

DELTRON
Presents



OFC based Block Working Applications using UFSBI (as per IRS:S-104/2012 Ver.0)

Presented By:

Deltron Equipment & Systems Pvt. Ltd.
26, Convent Road,
Kolkata-700014

Mob# : 9330378001 / 02 / 03

Email: deltron.india@gmail.com
suparno.deltron@gmail.com

**Welcome to the S&T
Officers & Staff
of
Indian Railway**

Definition:

UFSBI is a 2 out of 3 fail-safe (SIL-4) multiplexer capable of exchanging 16 relay states simultaneously over each direction between 2 locations separated by a distance but connected over Quad-Cable, OFC or Radio.

Salient Features:

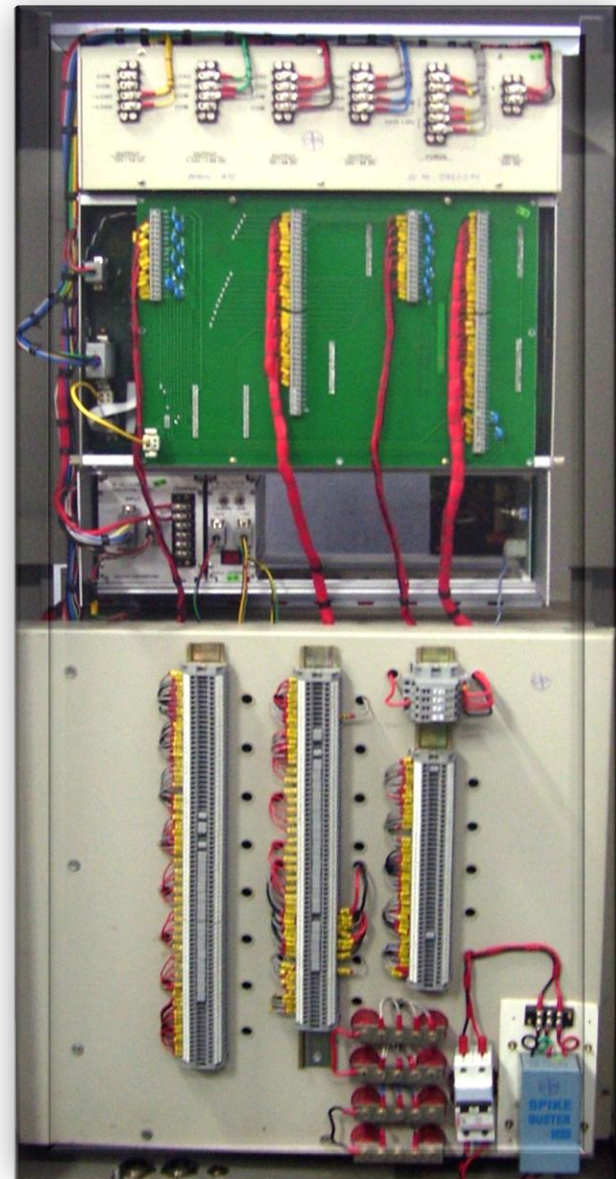
- ✓ 16 Input-16 Output Fail-Safe Multiplexer specially designed for use Railway Signalling applications. Software & Hardware Validated as per CENELEC SIL-4 standards (complying EN50126 / EN50128 / EN50129, EN50159-1) & approved as per RDSO/SPN/147/05 now revised to IRS:S-104/2012
- ✓ 2 out of 3 Triple Modular Redundant (TMR) architecture ensuring safer system with high availability (almost 100%) & reliability
- ✓ Galvanically as well as optically isolated Inputs and transformer coupled, mutually isolated unreferenced output with digital data-communication protocols makes the system robust against induced electrical noises making it usable in RE areas
- ✓ Hot standby power supply to make the system work uninterrupted, 24X7, round the year

System Architecture of UFSBI

UFSBI consists of the following parts:

1. Power Supply Units
2. The 2 out of 3 UFSBI-Digital System
 - a) Input Card
 - b) Output Card
 - c) CPU Card
 - d) Ctrl & Comm Card
 - e) Modem (& Changeover)
 - f) Reset Box
3. Relay Rack / EBLM / Interface





Back View

Deltron Equipment & Systems Pvt. Ltd., Kolkata



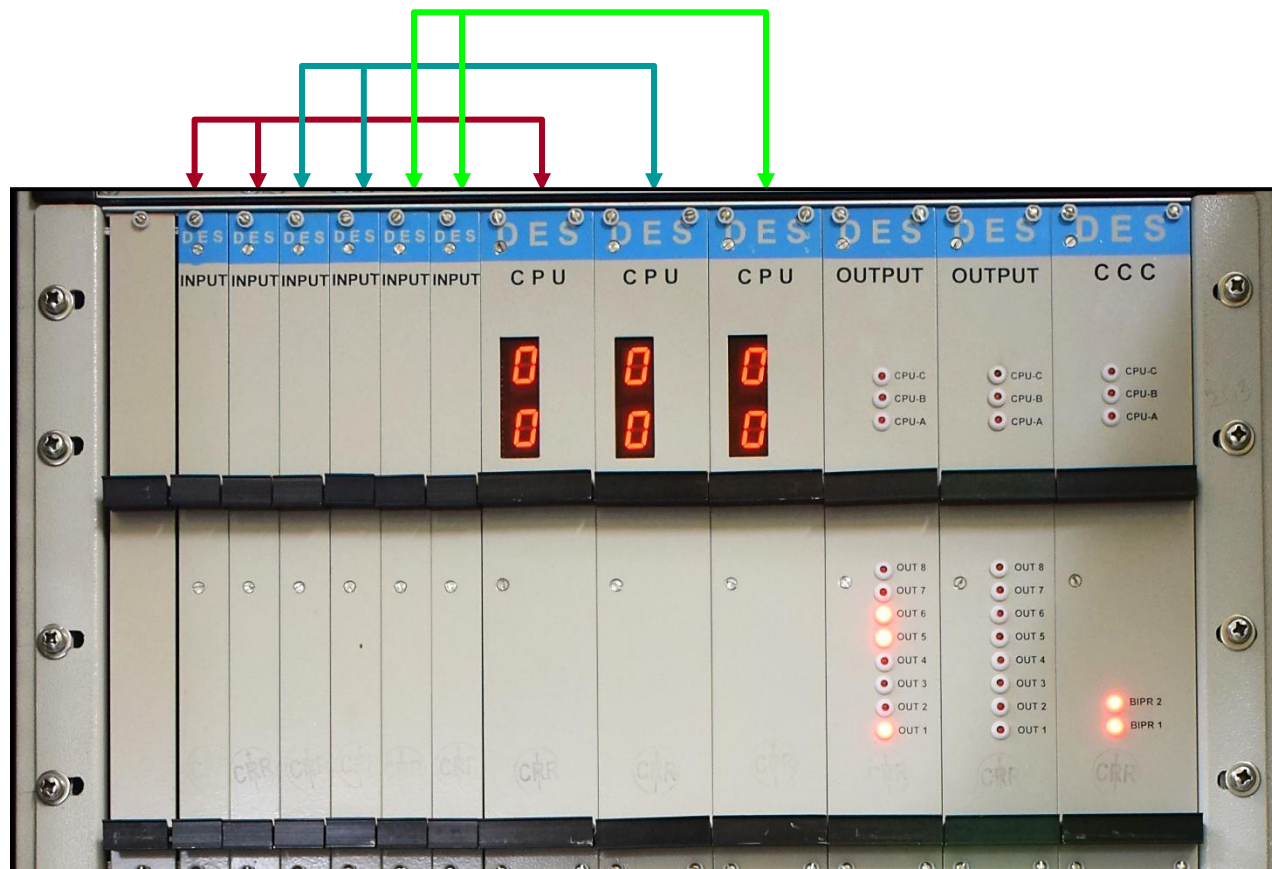
Power Supply
Units

2 out of 3
UFSBI-Digital
System

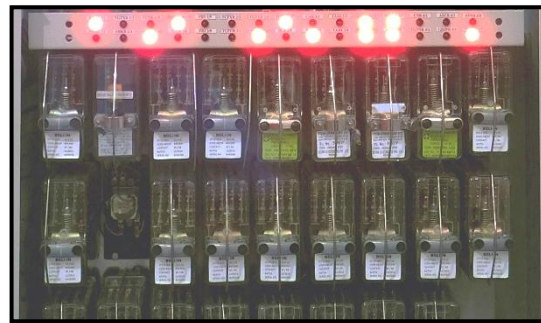
Reset Box ,
Modems, Media
Changeover &
Version Display

Connection between Input and Processors

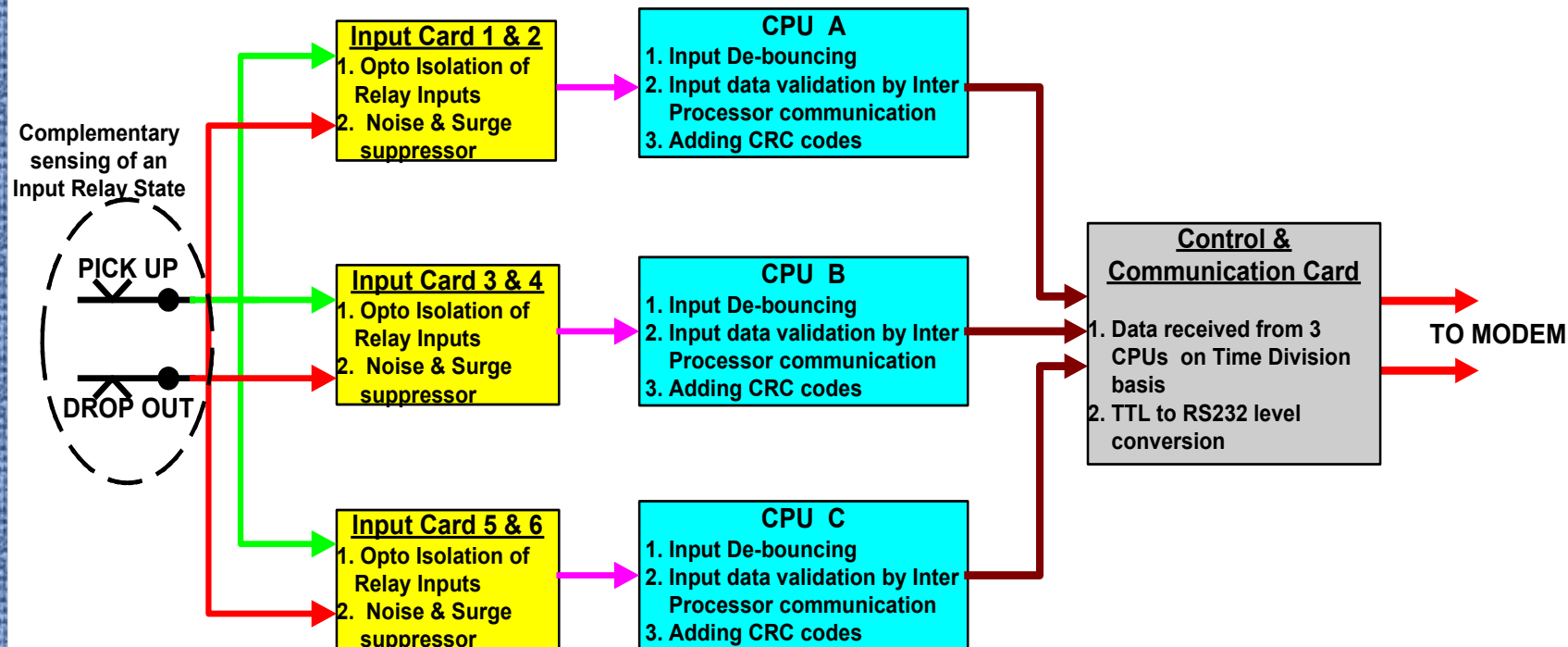
Input information are send to the processors for validation purpose and an input is considered to be true only on majority voting logic of the three individual CPUs. The first two input cards sends information to the first CPU, the next two to the second and the other two to the third CPU as shown in the figure below:



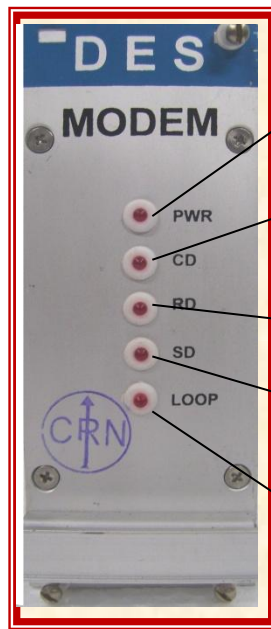
UFSBI – Input Reading Process



Relays feed the
input processor
cards provided
with opto-isolators



UFSBI – Quad / VF Channel Modem (most commonly used)



Steady Red.
To Indicate the
MODEM Power ON
Condition

Steady Red to Indicate
The Carrier Detect

Flashing Red.
To Indicate the
MODEM receives Data

Flashing Red.
To Indicate the
MODEM Sends Data

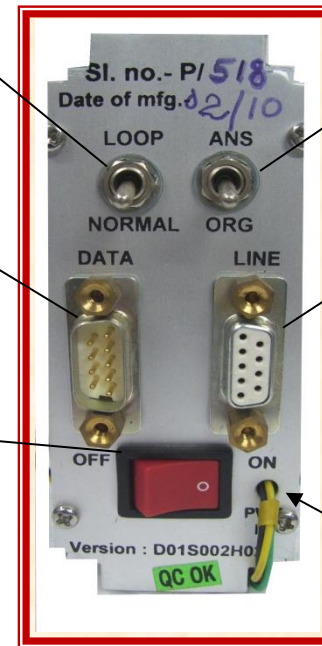
Steady Red when
Modem Put in
LOOP position

MODEM FRONT VIEW

Loop / Normal
Switch
To Test the
Modem

Data Connector
from Mother
Board to
Modem

MODEM
ON/OFF
Switch



ANS / ORG Switch
To Select the
Modem mode

Line Connector
from MODEM to
OFC or QUAD
Cable

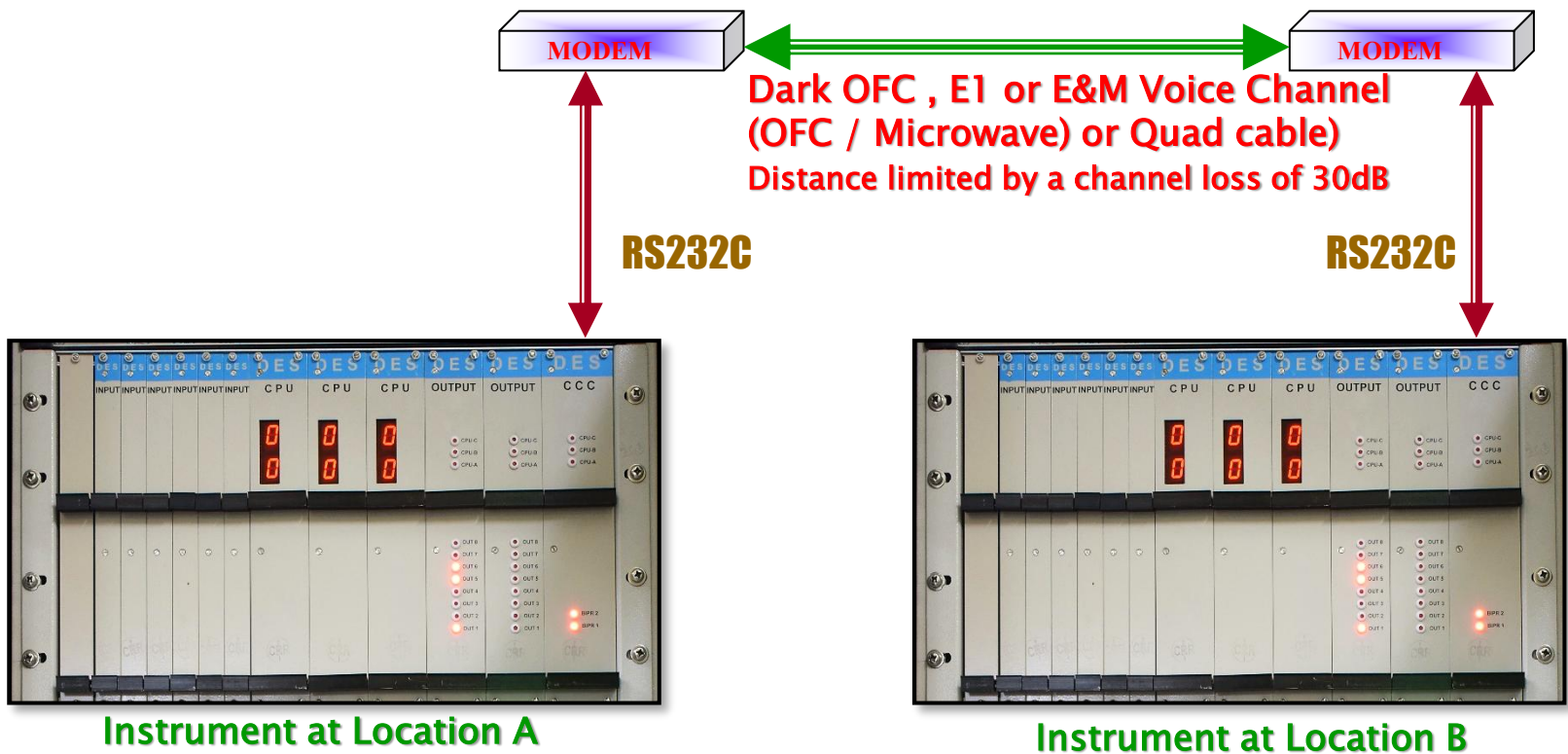
PWR
IN

MODEM BACK VIEW

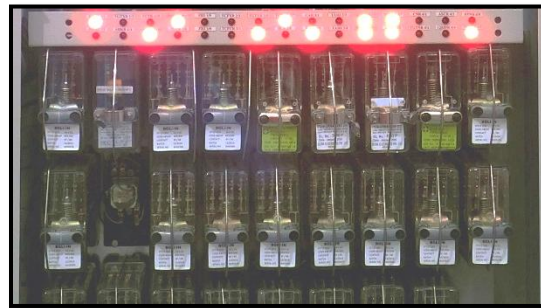
Modem is provided to convert the data as per RS232 to Voice Frequency. The Fig above shows the front and back view of the Modem. Modem works on 4 wire, Asynchronous, 2400 bps mode. Maximum permitted loss between to modem is 30db.

UFSBI to UFSBI connection Through Telecomm Medium

The Communication Card of the UFSBI feeds the modems with data which is transmitted via the telecommunication channel

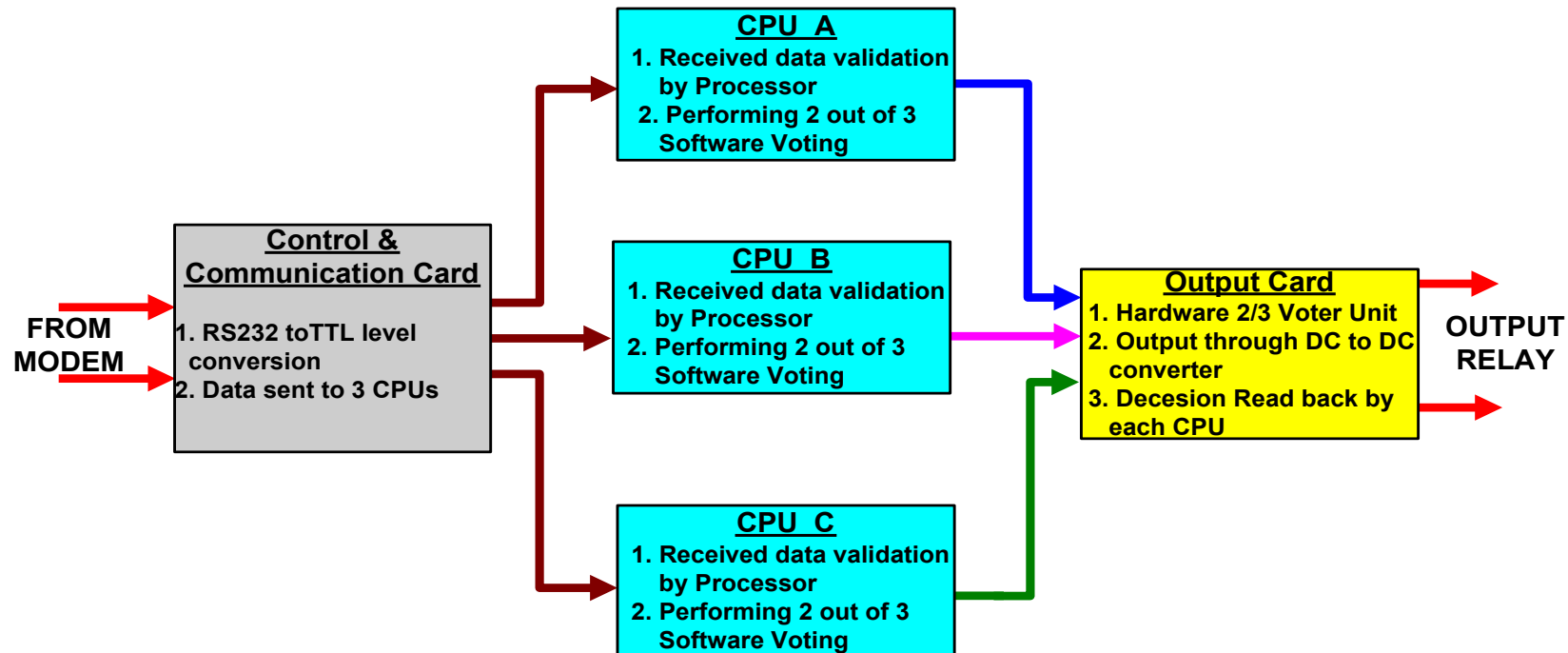


Relay feed to Output Card Connection

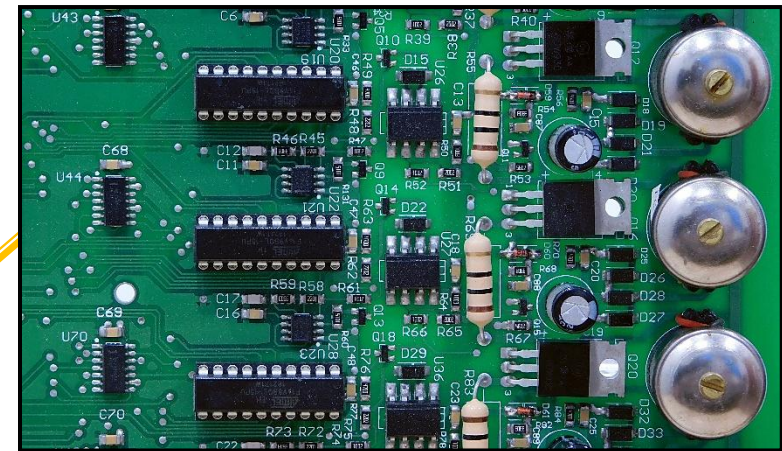
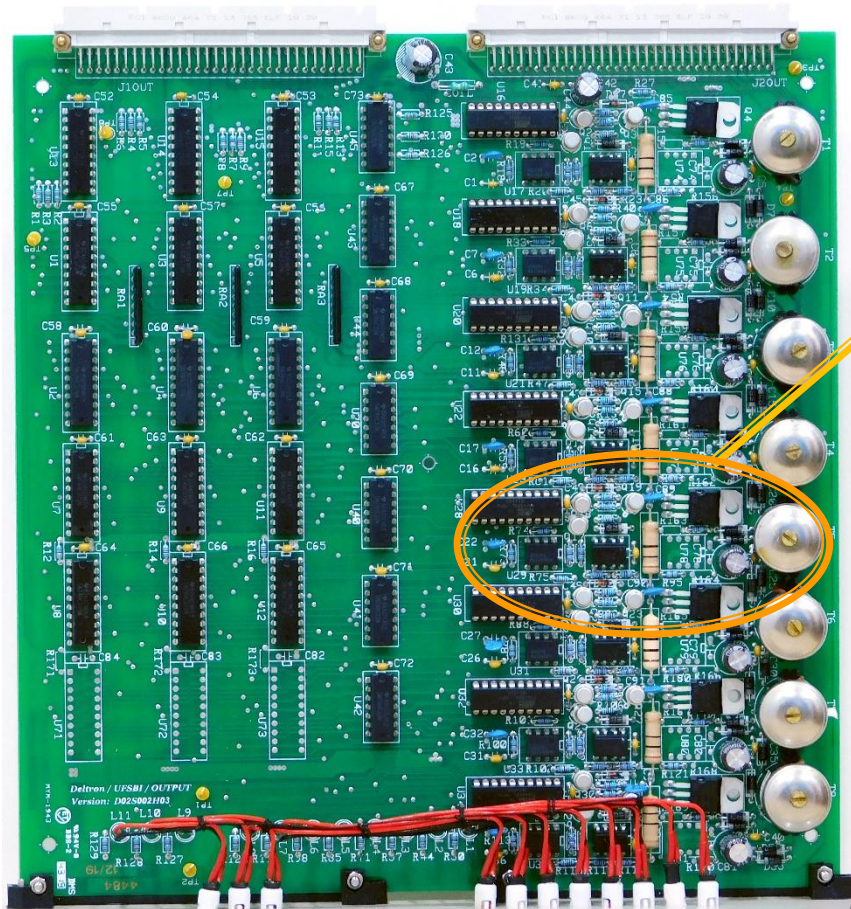
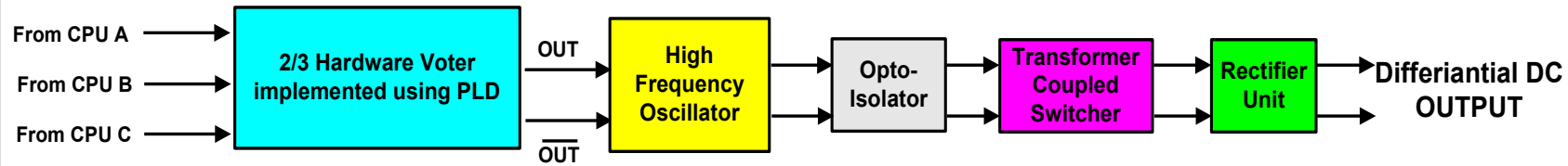


Output Cards at
Receiving ends drives

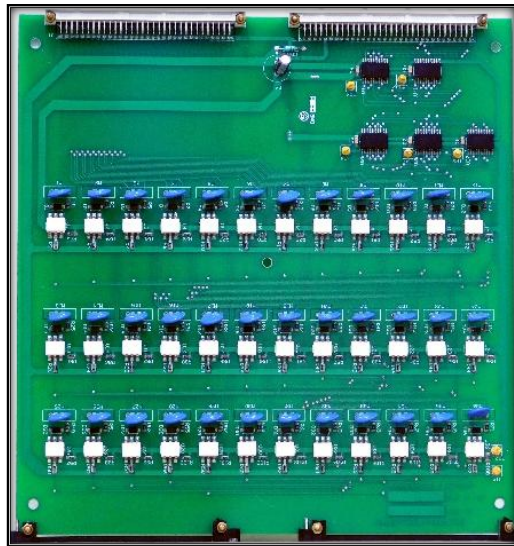
Relay outputs at the
other end



Mechanism for Picking Up an Output Relay



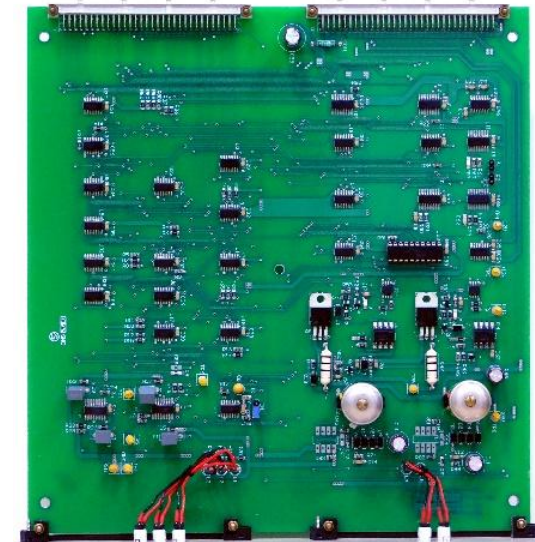
UFSBI Cards



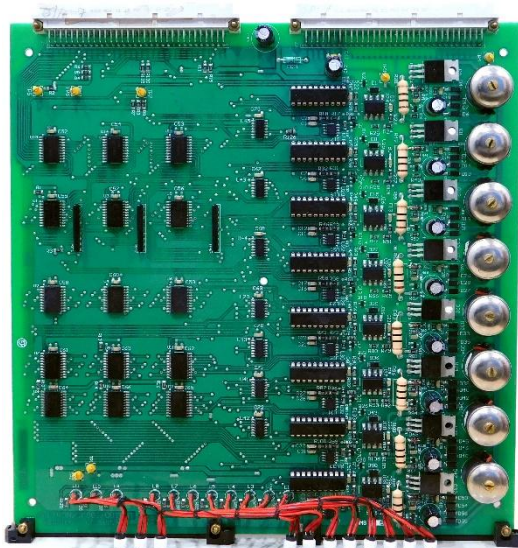
Input Card



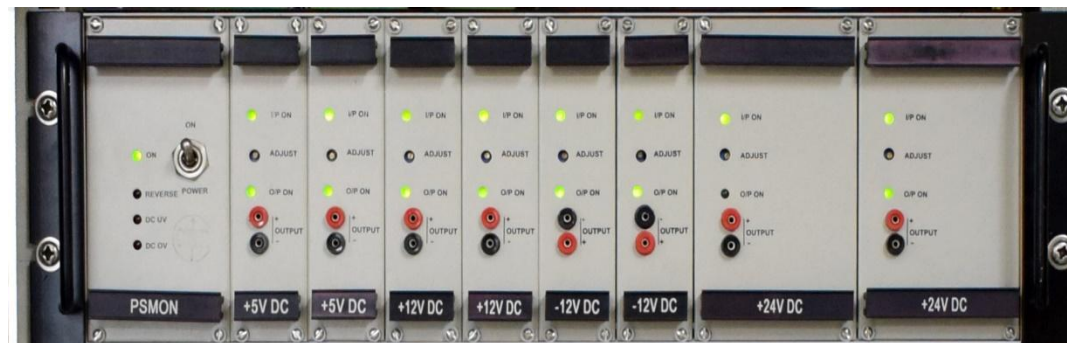
CPU Card



CC Card



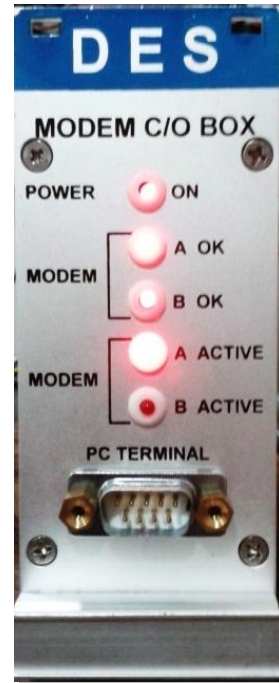
Output Card



DC - DC Converter

Introducing Media Redundancy with Automatic Media Changeover

Front View



Rear View



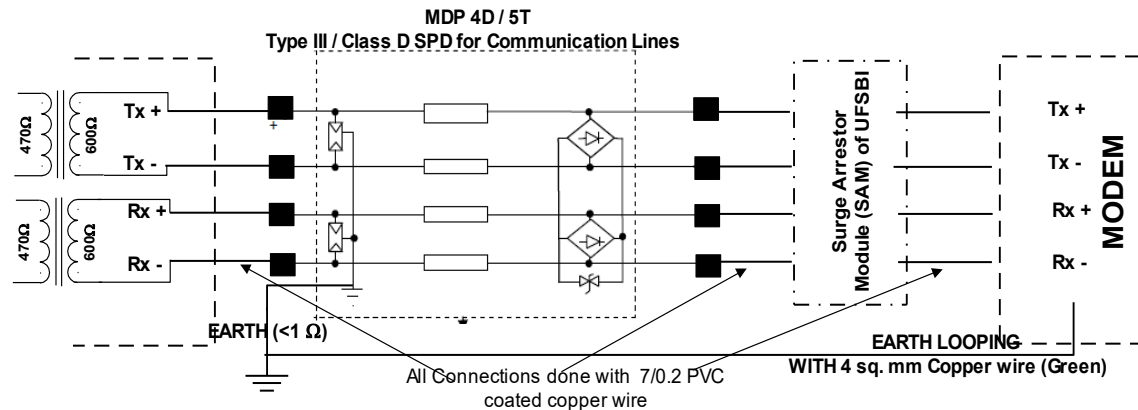
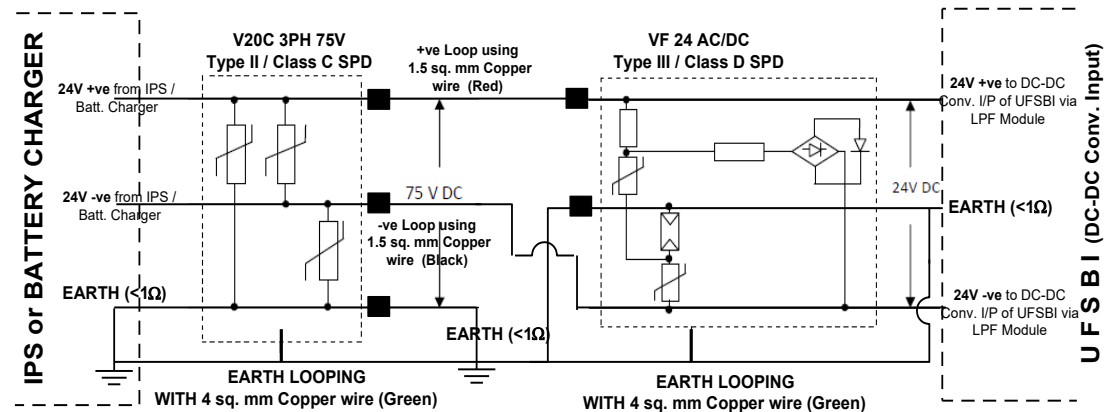
The functional advantages of the Automatic Media Changeover

- Seamless changeover between the primary and the secondary media
- Very low latency media switchover (<1 ms), thereby ensuring no link failure of UFSBI.
- Continuous monitoring of both working / non-working media providing potential free contact for recording media performance over networked data logger.

Note: The same media changeover unit may be used for other devices like digital axle-counter provided the communication packet format (like size, speed, number of Start/Stop bit etc. are provided

Mitigating Surge Damages with Class C & D SPD for Power / Data Line

- A combination of Class C & D SPD for Power Line and Class D SPD for Data Line from OBO Betterman



For this to be Effective a Good Earthing (<1Ω) is essential . . . !!

The applications of UFSBI can be classified as:

1. **As a Block Interface to Conventional Block Instruments** (Neal's Token, Diado TLBI, PTJ Push Button TLBI & SGE DLBI)
1. **As a Push Button type Axle Counter Block Instruments**
Block Proving with Axle Counter using Block Panel & UFSBI (as per IRS: S-105/2012)
 - # Using Q-Series Relays
 - # Using Hot Standby EBLM units
2. **As 16 Input-16 Output Fail-safe Multiplexer**
for reduction of usage of costly & theft prone Copper Cables / complete replacement possible with OFC in
 - # Intermediate Block Signalling
 - # Automatic Block Signalling

Block Proving with Axle Counter using Block Panel & UFSBI (as per IRS:S-105/2012) Ver.0

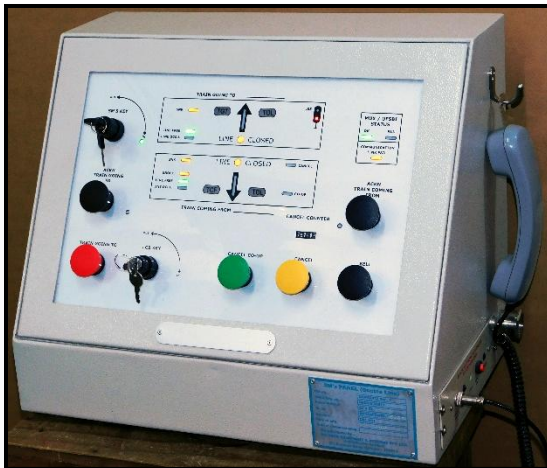
Using Q-Series Relays

Using Hot Standby EBLM units

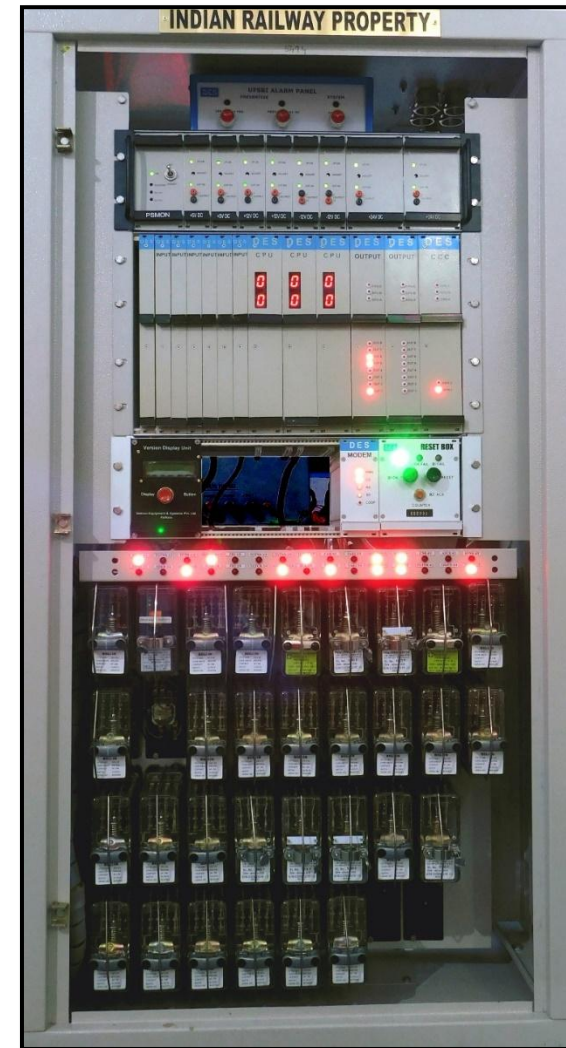
Block Proving with Axle Counter using Block Panel & UFSBI (as per IRS:S-105/2012)



Single Line Block Panel



Double Line Block Panel

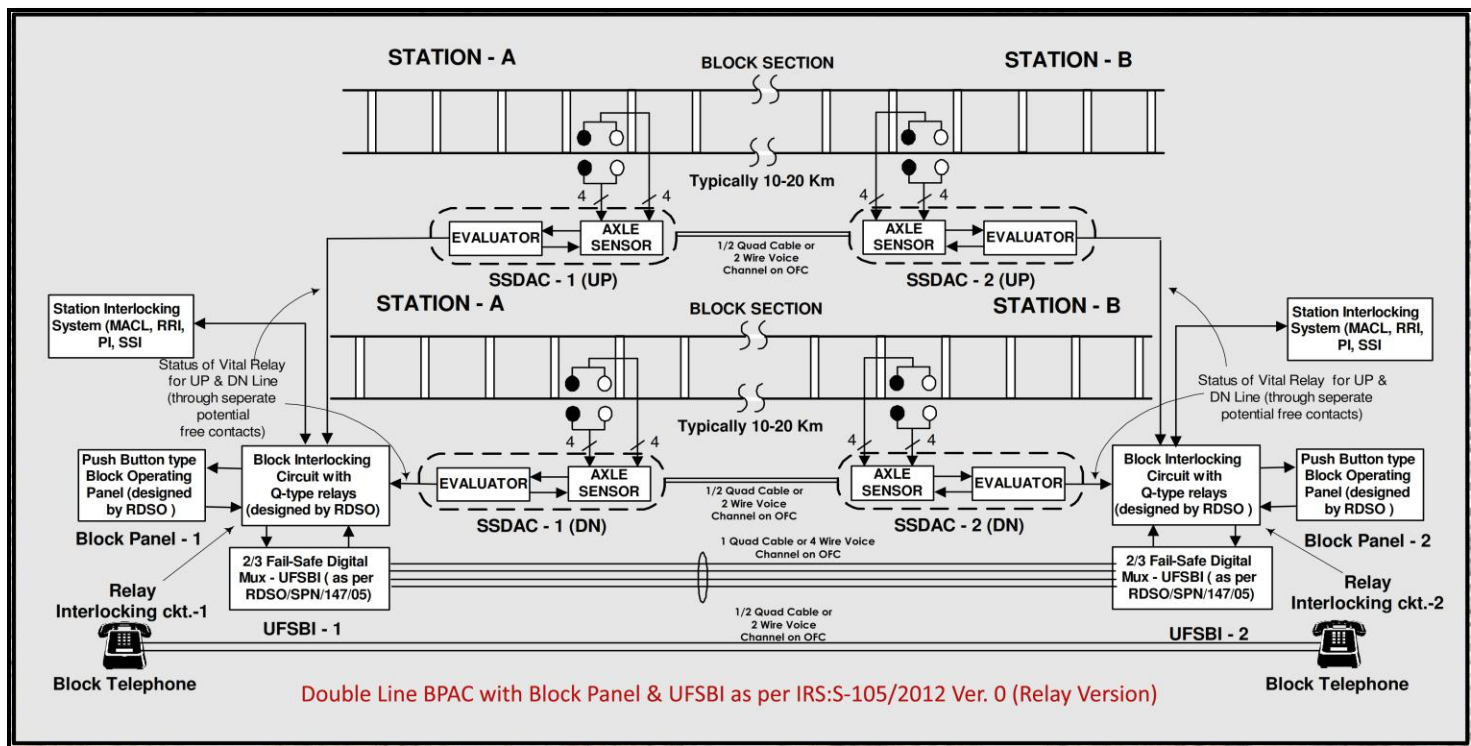
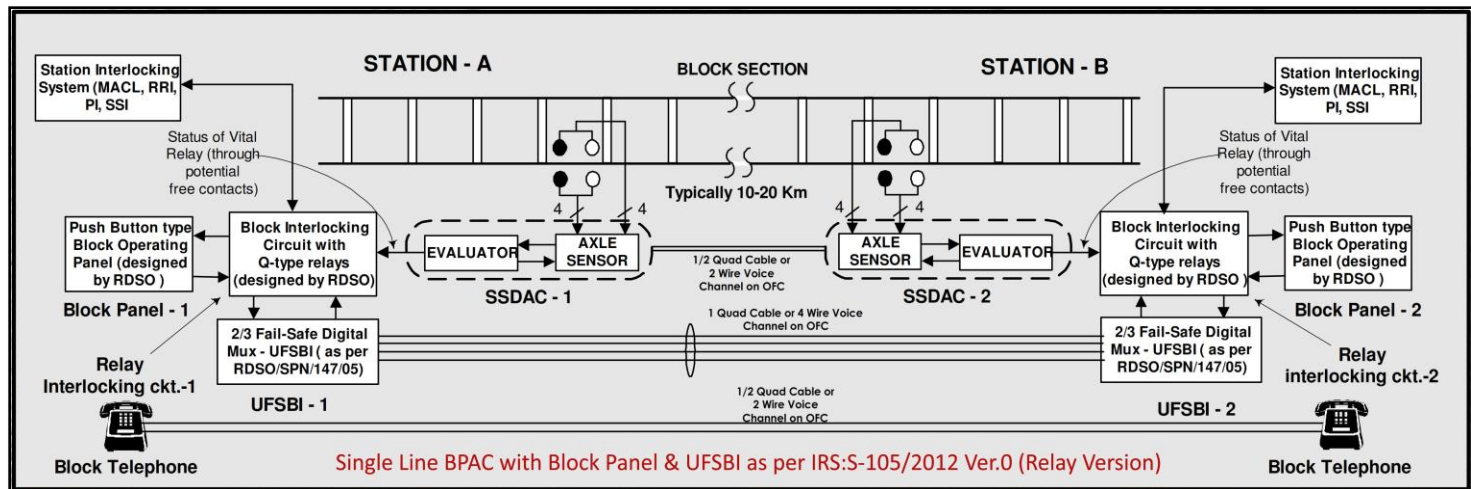


Block Panel with UFSBI
(using Q-Series Relays)

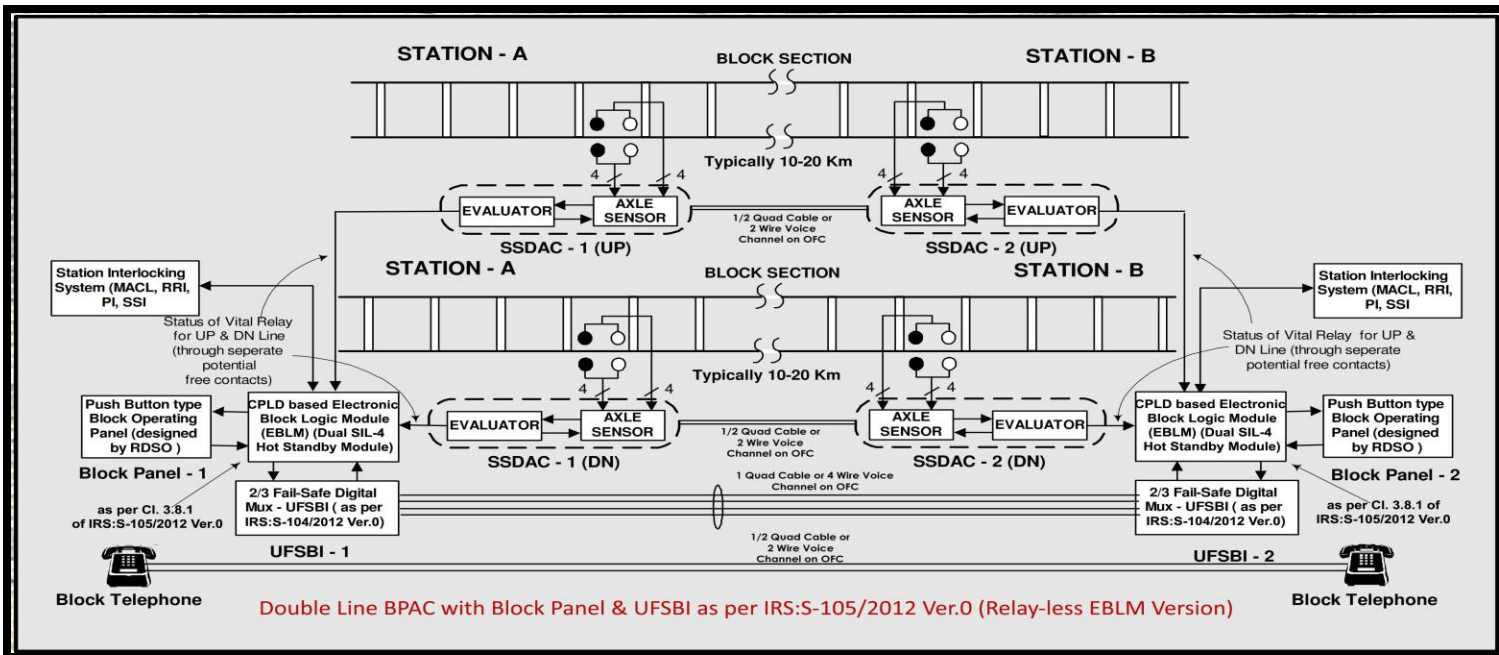
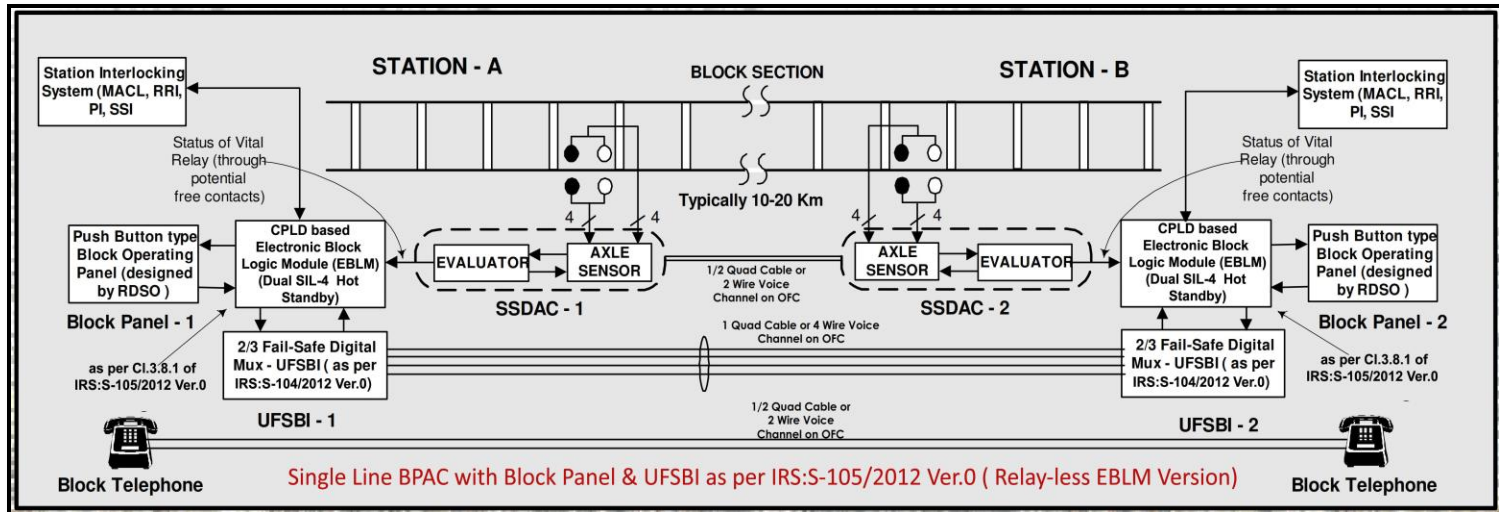
Salient Features

1. It is a non-co-operative, consent dependent, user-friendly push button type Block Instrument capable of providing the last vehicle verification information in both single & double line sections.
2. The Block Panel provided, offers easy-to-understand audio-visual indications for all vital information.
3. The unique design of interlocking circuits and input/outputs through Q-series relays provide galvanic isolation, making the system usable in both RE & Non-RE sections.
4. The system is media independent i.e. it works on Copper cable, OFC or microwave radio without hampering the fail-safety of the operation.
5. Provides media fall-back options through Seamless switching OFC or E1 / Quad using Automatic Media Changeover and optional E1-OFC Industrial grade VF Modem

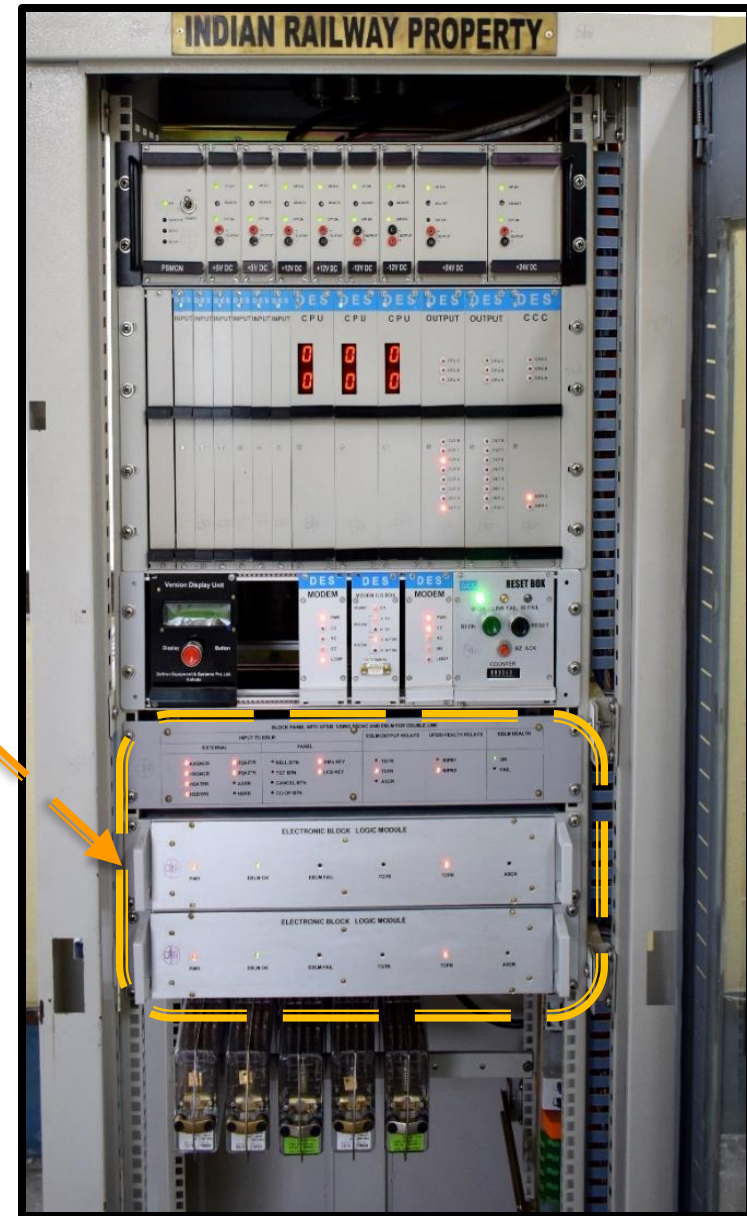
OFC based Block Signalling Schemes using UFSBI . . .



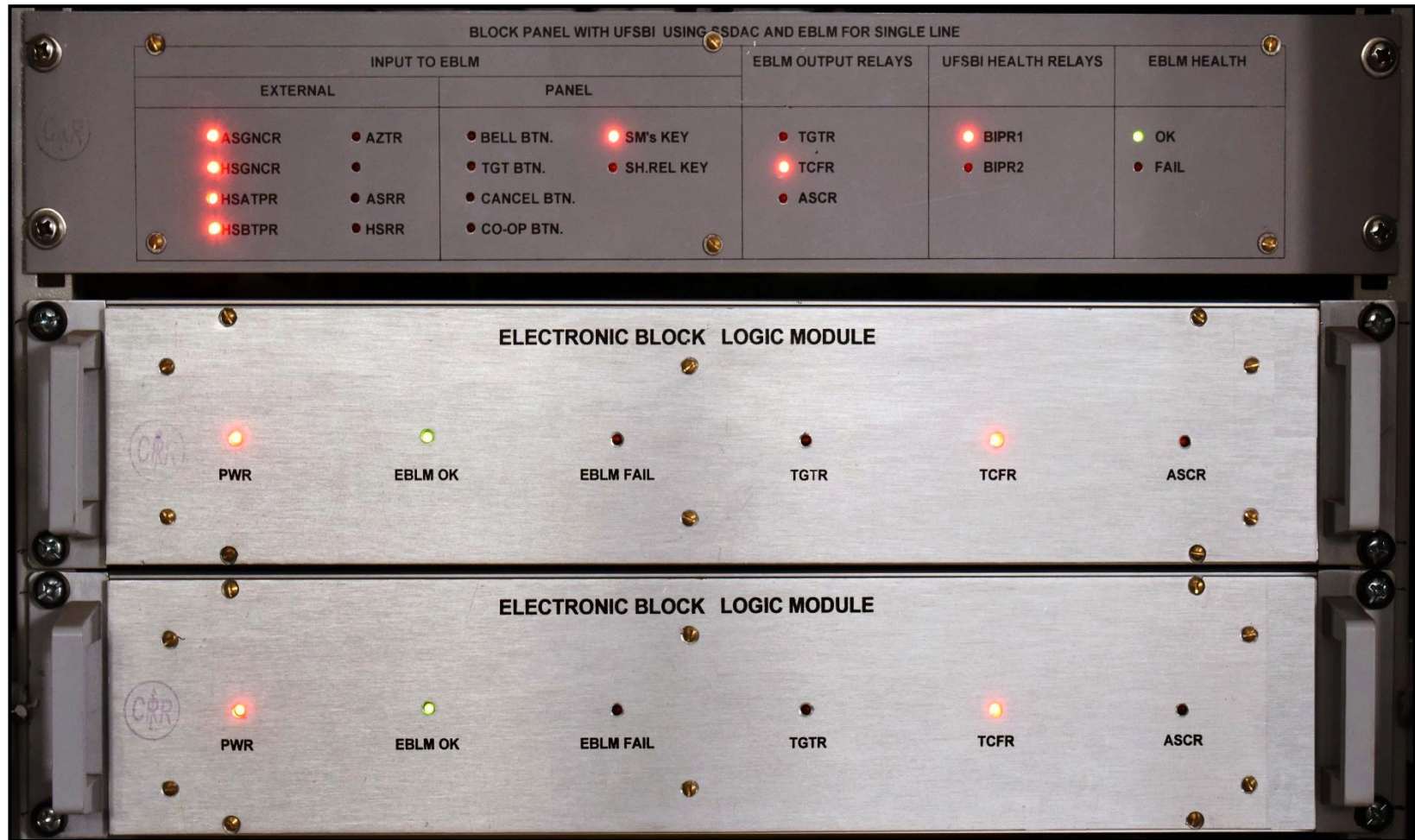
OFC based Block Signalling Schemes using UFSBI . . .



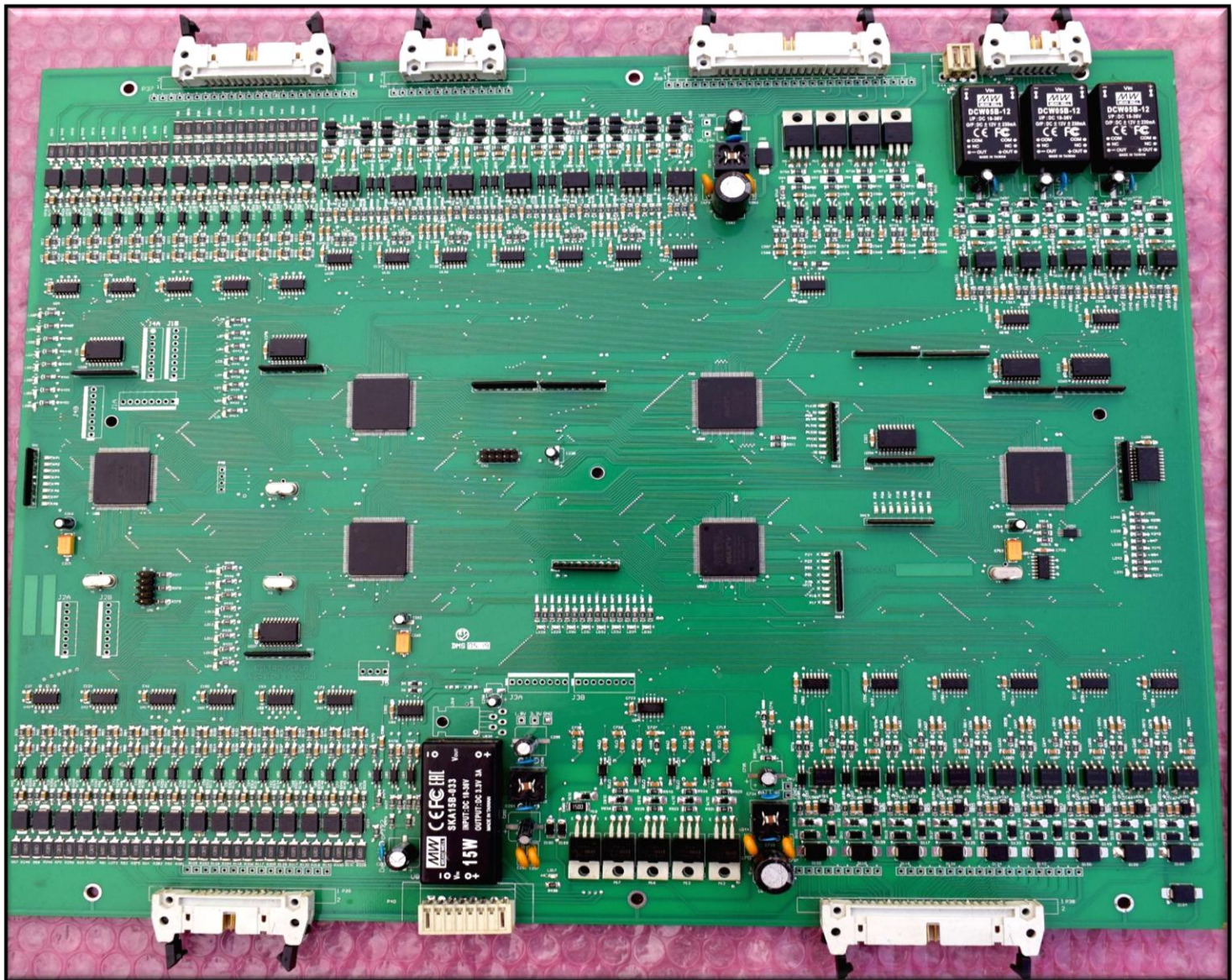
Replacing Relay Logic with Hot-Standby EBLM



A Closer Look into Hot-Standby EBLM



The EBLM Card with 2 oo 2 CPLD



OFC based Block Signalling Schemes using UFSBI . . .

Comparison of different Functionally Equivalent Axle Counter based Block Panel Instruments

COMPARISON BASIS	BPAC USING UFSBI WITH RELAYS (as per IRS: S-105/2012 Ver.0)	BPAC USING UFSBI WITH EBLM (as per Cl. 3.8.1 of IRS: S-105/2012 Ver.0)	SSBPAC (RDSO/SPN/175/2005)
Interlocking logic Resolving architecture	Using Q- series relays	Using 2 out of 2 CPLD based Hardware Logic with Hot-Standby & Hot-Swapability	Using 2 out of 3 Microprocessor without Hot-Standby
Inter-Station Communication	Using 16 I/O (SIL-4) Fail-Safe Mux UFSBI	Using 16 I/O (SIL-4) Fail-Safe Mux UFSBI	Inbuilt Fail-Safe (SIL-4) Communication
Redundancy	Communication: 2 out of 3 UFSBI with Auto Media C/O (Quad / OFC) Logic: Standalone (no contact paralleling)	Communication: 2 out of 3 UFSBI with Auto Media C/O (Quad / OFC) Logic: (2 out of 2) x 2 Hot-Standby & Hot-Swap ability	Communication: 2 out of 3 Block Logic: 2 out of 3
Safety Validation	Communication: SIL – 4 Logic: Q-series Relays (RDSO design)	Communication : SIL – 4 Logic: SIL – 4 (based on RDSO design)	Communication: SIL – 4 Logic: SIL – 4
No. of Q-Series Relays	29 for Double Line 31 for Single Line	5 for Double Line 5 for Single Line	9 for Double Line 9 for Single Line
Power requirement	24 Volts DC / 5 Amp	24 Volts DC / 4 Amp (with redundancy)	24 Volts DC / 5 Amp
Spare Communication channel Availability	9 Fail-Safe Relay State can be exchanged in each direction	9 additional Fail-Safe Relay State can be exchanged in each direction	2 Fail-Safe Relay State can be exchanged in each direction
Functionality	Dedicated for Absolute block operation	Dedicated for Absolute block operation	Dedicated for Absolute block operation
Backward compatibility with existing BPAC with UFSBI using Relays	Not Applicable	Yes, 100% across makes of RDSO approved Fail-Safe Mux UFSBI	No Old Block Instrument shall have to be fully cannibalized and replaced with the new SSBPAC
Cost of New Installation	Rs.7,35,000/- Per Pair (approx.)	Rs. 6,50,000/- Per Pair (approx.)	Rs. 9,50,000/- Per Pair (approx.)
Cost of Up gradation from fully Relay based system to less Relay Version (to Railways)	Not Applicable	Effectively NIL (Cost of EBLM Modules is 10-15% lower than the cost of Relays released)	Rs. 16,85,000/- Per Pair (Cost of Relay based System Replaced + Cost of New SSBPAC)

Prices are indicative and mentioned for comparison only. It may change slightly. Therefore, must not be considered as quotation.

Need of Intermediate & Automatic Block Signalling systems

1. Increase of **line capacity** by not less than **50% in IBS** and by **150% in ABS**

As already established by in multiple case studies eminent railway researcher Dr. Ashok Jhunjunwala of IIT (Madras) & Mr. P.R. Goundan, Ex-CSTE of Indian Railways

2. Ensure **maximized system Availability** for unhindered train operation
3. Deliver **High MTBF** of system through Redundancy wherever possible, and **least MTTR** if possible Zero down-time
4. A **Cost-effective** and **faster implementation** of generally extremely outdoor activity intensive implementation schemes

Implementing IBS schemes on Dual OFC (dark fiber) using UFSBI as per RDSO Schemes

Limitations in use Copper Conductors in Block Working systems

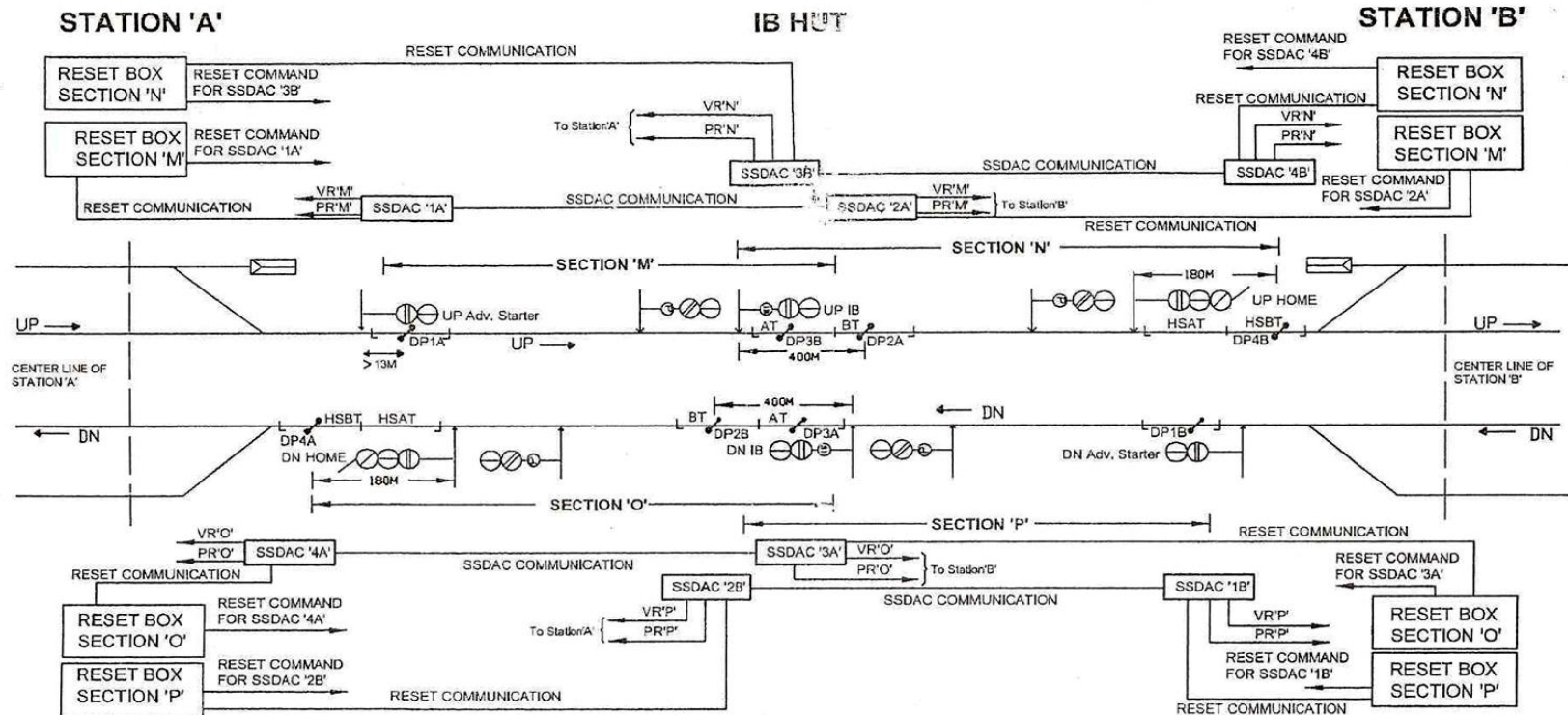
1. **High** and constantly increasing **import dependence** as well as **product cost**
2. **Prone to theft** as it impossible to protect the asset over the entire block section
3. **Susceptible to EMI/EMC damages** and induced voltages in RE area thus requiring special protective arrangement like cutting relays or isolation transformers.
4. **High cable laying time and maintenance hazard** as each core has to be periodically megered to ensure the integrity of insulation and avoid inter-conductor leakage voltage.
5. **High MTTR**, as locating fault is not as simple as in OFC
6. **Higher chances of aging and insulation damage**, resulting in fast conductor deterioration through ingress of moisture
7. **Redundant path / back-up provisions cannot be availed** without alternative physical cable

Benefits of using OFC in Block Working systems

1. **Low Cost** and progressively reducing owing to development of fiber technology
2. **No resale value**, thus **Not theft prone**.
3. **No EMI/EMC or induced EMF hazards** even in RE area as glass is an insulator
4. **Zero maintenance** if properly laid with HDPE duct.
5. **Low MTTR**, as locating fault is easy and fast using OTDR.
6. **Minimum aging or deterioration** through ingress of moisture, as no electricity is carried
7. **Redundant path / back-up provisions** can be availed through multiple path using dual OFC in different routes

All resulting in Very High Reliability and Availability of numerous Voice / Data channel at a much lower cost....

SCHEMATIC DIAGRAM OF INTERMEDIATE BLOCK SIGNALLING USING 2DP-1S SSDAC

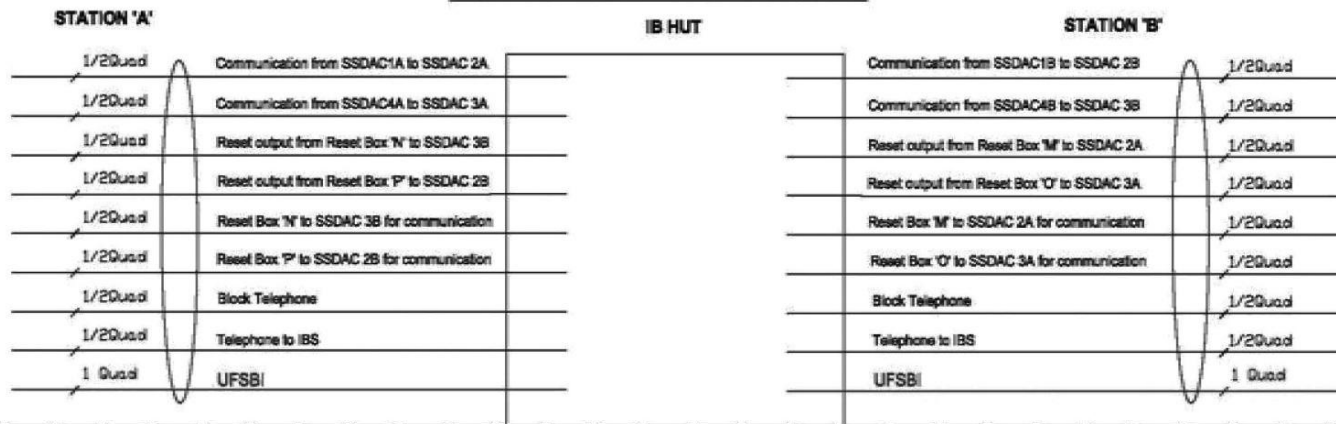


Note:

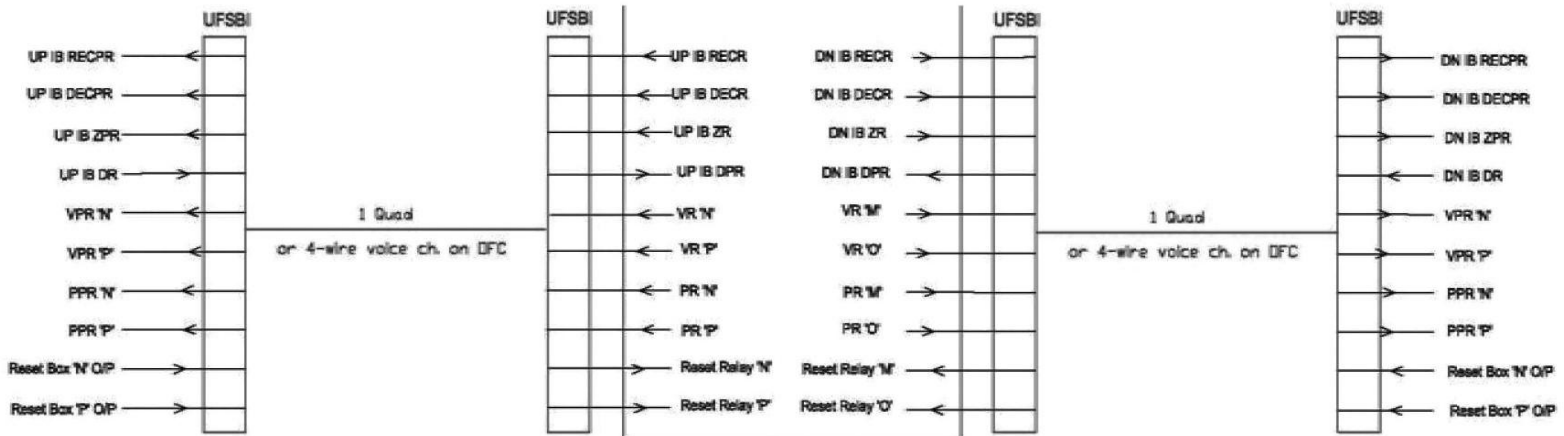
1. All the resetting shall be 'Preparatory' only.
2. All the resetting shall be done by the Station Masters of the both stations.
3. For resetting of a track section, entire Block Section has to be clear in that direction.

RDSO			
INTERMEDIATE BLOCK SIGNALLING USING 2DP-1S SSDAC			
SE/SIG	ADE/SIG	DIRECTOR/SIG	RDSO DWG. No. IBS/SSDAC/2DP-1S
			Sheet No.- 1 of 2

Distribution of Quad cable

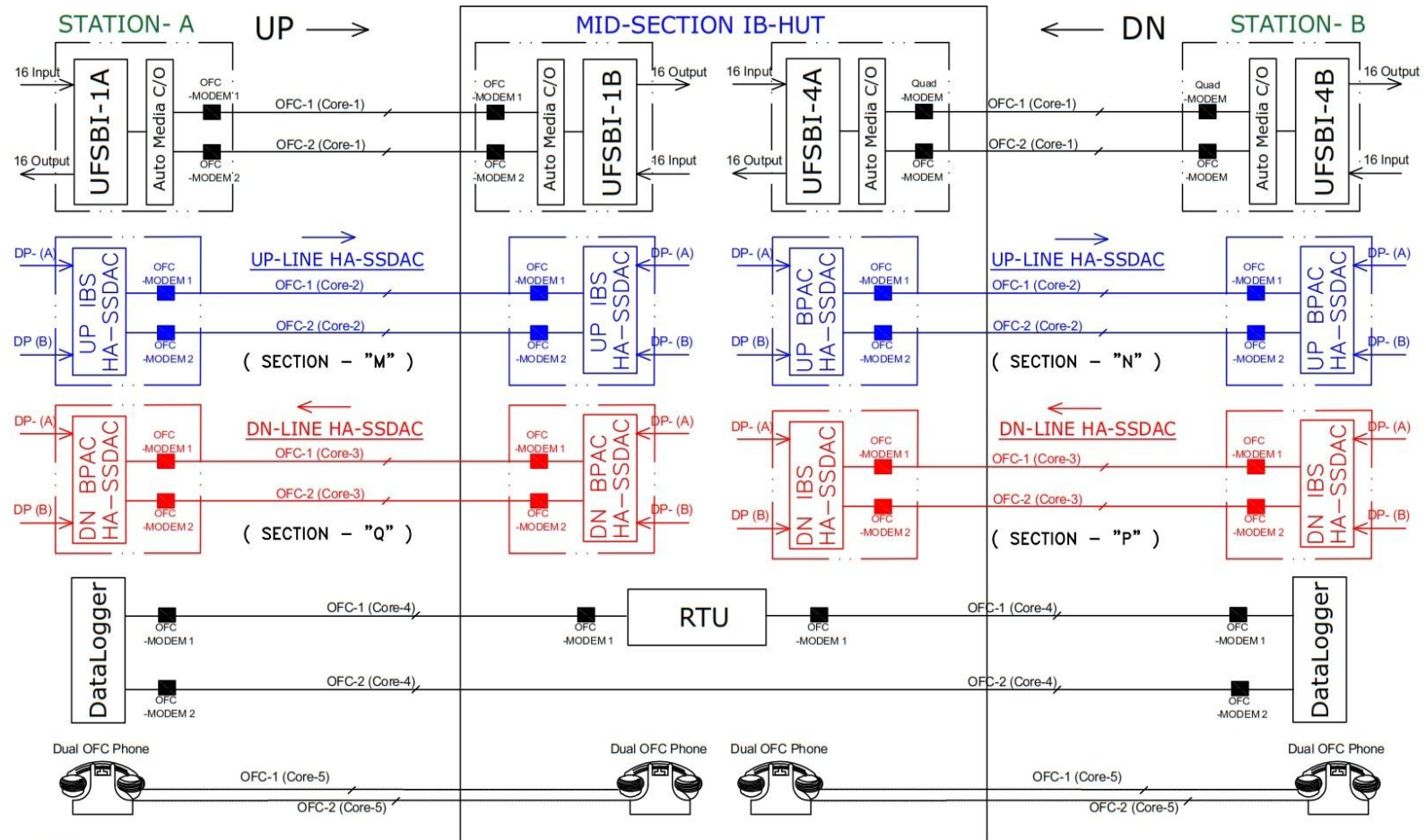


Distribution of Input / Output of IBS through UFSBI



RDSO		
INTERMEDIATE BLOCK SIGNALLING USING 2DP-1S SSDAC		
SE/SIG	ADD/SIG	DIRECTOR/SIG
RDSO DWG. No. IBS/SSDAC/2DP-1S		

Arrangement for Vital Relay State Exchange on Dual OFC in IBS using UFSBI (using HA-SSDAC over Dual dark OFC based on DP placements & vital-relay states exchange as on RDSO DWG. NO. IBS/SSDAC/2DP-1S)



NOTE:

- All Eqp., Modems etc. are of Industrial Grade (suitable for operation in -10°C to +70°C & upto 95% RH non-condensing, environment). Operating Voltage of 24V DC nominal (19-30V)
- Only Single Mode OFC available with Railway is used. The scheme is workable with Hut to Station Distance of 20 Km max.

			DELTRON EQUIPMENT & SYSTEMS PVT. LTD.	
DRG BY	CHK BY	APPROVED	INTERMEDIATE BLOCK SIGNAL	
IBS WITH UFSBI ON OFC			DWG.NO.	SH.NO.1 of 1
			DATE:25-FEB-2016	

Approval of UFSBI for 16 I/O Mux in IBS...



Fax: +91-522-2452332, Tel: +91-522-2465748
Email: dsig6@rdso.railnet.gov.in
dsig6rdso@gmail.com

No: STS/E/UFSBI/Deltron Vol. XI



भारत सरकार-रेल मंत्रालय
Government of India - Ministry of Railways
अनुसंधान अधिकल्प और मानक संगठन
Research Designs & Standards Organisation
लखनऊ-226011
LUCKNOW - 226011

Date: 12.01.2016

M/s Deltron Equipment Systems Pvt. Limited,
26 Convent Road,
Kolkata-700 014

Sub: Universal Fail Safe Block Interface (UFSBI) of M/s Deltron Equipment & Systems Pvt. Limited, 26 Convent Road, Kolkata to RDSO Specification IRS:S-104/2012 Ver. '0'.

Ref: (i) This office letter no. STS/E/Foffis/UFSBI Deltron Dt. 30.11.2012 (copy enclosed).

(ii) Firms letter no. DES/RDSO/F-11(i)/012/2014-15 dt. 08.01.2015.

(iii) Firms letter no. DES/RDSO/F-11(i)/012/2015-16 dt. 15.12.2015.

Vide ref. (i) M/s Deltron Equipment & Systems Pvt. Limited, 26 Convent Road, Kolkata, was approved for use of Universal Fail Safe Block Interface (UFSBI) with-

- Single Line daido handle type tokenless block instrument.
- Single Line Neal's tokenless block instrument.
- Double Line SGE block instrument.
- Block Proving by Axle Counter (BPAC) and Failsafe Multiplexer for 16 I/O.

In addition to above, M/s Deltron Equipment & Systems Pvt. Limited, Kolkata is hereby approved for use of Universal Fail Safe Block Interface (UFSBI) in Intermediate Block Signalling (IBS) applications also.

The other terms and conditions of letter under ref. (i) shall remain same.

DA: As above.

(H.O. Kushwaha)
Director/Signal-VI
For Director General/Signal

Copy to:

- The General Manager/S&T
The General Manager/S&T/(Const.) &
The General Manager(Store)
Central Rly., Mumbai CST-400001
Western Rly., Churchgate, Mumbai-400020
Eastern Rly., Fairlie Place, Kolkata-700001
South Eastern Rly., Garden Reach, Kolkata-700043
Northern Rly., Baroda House, New Delhi-110001
North Eastern Rly., Gorakhpur-273012

- North East Frontier Rly., Maligaon, Guwahati-781011
- Southern Rly., Park Town, Chennai-600003
- South Central Rly., Secunderabad-500371
- East Central Rly., Hajipur
- East Coast Railway, Rail Vihar BDA Rental Colony, Chandrasekharpur, Bhubneshwar-751023
- North Central Railway, Hasling Road, Allahabad
- North Western Railway, Jaipur-300206
- South Western Railway, Club Road, Keshavapur, Hubli-23
- West Central Railway, OSD Office, Jabalpur
- South East Central Railway, R.E. Office Complex, Bilaspur-495004
- Secretary/Signal, Railway Road, Rail Bhawan, New Delhi
- (Stores), Railway Board, Rail Bhawan, New Delhi
- Secretary/S&T (RE), Railway Board, Rail Bhawan, New Delhi
- The General Manager/S&T, Metro Railway, 23-A, Jawaharlal Nehru Road, Kolkata-071
- The General Manager/S&T, CORE, Nawab Yusuf Ali Road, Civil-Lines, Allahabad
- The General Manager, Konkan Railway Corpn. Ltd., Belapur Bhavan, Sector-II, CBD, Belapur, New Mumbai-400614
- The General Manager/S&T, IRCON, Palika Bhavan, Sector XIII, R.K. Puram, New Delhi-66
- The General Manager/S&T, RITES Ltd., RITES Bhawan, 5th Floor, Plot No. 1, Sector-29, Gurgaon-122 001
- The Director, IRISSET, Tarnaka Road, Lallaguda (P.O.) Secunderabad-500017
- The Principal, Railway Staff College, Vadodara
- The CSTE, Delhi Metro Rail Corporation, 3rd Floor, NBCC Place, Bhishampitamah Marg, New Delhi-110003
- Executive Director(QA/S&T), RDSO, Lucknow
- Executive Director(Telecom), RDSO, Lucknow
- Director/Inspn./S&T, RDSO, Ground Floor, DRM Office Building, Bangalore-23
- Director/Inspn./S&T, RDSO, 1st Floor, IRCOT Building, Shivaji Bridge, New Delhi-01
- Director/Inspn./S&T/RDSO, 1st Floor, New Annexe Building, Western Railway, Churchgate, Mumbai-400 020
- Director/Inspn./S&T/RDSO, 4th Floor, 17 N.S. Road, West Wing, Fairlie Place, Kolkata-700 001

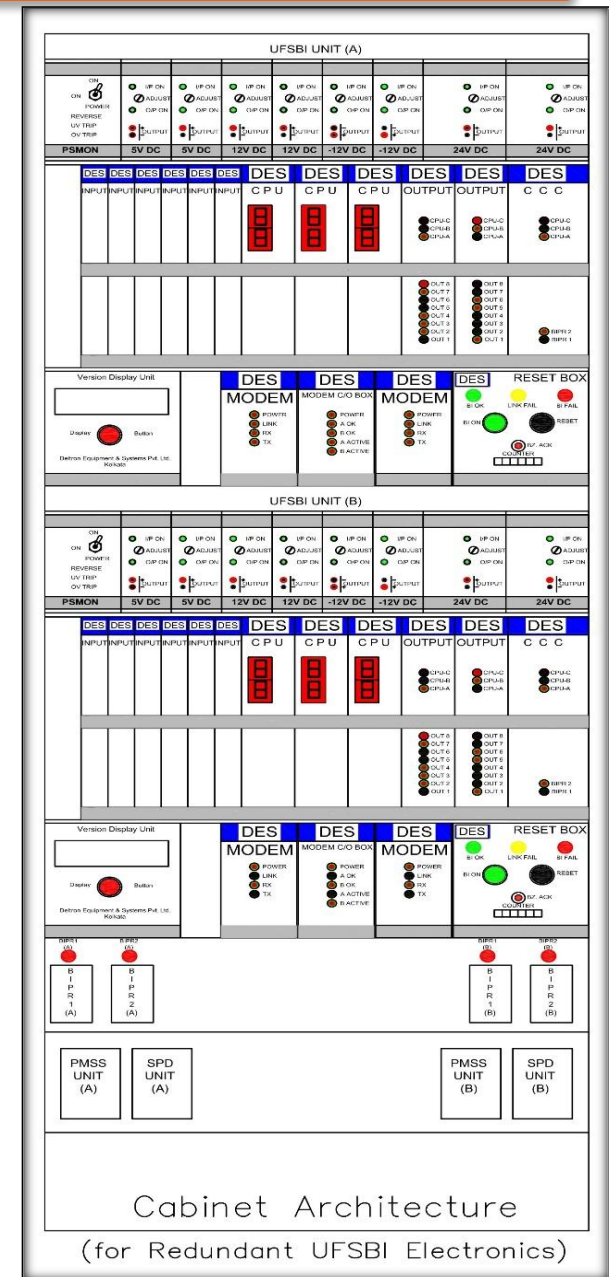
(H.O. Kushwaha)
Director/Signal-VI
For Director General/Signal

Advantages of using UFSBI in exchanging relay states in IBS

1. This RDSO scheme facilitates commissioning of new IBS installations with ease, with minimum outdoor activities, just be using spare Block Quad cable.
2. A **dedicated OFC** if laid for signalling in lieu of copper cables for IBS operations using UFSBI, is preferred due to **immunity to electrical interferences, EMI/EMC, Lighting Surges, Aging, Ingress of Moisture and substantially low cost** (causing it to be less theft prone).
3. This harnesses the true benefits of redundant media operation of HA-SSDAC / Dual SSDAC or Dual MSDAC, through use of UFSBI for relay state transmission with Automatic Media Changeover
(Although some alternative items showcase features of relay exchange but are not approved to the requirement of RDSO under IRS:S-104/2012 Ver.0)
4. The Auto Change-over allows seamless transition between Quad Cable system & OFC based system, continues IBS working even if physical Quad cable / OFC damaged

Advantages of using Redundancy in UFSBI Electronics

1. This Redundancy is provided by use of 2 independent UFSBI systems such that If any, one UFSBI units fails, it does not affect train running.
2. If any system fails / hangs due to external / internal fleeting faults it automatically restarts and recovers failed UFSBI Electronics while the other continues to function normally
3. The UFSBI Electronic units are coupled through the synchronized Input states that are fed into the systems from station / IBS / ABS interlocking circuits from independent contacts of same relay
4. The outputs are driven by both systems in parallel so that failure a single UFSBI Electronics does not causing any functional failure
5. UFSBI system and Input / Output relay status can be monitored with datalogger



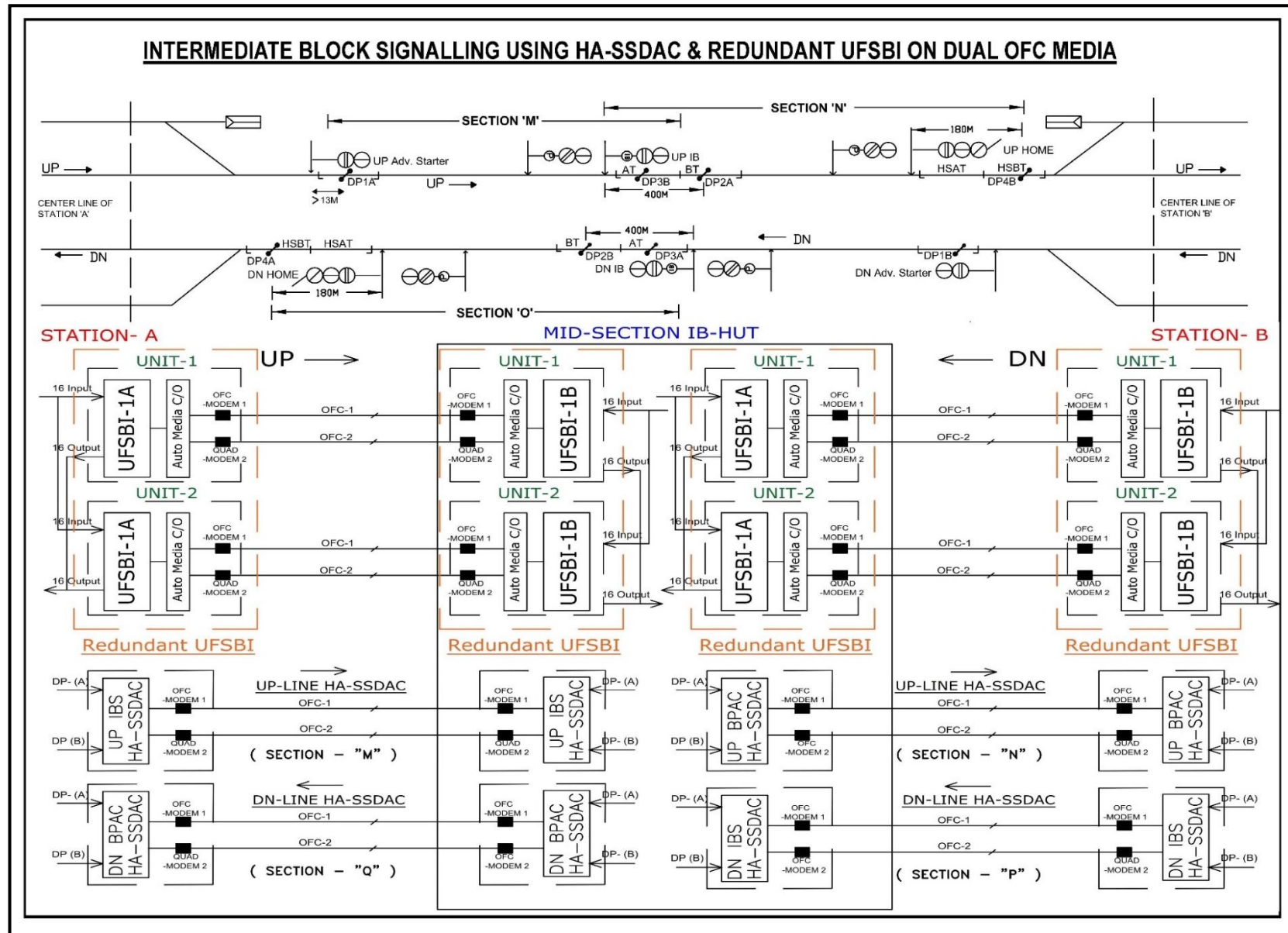
	FAILURE OF A SINGLE CARD / SUB MODULE					
System Config (2oo3)	Input Card	Output Card	CPU Card	CC Card	DC-DC Power Supply	Modem Unit
No. of Module (Per Pair)	12	4	6	2	2	2
Module Status	Fail	Fail	Fail	Fail	Fail	Fail
FUNCTIONAL EFFECT	System OK	System Fail	System OK	System Fail	System OK	System Fail

Chances of Stand-alone UFSBI System being Non-Functional due to a single card / sub-module failure is 50%

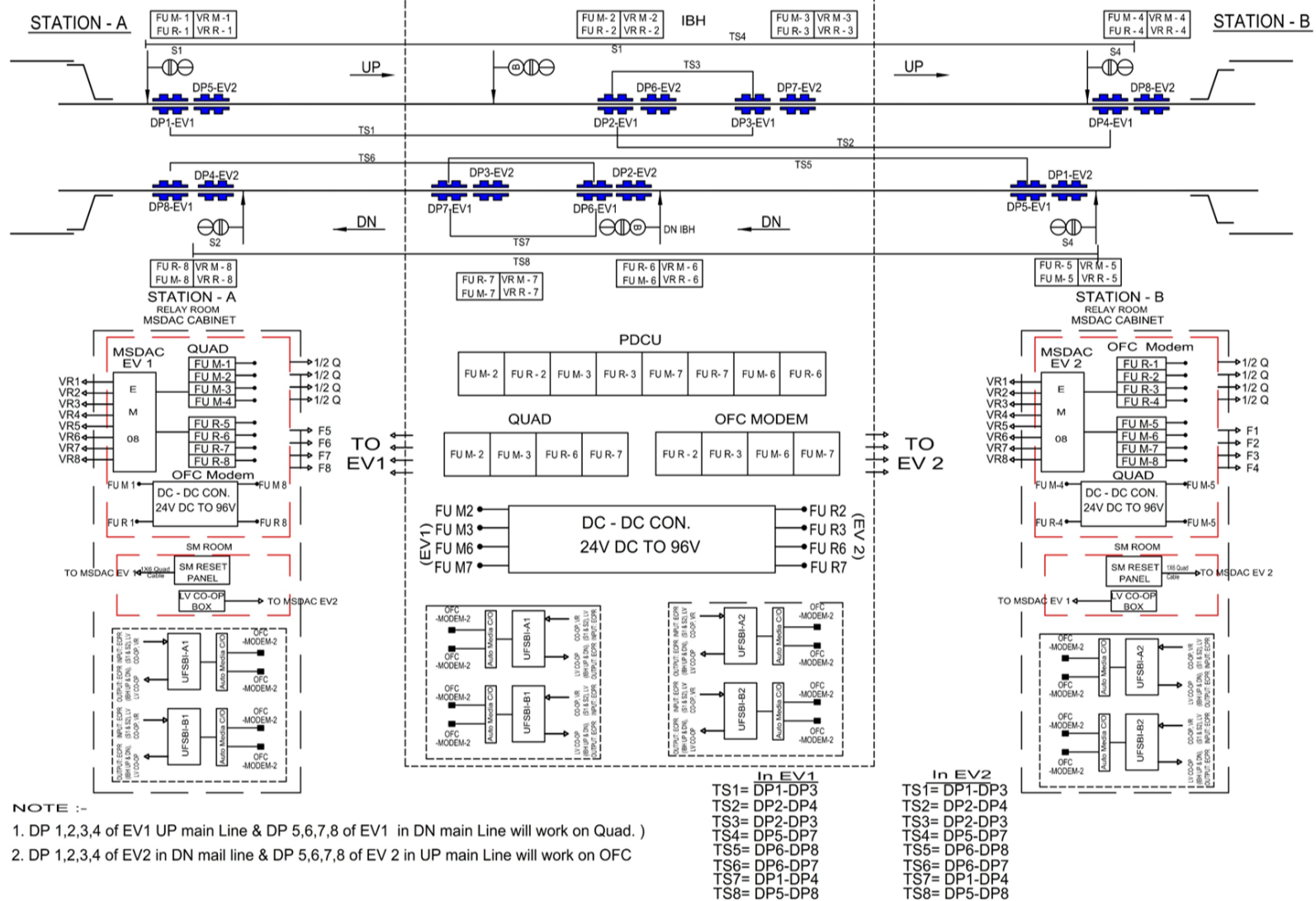
	FAILURE OF A SINGLE CARD / SUB MODULE					
System Config (2oo3 x 2)	Input Card	Output Card	CPU Card	CC Card	DC-DC Power Supply	Modem Unit
No. of Module (Per Pair)	12 + 12	4 + 4	6 + 6	2 + 2	2 + 2	2 + 2
Module Status	Fail	Fail	Fail	Fail	Fail	Fail
FUNCTIONAL EFFECT	System OK	System OK	System OK	System OK	System OK	System Fail

Chances of High Availability UFSBI System being Non-Functional due to a single card / sub-module failure is NIL. Since the 2 systems are independent and galvanically isolated the chances of common mode failures are minimum.



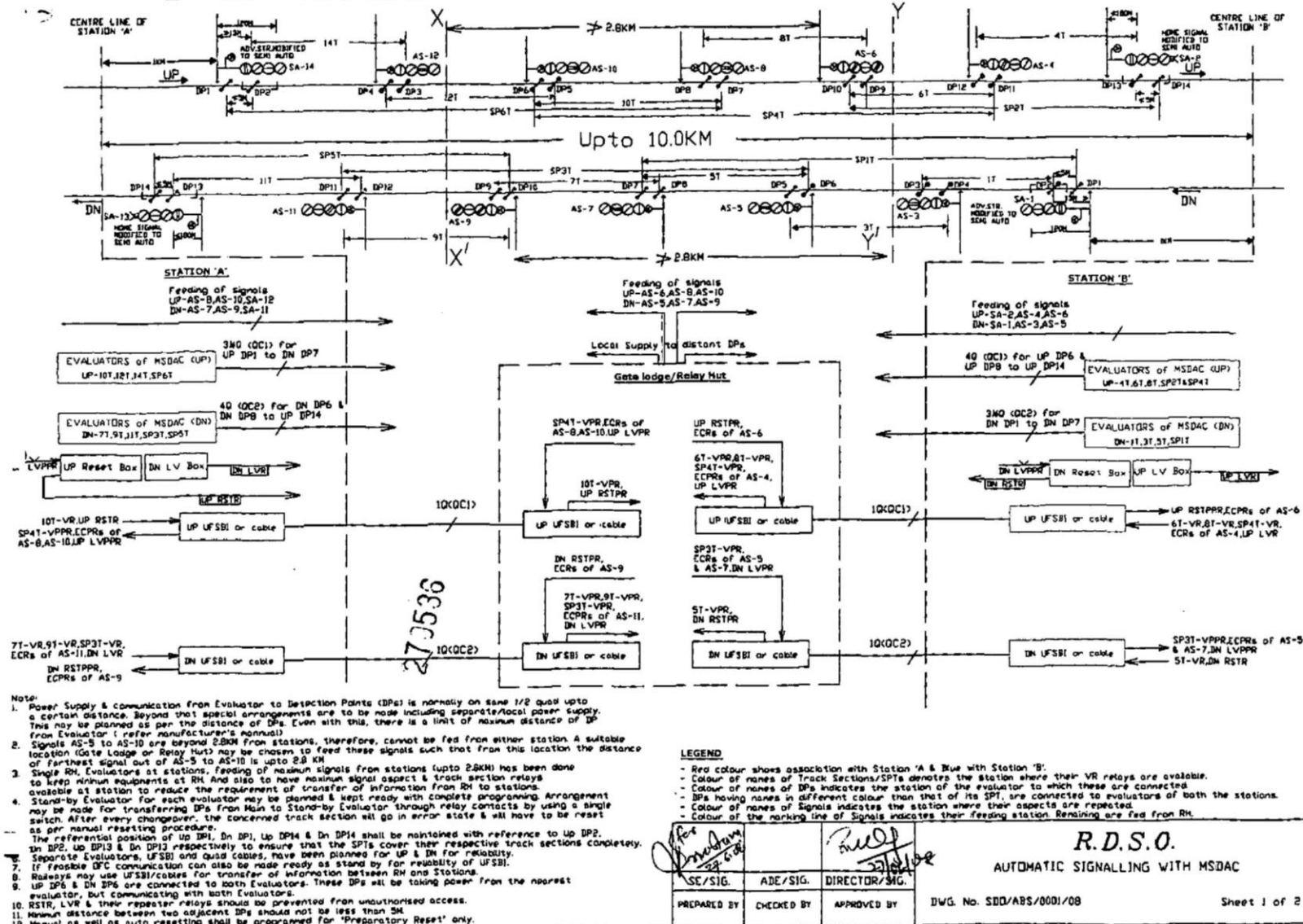


INTERMEDIATE BLOCK SIGNALLING USING DUAL MSDAC & HA-UFSBI ON QUAD / OFC REDUNDANT MEDIA

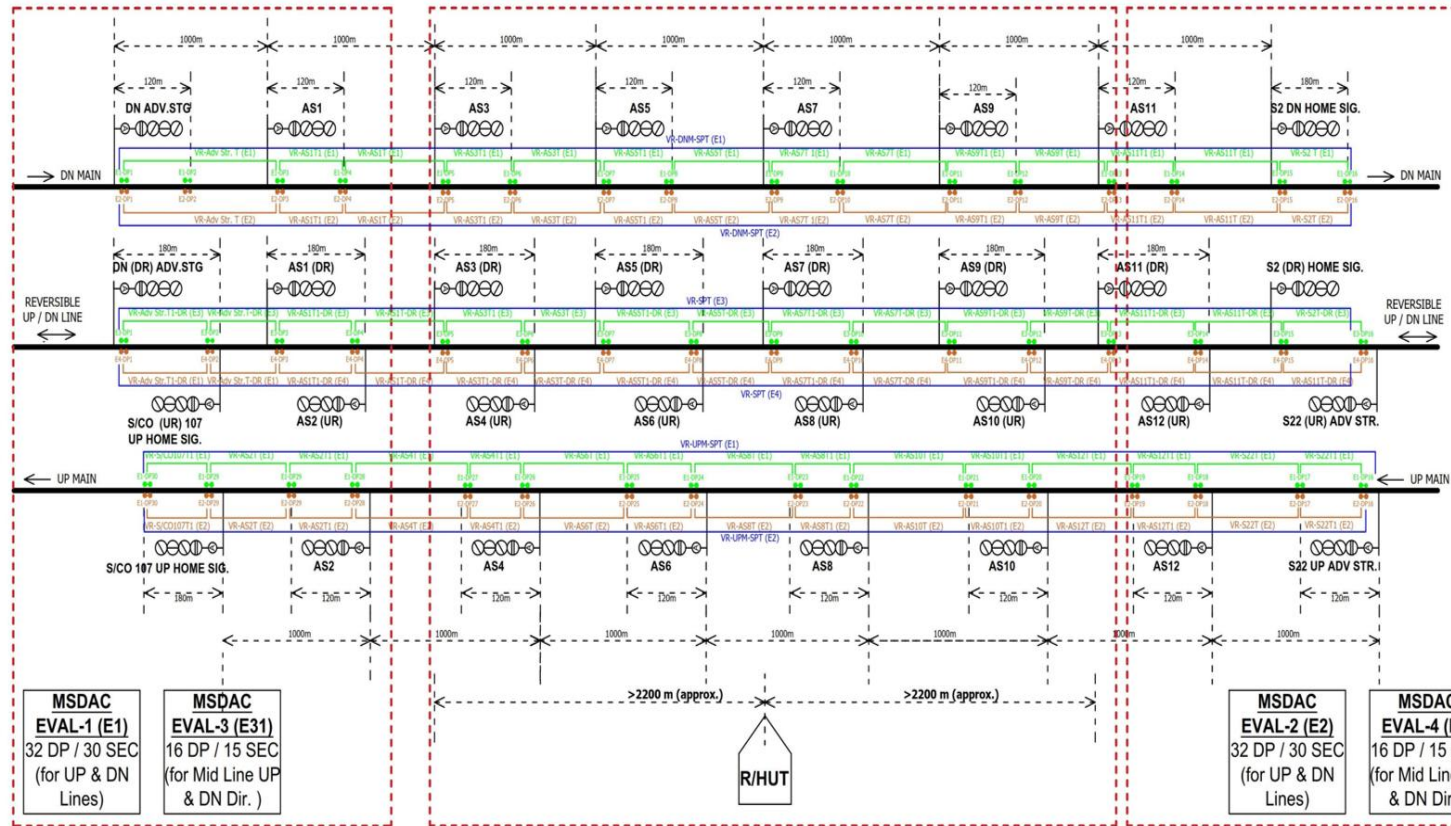


Implementing ABS schemes on Dual OFC (dark fiber) using UFSBI as per RDSO Schemes

SCHEME OF AUTOMATIC SIGNALLING WITH MSDAC (SECTION UPTO 10.0KMS)



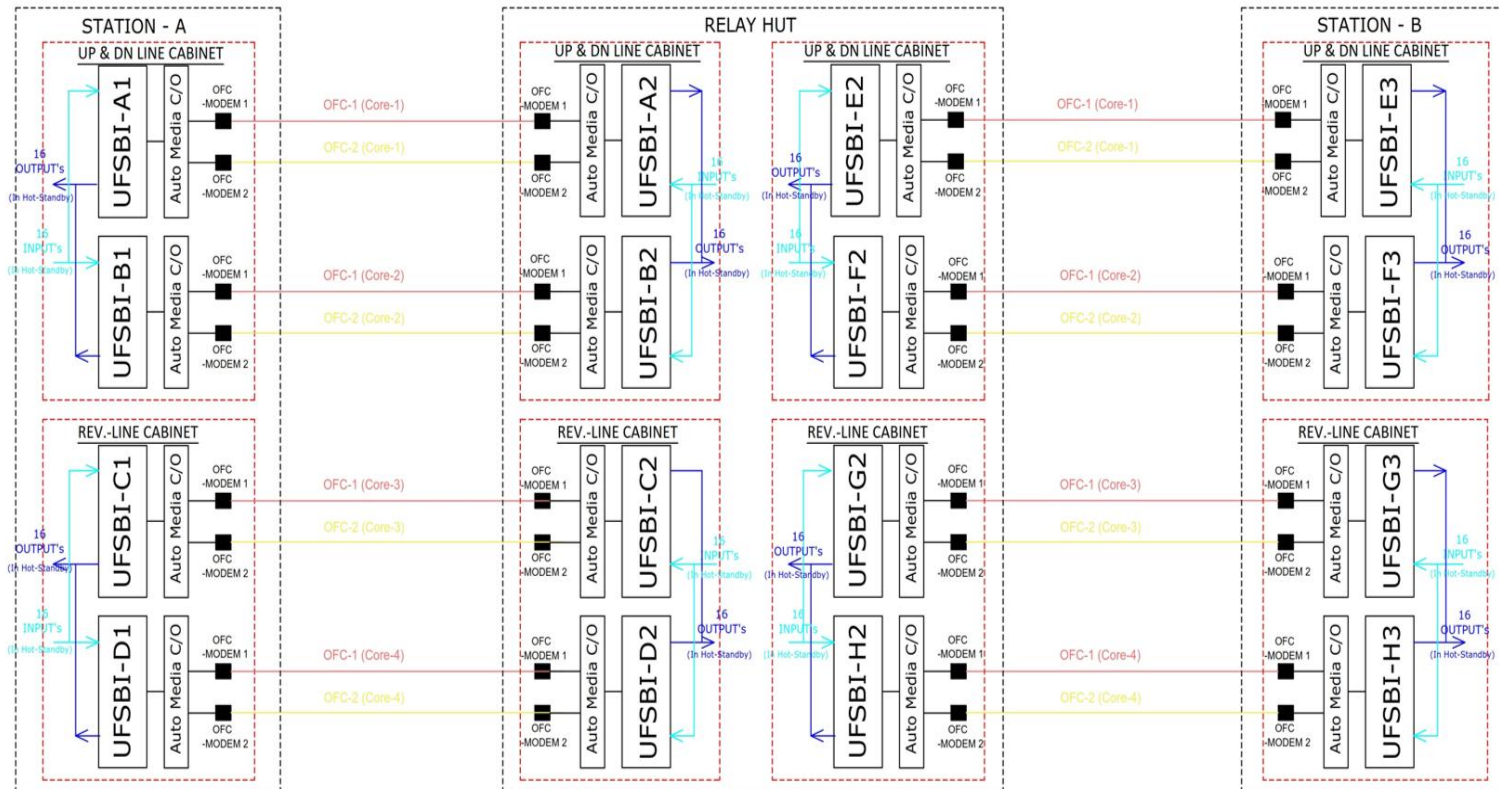
AUTOMATIC BLOCK SIGNALLING USING DUAL UFSBI & MSDAC ON QUAD / OFC REDUNDANT MEDIA



DELTRON EQUIPMENT & SYSTEMS PVT. LTD.

TITLE:	DETECTION POINT DISPOSITION PLAN OF STN. A - STN. B AUTOMATIC BLOCK SECTION	NAME	DATE
CUSTOMER:	WEST CENTRAL RAILWAY	PPD. BY	S. DAS
		CHKD. BY	06.03.2020
		DOC NO.	ABS / 01 / MSDAC-UFSBI / OFC
		SHT. NO.	1 OF 5
		REV NO.	0

AUTOMATIC BLOCK SIGNALLING USING DUAL UFSBI & MSDAC ON QUAD / OFC REDUNDANT MEDIA



NOTE:

1. Vital I/O's between End Stations and Relay Hut is exchanged through dual redundant UFSBI electronics, so that failure of a single UFSBI does not lead to a signalling failure.
2. Each UFSBI electronics is made to operate through 1-Core SM dark OFC from each of the 2 fiber cables through Automatic Media Change over system, so that failure of a single cable does not lead to a signalling failure. Even simultaneous failure of 1 OFC and 1 UFSBI media does not lead to a signalling failure.
3. Each UFSBI electronics is powered from independent 24V DC / 110V AC IPS modules, so that failure/overvoltage/undervoltage or short circuiting of one of the IPS modules affect at most only one UFSBI system thus having no impact on the signaling operation.
4. 4 safe earthings paralleled ensuring earth resistance $\leq 1 \text{ Ohm}$ may be provided per location.

Conclusion:

The proposed arrangement for exchange of vital states through Fail-Safe (SIL-4) Mux UFSBI, as per IRS:S-104/2012 Ver. 0 operating on dual redundant dark OFC leads to 100% Redundancy of UFSBI Electronics, Media and Power Supply modules. Direct interfacing of signalling relays practiced reducing number of intervening relays, its cost, space, contact failures and energy requirement

DELTRON EQUIPMENT & SYSTEMS PVT. LTD.

TITLE:	NAME	DATE
UFSBI INPUT / OUTPUT EXCHANGE PLAN	PPD. BY	S. DAS
PLAN OF STN. A - STN. B	CHKD. BY	06.03.2020
AUTOMATIC BLOCK SECTION	DOC NO.	ABS / 01 / MSDAC-UFSBI / OFC
CUSTOMER:	SHT. NO.	2 OF 5
WEST CENTRAL RAILWAY	REV. NO.:	0

THANK YOU.....

& Questions Please....