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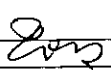
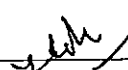
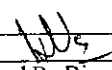
**RESEARCH DESIGN & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226011**

**INDIAN RAILWAY STANDARD SPECIFICATION
FOR
BLOCK PROVING BY AXLE COUNTER USING UFSBI**

**SIGNAL DIRECTORATE
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Document Title: INDIAN RAILWAY STANDARD SPECIFICATION FOR BLOCK PROVING BY AXLE COUNTER USING UFSBI (BPAC)			

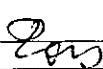
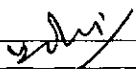
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Abstract: This document defines specification for Block Proving with Axle Counter using UFSBI			

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AMENDMENTS

Version	Chapter/Annexure	Amendment	Effective date
0	-	First issue	13.09.2012

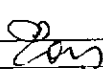
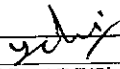
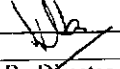
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**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

**INDIAN RAILWAY
STANDARD SPECIFICATION
FOR
BLOCK PROVING WITH AXLE COUNTER USING
UFSBI**

0. FOREWORD

- 0.1 This specification is issued under the fixed Serial No. IRS: S-105 followed by the year of adoption as standard or in case of revision the year of latest revision.
- 0.2 This specification requires reference to the following Indian Railway Standards (IRS) and Indian Standards (IS) and RDSO/SPN.

IRS: S-23	Indian Railway Standard Specification for electrical and electronic based signaling and interlocking equipment
RDSO/SPN/144	Safety and reliability of electronic signaling equipment
RDSO/SPN/177	Specification of Single Section Digital Axle Counter [SSDAC]
RDSO/SPN/147	Specification of Universal Fail Safe Block Interface [UFSBI].
RDSO/ SPN/165	Specification of SMPS based Integrated Power Supply System (IPS) for S&T Installation of Indian Railways.
IRS: S-76	Specification of Cable, Signaling Indoor for Signaling Installations
IRS: S-86	Specification for Battery Charger for Signalling Installations
IRS: S- 21	Specification of EKT
IRS: S -61	Fail Safe Electronic Timer
IRS:TC- 30	Specification for Jelly filled Quad cable
BRS: 930A & 931A	Relays 'Q' Series' Neutral Line relays.
IS: 5	Colors for ready mixed paints and enamels
IS: 513	Cold rolled low carbon steel sheets and strips - Specification
IS: 694	Specification for PVC insulated cable
IS: 814	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel - Specification
IS: 1573	Specification for electroplated coatings of zinc on iron and steel
IS: 2147	Degree of protection provided by enclosures for low-voltage switchgear and control gear
IS: 2629	Recommended practice for hot-dip galvanising of iron and steel
IS: 7088	Recommended practice for anodizing aluminum and its alloys
IS: 7569	Specification for cast acrylic sheets for use in luminaries
IEC 947-7-1	International standard on terminal blocks for copper conductors.

- 0.3 Whenever in this specification, any of the above mentioned specification is referred by number only, without mentioning the year of issue, the latest issue of that specification is implied, otherwise the particular issue referred to is meant.

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- 0.4 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.

1.0 SCOPE

- 1.1 This specification covers the general and technical requirements of Block Proving with Axle Counter using UFSBI to be used over Indian Railways for block working.
- 1.2 The specification covers integrated type block panel but not covers domino type panels. The body of panel should be fabricated from 18 SWG CRC MS sheet conforming to specification IS- 513 grade D.

2.0 Terminology:

The terminology as given in IRS:S-23 shall be applicable. In additions to the other terms which are referred in the specification are given below-

- 2.1 Rated voltage : The nominal voltage at which the Block System is designed to operate.
- 2.2 Rated Current : The nominal current consumption of Block System.

3.0 Requirements:

The Block Proving system will require the following sub systems for its working as per scheme depicted in **RDSO Drg.No. RDSO/S/32017 Sheet No.1 for Double Line and RDSO/S/32019 Sheet No. 1 for Single Line:**

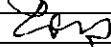
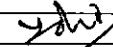
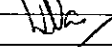
- (i) Block Panel
- (ii) Universal Fail Safe Block Interface
- (iii) Single Section Digital Axle Counter
- (iv) Block Telephone
- (v) Telecom cable, voice/ data channels provided over optical fiber or microwave system using proper multiplexer.
- (vi) Battery Set
- (vii) Battery Charger / IPS module
- (viii) Relay rack with relays

3.1 Block Panel

3.1.1 Mechanical & Physical requirements:

Panel shall suit to RDSO's Drg No. RDSO:S- 32017 Sheet no. 2 & 3 for double line & RDSO:S - 32019 Sheet no. 2 & 3 for single line. Body of panel to be made of CRC MS sheet of thickness not less than 18 SWG conforming to specification IS : 513 grade 'D'. Panel shall be drip proof and shall be protected against ingress of water. Sufficient strength, rigidity and stability required shall be ensured.

- 3.1.2 Body of the cabinet shall be free from dents, undulations, surface irregularities etc.
- 3.1.3 MS sheets shall be welded together and to its structure properly, if required, ensuring no welding defects.
- 3.1.4 Standard fasteners to relevant specification with zinc plating / Nickel plating shall be used for fastening.
- 3.1.5 Riveting, wherever necessary, to be carried out properly as per standard engineering practice.

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- 3.1.6 Provision shall be made for locking the back door.
- 3.1.7 The terminals used in the panel shall be non-disconnecting type polymer (6.6 Polyamide/nylon 6.6/Malamine) based terminals of Phoenix/ Wago make with DIN rail mounting arrangements.
- 3.1.8 Surface of the panel except faceplate shall be treated with chromate Primer followed by powder coating in Siemens gray color thickness as per current industry standards with Texture finish.
- 3.1.9 The faceplate will be made of 16 SWG MS, with an anodized aluminum faceplate above it.
- 3.1.10 Faceplate shall be free from all surface irregularities such as dents, tool marks, undulations etc.
- 3.1.11 Faceplate shall be covered with colorless (transparent) acrylic sheet of 4 mm thickness ± 0.5 mm as per IS: 7569. Acrylic sheet should not have any scratch, air bubbles, foreign material or any other marks.
- 3.1.12 Transparent acrylic sheet shall be fixed on top of the faceplate by a removable frame of minimum 3 mm thickness.
- 3.1.13 Panel shall have holes in the base suitable to fix the panel on the table.
- 3.1.14 All metallic nuts, bolts and washers used in fabrication of the panel shall be suitably zinc coated as per IS: 1573 to ensure rust proof working for entire life of the panel.
- 3.1.15 Metal arc-welding, wherever used, shall be done with welding electrodes as per IS: 814.
- 3.1.16 Panel shall conform to IP-54 class of protection as specified in table 1 of IS: 2147
- 3.1.17 Panel shall be provided with back covers. Back covers shall be easily opened to facilitate access to the internal wiring, termination etc. and shall be provided with double lock and sealing facility.
- 3.1.18 Legends shall be painted legibly on the panel faceplate as specified in the drawing.
- 3.1.19 Faceplate shall be firmly fixed on the cabinet using fasteners.
- 3.1.20 Station Master's (SM's) key lock shall be provided at top of the faceplate. The key shall normally remain locked in-turned position.
- 3.1.21 Small metal parts e.g. nuts, bolts, washers and such other out side fittings shall be suitably plated.
- 3.1.22 All component elements shall be rigidly fixed to withstand normal shock and vibration.
- 3.1.23 The panel shall be wired using 16/ 0.2 wire conforming to specification IRS: S-76.
- 3.1.24 Individual termination shall be marked with a unique number for easy identification.
- 3.1.25 Wiring inside the panel shall be properly bunched using cable ties and supported.
- 3.1.26 Any break or short circuit in wires shall not cause a wrong indication or operation of counter or pick-up of a wrong relay.
- 3.1.27 A laminated copy of wiring diagram and termination details of the panel portion shall be pasted inside back cover of the panel.
- 3.1.28 Block panel should pass insulation resistance test before and after applied high voltage test as per Cl. 9.5 & 9.6 of RDSO/SPN/144.

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3.1.29 Block Panel should be able to function at a distance of 50 M. from the Relay Rack. If the distance from block panel to relay rack is more than 50M, 1.5 sq mm out door signaling cable shall be used.

3.1.30 Parts of Block Panel:

3.1.30.1. Push Buttons:

The push buttons will be of Siemens or L&T (ESBEE) make as detailed below

3.1.30.1.1 Push Button Actuator

Type: HD 55C1 (Red) or HD 55C2 (Green) or HD 55C3 (Black) & HD 55C4 (Yellow)

3.1.30.1.2 Contact Element for Push Button and key actuator

Type- HC61A2 (INO), HC61B2 (INC)

3.1.30.2 Keys & Switches

The switches and keys shall be of different make.

The LCB key is L&T make (ESBEE brand) with catalog number HK85C3 for Key Actuator & HC61A2 (1 NO) / HC61B2 (1 NC) for elements.

The SM's key is Siemens make with catalog number CES1 & for actuator 3SB04 00-0B for element.

3.1.30.3 LEDs:

(i) LED's used shall be high intensity super bright water clear type of Agilent / Nichia make and must have 5 mm diameter and clear body/lens.

(ii) LEDs shall be with viewing angle of 15°. An illuminated LED should be visible from minimum 3 meters in clear daylight. Part no. and manufacturer's data sheet of LEDs used shall be supplied with the panel.

3.1.30.4 Electromagnetic Impulse Counter:

Electro magnetic impulse counter shall be 6 Digit, 10 impulse per second minimum, 24V DC non-resettable type, Shinmci make, Type ECT-6A or Keltron Make: Type EM010 or Fritz Kubler: Type W16.20

3.1.30.5 Buzzers:

Separate buzzers with different audio frequencies, working at 24 volts (+20% -10%) DC for audio alarm should be provided to register the BELL CODE sent by other end SM & to register the occupation and clearance of each Block Section. The buzzer for receive line shall be intermittent and for dispatch line shall be continuous type. Provision to mute the audio alarm through pressing an acknowledgement push button shall be provided. Block buzzer shall work through block telephone line.

3.2 UNIVERSAL FAIL SAFE BLOCK INTERFACE:

Universal Fail Safe Block Interface (UFSBI) required to interface the conventional block instruments over Telecom cable, voice/ data channels of any media like OFC & Digital Radio using proper multiplexer.

3.3 Single Section Digital Axle Counter:

Single Section Digital Axle Counter consists of a pair of axle detectors connected together by a transmission medium in VF range. It is capable of counting axles; count-comparisons,

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supervision, relay drive and transmission of counts and health of axle detector. Digital Axle Counter track relay output is available at both ends of the track section.

3.4 Block Telephone:

3.4.1 For speech communication with SM at other end of Block Section.

3.4.2 Separate block telephone shall be provided for every block section.

3.4.3 Block Panel to have provision for hanging block telephone as shown in Drg. No. RDSO /S - 32017 Sheet no. 3 for double line & RDSO /S - 32019 Sheet no. 3 for single line.

3.5 Quad Cable Or Voice channel:

Railways shall provide 4 pair copper conductors or 3 voice channels in OFC for single line block working and 5 pair copper conductor or 4 voice channels in OFC for double line block working from station to station. Cable shall be as per specification IRS:TC 30.

3.6 **Battery Set:** (Railways shall provide the battery set)

3.6.1 Block Proving with Axle Counter system comprising of Block Panel, Universal Fail Safe Block Interface & relays shall work on 24 V D.C. with a maximum current consumption of 5A.

3.6.2 Separate power supply shall be provided for Digital Axle Counter.

3.6.3 Separate power supply shall be provided for Block Telephone.

3.7 Charger / Module of IPS:

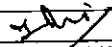
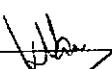
3.7.1 The charger should be as per IRS S-86 to cater 5A/24V DC load.

3.7.2 The IPS module should be as per RDSO/SPN/165 to cater 5A/24V DC load.

3.8 Relay Rack & Signaling Relays:

3.8.1 Number of relays used for Double Line Block working is 29 nos. and for Single Line Block working is 31 nos. All the relays used as per the circuit diagram shall be of RDSO approved make. Relays used as repeater of external relays shall be of 1000 ohms. Relay Rack can be separate or it can be in the same cabinet of UFSBI. The Electronic Fail Safe Timer (IRS: S - 61) shall be micro controller based only.

Alternatively, to minimize the number of relays, 2 out of 2 digital hardware logic (in compliance with CENELEC SIL-4 standard) based on reliable PLD / CPLD of reputed make like LATTICE / ALTERA / XYLINX, may be used to implement the Block Interlocking Logic with same functionality without any change in hardware / software or interfacing circuit of UFSBI (as per RDSO/SPN/147). The hardware logic module for Single Line and Double Line should be distinctly different and it shall not be possible to inter-change the modules. UFSBI should retain its functionality of Inter-station Block communication as per IRS:S-105 2012.

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3.8.2 NOMENCLATURE OF RELAYS FOR SINGLE LINE WITH UFSBI AS PER DRAWING NUMBER- RDSO/S-32020.

The nomenclature of various relays in the relay rack used at each station is given below -

	RELAY	TYPE and NORMAL STATUS	DESCRIPTION
3.8.2.1	TGTR	QL1, 11F.4B DROP	TRAIN GOING TO Relay. Operates to pick up on receipt of LINE CLEAR at train sending station. Normalises, when station at the other end sets to Line closed after train arrival or cancellation of LINE CLEAR.
3.8.2.2	TCFR	QL1, 11F.4B DROP	TRAIN COMING FROM Relay. Operates to pick up on receipt of LINE CLEAR enquiry from train sending station. Normalises after complete train arrival or cancellation of LINE CLEAR.
3.8.2.3	ASCR	QN1, 8F.8B DROP	Advance Starter Signal Control relay. Picks up, when LINE CLEAR is available and necessary controls are reversed by SM. Drops in any of the under-mentioned cases: a) Entry of train in Block Section b) Withdrawal of any SM control
3.8.2.4	TGTXR	QN1, 8F.8B DROP	TRAIN GOING TO code Relay. Picks up at train sending station presses buttons for LINE CLEAR enquiry. Drops when train sending station releases buttons for LINE CLEAR enquiry.
3.8.2.5	TCFXR	QN1, 8F.8B DROP	TRAIN COMING FROM code Receive Relay. Picks up on receipt of LINE CLEAR enquiry from train sending station. Drops when station at other end releases buttons for LINE CLEAR enquiry.
3.8.2.6	TGTYR	QN1, 8F.8B DROP	TRAIN GOING TO code Receive Relay. Picks up on receipt of LINE CLEAR at train sending station. Drops in any of the under-mentioned cases: a) Entry of train in Block Section b) Cancellation
3.8.2.7	120 JPR	QN1, 8F.8B DROP	Timer mature repeater Relay. Picks up on maturity of Timer for cancellation. Drops when block status set to Line Closed.
3.8.2.8	BPNR	QN1, 8F.8B DROP	Bell push button relay. Picks up on pressing of BELL push button else drop.
3.8.2.9	TGTNR	QN1, 8F.8B DROP	TRAIN GOING TO button Relay. Picks up on pressing of TRAIN GOING TO push button else drop.
3.8.2.10	CNR	QN1, 8F.8B DROP	CANCEL button relay. Picks up on pressing of CANCEL push button else drop.
3.8.2.11	FR1	QN1, 8F.8B DROP	Flash Controller relay No. 1.
3.8.2.12	FR2	QN1, 8F.8B DROP	Flash Controller relay No. 2.
3.8.2.13	TAR1	QNA1, 8F.8B	Train Arrival First Relay.
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		DROP	Picks up when control on Reception Signal is Reverse and HSAT occupied by train and HSBT clear. Drops when HSAT clear with a delay.
3.8.2.14	TAR2	QN1, 8F.8B DROP	Train Arrival Second Relay. Picks up when control on Reception Signal is Reverse and HSAT clear and HSBT occupied by train. Drops when block status set to Line Closed.
3.8.2.15	CAR	QN1, 8F.8B DROP	CANCEL relay. Picks up at Train receiving station on initiation of cancellation provided all controls pertaining to Advance Starter and Reception Signal/Signals and signals controlled by them are at Normal at both the stations.
3.8.2.16	BTSR	QN1, 8F.8B PICK UP	Block Track Stick Relay. Picks up when Block status is LINE CLOSED and Block track is clear. Drops in any of the under-mentioned cases: a) Entry of train in Block Section b) Cancellation
3.8.2.17	AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay of Dispatch Line. Drops in the under mentioned case: (a) Entry of train in block section. (b) Failure of axle counter.
3.8.2.18	TGTZR	QN1, 8F.8B PICK UP	Advance Starter Signal Normal Checking Repeater Relay. Picks up to repeat [D] ASGNCR at train receiving station after arrival of train or after a Line Clear cancellation has been initiated, else drops.
3.8.2.19	120 EJ	Electronic Time delay unit (Fail Safe)	Timer unit for cancellation time of 120 seconds.
3.8.2.20	HS ATPR	QNA1, 8F.8B PICK UP	First track for direction proving repeater relay. Picks up when HSAT track circuit is vacant else drop.
3.8.2.21	HS BTPR	QNA1, 8F.8B PICK UP	Second track for direction proving repeater relay. Picks up when HSBT track circuit is vacant else drop.
3.8.2.22	AS GNCR	QNA1, 8F.8B PICK UP	Advance Starter Signal Normal checking Relay. Picks up when Advance Starter Signal (LSS) and all its controls are at ON/Normal, else drop.
3.8.2.23	HS GNCR	QNA1, 8F.8B PICK UP	Reception Signal Normal Checking Relay. Picks up when Reception signal/signals and all its controls are at ON/Normal, else drop.
3.8.2.24	TCFCR	QN1, 8F.8B PICK UP	TRAIN COMING FROM CANCEL relay. Picks up at receiving station when CANCEL CO-OP button is pressed at sending station else drop.
3.8.2.25	TCFZR	QN1, 8F.8B PICK UP	TRAIN COMING FROM normal proving relay. Picks up at receiving station when TCFR drops else drop.
3.8.2.26	TGTPR	QN1, 8F.8B PICK UP	TRAIN GOING TO normal proving relay. Picks up at sending station when TGTR drops else drop.
3.8.2.27	SHKR	QN1, 8F.8B PICK UP	Shunt Key indicating relay. Picks up when key of EKT is 'IN' & shunt Release key is OUT, else drop.
3.8.2.28	AS GNCPR	QN1, 8F.8B PICK UP	Advance Starter Signal Normal checking (for other station) Relay.

			Picks up when Advance Starter Signal and all its controls are at Normal at the other station, else drope.
3.8.2.29	BIPR1	QN1, 8F.8B TOGGLE	UFSBI health check relay.
3.8.2.30	BIPR2	QN1, 8F.8B TOGGLE	UFSBI health check relay.
3.8.2.31	BLR	QN1, 8F.8B DROP	BELL RELAY Pick up when other station presses the Bell button

3.8.3 NOMENCLATURE OF RELAYS FOR DOUBLE LINE WITH UFSBI AS PER DRAWING NUMBER- RDSO/S-32018.

The nomenclature of various relays in the relay rack used at each station is given below:

	RELAY	TYPE AND NORMAL STATUS	DESCRIPTION
3.8.3.1	TGTR	QL1, 11F.4B DROP	TRAIN GOING TO Relay. Operates to pick up on receipt of LINE CLEAR at train sending station. Normalises, when station in advance sets to Line Closed after train arrival or cancellation of LINE CLEAR.
3.8.3.2	TCFR	QL1, 11F.4B DROP	TRAIN COMING FROM Relay. Operates to pick up on receipt of LINE CLEAR enquiry from train sending station. Normalises after complete train arrival or cancellation of LINE CLEAR.
3.8.3.3	ASCR	QN1, 8F.8B DROP	Advance starter signal control relay Picks up, when LINE CLEAR is available and necessary controls are reversed by SM. Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Withdrawal of any SM control.
3.8.3.4	TGTXR	QN1, 8F.8B DROP	TRAIN GOING TO code Relay. Picks up at train sending station pressing of buttons for LINE CLEAR enquiry. Drops when train sending station releases buttons for LINE CLEAR enquiry or picking up of TGTR which ever is earlier.
3.8.3.5	TGTYR	QN1, 8F.8B DROP	TRAIN GOING TO code Receive Relay. Picks up on receipt of LINE CLEAR at train sending station Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Cancellation of Line Clear.
3.8.3.6	I20 JPR	QN1, 8F.8B DROP	Timer mature repeater Relay. Picks up on maturity of Timer for cancellation. Drops when block status set to Line Closed.
3.8.3.7	BPNR	QN1, 8F.8B DROP	Bell push button relay. Picks up on pressing of BELL push button with SM's Key IN, else drop.
3.8.3.8	TGTNR	QN1, 8F.8B DROP	TRAIN GOING TO button Relay. Picks up on pressing of TRAIN GOING TO push button else drop.
3.8.3.9	CNR	QN1, 8F.8B DROP	CANCEL button relay. Picks up on pressing of CANCEL push button else drop.
3.8.3.10	ER1	QN1, 8F.8B	Flash controller relay No. 1.

		DROP	
3.8.3.11	FR2	QN1, 8F.8B DROP	Flash controller relay No. 2.
3.8.3.12	TAR1	QNA1, 8F.8B DROP	Train Arrival First Relay. Picks up when control on Reception Signal is Reverse and HS AT occupied by train and HS BT clear. Drops when AT clear with a delay.
3.8.3.13	TAR2	QN1, 8F.8B DROP	Train Arrival Second Relay. Picks up when control on Reception Signal is Reverse and HS AT clear and HS BT occupied by train. Drops when block status set to Line Closed.
3.8.3.14	CAR	QN1, 8F.8B DROP	CANCEL relay. Picks up at Train receiving station on initiation of cancellation provided all controls pertaining to Advance Starter and Reception Signal/Signals and signals controlled by them are at Normal at both the stations.
3.8.3.15	BTSR	QN1, 8F.8B PICK UP	Block Track Stick Relay. Picks up when Block status is LINE CLOSED and Block track is clear. Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Cancellation of Line Clear.
3.8.3.16	(R) AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay of receive line. Drops in the under mentioned cases: (a) Entry of train in block section, or (b) Axle Counter failure.
3.8.3.17	[D] AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay of dispatch line. Drops in the under mentioned cases: (a) Entry of train in block section, or (b) Axle Counter failure
3.8.3.18	TGTZR	QN1, 8F.8B PICK UP	Advance Starter Signal Normal Checking Repeater Relay. Picks up to repeat Line Closed condition at train receiving station after arrival of train or after a Line Clear cancellation has been initiated, else drop.
3.8.3.19	TCFXR	QN1, 8F.8B DROP	TRAIN COMING FROM code Receive Relay. Picks up on receipt of LINE CLEAR enquiry from train sending station. Drops when station in rear releases buttons for LINE CLEAR enquiry or TGTR pick up which ever is earlier.
3.8.3.20	120 EJ	Electronic Time delay unit (Fail Safe)	Timer unit for cancellation time of 120 seconds.
3.8.3.21	HS ATPR	QNA1, 8F.8B PICK UP	First track for direction proving repeater relay. Picks up when HSAT track circuit is vacant else drop.
3.8.3.22	HS BTPR	QNA1, 8F.8B PICK UP	Second track for direction proving repeater relay. Picks up when HS BT track circuit is vacant else drop.
3.8.3.23	AS GNCR	QNA1, 8F.8B PICK UP	Advance Starter Signal Normal checking Relay. Picks up when Advance Starter Signal and all its controls are at Normal, else drop.
3.8.3.24	HS GNCR	QNA1, 8F.8B PICK UP	Reception Signal Normal Checking Relay Picks up when Reception signal/signals and all its controls are at Normal, else drop.

3.8.3.25	AS GNCPR	QN1, 8F.8B PICK UP	Advance Starter Signal Normal checking (for other station) Relay Picks up when Advance Starter Signal and all its controls are at Normal at the other station, else drop.
3.8.3.26	BIPR1	QN1, 8F.8B TOGGLE	UFSBI health check relay.
3.8.3.27	BIPR2	QN1, 8F.8B TOGGLE	UFSBI health check relay.
3.8.3.28	TCFCR	QN1, 8F.8B PICK UP	TRAIN COMING FROM CANCEL relay. Picks up at receiving station when CANCEL CO-OP button is pressed at sending station else drop.
3.8.3.29	BLR	QN1, 8F.8B DROP	BELL RELAY Pick up when other station presses the Bell button

3.8.4 Wiring of Relay Rack:

- 3.8.4.1 The relay rack shall be wired using 16/0.2 wire conforming to specification IRS: S-76 (latest).
- 3.8.4.2 Every wire should be terminated properly. Termination of wires shall be done on non-disconnecting type terminals of Phoenix/Wago make with DIN rail mounting arrangements.
- 3.8.4.3 Individual termination shall be marked with a unique number for easy identification.
- 3.8.4.4 Wiring of relay rack shall be properly bunched using cable ties and support.
- 3.8.4.5 A laminated copy of wiring diagrams and termination details shall be provided along with supply.

4.0 Indications on Block Panel:

4.1 SM's Block Panel for *Single Line* is provided with following illuminated indications:

- 4.1.1 LINE CLOSED Indication
- Circular indication in between the directional arrowhead.
Mentioned in 4.1.2 & 4.1.3.
- YELLOW
- To indicate Block Section free from vehicles and LINE CLEAR not granted /received at train receiving / train sending station respectively.
- 4.1.2 TRAIN COMING FROM Indication
- In a directional arrowhead pointing downward for incoming traffic towards station.
- GREEN
- To indicate LINE CLEAR granted, when TRAIN GOING TO Button and BELL button have been pressed at sending station and the conditions for the granting of LINE CLEAR at receiving station have been complied with and a rectangular indication named TCF lights up GREEN.
- RED
- To indicate TRAIN ON LINE on entry of incoming train on LINE CLEAR and a rectangular indication named TOL lights up RED.
- FLASHING GREEN
- To indicate:
- Block section clear after arrival of train, but associated Signals and their controls not normal at either station.
 - Cancellation of LINE CLEAR before entry of train in Block Section.
 - Block section clear after arrival of train, associated signals and their controls at normal at both stations but after unintentional insertion of Shunt Release Key IN when the train was in section.

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- 4.1.3 TRAIN GOING TO Indication GREEN
In a directional arrowhead pointing upward for outgoing traffic away from station at train sending station
To indicate LINE CLEAR received when TRAIN GOING TO button and BELL button have been pressed on Block Panel of train sending station and the condition for taking the LINE CLEAR have been complied with at both stations and a rectangular indication named TGT lights up GREEN.
- RED
To indicate TRAIN ON LINE on entry of outgoing train on LINE CLEAR and a rectangular indication named TOL lights up RED.
- FLASHING GREEN
To indicate:
a) Block Section clear after arrival of train at other station, but associated signals and their controls not normal at either or both stations i.e. SNK off or Shunt key indication 'RED'.
b) LINE CLEAR cancelled before entry of train in block section.
- 4.1.4 Cancel indication YELLOW CO-OP
Indication to indicate co-operation extended by station at other end for cancellation of Line Clear by pressing Cancel Cooperation button.
- 4.1.5 CANCEL indication FLASHING YELLOW
Circular LED.
To indicate progress of LINE CLEAR cancellation timer of 120 seconds. The indication lights up on pressing of CANCEL alongwith BELL button, when TRAIN COMING FROM is displaying FLASHING GREEN indication.
- 4.1.6 SNK Indication SNK YELLOW
One such indication is provided.
i) Provided near TRAIN GOING TO directional arrowhead to indicate LAST STOP SIGNAL, Reception signal(s) and their controls at ON/Normal.
- 4.1.7 SNOEK (SNK other end) YELLOW
i) Provided near TRAIN COMING FROM directional arrowhead to indicate the following:
(a) LAST STOP SIGNAL and its controls at station at other end are at ON/ Normal.
(b) Shunt Key of EKT at other end station is 'IN'.
- 4.1.8 Last Stop Signal (LSS) Indication RED
Circular in monogram of signal.
To indicate Last Stop Signal is at 'ON'.
GREEN
To indicate Last Stop Signal is at 'OFF'.
- 4.1.9 LINE FREE Indication GREEN
To indicate Block Section is clear of vehicles.
- LINE OCCUPIED Indication RED
To indicate Block Section is occupied.
- 4.1.10 ACKN indication YELLOW
A Indication near ACKN button.
To indicate SECTION buzzer ON status.
- 4.1.11 SM KEY 'IN' indication GREEN
Indication near SM KEY.
To indicate SM key "IN".
- 4.1.12 SHUNT KEY GREEN
GREEN -To indicate SHUNT KEY OF EKT IS "IN".
RED- To indicate SHUNT KEY OF EKT IS "OUT".
- 4.1.13 UFSBI/MUX OK indication
Glows GREEN when MUX is OK otherwise Extinguished.
- 4.1.14 UFSBI/MUX FAIL indication
Glows RED when MUX goes into a failure mode otherwise Extinguished.

4.1.15 Communication LINK FAIL indication Glows steady YELLOW when LINK FAILS otherwise flickering.

4.2 SM's Block Panel for *Double Line* is provided with following illuminated indications

- 4.2.1 LINE CLOSED Indication YELLOW Circular indications (Two Numbers) in between the directional arrowhead.
To indicate Block Section free from vehicles and LINE CLEAR not granted /received at train receiving / train sending station respectively.
- 4.2.2 TRAIN COMING FROM Indication GREEN In a directional arrowhead pointing downward for incoming traffic towards station at train receiving station
To indicate LINE CLEAR granted, when TRAIN GOING TO Button and BELL button have been pressed at sending station and the conditions for the granting of LINE CLEAR at receiving station have been complied with and a rectangular indication named TCF lights up GREEN.
RED To indicate TRAIN ON LINE on entry of incoming train on LINE CLEAR.
FLASHING GREEN To indicate:
a) Block section clear after arrival of train, but associated Signals and their controls not normal at either of station or LCB Key is OUT.
b) Cancellation of LINE CLEAR before entry of train in Block Section.
- 4.2.3 TRAIN GOING TO Indication GREEN In an arrowhead pointing upward for outgoing traffic away from station at train sending station and a rectangular indication named TGT.
To indicate LINE CLEAR received when TRAIN GOING TO button and BELL button have been pressed on Block Panel of train sending station and the condition for taking the LINE CLEAR have been complied with at both stations and a rectangular indication named TGT lights up GREEN.
RED To indicate TRAIN ON LINE on entry of outgoing train on LINE CLEAR. and a rectangular indication named TOL lights up RED
FLASHING GREEN To indicate:
a) Block Section clear after arrival of train at other station, but associated signals and their controls not normal at either or both stations or LCB Key is OUT at receiving station.
b) LINE CLEAR cancelled before entry of train in block section.
- 4.2.4 Cancel indication CO-OP YELLOW Indication to indicate co-operation extended by station at other end for cancellation of line clear by pressing Cancel Cooperation button.
- 4.2.5 CANCEL indication FLASHING YELLOW Circular LED.
To indicate progress of LINE CLEAR cancellation timer of 120 seconds. The indication lights up on pressing of CANCEL Button along with BELL button, when TRAIN COMING FROM is displaying FLASHING GREEN indication.
- 4.2.6 SNK Indications SNK YELLOW Two such indications are provided.
i) SNK (D): Yellow provided near TRAIN GOING TO directional arrowhead to indicate LAST STOP SIGNAL and its controls at ON/ Normal.

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- ii) SNK (R): Yellow provided near TRAIN COMING FROM directional arrowhead to indicate reception signal (s) & its controls at ON/ Normal
- 4.2.7 SNOEK (SNK other end) YELLOW
i) Provided near TRAIN COMING FROM directional arrowhead to indicate LAST STOP SIGNAL and its controls at station in rear are at ON/ Normal.
- 4.2.8 Last Stop Signal (LSS) Indication
Circular in monogram of signal.
- RED To indicate Last Stop Signal is at 'ON'.
GREEN To indicate Last Stop Signal is at 'OFF'.
- 4.2.9 LINE FREE Indication
To indicate Block Section is clear of vehicles.
- GREEN
LINE OCCUPIED Indication
To indicate Block Section occupied.
- RED
- 4.2.10 ACKN indication A Indication near ACKN button.
YELLOW To indicate SECTION buzzer ON status.
- 4.2.11 SM KEY 'IN' indication Indication near SM KEY.
GREEN To indicate SM key "IN".
- 4.2.12 UFSBI/MUX OK indication Glows GREEN when MUX is OK otherwise Extinguished.
- 4.2.13 UFSBI/MUX FAIL indication Glows RED when MUX goes into a failure mode otherwise Extinguished.
- 4.2.14 Communication LINK FAIL indication Glows steady YELLOW when LINK FAILS otherwise flickering.

5.0 Brief System Description & Working:

The Block Panel will work in Absolute Block system incorporating Block Proving by Axle Counter to control the movement of trains on single line / double line block section from one block station to another in a fixed direction. These working instructions should be read in conjunction with General Rules (GR) of 1976 and its amendment in 2002. These working instructions do not supersede any rule laid down in GR.

6.0 Principle of working

- 6.1 The trains are worked on the Absolute Block system.
- 6.2 The block section is provided with an axle counter to verify the occupation or clearance of block section and indicated on Block Panel.
- 6.3 It is not possible to take the Last Stop Signal to 'OFF' unless LINE CLEAR has been obtained from station in advance.
- 6.4 It is not possible to obtain LINE CLEAR unless block section and an adequate distance beyond first stop signal of station in advance is clear of trains.
- 6.5 The Last Stop Signal assume 'ON' aspect automatically on entry of train into block section and when so replaced, is maintained in its 'ON' position, till a fresh LINE CLEAR is obtained on block panel.
- 6.6 Block section show automatically Train on Line on panel when train enters into the block section on line clear.

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- 6.7 Train entry/exit buzzer to/ from block section are provided and to be acknowledged.
- 6.8 Block section automatically closes on complete arrival of train at the receiving station.
- 6.9 A control to prevent the station in rear to take LINE CLEAR on its Block Panel without taking consent of receiving station.
- 6.10 A control to cancel the LINE CLEAR, already taken by station in rear.
- 6.11 It is possible to close the block section only, if no train has entered the Block Section for at least 120 seconds after application of cancellation as per clause 6.10 above with a co-operation from station in rear.

7.0 Description of Block Panel for *Single Line*.

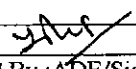
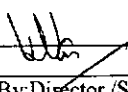
7.1 SM's Block Panel is provided with following **KEYS** for various functions.

- 7.1.1 SM key SM/ASM/Switchman's control key.
The key when out prevent following operations:
- Transmission of BELL code
 - Transmission of IS LINE CLEAR inquiry request
 - Cancellation of LINE CLEAR
- 7.1.2 Shunt release key (SHK) Shunt Release Key (normally OUT).

The following operation is possible when IN,
- To take out SHUNT KEY from electric key transmitter (EKT), which serves as tangible authority for Driver to shunt beyond Last Stop Signal up to First Stop Signal.
 - The following operations are not possible when IN;
 - To take LINE CLEAR.
 - Other side station to take LINE CLEAR.
 - Closing of block.
 - To take Last Stop Signal to "OFF".
- 7.1.3 SM's Back Cover lock Key To open or lock the back cover by SM/ASM/Switchman, when required by signal staff for maintenance or repairs.
- 7.1.4 Maintainer's Back cover lock key To open or lock the back cover by authorised signal staff, for maintenance or repairs, provided SM's back cover lock key as per 7.1.3 is also applied.

7.2 SM's Block Panel is provided with following **Push Buttons** (non-locking type).

- 7.2.1 BELL button (Black in colour) To transmit BELL code to station at other end of block section.
To take LINE CLEAR, when pressed along with TRAIN GOING TO button.
To cancel LINE CLEAR, when pressed along with CANCEL button.

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- 7.2.2 TRAIN GOING TO Button
(Red in colour) To transmit IS LINE CLEAR inquiry to station at other end to take LINE CLEAR. It is used in conjunction with BELL button at train sending station to light up TRAIN COMING FROM (GREEN) indication on Block Panel of other end station, which in turn automatically grants LINE CLEAR to light up and TRAIN GOING TO (GREEN) indication on Block Panel of former.
- 7.2.3 ACKN button
(Black in Colour) A button is provided To silence the SECTION buzzer on occupation or clearance of block section.
- 7.2.4 Cancel Co-op Button
(Green in colour) To give co-operation from sending station to cancel the line clear at receiving station.
- 7.2.5 CANCEL Button
(Yellow in colour) To Cancel Line Clear
It is used in conjunction with BELL button at train receiving Station under following conditions:
- Train has not entered the block section and Line clear cancellation has to be done.
 - Complete train has been pushed back at train sending station.

7.3 Cancellation Counter

To register the cancellation of Line Clear.

7.4 Shunt key of EKT

- 7.4.1 An auxiliary EKT is provided with SM's Block Panel to serve as SHUNTING Authority.
- 7.4.2 The Key of this transmitter is normally 'IN' and used as tangible authority given to Driver of a train to perform shunting upto opposing First Stop Signal (FSS).
- 7.4.3 Released when SHUNT RELEASE KEY of Block Panel is turned to 'IN'.

8.0 Description of Block Panel for *Double line*

8.1 SM's Block Panel is provided with following **KEYS** for various functions.

- 8.1.1 SM key SM/ASM/Switchman's control key.
The key, when out, prevents following operations:
- Transmission of BELL code
 - Transmission of IS LINE CLEAR inquiry request
 - Cancellation of LINE CLEAR
- 8.1.2 LCB key LINE CLEAR BLOCKING key.
It serves the following when out:
- To prevent station in rear to take LINE CLEAR.
 - To prevent closing of Block.
- 8.1.3 SM's Back Cover lock Key To open or lock the back cover by SM/ASM/Switchman, when required by signal staff for maintenance or repairs.
- 8.1.4 Maintainer Back cover lock key To open or lock the back cover by authorised signal staff, for maintenance or repairs, provided SM's back cover lock key as per cl.8.1.3 is also applied.

8.2 SM's Block Panel is provided with following *PUSH BUTTONS* (non-locking type)

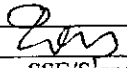
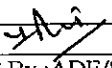
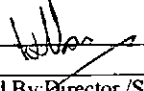
- 8.2.1 BELL button (Black in colour)
- To transmit BELL codes to station at other end of Block section.
 - To take LINE CLEAR, when pressed along with TRAIN GOING TO button.
 - To cancel LINE CLEAR, when pressed along with CANCEL button.
- 8.2.2 TRAIN GOING TO Button (Red in colour)
- To transmit IS LINE CLEAR inquiry to station in advance for taking LINE CLEAR. It is used in conjunction with BELL button at train sending station to light up TRAIN COMING FROM (GREEN) indication on Block Panel of receiving station, which in turn automatically grants LINE CLEAR to light up and TRAIN GOING TO (GREEN) indication on Block Panel of sending station.
- 8.2.3 ACKN button(s) (Black in Colour)
- Two such buttons are provided, one each for despatch line and receive line.
- To silence the SECTION buzzer on occupation or clearance of block section.
- 8.2.4 Cancel Co-op Button (Green in colour)
- To give co-operation from sending station to cancel the line clear at receiving station.
- 8.2.5 CANCEL Button (Yellow in colour)
- It is used in conjunction with BELL button at train receiving. Station under following conditions:
- Train has not entered the block section and Line clear cancellation has to be done.
 - Complete train has been pushed back at train sending station.
- 8.3 Cancellation Counter
- To register cancellation of line clear.

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9.0 Method of Signalling Trains from Block Station to Block Station for *Single Line*

- a) SM of the station intending to send a train from his station has to obtain verbal consent from station at other end before taking LINE CLEAR on its Block Panel.
- b) Before a request for IS LINE CLEAR is sent to station at other end, SM shall ensure the following on its Block Panel:
 - i) LINE CLOSED indication YELLOW &
 - ii) LINE FREE indication GREEN &
 - iii) SNK indication YELLOW &
 - iv) SNOEK indication YELLOW &
 - v) SHUNT KEY indication GREEN
- c) The station at other end while granting his consent shall ensure the following on its Block Panel;
 - i) LINE CLOSED indication YELLOW &
 - ii) LINE FREE indication GREEN &
 - iii) SNK indication YELLOW &
 - iv) SNOEK indication YELLOW &

SHUNT KEY indication GREEN
- d) Thereafter SM of sending station presses BELL & TRAIN GOING TO buttons.
- e) The directional arrowhead, TRAIN GOING TO/ TRAIN COMING FROM lights up green at sending/receiving station respectively.
- f) SM of sending station releases BELL & TRAIN GOING TO buttons on getting TRAIN GOING TO green indication.
- g) The sending station SM, after obtaining LINE CLEAR on its Block Panel, can send a train into Block Section by taking the LSS to 'OFF'. On entry of train into section, TRAIN ON LINE lights up at both the stations near arrowhead indication. The TRAIN GOING TO / TRAIN COMING FROM Arrow Head Indications turns RED in respective stations. SECTION buzzer sounds at both the stations along with ACKN indicator near ACKN button. Pressing of ACKN will turn off the buzzer and ACKN indicator.
- h) The train is received at receiving station on proper reception signals. On complete arrival of train, TRAIN COMING FROM indicator changes to FLASHING GREEN & LINE FREE indicator turns to GREEN at both the stations. TRAIN GOING TO /TRAIN COMING FROM indicator continues FLASHING GREEN at sending / receiving station respectively if reception & departure signals and their controls are not at normal or SHUNT KEY of EKT is 'OUT'. In case reception & departure signals and their controls are at normal & SHUNT KEY of EKT is 'IN' at sending/ receiving station, TRAIN GOING TO/ TRAIN COMING FROM turns off and LINE CLOSED indicator lights up YELLOW.

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9.1 Following is the sequence of operations of signalling a train between two stations:

The block section being clear and the 'LINE CLOSED' indication being displayed on Block Panel at both the stations. The action is taken by sending stations SM as under:

Sending Station		Receiving Station	
1.	SM ensures LINE CLOSED indication YELLOW, SNK indication YELLOW, SNOEK indication YELLOW, LINE FREE indication GREEN SM inserts SM key & turns to IN. a) SM sends 'Call Attention' signal to receiving station by pressing BELL button.	2.	SM inserts SM key & turns to IN SM acknowledges the 'Call Attention' signal by pressing BELL button.
3.	SM sends 'Attend Telephone' signal by pressing BELL button.	4.	SM acknowledges by pressing BELL button and attends telephone.
5.	SM attends telephone and advises station at other end about the intended movement of the train on telephone & asks for LINE CLEAR after prescribed BELL code.	6.	a) Exchanges information regarding train movement and ensures LINE CLOSED indication YELLOW, SNK indication YELLOW, SNOEK indication YELLOW, LINE FREE indication GREEN & SHUNT KEY indication GREEN & b) Grants verbal LINE CLEAR.
7.	SM presses BELL & TRAIN GOING TO buttons until 'TRAIN GOING TO' arrowhead indication lights up GREEN. (If aforesaid indicator does not appear after 3 seconds (approx.) of pressing the buttons, SM releases the buttons and rechecks conditions at his station and asks station at other end to recheck the conditions for grant of LINE CLEAR.)	8.	'LINE CLOSED' indicator turns off and 'TRAIN COMING FROM' arrowhead indication lights up GREEN.
9.	'LINE CLOSED' indicator turns off. 'TRAIN GOING TO' arrowhead indication lights up GREEN. Releases BELL & TRAIN GOING TO buttons.		

10	Takes LSS to 'OFF'. Train enters the Block Section. LSS replaces to 'ON'. LINE FREE indicator turns to RED. SECTION buzzer starts ringing & 'TRAIN GOING TO' arrowhead indication turns RED. ACKN indicator lights up. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off. Puts back the LSS controls to Normal. Ensures SNK lights up YELLOW.	11	LINE FREE indicator turns to RED . SECTION buzzer starts ringing & 'TRAIN COMING FROM' arrowhead indication turns RED. ACKN indicator lights up. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off. SNOEK lights up YELLOW Takes reception signal 'OFF' to receive the train. Train passes Home Signal. Home Signal replaces to 'ON'. Train clears the Block Section.
13	SECTION buzzer starts ringing. ACKN indicator lights up . LINE FREE indicator turns to GREEN 'TRAIN GOING TO' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off.	12	SECTION buzzer starts ringing. ACKN indicator light up & LINE FREE indicator turns to GREEN. 'TRAIN COMING FROM' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off.
15	SNOEK lights up yellow. 'TRAIN GOING TO' arrowhead indication turns off. 'LINE CLOSED' indicator lights up.	14	Replaces all controls pertaining to reception of train to Normal. SNK lights up YELLOW. 'TRAIN COMING FROM' arrowhead indication turns off. 'LINE CLOSED' Indicator lights up.

9.2 REFUSAL TO 'LINE CLEAR INQUIRY'

When a block section is blocked by the presence of a train in the section or train parting or shunting or opening of level crossing in mid section or for any other reason, the SHUNT key of EKT shall be taken out and kept in safe custody.

If the block station at other end refuses the IS LINE CLEAR enquiry signal, no train shall be allowed to leave until a fresh IS LINE CLEAR enquiry signal has been given to block station at other end and accepted.

On removal of obstruction, the Shunt Key of EKT shall be inserted and turned to IN position and the Shunt Release Key should be taken OUT. SM shall immediately inform SM of other end about the fact, so as to enable him to send a fresh IS LINE CLEAR signal.

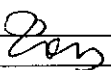
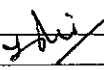
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9.3 CLOSING OF BLOCK AFTER A PUSH BACK OPERATION

After a train has been pushed back at the sending station, the sending station advises the receiving station. The receiving station can close the section by pressing BELL and CANCEL button after getting cooperation from the other end station.

9.4 Method of Push Back operation

SENDING STATION		RECEIVING STATION	
1.	Train clears the Block Section. LINE FREE indicator turns GREEN. SECTION buzzer starts ringing. ACKN indicator lights up. 'TRAIN GOING TO' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off.	2.	Train clears the Block Section. LINE FREE indicator turns GREEN. SECTION buzzer starts ringing. ACKN indicator lights up. 'TRAIN COMING FROM' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indicator turns off.
3.	Advises receiving end station SM about cancellation on telephone after prescribed BELL code.	4.	Agrees to request, ensures SNK indicator YELLOW, SNOEK indicator YELLOW, SHUNT KEY indicator GREEN and Gives consent on telephone after prescribed BELL code
5.	After verbal consent from other end SM Ensure SNK indication YELLOW, SNOEK indication YELLOW, SHUNT KEY indication GREEN Presses CANCEL CO-OP button and releases on receipt of BELL code.	6.	CO-OP to light up YELLOW. Presses BELL & CANCEL button with SM key IN. CANCEL COUNTER increments. CANCEL indication lights up FLASHING YELLOW & continues flashing for 120 seconds.
8.	TRAIN GOING TO arrowhead indication turns off. LINE CLOSED indication lights up.	7.	On expiry of 120 seconds, TRAIN COMING FROM arrowhead indication and CANCEL indication turns off. 'LINE CLOSED' indication lights up.

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9.5 BLOCK BACK

The SM, who intends to Block Back the line, shall inform the SM of station at other end on telephone for permission to Block Back, who will acknowledge the message and grant permission supported by a private number. SM takes SHUNT key of EKT OUT and keeps in safe custody. The SM will then issue necessary authority to driver of train to perform shunting in Block Section.

On completion of shunting, section clear message will be sent to SM of station at other end on telephone about obstruction removed supported by a private number, who in turn will acknowledge the same supported by a private number. Thereafter SM will insert SHUNT key of EKT and turn to 'IN' position and takes out the shunt release key.

All the entries in Train Signal Register (TSR) for this operation should be made in RED ink. The reasons for Block Back shall be recorded in remarks column against each entry.

	Station in rear		Station intending BLOCK BACK
2.	Block Panel displays; LINE CLOSED - YELLOW LINE FREE - GREEN SNOEK - YELLOW SHUNT KEY - GREEN	1.	Block Panel displays; LINE CLOSED - YELLOW LINE FREE - GREEN SNOEK - YELLOW SHUNT KEY - GREEN
4.	Acknowledges call attention / attend telephone signal.	3.	Inserts SM key & turns, Gives call attention / attend telephone signal.
6.	Attends telephone.	5.	Attends telephone.
8.	Acknowledges & gives consent by private number.	7.	Inform intention to perform shunting in Block Section.
10.	SNOEK turns off.	9.	Takes Shunt Key 'OUT' from EKT and keeps in safe custody. Issue necessary authority to driver of train to perform shunting in Block Section. SHUNT KEY indication turns to RED.
12.	On entry of train in Block Section, SECTION buzzer starts ringing & ACKN indication lights up. LINE FREE indication turns to RED. LINE CLOSED indication turns off.	11.	On entry of train in Block Section, SECTION buzzer starts ringing & ACKN indication lights up. LINE FREE indication turns to RED. LINE CLOSED indication turns off.
	Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.		Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
14.	On clearing of Block Section. SECTION buzzer starts ringing & LINE CLOSED indication lights up. ACKN indication lights up. LINE FREE indication turns to GREEN. LINE CLOSED indication lights up YELLOW.	13.	On clearing of Block Section. SECTION buzzer starts ringing & LINE CLOSED indication lights up. ACKN indication lights up. LINE FREE indicator turns to GREEN. LINE CLOSED indication lights up YELLOW.
	Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.		Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.

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16.	Acknowledges call attention /attend telephone signal.	15.	On completion of shunting, SM verifies the line between opposite STARTER (if any)/ Shunt signal or Stop Board/ Fouling mark and FSS, free from any vehicle. Inserts SM key & turns, Gives call attention / attend telephone signal.
18.	Attends telephone.	17.	Attends telephone.
20.	Acknowledges supported by a private number.	19.	Inform shunting is completed supported by a private number.
22.	SNOEK lights up YELLOW.	21.	Inserts SHUNT KEY of EKT & turns to 'IN'. SHUNT KEY indication turns to GREEN.

9.6 SHUNTING OF TRAIN

Where shunt signals are not provided for shunting on line leading towards Block section, the driver of shunting train shall be given shunting order at the foot of STARTER SIGNAL /STOP BOARD/FOULING MARK before allowing any shunting.

While shunting, the LAST STOP SIGNAL should be kept at ON.

9.6.1 SHUNTING UPTO LAST STOP SIGNAL

SHUNT KEY of EKT shall be taken OUT and kept in safe custody. The driver of shunting train shall be given shunting order to shunt up to LSS. On completion of shunting, the line between STARTER/ Shunt Signal/ Stop Board/ Fouling mark and LSS should be checked free from any vehicle. SHUNT KEY of EKT shall be inserted and turned to IN position.

When an IS LINE CLEAR enquiry is received from Block Station at other end of block section, permission for shunting up to LSS shall be granted only after compliance of GR 8.09 & 8.10 and as permitted by Station Working Rules (SWR).

9.6.2 SHUNTING BEHIND A TRAIN

Shunting behind a train should be performed with message to station at other end. SM shall take out SHUNT KEY of EKT after entry of train beyond LSS and hand over to Driver of shunting train along with shunting order.

On completion of shunting, Driver of shunting train hands over SHUNT KEY of EKT to SM. SM ensures clearance of line between STARTER/ Shunt Signal/ Stop Board / Fouling mark and LSS from any vehicle. The message regarding completion of shunting shall be sent to station at other end.

SM inserts SHUNT KEY of EKT and turns to IN position.

In case train arrives at station at other end before completion of shunting, TRAIN GOING TO/ TRAIN COMING FROM arrowhead indication will remain at RED, till shunting train clears the section. During such period line shall be **BLOCKED BACK** as per procedure laid down in the specification at Cl. 9.5.

9.6.3 Shunting in face of an approaching Train

9.6.3.1 Shunting in face of an approaching train, towards LSS, where permitted in SWR by special instructions, can be performed. The driver of shunting train shall be given shunting order to shunt up to LSS. On completion of shunting, the line between STARTER/ SHUNT SIGNAL/ STOP BOARD / FOULING MARK and FIRST STOP SIGNAL should be checked free from any vehicle.

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9.6.3.2 Shunting in face of an approaching train, beyond LSS and up to FSS can be performed only, when approaching train has been brought to a stop at FSS of the station. Whenever such shunting is to be performed, SM key shall be taken OUT and kept in safe custody. The driver of shunting train shall be given shunting order to shunt up to FSS. On completion of shunting, the line between STARTER/ SHUNT SIGNAL/ STOP BOARD / FOULING MARK AND FSS SIGNAL should be checked free from any vehicle and only then SM key shall be inserted and turned to IN position.

9.6.4 Shunting of Train beyond LSS in cases other than shunting behind a train or shunting in face of approaching train

The shunting should be done under protection of Block Back only.

9.7 BLOCK FAILURES AND ACTION TO BE TAKEN:

The block failures can be categorised into the following:

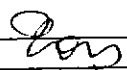
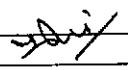
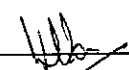
9.7.1 Failure of BLOCK PANEL:

Block panel should be considered to be defective and should not be restored for normal working until tested by competent signal staff & certified fit by them for use after the under-mentioned cases except for the case of Communication Link Failure (steady yellow indication). After the Communication Link Failure indication becomes flickering again block panel operation can be restored.

	TYPE OF FAILURE	ACTION TO BE TAKEN
1.	When no indication of any sort, at all appears on the block panel or;	For case 1-11, Block Panel should be treated as defective block working suspended & trains should be dealt with by taking LINE CLEAR on the electrical communication equipment provided and by provisions of GR 14.13 & SR thereunder, if any.
2.	When the Bell Code signals are received indistinctly or;	
3.	Any damage is seen or reported to block panel or;	
4.	When no train has entered into the block section but the 'LINE FREE/OCCUPIED' indicator changes to RED and this indication persists even after Resetting of Axle counter has been tried or;	
5.	When 'TRAIN GOING TO' or 'TRAIN COMING FROM' arrowhead indications does not appear by appropriate action though condition for asking 'LINE CLEAR' and granting permission to approach are available and LINE CLOSED 'YELLOW' is maintained or;	

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6.	When a train arrives at the receiving station or pushes back at sending station, but Block Panel still shows 'TRAIN COMING FROM & TRAIN GOING TO' RED arrowhead indication or;	
7.	TRAIN GOING TO or TRAIN COMING FROM arrowhead indication does not turn to RED to give TRAIN ON LINE on the entry of train into Block Section at either of the stations or;	
8.	When a train has arrived at the receiving station but the Block Panel shows FLASHING GREEN indication even after ensuring SNK , SNOEK & SHUNT key indicator GREEN or;	
9.	When, after a Line Clear cancellation, CANCEL indicator does not light up FLASHING YELLOW or lights up steady YELLOW after appropriate actions or;	
10.	When UFSBI/Mux Fail indication appears.	
11.	When Communication Link Fail indication becomes steady yellow.	
12.	When LSS can not be kept at 'ON' during its suspension /disconnection. or;	In addition to action taken for case 1-11, all efforts should be made to keep the LSS at ON position. If it is not possible, then a competent railway servant should be deputed with RED hand signal at the foot of the LSS to warn the drivers of approaching trains.
13.	When LSS of the station does not go back to 'ON' position on the entry of a train into the Block Section	In addition, all trains in the relevant direction should be stopped at Home signal and after ensuring that they have come to a stop, the Home signal should be cleared to caution aspect only.
		To dispatch a train, STARTER signal should not be taken OFF until issue of relevant authority to pass LSS & Caution order should also be issued to the driver about the defect of LSS.
14.	Total failure of communication during which train shall be worked as per extent rules in force on the Railway	In addition to action taken for case 1-13, the trains should be dealt with under the extent rules as laid down in GR 14.13 & SR there under

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9.7.2 Failure of LSS & Action to be taken

	Cause of failure of the LSS	Action to be taken
1.	When it cannot be taken OFF even though LINE CLEAR has been obtained; or;	The LSS should be considered to have failed & failure shall be informed to Signal staff immediately. The LINE CLEAR shall be obtained on the BLOCK PANEL & Line Clear ticket/Paper line clear as prevalent on railway shall be issued to driver of train
2.	When it can be cleared without obtaining LINE CLEAR; or;	The LSS should be considered to have failed & failure shall be informed to Signal staff immediately and follow Cl. 9.7.1.13 - 9.7.1.14
3.	It does not restore to ON position on entry of train into Block Section	

9.7.3 Suspension of Block Working & Action to be taken

	Cause of Suspension	Action to be taken
1.	When material lorry, Rail-cum-Road vehicle, Motor trolley, Tie-tamping machines, Rail Motor/Bus or Tower wagon (4wheeler) has to run in the section.	BLOCK PANEL shall be suspended. These vehicles shall be worked on PAPER LINE CLEAR.
2.	An accident takes place in the mid section.	BLOCK PANEL shall be suspended, if any line adjacent to line controlled by it is reported to be infringing, till the infringement exists. LSS shall be treated as INOPERATIVE & FAILED.
3.	When any part of Block Panel is opened or removed for repairs under duly accepted disconnection notice.	BLOCK PANEL shall be suspended. LSS shall be treated as INOPERATIVE & FAILED.
4.	When LSS of the station has been taken by Signal staff for repairs.	LSS shall be treated as INOPERATIVE & FAILED.
5.	During Block FORWARD.	LSS shall be treated as INOPERATIVE & FAILED.

When the cause of suspension of BLOCK PANEL and/or LSS is removed, SM shall restore the normal working of BLOCK PANEL / LSS, as the case may be.

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9.8 Technical details of Block equipment

9.8.1 DESCRIPTION OF CIRCUIT WITH UFSBI:

9.8.2 To dispatch a train

At Sending Station	At Receiving Station
The following relays are normally energised in LINE CLOSED ASGNCR↑, AZTR↑, BTSR↑, ASGNCPR↑, SHKR ↑, HSGNCR↑ The following indications are ON LINE CLOSED – Yellow, SNK-Yellow, SNOEK-Yellow, LINE FREE – green, Shunt Key Green, Last Stop Signal – Red	The following relays are normally energised in LINE CLOSED BTSR↑, HSATPR↑, HSBTPR↑, HSGNCR↑, AZTR↑, ASGNCR↑, ASGNCPR↑, SHKR ↑ The following indications are ON LINE CLOSED –Yellow, SNK-Yellow, SNOEK- Yellow, LINE FREE-Green, Shunt Key Green, Last Stop Signal – Red

1	a) The SM at sending station inserts its SM key and turns to IN position. SM Key - Green. b) Presses BELL button. BPNR↑ and TRAIN GOING TO button. TGTNR↑. c) TGTXR relay picks up, provided the conditions for taking LINE CLEAR exist and transmits LINE CLEAR enquiry. d) Waits for 'TRAIN GOING TO' indication to light up GREEN.	2	a) TCFXR picks up. b) TCFR operates and latches provided the conditions for granting LINE CLEAR exist. c) 'LINE CLOSED' turns 'OFF'. e) TCFK (G) "TRAIN COMING FROM" indication GREEN turns 'ON'. f) Sends LINE CLEAR granted code.
3	a) TGTZR picks up. b) TGTZR↓. c) TGTR picks up and latches and TGTXR↓. d) "LINE CLOSED" indication turns 'OFF'. e) TGTK (G) "TRAIN GOING TO" indication lights up GREEN. f) Releases BELL and TRAIN GOING TO buttons. BPNR↓ TGTNR↓. g) Advance Starter signal can be taken 'OFF' by SM control. ASGNCR↓ ASCR↑, SNK OFF, LSS - Green.	4	TCFXR↓. ASGNCPR↓, SNOKE turns OFF.
5	a) Train enters Block Section AZTR↓, ASCR↓, BTSR↓.	6	a) Train enters Block Section. b) AZTR↓, BTSR↓.
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	b) LINE FREE indication turns RED. c) TGTK (G) indication changes to TGTK(R). LSS – Red. d) SECTION Buzzer sounds with indication near ACKN button. e) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. f) TGTZR↓. g) Restores all Signal controls to Normal. ASGNCR↑, SNK-Yellow h) Train in section.		c) LINE FREE indication turns RED. d) TCFK (G) indication changes to TCFK(R). e) SECTION Buzzer sounds with indication near ACKN button. f) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. ASGNCR↓, SNOKE- YELLOW. Train in section.
		7	a) Train is received by reversing the Home Signal Lever, (R) HSGNCR↓, SNK- 'OFF'. b) Train occupies HSAT, (R) HSATPR↓, TARI↑ and sticks. c) Train occupies HSBT, HSBTPR↓ and clears HSAT, HSATPR↑ TAR2↑ and sticks. d) TARI↓. e) AZTR↑, Line Free-Green. f) SECTION Buzzer sounds with indication near ACKN button. g) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. h) FR1 and FR2 operate to give flashing indications. i) TCFK(R) changes to TCFK (flashing green).
8.	a) AZTR↑. b) LINE FREE indication turns GREEN. c) FR1 and FR2 operate to give flashing indications. d) TGTK(R) changes to TGTK (flashing green).	9.	a) Normalises all controls to pick up HSGNCR. b) Waits for TGTZR to pick up and on its pick up, de-latches (R)TCFR. c) BTR↑. d) LINE CLOSED indication turns ON. e) TCFK (flashing green) turns OFF.
10	a) TGTZR↓, TGTZR↑. b) LINE CLOSED indication turns ON. c) TRAIN GOING TO (Flashing Green) indication turns OFF.		

10.0 Method of Signaling Trains from Block Station to Block Station for *Double Line*.

- SM of the station intending to send a train from his station has to obtain verbal consent from station in advance before taking LINE CLEAR on its Block Panel.
- Before a request for IS LINE CLEAR is sent to station in advance, SM of sending station shall ensure the following near TRAIN GOING TO arrowhead on its Block Panel:
 - LINE CLOSED indication YELLOW &

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- ii) LINE FREE indication GREEN &
- iii) SNK indication YELLOW.
- c) The station in advance while granting his verbal consent shall ensure the following near TRAIN COMING FROM arrowhead on its Block Panel:
 - i) LINE CLOSED indication YELLOW &
 - ii) LINE FREE indication GREEN &
 - iii) SNK indication YELLOW &
 - iv) SNOEK indication YELLOW

Then inserts and turns LCB key.
- d) Thereafter SM of sending station presses BELL & TRAIN GOING TO buttons.
- e) The arrowhead, TRAIN GOING TO/ TRAIN COMING FROM lights up green at sending/receiving station respectively.
- f) SM of sending station releases BELL & TRAIN GOING TO buttons on getting TRAIN GOING TO green indication.
- g) The sending station SM after obtaining LINE CLEAR on its Block Panel can send the train into Block Section by taking the LSS to 'OFF'. On entry of train into section, TRAIN ON LINE lights up RED at both the stations in arrowhead indication. SECTION buzzer sounds at both the stations along with ACKN indication near respective ACKN button. Pressing of ACKN button of concerned line (Despatch/Receive) will turn off the buzzer and ACKN indication.
- h) The train is received at receiving station on proper reception signals. On complete arrival of train, TRAIN GOING TO /TRAIN COMING FROM arrowhead indication turns to FLASHING GREEN & LINE FREE indication turns to GREEN at both the stations. TRAIN GOING TO /TRAIN COMING FROM arrowhead indication continues FLASHING GREEN at sending / receiving station respectively till reception & departure signals and their controls are not at normal or LCB Key is not 'IN'. In case reception & departure signals and their controls are at normal & LCB key is IN, TRAIN GOING TO /TRAIN COMING FROM arrowhead indication turns off and LINE CLOSED indication lights up YELLOW.

10.1 Following is the sequence of operations of signalling a train between two stations:

The block section being clear and the 'LINE CLOSED' indication being displayed on Block Panel at both the stations. The action is taken by sending stations SM as under:

Sending Station		Receiving Station	
1.	SM ensures LINE CLOSED indication YELLOW, SNK indication YELLOW, LINE FREE indication GREEN. a) SM inserts SM key & turns to IN. b) SM sends 'Call Attention' signal to receiving station by pressing BELL button.	2.	SM acknowledges the 'Call Attention' signal by pressing BELL button.
3.	SM sends 'Attend Telephone' signal by	4.	SM acknowledges by pressing BELL

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	pressing BELL button.		button and attends telephone.
5.	SM attends telephone and advises station in advance about the intended movement of the train on telephone & asks for LINE CLEAR.	6.	a) Exchanges information regarding train movement and ensures LINE CLOSED indication YELLOW, SNK indication YELLOW, LINE FREE indicator GREEN & LCB key IN & b) Grants verbal LINE CLEAR.
7.	SM presses BELL & TRAIN GOING TO buttons until 'TRAIN GOING TO' arrowhead indication lights up GREEN. (If aforesaid indication does not appear after 3 seconds (approx.) of pressing the buttons, SM releases the buttons and rechecks conditions at his station and asks station in advance to recheck the conditions for grant of LINE CLEAR.)	8.	'LINE CLOSED' indication turns off and 'TRAIN COMING FROM' arrowhead indication lights up GREEN.
9.	'LINE CLOSED' indication turns off. 'TRAIN GOING TO' arrowhead indication lights up GREEN. Releases BELL & TRAIN GOING TO buttons.		
10	Takes LSS to 'OFF' Train enters the Block Section. LSS replaces to 'ON'. LINE OCCUPIED indication lights up RED. SECTION buzzer starts ringing & 'TRAIN GOING TO' Arrow Head Indication turns RED. ACKN indication lights up. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off. Puts back the LSS controls to Normal. Ensures SNK lights up YELLOW .	11	LINE OCCUPIED indication lights up RED. SECTION buzzer starts ringing & 'TRAIN COMING FROM' Arrow Head Indication turns RED. ACKN indication lights up. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off. SNOEK lights up YELLOW. Takes reception signal(s) 'OFF' to receive the train. Train passes Home Signal. Signal replaces to 'ON'. Train clears the Block Section including Block overlap.
13	SECTION buzzer starts ringing. ACKN indication lights up YELLOW. LINE FREE indication turns to GREEN. 'TRAIN GOING TO' indication turns FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.	12	SECTION buzzer starts ringing. ACKN indication lights up YELLOW. LINE FREE indication turns to GREEN. 'TRAIN COMING FROM' Arrow Head Indication turns FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.

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15	'TRAIN GOING TO' Arrow Head Indication turns off. 'LINE CLOSED' indication lights up.	14	Replaces all controls pertaining to reception of train to Normal. SNK lights up YELLOW. 'TRAIN COMING FROM' Arrow Head Indication turns off. 'LINE CLOSED' indication lights up.
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10.2 REFUSAL TO 'LINE CLEAR ENQUIRY'

When the line is being blocked by the presence of a train in the section or train parting or shunting or opening of level crossing in mid section or for any other reason, the LCB key shall be taken out and kept in safe custody.

On removal of obstruction, SM shall immediately inform SM of station in rear about the fact and put LCB Key IN, so as to enable him to send a fresh LINE CLEAR ENQUIRY.

10.3 CLOSING OF BLOCK AFTER A PUSH BACK OPERATION

After a train has been pushed back at the sending station, the sending station advises the receiving station. The receiving station can close the section by pressing BELL & CANCEL button after getting cooperation from sending station.

10.4 Method of Push Back operation

SENDING STATION		RECEIVING STATION	
1.	Train clears the Block Section. LINE FREE indication turns GREEN. SECTION buzzer starts ringing. ACKN indication lights up. 'TRAIN GOING TO' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off. Ensure SNK indication YELLOW.	2.	Train clears the Block Section. LINE FREE indication turns GREEN. SECTION buzzer starts ringing. ACKN indication lights up. 'TRAIN COMING FROM' arrowhead indication turns to FLASHING GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
3.	Advises other end station SM to close the block, on telephone after prescribed BELL code.	4.	On request from sending station SM about closing of block on telephone after prescribed BELL code. Ensures SNK indication YELLOW.
5.	Gives co-operation to other end station for cancellation.	6.	Co-operation indication light up yellow. BELL and CANCEL button pressed, Released with SM key IN, Cancel counter increments CANCEL indication lights up FLASHING YELLOW and continues flashing for 120 seconds.
8.	TRAIN GOING TO Arrow Head Indication turns off. LINE CLOSED indication lights up.	7.	On expiry of 120 seconds, TRAIN COMING FROM arrowhead indication & cancel indications turn off. LINE CLOSED indication lights up.

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10.5 BLOCK BACK

The SM, who intends to Block Back the line, shall inform the SM of station in rear on telephone for permission to Block Back, who will acknowledge the message and grant permission supported by a private number. SM who intends to block back takes LCB key OUT and keeps in safe custody. The SM will then issue necessary authority to driver of train to perform shunting in Block Section. On completion of shunting, section clear message will be sent to SM of station in rear on telephone about obstruction removed supported by a private number, who in turn will acknowledge the same supported by a private number. Thereafter SM will insert LCB Key and turn to IN position.

All the entries in Train Signal Register (TSR) for this operation should be made in RED ink. The reasons for Block Back shall be recorded in remarks column against each entry.

	Station in rear		Station intending BLOCK BACK
2.	Block Panel displays; LINE CLOSED – YELLOW LINE FREE – GREEN SNK - YELLOW	1.	Block Panel displays; LINE CLOSED – YELLOW LINE FREE – GREEN SNOEK – YELLOW
4.	Acknowledges call attention / attend telephone signal.	3.	Inserts SM key and turns, Gives call attention / attend telephone signal.
6.	Attends telephone.	5.	Attends telephone.
8.	Acknowledges and gives consent by private number.	7.	Inform intention to block back for shunting in Block Section.
		9.	The LCB is taken out and kept in safe custody. Issue necessary authority to driver of train to perform shunting in Block Section.
11.	On entry of train in Block Section, SECTION buzzer starts ringing and LINE CLOSED indication turns off. ACKN indication lights up. LINE OCCUPIED indication lights up RED. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.	10.	On entry of train in Block Section, SECTION buzzer starts ringing and LINE CLOSED indication turns off. ACKN indication lights up. LINE OCCUPIED indication lights up RED. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
13.	On clearing of Block Section. SECTION buzzer starts ringing and LINE CLOSED indication lights up. ACKN indication lights up. LINE FREE indication turns to GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.	12.	On clearing of Block Section. SECTION buzzer starts ringing and LINE CLOSED indication lights up. ACKN indication lights up. LINE FREE indication turns to GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
15.	Acknowledges call attention /attend telephone signal.	14.	On completion of shunting, SM verifies the line between opposite STARTER (if any) / Shunt signal or Block section Limit Board/ Stop Board/fouling mark and FIRST STOP SIGNAL, free from any vehicle.

17.	Attends telephone.	16	Attends telephone.
19.	Acknowledges supported by a private number.	18	Inform shunting is completed supported by a private number.
		20	Inserts LCB and turns in.

10.6 BLOCK FORWARD

The SM, who intends to Block forward the line, shall inform the SM of station in advance on Telephone for permission to Block forward, who will acknowledge the message and grant permission supported by a private number. The SM of advance station takes LCB key OUT and keeps in safe custody. The SM of this station will then issue necessary authority to driver of train to perform shunting in Block Section.

On completion of shunting, message will be sent to SM of station in advance on telephone about obstruction removed supported by a private number, who in turn will acknowledge the same supported by a private number. Thereafter SM of advance station will insert LCB key and turn to IN position.

All the entries in Train Signal Register for this operation should be made in RED ink. The reasons for Block forward shall be recorded in remarks column against each entry.

	Station intending BLOCK FORWARD		Station in advance
1.	Block Panel displays; LINE CLOSED – YELLOW LINE FREE – GREEN	2.	Block Panel displays; LINE CLOSED – YELLOW LINE FREE – GREEN
3.	Inserts SM key and turns, Gives call attention /attend telephone signal.	4.	Acknowledges call attention / attend telephone signal.
5.	Attends telephone.	6.	Attends telephone.
7.	Inform intention to perform shunting in Block Section.	8.	Acknowledges and gives consent by private number.
10.	Issue necessary authority to driver of train to perform shunting in Block Section.	9.	The LCB Key is taken out and kept in safe custody.
11.	On entry of train in Block section, SECTION buzzer starts ringing and LINE CLOSED indication turns off. ACKN indication lights up. LINE FREE indication turns to RED. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.	12.	On entry of train in Block section, SECTION buzzer starts ringing and LINE CLOSED indication turns off. ACKN indication lights up Yellow. LINE FREE indication turns to RED. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
13.	On clearing of Block Section. SECTION buzzer starts ringing and LINE CLOSED indication lights up yellow. ACKN indication lights up Yellow. LINE FREE indication turns to GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.	14.	On clearing of Block Section SECTION buzzer starts ringing and LINE CLOSED indication lights up. ACKN indication lights up yellow. LINE FREE indication turns to GREEN. Acknowledges the buzzer by pressing ACKN button. ACKN indication turns off.
15.	On completion of shunting, SM verifies the line between STARTER /Shunt signal/Stop	16.	Acknowledges call attention to attend telephone.

	Board/fouling mark and LAST STOP SIGNAL, free from any vehicle. Inserts SM key and turn. Gives call attention to attend telephone.		
18.	Attends telephone.	17.	Attends telephone.
20.	Inform shunting is completed supported by a private number.	19.	Acknowledges supported by a private number.
		21.	Inserts LCB and turn in.

10.7 SHUNTING OF TRAIN

Where shunt signals are not provided for shunting on line leading towards Block section, the driver of shunting train shall be given shunting order at the foot of STARTER SIGNAL /STOP BOARD/FOULING MARK before allowing any shunting.

10.7.1 SHUNTING OF TRAIN UP TO LAST STOP SIGNAL

While shunting on dispatch line, the LAST STOP SIGNAL should be kept at ON. SM Key shall be taken out. The driver of shunting train shall be given shunting order to shunt up to LAST STOP SIGNAL. On completion of shunting, the line between STARTER/Shunt Signal/Stop Board/fouling mark and LAST STOP SIGNAL should be checked free from any vehicle and only then SM key shall be inserted and turned to IN position.

10.7.2 SHUNTING BEHIND A TRAIN

Shunting behind a train should be performed with a message to station in advance. The station in advance shall take LCB Key out and keep in safe custody.

Shunting shall be performed as per 10.7.1. On completion of shunting, SM of sending station verifies the line between STARTER/Shunt Signal/Stop Board /Fouling Mark and LAST STOP SIGNAL free from any vehicle. The message regarding completion of shunting shall be sent to station in advance.

SM of station in advance inserts LCB Key and turns to IN position.

10.7.3 SHUNTING OF TRAIN BEYOND LAST STOP SIGNAL

The shunting shall be done under protection of Block Forward only.

10.7.4 SHUNTING OF TRAIN TOWARDS FIRST STOP SIGNAL

The shunting shall be done under protection of Block Back only.

10.7.5 SHUNTING OF TRAIN IN FACE OF APPROACHING TRAIN

No shunting in face of approaching train, towards receive line should be permitted, until the approaching train has been brought to a stop at first stop signal of the station. Whenever such shunting is to be performed, LCB Key shall be taken OUT and kept in safe custody. The driver of shunting train shall be given shunting order to shunt up to FIRST STOP SIGNAL. On completion of shunting, the line between STARTER/SHUNT SIGNAL/STOP BOARD / FOULING MARK AND FIRST STOP SIGNAL should be checked free from any vehicle and only then LCB key shall be inserted and turned to IN position.

10.8 BLOCK FAILURES AND ACTION TO BE TAKEN:

The block failures can be categorised into the following:

10.8.1 FAILURE OF THE BLOCK PANEL:

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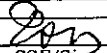
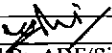
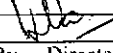
13. When Last Stop Signal cannot be kept at 'ON' during its suspension /disconnection.	
14. When Last Stop Signal of the station does not go back to 'ON' position on the entry of a train into the Block Section	In addition to action taken for case 1-12, all efforts should be made to keep the LAST STOP SIGNAL at ON position. If it is not possible, then a competent railway servant should be deputed with RED hand signal at the foot of the LAST STOP SIGNAL to warn the drivers of the approaching trains. In addition all trains in the relevant direction should be stopped at Home signal and after ensuring that they have come to a stop, the Home signal should be cleared to caution aspect only. The STARTER signal should not be taken OFF until the issue of relevant authority to pass the STARTER and LAST STOP SIGNAL to the driver. Caution order should also be issued to the driver about the defect of LAST STOP SIGNAL.
15. Total failure of communication during which train shall be worked as per extent rules in force on the Railway	In addition to action taken for case 1-14, the trains should be dealt with under the extent rules as outlined in GR 14.13 and SR there under

10.8.2 FAILURE OF LAST STOP SIGNAL AND ACTION TO BE TAKEN

Cause of failure of the LAST STOP SIGNAL	Action to be taken
1. When it cannot be taken OFF even though LINE CLEAR has been obtained; or,	The LAST STOP SIGNAL should be considered to have failed and failure shall be informed to Signal staff immediately. The LINE CLEAR shall be obtained on the BLOCK PANEL and Line Clear ticket/Paper line clear as prevalent on railway shall be issued to driver of train.
2. When it can be cleared without obtaining LINE CLEAR; or,	The LAST STOP SIGNAL should be considered to have failed and failure shall be informed to Signal staff immediately and follow 10.8.1.16-10.8.1.17.
3. It do not restore to ON position on entry of train into Block Section.	The LAST STOP SIGNAL should be considered to have failed and failure shall be informed to Signal staff immediately and follow 10.8.1.16-10.8.1.17.

10.8.3 SUSPENSION OF BLOCK WORKING AND ACTION TO BE TAKEN

Cause of Suspension	Action to be taken
1. When material lorries or Motor trolleys or Tie-tamping machines or Rail Motor/ Bus or Rail cum road vehicle or Tower wagon (4 wheeler) has to run in the section.	BLOCK PANEL shall be suspended for respective line and these vehicles shall be worked on PAPER LINE CLEAR.
2. An accident takes place in the mid section.	BLOCK PANEL shall be suspended for both lines, if line adjacent to affected line is reported to be infringed, till the infringement exists for dispatch line or, LAST STOP SIGNAL shall be treated as INOPERATIVE and FAILED.

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3. When any part of Block Panel is opened or removed for repairs under duly accepted disconnection notice.	BLOCK PANEL shall be suspended LAST STOP SIGNAL shall be treated as INOPERATIVE and FAILED.
4. When Last Stop Signal of the station has been taken by Signal staff for repairs.	LAST STOP SIGNAL shall be treated as INOPERATIVE and FAILED.
5. During Block FORWARD.	LAST STOP SIGNAL shall be treated as INOPERATIVE and FAILED.

10.8.3.1 When the cause of suspension of BLOCK PANEL and/or LAST STOP SIGNAL is removed the normal working of BLOCK PANEL and/or LSS as the case may be, shall be restored by SM.

10.9 TECHNICAL SCHEME:

10.9.1 DESCRIPTION OF CIRCUIT WITH UFSBI:

10.9.2 To dispatch a train

At Sending Station	At Receiving Station
The following relays are normally energised in LINE CLOSED. ASGNCR↑, [D] AZTR↑. The following indications are ON. LINE CLOSED – Yellow, SNK-Yellow, LINE FREE – green, Last Stop Signal – Red.	The following relays are normally energised in LINE CLOSED. BTSR↑, HSATPR↑, HSBTPR↑, ASGNCPR↑, [R] AZTR↑. HSGNCR↑. The LCB key is IN. The following indications are ON. LINE CLOSED –Yellow, SNK-Yellow, LINE FREE-Green, SNOEK-Yellow, Last Stop Signal – Red.

1	a) The SM at sending station inserts its SM key and turns to IN position. SM Key – Green. b) Presses BELL button. BPNR↑ and TRAIN GOING TO button. TGTNR↑. c) TGTXR relay picks up, provided the conditions for receiving LINE CLEAR exist and transmits LINE CLEAR enquiry. Waits for 'TRAIN GOING TO' indication to light up GREEN.	2	a) TCFXR picks up. b) TCFR operates and latches, provided the conditions for granting LINE CLEAR exist. c) 'LINE CLOSED' turns 'OFF'. d) TCFK (G) "TRAIN COMING FROM" indication GREEN turns 'ON'. e) Sends LINE CLEAR granted code.
3	a) TGTYR picks up. b) TGTZR↓. c) TGTR picks up and latches and TGTXR↓. d) "LINE CLOSED" indication turns 'OFF'. e) TGTK (G), "TRAIN GOING	4	TCFXR↓.

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	TO" indication lights up GREEN. f) Releases BELL and TRAIN GOING TO buttons. BPNR↓ TGTNR↓. g) Advance Starter signal can be taken 'OFF' by SM control. ASGNCR↓ ASCR↑, SNK - OFF, LSS-Green.		ASGNCR↓, SNOEK-extinguished.
5	a) Train enters Block Section ASCR↓, AZTR↓, BTSR↓. b) LINE FREE indication turns RED. c) TGTK (G) indication changes to TGTK(R), LSS Red. d) SECTION Buzzer sounds with indication near ACKN button. e) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. f) TGTNR↓. g) Restores all Signal controls to Normal ASGNCR↑, SNK-Yellow. h) Train in section.	6	a) Train enters Block Section. b) AZTR↓, BTSR↓. c) LINE FREE indication turns RED. d) TCFK (G) indication changes to TCFK(R). e) SECTION Buzzer sounds with indication near ACKN button. f) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. g) ASGNCR↑, SNOEK-Yellow. g) Train in section.
		7	a) Train is received by reversing the Home Signal Lever, HSGNCR↓, SNK-OFF. b) Train occupies HSAT, HSATPR↓, TAR1↑ and sticks. c) Train occupies HSBT, HSBTPR↓ and clears HSAT, HSATPR↑ TAR2↑ and sticks. d) TAR1↓. e) AZTR↑, Line Free -Green f) SECTION Buzzer sounds with indication near ACKN button. g) SM presses ACKN to silence the SECTION buzzer and turn 'OFF' aforesaid indication. h) FR1 and FR2 operate to give flashing indications. i) TCFK(R) changes to TCFK (flashing green).
8	a) [D] AZTR↑. b) LINE FREE indication turns GREEN. c) FR1 and FR2 operate to give flashing indications. d) TGTK(R) changes to TGTK (flashing green). e) FR1 and FR2 transmit TGTZR↑ to other station. (this proves all signals at	9	a) Normalises all reception controls to pick up HSGNCR, SNK-Yellow. b) Waits for TGTZR to pick up and on its pick up, de-latches TCFR. c) BTSR↑. d) LINE CLOSED indication turns ON. e) TCFK (flashing green) turns OFF.

	sending station at Normal before closing the section at receiving station).		
10	a) TGTR↓. b) LINE CLOSED indication turns ON. c) TRAIN GOING TO Flashing Green indication turns OFF.		

11.0 Method Of "Line Clear Cancellation" Both For Single Line & Double Line (Before entry of train in the Block Section).

After a train sending station has taken line clear, the receiving station can carry out line clear cancellation with the consent of other end station. Sending station puts back LSS to "ON", if already taken "OFF" and its control to normal ensures SNK at "YELLOW". Sending station extends co-operation by pressing CANCEL CO-OPERATION button.

On receipt of co-operation indication, receiving station presses bell and cancel button with SM KEY "IN". Receiving station observes cancel indication to light up flashing yellow and releases the buttons. TRAIN GOING TO/ TRAIN COMING FROM Arrow Head Indication turns to flashing green at sending/ receiving station respectively. After 120 seconds LINE CLOSED indication lights up "YELLOW". TRAIN GOING TO/ TRAIN COMING FROM Arrow Head Indication and cancel indication extinguishes.

11.1 Method of Cancellation

SENDING STATION		RECEIVING STATION	
1.	PUTS back LSS to 'ON', if already taken 'OFF', ensures SNK at YELLOW, Advises receiving end station SM about cancellation on telephone after prescribed BELL code.	2.	Agrees to request, ensures SNK at YELLOW and SNOEK at YELLOW and gives consent on telephone after prescribed BELL code.
3.	After verbal consent from other end SM, presses cancel co-operation button and releases on receipt of bell code.	4.	Waits for co-operation light up yellow and presses, bell & cancel button with SM key IN. Cancel counter increments. TRAIN COMING FROM Arrow Head indication turns to flashing green. Cancel indication lights up flashing yellow & continues flashing for 120 seconds.
5.	'TRAIN GOING TO' indication turns flashing green.		
7.	'TRAIN GOING TO' Indication turns off LINE CLOSED indication lights up.	6.	On expiry of 120 seconds, TRAIN COMING FROM Indication & cancel indication turns off. LINE CLOSED indication lights up.

12.0 Design Criteria:

All electronic components including connectors shall be of industrial grade and shall comply Cl.5.1 of RDSO/SPN/144, as applicable.

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13.0 System Requirement

- 13.1 Quick replacement of faulty components and parts.
- 13.2 Easy and fast maintenance of panel.
- 13.3 Cost effectiveness without loss of reliability and performance.
- 13.4 User friendly regarding operation & maintenance.

14.0 Information to be given by Supplier:

- 14.1 The type of cable with number of core to be required including 10 % spare for connecting the panel with Relay rack.

15.0 Information to be given by Purchaser:

- 15.1 Requirement of single line block or Double Line block.
- 15.2 Communication Media from station to station is quad cable or voice channel in OFC.
- 15.3 Distance between block panel and relay rack, type of cable between them.
- 15.4 Any other information, as deemed fit

16.0 DOCUMENTATION

- 16.1 Two copies of the following documents shall be supplied.
- 16.2 Wiring diagram and termination details
- 16.3 Installation and maintenance manual. This should also include following information:
 - a) Guaranteed performance data, technical and other particulars
 - b) Schematic block diagram showing mounting arrangement of various modules/components
 - c) Mechanical drawings of all type of modules, control panel along with specification of material used and part list
 - d) Part no. and manufacturer's data sheet of LEDs, switches/ buttons and their components, used.
 - e) Trouble shooting procedure
 - f) Dos & Don'ts
 - g) Installation check list

17.0 ACCEPTANCE CRITERIA

- 17.1 Following shall be provided by manufacturer for evaluating the product before it is considered suitable for signalling application on Indian Railways:

- 17.1.1 Remarks/compliance for all clauses of this specification

- 17.1.2 Detailed quality assurance plan along with its flow chart detailing manufacturing criteria, raw material specification and its source of procurement, test and monitoring details from raw material stage to finished product to ensure manufacturing a reliable and quality product as per this specification, etc.

- 17.1.3 All documents as per Cl. 16.0

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17.2 Manufacturing unit should be ISO (International Organisation for Standardisation) certified and should have requisite manufacturing and test infrastructure to produce a reliable and quality product as per this specification.

17.3 Manufacturer should guarantee for supply of spares for minimum 10 years.

17.4 Manufacturer shall arrange for any other test and / or documents considered necessary to establish quality and performance of the product.

17.5 Block Panel with UFSBI shall be supplied with following sub-systems:

- i) Universal fail safe block interface.
- ii) Block Panel.
- iii) Relay rack with pre-inspected relays.
- iv) Block telephone.

18.0 Inspection

18.1 Inspection shall be conducted by RDSO along with UFSBI, relays & EKT (For Single Line Only)

19.0 Test Procedure:

19.1 Block Panel shall be tested with Digital Axle Counter Block working as per SIF 0643/SIF 0644.

20.0 Marking -

20.1 The Block Panel shall be distinctly and indelibly marked with the following information:

- (i) Reference number
- (ii) Rated voltage
- (iii) Lot/Batch No.
- (iv) Manufacturer's name or trademark
- (v) Month and year of manufacture in code for example March 1993 may be marked as 393.

21.0 Packing

21.1 Block panel and other equipments shall be properly packed with thermocol packing and / or bubble sheet on the inner surface all around and suitable wooden crates to avoid damages during transit, storage and handling.

22.0 Warranty:

22.1 The manufacturer shall warrant the Block Panel covered by this specification to be free from defects in design, material and workmanship under ordinary use and service, his obligation under this warranty being limited to replace free of cost the Block Panel which shall be found defective before installation in the field within one year after delivery to the purchaser.

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**SPECIFICATION FOR
SOLID STATE BLOCK PROVING BY AXLE COUNTER (DIGITAL)
(Tentative)**

Version 1
Number of Pages 25

SPECIFICATION NO. RDSO/SPN/175/2005

**SIGNAL DIRECTORATE
RESEARCH DESIGN & STANDARDS ORGANISATION
LUCKNOW-226011**

DOCUMENT DATA SHEET			
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Authors: Sudip Mukhopadhyay Designation: Director/Signal/RDSO			
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Abstract: This document defines specification for SOLID STATE BLOCK PROVING BY AXLE COUNTER (DIGITAL)			

DOCUMENT CONTROL SHEET

NAME	ORGANISATION	FUNCTION	LEVEL
Sudip Mukhopadhyay	RDSO	Member	Prepare
G.D. Bhatia	RDSO	-	Approve

AMENDMENTS

Version	Chapter/Annexure	Amendment	Effective date
0	--	First issue	
1			15.01.05



SPECIFICATION FOR
SOLID STATE BLOCK PROVING BY AXLE COUNTER (DIGITAL)
(Tentative)

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RESEARCH DESIGN& STANDARDS ORGANISATION
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1.0 FOREWORD:

- 1.1 This specification is issued under the fixed Serial No. RDSO/SPN/ 175 / 2005 followed by the year of adoption as standard or in case of revision the year of latest revision.
- 1.2 The specification has been made to aid the development and validation of SSBPAC (D) i.e Solid State Block Proving by Axle Counter (DIGITAL) system for railway signaling. This should follow the provisions of General Rules of 1976 and Indian Railway (Open Lines) General (amendment) rules 2002
- 1.3 The specification may undergo minor changes during the development of the product. If during the process of development it is considered that changes are required in the specification, it shall be carried out by RDSO /Lucknow.
- 1.4 The specification will be frozen only after the laboratory and field tests are completed. .
- 1.5 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.

2.0 SCOPE

- 2.1 This specification covers the operational, technical, safety, performance and documentation requirements of SSBPAC (D) for single / double line section to be used on Indian Railways for block working.
- 2.2 System shall house necessary relays for field interface.

3.0 REFERENCE SPECIFICATIONS

- 3.1 This specification requires reference to the following Standards and specifications.

IRS: S23	Indian Railway Standard specification for electrical and electronic based signaling and interlocking equipment.
RDSO/SPN/188	Block Panel With UFSBI/MUX-Combiner.
RDSO/SPN/144	Safety and reliability of electronic signaling equipment.
RDSO/SPN/177	Specification of Single section Digital Axle Counter.
RDSO/SPN 147	Specification of universal Fail Safe Block Interface.
RDSO SPN 165/2004	Specification of SMPS based Integrated Power Supply System (IPS) for S&T Installation of Indian Railways.
IRS: S-76	Specification of Cable Signaling Indoor for Signaling Installations.
IRS S-86 / 2000	Specification for Battery Charger for Signalling Installations.
IRS S- 21/2001	Specification of EKT.

BRS: 930A & 931A	Relays 'Q' Series Neutral Line.
IS: 7088	Recommended practice for anodizing aluminum and its alloys.
TC 30/97	Specification for Jelly filled Quad cable.
IS: 513	Cold rolled low carbon steel sheets and strips – Specification.
IS: 7569	Specification for cast acrylic sheets for use in luminaries.
IS: 2629	Recommended practice for hot-dip galvanising of iron and steel.
IS: 694	Specification for PVC insulated cable.
IS: 1573	Specification for electroplated coatings of zinc on iron and steel.
IS: 2147-1962	Degree of protection provided by enclosures for low-voltage switchgear and control gear.
IS: 5-1994	Colours for ready mixed paints and enamels.
IS: 814	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel – Specification.
IEC 947-7-1	International standard on terminal blocks for copper conductors.
IS :9000	Basic environmental testing procedures for electronic and electrical items.
ISO 9001	Quality systems – model for quality assurance in design, development, production, installation and serving.
IEC529 / EN 60529	Specification for degree of protection provided by enclosures (IP code).
PrEN50126	Railway applications - specification and demonstration of - reliability, availability, maintainability and safety.
PrEN50128	Railway applications – Signaling and Communications – Software for Railway Control and Protection system.
PrEN50129	Railway application: Safety related electronic systems for signaling.
EN 50159-1 & 2	Railway Application: Signaling and Communication Safety related communication in closed and open Transmission system.

- 3.2 Whenever in this specification, any of the above mentioned specification is referred by number only, without mentioning the year of issue, the latest issue of that specification is implied, otherwise the particular issue referred to is meant.

4.0 SYSTEM CONFIGURATION AND BRIEF DESCRIPTION

- 4.1 Solid State Block Proving by Axle Counter (Digital) is a microprocessor based system used for exchanging signaling information between two stations forming a block section. It controls signaling of block section through a block panel. Objective of the system is to provide interlocking functions of block signaling according to approved method of working, ensuring high degree of safety, availability & reliability.
- 4.2 The train shall be worked on the absolute block system. Block section (s) shall be provided with a digital axle counter(s) to verify the occupation or clearance of block section. System shall implement block working on following principals.
- 4.2.1. It shall not be possible to take the last stop signal to OFF unless LINE CLEAR has been obtained from station at the other end.
- 4.2.2. It shall not be possible to obtain LINE CLEAR unless block section & an adequate distance beyond first stop signal of station at other end is clear of trains, Last stop Signal & its control at ON/NORMAL & on single line no line clear has been taken by the station at other end to send a train towards the station taking line clear. Shunting Key shall be IN at both stations.
- 4.2.3. The Last Stop Signal shall assume 'ON' aspect automatically on entry of train into block section and when so replaced, shall be maintained in its 'ON' position, till a fresh LINE CLEAR is obtained on block panel.
- 4.2.4. Block section automatically shows TRAIN ON LINE on panel when train enters into block section on LINE CLEAR.
- 4.2.5. Train entry/exit buzzer to/ from block section are provided and to be acknowledged.
- 4.2.6. Block section shall automatically close on complete arrival of train at the receiving station after ensuring reception signal (s) & its controls at on / normal, as well as last stop signal & its control at on / normal at sending station and on single line SHUNTING KEY of EKT is IN at both the stations.
- 4.2.7. System shall have control with train receiving station to prevent sending station to take LINE CLEAR on its Block Panel without the consent of receiving station.
- 4.2.8. A control to cancel the line clear already taken by SM at other end (if already taken) such cancellation shall be with co-operation of other end SM.
- 4.2.9. It shall be possible to close the block section only if no train has entered the Block Section and at least 120 seconds have elapsed after application of cancellation as per Cl. 4.2.8 above.

4.2.10. On single line, a control to permit shunting in block section.

4.3 The system (SSBPAC (D)) will require the following sub system for its working as per scheme depicted in RDSO's Drg No. RDSO/S/32025 for double line & RDSO/S/32023 for single line:

- (i) Block Panel
- (ii) Single section Digital Axle Counter
- (iii) Block Telephone
- (iv) Quad Cable or Voice channel
- (v) Battery Set
- (vi) Battery Charger / IPS module
- (vii) Relay rack with relays
- (viii) Electronic interlocking and communication module (SSBPAC (D) equipment)

4.3.1 BLOCK Panel: As per para 3.1 of RDSO / SPN 188

4.3.2 Single Section Digital Axle Counter: As per para 3.3 of RDSO / SPN 188

4.3.3 Block Telephone: As per para 3.4 of RDSO / SPN 188

4.3.4 Quad Cable Or Voice channel: Railways shall provide 3 pair copper conductors or 3 voice channels in OFC for single line block working and 4 pair copper conductor or 4 voice channels in OFC for double line block working from station to station. Cable shall be as per specification TC 30/97.

4.3.5 Battery Set: As per para 3.6 of RDSO / SPN 188

4.3.6 Charger / Module of IPS: As per para 3.7 of RDSO / SPN 188

4.3.7 Relay Rack & Signaling Relays:

4.3.7.1 All the relays used shall be of RDSO approved make. Relays used as repeater of external relays shall be of 1000 ohms. Relay Rack can be separate or it can be in the same cabinet of Electronic interlocking and communication module (SSBPAC (D) equipment)

4.3.7.2 NOMENCLATURE OF RELAYS FOR SINGLE LINE

S. No.	RELAY	TYPE and NORMAL STATUS	DESCRIPTION
1)	TGTR	QL1, 11F.4B DROP	TRAIN GOING TO Relay. Operates to pick up on receipt of LINE CLEAR at train sending station. Normalises, when station at the other end sets to Line closed after train arrival or cancellation of LINE CLEAR.
2)	TCFR	QL1, 11F.4B DROP	TRAIN COMING FROM Relay. Operates to pick up on receipt of LINE CLEAR enquiry from train sending station.

			Normalises after complete train arrival or cancellation of LINE CLEAR.
3)	ASCR	QN1, 8F.8B DROP	Advance Starter Signal Control relay. Picks up, when LINE CLEAR is available and necessary controls are reversed by SM. Drops in any of the under-mentioned cases: a) Entry of train in Block Section b) Withdrawal of any SM control
4)	AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay. Drops in the under mentioned case: (a) Entry of train in block section. (b) Failure of axle counter.
5)	HS ATPR	QNA1, 8F.8B PICK UP	First track for direction proving repeater relay. Picks up when HSAT track circuit is vacant else drop.
6)	HS BTPR	QNA1, 8F.8B PICK UP	Second track for direction proving repeater relay. Picks up when HSBT track circuit is vacant else drop.
7)	AS GNCR	QNA1, 8F.8B PICK UP	Advance Starter Signal Normal checking Relay. Picks up when Advance Starter Signal (LSS) and all its controls are at ON/Normal, else drops.
8)	HS GNCR	QNA1, 8F.8B PICK UP	Reception Signal Normal Checking Relay. Picks up when Reception signal/signals and all its controls are at ON/Normal, else drops.
9)	SHKR	QN1, 8F.8B PICK UP	Shunt Key indicating relay. Picks up when key of EKT is 'IN' & shunt Release key is OUT, else drop.

4.3.7.3 NOMENCLATURE OF RELAYS FOR DOUBLE LINE

S. No.	RELAY	TYPE and NORMAL STATUS	DESCRIPTION
1)	TGTR	QL1, 11F.4B DROP	TRAIN GOING TO Relay. Operates to pick up on receipt of LINE CLEAR at train sending station. Normalises, when station in advance sets to Line closed after train arrival or cancellation of LINE CLEAR.
2)	TCFR	QL1, 11F.4B DROP	TRAIN COMING FROM Relay. Operates to pick up on receipt of LINE CLEAR enquiry from train sending station. Normalises after complete train arrival or cancellation of LINE CLEAR.

3)	ASCR	QN1, 8F.8B DROP	Advance starter signal control relay Picks up, when LINE CLEAR is available and necessary controls are reversed by SM. Drops in any of the under-mentioned cases: a) Entry of train in Block Section. b) Withdrawal of any SM control.
4)	(R) AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay of receive line. Drops in the under mentioned cases: (a) Entry of train in block section, or (b) Axle Counter failure.
5)	[D] AZTR	QNA1, 8F.8B PICK UP	Block Section track Relay of dispatch line. Drops in the under mentioned cases: (a) Entry of train in block section, or (b) Axle Counter failure
6)	HS ATPR	QNA1, 8F.8B PICK UP	First track for direction proving repeater relay. Picks up when HSAT track circuit is vacant else drop.
7)	HS BTPR	QNA1, 8F.8B PICK UP	Second track for direction proving repeater relay. Picks up when HS BT track circuit is vacant else drop.
8)	AS GNCR	QNA1, 8F.8B PICK UP	Advance Starter Signal Normal checking Relay. Picks up when Advance Starter Signal and all its controls are at Normal, else drops.
9)	HS GNCR	QNA1, 8F.8B PICK UP	Reception Signal Normal Checking Relay Picks up when Reception signal/signals and all its controls are at Normal, else drops.

4.3.7.4 **Wiring of Relay Rack:** As per Para 3.8.4 of RDSO / SPN 188

4.3.8 **Electronic Interlocking & Communication Module (SSBAC (D) equipment)**

4.3.8.1 **Architecture of SSBPAC (D)**

System shall follow two out of three hardware architecture with identical hardware and common software. The system shall comprise of the following modules :

- i) Power supply modules
- ii) Processor modules
- iii) Input modules
- iv) Output modules
- v) Communication Interface module

4.3.8.1.1 Power Supply module:

(a) Two power supply modules should be used in hot-stand by mode. Each power supply module should be able to take 150% of full load of the equipment. If one power supply module fails, the other should take over the load without hampering the working of the equipment. Separate power supply should be provided for block bell and block telephone.

(b) The power supply that will be provided by Rly is +24VDC, +30%, -20% with ripple content as per para 5.4.23 of IPS specification No. RDSO/SPN/165/2000 Amd. I or Para 5.4.2 of IRS: S 86/2000 (specification of Self Regulating Battery Charger), It shall have Short circuit protection and there shall not be any minimum load requirements for the working of power supply. It will have power failure signal and overload indication. Suitable measures for radio interference suppression shall be provided. With load variation from 0 to 100 %, output variation shall not exceed 50 mV and control will be exercised in less than 1 millisecond time. It should have polarity protection, over voltage protection (more than 36V), under voltage protection (less than 16 V) at input, efficiency should be more than 80 %.

4.3.8.1.2 Processor Module

- a) Processor card should be based on high performance 16/32 bit microprocessors / micro controllers.
- b) It shall have built-in internal and external Watchdog for monitoring program sequence. Trigger time shall be possible to be set in 5 milliseconds time.
- c) Processor should have extensive serial I/O sub-units to support inter processor and intersystem communication requirements.
- d) It shall have voltage monitor which will trigger power failure signal when power supply falls below 4.5 volts
- e) It shall have on – line alarm display (alphanumeric) and remote alarm monitoring to ensure easy diagnostic of faults.

4.3.8.1.3 Input module:

- (a) Input module shall be able to read relays / switches/ keys.
- (b) Inputs shall be isolated using opto-isolators with an isolation voltage of 2000 volts minimum.
- (c) All inputs shall be protected against surge and transient voltages.
- (d) Input Cards shall be address independent.

- (e) Both make and break contacts of switch/relays/keys shall separately be sensed.
- (f) All power supplies on cards where digital ICs are used shall be locally decoupled using a capacitor of good high frequency characteristics.
- (g) Input card shall be driven through software controlled I/O bus.
- (h) LED shall display condition of input on the front facia panel
- (i) Number of inputs per card –16
- (j) Input voltage 24 volts
- (k) For” 0 “signal –30 volts to +5 volts
- (l) For “1 “signal + 13 volts to + 30 volts
- (m) Input current 10 m A

4.3.8.1.4 **Output module:**

- a) Output module shall be capable of driving Q series relays through AC coupled drivers with optical/galvanic isolation.
- b) Output card shall accept inputs from 3 processors, which shall be fed to hardware voter to derive the majority voted output. The validated outputs shall be buffered through AC coupled optically/galvanically isolated drivers.
- c) Health status of processors shall be continuously monitored. In case of error, output shall be withdrawn.
- d) Relay driver outputs shall be read back from at least two stages. Display output shall be read back from at least one stage.
- e) Output shall be driven through software controlled I/O bus
- f) Output card shall provide transient free short circuit protected 24V supply for driving external Q series relays.
- g) Output shall have overload and short circuit protection. Status bit of channel shall switch ON automatically after the end of over load.

4.3.8.1.5 **Communication Driver & Common hardware Module**

- a) This module shall accommodate hardware common for all three processors.
- b) It shall provide driver interface for inter block communication as per CCITT standard at baud rate 1200 minimum.

- c) Inter processor communication speed shall be sufficiently high to meet cycle time requirements.
- d) It shall provide external (global) re-set hardware
- e) It shall monitor 2/3 logic processor activities
- f) **Reset Switch**

A non-lock reset switch with a veeder counter shall be provided for the user to “start” the SSBPAC (D) processing after power ON. SSBPAC (D) shall remain in power ON self-test mode till the reset switch is pressed, after which the system shall enter into normal functional as per mode transition description given in software functions.

- g) Two connected SSBPAC (D) should work for a transmission loss of upto 20 dB at 1KHz.

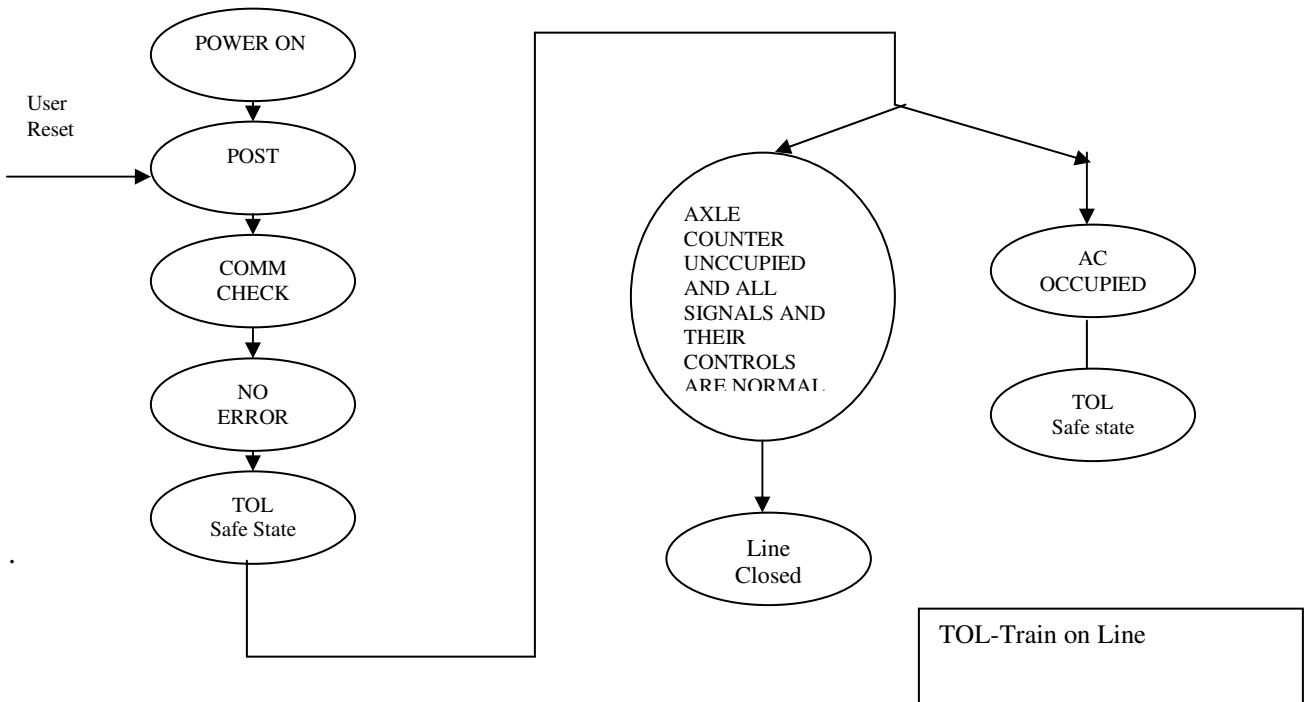
4.3.8.2 **TECHNICAL REQUIREMENTS**

- 4.3.8.2.1 No change in the hardware shall be required for making the system to work for single line / double line section. System shall be so constructed that there are minimum changes in single line/ double line sections for using.
- 4.3.8.2.2 Lightening & Surge protection to be provided as per RDSO/SPN/144.
- 4.3.8.2.3 For implementation of interlocking, appropriate track repeater relays, Signal normal checking relays shall be available in the SSBPAC (D). SSBPAC (D) shall drive TGTR relay at the train sending station and TCFR relay at train receiving station. On single line, a shunting key control relay (SHKR) is required. Contacts of these relays shall be available at the SSBPAC (D) terminals for controlling signals/interlocking. The interlocking logic should be same as that of RDSO drawing No. RDSO/S/32018 & 32020.
- 4.3.8.2.4 Provision should be there for repeating relay condition of at least two relays from one end to other end. These relays will have no requirements of operation of SSBPAC (D).

4.3.8.3 **SOFTWARE FUNCTIONS**

- 4.3.8.3.1 The system shall be 2 out of 3 type wherein at least 2 systems must agree to release command. Voting shall take place for vital decisions.
- 4.3.8.3.2 Software shall implement block-working requirements listed in para 4.2, 4.3.7, 4.3.8.2 and operation requirements listed in para 5.

- 4.3.8.3.3 Status of relays /switches /keys shall be sensed by both front & back contacts so that valid data is either 01 or 10. Input 11 and 00 are invalid. The processor shall read, de-bounce & locally validate the status of contacts periodically.
- 4.3.8.3.4 Inter processor communications shall be used for the validation of data.
- 4.3.8.3.5 Various modes of the system shall be clearly defined.
- 4.3.8.3.5.1 System shall go through a set of diagnostic routines (POST) at power ON. It shall be ensured just after power ON that output relays are de-energized condition. Within POST the system shall perform sufficient tests to ensure the integrity of the system before starting the actual operation.
- 4.3.8.3.5.2 After successful execution of POST system shall wait for reset operation. After reset the system shall transit to safe state (train on line) waiting for inter block communication. After successful reception of at least three inter block communications system shall transit to normal state (Line Close) if no other failure condition exist and section is clear of vehicles and signals are at ON.



- 4.3.8.3.5.3 Reset shall not be effective during POST.
- 4.3.8.3.6 Integrity of the software stored in EPROM shall be protected by CRC. This shall be checked at least every one second interval.
- 4.3.8.3.7 All free areas in the EPROM shall be loaded by software trap codes (mine fields)
- 4.3.8.3.8 Software shall run self-diagnostic to check health of the processor. This shall be executed every one second
- 4.3.8.3.9 The SSBPAC (D) shall assign specific addresses to each Block System (by hard-wired logic) and ensure that the message/telegram sent is received by the Block System for which it is meant.
- 4.3.8.3.10 SSBPAC(D) in the section shall have a unique address, which shall be stored in the system. Address of the adjacent equipment shall be hard wired.
- 4.3.8.3.11 The information exchanged between the pair of the SSBPACD shall contain the source & destination address.
- 4.3.8.3.12 The data packet for inter processor communication shall be protected with CRC .
- 4.3.8.3.13 The coding of signal information shall take care noise generally encountered in the transmission system and to ensure safety in operation against those noise levels.
- 4.3.8.3.14 Message integrity between two connected SSBPAC (D) shall be ensured by adequate CRC to obtain hamming distance of 5 or better.
- 4.3.8.3.15 Wrongly addressed information packets shall be promptly rejected by the system and continuous receipt of such packets should raise an alarm and result in shutdown of the system.
- 4.3.8.3.16 Less restrictive message shall not be asserted to the application logic until it has been received in two consecutive messages.
- 4.3.8.3.17 A more restrictive input shall be asserted in application logic after one message has been received.
- 4.3.8.3.18 An output, which is more restrictive, shall be latched and transmitted until acknowledged by receiver. Latching shall be done as a result of stable system. Stable system means system has processed all application logics triggered as a result of changes in input or other application variable changes. OR system is logically stable.

4.3.8.3.19 Handling of communication failure: SSBPAC (D) shall exchange health status of system at regular interval not exceeding 10 seconds. On non-receipt of health status out put relays shall shut down. When system health becomes normal it shall take action as under:

- 1) Individual system health is normal & axle counter are showing unoccupied condition:- In this situation system shall assume normal working without intervention from Station Master.
- 2) If system is showing error it can be re-setted after taking the precautions that section is free of vehicles.

4.3.8.3.20 **Cycle time:** Cycle time of system shall not exceed 500 milliseconds.

4.3.8.3.21 Processor must cross check with each other on their health and actions. In the event of one processor disagreeing with the decision of other processor, the system shall raise an alarm to indicate the failure of one system.

4.3.8.3.22 In the event of a failure of any component/module/sub-system or bug in the software, the system shall revert all its vital output to the most restrictive mode of operation (i.e. Train On Line) and remove power from the physical output in a fail-safe manner.

5. OPERATIONAL REQUIREMENTS

5.1 Indications on Block Panel

- a) As per para 4.0 of Specification. RDSO/SPN/188
- b) The following indications shall be driven from relay contacts.
 - SNK indication (Cl 4.1.6 and 4.2.6 of Specification. RDSO/SPN/188)
 - LSS indication Red/Green (Cl. 4.1.8 & 4.2.8 of Specification. RDSO/SPN/188)
 - Line free / occupied

5.2 Description of Block Panel for Single Line:

As per para 7.0 of Specification. RDSO/SPN/188.

5.3 Description of Block Panel for Double Line

As per para 8.0 of Specification. RDSO/SPN/188.

5.4 Method of signaling train from Block station to Block station on Single Line

As per Para 9.0 of Specification. RDSO/SPN/188.

5.5 Method of signaling train from Block station to Block station on Double Line

As per Para 10 of Specification. RDSO/SPN/188.

5.6 Method of line clear cancellation both of Single & Double line.

5.6.1 As per para 11.0 of Specification RDSO/SPN/188.

5.6.2 If axle counter or overlap track circuit becomes occupied during the cancellation process, cancellation process shall be with drawn.

6. GENERAL REQUIREMENTS

6.1 The system shall be suitable for working in area having 25KV AC traction and where passenger/freight trains hauled by single-phase thyristor controlled or three phase induction motor controlled AC locomotives or chopper controlled EMU stock are operated (lowering / raising of pantograph of electrical locos should not affect the equipment).

6.2 The system shall be capable of working in non-air-conditioned environment in an ambient temperature range of -10°C to 70°C and RH upto 95% at 40°C.

6.3 The equipment shall be so constructed as to prevent unauthorized access to the system. The instrument shall be so constructed as to give easy access to various parts for repairs/maintenance. However, there shall be no opening on the exterior, which would permit irregular access through its interior, permitting irregular operation and /or interference to it working parts.

6.4 19" rack mountable and 4 U high cabinets made of aluminum of minimum thickness 2 mm should be used for housing the PCB cards. The cabinet should be powder coated as per specification of Block Panel (RDSO/SPN/188). The front & backsides of the cabinets shall have the facility for completely locking and sealing the equipment.

6.5 Overall height of cabinet and panel shall help SM in operating the Block Panel.

6.6 Insertion of PCB in wrong card slots should not be possible.

6.7 Shielding at card level shall be provided by metallic plate over the cards.

6.8 Conformal coating shall be provided on all cards to work in rough environments.

6.9 System shall be suitable natural air-cooling.

6.10 The ICs used in the equipment shall be of industrial grade capable of withstanding surface temperature of 85°C.

6.11 Event Logger-should have inbuilt event logger with date & time stamping for logging events up to 10,000 events minimum. The event logger should be protected from unauthorized intervention. There must be down loading & report generating facility using common computer in windows environments.

6.12 Events to be logged.

6.12.1 Change of state of the section.

6.12.2 Change of state of input & output relays.

6.12.3 Failure of cards.

6.12.4 All errors.

6.13 There should be provision for connection to data logger (as per IRS-S-99/2001). The protocol should be as per IRS-S-99/2001.

7 FAIL SAFETY REQUIREMENTS

7.1 Unsafe condition shall not develop due to faults. Adequate safety margins must be incorporated in the design for all modes of failures.

7.2 No single failure shall result in an unsafe condition i.e. the system shall be brought to a safe state as soon as a failure occurs. The failure should be suitably indicated.

7.3 System shall meet SIL-4 requirements.

8. SOFTWARE DEVELOPMENTS AND VALIDATION

System shall comply the requirements listed in CENELEC standards PrEN 50126, EN50128 & EN 50129 for SIL-4. System shall comply the requirements listed in CENELEC standards PrEN50159 specified in Part I, which is for safety related communication in closed transmission systems.

9 PERFORMANCE REQUIREMENT

9.1 MTBF of complete system excluding DAC shall be better than 20000 hours.

10 SAFETY AND RELIABILITY REQUIREMENT

As per RDSO/SPN/144.

11 TYPE TESTS

11.1 The following shall comprise type tests:

- a) Visual inspection
- b) Insulation resistance

- c) Test for continuous operation
- d) Applied high voltage test
- e) Card level checking
- f) System-level checking
- g) Module level checking
- h) Climatic tests and environmental test.
- i) 7 KV Discharge test.
- j) Hard ware fail safety test.

(For initial type approval only, if there is design change then in maintenance type approval also)

- k) SIL-4 documentation and Validation from approved validator.

- 11.2 One type of complete equipment shall be tested for this purpose. The equipment shall successfully pass the entire type test for proving conformity with this specification. If the equipment fails in any of the type tests, the purchaser or his nominee at his discretion, may call for another equipment of the same type and subject it to all tests or to the test(s) in which failures occurred. No failure shall be permitted in the repeat test (s).
- 11.3 To obtain a type approval certificate, the manufacturer or supplier shall submit to the testing authority two numbers of samples, for conducting all the tests mentioned. In case of maintenance type approval, the samples shall be selected at random from regular production lots so as to be as representative as possible of the type under consideration. If, however, specially manufactured samples are offered, validity period of the equipment may be reduced accordingly.
- 11.4 Tests may also be carried out on actual installation to make sure that the equipment shall correctly perform the required function.
- 11.5 Type approval shall be issued to a manufacturer if samples pass all the prescribed tests in accordance with this specification.
- 11.6 Type approval certificate once issued shall not be valid if a change in design, construction, material used or manufacturing process is made subsequently, unless this change has the approval of RDSO.

12. MAINTENANCE TYPE APPROVAL

- 12.1 At the end of validity period of 3 years or earlier if necessary, the Testing authority may call for fresh samples for type testing for the purpose of Maintenance Type Approval.

13. ACCEPTANCE TEST

- 13.1 Inspecting authority shall carry out acceptance tests on all the equipment/sub units at manufacturers premises.
- 13.2 The following shall comprise acceptance tests
 - a) Visual inspection.
 - b) Insulation resistance.
 - c) Card level checking.
 - d) System level checking.
 - e) Module level checking.
- 13.3 A complete test report of all the tests conducted shall be submitted, giving the detailed observations made in every case and actual values recorded. Specific mention shall be made whenever the equipment has failed to comply with the requirements and indicating as to how far it has failed to comply.
- 13.4 Disposal of samples: Sample equipment, which has been subjected to type tests mentioned in clause 11, shall not form part of supply.

14. ROUTINE TEST

- 14.1 Following shall constitute routine tests and shall be conducted by manufacturer on every equipment/sub units and test results shall be submitted during the inspection.
 - a) Visual inspection.
 - b) Insulation resistance.
 - c) Card level checking.
 - d) System level checking.
 - f) Module level checking.

15. TEST PROCEDURE**15.1 Visual Inspection**

- 15.1.1 The equipment/sub units shall be examined for provisions of all facilities stipulated in this specification such as correct wiring, proper mounting and marking of components, marking, workmanship and finish for which no tests have been specified.

15.2 Insulation Resistance Test

- 15.2.1 To be carried out as per RDSO/SPN/144.

15.3 Test for continuous operation

- 15.3.1 The equipment shall be subjected to continuous run for 48 hrs with maximum input voltage specified. After this test the equipment shall satisfy the requirements of clause 15.2 and there shall not be any deterioration in the performance.

15.4 Applied High voltage test

- 15.4.1 To be carried out as per RDSO/SPN/144.

15.5 Card level checking

PCB laminates thickness
Quality of soldering
General track layout
Conformal coating and shielding
Legend printing
Green masking

15.6 System level checking

One system shall be completely assembled in factory and functional tests of the specification shall be performed.

15.7 Module level checking

Mechanical polarization
General shielding arrangement of individual cards
Indication and display
Mounting and clamping of connectors
Proper housing of cards

15.8 Climatic Tests and Environmental Test.

- 15.8.1 To be carried out as per RDSO/SPN/144.

15.9 7 KV Discharge Test.

- 15.9.1 To be carried out as per RDSO/SPN/144.

15.10 Hardware Fail-safety Test.

- 15.10.1 To be carried out as per CENELEC guidelines.

16 PLANTS AND MACHINERY

16.1 Essential machinery and plants required for production:

1. Hot & cold climate chambers for temperature cycling
2. Burn-in chamber
3. Computer aided design system with workstations
4. Microcomputer based development workstations for hardware & software.
5. Programmer & eraser as required for embedded software.
6. Flow solder line consisting of-
 - Magnifier for PCB examination
 - Automatic Integrated soldering machine
 - Temperature controlled manual soldering machine
 - Aqueous cleaner for automatic cleaning and degreasing (if out sourced to be indicated in QAP).
7. Component forming machine (if out sourced to be indicated in QAP).
8. PCB populating machine (if out sourced to be indicated in QAP).

16.2 ESSENTIAL TESTING EQUIPMENTS REQUIRED FOR QUALITY ASSURANCE:

1. Pentium IV or equivalent PC system with serial communication facility.
2. Storage dual beam oscilloscope of 20 MHz or above bandwidth.
3. True R.M.S digital millimeter – 4 digits display with facility of diode & transistor testing.
4. True R.M.S digital millimeter- 4 ½ digits suitable upto 50 KHz, high accuracy.
5. Function generator.
6. Frequency counter 10 MHz.
7. Variable DC power supply (+5V, +12V, 24V, 0-48V) (of suitable current capacity as required). (0- 130V for data logger).
8. Digital IC tester.
9. Million Mega ohm meter (500V).
10. D.C. high voltage tester (0-5KV).
11. Digital LCRQ meter.
12. Variac (0 to 260v, 1 KVA).
13. Computerized test set up with relevant software.
14. Specialised test stations for testing electronic sub-assemblies/PCBs.
15. Test jigs and fixtures.
16. Electro magnetic interference simulator.
17. Circuit measuring apparatus.
18. Rails of size 52Kg, 60Kg, 90lb each of at least 5 meter length for axle counter.
19. Test setup for measurement of communication between equipments.

16.3 Manufacturer shall also attempt to automate the testing of the system.

17 MARKING, IDENTIFICATION AND PACKING.

- 17.1 A nameplate shall be provided in a conspicuous position giving manufacturer's name, specification reference, serial number of the equipment, date of manufacture etc.
- 17.2 Packing should be as per RDSO/SPN/144.

18. WARRANTY

- 18.1 The warranty of the equipment shall be in accordance with IRS Specification No. S-23.

19. QUALITY ASSURANCE

- 19.1 The equipment shall be manufactured by using best quality material and workmanship as per quality assurance procedure laid down so as to meet the requirements of the specification.
- 19.2 Amongst other requirements of the specification, validation and system of monitoring of QA procedure shall form a part of type approval. The necessary plant, Machinery and Test instruments shall be available with the manufacturer.
- 19.3 Along with the prototype sample for type test, the manufacturer shall submit the Quality Assurance Manual, operation, maintenance & fault repairing manuals.

20 DOCUMENTATION

- 20.1 Manufacturer will provide following documentation with each set of equipment Installation and Maintenance manual.
- 20.2 Trouble shooting chart
- 20.3 Mechanical Drawings

21. INFORMATION TO BE SUPPLIED BY RAILWAYS

- 21.1 Whether SSBPAC (D) is required for Single line or double line section.
- 21.2 Whether communication medium between two stations will be 0.9 mm dia quad cable as per IRS: TC-30/97 or voice channel in OFC.
