सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

सी ई एल डीएसीएफ - 720 पी

हाई अवेलिबिलिटी

सिंगल सेक्शन डिजिटल एक्सल काउंटर

पर

अनुरक्षण हस्तपुस्तिका

Maintenance Handbook

on

CEL DACF - 720 P

High Availability

Single Section Digital Axle Counter



नियत समूह : एस एस ई /जे ई (सिग्नल) तथा सिग्नल तकनीशियन

Target Group: SSE/JE(Signal) & Signal Technician

कैमटेक/एस/प्रोज/2016-17/एचबी_सीईएल_एचएएसएसडीएसी/1.0

जनवरी 2017

CAMTECH/S/PROJ/2016-17/HB_CEL_HASSDAC/1.0

January 2017

अआप्रासंRDSO
रेल अग्रदूत Transforming Railways

An ISO 9001:2008 Certified Organization
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EXCELLENCE IN MAINTENANCE

Indian Railways
Centre for Advanced Maintenance Technology

Maharajpur, Gwalior (M.P.) - 474005

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January 2017

प्राक्कथन

एक्सल काउन्टर रेल्वे संकेत प्रणाली मे एक महत्वपूर्ण भूमिका निभाते हैं, तथापि एक्सल काउन्टर की खराबी से यातायात बाधित हो सकता है जिसके चलते गाड़ियों की समयबद्धता प्रभावित हो सकती है। इस प्रकार की खराबियों को टालने हेतु मै. सेन्ट्रल इलेक्ट्रोनिक्स लि. ने हाई अवेलिबिलिटी सिंगल सेक्शन डिजिटल एक्सल काउंटर (एच ए एस एस डी ए सी) विकसित किया है जिसमें ड्युअल प्रोसेसिंग यूनिट तथा ऑटो रीसेट की सुविधा है | अपनी उन्नत संरक्षा युक्त विशेषताओं तथा विश्वसनीयता के कारण डिजिटल एक्सल काउंटरो के इस संस्करण का संस्थापन भारतीय रेल्वे में निरंतर हो रहा है।

कैमटेक अनुरक्षण विधियों से संबन्धित सूचनाओ के अभिलेखों के प्रस्तुतीकरण एवं उन्नयन मे प्रयत्नशील है। कैमटेक ने सिग्नल कार्मिकों को एच ए एस एस डी ए सी की जानकारी हेतु इस हस्तपुस्तिका को तैयार किया है।

मुझे आशा है कि इस हस्तपुस्तिका मे दी गयी जानकारी संकेत विभाग के कार्मिको को उपरोक्त प्रणाली के अनुरक्षण मे सहायक होगी।

केमटेक, **ग्वालियर** **ए आर तुपे**

दिनांक : 19.01.2017 **कार्यकारी निदेशक**

FOREWORD

Axle counters play a vital role in railway signalling, however failure of axle counter may paralyze the movement of traffic thereby affecting the punctuality of trains. To avoid such failures, the High Availability Single Section Digital Axle Counter (HASSDAC) is developed by M/s Central Electronics Ltd. which consists of dual processing units and auto resetting feature. This version of digital axle counter is being installed on Indian Railways due to its enhanced safety features and reliability.

CAMTECH is continuously making efforts in documentation and upgradation of information on advanced maintenance practices. CAMTECH has prepared this handbook to make the signal personnel familiar with the HASSDAC system.

I hope that the information given in this handbook will help signal personnel in maintaining the above system.

CAMTECH Gwalior **A.R.Tupe**
Date: 19.01.2017 **Executive Director**

भूमिका

डिजिटल एक्सल काउन्टर, सिंगल सेक्शन अथवा मल्टी सेक्शन ट्रेनों के संचालन में बहुत प्रभावी होते हैं जब तक कि वे बिना किसी खराबी के ठीक प्रकार से कार्य कर रहे हैं | कुछ रेलवे में खराबियों से बचाने के लिए डिजिटल एक्सल काउंटरों के साथ परंपरागत ट्रेक सर्किटों अथवा ए एफ टी सी का उपयोग करके ड्युअल डिटेक्शन का प्रावधान किया गया है | सरलता, अनुरक्षण की सुलभता एवं एकल यूनिट में ड्युअल डिटेक्शन की उपलब्धता हेतु मै. सेन्ट्रल इलेक्ट्रोनिक्स लि. ने हाई अवेलिबिलिटी सिंगल सेक्शन डिजिटल एक्सल काउंटर (एच ए एस एस डी ए सी) विकसित किया है जो आर डी एस ओ द्वारा अनुमोदित है |

यह हस्तपुस्तिका फील्ड कार्मिको को उनके सेक्शन मे संस्थापित एच ए एस एस डी ए सी के अनुरक्षण तथापि त्रुटिविहीन कार्य मे सहायता हेतु तैयार की गयी हैं। सभी उपयोगी जानकारियों जैसे सिग्नल लेवलों की रिकॉर्डिंग, अनुरक्षण की अनुसूची, त्रुटि निवारण, एरर कोड इत्यादि को इस हस्तपुस्तिका में सम्मिलित करने का यथासंभव प्रयत्न किया गया है |

हम आर॰ डी॰ एस॰ ओ॰ **,** मेसर्स सेंट्रल इलेक्ट्रॉनिक्स लिमिटेड साहिबाबाद तथा भारतीय रेलवे के उन संकेत अभियंताओं एवं तकनीशियनों के अत्याधिक आभारी हैं जिन्होने इस हस्तपुस्तिका को बनाने में हमारी सहायता की है |

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

कैमटेक, ग्वालियर **दिनेश कुमार यादव**

दि.: 19.01.2017 **निदेशक (सिग्नल एवं दूरसंचार)**

PREFACE

Digital Axle Counters whether Multi-section or Single –section are very effective in the movement of trains so long as they are working without failure. In some Railways, to avoid failures dual detection is provided with the help of conventional track circuits or AFTC along with Digital Axle Counters. For simplicity, ease of maintenance and availability of dual detection in one single system, High Availability Single Section Digital Axle Counter (HASSDAC) is developed by M/s Central Electronics Ltd. which is approved by RDSO.

This handbook has been prepared to help the field personnel in maintaining HASSDAC installed in their section for trouble-free performance. Effort has been made to cover all the useful information such as recording of signal levels, maintenance schedule, troubleshooting, error codes etc. of the system in this handbook.

We are sincerely thankful to RDSO and M/s Central Electronics Ltd., Sahibabad and all those Signal Engineers and technicians of Indian Railways who helped us in preparation of this handbook.

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

CAMTECH Gwalior **D.K.M.Yadav**
Date: 19.01.2017 **Director (S&T)**

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सुधार पर्चियों को जारी करना

ISSUE OF CORRECTION SLIPS

इस हस्तपुस्तिका के लिए भविष्य में जारी की जाने वाली सुधार पर्चियों के क्रमांक इस प्रकार से रहेंगे:

The correction slips to be issued in future for this handbook will be numbered as follows:

केमटेक/एस/प्रोज/2016 - 17/एचबी_सीईएल_एचएएसएसडीएसी/1.0 # XX दि .....

CAMTECH/S/PROJ/2016-17/HB_CEL_HASSDAC/1.0# XX date .....

जहां "XX" सम्बंधित सुधार पर्ची की क्रम संख्या है (01 से शुरू होकर)
Where "XX" is the serial number of the concerned correction slip (starting from 01 onwards).

सुधार पर्चीयाँ जारी की गयीं

CORRECTION SLIPS ISSUED

सुधार पर्ची की क्रम संख्या Sr. No. of Correction Slip	जारी करने की तारीख Date of issue	संशोधित पृष्ठ क्रमांक एवं मद संख्या Page no. and Item No. modified	टिप्पणियाँ Remarks

डिस्क्लेमर

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

DISCLAIMER

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

हमारा उद्देश्य

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

OUR OBJECTIVE

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

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

संपर्क सूत्र : निदेशक (संकेत एवं दूरसंचार)

पत्राचार का पता : भारतीय रेल उच्च अनुरक्षण प्रौद्योगिकी केंद्र,
महाराजपुर, ग्वालियर (म. प्र.) पिन कोड 474 005

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

Contact person : Director (Signal & Telecommunication)
Postal Address : Centre for Advanced Maintenance Technology, Maharajpur, Gwalior (M.P.) Pin Code – 474 005
Phone : 0751 - 2470185
Fax : 0751 – 2470841
Email : dirsntcamtech@gmail.com

सी ई एल डीएसीएफ - 720 पी
हाई अवेलिबिलिटी सिंगल सेक्शन डिजिटल एक्सल काउंटर
CEL DACF - 720 P
High Availability Single Section Digital Axle Counter

1.1 परिचय Introduction

1.1.1 Single Section Digital Axle Counter (SSDAC) system

Single section axle counters are generally used to monitor a single track section i.e there is only one entry point and one exit point for a particular track section. Digital data is transmitted directly between two axle counter field equipments by means of modem communication The CEL Single Section Digital Axle Counter system comprises of trackside counting units, installed at both ends near the detection points on the track. No separate evaluator is required. There are two versions available:

(i) DACF 710 P (Phase reversal type)
The DACF 710 P is not affected by the push trolleys consisting of 4 spoke and 8 spoke wheels; and rail dolly. Trolley suppression track circuit is not required.

4/8 spokes push trolleys shall have the following parameters for not affecting the system: (a)Flange Height < 22mm+/- 2mm, (b) Flange width< 10mm, (c) wheel base < 100 mm. There shall be no Rim inside the wheel and orientation of spokes shall be in the plane to allow passage to flux. Trolley suppression track circuit is not required.

It counts the following push trolleys: (a) Push trolley with perforated wheel; (b) Dip lorry and (c) Motor trolley.

Trolley with following parameters will be counted
(a) Flange Height >28mm, (b) Flange width> 15mm, (c) Tyre base >110 mm.
Any variation in even one parameter of Push/Motor Trolley may lead the system to error.

(ii) DACF 710 A (Amplitude Modulation type) The SSDAC remains unaffected with all types of insulated push trolleys but goes into disturbed state (ERROR condition) for non insulated trolleys. Trolley suppression track circuit is required.

1.1.2 High Availability Single Section Digital Axle Counter (HASSDAC) System

High Availability Digital Axle Counter (HASSDAC) is the advanced version of SSDAC, in which redundancy is ensured in counting, processing, communication, output relay and power supply. Also optional redundancy in SCC cards and track devices is provided. Auto reset feature is given in which if out of two processing units in HASSDAC one unit fails then that unit will get reset automatically. The HASSDAC is developed to ensure the availability of Digital Axle Counter, thereby eliminating the possibility of failure. The HASSDAC model DACF-720P is available in phase reversal type for monitoring single section. It is designed as per RDSO Specification No. RDSO/SPN/177/2012 ver. 3.0 or latest.

CEL HASSDAC is designed to accommodate two sets of identical circuit of single section digital axle counters into single chassis. It has two variants namely:

- Single Sensor HASSDAC and
- Dual Sensor HASSDAC.

Single Sensor HASSDAC and Dual Sensor HASSDAC units are configurable using different number of cards and use of jumpers. In the dual sensor variant of HASSDAC all the cards along with two sets of sensors are used for achieving 100% redundancy, whereas, in the single sensor variant, common sensor along with associated SCC card is used.

1.1.3 Applications of HASSDAC

- Block Working
- Intermediate block signaling
- Automatic signalling
- Track circuiting for
  Loop line ii) Main line iii) Yard lines

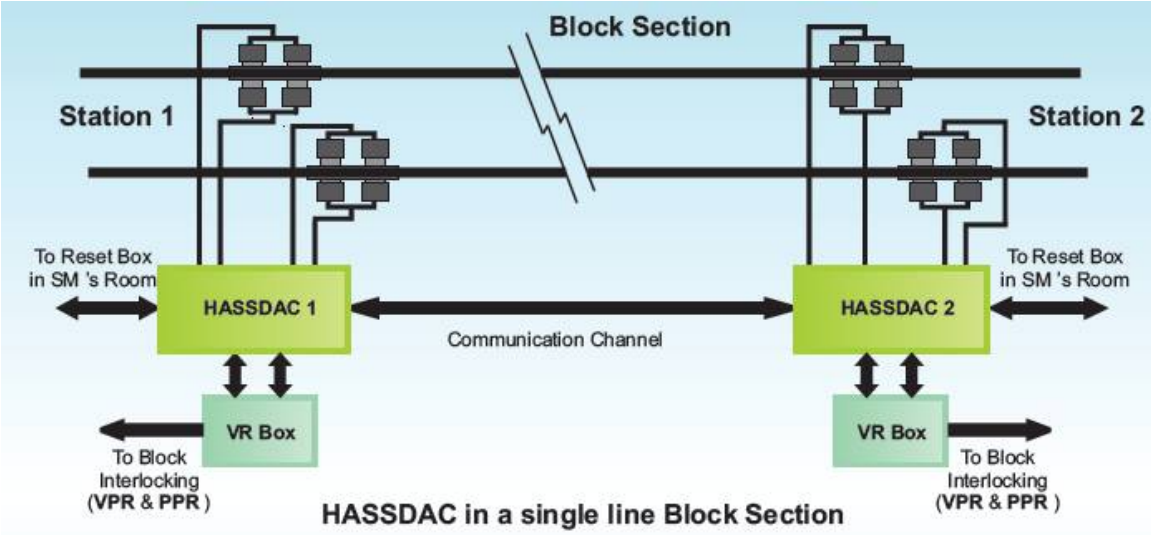


Fig.1.1: Block diagram for an application of HASSDAC

1.1.4 Salient feature of HASSDAC

- Trackside electronic counting equipment.
- Web type axle detectors.
- Compatible with 90R, 52 Kg & 60 Kg rail profiles
- Redundancy provided in counting, processing, communication, output relay and supply section.
- Redundancy in track devices and counting process is optional.
- Auto reset feature is available, if one of the output relay remained occupied after train
- clears the section, auto reset takes place.
- Circuit of two MLB cards is duplicated in card called Dual MLB Card.
- 2 Nos of Dual MLB cards are used in each entry / exit unit.

- 2 Nos of Modem cards are used in each entry /exit unit.
- Event Logger card is provided at the rear of the entry / exit unit.
- 2 Nos of DC –DC Converter cards used.
- Two separate relay driver cards are used.
- Separate vital relays are used for each set of processing unit.
- Final VPR relay provided in relay room picks up if any of the two Vital Relays is picked up.
- Spring type cage terminals provided at the back of Unit & Vital Relay box instead of couplers for higher contact reliability.
- Track clear/occupied status at both stations.

1.2 कार्य का सिद्धांत Principle of operation

The basic principle of operation of the system is same as that for Single Section Digital Axle Counter. It is based on counting the number of axles passing at each detection point. These stored counts are transmitted to the second unit of the system and vice versa by means of modem communication. If counts registered at both detection points are equal then section is cleared. Otherwise the section is shown as occupied.

The only difference is that the HASSDAC unit comprises two independent SSDAC subunits working in conjunction with respective pairs at the other end.

When wheels of the train pass over the detection point, the carrier signal is modulated by means of phase reversal upto 180 degree in the Rx coils. The phase-modulated signal is compared with standard reference signal and processed in the counting unit. The resultant signal is converted into a wheel pulse. The HASSDAC unit monitors these wheel pulses generated by passing wheels and registers the counts of the number of wheels passing over the location. The first processing unit sends its count to the respective first processing unit located at the other end of the track section at regular intervals. Similarly the first processing unit receives the count status from the respective first processing unit of the system. The second processing units at both ends also process the counts similarly. Each HASSDAC unit of the system drives its Vital Relay to energized condition (Pick up) at their location after verification of the following:

i. The self-count and remote counts are matched and equal.
ii. The supervisory signals are normal at both locations.

The track section is shown as CLEAR when any one out of two or both the Vital Relays are picked up. Otherwise the track section is shown as OCCUPIED. The contacts of vital relays at both ends or at any one end can be used in signalling circuits as per requirement.

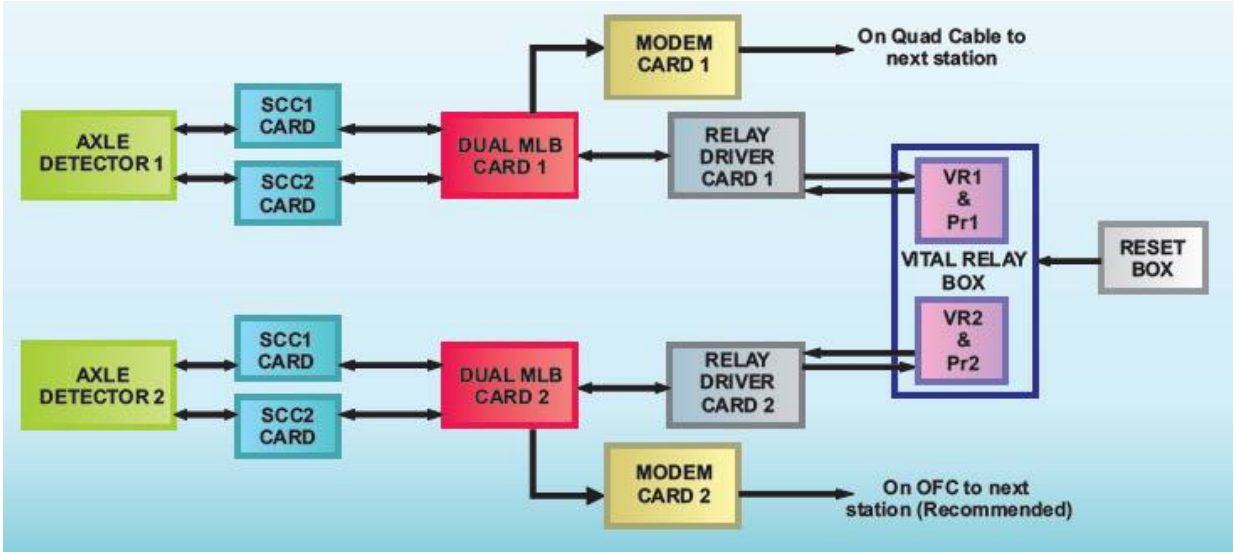


Fig.1.2: Functional Block Diagram of HASSDAC Unit

1.3 डीएसीएफ एचएएसएसडीएसी के घटक Components of DACF HASSDAC

The CEL DACF system consists of following units

1.3.1 Axle detectors AD 711

An Axle Detector consist of 2 transmitter(Tx) and 2 receiver(Rx) coils. One pair of Tx & Rx coil works on 21KHz frequency and other on 23 KHz.

Transmitter (TX) coils – 2 Nos. for single sensor type, 4 Nos for dual sensor type, fed with 21 kHz and 23 kHz carrier signals

Receiver (RX) coils – 2 Nos. For single sensor type, 4 Nos for dual sensor type to receive the transmitter signal

The Rx signal is phase modulated with each train wheel passing over the detection point.



Fig.1.3 (i): Axle Detectors AD711

1.3.2 Trackside electronic unit DACF 720P (HASSDAC)

The HASSDAC unit is a microcontroller based embedded system and comprise of two SSDAC subunits. Each subunit takes signals from Axle Detectors and performs wheel detections and counting. It simultaneously sends and receives the wheel counts from other end of the section, independently. On the basis of comparison of wheel counts of

both ends Clear or Occupied status of section is given. HASSDAC unit keeps track of its health and logs the status of each subunit in separate event loggers to record event statistics.



Fig.1.3 (ii): Front view of HASSDAC

The HASSDAC unit (2 Nos.) consists of following cards:

Card description	**Card Nos.**	**Function**
Signal Conditioner Cards	1,2 & 7,8	i) Carrier Signal Generation ii) Demodulation and Pulse generation
Dual Micro controller logic blocks (2 micro controllers)	4 & 10	i) Pulse counting. ii) 2 out of 2 decision iii) Vital Relay Command Read back iv) Preparatory Relay Drive Command
Event Logger Card (for monitoring failures, etc)	--	For storage of events in the system.
Modem Card	3 & 9	i) Serial I/O Multiplexer ii) Resetting Circuit
Relay Driver Card	5 & 11	Output drive for vital relay & PR Relay
Power Supply Module (DC-DC converter)	6 & 12	i) All the supply voltages required in HASSDAC are generated. ii) Both DC-DC converter card are independent

All the above cards are of extended single Euro size (220mm x 100mm), which plugs into a motherboard in the sub rack. The cards must be inserted from card 1 to 12 starting from left within the sub rack.

Configuration table for single sensor & dual sensor HASSDAC

Sr. No.	Slot No.	Single Sensor HASSDAC	Dual Sensor HASSDAC
1.	1	SCC Card (21 KHz Freq.)	SCC Card (21 KHz Freq.)
2.	2	SCC Card (23 KHz Freq.)	SCC Card (23 KHz Freq.)
3.	3	Modem Card	Modem Card
4.	4	Dual MLB Card	Dual MLB Card
5.	5	Dual Relay Driver Card	Dual Relay Driver Card
6.	6	DC DC Converter Card	DC DC Converter Card
7.	--	Event Logger Card (At back Plate)	Event Logger Card (At back Plate)
8.	--	Mother Board	Mother Board
9.	7	Dummy Card	SCC Card (21 KHz Freq.)
10.	8	Dummy Card	SCC Card (23 KHz Freq.)
11.	9	Modem Card	Modem Card
12.	10	Dual MLB Card	Dual MLB Card
13.	11	Dual Relay Driver Card	Dual Relay Driver Card
14.	12	DC Converter Card	DC Converter Card
15.	--	Event Logger Card (At back Plate)	Event Logger Card (At back Plate)
16.	--	Mother Board	Mother Board
17.	--	One to one connector at P7 and P10 connected at back.	One to one connector at P7 and P10 is removed.
18.	--	Current drawn from 24 V DC supply is around 750 mA	Current drawn from 24 V DC supply is around 1.0 Amp

1.3.3 Vital relay box VR-722

The Vital Relay Box (VR Box) encases the Vital Relays of both subunits of HASSDAC. It consists of 4 relays i.e. 2 numbers of VR & one Reset Relay Q Type, 24V and 1000Ω type and one dual PR relay. The dual PR relay contacts can be extended to relay room for proving PPR relay.The auto reset card of HASSDAC is installed in VR Box which send reset voltage to failed unit in case of one unit failure. VR Box now has two red and two green LED for respective VR, two yellow colour LED and it will glow when particular section is in Preparatory mode and one yellow colour LED for RR relay which will glow when Reset Relay get picked up i.e in case of auto resetting. Both the VR relay outputs are **'OR'**ed to pick up the Final VPR relay in relay room. Separate counters are provided in Vital Relay Box for each processing unit which is incremented only on auto reset. This helps in maintaining data related to failure of individual processor units



Fig.1.3 (iii) : Vital Relay Box

1.3.4 SM's Reset Box RB 259A

Reset Box of HASSDAC sends reset command to trackside unit to normalize the system on failure of both subunits. It provides the status of system and error information to station master. Status of both subunits can be seen on the same display using the select switch. Reset box

- 1 No. for common resetting (when used in station area/platform lines). Provision for Line verification is also available if required.
- 2 Nos. for independent resetting (when used in block sections)

The reset box consists of the following:

i. The LED indications
   - Section Clear - Green indication.
   - Section Occupied - Red indication.
   - Power ON - Yellow indication.
   - Preparatory Reset - Green indication.
   - Line Verification – Yellow indication.
   - One unit fail- Red indication

ii. SM's key actuator.
iii. Reset Push button (Red colour).
iv. Counter for recording the number of reset operations.
v. 20 X 2 LCD display with backlit.
vi. 4 keys keypad for setting the date and time operation.
vii. Miniature reset switch for refreshing the LCD display.
viii. Toggle Switch for displaying data of processing unit 1 or 2.



Fig.1.3(iv): SM's Reset Box

1.3.5 Filter and Surge Voltage Protection Device

In order to prevent surge voltages from destroying the equipment, all the input lines of HASSDAC i.e. Power Supply (24V), Reset (48V) & all the Modem lines i.e. HASSDAC to HASSDAC & HASSDAC to reset box is to be routed through surge voltage protection devices for effectively protecting the system. In addition to these surge modules, added protection is given for input 24V line that acts as a filter for 24V DC. It helps in filtering out the surge entering in the system during changeovers etc.

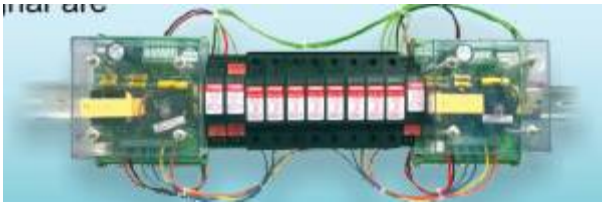


Fig.1.3 (v): Surge Voltage Protection Device

1.4 सहायक घटक Supportive Components

The procedure for installation of HASSDAC is same as that for DACF 710 A or DACF 710 P Single Section Digital Axle Counter. For guidance the list of supportive components applicable to different applications is given below:

Sr. No.	Supportive equipment and accessories	Quantity		
		Station Area(1 No. HASSDAC)	**Block Section(S/L) 1 No. of HASSDAC**	**Block Section(D/L) (2 No. of HASSDAC)**
1	24V, 40 AH low maintenance battery or 24V, 5 Amp output from one module of IPS	1 No.	2 Nos.	2 Nos.
2	24V, 5A Axle counter type Battery Charger	1 No.	2 Nos.	2 Nos.
3	4/6 Quad cable For HASSDAC (Station to Station) For reset box (From Location to SM's Room)	0.9 mm (2 Pairs) (2 Pair)	0.9 mm (2 Pair) (2 Pair)	0.9 mm (4 Pair) (4 Pair)
4	Apparatus case (Full) with termination board	2 Nos.	2 Nos.	4 Nos.
5	25 sq mm 'AL' Power Cable, 2 core.	Length as required	Length as required	Length as required
6	1.5 Sq.mm, Signalling cable(6 Core required +4 spare for S/L) (12 Core required + 4 spare for D/L)	Length as required	Length as required	Length as required
7	Earthing of Apparatus case (Locations).	2 Nos.	2 Nos.	4 Nos.
8	Surge Voltage Protection Device	2 Nos.	2 nos.	4 Nos.
9	Deflectors for Axle detectors supplied	4/8 Nos.	4/8 Nos.	8/16Nos.
10	QN1 type Relay, 24 V, 1000 Ω, 6F/6B	2 Nos.	4 Nos.	8 Nos.

1.5 एक्सल डिटेक्टरों का संस्थापन Installation of Axle detectors

1.5.1 Pre-requisites for installation of Axle detectors

- The Axle detector separation between two sets of different HASSDAC systems should be at least 2 meters so as to avoid mutual interference.
- The detectors have to be fixed on the clear spacing between two sleepers**.**
- It should be ensured that the rail is not badly worn causing the wheel flanges to graze over the fittings.
- Transmitter and Receiver cables are to be laid in the 40mm HDPE pipe for safety and buried underground below ballast at the depth of approx. 0.3mts.
- Transmitter and Receiver cables should run separately at a minimum separation of 400mm in different HDPE pipes.
- The transmitter and Receiver coils are provided with 24/0.2mm, 2 core shielded PVC cable with gray sheath and have to be taken to location box directly without any loops.
- If dual sensor HASSDAC is being installed it is advised to install one sensor on left rail and one sensor on right rail with minimum diagonal distance of 2 meters to avoid cross interference. Also the gap shall not be much more as it is desirable that both processing units go in occupied state almost simultaneously.

1.5.2 Tools required for installation & maintenance of DACF 720P

The following tools are required for installation and maintenance of Axle Detector

Tool Kit

1.	Pure sine wave Digital Multimeter make Fluke model 287/Rishabh model 285 or 6016/ Kusum Meco model 859CF or equivalent.	1 No.
2.	Dummy wheel (as per CEL drg. No. L007750A3, D14)	1 No.
3.	Ring spanner 17-19, 24-26	1 No. each
4.	Open end spanner 17-19, 24-26	1 No. each
5.	Socket spanner with handle	1 No.
6.	Torque wrench (Jaicom JPR65 or equivalent, 88NM)	1 No.
7.	Screw driver No. 902	1 No.
8.	Screw driver No. 935	1 No.
9.	Marking jig for drilling (CEL Drg. No.F008300, on D29 & D29A)	1 No.
10.	Dummy load to check power supply (resistive)	1 No.
11.	Serial to USB Converter with driver CD make MOXA	1 No.

Optional items

1.	Portable data analyzer for downloading event logger data for analysis and report generation.	1 No.
2.	Extender card (Card No.557 or latest)	1 No.



Fig. 1.5 (i): Marking Jig



Fig. 1.5 (ii): Punch and fixing device



Fig.1.5 (iii): Torque wrench model JPR65



Fig.1.5 (iv)

- **Socket spanner with handle**
- **Screw Driver No. 902**
- **Screw Driver No. 935**
- **Ring spanner 17-19,24-26**
- **Open end spanner 17-19, 24-26**

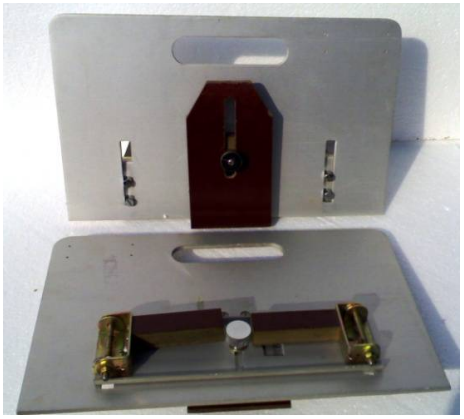


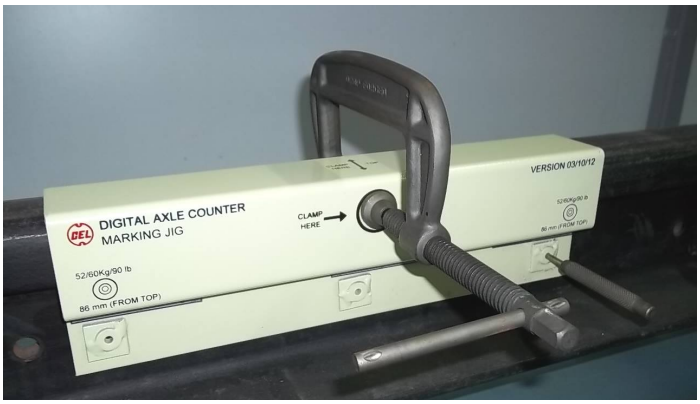
Fig. 1.5 (v): Dummy Wheel

1.5.3 Marking and drilling holes on the Rail

- The marking jig is to be fixed from top of the rail and tightened to the rail with clamps.
- The marking for 3 holes with punch is to be made on the Web of rail using marking jig.
- The marking for 3 holes is given at a distance of 0 - 170 – 340 mm.
- The 3 Holes of specified dimension given in table below are to be drilled on the web as per the markings at each location.

Rail Profile	90 lb	52 Kg	60 Kg
Distance from top of the rail	86 mm	86 mm	86 mm

- The drilling is to be carried out on the web of rail at marked places with the help of drill machine by ratchet drill method.
- The burr is to be removed from the holes after drilling.



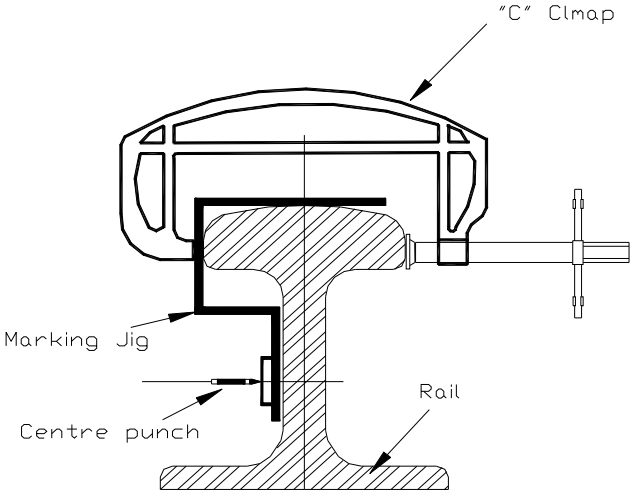


Fig.1.5 (vi) & (vii): Fixing of Marking jig and marking using punching guide as per rail size

1.5.4 Fixing of Axle Detectors (Tx and Rx coils)

- The Axle detectors are to be fixed on web of the rail at the drilled holes by means of M12 bolts & nuts with spring washers and check nuts. (NOTE: the torque wrench, specified in the tools, should be used for tightening of nuts and bolts.)
- M12 x 100mm - 3 Nos. bolts & nuts are used for fixing the axle detectors. 2nd nut is with Nylon washer and is to be used on each bolt.
- Transmitter coil assembly (21 KHz & 23 KHz) should be fixed on the outer side of rail. The transmitter assembly should sit properly on the web of rail.
- Receiver coil assembly (21 KHz & 23 KHz) should be fixed on the inner side of rail. The receiver assembly should be placed properly on the web of rail.
- The TX coil cables 21 KHz & 23 KHz are taken together in one HDPE pipe to the location Box.
- Similarly both 21 KHz & 23 KHz Rx coils are taken together but separately from TX coil cables to the location box.
- The 1st set of Transmitter and Receiver Coils is made of 21 KHz signal and 2nd set is made of 23 KHz signal at each Location.

Note: Both at the Entry & Exit of the section, the axle detectors should be fixed on same rail for one processing unit i.e. either on left side or on right side rail of the track. This should not be installed with 1st set on left rail and 2nd set on right rail of the track at Entry & Exit of the section. If it is installed on alternate rails of the track, the counting will not match and the system will not function normally for train movement.

1.5.5 Fixing of Rail Deflector

To protect axle detectors against the damage from hanging parts of train, rail deflector plates (protectors) should be mounted on both sides of the axle detectors.
These should be installed in the sleeper space (approx 30 cm to 40 cm next to the axle detectors). The deflector clamps are first fixed to bottom of rail.
These deflector plates are fitted to deflector clamp with bolts and nuts on each side.
While fixing deflector plates, it should be ensured that the deflector plates are positioned in front of transmitter and receiver coil.

1.6 सम्बंधित घटकों/उपकरणों का संस्थापन Installation of associated components/equipments

1.6.1 Location Box (Full size)

The location box should be installed at rail level and as close as possible to detection point so that the length of Axle detector cable does not exceed 10m.
One Shelf of wooden/ Hylam /NFTC plank should be provided in the location box for keeping HASSDAC Counting Unit & Vital Relay Box.

1.6.2 HASSDAC unit and VR box

Fix the HASSDAC counting unit on the shelf firmly using clamps, nuts & bolts.
The VR Box is also firmly fixed on the same wooden/Hylam/NFTC plank using clamps, nuts & bolts.
The VR and PR relays are wired using standard 24/0.2 wire.
A diode BY127 or IN4007 or IN5408 is used across each relay coil in reverse bias in VR box and same shall be wired for VPR & PPR in relay room.
Provide the earthing connection to HASSDAC unit and VR box by earthing cable supplied separately with the counting unit.

1.6.3 Surge Voltage Protection Device

SVPDs (10 numbers) are mounted on DIN Rail and supplied along with the system. One number of SVPD assembly is to be installed at each location and wired to the HASSDAC
Remove the top cover of the SVPD unit.
Fix the SVPD unit inside location box on hylam sheet using nuts and bolts.
Connect the wiring to the Surge protection device as per wiring details provided.
Provide the earthing connection by use of earthing cable supplied separately with the SVPD unit.

1.6.4 Terminal Board

The incoming and outgoing cables are terminated on spring cage type connectors from M/s WAGO, M/s Phoenix or M/s Weidmullar fitted at the back of the HASSDAC unit.

1.6.5 Power Supply arrangement

The power supply to HASSDAC consists of
i) 24V, 40 AH Battery and 24V, 5A Battery charger or 24V, 5A dedicated module of IPS.
ii) Power cable for connection from battery to HASSDAC unit.
Only Axle counter type battery charger as per latest specification is to be procured and installed in the equipment room. The battery chargers are usually kept on teak wood shelf fixed on MS Angles. The 24V, 5A battery charger has to be installed and connected to battery on auto mode. The current consumption of each HASSDAC unit is <1.25A @ 24V. For complete system (2 HASSDAC units) it is <2.5A @ 24V.
When integrated Power Supply (IPS) of 24V, 5 A is used, its ripple content should be within limits. The same 24V Battery can be used for advance and home location of UP & DN HASSDAC units of double line block section.
This power supply should not be used for any other signalling gear/systems.

1.6.6 Batteries

The 24V, 40 AH low Maintenance Battery (12V X 2Nos.) or 24V; 40AH Battery Bank may be used for powering the two units of HASSDAC. The batteries are to be procured as per latest RDSO specifications.

i. The batteries are kept on teak wood/ hard wood shelf on MS angles and are to be installed in the battery room.
ii. Insulators are to be provided below the batteries.
iii. The charging of batteries has to be done as per manufacturer's manual.

1.6.7 Cables

- 2 core x 25 Sq. mm Aluminum cable / 12 core signal cable for 24V supply from relay room to Location box, for Single and Double Line (Same as SSDAC)
- 6 core signal cable for VPR, PPR & Reset voltage from relay room to location box for single line
- Communication Media: 2 pairs of quad cable / one pair of quad cable & one OFC channel / Two OFC channels between station to station.
- Quad cable – 2 pairs (1 quad) from location to relay room for display in reset box

Additional cable requirement in comparison to SSDAC

One extra quad pair (2 Conductors) from Location to SM Panel for data display of second processing unit.

One extra quad pair / OFC channel from station to station.

If some railways require to repeat both VRs and both PRs at Relay Room, then:

Two numbers of SSDAC model DACF-710 P/A may be used in parallel with CEL auto reset box at Relay Room.

OR

VR1 and VR2 may be separated in VR box and made parallel in relay room i.e. VPR1 and VPR2**.**

1.6.8 Reset Box

Ensure that the Reset box supplied is model RB-259A.

Fix the Reset Box on the on SM's main table with nuts and bolts.

Connect all the wiring properly on 18 pin connector supplied with reset box.

½ quad cable should be used for modem connection to display the information on Reset box.

Connect the reset box body to the earthing available in SM's room.

Connect/extend B24 V used for HASSDAC Reset box Power ON and other indications.

Set the date and time of real time clock by use of keypad before commissioning if found disturbed.



Fig. 1.6 (i): Keypad inside Reset Box to set Date and Time

(For details please refer CEL's "Installation Manual for HASSDAC 720P" or CAMTECH's Handbook on "Installation of Digital Axle Counter").

1.7 अर्थिंग Earthing

Earth Electrode should be Galvanised iron pipe(s) of internal diameter $\geq$ 38 mm and length $\geq$ 2.5 mtr. in length with spike at one end and lug at the other end for connecting with earth lead. The lead wires used for connecting the installation and the earth electrode – 29 sq mm (19 strand wires of 1.4 mm diameter). In areas where copper wire may be frequently stolen due to theft, ACSR of size 64 sq.mm (19 strands of 2.11 mm diameter) may be used. The maximum values of earth resistance specified for earthing of SSDAC and its accessories are as follows:

S.No.	Equipment to be earthed	Value of Earth resistance
1	(i) Apparatus case connected to Earth (HASSDAC and vital relay box if housed in apparatus case and connected to earth at outdoor). (ii) All cable armours connected to same earth.	$\leq$ 1 Ohms
2.	Reset box connected to earth (indoor) near SM's Room.	$\leq$ 1 Ohms

Equipments to be earthed

A Common Earth should be provided for HASSDAC for items 1 (i & ii) of the above at the outdoor

(i) The Apparatus Case is to be connected to earth (the chassis of HASSDAC & Vital Relay Box should be properly connected to apparatus case).

(ii) Metallic sheath and armouring of all the underground main cables are to be earthed
   a. In R.E area, the metallic sheath and armouring of main telecom cables are earthed at both ends.
   b. In R.E area, the armouring of jelly filled cable shall be earthed at both ends.

(iii) Earth already available for other equipment may be used for earthing of Reset Box near SM's Room / Cabin etc.

(iv) The Earthing shall be provided at every location box where cables are terminated.

1.8 एड्रेस सैटिंग Address setting

Factory address setting in Entry unit for first processing unit is set
02, and for second processing unit it is set as 04. Correspondingly in Exit unit address for first processing unit is set as 03 and for second processing unit it is set as 05. This shall be kept as it is for single sensor HASSDAC when sensors are installed on left rail. For dual sensor HASSDAC for processing unit2, sensors shall be installed on right rail and factory set address 04 and 05 shall be interchanged.
The HSSDAC units are provided with unique address schemes for selection of 15 different pairs of units by means of 8-way DIP switch on motherboard of processing unit 'A' and processing unit 'B' The units are supplied with first pair of address set in the factory. However, for providing different pairs of units in station area/ Block section, the address scheme as given in the table on next page should be followed. To access this switch, open 6 Nos. of screws on back cover). The switches can be slide to move to Right (ON) or LEFT (OFF) as required.

The factory setting address provided by selecting the following switch position in the units.:

Pair 1

Processing Unit 1:02 ENTRY

Selection	8-way switch	Selection
OFF	1	--
--	2	ON
OFF	3	--
--	4	ON
--	5	ON
--	6	ON
--	7	ON
--	8	ON
To LEFT side	Switch position	To RIGHT side

Processing Unit 1:03 EXIT

Selection	8-way switch	Selection
OFF	1	--
OFF	2	--
OFF	3	--
--	4	ON
--	5	ON
--	6	ON
--	7	ON
--	8	ON
To LEFT side	Switch position	To RIGHT side

Pair 2

Processing Unit 2:04 ENTRY

Selection	8-way switch	Selection
OFF	1	--
--	2	ON
--	3	ON
OFF	4	--
--	5	ON
--	6	ON
--	7	ON
--	8	ON
To LEFT side	Switch position	To RIGHT side

Processing Unit 2:05 EXIT

Selection	8-way switch	Selection
OFF	1	--
OFF	2	--
--	3	ON
OFF	4	--
--	5	ON
--	6	ON
--	7	ON
--	8	ON
To LEFT side	Switch position	To RIGHT side

The address setting for all the 15 pairs is shown in the table below:

8-way switch position								Mode	Address setting	
8	7	6	5	4	3	2	1			
ON	ON	ON	ON	ON	OFF	ON	OFF	ENTRY	02	Pair 1
ON	ON	ON	ON	ON	OFF	OFF	OFF	EXIT	03	(Factory selected)
ON	ON	ON	ON	OFF	ON	ON	OFF	ENTRY	04	Pair 2
ON	ON	ON	ON	OFF	ON	OFF	OFF	EXIT	05	(Factory selected)
ON	ON	ON	ON	OFF	OFF	ON	OFF	ENTRY	06	Pair 3
ON	ON	ON	ON	OFF	OFF	OFF	OFF	EXIT	07	
ON	ON	ON	OFF	ON	ON	ON	OFF	ENTRY	08	Pair 4
ON	ON	ON	OFF	ON	ON	OFF	OFF	EXIT	09	
ON	ON	ON	OFF	ON	OFF	ON	OFF	ENTRY	0A	Pair 5
ON	ON	ON	OFF	ON	OFF	OFF	OFF	EXIT	0B	
ON	ON	ON	OFF	OFF	ON	ON	OFF	ENTRY	0C	Pair 6
ON	ON	ON	OFF	OFF	ON	OFF	OFF	EXIT	0D	
ON	ON	ON	OFF	OFF	OFF	ON	OFF	ENTRY	0E	Pair 7
ON	ON	ON	OFF	OFF	OFF	OFF	OFF	EXIT	0F	
ON	ON	OFF	ON	ON	ON	ON	OFF	ENTRY	10	Pair 8
ON	ON	OFF	ON	ON	ON	OFF	OFF	EXIT	11	
ON	ON	OFF	ON	ON	OFF	ON	OFF	ENTRY	12	Pair 9
ON	ON	OFF	ON	ON	OFF	OFF	OFF	EXIT	13	
ON	ON	OFF	ON	OFF	ON	ON	OFF	ENTRY	14	Pair 10
ON	ON	OFF	ON	OFF	ON	OFF	OFF	EXIT	15	
ON	ON	OFF	ON	OFF	OFF	ON	OFF	ENTRY	16	Pair 11
ON	ON	OFF	ON	OFF	OFF	OFF	OFF	EXIT	17	
ON	ON	OFF	OFF	ON	ON	ON	OFF	ENTRY	18	Pair 12
ON	ON	OFF	OFF	ON	ON	OFF	OFF	EXIT	19	
ON	ON	OFF	OFF	ON	OFF	ON	OFF	ENTRY	1A	Pair 13
ON	ON	OFF	OFF	ON	OFF	OFF	OFF	EXIT	1B	
ON	ON	OFF	OFF	OFF	ON	ON	OFF	ENTRY	1C	Pair 14
ON	ON	OFF	OFF	OFF	ON	OFF	OFF	EXIT	1D	
ON	ON	OFF	OFF	OFF	OFF	ON	OFF	ENTRY	1E	Pair 15
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	EXIT	1F	

Note: The HASSDAC units installed for a single section should not be either both Entry type or units installed should not be both Exit type for 2 D section. This may result in continuous configuration Error in the system. The Entry and Exit unit markings have been printed on the units for easy identification of the system. For avoiding wrong installation it is advised that the same serial no units should be installed for one section.

1.9 रीसेट की प्रक्रिया Resetting procedure

1.9.1 Common Resetting – When HASSDAC used for track circuiting at stations

The common resetting of both HASSDAC units is to be carried out when used for track circuiting such as platform lines, yard lines etc. The provision for LV proving is also provided for its use if required.

When both processing units fail simultaneously and successful resetting for both processing units is carried out by SM Reset, both PR Relays in VR box pick up which in

turn pick up PPR Relay in Relay Room. Corresponding to PPR, 'Prep. Reset' indication glow steady high and Reset Counter increments by One count in Reset Box.

Auto reset circuit is provided in the vital relay box. When one Processing unit is working normal and another one is in error, Reset Relay and auto reset circuit reset the processing unit in error after 12 seconds. Processing unit in error achieve preparatory state and clears after movement of one train into the section. After auto reset operation, only one PR relay picks up, and PPR relay is not picked up. Prep Reset indication does not glow and Reset counter does not increment in Reset box.

1.9.2 Independent Resetting – When HASSDAC used in Block Sections

The independent resetting of HASSDAC units at each station is to be carried out when used in block sections. Sometime it may be required to prove the SM's Key and Button and extend 24V for remote location for its use in railways circuit.

Auto reset circuit is provided in the vital relay box. One Processing unit is working normal and another one is in error, Logic Relay and auto reset circuit reset the processing unit in error after 12 seconds. Processing unit in error achieve preparatory state and clears after movement of one train into the section.

Both sides resetting operation is required with or without time gap in BPAC use. The procedure for resetting is as follows: -

(i) Insert SM's key, turn right and keep pressed.
(ii) Press Reset button for 3 to 5 secs
(iii) Preparatory LED starts flashing.
(iv) Release SM's Key and Reset Button
(v) Turn left, remove SM's key and keep in safe custody

With the above operation

- 48 V DC from reset box is extended to HASSDAC unit.
- This 48V DC activates the reset circuit in modem card (card 3 or 6) of HASSDAC unit.
- Reset command is generated in Dual MLB cards (Cards 4 & 10).
- The HASSDAC units are reset and counts become zero.
- The HASSDAC units attain the preparatory reset state.
- The PR & PPR relays pick up and Prep. Reset indication glows on the reset box in SM's room
- The reset counter reading increments by 1 count after a gap of 5 seconds.
- After one pilot train is passed in the section the system becomes normal.
- Vital Relay picks up at both stations

Note

(i) Resetting operation by both stations is required and is necessary in BPAC use.
(ii) Reset command to Micro-controllers will not be generated if system is in clear/preparatory/occupied state. System can be resetted if it is in error state or out counts were registered after occupied state.
(iii) If 48 V reset command is received for less than 2 seconds or more than 10 seconds, system will not reset. 5 seconds timer is provided in the reset box.

1.10 अनुरक्षण Maintenance

1.10.1 Recording of Signal levels

The various signal input and output levels and its limits which are to be recorded and adjusted to correct levels wherever necessary are given in following tables:

24 V DC Supply (Battery)

Measure the DC 24 V input to the system with charger ON, charger OFF condition with all the units connected (i.e. on load) or using dummy load.

S.No.	Input Range near HASSDAC unit (In DC Volts)	Actual measured value	
		With Charger ON	Charger OFF
1.	23 V to 28.8 V		

Note: Keep Charger OFF for 15 minutes before taking measurements.

Oscillator Output (TX Coils)

Measure the oscillator output, frequency of TX coil of Axle detectors.

S.No.	Parameter	Limit	TX coil 1 (21 KHz) Card 1	TX coil 2 (23 KHz) Card 2	TX coil 1 (21 KHz) Card 7 Optional	TX coil 2 (23 KHz) Card 8 Optional
1.	Oscillator output	30V to 40V rms				
2.	Oscillator frequency	(i) 20.80 to21.20 KHZ (ii) 22.80 to 23.20 KHz				

Receiver Coil Output

Measure the RX coil signal output with and without dummy wheel.

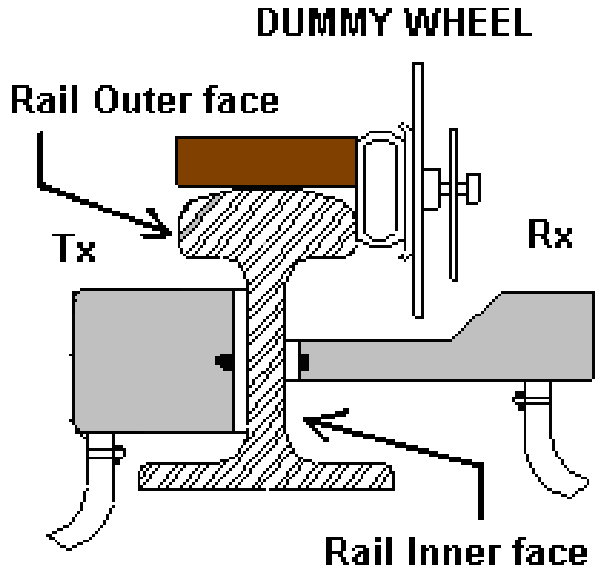


Fig 1.10 (i) : Dummy wheel setting = 44 mm for 90 R, 52 kg and 60- kg rails

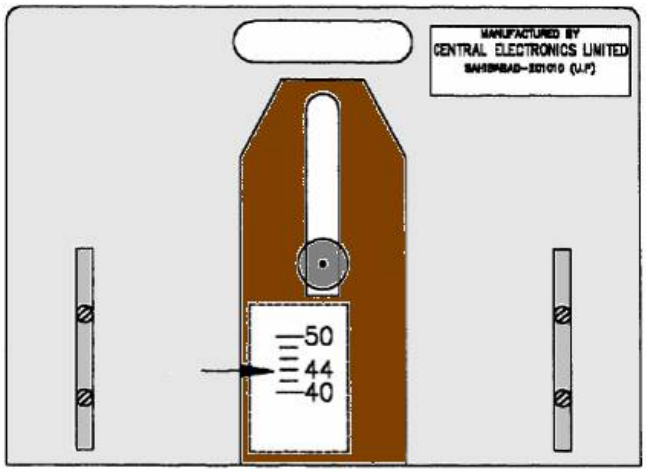


Fig. 1.10(ii): Adjustment of Receiver coil with the help of dummy wheel

S.No.	Parameter	Limit mVrms	Measured Value (Card 1 & 2)	Measured Value (Card 7 & 8) Optional
1.	RX Coil 1 (21 KHz)	275 - 600		
2.	RX Coil 2 (23 KHz)	275 - 600		

SCC Cards (Cards 1 & 2)

Measure the DC voltages at monitoring sockets of SCC cards 1 & 2 with respect to ground.



S. No.	Card	Measured output voltage (DC volts)					
		Without dummy wheel		With dummy wheel		With push trolley (4/8 spokes) on axle detectors	
		Limit	Meas-ured value	Limit	Meas-ured value	Limit	Meas-ured value
1.	SCC 1	2.0 to 2.5 V		<0.7		>1.7 V	
2.	SCC 2	2.0 to 2.5 V		<0.7		>1.7 V	

Fig 1.10 (iii).: Front view of SCC 1 Card

Modem Output (Card 3 & 9)

Check and record the modem signal output of SSDAC during normal working condition of the system.

S.No.	Measuring Limit (mV rms)	Measured Output for Card 3 (mV rms)	Measured Output for Card 9 (mV rms)
1.	>300 mV (-6 dB)		

Relay Drive (Card 5 & 11)

Check and record Relay drive output to the Vital Relay with section clear and section occupied condition. (This may be checked across R1 & R2 of relay coil in vital relay box).

S.No.	Parameter	Measuring Limit (DC volts)	Measured output for VR1 (DC volts)	Measured output for VR2 (DC volts)
1.	Clear mode	>20 V		
2.	Occupied mode	<2 V		

DC –DC Converter Card (Card 6 & 12)

Measure the DC –DC Converter output voltages with respect to respective ground for 24 V DC input fed to the HASSDAC.



S. No.	Parameter	Limit (DC Volts)	Measured output for Card 6 (DC Volts)	Measured output for Card 12 (DC Volts)
1.	5 V	4.75 to 5.25 V		
2.	12 V	11.50 to 12.50 V		
3.	24 V	23.50 to 24.50 V		
4.	15 V ISO	14.50 to 15.50 V		

Fig.1.10 (iv): Front view of DC-DC Converter

Note: *In HASSDAC DC-DC Converter card, there is provision that if any output voltage drops/exceeds predetermined level then the DC-DC Converter card shuts down. To restore it, switch OFF the "Power ON" switch for more than 10 seconds and then switch it ON.*

1.9.2 Maintenance Schedule (Monthly)

(i) Tx & Rx Coil Axle Detectors (At site)

- Measure the TX coil (21 KHz & 23 KHz) signal levels and record them. These measurements are to be tallied with the previous readings. These should be within the specified limits and should not change more than 10%.
- Measure the Rx coil (21 KHz & 23 KHz) signal levels and record them. These measurements are to be tallied with the previous readings. These should be within the specified limits and should not change more than 10%.
- Check the M12 Bolts & Nuts of web mounted TX & Rx coil Axle detectors. All the nuts should be in tight condition.
- Check and tighten the deflector plates if found loose.

(ii) HASSDAC Unit (At site)

- The 2.2V DC signal levels of card 1&2 of the HASSDAC Counting Units are measured and recorded. The level should be between 2.0 to 2.5V DC.
- DC-DC converter output voltages should be measured and recorded. The outputs measured should remain within the specified limits and match with the previous readings.
- The modem card output should be measured and recorded. The reading should match with the previous readings
- Check the relay driver output and it should be >20 V DC. This reading is recorded.
- Ensure that screws of modules are tight.
- Ensure that MS circular connectors are tight.

(iii) Power Supply (Battery Room & Site)

- The 24V DC power supply should be measured and recorded. The 24V DC should remain within specified limits.
- Inspect the battery charger and check its charging current and ensure it is properly charging the battery.
- Any interference with power supply and connections of HASSDAC is likely to cause failure.
- This should be done only after ensuring that no train is occupying or approaching the section.

(iv) Inspection of Reset Box (SM' s room)

- Monitor the reset box while the train is occupying the section. The occupied (red) LED should be glowing.
- When the train clears the section, the clear LED (green) glows.
- The Reset to the system is controlled through the key actuator & Reset button of reset box. This should not be disturbed.
- The LCD displays all the information regarding the system.
- Press Red button for more than 10 seconds keeping toggle switch at position 1 or 2 and release. LCD will display last 10 error codes of 1 or 2 processing unit.

(v) General

- Check all the cable connections on the CTboard of apparatus case at both locations.
- Ensure that these are in tight condition.
- Check the deflector plates of the Axle detectors are in normal position. If found loose this should be properly tightened.

(vi) Repair of Faulty Cards

- Before declaring any card is faulty, the fault should be analysed and confirmed.
- Repair of cards is a highly technical job and is not possible at site. Hence Railways should not carry it out. The card should be sent to CEL for repair.

1.11 त्रुटि निवारण Troubleshooting

1.11.1 LED Indications

The LED indications are provided on the facial plate i.e. on front side of different modules of HASSDAC viz. SCC cards, Dual MLB Cards, Modem Card, Relay Driver, DC-DC Converter and Event Logger to indicate OK or Error condition. These indications are helpful in the troubleshooting of DACF 710 P HASSDAC.

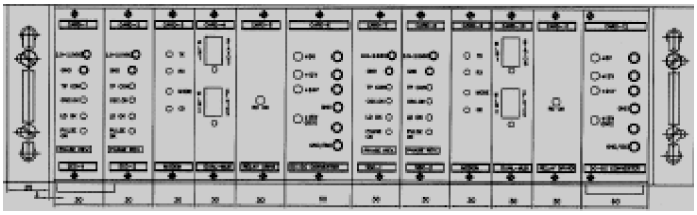


Fig. 1.11 (i) Front view of LED indications of HASSDAC module

SCC Cards

Sr. No.	LED	Colour	Information
1.	OSC OK	GREEN	ON when TX coil & Oscillator are working normally. OFF when these becomes faulty.
2.	LD OK	GREEN	ON when signal from RX coils are normal and above certain level, OFF when fault in RX coil or disconnection
3.	PULSE OK	GREEN	ON when signal from RX coil normal and pulse level in Card OK. OFF when RX coil faulty, wrongly connected or disconnected
4.	TP CON	GREEN	Permanently OFF as trolley suppression track circuit is not required in phase reversal type system.

Dual MLB Card

Sr. No.	LED	Colour	Information
1.	Two 8 LED BLOCK	All RED	Normally OFF, ON when error appears
2.	CLEAR	GREEN	ON for clear condition
3.	OCCUPIED	RED	ON for occupied condition

Modem Card

Sr. No.	LED	Colour	Information
1.	Tx	GREEN	Transmitting the signal when LED is flashing.
2.	RX	GREEN	Receiving the signal when LED is flashing
3.	MODE	GREEN	Normally OFF, Glows and again goes low when system is reset.
4.	CD	GREEN	Carrier is detected when LED is flashing

DC-DC Converter

Sr. No.	LED	Colour	Information
1.	+5V	GREEN	ON when +5V supply available
2.	+12V	GREEN	ON when +12V supply available
3.	+24V	GREEN	ON when +24V supply available
4.	+15V ISO	GREEN	ON when +15V ISO supply available

Relay Driver

Sr. No.	LED	Colour	Information
1.	RELAY DRV OK	GREEN	ON when section clear, OFF when section occupied

1.11.2 Troubleshooting through LED indications

The two MLB cards continuously check and monitor the health of the system. During normal working condition of the system, all the LEDs are OFF. When the system detects error, it will be displayed on these cards by means of flashing/glowing one or more LEDs for the particular error.

The errors occurring in the system during the operation of the HASSDAC are encoded and are indicated by means of Two 8 - LED blocks present on the front panel of the MLB cards. A glowing LED implies a 1 while OFF LED indicates a 0. All the LEDs are numbered as given below. DS1 to DS4 are designated for Least Significant Bits (LSB) and DS5 to DS8 are designated for High Significant Bits (HSB). The value given to each LED is given in Fig. 1.10 (ii) below:

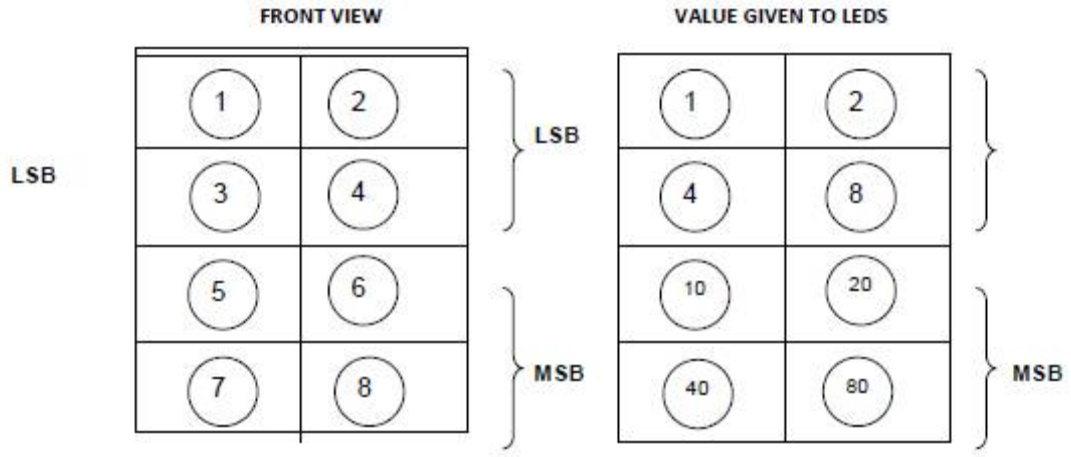


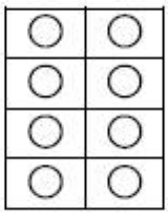
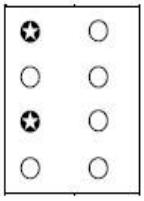
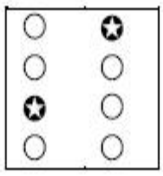
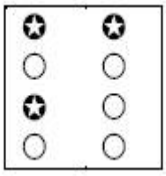
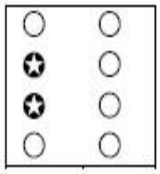
Fig. 1.11 (ii) Numbering of LED indications for errors (iii) Values given to each LED

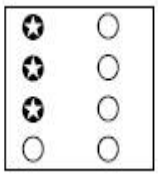
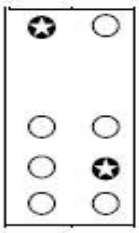
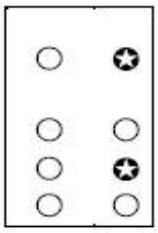
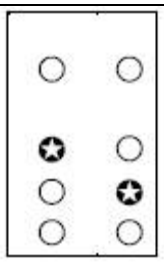
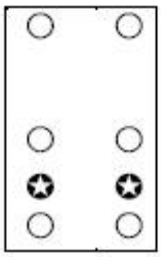
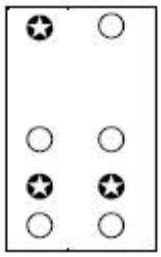
The Errors are given in Hexa decimal codes which can be read as given below:
Example
If LEDs 1 & 3 of LSB glow and LEDs 5 & 6 of HSB glow and all other LEDs are OFF. By adding LSB+HSB LED values, (1 + 4) + (10 + 20) = 35. Thus error no. is 35 i.e. negative count error.

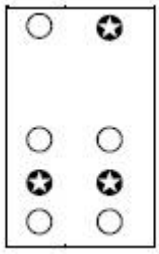
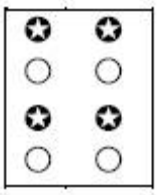
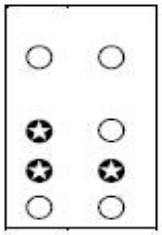
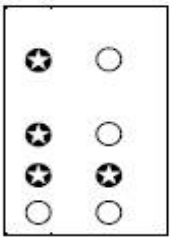
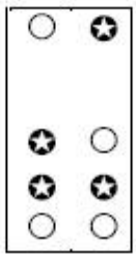
1.11.3 System Error Codes

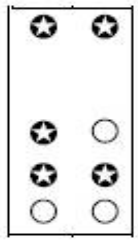
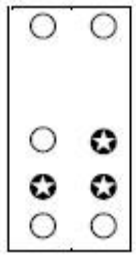
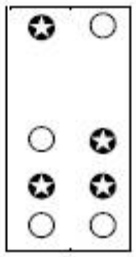
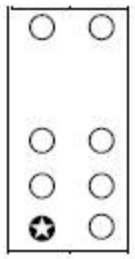
Details of error corresponding to the error no. and action to be taken can be seen from table below:

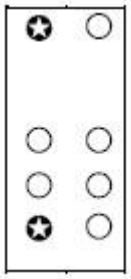
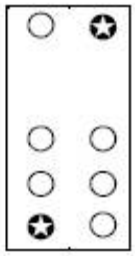
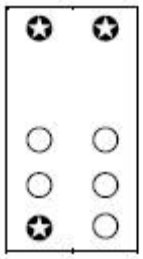
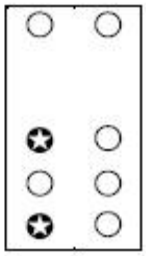
- ✪ Indicates LED is Flashing
- ● Indicates LED is ON
- ○ Indicates LED is Blank

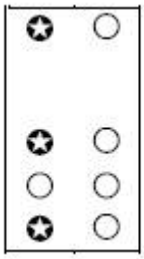
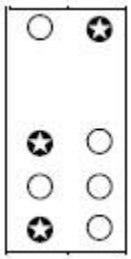
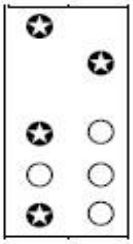
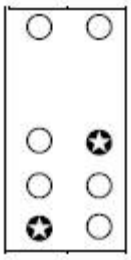
Sr No	Indications	Error No.(Hex Decimal)	Process/Error	Cause	Action to be taken
1.		00	No error	System Normal	No action to be taken
2.		11	ROM test during Power On Self Test	Memory of MLB card is corrupted.	Replace the microcontroller IC or MLB card.
3.		12	RAM test during Power On Self Test	Memory of MLB card is corrupted.	Replace the microcontroller IC or MLB card.
4.		13	Serial port test during Power On Self Test	On chip serial port is corrupted.	Replace the microcontroller IC or MLB card.
5.		14	Card presence test	Any card is removed or not inserted properly.	Insert all the cards properly or replace the MLB cards

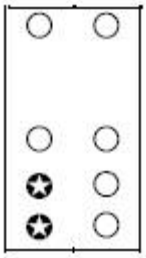
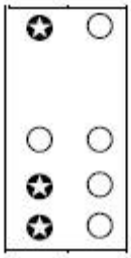
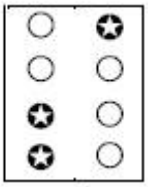
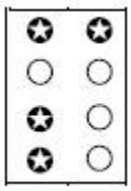
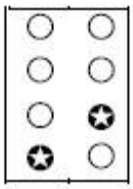
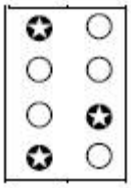
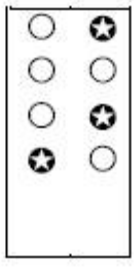
6.		15	Relay test during Power On Self Test	Relay and its connections are not proper	Check the presence of relay. Check the connections of relay. Make proper connections.
7.		21	ROM Test fail during system working	Memory of MLB card is corrupted.	Replace the microcontroller IC or MLB card.
8.		22	RAM Test fail during system working	Memory of MLB card is corrupted.	Replace the microcontroller IC or MLB card.
9.		24	Card presence test during system working	Any card is removed or not inserted properly.	Insert all the cards properly or replace the MLB cards
10.		30	Link error	Link between two SSDAC units is open or loss of Carrier Detect (CD).	Check the communication link between the units and rectify the fault.
11.		31	Sequence error	Sequence of pulse not correct when axle is detected on the sensor.	Check the arrangement of the detectors. It shall be at proper height from top of rail. Check card 1 & 2 and replace if necessary.

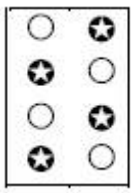
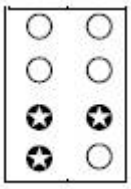
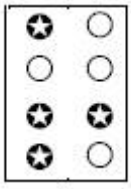
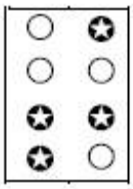
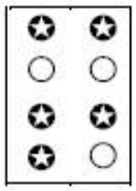
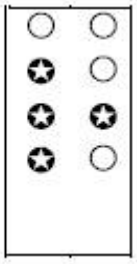
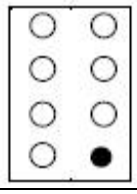
12.		32	Self count mismatch	Difference in counts of the two MLB cards in local unit after detection of all the axles passed over the axle detectors.	Reset the system. If error persists replace the MLB cards with the spare cards. Send the cards for repair.
13.		33	IN/OUT error	The number of axles going OUT of the section is more than coming INTO the section. This error is also displayed after reset is applied and while the system is trying to synchronize, there is train movement in the section.	Check the system for error and apply reset to normalize the system.
14.		34	OUT before IN error	The system is in preparatory state and train exits from the section without entering into the section.	Check the axle detectors A. Check SCC1 card & replace if found faulty.
15.		35	Negative count error	Counts OUT of the section are more than the counts INTO the section.	Check signals dip at both locations in single line section. Check signals dip and coil position at entry end in double line block section. Check DC voltage in SCC 1 & 2 cards.
16.		36	Shunt error	Train moving forward & backwards (shunting) on axle detectors without proper direction influencing only external detector twice without affecting internal detector.	Station master has to apply reset after section is verified as per SWR. Movement of pilot train in the section makes system clear.

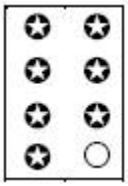
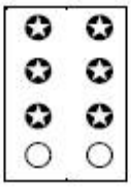
17.		37	Supervisory error	Any of the axle detector signals becomes low.	Check the Tx & Rx signal level of the axle detectors. It should be as per the recorded readings. Check the SCC 1 & 2 card DC voltages. Adjust or replace if any of the above is not OK.
18.		38	Internal shunt error	When train is moving forward & backwards (shunting) on axle detectors without proper direction in such a way that both detectors are influenced and internal detector is influenced twice.	Station master has to apply reset after section is verified as per SWR. Movement of pilot train in the section makes system clear.
19.		39	Count unequal error	Mismatch of counts by both MLB cards.	If the error is continuously displayed, replace the MLB cards.
20.		40	Communication error	Communication between the two units is not proper i.e. packet information is corrupted due to noise in the Quad Pair used.	Check the pair used for the communication. Check that no parallel wires are used for modem communication. Check that correct Quad pair is used for communication. If problem persists, replace the spare pair.

21.		41	CRC error	Data of the packets got corrupted thereby CRC of the packet not matching.	Check the pair used for communication. Check that no parallel wires are used for modem communication. Check the correct Quad pair is used for communication. If problem persists replace the spare pair or improve the earthing to the unit.
22.		42	EOB error	Data of the packets got corrupted thereby End of packet information is not detected.	Check link between the two units. Check the modem cards and apply reset in the system.
23.		43	Wheel shunt error	Sequence of pulses from the axle detectors and SCC cards is disturbed	Check whether the position of axle detectors is OK and correct. Check for failure due to motor trolley, perforated push trolley, dip lorry, etc and apply reset in the system.
24.		44	Independent pulses error	If the wheel is moved in such a way that independent pulses are generated by system in *FORWARD* direction. This happens only if motor trolley wheel that are similar in diameter is moved beyond the permissible limit.	Check whether the position of axle detectors is OK and correct. Check for failure due to motor trolley, perforated push trolley, dip lorry, etc and apply reset in the system

25.		45	Independent pulses error	If the wheel is moved in such a way that independent pulses are generated by system in *REVERSE* direction. This happens only if motor trolley wheel that are similar in diameter is moved beyond the permissible limit.	Check whether the position of axle detectors is OK and correct. Check for failure due to motor trolley, perforated push trolley, dip lorry, etc and apply reset in the system.
26.		46	Exit mismatch error	The section occupancy and section clearance by different type of wheel i.e. section is occupied by train but clears by motor trolley wheel and vice versa.	Reset the system.
27.		47	Train trolley mismatch error	Following Motor trolley shunts back or if only train entered the section and crossed exit and leaving two counts, now motor trolley leaves section balancing counts.	Reset the system.
28.		48	Non overlap pulses before overlap pulses error	If motor trolley enters the section and after that train enters the section	Reset the system

29.		50	Relay removed (physically from plug board)	During power on self test (POST) of the system the presence of relay is not detected.	Check the presence of Vital relay in the relay box of the system & insert in the plug board.
30.		51	Relay contacts failure in occupied state	When section is occupied and the back contact of the vital relay is found open.	Check the back contacts (D5 & D6) of the vital relay used for read back in the system & rectify.
31.		52	Relay contacts failure in unoccupied state (clear)	When section is clear after passage of train but front contact of vital relay is found open.	Check the pick up contacts of the vital relay and rectify or replace the relay.
32.		53	Relay drop failure in occupied state	The system after detection of train in the section goes to OCCUPIED state but vital relay fails to drop	Check the back contacts of the relay and rectify or replace the relay.
33.		60	Tracing error	Both MLBs work in tandem and software follow a particular sequence, but any sequence is missed.	Replace the MLB card which is displaying the error.
34.		61	Secondary CPU error	If MLB1 detects that the adjacent MLB2 is in different state or vice versa.	Apply reset to normalise the system
35.		62	Secondary CPU fails	When MLB card detects the adjacent MLB card is faulty.	The adjacent MLB card is faulty. Replace the adjacent MLB card with spare card.

36.		66	Watchdog Reset	Power supply is interrupted thereby DC-DC converter voltages are also interrupted in the system.	Check the power supply to the system and rectify.
37.		70	Configuration error during self test	The unit address of any unit is disturbed or both units have the same address.	Check and install the Entry and Exit Units with correct address setting in the section.
38.		71	J packet configuration error	The unit address of any unit is disturbed or both units have the same address.	Check and install the Entry and Exit Units with correct address setting in the section.
39.		72	R packet configuration error	The unit address of any unit is disturbed or both units have the same address.	Check and install the Entry and Exit Units with correct address setting in the section.
40.		73	Configuration error during normal working	The address of unit is disturbed/changed while the system is running.	Rectify the unit address as per the factory setting. Reset is applied.
41.		74	U packet configuration error	The unit address of any unit is disturbed or both units have the same address.	Check and install the Entry and Exit Units with correct address setting in the section.
42.		80	Remote error	The remote unit is in error state. The local unit is OK	Check the errors in remote unit and rectify.

43.		7F	Remote Reset error	The remote unit has been reset.	Apply reset in the local unit or else apply reset in both HASSDAC units.
44.		3F	Self Reset error	The local unit is reset and is waiting for remote unit to be reset.	Remote unit is to be reset or else both HASSDAC units are to be reset.

Other type of errors

Sr. No.	Condition	Error No.	System status	Action required
1.	Entry counts are more than Exit counts	No Error	Vital relays are dropped. System may fail for each train movement.	1. Check Exit end axle detectors and align them properly. 2. Check SCC1 & 2 cards and its output

1.12 क्या करें व् क्या न करें Do's & Don'ts

1.12.1 Do's

- The inter connection drawings are to be followed for connecting the Transmitter & Receiver coils. Tx1 is 21 KHz, Tx2 is 23 KHz & Rx1 and Rx2 coils are 21 KHz & 23 KHz, respectively.
- Ensure that Receiver and Transmitter coil cables have been laid in different pipes.
- Ensure that both the TX coils & Rx coils are having proper alignment on Rail.
- While fixing axle detectors, ensure that the direction of bolts of extreme ends is different from that of bolt in the centre.
- Use 3 Nos. of check nuts of size M12 to tighten the axle detectors.
- Make sure to keep hose pipes attached to Tx and Rx coils housings in curve and not to be pressed in the ballast. This curve will help in reducing the tension or damage to housing during vibration.

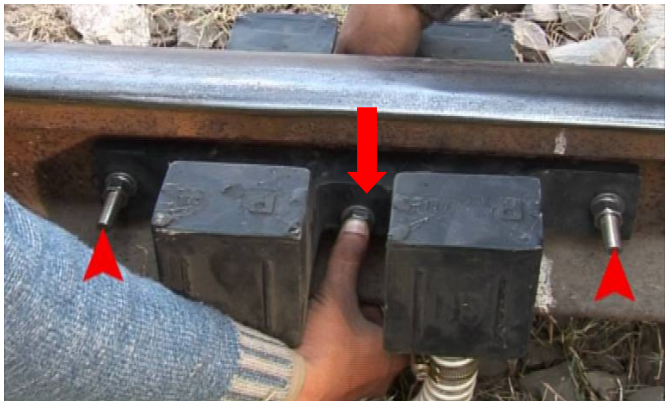


Fig.1.12(i): Insertion of fixing bolts

- Ensure that packing of sleepers with ballast on both sides of Axle detector is proper.
- Check that metal sheaths of the outdoor cable are connected to earth at both ends
- Cut the unused pair of quad cable in such way that none of the conductors remains exposed.
- The recommended cables for wiring of the system at site should be used.
- The steady Battery voltage 24V should be maintained.

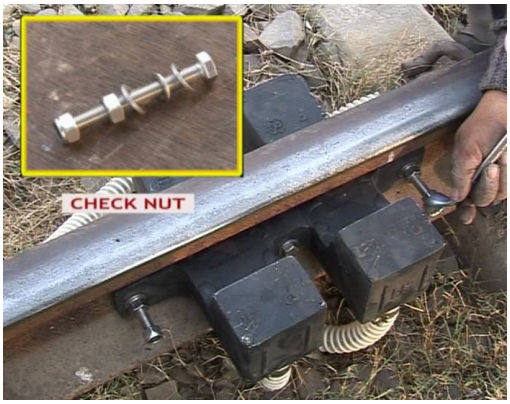


Fig.1.12 (ii): Provision of check nuts

- The cable connections should not be connected loosely.
- Ensure that all the M.S couplers of HSSDAC are properly tightened.
- Ensure that the relays supplied along with VR box are used and they are fixed properly and retaining clips are used.
- Ensure that the transparent acrylic sheet on front of VR box is properly tightened with screws provided.
- The HASSDAC & Reset box is provided with sealing arrangement. They should be sealed at site.
- Resetting should be done only after ensuring that there is no train in the section

1.12.2 Don'ts

- Don’t install the Axle detectors near the rail joint (should be more than 6 sleepers away).
- Don’t install the Axle detectors where the rail is badly worn out.
- Don’t cut or join the Transmitter / Receiver cables supplied along with the coil. It would result in change of frequency of signal.
- Don’t lay the TX and RX coil cables in the same pipe.
- Don’t use any other outdoor cable other than the recommended cables.
- Avoid spiralling of conductor at the terminal.
- Avoid installing the Axle detectors on curve of rail / too much slope of rail to the possible extent.
- Don’t install rail deflectors higher than rail top.
- Don’t remove the cards from HASSDAC units under power ON condition of system.
- Remove card if necessary after Switching OFF the power to the unit.

1.13 संक्षिप्त शब्दावली Abbreviations

AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
AH	Ampere Hour
AL	Aluminium
CEL	Central Electronics Limited
DACF 710 A	CEL Single Section Digital Axle Counter Amplitude Modulation type
DACF 710 P	CEL Single Section Digital Axle Counter Phase Reversal type
DACF 720P	CEL High Availability Single Section Digital Axle Counter Phase Reversal type
dB	Decibel
DC	Direct Current
DIP	Dual In line Packaged
D/L	Double Line
DN	Down
HASSDAC	High Availability Single Section Digital Axle Counter
HDPE	High Density Poly Ethylene
IPS	Integrated Power Supply
ISO	Isolated
Kg	Kilogram
KHz	Kilo Hertz
LCD	Liquid Crystal Diode
LED	Light Emitting Diode
MLB	Micro Controller Logic Block
mm	Milli meter
MS	Mild Steel
mV	Milli Volt
NFTC	Natural Fibre Thermoset Composite
PR	Preparatory Relay
PPR	Repeater Relay for Preparatory Relay
QN1	Style Q relay
RDSO	Research Designs & Standards Organisation
Rx	Receiver
SCC	Signal Conditioning Card
S/L	Single Line
SM	Station master
SSDAC	Single Section Digital Axle Counter
SVPD	Surge Voltage Protection Device
Tx	Transmitter
VR	Vital Relay
VPR	Proving Relay for Vital Relay
V	Volt

1.14 सन्दर्भ References

- Specification No.: RDSO/SPN/177/2012 Version 3
- M/s CEL Installation manual- High Availability Single Section Digital Axle Counter DACF 720 P Phase Reversal Type

1.15 एस एस डी ए सी/ एच ए एस एस डी ए सी हेतु मेन्टेनेन्स लॉग शीट

Maintenance log sheet for SSDAC/HASSDAC
(Applicable for both Entry and Exit end)

Sr. No.		Battery (24 V)	TX1 V rms /freq	TX2 V rms /freq	RX1 V rms /freq	RX2 V rms /freq	Modem Tx Level (Card 6) AC Vrms	SCC1 (Card 1) DC Volts		SCC2 (Card 2) DC Volts		With Push Trolley on axle detectors (4 spokes / 8 spokes		DC – DC Converter			
														DC Volts			
														5V	12V	24V	15V ISO
								Red & Black Socket		Red & Black Socket		Red & Black Socket		Monitoring sockets on card 8			
								Normal	Dummy wheel	Normal	Dummy wheel	SCC1	SCC2				
Test Point		TS1 1& 5	TS4 1&2	TS4 3&4	TS4 5&6	TS4 7 & 8	TS2 7&8										
Limit For Phase	DATE	23 to 28.8V	30 to 40 V 20.8 to 21.2 KHz	30 V to 40V 22.8 to 23.2 KHz	275 to 600 mV	275 to 600mV	> 400 mv (-6 dB) (approx.) When other end field unit switched off’	2.0 to 2.5 V	< 0.7 V	2.0 to 2.5 V	< 0.7 V	> 1.7 V DC	> 1.7 V DC	4.75 to 5.25V	11.50 to 12.50 V	23.50 to 24.50 V	14.50 to 15.50 V
Limit For AM					750 to 1200 mV	750 to 1200 mV											

गुणवत्ता नीति

रेलों में यात्री और माल यातायात की बढ़ती मांग को पूरा करने के लिए गुणवत्ता प्रबंध प्रणाली में अनुसंधान, डिजाइनों और मानकों में उत्कृष्टता तथा सतत सुधारों के माध्यम से सांविधिक और नियामक अपेक्षाओं को पूरा करते हुए सुरक्षित, आधुनिक और किफायती रेल प्रौद्योगिकी का विकास करना ।

Quality Policy

To develop safe, modern and cost effective Railway technology complying with Statutory and Regulatory requirements, through excellence in Research, Designs & Standards and Continual improvements in Quality Management System to cater to growing demand of passenger and freight traffic on the Railways.



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