/SPN/144.

21.10 Applied High Voltage Test:
Applied High voltage test shall be conducted as per RDSO/SPN/144

21.11 Environmental/ Climate Tests:
Environmental/ climate tests shall be conducted as per RDSO/SPN/144.
21.12 Endurance Test:

Endurance test shall be conducted on one of the modules for continuous operation which shall be 30 days burning with all LEDs of the module in “on” condition using a test software. The lux level at a distance of 1m normal to the module shall be measured at the center normal position of the module 20 minutes after the beginning of the test. The Lux test shall be repeated at the end of the endurance cycle and reduction in lux level observed shall not be more than 5%. Unit shall be tested with a cycle of 10,000 operations of 2 minute “on” and 1 minute “off”.

---------------------- x -----------------------
shall be done with 1.5 sq. m. e beam cable as per RDSO specification no B/9310, no 1,2,3 & 4 or latest.

shall be running in conduit. Conduit shall be Polyamide 6 and it should comply with the design according to IEC 61396. Power supply shall be protected by 2.5 Ampere double pole MCB make only.

Preparation and layout scheme should comply with the requirement of code of practice for the respective category of railway service or as per carriage directorate specification no RDSO/Rev 1/97.

Connector with IP 67 protection of M/s HARTING/ M/s Amphenol/ M/s Hypertec make only.

Destination board. Junction box on coach side wall shall have female MCB 100Ampere.

霉素 cable sealing arrangement shall be provided on walls of the coach.

Layout plan along with interface arrangement shall be approved by RDSO/ME department.

As shown in dotted line shall be provided by carriage directorate specification no RDSO/Rev 1/97.

Sliding doors shall be halogen free and fire retardant.

Ref. No. PART NO.
REF/CL/73.6-102 250W
doctor for fire in AC coaches RDSO/PE/0008-2005 (Revised) for 3 phase system.

MICROPROCESSOR BASED DESTINATION BOARD

POWER PANEL

1.5 mm Sq. E-beam cable by Hypertec make shall be provided for power part of connector with IP 67 protected and this shall be laid/supervised by

**Table:**

<table>
<thead>
<tr>
<th>STATUS</th>
<th>ALT. REF.</th>
<th>DESCRIPTION</th>
<th>APPR. BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDSO/PE/0008-2005</td>
<td>REV 1/97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Diagram:**

- 2-pin connector
- Master destination board
- Slave destination board
- Screened data cable
- Conduit and cable sealing arrangement
- Junction box on coach side wall
- Female MCB 100Ampere
- Connector with IP 67 protection
- Destination board
- Layout plan along with interface arrangement
- Sliding doors shall be halogen free and fire retardant
- Microprocessor based destination board
- Power panel
- 1.5 mm Sq. E-beam cable by Hypertec make

**Signature:**

- Prepared By
- Checked By
- Approved By
COMMUNICATION PROTOCOL OF THE MICROPROCESSOR BASED
DESTINATION BOARD DISPLAY SYSTEM WITH GPS FOR IR BG COACHES

1. INTRODUCTION:
This document shall be read with RDSO specification RDSO/2009/CG-01. This specification is for communication protocol of the microprocessor based destination board display system using Global Positioning System (GPS), LED technology for display boards and VHF Radio communication in between main system & remote control. This system uses GPS technology for locating the coach and communicating valuable information to passengers at the time of boarding the train and during the journey in regional languages besides Hindi & English.

This document covers the general, functional and design requirements of communication protocol of such train information display system for Indian Railway coaches.

1.1 Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

2. PURPOSE:
A suitable standard communication protocol should be designed in consultation / approval of RDSO, so that a standard transmission protocol can be used for wireless communication in between the coach control unit and remote unit. Using a standard protocol it can be ensured that working of entire destination board and passenger information display system universal over Indian railway, all vendors systems can be communicated to each other and interchangeability can be possible.

3. DEFINITION & EXPLANATION:
3.1 ‘TENDERER’ means firm/company from whom the offer of the supply of ‘GPS BASED DESTINATION BOARD DISPLAY SYSTEM’ is invited.

3.2 ‘DESTINATION BOARD DISPLAY SYSTEM’ means “VHF REMOTE CONTROLLED µP BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS” including all related equipments.

3.3 Following terms are used in specification for their relevant meaning like µP means microprocessor, LED means light emitting diode, GPS means global positioning system, VHF means very high frequency, and CPU means central processing unit.

3.4 ‘Supplier ‘ means the present firm/company on whom the order of the supply of the Destination Display Board System is placed/will be placed.

3.5 ‘PURCHASER’ means the Indian Railways on behalf of the President of the Republic of India who are Purchasing the destination board and passenger information display system.

<table>
<thead>
<tr>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name &amp; Designation</td>
</tr>
</tbody>
</table>
3.6 ‘INSPECTING AUTHORITY’ means the Organisation or its representative nominated by the Purchaser to inspect the destination board display system on his behalf.

3.7 The Research Designs and Standards Organisation, Manak Nagar, Lucknow-226011 is hereafter referred to as RDSO.

3.8 Indian Railways is hereafter referred to as I.R.

3.9 In case of Tenderer needs any clarification in respect of any clause of this specification or regarding the drawings the Tenderer shall obtain the same from purchaser/DG (Carriage), RDSO.

4. **SCOPE:**
   This document describes communication protocol between remote unit and VHF destination board master unit. In this protocol two different media of communication is involved, one is wireless VHF radio communication and another is wire mode communication. This Protocol defines all required functions like erasing train information, assigning coach number, programming train information, reading kilometers accumulated, coach problem messages reading/writing and selecting train information.
5. Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCU</td>
<td>Coach Control Unit</td>
</tr>
<tr>
<td>RCU</td>
<td>Remote Control Unit</td>
</tr>
<tr>
<td>ODU</td>
<td>Outer Display Unit</td>
</tr>
<tr>
<td>DBDS</td>
<td>Destination Board Display System</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
</tbody>
</table>

6. Control Bytes

<table>
<thead>
<tr>
<th>Description</th>
<th>Command Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Commands</td>
<td></td>
</tr>
<tr>
<td>Select train route</td>
<td>'1'</td>
</tr>
<tr>
<td>Write problem message</td>
<td>'U'</td>
</tr>
<tr>
<td>Read single problem message</td>
<td>'V'</td>
</tr>
<tr>
<td>Read KM earned data for specified month</td>
<td>'K'</td>
</tr>
<tr>
<td>Slave health query</td>
<td>'G'</td>
</tr>
<tr>
<td>Display board settings</td>
<td>'4'</td>
</tr>
<tr>
<td>Read Slave enable or disable information</td>
<td>'2'</td>
</tr>
<tr>
<td>Write Slave enable or disable information</td>
<td>'3'</td>
</tr>
<tr>
<td>Read LED intensity</td>
<td>'M'</td>
</tr>
<tr>
<td>Write LED intensity</td>
<td>'N'</td>
</tr>
<tr>
<td>Train information programming</td>
<td>'A'</td>
</tr>
<tr>
<td>Erase all train information</td>
<td>'6'</td>
</tr>
<tr>
<td>Erase single train information</td>
<td>'5'</td>
</tr>
<tr>
<td>Erase KM earned data</td>
<td>'X'</td>
</tr>
<tr>
<td>Change coach number</td>
<td>'7'</td>
</tr>
<tr>
<td>Read hardware id</td>
<td>'O'</td>
</tr>
<tr>
<td>Display board status modem</td>
<td>'F'</td>
</tr>
<tr>
<td>Display board status GPS</td>
<td>'G'</td>
</tr>
<tr>
<td>Read all problem messages</td>
<td>'P'</td>
</tr>
<tr>
<td>Erase all problem messages</td>
<td>'R'</td>
</tr>
<tr>
<td>Read 36 months KM earned data</td>
<td>'W'</td>
</tr>
<tr>
<td>Read KM earned data on specified date</td>
<td>'C'</td>
</tr>
<tr>
<td>Reading accumulated Kilometers information</td>
<td>'Y'</td>
</tr>
<tr>
<td>Retrieve vendor code</td>
<td>'E'</td>
</tr>
<tr>
<td>Display Board Reset</td>
<td>'4'</td>
</tr>
<tr>
<td>Scroll frequency Configuration</td>
<td>'L'</td>
</tr>
<tr>
<td>Done</td>
<td>'D'</td>
</tr>
<tr>
<td>Fail</td>
<td>'F'</td>
</tr>
<tr>
<td>No data</td>
<td>'N'</td>
</tr>
<tr>
<td>Erase done</td>
<td>'B'</td>
</tr>
<tr>
<td>Flash fail</td>
<td>'Z'</td>
</tr>
<tr>
<td>CRC failed</td>
<td>'a'</td>
</tr>
</tbody>
</table>
### Description

<table>
<thead>
<tr>
<th>Wired Commands</th>
<th>Command Byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Train Information</td>
<td>0x80</td>
</tr>
<tr>
<td>Erasing all trains information</td>
<td>0x81</td>
</tr>
<tr>
<td>Erasing train information</td>
<td>0x87</td>
</tr>
<tr>
<td>Erasing Kilometers Information</td>
<td>0x89</td>
</tr>
<tr>
<td>Coach Number Programming</td>
<td>0x82</td>
</tr>
<tr>
<td>Reading Coach Number Information</td>
<td>0x83</td>
</tr>
<tr>
<td>Train Route Selection</td>
<td>0x98</td>
</tr>
<tr>
<td>Display Reset</td>
<td>0x8A</td>
</tr>
<tr>
<td>Done</td>
<td>0x90</td>
</tr>
<tr>
<td>Fail</td>
<td>0x91</td>
</tr>
<tr>
<td>CRC Fail</td>
<td>0x74</td>
</tr>
<tr>
<td>Flash Fail</td>
<td>0x8B</td>
</tr>
</tbody>
</table>

### General Description

The GPS based destination board display system is a display system mounted on coaches used to display the following train information:

- Train no & Coach Commercial Abbreviation
- Train Name
- Source to Destination Station
- List of important stations
- Custom Messages

The database which contains the station information, train route information and message information (such as station names with station GPS co-ordinates, train name, list of important stations and custom messages) is known as train information database. Remote control unit and master display unit is capable to store up to 100 train routes information.

Remote unit is used to configure the display parameters such as train route selection, uploading train route information, getting the status of master and slave display units, downloading last 36 months kilometer age earned data, recording the problem messages and retrieving the same and configuring the master display id (coach id). It can communicate with master display in wireless and wired mode.

### Wire Mode Communication

In this mode of communication standard RS-232 serial port with baud rate of 19200 bits/sec, one start bit, one stop bit, 8 data bits and no parity mode is used. Remote unit is connected to VHF destination board Master through serial cable. Protocols for different tasks are described as follows...
8.1 Programming Train Information

**REMOTE UNIT TRANSMISSION FRAME:**

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX )</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x80</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

**MASTER UNIT REPLY: [DONE]**

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

**MASTER UNIT REPLY: [FAIL]**

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

**MASTER UNIT REPLY: [MEMORY FULL]**

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x93</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

**MASTER UNIT REPLY: [TRAIN INFORMATION AVAILABLE]**

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x92</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

**MASTER UNIT REPLY: [CRC FAILED]**

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x74</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>
MASTER UNIT REPLY: [FLASH FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x8B</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx................xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

All protocol parameters in frame are hexadecimal numbers. All hexadecimal numbers are ranges from 0 to 255 numbers only. 16 bit CRC (mod bus) is calculated for each and every byte from start of the frame to end of data bytes portion. In data bytes portion, only led text data is in hexadecimal format and remaining all other fields are in ASCII format only. Packet preparation for train information is described as follows...

BMP data size shall not exceed 900 bytes in a single frame and Train name character length shall not exceed 40 characters.

PSTART,
TINF,TINF-SIZE,TRAIN-NUMBER,TRAIN-NAME,STARTING-STATION,END-STATION,TOTAL-STATIONS,ROUTE-NUMBER,TOTAL-MESSAGES,DISPLAY-SEQUENCE,RUN,TEND.

MINF,MINF-SIZE,MESSAGE-SERIAL-NUMBER,MSG-PLAY-ENABLE/DISABLE,MESSAGE-CODE,LANGUAGE CODE,TOTAL-LED-DATA BYTES,B XX........XX E,MESSAGE-SERIAL-NUMBER,MEND.

..
..
SINF,SINF-SIZE,STATION-SERIAL-NUMBER,STATION-NAME,LATITUDE,LONGITUDE,ARRIVAL-TIME,DEPARTURE-TIME,DISTANCE-IN-KMS,HALT,STATION-CODE,DAY,MESSAGE-CODE,LANGUAGE-CODE,TOTAL-LED-DATA BYTES,B XX XX XX........XX E,STATION-SERIAL-NUMBER,SEND.

..
..
PEND.

PACKET INFORMATION DATA

PSTART : PACKET START IDENTIFIER
PEND : PACKET END IDENTIFIER

TRAIN INFORMATION DATA

TINF : TRAIN INFORMATION START IDENTIFIER
TINF-SIZE : SIZE INCLUDING TINF AND TEND.

TRAIN NUMBER : 2738 or 2712A

TRAIN NAME : GOUTHMI EXPRESS

STARTING STATION : SECUNDERABAD

END STATION : KAKINADA PORT

TOTAL STATIONS : 24

ROUTE NUMBER : 1

TOTAL MESSAGES : 16 (Messages to be displayed on board)

DISPLAY SEQUENCE : EHFS (note1)

RUN : MTWTSS (note 2)

TEND : TRAIN INFORMATION END

Note 1 -> EHFS : English, Hindi, source station language and end station language

Note 2 -> MTWTSS : Mon, Tue, wed, thu, fri, sat, sun.

MESSAGE INFORMATION DATA

MINF : MESSAGE INFORMATION

START IDENTIFIER

MINF-SIZE : SIZE INCLUDING MINF AND MEND.

MESSAGE SERIAL NUMBER : SERIAL NUMBER

MSG PLAY ENABLE/DISABLE : E / D

MESSAGE CODE : XX (note 4)

LANGUAGE CODE : XXX (note 3)

TOTAL LED DATA BYTES : TOTAL DATA BYTES OF LED IMAGE

B : BEGINNING OF LED TEXT

E : END OF LED TEXT

MEND IDENTIFIER : MESSAGE INFORMATION END
Note 3 ->

LANGUAGE CODE DEFINITION

ENG : ENGLISH       HDI : HINDI       TLU : TELUGU
TML : TAMIL         KDA : KANNADA     ORA : ORIYA
SKT : SANSKRIT      MLM : MALAYALAM   MRT : MARATHI
NPI : NEPALI        PJB : PUNJABI     KKN : KONAKANI
KHR : KASHMIRI      GJT : GUJARATHI   SND : SINDHI
UDU : URDU          MNP : MANIPURI    BLI : BENGALI
ASE : ASSAMESE

Total 19 Different languages are included

Note 4  →

MESSAGE CODE DEFINITION:

EW : English welcome message
EN : English train name message
ED : English [source station] to [destination station]
EV : English [important station in route]
HW : Hindi welcome message
HN : Hindi train name message
HD : Hindi [source station] to [destination station]
HV : Hindi [important station in route]
FW : Source station regional language welcome message
FN : Source station regional language train name message
FD : Source station regional language [source station] to [destination]
FV : Source station regional language [important station in route]
SW : End station regional language welcome message
SN : End station regional language train name message
SD : End station regional language [source station] to [destination]
SV : End station regional language [important station in route]
RD : Regional language as per GPS [source station] to [destination]

By Default English and Hindi message information frames are to be prepared.

Source station and end station languages are included, if they are different from English and Hindi languages. Other than above, RD type of message information frames are to be included, if languages are other than source and end station languages. Maximum up to ten RD type of message information frames supports

STATION INFORMATION DATA

SINF IDENTIFIER : MESSAGE INFORMATION START
SINF-SIZE : SIZE INCLUDING MINF AND MEND.
STATION SERIAL NUMBER : SERIAL NUMBER
STATION-NAME : XXXXXXX
LATITUDE : DDMM.MM
LONGITUDE : DDDMM.MM
ARRIVAL-TIME : HH:MM
DEPARTURE-TIME : HH:MM
DISTANCE-IN-KMS : XXX
HALT : Y / N (YES) or (NO)
STATION CODE : SC (SECUNDERABAD CODE)
DAY : 1 (TRAVELLING DAY)
MESSAGE CODE : E/H
LANGUAGE CODE : XXX (Defined ABOVE)
TOTAL LED TEXT DATA BYTES : XXX
B : BEGINNING OF LED TEXT
E : END OF LED TEXT
SEND : STATION INFORMATION END IDENTIFIER

PSTART, MINF and SINF strings must be in the start of string in data bytes portion of the frame.

LED TEXT FORMAT: each column represents 16 led’s from D15 to D0. D15 represents Top led in Column and D0 represents bottom led in column. Led text data string is defined as follows

Column 1 D15 – D8  Column 1 D7 – D0  Column 2 D15 – D8  column 2 D7 – D0

Signature

Name & Designation
Prepared By
Checked By
Approved By
8.2 Erasing all trains information

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x81</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [DONE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [ERASE FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x8B</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

8.3 Erasing train information

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x87</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

Data string portion must be 10-character train number.
### 8.4 Erasing Kilometers Information

**REMOTE UNIT TRANSMISSION FRAME:**

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x89</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………..xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>
8.5 Coach Number Programming

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x82</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

Data string portion must be 12-character coach number i.e xxxxxxxxxx

MASTER UNIT REPLY : [DONE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY : [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [ERASE FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x8B</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>
MASTER UNIT REPLY: [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [WRITING FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x8B</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

8.6 Reading Coach Number Information

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data byte (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x83</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [DONE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

12 char coach number is included in reply data bytes portion of frame

MASTER UNIT REPLY: [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>
8.7 Train Route Selection

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER Unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX)</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x98</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

Data string format: 10 char train number, 4 char coach id

Example: XXXXXXXXXXXX, XXXX

MASTER UNIT REPLY: [DONE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [TRAIN INFORMATION NOT AVAILABLE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x97</td>
<td>0xXX</td>
<td>0xXX</td>
<td>0xXX</td>
<td>xx…………xx</td>
<td>0xXX</td>
<td>0xXX</td>
</tr>
</tbody>
</table>
MASTER UNIT REPLY: [CRC FAILED FOR ENTIRE TRAIN ROUTE INFORMATION]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x74</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [FLASH READ FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x8B</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

8.8 Display Reset

REMOTE UNIT TRANSMISSION FRAME:

<table>
<thead>
<tr>
<th>MASTER unit address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Data bytes (200 MAX )</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11</td>
<td>0x8A</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [DONE]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x90</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
<td></td>
</tr>
</tbody>
</table>

MASTER UNIT REPLY: [FAIL]

<table>
<thead>
<tr>
<th>REMOTE UNIT address</th>
<th>Function Code</th>
<th>Frame length</th>
<th>Packet s.no</th>
<th>Frame s.no</th>
<th>Reply Data bytes</th>
<th>Data bytes</th>
<th>CRC low byte</th>
<th>CRC high byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>0x91</td>
<td>0XX</td>
<td>0XX</td>
<td>0XX</td>
<td>xx…………..xx</td>
<td>0XX</td>
<td>0XX</td>
<td></td>
</tr>
</tbody>
</table>

9. Wireless Communication Protocol

In this mode of communication serial port with baud rate of 1200 bits/sec, one start bit, one stop bit, 8 data bits and no parity mode is used. Protocol for different tasks are described as follows:

Remote Unit Transmission Frame:
9.1 Wireless communication parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation Scheme</td>
<td>FFSK</td>
</tr>
<tr>
<td>TX/RX Mark frequency</td>
<td>1.2 KHz</td>
</tr>
<tr>
<td>TX/RX Space frequency</td>
<td>1.8 KHz</td>
</tr>
<tr>
<td>VHF frequency</td>
<td>148.1 MHZ</td>
</tr>
</tbody>
</table>
Air Baud rate: 1200 bps
Data Bits: 8
Parity: None

RS232 Wired Protocol (Modem to System)
Communication between system and modem is done with a baud rate of 9600 bps/sec. Protocol is defined below.

9.1.1 Sending data to modem from the system.

<table>
<thead>
<tr>
<th>Command</th>
<th>CCU/RCU Transmission frame</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xCCDD</td>
<td>xx  -------------- xx</td>
<td>Bytes in data field are the actual data which is transmitted through wireless. Hence this data is copied into data field of wireless data communication.</td>
</tr>
</tbody>
</table>

9.1.2 Receiving data from modem to the system

<table>
<thead>
<tr>
<th>Command</th>
<th>CCU/RCU frame Transmission frame</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x33AA</td>
<td>xx  -------------- xx</td>
<td>Bytes in data field are the actual data which is received from wireless.</td>
</tr>
</tbody>
</table>

After receiving transmission frame of CCU/RCU, modem will add preamble(Bit sync & Frame sync) & Post amble(End of frame) and gives to data radio as shown below.

9.1.3 Wireless data frame:

<table>
<thead>
<tr>
<th>Bit sync</th>
<th>Frame Sync</th>
<th>CCU/RCU Transmission Data</th>
<th>End of Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xAA</td>
<td>---- 0xA</td>
<td>0xE 0x48 xx  ----- xx</td>
<td>0x46 'F' 0x69 'i' 0x4E 'N' 0x69 'i' 0x53 'S' 0x68 'h'</td>
</tr>
<tr>
<td>1</td>
<td>---- 20</td>
<td>1 2 230 bytes(Max)</td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>

Out of 20 bytes of bit sync 3 bytes are validated at the receiving end

Note: It is assumed that end of frame sequence(FiNiSh) is not exist in data from HOST

Data flow is explained with the following diagram.

Signature

Name & Designation  Prepared By  Checked By  Approved By
9.2 Wireless Commands

9.2.1 Selecting Train Information

**REMOTE UNIT TRANSMISSION**

Function code : 1 [ASCII Character]
Data string : 10 char train number, 4 char coach id
Example : XXXXXXXXXX, XXXX

**DISPLAY UNIT REPLY**

Function code : D or F or N or Z or a [ASCII Character]
D: Task done, F : Data failure, N : No data, Z : Flash fail, a : CRC failed

For example if train number is 4 characters like 2713, rest of 6 characters are filled with blank characters
Like 2713bbbbbb. Here b represents blank character.
9.2.2 Writing Problem Message

REMOTE UNIT TRANSMISSION

Function code : U [ASCII Character]
Data string : 16 char message
Example : XXXXXXXXXXXXXXX

DISPLAY UNIT REPLY

Function code : D or F or Z or M [ASCII Character]
D : Task done , F : Data failure , Z : Flash fail , M : Memory full
Note : If the problem message is less than 16 characters it should be append with blank spaces.

9.2.3 Reading All Problem Messages

REMOTE UNIT TRANSMISSION

Function code : P [ASCII Character]

DISPLAY UNIT REPLY

Function code : D or F or N or Z [ASCII character]
D : Task done , F : Data failure , N : No data , Z : Flash fail

Data string : Data length of the problem messages can be calculated from (number of problem messages * 16)

DATA FORMAT :

<table>
<thead>
<tr>
<th>Coach id</th>
<th>No of problem msg</th>
<th>Problem msg 1</th>
<th>............</th>
<th>Problem msg n</th>
<th>END</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Bytes</td>
<td>1 Bytes</td>
<td>16 bytes</td>
<td>............</td>
<td>16 bytes</td>
<td>3 bytes</td>
</tr>
</tbody>
</table>

Total no. of Problems : This will be hexadecimal number, Value will vary from 1-100.

END is the termination string (ASCII) which is sent as a separate frame.

Upon receiving the each frame of problem messages from CCU remote unit should reply with DONE function code.

9.2.4 Reading Single Problem Message

REMOTE UNIT TRANSMISSION

Function code : V [ASCII Character]
Data string : 2 digit serial number ranging from (0-99)
Example : XX
DISPLAY UNIT REPLY
Function code : D or F or N or Z [ASCII character]
D: Task done, F: Data failure, N: No data, Z: Flash fail
Data string : 16 char message
Example : XXXXXXXXXXXXXXX
In case the problem message is less than 16 characters append with blank spaces.

9.2.5 Erase all problem messages

REMOTE UNIT TRANSMISSION
Function code : R [ASCII Character]

DISPLAY UNIT REPLY
Function code : D or F or N or Z [ASCII character]
D: Task done, F: Data failure, N: No data, Z: Flash fail

9.2.6 Reading Kilometers Earned for the last 36 Months
Function code : W [ASCII character]

DISPLAY UNIT REPLY
Function code : D or F or N or Z [ASCII character]
D: Task done, F: Data failure, N: No data, Z: Flash fail

Upon receiving each frame of Kilometers information from CCU, remote unit should reply with DONE function code.

When the command received by CCU accumulated data or Month Data or Year data will be sent to PC/RCU. RCU or PC has to calculate to convert that value into KMPH to avoid fractional values handling in Embedded side.

To avoid huge data viewing in RCU, suggested way is to transfer the retrieved last 36 months data to PC. PC should decode the month wise, year wise and accumulated data.

DATA FORMAT:

<table>
<thead>
<tr>
<th>Coach id (12 Bytes)</th>
<th>No of days (2 Bytes)</th>
<th>Day 1 data</th>
<th>Day 2 data</th>
<th>.....</th>
<th>.....</th>
<th>Day n data</th>
</tr>
</thead>
</table>

Day x data Format:

<table>
<thead>
<tr>
<th>Date</th>
<th>Km earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Byte</td>
<td>4 Bytes</td>
</tr>
</tbody>
</table>

Signature

Name & Designation

Prepared By

Checked By

Approved By
Example for date: 050610 (2010 is indicated as 10) will be given as 0x00,0x00,0xc5,0xb2 (Decimal date converted to Hex).

For both the fields MSB byte comes first.

Data length of km earned data can be calculated from no of days

All the parameters in the data field are in Hexa decimal numbers.

**NOTE:** From the retrieved data following options shall be given to the user to view the data

After transferring the complete km earned data master display unit sends “END” string to terminate the communication.

**Calculating the Kilometarage earned information:**

Distance traveled by the coach is calculated by the method of speed integration. For every 5 seconds speed (in knots/secs) sample is taken from GPS, accumulate till the samples reaches 180 that means 15 minutes data. Whenever a day is completed all the 15 mins data is accumulated and multiplied it by \((5/3600)*1.86\) (Converting Km in knots/Sec to Km/Hr). This results in Kilometers traveled by the coach in that particular day. Multiplication factor \((5/3600)*1.86\) is done in RCU/PC to avoid truncation of floating point operations.

9.2.7 Kilometers earned in the specified date

**REMOTE UNIT TRANSMISSION**

Function code : C \[ ASCII character \]

Data string : Date will be given in data bytes of the frame.

Example is explained below.

For the date of 10/11/2010 (DD:MM:YYYY). The decimal value 101110 (for 2010 only 10 is taken) is converted as a hex value 0X018AF6. This value is included in the data bytes as 0X00,0X01,0X8A,0xF6.

**DISPLAY UNIT REPLY**

Function code : D or F or N or Z \[ ASCII character \]

D : Task done, F : Data failure, N : No Data, Z : Flash fail

**Day x data Format:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Km earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Byte</td>
<td>4 Bytes</td>
</tr>
</tbody>
</table>

Signature

Name & Designation

Prepared By  Checked By  Approved By
9.2.8 READING DATEWISE KMS FOR A MONTH:

REMOTE UNIT TRANSMISSION

Function code : K
Data string : 2 bytes
Example : MMYY.
1211 in hex format i.e. 0x04,0xBB(for 12/11(MM:YY)11 in 2011).

DISPLAY UNIT REPLY

Function code : D or F or N
D: Done    F: Fail    N: Data not available
Data string : Daily kilometer traveled from day 1 to 31 of the month selected with 4 digits per day. Dates in which information is not available N with 3 blank spaces will be sent.

Example : 0X32564565(For day1)Nbbb(For day2 which is not available) up to 31st
Where b is blank space. Kilometers information calculation is same as explained above.

9.2.9 READING ACCUMULATED KMS FOR A YEAR:

REMOTE UNIT TRANSMISSION

Function code : Y
Data string : 4 - digit year selected by user
Example : YYYY 2010

DISPLAY UNIT REPLY

Function code : D or F or N
D: Done    F: Fail    N: Data not available
Data string : 4 digit accumulated kilometers in hex format
Kilometers information calculation is calculated by multiplying the received 4 digit accumulated kilometers with (5*1.86)/3600.

9.2.10 Retrieve Vendor code

REMOTE UNIT TRANSMISSION

Function code : E
[ ASCII character ]

DISPLAY UNIT REPLY

Function code : D/F
D : Task done , F : Data failure
Data string : 12 Digit vendor code
Ex: MEDHA0000001 (ASCII Characters)
If the vendor code is less than 12 characters append with blank spaces.

9.2.11 Slave Health Query

REMOTE UNIT TRANSMISSION
Function code : 9 [ASCII character]
Data string : 1 digit slave number ('1' - Master
('2' - Slave)
Example : X

DISPLAY UNIT REPLY
Function code : D or F [ASCII Character]
D : Task done, F : Data failure
Data string : 1 digit
Example : X
Digit received in data string portion is '1' slave health is good otherwise slave health failure

9.2.12 Display Board Reset

REMOTE UNIT TRANSMISSION
Function code : 4 [ASCII Character]

DISPLAY UNIT REPLY
Function code : D or F [ASCII character]
D : Task done, F : Data failure

9.2.13 Reading Slave Enable/Disable Information

REMOTE UNIT TRANSMISSION
Function code : 2 [ASCII character]

DISPLAY UNIT REPLY
Function code : D or F [ASCII character]
D : Task done, F : Data failure
Data string : REEDD
E : enable, D : disable
Note:

<table>
<thead>
<tr>
<th>Character position</th>
<th>Character</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>Fixed</td>
</tr>
<tr>
<td>2</td>
<td>E/D</td>
<td>Enable or disable for Master</td>
</tr>
<tr>
<td>3</td>
<td>E/D</td>
<td>Enable or disable for Slave</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>Fixed</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

9.2.14 Writing Slave Enable/Disable Information

REMOTE UNIT TRANSMISSION

Function code : 3
Data string : REEDD

DISPLAY UNIT REPLY

Function code : D or F
D: Task done, F: Data failure

9.2.15 Reading LED Intensity Information

REMOTE UNIT TRANSMISSION

Function code : M

DISPLAY UNIT REPLY

Function code : D or F
D: Task done, F: Data failure
Data string : A/D/N
A: AUTO  D: DAY  N: NIGHT
9.2.16 Writing LED Intensity Information

REMOTE UNIT TRANSMISSION

Function code : N [ASCII Character]
Data string : D/N/A
A : AU TO D: DAY N: NIGHT

DISPLAY UNIT REPLY

Function code : D or F [ASCII Character]
D : Task done , F : Data failure

9.2.17 Train Information Programming

REMOTE UNIT TRANSMISSION

Function code : A [ASCII Character]
Data string : maximum 200 bytes of train information is allowed per each frame

DISPLAY UNIT REPLY

Function code : D or F or Z or a or M [ASCII Character]
D : Task done , F : Data failure
M : memory full E : train information available Z : Flash fail , a : CRC failed

Method of validation of the database :

CRC is calculated from the TINF to PEND. In the PEND packet, CRC of the whole train route information is included and sent to the host system. If the CRC of the train route information is matched then only train route information is considered as valid train route information. The same CRC is stored in the flash memory of RCU/CCU. While selecting the train route in the CCU/ uploading the train route information from RCU, CRC is calculated for the total train route information and validated with stored CRC. If the CRC is failed “CRC fail” command is issued to the host system.

Method of CRC calculation :

CRC used for train route information validation is the MOD bus CRC calculation. In which initial CRC values are considered as FF and the cumulative CRC is calculated i.e CRC of one packet is the initial CRC for the next packet.

CRC Bytes : 1st MSB byte and 2nd LSB byte
9.2.18 Erasing All Trains Information

REMOTE UNIT TRANSMISSION

Function code : 6  
[ASCII Character]

DISPLAY UNIT REPLY

Function code : D or F or Z  
[ASCII Character]
D: Task done, F: Data failure, Z: Flash fail

9.2.19 Erasing Single Train Information

REMOTE UNIT TRANSMISSION

Function code : 5  
[ASCII Character]
Data string : XXXXXXXXXX
Example : 10 char train information

DISPLAY UNIT REPLY

Function code : B or N or Z  
[ASCII Character]
B: erase done, N: no train data available, Z: Flash fail

9.2.20 Erasing KM Earned Information

REMOTE UNIT TRANSMISSION

Function code : X  
[ASCII Character]

DISPLAY UNIT REPLY

Function code : D or F or Z  
[ASCII Character]
D: Task done, F: Data failure, Z: Flash fail

9.2.21 Changing Coach Number Information

REMOTE UNIT TRANSMISSION

Function code : 7  
[ASCII Character]
Data string : 12 char coach no (new coach no)
Example : XXXXXXXXXX

DISPLAY UNIT REPLY

Function code : D or F or Z  
[ASCII Character]
D: Task done, F: Data failure, Z: Flash fail
Display unit will reply with old coach ID. After this command communication, display will start communicating with the new coach ID.

9.2.22 Reading Device Hardware ID

REMOTE UNIT TRANSMISSION

Function code : Q  
[ASCII Character]
DISPLAY UNIT REPLY
Function code: D or F or Z [ASCII character]
D: Task done, F: Data failure, Z: Flash fail
Data string: XXXXXXXXXXXX
Example: 12 char hardware id

9.2.23 Display Board Status

REMOTE UNIT TRANSMISSION
Function code: F, G, [ASCII Character]
F: Modem status request
G: GPS status request

DISPLAY UNIT REPLY
Function code: D or F [ASCII Character]
Data string: W or N or D
W: working good
N: not working
D: disabled

9.2.24 Scroll frequency Configuration:

REMOTE UNIT TRANSMISSION
Function code: L [ASCII Character]
Data string:

<table>
<thead>
<tr>
<th>WD</th>
<th>ND</th>
<th>DD</th>
<th>VD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WD : Train number message scroll frequency factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ND : train name message scroll frequency factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DD : [source station] to [destination station] scroll frequency factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VD : [important station in route] scroll frequency factor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scroll frequency factor ranges from 5 (Max speed) -15 (Min speed). Other than this range of frequency factor Master unit will not accept any data to change the scroll speed.

DISPLAY UNIT REPLY
Function code: D or F [ASCII Character]
10. **Wireless commands description**

<table>
<thead>
<tr>
<th>Command type</th>
<th>Action in RCU</th>
<th>Action in CCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upload data base</td>
<td>If train route information is available with user keyed train no then remote unit will upload the complete train route information to master display unit</td>
<td>When ever the data base upload is initiated by RCU CCU will stop sending bit map data to the displays until train route is selected.</td>
</tr>
<tr>
<td>Train route selection</td>
<td>Accepts the user keyed train no and sends to master display unit</td>
<td>When ever the train route selection is initiated by RCU ,CCU will stop sending bit map data to the displays and searches for train route data in the flash. If the train route is found CCU will respond with done response and starts sending Train route bitmap data to the displays. other wise it will with Not available response. If the flash read is failed at any time while searching the train route flash fail command is sent to the RCU. In this process if flash write CCU will respond with flash fail response .If the train route is found CRC of the train route is not matched then CCU will respond with CRC fail response.</td>
</tr>
<tr>
<td>Hard ware ID retrieve</td>
<td>Sends the hardware id retrieval command to master display unit and displays the retrieved hardware id on LCD</td>
<td>When ever this command comes from RCU it will read the hard ware id location in the flash and sends the same to the RCU. If flash read is failed CCU will respond with the flash fail command.</td>
</tr>
<tr>
<td>Configuration of Coach ID</td>
<td>Accepts the user keyed coach id information and sends the same to master display unit</td>
<td>When ever this command comes from RCU,CCU will erase two of its coach id sectors and writes the new coach id in to the flash and responds with the old coach id. After the completion of this command CCU will respond with the new coach ID. In this process if flash write or erase fails CCU will respond with flash fail response and continuous with the default coach id “MEDHA MPI780”.</td>
</tr>
<tr>
<td>Slave health query</td>
<td>Sends the hlt query command to master display unit based on the user selection (Master or Slave)</td>
<td>Based on the slave number CCU will respond to the RCU with the slave status(Working/Not working).</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Display Reset</td>
<td>Sends the display reset command to master display unit and displays the status on LCD.</td>
<td>When the display reset is received from the RCU CCU shall stop sending the train route information bitmaps to the Displays until a new train route is selected.</td>
</tr>
<tr>
<td>Read Display enable disable information</td>
<td>Sends the read display enable/disable information command and displays the status received from master display unit.</td>
<td>Responds with the slave enable disable status.</td>
</tr>
<tr>
<td>Write enable disable information</td>
<td>Sends the write enable/disable information command based on user selection (Enable/Disable).</td>
<td>Using this command displays can be configured as enabled or disable (Stand by or not in stand by). This enabling and disabling is valid only for this power cycle. Once the Power cycle is done both the displays will be in enable mode.</td>
</tr>
<tr>
<td>Read LED information</td>
<td>Sends the read led information command to master display and displays the status on LCD.</td>
<td>Gives the mode of display brightness (AUTO/DAY/NIGHT) mode.</td>
</tr>
<tr>
<td>Write LED information</td>
<td>Sends the write led information command to master display unit and displays the status on LCD.</td>
<td>Brightness mode of the display can be changed using this command. The brightness mode is reflected in the displays only when the train route information is displaying in the displays. This brightness mode is valid only for this power cycle. Once the Power cycle is done both the displays will be in enable mode. By default on power on this mode will be day mode.</td>
</tr>
<tr>
<td>Modem Health</td>
<td>Sends the modem health command to master display unit and displays the status on LCD.</td>
<td>CCU will just respond with the working response.</td>
</tr>
<tr>
<td>GPS status</td>
<td>Sends the GPS status command to master display unit and displays the status on LCD.</td>
<td>The response is given will be not working if in that instant GPS signal is poor. If GPS signal is good CCU will respond with working good response.</td>
</tr>
<tr>
<td>Task Description</td>
<td>Function Description</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Problem ID read</td>
<td>Sends the read single problem message command with user keyed problem id to master display unit and displays the retrieved problem message on LCD. RCU will give the index of the Problem ID along with this command. Based on the index if the index is in valid range(0-99)CCU will search the problem id and validates the start of frame and end of frame and accordingly gives response to the RCU. If flash read is failed CCU will respond with the flash fail command.</td>
<td></td>
</tr>
<tr>
<td>Problem ID write</td>
<td>Sends the write problem message command with problem message keyed by user to master display unit and displays the status on LCD. If the no. of problems already written in the CCU are greater than 100 CCU will respond with memory full command. Otherwise after calculation of the address CCU will write the problem id in to the flash. In this process if flash write or erase fails CCU will respond with flash fail response.</td>
<td></td>
</tr>
<tr>
<td>Read all problem messages</td>
<td>Sends the read all problem message command to master display unit and retrieves all problem messages and stores the same in flash. CCU will search for problem messages. If no problem messages are found CCU will respond with the not available response. Otherwise reads all problem messages and sends to the display. In this process if flash read fails CCU will respond with flash fail response.</td>
<td></td>
</tr>
<tr>
<td>Single train information erase</td>
<td>Sends the erase single train information command to master display unit with train no keyed by user and displays the status on LCD. When ever the train route selection is initiated by RCU ,CCU will stop sending bit map data to the displays and searches for train route data in the flash. If the train route is found CCU will start erasing the train route if the flash erase is success it will respond with done response. Other wise responds with the flash fail response. If the train route is not found responds with NO data response.</td>
<td></td>
</tr>
<tr>
<td>Erase all data base</td>
<td>Sends erase all train route information command to master display unit and displays the status on LCD. Start erasing the all train route data base and gives the response after completion of erase.</td>
<td></td>
</tr>
<tr>
<td>Erase KM data</td>
<td>Sends erase KM earned data command to master display unit and displays the status on LCD. Start erasing the KM data. If the km data is successfully is erased CCU will respond with Erased successfully other wise will respond with the flash fail command.</td>
<td></td>
</tr>
</tbody>
</table>

Signature

Name & Designation
Prepared By
Checked By
Approved By
Erase Problem messages | Sends erase all problem messages command to master display unit and displays the status on LCD | Start erasing the Problem messages data. If the erase is successful, CCU will respond with Erased successfully response otherwise will respond with the flash fail command.

Retrieve vendor code | Sends retrieve vendor code command to master display unit and displays the retrieve vendor code on LCD | Reads vendor code from the flash. If the flash read is success full CCU will respond with done response along with the vendor code. If the flash read is failed gives flash fail response.

Read KM earned for specified data | Sends read km earned on specified data command to master display unit with user keyed date and displays the retrieve km earned on LCD | Reads KM data of a particular data given by RCU .If the flash read is failed CCU will respond with flash fail response. If the data found data will be given to the RCU. Other wise not available response is given.

Read KM data for last 36 months | Sends the read KM earned data for last 36 months command to master display unit , retrieves km earned data for last 36 months and stores the same in flash. | Reads Km data for the last 36 months data..If the flash read is failed CCU will respond with flash fail response. If there is not data CCU will respond with no data response.

11. Communication Timeouts

When user selects the command from remote unit, remote unit sends the command to master display unit through wireless communication. If master display unit is not responding it should retransmit the same frame (Maximum of 2 times). If master display unit is not responding after 2 retries then remote unit should display timeout message on LCD screen and terminates the communication.

| Maximum no of retries | 2 times |
| Timeout time | 5 Seconds |
| For all train route erase command | 1 Minute |

If CRC fail command is received from master display unit then remote unit should retransmit the same frame. After retransmitting of same frame for 2 times (maximum retries) still if master display unit response with CRC fail then remote unit should terminate the communication and display the status message on LCD.
11.1 Cable Connection details (Wired mode)

Master Display Unit (DB9 Male Connector)  
RCU (DB9 Female connector)
PARAMETERS TO BE CHECKED DURING THE FIELD TRIAL:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameter to be recorded in the field trial</th>
<th>Compliance</th>
<th>Adequacy</th>
<th>Remarks if any</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Software for preparation of database of routes in PC/Laptop and interface of the remote unit with software provided for data entry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Uploading of route database /Modification/Replacing using remote unite and laptop in master unit.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Recording coach health messages in master unit through remote unit.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Train selection by remote unit and testing of transmitter capacity of 1Km.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Remote unit interchangeability for common operations with other vender’s remote unit.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Display of the destination board as per clause no. 17.3.3 of the specification.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Failure monitoring of the complete system including remote unit and power supply of the system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Response time of the vendor for attending the complaints. Date of fitment and details of the firm along with contact address are required to be provided.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Downloading the daily log report of the Kms. earned by the coach.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Display quality and visibility of the destination board during daylight and other timings.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data of the train routes shall be provided by the depot conforming to the clause no. 19 of the specification.
UNDERTAKING AGAINST CARTEL FORMATION

We, ……………………………………. hereby, give an undertaking that as a Registered Vendor for manufacture and supply of MICROPROCESSOR BASED DESTINATION BOARD DISPLAY SYSTEM WITH GPS FOR IR BG COACHES will not be a part of a cartel with other vendors and will be quoting competitive rates in the tenders invited by the Indian Railway/PUs.

We …………………………… are aware of the fact that the Registering Authority i.e. RDSO may de-list the name of our firm from the Master List of Approved Vendors if complaint is received about such cartel formation from any of the Railways/Production Units.

We confirm that the information furnished is correct to the best of our knowledge.

Seal and Signature
(Authorised signatory of the firm)

Date :
Place :
Seal :

Signature

Name & Designation | Prepared By | Checked By | Approved By