



TECHNICAL GUIDELINES & SPECIFICATIONS

(PART – IV)

For

1. SIGNALLING & TELECOMMUNICATION ARRANGEMENTS IN CONNECTION WITH PROVIDING LONGER LOOP AT NASHKAL (NSKL) STATION IN UP LOOP LINE TOWARDS SC END and GHANPUR (GNP) STATION IN DN LOOP LINE TOWARDS KZJ END.

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TABLE OF CONTENTS

S.No	Description	Page
1	Abbreviations	5
2	Introduction & Site Information	7
2.0	Introduction	7
2.1	Objective	7
2.2	Section Details	7
2.3	Infrastructure Details	7
2.4	Project Scope	10
3	Technical Details	11
3.5	General Requirements	11
3.8	Laying of Signalling, Power & Telecom Cables	15
3.9	Signal and Location Box	17
3.10	Power Supply	19
3.11	Indoor Wiring	19
3.12	Outdoor Wiring	21
3.13	Electronic Interlocking	21
3.14	High Availability Single Section Digital Axle Counters (HASDAC)	22
3.15	UFSBI	23
3.16	Data Loggers	23
3.17	Earthing, Lightning and Surge Protection	23
3.18	Point Machines	24
3.19	Track Circuits	25
3.20	IP Based Surveillance Cameras	25
3.21	Testing of the System	25
3.22	Batteries	27
3.23	Post Commissioning Maintenance	28
3.24	Documentation	29
3.25	Releasing of Material	29
4	Reference Drawings	30
5	List of Annexures	32
Annexure	3A List of Design and Documents	33
Annexure	3B List of As Made Documents	34
Annexure	3C List of documents to be submitted for Quality Hand Book	35
Annexure	5 List of Pre-Commissioning Checklists and OEM Installation Certificate	37
Annexure	6 List of Maintenance Registers	38
Annexure	7 List of Policy Letters / Circulars	39
Annexure	11 Typical Drawing for RCC Cable Duct (modified)	
Annexure	12 Arrangement of cables trunking under road/track crossing	
Annexure	15 Technical Specifications for Ethernet Switch	40

Section1

Abbreviations

In this Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively assigned to them:

AT	Auxiliary Transformer	AWS	Approach Warning System
BPAC	Block Proving by Axle Counters	BIS	Bureau of Indian Standards
SC	Secunderabad	CBTC	Communication Based Train Control System
CLS	Color Light Signal	CPM	Chief Project Manager
CRS	Commissioner of Railway Safety	CT	Cable Termination
CTC	Centralized Traffic Control	CTB	Cable Termination Box
DL	Data logger	DMTR	Daily Material Transaction Register
DN line	Down Line	DP	Detection Point
ELD	Earth Leakage Detector	EI	Electronic Interlocking
EOLB	Electrically Operated Lifting Barrier	FACS	Fuse Auto Changeover System
FAT	Factory Acceptance Test	FDMS	Fibre Distribution Management System
FN mux	Failsafe Network Multiplexer	FRP	Fibre Reinforced Plastic
GAD	General Arrangement Drawing	GI	Galvanized Iron
GKP	Gorakhpur	GUI	Graphical User Interface
G&SR	General & Subsidiary Rules	HDN	High Density Network
HDPE	High Density Polyethylene	IBS	Intermediate Block Signal
IIT	Indian Institute of Technology	IPS	Integrated Power Supply System
IRP W M	Indian Railways Permanent Way Manual	IRS	Indian Railway Specifications
IRSE	Institution of Railway Signal Engineers	IRSEM	Indian Railway Signal Engineering Manual
IRSOD	Indian Railway Schedule of Dimensions	IRSTELO	Institution of Railway Signal & Telecommunication Engineers Licensing Organization
IS	Indian Specification	KVA	Kilo Volt Ampere
LC	Level Crossing	LED	Light Emitting Diode
LoP	Layout Plan	LMLA	Low Maintenance Lead Acid
LTE	Long Term Evolution	LUX	Luminous Flux
LVR	Low Voltage Relay	MOLB	Mechanically Operated Lifting Barrier

MS	Mild Steel	MSDAC	Multi Section Digital Axle Counter
MUX	Multiplexer	NI	Non-Interlocking
NP2	Non-Pressure 2	NVR	Network Video Recorder
OEM	Original Equipment Manufacturer	OFC	Optical Fibre Cable
OTDR	Optical Time Domain Reflectometer	PA	Public Address
PCB	Printed Circuit Board	PI	Panel Interlocking
PCE	Principal Chief Engineer	PCEE	Principal Chief Electrical Engineer
PCOM	Principal Chief Operations Manager	PCSTE	Principal Chief Signal & Telecom Engineer
PPTC	Polymeric Positive Temperature Coefficient	QAP	Quality Assurance Plan
RAMS	Reliability Availability Maintainability and Safety	RCC	Reinforced Cement Concrete
RDSO	Research Designs and Standards Organization	RITES	Rail India Technical and Economic Services
RRI	Route Relay Interlocking	RTU	Remote Terminal Unit
SAT	Site Acceptance Test	SC	Secunderabad
SCR	South Central Railway	SIL-4	Safety Integrity Level-4
SIP	Signalling Interlocking Plan	SMPS	Switch Mode Power Supply
SMS	Short Messaging Service	SWR	Station Working Rules
SWRD	Station Working Rule Diagram	TAN	Technical Advisory Note
TCAS	Train Collision Avoidance System (KAVACH)	TOC	Table of Control
TSAA	Technical System Application Approval	UD line	UP & DN Bi-Directional line
UP Line	UP Line	UFSBI	Universal Fail Safe Block Interface
VDU	Visual Display Unit	VRLA	Valve Regulated Lead Acid
XLPE	Cross Linked Polyethylene	YR	Slot Relay
6Q	6Quad	NABL	National Accreditation Board for Testing and Calibration Laboratories

Scope of signalling and telecommunication works:**Works to be done by Contractor:**

SIGNALLING & TELECOMMUNICATION ARRANGEMENTS IN CONNECTION WITH PROVIDING LONGER LOOP AT NASHKAL (NSKL) STATION IN UP LOOP LINE TOWARDS SC END and GHANPUR (GNP) STATION IN DN LOOP LINE TOWARDS KZJ END. .as per latest Railway Board Policy / Guidelines and RDSO Specifications RDSO/SPN/192/2019 Ver. 2.0 or latest.

As per Railway Board Letter No 2021/Sig/25-Conf/5/SSC dt 26.02.2021.

A. Supply, Installation, Testing and Commissioning of Electronic Interlocking System at Akot station as per latest Railway Board Policy / Guidelines and RDSO Specifications RDSO/SPN/192/2019 Ver. 2.0 or latest. As per Railway Board Letter No 2021/Sig/25-Conf/5/SSC dt 26.02.2021.

B. Supply, trenching and laying of 6 Quad and 24F OFC and carrying out all indoor works **AT NASHKAL (NSKL) STATION IN UP LOOP LINE TOWARDS SC END AND AT GHANPUR (GNP) STATION IN DN LOOP LINE TOWARDS KZJ END.**

C. Carrying out Outdoor works like trenching, cable laying, provision of RCC duct, installation of track circuits, point machines, signals, location boxes, earthing and any other works as directed by engineer as per site requirement for complete working of the station.

Note: Bidders may please note that the Technical Specifications of the Project is being provided only as a preliminary reference document by way of assistance to the Bidders who are expected to carry out their own surveys, investigations and other detailed examination of the Project before submitting their Bids. Nothing contained in the document shall be binding on the Engineer nor confer any right on the Bidders and the Engineer shall have no liability whatsoever in relation to or arising out of any or all contents of this document.

Section 3 Technical Details

3.0 The scope of the work is ‘**SIGNALLING & TELECOMMUNICATION ARRANGEMENTS IN CONNECTION WITH PROVIDING LONGER LOOP AT NASHKAL (NSKL) STATION IN UP LOOP LINE TOWARDS SC END and GHANPUR (GNP) STATION IN DN LOOP LINE TOWARDS KZJ END.** as per approved System Configuration and Scheme Plan. The scope of each sub work is detailed below under various heads.

- 3.1** The entire work is to be executed as per the provisions of the Rules for opening of railways, IRSOD, SCR G&SR, IRPWM, Indian railways Bridge Manual, Indian Railway Signal Engineering Manual (IRSEM), Indian Railway Telecom Manual, Operating Manual IRS/RDSO specifications, IS Specifications, RDSO TAN's, PCSTE Technical Circulars of South Central Railway, Technical manuals of OEM and the latest guidelines issued by Railway Board, RDSO and South Central Railway.

Note: Any document /drawing /manual /circular /guidelines, etc. which are not attached along with the bid document may be obtained from the Engineer, during office hours on any Business day.

- 3.2** The technical details given below provide the description of the work to be executed. In case of conflict between any two clauses in this document, the decision of the Engineer is final and binding.

- 3.3 General requirements:** This chapter gives the general requirements of the work to be executed.

S. No	Description
3.5.1	Supply of Material
i	The material shall be supplied as per the bill of quantities with prior approval of Engineer before their supply.
3.5.2	Inspection of Material
i	The material shall be inspected by RDSO/RITES/Consignee as specified in the Bill of quantities. Normally, the inspecting agency shall not be changed. However, in case the nominated inspecting agency is not in a position to carry out inspection due to policy changes / or any other reason, the inspection shall be carried out as per Railway's decision. In such a case inspection charges @ 1% of the material cost shall be deducted from the contractor's bills. Decision for change of inspection clause shall require Approval of Sr.DSTE/Co-Ord/SC.
ii	Material with RDSO specifications shall be procured from RDSO approved vendors only. If no RDSO approved vendor is available, material shall be procured from other sources as approved by Railway.
iii	Notwithstanding any approval which the inspecting officer may have given in respect of the stores or any materials or the work or workmanship involved in the performance of the contract (Whether with or without any test carried out by the contractor or the Inspecting officer or under the direction of the Inspecting officer) and notwithstanding delivery of the stores where so provided to the interim consignee, it shall be lawful for the consignee, on behalf of the purchaser, to reject the stores or any part, portion of consignment thereof within a reasonable time after actual delivery thereof to him at the place or destination specified in the contract. If such stores or part, portion of consignment thereof is not in all respects in conformity with the terms and conditions of the contract whether on account of any loss, deterioration or damage before dispatch or delivery or during transit or otherwise whatsoever.

iv	In order to facilitate Railway's representative inspection, Contractor shall produce all certificates, e-way bills and invoices in original during inspection. Contractor will also facilitate the Railway representative with labour and skilled staff for sample testing of the material. Material, irrespective of value, which is not in conformity with the specifications, loss, defective or damaged, will be rejected summarily.
3.5.3	Augmentation / Alterations and Interfacing with existing equipment
i	The contractor shall arrange and coordinate with the OEMs of existing system for interfacing with hardware / software with necessary alterations.
3.5.4	Installation and Commissioning
i	All the equipment shall be installed and commissioned by OEM's authorized engineers. OEM Installation certificates, testing certificates, Pre- commissioning checklists etc., shall be arranged by the contractor. Procedures specified in the latest RDSO TAN shall be followed.
3.5.7	Tools & Plants
i	All tools & plants, measuring instruments etc. required for installation, testing & commissioning shall be arranged by the contractor and shall be the contractor's property.
3.6.2	Technical Details: The proposed cable route path for trenching shall be prepared by carrying out site survey. The survey report shall be prepared in a diagrammatic representation, showing the existing cable paths, distances of various cable paths from the nearest track centre, railway land boundary etc.. The cable paths shall be preferably planned at a distance of one meter from railway boundary. Nomination of fibers for various applications shall be as under

3.7. Laying of Signalling, Power & Telecom Cables:

3.7.1 Scope of the work: Trenching and laying of cable ducts, signalling, power and telecom cables in the main path (on either side of track), as per the approved cable route plan, termination, jointing & wiring required for commissioning of the Automatic Block Signalling in the entire section and stations as detailed below.

3.7.2 Technical details:

S No.	Description
3.8.2.1	Cable Laying
i	Trenching and laying of cable ducts, Signaling, telecommunication, Power cables, termination of cable on terminals, blowing of OFC, splicing, jointing, provision of joint chambers and termination of fibres on FDMS of OFC and testing of cables and fibres and associated works. Practices as specified in IR Telecom Manual, guidelines issued by RDSO for signal cable laying vide RDSO/SI/G/2010 Ver 1.1 or latest, PCSTE/SCR technical guidelines shall be followed. In RE area special precautions laid down in RDSO guidelines shall be followed.
ii	Requirements of micro-tunnelling / trenchless laying, laying of RCC duct / HDPE pipe / polyolefin duct / RCC pipes / GI Pipe and protection arrangements etc. shall be assessed based on site survey and shall be indicated in the cable route plan and submitted for approval of Railway. Cable shall be laid as per approved cable route plan and cable core / distribution plan. An extra cable loop of 6 to 8 meters shall be kept at each end of the main cable / tail cable / power cables / 6Q cable, at apparatus cases, at signal foundations, ABS huts / Relay rooms, major bridges and culverts. If the cables are to be laid in the station area/circulating area by breaking concrete/road/platform/any other surface, the work area shall be brought back to its original state after completion of cable laying.

iii	<p>a) RCC duct as per SCR DRG No.5778A shall be laid at a depth not less than 600 mm. RCC duct shall be filled with River sand / Sieved quarry dust / Robo Sand. The joints of RCC duct covers shall be sealed with cement mortar. The trench shall be refilled after closing of the duct. Sand used for casting of RCC duct shall be as per IS 1542 (1992) or latest.</p> <p>b) The trench path shall be straight as far as possible. The trenching shall be carried out without causing damage to the working cables and utilities. A qualified engineer shall be deployed at the work spot continuously. JPO No.1/SG/2004 Dt:17.12.2004 or latest for taking up digging activity near S&T cables shall be followed. Necessary bushes/trees/jungle shall be cleared before taking up the trenching.</p> <p>c)</p> <p>If any cables or utilities are damaged during digging of cable trench or any other activity, the same shall be repaired and restored to working condition at contractors own cost. Damages which are affecting safety and train operations shall be restored immediately.</p>
3.8.2.2	Cable Laying on Bridges
i	<p>a) Cable laying on major bridges having steel girders shall be either through GI trough vide DRG No.15-D6 of IRSEM (Supporting channels vide DRG No. S&T/RE/78/2/76 page 1, galvanized to Spec IS 2629-1985) or through Medium class GI pipe confirming to IS.1239 (part-I) 1990 and galvanized to specification IS.4736-1986 of adequate diameter supported by 'C' Channels of size not less than 100mm x 50mm x 1200 mm thickness 5mm galvanized to specification IS 2629-1985.</p> <p>No drilling of holes on girders is permitted.</p> <p>b) Cable laying on major Bridges with concrete girders and having built in duct shall be laid through HDPE pipe of Dia 110 mm, to specification PE 80 (IS 4984). Masonry brick blocks of size 500 x 500 mm (width X height) shall be provided at either end of the bridge to cover exposed HDPE pipe completely.</p> <p>c) Cable laying on major Bridges with concrete girders without built in duct shall be done through GI pipes of adequate diameter. Concrete masonry of 300X300X300 mm above GI pipes shall be provided at every 2 mts .The GI pipes shall be clamped at every 1 mt. The GI pipes and concrete masonry shall not infringe as per IRSOD. Both ends of the GI pipes are to be closed with brick masonry.</p> <p>Cable laying on all minor bridges / culverts shall be as per DRG No. 15-D8 of IRSEM. Medium class GI Pipes of adequate diameter for laying cable on the culvert shall be used. When the cables are to be laid on the bed of culverts or under culvert, the laying shall be done as per IRSEM drawing no DRG No. 15-D7. This procedure shall be adopted for minor bridges/culverts where there is no perennial water flow. The pipe shall be of non-pressure NP2 class (light duty) of 150mm dia R.C.C. pipes with collars jointed with a stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand). GI Pipe shall be perforated at regular intervals. GI pipe shall have collar at one end and threads at the other end. GI pipes shall be threaded tightly without any gaps.</p>
ii	<p>When cables are to be taken inside Relay room/Goompty/Dy SS room/LC gate hut or into any other building the cables shall be taken through GI pipe of adequate size with suitable 'U' bends tightly threaded to the GI pipes through the wall cut at minimum height. The GI pipes shall be protected by carrying out brick masonry work around the GI pipes. The Elevation of the building shall not be spoiled.</p>
iii	<p>When the cables are required to be taken inside working location boxes / Signal Post, the cable shall be taken from underneath the location box/signal post foundation. Inside of the location box shall be sand filled, plastered after taking the cables inside.</p>

iv	<p>6Q cable shall be jointed using jointing kits to specification IRS TC 77/2012 Rev 3 with latest amendments. These joints shall be kept in a separate new Full Location Box duly fixing with teak wood reapers on both ends of the joint without any sharp bends.</p> <p>6Q cable shall be terminated on Disconnect terminals which shall confirm to RDSO Specification No. 189/2004 or latest. 6Q cable pairs shall be twisted before termination.</p>
3.8.2.3	OFC Cable Laying
i	<p>a) Laying of HDPE duct and blowing of OFC Cable shall be done as per guidelines given in Section VIII of Chapter 13 of IR Telecom Manual. OFC cable shall be blown through HDPE duct confirming to specification RDSO/SPN/TC/45/2013. OFC cable shall be blown through HDPE duct using a blowing machine and no manual pulling is permitted. Before blowing of OFC cable, Duct Integrity test shall be carried out on HDPE duct as per procedure laid down in Annexure-I Chapter 13 of IR Telecom Manual and readings shall be recorded before blowing OFC cables. OFC cable shall be jointed as detailed in Section X Chapter 13 of IR Telecom Manual. After splicing, OFC shall be tested and readings recorded as per format in Para 13.10.23 of IR Telecom Manual and adopted in SCR.</p> <p>All the fibers of OFC shall be terminated in FDMS in Stations / Cabins as per system requirement. These FDMS shall be housed in a suitable standard make 42U rack such as Vero President / Rittal / AEW etc. at the ABS Huts / Stations. The rack shall have cooling fans, Power managers, cable managers, equipment trays of adequate numbers. OFC Patch cords of adequate length shall be provided to connect OFC cables to Equipment.</p>

3.8. Signal and Location Box

3.8.1 Scope of the work: Supply, transportation, casting foundation, installation, termination of cables, wiring, testing of location boxes and signals with all accessories required for commissioning of the system.

3.8.2 Technical details:

S. No.	Description
3.9.2.1	Location boxes
i	The top surface of the foundation shall normally be at rail level in a plain area. The apparatus case shall be painted with two coats of aluminum paint on outer surface and two coats of white paint inside. The paints shall be of make Berger / Asian / British / JSW etc.
ii	The apparatus case shall be painted with two coats of aluminum paint on outer surface and two coats of white paint inside. The paints shall be of make Berger / Asian / British / JSW etc.
iii	The apparatus case in which any equipment like MSDAC / DCDP / Chargers etc. need to be kept shall be provided with teak wood plank of size 940 X 470 X 20 mm neatly finished and applied with two coats of wood primer.
iv	A cable loop pit of size not less than 1mtr depth and 1.5 mtr diameter shall be made near every location box and a loop of 6 to 8 mtr of each cable shall be coiled and kept in the pit. Individual cable coils shall be tied with released cable pieces and kept in the pit one top of the other, if multiple cables are to be terminated in the same location box. The loop pit shall be refilled and rammed. In any case the depth of top most cable shall not be less than 1 mtr.
v	The location box shall be painted and numbered as per the existing practice of SCR. To the extent possible, location Boxes shall be pre-wired at a central location and erected on foundations. For ease of maintenance, the wiring and terminations shall be uniform throughout the section. Infringement particulars, earth resistance particulars of Location box shall be painted on the track side of location box. Stoppers to be provided for LB doors which are infringing the nearby tracks.

3.9.2.2	Signals
i	The signal post shall be suitably plumbed to make it straight. The Gap between Surface base and signal post shall be filled with glass wool and shall be lead sealed.
ii	The complete signal shall be painted with two coats of enamel / Aluminum paint.
iii	The signal infringement distance shall be painted on the signal surface base towards track side. The paints shall be of make Berger / Asian / British / JSW etc.
iv	<p>A cable loop pit of size not less than 1mtr depth and 1.5 mtrs diameter shall be made near every signal and a loop of 6 to 8 mtrs of each cable shall be coiled and kept in the pit. Individual cable coils shall be tied with released cable pieces and kept in the pit one top of the other, if multiple cables are to be terminated in the same signal. The loop pit shall be refilled and rammed. In any case the depth of the top most cable shall not be less than 1 mtr.</p> <p>The tail cables shall be taken through the foundation, signal post and terminated in the signal unit using 6 way terminals. The wiring from 6 way terminal to signal LED shall be carried out using adequate dia. flexible PVC/steel hose pipe and 28/0.3 mm copper wire with lugs of suitable size.</p>
v	For the Colour Light signals in the RE area which are coming in the infringing zone, screening arrangement as per SCR Drawing No.5767 shall be provided and separately earthed as per IRSEM para No 19.11.3(f). The screen shall be made of MS wire-mesh and shall be fixed on MS angles of size 25mm x 25mm x 6mm with suitable fixing clamps, bolts and nuts and painted with one coat of red oxide and two coats of black paint of make Berger / Asian / British / JSW etc.
vi	All Route Indicators shall be mounted on the top of the signal post firmly. The tail cables for route indicators shall be taken through signal post without any damage to the insulation and armour, skinned and terminated on route indicators. Route indicators shall be wired with 28/0.3mm copper wire as per the approved circuit diagram. Hoods shall be fixed properly and examined during day time and if required extension of hoods shall be made to have proper visibility.
vii	Calling on signals/ 'A' marker/'AG' marker/ Shunt signals shall be fitted on the signal posts at required height using suitable off-set bracket. Suitable hole shall be drilled on the signal post to bring the cable/jumper wires. The cable/jumper wires shall be taken to calling on signal/ 'A' marker/'AG' marker/Shunt signal through suitable steel hose pipes and wired. The calling on signals shall be provided with 'C' marker and 'Automatic signals with 'A'/'AG' marker. Number plates to be fixed and painted as per the standard practice of South Central Railway.
viii	In Case of signals with horizontal clearance less than 2.36 mtrs from the nearest track centre, blanking arrangement shall be provided as per IRSOD. The ladder of the signal shall be blanked off to a height of 300 mm between 2060 mm and 2360 mm above rail level using MS plate not less than 8 mm thickness. The end portions of the plate shall be rounded off and no sharp edges shall be protruding. The plate shall be painted with two coats of black color. The signal post shall be painted as per Annexure 19-A1 of IRSEM. The paints shall be of make Berger/Asian/British/JSW etc.
ix	The work includes excavation of pits casting of shunt signal foundations as per Drg. NO. SC/N/CN/62-B using Anchor bolts of size 20mm X 450mm. The position of shunt signals will be indicated by Railways in the signaling plan.
x	Foundations for shunt signal should be of cement concrete with ratio of 1:3:6 using stone ballast of 20/25mm size to be cast at location shown by the Railway's representative. The foundation to be plastered in all sides.
xi	The position light shunt signal shall be properly mounted on post and plumbed.
xii	Necessary earthwork shall be made for each position light shunt signal if required by Railway. The cables are to be taken through the post to the unit, skinned and terminated.
xiii	Position light shunt signal are to be wired as per approved practice by Railway. The wiring is to be tested jointly. The shunt signal to be focused correctly in day time at bright light at rated voltage. The signal unit's back door covers are to be locked using universal locks.

3.11. Indoor wiring:

3.11.1. Scope of the work: Design, supply, installation, wiring, testing, energization and commissioning of indoor circuits at Stations, LC gates and for alterations in existing relay rooms at stations / LC gates.

3.11.2. Technical details:

S. No	Description
i	All the contacts of relay shall not be used, at least one front contact and one back contact shall be kept as spare for future requirements.
ii	Relay bases of only the correct configuration shall be used. Under no circumstances, configuration of bases shall be disturbed. Penalty of Rs 10,000/- per relay will be imposed for such wrong configuration.
iii	Wiring shall be done as per approved circuits and practices adopted in South Central Railway. All the wiring should comply with the EI / ABS (equipment) OEM checklist, latest RDSO TANs. All wiring is to be properly bunched with lacing twine or cable ties.
iv	The details of wires / cables to be used for various types of indoor wiring is listed below: Relay to relay, relay to cable termination rack, relay to fuse blocks: 16/0.2mm wire coils ATC as per IRS S76/89 Amendment No.2 or latest. Power supply wiring: 35 sq.mm (277/0.4 mm)/10 sq.mm wire coils (140/0.3 mm) as per IRS S76/89 Amendment No.3 or latest according to load calculations / OEM recommendation. Relay rack to panel: 60 core indoor cable as per IRS-S-76/89 Amendment-2 or latest / signalling cable as per specification IRS 63/2014 Rev 4 or latest. Earthing: Multistrand copper conductor of appropriate dia. shall be used for connection of equipment / earth bus bar as per RDSO code of practice for earthing. Data logger wiring: i) Tag Block to data logger: 60 core indoor cable as per IRS-S-76/89, Amendment-2 or latest. ii) Relay to Tag Block 16/0.2mm wire coils ATC as per IRS.S76/89 or latest. MSDAC, UFSBI, FNmux, EI: as per OEM recommendations.
v	All the flexible wires shall be terminated using suitable sized lugs. These lugs shall be crimped and soldered. Wire identification tags / sleeves / Ferrules of insulation material shall be provided at both ends of the wire with terminal particulars printed on it. Soldering shall be carried out as per para 19.1.2 of IRSEM. At fuses i.e., on bus bar side, wiring shall be in ring fashion.
vi	Relay name and number shall be painted / printed on the relay racks as per the standard practice (both in front and rear side of each relay) and CT rack termination particulars, fuse particulars shall be painted / printed on the CT rack / power rack in addition to details displayed on the wall.
vii	Relays flashing shall be done before plugging in the relays and flashing readings shall be recorded.
viii	Testing of wiring shall be in accordance with the IRSEM Para 19.8.5. Testing is to be carried out by Competent Engineer before offering to railways. Testing shall be offered to railways at two stages: Stage 1: Wire to wire test with buzzer before soldering Stage 2: Wire to wire test with buzzer after soldering The wiring will be tested separately by SSE & Officer nominated by Railway at each stage. Different colour ink shall be used for testing at different stages. Necessary manpower and tools required for testing of circuits by SSE & Officer shall be arranged by the contractor.

ix	Potential free contacts of remote sensor / alarm unit of fuse automatic changeover unit shall be wired to data logger.
x	The power cables of either side of stations shall be connected to different channels of ELD. Pre commissioning checklist and OEM installation certificate shall be prepared and submitted. All the power cables shall be in healthy condition as per earth leakage detector set values. Potential free contacts of Earth Leakage Detector shall be wired to data logger.
xi	All the cable entries shall be closed properly using concrete / Silica Gel or any other compound to avoid entry of rodents or cable theft.
xii	Arrangement shall be made by way of proximity switch or any other means to monitor the opening of relay room through data logger.
xv	Suitable arrangements shall be made in the relay rack for fixing condenser and resistance units as per the circuit design requirement. Letter painting shall be made against each unit to identify the circuit for which it is used.

3.12. Outdoor wiring

3.12.1: Scope: Design, installation, wiring, testing and energization of all outdoor circuits to make the installation functional.

3.12.2. Technical details:

S. No	Description of the work
i	The installation in location boxes and wiring shall be done as per the approved wiring diagrams. The wiring shall be tested by Competent Engineer, before offering to the railways for final testing. The contractor shall arrange necessary manpower and tools for the testing of circuits / functional testing by railway officials.
ii	Wherever necessary, the existing tail cables of signals/Location Boxes shall be released from the existing signals / Location Boxes and new tail cables shall be drawn to the functions and terminated as per approved scheme. This work shall be planned in such a way that disconnection required is either nil or bare minimum. If felt advantageous, new foundations shall be casted for signals to eliminate the need for disconnections.
iii	All the flexible wires shall be terminated using suitable sized lugs. These lugs shall be crimped and soldered. Wire identification tags / sleeves / Ferrules of insulation material shall be provided at both ends of the wire with terminal particulars printed on it. Soldering shall be carried out as per para 19.1.2 of IRSEM. At fuses i.e., on bus bar side, wiring shall be in ring fashion.
iv	Cable termination particulars of location boxes shall be painted inside location box.
v	Consequent to introduction of new circuits or alterations to existing circuits in apparatus cases / CTBs, new nomenclature should be painted on the cable sleeve. And also, the new particulars / corrections to existing particulars shall be painted / printed on the inner side of the doors.

3.13 Electronic Interlocking:

3.13.1. Scope of work:

Design, supply of hardware & software, wiring, testing, energizing of circuits as per approved SIP as per Spec No. RDSO/SPN/192/2019, Ver.2 or latest.

3.13.2. Technical Details

S. No	Description
3.13.2.1	Electronic Interlocking
i	The whole interlocking of a yard shall be controlled either by central operation or distributed operation.
ii	The system shall have facility of monitoring of internal variables as well as status of I/O. Through the maintenance terminal and data logger network of the Railway.
iii	External data logger shall be connected in such a way both for logging of analog/digital inputs of external functions and for EI modules inherent diagnostics. It shall be possible to connect EI with central monitoring unit kept at HQ control unit.
iv	MT shall be used to diagnose problems/events related to hardware and software of EI. MT shall have facility for automatic serial data transfer to a central monitoring unit. The common protocol for this communication shall be as per data logger specification no. IRS: S-99 latest version for interface only.
v	The system shall be capable for working in non-air-conditioned environment and ambient temperature range between -10° c to 70 ° c and relative humidity upto 95% at 40° c.
vi	EI shall have user-friendly graphic based design tool to generate station specific application software to carry out future yard modifications. It shall be possible for Railway to carryout minor yard modifications without the help of firm and the training shall be imparted to Railway maintenance staff for the same as per agreement with the Railway.
vii	For all vital inputs/ outputs, going out of EI room's double cutting arrangement shall be provided.
viii	The RTC of EI system(s) should be updated/ synchronized with the external data logger and it shall be possible to log the events in chronological order in case of use of either single/multiple EI with data logger through CMU (central monitoring unit) if provided in network otherwise through protocol converter.
ix	case any peripheral equipment (such as VDU, MT, Data Logger etc.) Needs to be connected to the EI through serial ports and then EI system shall be isolated from the peripheral systems, suitable isolators shall be used for connecting the peripheral devices.
x	Requirements of earthing and lightening protection as laid down in relevant clause of latest version of RDSO/SPN/197/2008 shall be complied.
xi	The terminals through which common positive or negative supply is provided to EI, must be duplicated, this shall also require duplicated power supply cables from power supply source to EI.
xii	The system shall have log of all the counters like emergency route cancellation, calling on signal, emergency point operation, overlap release operation etc. And that will be logged in maintenance terminal. It shall be possible to read all counters as and when required. If Railway required, it shall also be possible to provide a counter box having non-resettable counters.
xiii	The next level signal control circuits like cascading of signal aspects, red lamp protection etc., shall be achievable through software only.
xiv	The audio-visual alarm shall be available for approach locking, button stuck up etc. Command held high for more than a specified duration in EI as specified by the user Railway.

xv	The VDU system as well as central interlocking unit shall have back up information on log of all counters provided on VDU like emergency route cancellation, calling on signal, emergency point operation, overlap release operations etc.
xvi	Cycle time and response time to read and process the input shall be fast enough to ensure safety and avoid any apparent delay. Cycle time and response time of the system shall be clearly indicated. The longest route for which all points are in favor shall not take more than 5 seconds from initiation of Command to display of lowered signal aspect on control panel.
xvii	All the inputs and outputs of OCs shall be isolated.
xviii	The EI system including its equipment and subsystems shall be under warranty for one year from the date of completion of work in the specified section.
ix	<p>i. Additional software work due to change in scope of signal Interlocking plan shall be carried out by the contractor without any extra cost up to 10% increase in routes and 15% increase Input/output functions. The tenderer shall submit the clause by clause compliance to the RDSO specification RDSO/SPN/192/2019 version-2 or latest with latest amendment including any deviation if any, to the specification along with tender document. Tenderer shall submit clause by clause compliance to Technical advisory notes/improvements suggested by RDSO from time to time.</p> <p>ii. EI system shall comply with instructions issued by RDSO from time to time in terms of Technical Advisory Notes and improvements.</p> <p>iii. The EI equipment shall be installed, tested and commissioned by OEM only. The EI shall comply with all items specified in the pre commissioning check list for EI's issued by RDSO from time to time and items specified in technical system approval by RDSO. OEM shall certify the installation as specified by RDSO.</p> <p>iv. It shall be possible to connect EI's in a network fashion with central monitoring unit kept at divisional/zonal HQ control unit.</p> <p>v. Installation, wiring, testing and commissioning of dual operator VDU with 55" LED monitor. Their connectivity to EI shall be either on ethernet or through an optical fiber cable. Optical fiber cable is preferred medium. It shall display yard and Automatic signals on either side in one screen. Yard to be displayed in bigger size at the top and Automatic signals in smaller size at the bottom of the monitor. Display of yard and Automatic signals shall be shown as per instructions of the site in-charge.</p> <p>vi. Installation, wiring, testing and commissioning of Maintainer VDU with 32"/42"/46"/55" monitor as available at existing station.</p> <p>vii. Hard SM key along with soft controlled touch to prevent unauthorized operation in addition to password protection shall be provided with VDU</p> <p>viii. Non resettable counters with necessary wiring and fixing arrangements as per instructions of engineer shall be provided in the Dy.SS room. There will be no payments for counter bits irrespective of make of EI</p> <p>ix. Blocking of functions (points, signals, track circuits etc.) Shall be possible through VDU.</p> <p>x. Input/output functions of Object controller shall be selected in such a way that failure of one object controller shall not paralyze the entire yard.</p> <p>xi. 230 V AC power supply will be made available in the equipment room by Railway. 230V AC to 110 V DC conversion shall be done by the Railways through IPS. Further extension to EI, DC-DC converters of EI shall be carried out by the contractor. Power supply conversion required for EI shall be provided by the tenderer. The maximum current requirement and the load calculations shall be furnished by the tenderer. The DC- DC converters used for EI shall be provided in N+1 configuration with a safety factor of 1.5. Segregation between the DC-DC converters for system A & B shall be made so that if any DC-DC converter fails whole system should not get affected. The DC-DC converters shall be of approved make as recommended in RDSO Specification/Technical Advisory notes. The power cable and the terminals bringing from IPS/battery charger shall be duplicated with minimum 16 sq. mm. Copper cable so as to provide redundancy. Availability of pure DC supply (harmonics and</p>

	<p>ripples free) for working of different modules/cards shall be the responsibility of the contractor.</p> <p>xii. Input and output interface relays (QECR, QNI, QNAI, QN1K, QTA2, QL1 & QBCA1 working on 24 V) are known to the Railways.All relays used for interface of EI including tracks,signals, points,BPAC,LC gates ,counters etc has to be supplied and installed by contractor as per item no 1&2 of Sch E (Electronic interlocking).</p> <p>xiii. The System shall be supplied with properly interfaced Data logger with protocol converter and adequate capacity of digital and analog inputs, which meets the latest specification of Data logger specification No.IRS.S.99/2006 or latest. The data logger PC shall be provided separately and it shall not be combined with maintenance VDU as per approved Spec.</p> <p>xiv. Maintenance free ring earthing arrangements along with the protection against Electromagnetic and Electrostatic interference for the equipment and to the S&T Rooms respectively shall be provided by the tenderer. The requirements laid down in clause 6.3 of RDSO/SPN/192/2019 version-2 or latest amendment shall be complied. The earthing shall be as per Railway board letter no.2010/SIG/SGF/EI (Ansaldo) dated 22.6.2011 and RDSO TAN.STS/E/TAN/3006 dated 02.11.2012. As per RDSO letter no.STS/L/SSI dated 28.3.2012 (Para-24), all the EI vendors were advised to use the same drawing. If the earth resistance prescribed by the RDSO is not achieved, additional earth pits shall be provided. No additional payment will be made by Railways.</p> <p>xv. All the accessories and consumable material like communication equipment, relay racks, wiring materials, wire coils Aluminium Ladder, fuses etc as covered in schedule required for EI shall be provided by the Contractor. Outdoor signaling cables required will be provided by the Railways.</p>
xx	<p>OPERATOR AND MAINTENANCE VDU DISPLAY requirements:</p> <ol style="list-style-type: none"> The software of VDU shall be certified by independent safety assessor. Shall have Ethernet/OFC communication with the CIU either on OFC, with suitable isolators. Shall have required level of security features & access control for the operator/maintainer. Shall have key board/mouse operation. It shall synchronize the counters/clocks all the time and particularly when resuming from a failure. Shall support buzzers/alarms as in CCIP. It is desired that it shall be possible to analyses the operation and run the play back of the yard for the events of last 30 days. A flashing indication shall be provided on the VDU to indicate healthy condition of the main system, communication channel. Three dot markers in red, blue & green colours respectively shall also be displayed prominently at conspicuous location on the VDU terminal to indicate that the colour monitor is healthy and all the three colours (red, blue & green) are present in right proportion. It shall be possible to display the status of the yard by distinguishing with two differ colours (i.e., system active and system inactive). It shall be possible to display the complete yard layout including the section on the monitor. It shall also have facility for displaying a portion of the yard or section in an enlarged mode or with scrolling arrangement, if required. The current position/ status of various field equipments and track circuits shall be displayed on the VDU using different colors/ symbols, as desired by the purchaser. Availability of communication channel shall be indicated by a constantly flashing indication. Whenever the communication channel goes faulty, a suitable error message shall be displayed on the terminal. Blocking of functions (points, signals, track circuits etc.) Shall be possible through VDU. The blocking operations shall be achieved in fail-safe manner. If VDU and CIU are in separate building, then they shall be interfaced using FOM (fiber

	<p>optic modem) to protect against lightning and surges.</p> <p>xv. Operation of signal gear shall not be possible simultaneously through both VDUs. In case of VDU's used in hot standby, VDU switch over is required as per Railway requirements.</p> <p>xvi. Existing VDU with PC at stations shall be used</p>
xxi	<p>MAINTENANCE AND DIAGNOSTIC AIDS requirement:</p> <ul style="list-style-type: none"> i. Display of the current status of points, signals, controls etc. Of the yard. ii. Storage of minimum one-month data or 10, 00,000 events. iii. Display of recorded events and iv. Data transfer to floppy, CD, flash memory or any other storage media. v. Transfer of recorded events to external data logger. vi. Generation of exception reports shall be possible on MT for analysis purpose and past events simulation on yard layout etc. vii. The soft copy of signalling circuits/manuals provide at the station shall also be loaded on MT for ready reckoner of ESM in simple/local language. viii. MT shall be preferably connected to EI through OFC. If copper cable is used for connectivity the MT port shall be isolated from the port of EI. At both ends RS232 isolator/industrial grade opto-isolator shall be used. ix. Result of the failure of any card/module in the system should be clearly indicated. The supplier should also indicate process of replacing such defective cards / modules. x. MT shall be user friendly and the displays on MT shall be self-guiding type for identifications of faults as well as for maintenance of system. xi. In case of any module/ card becoming faulty, this fact should be displayed on MT with diagnostic facility to identify faulty module/ card.
xxii	<p>POWER SUPPLY REQUIREMENTS:</p> <ul style="list-style-type: none"> i. Non-regulated 230 volts, 50 Hz. Single phase or three phase, one or multiple supply shall be provided by Railways for EI functioning to the vendor/manufactures and rest all subsequent power supply requirements for EI, MT, VDU, OC etc. for EI system shall be arranged by the vendor. The system shall work satisfactorily with input voltage variation from 150 V to 275 V AC and frequency variation from 48 Hz to 52 Hz. This shall also include provision of power supply change over panel for selection of power supply from available multiple sources. The details of power supply shall be specified by the purchaser. ii. Two different voltages shall be used, one to drive EI equipment and the other for receiving the inputs from the field gears. iii. All the DC-DC converters used to provide the different supply to the EI Shall be provided for main and standby EI system separately. iv. DC-DC converters shall be capable for working in non-air conditional environment and ambient temperature range between -10° C to 70° C and relative humidity up to 95% at 40° C. v. Power supply for VDU PC/Panel processor module installed in the SM room shall be provided from 110V DC (from EI or IPS room) with duplicated cable arrangement. This shall have separate suitable DC-DC converter in N+1 configuration. vi. 230V AC supply for VDU Monitor shall be provided through separate inverter (Input voltage 24V DC and output 230V AC, pure sine wave along with SPD & DC-DC converters) shall be provided at SM room with redundant arrangement. Inverter's 230V AC input cable shall be unplugged. vii. The short circuit & over voltage protection of self-restoring type shall be provided. viii. The required protection shall be provided to protect from any malfunctioning due to false/spurious feed. ix. Suitable surge protection and proper earthing arrangement shall be provided in the power supply system to protect against transient voltages, lightning & spikes etc. As per iec normative. x. Tenderer shall provide a document capturing the installation / maintenance methods / work instruction prior to installation. xi. A detailed power supply arrangement diagram/ circuit shall be provided.

	Power supply arrangement for individual processor should be such that, in case of fault in power supply of one processor, all processors should not cease to function simultaneously. It should be possible to switch off and take out faulty processor for repairing/replacement without affecting working of the balance system.
xxiii	EI works as specified in the scope shall be executed in close coordination with the other Indoor & outdoor contract works being executed by other agencies. The contractor shall arrange for one dedicated supervisor at each active work spot for close liaison with other agencies involved.
xxiv	Compatibility: The EI system to be provided shall be compatible with the existing outdoor/any other equipment in use such as HASSDAC, UFSBI etc. Any interface required to be connected to the existing equipment to make the system functional shall be procured and installed by the tenderer. No changes in the existing system will be undertaken by railways for the purpose of commissioning of EI system.
xxv	The EI system shall be installed and commissioned with dual VDU for operations of points, signals, LC gates etc as per the signaling interlocking plan (SIP) issued by Railways. The operators VDUs shall be interfaced with EI.
xxvi	Stable 110 V DC/110V AC required for EI/Object controllers at station and gumties /VDUs will be provided by Railway. DC-DC converters, as per RDSO recommendations (Inspection by RDSO), required for deriving supplies to EI, object controllers and any other equipment shall be supplied and installed by tenderer. The maximum current requirement and the load calculations shall be furnished by tenderer. The DC- DC Converters used for EI shall be provided in N+1 configuration with a safety factor of 1.5. Segregation between the DC-DC Converters for system A & B shall be made such that if any DC-DC converter fails only one system will be affected. The DC-DC converters shall be of approved make as recommended in RDSO Specification/Technical Advisory notes. The power cable and the terminals bringing from IPS/battery charger shall be duplicated with minimum 16 sq. mm. Copper cable so as to provide redundancy. Availability of pure DC supply (harmonics and ripples free) for working of different modules/cards shall be the responsibility of the contractor.
xxvii	Required number of Relay racks, aluminum ladder, wire coils, 6 way terminals/ wago terminals/phoenix terminals, indoor signaling cables, tag blocks, Fuses, Fuse blocks etc. as approved by the engineer in charge shall be supplied by the tenderer. All the interface relays such as QN1, QNA1, QBCA1, QSPA1, required for commissioning of EI system are to be provided by Tenderer. All such relays shall be inspected by RDSO and shall be as per latest specification of RDSO.
xxvii	EI system shall comply with Instructions issued by RDSO from time to time in terms of Technical Advisory Notes and improvements.
xxviii	Various communication modules required for communication between EI, operator VDU, maintenance terminal, object controller and Data logger are to be supplied and installed by the Tenderer. All communication modules shall be of industrial grade. Media (OFC Single Mode only, with RDSO SpecIRSTC-55/2006) will be provided by railways. The EI equipment/ Communication modules shall be compatible with the same. Any media other than OFC shall be provided by the tenderer.
xxix	Protocol converters required for connecting the EI system to Data loggers shall be provided at central EI and end Gomutis as required by the contractor. Data loggers with requisite number of digital and analog inputs will be arranged by the railways. Net-working of Data logger to the control room will be carried out by the Railways. The RTC of data logger should be updated/ synchronized with EI systems and it shall be possible to log the events in chronological order in case of use of either single/multiple EI with Data logger.
xxx	Station Master is to be provided with DUAL VDU with changeover facility. Where SM room and equipment room are situated in two different building, augmented surge protection/Optical Interface shall be provided by EI manufacturer.

xxxii	<p>a) Certificates and Documents confirming RDSO approval for software and hardware versions shall be enclosed with tender document. Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) to be conducted as per RDSO's guidelines.</p> <p>b) On receiving Head Quarter approved Drawings. Internal FAT including square sheet testing to be conducted by Contractor. Qualified Team and clear Documentary proof/Log to be maintained for the same. On completion of Internal FAT Railway Engineers will conduct FAT at Manufacturer premises. Necessary logistics to be provided for conducting FAT at contractors expense for two Railway Engineers for each Installation. If any error is found in Railway FAT, the same penalties as mentioned above are applicable. c) SAT will be conducted at site by the officer nominated by SR.DSTE/CO-ORD/SC. Tenderer shall arrange simulation panel for same. d)The response time of the system for the longest/complex route of a station shall not be more than prescribed time limit set by railways/RDSO if the points are in unfavorable condition in that route. e) The commissioning support by Manufacturer for all items supplied by tenderer shall be ensured at least one month before and after commissioning. Tenderer is responsible for obtaining technical system application approval from RDSO vide Lr No. STS/E/TAN/DS-III/Vol-1 dated 22.08.2016. All teething troubles post commissioning (up to 1 month) must be attended within 6 Hrs</p>
xxxiii	Any minor modification as per concerned RDSO TAN except any addition /deletion of signaling functions to EI during specified warranty period is also to be carried out by the contractor at no additional cost. Whereas for major yard modifications (other than mentioned above) during warranty period will be paid separately by Railways
xxxiii	The manufactures shall guarantee that spare parts for the system shall be available for life cycle period i.e., 15 Years. The tenderer shall give an under taking to supply on payment all maintenance spares and tools required for the equipment during the night time. In case of any plan to discontinue any equipment or components from the manufacturing process, at least one year notice shall be given to the Railway before they are discontinued or phased out to enable Railways to order sufficient quantity of spares prior to stoppage of manufacture. This condition is to be observed for 14 years after expiry of warranty period of one year so that the Railways can procure for the components/modules from the supplier. However, the details of the same shall be kept confidential by the Railways. The Tenderer shall undertake an agreement to enter into an AMC/ARC with Railways, if the Railway desires, beyond the warranty period under which, supply of spare, repairs to defective cards and call charges for each visit as may become necessary shall be specified. Networking shall be done from stations (Stations/RTU) to a central location and Divisional control /SC for centralized monitoring of Diagnostics. All the required materials for this shall be supplied by the contractor. Required bandwidth @2 Mbps and computers if any will be arranged by railways. The Tenderer shall also under take to supply of additional equipment required for replacement of expansion of the network that may become necessary due to additional traffic requirement during the currency of the agreement.

3.14. HA Single Section Digital Axle Counters (HASSDAC):

3.14.1. Scope of the work

Design, Supply, installation, testing and commissioning of High Availability Single section Digital Axle Counters (HASSDAC) as per RDSO/SPN/177/2012 Ver. 3 or latest with dual detection along with all associated works as per approved signalling plan.

Technical details:

S. No	Description
i	<p>Single section digital Axle counter consists of axle detectors & associated electronics (1 or 2 or 3 or 4) confining a track section connected together by a transmission medium where transmission is in VF range. It is capable of counting axles, doing count comparison, finding direction of axle movement, supervision, relay drive and transmission of counts and health of axle detectors & field units.</p> <ol style="list-style-type: none"> Track clear indication shall only be given when IN count and OUT count are equal and equipment is functioning all right. This implies that until all axles that enter a section are completely counted out, the section concerned shall not show as clear. Axle counter shall show occupied the moment any of the axle counter subassemblies belonging to the section is damaged, missing or has become faulty Axle Counter shall use amplitude/phase change techniques or any other fail-safe techniques for safe and reliable wheel detection functions. Axle counter shall have arrangement so that wheels of push trolleys, dip lorry, rail dollies etc. are not counted by it. These wheels shall not result in axle counter going to error. Trolley protection track circuit shall not be required with phase detection. Axle counter operation shall be independent of wear & tear of wheels as permitted vide Indian Railway's Schedule of Dimension, lateral displacement of wheels on rails etc. The manufacturer shall specify the minimum diameter of the wheels, condition of wheels etc., to which the performance of equipment shall not be affected. Axle Counter operation must be independent of type of sleepers in the section such as wooden, RCC, or steel etc. and shall work on all types of rail profiles and construction such as welded or non-welded rails of 52 kg / 60 kg / 90R etc. Axle counter shall operate up to the limit for worn-out rail as given below: Sl. No. Rail section Vertical wear in mm. 1. 60 Kg / metre 13.00 2. 52 Kg / metre 8.00 3. 90 R 5.00 Axle counter shall be suitable for train speeds up to 250 Km/h. Axle counter system shall be designed for ease of maintainability and testability. The equipment shall be robust in construction and shall work on the permanently energized principle. Any defect occurring in the equipment shall not result in a condition that will lead to unsafe situation. The equipment shall be of continuously self-checking type and shall have separate indication to show conditions of track clear and track occupied (including fault). Any disturbance or failure in the equipment including power supply failure shall result in withdrawal of clear indication and occupied indication shall be lit. Card wise failure indication shall be provided. It is desirable to give suitable indication of the nature of failure. Also total system failure and O.K. indications shall be provided. Axle detector/Track Device & field units shall have no moving parts and shall require negligible maintenance. The equipment shall be so constructed as to prevent unauthorized/irregular access to sub-assemblies of the system. Authorized persons should, however, have access to these sub-assemblies for the purpose of installation and maintenance by unlocking the outer cover/breaking of seal provided on the outer cover. The field unit shall be provided with testing, measuring and adjusting facilities for maintenance. The equipment shall be fully solid-state using carefully chosen components of grade. The system shall provide for continuous supervision of axle detector including the cable connecting the counting device and axle detector. Any defect in these shall be immediately detected, error code displayed and the system should go in error mode. .0.18 The maximum axle count, the axle counter can handle should be > 1024. 4.0.19 Response time of train occupancy for any track section shall be less than 1.0 second. Clearance time of any track section after train leaves the section shall be less than 2.5 sec.

	<p>q. Axle counter system design shall take into consideration system growth capability and architecture of digital axle counter shall be such that it is fit to be used on all the sections of Indian Railways including suburban sections.</p> <p>r. Environmentally, slight moisture condensation shall not lead to malfunction or failure of equipment.</p> <p>s. The design of axle counter shall take into account switching transients that may occur either inside or outside the system and of any magnitude., up to and including interruption of full short circuit current.</p> <p>t. Axle counter shall withstand the effect of lightning & surges incorporating lightning & surge protection as per RDSO/SPN/144.</p> <p>u. The equipment shall conform to the Safety Integrity Level 4 as per CENELEC Standard.</p> <p>v. The axle counter should not affect the operation of other wayside signalling equipments. The axle counter shall neither affect or be affected by presence in vicinity of track side signalling equipments like AFTC, TPWS, AWS etc.</p> <p>w. Error rate should not be more than 2 errors per million correctly counted axles, and if there is error, it should not result in unsafe condition. The equipment shall be capable of simultaneously counting in and / or counting out from the ends of the monitored section. Response of rocking of wheels on Axle Detector: If any sensor is influenced two or more times consecutively without a proper count pulse, the system should go to error. If both sensors are influenced four or more times consecutively without a proper count pulse the system should go to error.</p> <p>Axle counter should tolerate induced voltage of at least 150V AC, 50Hz on the quad cable. Any external surge protection device required to achieve this shall be part of SSDAC supply. It shall fulfill fail safety requirements as per RDSO/SPN/144. It shall fulfill the requirements of Signal Engineering Manual as per RDSO/SPN/144. The software shall fulfil the software requirements as per RDSO/SPN/144. Both hardware and software functions will be partitioned to ensure that integrity of certified design will not be compromised through routine software and hardware upgrades. Design of axle counter will maximize the use of vendor independent implementations.</p>
ii	<p>CONFIGURATION: Single section axle counter will work in following configurations:</p> <p>a. One detection point Single section: In terminal lines / siding.</p> <p>b. Two detection points Single section: In straight line.</p> <p>c. Three detection points Single section: In point zone.</p> <p>d. Four detection points Single section: In point zone.</p> <p>e. Three-detection points two sections and also scalable for consecutive sections in a straight line.</p> <p>f. Use as High Availability SSDAC system (HA-SSDAC) (e.g. for BPAC applications): High availability system uses proven electronic circuits of standard SSDAC, duplicated on same board/card. This system also facilitates use of redundant communication channels by using quad/OFC to overcome common mode failures. System provides two vital relay outputs from two channels that are used in 'OR' mode to interface with interlocking/block circuits. System uses for 'Auto-reset Feature' to reset the failed channel of system by correctly working channel under steady state conditions. Complete electronics of high availability SSDAC system is integrated in the same chassis of a standard single channel SSDAC. Interfaces for the operator still remains the same and he is required to manually reset the system only when both channels of the systems have failed. Single reset interface will send reset command to both the channels and the reset command is extended to electronic via drop contact of vital relay of concerned channel. The High Availability SSDAC system can be provided with</p> <p>g. Single track sensor input fed to both channels of HA-SSDAC .</p> <p>h. Dual track sensor inputs fed to different channels of HA- SSDAC.</p> <p>Note: The option [selection] of single-track sensor/dual track sensor can be exercised by the ordering authority based on density of traffic and considering MTBF requirements.</p>
iii	<p>Diagnostic system of the axle counter shall provide</p> <p>Local and remote diagnostics and testing of system through a serial connection.</p> <p>Self-detection of errors and display through error codes and brief description in diagnostic terminal.</p>

	Diagnostic functions shall be carried out on a permanent basis without disturbing normal operation of the equipment. Information on the state of the equipment in failure situations and on operations performed by the staff shall be registered with time stamping.
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3.15. UFSBI

3.15.1. Scope of the work: Design, supply, installation, testing and commissioning of UFSBI as per IRS Spec. No IRS:S-105/2012 Ver.0 with Latest Amendments.

3.15.2. Technical details:

S.No	Description
i	UFSBI shall be wired, installed and commissioned by Competent Engineers of OEM. Pre commissioning check lists shall be prepared and signed by an authorised representative of OEM.
ii	It is preferable to equip more than one UFSBI equipment in one rack to optimize floor space.
iii	Networking equipment used for interconnecting UFSBI shall be of industrial grade.

3.16. Data Loggers:

3.16.1. Scope of the work: Supply, installation, testing, validation, networking and commissioning of data loggers, modification / augmentation of data base, fault logics of existing data logger as per the technical details given below.

3.16.2. Technical Details:

S.No	Description
i	Installation, wiring, validation, networking of data loggers shall be carried out by authorized Engineer of OEM. Pre-Commissioning checklists and OEM installation certificates shall be prepared and signed by OEM authorised engineers.
ii	Potential free contacts of IPS, ELD, SPD, MSDAC, UFSBI networking equipment, proximity switch, FACS etc. shall be wired to data logger and required fault logics shall be implemented to generate alarms and SMS alerts as required.

3.17. Earthing, Lightning and Surge Protection

3.17.1. Scope of the work: Supply, installation and wiring of earthing, lightning and surge protection arrangements at stns, for all the new equipment at Stations and in the mid-section as per OEM recommendations and requirements specified in IRSEM / IR Telecom Manual.

3.17.2. Technical details:

S. No	Description
I	All the equipment viz. apparatus cases, signal posts, MSDAC equipment, outdoor cables, power supply equipment, IPS, power panels, all indoor equipment and LC gate equipment etc. shall be earthed as per OEM recommendations, SCR practice, IRSEM and IR Telecom Manual.
3.17.2.1	Earthing of Location boxes & signals
I	a) Earths as per SCR Drawing No. 5775 shall be provided for all Signals, Location boxes. All nuts / bolts used to connect MS Flat to function and MS Flat welded to earth electrode shall be galvanized. b) The earth resistance shall not be more than 10 Ohms. Additional Earths shall be provided and paralleled if required to achieve final earth resistance of less than 10 ohms. c) Earth Chamber shall be filled with River sand / Robo sand. d) Earth resistance shall be painted on the function with date of measurement.
3.17.2.2	Earthing of cables
I	a) All the signalling and telecommunication cable armours shall be earthed properly. Both Sheath & Armour of Main cables are to be earthed. All cable armours shall be Tinkered with released cable copper conductors of required length and the other end of the conductors shall be connected to Cable gland plate. Armour of OFC shall be earthed at both ends. 6Q cable armour, sheath and screen shall be earthed at both ends.

3.18. Point Machines.**Technical Details**

S. No	Description
i	Electrically operated point machines combined type shall be fitted in level to all points as per Signalling plan on long sleepers on extended gauge tie plate, clear of infringement as per the latest RDSO Drg.
ii	The point machine shall be installed after cleaning both inside and outside the machine, after greasing/oiling to all moving parts. The point machine shall be hand operated and detection and motor-controlling contacts shall be adjusted before taking to site. All unwanted openings shall be covered with MS sheets.
iii	The point machines shall be fixed with proper bolts, nuts and flat/spring washers with correct size of holes through the special sleepers to avoid lateral/longitudinal play, on extended Gauge Tie Plate.
iv	All point connecting rods shall be connected to point machines without any strain and with Min. offset. All connecting rods shall be in level and correct size of bolts and nuts shall be used to avoid longitudinal play. Any changes in the connecting rodding during installation which necessitates welding and offsets shall be carried out by the Contractor at site. The welding shall be by smithy process. Lengthy rodding shall be supported suitably by roller guides.
v	All the wooden sleepers on which the point machine is installed shall be strapped on both sides with 50mm X 20mm M.S. strap. Necessary holes 21.5mm dia shall be used for fixing to the sleepers.
vi	Separate junction box shall be installed clear of infringement near the point machine and the respective cables shall be terminated. The leading in wires from the box to pint machine shall be taken through GI pipes securely fixed respectively to machine and Junction box (coaxially arranged). The wiring inside the point machine for motor and detector circuit shall be carried out neatly. All the electrical wiring shall be tested for insulation and earth and all connections tightened. PVC copper wire/cable of sufficient capacity

	shall be used for wiring point machines as per standard practice approved by Railways. Number plates to be fixed on termination box.
vii	Wiring between Termination box to machine shall be done using 3/20 or 3/ 0.737 wires. Cost of wires and junction box is separately covered.
viii	Point machines and junction boxes shall be painted and point numbers shall be painted neatly. Wiring diagram shall be painted on the inside of the point machine cover.
	ADJUSTMENT AND TESTING:
i	The point machine shall be worked by crank handle and the housing of switch rail with the stock rail shall be checked.
ii	The point machine shall be worked both ways with proper feed without undue friction and working current shall be recorded.
iii	The point detector and lock connections are adjusted in such a way that with a 3.25mm thick test piece obstruction placed between the switch and stock rail at 150mm from the top of switch.
iv	The point does not get locked. The point detection circuit is not completed (contact not made).
v	Both shall be tested independently.
	SIDING CONTROL:
i	Method - I: (Points operated by 1 Lever GF): Erection of single lever frame near the siding points on 'A' type foundation and running rodding between the ends of cross over points duly interposing the compensator. The facing end of the siding points shall be provided with a hand plunger lock normally locking the points and is to be unlocked by the key from the EKT fixed near the single lever frames. The apparatus case near the sidings points will have to be fitted with Electric key transmitter and a magneto telephone. Trap points are to be fitted with Trap Indicators.
ii	Method - II: (Locally operated Points by Spring Levers): Drilling of holes on switch rails and on sleepers, fixing of switch extension pieces, H.P. lock, setting HP lock stretcher, adjusting the opening of switches and spring along with Permanent Way Officials. Cutting of notches on Split Lock Stretchers, filing, adjusting. Fixing of 'E' type locks on the HP lock for succession key locking arrangement and testing the point for obstruction test as laid down in Signal Engineering Manual.
iii	Fixing Point/Trap indicator stand and point/trap indicator including lenses with required bolts and nuts, washers, connecting the Point Indicator base with connecting rod to the switch rail, adjusting the Point Indicator for correct operation as per SEM and focusing. 3 Nos. of 20mm X 200/250mm bolts are required to fix Point/Trap indicator stands onto the sleepers. If the Point happens to be in the track circuit zone, necessary arrangements for insulating the split lock stretcher, switch extension pieces from switch rail has to be carried out by enlarging holes on split lock stretchers and switch extension pieces.

3.19. Track Circuits

3.19.1. Technical Details

3.19.2.

S.No	Description
i	Track circuits shall be provided to confirm to para 8 of IRS specification S.36/69.
ii	The work includes bonding of rail joints which shall be made with rope wire, holes are to be drilled close to fish plates on the web of rail and the bond wires are fixed by driving channel bond pin, tightly. In point track circuit parallel jumpers bond wires/cables shall be provided as required by the Railways.
iii	The work includes bonding of rail joints which shall be made with rope wire, holes are to be drilled close to fish plates on the web of rail and the bond wires are fixed by driving channel bond pin, tightly. In point track circuit parallel jumpers bond wires/cables shall be provided as required by the Railways.
iv	Four TLJ boxes (two at track feed end and two at relay end) shall be fixed clear of infringement and the respective track circuit tail cable two no of 2 x 2.5 Sq.mm PVC copper conductor from the apparatus case shall be terminated. The connection from the TLJ boxes to the rail should be through the solid wire rope which should be fixed to the Rail by channel Bond pin both at feed and relay ends. The GI wire from TLJ boxes to sleepers should be covered with suitable PVC colored sleeve and there upon neatly clipped on the sleepers to prevent shorting with rails. Insulations / gromates - PVC shall be provided on TLJ box to prevent gi wire earthing. Double lead wire shall be provided both for feed and relay ends.
v	Both TLJ boxes shall be painted and track circuits shall be neatly numbered as required by Railways. Number plates to be provided on tljb boxes.
vi	Rail joint insulation RDSO type shall be provided with long bolts and nuts at places marked by Railways. The required long bolts and nuts will be supplied by Railways. Every rail joint insulation shall be tested jointly after installation. Wherever point track circuit is involved, the gauge/crossing tie plates/stretcher bars and switch extension pieces shall be insulated. Only non-insulated gauge tie plate/crossing plate/leading and following stretchers for the above will be supplied by the Railways. Insulation shall be provided correctly and tested jointly. After providing insulation, it should be inserted in the presence of Railway representative only. The switch extension pieces/'D' clamp fittings also should be insulated. The contractor shall supply all insulations as per schedule.
vii	Polarity bonding in point track circuit in duplicate shall be provided for each point track using wire rope insulated.
viii	After completing the installation of track circuit, it shall be energized, tested, adjusted and readings recorded in a register/track circuit history card.
ix	Wire rope, TLJBs, 2.5 Sq.mm cable are supplied by Railway or covered by separate schedule items.
x	Exothermic bonding sourced from RDSO approved / recommended firms where covered in schedule.
xi	Miscellaneous material like bond pins, tools, sleeves, drill bits, lugs for termination etc shall be catered by contractor as part of labour portion of work.

3.20. IP based Surveillance Cameras:

3.20.1. Technical Details:

S. No	Description
i	Surveillance cameras provided at Stations and shall be networked. This networking shall be extended to SSE/Sig office. It shall be possible to extend the monitoring facility to additional locations.

3.21. Testing of the system:

3.21.1. **Scope of the work:** Testing of both indoor and outdoor installations along with all associated works individually and after integrating with the system for its full functionality to meet the requirements laid down in SCR G&SR, IRSEM, IR Telecom Manual and Operating Manual.

3.21.2. **Technical Details:** The indoor and outdoor testing shall be carried out as per the details given below.

S. No	Description
3.21.2.1	Testing Strategy
i	Tests as may be necessary to demonstrate to the satisfaction of the Railway that the apparatus and the system as installed are in accordance with the specification and meet the requirements of SCR G&SR, IRSEM, IR Telecom manual and Operating manual.
ii	The equipment such as EI, MSDAC, UFSBI / FNmux, IPS, data logger, Class A protection, telecom equipment, surveillance cameras etc. shall be installed, wired, tested and commissioned by OEM's authorised engineer only. Pre-commissioning checklists shall be signed and OEM certificates for satisfactory installation shall be issued for all equipment.
iii	The contractor shall arrange tools, instruments and apparatus, required number of skilled staff, transportation to site for testing of equipment.
iv	All the new gears installed need to be tested before commissioning to ensure that the gears are in proper working order.

3.21.2.2	Cables: Signalling, Telecommunication, Power and OFC
I	Signalling, power and telecommunication cables shall be meggered once before laying and again after laying as per the procedure given in Chapter 15, Section 4 of IRSEM and Chapter 7 of IR Telecom Manual. The test results shall be recorded as per the format given in IRSEM and IR Telecom Manual and adopted in SCR Joint cable testing shall be carried out along with maintenance staff and readings shall be recorded. Cables shall be tested again before commissioning if more than three months' time is elapsed after joint cable testing. Sample testing of each cable shall be done before commissioning.
Ii	Pairing of conductors shall be done. All the power cables shall be made through and power supply shall be extended to all locations. Dummy load such as bulb shall be connected at the far end to observe for sinking of voltage.
Iii	6Q cables shall be tested as per para 7.2.8 of IR telecom manual and parameters shall be recorded on the format as per SCR practice. Joint cable testing shall be carried out along with maintenance staff and readings shall be recorded.

	Cables shall be tested again before commissioning if more than three months' time is elapsed after joint cable testing. Sample testing of each cable shall be done before commissioning.
Iv	Duct Integrity test shall be carried out on HDPE duct as per procedure laid down in Para Annexure-I Chapter 13 of IR Telecom Manual and in case of leakage, duct shall be attended before blowing. Joint OFC testing shall be carried out along with maintenance staff and readings shall be recorded. OFC shall be tested again before commissioning if more than three months' time is elapsed after joint testing. Sample testing of each cable shall be done before commissioning.
3.21.2.3	Signals
i	<ol style="list-style-type: none"> Wire to Wire bell test shall be carried out in Location Boxes by the supervisors and officer. All signal aspects shall be checked by giving 110V AC feed from Location Box and then the test shall be repeated by giving feed from the relay room CT rack. This test shall be done for each aspect, route, Calling ON, shunt signals, A/AG markers of Semi-Automatic Signals. Care shall be taken to ensure that no train is approaching during this test to avoid misleading information to drivers. Adjustment of orientation of signal units to achieve optimum visibility for signals, record the aspect voltages and ensure that it is within the permissible limit Check the aspect control sequence as per SIP and marking on the signal aspect control chart. Facilitating the conduct of signal sighting committee and preparation of report.
Ii	All automatic signals shall be tested by a wiring simulation panel and simulating all conditions with switches as per approved SIP.
3.21.2.4	Earthing
I	All earth pits shall be tested individually as per procedure described in Para 19.11.7 of IRSEM. Measurement of ring earth shall be carried out first for individual earth pits and after interconnecting all earth pits.
3.21.2.5	Indoor wiring
I	All the circuits shall be tested as per Section 8 Chapter 19 of IRSEM.
Ii	Field correspondence test shall be carried out as per the procedure given in para 19.8.8(f) of IRSEM.
Iii	<p>Testing of relay interlocking and Indoor equipment consists of:</p> <ol style="list-style-type: none"> Wire to Wire bell test at the level of Supervisor and officer before and after soldering Wire count test. Soldering integrity test with magnifying glass. Cross checking of contact analysis Relay pin locking test Energisation of relays by connecting the simulation panel. Recording of End Voltages on relays Clearing of signals on the simulation panel and carrying out the following tests (As per table of control)/OEM/South: <ol style="list-style-type: none"> Negative tests Dead/Approach locking tests Route/Back locking tests Testing of conflicting signals Testing of HASSDAC, UFSBI/FNmux as per RDSO/OEM/South Central Railway formats. Data logger validation, analog voltages calibration test and any other test as per

	RDSO/OEM/South Central Railway formats. 11. Indoor Cable Meggering. 12. Bulb Test to check leakages at relay racks and in power supply equipment.
3.21.2.6	Electronic Interlocking
I	Internal FAT shall be carried out by the OEM as per approved SIP and TOC before offering the same to railways for FAT. Necessary infrastructure for the same shall be arranged.
II	Wire to wire test, wire count test of interface wiring along with port verification and bit chart verification shall be carried out before offering to railways for inspection of the same.
III	SAT as per para 21.5.2 of IRSEM will be carried out by railway authorities. The necessary infrastructure for the same shall be arranged. Comparative statement of Application Logic between SAT version and Service Version duly certified by OEM shall be submitted to Railway Engineer for scrutiny and approval.
3.21.2.6	Power supply system
I	Capacity test shall be carried out on new batteries with dummy load at the rate of C/10.
II	All modules of IPS viz. DC-DC converters, inverters, SMRs, transformers etc. shall be tested with dummy load at not less than 90% of rated capacity for not less than 120 minutes.
III	Bulb Test shall be carried out in IPS racks to check leakage. Voltage drop shall be measured from IPS to Relay room for various bus bars. The voltage drop shall not be more than 1.0 Volt.
3.21.2.8	Miscellaneous Tests
I	Cube test for RCC Duct, Cable markers, prestressed Pre cast RCC Panels etc. for each batch of casting as prescribed in relevant IS codes shall be carried out at NABL accredited laboratories. Slump test for concrete shall be carried out and recorded as per approved QAP.
II	Materials such as steel, cement, sand etc. used in Pre-Cast RCC structures, RCC Duct, RCC Cable markers etc. shall be tested as per relevant IS codes and approved QAP.
III	All tools, plants, measuring instruments used for testing and Commissioning shall be properly calibrated at a government approved laboratory
IV	All the costs associated with the testing shall be in the scope of the project.
V	Pre-commissioning checklist and OEM installation certificate for equipment listed in Annexure 5 shall be submitted duly signed by OEM.

3.22 Batteries:

3.22.1 Technical details:\

i.	The charged batteries shall be provided in the battery room locations as per drawing/instructions.
ii.	Charged lead batteries of different capacities shall be installed in the battery room on suitable battery rack as per Railway's drawing. The battery stand shall be given anti-corrosive black paint before installation of battery. The cells shall be arranged neatly with sufficient working space for maintenance.
iii.	CHARGING OF A BATTERY: i. Proper arrangements must be provided in SSE office or at site, preferably at site. ii. For good performance of a battery, strictly manufacturer's instructions must be followed for preparation of electrolyte and the charging of a battery. iii. In the absence of manufacturer's instructions the following method shall be followed iv. All the cells, which are to be charged, must be of same capacity.

iv.	PREPARATION OF ELECTROLYTE:			
v.	Porcelain or Glass or Rubber or PVC or any other container with lead lining shall be taken. METALLIC CONTAINERS SHOULD NOT BE USED.			
vi.	Always use suitable goggles, rubber gloves and wear an apron, while working with electrolyte.			
vii.	Always ADD ACID to DISTILLED WATER only, but not water to acid.			
viii.	Mix acid and distilled water in the ratio as given below:			
	Sp Gr. of conc. H₂SO₄	Required Sp.Gr. of solution Dil. H₂SO₄	Ratio of acid: distilled water	Sp Gr. of conc. H₂SO₄
	1825	1400	7:11	1825
	1825	1190	1:5	1825
	1400	1190	5:6	1400
ix	With a Wooden rod (or) glass rod the solution must be stirred continuously, while adding the acid little by little.			
x.	Temperature of the solution must be monitored continuously during the preparation and it should not be allowed more than 450c .			
xi	Allow the solution to cool at least for 10 to 12 hours			
xii	After cooling measure the specific gravity. It shall be 1190 to 1200 at 270c. Specification of distilled water = IS 1069.			
xiii	<p>Since sp.gravity is inversely proportional to temperature, temperature correction must be applied. $\text{Sp.gravity at } 27^{\circ}\text{C} = \text{Sp.gr. At } T^{\circ}\text{C} + [(T-27) \times 0.7]$ $T = \text{Room temp. (Electrolyte temp)}$ $\text{Change in specific gravity} = 0.7/^{\circ}\text{C}$ SPECIFICATION of acid = IS 266.</p>			
xiv	Clean all the new cells with distilled water and fill them with electrolyte.			
xv	The level of the electrolyte should be 12mm to 15 mm (1/2") above the plates (electrodes).			
xvi	The charger output terminal must be correctly connected to the Battery set. I.e. '+' to '+' and '-' to '-'.			
xvii	<p>INITIAL CHARGING:</p> <p>i. Apply charge for 35 hours at the starting current rate of 4% of the AH capacity of the cells.</p> <p>ii. Starting I = capacity of cell x 0.04 amps for 35 hrs.</p> <p>iii. Check specific gravity & voltage readings at every 8 hrs.</p> <p>iv. Stop charging when sp.gravity becomes 1210 + 5 .</p> <p>v. If the sp.gravity of a cell after charging does not improve to 1210 + 5, then a small quantity of the electrolyte is taken out and is replaced with higher (1400) sp. Gravity of electrolyte. After this, a fresh charging cycle must be given for 2 Hrs to ensure mixing of electrolyte.</p> <p>vi. Discharge the battery through suitable load (lamps) till the sp.gravity reduces to 1180 to 1190 and voltage of cells to 1.8 V.</p> <p>vii. Repeat the cycle of charge and discharge once again and then charge it finally for use</p>			
xviii	EQUALIZING CHARGING:			
xix	<p>i. After initial charging, batteries are not connected to load (not put in use) for 15 days then equalizing charge must be given.</p> <p>ii. If the batteries are continuously used in "FLOAT charging" then equalizing charge must be given once in 3 months (or) whenever required (after restoration of power supply failure)</p> <p>iii. Equalizing charging current must given at the rate of C/10 amp, till the voltage & sp. Gravity of the all the cells have remains constant for 3 consecutive ½ hourly readings. (C=AH capacity of the cell) i.e. Equalizing charge (Boost mode) brings the sp. Gravity of the cells to 1210+5 and voltage to 2.2 V.</p>			
xx	Apply a coat of petroleum jelly or non-oxidizing grease on the battery connections to avoid corrosion.			
xxi	Close all the Vent caps and ensures that float indicators, indicates the electrolyte level, are in proper position.			

xxii	Charger o/p voltage shall normally be adjusted to the following values in case of constant voltage type charging.	
xxiii	With a Wooden rod (or) glass rod the solution must be stirred continuously, while adding the acid little by little.	
xiv	Float mode	2.15 V/Cell
	Boost mode Equalising charging	2.4/Cell
	Initial charging mode	2.7 V/Cell.
xv	Note : Specific gravity mentioned in this notes is Hydrometer reading for easy reference. In fact, if the hydrometer reading is 1210 then the sp.gravity of the electrolyte = 1.210.	
xvi	BATTERY CONNECTIONS AND ARRANGEMENTS: Cells are to be connected with suitable links sufficient to carry full load. Immediately, after connection, petroleum jelly shall be applied on battery terminals. The wiring shall be carried out by 10 sq.mm multi strand copper wire. The details of batteries and the capacity, circuit, date of installation etc., should be painted. The specific gravity and voltage reading shall be recorded for each cell in a separate register, along with the guarantee certificate of the supplier and handed over to Railway duly signed. A wooden stand for keeping hydrometer shall be fixed in each battery room.	

3.23.1 : Scope of the work: To monitor and maintain the entire system commissioned.

3.23.2 : Technical details

S. No	Description
i	The contractor shall ensure that Competent Engineers of OEMs for HASSDAC, UFSBI , EI ,IPSetc. shall have round the clock support to attend teething troubles in SSE/Signal jurisdiction from the date of commissioning up to the completion of maintenance period.OEM certification for the installation before commissioning to be issued for each of the equipment meticulously

3.24. Documentation:

3.24.1 : Scope of the Work: Preparation of various documents required for processing of statutory approvals, recording of measurements, as made documents, any other documentation work required for commissioning and maintenance of the system.

3.24.2 : Technical details:

S. No	Description
i	For EI installations, application logic and VDU layout / logic in the format loaded and pre-loaded configuration along with Application Data Generation tools shall be provided in DVD / Pen Drive / Hard Drive.
ii	The contractor shall furnish six sets hard copies of the final As Made cable plan and integrated cable route path showing the old as well as newly laid cables, distance of cables from the nearest track center at not less than every 30m intervals, protection arrangements, Cable Markers, LBs, Signals etc.
iii	All test reports, pre commissioning checklists, OEM certificates etc. shall be submitted in three sets in the form of a booklet neatly bound and in a scanned soft copy.
iv	Measurement records in bound registers shall be submitted in one set.

3.25. Releasing of Material:

3.25.1 Scope of work: All materials which are non-functional after commissioning shall be released and transported to designated location.

3.25.2 Technical Details

S. No	Description
i	The contractor shall prepare a list of all signalling and telecom equipment that will become non-functional after commissioning of the Signalling system jointly with Stock Verifier and Railway's representative. All released materials shall be Railway property.
ii	The material shall be released with utmost care. Items which have not completed their codal life and fit for re-use shall be released carefully and stacked at a secure place with proper packing.
iii	Signal posts, Location boxes, etc. which are going to infringe after commissioning shall be released during NI/Disconnection only duly following safety precautions.
iv	All released material shall be stacked at a central location such as Station / LC gate for proper accountal immediately after releasing.
v	All released material shall be transported to stores or scrap depots as instructed by the Railway Engineer.
vi	All concrete foundations of released signals, location boxes etc. shall be dismantled and earth shall be levelled.

SECTION 4

Reference Drawings

The following table gives a list of reference drawings to be followed for execution of works. Any other drawings which are required shall be prepared and submitted by the contractor as per the standard practice followed in South Central Railway for the approval of SR.DSTE/CO-ORD/SC.

S. No	Description	Drawing No
1	Main Signal Foundation in between tracks	RDSO/M-00011/R4
2	Main Signal Foundation	SCR Drawing No.5772
3	Cable laying when rock faced at 300 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 1
4	Cable laying when rock faced at 400 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 2
5	Cable laying when rock faced at 600 mm depth from ground level	DRG 15-D2 of IRSEM Sheet 3
6	Cable laying on the bed of culverts or under culvert	DRG 15-D7 of IRSEM
7	C channel for Trough & GI Pipe	DRG No.S&T/RE/78/2/76
8	Gland Plate for full Location Box	SCR Drawing No. 5774
9	Class A Lightning Protection arrangements	SCR Drawing No. 5777A
10	Copper plate earthing	SCR Drawing No. 5773
11	Earthing Arrangement for Signals and Location Boxes	SCR Drawing No. 5775
12	Full Location Box Foundation	SCR Drawing No.5781
13	Horizontal boring /Micro Tunnelling	SCR Drawing No. 5770
14	RCC Cable Duct	SCR Drawing No. 5778A
15	RE Protection Screen	SCR Drawing No. 5767
16	Track/Road crossings	SCR Drawing No. 5768A
17	Typical Power Supply Arrangements at Mid-Section Interlocked LC Gate in Automatic Section	SCR Drawing No. 5764
18	Typical Drawing for Ladder	SCR Drawing No. 5769
19	Protection Arrangement for cables at Less Depth	SCR Drawing No. 5771
20	Manual Road /Track Crossing	IRSEM Drawing No.15-D5
21	Cable Trough for Metallic Bridge	IRSEM Drawing No.-15-D6
22	Cable laying on minor bridges / culverts	DRG No. 15-D8 of IRSEM
23	Signalling Legend Boards	B/GSU/MISC/02/2022
24	System configuration for Automatic Signalling Triple Line	SCR Drawing No. 5755/Alt-I
25	Fencing Arrangements	S&T/MFT/7100

SECTION 5
List of Annexures

Annexure No.	Description
1	System configuration for Automatic Signalling
3A	List of Designs and Documents
3B	List of As Made Documents
3C	List of documents for Quality Hand Book
5	List of Pre-Commissioning Checklists and OEM Installation Certificates
6	List of Maintenance Registers.
7	List of Policy Letters / Circulars
8	Specifications for Ethernet Switch

Annexure 3A**List of Design and Documents**

S. No.	Description
2	SIP, TOC and SWRD
3	Station Working Rules
4	Dispensation Applications
5	CRS/PCSTE/PCOM/PCEE/EIG Application along with Enclosures
6	Sighting committee report
7	Circuit Diagrams of Stations, ABS Huts and ABS Equipment huts at stations
8	Relay Index, Disposition Particulars and Relay Contact Analysis
9	K Rack Particulars: Cable Termination Particulars
10	P Rack Particulars
11	Fuse / Fuse Rack Particulars
11	Condenser and Resistors Particulars
12	Power Rack Termination Particulars
13	Datalogger Termination Particulars and Validation Report
14	Integrated Cable Path Diagram
15	Cable Distribution Diagram
16	Apparatus Case Wiring Diagram, Termination and Cable Particulars
17	Power Distribution Diagram
18	Floor Plans of Relay Room, Equipment Room & Earthing Diagrams
19	TSAA Documents
20	Quality Manual as per South Central Railway practice
21	MSDAC, UFSBI/FN mux wiring diagrams
22	OFC Distribution plan and termination particulars
23	Telecom & Surveillance Camera Wiring diagrams
24	Pre-commissioning Checklist and OEM installation Certificate

Annexure 3B
List of As Made Documents

S. No	Description
I	Design Documents (Auto-Cad Drawings)
1	SIP, TOC, SWRD
2	As made circuit diagrams of Stations & ABS huts
3	Relay Contact analysis
4	K rack particulars: Cable termination particulars
5	P rack particulars
6	Relay index, Disposition particulars and Relay Contact Analysis
7	Fuse rack particulars
8	Condenser and resistors particulars
9	Power rack termination particulars
10	Data logger termination particulars
11	Integrated Cable path diagram
12	Cable distribution diagram
13	Apparatus case wiring diagram, Termination and cable particulars
14	Power distribution diagram
15	Floor plans of relay room, equipment room, Earthing diagrams
16	MSDAC, UFSBI wiring diagrams
17	OFC Distribution plan and termination particulars
18	Telecom & Surveillance Camera Wiring diagrams
II	Commissioning documents
22	Copies of CRS/PCSTE/PCOM/PCEE/ EIG sanctions and Dispensations
23	Copies of XR message and Safety certificate
24	Inspector work completion certificate
25	Sighting committee report
26	Copy of Technical system approval
27	Pre-commissioning Checklist and OEM installation Certificate
28	Data Logger validation report

Annexure 3C
List of documents to be submitted for Quality Hand Book

S. No	DESCRIPTION
1	Work Ready for Interlocking Certification for CSTE's approval
2	Approved ESP
3	Latest SIP (Updated with Dispensations)
4	Latest TOC
5	FAT Tested TOC
6	SAT Tested TOC
7	FAT Certificate
8	Square Sheet
9	TSAA
10	SAT Certificate
11	Approved Floor Plan
12	Earthing Plan
13	Data Logger Validation Report
14	CRS Sanctions
15	CRS & COM Dispensations
16	SWRD
17	Cable Corage Plan
18	Track Bonding Diagram
19	Cable Route Plan (With record of Depths)
20	NI Program Day wise
21	Pre-commissioning OEM Checklist for EI, IPS, DL, MSDAC, UFSBI / FNmux etc.
22	RDSO Inspection Certificates for EI, IPS, MSDAC, DATA LOGGER, ELD, UFSBI /FNmux, Relays, Wire coils & Cables with serial Numbers
23	Sighting Committee Report

Sl. No	DESCRIPTION
24	Reading/Parameters of Signals – including distance from center line of the track
25	CRS Sanction / Authorization Letter
26	Cable Meggering Details (At Different Stages) copy duly signed by SSE/S
27	Earth Resistance register duly signed by SSE/S
28	Location particulars
29	Working Diagram or Key Diagram showing old and new layout
30	Training Details (for S & T) & (Optg)
31	Works to be done during Pre NI & NI
32	Asset Register

Annexure 5**Pre commissioning checklists and OEM installation certificate**

S. No	Name of the equipment
1	Datalogger
2	Integrated Power Supply system
3	Electronic interlocking
4	Earth leakage detector
5	UFSBI
6	MSDAC
7	Video surveillance system
8	Class A protection

Annexure 6
Maintenance Registers

S. No	Description
1	S&T HB- Signal History book
2	S&T/R-1- Station Asset Register
3	S&T/R-4- Work Site Orientation classes note book
4	S&T/R-6- Infringement measurement Register for Signalling gears
5	S&T/R-10- Cable Testing Summary
6	S&T/R-11- Signal Maintenance Record
7	S&T/R-12- Integrated Power supply System maintenance Record
8	S&T/R-13- Battery Set/Battery Charger Maintenance Record-110V
9	S&T/R-25- Location box Maintenance Record
10	S&T/R-26- Earth testing and maintenance record
11	S&T/R-27- Cabin/Relay Room Maintenance Record
12	UFSBI Maintenance Register
13	DC-DC Converter- IPS Module maintenance Register
14	Data logger/IPS/LED failure Register
15	MSDAC Maintenance Register
16	Data logger Maintenance Register
17	Telecom Asset Maintenance Registers
18	Video Surveillance System Maintenance Register
19	FNmux Maintenance Register

Annexure 7**List of Policy Letters / Circulars**

(Note: The following documents or any other policy letter mentioned in feasibility report can be obtained from SR.DSTE/CO-ORD/SC)

S. No	Description	Letter No.
1	Basis of the safety plan issued by PCE/SCR	PCE/SCR Engineering Standing Order No. 89 & 65 Dt: 29.07.2020 & dt 05.07.2010 respectively
2	Approved list of Brands / Makes of items for the use in Civil Engineering works issued by PCE.	Dy.CE/Works/SC vide Lr No. No.SCR-HQ0ENGG(SOR)/1/2020-DyCE/WORKS/SCR; Date. 13.09.2023.
3	Digging Activity Near S&T Cable Areas.	JPO No. 1/SG/2004 Dt: 17.12.2004 or latest
4	Materials to be Inspected by RDSO/ RITES.	Railway Board letter No.74/RS(G)/379/2Pt. Dt: 04.03.1991 and 18.06.1991
5	Technical Circular of MSDAC for ABS	South Central Railway Technical Circular No. SCR TC 01/2022 or latest
6	Design Philosophy and Process Guidelines	SCR Letter No. SCR-HQ0SNT (SGPC)/5/2019 Dt: 05.01.2021.
7	RDSO Guidelines for Signal Cable Laying	RDSO/SI/G/2010 Ver 1.1 or latest
9	FAT/SAT of Electronic Interlocking	Railway Board Lr No. 2017/SIG/3/85 th SSC dtd 04.12.2018
11	Policy of inspection: Inspection Charges by RITES	RB Lr No: 2022/RS(G)779/9 Dt: 01.12.2022

Annexure-8

ETHERNET Switch - Technical Specification		
Type		Industrial Grade
Capacity	Port Quantity	8 RJ45 + 4 FO (or) Higher
	Port Types	RJ45: 10/100BASE-TX, SFP FO
Networking	Managed switch	Managed Layer 2 switch (or Higher)
	Diagnostics	Signal Contact (for error), Device Status Indication, LEDs, Syslog, System Information
Power Requirements	Operating Voltage	24/48/60 VDC
Form Factor	Mounting Type	DIN-RAIL / RACK MOUNT
	Protection class	IP20
Environment	Operating Temperature maximum	(+70° c)
	Operating Temperature minimum	(-40° c)
Approvals	Transportation	EN 50121-4 (Conformity given)
Monitoring	Indications	Power ON, Health status, Port status, Main/Standby media status
	Potential free contacts	One NO/NC