AUTOMATIC BLOCK SIGNALLING USING UFSBI

DELTRON EQUIPMENT AND SYSTEMS PVT.LTD.

Installation & commissioning handbook for ABS

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Abstract:
This document described the functionality, installation & maintenance procedures of the equipment for block proving with axle counter using DUAL UFSBI ON ABS, manufactured as per IRS:S-104/2012

FOREWORD

Optical fiber usage is now becoming a homely phrase being used for any communication related projects which has both time and reliability targets.

The document envisages the implementation of Automatic Block Signalling using Universal Fail Safe Block Interface (UFSBI) over dark fiber communication. Ever since the days of UFSBIs being used on voice channels over optical fibers for operating conventional block instruments, it has come a long way and is being now used as a cable substitute option in the Railway Signalling environment.

Going through the pages of implementation of various block applications whereby the usage of copper conductors as a principal data handshaking media, a lot of unexplained communication problems are encountered. On top of it EMI/EMC, lightning, provision of SPDs, earthing and equipment damage issues had been encountered. With the advent and usage of optical fibers, especially end to end dark fiber connectivity a solution to these pertinent problems is in sight. Block solutions involving intermediate and automatic block signalling which earlier involved a lot of time and huge amount of cable laying are now completed in very short time with 100% media and electronic equipment diversity.

In the document we provide an insight to the scheme of automatic block signalling using UFSBI wherein the relay status exchange through the use of copper conductors is substituted with UFSBI.

Automatic signalling is now being implemented in a very big manner in Indian Railways. Usage of this scheme, will not only reduce the dependency on copper conductors, multi section digital axle counters and electronic interlocking but will provide the necessary flexibility in implementation of automatic signalling within stipulated time frames.

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1 System Description

The system requirement specification of the "Universal Fail-safe Block Interface (UFSBI)" equipment has been described in RDSO specification IRS: S – 104 / 2012 Ver. 0 or latest. The functionalities are elaboration of the general requirements contained RDSO specification IRS: S – 104 / 2012 Ver. 0 or latest.
The environment conditions under which the system will operate are described in IRS: S – 104 / 2012 Ver. 0 or latest.

- **General:**

The UFSBI system acting as multiplexer for communicating the status of relay(s) from ABS hut to other station or ABS hut in a fail safe manner. This is used for simply repeating the status of one relay to the other end for this application. The communication mode is full duplex. The medium of communication is dark fiber.
The mux with its accessories like power supply and digital part are housed in a cubicle 36U rack (1746mm x 600mm x 600mm). The interface relays of this system are placed outside of the cabinet with a maximum distance of 20 meters.

- **Technical:**

a) The equipment is capable of driving safety-signalling relays conforming to specification BRS: 930 (Q – Series relays).
b) The coding of signal transmission takes care of types of noise generally encountered in the transmission system and ensures safety of operation against these noise.
c) Each equipment in the section has a unique address, which is settable through back-plane jumpers. Please refer "UFSBI Address Configuration Jumpers" given later in this manual.
d) The information exchanged between the pair of the interface equipment contains the source & destination address.
e) Wrongly addressed information packets are promptly rejected by the system and frequent receipt of such packets is detected as link failure by the system.
f) The telephone will work on a separate voice channel.
The system works on 24V DC + 20% - 10%.
g) A push button is provided for resetting UFSBI inside the cubicle on a reset box. The resetting system is provided with a Veeder counter to count the number of reset action.

2 UFSBI CABINET:

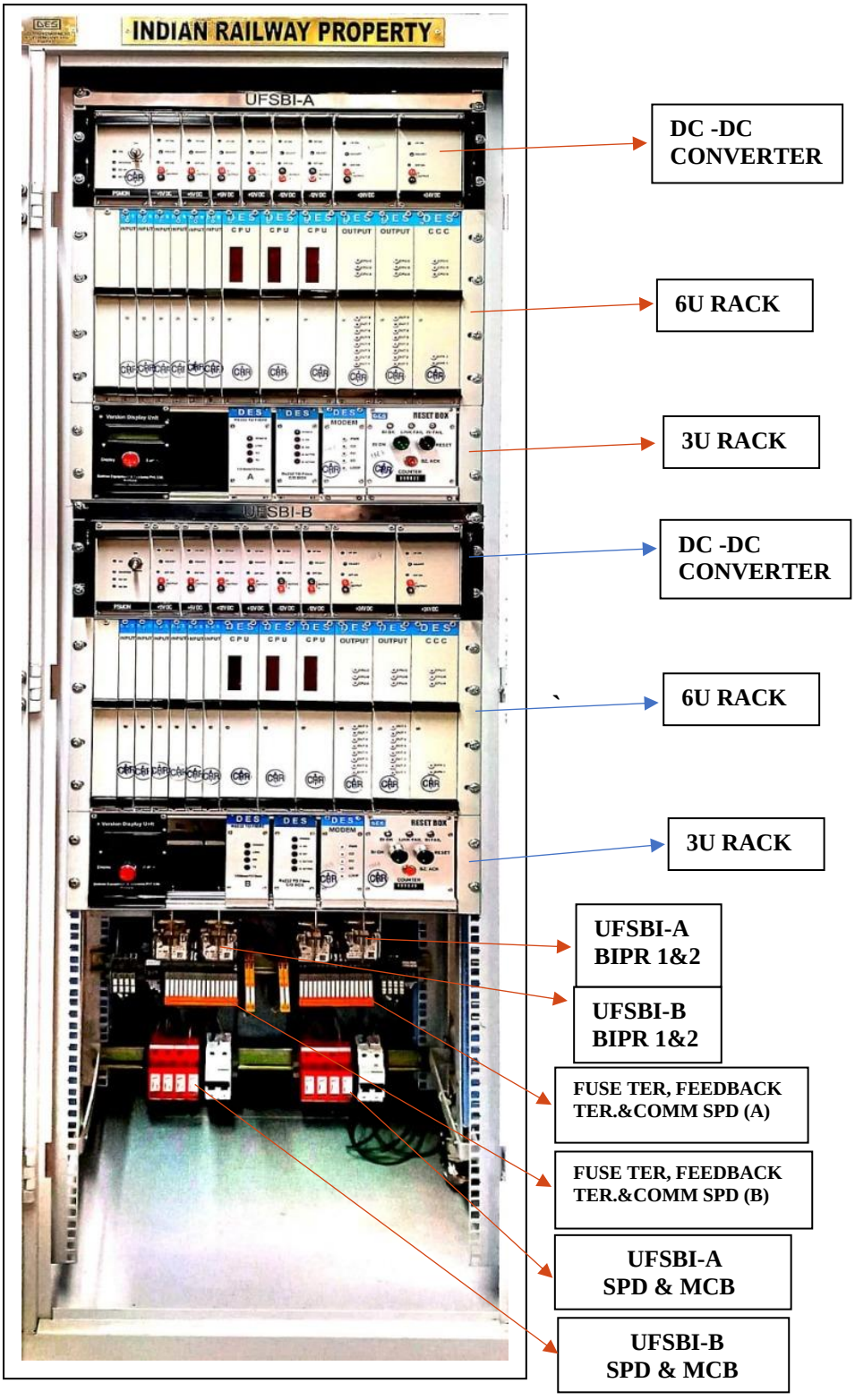


Figure 1: UFSBI CABINET FRONT VIEW

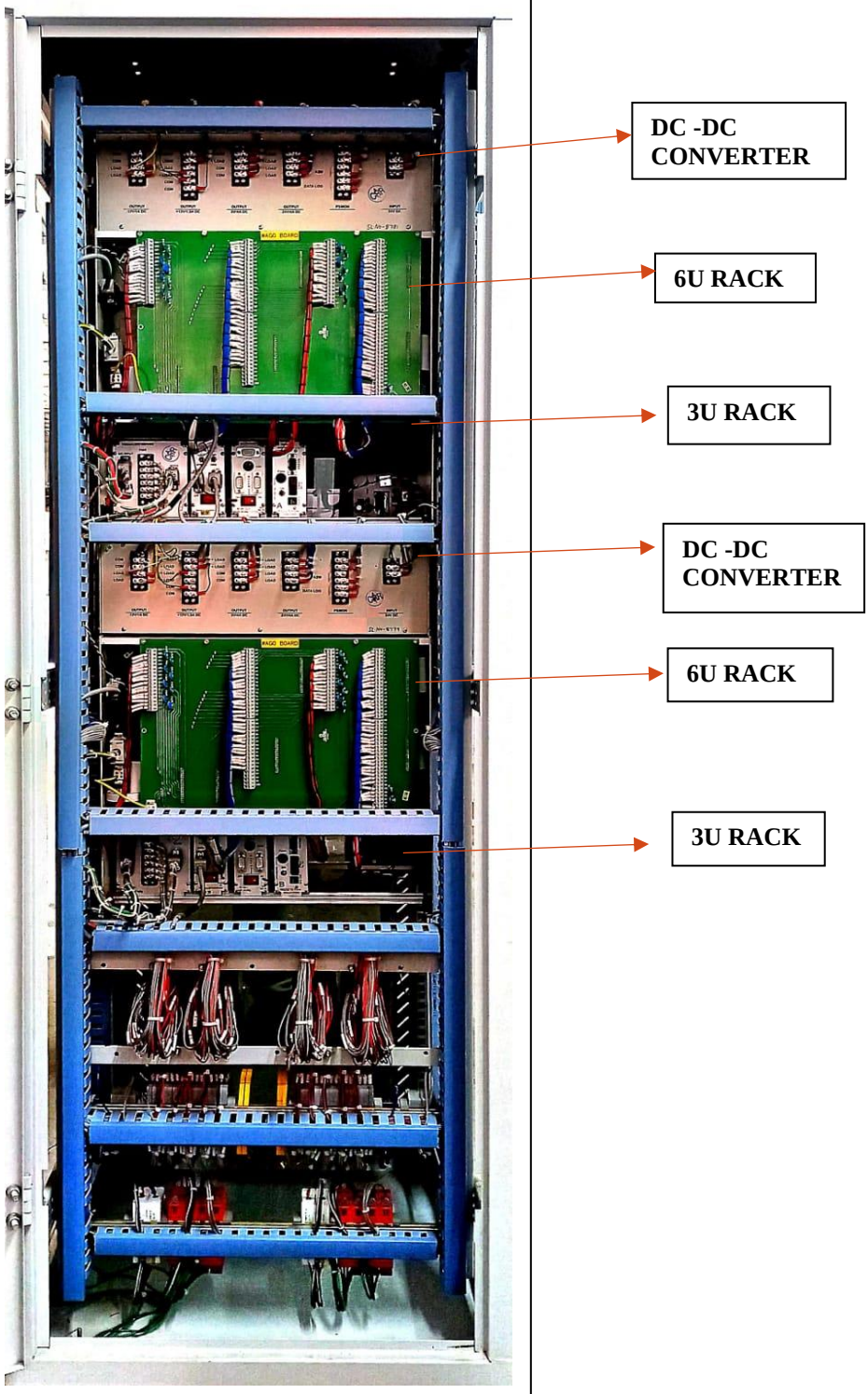


Figure 2: UFSBI CABINET BACK VIEW

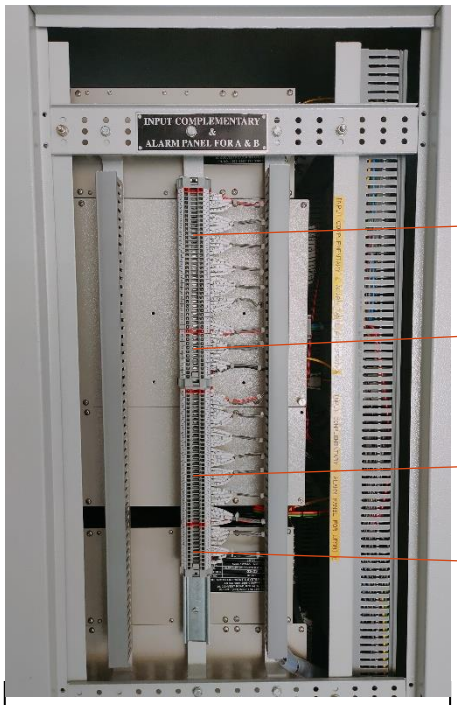
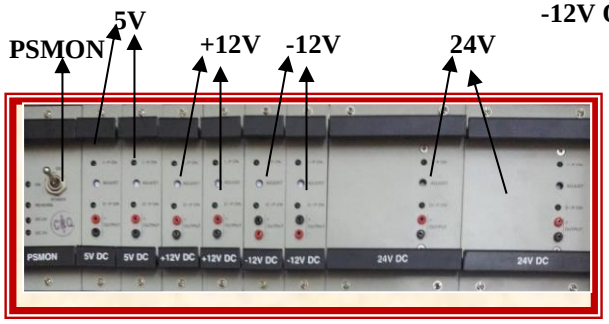


Figure 3: UFSBI CABINET LEFT VIEW

Figure 4: UFSBI CABINET RIGHT VIEW

Parts of UFSBI:

2.1 DC-DC Converter



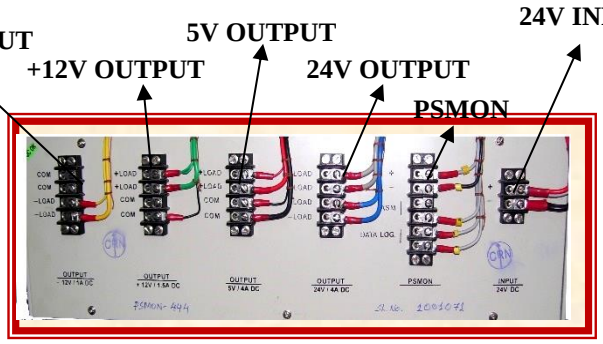


Figure 5: DC – DC Converter Front View **Figure 6: DC – DC Converter back View**

DC-DC Converter is provided to drive the necessary voltage and current to operate the UFSBI.

The system operates with nominal 24V DC input supply given to DC-DC converter either from IPS or Battery charger. DC-DC Converter drives different supplies from the inputs. The specifications for the power supply are shown in the table below:

TYPE	Description	REMARKS
INPUT	24V DC +20% - 20%, 5 Amps	Preferred 10 Amp module.
OUTPUT	1. 24V DC 4 Amps.	A. For sensing Input, Output Feedback, BIPR1 & BIPR2 Relay Contacts through Input Card. B. For Driving Output Relays.
	2. 5V DC 4 Amps.	For Power and working of Electronic IC's viz. microcontroller, RAM, ROM, UART etc.
	3. +12V DC 1.5 Amps.	For MODEM Power and Communication As per RS232C.
	4. –12V DC 1.5 Amps.	For Communication As per RS232C.

Table 1: Input and Output of DC-DC Converter

2.1.1 The features of the DC-DC converter are:

- Input-output Isolation.
- Input over voltage and under voltage protection. ***If Input Supply goes below 19.2V the Output of DC-DC Converter shuts down showing UV (Under Voltage) Trip. If Input Supply goes above 30.2V the Output of DC-DC Converter shuts down showing OV (Over Voltage) Trip. There is a 1V hysteresis for resumption of Output from UV or OV trip.***
- Output short circuit and over load protection.
- 24V DC output is isolated from other outputs.
- Ripple is less than 50mv at rated value.
- Efficiency is more than 70%.
- Works on "HOT STAND-BY" mode.
- PSMON (Power Supply Monitoring Unit) is provided to initiate audio visual alarm in SM's room on UFSBI ALARM PANEL discussed in a later chapter.

Indication & Switches	The following Indication and switches are provided on DC-DC Converter.
Input ON	Input 24V from Battery charger or IPS is coming to INPUT of DC-DC converter through MCB and SPD.
Input 24V DC Reverse	The 24V input connection from Battery charger or IPS is connected to DC–DC converter with reverse polarity.
UV Trip	The Input Voltage to DC-DC converter is below 19.2 volts. The system will not start.
OV Trip	The Input Voltage to DC-DC converter is above 30.2 volts. The system will not start.
OP ON	These two indications are provided to check that all the modules of each O/P voltage level is working or not.
SWITCH	For ON / OFF operation of DC-DC Converter which in turn Put On or Shut down the UFSBI DS.
ADJUST	To adjust the Output voltage of each Module. ***Factory Adjusted. Need not any adjustment at site.***

Table 2: Input and Output of DC-DC Converter

2.2 UFSBI-DS consisting of the following parts

a) Input card
b) CPU card
c) Control cum Communication Card (CCC)
d) Output Card
e) Reset Box.
f) MODEM.
g) UFSBI Alarm Panel

The functionalities of each card is Given below

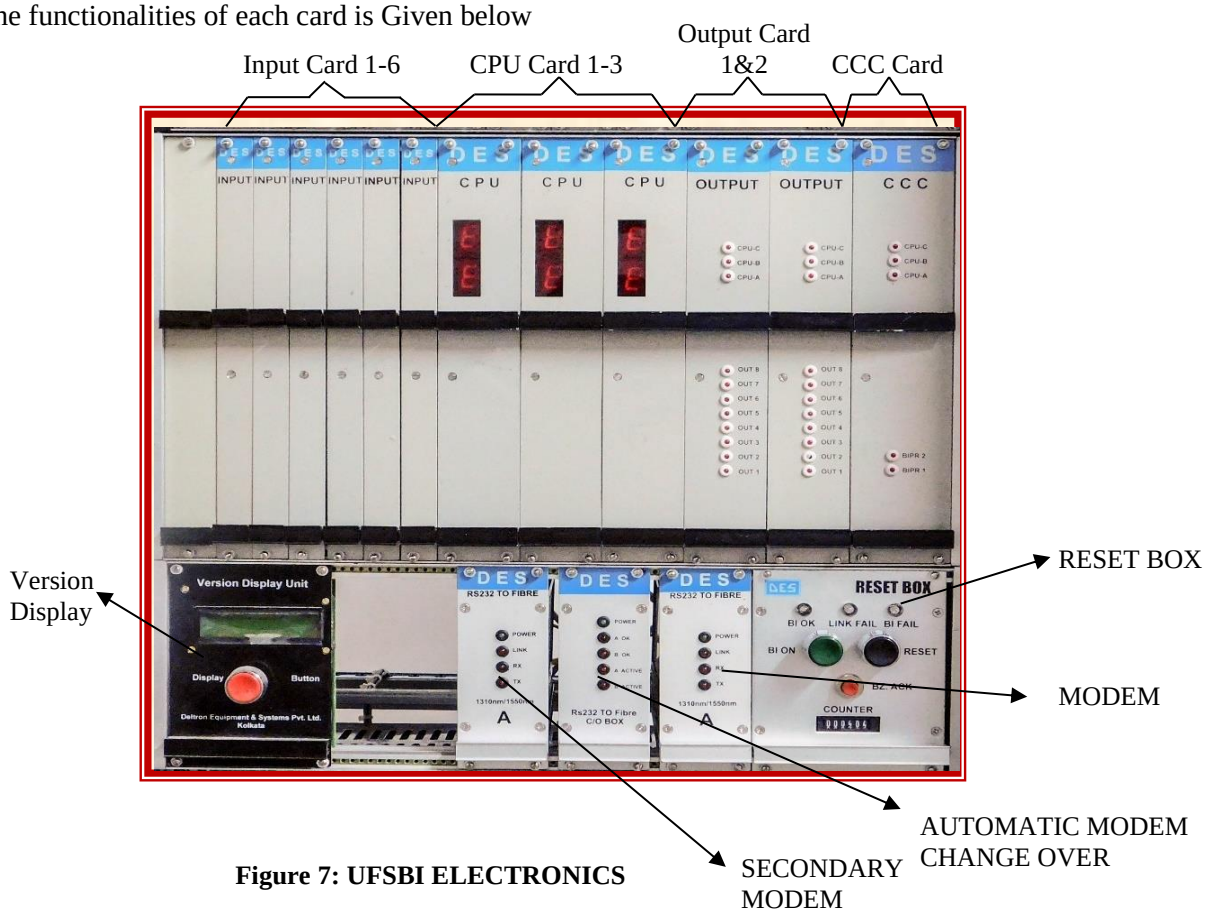
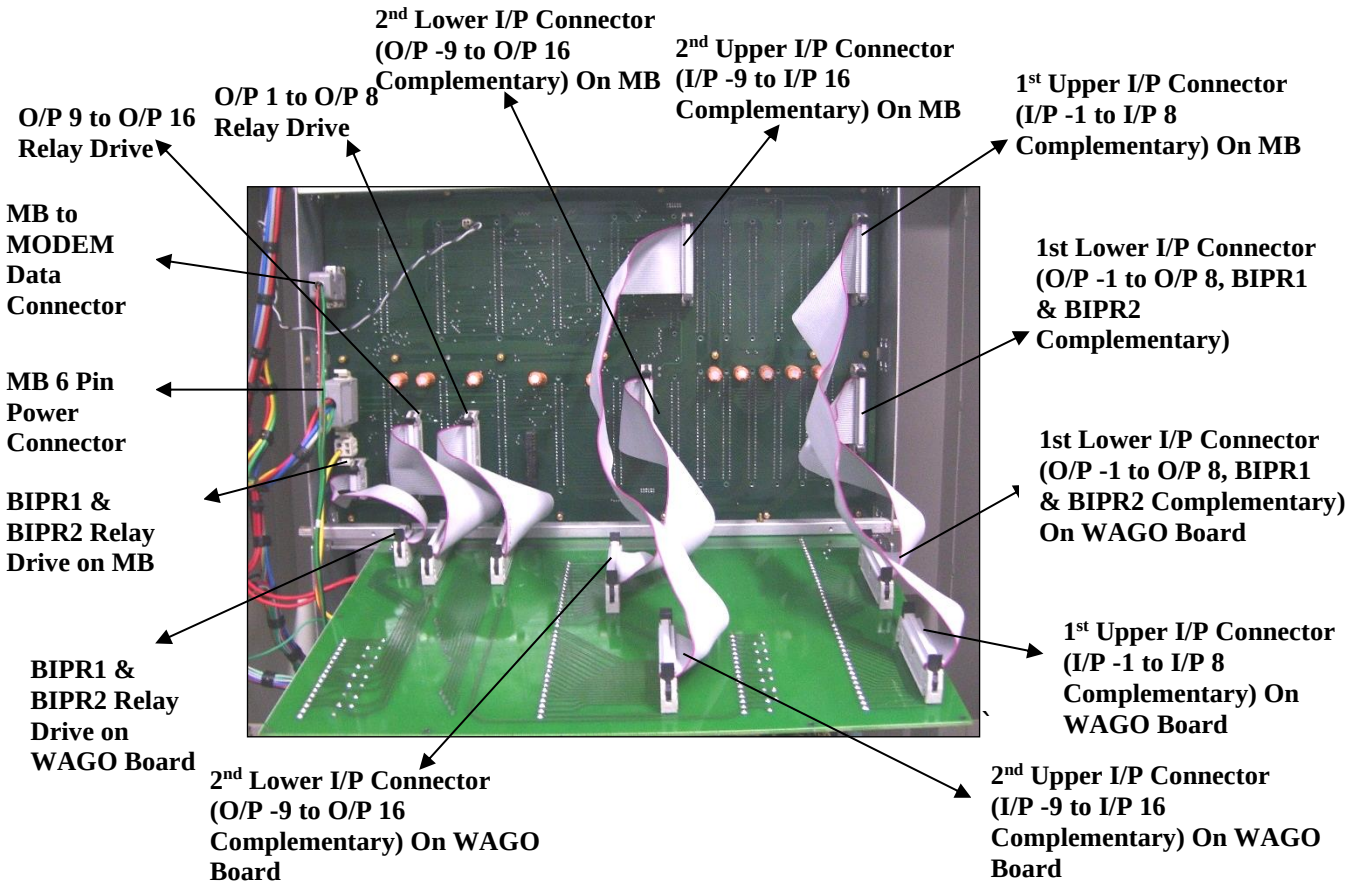


Figure 7: UFSBI ELECTRONICS

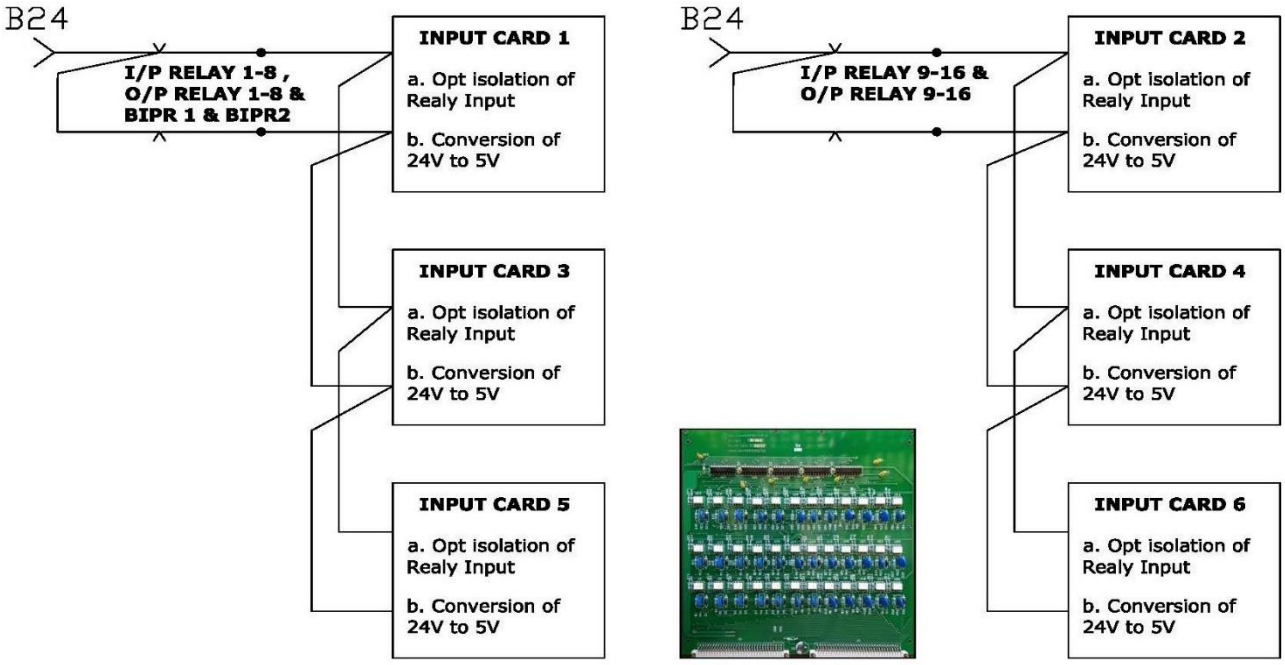


WAGO BOARD TO MOTHERBOARD INTERCONNECTIVITY

2.2.1 Input Card:-

It is responsible for complementary sensing of the relay status of UFSBI. i.e. for sensing one pick up and one drop contact of each input relay, feedback contact of each output relay and health checking relays (BIPR1 & BIPR2).

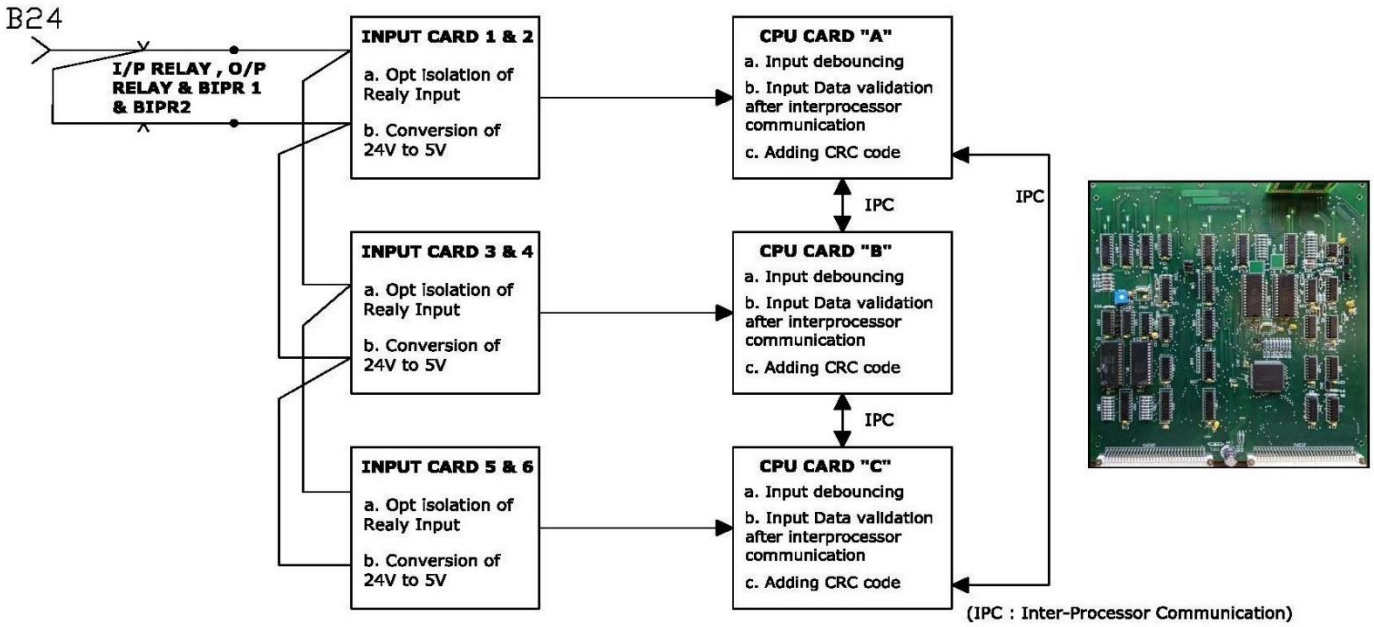
The sensing of relays is described in the figures below:



2.2.2 CPU Card:-

The UFSBI system works on a 2 out of 3 majority voting logic i.e. if one CPU card or its corresponding Input cards goes bad then also system can work. CPU – "A" reads the Inputs through Input Card 1&2, CPU – "B" reads the Inputs through Input Card 3&4 and CPU – "C" reads the Inputs through Input Card 5&6. Thereafter validates the data by Inter-processor communication, adds CRC code and send this to CC card for transmission. On the other end after receiving the data from CC card it decodes it and sends that to Output card to pick up the Output relay.

The Input reading process of CPU card working principle is shown in the figure below:



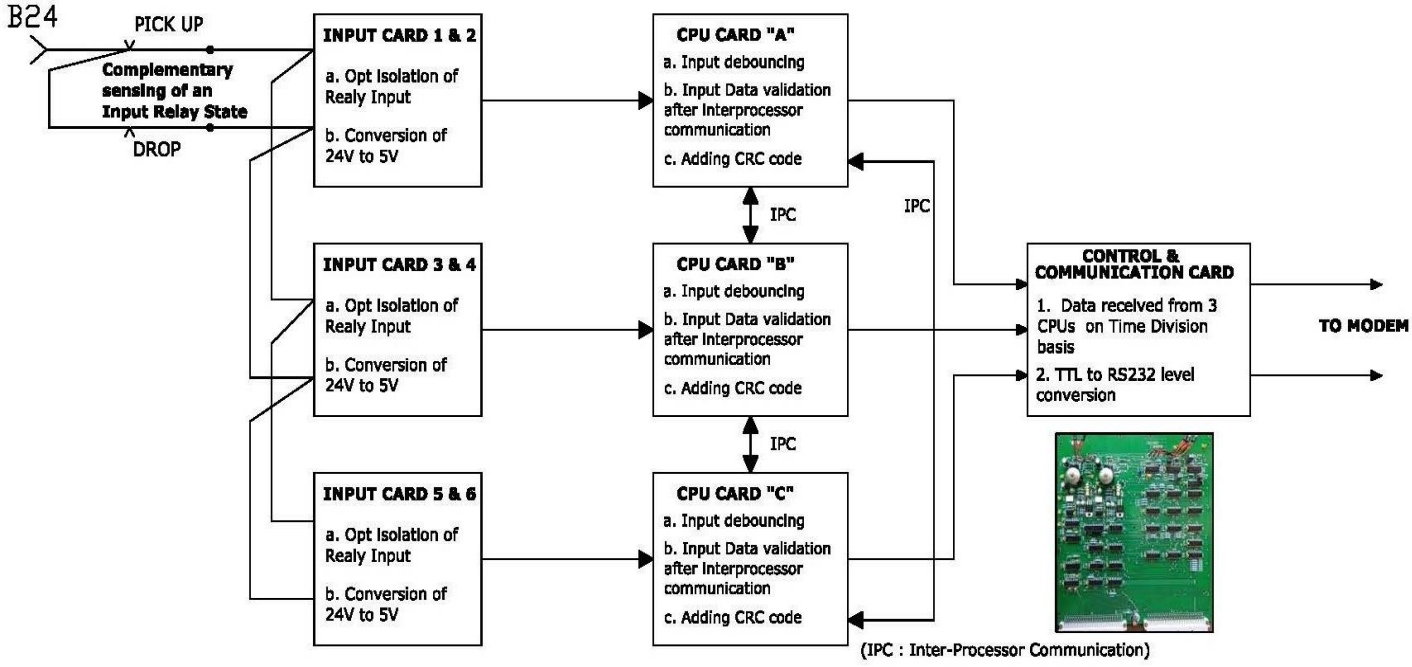
2.2.3 Control cum communication (CCC) Card:-

The CCC Card mainly performs two important functions

a) It drives health check relays (BIPR1 & BIPR 2) and

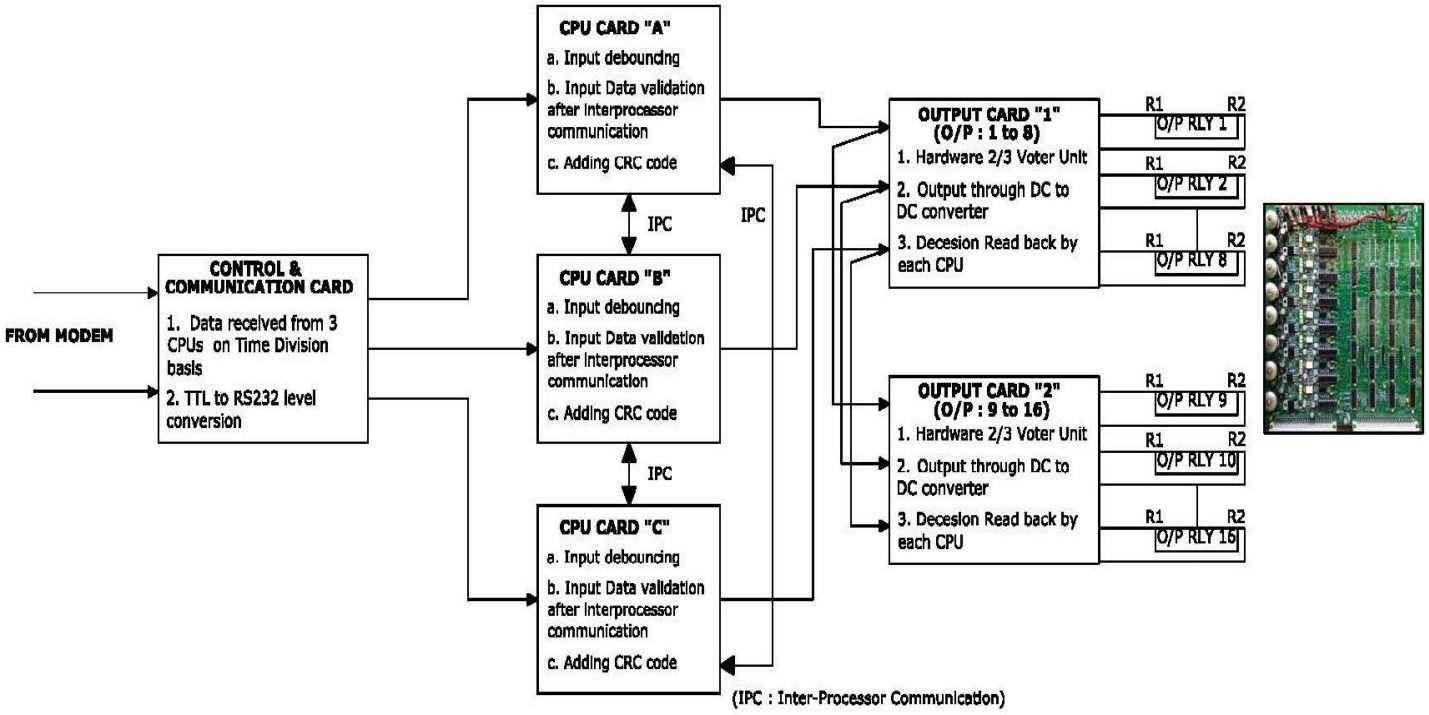
b) It converts the data provided by the CPU card as per RS 232 protocol and sends it to the Modem.

The process of functioning of CCC Card is shown in the figure below:



2.3 Output Card:-

2 numbers of such cards are provided for driving Output relay. 1st Output card drives Output relays 1 - 8 and rest 9 - 16 number output relays are driven by Output card number 2.



2.4 Reset Box:-

Figure 9: **RESET BOX FRONT VIEW**

Figure 8: **RESET BACK VIEW**

The functions of all the components are given below:

Item	Function
Counter	It keeps track of the number of Reset operations taking place. The counter is non-resettable electro-magnetic type.
RESET Button	Sometimes the power-off and power-on sequence may not lead to display "0b" (ready to press BI- ON button) on all CPUs. In that case press the RESET button so that the CPUs again resets itself to show "0b"(ready to press BI-ON button) on all CPUs.
BI-ON Button	This button is required for starting the system. Whenever all the CPUs display "0b", it indicates that it is ready for start. The user has to press this button for starting the system. In self-healing mode this switch need not to be pressed.
BZ-ACK Button	This button is required for acknowledging the buzzer whenever it sounds due to dropping of "Shut down relays" (BIPR1 & BIPR2).
BI-OK IND.	This indication (green) glows when the UFSBI is in working condition.
BI-FAIL IND.	This indication (red) glows when the Block Interface is in failure mode.

LINK FAIL IND.	This indication (yellow) glows steadily when the modem fails to receive any data form remote station. In normal working condition, when the modem receives data from remote station, this indication (yellow) will flicker continuously. ***Flickering of this indication does not necessarily means that the UFSBI communication is fully established. Full establishment of UFSBI communication is only decided by seeing "00" in the CPU cards and Output relays are picking up.***

Table 3: FUNCTION OF COMPONENTS ON RESET BOX

2.4.1 POWER-ON-RESET Operation

After system is powered on observe the following:

- Check the display of the CPU.
- Wait till the display on all the CPUs display "0b"
- If "0b" is not displayed, try by pressing the RESET button. If the problem persists check corresponding codes in the error code list and take appropriate action as suggested in the remedial action column.
- If all the CPUs display "0b" then press the BI-ON button. ***For self-healing mode BI-Button is need not to be pressed.***
- Observe that both BIPR1 and BIPR2 picked up.
- Once BIPR1 and BIPR2 pick up, BI fail (Red) indication goes off and BI OK (Green) indication comes on.
- Link fail (Yellow) steady indication goes off & starts flickering as soon as the modem starts receiving data from remote station modem and once full communication is established all the CPU's will start displaying "00"

2.4.2 RESET Operation

The following steps are to be performed for carrying out the RESET operation of the UFSBI:

- Press the Reset Button and observe that the display in all 3 CPU's becomes no light then to "--"
- Wait till the display on all the CPUs display "0b"
- If "0b" is not displayed, try by pressing the RESET button. If the problem persists check corresponding codes in the error code list and take appropriate action as suggested in the remedial action column.
- If all the CPUs display "0b" then press the BI-ON button. ***For self-healing mode BI-Button is need not to be pressed.***
- Observe that both BIPR1 and BIPR2 picked up.
- Once BIPR1 and BIPR2 pick up, BI fail (Red) indication goes off and BI OK (Green) indication comes on.
- Link fail (Yellow) steady indication goes off & starts flickering as soon as the modem starts receiving data from remote station modem and once full communication is established all the CPU's will start displaying "00"

2.5 Fiber Optic MODEM: -

The fiber optic modem converts Electrical Asynchronous Serial RS232 signals into optical signals and transmitted over Single-Mode fiber optic cable, extending these services range up to 40 km (max.). It is designed to provide a cost-effective point-to-point solution for extending the transmission distance and improving the transmission reliability. This fiber optic modem supports different fiber optic interfaces in single core optic fibers and can operate with several grades of fiber optic cable.

Figure 10: FIBER MODEM FRONT VIEW

Figure 11: FIBER MODEM BACK VIEW

Product Versions & Features

2.5.1 Features:

Optical Network Interface:

- Transmission Power: -3dBm~-6dBm approx.
- Receiving Sensitivity: -28dBm~ -30dBm approx.
- Fibre connector type SC in single-mode
- Operates on Single-Strand fibre for both transmit & receive.
- Input power requirement 24V with range -10% / +20%
- Operating Temperature: -10 ^{o}C to +70 ^{o}C upto 90% RH (non-condensing)
- Power Consumption < 10 Watts
- Provided with comprehensive LED indicators.

2.6 Voice MODEM: -

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

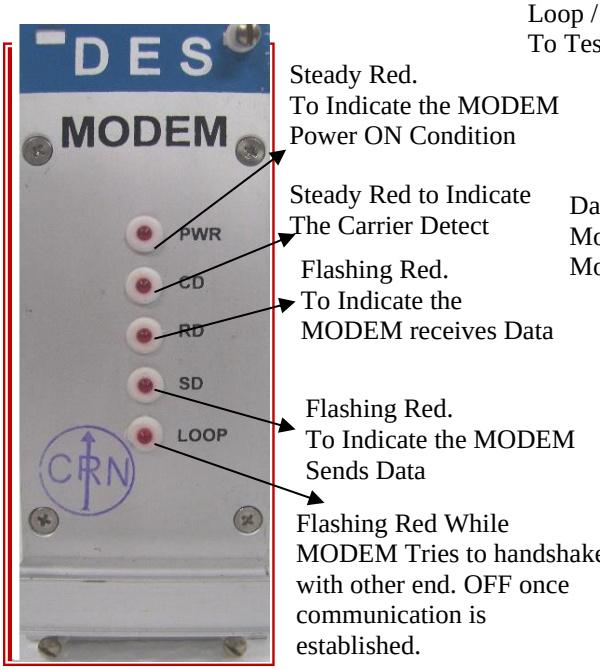


Figure 13: **MODEM FRONT VIEW**

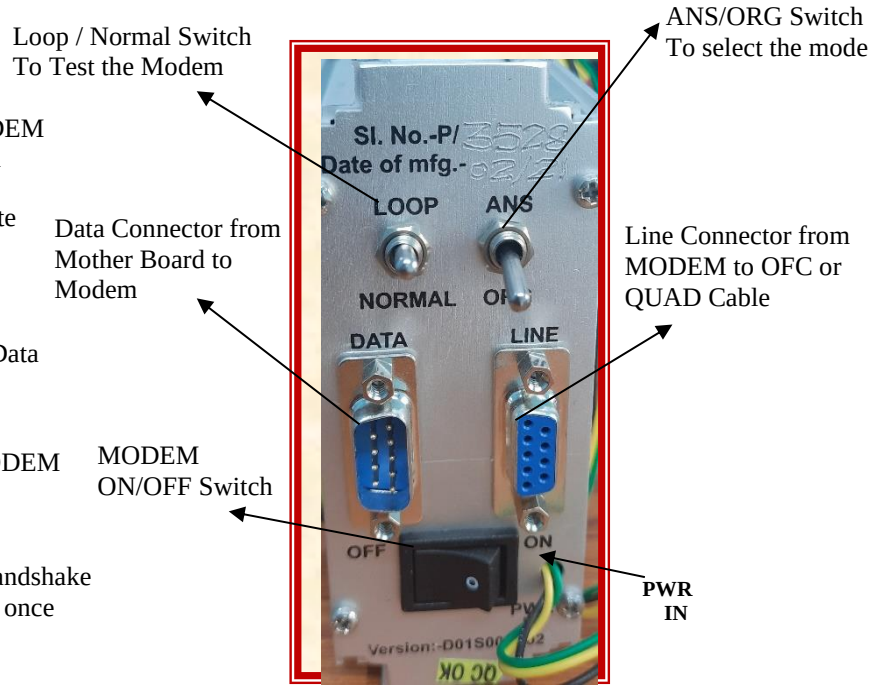


Figure 12: **MODEM BACK VIEW**

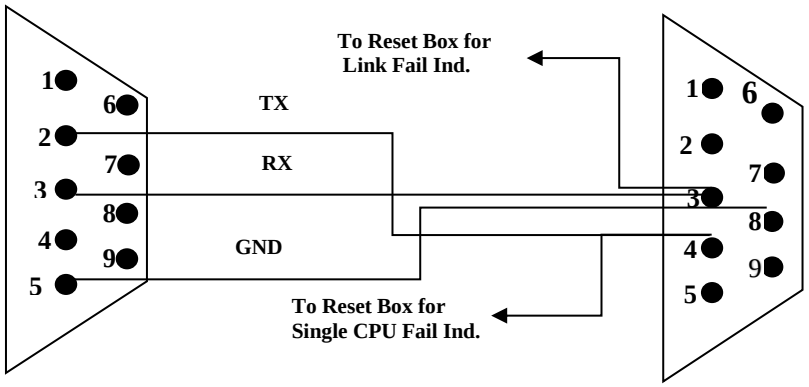
2.7 AUTOMATIC MODEM CHANGE OVER: -

Figure 14: MODEM C/O FRONT VIEW

Figure 15: MODEM C/O BACK VIEW

2.7.1 The functional advantages of the Automatic Media Changeover

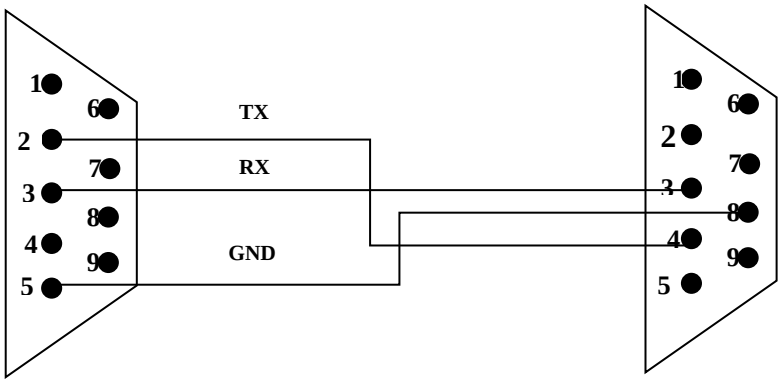
- Seamless changeover between the primary and the secondary media
- Very low media switchover (<1 ms), thereby ensuring no link failure of UFSBI.
- Continuous monitoring of both working / non-working media providing potential free
- contact for recording media performance over networked data logger.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



C/O BOX 9-PIN DATA CONNECTOR

MB 9-PIN DATA CONNECTOR (M)

CHANGEOVER TO MOTHERBOARD DATA CONNECTION



MODEM 9-PIN DATA CONNECTOR (M)

C/O BOX 9-PIN DATA CONNECTOR

MODEM TO C/O BOX DATA CONNECTION

2.7.2 Automatic change over alarm cum indication box(optional)

Figure 16: Automatic change over alarm cum indication box(optional)

Details of c/o alarm cum indication box

Mechanical details	
Dimension	L 150mm X W 137mm X H 80mm
Indication details	
power	It glows green if the power defect then red led lit with buzzer
Comm link	It glows green if communication link is brocken then red led lit with buzzer
Modem A	It glows green if modem A goes to bad then red led glows lit with buzzer
Modem B	It glows green if modem B goes to bad then red led glows lit with buzzer
Push botton details	
ACKN	If any of above 4 failures buzzer to mute condition press the ackn button
Connection details	
Pwr on	Terminal 1
Pwr off	Terminal 2
Comm fail	Terminal 3
Comm ok	Terminal 4
Modem a ok	Terminal 5
Modem b ok	Terminal 6
Modem a fail	Terminal 7
Modem b fail	Terminal 8
N 24v	Terminal 9
spare	Terminal 10

Table 4:Details of change over alarm cum indication box(optional)

2.8 UFSBI Alarm Panel :-

The UFSBI alarm panel provided at SM room incorporated in Block Panel to give preventive alarm for single CPU failure, Redundant DC-DC converter failure and System total failure.

Figure 17:UFSBI Alarm Panel (Front View)

Figure 18:UFSBI Alarm Panel (Back View)

Details of Alarm Panel

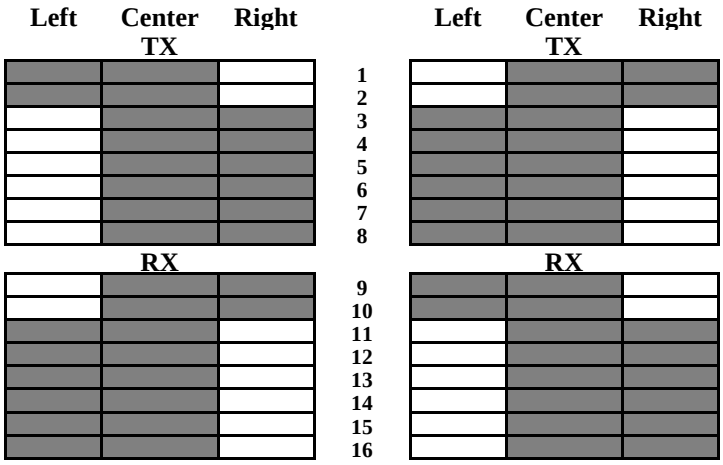
Mechanical details	
Dimension	L 157 mm X W 107 mm X H 68 mm
Indication details	
Single CPU fail	It glows when any one of the CPU of UFSBI goes bad and remains "ON" till the fault rectified.
Redundant DC-DC	It glows when any module of DC-DC converter goes bad and remains "ON" till the fault rectified.
System Failure	It glows when UFSBI system goes to shut down mode and remains "ON" till the fault rectified.
Push Button Details	
Single CPU fail ACKN.	To mute the buzzer if any one of the CPU of UFSBI goes bad.
Redundant DC-DC ACKN.	To mute the buzzer if any Output module of DC-DC converter goes bad.
System Failure ACKN.	To mute the buzzer if UFSBI system goes to failure mode.
Connector Details	
Redundant DC-DC	4 Pin Connector Pin 1
CPU	4 Pin Connector Pin 2
System	4 Pin Connector Pin 3

Connectivity between UFSBI cubicle to UFSBI Alarm panel & Datalogger.

Sl. no.	Alarm panel terminal no.	UFSBI terminal No for ALARM PANEL	Potential Free Contact for Data Logger	Remarks
1.	1	L35	L36	For Power Supply Monitor
2.	2	N24®L45	L37	
3.	3	L38	L39	For Single CPU Failure (SCFD)
4.	4	N24®L45	L40	
5.	5	L41	L42	For System Failure
6.	6	N24®L45	L43	

2.9 UFSBI Address Configuration Jumpers

The Address Configuration jumpers are set in the Connector side of the motherboard. A pattern of this jumper setting is shown below:



The TX Address of one unit should correspond with the RX Address of other unit. The same type of settings should not be used in the adjacent pair of units.

NOTE: 9 unique Address Configuration Jumpers are given in Annexure A

3 Installation Procedures:-

3.1 Installation & Testing Guidelines

All the units including the modules, connectors and other accessories are factory-checked. However, after unpacking, following pre-installation test schedule is being recommended to examine if any kind of damage has occurred during transshipment.

3.2 Physical Examination required for

a) Connectors
b) Relays and Relay-bases
c) All the PCB modules
d) Rack and the mainframe
e) Card Guides
f) Motherboard
g) Interconnecting ribbon cables and wires
h) Reset Box
i) Modem

3.3 Power Supply

a) Input Voltage should not exceed the range: 19.2V to 30.2V DC with 10Amps drive capacity.
b) Ensure that the above supply is not arbitrarily grounded.
c) Before insertion of other modules, DC-DC converter is to be connected to the Input Supply and its correct output levels should read as:

i) 5V [+10/- 3%]
ii) +12V [+/- 5%]
iii) –12V [+/- 5%]
iv) 24V [+/- 5%]

WARNING: For removing and fitting PCB in the unit, please switch off the power supply.

Now switch 'ON' the power supply of the unit and check for:
Observe for power on sequence as given in clause _____2.4.1

a) Now check all the external circuits connected with UFSBI.
b) Now perform Two to Three test signaling rounds and check all the signal interlocking safety aspects.
c) Put the system online and observe for two days before commissioning.

4 Maintenance

4.1.1 Preventive maintenance

- **Power supply:** In tropical countries power supply unit of any type is the single source responsible for most of the equipment faults and malfunctioning. A regular check on power supply units such as battery banks, battery charger and DC-DC converters is mandatory.
- **Relays:** UFSBI has used most reliable type of relays, but special care and testing is required for those to be used after long storage. No attempt is to be made to repair a relay. Use a new one.
- **DO's and DON'T's** given below can be a formidable guideline for Preventive Maintenance.

4.2 Maintenance of Communication Link

- Fibre is to be protected from injury during other kinds of installation at its vicinity.
- If disconnection of fibre is required, the fibre terminal is to be refitted firmly.
- The loss of signal due to fiber junction loss is to be kept under check.
- The display indication "33" indicates link failure. If the modem is found to be O.K, next to be checked is the fiber.

4.3 Maintenance of Equipment

a. UFSBI unit will automatically trip-off if the Battery supply goes below 19.2V & above 30.2V DC. In case of repeated trip-off, both the DC supply level and the loading are to be checked. A healthy UFSBI should not draw more than 2.9-3.0 Amp DC without any Input or Output relay in Pick up condition.

b. No attempt of "resetting" is to be made in case of supply impairment or link failure.

c. If a faulty UFSBI system is not brought back to normal after "resetting" one must check:

i) If there is any loosely fitted connector or improperly pressed PCB module.

ii) Connecting leads inserted in Terminal.

iii) The DC supply levels of the DC-DC converter.

d. For specific information on faults, refer **"UFSBI Error Code List"**.

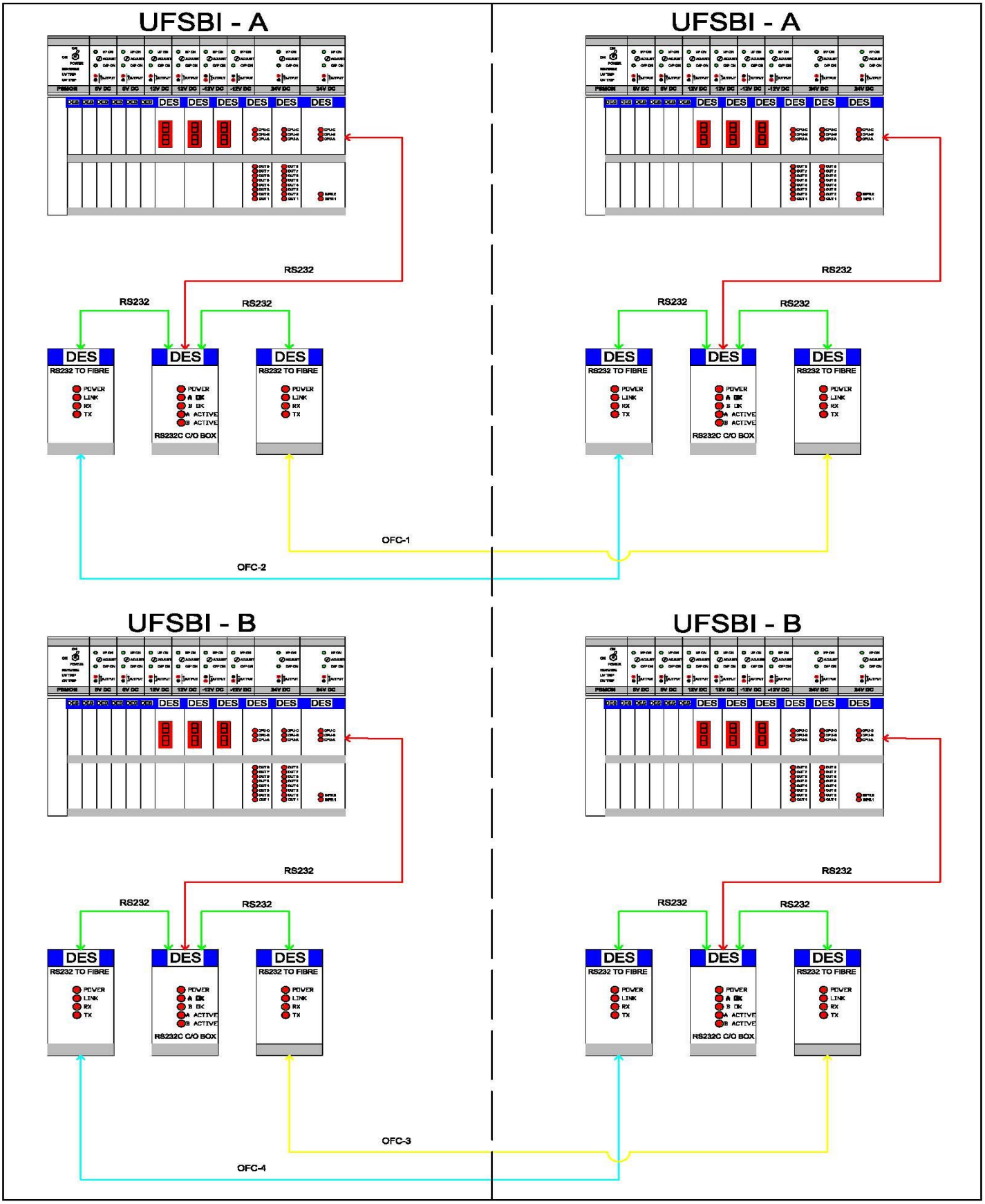
e. Once a fault is found, the user should not attempt repairing at component level of any card or module etc.. The impaired module / PCB needs to be replaced by a spare one.

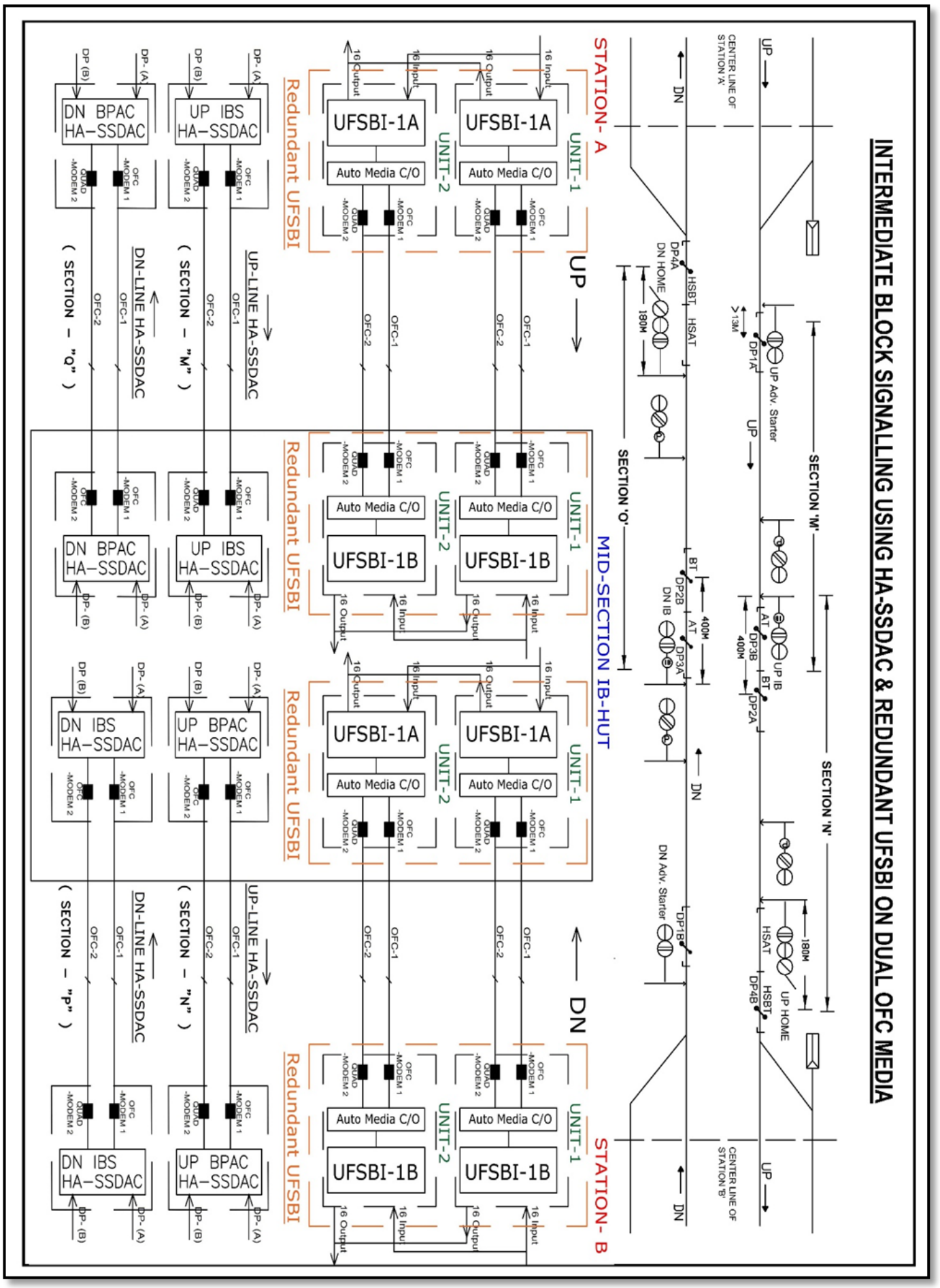
5 Do's & Don'ts

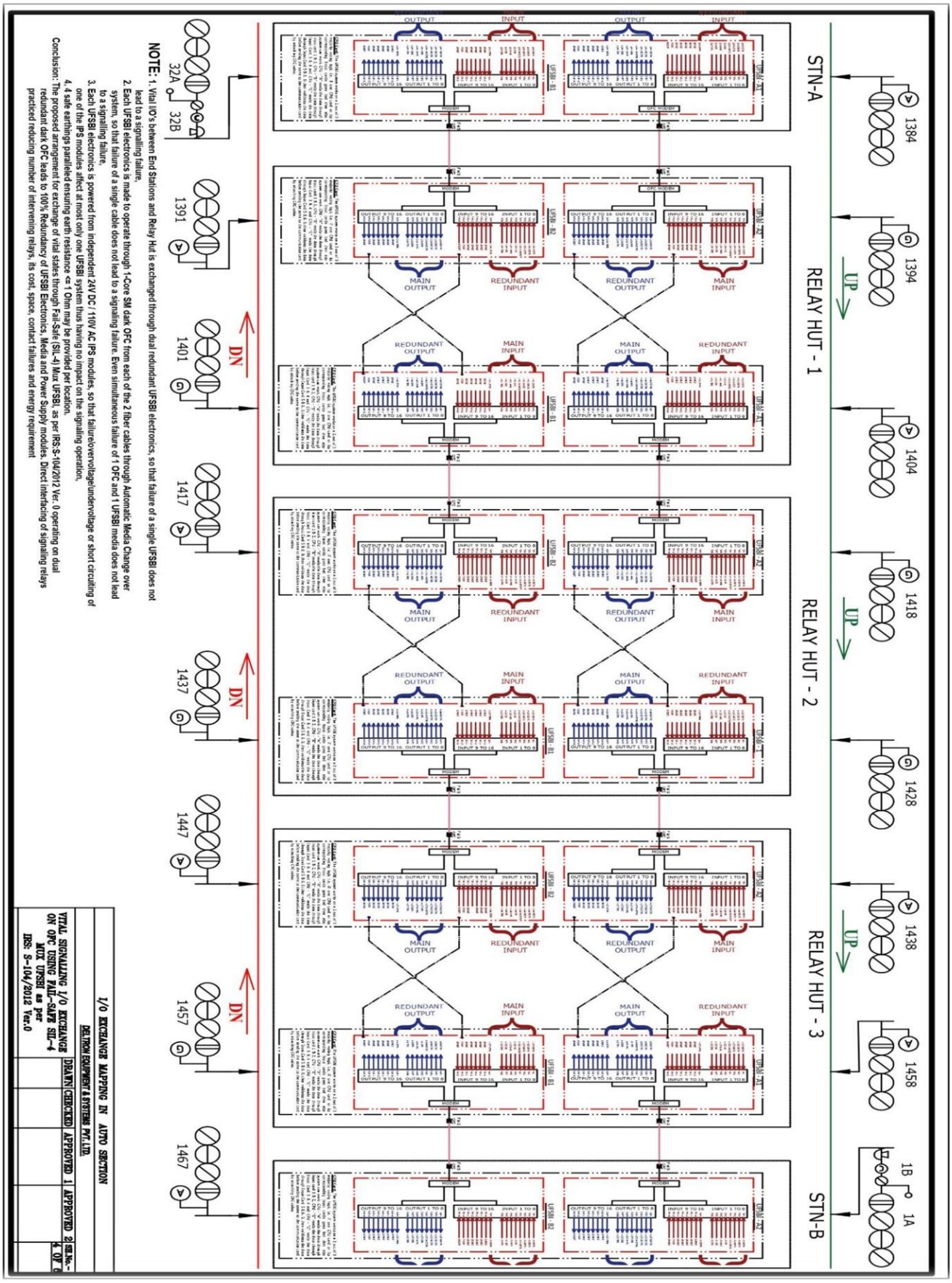
- UFSBI system is to be operated or maintained only by trained persons.
- No attempt is to be made to operate the equipment at Battery Voltage ranging bellow 19.2V and above 30.2V DC.
- Connectors or PCBs is to be plugged in or out after switching off the Power Supply.
- "RESET" should not be applied in case of "Link Failure" or "Supply" Break Down.
- Replacement of components or modules is to be done with spares supplied / prescribed by the manufacturer.
- While plugging in / out a PCB, care is to be taken to avoid application of excessive force.
- Arbitrary grounding should not be done to any "common" terminal inside the equipment.
- Relay testing should not be performed involving forced 'pick-up' or 'drop' while the instrument is "ON".
- Standard restrictions against mishandling and opening of Block Instrument are applicable also to UFSBI.

WARNING: No violation of above "MESSAGE OF CAUTION" is desirable for safe & reliable signaling operation.

6 Application Diagram



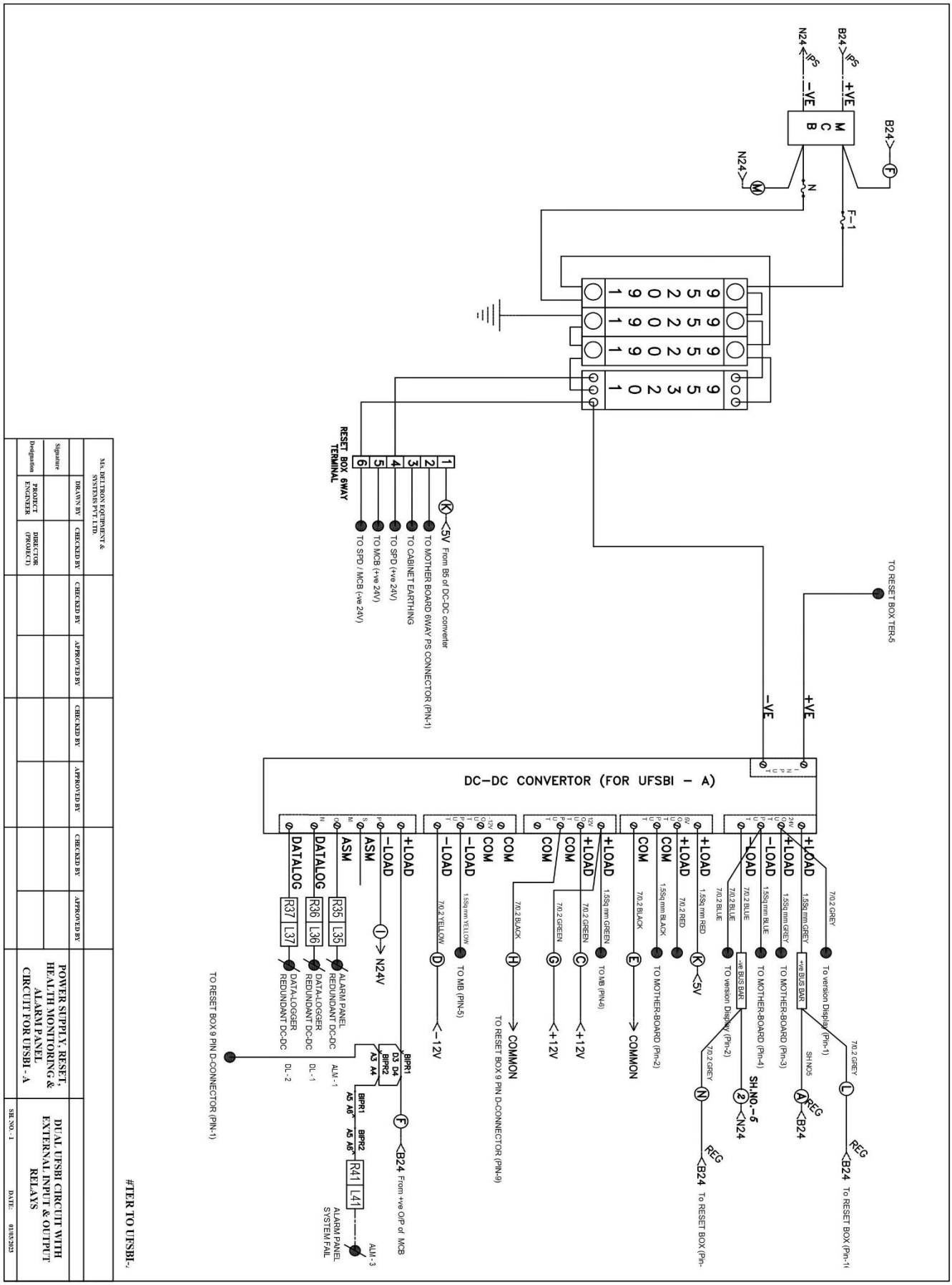

INTERMEDIATE BLOCK SIGNALLING USING HA-SSDAC & REDUNDANT UFSBI ON DUAL OFC MEDIA
STATION- A
MID-SECTION IB-HUT
STATION- B
UP
DN
UNIT-1
UNIT-2
UFSBI-1A
UFSBI-1B
Auto Media C/O
Redundant UFSBI
16 Input
16 Output
OFC-1
OFC-2
OFC -MODEM 1
QUAD -MODEM 2
DN BPAC HA-SSDAC
UP IBS HA-SSDAC
DN IBS HA-SSDAC
UP BPAC HA-SSDAC
DP- (A)
DP- (B)
UP-LINE HA-SSDAC
DN-LINE HA-SSDAC
(SECTION – "Q")
(SECTION – "M")
(SECTION – "N")
(SECTION – "P")
SECTION 'O'
SECTION 'M'
SECTION 'N'
CENTER LINE OF STATION 'A'
CENTER LINE OF STATION 'B'
DP4A
DN HOME
DP1A
UP Adv. Starter
DP2B
DN IB
DP3A
UP IB
DP3B
DP2A
DP1B
DN Adv. Starter
UP HOME
DP4B
HSBT
HSAT
BT
AT
180M
400M
> 13M

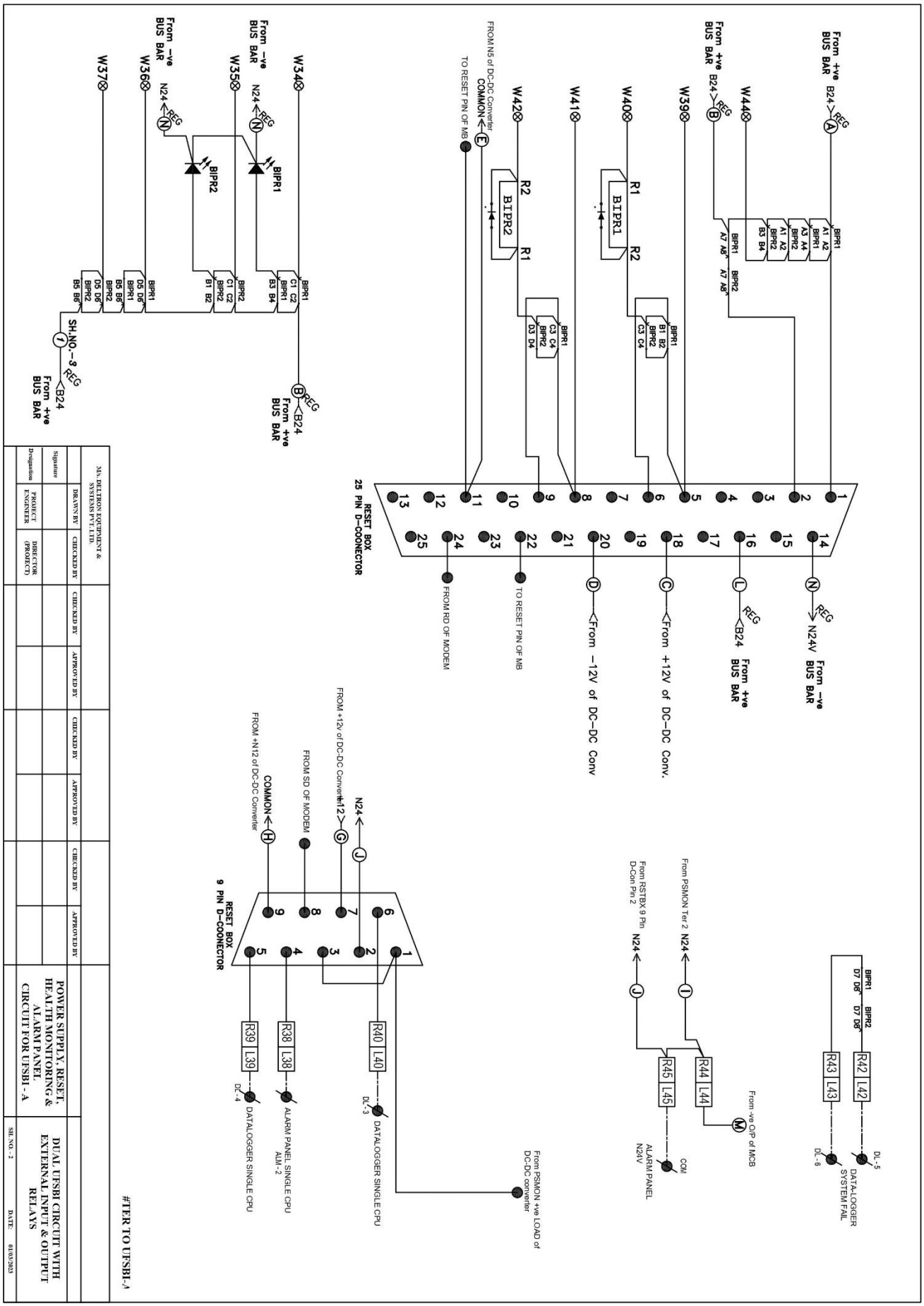

STN-A
RELAY HUT - 1
RELAY HUT - 2
RELAY HUT - 3
STN-B
UP
DN
1384
1394
1404
1418
1428
1438
1458
1B
1A
32A
32B
1391
1401
1417
1437
1447
1457
1467
MAIN OUTPUT
REDUNDANT INPUT
REDUNDANT OUTPUT
MAIN INPUT
NOTE: 1. Vital IO's between End Stations and Relay Hut is exchanged through dual redundant UFSBI electronics, 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 signaling 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. A safe earthings paralleled ensuring earth resistance <= 1 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 signaling relays practiced reducing number of intervening relays, its cost, space, contact failures and energy requirement
I/O EXCHANGE MAPPING IN AUTO SECTION
DELTRON EQUIPMENT & SYSTEMS PVT.LTD.
VITAL SIGNALLING I/O EXCHANGE ON OFC USING FAIL-SAFE SIL-4 MUX UFSBI as per IRS: S-104/2012 Ver.0
DRAWN
CHECKED
APPROVED 1
APPROVED 2
SHEET No.- 4 OF 6

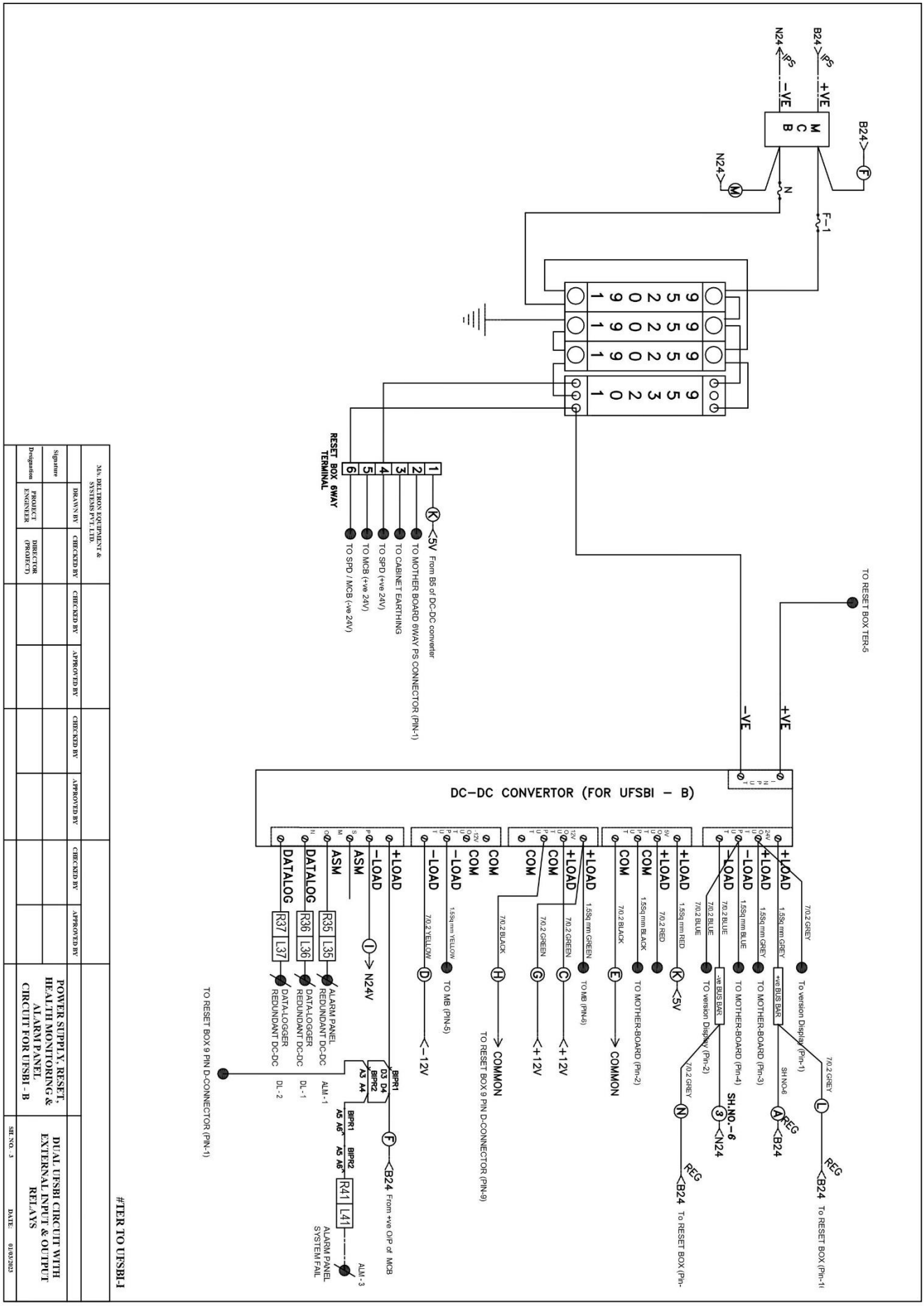
CONTACT ANALYSIS CHART FOR UFSBI - ABS

SL. NO	RELAY NAME	TYPE	COIL	CONFIG.	A 1–2	A 3–4	A 5–6	A 7–8	B 1–2	B 3–4	B 5–6	B 7–8	C 1–2	C 3–4	C 5–6	C 7–8	D 1–2	D 3–4	D 5–6	D 7–8
1	UFSBI-A BIPR1	QN1	1 1 R1,R2 **5**	8F/8B	2 2 W 44 **10**	2 2 RST BX PIN 1 **10**	1 1 SYS FAIL CKT **10**	1 1 RST BX PIN 2 **10**	1 1 RST BX PIN 5 **10**	2 1 W34 **10**	1 2 W 36 **10**		2 2 W 34 **10**	2 2 RST BX PIN 9 **10**			2 1 RELAY IND **13**	2 1 SCFD CKT **10**	2 2 W 36 **10**	1 1 ALARM PANEL
2	UFSBI-A BIPR2	QN1	1 1 R1,R2 **5**	8F/8B	2 2 W44 **10**	2 2 SCFD CKT **10**	1 1 SCFD CKT **10**	1 1 RST BX PIN 2 **10**	2 1 W 35 **10**	1 2 W 44 **10**	1 1 W 37 **10**		2 2 W 35 **10**	1 1 RST BX PIN 6 **10**			2 1 RELAY IND **13**	1 1 RST BX PIN 9 **10**	2 2 W 37 **10**	1 1 ALARM PANEL
3	UFSBI-B BIPR1	QN1	1 1 R1,R2 **5**	8F/8B	2 2 W 44 **10**	2 2 RST BX PIN 1 **10**	1 1 SYS FAIL CKT **10**	1 1 RST BX PIN 2 **10**	1 1 RST BX PIN 5 **10**	2 1 W34 **10**	1 2 W 36 **10**		2 2 W 34 **10**	2 2 RST BX PIN 9 **10**			2 1 RELAY IND **13**	2 1 SCFD CKT **10**	2 2 W 36 **10**	1 1 ALARM PANEL
4	UFSBI-B BIPR2	QN1	1 1 R1,R2 **5**	8F/8B	2 2 W44 **10**	2 2 SCFD CKT **10**	1 1 SCFD CKT **10**	1 1 RST BX PIN 2 **10**	2 1 W 35 **10**	1 2 W 44 **10**	1 1 W 37 **10**		2 2 W 35 **10**	1 1 RST BX PIN 6 **10**			2 1 RELAY IND **13**	1 1 RST BX PIN 9 **10**	2 2 W 37 **10**	1 1 ALARM PANEL

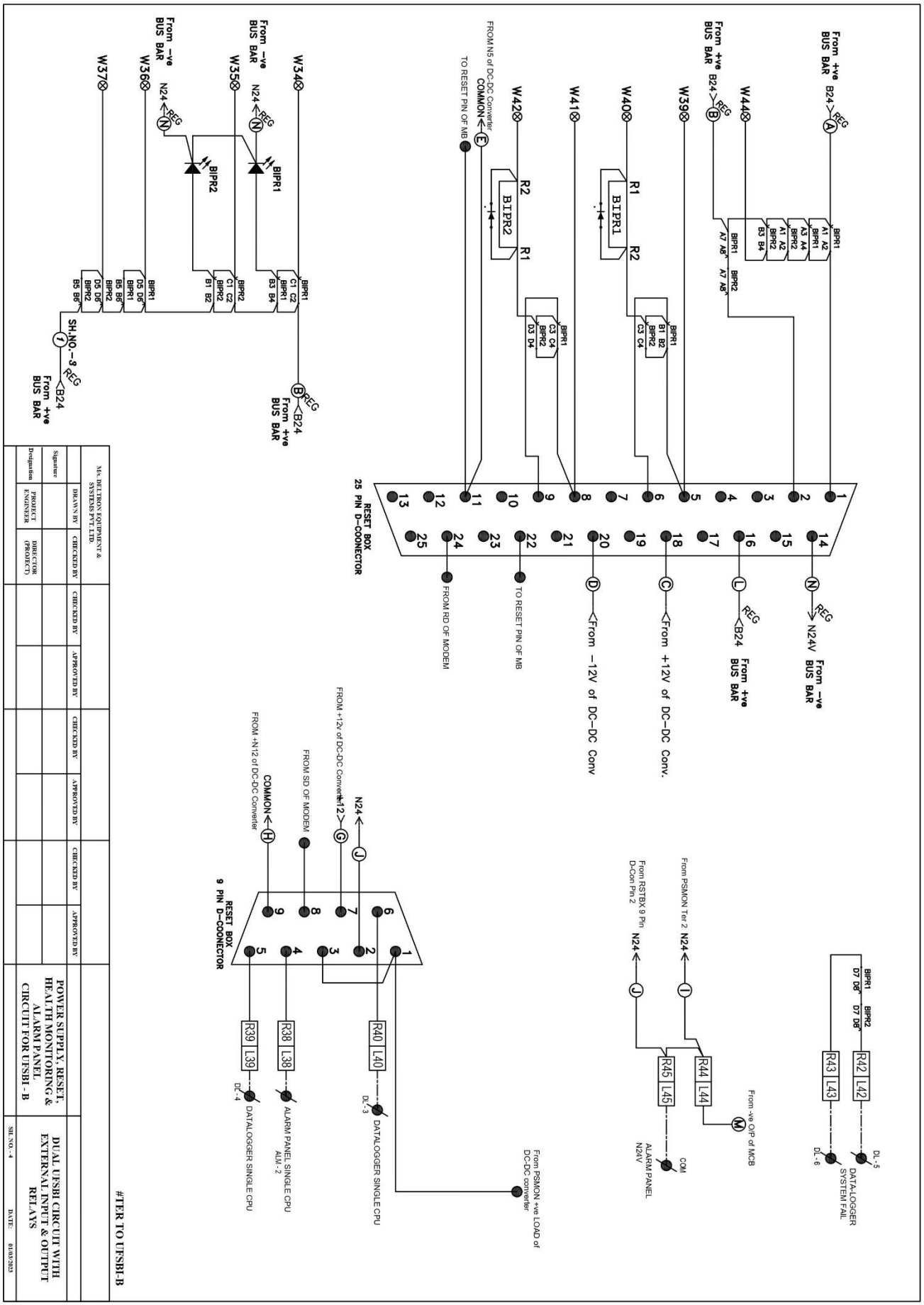
7 CIRCUIT DIAGRAM FOR DUAL UFSBI ELECTRONICS:

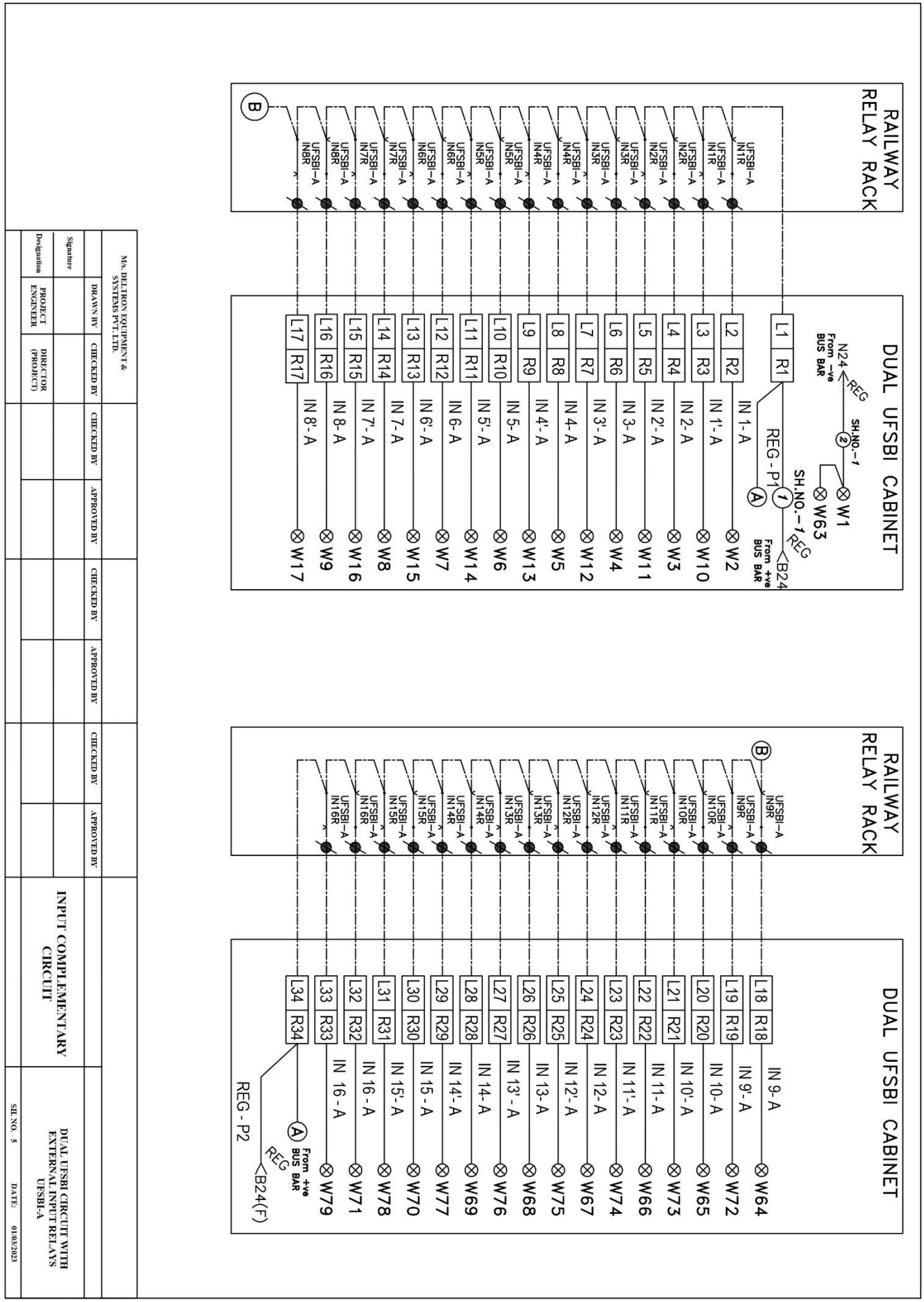


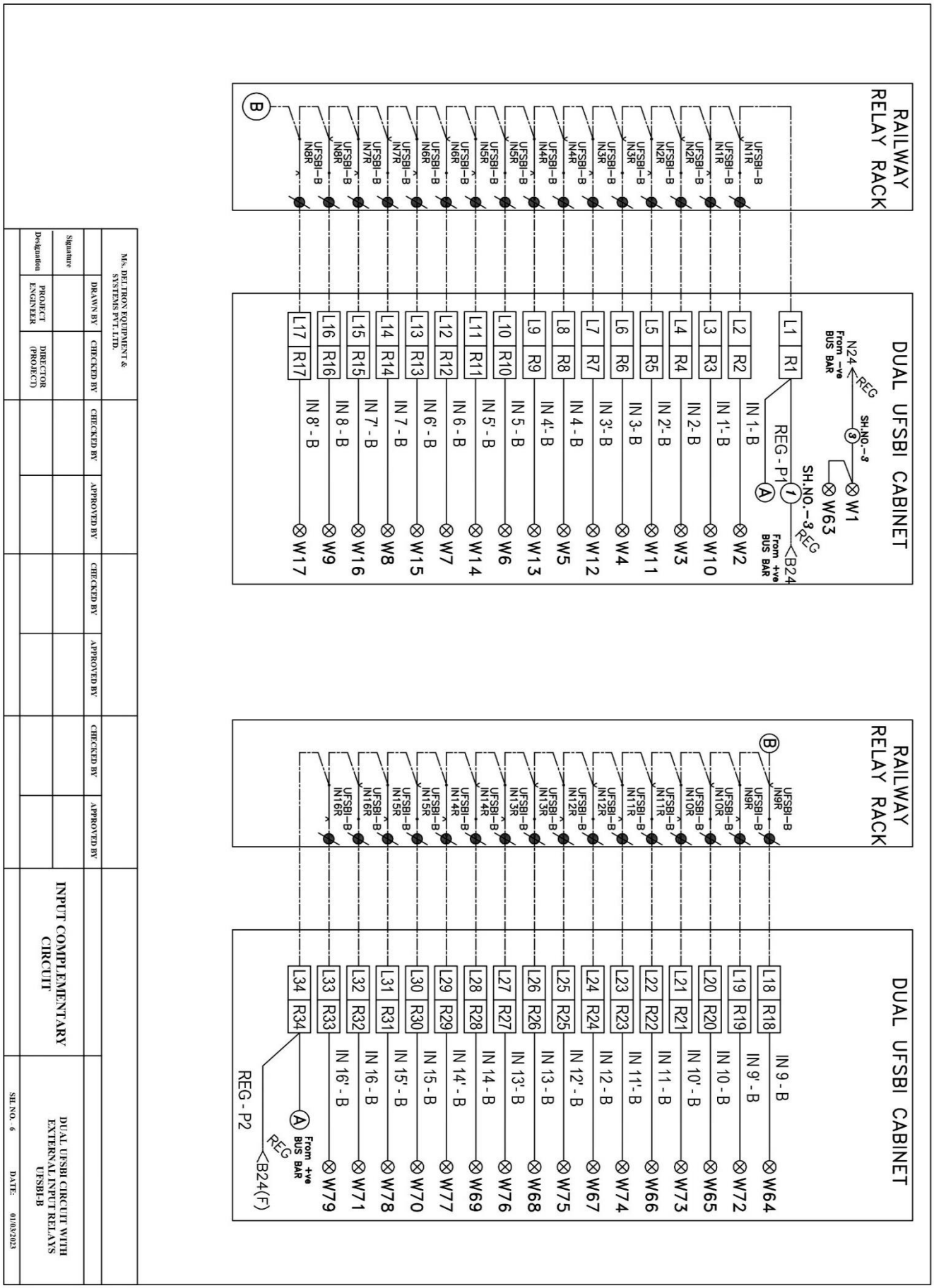

From +ve BUS BAR
From -ve BUS BAR
W44
W39
W40
W41
W42
W34
W35
W36
W37
BIPR1
BIPR2
R1
R2
RESET BOX 25 PIN D-COONECTOR
FROM N5 of DC-DC Converter COMMON
TO RESET PIN OF MB
FROM RD OF MODEM
TO RESET PIN OF MB
From +12V of DC-DC Conv.
From -12V of DC-DC Conv
From -ve O/P of MCB
From PSMON Tel 2
From RSTBX 9 Pin D-Con Pin 2
ALARM PANEL N24V
COM
DATA-LOGGER SYSTEM FAIL
DL-5
DL-6
R42 L42
R43 L43
R44 L44
R45 L45
R40 L40
R38 L38
R39 L39
DATALOGGER SINGLE CPU
ALARM PANEL SINGLE CPU ALM-2
DATALOGGER SINGLE CPU
FROM +12v of DC-DC Converter +12
FROM SD OF MODEM
FROM +N12 of DC-DC Converter COMMON
From PSMON +ve LOAD of DC-DC converter
RESET BOX 9 PIN D-COONECTOR
SH.NO.-3
#TER TO UFSBI-A
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
PROJECT ENGINEER
DIRECTOR (PROJECT)
Signature
Designation
POWER SUPPLY, RESET, HEALTH MONITORING & ALARM PANEL CIRCUIT FOR UFSBI - A
DUAL UFSBI CIRCUIT WITH EXTERNAL INPUT & OUTPUT RELAYS
SH. NO. - 2
DATE: 01/03/2023

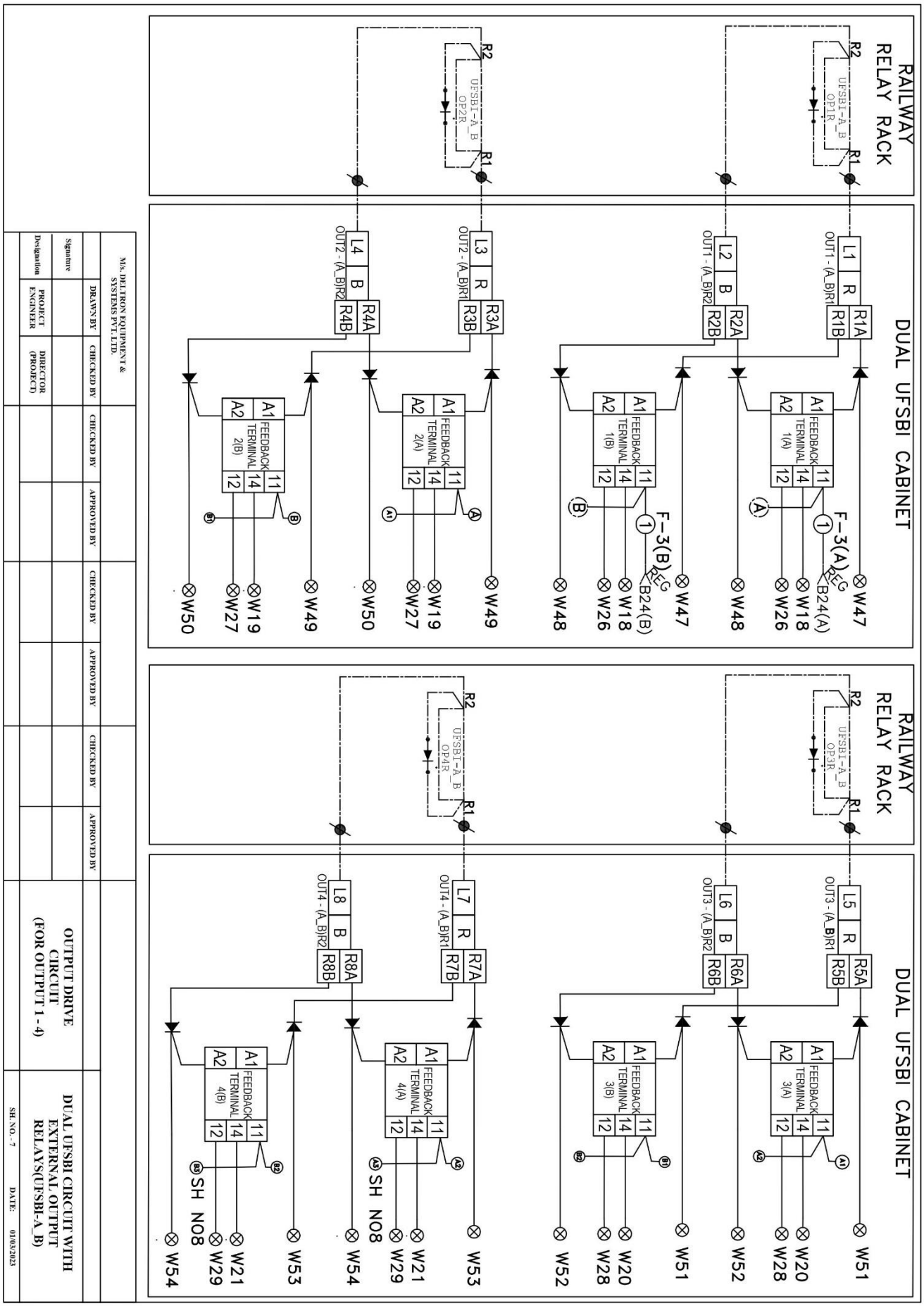


M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.									
	DRAWN BY	CHECKED BY	CHECKED BY	APPROVED BY	CHECKED BY	APPROVED BY	CHECKED BY	APPROVED BY	
Signature									
Designation	PROJECT ENGINEER	DIRECTOR (PROJECT)							
POWER SUPPLY, RESET, HEALTH MONITORING & ALARM PANEL CIRCUIT FOR UFSBI - B									DUAL UFSBI CIRCUIT WITH EXTERNAL INPUT & OUTPUT RELAYS
SHEET NO. 3									DATE: 01/07/2023

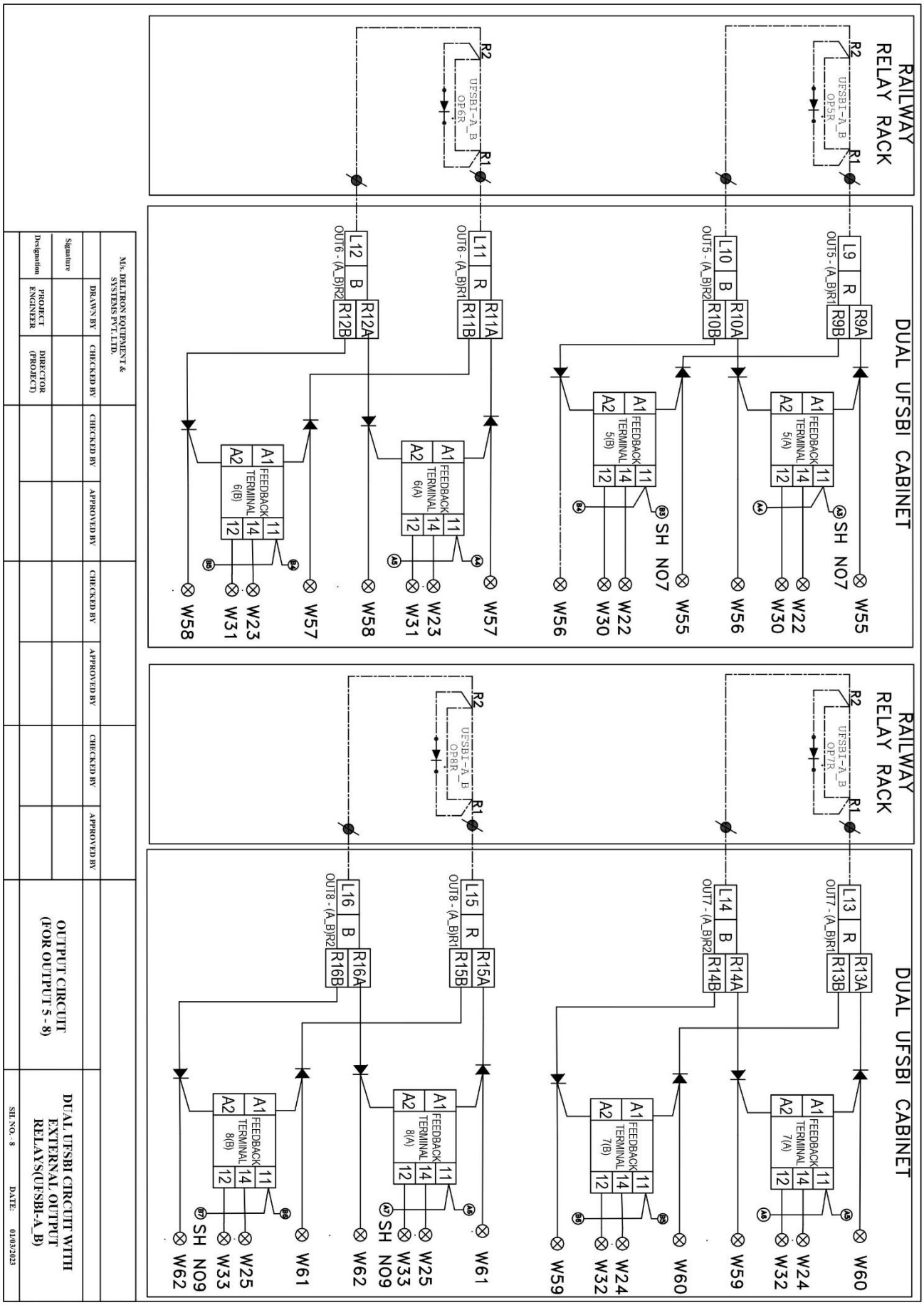

From +ve BUS BAR
From -ve BUS BAR
W44
W39
W40
W41
W42
W34
W35
W36
W37
BIPR1
BIPR2
R1
R2
RESET BOX 25 PIN D-COONECTOR
FROM N5 of DC-DC Converter COMMON
TO RESET PIN OF MB
FROM RD OF MODEM
TO RESET PIN OF MB
From +12V of DC-DC Conv.
From -12V of DC-DC Conv
From +ve BUS BAR
From -ve
SH.NO.-3
DATALOGGER SINGLE CPU
ALARM PANEL SINGLE CPU ALM - 2
DATALOGGER SINGLE CPU
FROM SD OF MODEM
FROM +12v of DC-DC Converter
FROM +N12 of DC-DC Converter
COMMON
RESET BOX 9 PIN D-COONECTOR
From PSMON +ve LOAD of DC-DC converter
From PSMON Ter 2
From RSTBX 9 Pin D-Con Pin 2
From -ve O/P of MCB
ALARM PANEL N24V
DATA-LOGGER SYSTEM FAIL
R40 L40
R38 L38
R39 L39
R42 L42
R43 L43
R44 L44
R45 L45
DL-3
DL-4
DL-5
DL-6
#TER TO UFSBI-B
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
PROJECT ENGINEER
DIRECTOR (PROJECT)
POWER SUPPLY, RESET, HEALTH MONITORING & ALARM PANEL CIRCUIT FOR UFSBI - B
DUAL UFSBI CIRCUIT WITH EXTERNAL INPUT & OUTPUT RELAYS
SH. NO. - 4
DATE: 01/03/2023

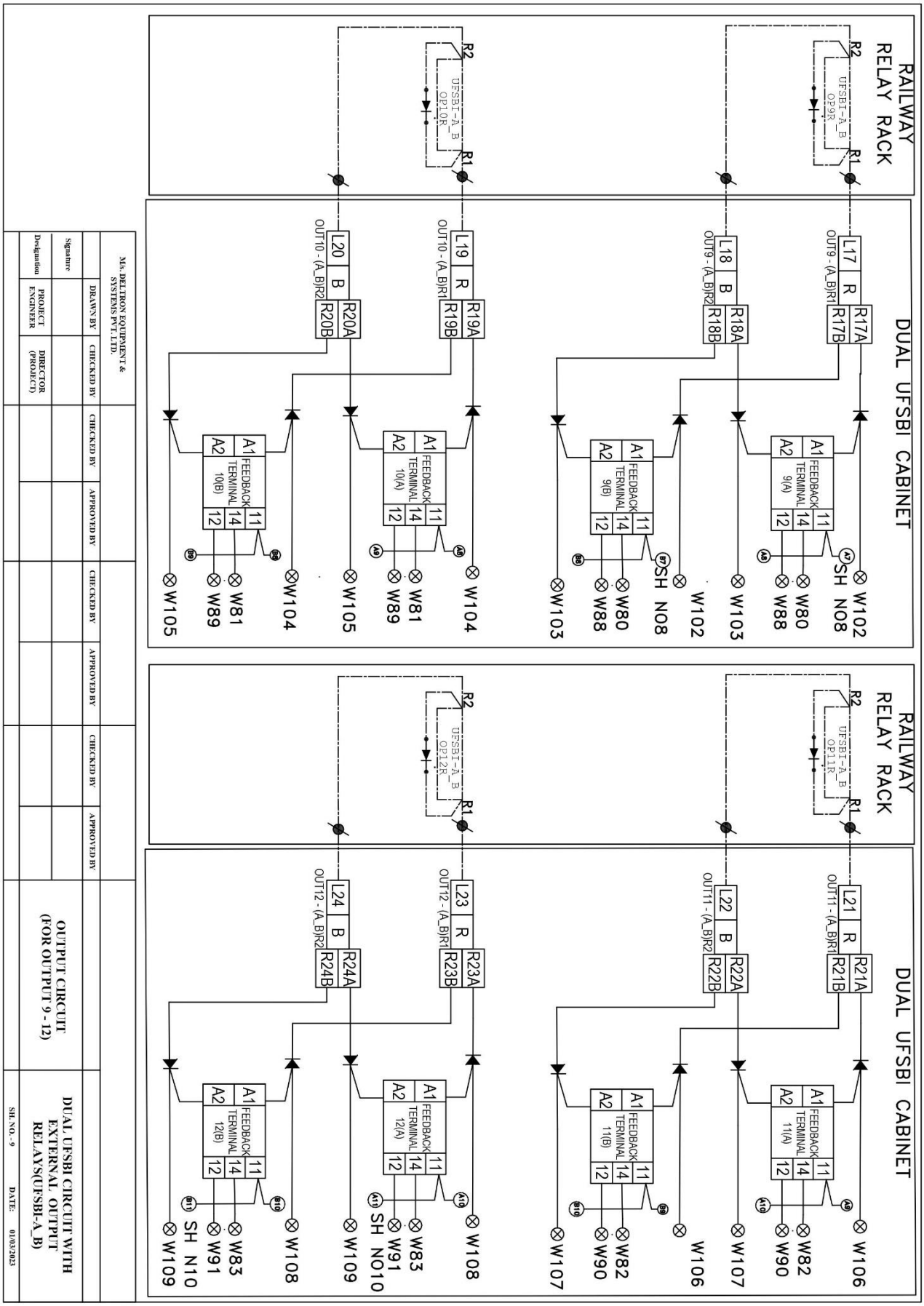

RAILWAY RELAY RACK
DUAL UFSBI CABINET
N24
REG
From -ve BUS BAR
SH.NO.-1
W1
W63
SH.NO.-1
REG
B24
From +ve BUS BAR
REG - P1
L1 R1
L2 R2 IN 1-A W2
L3 R3 IN 1'-A W10
L4 R4 IN 2-A W3
L5 R5 IN 2'-A W11
L6 R6 IN 3-A W4
L7 R7 IN 3'-A W12
L8 R8 IN 4-A W5
L9 R9 IN 4'-A W13
L10 R10 IN 5-A W6
L11 R11 IN 5'-A W14
L12 R12 IN 6-A W7
L13 R13 IN 6'-A W15
L14 R14 IN 7-A W8
L15 R15 IN 7'-A W16
L16 R16 IN 8-A W9
L17 R17 IN 8'-A W17
UFSBI-A IN1R
UFSBI-A IN1R
UFSBI-A IN2R
UFSBI-A IN2R
UFSBI-A IN3R
UFSBI-A IN3R
UFSBI-A IN4R
UFSBI-A IN4R
UFSBI-A IN5R
UFSBI-A IN5R
UFSBI-A IN6R
UFSBI-A IN6R
UFSBI-A IN7R
UFSBI-A IN7R
UFSBI-A IN8R
UFSBI-A IN8R
UFSBI-A IN8R
RAILWAY RELAY RACK
DUAL UFSBI CABINET
UFSBI-A IN9R
UFSBI-A IN9R
UFSBI-A IN10R
UFSBI-A IN10R
UFSBI-A IN11R
UFSBI-A IN11R
UFSBI-A IN12R
UFSBI-A IN12R
UFSBI-A IN13R
UFSBI-A IN13R
UFSBI-A IN14R
UFSBI-A IN14R
UFSBI-A IN15R
UFSBI-A IN15R
UFSBI-A IN16R
UFSBI-A IN16R
UFSBI-A IN16R
L18 R18 IN 9-A W64
L19 R19 IN 9'-A W72
L20 R20 IN 10-A W65
L21 R21 IN 10'-A W73
L22 R22 IN 11-A W66
L23 R23 IN 11'-A W74
L24 R24 IN 12-A W67
L25 R25 IN 12'-A W75
L26 R26 IN 13-A W68
L27 R27 IN 13'-A W76
L28 R28 IN 14-A W69
L29 R29 IN 14'-A W77
L30 R30 IN 15-A W70
L31 R31 IN 15'-A W78
L32 R32 IN 16-A W71
L33 R33 IN 16'-A W79
L34 R34
From +ve BUS BAR
REG
B24(F)
REG - P2
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
PROJECT ENGINEER
DIRECTOR (PROJECT)
Signature
Designation
INPUT COMPLEMENTARY CIRCUIT
DUAL UFSBI CIRCUIT WITH EXTERNAL INPUT RELAYS UFSBI-A
SH. NO. 5
DATE: 01/03/2023

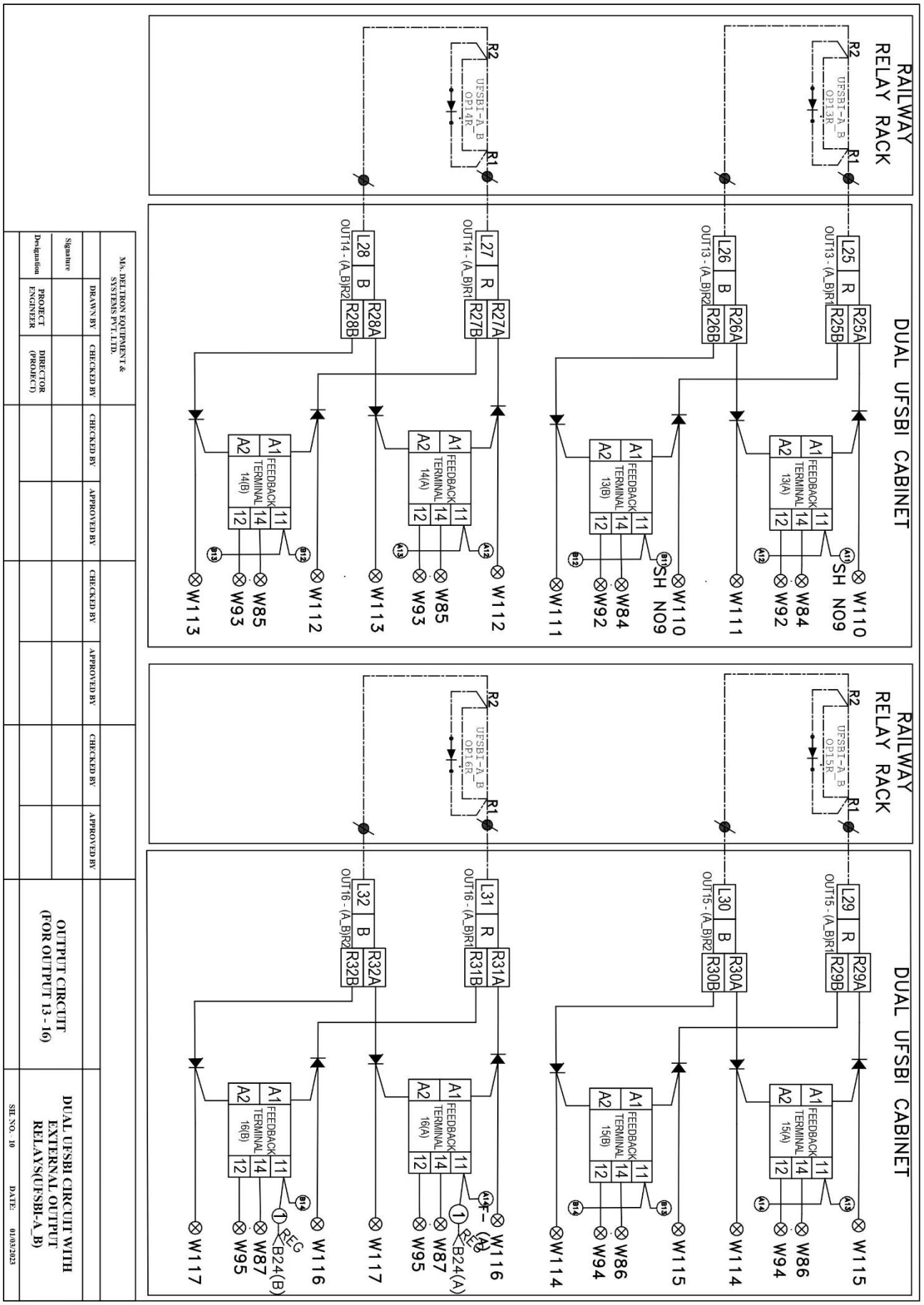

RAILWAY RELAY RACK
DUAL UFSBI CABINET
N24
REG
From -ve BUS BAR
SH.NO.-3
W1
W63
SH.NO.-3
REG
B24
From +ve BUS BAR
L1 R1
REG - P1
A
IN 1 - B
L2 R2 W2
IN 1' B L3 R3 W10
IN 2- B L4 R4 W3
IN 2' B L5 R5 W11
IN 3- B L6 R6 W4
IN 3' B L7 R7 W12
IN 4 - B L8 R8 W5
IN 4' B L9 R9 W13
IN 5 - B L10 R10 W6
IN 5' - B L11 R11 W14
IN 6 - B L12 R12 W7
IN 6' - B L13 R13 W15
IN 7 - B L14 R14 W8
IN 7' - B L15 R15 W16
IN 8 - B L16 R16 W9
IN 8' - B L17 R17 W17
UFSBI-B IN1R
UFSBI-B IN1R
UFSBI-B IN2R
UFSBI-B IN2R
UFSBI-B IN3R
UFSBI-B IN3R
UFSBI-B IN4R
UFSBI-B IN4R
UFSBI-B IN5R
UFSBI-B IN5R
UFSBI-B IN6R
UFSBI-B IN6R
UFSBI-B IN7R
UFSBI-B IN7R
UFSBI-B IN8R
UFSBI-B IN8R
UFSBI-B IN8R
B
RAILWAY RELAY RACK
DUAL UFSBI CABINET
UFSBI-B IN9R
UFSBI-B IN9R
UFSBI-B IN10R
UFSBI-B IN10R
UFSBI-B IN11R
UFSBI-B IN11R
UFSBI-B IN12R
UFSBI-B IN12R
UFSBI-B IN13R
UFSBI-B IN13R
UFSBI-B IN14R
UFSBI-B IN14R
UFSBI-B IN15R
UFSBI-B IN15R
UFSBI-B IN16R
UFSBI-B IN16R
UFSBI-B IN16R
B
L18 R18 W64
IN 9 - B
L19 R19 W72
IN 9' - B
L20 R20 W65
IN 10 - B
L21 R21 W73
IN 10' - B
L22 R22 W66
IN 11 - B
L23 R23 W74
IN 11' - B
L24 R24 W67
IN 12 - B
L25 R25 W75
IN 12' - B
L26 R26 W68
IN 13 - B
L27 R27 W76
IN 13' - B
L28 R28 W69
IN 14 - B
L29 R29 W77
IN 14' - B
L30 R30 W70
IN 15 - B
L31 R31 W78
IN 15' - B
L32 R32 W71
IN 16 - B
L33 R33 W79
IN 16' - B
L34 R34
A
From +ve BUS BAR
REG
B24(F)
REG - P2
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
PROJECT ENGINEER
DIRECTOR (PROJECT)
Signature
Designation
INPUT COMPLEMENTARY CIRCUIT
DUAL UFSBI CIRCUIT WITH EXTERNAL INPUT RELAYS UFSBI-B
SH. NO. - 6
DATE: 01/03/2023



M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.		DRAWN BY	CHECKED BY	CHECKED BY	APPROVED BY	CHECKED BY	APPROVED BY
Signature							
Designation	PROJECT ENGINEER	DIRECTOR (PROJECT)					
OUTPUT DRIVE CIRCUIT (FOR OUTPUT 1 - 4)							
DUAL UFSBI CIRCUIT WITH EXTERNAL OUTPUT RELAYS(UFSBI-A_B)							
SH. NO. - 7		DATE: 01/03/2023					

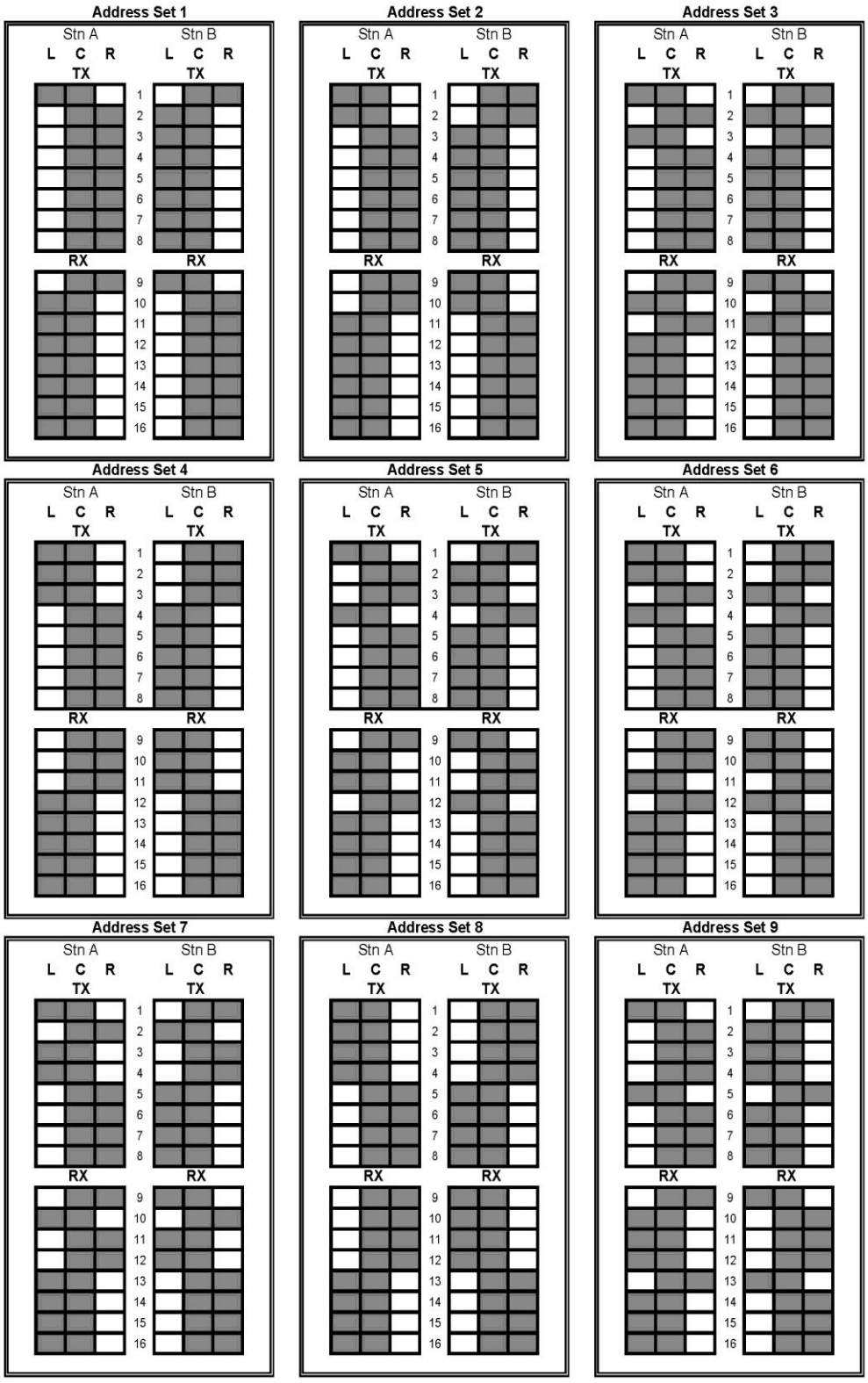

RAILWAY RELAY RACK
DUAL UFSBI CABINET
UFSBI-A_B OP5R
UFSBI-A_B OP6R
UFSBI-A_B OP7R
UFSBI-A_B OP8R
R1
R2
L9 R R9A R9B
OUT5 - (A_B)R1
L10 B R10A R10B
OUT5 - (A_B)R2
L11 R R11A R11B
OUT6 - (A_B)R1
L12 B R12A R12B
OUT6 - (A_B)R2
L13 R R13A R13B
OUT7 - (A_B)R1
L14 B R14A R14B
OUT7 - (A_B)R2
L15 R R15A R15B
OUT8 - (A_B)R1
L16 B R16A R16B
OUT8 - (A_B)R2
A1 A2 FEEDBACK TERMINAL 5(A) 11 14 12
A1 A2 FEEDBACK TERMINAL 5(B) 11 14 12
A1 A2 FEEDBACK TERMINAL 6(A) 11 14 12
A1 A2 FEEDBACK TERMINAL 6(B) 11 14 12
A1 A2 FEEDBACK TERMINAL 7(A) 11 14 12
A1 A2 FEEDBACK TERMINAL 7(B) 11 14 12
A1 A2 FEEDBACK TERMINAL 8(A) 11 14 12
A1 A2 FEEDBACK TERMINAL 8(B) 11 14 12
SH NO7
SH NO9
W55 W56 W22 W30 W57 W58 W23 W31
W59 W60 W24 W32 W61 W62 W25 W33
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
Signature
Designation
PROJECT ENGINEER
DIRECTOR (PROJECT)
OUTPUT CIRCUIT (FOR OUTPUT 5 - 8)
DUAL UFSBI CIRCUIT WITH EXTERNAL OUTPUT RELAYS(UFSBI-A_B)
SH. NO. - 8
DATE: 01/03/2023


RAILWAY RELAY RACK
DUAL UFSBI CABINET
UFSBI-A_B OP9R
UFSBI-A_B OP10R
UFSBI-A_B OP11R
UFSBI-A_B OP12R
R1
R2
L17 R R17A R17B OUT9 - (A_B)R1
L18 B R18A R18B OUT9 - (A_B)R2
L19 R R19A R19B OUT10 - (A_B)R1
L20 B R20A R20B OUT10 - (A_B)R2
L21 R R21A R21B OUT11 - (A_B)R1
L22 B R22A R22B OUT11 - (A_B)R2
L23 R R23A R23B OUT12 - (A_B)R1
L24 B R24A R24B OUT12 - (A_B)R2
A1 FEEDBACK TERMINAL 9(A) 11 14 12 A7 A8
A1 FEEDBACK TERMINAL 9(B) 11 14 12 B7 B8
A1 FEEDBACK TERMINAL 10(A) 11 14 12 A9 A10
A1 FEEDBACK TERMINAL 10(B) 11 14 12 B9 B10
A1 FEEDBACK TERMINAL 11(A) 11 14 12 A9 A10
A1 FEEDBACK TERMINAL 11(B) 11 14 12 B9 B10
A1 FEEDBACK TERMINAL 12(A) 11 14 12 A10 A11
A1 FEEDBACK TERMINAL 12(B) 11 14 12 B10 B11
W102 SH NO8 W80 W88 W103 W102 W104 W81 W89 W105 W104
W106 W82 W90 W107 W106 W108 W83 W91 SH NO10 W109 W108
Ms. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
PROJECT ENGINEER
DIRECTOR (PROJECT)
Signature
Designation
OUTPUT CIRCUIT (FOR OUTPUT 9 - 12)
DUAL UFSBI CIRCUIT WITH EXTERNAL OUTPUT RELAYS(UFSBI-A_B)
SH. NO. - 9
DATE: 01/03/2023


RAILWAY RELAY RACK
DUAL UFSBI CABINET
UFSBI-A_B OP13R
UFSBI-A_B OP14R
UFSBI-A_B OP15R
UFSBI-A_B OP16R
OUT13 - (A_B)R1
OUT13 - (A_B)R2
OUT14 - (A_B)R1
OUT14 - (A_B)R2
OUT15 - (A_B)R1
OUT15 - (A_B)R2
OUT16 - (A_B)R1
OUT16 - (A_B)R2
L25 R R25A R25B
L26 B R26A R26B
L27 R R27A R27B
L28 B R28A R28B
L29 R R29A R29B
L30 B R30A R30B
L31 R R31A R31B
L32 B R32A R32B
A1 FEEDBACK TERMINAL 13(A) A2 11 14 12
A1 FEEDBACK TERMINAL 13(B) A2 11 14 12
A1 FEEDBACK TERMINAL 14(A) A2 11 14 12
A1 FEEDBACK TERMINAL 14(B) A2 11 14 12
A1 FEEDBACK TERMINAL 15(A) A2 11 14 12
A1 FEEDBACK TERMINAL 15(B) A2 11 14 12
A1 FEEDBACK TERMINAL 16(A) A2 11 14 12
A1 FEEDBACK TERMINAL 16(B) A2 11 14 12
SH NO9
SH NO9
W110
W111
W112
W113
W84
W85
W86
W87
W92
W93
W94
W95
W114
W115
W116
W117
B24(A)
B24(B)
REG
REG
M/s. DELTRON EQUIPMENT & SYSTEMS PVT. LTD.
DRAWN BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
CHECKED BY
APPROVED BY
Signature
Designation
PROJECT ENGINEER
DIRECTOR (PROJECT)
OUTPUT CIRCUIT (FOR OUTPUT 13 - 16)
DUAL UFSBI CIRCUIT WITH EXTERNAL OUTPUT RELAYS(UFSBI-A_B)
SH. NO. 10
DATE: 01/03/2023

ANNNEXURE - A

ADDRESS CONFIGURATION JUMPERS



ANNEXURE – B

8 Error code list & Recommended actions for Block Working With UFSBI & DAC in case of Faults/Errors

NOTE: BEFORE TAKING OUT OR INSERTING A CARD, ALWAYS TURN-OFF THE POWER SUPPLY

Codes	Failure Cause	Recommended Actions
00	NORMAL MODE.	**a)** Flashing '00' indicates that the system is healthy & functioning properly. **b)** If this code becomes steady in certain CPU and an error code of '37', '38' or '39' appears (according to the stuck CPU) on the other CPU's try "RESETTING" the system as stated in item no. **II.16**. **c)** In case the problem persists change the CPU showing the steady code.
01	Output Latch 1 Read-back bad	**a) If the code is displayed simultaneously in more than 1 CPU:** Then check if the CCC card is inserted properly in the slot. If the problem still persists replace the CCC card. **b) If the code comes on a single CPU:** i) First swap the faulty CPU with another slot. ii) If the code shifts with the CPU to the new slot, change the CPU card else change the Output card
02	Output Latch 2 Read-back bad	
05	UFSBI source address mismatch in receive message	Check Address jumpers of both mother cards of connected UFSBI units for their correspondence refer page 33. If the fault is in one CPU card only (unlikely) replace the CPU card.
06	UFSBI destination address mismatch in receive message	Check Address jumpers of both mother cards of connected UFSBI units for their correspondence refer page 33. If the fault is in one CPU card only (unlikely) replace the CPU card.
07	TXENABLE-A/B/C signal produced by Inter-block data selector logic in CCC not matching with Inter-block phase.	If this occurs in all the CPUs, change the CCC Card. This can also happen when the UFSBI is working in 2/2 mode and a further failure occurs. This is not a serious problem and will go up on "RESET".
08	CPU failed to transmit	**a)** Swap the CPU with another slot, if the problem shifts with the CPU , then change the CPU card. **b)** Check the system , if the fault persists in the same slot, change the CCC card.
0A	Clear input to U9 low	
0B(Ob)	Ready to accept 'start' command after POST	**a)** Press "BI-ON" button to start the system within 30 sec. If the button is not pressed in time then all the three CPUs will display "99" code and go to shutdown. To recover from this problem the power supply is to be turned off and the on. After the POST process all the CPUs will display "Ob" again. **b)** In case any one CPU is showing steady 0B, while others are running with 37, 38 or 39 , try "RESETTING" the system as stated in item no. **II.16**.
0C	PS monitor test in progress in POST	Wait for all CPUs to display "Ob".

<table>
<tr><td>10</td><td>IN1 complementary failure
(Ckt ref. W2 & W10)</td><td rowspan="12">Manually RESET the system following the same process as stated in item no. II.15. If the problem persists then
i) In case the Error Code is appearing in 1 of the 3 CPU’s,
a) Swap the Input Card 1 with another Input Card 1 for Error Codes “10” to “1F”, observe the outcome
b) Swap the Input Card 2 with another Input Card 2 for Error Codes “20” to “2F”, observe the outcome.
In case (I)-a,b fails to solve the problem,
c) Change Input Card 1 for Error Codes “10” to “1F”
d) Change Input Card 2 for Error Codes “20” to “2F”
Manually RESET the system and observe its operation
ii) If the Error codes are appearing in at least 2 of the 3 CPU’s simultaneously then check voltages at the respective relay contacts and wago terminals as per circuit diagram.
iii) If the problem still persists check the flat cable connections between the wago board and motherboard Manually RESET the system and observe its operation
iv) In case the error still persists, replace-
a) Input Card 1 for Error Codes “10” to “1F”
b) Input Card 2 for Error Codes “20” to “2F”
Manually RESET the system and observe its operation</td></tr>
<tr><td>11</td><td>IN2 complementary failure
(Ckt ref. W3 & W11)</td></tr>
<tr><td>12</td><td>IN3 complementary failure
(Ckt ref. W4 & W12)</td></tr>
<tr><td>13</td><td>IN4 complementary failure
(Ckt ref. W5 & W13)</td></tr>
<tr><td>14</td><td>IN5 complementary failure
(Ckt ref. W6 & W14)</td></tr>
<tr><td>15</td><td>IN6 complementary failure
(Ckt ref. W7 & W15)</td></tr>
<tr><td>16</td><td>IN7 complementary failure
(Ckt ref. W8 & W16)</td></tr>
<tr><td>17</td><td>IN8 complementary failure
(Ckt ref. W9 & W17)</td></tr>
<tr><td>18</td><td>OUT1 complementary failure
(Ckt ref. W18 & W26)</td></tr>
<tr><td>19</td><td>OUT2 complementary failure
(Ckt ref. W19 & W27)</td></tr>
<tr><td>1A</td><td>OUT3 complementary failure
(Ckt ref. W20 & W28)</td></tr>
<tr><td>1B</td><td>OUT4 complementary failure
(Ckt ref. W21 & W29)</td></tr>
<tr><td>1C</td><td>OUT5 complementary failure
(Ckt ref. W22 & W30)</td></tr>
<tr><td>1D</td><td>OUT6 complementary failure
(Ckt ref. W23 & W31)</td><td rowspan="12">Manually RESET the system following the same process as stated in item no. II.15. If the problem persists then
In case the Error Code is appearing in 1 of the 3 CPU’s,
a) Swap the Input Card 1 with another Input Card 1 for Error Codes “10” to “1F”, observe the outcome
b) Swap the Input Card 2 with another Input Card 2 for Error Codes “20” to “2F”, observe the outcome.
In case (I)-a,b fails to solve the problem,
c) Change Input Card 1 for Error Codes “10” to “1F”
d) Change Input Card 2 for Error Codes “20” to “2F”
Manually RESET the system and observe its operation
If the Error codes are appearing in at least 2 of the 3 CPU’s simultaneously then check voltages at the respective relay contacts and wago terminals as per circuit diagram for the inputs. Manually RESET the system and observe its operation</td></tr>
<tr><td>1E</td><td>OUT7 complementary failure
(Ckt ref. W24 & W32)</td></tr>
<tr><td>'1 ' (1F)</td><td>OUT8 complementary failure
(Ckt ref. W25 & W33)</td></tr>
<tr><td>20</td><td>IN9 complementary failure
(Ckt ref. W64 & W72)</td></tr>
<tr><td>21</td><td>IN10 complementary failure
(Ckt ref. W65 & W73)</td></tr>
<tr><td>22</td><td>IN11 complementary failure
(Ckt ref. W66 & W74)</td></tr>
<tr><td>23</td><td>IN12 complementary failure
(Ckt ref. W67 & W75)</td></tr>
<tr><td>24</td><td>IN13 complementary failure
(Ckt ref. W68 & W76)</td></tr>
<tr><td>25</td><td>IN14 complementary failure
(Ckt ref. W69 & W77)</td></tr>
<tr><td>26</td><td>IN15 complementary failure
(Ckt ref. W70 & W78)</td></tr>
<tr><td>27</td><td>IN16 complementary failure
(Ckt ref. W71 & W79)</td></tr>
<tr><td>28</td><td>OUT9 complementary failure
(Ckt ref. W80 & W88)</td></tr>
<tr><td>29</td><td>OUT10 complementary failure
(Ckt ref. W81 & W89)</td></tr>
<tr><td>2A</td><td>OUT11 complementary failure
(Ckt ref. W82 & W90)</td></tr>
</table>

2B	OUT12 complementary failure (Ckt ref. W83 & W91)	i) If the problem still persists check the flat cable connections between the wago board and motherboard. Manually RESET the system and observe its operation **ii) In case the error still persists, replace-** a)Input Card 1 for Error Codes "10" to "1F" b) Input Card 2 for Error Codes "20" to "2F" Manually RESET the system and observe its operation
2C	OUT13 complementary failure (Ckt ref. W84 & W91)	
2D	OUT14 complementary failure (Ckt ref. W85 & W92)	
2E	OUT15 complementary failure (Ckt ref. W86 & W93)	
'2 ' (2F)	OUT16 complementary failure (Ckt ref. W87 & W94)	
30	BIPR1 complementary failure	Take similar steps as in the case for other relays.
31	BIPR2complementary failure	
33	Link Fail (SSB mode)	**If the error code appears in any one of the CPU card:** i) Swap it with other slot. If the error shifts with the card Change the CPU card. **If the error code appears in any one of the CPU card:** i) If the problem still persists, Switch off the Modem , and then restart it after 60s. ii) If the problem still persists perform Power-On Reset of the System and observe its operation
34	RSSB mode	This mode indicates that the UFSBI on the other side is not receiving data. Try by checking the channel, modem and communication in that order as stated for error code '33'. Ensure that the other side System is working and showing error code '33' only.
37	CPU A bad	i) Change corresponding CPU Cards in which the static error code is showing. Manually RESET the system and observe its operation. ii) If this indication is on all the CPU cards then change the CCC (Communication) Card. Manually RESET the system and observe its operation
38	CPU B bad	
39	CPU C bad	
3A	Inter-processor communication channel failure (common mode)	If occurs in all the CPUs, change the communication card. Manually RESET the system and observe its operation
40	OUT1 forced pickup	Manually RESET the system following the same process as stated in item no. II.15. If the problem persists then For codes "40" to "4F" check the corresponding relays as follows i) Check if the relay is properly plugged and the retaining clip is place correctly. Also ensure that all its receptacles are rightly placed and locked in the plug board. Manually RESET the system and observe its operation. ii) Check the corresponding relays to see if the front contacts somehow got voltage or back contacts got broken or if the relay has got picked up out of sequence by some stray feed given externally. Manually RESET the system and observe its operation. iii) Check the wago terminals for unwanted shorting between terminals other than those showed in circuit. In case any such short circuits found please remove the same. Manually RESET the system and observe its operation.
41	OUT2 forced pickup	
42	OUT3 forced pickup	
43	OUT4 forced pickup	
44	OUT5 forced pickup	
45	OUT6 forced pickup	
46	OUT7 forced pickup	
47	OUT8 forced pickup	
48	OUT9 forced pickup	Manually RESET the system following the same process as stated in item no. II.15. If the problem
49	OUT10 forced pickup	

4A	OUT11 forced pickup	persists then For codes "40" to "4F" check the corresponding relays as follows iv) Check if the relay is properly plugged and the retaining clip is place correctly. Also ensure that all its receptacles are rightly placed and locked in the plug board. Manually RESET the system and observe its operation. v) Check the corresponding relays to see if the front contacts somehow got voltage or back contacts got broken or if the relay has got picked up out of sequence by some stray feed given externally. Manually RESET the system and observe its operation. vi) Check the wago terminals for unwanted shorting between terminals other than those showed in circuit. In case any such short circuits found please remove the same. Manually RESET the system and observe its operation.
4B	OUT12 forced pickup	
4C	OUT13 forced pickup	
4D	OUT14 forced pickup	
4E	OUT15 forced pickup	
4F	OUT16 forced pickup	
50	IN1 jitter	Jittery contacts of the relay may occur when a particular relay does not stabilize, i.e. it 'chatters'. This may happen due to <u>low coil voltage</u>, <u>faulty receptacles</u> (coil or contacts) or <u>improper plugging of the relays</u> without retaining clips. The following actions are suggested: a) Check the setting in the plug board for proper plugging b) Check firmness of the contacts and all connections from output connector coil (for output relays). c) Check coil and contact voltage for each input paths from the circuit. Try removing and re-plugging each relay in the circuit path separately ensuring that it is fitted firmly to the plug board and the retaining clip is in the right place d) For output relays, try to measure the coil voltage at the corresponding wago terminal as well as the relay coil R1-R2. Note that this voltage is available for less than ½ sec, so using an analog voltmeter is preferred. It is advisable to try by changing the corresponding output card. <u>Manually RESET the system and observe its operation.</u>
51	IN2 jitter	
52	IN3 jitter	
53	IN4 jitter	
54	IN5 jitter	
55	IN6 jitter	
56	IN7 jitter	
57	IN8 jitter	
58	OUT1 jitter	
59	OUT2 jitter	
5A	OUT3 jitter	
5B	OUT4 jitter	
5C	OUT5 jitter	
5D	OUT6 jitter	
5E	OUT7 jitter	
5F	OUT8 jitter	
60	IN9 jitter	
61	IN10 jitter	Jittery contacts of the relay may occur when a particular relay does not stabilize, i.e. it 'chatters'. This may happen due to <u>low coil voltage</u>, <u>faulty receptacles</u> (coil or contacts) or <u>improper plugging of the relays</u> without retaining clips. The following actions are suggested: a) Check the setting in the plug board for proper plugging b) Check firmness of the contacts and all connections from output connector coil (for output relays). c) Check coil and contact voltage for each input paths from the circuit. Try removing and re-plugging each relay in the circuit path separately ensuring that it is fitted firmly to the plug board and the retaining clip is in the right place
62	IN11 jitter	
63	IN12 jitter	
64	IN13 jitter	
65	IN14 jitter	
66	IN15 jitter	
67	IN16 jitter	
68	OUT9 jitter	
69	OUT10 jitter	
6A	OUT11 jitter	
6B	OUT12 jitter	
6C	OUT13 jitter	
6D	OUT14 jitter	
6E	OUT15 jitter	
6F	OUT16 jitter	

70	BIPR1 jitter	d) For output relays, try to measure the coil voltage at the corresponding wago terminal as well as the relay coil R1-R2. Note that this voltage is available for less than ½ sec, so using an analog voltmeter is preferred. It is advisable to try by changing the corresponding output card. Manually RESET the system and observe its operation.
71	BIPR2 jitter	
73	Shut down relay phase generator failure (phase not changing within 30 minutes)	If this indication is on a single CPU card change the CPU card. If all the 3 CPUs show this code then change the communication card.
75	Timer2 input bad	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card.
78	Data bus check failed	
79	EPROM Checksum failed	
7A	BIPR1 input to GAL stuck at low	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the problem still remains change CCC Card. When all CPUs show the code, change CCC.
7B	BIPR2 input to GAL stuck at low	
7C	BIPR1 command output not matching with shutdown relay phase.	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card.
7D	BIPR1 command output not matching with shutdown relay phase.	
80	OUT1 failed to pick up	Check the LEDs in the output card. If LED corresponding to that relay does not glow then change output card, else check the relay connections for corresponding relays following the circuit diagrams. **Note:** Indications in the output card – Indication 1, 2, and 3 from the top are indications for CPU-C, CPU-B and CPU-A respectively.
81	OUT2 failed to pick up	
82	OUT3 failed to pick up	
83	OUT4 failed to pick up	
84	OUT5 failed to pick up	
85	OUT6 failed to pick up	
86	OUT7 failed to pick up	
87	OUT8 failed to pick up	
88	OUT9 failed to pick up	
89	OUT10 failed to pick up	
8A	OUT11 failed to pick up	
8B	OUT12 failed to pick up	
8C	OUT13 failed to pick up	
8D	OUT14 failed to pick up	
8E	OUT15 failed to pick up	Same as codes “80 to 8D”.
8F	OUT16 failed to pick up	
90	BIPR1 or BIPR2 or both picked up before POST initialization	At power-on, before performing the RESET operation by pressing “BI-OK” button, the relays should not pick-up and the voltage at the contacts should correspond. **a) If the error code appears on a single CPU:** Check whether Input Card 1 corresponding to that CPU are plugged-in properly. **b) If all the 3 CPU show the same error code then:** Check the contacts of BIPR1 & BIPR2 and see that the retaining clip is at its right position. Check up the voltage
92	UFSBI address bad	Check address jumpers at the back panel and see if they are connected tightly and in proper place as instructed.
93	Output voter (GAL) differential output complementary mismatch (run-time).	**a) If the fault comes in single CPU:** i) Swap the CPU from the slot showing the error code with another . If the error shifts with the CPU, then change the CPU, and observe the outcome

		ii) If the error does not shift with the faulty card, then change the Output cards , one by one and observe the outcome. **b) If the fault occurs in more than 1 CPU:** Change the output cards one by one and observe the outcome.
95	GAL complementary mismatch in output card1 (POST checking)	Same as error code 93 but here change only Output Card 1.
96	GAL complementary mismatch in output card2 (POST checking)	Same as error code 93 but here change only Output Card 2.
99	'Start' not pressed within 30 sec. of power on.	RESET the system by turning the POWER-off and then ON and then pressing the RESET button and BI-OK button. 1. Observe that the feed for both BIPR1 & BIPR2 are established in the CCC Card (indicated by two LEDs at the bottom. Indication1 is for BIPR2 & Indication 2 is for BIPR1). If these two indications are missing than change CCC Card else, check the following: i) 24V output of DC-DC converter. ii) Check connector no. SN1 and CN4 (two pin connector with yellow wire). iii) Change the CCC Card. 2. If BIPR1 & BIPR2 feed are O.K, check terminal connections at the back of reset box.
A0	X-ACTIVE and X-ACTIVE/ signals found mismatched in WDT check.	**a) If the fault comes in single CPU:** i) Swap the CPU from the slot showing the error code with another . If the error shifts with the CPU, then change the CPU, and observe the outcome ii) If the error does not shift with the faulty card, then change CCC card and observe the outcome. **b) If the fault occurs in more than 1 CPU:** Change the CCC card and observe the outcome.
A1	Active signal bad detected in wdt check (stuck_at_high)	
A2	OUTEN signal stuck_at_high	
A3	Output latches detected non-zero during in wdt checking	
A4	Active signal bad in wdt2_check (stuck_at_high)	
A5	IPC phase sequence bad	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change CCC Card.
A6	IPC phase sequence bad	
A7	IPC phase sequence bad	
A8	IPC phase sequence bad	
AA	Relay check in progress in POST / output latch1 detected bad in zero test	This is not a fault code when displayed during the POST mode. But during the functioning of the system if this code somehow appears this is treated as a fault. **a) If the fault comes in single CPU:** i) Swap the CPU from the slot showing the error code with another . If the error shifts with the CPU, then change the CPU, and observe the outcome ii) If the error does not shift with the faulty card, then change Output card 1 and observe the outcome. **b) If the fault occurs in more than 1 CPU:** Change the Output card 1 and observe the outcome.
AB	Latch2 bad in zero test	**a) If the fault comes in single CPU:** i) Swap the CPU from the slot showing the error code with another . If the error shifts with the CPU, then change the CPU, and observe the outcome ii) If the error does not shift with the faulty card, then change Output card 2 and observe the outcome.

		b) If the fault occurs in more than 1 CPU: Change the Output card 2 and observe the outcome.
B0	Stack check failed	Perform Power-On-Reset. If the failure remains or recurs after that change the CPU card showing the Error code.
B1	Rapid address check fail	
B4	Register check fail	
B5	BIPR2 (LFR) relay picked up out of phase	**a) If the fault comes in single CPU:** e) Swap the Input card from the slot showing the error code with another working slot. ii) If the error does not shift with the faulty card, then change CPU card and observe the outcome. **b) If the fault occurs in more than 1 CPU:** Change the CCC and observe the outcome.
B6	BIPR1 relay picked up out of phase	
B7	Backup check fail	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change CCC Card.
B8	Neighbour shutdown fail for A	
B9	Neighbour shutdown fail for B	
BA	Neighbour shutdown fail for C	
BD	BIPR1 dropped out of phase	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the problem still remains change CCC Card.
BE	BIPR2 (LFR) dropped out of phase	
C1	IPC phase timer out of range/not working	
C6	Sustained mismatch between self parallel input and neighbour parallel input	
C9	Data bus error	
CA	Inter block phase sequence error	
D0	GAL 1 illegal high	Output Card1 *Manually RESET the system following the same process as stated in item no. II.15. If the problem persists then change*
D1	GAL 2 illegal high	
D2	GAL 3 illegal high	
D3	GAL 4 illegal high	
D4	GAL 5 illegal high	
D5	GAL 6 illegal high	
D6	GAL 7 illegal high	
D7	GAL 8 illegal high	Output Card 2 *Manually RESET the system following the same process as stated in item no. II.15. If the problem persists then change*
D8	GAL 9 illegal high	
D9	GAL 10 illegal high	
DA	GAL 11 illegal high	
DB	GAL 12 illegal high	
DC	GAL 13 illegal high	
DD	GAL 14 illegal high	
DE	GAL 15 illegal high	
DF	GAL 16 illegal high	
E0	TXAEN signal from CPU improper (stuck at high/low)	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the problem still persists change CCC.
E1	TXBEN signal from CPU improper (stuck at high/low)	
E2	TXCEN signal from CPU improper (stuck at high/low)	
E8	GAL output complementary mismatch for BIPR1	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the problem still remains change CCC Card.
E9	GAL output complementary mismatch for BIPR2	
EB	Watchdog test by pulse withdrawal failed	

EC	PULSEN signal stuck at high (in wdt check)	
ED	BIPR2 feed to gal not low in BIPR1 phase	
F1	Configuration failure (output card1 absent)	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the code comes in more than 1 CPU, check that all the cards are mated correctly to motherboard
F2	Configuration failure (output card2 absent)	
F5	CPU_ID failure	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card.
F8	FRSNESS pulse stuck at high	
F9	Vcc monitoring latch Q output stuck at 0 (POST checking)	
FA	BIPR gal inputs not going low during zero test (any of BIPR1 and BIPR2 or both)	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change CCC Card.
FB	BIPR1 or BIPR2 feed from U28 stuck at high in zero test/	
FC	ST pulse stuck at low	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card.
FD	FRSNESS pulse stuck at high	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card. If the problem still remains change CCC Card.
FE	ST pulse stuck at high	RESET the system by pressing RESET button and then BI-OK button in a sequential manner. If problem persists change corresponding CPU card.

NOTE: AFTER EACH PROCESS, PERFORM THE RESET OPERATION TO RESTART THE MUX.