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सत्यमेव जयते

भारत सरकार, रेलमंत्रालय,
अनुसंधान अभिकल्प और मानक संगठन,
लखनऊ–226011

Government of India - Ministry of Railways
Research Designs & Standards Organisation
LUCKNOW – 226011

अभिमान से RDSO रेल अग्रदूत Transforming Railways

No.: RDSO-SIG0MDAC(CEL)/1/2020

Date: As signed
By E-mail

M/s CENTRAL ELECTRONICS LIMITED-GHAZIABAD
781, Desh Bandhu Gupta Road, Karol Bagh,
Delhi - 110005, India

(E-mail: piyushsinghal@celindia.co.in, darpan@celindia.co.in & spdmktg@celindia.co.in)

Sub/विषय:	Pre-Commissioning Check List for Multi-Section Digital Axle Counter (Ver.: D01S001H01) of M/s Central Electronics Limited, Sahibabad as per RSDO specification No. RDSO/SPN/176/2013 Ver. 3.0.
Ref/ संदर्भ:	1. This office letter no. RDSO-SIG0MDAC(CEL)/1/2020 dtd. 12.02.2025. 2. Firm's letter No. CEL/SPD/R&D/RDSO dtd. 11.03.2025 & 18.03.2025.

With reference to above referred letters, Pre-Commissioning Check List (SIG 0615 Ver. 0) for Multi-Section Digital Axle Counter (Ver.: D01S001H01) of M/s Central Electronics Limited, Sahibabad as per RSDO specification No. RDSO/SPN/176/2013, Ver. 3.0 is revised to include the SPD scheme for MSDAC system and Technical Advisory Note No.-STS/E/TAN/7010 dated: 20.11.2024 (Annexure-III) with minor corrections/additions/deletions. The revised PCCL No. SIG 0615 Ver. 1.0 is being issued herewith for your kind information & further necessary action please.

DA: As above

20/3/25

(Triambak Tiwari)
Director/signal –II
For Director General/S&T

Copy to: All PCSTEs, Indian Railways.
(Through E-mail)

सत्यमेव जयते

RESEARCH DESIGNS AND STANDARDS ORGANISATION

MANAK NAGAR, LUCKNOW

SIGNAL DIRECTORATE

Pre-commissioning checklist for Multi Section Digital Axle Counter MSDAC of M/s Central Electronics Ltd, Sahibabad

S.N.	Date of amendment	MSDAC Version	Page No.	Version	Reasons for amendment
1.	05.09.2013	D01S001H01	17 pages	0	First Issue
2.	20.03.2025	D01S001H01	23 pages	6	Addition of SPD in page no. 4, 5, 7 & 8, minor corrections/additions/deletions at page no. 1, 3, 4, 5, 11 – 17, 18, 19 & 23 according to the firm's request and Compendium TAN No. STS/E/TAN/7010 Ver. 1.0 dated 20.11.2024.

Authors

Name & Signature	Function	Level	Signature
Ranjeet Singh (SSE (D)/S&T)	Member	Prepared	
A.K. Srivastava(ADE/Sig/VI)	Member	Checked	20/03/2025
Triambak Tiwari (Director/Sig-II)	Member	Issued	20/3/25

Approved by: Shri Suresh Kumar (PED/S&T)

Inspected by: Name & Signature of Railway Representative	Tested by: Name & Signature of firm's Representative

Pre-commissioning check list for Multi Section Digital Axle Counter
MSDAC [DACF 730-8D/16D/24D/32D/40D]
(As per RDSO/SPN/176/2005 Ver. 2.0)

0. General Information

Station/Yard Name:	
Section:	
Division/Zonal Railway:	
Contact Details of Railways in Site:	
Contact Details of Railway at HQ/Division:	
Total Nos. of Detections & Section:	
Total Nos. of Central Evaluators :	
Name & Address of manufacturer/Supplier:	
Serial No of Equipment:	
Contract No:	
Date of Pre-commissioning Inspection:	

Note:

1 The system should be installed and commissioned by authorized technical staff of M/s. Central Electronics Limited only.
2 The installation practices should be strictly adhered to and checked before commissioning, covering all points in the following documentation.
3 OEM shall certify that verification of system installation has been completed by representative authorized by OEM and all necessary arrangements meet the required standards of engineering for trouble free working of installed system, as per **Annexure-VI**.

1) Location (outdoor):

Sl. No.	Item	Required	Observed	OK /Not OK
1.1	Sl. No. of Field Units of MSDAC	Should have serial no's on the back plate		
1.2	Placement of Cards	Should be in order		
1.3	Placement of Modules	Should be tight		
1.4	MS Couplers	Installed and tightened properly		
1.5	MS coupler cables	Wired properly as per color code		
1.6	Wiring of TX/Rx coils & MS coupler cables	Wired on WAGO/Phoenix Disconnect Type Spring Type Connectors		
1.7	Earthing of Field units	Should be provided firmly through copper strips or other standard copper cable. Value $\leq$ 1 Ohms		
1.8	Fixing of Field unit	Firmly fixed using clamp		
1.9	Condition of Rail	Should be within vertical limit of worn out. (60 Kg - 13 mm, 52 Kg - 8 mm, 90R – 5 mm.)		
1.10	Marking of holes on rail	The marking should be done by using CEL marking Jig		
1.11	Drilling of holes in the web of rail	a. Should be of 14mm diameter b. Should be square (perpendicular), c. Should not be oblong.		
1.12	Torque applied to fix track device using Torque wrench	Jaicom make JPR65 or equivalent – 88Nm		
1.13	Fixing of TX	Outside the rail		
1.14	Fixing of Rx	Inside the rail		
1.15	Fixing of axle detectors	On the same rail		
1.16	Laying of axle detector cable	In corrugated/HDPE pipe		
1.17	Screen of axle detector cable	Should be earthed		
1.18	Fixing of deflector plates	Should be proper		
1.19	Insulation of QUAD cable	Should be >= 10 M ohm		
1.20	Dressing of Quad Pair	To be properly dressed with insulated tape		
1.21	Length of quad cable	As measured.		
1.22	Clamp type track device (installed as per CEL installation manual)	Torque Required: M10 Bolt Torque - 50 Nm M20 Bolt Torque – 140Nm		

1.23	Unused Quad Pair	To be terminated on terminals. **Annexure-I** for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure -III**		
1.24	Training	It should be installed & commissioned by personnel trained by the manufacturer. Rly personnel shall be trained before commissioning.		
1.25	Power supply for axle counter	Charger should be fit for axle counter use. There should not be any other load to the power supply except axle counter.		
1.26	Address of Field Unit	Address of field unit for one-track section shall be as per the configuration finalized by Railways.		
1.27	Embossing on rail	Should not be covered by Track device		
1.28	Height of deflector	Should not be higher than the rail top		

1.28 SPD used in outdoor equipment

SN	Description	Make	Quantity	Remark (OK/Not OK)
1	SPD	CEL or Phoenix or OBO or CITEL or any other reputed make	1 number / DP	

2) Indoor Relay Room (Power Supply & CT Rack)

Sl. No.	Item	Required	Observed	OK/Not OK
2.1	Power Supply	Power supply should be suitable for use with axle counter system. (b) There should not be any other load on the power supply except the axle counter system.		
2.2	Cable	Minimum 6 mm^2 multi-strand copper cable or 25 mm^2 multi-strand Aluminum cable must be used for the power supply.		
2.3	Rating of main indoor fuse	• Fuse ~~2A~~ 6A rating to be used for Central Evaluator. • Fuse 2 A rating to be used for SM panel		
3.4	Voltage available at the Central Evaluator keeping battery charger off for 15minutes	Should not go below 22V.		
3.5	Input voltage at the Trackside connection box keeping the charger off for 15 minutes	Should not go below 50VDC.		
2.6	Ripple content of power supply	Should not exceed 50 mV rms.		
2.7	Terminal blocks between evaluator &CT Rack	Wago/Phoenix make cage clamp type terminals to be used.		
2.8	Cable from the evaluator to the CT Rack	4-core, 24 x 2 twisted, shielded cable to be used.		
2.9	Earthing	Connected to earth properly		

2.10	Diode across VPR & PPR relays	Should be provided with BY127/1N4007/1N5408		

2.11 SPD used in indoor equipment

SN	Description	Make	Quantity	Remark (OK/Not OK)
1	SPD	CEL or Phoenix or OBO or CITEL or any other reputed make	2 + (1 number /DP)	

3) Reset Box Location

Sl. No.	Item	Required	Observed	OK /Not OK
3.1	Reset Box wiring	The Data cable from Central Evaluator to SM Panel should be twisted and shielded.		
3.2	Power Supply	Input to SM's Panel should not increase more than 29V DC		
3.3	Terminal blocks between evaluator &SM's Panel	Wago/Phoenix make cage clamp type terminals to be used.		
3.4	Reset Box Earthing.	Connected to earth properly.		
3.5	Reset function	Reset not possible when Axle Counter section is clear and healthy. Reset not possible when Axle counter section is in Preparatory reset mode.		
3.6	Ripple content of power supply	Should not exceed 50 mV rms.		

4) Centralised DC-DC Converter (24V to 96V DC supply to Field Unit)

Sl. No.	Item	Required	Observed	OK /Not OK
4.1	Input voltage with Charger ON	22 V to 30 v DC		
4.2	Input voltage with Charger OFF.(Keep charger OFF for 15 minutes before reading)	22 V to 30 v DC		
4.3	96V DC Voltage output for each channel at CT Rack	Should be in range of 94V to 98V DC.		
4.4	Earthing.	Connected to earth properly.		
4.5	Cable	4-core twisted and shielded cable to be used from terminal to PDCU		
4.6	Connections	Minimum 4 DC to DC converter channels to be used		

5) OSCILLATOR OUTPUT (TX Coils)

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

Sl. No.	Item	Required	Observed	OK /Not OK
5.1	TX 1	30V to 40Vrms, 20.80 to 21.20 KHz		
5.2	TX 2	30V to 40Vrms, 22.80 to 23.20 KHz		

6) RECEIVER COIL OUTPUT

Measure the Rx coil signal output when it is not influenced by any wheel / dummy wheel.

Sl. No.	Item	Required	Observed	OK /Not OK
6.1	Rx 1	275 to 600 mV rms		
6.2	Rx 2	275 to 600 mV rms		

7) SCC CARDS (CARD 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)						OK / Not OK
		Without dummy wheel		With dummy wheel		With push trolley (4/8 spokes) on axle detectors		
		Limit	Measured Value	Limit	Measured Value	Limit	Measured Value	
7.1	SCC 1	2.0 to 2.5V		< 0.7V		> 1.7 V		
7.2	SCC 2	2.0 to 2.5V		< 0.7V		> 1.7 V		

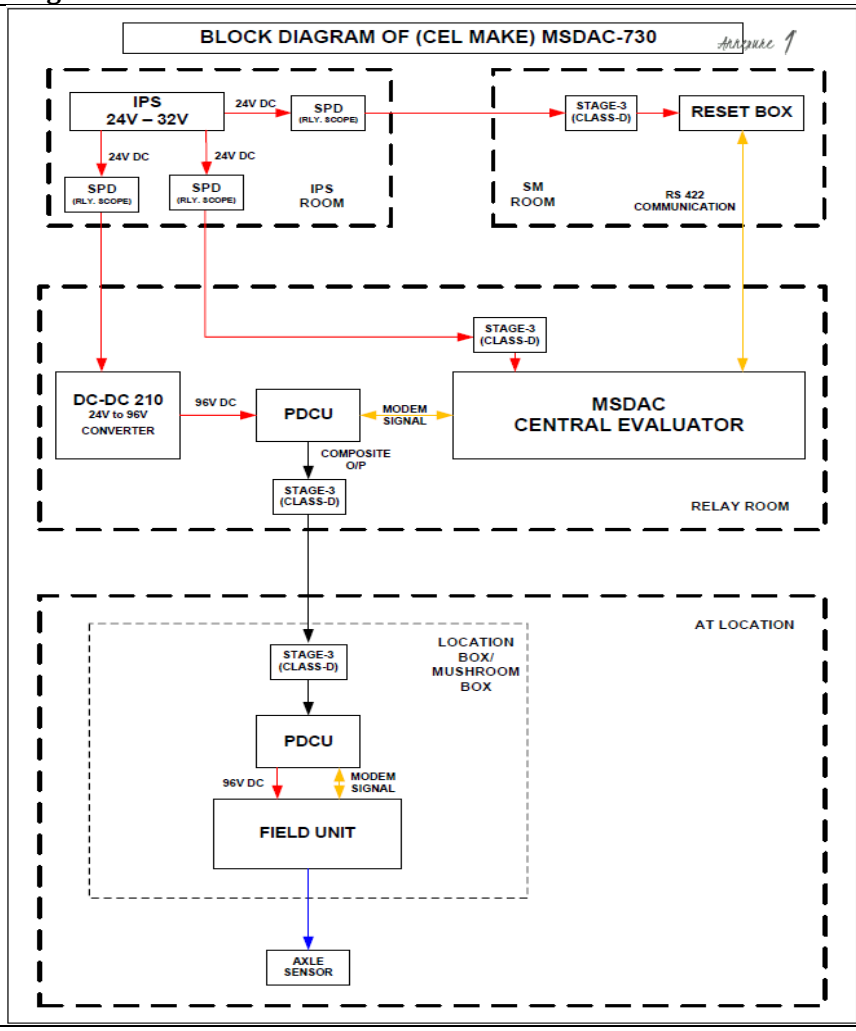
Note:- The observations for remaining field unit is to be recorded on the recording sheet kept in the location box

8.0 COMMISSIONING

8.1 Commissioning Log sheet of MSDAC model**: DACF 730-8D/16D/24D/32D/40D, version: D01S001H01**

Item No.	Item Description	Part No(Please Tick whichever is applicable)	Version No.	Remarks (Ok/Not OK)
1	Axle Detector - TX Coil	**AD-711**	D02 H02	
2	Axle Detector -RX Coil	**AD-711**	D02 H02	
3	Digital Axle Counter Field unit	**FU 220**	D01 S001 H01	
4	Power Data Coupling Unit	**PDCU-230**	D01 H02	
5	Central Evaluator	**CE-501-8D/16D/24D/32D/40D**	D01 S001 H01	
6	MSDAC Rack	**MSDAC-730-8D/16D/24D/32D/40D**	D01 H01	
7	SM's Reset Panel	**RP-601-8D/16D/24D/32D/40D**	D01 S001 H01	
8	Line Verification Unit	**LV-261**	D01 H01	
9	Centralised DC to DC converter	**DC-210**	D01 H01	

8.2 Provision of SPD has been done as per the following schematic diagram:-

Diagram	Remarks (Ok/Not OK)
	

8.3 Details of SPDs used:-

8.3.1 Details of SPDs used with central evaluator:

SN	Make and model of SPD	Type of SPD	No. of used SPD	Remarks
1.	CEL	Class D	2 + (1 number / DP)	

8.3.2 Details of SPDs used with reset box:

SN	Make and model of SPD	Type of SPD	No. of used SPD	Remarks
1.	CEL	Class D	1	

8.3.3 Details of SPDs used in communication line and power line:

SN	Make and model of SPD	Type of SPD	No. of used SPD	Remarks
1.	CEL	Class D	4	

8.3.4 Details of SPDs used in Location box/Mashroom box:

SN	Make and model of SPD	Type of SPD	No. of used SPD	Remarks
1.	CEL	Class D	1	

8.4

Sl. No.	**Item**	**Required**	**Measured / Observed**	**Remarks (OK/Not OK)**
1	Commissioning	System should be installed & commissioned by persons trained by the manufacturer.		
2	Training	Railway personnel should be trained before commissioning.		
3	Verification of working	After complying to all items as per pre-commissioning checklist, system to be monitored for 72 hours for trouble free operation before commissioning. During this period, effect of various trolley wheels used in the section should be checked as per Annexure V		
4	Configuration	The configuration report should be attached along with this document signed by CEL and by railways.		
5	Checksum of the Configuration	The checksum of the configuration may be noted and recorded		
6	Checksum of the Software	Checksum of the Central Evaluator to be displayed on PC or Monitoring unit		
7	Record the reset Box Counter reading at the time of Commissioning for each track section.			

Annexure- I

Precautions to be taken care during the wiring/connections are to be done at the time of commissioning of SSDAC/MSDAC/BPAC/SSBPAC (D)

Position of One Quad in Quad cable:

White
(A)
X

Red
(C) X

Grey
X (D)

X
(B)
Quad color

1st pair = White & Quad colour i.e A & B Wires

2nd pair= Red & Grey colour i.e C & D Wires of designated colour of Quad.

Each Quad is binded by the respective Quad colour binder

Table-1

Colour scheme of PE insulated Quads							
Quad Colour							
	Quad No	**Pair No.**	**A - Wire**	**B -Wire**	**Pair No.**	**C- Wire**	**D - Wire**
Orange	1	1A	White	Orange	1B	Red	Grey
Blue	2	2A	White	Blue	2B	Red	Grey
Brown	3	3A	White	Brown	3B	Red	Grey
Green	4	4A	White	Green	4B	Red	Grey
Yellow	5	5A	White	Yellow	5B	Red	Grey
Black	6	6A	White	Black	6B	Red	Grey

Precautions to be taken for using QUAD Cable:

- Designated pair of wire of the same quad (mentioned in Table -1) should be used.
- Do not use one wire from one quad and another wire from some other quad.
- If any wire of a pair of the quad is broken/Non functional, then use fresh pair of wire.
- Do not parallel wires of quad cable.

Annexure-II

TEMPERATURE CORRECTION FACTOR FOR CONDUCTOR RESISTANCE FOR ANNEALED HIGH CONDUCTIVITY COPPER

Temp. Deg C 1.	Corre. factor 2.	Temp. deg C 1.	Corre. Factor 2.	Temp deg C 1.	Corre. factor 2.	Temp. deg C 1.	Corre. factor 2.	Temp. deg C 1.	Corre. Factor 2
5.	1.0638	17	1.0122	29	0.9653	41	0.9225	53	0.8834
5.5	1.0618	17.5	1.0101	29.5	0.9634	41.5	0.9208	53.5	0.8818
6.	1.0593	18	1.0081	30	0.9615	42	0.9191	54	0.8803
6.5	1.0571	18.5	1.0060	30.5	0.9597	42.5	0.9174	54.5	0.8787
7.	1.0549	19.	1.0040	31.	0.9579	43.	0.9158	55.	0.8772
7.5	1.0526	19.5	1.0020	31.5	0.9560	43.5	0.9141	55.5	0.8757
8.	1.0504	20.	1.0000	32.	0.9542	44..	0.9124	56.	0.8741
8.5	1.0482	20.5	0.9980	32.5	0.9524	44.5	0.9107	56.5	0.8726
9.	1.0460	21.	0.9960	33.	0.9506	45.	0.9091	57.	0.8711
9.5	1.0438	21.5	0.9940	33.5	0.9488	45.5	0.9074	57.5	0.8696
10.	1.0417	22.	0.9920	34.	0.9470	46.	0.9058	58.	0.8681
10.5	1.0395	22.5	0.9900	34.5	0.9452	46.5	0.9048	58.5	0.8667
11.	1.0373	23.	0.9881	35.	0.9434	47.	0.9025	59.	0.8651
11.5	1.0352	23.5	0.9862	35.5	0.9416	47.5	0.9009	59.5	0.8636
12.	1.0331	24.	0.9843	36.	0.9398	48.	0.8993	60.	0.8621
12.5	1.0309	24.5	0.9823	36.5	0.9380	48.5	0.8977	60.5	0.8606
13.	1.0288	25.	0.9804	37.	0.9363	49.	0.8961	61.	0.8591
13.5	1.0267	25.5	0.9785	37.5	0.9346	49.5	0.8945	61.5	0.8576
14.	1.0246	26.	0.9766	38.	0.9328	50.	0.8929	62.	0.8562
14.5	1.0223	26.5	0.9747	38.5	0.9311	50.5	0.8913	62.5	0.8547
15.	1.0204	27.	0.9728	39.	0.9294	51.	0.8897	63.	0.8532
15.5	1.0183	27.5	0.9709	39.5	0.9276	51.5	0.8881	63.5	0.8518
16.	1.0163	28.	0.9690	40.	0.9259	52.	0.8863	64.	0.8503
16.5	1.0142	28.5	0.9671	40.5	0.9242	52.5	0.8850	64.5	0.8489

Annexure – III

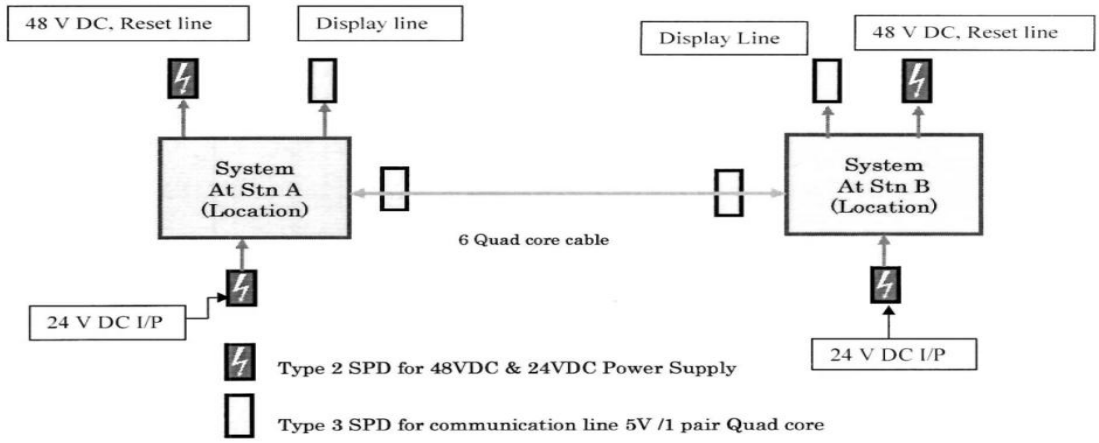
Compliance of Technical advisory Note no.STS/E/TAN/7010 Ver. 1.0 or latest which is reproduced below has been ensured during installation and commissioning of SSDAC/HASSDAC**:**

Technical Advisory Note- Compendium of Axle counter TANs			
Subject	Guidelines and precautions of installation of Digital Axle Counter		
Document Number	STS/E/TAN/7010	Version	1.0
Dated	20.11.2024		

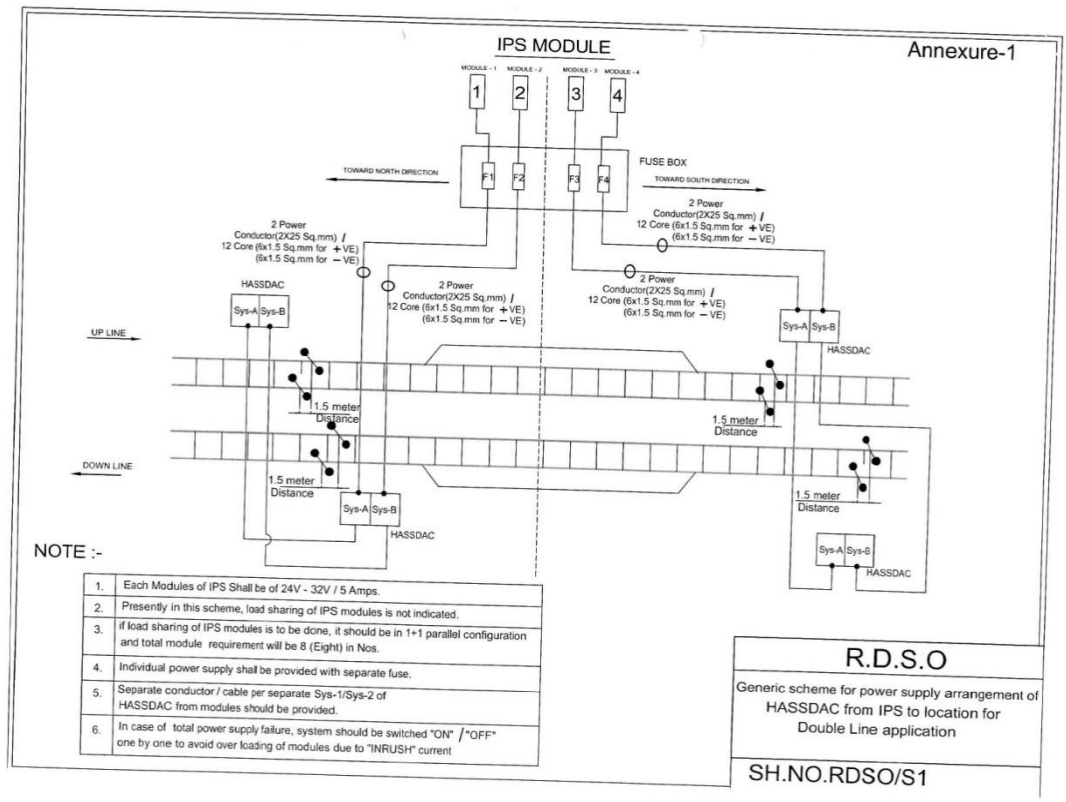
A compilation of instructions given in different advisories for digital axle counter systems is being published.

Sr. No.	Description
A.	**Indoor Installations**
1.	For MSDAC, Evaluators should be kept in dust free and ventilated rooms.
2.	For IBS/ABS installation using MSDAC, line wise electronics should be planned. In which, the requirement is that there shall be no single point of failure that can affect both the lines at the same time. MSDAC can provide multiple track section monitoring by single evaluator but it shall be ensured that one evaluator failure does not affect signals on both UP & Down lines. This primarily leads to provision of line wise evaluators with separate power supply modules.
3.	Line side portable cabins/relay huts etc. shall have sufficient space for keeping circuit books, manuals, and diagnostic PC on a table of adequate size and also for movement of staff during routine maintenance and fault finding.
4.	Battery shall not be installed in the same space where electronic systems are installed. Battery room shall be separate and sufficiently ventilated.
5.	These line side portable cabins/relay huts etc. shall be preferably located near Level crossings for quick access otherwise a suitable access route shall be identified and approved by open line.
B	**Outdoor Installations**
6.	Continuity of Traction bonds in the vicinity of the sensors (50m) should be ensured to keep earth potential rise near DP minimum.
7.	DP should be away from neutral section by 30m. Distance separation between 2 adjacent DPs should be min. 2m.
8.	Sensors should be sufficiently far away from rail joints
9.	As far as possible, TX/ RX coils need to be installed on non-cess rails. This will prevent failures due to movement of rail dolly etc.
C	**Wiring and Cabling Practices**
10.	Avoid bunching of power and DAC cables in relay room.DAC circuits in location shall also not be bunched along with parallel relay/power circuits. Relay circuits are known to generate switching transients that can couple enough energy in parallel circuits nearby and interfere with low power DAC data circuits.
11.	Only Shielded cable should be used in indoor wiring of DAC.
12.	Wiring and cabling shall not be bent abruptly and shall be given sufficient bending radius to ensure that conductors inside the cabling/wiring are not damaged due to bending.Wiring shall be properly supported by channels troughing, cable clamps and other means to ensure that connections are not under pressure due to wire hang.Wiring and cabling shall not be supported at any sharp-edged object to ensure that conductors are not damaged during their installation/ maintenance.
13.	Relay circuits shall preferably be not taken in same cable as DAC circuits. In unavoidable circumstances relay circuits shall be in furthest quad (spatially) from the one containing DAC circuits.
14.	Preferably, quad cable shall be terminated in cage clamp type terminals that provide solid 360 degree surface connection and sufficient pressure on the wire to make a good electrical contact. Any unused/spare conductor of the quad cable shall be terminated and tightened properly at CTR, Locations and in between junction boxes.
15.	Cables shall be terminated at the bottom portion of location keeping equipment and their wiring at higher level inside location. This will help in keeping wiring of different types segregated from each other. All earth wires and surge protection devices also shall be kept at the lower levels for the same reasons.

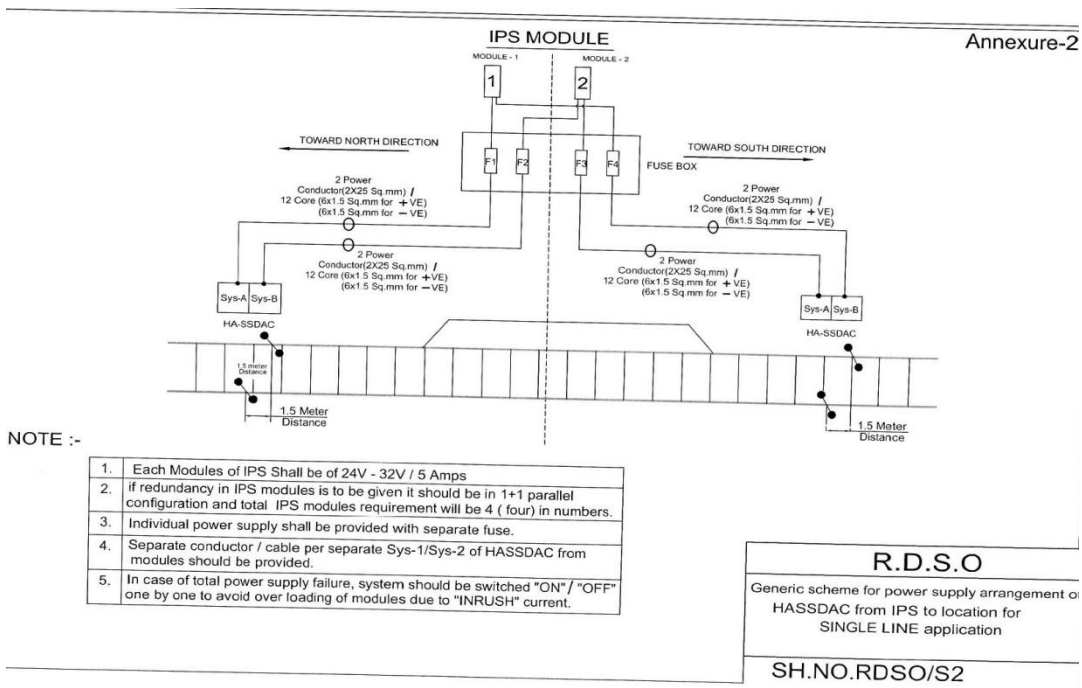
16.	Twisted pairs are required to avoid mutual interference between low level data signals. Even short lengths of non- twisting (few inches) can couple enough noise to interfere with low voltage DAC communication signals.
17.	Quad cable twisting shall be ensured during termination so that minimum one twist per inch is maintained till the last inch into terminations.
18.	Any wiring from quad cable terminations to equipment shall be done using twisted singles of indoor signalling cable (1 mm square) or any other approved indoor twisted pair cable.
19.	Signalling cable or any other untwisted cable pair shall never be used in DAC communication circuits to avoid intermittent type of failure.
20.	Requirement is that parallel circuits shall be as far spaced, spatially, as possible. Long parallel circuits shall be avoided in the same quad. So, one long and one short circuit can be accommodated in same quad but not both long circuits.
21.	DAC circuits in BPAC of up and down lines in double line sections shall be in separate quads and kept one/two quad distance away from each other to avoid mutual interference in long parallel circuits.
22.	Any other parallel wiring (relay circuits/power circuits/earthing wires etc.) shall cross DAC circuits at perpendicular and any parallel portion shall be kept at minimum 150mm (lateral distance) away from the wiring for DAC circuits.
23.	Cabling, as far possible, shall be planned line wise in such a way that single cable failure does not affect the signalling on other line and there are sufficient spares for concerned line.
24.	Periodic checking of Quad cable parameters including IR, Loop Resistance, attenuation and cross talk. Parameters are mentioned in PCCL also. IR should preferably be equal to or better than 10M ohms, Loop resistance should generally not exceed 56 ohms/km, attenuation loss should not be greater than 30dB, FEXT /NEXT should be better than 55dB. It should be ensured that line loss is not more than specified by OEM.
D	**Power Supply Installations**
25.	Power supply ripples shall be ensured to be less than 50 mv peak to peak as per IPS specifications. This should be part of routine maintenance measurements and records.
26.	Separate power supply/module for DAC to be used.
27.	To realise full advantage of line wise electronics provision, evaluator for each line shall be supplied from independent power supply module.
28.	Power supply for evaluator shall not be shared for anything else like cabinet fan or track section relays etc.
29.	Power supply module feeding external circuits shall never be used for feeding indoor electronic systems like evaluators that require separate isolated supply
30.	For taking full advantage of dual system and HASSDACs two pair of separate power conductors (2X25 Sq. mm Aluminium power cable/equivalent signalling cable) shall be provided for power. Each pair of such power conductor shall be connected to individual DC-DC converters in the IPS and power supply cards of dual system/HASSDAC.
E	**Earthing and Surge Protection Devices**
31.	Availability and intactness of Class B & C SPDs which are being supplied along with IPS in a separate wall mountable box should be checked and provided wherever not available.
32.	The equi-potential bonding of indoor signalling equipment including, IPS racks should be provided in the power room and connected to low resistance earth of less than 1 Ohm
33.	Earth connections shall be kept as short and as straight as possible because any loop or turns can create inductive elements that impede quick discharge of transients and surges to ground. The length of cables from SPDs to earth bus bar and from equipment to earth bus bar should be shortest possible without any bends Loops should not be present.
34.	The size of cable from SPD to earth bus bar should be minimum 16 sq. mm copper cable and the size of cable from equipment to earth bus bar should be minimum 10 sq. mm copper cable
35.	All connections from equipment or SPD to earth bus bar shall be exothermic welded or soldered.
36.	Suitable Class-C SPDs should be provided in the power line, communication line and reset line for surge protection in DAC's. In this way, it has to be ensured that wherever power cables/data lines go out of location/relay room, proper SPDs need to be provided at both ends.
37.	In quad cable, the armour, screen and sheath continuity should be maintained while jointing it. Screening of quad cable is effective only when sufficient induced current can flow in the screen thereby cancelling/reducing the induction from 25KV AC for the cable conductors. For adequate induced current to flow in screen, it is necessary that good earth connections are provided for cable screen & armour. Combined earth for armour and screen at intermediate locations shall have earth value as low as possible, but shall never be more than 5 Ω (Ohms).
38.	Low resistance earth of value less than 5 Ohms needs to be provided in the location boxes where field unit of Digital Axle Counter is provided.

39.	All equipments, cables in the location box need to be connected firmly to the earth bar inside location. Periodical checking of earth bus bar continuity and earth values should be undertaken and recorded.
40.	Screen of Sensor cables should be properly earthed at location end.
41.	High quality, high speed & self-diagnosing/indicative type SPDs should be used.SPD& their wiring — short and straight wire with low inductance away from other wiring of electronics, SPD of proper quality needs to be ensured. OEM shall select appropriate rating of SPD for use in quad cable considering effect of induced voltage
42.	OEM shall select appropriate rating of SPDs for use in quad cable considering effect of induced voltage. Intactness and availability of SPDs in DAC should be checked periodically and recorded in maintenance logbooks. To ensure their availability in the system, their health should be monitored /checked periodically, specially before monsoon, after every heavy rain/lightning, storm, and during maintenance/inspection. In case of failure or deterioration in performance, same should be replaced.
43.	Record of provision of SPDs with make and model details should be made in PCCL by OEM & Railways.
44.	For surge protection arrangement in HASSDAC a generic scheme is shown below:  The SPDs as indicated above shall be indicative type and provided by OEM of HASSDAC as stipulated in their user/installation manual.
45.	Earthing & Bonding arrangement to be ensured as per RDSO/SPN/197 Ver. 1.0 or latest.

46.	Generic scheme for power supply arrangement- Use of HASSDAC for double line application:–



Use of HASSDAC for single line application-



F	**Precautions during maintenance of DACs**
47.	Maintenance activity shall be done with utmost care and as per technical manuals of OEMs related to this subject. As a general rule, any maintenance activities in track device area, like, ballast packing & rail changing etc., that require disconnection of track devices and adjustments of axle counter parameters shall not be done in working system. If so required, maintenance staff shall take proper disconnection, duly de-energizing the related sections of SSDAC/HASSDAC/MSDAC

	from CT rack/disconnection terminals before starting indoor/outdoor maintenance activities.
48.	Once work is completed the section should be connected/ energized following all precautions related to resetting, checking of parameters as stipulated and physical clearance of track section before reconnection.
49.	**Routine Maintenance** Activities like measurement of parameters, cleaning etc. which does not interfere with working of system, may be carried without disconnection **Specific Checks on Track Device** Periodic preventive checks by maintenance staff to ensure that track device is properly fitted at site and fixing nuts/bolts are properly tight and intact_ Connections of track device cables are also proper. Any damage/irregularity noticed in nuts/bolts/cables near the trackside shall be immediately attended to duly disconnecting the associated track section while attending the same for damages/ irregularities. Fixing Nuts/Bolts shall be used as recommended by OEM
50.	Handling of Track Devices: 1 Wheel sensors / Track devices are the most sensitive element in DAC technology and these needs to be handled with utmost care. OEM instructions for removing, installing and adjusting shall always be adhered to. Any attempt to experiment with wheel sensors on an operational system can lead to unforeseen hazards. If there are any doubts, railways can always raise those to RDSO, in turn required testing and checks will be done and a mitigation for those doubts will be undertaken in RDSO without jeopardizing the working system on operational railway.
51.	Handling of Track Devices: 2 All Wheel sensor / Track devices installed so far on IR, work on principal of electromagnetic flux linking between transmitter and receiver coils. Electronics connected to these track devices keeps monitoring the track devices continuously for the changes in current/voltage induced in receiver coils due to change in flux linkage between transmitter and receiver coils. When a ferromagnetic metallic item is brought near to the track device, it influences the flux linking between the transmitter and receiver coils to a certain level and if this change is less than the set threshold level, then electronics ignores that change. This is how a trolley is, generally, suppressed, as the change in induced receiver voltage is less than set threshold for electronics to process that signal for wheel detection.
52.	Handling of Track Devices: 3 If the change in receiver voltage is beyond the set threshold level then associated electronics starts processing that signal for detecting and counting train wheels. Track devices detect the train wheel based on a specific pattern of flux changes in receiver coil. Any Receiver voltage change beyond the set threshold but not followed by specific wheel detection pattern will lead to the section going into occupancy as a failsafe response.
53.	Handling of Track Devices: 4 If any attempt is made to displace the track device components in a manner that flux linkage between transmitter and receiver coils does not result in threshold being crossed then it may lead to a situation where track device is no more installed in the manner specified by OEM. Such attempt may then create unwanted scenario of track section neither going to occupied condition nor the track device being able to count a train wheel. It is again reiterated that any such concern related to track device displacement shall be discussed and analyzed in lab environment and not in operational field conditions where it can impact signaling system in an undesirable manner.
54.	Intactness and availability of SPDs in DAC should be checked periodically and recorded in maintenance logbooks. To ensure their availability in the system, their health should be monitored /checked during maintenance/ inspections and after the events of heavy lightning.
G	**Dual Detection using DACs and HASSDACs**
55.	Track devices for both the DAC systems shall be provided on separate rails with specified staggering of minimum 1.5 meters.
56.	In dual system and HASSDAC, two DAC systems works in parallel. Health of individual systems to be monitored through Data logger and exception reports/ alarms to be generated for predictive maintenance
57.	For HASSDAC, the status of LR (logic relay)/RR relay (Reset relay) shall be connected in relay room using 2 cores of Signalling cable from location to relay room

58.	For M/s CEL HASSDAC, the information of LR/RR relay is available at pin 15, 16 of VR-Box. Normally there is no continuity between these two pins. When there is a failure in any of the system, pin 15 and 16 shorts. This information shall be provided to data logger and exception report/alarm needs to be generated when shorting continues for more than 10 seconds (10 second exception is compulsory to avoid false alarm)
59.	For M/s GG Tronics HASSDAC, repeater relays of the vital relays of each individual system are available in relay room also. Pick UP contacts may be used in data logger to monitor the status of individual systems and to generate exception report/alarm
60.	Two set of independent cables shall be provided between locations to station for individual systems.
61.	Diversity has to be built right from the stage of power supply and the connecting cables and the method of train sensing and train detection.
62.	Wherever Axle Counters have been used as one of the Train Detection Systems, the resetting shall invariably be activated automatically by the other train Detection Device. Resetting of Axle Counters shall always be in the preparatory mode.
63.	Each of these Train Detection Devices shall be separately monitored by the Data Loggers and Exception Reports/alarms be transmitted to Maintenance Team & Signal Control, in case of mismatch/failure of devices, Messages received about mismatch/failure of the devices should be promptly attended.
64.	During failure of any one device of Dual Detection, train shall be dealt on proper signal. Failed device shall be attended & rectified, where required, only under proper disconnection taken dung lean period of traffic
65.	In case of failure of both the devices, trains shall be dealt on written authority at restricted speed. Rectification and restoration work should be done after receipt of failure memo/under proper disconnection as required as per extant practice.
66.	Dual Train Detection Devices should be checked and inspected regularly as per the stipulated periodicity of maintenance and inspection.
H	**Communication**
67.	Redundancy in media can be planned where communication failures are high. Media changeover arrangement/ switch should be provided for this
68.	Use of High availability SSDAC in high density traffic areas can give more availability and reliability of system (BPAC applications).
69.	Communication Both the systems of HASSDAC systems shall be provided with media diversity for reliability i.e. one system on dark optical fiber or dedicated El channel (point to point) and the other system on 6 quad cable
I	**General Items**
70.	OEMs have been advised to give on-site training to staff as per requirement of Railway
71.	Implement effective Installation and Commissioning procedures as per PCCL. All columns of the PCCL should be filled in and only then signed.
72.	Person signing the PCCL should be different from installer so that additional check is enforced.
73.	Association of OEM during pre-commissioning check to be ensured.
74.	Monitoring of VRs of DACs shall be done through Data Logger.
75.	Methodology for calculation of FRPCPY of different types of DACs(MSDAC, HASSDAC and SSDAC) is prescribed vide the Railway Board letter no. 2022/Sig/19-FRPCPY/12 dated- 15.07.2022, same should be followed.

The sources of all these points are following-

1. TAN- STS/E/TAN/6001 for Digital Axle Counter- Wiring Discipline*
2. TAN- STS/E/TAN/6002 for ABS & IBS Scheme using MSDAC*
3. TAN- STS/E/TAN/7005 for Lightning protection for DAC in lightning prone area.*
4. TAN- STS/E/TAN/7006 for Technical Advisory for Digital axle counters*
5. TAN- STS/E/TAN/7008 for Installation of HASSDAC*
6. TAN- STS/E/TAN/7009for Axle counter*
7. RB letter no. 2012/Sig/M/DAC/DC dated: 31.12.2013
8. RB letter no. 2022/Sig/19-FRPCPY/12 dated- 15.07.2022

*Note- TANs mentioned vide sl. No. 1 to 6 are henceforth being withdrawn as all their points are covered in this documents number STS/E/TAN/7010.

For any issues related to this TAN (technical advisory note) please contact Director/Signal-II at RDSO, Lucknow (Rly phone- 032-42659, DOT-0522-2452332, Email: Triambak.tiwari@gov.in.

Annexure - IV

A Test format for testing of QUAD cable before commissioning of SSDAC/MSDAC/BPAC/SSBPAC (D)

Sl No		Item	Expected	Measured/ Observed	Remarks if any
1	a	Communication Media Type of Cable	Only Proper pair of wires of Quad cable is to be used for connectivity between field units. No Signaling Cable is to be used in totality / parts. **Annexure-I** for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure -III**		
	b	Use of pair	Proper pair of wires to be used for connectivity. **Annexure – I** for quad cable may be referred. Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure - III**		
	c	Parallelism of Wires	No wires to be paralleled.		
	d	Insulation resistance of Quad cable	Shall be greater than /equal to 10 M ohm.		
	e	Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 20^0 C. See **Annexure -II** for correction factor.		
	f	Attenuation loss measured at 2 KHz	Shall not be greater than 30.0 dB for full length of the cable used.		
	g	Near End Cross Talk (NEXT)	Shall be better than 55 dB.		
	h	Far End Cross Talk (FEXT)	Shall be better than 55 dB.		
	i	Continuity of cable armour	Continuity shall be there and armour of the cable must be earthed Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure -III**		
	j	Earth of Quad cable	Shall be less than 1 ohm		
	k	Cable allocation table	Shall be filled up and attached		

Note: Procedure for test-

Attenuation Loss: The output/Input impedance of signal generator/dB meter shall be 600 ohm.

Near End Crosstalk: Test tone of 150 **KHz** to be fed in the adjacent pair of the same quad & NEXT to be measured at the same end on the other pair of the same quad.

Far End Cross talk: Test tone of **150 KHz** to be fed in the adjacent pair of the same quad & FEXT to be measured at the far end on the other pair of the same quad.

B <u>Test format for testing of OFC cable before commissioning of SSDAC/MSDAC/BPAC/SSBPAC (D)</u>

Sl No.		Item	Expected	Measured/ Observed	Remarks if any
1	a	Communication Media Type of Cable	Jelly filled telecom cable/ Quad cable to be used between field units & OFC Equipment room. Signaling Cable shall not be used at all. **Annexure-I** for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure - III**		
	b	Use of pair	Proper pair of wires to be used for connectivity. **Annexure-I** may be referred. Wiring practices should be adopted in accordance to TAN 7010 dated 20.11.2024 See **Annexure -III**		
	c	Parallelism of Wires	No wires to be paralleled.		
	d	Insulation resistance of Quad cable	Shall be greater than /equal to 10 M ohm.		
	e	Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 200 C for quad cable & * ohm/Kms for PIJF telecom cable. See **Annexure -II** for correction factor.		
	f	Channel line up	For Trans signal levels introduce the attenuation of 12dB for each channel, For RX signal introduce the attenuation of 12dB.-		

* PIJF telecom cable is available with three types of Conductor dia-

Sl. No	Condr Dia used in PIJF cable	Resce at 200 C	Loop Resce /KM
1	0.50 mm	86 ohm +/- 6	172 ohm / Kms
2	0.63 mm	58 ohm +/- 4	116 ohm / Kms
3	0.90 mm	28 ohm +/- 2	56 ohm / Kms

Note: Procedure for test-
Attenuation Loss: The output/Input impedance of signal generator / dB meter shall be 600 ohm.
Near End Crosstalk: Test tone of 150 KHz to be fed in the adjacent pair of the same quad & NEXT to be measured at the same end on the other pair of the same quad.
Far End Cross talk: Test tone of 150 KHz to be fed in the adjacent pair of the same quad & NEXT to be measured at the far end on the other pair of the same quad.

Annexure-V

Response test of digital Axle Counter with different type of Trolley Wheels done jointly with railways

S.No.	Type of Trolley wheel	Observed Result(No infuence / Goes to error / Counted / other)	Remarks
1	4 spoke wheel Wheel Dia with flange – Wheel Width – Flange width – Flange depth – Spoke width –		
2	6 spoke wheel Wheel Dia with flange – Wheel Width – Flange width – Flange depth – Spoke width –		
3	Solid Wheel with 6 holes Wheel Dia with flange – Wheel Width – Flange width – Flange depth –		
4	8 spoke wheel Wheel Dia with flange – Wheel Width – Flange width – Flange depth – Spoke width – 		
5	8 spoke with slots Wheel Dia with flange – Wheel Width – Flange width – Flange depth – Spoke width –		

S.No.	Type of Trolley wheel	Observed Result(No infuence / Goes to error / Counted / other)	Remarks
6	Perforated		
	No. of perforation with dia.		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
	Spoke width –		
7	Solid wheel		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
8	Motor trolly wheel , Solid		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
9	Rail Dolly Wheel solid		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
10	Material Trolley solid wheel		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
11	Motor Trolley wheel with 6 holes		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
12	Tower Wagon		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		

ANNEXURE – VI

OEM's Site Installation Certificate

(Ref: This office letter no.: STS/E/AC/Dig/Genl Dt. 21.06.2011)

To

CSTE/ Railway

This is to certify that verification of system installation (details given below) has been completed by undersigned (OEM representative) and all necessary arrangements like earthing, surge protection, power supply, power & communication cables and equipment wiring meet the required standards of engineering for trouble free working of installed system.

1. System being commissioned:
2. Station/Section:
3. Division:
4. Date of commissioning:

Name of RDSO approved Original Equipment Manufacturer

Name of OEM representative with Designation

Signature of OEM representative with Date:

Maintenance log sheet for MSDAC (FIELD UNIT)

Sr. no.		Battery (24V/96V)	Tx1 Vrms / freq	Tx2 Vrms / freq	Rx1 Vrms	Rx2 Vrms	Modem Tx Level (Card 3) 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			
														5 V	12 V	24 V	15 V ISO
Test Points		TS1 13 & 14	TS1 1 & 2	TS1 4 & 5	TS1 7 & 8	TS1 7 & 8	TS1 10 & 11	Red & Black Socket		Red & Black Socket		Red & Black Socket		Monitoring Sockets on card 8			
								Normal	Dummy wheel	Normal	Dummy wheel	SCC1	SCC 2				
(Limit) for Phase		23 - 28.8 V / 40 - 96V	30 to 40 V	30 V to 40V	275 to 600mV	275 to 600 mV	> 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 5.25 V	11.50 V to 12.50 V	23.50 to 24.50	14.50 to 15.50
(Limit) for AM	Date		20.8 to 21.2 KHz	22.8 to 23.2 KHz	750 to 1200 mV	750 to 1200 mV											

Inspected by: Name & Signature of Railway Representative	Tested by: Name & Signature of firm's Representative