

East Central Railway

**Office of the
General Manager
(Signal & Telecomm)
ECR, Hajipur**

**No. ECR-HQ0SnT (CCP)/2/2024
(Comp.no. 279039)**

Dated: 04.12.2024

**Sr.DSTEs/
DDU/DHN/DNR/SEE /SPJ,
East Central Railway.**

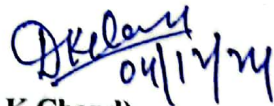
**Sub: RDSO Pre-commissioning Check list for Multi Section Digital Axle Counter
(MSDAC-G39) of M/s G.G. Tronics India Private Limited, Bangalore as per RDSO
Specification No. RDSO/SPN/176/2013 Ver.3.0**

Ref: RDSO letter no. No. RDSO-SIG0MSDAC (GGT)/1/2020 dated 30.10.2024

With reference to above referred RDSO letter, Pre-Commissioning Check List (SIG0627, Ver.1.0) for Multi Section Digital Axle Counter (MSDAC-G39) of M/s G.G. Tronics India Private Limited, Bangalore as per RDSO Specification No. RDSO/SPN/176/2013 Ver.3.0. has been revised to include the provision of SPD for field unit inside the Mushroom Box.

A copy of the revised PCCL No. SIG: 0627 Ver.1.1 is being enclosed herewith for your kind information and necessary action.

DA : As above.


(D.K.Chand)
Dy.CSTE/Signal/HJP
for GM (S&T)/ECR/HJP

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No: RDSO-SIG0MDAC (GGT)/1/2020

Date: 30.10.2024

By E-mail

M/s G.G. Tronics India Pvt. Ltd.,
Plot No. 10, 3rd Phase, 6th Main,
Peenya Industrial Estate,
Bangalore — 560 058
 (E-mail: info@ggtronics.com)

Sub/विषय:	Pre-Commissioning Check List for Multi-Section Digital Axle Counter (MSDAC-G39) of M/s G. G. Tronics India Pvt. Limited, Bangalore as per RSDO specification No. RDSO/SPN/176/2013 Ver. 3.0.
Ref/संदर्भ:	1. Firm's letter no. GGT/D&D/MSDAC-G39/NFR/2024-25/10/32 dtd. 10.10.2024 & 11.10.2024. 2. This office letter of even no. dtd. 18.09.2024 & 01.10.2024.

With reference to above referred letters, Pre-Commissioning Check List (SIG 0627, Ver. 1.0) for Multi-Section Digital Axle Counter (MSDAC-G39) of M/s G. G. Tronics India Pvt. Limited, Bangalore as per RSDO specification No. RDSO/SPN/176/2013, Ver. 3.0 is revised to include the provision of SPD for field unit inside the Mushroom Box. The revised PCCL No. SIG:0627 ver. 1.1 is being issued herewith for your kind information & further necessary action please.

DA: Revised PCCL Ver. 1.1 for MSDAC-G39.

De
30/10/24

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

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

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**RESEARCH DESIGNS AND STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW**

SIGNAL & TELECOM DIRECTORATE

Title: Pre-commissioning check list for Multi-Section Digital Axle Counter (MSDAC-G39) with Phase Detection Track device of M/s G. G. Tronics India Pvt. Limited, Bangalore (As per RDSO/SPN/176/2013, Ver. 3)

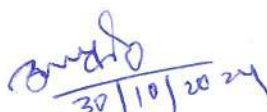
S.N	Date of amendment	Version	Modification Details
1.	-	1.0	First issue
2.	30.10.2024	1.1	To include the provision of SPD for field unit inside the Mushroom Box.

Authors:

Name	Function	Level
Shri Suresh Kumar, PED/S&T	Approving authority	Approval
Shri Triambak Tiwary Director/Signal-II	Member	Issue
Shri Alok Kumar Srivastava, ADE/Signal-VI	Member	Check
Shri Shobha Ram, SSE/Signal	Member	Prepare


30.10.2024

Prepared by: SSE/Signal


30/10/2024

Checked by: ADE/Signal-VI


30/10/24

Issued by: Director/Signal-II

Signature of G.G.Tronics Representative
With Name, Designation & Date

Signature of Railway Representative
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Pre-Commissioning Check List for Multi Section Digital Axle Counter

Sl. No Central Evaluator _____

1. General Information:

Station /Yard Name:	
Section:	
Division/Zonal Railway:	
Contact Details of Railways at site:	
Contact Details of Railways at HQ/Division	
Contract No./P.O. No.	
Application [Yard/ABS/IBS/BPAC/LC Gate]	
Total Nos. Of Detection points& Section:	
System Part Number (MSDAC-G39-00)	
System Software version Number (V 2.0)	
Serial number of the equipment:	
Date of installation:	
Date of pre-commissioning inspection:	

Note:

- (i) System should be installed and commissioned by authorized technical staff of manufacturer only.
- (ii) Commissioning of Multi Section Digital Axle Counter (MSDAC) has to be done by OEM as per RDSO pre-commissioning checklist No. SIG. 0627 Version 1.0.
- (iii) OEM shall certify that verification of system installation has been completed by authorized representative of OEM and all necessary arrangements meet the required standards of engineering for trouble free working of installed system.
- (iv) Installation procedures shall be followed strictly as per TANs attached herewith.

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Note :

Following checklist shall be filled for selecting no of copies of the following PART on category,

Sl. No	PART / ANNEXURE	Required Pages	No. of Copies required
1.	Main Page – Details for MSDAC-G39 system	Page No: 1-2	1
2.	PART – A – details of outdoor equipment (FDP) -	Page No : 4- 8	As per FDP quantity. (one set per one detection point)
3.	PART – B – details of Indoor equipment (Central Evaluator) -	Page No: 9 - 13	1
4.	PART – C – Indoor power supply measurements	Page No: 14	1
5.	PART – D – Measurements of MDC module	Page No: 15	1
6.	PART – E – Measurements of MSC module	Page No: 16	As per No of track sections. (one set per one section)
7.	PART – F – Measurements of VO-NVO module	Page No: 17	As per No of VO-NVO modules used. (one set per one module)
8.	PART – G – Indoor Sub systems Reset Panel , VDU and LV interface module	Page No: 18 - 19	1
9.	PART -H – Testing of trolley movements	Page No: 20 – 22	1
10.	PART -I – Commissioning	Page No: 23-26	1
11.	Annexure – 1	Page No: 27	1
12.	Annexure – 2	Page No: 28	1
13.	Annexure – 3	Page No: 29	1
14.	Annexure – 4 – TAN 6001	Page No: 30 –31	1
15.	Annexure – 5 – TAN 7006	Page No: 32-33	1
16.	Annexure – 6 – TAN 7005	Page No: 34-35	1
17.	Annexure – 7 – TAN 7009	Page No: 36 –37	1

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CATEGORY: PART – A

(This part of work should be done before commissioning)

1. Outdoor (Field Detection Point Details) (FDP-G39 / FDP-G39 A)

DP NO : _____

Track Section(s) NO : _____

Sl. No.	Description	Required		Observed	OK / Not OK
1.	FDP units DP No. (Address)	DP No shall be between 1 to 40			
2.	Serial No	Sl. No / MFG Date			
3.	Network ID 1 & 2	Network ID should be match with connected MSDAC system (001-015)	NW ID 1		
			NW ID 2		
4.	Configuration	1C1E / 2C1E / 2C2E			
5.	Placement of Cards / modules	Should be in proper position			
6.	Firmness of card / Modules	Should be tightened with screw / clip provided			
7.	SPD for field unit inside the Mushroom box	Indicative type SPD of 110 Volt AC/DC (make: OBO/Phoenix/CITEL) shall be provided on DIN rail at input side of MPLCC inside the Mushroom box. (*The voltage rating of SPD will be decided as per the voltage rating of FDP i.e. 110 volt, 24 volt & 48 volt DC)			
8.	Connecters	Installed and tightened properly			
9.	Connector cables	Wired properly as per color / label code			
10.	Housing Type of FDP unit	Should be fixed firmly in Mushroom Box / Location Box.			
11.	Earthing of Housing	Should be earthed			
12.	Earthing of FDP unit	Should be provided firmly through copper strips or other standard copper cable and it shall be isolated from Cable and cabinet earth. Earth required only when distance between CE to FDP is more than 2 Kmtr. Expected Value < 1 Ohms			
13.	Cable Armours	Incoming cable armours should be connected firmly to copper bus bar or other provision for connecting armours. Armor continuity shall be maintained between Field to CE.			
14.	Provision of PLCC	PLCC is a combination of PDC and SPD, it should be used when centralized power used.			

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2. Outdoor (Track Device)

Sl. No.	Item	Required	Observed	OK / Not OK
1.	Wiring of TX / RX coils	Wired on approved Wago/ Phoenix / Decamake terminals.		
2.	Condition of worn out of Rail 60 Kg - 13 mm 52 Kg - 8 mm 90 R - 5 mm	Should be within vertical limit of worn out 159 -172 mm 148 -156 mm 138 -143 mm		
3.	Marking of holes on rail (From bottom of the rail)	GGT Jig as per drawing available in Installation and commissioning procedure to be used as per rail section. 60 Kg - 84 mm 52 Kg - 68 mm 90 R - 57 mm From the bottom of the rail.		
	Fixing of Base clamp type axle detectors.	Fixed properly as per the axle detectors drawing available in Installation and commissioning Procedure.		
4.	Drilling of holes in the web of rail	Should be of 14mm dia. Should be square (perpendicular), should not be oblong. (Not required for Base clamp type axle detectors)		
5.	Torque applied to fix track device using Torque wrench	Jaicom make JPR65 or equivalent - 88 Nm.		
6.	Fixing of TX	Outside the rail		
7.	Fixing of RX	Inside the rail		
8.	Laying of axle detector cable	In corrugated / HDPE pipe		
9.	Screen of axle detector cable	Should be earthed		
10.	Rail section	60 Kg / 52 Kg / 90 R		
11.	Nuts, bolts & washers for fixing rail contacts	Insertion of bolt from RX coil side i.e., inside of the rail (Not required for base clamp type track device)		
12.	Position of deflector	30 cm away from TX / RX coils in the next sleeper		
13.	Height of deflector	Should not be higher than the rail top		
14.	Clearance between sleepers	Minimum 450 mm between sleepers		
15.	Embossing on rail	Should not be covered by Track device		

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3. Outdoor Quad Cable

3.1 Outdoor (Quad Cable / PIJF twisted pairs telecom cable for Axle counter system working in station area)

(Test format for testing of QUAD cable before commissioning of Field Detection Point used in between FDP to Central Evaluator of MSDAC-G39)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	Distance between FDP to CE	Up to 12 Kmtr in Local Power supply or < 4 kmtr in centralized power supply to FDP units.		
2.	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-1 for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
3.	Use of pair	Proper pair of wires to be used for connectivity. Annexure – 1 for quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
4.	Duplication of Wires	No wires to be paralleled for reducing conductor resistance.		
5.	Insulation resistance of Quad cable	Shall be greater than / equal to 10 M ohm.		
6.	Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 20°C. See Annexure – 2 for correction factor.		
7.	Attenuation loss measured at 2 KHz	Shall not be greater than -30.0 dB for full length of the cable (including tail cables) used.		
8.	Near End Cross Talk (NEXT)	Shall be better than -55 dB for quad cable.		
9.	Far End Cross Talk (FEXT)	Shall be better than -55 dB for quad cable.		
10.	Continuity of Quad cable armor	Continuity shall be there and armor of the cable must be earthed (earth is not required when the Distance		

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		between CE to FDP is within 2 Kmtr) Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 (See annexure -4)		
11.	Separate Earth of quad cable	Shall be \leq One ohm (not required if distance between Central Evaluator and Field Detection Point is within 2 Kmtr)		
12.	Cable allocation table	Shall be filled up & attached		
13.	Unused Quad pair	To be terminated on terminals.		
14.	Dressing of Quad pair	To be properly dressed with insulated tape.		
15.	Spiral before termination.	No individual conductor to be made spiral		
16.	Input power of Field Detection point	(i) 24 VDC (ii) 48 VDC (iii) 110 VDC		

4. Outdoor OFC

4.1 Outdoor (OFC for Axle counter system working in station area)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	OFC			
2.	Channel line up	For 0 dB Trans signal level, the received signal level at other end shall not be more than -3.5dB		

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Maintenance Check List for FDP Unit measurements

Description	Test Points	Date	Source Power (Vdc)	Tx1 Vrms / freq	Tx2 Vrms / freq	Rx1 Vrms / freq	Rx2 Vrms/ freq	RX SIG & GND Socket FPD 1	RX SIG & GND Socket FPD 2	SUP level At FPD1 Card	SUP level At FPD2 Card	Phase Detector 1 DC Volts	Phase Detector DC Volts	With Push Trolley on axle detectors (4 spokes / 8 spokes)	DC – DC Converter					
															DC Volts					
															5 V	12 V	-12 V	+18V	24 V	
												RX PH-SIG & GND Socket	RX PH-SIG & GND Socket	RX PH-SIG & GND Socket	Monitoring Sockets on DC-DC converter card					
															Normal	Dummy wheel	Normal	Dummy wheel	FPD1	FPD2
				40 to 70 V	40 to 70 V	300 mV to 800 mV (AC)	300 mV to 800 mV (AC)	750mV (700 to 1000 mVAc)	750mV (700 to 1000 mVAc)	3.0 Vdc (2 Vdc To 4 Vdc)	3.0 Vdc (2 Vdc To 4 Vdc)	4.5 Vdc to 5 Vdc	< 1 V	4.5 Vdc to 5 Vdc	4.5 Vdc to 5 Vdc	4.75 to 5.25 V	11.50 Vdc to 12.50 Vdc	11.50 Vdc to 12.50 Vdc	17.50 Vdc to 18.50 Vdc	22V to 26V
				20.937 to 24.937 to 21.063 25.063 KHz	20.937 to 24.937 to 21.063 25.063 KHz	20.937 to 21.063 KHz	24.937 to 25.063 KHz													

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CATEGORY: PART - B

1. Indoor Electronics (Central Evaluator)

Sl. No	Item	Required	Observed	OK / Not OK
1.	MSDAC Serial No	Sl. No / MFG Date		
2.	MSDAC Network ID	Network ID should be different from any MSDAC system working on the same station. (001-015)		
3.	MSDAC System ID	System ID should be different from any MSDAC system working on the same station. (001-255)		
4.	Placement of Cards / modules	Should be in proper position		
5.	Firmness of card / Modules	Should be tightened with screw / clip provided		
6.	Connecters	Installed and tightened properly		
7.	Connector cables	Wired properly as per color / label code		
8.	Earthing of MSDAC units	Should be provided firmly through copper strips or other standard copper cable. Value < 1 Ohms		
9.	Earthing of Relay Frame (If available)	Earthing should be provided firmly through copper strips or other standard copper cable. Value < 1 Ohms		
10	External Surge Protection Devices on input, output and power supply lines	Indicative type pluggable or easy to install on a DIN rail. Non pluggable shall be connected in parallel. On Power line- Type-2/Class-C SPD On data line- Type-3/Class-D SPD On reset line- Type-2/Class-C SPD		

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2. Indoor Measurements of MSDAC(CE to CE Communication)

2.1 Outdoor Quad Cable / PIJF twisted pairs telecom cable for Axle counter system working between Two Central Evaluators (For MCOM – A communication)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	Block section length limit	<12 Kmtr		
2.	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. Annex-1 for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
3.	Use of pair	Proper pair of wires to be used for connectivity. Annexure – 1 for quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
4.	Duplication of Wires	No wires to be paralleled for reducing conductor resistance.		
5.	Insulation resistance of Quad cable	Shall be greater than / equal to 10 M ohm.		
6.	Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 20°C. See Annexure – 2 for correction factor.		
7.	Attenuation loss measured at 2 KHz	Shall not be greater than -30.0 dB for full length of the cable (including tail cables) used.		
8.	Near End Cross Talk (NEXT)	Shall be better than -55 dB for quad cable.		
9.	Far End Cross Talk (FEXT)	Shall be better than -55 dB for quad cable.		
10.	Continuity of cable armour	Continuity shall be there and armour of the cable must be earthed Wiring practices should be adopted in		

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		accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
11.	Separate Earth of quad cable	Shall be \leq One ohm		
12.	Cable allocation table	Shall be filled up & attached		
13.	Unused Quad pair	To be terminated on terminals.		
14.	Dressing of Quad pair	To be properly dressed with insulated tape.		
15.	Spiral before termination.	No individual conductor to be made spiral		

2.2 OFC (OFC cable used between Central Evaluator to Central Evaluator)- (For MCOM
– A communication)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	OFC			
2.	Channel line up	For 0 dB Trans signal level, the received signal level at other end shall not be more than - 3.5dB		

2.3 Outdoor Quad Cable / PIJF twisted pairs telecom cable for Axle counter system
working between Two Central Evaluators (For MCOM – B communication)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	Block section length limit	<12 Kmtr		
2.	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. Annex-1 for Quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		

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3.	Use of pair	Proper pair of wires to be used for connectivity. Annexure – 1 for quad cable may be referred. Wiring practices should be adopted in accordance to TAN 6001 dt 04.10.2011 See Annexure -4		
4.	Duplication of Wires	No wires to be paralleled for reducing conductor resistance.		
5.	Insulation resistance of Quad cable	Shall be greater than / equal to 10 M ohm.		
6.	Loop resistance of designated pair	Not to exceed 56 ohm/Kms at 20°C. See Annexure – 2 for correction factor.		
7.	Attenuation loss measured at 2 KHz	Shall not be greater than -30.0 dB for full length of the cable (including tail cables) used.		
8.	Near End Cross Talk (NEXT)	Shall be better than -55 dB for quad cable.		
9.	Far End Cross Talk (FEXT)	Shall be better than -55 dB for quad cable.		
10.	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 6001 dt 04.10.2011 See Annexure -4		
11.	Separate Earth of quad cable	Shall be \leq One ohm		
12.	Cable allocation table	Shall be filled up & attached		
13.	Unused Quad pair	To be terminated on terminals.		
14.	Dressing of Quad pair	To be properly dressed with insulated tape.		
15.	Spiral before termination.	No individual conductor to be made spiral		

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2.4 OFC (OFC cable used between Central Evaluator to Central Evaluator)- (For MCOM – B communication)

Sl. No.	Item	Expected	Measured / Observed	Remarks (OK / Not OK)
1.	OFC			
2.	Channel line up	For 0 dB Trans signal level, the received signal level at other end shall not be more than -3.5dB.		



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CATEGORY: PART – C

1. Indoor Measurements of MSDAC :

Sl. No.	Required	Observed	Remarks OK / NOT OK
1.	Fuse	200 % of the Input power	
2.	Input voltage with Charger ON	22 V to 30 V DC	
3.	Input voltage with Charger OFF.(Keep charger OFF for 15 minutes before taking reading)	22 V to 30 V DC	
4.	Ripple of Input Power Supply	Less than 10 mV rms / 50 mV peak to peak.	



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CATEGORY: PART - D

1. MDC card Measurements

Chassis No:1

Sl. No.	Description	Required	Observed		Remarks OK / NOT OK
			MDC 1	MDC 2	
1.	3.3 Vdc	3.0 to 3.7 Vdc			

Chassis No:2

Sl. No.	Description	Required	Observed		Remarks OK / NOT OK
			MDC 1	MDC 2	
1.	3.3 Vdc	3.0 to 3.7 Vdc			

Chassis No:3

Sl. No.	Description	Required	Observed		Remarks OK / NOT OK
			MDC 1	MDC 2	
1.	3.3 Vdc	3.0 to 3.7 Vdc			

Chassis No:4

Sl. No.	Description	Required	Observed		Remarks OK / NOT OK
			MDC 1	MDC 2	
1.	3.3 Vdc	3.0 to 3.7 Vdc			

Chassis No:5

Sl. No.	Description	Required	Observed		Remarks OK / NOT OK
			MDC 1	MDC 2	
1.	3.3 Vdc	3.0 to 3.7 Vdc			

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CATEGORY: PART - E

1. Indoor Measurements of MSC Module SI.No / Section output

No: _____

Sl. No	Item	Required	Observed	OK / Not OK
1.	Relay drive output to the Vital Relays. (This may be checked across the front facia monitoring point).			
	Section Unoccupied (Clear)	>20V		
	Section Occupied	< 2V		
	Relay Type	1000 Ohms Q type relay		
2.	Relay drive output to the Preparatory Relays. (This may be checked across R1 & R2 of coil of Preparatory relay in relay box).			
	Section in PILOT mode	>20V		
	Section in Non-PILOT Mode	< 2V		
	Relay Type	Miniature relay		
3.	Drive voltage of repeater relays in picked up condition, when charger is OFF for 15 minutes.			
	VPR	>22V		
	PPR	>22V		

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CATEGORY: PART - F

1. Indoor Measurements of VO-NVO Module Sl.No / VO-NVO output

No: _____

Sl. No	Item	Required	Observed	OK / Not OK
1.	Relay drive output to the Vital output (VO). (This may be checked across the front facia monitoring point).			
	VO output driving HIGH	>20V		
	VO output driving LOW	< 2V		
	Relay Type	1000 Ohms Q type relay		
2.	Non-Vital Output (NVO)			
	NVO output driving HIGH	>20V		
	NVO output driving LOW	< 2V		
	Relay Type	Miniature relay		

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CATEGORY: PART - G

1. INDOOR (Reset Box): SI.No _____

Sl. No.	Item	Required	Measured / Observed	Remarks OK / Not OK
1.	Reset Box	Wired as per drg given in Installation and commissioning procedure.		
2.	Reset Box Earthing.	Connected to earth properly.		
3.	Reset function	a) Reset not possible when Axle Counter section is clear and healthy.		
		b) Reset not possible when Axle counter section is in Preparatory reset mode.		
4.	24 VDC level at Reset box input.	22V DC to 30 V DC		
5.	Level of reset signal from reset box. For all reset modules output	48 V \pm 4 V DC		
6.	Level of reset signal at MSDAC unit input.	38 V to 52V DC		

2. INDOOR (LV interface Module): SI.No _____

Sl. No.	Item	Required	Measured / Observed	Remarks OK / Not OK
1.	Installation of LV interface module	Wired as per drg given in Installation and commissioning procedure.		
2.	LV interface module Earthing.	Connected to earth properly.		
3.	24 VDC level at LV interface module input.	22V DC to 30 V DC		
4.	Cable used for communication with VDU.	Only Proper pair of wires of Quad cable is to be used for connectivity between VDU and LV interface modules. No Signaling Cable is to be used in totality / parts.		
5.	LV connections between LV box to LV interface module.	Connections shall be made properly and shall be tested individually.		

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3. INDOOR (Visual Display Unit): SI.No _____

Sl. No.	Item	Required	Measured / Observed	Remarks OK / Not OK
1.	Installation of VDU	Wired as per drg given in Installation and commissioning procedure.		
2.	Is Uninterrupted power supply provided?	YES / NO		
3.	Cable used for communication	Only Proper pair of wires of Quad cable is to be used for connectivity between VDU and CE. No Signaling Cable is to be used in totality / parts.		
4.	Is redundant communication provided?	YES / NO		
5.	Is RFID Tag provided for VDU operations?	RFID tag shall provide with RFID Reader.		
6.	RFID configured and operation	RFID communication configured and operations are normal.		
7.	Displaying Layout	Layout provided as per MSDAC systems track section configuration.		

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CATEGORY: PART - H

1. Testing of Trolley movements on MSDAC

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

S.No.	Type of Trolley wheel	Observed Result(No influence / Goes to error / Counted / Partially Occupied / other)	Remarks
1.	4 spoke wheel		
	Wheel Dia with flange		
	Wheel base –		
	Flange thickness –		
	Wheel Flange –		
	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 base –		
	Flange thickness –		
	Wheel Flange –		
	Spoke width –		

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S.No.	Type of Trolley wheel	Observed Result(No influence / Goes to error / Counted / other)	Remarks
5.	8 spoke with slots		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
	Spoke width –		
6.	Perforated		
	No. of perforation with Dia.		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
7.	Solid wheel		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
8.	Motor trolley 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 –		

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S.No.	Type of Trolley wheel	Observed Result(No influence / Goes to error / Counted / other)	Remarks
11.	Motor Trolley wheel with 6holes		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
12.	Tower Wagon		
	Wheel Dia with flange –		
	Wheel Width –		
	Flange width –		
	Flange depth –		
13.	Motor trolley following a train		
14.	Effect of Tower wagon		



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CATEGORY: PART - I

1. COMMISSIONING:

Sl. No.	Item	Required	Measured / Observed	Remarks (OK / Not OK)
1.	Commissioning	System should be installed & commissioned by personal trained by the manufacturer.		
2.	Training	Railway personnel should be trained before commissioning.		
3.	Verification of working	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.		
4.	OEM's Certificate	As per Annexure- 3		

2. Commissioning log sheet of MSDAC-G39 – Part Number MSDAC-G39-00

Model: MSDAC – G39

Software version: V 2.0

The Following card version shall be checked

S. No	Module Name	Manufacturer's Identification / Part Number	RDSO Version Number	Remarks (OK / NOT OK)
1.	Central Evaluator Basis Chassis (12 I/O) with mother board	MSDAC -G39 -12I/O 00	D01/S001/H01	
2.	Central Evaluator Extended Chassis (16 I/O) with mother board	MSDAC -G39 -16I/O 00	D01/S001/H01	
3.	MCPU module	H001M209R1	D01/S001/H01	
4.	MCPU PFM module	H001M211R1	D01/H01	
5.	MDP module	H001M205R1	D01/S001/H01	
6.	MDP PFM module	H001M206R1	D01/H01	
7.	MSC module	H001M221R1	D01/S001/H01	
8.	MSC PFM module	H001M222R1	D01/H01	
9.	MCE module	H001M207R1	D01/S001/H01	
10.	MCE PFM module	H001M208R1	D01/H01	
11.	MDC module	H001M225R1	D01/S001/H01	

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12.	MDC PFM module	H001M202R1	D01/H01	
13.	MBD12IO module	H001M212R1	D01/S001/H01	
14.	MBD16IO module	H001M213R1	D01/S001/H01	
15.	MCAN PFM	H001M216R1	D01/H01	
16.	LDU (24 Vdc)	G36-LTDU00	D01/H01	

FDP Unit - Modules				
S. N o	Module Name	Manufacturer's Identification / Part Number	RDSO Version Number	Remarks (OK / Not OK)
1.	Field Detection point (FDP)	FDP - G39 00	D01/S001/H01	
		FDP - G39A 00	D01/S001/H01	
2.	Axle detectors	G36-T212503	D03/H03	
		G36-R212503		
		G36-T212504	D04/H04	
		G36-R212504		
		G36-T212505	D05/H05	
		G36-R212505		
3.	FCPU module	H001M112R1	D01/S001/H01	
4.	FPD1 module	H001M101R1	D01/H01	
5.	FPD2 module	H001M102R1	D01/H01	
6.	FCOM module	H001M115R1	D01/H01	
7.	FDC module	H001M122R1	D01/H01	
		H001M123R1	D01/H01	
		H001M124R1	D01/H01	
8.	FMBD G39 module	H001M120R1	D01/H01	
9.	FMBD G39A module	H001M133R1	D01/H01	

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Accessories of MSDAC				
S. No	Module Name	Manufacturer's Identification / Part Number	RDSO Version Number	Remarks (OK / Not OK)
1.	Visual Display Unit with VDU software for displaying section status and Software resetting	MSDAC – G39 – VDU00	D01/S001/H01	
2.	Mushroom Box for FDP-G39A 00	MSDAC-G39-MV003	D01/H01	
3.	Mushroom Box for FDP-G39- 00	MB-V002	D01/H01	
4.	Reset Box / Panel (user selectable)	MSDAC – G39 – RSBX00	D01/S001/H01	
5.	Relay Panel (Required as per no of Track sections)	MSDAC – G39 – RLYP00	D01/H01	
6.	Power and Data Combiner	MSDAC – G39 – MPLCC	D01/H01	
7.	MCOM module	H001M214R1	D01/S001/H01	
8.	MCOM PFM module	H001M215R1	D01/H01	
9.	VO-NVO Module	H001M223R1	D01/S001/H01	
10.	VO-NVO PFM Module	H001M224R1	D01/H01	
11.	MCFI Module	H001M227R1	D01/S001/H01	
12.	MCFI PFM Module	H001M224R1	D01/H01	
13.	MPOWER module	H001M29R1	D01/H01	
14.	MRESET module	H001M220R1	D01/H01	
15.	MLAN module	H001M217R1	D01/S001/H01	
16.	FRD1 Module	H001M117R1	D01/H01	
17.	FRD2 Module	H001M118R1	D01/H01	
18.	Line Verification Box	MSDAC-G39-LV-BOX	D01/H01	
19.	MLV module	H001M232R1	D01/H01	

3. Checksum Verification of MSDAC-G39 Software Modules

Sl.No	Software Name	Version	Checksum	Observed		Remarks OK/NOT OK
				Version	Checksum	
1.	MCPU Software	2.0	0 x BC07			
2.	MDP Software	2.0	0 x FDEC			
3.	MSC Software	2.0	0 x 8044			
4.	MCOM Software	2.0	0 x 0B65			
5.	FCPU Software	2.0	0 x 7F8C			
6.	MCE 1 Software	2.0	0 x 3E51			
7.	MCE 2 Software	2.0	0 x B248			
8.	VO-NVO Software	2.0	0 x 8044			
9.	MCFI Software	2.0	0 x D7BE			

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4. Recommended Tool Kit for testing as per Pre-Commission Check List

Sl.No	Tools	Quantity
1	Portable Data logger for downloading event logger data for analysis and report generation	1
2	Pure sine wave Digital Multimeter (Fluke make 187 or Rishab make 28S or similar which can measure voltages & currents accurately at 25Khz)	1
3	Dummy wheel	1
4	Ring spanner 17-19,24-26	1
5	Open end spanner 17-19, 24-26	1
6	Socket spanner with handle	1
7	Torque wrench, Jaicom make JPR65 or Equivalent - 88 Nm.	1
8	Screw Driver No. 902	1
9	Screw Driver No. 935	1
10	Marking jig for drilling	1
11	Earth Insulation Tester	1
12	Megger	1
13	X-Talk Measuring Instrument	1
14	Field DP LCD display	1



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Annexure-2

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



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Annexure-3

OEM's Site Inspection Certificate

To

PCSTE/

Railway

This is to certify that verification of system installation (details given below) has been complied by undersigned (OEM's representative) and all necessary arrangements like Earthing, Surge Protection Devices, 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 commissioned:

Name of RDSO approved OEM:

Name of OEM representative with Designation:

Signature of OEM representative with Date:



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Annexure - 4

Technical Advisory Note			
Subject	Digital Axle Counter – Wiring Discipline		
<u>Document Number</u>	<u>STS/E/TAN/6001</u>	<u>Version</u>	<u>1.0</u>
<u>Dated</u>	<u>04/10/2011</u>	<u>Pages</u>	<u>2</u>

It has come to notice that usage, termination and wiring of quad cable is far from satisfactory for trouble-free working of electronic equipments like digital axle counters/UFSBI. Basic issue pertains to electromagnetic interference from parallel circuits in the cable and location.

Following guidelines are recommended to enhance performance of DAC systems.

1. Parallel circuits:

- a. 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.
- b. 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.
- c. DAC circuits in location shall 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.
- d. 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.
- e. 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.

2. Twisting of cable pair:

- a. 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.
- b. Quad cable twisting shall be ensured during termination so that **minimum one twist per inch** is maintained till the last inch into terminations.
- c. Any wiring from quad cable terminations to equipment shall be done using **twisted singles** of indoor signaling cable (1 mm square) or any other approved indoor twisted pair cable.

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- d. Signaling cable or any other untwisted cable pair **shall never** be used in DAC communication circuits to avoid intermittent type of failure.

3. Wiring & Terminations:

- 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.
- 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.
- 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 toughing, 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.

4. Continuity and Earthing of cable armor & screen at intermediate terminations/Joints:

- 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 & armor.
- Quad cable screen & armor shall be made **electrically continuous** at the intermediate terminations/ joints by soldering and connecting both ends of cable screens & amours at the locations.
- Connections to screen shall preferably be made by thin metallic clamps soldered to screens to ensure **good surface connection** for electrical continuity.
- Combined Earth for armor and screen at intermediate locations shall have earth values as low as possible but shall be never more than 5 ohms.
- 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.

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Annexure - 5

Technical Advisory Note			
Subject	Technical Advisory for Digital axle counters		
Document Number	STS/E/TAN/7006	Version	1.0
Dated	13/02/2015	Page	1

A general technical advisory for installation and maintenance of Digital axle counters is mentioned below.

Quad Cable

1. 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 10Mohms, 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.
2. Twisting of quad cable pair should be upto the terminations - one twist/inch.
3. Earthing connections to quad cable screen should preferably be through clamps soldered to screen to have good connection.
4. Avoid using same cable as DP information for long distance relay circuits. Under unavoidable cases, the quads used should be farthest in spatial distance.
5. Technical advisory note no. 6001 (wiring discipline) has already been issued earlier. This should be strictly followed.

Power Supply

6. Measurement of Voltage levels and AC ripples at DAC input. Ideally ripples should be less than 50mVp-p.
7. Separate power supply/module for DAC to be used.
8. Avoid bunching of power and DAC cables in relay room.
9. Line-wise segregation of Evaluators and its power supply to be followed.

Earthing and SPDs

10. Earthing of cable armor & screen - to achieve a low screening factor. Continuity also to be ensured.
11. Surge protection arrangement on power/communication/reset lines is required to be provided.
12. SPD & their wiring - short and straight wire with low inductance away from other wiring of electronics, SPD of proper quality needs to be ensured. Periodic checking of SPD should also be undertaken.
13. The filter and SPD unit, wherever provided separately, should always be kept in circuit. Periodic checking of same needs to be ensured.
14. TAN no. 7005 has already been issued for lightning protection measures to be taken in DAC installations.

Others

15. Continuity of Traction bonds in the vicinity of the sensors (50m) should be ensured to keep earth potential rise near DP minimum.
16. DP should be away from neutral section by 30m. Distance separation between 2 adjacent DPs should be min. 2m.
17. Sensors should be sufficiently far away from rail joints.

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Technical Advisory Note			
Subject	Technical Advisory for Digital axle counters		
Document Number	STS/E/TAN/7006	Version	1.0
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18. 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.
19. Screen of Sensor cables should be properly earthed at location end.
20. Redundancy in media can be planned where communication failures are high. Media changeover arrangement/ switch should be provided for this.
21. Use of High availability SSDAC in high density traffic areas can give more availability and reliability of system (BPAC applications).
22. For MSDAC, Evaluators should be kept in dust free and ventilated rooms.
23. Interactive website has been developed by CEL & Eldyne to log complaints and get feedback. Siemens have also circulated email Id for logging complaints. Railways may utilize these for reporting their issues to concerned OEMs.
24. OEMs have been advised to give onsite training to staff as per requirement of Railway.
25. Implement effective Installation and Commissioning procedures as per PCCL. All columns of the PCCL should be filled in and only then signed.
26. Person signing the PCCL should be different from installer so that additional check is enforced.

This is not exhaustive and will be updated based on feedback and suggestions from Zonal Railways.

For any issues related to this TAN (technical advisory note) please contact Director/Signal-VII at RDSO, Lucknow (Rly phone- 032-42659, DOT-0522-2465751, Email: edsig@rdso.railnet.gov.in)




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Annexure - 6

Technical Advisory Note			
Subject	Guidelines for lightning protection arrangements for DACs installed in lightning prone areas		
Document Number	STS/E/TAN/7005	Version	1.0
Dated	11/11/2014	Page	1

Quite a few incidences of failures of MSDAC/SSDAC are being reported where main cause is lightning. Accordingly, guidelines for protection for installations in lightning prone areas are given below. These are not exhaustive and Railways may have additional measures also if so required.

1. 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.
2. The equi-potential bonding of indoor signalling equipments including IPS racks should be provided in the power room and connected to low resistance earth of less than 1 Ohm.
3. 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.
4. 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.
5. All connections from equipment or SPD to earth bus bar shall be exothermic welded or soldered.
6. Suitable Class C SPDs should be provided in the power line, communication line and reset line for surge protection in DACs.
7. High quality, high speed & self-diagnosing type SPDs should preferably be used.
8. Intactness and availability of SPDs in DAC should be checked periodically and recorded in maintenance logbooks.
9. Record of provision of SPDs with make and model details should be made in PCCL by OEM & Railways.
10. Only Shielded cable should be used in indoor wiring of DAC.
11. 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.

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12. 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.
13. 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.
14. The armour of all Quad cables should be properly earthed at both ends.
15. Cable armour continuity should be maintained while making joints in Quad cable.

For any issues related to this TAN (technical advisory note) please contact Director/Signal-VII at RDSO, Lucknow (Rly phone- 032-42659, DOT-0522-2465751, Email: edsig@rdso.railnet.gov.in)

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Annexure - 7

Technical Advisory Note			
Subject	Precautions during maintenance activities related to Axle Counters		
Document Number	STS/E/TAN/7009	Version	1.0
Dated	11/12/2020	Pages	Page 1 of 2

Railways are advised to disseminate following discipline among maintenance staff during replacement/ maintenance activities of axle counters of any make, as given below-

1. Replacement of components of SSDAC/HASSDAC/MSDAC:

- a. This 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.
- b. 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.
- c. Monitoring of VR of DACs shall be done through Data logger.

2. 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.

3. Handling of Track Devices:

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. As a general explanation to railways for various issues raised so far following guidance is shared:-

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Technical Advisory Note			
Subject	Precautions during maintenance activities related to Axle Counters		
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- a. 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.
- b. 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.
- c. 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.
- d. 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 undesirable manner.

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