
# INDIAN RAILWAY

# STANDARD SPECIFICATION

# FOR

# UNIVERSAL FAIL-SAFE BLOCK INTERFACE

# (UFSBI)

## IRS: S-104/2012 ver- 0


**SIGNAL DIRECTORATE**
**RESEARCH DESIGN & STANDARDS ORGANISATION**
**LUCKNOW – 226 011**

DOCUMENT DATA SHEET

| **Designation**<br><br>**IRS S:104/2012** | | | **Version**<br><br>**0.0** |
|---|---|---|---|
| **Title of Document**<br><br>**INDIAN RAILWAY STANDARD SPECIFICATION FOR UNIVERSAL FAIL-SAFE BLOCK INTERFACE** | | | |
| **Author:**<br><br>**Name: Akhilesh Kr. Yadav**<br>**Designation: Director/ Signal/ RDSO** | | | |
| **Approved by**<br><br>**Name: Shri Mahesh Mangal**<br>**Designation: Sr. Executive Director/ Signal, RDSO** | | | |


Abstract

**This document defines Universal Fail Safe Block Interface.**

**DOCUMENT CONTROL SHEET**

| NAME | ORGANIZATION | FUNCTION | LEVEL |
|---|---|---|---|
| **Akhilesh Kr. Yadav** | **RDSO** | **Member** | **Prepare** |
| **Mahesh Mangal** | **RDSO** | **- -** | **Approve** |

**AMENDMENTS**

| Version | Chapter/ Annexure | Amendment | Effective date |
|---|---|---|---|
| 0 | | First Issue | 24.12.2012 |

## *Table of Content*

| | | **Page No.** |
|---|---|---|
| 0 | Foreword | 6 |
| 1 | Scope | 6,7 |
| 2 | Terminology | 7 |
| 3 | General Requirements | 7-8 |
| 4 | Technical Requirements | 8-9 |
| 5 | System Composition | 9-12 |
| 6 | Fail Safety Requirement | 12-15 |
| 7 | Transmission of safety information | 15-16 |
| 8 | Software & validation | 16-18 |
| 9 | Maintenance, Testing & Diagnostic requirements | 18,19 |
| 10 | Tests & Requirements | 19-21 |
| 11 | Quality Assurance | 22 |
| 12 | Packing | 22 |
| 13 | Information to be supplied by the Manufacturer | 23 |
| 14 | Information regarding Block Instruments IBS and BPAC | 23 |
| 15 | Options to be specified by the Purchaser | 23 |
| | Annexure - I | 24-25 |
| | Annexure – II | 26 |
| | Annexure – III | 27-28 |
| | Annexure – IV | 29 |
| | Annexure – V | 30 |
| | Annexure – VI | 31 |

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

# INDIAN RAILWAY STANDARD SPECIFICATION FOR UNIVERSAL FAIL-SAFE BLOCK INTERFACE (UFSBI)

## 0 FOREWORD

0.1 This specification is issued under the fixed serial number IRS: S: 104 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 specifications.

| | |
|---|---|
| IRS: S23 | Electrical signalling and interlocking equipment. |
| RDSO/SPN/144 | Safety and reliability requirements of electronic signalling equipment. |
| IS: 9000 | Basic environmental testing procedures for electronics and electrical items. |
| IS 2147 | Degrees of protection provided by enclosure for low Voltage switchgear and control gear. |

0.3 Whenever, reference to any specification appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

## 1 SCOPE

1.1 The specification covers the technical and operational requirements of the block interface required to interface the conventional block instruments over telecom cable, voice/ data channels provided over optical fiber or microwave system using proper multiplexer.

1.2 The block interface shall be capable to be used as 16 input-output fail safe multiplexer over telecom cable or voice/ data channels of any media like OFC & Digital Radio where the de-energisation of all the output relays is considered as a fail safe state. It shall receive changeover inputs (front and back contacts) and pickup output relay in correspondence with the input condition in a fail safe manner. It shall faithfully pickup output relays corresponding to different input patterns in the time interval of 500 mili seconds and more.

## 2 TERMINOLOGY

2.1 For the purpose of this specification, the terminology given in IRS: S23 and RDSO/ SPN/ 144 shall apply.

## 3 GENERAL REQUIREMENTS

3.1 The system and its accessories shall comply with the requirements of signalling circuits using electronic equipment as laid down in Signal Engineering Manual Part-I 1988 (Para 7.121 to 7.130) and as stipulated in RDSO/ SPN/ 144.

3.2 The system shall comply with the specification no. RDSO/ SPN/ 144 for safety and reliability requirements of Electronic Signalling equipment.

3.3 The system shall comply with the environmental/ climatic requirements as specified in RDSO/SPN/144.

3.4 The system shall be capable of working in non-air-conditioned environment.

3.5 The equipment shall be so constructed as to prevent unauthorized access to the system.

3.6 The system shall be fully tested to ensure that it is free of systemic errors at the time of commissioning.

3.7 Interface equipment shall be so designed that no modification, either technical or operational is required in the equipment, which are interfaced.

3.8 The system shall check both local and remote systems and show "System loop back" in Numeric/alphaneumeric code.

The termination of wires and housing rack shall be constructed to comply with requirements stipulated in RDSO/ SPN/ 144.

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

3.10 Suitable lightning and surge protectors shall be provided as per RDSO / SPN/ 144.

3.11 MTBF of the system shall be better than 15 years.

3.12 The equipment shall offer ergonomic ease in its operation and maintenance.

## 4 TECHNICAL REQUIREMENT

4.1 The equipment shall be compatible with block instrument as specified by the purchaser or capable of working as 16 input -16 output failsafe multiplexer where the de-energisation of all the output relays is considered fail safe state.

4.2 The block telephone shall work on a separate 2-wire voice channel. E/M signalling of this channel or existing data channel shall be used for working bell of Block instrument.

4.3 The system shall work on 24V DC (+20%, - 10%.)

4.4 A reset button with a veeder counter shall be provided for safe resetting of UFSBI when the system goes to an error due to any major error.

4.5 The system shall cater for at least 16 changeover inputs and 16 output ports capable of outputting 24V 100 ma (min.) to drive signalling relays. For the purpose of sensing inputs, potential free contacts of relays shall be used. When used as a multiplexer it shall receive changeover (complementary potential free front and back contacts) inputs and delivers corresponding out put relay with two each front and back contacts in a fail safe manner.

4.6 The equipment shall be capable of working on Telecom Cable as well as on Voice/ data channel provided over Optical Fiber or Microwave systems.

When working on quad cable/ telecom cable/ signalling cable, the equipment shall withstand the induced voltage in electrified area and match with the characteristic impedance of the cable.

4.6.1 A RS 232-c port should be provided for directly connecting to low speed data channel on OFC/microwave radio.

4.7 In case of disruption of communication link between two stations or failure or interface equipment, there shall be no out of correspondence in indications of the block instruments at two stations. In case of multiplexer, if communication link disrupts then the system shall de-energize all output relays in fail safe state.

4.8 The pair of interface equipment and optical fiber/ radio transmission system shall be transparent to the block instrument connected through them.

4.9 The interface equipment shall conform to the voltage and current requirements, impedance matching and other electrical characteristics of the block instrument.

4.10 Each interface equipment in the section shall have atleast 100 unique address, which shall be stored in the system. Address of the adjacent equipment shall be hard wired.

4.11 The information exchanged between the pair of the interface equipment shall contain the source & destination address.

## 5 SYSTEM COMPOSTION

5.1 In order to maintain safety the following hardware features shall be specifically adopted to the design of interface.

(a) Two out of three systems for fail-safety.

(b) Watch dog timer for checking the process, the processor and other device activities.

(c) Relay output latches with read back.

(d) Use of opto-isolators for input isolation.

(e) Inter-processor checking mechanism.

(f) Signal processing at the input and output through redundant path.

(g) Multiple Data memory.

(h) UFSBI addressing and fixed message length.

(i) Shutdown of outputs in case of unsafe failure.

(j) Conformal coating & metallic shielding of all cards for rough environments.

(k) Natural air-cooling.

(l) Use of transformer/ opto-isolators for isolation of digital circuits and output relays.

(m) Outputs are read back for cross checking.

(n) The digital ICs used in the equipment shall be capable of withstanding surface temperature of $85^0$C.

(o) The discrete components like diodes, transistors, SCRs etc. should comply with RDSO/SPN/144.

(p) All power supplies on cards where digital ICs are used shall be locally decoupled using capacitors of good high frequency characteristics.

(q) To protect against the electromagnetic interference, at least two of shielding should be provided i.e.

(i) Shielding at card level by providing a metallic plate over the cards.

(ii) Shielding at chassis/ rack level.

5.2 The system shall comprise of the following modules/ functions:

- Power supply module
- Processor Modules
- Communication Controller Module
- Relay Input Modules

- Relay Output Modules

5.2.1 Power supply module:

The power supply module shall work with input voltage of 24 volt DC as specified in clause 4.3. It should comply Clause 4.3 with following stipulation.

i) The ripple voltage in the output shall not exceed 40 mv peak to peak for +5V supply at 40 MHz bandwidth. The output ripple voltage (peak to peak) of other than +5V output shall not be more than 1% of the rated output voltage at full load.
ii) Monitored hot standby module shall be provided for better reliability.
iii) Glass fuses of proper rating shall be provided to protect the equipment.
iv) The power supply module shall have self re-setting type protection from under voltage of DC input, over voltage of DC input, over load of DC output & short circuit of DC output.
v) Voltage regulation shall be less than 1% of output rated voltage.

5.2.2 Processor Module:

This module shall be designed to facilitate following functions:

(a) Decoding of the incoming message and transmission of the relevant information to the corresponding relay output module.

(b) Receiving of the message from the relay-input module, encoding the message telegram and communicating with communication controller module.

5.2.3 Communication controller Module:

This module shall be designed to facilitate following functions:

(a) Communication with adjacent block interface equipment.

(b) Controlling and allotting the serial communication channel to different modules by polling.

(c) Keeping a watch on the health of other modules and performing a safe shutdown on detection of shutdown failure.

5.2.4 Relay Input Modules:

Relay input module shall be so designed that two optical isolators sense back and front contacts of the relays. After proper sensing of the relay contacts, data is send to processor module.

5.2.5 Relay output modules:

Message regarding status of the relay read from communication and controller module is decoded and voltages for relay operation are generated by the relay driver circuit status of the output relays are continuously monitored by this module vis-à-vis the last command given.

5.3 An integrated display system shall be provided for display of both local and far end faults. The display shall be mounted on the main cabinet at a conspicuous location and readable height on the front.

5.4 Integrity of the relay driver circuit should be checked periodically to guard against inadvertent energisation of the relays. Read back facility should be provided to monitor the status of the relay vis-à-vis the processor commands.

## 6 FAIL-SAFETY REQUIREMENTS

6.1 The UFSBI shall assign specific addresses to each Block Instrument/ System (By Hard Wired Logic) and ensure that the message/ telegram sent is received by the Block Instrument/ System for which it is meant.

6.2 The system configuration shall be 2 out of 3 wherein at least 2 systems must agree to release the command. In 2 out of 3 system, it has to be made fail-safe by employing a triple modular redundant architecture. The system shall be configured in such a manner that there shall be 2 out of 3 voting in every vital decision. The 3 processors must cross check with each other on their health and actions. In the event of one processor disagreeing with the decision of other two processors, the system will work on 2 out of 2 voting logic and an alarm shall be raised to indicate the failure of one system.

Monitored hot stand-by power supply card shall also be provided to take care of failure of power supply module.

6.3 The coding of signal information shall take care of type of noise generally encountered in the transmission system and ensure safety in operation against those noise levels.

6.4 Codification of input data for transmission must ensure a hamming distance of 5 or better and at least 2 out of 3 consecutive message redundancy checks must be ensured.

6.5 In case of disruption of the communication link between two stations or failure of interface equipment, there shall be no out of correspondence in indications at the two stations with regard to the position of the Block. In link failure condition needle should go back to the line closed. In case of multiplexer, if communication link disrupts then the system shall de-energize all the output relays in fail safe state.

6.6 The information exchanged between the pair of the interface equipment shall contain all safety-related data e.g. (Sync1, source address, destination address, Data, inverted data, Redundancy Bytes etc.).

6.7 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.

6.8 The system shall be so designed to prevent unauthorised access. System shall shutdown in case of unauthorized interference/ forced pick up of relay.

6.9 With respect to the inputs the following requirements shall be satisfied:

(a) Proper debouncing technique should be adopted for the input reading process.

(b) Inputs must be isolated by opto-isolators and separate opto-isolators must be used for the same input in order to provide multiple signal paths for multiple processing of input data.

(c) Before proceeding to process the inputs, the two processors must exchange the input values read by them for their equality.

(d) For relay inputs, the vital relays must be read for both the states. In case of a unsafe variation, the system shall proceed to shutdown.

6.10 With respect to the outputs the following requirements shall be satisfied:

(a) Before writing the output or setting the output latches, the processor must exchange the output set (i.e. data received from far-end UFSBI) between themselves and in case of equality only, the processor shall process to output the data.

(b) The output latches of the processors shall be followed by a hardware equality comparator or output driving circuits with redundancy with separate drive paths.

(c) Data written to the individual output latches must be read back through the processor bus for integrity. In case of mismatch, the system processes a most restrictive mode.

(d) Presence of any other unwanted signal should not lead to unsafe conditions.

6.11 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 and remove power from the physical output in a fail-safe manner.

6.12 Unsafe condition shall not develop due to faults and adequate safety margins must be incorporated in the design for all modes of failure for the following:

(a) High impedance and open circuit fault of a component and multi-terminal devices.

(b) Low impedance and short circuit faults of a component and multi-terminal device.

(c) Variation in the component values beyond their tolerable limits.

(d) Operational faults likely to lead to unsafe condition.

(e) "Stuck at Faults" particularly in comparator circuits, I/O circuits, controlling circuits of microprocessor etc.

(f) Fleeting errors in memory chips data buses.

(g) Damages to the data bus.

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

6.14 It must be ensured that if a failure of equipment occurs which by itself does not result in unsafe condition, but which in combination with a second or subsequent failure could result in a unsafe condition, then the first failure should be detected and negated. The probability of occurrence of a second failure, while the first failure has not been detected and negated should be negligible so that Mean Time between Wrong side failures is more than one billion hours.

6.15 The design of the equipment shall cater for detection and restoration of system to a safer state in case of following faults if these are likely to result in unsafe condition:

(a) Variation in power supply beyond its tolerance limits, including momentary failure of the power supply module.

(b) Spikes in the power supply system, stray fields caused by traction vehicles or standby diesel generator sets.

(c) Earthing of any component or wire or a combination of such earthing faults.

(d) Broken wires, damaged or dirty contacts, failure of a component to energies, loss of power supply or blown fuses etc.

6.16 System should comply to SIL—4 of CENELEC standard or equivalent standard.

## 7 TRANSMISSION OF SAFETY INFORMATION

7.1 In the systems requiring transmission of vital safety information, the following requirements shall be fulfilled:

(i) It shall be possible to transmit the safety information over telecom cable as well as voice or data channels through any media using proper multiplexers. The transmission protocol should ensure integrity of safety related information irrespective of the transmission medium.

(ii) If communication fails for a short duration i.e. upto three frames then the last valid output data shall be held. If communication failure is for a longer duration i.e. more than three frames then system shall assume most restrictive and fail safe state.

(iii) For systems relying on error prevention, all transmission equipment such as filters and amplifiers must be designed to meet specified fail safety standards.

(iv) Errors introduced or not detected at a given level in the transmission system must be detected at higher levels. Error detection methods used at any level must take into account the characteristics of the lower levels.

(v) Error detection techniques should permit the use of standard telecommunication techniques, which offers much more economic solution than the special hardware needed to implement error prevention techniques.

(vi) Error detecting coding shall not form the sole means of protection of transmitted information, but should be combined with other methods such as higher level procedures and protocols, and hardware redundancy or diversity.

(vii) Forward error correcting coding shall not be used unless precautions are taken at the higher level to prevent invalid corrections from being accepted at the higher level.

(viii) The response time should be less than 500 msec. for the complete system up to a 2400 bps data rate.

## 8 SOFTWARE AND VALIDATION

8.1 Software used in UFSBI system should have been developed in conformity with a software engineering standard issued by recognized standards body such as European Committee for Electro Technical Standardization (CENELEC) with special relevance to safety critical applications. Particular

software engineering standards used shall be specified and one complete set of such standards shall be made available to RDSO.

8.1.1 The software shall conform to all the safety requirements of block-operation. Design shall ensure that during malfunction of the UFSBI not only power is removed from the output circuits in a fail-safe manner but also the processor are prevented from executing codes at random.

8.2 The software shall be developed in such a way that it is possible to test and validate each module independently.

8.3 The software shall be such that in case of variable data, the possibility of using incorrect data does not exist. Further the software should check and reject:

(a) Use of data which is obsolete or meant for some earlier state of the system, and

(b) Corrupted data.

8.4 As far as possible, program flow shall be independent of the input data. The program should preferably execute the same sequence of instructions in each cycle.

8.5 The use of interrupts shall be kept to a bare minimum.

8.6 Software should include self-check procedures to detect faults in the hardware. The self-check should include the following:

(a) Memory containing the vital software and data shall be checked periodically so that probability of corrupted software jeopardizing the safety of the equipment is minimized.

(b) Components of the CPU such as general purpose registers program counters stack pointers, instruction register, instruction decoder, ALU etc. shall be checked periodically as far as practicable.

8.7 Self-check of the associated functional hardware as required by the hardware design should be performed periodically.

8.8 Critical and non-critical software should be segregated in the memory area so that special procedures to check the program flow may be adopted during the self-check process for the critical software.

8.9 The following shall ensure:

a) Error detection capability of data packets

b) 2 out of 3 message redundancy

c) Correspondence check between inverted and non-inverted signals.

8.10 As specified in the software Engineering Standards, full documentation on Quality Assurance Program specially the Verification and Validation (V&V) procedures carried out in-house or by any independent agency should be made available to RDSO to check their conformity to standards. If the procedure and documentation for V&V is considered inadequate, RDSO reserves the right to get the verification and validation of software and hardware done by an independent agency at the cost of the supplier.

8.11 The software must check that –

a) Inputs to the processors are correct
b) Program has been executed correctly
c) Data tables have not changed
d) Inputs and variable data are correct
e) No program segments have been skipped
f) The outputs are correct
g) The outputs have not been changed by device failure in an unsafe manner
h) Integrity of whole system (self-check)

## 9 MAINTENANCE, TESTING AND DIAGNOSTIC REQUIREMENTS

9.1 To ensure that the above safety criteria is maintained, the system shall have diagnostic checks carried out at frequent intervals, monitoring a condition giving appropriate indications and alarms.

9.2 The system shall be provided with a front-panel display unit indicating various failures. The error code should indicate the type of the failure.

9.3 A trouble-shooting chart should be provided indicating the action required to be taken for repair of the equipment corresponding to each error code.

9.4 Audiovisual alarm shall be provided in case of failure. The audio alarm should stop when acknowledged but the visual alarm should continue till the fault is rectified.

9.5 Whenever power to the equipment is switched on, the equipment should wait for a system reset.

9.6 A system-reset switch be provided for starting the system operation and an electo-mechanical counter should be provided which should be incremented every time a reset operation is performed. System reset switch should have a sealing arrangement to prevent unauthorised operation.

9.7 Necessary provision shall be made in the hardware and software for modular expansion of the equipment.

## 10 TESTS AND REQUIREMENTS

### 10.1 Conditions of tests

Unless otherwise specified all the tests shall be carried out at ambient atmospheric conditions.

10.2 For inspection of material, relevant clauses of IRS: S 23 and RDSO/SPN/144 shall apply.

### 10.2.1 Test Equipment

Test equipments should be provided as per STR for Electronic Signaling equipment and should include the following:

i) Dual beam oscilloscope of 20 MHz bandwidth
ii) Digital multimeters – 3.1/2 digit display with facility of diode & transistor testing
iii) Frequency counter
iv) DC power supply (± 5V, 24V)
v) EPROM Programmer and UV eraser
vi) Megger (500V)
vii) LCR meter
viii) HV tester
ix) Function Generation
x) Digital IC tests

## 10.3 **Type Tests**

The following tests shall constitute type tests:

a) Visual inspection as per Clause 10.6
b) Insulation Resistance tests as per Clause 10.7
c) Card-level functional and fail-safety tests on all the cards
d) System-level functional and fail-safety tests
e) Environmental/climatic tests as per relevant clause of RDSO/SPN/144 (Indoor Equipment).
f) Applied high voltage test as per clause 10.8 .

10.3.1 Only one pair of equipment shall be tested for this purpose. The equipment shall successfully pass all the type tests 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/card(s) of the same type and subject it to all tests or to the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s).

## 10.4 **Acceptance Tests**

The following shall comprise acceptance tests:

a) Visual inspection as per Clause 10.6
b) Insulation Resistance tests as per Clause 10.7
c) Card-level functional tests on one card of each type
d) System-level functional and fail-safety tests

## 10.5 **Routine Tests**

The following shall comprise the routine tests and shall be conducted by manufacturer on every equipment and the test results shall be submitted to the inspection authority before inspection.

a) Visual inspection as per Clause 10.6
b) Insulation Resistance tests as per Clause 10.7
c) Card-level functional test on all the cards
d) System-level functional and fail-safety tests
e) Environmental stress screening test for PCB & sub- systems as per relevant clause of RDSO/SPN/144

## 10.6 **Visual Inspection**

The equipment shall be visually inspected to ensure compliance with the requirement of Clauses of this specification. The visual inspection will broadly include –

i) **System Level Checking**:

- Constructional details
- Dimensional check
- General workmanship
- Configuration

ii) **Card Level Checking**

- PCB laminate thickness
- General track layout
- Quality of soldering and component mounting
- Conformal coating & shielding
- Legend printing
- Green masking

iii) **Module Level Checking**

- Mechanical polarisation
- General shielding arrangement of individual cards
- Indications and displays
- Mounting and clamping of connectors
- Proper housing of cards

## 10.7 **Insulation Resistance Test**

Insulation Resistance test shall be carried out as per relevant clause of RDSO/SPN/144.

## 10.8 **Applied High Voltage Test**

Applied High Voltage Test shall be carried out as per relevant clause of RDSO/SPN/144.

# 11 QUALITY ASSURANCE

11.1 All materials shall be of the best quality and the workmanship shall be of the highest class as per QAP standards laid down by RDSO.

11.2 The equipment shall be manufactured as per quality assurance procedure laid down so as to meet the requirement of the specification.

11.3 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 as given below shall be available with the manufacturer.

11.3.1 **Plant & Machinery:**

Test equipments should be provided as per STR for Electronic equipment and should include the following:

i) Wave soldering station
ii) Burn in chamber
iii) Dry heat and Humidity chambers
iv) Cold chamber
v) PCB assembling zig
vi) Anti-static assembly
vii) EPROM/Micro-controller Programmer
viii) UV Eraser
ix) Microprocessor development system
x) Computer aided design system

11.3.2 **Test Instruments:**

All test instruments as given in Clause 10.2.1 shall be available with the manufacturer.

11.3.3 Along with the prototype sample for type test, the manufacturer shall submit the Quality Assurance Manual, Operation, Maintenance & Fault Repairing Manuals.

# 12 PACKING

As per relevant clause of RDSO/SPN/144.

## 13 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

13.1 Documentation as per relevant clause of RDSO/SPN/144.

13.2 The manufacturer should supply the following information:

a) Design approach for the system;

b) Functions achieved in hardware & software;

c) Mode of interaction between hardware & software;

d) Salient features through which fail safety has been achieved e.g. use of a watchdog timer, automatic shut down etc. &

e) Proof of safety.

## 14 INFORMATION REGARDING BLOCK INSTRUMENTS, BPAC (BLOCK PROVING WITH AXLE COUNTER) AND IBS

Information regarding block instruments, BPAC and IBS are enclosed in Annexure-I to Annexure –VI.

| | | | |
|---|---|---|---|
| a) | Single line Diado instrument | - | Annexure-I |
| b) | Single line token instrument | - | Annexure-II |
| c) | Single line IRS push button instrument | - | Annexure-III |
| d) | Double line SGE instrument | - | Annexure-IV |
| e) | IBS | - | Annexure-V |
| f) | BPAC | - | Annexure-VI |

## 15 OPTIONS TO BE SPECIFIED BY THE PURCHASER

a) Medium on which UFSBI is intended to work OFC/Cable/Microwave.
b) Type of Block Instrument to which UFSBI will be interfaced.
c) Whether the UFSBI will work on VOICE / DATA channel.
d) Whether the relay rack should be wired to suit operation of a single line/double line block instrument for BPAC application, IBS/ABS operation [single line/double line] operation or, user railway may also procure unwired relay rack.

.....

**ANNEXURE -I**

## DAIDO TOKENLESS INSTRUMENT

Operational Requirement

Sequence of operation for sending a train from station A to station B (considering carrier frequency 1800 Hz).

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| a) | Press PBI button | -ve on L1<br>+ve on L2<br>(50-64V DC) | | BLR picks up. Bell sounds. Advise A on telephone of his willingness. |
| b) | Press PBI and PB2. PBPR energised. | 1800 Hz modulated by 85Hz (2-3V) with +ve on L1 and –ve on L2 simultaneously. | c) | NR & CR1 picks up. B turns handle to TCF. |
| e) | NR & CR2 picks up. Handle turns to TGT. TRSR & ASR picks up (and LSS is taken off). | 1800 Hz modulated by 65 Hz (2-3V) with +ve on L1 and –ve on L2. | d) | Presses PB1 and PB2. PBPR picks up |
| f) | Train enters block section. TPR drops and TOLR picks up. TOL indication appears & BZ1 sounds. | 1800Hz modulated by 65 Hz (automatically transmitted). | g) | CR2 and TOLR picks up. TOL ind. appears. BZ1 sounds. |
| h) | A presses PB1 and transmit train entering section signal. | | i) | BLR picks up. Presses PB1 to acknowledge the train entering section signal. |
| k) | NR picks up & TOLR drops. BZ1 stops sounding. Disconnect the transmission of frequency to B. | +ve on L1 and<br>-ve on L2. | j) | PBPR picks up. |
| m) | NR & CR1 picks up. A turns the handle to line closed. | 1800 Hz modulated by 85Hz transmitted. +ve on L1 and –ve on L2. | l) | Clears home signal. Train enters. 2R picks up. BZ2 operates. Put back the signal lever. BZ2 stop sounding. Press PB1 & PB2. PBPR picks up. |
| n) | Presses PB1 & PB2. PBPR picks up. | 1800Hz modulated by 85Hz transmitted. +ve on L1 and –ve on L2. | o) | NR & CR1 picks up. A turns the handle to line closed. |

Note: Carrier frequency of adjacent equipment will be 2700 Hz.

**ANNEXURE -I**

## DIADO

For closing Block section when a train pushes back to the same station from where it had left

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| a) | Inst. Is in TGT position | | b) | Inst. In TCF. |
| c) | Operates S2 and takes off Home signal. Train passed signal. 2R picks up. | | | |
| d) | Press PB1, PB2 and PBPR picks up. | 1800 Hz modulated by 85 Hz transmitted. +ve on L1 & -ve on L2. | e) | NR & CR1 picks up. |
| | | | f) | Turn handle to Line closed. |
| h) | NR & CR1 picks up | 1800 Hz modulated by 85 Hz transmitted. +ve on L1 & -ve on L2. | g) | Press PB1, PB2 and PBPR picks up. |
| i) | Turns the handle to Line closed. | | | |

## DIADO

Cancellation of Line clear

1. Line clear has been obtained but the train has not entered the block section.
2. The LSS is at 'ON' position.

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| a) | S1 operated. After 120 secs. TEPR and 3R picks up. | | | |
| b) | Press PB1 and PB2. PBPR picks up. | 1800 Hz modulated by 85 Hz and +ve on L1 & -ve on L2. | c) | c) NR & CR1 picks up. |
| | | | d) | Turns handle to Line closed. |
| f) | NR & CR1 picks up. | 1800 Hz modulated by 85 Hz and +ve on L1 & -ve on L2. | e) | Press PB1 & PB2. PBPR picks up. |
| g) | Turns handle to line closed. | | | |

## ANNEXURE -II

## Operation of Token Block Instrument for Despatching a Train from Station 'A' to Station 'B'

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| **Having normal polarity instrument.** | | | **Having reverse polarity instrument** | |
| a) | Presses bell plunger. | +ve on Line | b) | Galvo deflects to right TCF energised through 3-pos. relay. Bell sounds. Handle turns to TCF. |
| d) | Galvo deflects to left. 3-pos. relay operates. Bell sounds. TGT picks up. | +ve on Line | c) | Presses bell plunger. Galvo deflects to left. |
| e) | Turns handle to TGT. Token extracted. Train entered block section with token. | | f) | Train arrives. Insert token into instrument, bell plunger is pressed. Galvo deflects to right. Transmit negative on line. |
| g) | Galvo deflects to right TCF energised. 3-pos. relay operates. Turn handle from TGT to line closed. | | | |
| h) | Bell plunger is pressed. Galvo deflects to right. | +ve on Line | i) | Galvo deflects to right. TCF energised. Turn handle from TCF to line closed. |

Note: 3-pos. relay: Resistance – 77 ohm, operating current – 18mA
TCF/TGT – Resistance – 28 ohm and operating current – 160mA.

## CANCELLATION OF LINE CLEAR

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| **(Instrument is at TGT)** | | | **(Instrument is at TCF)** | |
| a) | Insert token and bell plunger is pressed. | +ve on line | b) | Galvo deflects. 3-pos. relay energised. TCF energised. Handle turns to line closed. |
| d) | Galvo deflects. 3-pos. relay energised. TCF energised. Handle turns to line closed. | -ve on line | c) | Bell plunger is pressed. |

**ANNEXURE –III**

## PUSH BUTTON INSTRUMENT

### Sending train from Station 'A' to Station 'B'

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| a) | Press BCB | +ve on L1 and<br>-ve on L2 | b) | CRR operates to normal. Bell sounds. Bell signals are exchanged. |
| c) | Presses BCB and TGB | -, +, - (on line) | d) | CRR throws to reverse. (Completes relay logic). TCFR is latched in reverse. Instrument set to TCF. |
| f) | Instrument set to TGT | -, -, + (on line) | e) | Transmit TGT code (automatically). |
| g) | Clears LSS. Train enters – TOL appears. Transmit TOL code. | (-, -, -) | h) | Bell rings, TOL indication appears. Press BCB. Bell stops. |
| j) | TOL indication switched off. Reply line closed. Code transmitted. (line closed in. app.) | (-, +, +) | i) | Clear home signal train arrives. Press BCB and LCB. |
| | | | k) | Line closed indication appeared. Released the buttons. |
| Note: - Means -ve on line1<br>+ve on L2<br>+ Means +ve on L1<br>-ve on L2 | | | For every operation one neutral relay at sending station and one polarised relay at receiving station will be energised in series. | |

CRR operates on 12V and all other relays operate on 24V.

## ANNEXURE –III

## PUSH BACK OPERATION

| | **Station A** | | | **Station B** |
|---|---|---|---|---|
| **(Instrument in TGT. TOL is 'ON'. TGTPR in energised condition)** | | | | **(Instrument in TCF. TOL is 'ON'. TCFPR in energised condition)** |
| a) | Train receives at A on signal. TAR picks up. | | | |
| b) | Press BCB and cancel button. After 120 secs. Free indication appears. New number is lodged. | | | |
| c) | Advise B to co-operate. | | | |
| d) | Presses BCB and LCB. | (-, +, +) | d) | Presses BCB and LCB. |
| | | | e) | TCF indication switched off and line closed indication appears. |
| g) | TGT disappears. Line closed indication appears. Releases BCB & LCB. | (-, +, +) | f) | Releases BCB & LCB. |

## LINE CLEAR CANCELLATION

| | **Station A** | | | **Station B** |
|---|---|---|---|---|
| **(Instrument at TGT )** | | | | **(Instrument at TCF )** |
| | | | | |
| a) | Press BCB and cancel button. After 120 secs. free indication appears. New number is lodged. | | | |
| b) | Advise B to co- operate. | | | |
| c) | Press BCB & LCB. | (-, +, +) | c) | Press BCB & LCB. |
| | | | d) | TCF indiaction switched off. Line closed indication appears. |
| f) | TGT disappears. Line closed appears. Releases BCB and LCB. | (-, +, +) | e) | Releases BCB and LCB. |

**ANNEXURE –IV**

## SGE DOUBLE LINE INSTRUMENT

| **Station A** | | | **Station B** | |
|---|---|---|---|---|
| a) | Presses Bell plunger | 50V 150 C/s | b) | BLR picks up. Bell sounds. Agree to give line clear. |
| d) | Top needle deflects to line clear. 3-pos. relay operated towards line clear. | -ve on line<br>+ve earth (about 18V) | c) | Turn handle to line clear. |
| | | | d) | Bottom needle deflects to line clear. |
| e) | LSS is taken off. Train enters. Advise B on telephone. | | f) | Turn handle to TOL. |
| g) | Top needle deflects to TOL. 3-pos. relay operated towards train on line. | +ve on line<br>-ve earth | g) | Bottom needle deflects to TOL. |
| | | | h) | H/Signal clears. Train arrives. Turn handle to line closed. |
| i) | Needle comes down to line closed. | No current. | i) | Needle comes down to line closed. |

**ANNEXURE V**

## OPERATIONAL REQUIREMENT OF I B S

| **Station A** | | **I B S** | **Station B** | |
|---|---|---|---|---|
| 1. | Channel C<br>Channel D | 5 KHz, 1000 mV | | Channel C<br>Channel D |
| 2. | Reset Up | | 2. | Reset UP |
| 3. | Reset Dn | | 3. | Reset Dn |
| 4. | Block needle Up | | 4. | Block needle Up |
| 5. | Block needle Dn | | 5. | Block needle Dn |
| 6. | Block Tele | | 6. | Block Tele |
| 7. | ON ECR | Both side from IB | | |
| 8. | OFF ECR | | | |
| 9. | UP TPR | Both side from IB to control GR. | | |
| 10. | DN TPR | | | |
| 11. | UP TPR | For indication from IB. | | |
| 12. | DN TPR | | | |
| 13. | UP GR | Both side from IB. | | |
| 14. | DN GR | | | |
| 15. | TRAR UP | Both side station to station. | | |
| 16. | TRAR DN | | | |
| 17. | Post tele UP | Both side from IB | | |
| 18. | Post tele DN | | | |

## ANNEXURE VI

## UFSBI for BPAC

| Sl.No. | Station "A" | Station "B" |
|---|---|---|
| 1. | Pickup one input keeping all other inputs in dropped state | Observe that corresponding output relay picks up and other outputs are in dropped state |
| 2. | Repeat above for remaining inputs one by one | Observe that corresponding output relay is picked up. |
| 3. | Pickup any combination of 16 inputs | Observe that output relays are picked up in the same combination state |
| 4. | Pickup any combination of 16 inputs and change the combination after the gap of 500 milli seconds or more | Observe that output relays are picked up in the same combination state. |