MEDHA

Driver's Manual

25 kV AC Three Phase Propulsion & Other Equipment For TRAIN SET

Type MAE675UV2 - TRAIN SET

IM-418 rev 00

MEDHA SERVO DRIVES PVT. LTD.

Document No: IM - 418 rev 00

Released: January, 2023.

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Chapter 1

INTRODUCTION

Conventional EMUs use DC traction motors which are directly connected to the rectifier. The current trend for last decade is to move from DC traction motors to AC traction motors, which offer better control, better reliability and are less prone to breakdown and repair.

In this regard, RDSO has released specification no. **RDSO /PE /SPEC /EMU /0196-2019 (REV.0)** for producing 3-phase drive propulsion equipment for TrainSet. ICF proposed to design Trainset with 50% motoring with all power components underslung. This trainset has coach with sitting arrangement. Coach in configuration is of different type such as driving AC chair car, AC chair car and executive AC chair car.

1.1 List of Abbreviations used

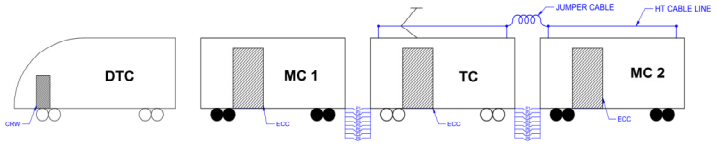
Acronym	Description
AC	Alternating Current
ACU	Auxiliary Converter Unit
ADC	Analog to Digital Converter
AIP	Analog Input
ATC	Auxiliary Traction Converter
BC	Brake Cylinder
BCP	Brake Cylinder Pressure
BE	Braking Effort
CAN	Controlled Area Network
CCU	Coach Control Unit
DC	Direct Current
DCS	Driver Control Switch
DE	Driving End
DIP	Digital Input
DOP	Digital Output
DPRAM	Dual Port Random Access Memory
DSP	Digital Signal Processor
DTC	Driving Trailer Coach
EBCU	Electronic Brake Control Unit
EBL	Emergency Brake Loop
ECN	Ethernet Consist Network
ED	Electro Dynamic
EEPROM	Electrically Erasable and Programmable Read Only Memory

Acronym	Description
EMU	Electrical Multiple Unit
EOL	Emergency Off Loop
EP	Electro Pneumatic
FDP	Fault Data Pack
HWTL	Hard Wired Train Line
ICF	Integral Coach Factory, Chennai
LED	Light Emitting Diode
MC	Motor Coach
MSDPL	Medha Servo Drives Pvt. Ltd.
PA PIS	Passenger Announcement and Passenger Information System
PWM	Pulse Width Modulation
RDSO	Research Development and Standards Organization
TC	Trailer Coach
TCMS	Train Control and Management System
TE	Tractive Effort
TM	Traction Motor
TSA	Traction System Austria
AWS	Auxiliary Warning System
LTC	Line and Traction Converter
LTCU	Line and Traction Converter Computer
MCU	Main Control Unit
NDE	Non Driving End
NDTC	Non Driving Trailer Coach
PCC	Passenger Comfort Computer
PS	Power Supply
RDM	Rescue Drive Mode
TCN	Train Communication Network
TIC	Traction Inverter Computer
USB	Universal Serial Bus
VCB	Vacuum Circuit Breaker
CCMS	Coach Control Monitoring System
TCAS	Train Collision Avoidance System

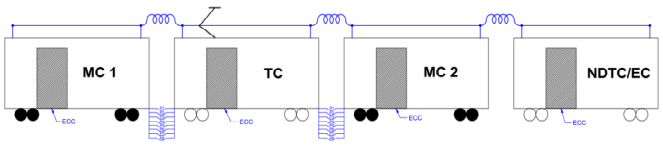
Chapter 2

SYSTEM OVERVIEW

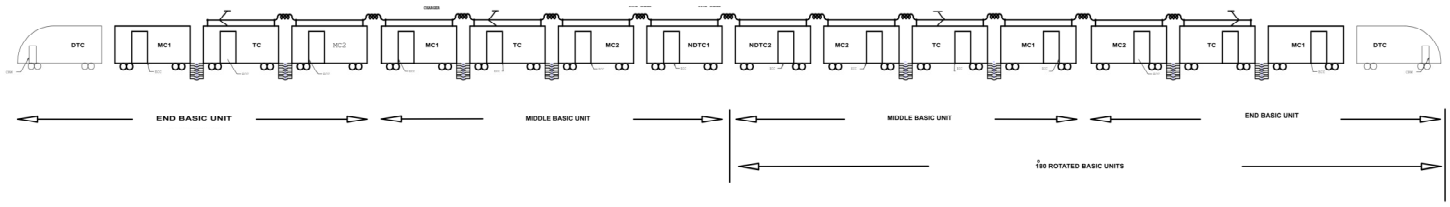
One basic unit of 4-car unit is the building block for Trainset rake formation. Each basic unit consists of one Driver Trailer Coach (DTC) at the end, two Motor Coaches (MC) and one Trailer Coach (TC). Each middle basic unit consists of Non driving Trailer Car (NDTC), two motor car (MC) and one Trailer Car (TC). Four such basic units are coupled together to form one rake of 16 cars:



END BASIC UNIT



MIDDLE BASIC UNIT



RAKE FORMATION

2.1 Driving Trailer Coach (DTC)

DTC is a non-powered vehicle with a driver cab at one end. The driver cab is furnished with a pre-fabricated driver desk. All driving operations are possible from this driver desk. Feedback from the system in all the coaches/basic units is available for viewing by motor man on the driver desk. In this regard, CCU aggregates the Information from all the coaches and a 10.4 " TFT driver display screen provides information to motor man. Further an illuminated indication panel is provided for important driving related information for quick viewing by motor man. Various gauges are also provided for viewing MR, BP, BC pressure. Motor man can also control the passenger information system from the driver desk DTC. Apart from the driver cab is called as passenger saloon area. Passenger saloon area is similar to trailer coach, except the space occupied by driver cab.

DTC also consists of battery box, battery charger and compressor which are mounted under-slung. Rest of the DTC apart from the driver cab is passenger saloon area which consists of pantry, RMPU control unit, mono block pump controller, CRW panel and various end wall panels. It is an air-conditioned coach. All passenger comfort related load are controlled by driver from driver cab.

2.2 Motor Coach (MC)

MC is a powered vehicle with one traction motor driving each axle. The motor coach consists Line and Traction Converter Unit (LTC) for each Bogie mounted under-slung. Also Brake chopper resister is mounted under-slung. Transformer secondary cable for both LTC unit from power transformer come from Trailer Coach through under-slung mounted IV Coupler. It also consists of passenger saloon area, pantry, RMPU, mono block pump controller, electrical cabinet and various end wall panels. It is air-conditioned coach. The passenger saloon area is similar to trailer coach.

2.3 Trailer Coach (TC)

TC is a non-powered vehicle with only a passenger saloon area. The passenger saloon area includes lights, fans, emergency lights, air handling unit (for ventilation), and passenger information system consisting of LED displays and speakers (for announcements). TC consists of a photograph, vacuum circuit breaker and HV isolator on roof. it also consists of auxiliary converter unit and power transformer mounted under-slung. Power to LTC units of both motor coaches is distributed from same power transformer.

2.4 Non Driving Trailer Coach (NDTC)

NDTC consists of passenger saloon area, pantry, RMPU, mono block pump controller, electrical cabinet and various End wall panels. It is a air-conditioned coach. Non Driving Trailer Coach (NDTC) is similar to DTC except driver related interface. It also consists of battery box, battery charger and compressor mounted under-slung. It also consists of passenger saloon area which consists of pantry, RMPU control unit, mono block pump controller, and various end wall panels. It is a air-conditioned coach.

viewing by motor man. Various gauges are also provided for viewing MR, BP, BC pressure. Motor man can also control the passenger information system from the driver desk DTC. Apart from the driver cab is called as passenger saloon area.

Passenger saloon area is similar to trailer coach, except the space occupied by driver cab.

Chapter 3

SAFETY FEATURES

3.1 Particulars of the Train

Table 3.1 gives the leading particulars of Train-Set, on which supplied equipment is fitted.

Track gauge	1,676 mm
Coach length over body	23,100 mm
Max. width over body side	3,240 mm
Maximum permissible axle load (any coach)	17.00 tonnes

Table 3.1

Table 3.2 gives data about Train-Set coach formation.

Number of Coaches in Basic Unit	4 per basic unit
Train formation	16 coaches
Maximum Service Speed	160 km/ hr
Maximum Test Speed	180 km/ hr
OHE Line Voltage	25kV AC, 50 Hz
Variations in OHE Line Supply	Normal variation: 19 kV to 27.5 kV Occasional max (cut-off): 30 kV Occasional min: 17 kV Cut off voltage: 16 kV Frequency variation: 48.5Hz to 51.5Hz

Table 3.2

Temperature Range	-10ºC to 50ºC Average Annual Ambient of 35ºC
Altitude	Coastal Area (Sea Level)
Rainfall	Very Heavy (up to 2500 mm during rainy season)
Water flooding	Max speed of 8 km/ h in water up to 203 mm above rail level with wave effect
Relative Humidity	Up to 98% during rainy season which last 5 months

Table 3.3

3.2 Train Propulsion Characteristics

3.2.1 With Axle Hung Fully Suspended Motor for Train-Set

Tractive effort and braking effort curves Based on the acceleration, deceleration and other requirements of the specification, the following tractive effort and braking effort curves are arrived. Below is the tractive effort and braking effort curve (electrical) Vs speed per MC of the Train-Set.

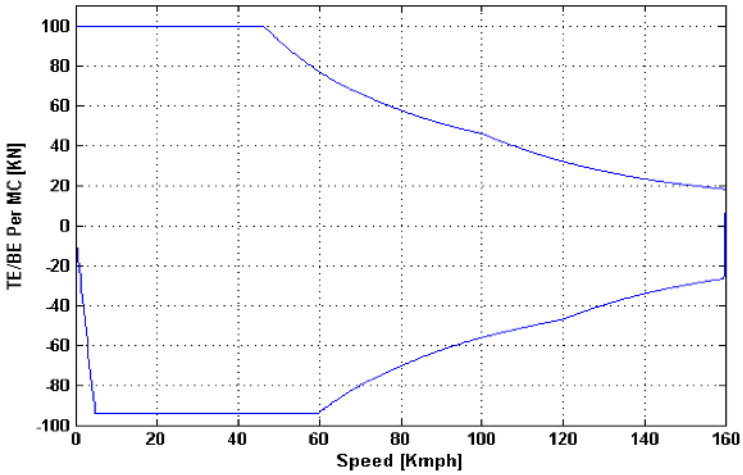


Fig 3.1 Tractive Effort Vs Speed curve

The braking effort of Train-Set is a total sum of electrical (regenerative) and electro-pneumatic braking efforts. Fig. 3.2 is the graph of Electrical (regenerative) braking effort and total braking effort (including Electro-pneumatic braking effort) along with TE. The difference between the two graphs is the electro-pneumatic braking effort that is required at different speeds.

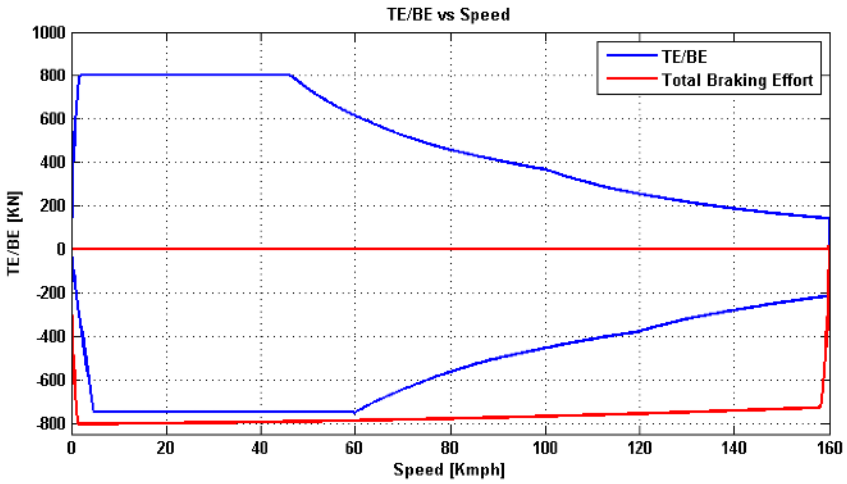


Fig 3.2 TE Vs Regenerative Braking Effort curve

Fig 3.2 TE & Regenerative Braking Effort and Total Braking Effort (including EP Brake) for maximum braking operation for 16-car rake

Chapter 4

DRIVER DESK LAYOUT EQUIPMENT

Driver Desk is provided in driver cab for user interface. All equipment such as switches, lamps, master controller, DDU, PIS interface which are required for driver interface are mounted on driver desk. Layout of equipment are given in below sections.

Driver's cab is for motor man and guard. The left-hand side of the driver's cab is the workstation for the motor man. The operation switches, lamps, gauges displays which are used motor man during driving are provided in front of motor man. The right-hand side is designed for the guard.

4.1 Driver Desk Overview

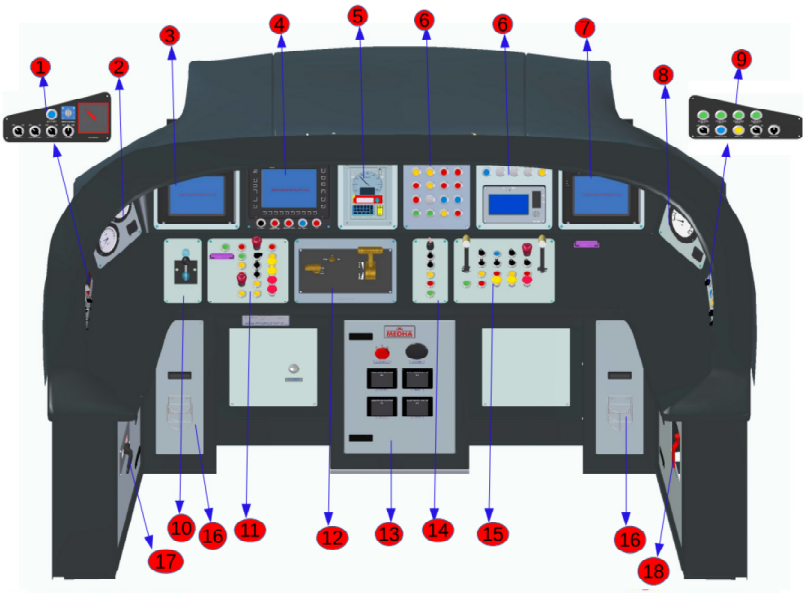


Fig. 4.0

4.1.1 Panel-1 DRIVER SWITCH PANEL

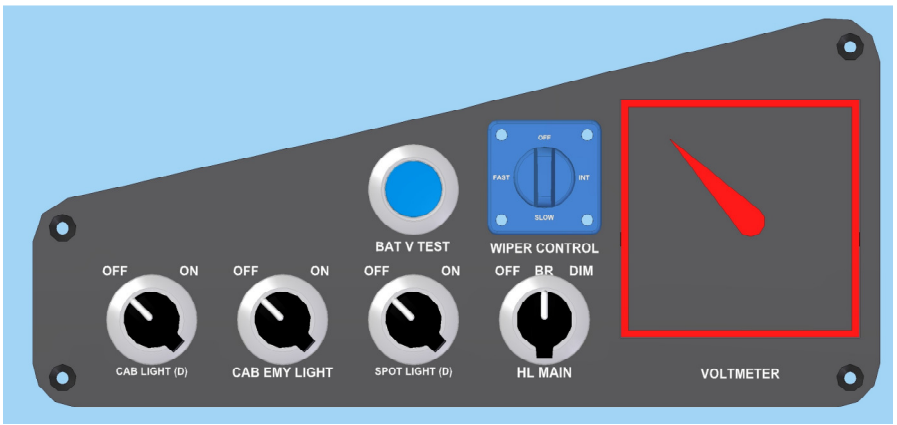


Fig. 4.1

4.1.2 Panel-2_ MR-BP Duplex Gauge and BC Gauge

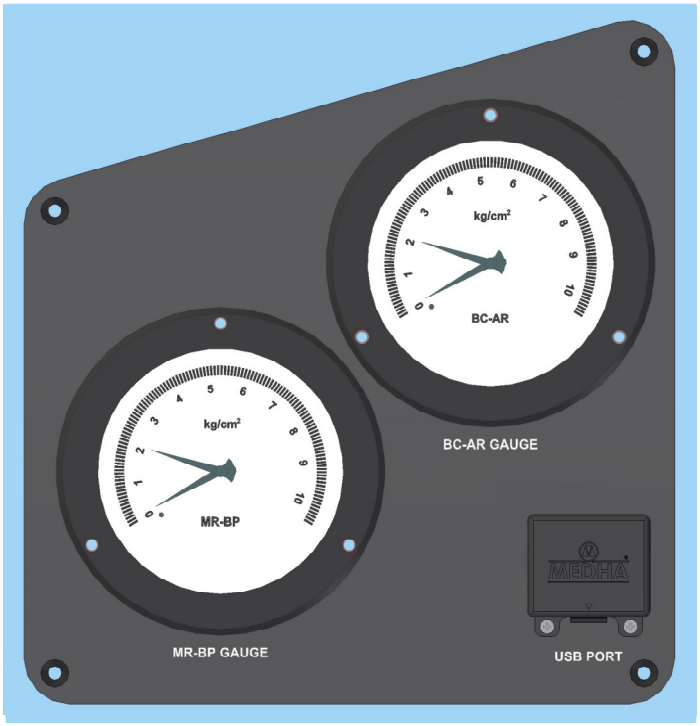


Fig. 4.2

4.1.3 Panel-3 TCMS Display Unit

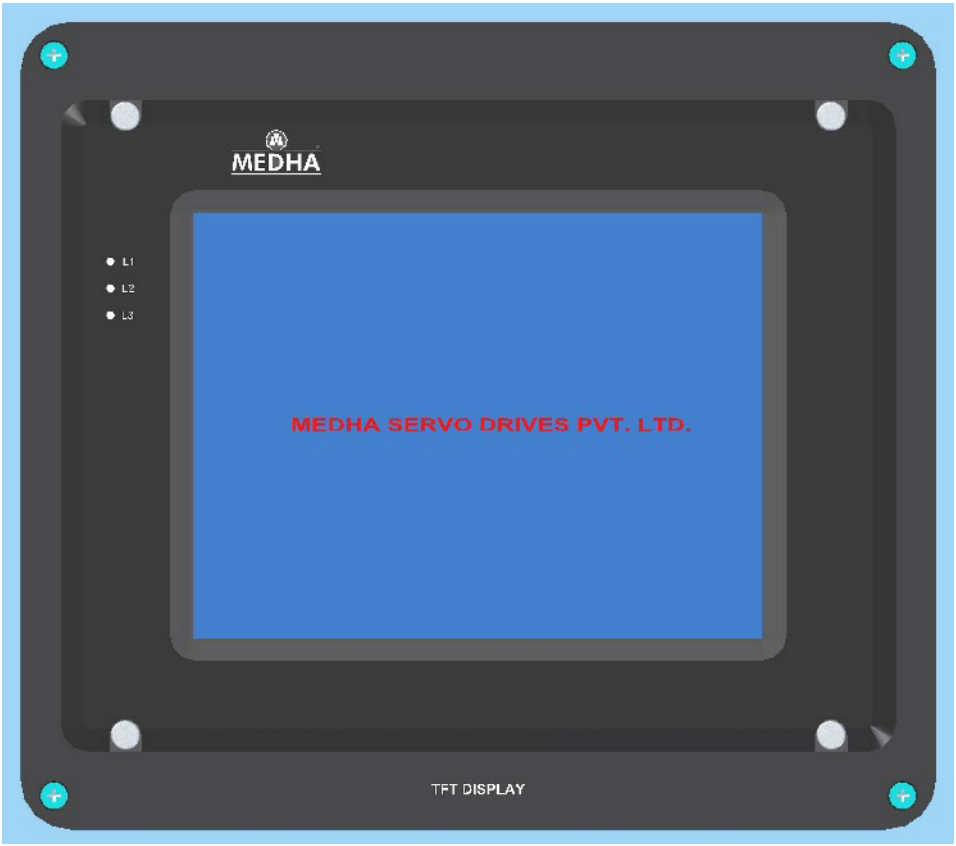


Fig. 4.3

4.1.4 Panel-4 TCAS Display Unit

Fig. 4.4

4.1.5 Panel-5 Speed Recorder cum Indicator

Fig. 4.5

4.1.6 Panel-6 Indication & PIS MCP Panel

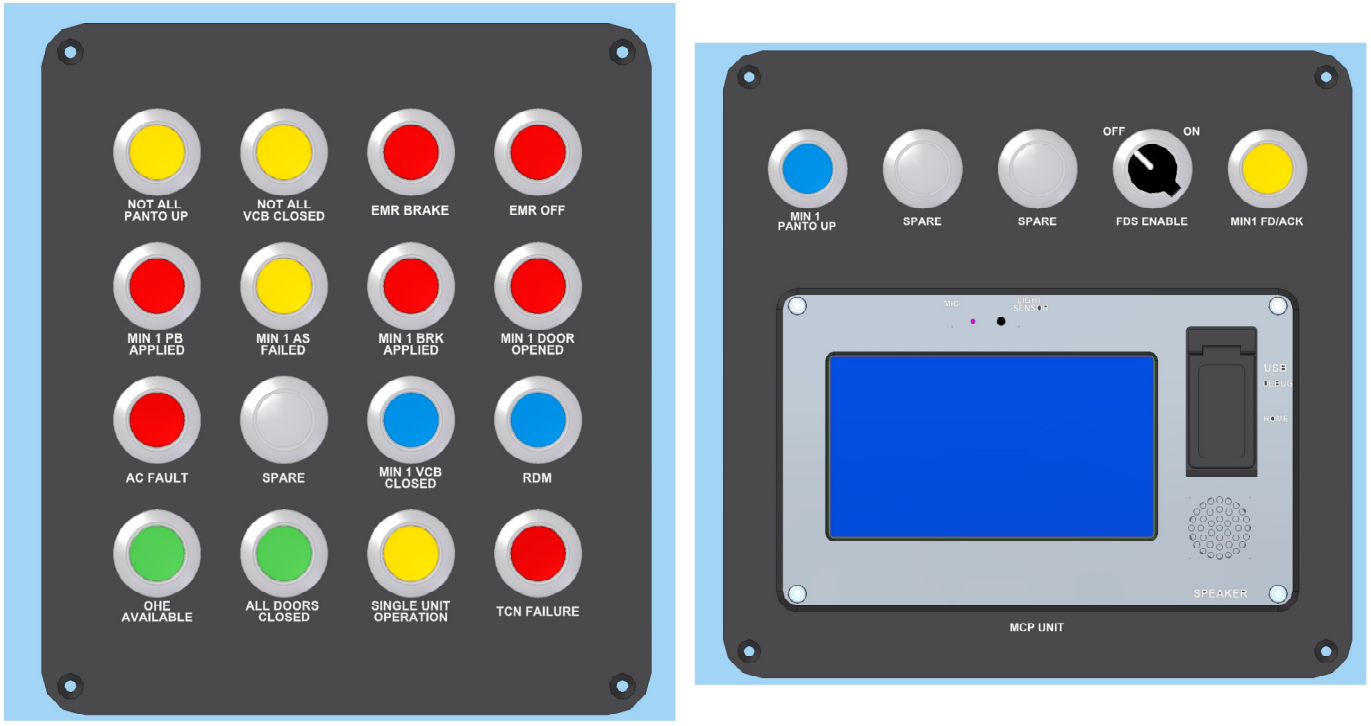


Fig. 4.6

4.1.7 Panel-7 CCTV DISPLAY UNIT

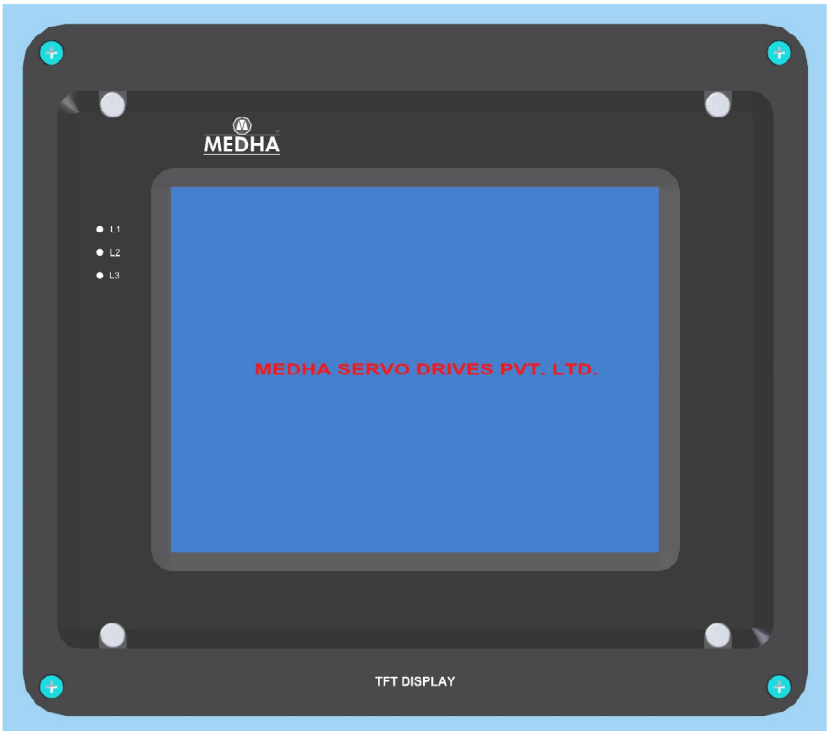


Fig. 4.7

4.1.8 PANEL-8 SINGLE PRESSURE GAUGE 6" - 0-6kg/cm2 (BP)

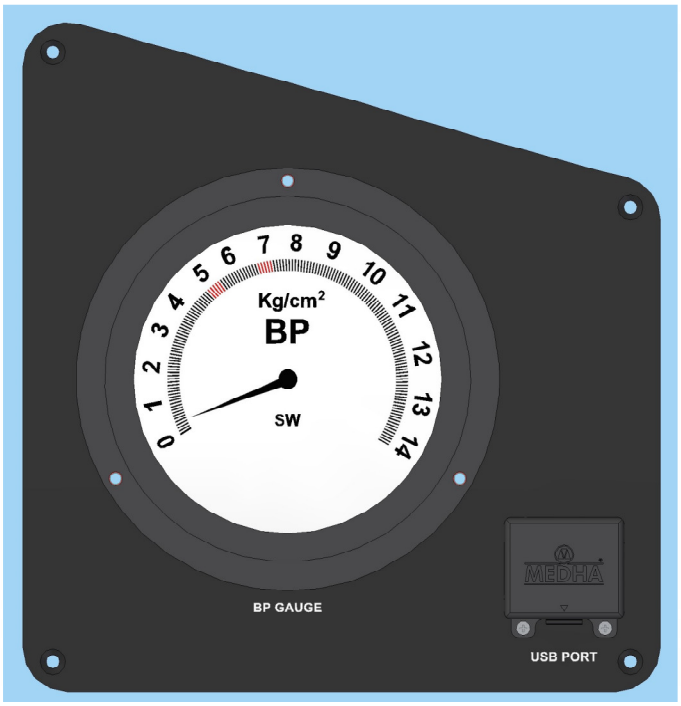


Fig. 4.8

4.1.9 PANEL-9 GUARD SWITCH PANEL - 1

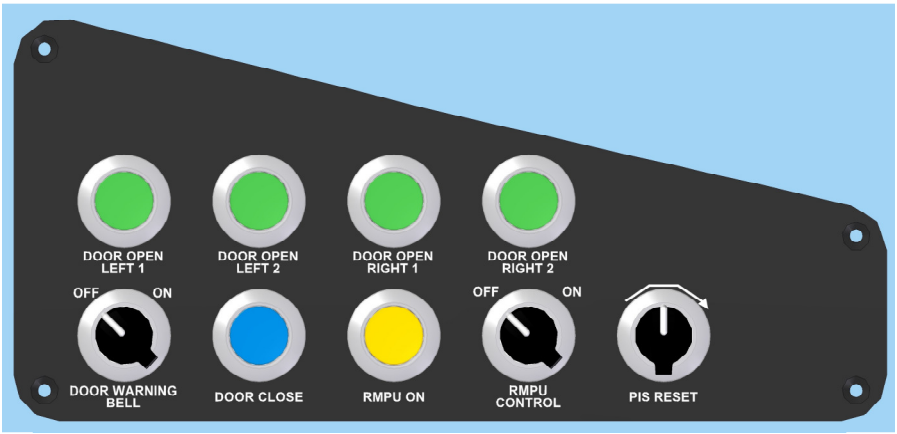


Fig. 4.9

4.1.10 PANEL- 11 DRIVER SWITCH PANEL - 2

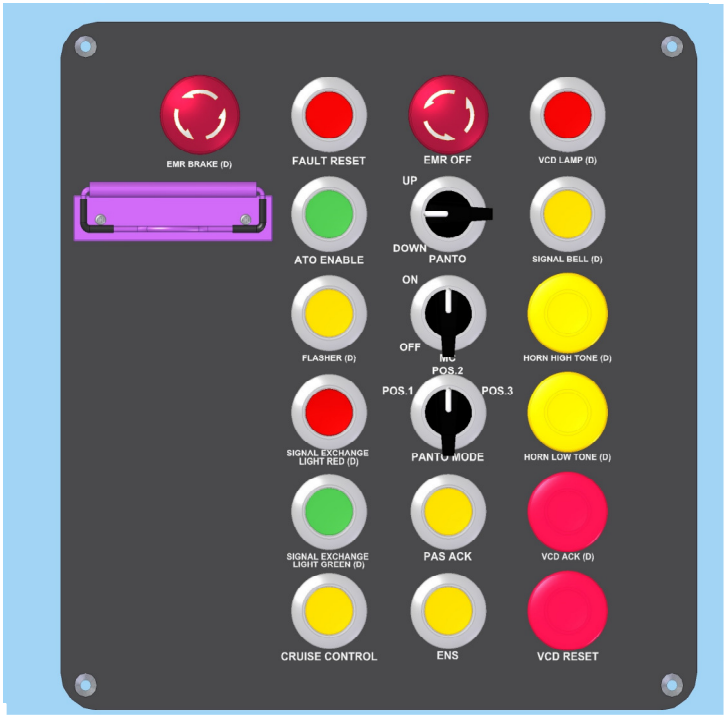


Fig. 4.10

4.1.11 PANEL-12 MASTER CONTROLLER

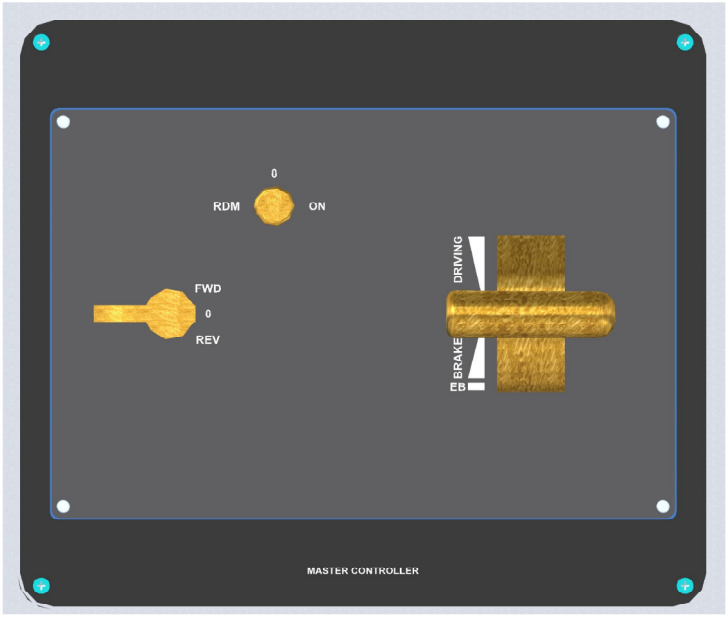


Fig. 4.11

4.1.12 PANEL-13 HOOTER/BUZZER PANEL

Fig. 4.12

4.1.13 PANEL-14 SHUNTING OPERATION SWITCH PANEL

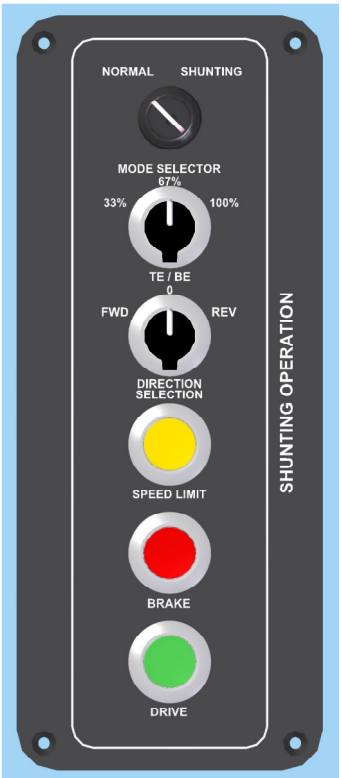


Fig. 4.13

4.1.14 PANEL-15 GUARD SWITCH PANEL 2

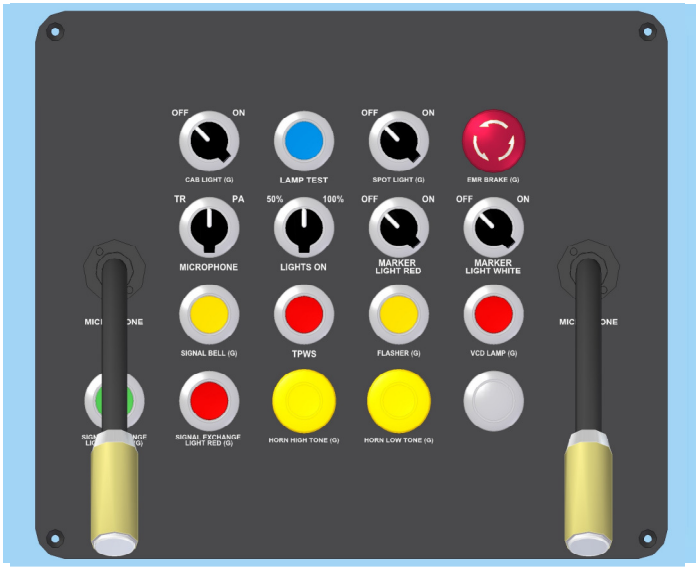


Fig. 4.14

4.1.15 PANEL-17 TCAS EMY VALVE ISOLATION COCK

Fig. 4.15

4.1.16 PANEL-18 GUARD EMERGENCY VALVE

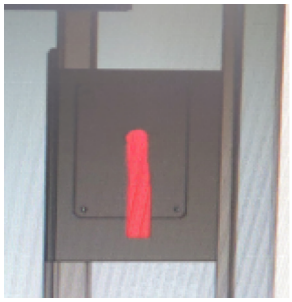


Fig. 4.16

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
1	SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	CAB LIGHT(D)	To switch ON / OFF the Cab Light
	SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	CAB EMY LIGHT	To switch ON / OFF the Driver cab Emy light
	SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	SPOT LIGHT(D)	To switch ON / OFF the Spot Light(D)
	PUSH BUTTON SWITCH, MOMENTARY, BLUE	1	BAT V TEST	To test Battery Voltage
	ELECTRICAL WIPER ASSEMBLY, CONTROL SWITCH.	1	WIPER SWITCH	Control Wiper Functioning
	MR/BP GAUGES-4 INCH-DRIVER 1	1	HL MAIN	To ON / OFF main Head light
	VOLTMETER, FLUSH MOUNTING, MC, RECTANGULAR TYPE	1	VOLTMETER	To check Battery Voltage
2	BC GAUGE -4 INCH-DRIVER	1	MR/BP GAUGES-4 INCH-DRIVER	To check MR/BP pressure
		1	BC GAUGE -4 INCH-DRIVER	To check BC pressure
3	DISPLAY UNIT MDS740	1	TCMS DISPLAY	Display operational status of train functions
	USB PORT	1	USB PORT	To download the data
4	TCAS DISPLAY PANEL	1	TCAS Display Panel	--
5	MBOM MRT918 REC,WM160, VER-4,	1	SPEEDOMETER	--
6	PILOT LAMP, FLUSH, YLW	1	NOT ALL PANTO UP	To indicate not all pantos in UP state
	PILOT LAMP, FLUSH, YLW	1	NOT ALL VCB CLOSED	To indicate not all VCB(MC) is in close state
	PILOT LAMP, FLUSH, RED	1	EMR BRAKE	To indicate Emergency brake status
	PILOT LAMP, FLUSH, RED	1	EMR OFF	To indicate Emergency off status

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
	PILOT LAMP, FLUSH, BLUE	1	MIN1 PANTO UP	
	BLIND PLUG	1	SPARE	--
	BLIND PLUG	1	SPARE	--
	BLIND PLUG	1	SPARE	--
	PILOT LAMP, FLUSH, YLW	1	MIN1 FD	To indicate at least in One coach fire is detected
	PILOT LAMP, FLUSH, RED	1	MIN1 PB APPLIED	To indicate minimum one Parking Brake applied.
	PILOT LAMP, FLUSH, RED	1	AC FAULT	To indicate AC Fault
	PILOT LAMP, FLUSH, GREEN	1	OHE AVAILABLE	To indicate OHE Supply availability status
	--	1	PIS MCP Unit	--
	PILOT LAMP, FLUSH, YLW	1	MIN 1 AS FAILED	To indicate minimum one Air suspension Failure
	BLIND PLUG	1	SPARE	--
	PILOT LAMP, FLUSH, GREEN	1	ALL DOORS CLOSED	To indicate All Doors are Closed
	PILOT LAMP, FLUSH, RED	1	MIN 1 BRK APPLIED	To indicate minimum one brake applied
	PILOT LAMP, FLUSH, YLW	1	SINGLE UNIT OPERATION	To indicate single unit operation active status
	PILOT LAMP, FLUSH, BLUE	1	MIN 1 VCB CLOSED	To indicate minimum one VCB is in ON(close) state
	PILOT LAMP, FLUSH, RED	1	TCN FAILURE	To indicate Train communication network failure
	PILOT LAMP, FLUSH, BLUE	1	RDM	To indicate RDM status
	PILOT LAMP, FLUSH, RED	1	MIN 1 DOOR OPENED	To indicate minimum one door is Opened

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
7	CCTV DISPLAY	1	CCTV DISPLAY	To check online cctv data
8	BP GAUGE-6INCH-ASST DRIVER	1	BP GAUGE	To check BP pressure
	USB PORT	1	USB PORT	To downloding the data
9	PB SWITCH, MOMENTARY,GREEN	1	DOOR OPEN LEFT	To open left side doors
	PB SWITCH, MOMENTARY, GREEN	1	DOOR OPEN LEFT	To open left side doors
	PB SWITCH, MOMENTARY, GREEN	1	DOOR OPEN RIGHT	To open right side doors
	PB SWITCH, MOMENTARY, GREEN	1	DOOR OPEN RIGHT	To open right side doors
	SHORT LEV,SELECTOR SWITCH,2P, MAINT.,BLK	1	DOOR ENABLE SWITCH	To Enable Doors
	PB SWITCH, MOMENTARY, LAMP_ BLUE	1	DOOR CLOSE	To close doors
	PILOT LAMP, FLUSH, YLW	1	RMPU ON	To indicate RMPU is ON
	SHORT LEV,SELECTOR SWITCH,ILLUM,3P,MOMEN,BLK	1	RMPU CONTROL SW	To ON/OFF the RMPU
	SHORT LEV,SELECTOR SWITCH,ILLUM,3P,MOMEN,BLK	1	PIS RESET SWITCH	To give RESET signal to PIS
10	BRAKE CONTROLLER	1	BRAKE CONTROLLER	To apply the auto brake
11	EMR.STOP PB SW,37MM, MAINTAINTWIST TO UNLOCK	1	EMR OFF	To Isolate VCB and Panto electrically through hardware
	PB SWITCH, MOMENTARY, GREEN	1	SIGNAL EXCHANGE LIGHT GREEN	To Operate Signal Exchange light
	PB SWITCH MAINTAINED, LAMP_YELLOW	1	FLASHER	To switch on ON & OFF the Flasher light of the train
	PB SWITCH , MOMENTARY, LAMP_BLUE	1	FAULT RESET	To give fault reset command
	EMR.STOP PB SW,37MM,MAINTAINTWIST TO UNLOCK	1	EMERGENCY BRAKE	To apply emergency brake
	PB SWITCH, MOMENTARY, LAMP_YELLOW	1	CRUISE CONTROL	To Enable constant speed control
	LONG LEV, SELECTOR SWITCH, 3P, MOMENT., BLK	1	MC	To make VCB to Close / Open

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
	LONG LEV, SELECTOR SWITCH, 3P, MOMENT, BLK	1	PANTO	To make Panto Up/Down
	PB SWITCH , MOMENTARY,RED	1	SIGNAL EXCHANGE LIGHT RED	To signal exchange
	PILOT LAMP, FLUSH, RED	1	VCD LAMP	To indicate VCD timer
	PB SWITCH, MOMENTARY, LAMP_YELLOW	1	SIGNAL BELL	To communicate Guard, with pulse Based signal Code.
	MUSHROOM HEAD P.B. YELLOW, MOMENTARY	1	HORN – HIGH TONE	To operate HORN at high decibles
	MUSHROOM HEAD P.B. YELLOW, MOMENTARY	1	HORN - LOW TONE	To operate HORN at low decibles
	MUSHROOM HEAD P.B. RED, MOMENTARY	1	VCD ACK	To acknowledge VCD cycle
	MUSHROOMHEAD P.B.RED, MOMENTARY	1	VCD RESET	To reset VCD cycle
	PB SWITCH, MOMENTARY, LAMP_YELLOW	1	ENS	1. ENS is pressed by motorman before 250m to provide indication to TCMS to start neutral section negotiation. 2. During neutral section negotiation, TCMS drives ENS lamp to indicate the neutral section progress status.
	PB SWITCH , MAINTAINED, LAMP_YELLOW	1	PAS ACK	To Acknowledge Passenger Alarm sound in driver cab
	SHORT LEV, SELECTOR SWITCH, 3P.MAINT.,BLK	1	PANTO MODE	To select Panto combination
	PB SW, MOMENTARY, GREEN / Blind Blug	1	ATO ENABLE/	To Enable ATO Mode (Future provision)
12	KEY	1	KEY	Part of Master Controller (To occupy and de- occupy the cab)
	DIRECTION HANDLE	1	DIRECTION HANDLE	Part of Master Controller (To select direction of movement)
	MASTER CONTROLLER HANDLE	1	MASTER CONTROLLER HANDLE	Part of Master Controller (To provide Traction/Brake command)

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
13	110V AC CHARGING SOCKET	1	110V AC SOCKET	To Take external supply
	FAULT BUZZER	1	FAULT BUZZER	--
	PA BUZZER	1	PA BUZZER	--
	SIGNAL BUZZER	1	SIGNAL BUZZER	--
	VCD BUZZER	1	VCD BUZZER	--
	TCAS BUZZER	1	TCAS BUZZER	--
14	KEY SWITCH ACTUATOR 2 P	1	MODE SELECTOR	To select the Normal mode or Shunting mode
	SHORT LEV., SELECTOR SWITCH,3P.MAINT.,BLK	1	TE/BE	To select the Tractive Effor or Braking Effort in 33%, 67% or 100%
	SHORT LEV.,SELECTOR SWITCH,3P.MAINT.,BLK	1	DIRECTION SELECTION	To select the Forward or Reverse direction
	PB SWITCH MAINTAINED, LAMP_YELLOW	1	SPEED LIMIT	To select speed limit of the train in shunting operation.
	PB SWITCH, MOMENTARY, RED	1	BRAKE	To apply the brake in shunting operation
	PB SWITCH, MOMENTARY, GREEN	1	DRIVE	To drive in shunting operation
15	TO DRIVE IN SHUNTING OPERATION SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	CAB LIGHT(G)	To switch ON / OFF the Cab Light
	SELECTOR SWITCH ACTUATOR 3 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED	1	MICROPHONE SWITCH	To Select PA/TR Function
	PB SWITCH, MOMENTARY, GREEN	1	SIGNAL BELL(G)	To operate Signal Exchange Light Green
	PB SWITCH, MOMENTARY, LAMP_YELLOW	1	SIGNAL BELL(G)	To communicate Guard ,with pulse Based signal Code.
	EMR.STOP PB, 37MM, RED,MAINTAIN, TWIST TO UNLOCK	1	EMERGENCY BRAKE SW(G)	To apply emergency brake
	SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	MARKER LIGHT WHITE	To switch ON / OFF the Marker Light white

PANEL NUMBER	DESCRIPTION	QTY	APPLICATION	FUNCTION
	PILOT LAMP, FLUSH, RED	1	VCD LAMP	To indicate VCD timer
	MUSHROOM HEAD P.B. RED, MOMENTARY	1	VCD ACK	To acknowledge VCD cycle
	SHORT LEV, SELECTOR SWITCH, ILLUM,3P,MOMEN,BLK	1	LIGHTS ON	To Switch ON the interior lights
	PB SW, MOMENTARY, LAMP_BLUE	1	LAMP TEST	To test the Lamps in Driver Desk
	SELECTOR SWITCH ACTUATOR 2 POSITIONS, SHORT LEVER, FLUSH MOUNTING, MAINTAINED ACTION	1	SPOT LIGHT(G)	To switch ON / OFF the Spot Light
	SHORT LEV, SELECTOR SWITCH, 2P,MAINT.,BLK	1	MARKER LIGHT (RED)	To Switch On/off red marker lights
	PILOT LAMP, FLUSH, RED	1	TPWS/SPARE	To indicate TPWS Emergency brake applied
	MUSHROOM HEAD P.B. YELLOW, MOMENTARY	1	HORN - HIGH TONE(G)	To operate HORN at high tone
	MUSHROOM HEAD P.B. YELLOW, MOMENTARY	1	HORN - LOW TONE(G)	To operate HORN at low tone
	PB SWITCH , MAINTAINED, LAMP_YELLOW	1	FLASHER(G)	To switch on ON & OFF the Flasher light of the train
	MICROPHONE	1	MICROPHONE	To communicate with passenger and Guard
	PB SWITCH, MOMENTARY, RED	1	SIGNAL EXCHANGE LIGHT RED	To Operate Signal Exchange Light RED
16	WATER BOTTLE HOLDER	2	WATER BOTTLE HOLDER	--
17	TCAS EMY VALVE ISOLATION COCK	1	TCAS HANDLE	To Isolate the TCAS EMY Valve
18	GUARD EMERGENCY BRAKE	1	GUARD EMERGENCY BRAKE	To apply emergency brake by Guard

Chapter 5

DRIVER DISPLAY UNIT

TCMS DDU provides information for the TCMS system to support motor man in operating rake while normal operation, as well as in case of malfunction of a subsystem.

DDU supports the maintenance staff in setting basic system parameters and fault finding. In case of failure of TCMS DDU, train can still be operated.

There is one DDU installed in each DTC cab.

DDU communicates with TCMS and performs the following basic functions:

Provide an interface to control train functions

- Display operational status of train functions
- Display diagnostic events

There are two user groups:

- Driver ID and
- Maintenance ID

These IDs and corresponding user names can be configured (add or remove) through Medha configuration software.

5.1 Menu Description

5.1.1 Head line area

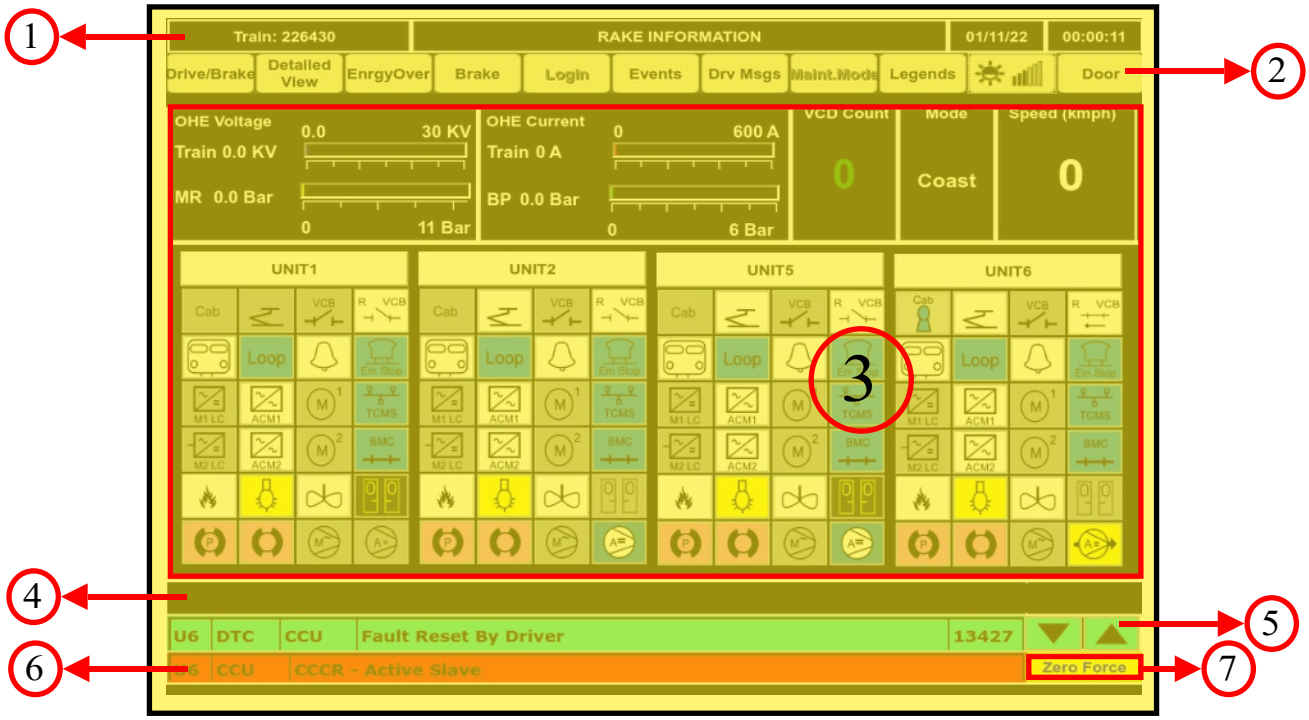


Fig. 5.1

Screen layout consists of 7 sections which are described below:

5.1.1.1 Section 1 - Head line area

Head Line area gives the information about train number configured, screen heading, date and time fields.

5.1.1.2 Section 2 – Soft key buttons area:

The soft key button area contains 10 touch sensitive buttons for different menu entries.

5.1.1.3 Section 3 – Main Screen area:

The main screen area shows the actual content of the selected screen. If required, further touch sensitive buttons are shown in the main screen area.

5.1.1.4 Section 4 - High Priority Message field:

Active diagnostic events which require acknowledgement by motor man are present in high priority message field area. For each event, the source of the event (basic unit number) and its event text are displayed along with an acknowledge button. If no such event is present, the text field and acknowledge button are not displayed. The events are presented in the order of their time of occurrence, across all event sources. When the acknowledge button is pressed, the respective event is acknowledged and disappears from this area. Clicking on the event is available at events list.

5.1.1.5 Section 5 - Scrolling Events area:

All pending active events are presented in scrolling events area in a scrolling pattern. For each event, the source of the event (basic unit, module details) and its event texts are displayed. If no such event is present, the text field is not displayed. Motor man can manually scroll up and down the list with the provided scroll buttons

5.1.1.6 Section 6 - Pop up Messages area:

Pop up messages area is used to show informative (Popup) messages to motor man depending on the operational status of the train. If no popup message is pending, the area shall be blank.

5.1.1.7 Section 7 - Vmax area:

Vmax area indicates the maximum available/ allowed speed of the train. If traction interlock condition is detected by CCC, then ‘Zero Force’ appears in this area.

Table 5.1 gives the information of color significance of different symbols.

TYPE	ICON	FUNCTION
TYPE1		Ready, Released for operation
TYPE2		Displayed, OFF
TYPE3		Manual isolated or blocked for operation
TYPE4		Alarm
TYPE5		ON or pressure OK
TYPE6		Warning

Table 5.1

5.1.2 DDU screen views

5.1.2.1 Train level view

Fig 5.2 shows the train level view of DDU. Rake level, all the important symbols (basic unit wise), OHE voltage, OHE current, train speed, and train operational mode information are displayed here

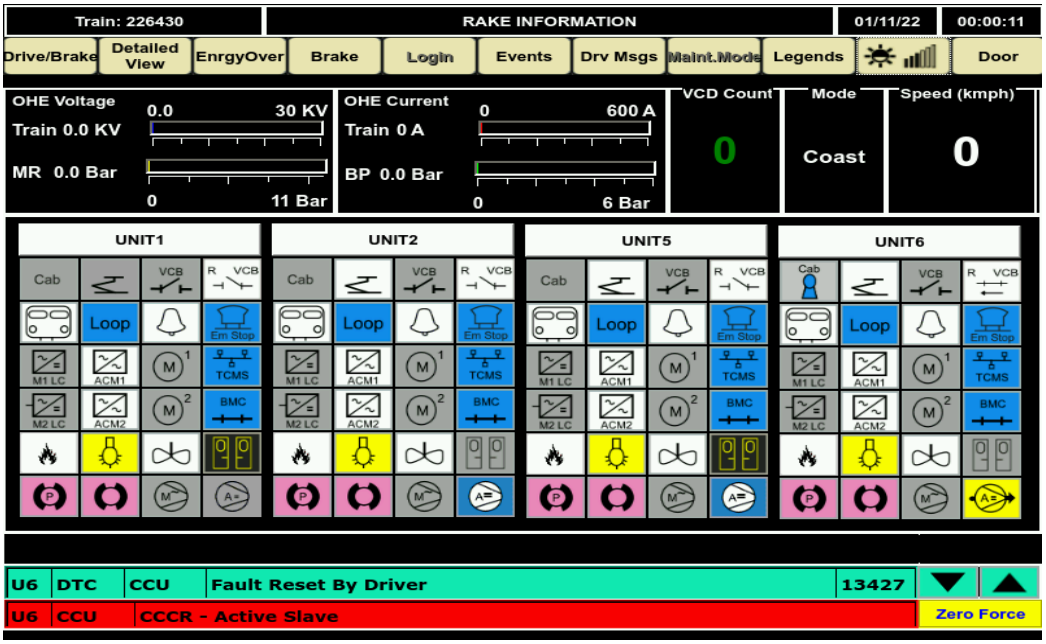


Fig. 5.2

5.1.2.2 Basic unit view

Basic unit view shows a graphical representation of the front basic unit, which consists DTC, MC1, TC, and MC2 cars. It provides a status overview of the major systems in the coaches. Fig 5.3 shows DDU front view for Basic unit 1.

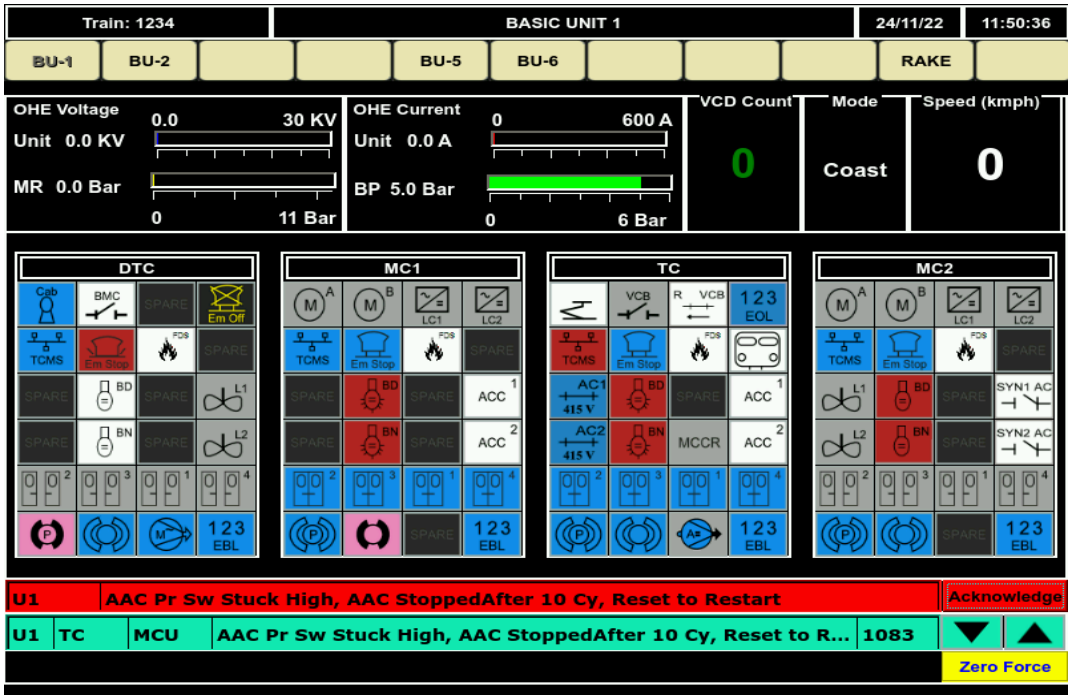


Fig. 5.3

5.1.2.3 Drive/ Brake view

Drive/ Brake view screen shows the OHE line voltage, current as well as traction effort values for each basic unit in the train. The small triangle type indicator indicates the set value for tractive/braking effort, as percentage of the maximum available tractive/braking effort. The set value is calculated by the function that distributes the desired efforts across the available basic units as a function of available traction systems, basic unit weight and other parameters. Consequently, at a given position of the master controller, the set values for different basic units can differ.

The large level graph and the value beneath indicate the achieved total tractive/braking effort as percentage of the maximum available tractive/ braking effort. The bar graph and value shown in orange color gives information about braking effort whereas the blue color gives information about tractive effort. The maximum available tractive and braking effort is dependent on the weight and speed of a basic unit.

The braking efforts are combined values for electrical (ED) and pneumatic (EP) brakes. The solid bars in each basic unit show the actual (achieved) traction/ braking effort values. The actual achieved value is displayed in the label below the solid bars for each basic unit as shown in Fig 5.4.

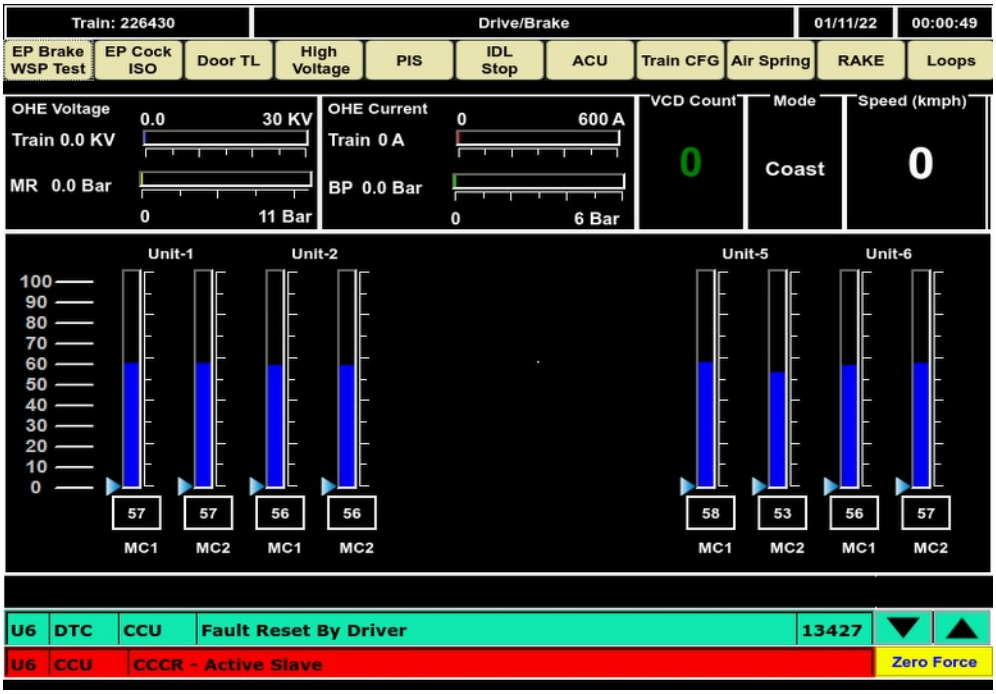


Fig. 5.4

5.1.2.4 Air Spring Overview Screen

Air Spring Overview screen gives information about bellow wise air suspension pressure values (in bars), end basic unit MR, and BP pressure values (in bars). The sensor healthiness information is displayed in color decoding of sensor name field. In case of sensor failure, corresponding value is shown in X, color of name field shall be differed. Basic unit level navigation can be possible through 'BU-x Suspension' soft key. Sensor name field color coding is shown below

Background Color	Information
Airspr Bellow x	Sensor healthy and within Range
Airspr Bellow x	Sensor faulty
Airspr Bellow x	Sensor value showing out of range
Airspr Bellow x	Sensor override from DDU
Airspr Bellow x	Air Spring Suspension failed
Airspr Bellow x	Sensor Status Isolated by System

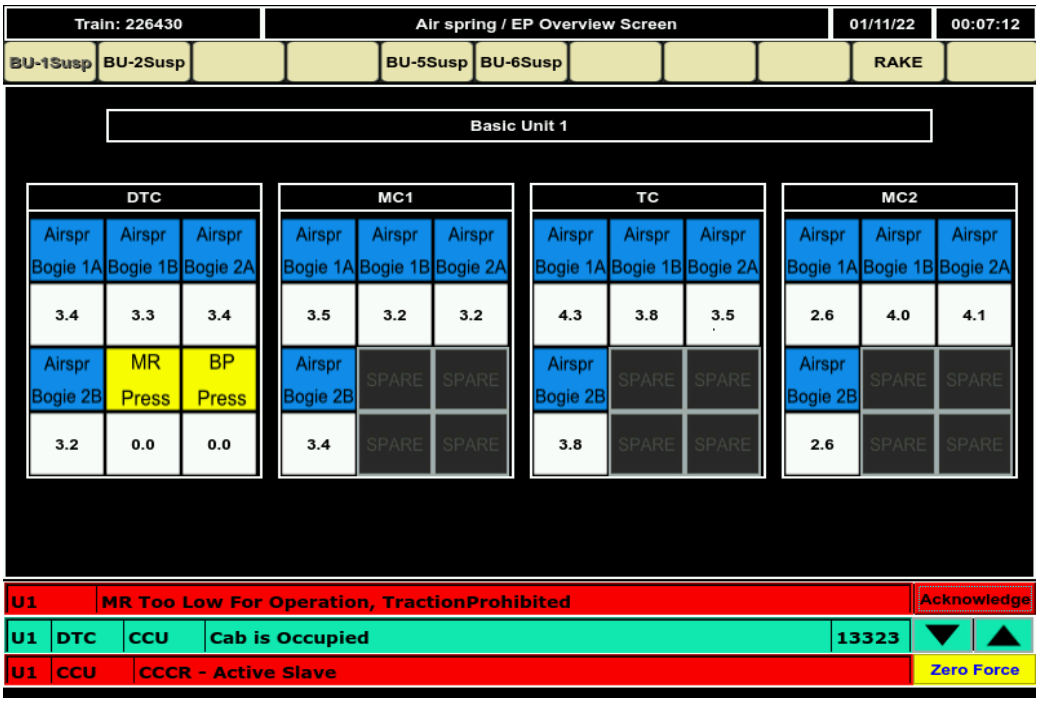


Fig. 5.5

5.1.2.5 Energy Overview

Energy Overview screen, shown in Fig 5.6 displays the energy consumption and energy regeneration values for each basic unit and for the whole train. It also displays the total distance travelled by train. Energy details of each basic unit is available in cumulative and trip wise.

Trip wise data is available for latest entered driver ID. Trip can be reset by using store track option in energy overview screen or by entering a new user ID from login screen.

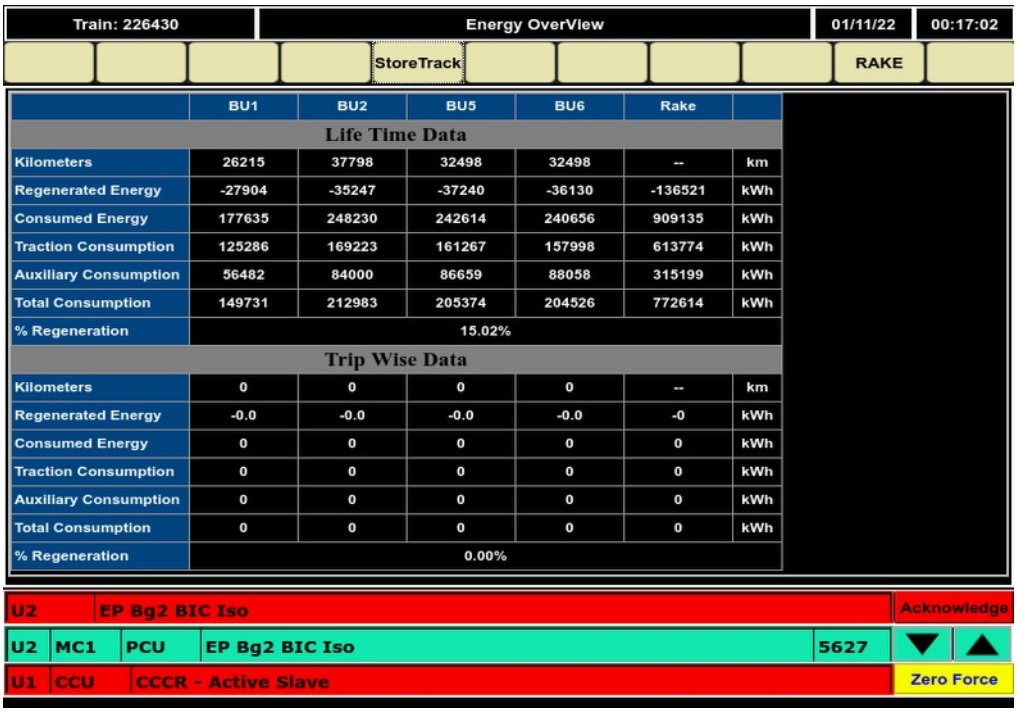


Fig.5.6

5.1.2.6 Login Screen

Login screen, shown in Fig 5.7 is used to enter new user ID or to logout from existing user. Driver ID can be logged out using reset ID/ logout button. This screen is available only in occupied cab. User can change the train number from this screen.

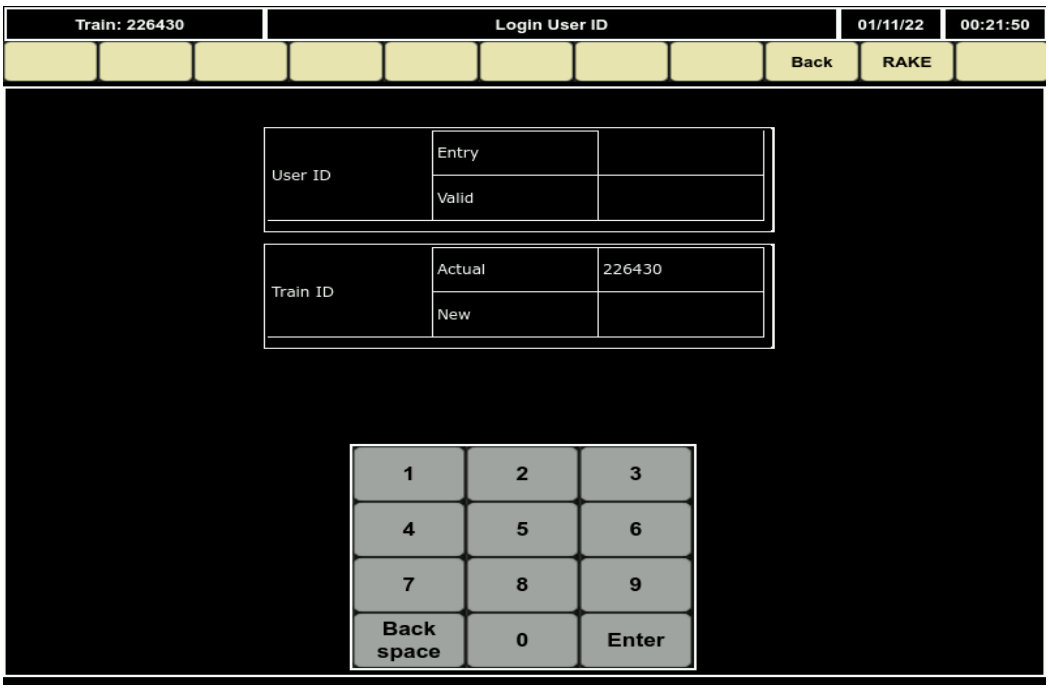


Fig. 5.7

5.1.2.7 Events Screen

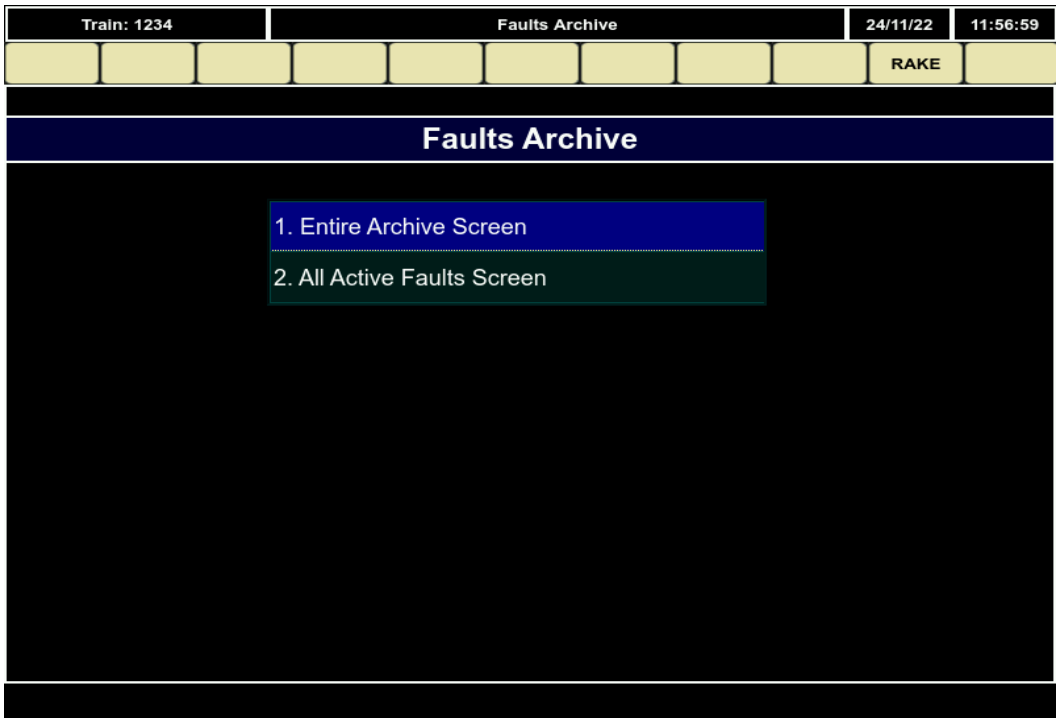
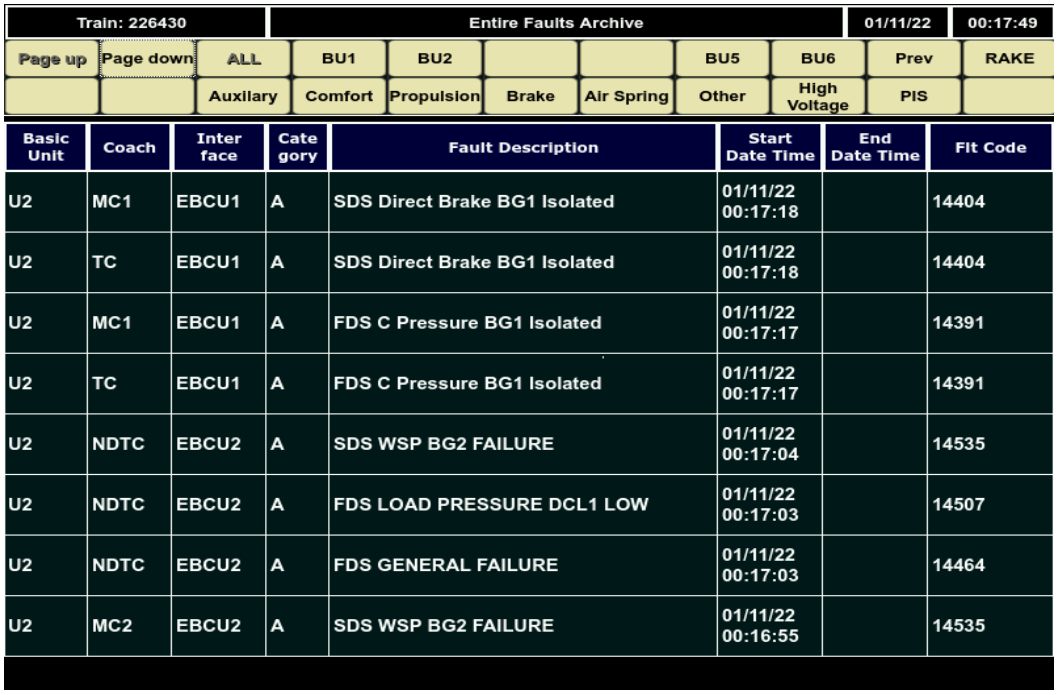


Fig. 5.8



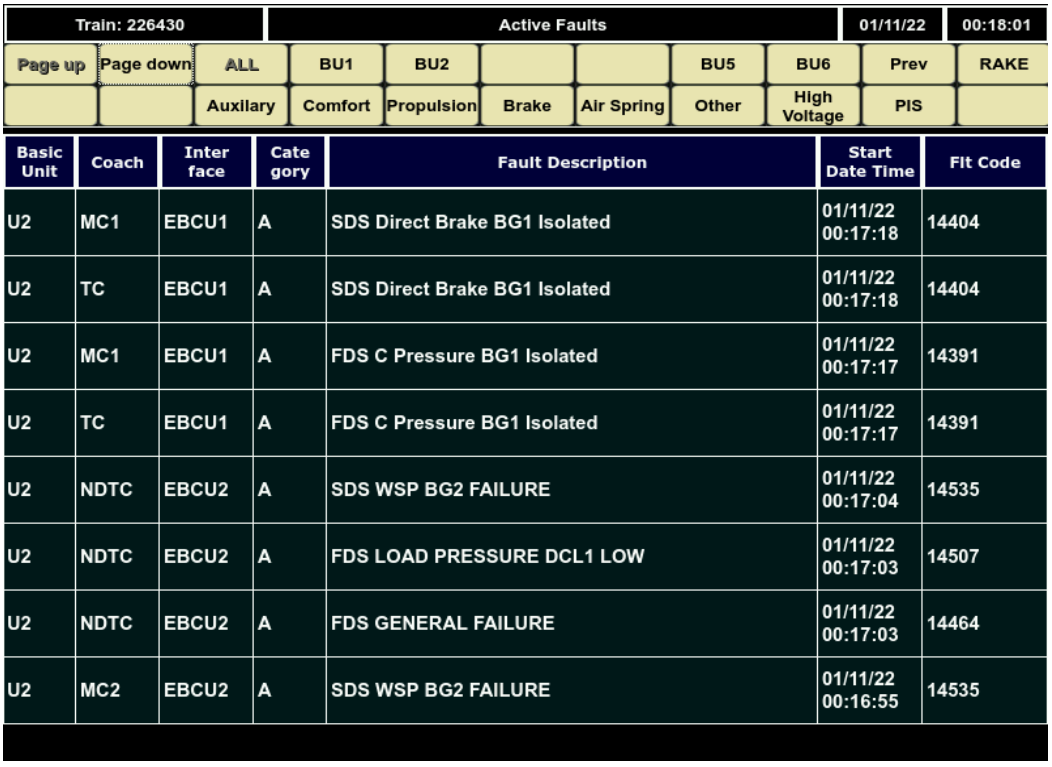
Train: 226430	Entire Faults Archive							01/11/22	00:17:49
Page up	Page down	ALL	BU1	BU2			BU5	BU6	Prev	RAKE
		Auxilary	Comfort	Propulsion	Brake	Air Spring	Other	High Voltage	PIS	

Basic Unit	Coach	Inter face	Cate gory	Fault Description	Start Date Time	End Date Time	Flt Code
U2	MC1	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18		14404
U2	TC	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18		14404
U2	MC1	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17		14391
U2	TC	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17		14391
U2	NDTC	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:17:04		14535
U2	NDTC	EBCU2	A	FDS LOAD PRESSURE DCL1 LOW	01/11/22 00:17:03		14507
U2	NDTC	EBCU2	A	FDS GENERAL FAILURE	01/11/22 00:17:03		14464
U2	MC2	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:16:55		14535

Fig. 5.9

Faults/ events are categorized into two types:

- Entire fault Archive Type – It consists of all logged events along with recovery details.
- Active Fault Archive Type – It consists of only the present active faults



Train: 226430	Active Faults							01/11/22	00:18:01
Page up	Page down	ALL	BU1	BU2			BU5	BU6	Prev	RAKE
		Auxilary	Comfort	Propulsion	Brake	Air Spring	Other	High Voltage	PIS	

Basic Unit	Coach	Inter face	Cate gory	Fault Description	Start Date Time	Flt Code
U2	MC1	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18	14404
U2	TC	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18	14404
U2	MC1	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17	14391
U2	TC	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17	14391
U2	NDTC	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:17:04	14535
U2	NDTC	EBCU2	A	FDS LOAD PRESSURE DCL1 LOW	01/11/22 00:17:03	14507
U2	NDTC	EBCU2	A	FDS GENERAL FAILURE	01/11/22 00:17:03	14464
U2	MC2	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:16:55	14535

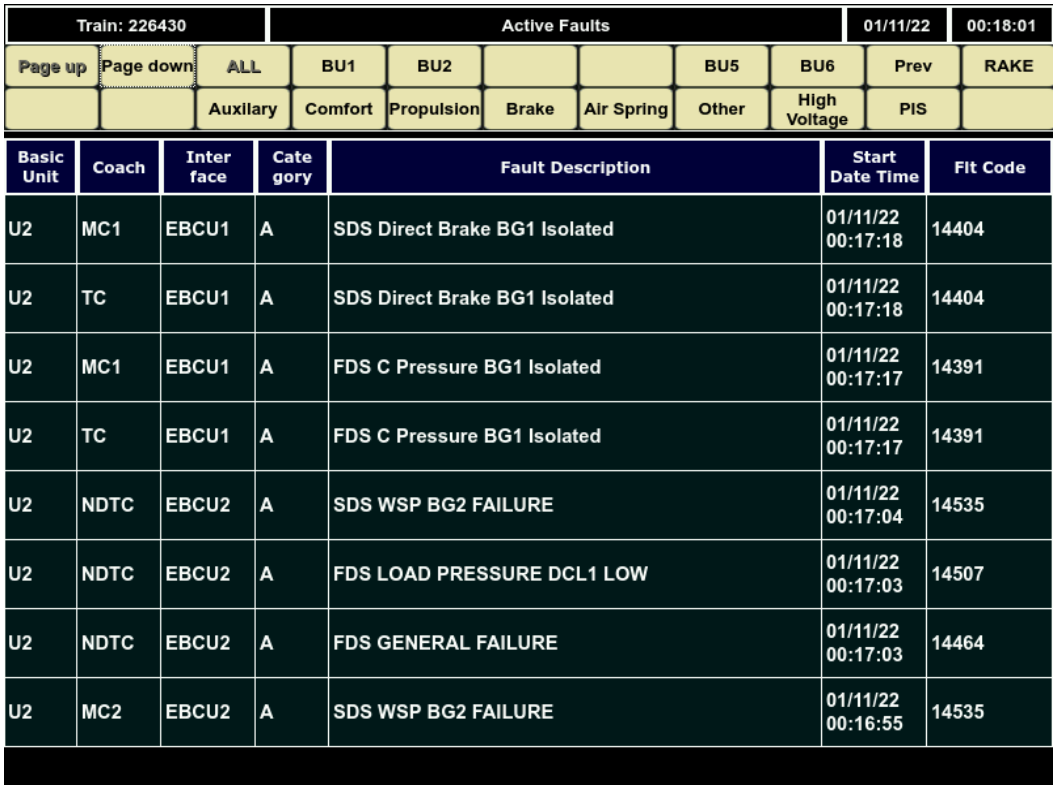
Fig.5.10

All faults screen gives information about fault description, start time, end time (if recovered), basic unit number, and module information along with fault category.

In case of all active fault screen, same information is available except 'End Time' column.

5.1.2.8 Driver/ Crew Messages Screen

Driver Messages screen, shown in Fig 5.11 displays only the active fault/ event information which is required for motor man. HMI fault reset option is also available in this screen.



Basic Unit	Coach	Inter face	Cate gory	Fault Description	Start Date Time	Flt Code
U2	MC1	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18	14404
U2	TC	EBCU1	A	SDS Direct Brake BG1 Isolated	01/11/22 00:17:18	14404
U2	MC1	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17	14391
U2	TC	EBCU1	A	FDS C Pressure BG1 Isolated	01/11/22 00:17:17	14391
U2	NDTC	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:17:04	14535
U2	NDTC	EBCU2	A	FDS LOAD PRESSURE DCL1 LOW	01/11/22 00:17:03	14507
U2	NDTC	EBCU2	A	FDS GENERAL FAILURE	01/11/22 00:17:03	14464
U2	MC2	EBCU2	A	SDS WSP BG2 FAILURE	01/11/22 00:16:55	14535

Fig. 5.11

5.1.2.9 Brake

Brake screen, shown in Fig 5.12 gives information about basic unit level and brake cylinder pressures (EP system) of train. This screen consists of two sections. First section consists all brake pressures status and second section gives options for enabling/ disabling holding brake to the train. This can be useful for the motor man while brake test validation.

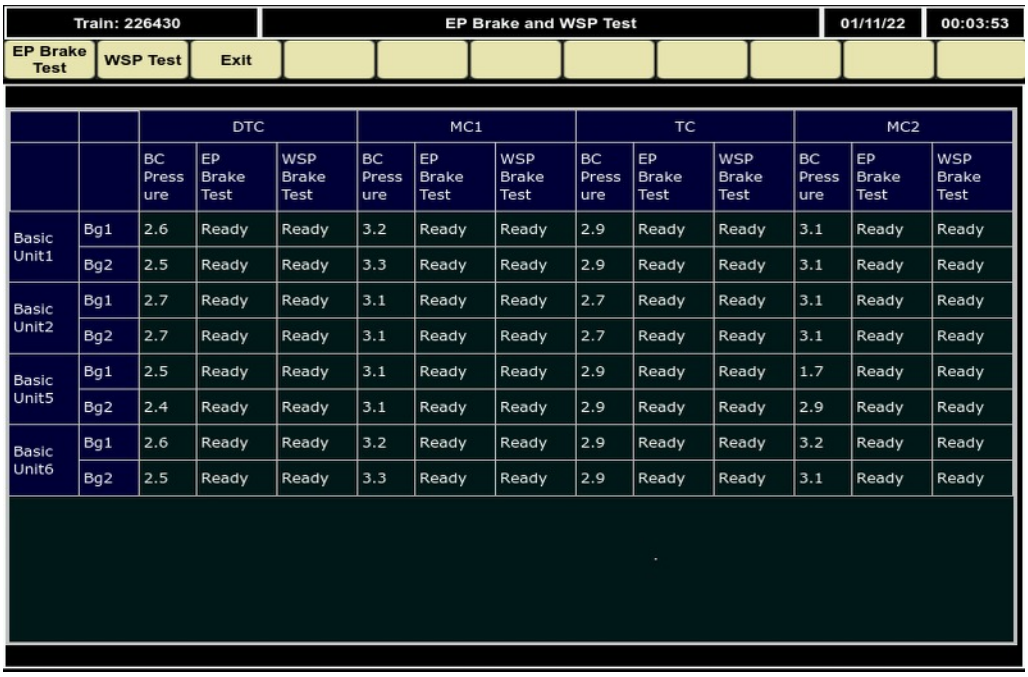


Fig. 5.12

5.1.2.10 Brightness Control

When user press ‘Brightness’ soft key, then the brightness control appears on the screen. Touch on the bar chart, controls the brightness of the screen. This brightness control disappears when user touches again the same brightness button.

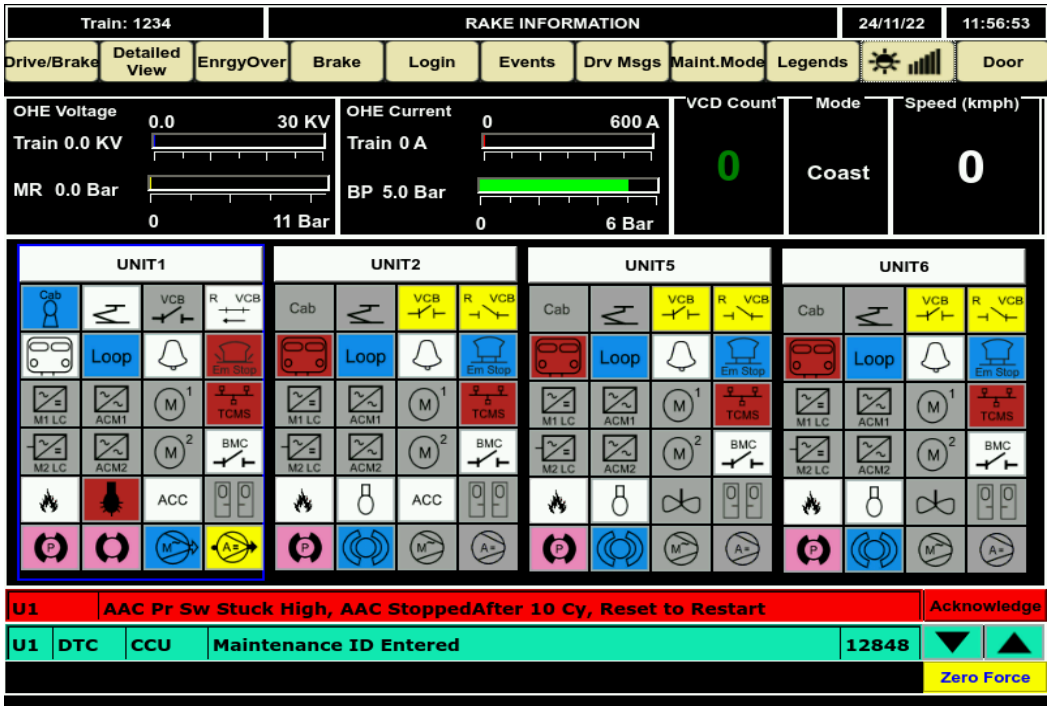


Fig. 5.13

5.1.2.11 Maintenance Mode Screen

Fig 5.14 displays different options available in the maintenance mode.

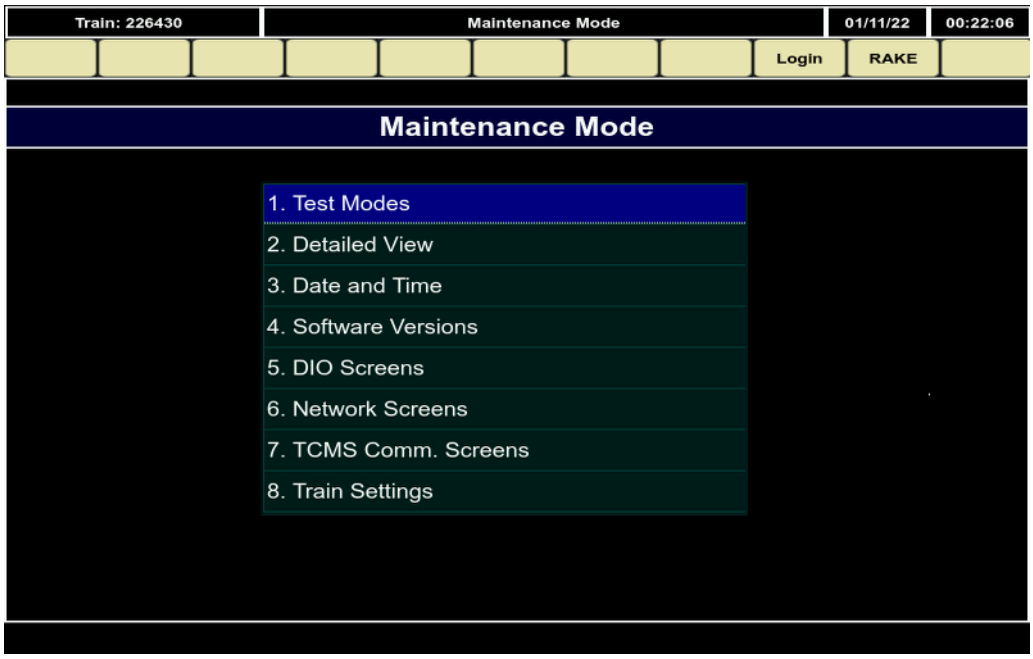


Fig. 5.14

1. Test Modes

Test Modes are defined to validate train level wiring verification, train lines checking, DTC-CAB wiring, brake related tests, etc. All test modes have few entry conditions. Before entering into any test, these entry conditions are to be satisfied.

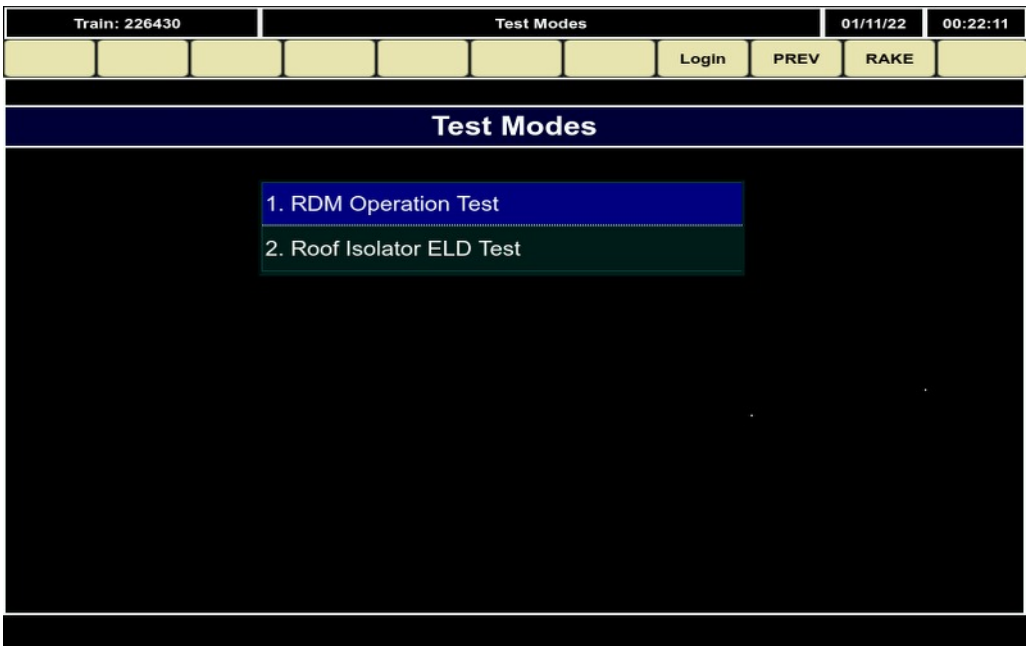


Fig. 5.15

RDM Operation Test

1. In RDM Operation test, two sub tests are available i.e., Frequency Input Test:

Frequency Input test is defined to validate Frequency generator unit functionality. Based on selected MCH%, FGU generates the frequency to train line. All MCC, MCCR nodes which are available in basic units of the train monitors the frequency and sends back the status to CCC for validation. Finally CCC gives final results with validity i nformation to DDU.

Train Line test: It is defined to check the present status of important train line covers Panto, VCB switches, MCH Inputs (Direction – FWD, REV, Mode Drive, Brake, Coast) routing to MCC and MCCR nodes which are available in all basic units of the train.

2. Detailed View

Detailed view option is defined to give information about sub system level parameter monitoring for train level functional checking. The parameters which are available in the screens can be changed or re-arranged through configuration software.

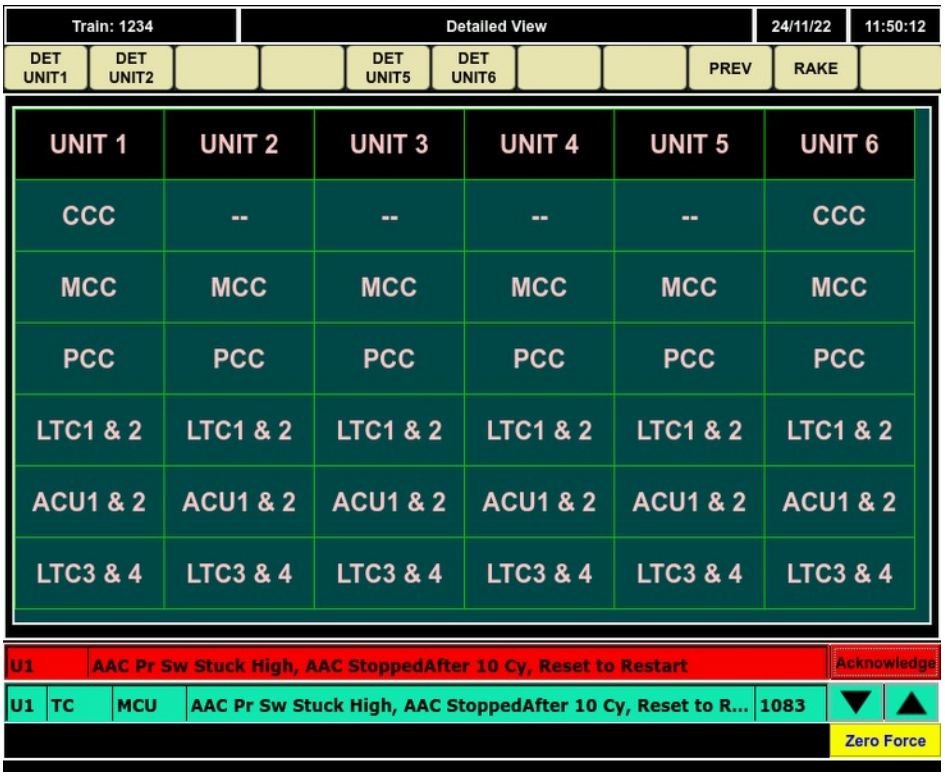


Fig. 5.16

3. Date & Time

Date and Time feature is defined to set date and time in train. User is requested to change the date & time through navigation keys and press ‘Enter’ for final configuration. All TCMS systems update the date and time locally. Following screen gives information about date & time settings

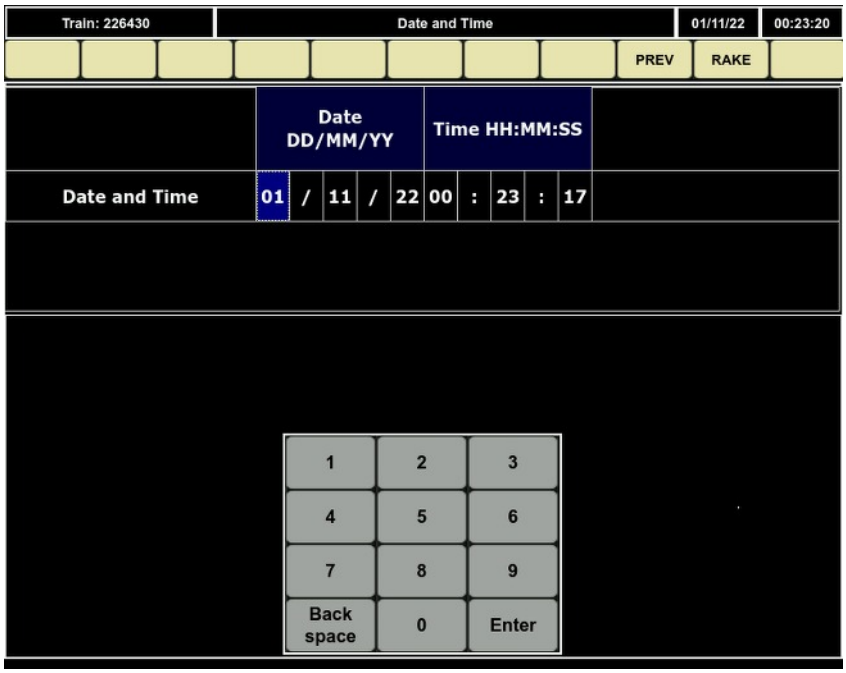


Fig. 5.17

4. Software Version:

This screen used to view software version details of various modules of Train18.

5. DIO :

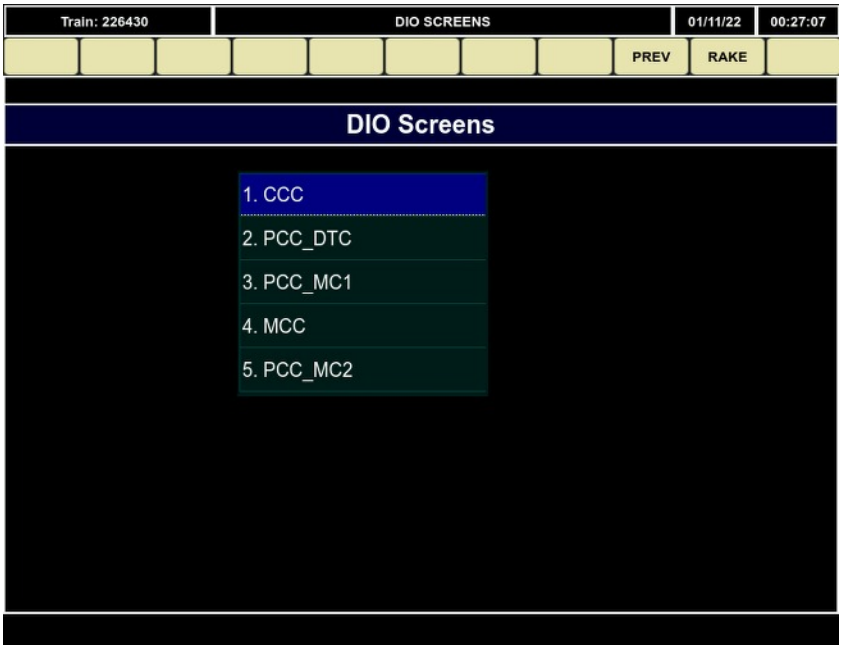


Fig. 5.18

This screen is used to view digital inputs and outputs of various control units CCC DIO screen is shown in Fig 5.19.

Fig. 5.19

6. Network screens:

Network screens gives information about rake level ETB, ECN modules health information.

7. TCMS Communication Screen:

TCMS screen used to view communication health information between various modules. Provision is given to view, Basic unit wise modules communication status. Module wise communication health status shown in Fig 5.20.

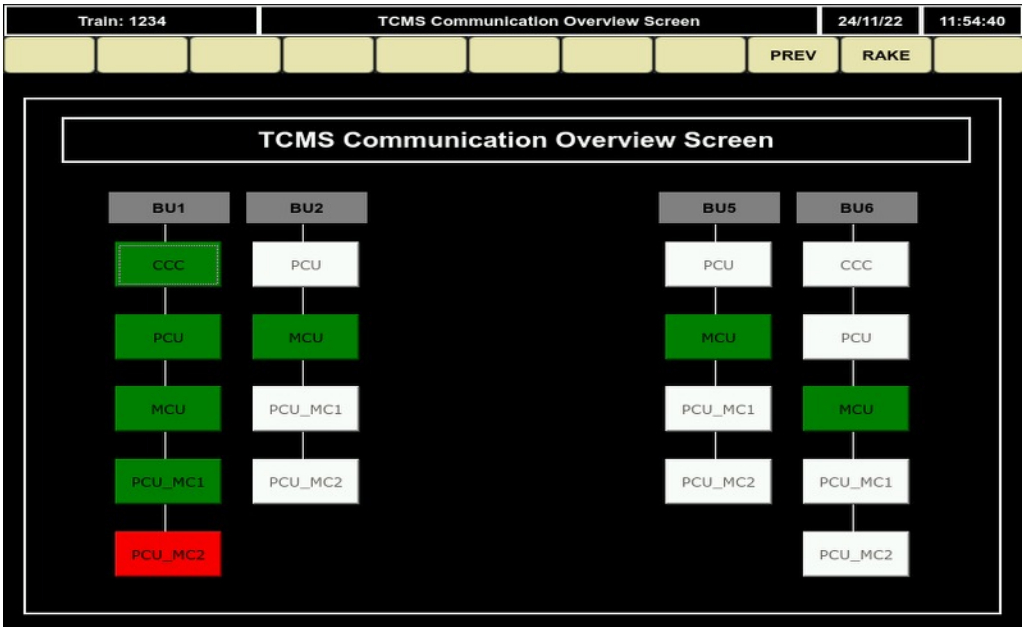


Fig. 5.20

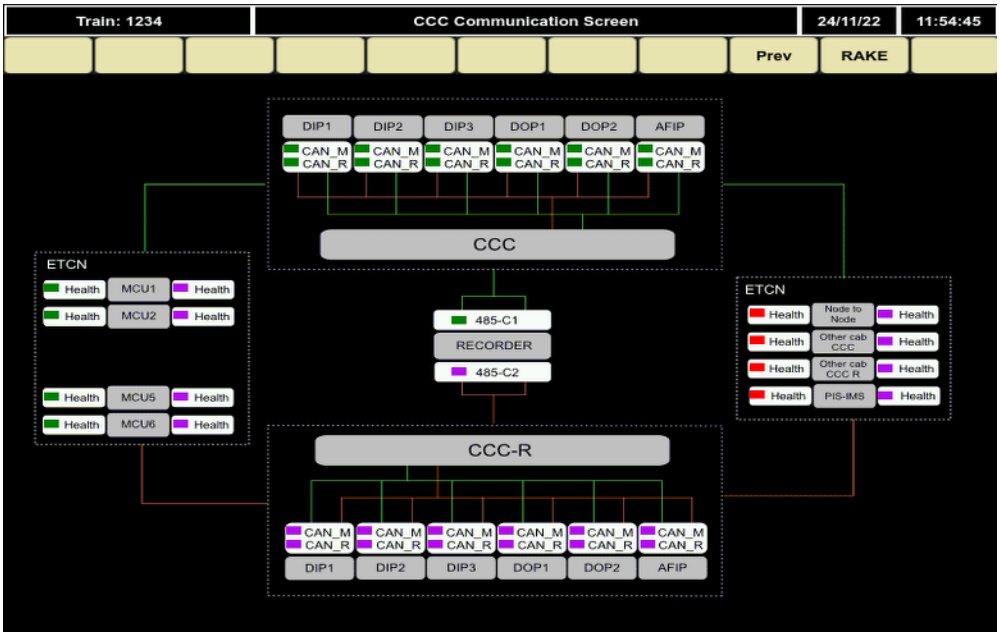


Fig. 5.21

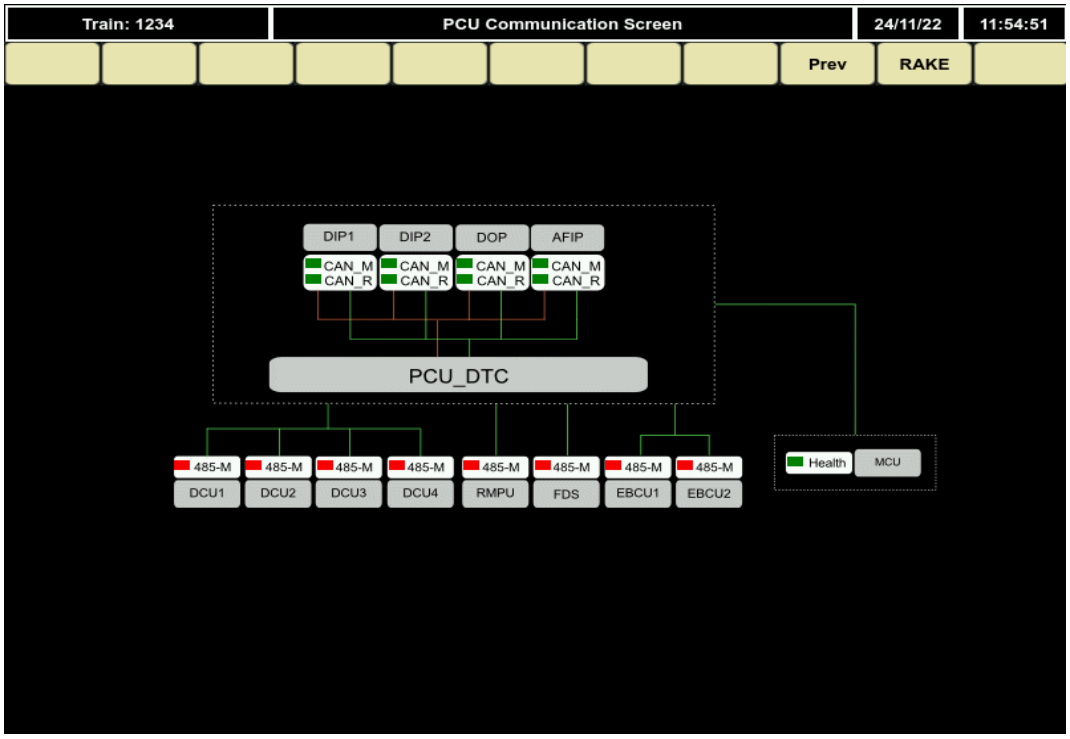


Fig. 5.22

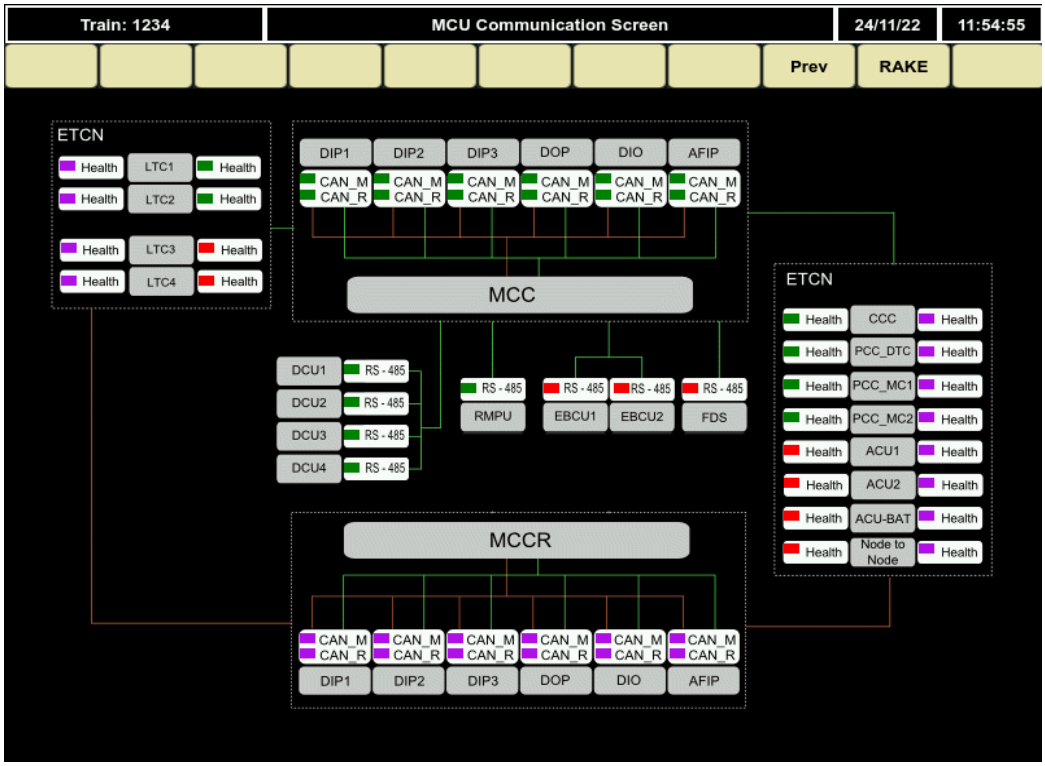


Fig. 5.23

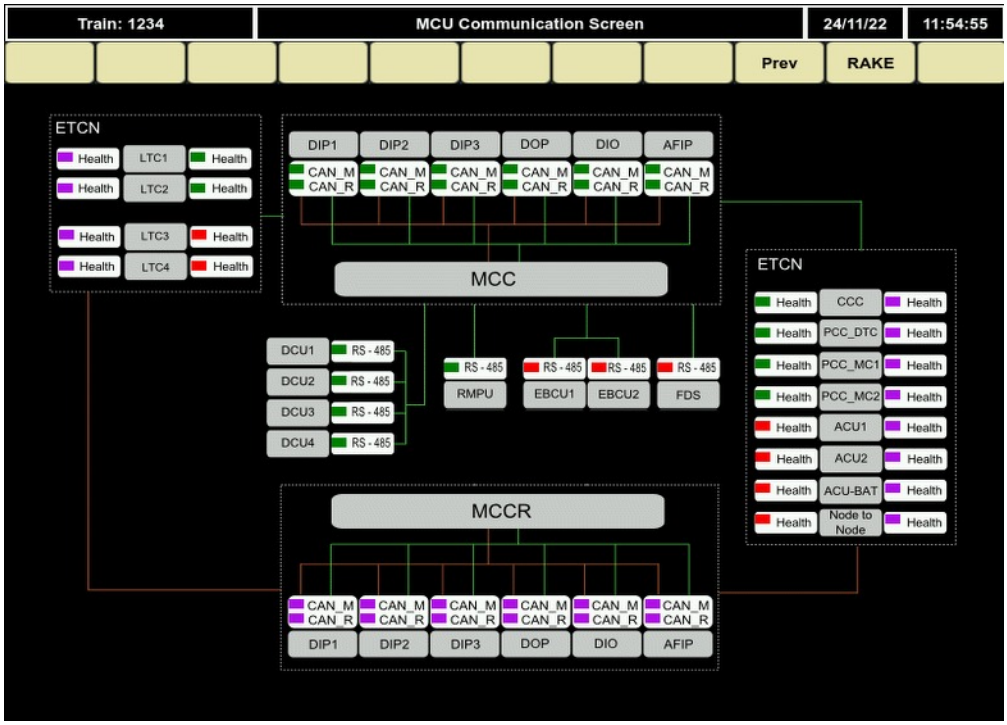


Fig . 5.24

8. Idle Stop:

This option to be used to allow the pen drive safe removal function

9. Train Settings

Train settings are defined to forcibly change the normal functionality of EMU operation. Some of these settings can be done by Maintenance person (Main ID is required). All settings can be done when predefined entry conditions are satisfied. Some of the settings are not allowed in train running case. All these entry conditions are displayed when navigating through selected settings in the train settings menu. TCMS stores the changed settings information and displays suitable message in DDU. All these changed setting information are stored in TCMS until power Reset.

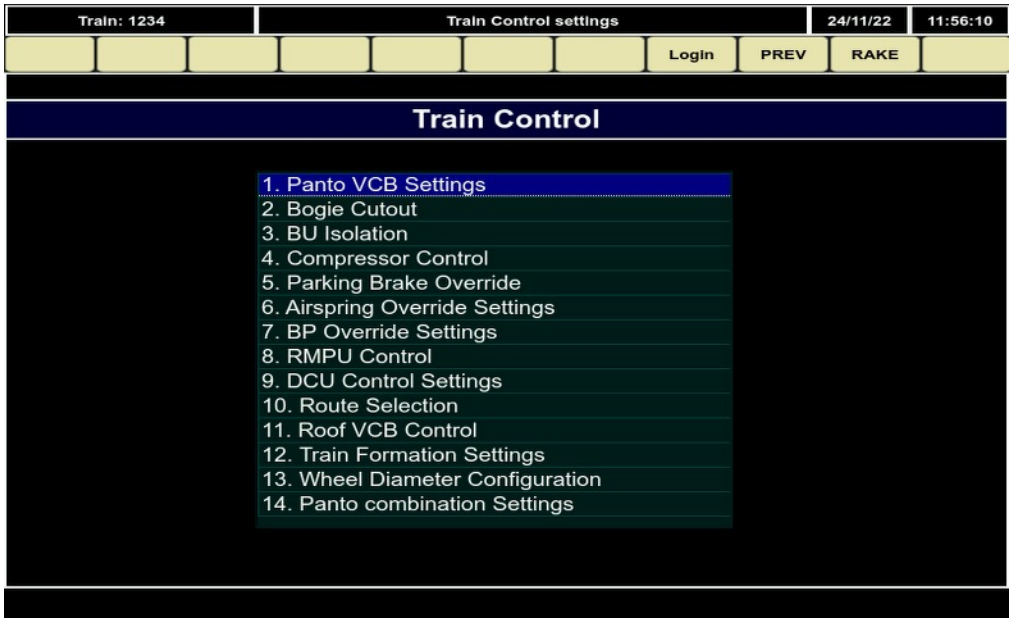


Fig. 2.25

1. Panto VCB Settings

Panto and VCB setting are used to open VCB and to down the pantograph of any particular basic unit in the rake formation. But VCB close operation and raising of pantograph operation are not possible

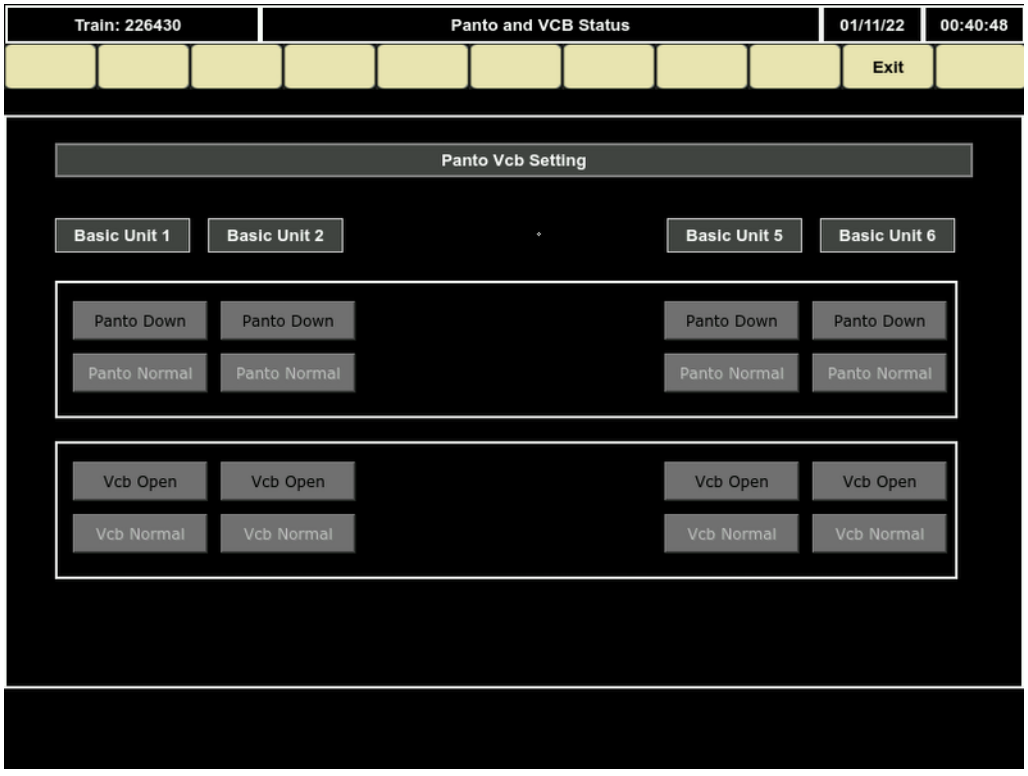


Fig. 5.26

2. Bogie Cutout

Bogie cutout setting is used to isolate the bogie1/ bogie 2/ both bogies of selected basic unit in the rake formation. For isolated bogies, traction, electrical braking are not available.

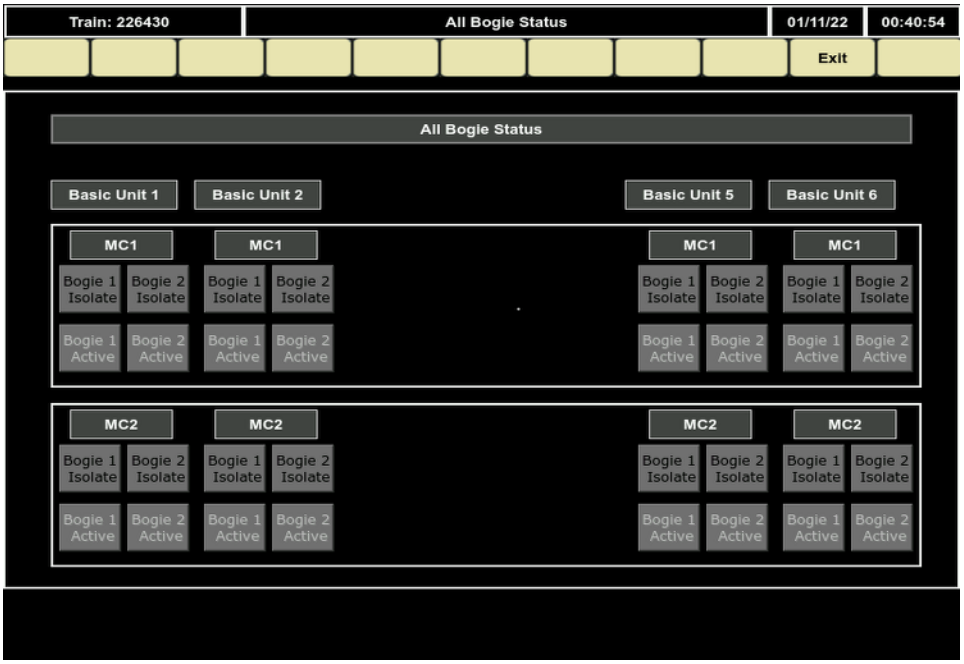


Fig. 5.27

3. BU Isolation

BU Isolation setting is used to isolate the basic unit from the rake formation. For isolated basic unit, power is not available for traction and braking operation, since pantograph is made down by system. For this unit, aux supply is available through change over contactors from adjacent basic units (if power available). This feature is as good as basic unit isolation switches functionality which are available on ECC panel of DTC Cab.

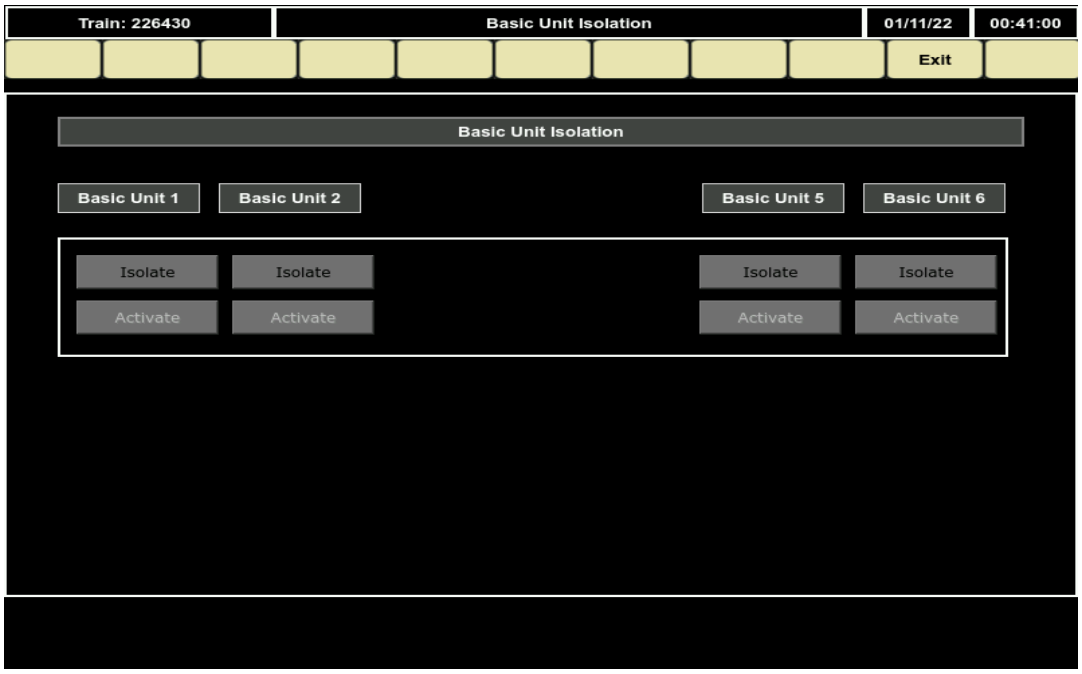


Fig. 5.28

4. Compressor Control

Compressor Control setting is used to control the compressor from DDU. In this setting, we can switch ON or switch OFF compressor of any of basic unit. Once compressor ON command is received from this setting, then the corresponding compressor shall be ON until pressure is reached to healthy range. 'ALL MAC ON' is also available in the same setting (through Train selection)

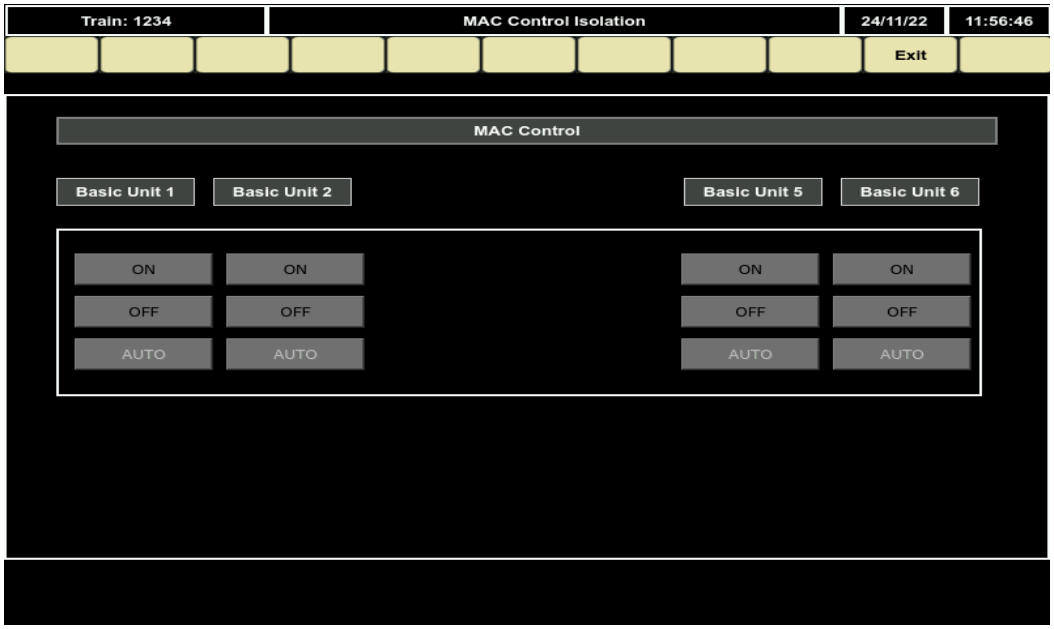


Fig. 5.29

5. Parking Brake Override

Override Parking Brake Override setting is used to override the parking brake status in the selected basic unit. Once override is selected, then TCMS ignores parking brake status of that basic unit for parking brake lamp driving, stuck brake condition checking, Vmax limitation due to parking brake stuck, etc.

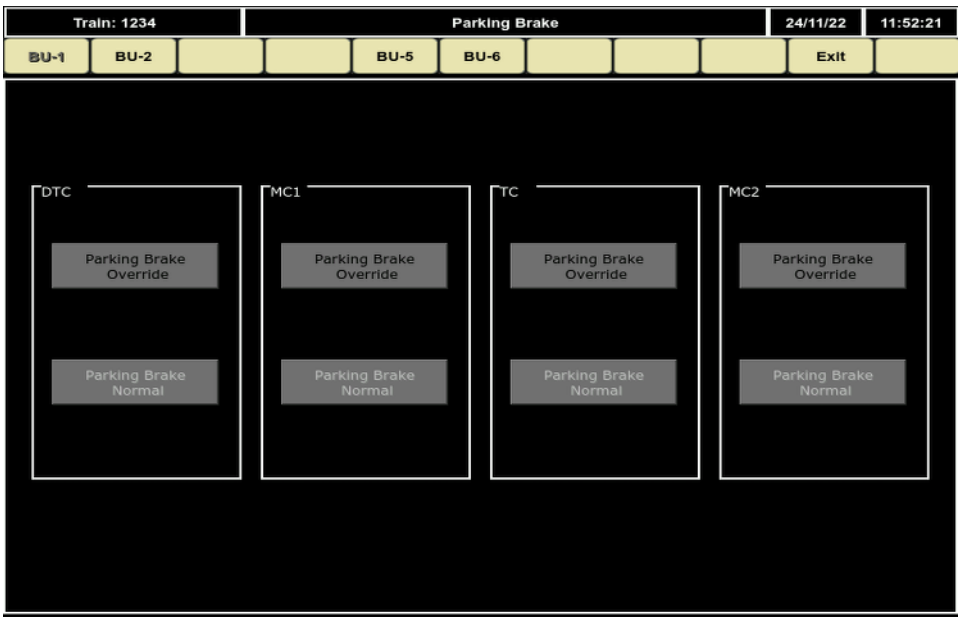


Fig. 5.30

6. Air spring Override Settings

Air spring override setting is used to override the air spring status in the selected coach in a basic unit. Once override is selected, then TCMS ignores air spring failure status of selected coach, so that speed restriction due to suspension failure feature gets bypassed.

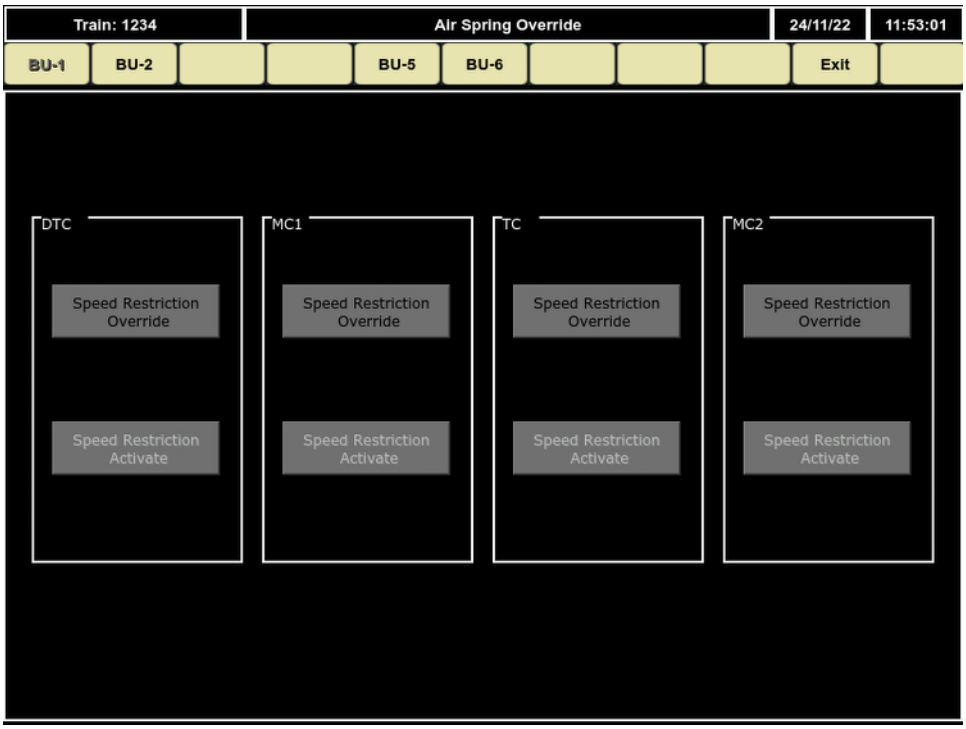


Fig. 5.31

7. BP override settings

BP override setting is used to override the BPstatus in the selected coach in a basic unit. Once override is selected, then TCMS ignores corresponding BP status of selected coach, so that speed restriction due to BP failure feature gets bypassed.

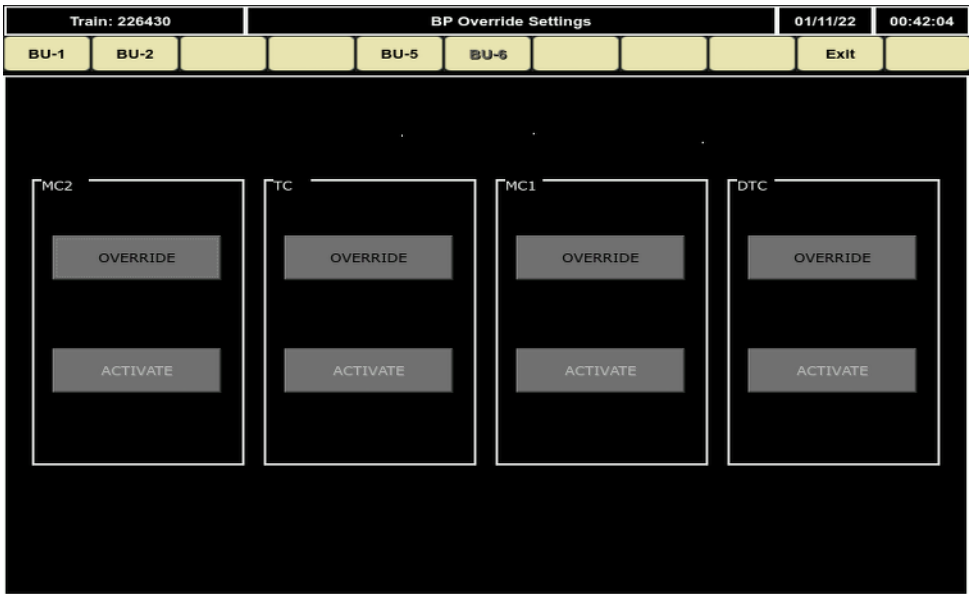


Fig. 5.32

8. RMPU Control Screen

RMPU control screen can be used to give forced RMPU command either 50% or 100% or OFF command in any coach for any RMPU

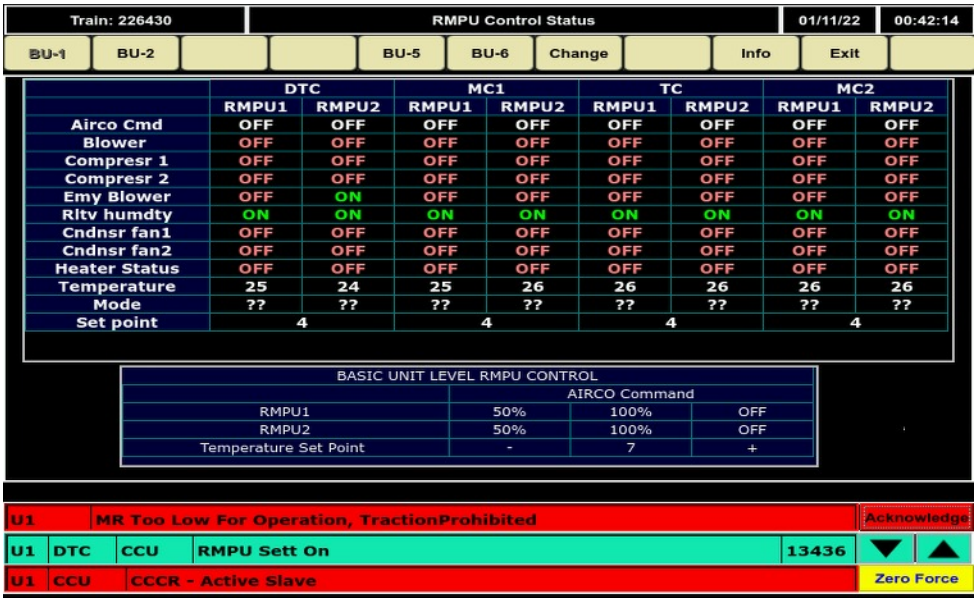


Fig. 5.33

9. Door Control Settings

Door control settings screen can be used to provide door open/close command to any door in any coach. In case of failure of All door proving loop, provision is given to override the ADCR relay, so that Door Proving Loop can be ignored for traction.

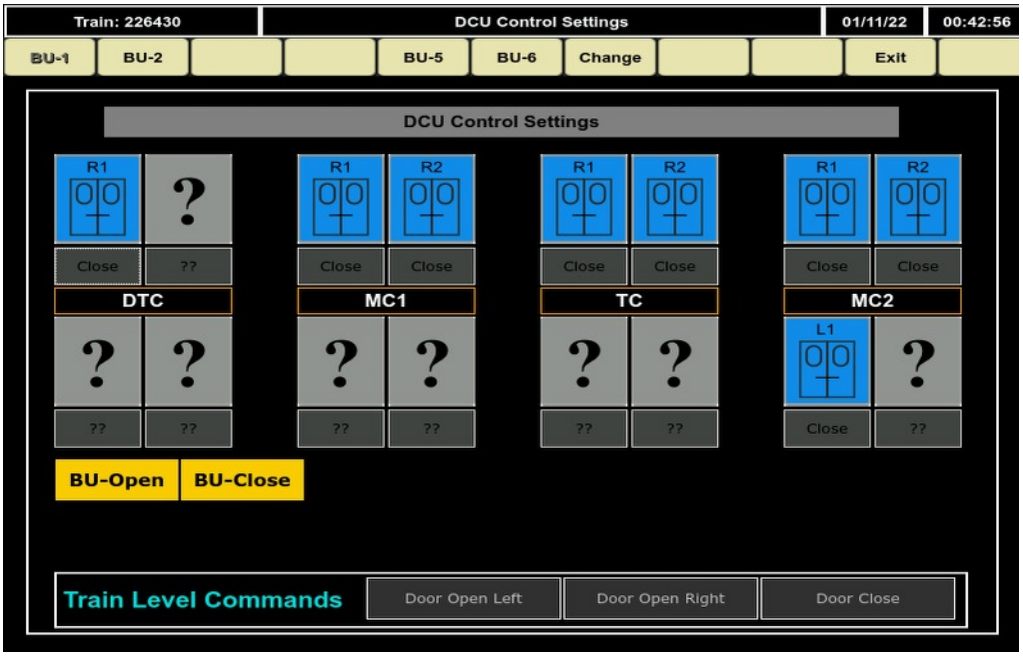


Fig. 5.34

10. PIS Route Selection

There is a provision to select the train route through TCMS display. This feature can be useful to enable destination information only on head code, in case of PIS MCP is non functional and unable to select the train route.

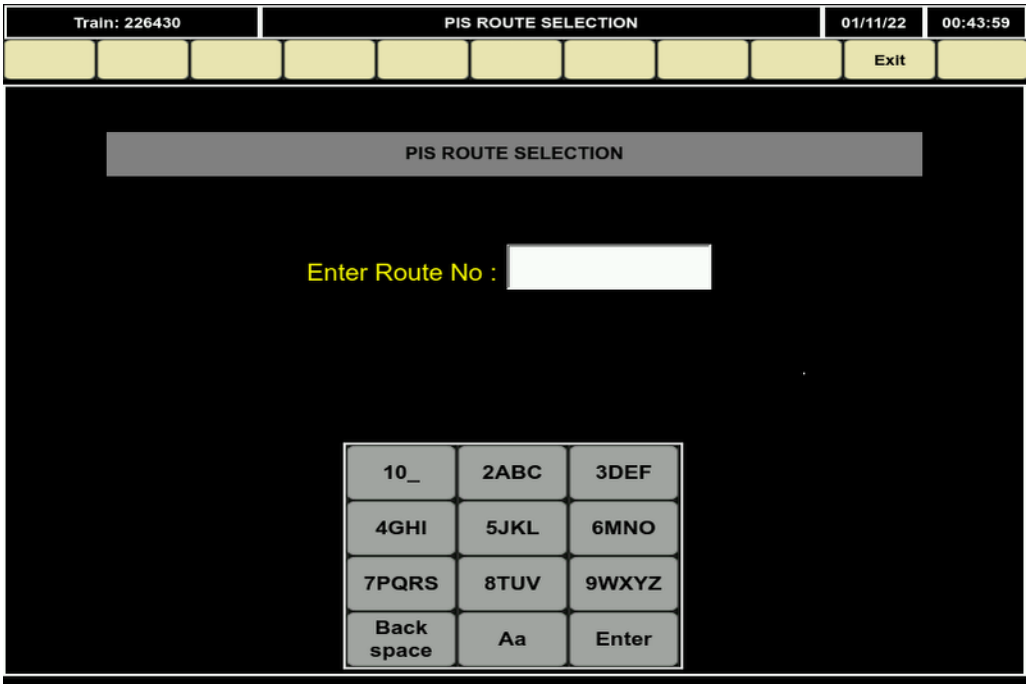


Fig. 5.35

11. Roof VCB Control

Roof VCB control is used to Roof VCB ON/OFF of each individual basic unit as per requirement.

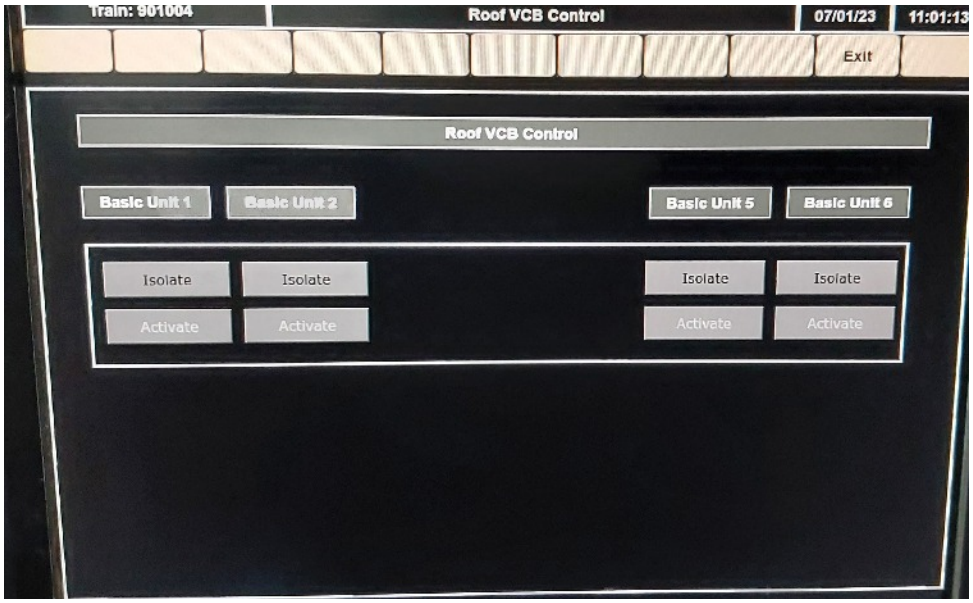


Fig. 5.36

12. Train Formation Setting

In display, provision shall be given for train formation settings, If user enters into this settings in display, the number of basic units are available for configuration.

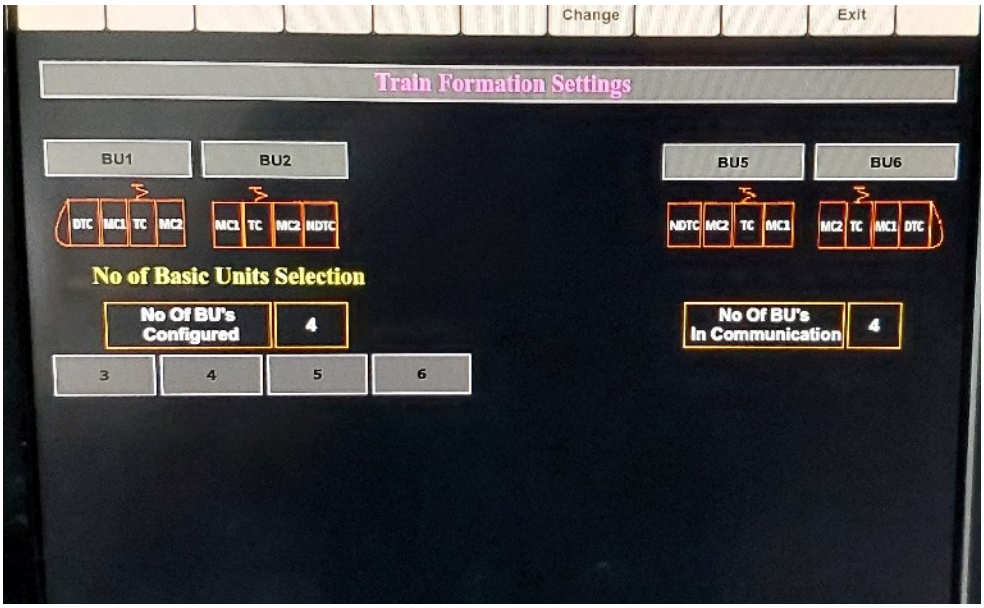


Fig. 5.37

13. Wheel Diameter Configuration

There shall be a provision to enter the wheel dia meter of individual reference wheel from DDU, this provision shall be useful , in-case of wheel turning if the user wants to enter the new wheel dia meter in the system.

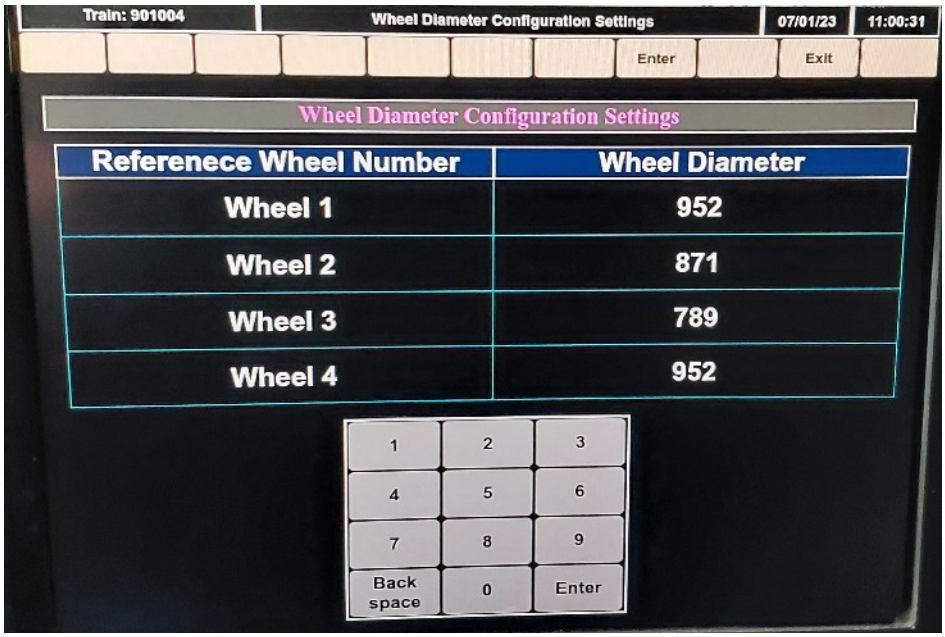


Fig. 5.38

14. Panto Combination Settings

In display, provision shall be given to make one pantograph up from set of basic units (BU1,2,3 are one set, BU4,5,6 are another set).

If any one of panto is up in one set of basic units, we can disable up/down buttons for remaining basic units of same set.

Display Legends Information

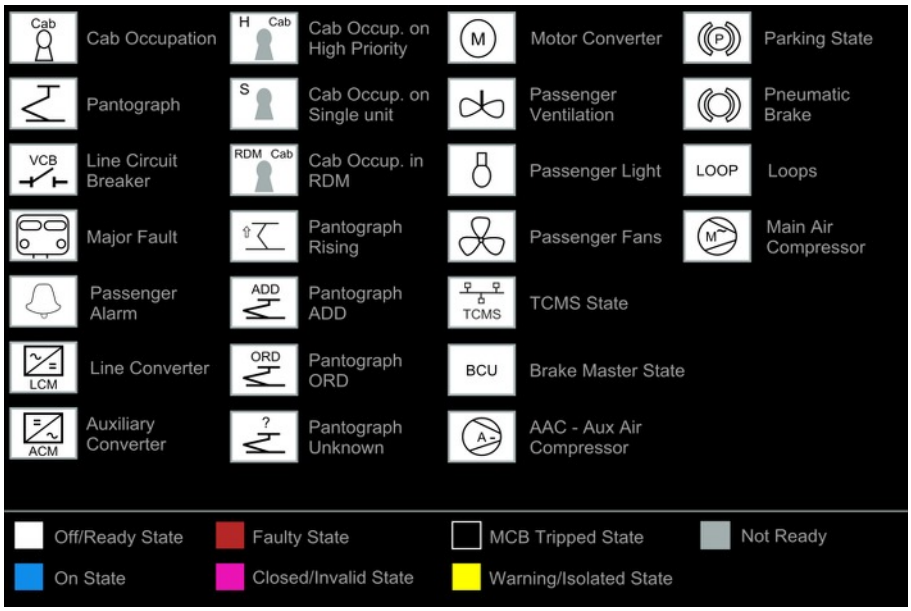


Fig. 5.39

Chapter 6

CAB REAR WALL PANEL & ECC PANELS

DTC Coach contains of CRW Panel and MC, TC, NDTC coachs contains of ECC Panel

6.1 DTC CRW

6.1.1 Isometric view of DTC CRW

One electrical cubicle is provided at rear side of driver driver cab. It houses all electrical and electronics components required for rake level control. It houses CCU'S, LRMS, TPWS, ECN Switches, MCB's, Relays & contactors for various application. Equipment layouts are shown in below section.

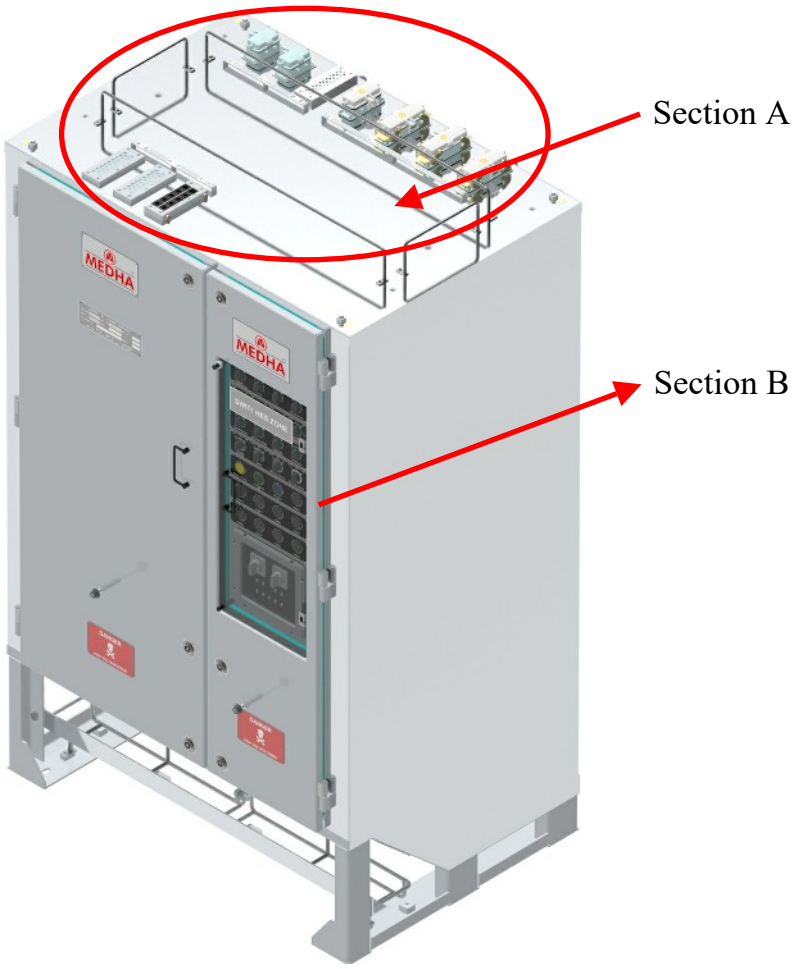


Fig. 6.1.1 Isometric view of DTC_CRW

6.1.2 Isometric view of DTC_CRW

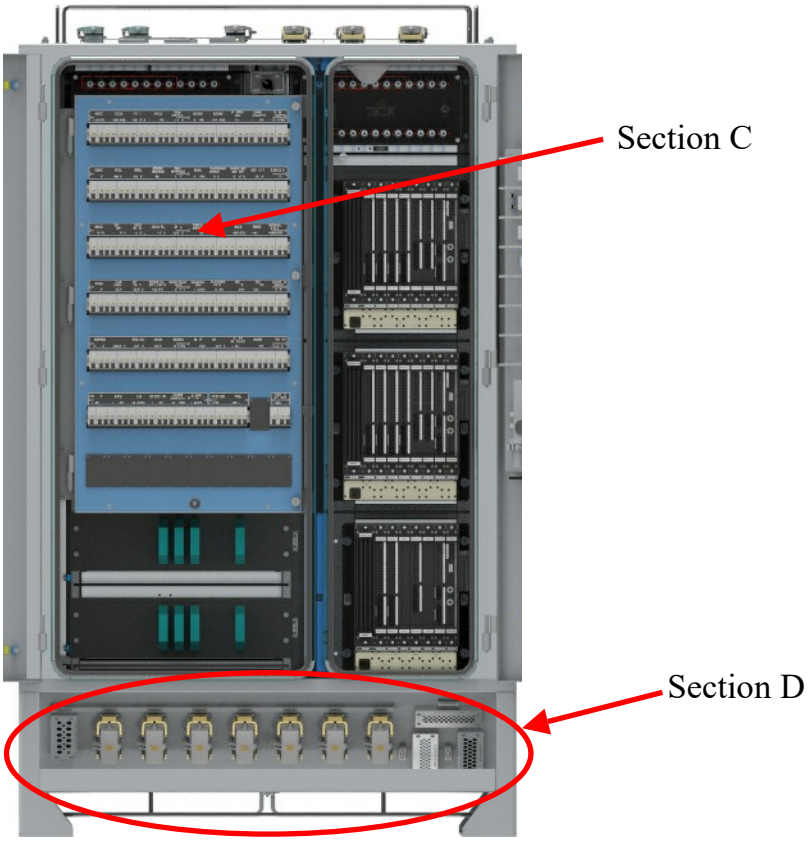


Fig. 6.1.2 Isometric view of DTC_CRW

6.1.3 DTC_CRW front view without door

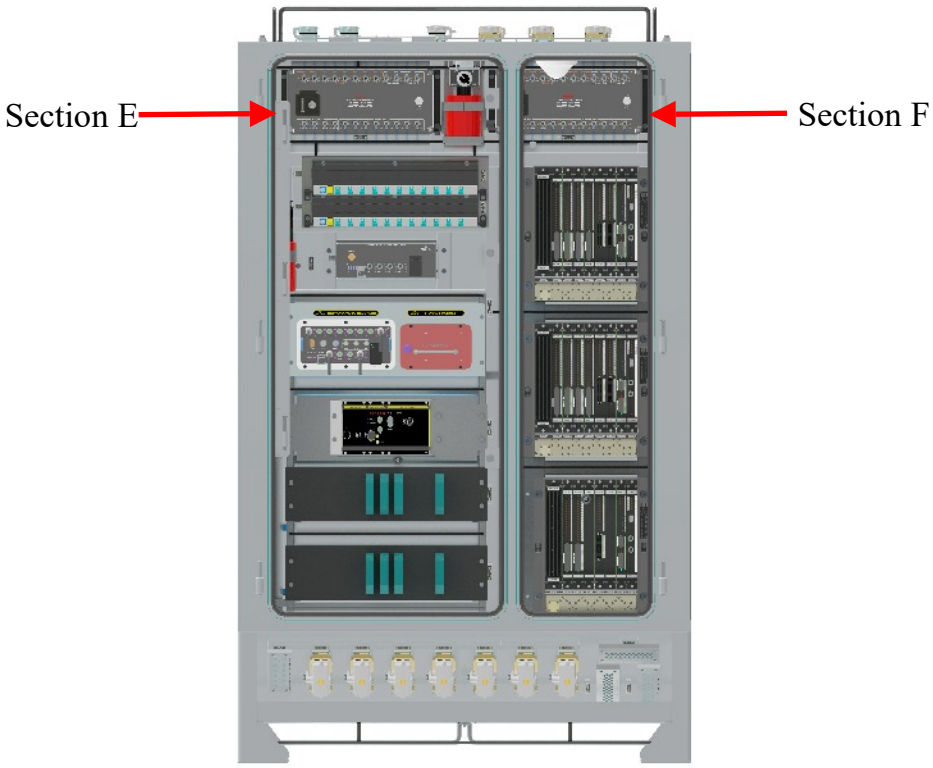


Fig. 6.1.3 Front view of DTC_CRW without Door

6.1.4 DTC_CRW rear view without door

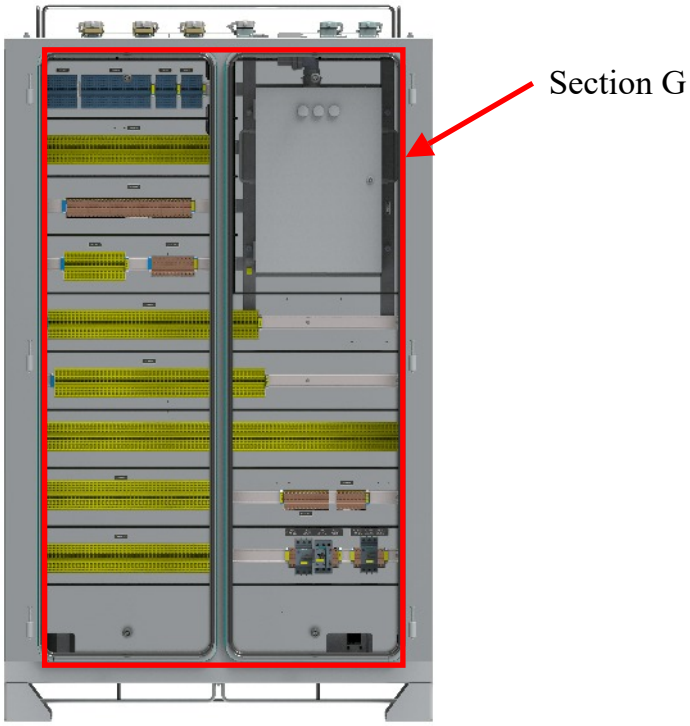


Fig. 6.1.4 Rear view of DTC_CRW without Door

6.1.5 CRW panel rear right side door back view

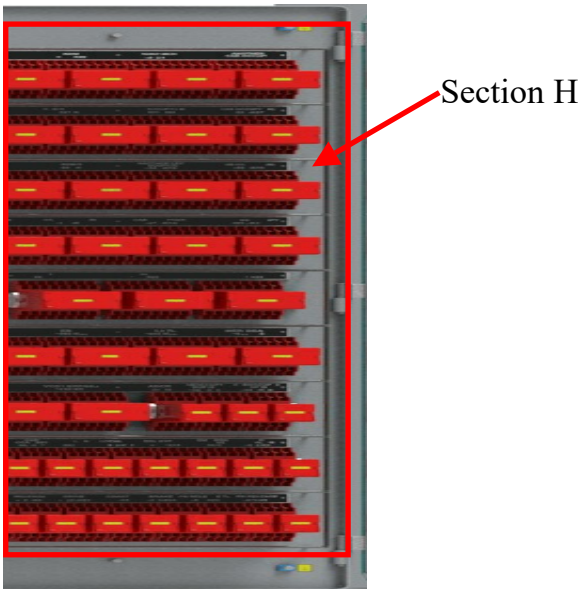


Fig. 6.1.5 Rear Right Side Door Back view of CRW Panel

6.1.6 CRW panel rear left side door back view

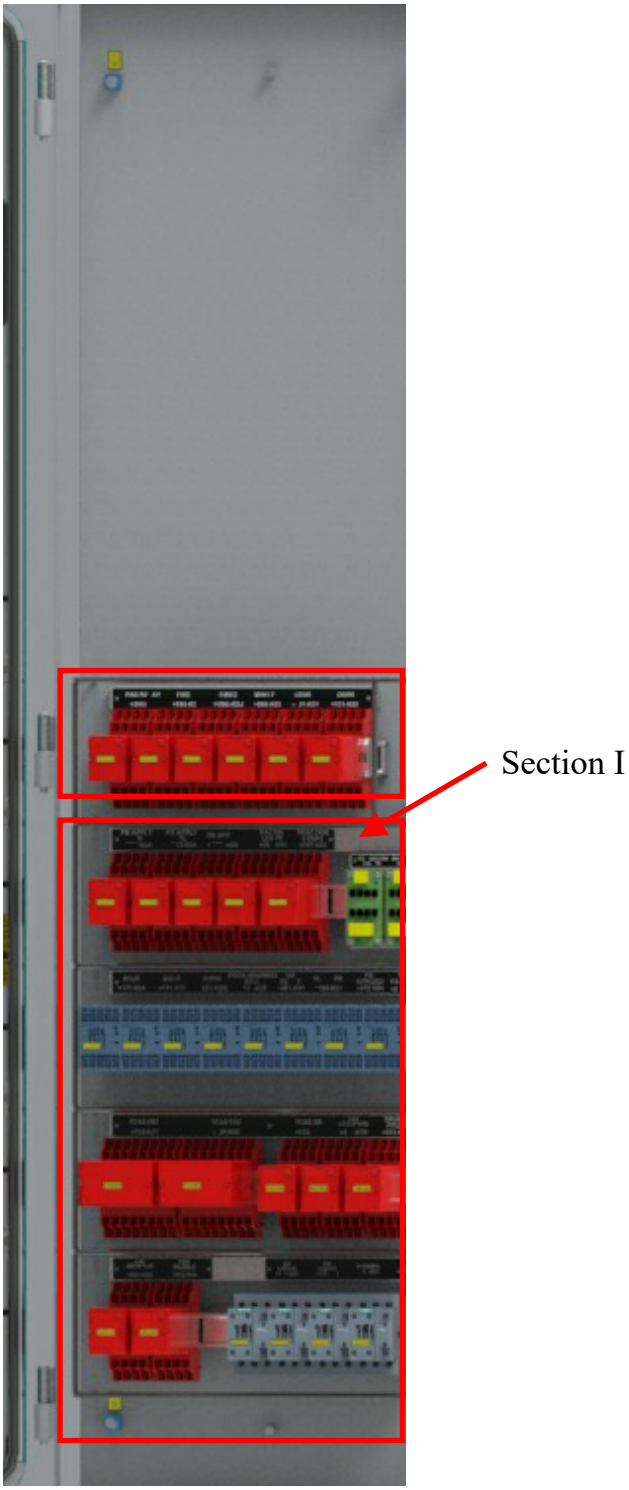


Fig. 6.1.6 Rear Left Side Door Back view of CRW Panel

SECTION-A_TOP SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
A	CONNECTOR MALE	2	71-X23 (TL1 EWP) 71-X24 (TL2 EWP)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
A	CONNECTOR MALE	1	71-X25 (Door & RMPU Interface)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
A	CONNECTOR MALE	1	71-X16(PIS)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
A	CONNECTOR FEMALE		71-X74 CAB AC CU
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
A	CABLE ENTRY FRAMES TOP OF CRW	4	SENOSRS & AUDIO TCMS & PIS COMMUNICATION
			HDMI, CCTV CAT7 COMMUNICATION
			BN, BD & LIGHTS DC110V

SECTION-B LAMPS AND SWITCHS PANEL DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
B	SHORT LEV.,SELECTOR SWITCH, 2P, MAINT.,BLK	1	CAB SELECTOR
		1	DRIVER AUTHENTICATION
		1	ADCR BYPASS
		1	UV ISO
		1	EMERGENCY OFF BYPASS
		1	SINGLE UNIT OPERATION
		1	EBL BYPASS
		1	EB SW BYPASS
		1	TRACTION SELECTION
		1	VCD BYPASS
		1	BAL ISO
B	PB SWITCH,MOMENTARY,YELLOW	1	START ALL MAC
B	PB SWITCH,MOMENTARY,GREEN	1	PB RELEASE SW
	PB SWITCH,MOMENTARY,BLUE	1	PB APPLY SW
	SHORT LEV.SEL.SWITCH,ILLUM, 3P, MOMEN,BLK	1	BATTERY SUPPLY
	SHORT LEV.,SELECTOR SWITCH,3P, MAINT.,BLK	1	MAC SW
		1	BN LTS CTRL
		1	BD LTS CTRL
	BLIND PLUG,GRY	1	BLIND PLUGS
	CAB AC SWITCH BOX SWITCH BOX	1	CAB AC SWITCH BOX
SECTION-C CRW MCB DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QYT**	**APPLICATION**
C	MCB,2POLE,440VDC,8A	1	PANTO MC
		1	CAB OCCUPY1
		1	CAB OCCUPY2
		1	DBC
		1	ECN1
		1	ECN2
		1	TCMS DISPLAY
		1	DCU LEFT
		1	DCU RIGHT
		1	DCU TL
		1	DPL

SECTION	MATERIAL DESCRIPTION	QYT	APPLICATION
C	MCB,2POLE,440VDC,8A	1	IC DOOR DE
		1	DTC
		1	CCU1
		1	CCU2
		1	PCU
		1	MAC
	MCB,2POLE,440VDC,8A	1	PARKING BRAKE TL
		1	PARKING BRAKE
		1	EBCU1
		1	EBCU2
		1	BATTERY CONTROL
		1	BCS
		1	BMS
		1	HLS
		1	EOL
	MCB,2POLE,440VDC,8A	1	EBL
		1	EMER BRAKE
		1	EBL BYPASS
		1	BAL
		1	SIGNAL BELL
		1	PAS
		1	BN LIGHTS
		1	BD LIGHTS
		1	FDS
		1	APC
C	MCB,2POLE,440VDC,8A	1	CAB LIGHT
		1	SPOT LIGHT
		1	MAIN HEAD LIGHT
		1	MARKER LIGHT
		1	FLASHER LIGHT
		1	RMPU CONTROL
		1	DRIVER CAB EMY LIGHT
		1	PIS CC
		1	SDBU
		1	HCD
		1	MCP
		1	IFTCU
		1	CCTV
		1	NVR
		1	CCTV_T1
		1	CCTV_T2/T3
		1	WIPER
		1	SPEED INDICATOR

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
C	MCB,2POLE,440VDC,8A	1	110VAC CHRG SOCKET
		1	ICD
		1	TSL
		1	CCMS DISPLAY
C	CB DUMMY PLATE	11	SPARE
SECTION -D_BOTTOM SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
D	CONNECTOR MALE	5	71-X11, 71-X12, 71- X13, 71-X14 & 71-X15 (Driver Interface)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	71-X64 & 71-X65 (Brake Interface)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CABLE ENTRY FRAMES BOTTOM OF CRW	1	SENSOR
		1	COMMUNICATION
		1	110V DC
		1	415V & 230V
SECTION-E_CRW PANEL FRONT VIEW LEFT SIDE EQUIPMENT			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
E	GIGA BIT ETHERNET SWITCH (ECN+ETB)	1	PIS/CCTV Network
	ECN	2	ECN 1&2
	IFTCU	1	Infotainment Control Unit
	NVR	1	NVR
	CAR CONTROL UNIT	1	CAR CONTROL
	EBCU	2	EBCU1 & 2
	SHORT LEV.,SELECTOR SWITCH,2P, MAINT.,BLK	1	CRW SPOT LT
SECTION -F_CRW PANEL FRONT VIEW RIGHT SIDE EQUIPMENT			
SECTION	**MATERIAL DESCRIPTION**	**QYT**	**APPLICATION**
F	GIGA BIT ETHERNET SWITCH (ECN)	1	PIS/CCTV Network
	PCU	1	PCU
	CCU	2	CCU & CCU(R)
	SMOKE SENSOR SLR-E-IS	1	SMOKE SENSOR

SECTION-G CRW PANEL REAR SIDE EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
G	4 THROUGH TERMINAL BLOCK	18	70-X15 (110V BN LIGHTS)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,GRY	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	FTTB,2WAY,0.2TO16SQ.MM,GRY	2	70-X03 (110VDCBN DistributionTB)
	4 THROUGH TERMINAL BLOCK	4	
	4 CONDUCTOR THROUGH TERMINAL BL	24	
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 CONDUCTOR THROUGH TERMINAL BL	6	
	4 THROUGH TERMINAL BLOCK	6	
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 CONDUCTOR THROUGH TERMINAL BL	66	70-X04 (TL TB)
	FTTB,2WAY,0.08-2.5MM2,GRY	26	
	END & INTERMEDIATE PLATE,GRY	4	
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	FTTB,2WAY,0.08-2.5MM2,GRY	64	70-X19 (PCUDIPTB)
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	FTTB,2WAY,0.08-2.5MM2,GRY	12	70-X18 (PCUDOPTB)
	4 CONDUCTOR THROUGH TERMINAL BL	8	
	END & INTERMEDIATE PLATE,GRY	1	
	END & INTERMEDIATE PLATE,GRY	2	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 CONDUCTOR THROUGH TERMINAL BL	31	70-X07 (CCU DOP TB)
	FTTB,2WAY,0.08-2.5MM2,GRY	9	
	END & INTERMEDIATE PLATE,GRY	1	
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 CONDUCTOR THROUGH TERMINAL BL	37	
	FTTB,2WAY,0.08-2.5MM2,GRY	155	

SECTION-G CRW PANEL REAR SIDE EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
G	END & INTERMEDIATE PLATE,GRY	11	
	END & INTERMEDIATE PLATE,GRY	2	
	WAGO GROUP MARKER	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	4 CONDUCTOR THROUGH TERMINAL BL	171	70-X06 (110VDC PS TB
	FTTB,2WAY,0.08-2.5MM2,GRY	28	
	4 THROUGH TERMINAL BLOCK	4	
	END & INTERMEDIATE PLATE,GRY	5	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 CONDUCTOR THROUGH TERMINAL BL	22	70-X12 (EBCU1 TB) 70-X13 (EBCU2 TB)
	FTTB,2WAY,0.08-2.5MM2,GRY	125	
	FTTB,2WAY,0.08-2.5MM2,GR-Y	24	
	4 CONDUCTOR THROUGH TERMINAL BL	2	
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE, ORANGE	2	
	END & INTERMEDIATE PLATE, ORANGE	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	CAB AC MPCB	1	CAB AC
	MPCB 3P,28A	1	MAC MPCB
	CONTACTOR,3P,400VAC,25A	1	MAC CONT
	FTTB,2WAY,0.08-4MM2,GRY	3	70-X16 (MAC I/P TB)
	WAGO GROUP MARKER	1	
	END & INTERMEDIATE PLATE	1	
	END STOP FOR DIN35 RAIL, GREY	2	70-X17 (MAC Output TB)
	FTTB,2WAY,0.08-4MM2,GRY	6	70-X26 (CAB AC Output TB)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,GRY	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	FTTB,2WAY,0.08-4MM2,GRY	3	70-X21 (CABAC)
	END STOP FOR DIN35 RAIL, GREY	2	
	WAGO GROUP MARKER	1	
	END & INTERMEDIATE PLATE,GRY	1	
	CAB AC CU	1	CAB AC CONTROL UNIT
SECTION-H CRW PANEL REAR RIGHT SIDE DOOR EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
H	INSTAN.RELAY WITH COIL OVP,8P,110VDC	1	RDNT MCH
		1	EOL1
		1	EOL2
		1	EOL3
		1	EBL1
		1	EBL2

SECTION-H CRW PANEL REAR RIGHT SIDE DOOR EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
H	INSTAN.RELAY WITH COIL OVP,8P,110VDC	1	EBL3TL
		1	ADCR
		1	VCD1 BYPASS
		1	VCD1
		1	FORWARD
		1	REVERSE
		1	COAST
		1	BRAKE
		1	PB RELEASE TL
		1	PB RELEASE
		1	VCD2/LOCAL EB1
		1	EBL3
	INSTAN. RELAY WITH COIL OVP,4P,110VDC	1	LOCAL EB1
		1	LOCAL EB2
		1	VCD2/LOCAL EB2
		1	EBL BYPASS
		1	CAB OCCUPY1 LOOP ISO
		1	CAB OCCUPY2 LOOP ISO
		1	EMY BRK VALVE
		1	DRIVE
SECTION-I CRW PANEL REAR LEFT SIDE DOOR EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
I	INSTAN. RELAY WITH COIL OVP,4P,110VDC	1	PAS
		1	FIRE1
		1	FIRE2
		1	MIN1 FD
		1	LDSRL
		1	LDSRR
		1	TRACTION LOOP1
		1	TRACTION LOOP2
		1	PB APPLY EN
		1	PB APPLY TL
		1	PB APPLY
	CONTACTOR,3P,110VDC,9A	1	BN LIGHTS
		1	BD LIGHTS
		1	V>5KMPH
		1	ZVAR
	AUX.CONTACTOR,4NOAUX.CONTACTOR	1	DCLR
		1	DOLR
		1	DORR
		1	DOOR WARNING BELL
		1	PB APPLIED
		1	UV
		1	FLASHER

SECTION-I CRW PANEL REAR LEFT SIDE DOOR EQUIPMENT DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
I	AUX.CONTACTOR,2NO+2NC	1	TCN FAILURE
	BCS DIODE PANEL	1	BCS DIODE PANEL
	BMS DIODE PANEL	1	BMS DIODE PANEL

6.2 MC ECC

One Electrical Cubical is provided at driving end of MC cab. It houses all electrical & electronics components required for rake level control. It houses MCUS, EBCUS, MCB, Relays & contactor for various application. Equipment layouts are shown in below section.

6.2.1 Isometric view of MC ECC

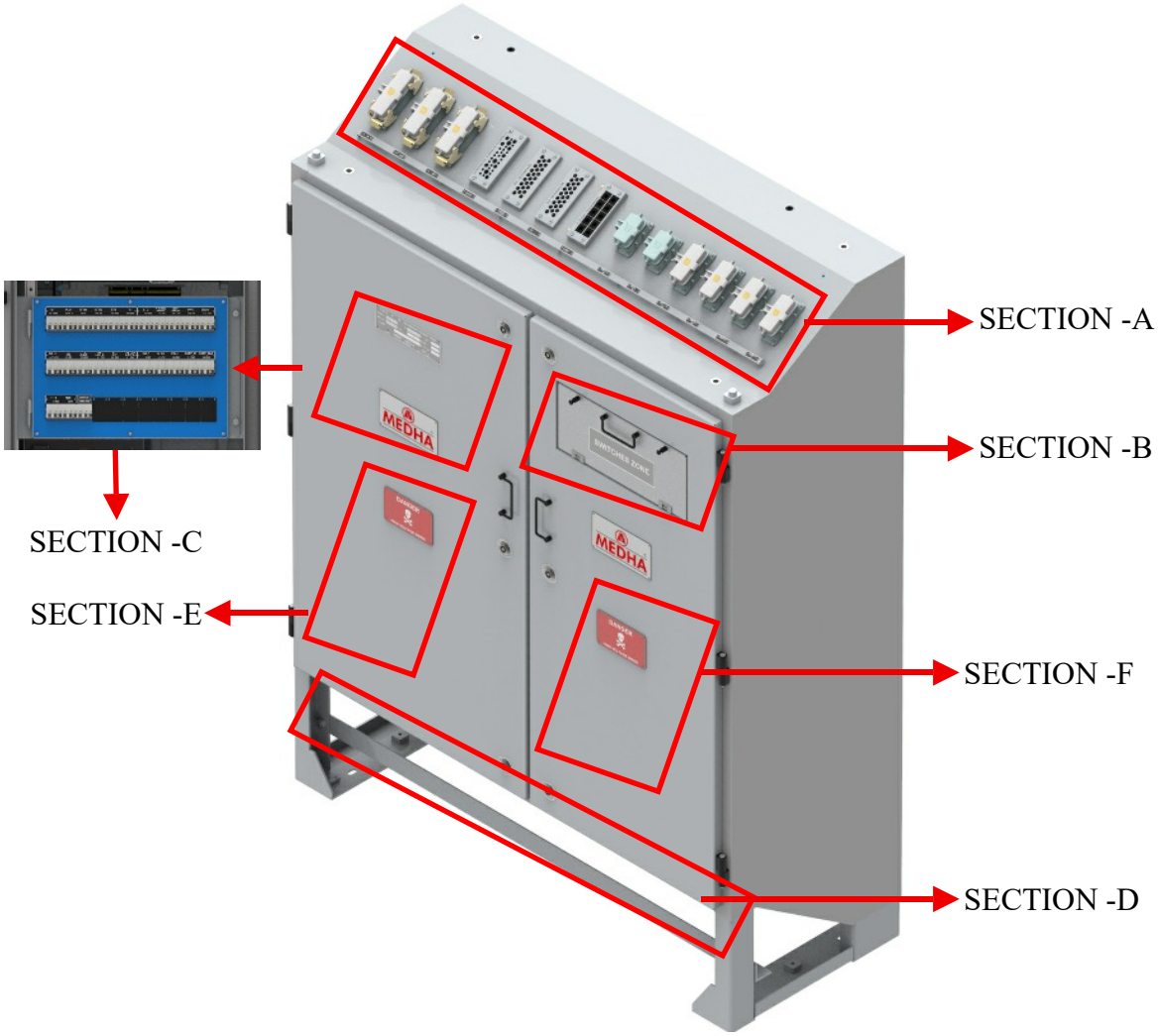


Fig. 6.2.1 Isometric view of MC ECC

6.2.2 MCC *ECC* Panel Front View without Doors

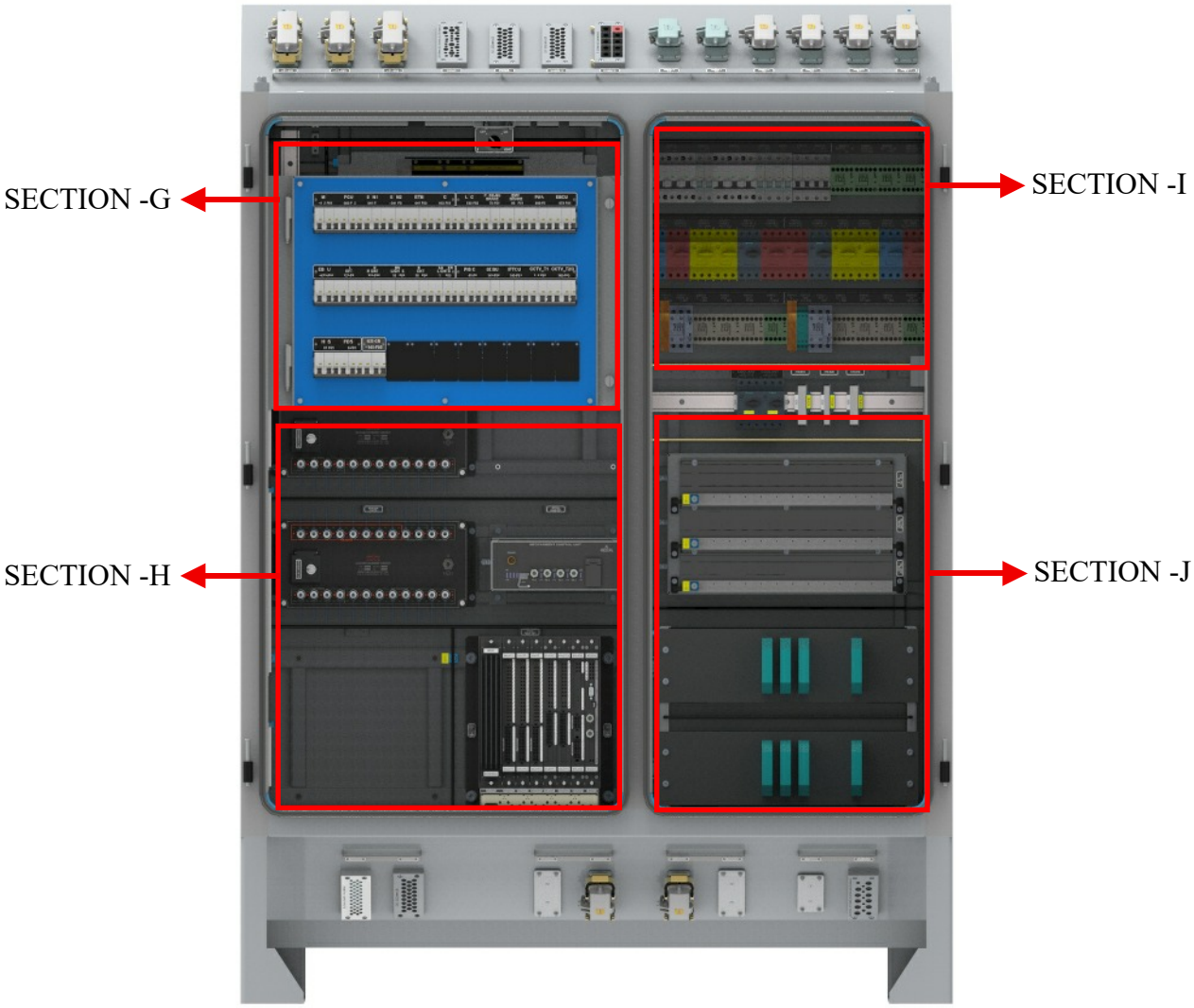


Fig. 6.2.2 Front view of MC ECC Panel without Doors

6.2.3 MC_ECC EQUIPMENT DETAILS

MC-ECC_SECTION-A_TOP SIDE CONNTECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
A	HARTING	2	RMPU1 & 2 A1 CONTROL
	HARTING	2	RMPU1 & 2 A2 CONTROL
	HARTING	2	RMPU1 & 2 A3 CONTROL
	HARTING	3	71-X01 (TL1) 71-X02 (TL2) 71-X05 (EXT. INTERFACE)
MC-ECC_SECTION-B_LAMPS AND SWITCH DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
B	PILOT LAMP,FLUSH,RED	1	EMY BRAKE LAMP
	SHORT LEV.,SELECTOR SWITCH, 3P, MAINT.,BLK	2	BN CONTROL & BD CONTROL
	BLIND PLUG,GRY	7	BLIND PLUGS
MC-ECC_SECTION-C_MCB PANEL DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
C	MCB,2POLE,440VDC,8A	1	LTC1
		1	LTC12
		1	ECN1
		1	ECN2
		1	ETB CB (ONLY IN MC2/3)
		1	DCU LEFT
		1	DCU RIGHT
		1	MC
		1	PCU
		1	PB
		1	EBCU1
		1	EBCU2
		1	HLS CB
		1	EMY BRAKE
		1	PAS
		1	BN LIGHTS
		1	BD LIGHTS
		1	DISASTER LIGHTS
		1	PIS
		1	IFTCU
		1	SDBU
		1	CCTV_T1
		1	CCTV_T2/3
		1	FDS

MC-ECC_SECTION -D_BOTTOM SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
D	HARTING	2	71-X06 (LTC & EBCU Interface) 71-X07 (EBCU Interface2)
	HARTING	1	71-X08 (SPARE) 71-X130 (SPARE)
	HARTING	2	71-X09 (SPARE)
SECTION -E _MC-ECC_RIGHT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
E	CONTACTOR,3P,110VDC,9A	1	BN CONT
		1	BD CONT
		1	LDSLR
E	INSTAN. RELAY WITH COIL OVP,4P, 110VDC	1	LDSRR
		1	EBL BYPASS
		1	EBL1
		1	EBL2
		1	EBL3
		1	FIRE1
		1	FIRE2
		1	PAS
		1	PB APPLY
		1	EMY VALVE
		1	PB APPLIED
		1	TRACTION ENABLE 1
		1	TRACTION ENABLE 1R
		1	TRACTION ENABLE 2
		1	TRACTION ENABLE 2R
MC-ECC_SECTION -F LEFT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
F	RMPU CONTROL UNIT	1	RMPU
	WAGO	180	70-X11 (EBCU1 TB) 70-X12 (EBCU2 TB)
MC-ECC_SECTION - G_CAR CONTROL, NVR & TB DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
G	CAR CONTROL UNIT	1	CAR CONTROL
	SHORT LEV.,SELECTOR SWITCH,2P,MAINT.,BLK	1	ECC SPOT LT
	SPOT LIGHT FOR TOILETS - 1.5W	1	ECC SPOT LIGHT
	4 THROUGH TERMINAL BLOCK	20	70-X06 (BN TB) 70-X16 (BD TB)

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
G	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	4 THROUGH TERMINAL BLOCK	4	70-X09 (110VDC BD distribution TB)
	FTTB,2WAY,0.2 TO 6SQ.MM,GRY	2	
	END & INTERMEDIATE PLATE,GRY	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	6	70-X10 (110VDC BN distribution)
	FTTB,2WAY,0.2TO16SQ.MM,GRY	2	
	WAGO GROUP MARKER	10	
	4 CONDUCTOR THROUGH TERMINAL BL	1	
	END & INTERMEDIATE PLATE	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	48	70-X05 (TL TB)
	WAGO GROUP MARKER	1	
	WAGO END PLATES	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	24	70-X19 (PIS TB) 70-X07 (Comm. TB)
	WAGO GROUP MARKER	2	
	WAGO END PLATES	2	
	4-CONDUCTOR GROUND TB,GRN-YEL	2	
	FTTB,2WAY,0.08-2.5MM2,GRY	26	
	2-CONDUCTOR GROUND TB,GREEN-YLW	15	
	END STOP FOR DIN35 RAIL, GREY	4	
	4 THROUGH TERMINAL BLOCK	2	70-X20 (230V Distribution)
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
MC-ECC_SECTION–H_PCU, GIGA BIT ETHERNET SWITCH & IFTCU			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
H	IFTCU	1	Infotainment Control Unit
	GIGA BIT ETHERNET SWITCHES	2	PIS/CCTV Network
	PCU	1	PCU

MC-ECC_SECTION – I, RMPU SECTION			
MC-ECC_SECTION - J_MPCB, CONNECTORS, EBCU AND ECN SWITCH DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
J	MPCB 3 POLE 8A,690VAC	2	LTC1&2 COOLENT
	ECN	2	ECN 1&2
	ETB(ONLY IN MC2/3)	1	ETB
	EBCU	2	EBCU1 & 2
	WAGO	11	70-X13 (415V AC) 70-X14 (415V AC BUS 2)

6.3 TC ECC

One Electrical Cubicle is provided at driving end of TC cab. It houses all electrical & electronics components required for rake level control. It houses MCU'S, EBCU'S, MCB's, Relays & contactors for various application. Equipment layouts are shown in below section.

6.3.1 Isometric View of TC ECC

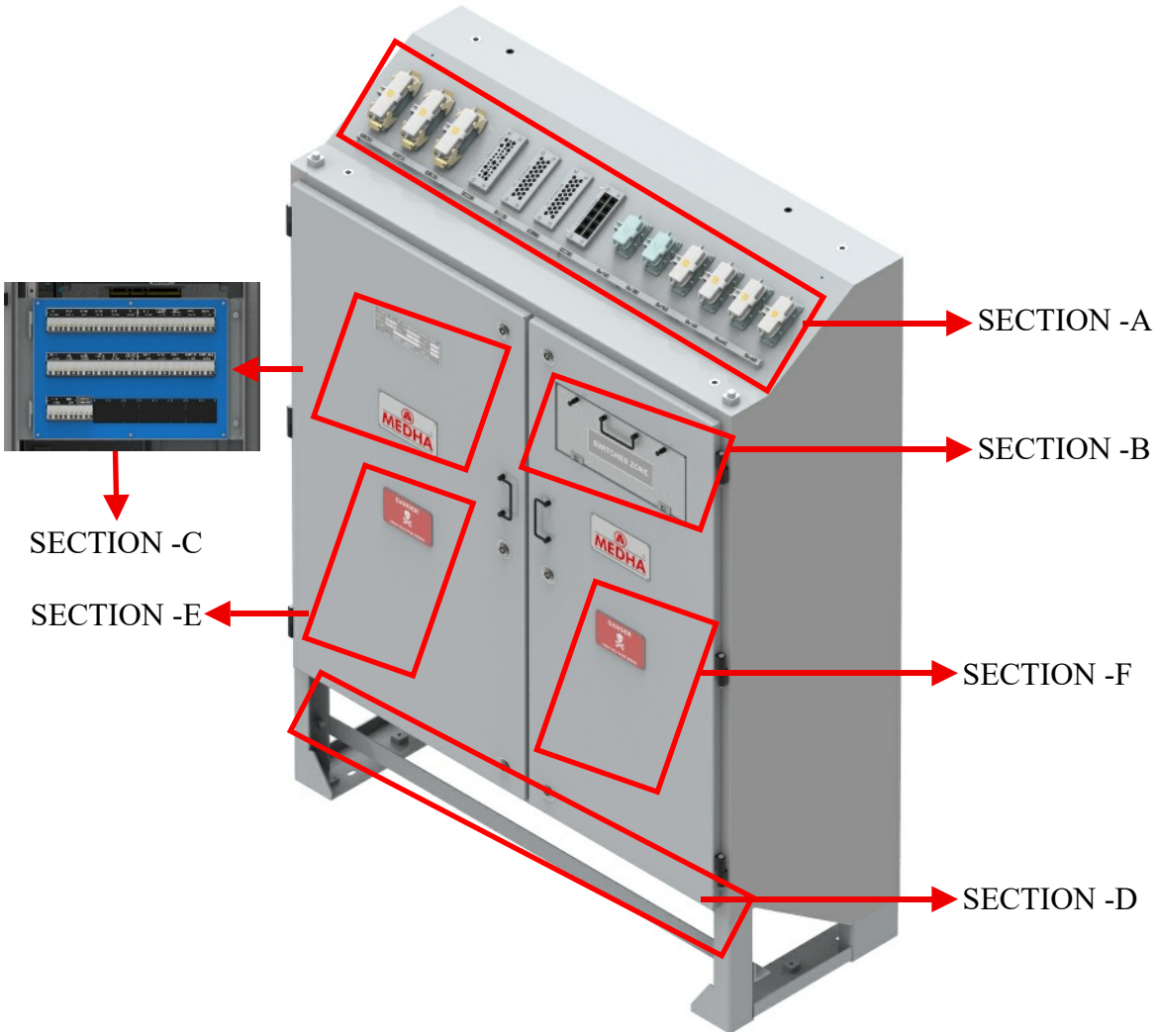


Fig. 6.3.1 Isometric view of TC ECC

6.3.2 ECC Panel Front View without Doors

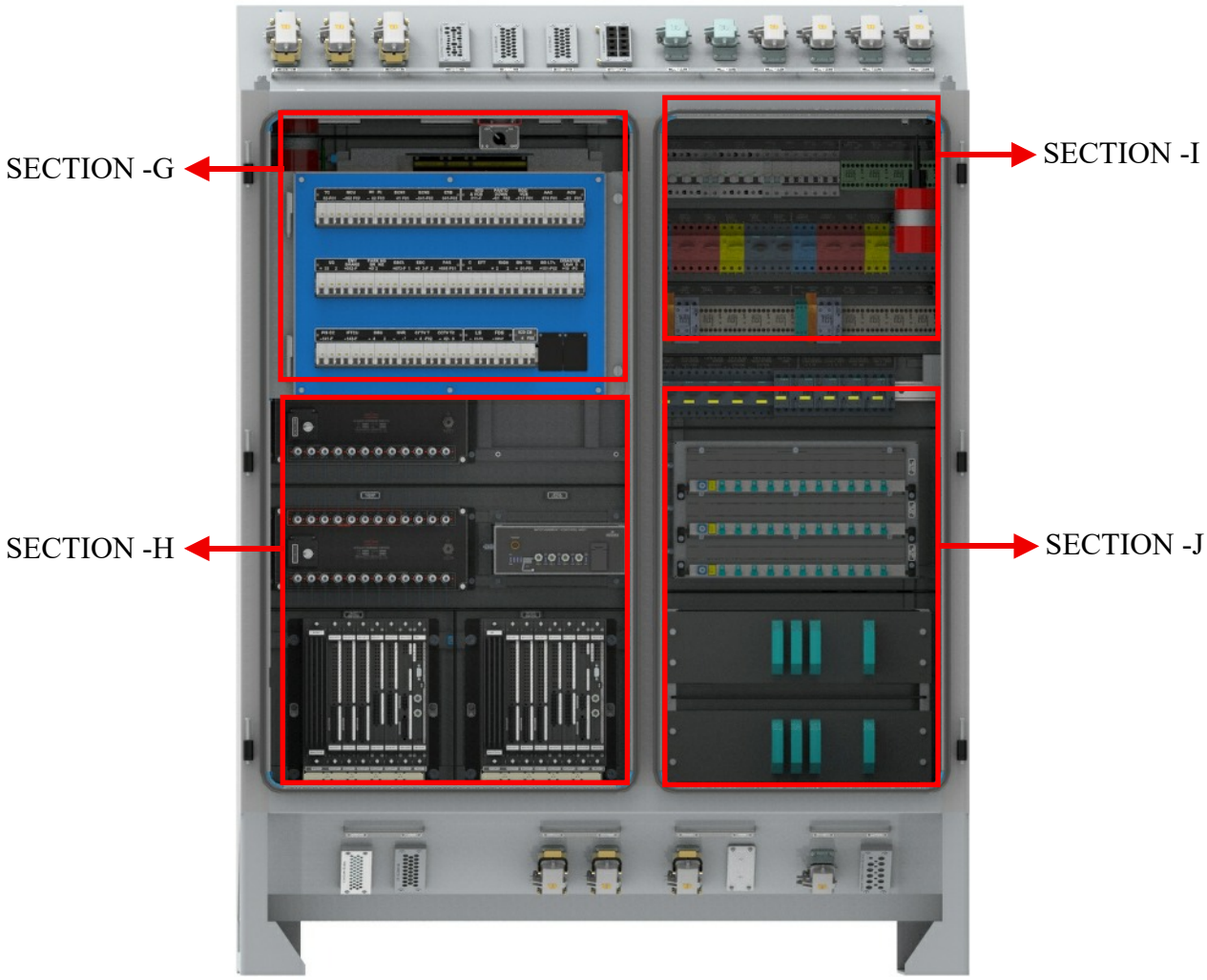


Fig. 6.3.2 Front view of ECC Panel without Doors

6.3.3 List of Equipment of TC-ECC

TC-ECC_SECTION-A_TOP SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
A	CONNECTOR MALE	2	RMPU1 & 2 A1 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	RMPU1 & 2 A2 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	RMPU1 & 2 A3 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	71-X01 (TL1) 71-X05 (EXT. INTERFACE)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	1	71-X02 (PIS)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
A	CABLE ENTRY FRAMES TOP OF ECC	1	BN, BD & LIGHTS DC110V
		1	SENOSR, AUDIO & CCTV CAT5 COMMUNICATION
		1	TCMS, PIS COMMUNICATION
		1	HDMI & CCTV CAT7 COMM.

TC-ECC SECTION-B_LAMPS AND SWITCH DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
B	SHORT LEV.,SELECTOR SWITCH,2P, MAINT.,BLK	1	AAC SW
	PILOT LAMP,FLUSH,BLUE	1	LOCAL PANTO UP
		1	LOCAL VCB ON
	PILOT LAMP,FLUSH,RED	1	EMY OFF LAMP
		1	EMY BRAKE LAMP
	SHORT LEV.,SELECTOR SWITCH, 3P, MAINT.,BLK	1	BN LTS CNTRL
		1	BD LTS CNTRL
	BLIND PLUG,GRY	4	BLIND PLUGS
TC-ECC_SECTION-C_MCB PANEL DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
C	MCB,2POLE,440VDC,8A	1	PANTO&VCB
	MCB,2P,440VDC,16A	1	ROOF VCB
		1	ACU1 CB
		1	ACU2 CB
		1	ECN1
		1	ECN2
		1	ETB CB
		1	DCU LEFT
		1	DCU RIGHT
		1	TC
		1	MCU
		1	MCU(R)
		1	PB
		1	EBCU1
		1	EBCU2
		1	HLS CB
		1	EMY BRAKE
		1	PAS
		1	BN LIGHTS
		1	BD LIGHTS
		1	PIS
		1	IFTCU
		1	SDBU
		1	FDS
		1	PANTO DOWN
		1	NVR
		1	CCTV_T1
		1	CCTV_T2/3
		1	AAC

TC-ECC_SECTION -D_BOTTOM SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
D	CONNECTOR MALE	2	71-X06 (ACU & EBCU Interface) 71-X07 (EBCU Interface2)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	1	71-X08 (Transformer Control)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	1	71-X09 (415V AC)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	HOUSING	1	71-X130 (SPARE)
	CABLE ENTRY FRAMES BOTTOM OF ECC	1	SENSOR
		1	COMMUNICATION
		1	415V & 230V
TC-ECC SECTION -E_RIGHT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
E	CONTACTOR,3P,110VDC,9A	1	BN LIGHTS
		1	BD LIGHTS
	CONTACTOR,3P,110VDC,15A(DC2, 2P)	1	AAC CONT

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
E	INSTAN. RELAY WITH COIL OVP,4P,110VDC	1	LDSLR
		1	LDSRR
		1	EBL BYPASS
		1	EBL1
		1	EBL2
		1	EBL3
		1	FIRE1
		1	FIRE2
		1	PAS
		1	TRACTION LOOP1
		1	TRACTION LOOP2
		1	PB RELEASE
		1	EMY VALVE
E	AUX.CONTACTOR,4NO	1	PANTO STATUS
		1	VCB STATUS
		1	VCB ON
		1	PB APPLIED
		1	ROOF VCB
	INSTAN.RELAY WITH COIL OVP,8P,110VDC	1	EOL1
		1	EOL2
		1	EOL3
		1	EOL123
	BD BN DIODE PANEL1	1	BD BN DIODE PANEL1
	BD BN DIODE PANEL2	1	BD BN DIODE PANEL2
TC-ECC SECTION-F_LEFT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
F	RMPU CONTROL UNIT	1	RMPU
	4 CONDUCTOR THROUGH TERMINAL BL	172	70-X11 (EBCU1 TB) 70-X12 (EBCU2 TB)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,ORANGE	2	
	END STOP FOR DIN35 RAIL, GREY	4	
TC-ECC_SECTION - G_CAR CONTROL, NVR & TB DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
G	CAR CONTROL UNIT	1	CAR CONTROL
	SHORT LEV.,SELECTOR SWITCH,2P,MAINT.,BLK	1	ECC SPOT LT
	SPOT LIGHT FOR TOILETS - 1.5W	1	ECC SPOT LIGHT
	4 THROUGH TERMINAL BLOCK	20	70-X06 (BNLTSTB) 70-X16 (BDLTSTB)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,GRY	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	FTTB,2WAY,0.2TO16SQ.MM,GRY	2	70-X10 (110VDC BN distribution)
	4 THROUGH TERMINAL BLOCK	6	
	END & INTERMEDIATE PLATE,GRY	1	
	END STOP FOR DIN35 RAIL, GREY	2	

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
G	FTTB,2WAY,0.2 TO 6SQ.MM,GRY	2	70-X09 (110VDCBDdistributionTB)
	4 THROUGH TERMINAL BLOCK	4	
	END & INTERMEDIATE PLATE,GRY	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	31	70-X05(TL TB)
	WAGO GROUP MARKER	1	
	WAGO END PLATES	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	29	70-X19(PIS TB) 70-X03(Comm. TB)
	FTTB,2WAY,0.08-2.5MM2,GRY	14	
	4-CONDUCTOR GROUND TB,GRN-YEL,	3	
	2-CONDUCTOR GROUND TB,GREEN-YLW	7	
	WAGO GROUP MARKER	2	
	WAGO END PLATES	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	4 THROUGH TERMINAL BLOCK,P/NO	2	70-X20 (230V Distribution)
	END AND INTERMEDIATE PLATE,P/NO:	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	WAGO GROUP MARKER	1	
	FTTB,2WAY,0.08-2.5MM2,GRN-YEL	18	70-X07(AIP/FIP TB)
	WAGO GROUP MARKER	1	
	WAGO END PLATES	1	
	2-CONDUCTOR GROUND TB,GREEN-YLW	12	
	4-CONDUCTOR THROUGH TB,GRY	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	NVR	1	NVR

TC-ECC_SECTION – H_MCU, GIGA BIT ETHERNET SWITCH & IFTCU

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
H	IFTCU	1	Infotainment Control Unit
	GIGA BIT ETHERNET SWITCHES	2	PIS/CCTV Ethernet network
	MCU	2	MCU 1 & MCU2

TC-ECC SECTION-I_ RMPU SECTION

TC-ECC_SECTION – J_MPCB, CONTACTORS, EBCU AND ECN SWITCHES DETAILS

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
J	MPCB 3 POLE,12.5A,690VAC	1	TXFR OIL PUMP
		1	TXFR BLW1 HIGH SPEED
		1	TXFR BLW1 LOW SPEED
		1	TXFR BLW2 HIGH SPEED
		1	TXFR BLW2 LOW SPEED
	CONTACTOR,3P,110VDC,9A	1	TXFR OIL PUMP
		1	TXFR BLW1 LOW SPEED
		1	TXFR BLW2 LOW SPEED
	CONTACTOR,3P,110VDC,9A	1	TXFR BLW1 HIGH SPEED
		1	TXFR BLW2 HIGH SPEED
	ECN	2	ECN 1&2
	ETB	1	ETB
	EBCU	2	EBCU1 & 2

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
J	FTTB,2WAY, 0.2TO10SQ.MM,BLUE	6	70-X13(415V AC) 70-X17(415V AC BUS 2)
	4 THROUGH TERMINAL BLOCK	6	
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,GRY	2	
	END STOP FOR DIN35 RAIL, GREY	4	

6 .4 NDTC-ECC

6.4.1 Isometric View of NDTC ECC

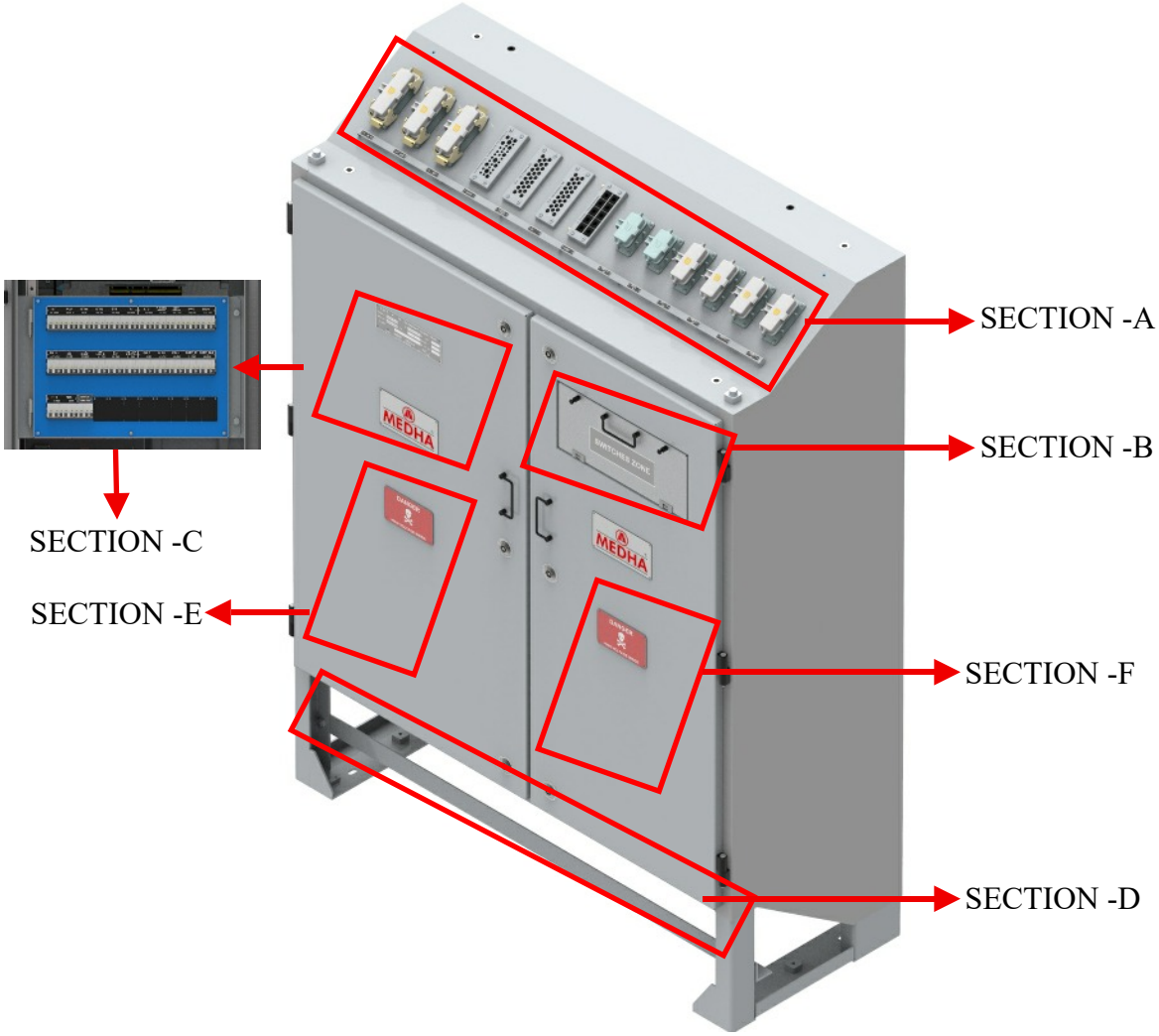


Fig. 6.4.1 Isometric view of NDTC ECC

6.4.2 NDTC-ECC Panel Front View

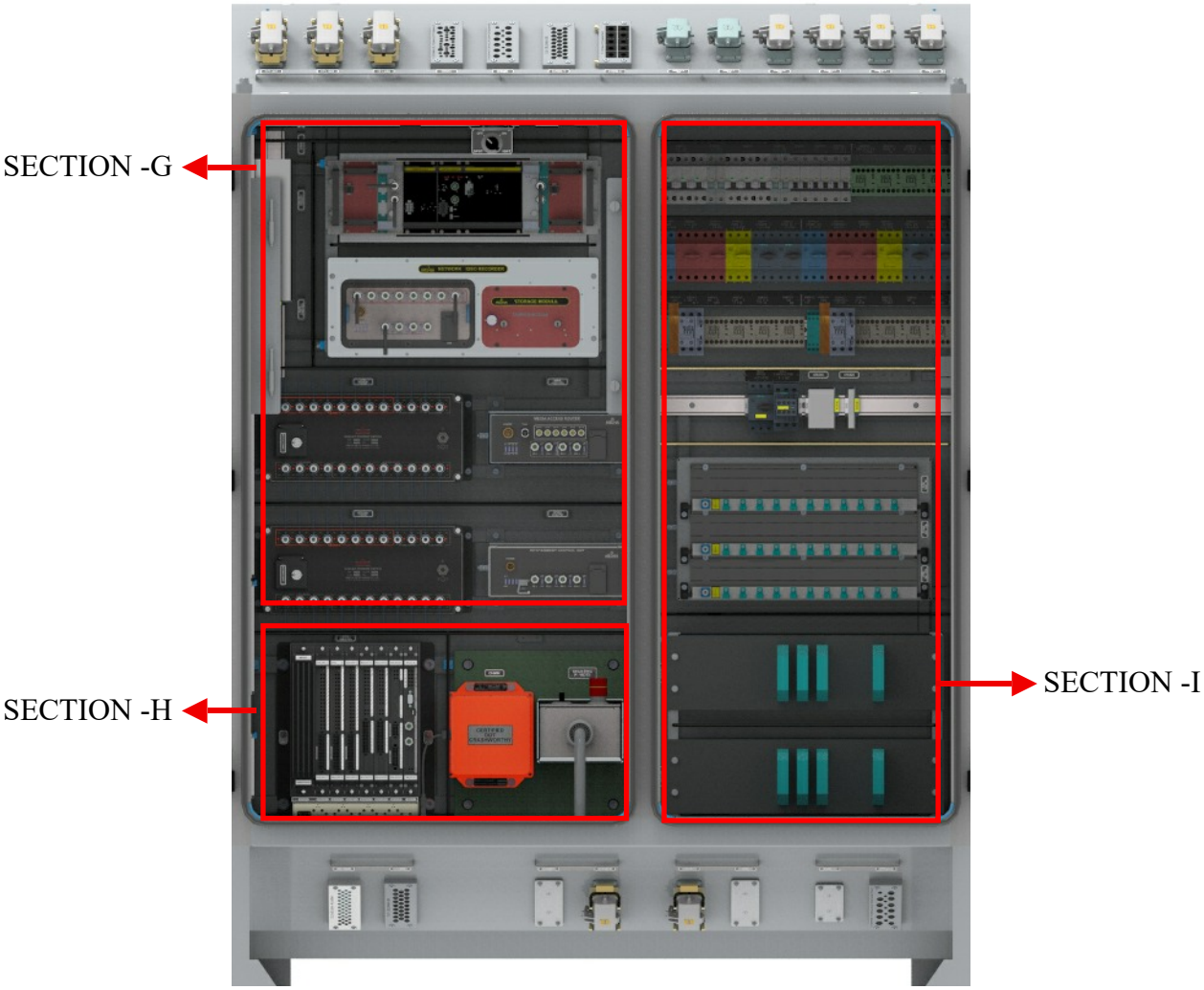


Fig. 6.4.2 Front view of NDTC ECC Panel

6.4.3 List of Equipment of NDTC-ECC

NDTC-ECC_SECTION-A_TOP SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
A	CONNECTOR MALE	2	RMPU1 & 2 A1 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	RMPU1 & 2 A2 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	RMPU1 & 2 A3 CONTROL
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CONNECTOR MALE	2	71-X01(TL1) 71-X02(TL2)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CRIMP CONTACT FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CRIMP TERMINAL,MALE	1	71-X05(EXT. INTERFACE)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	CABLE ENTRY FRAMES TOP OF ECC	1	BN, BD & LIGHTS DC110V
		1	SENOSR, AUDIO & COMMUNICATION
		1	TCMS, PIS & CCTV CAT5 COMMUNICATION
		1	HDMI & CCTV CAT7 COMMUNICATION
NDTC-ECC_SECTION-B_LAMPS AND SWITCHES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
B	SHORT LEV.,SELECTOR SWITCH,2P, MAINT.,BLK	1	SINGLE UNIT OPERATION
		1	ADCR BYPASS
		1	RMPU1 MAN ON
		1	RMPU2 MAN ON
	SHORT LEV.SEL.SWITCH,ILLUM,3P, MOMEN.,BLK	1	BATTERY SUPPLY
		1	PANTO
		1	MC ON
	PILOT LAMP,FLUSH,BLUE	1	MIN1 PANTO UP
		1	MIN1 VCB CLOSED
	PILOT LAMP,FLUSH,RED	1	EMY OFF
		1	MAJOR FAULT
		1	OHE AVAILABLE
		1	EMY BRAKE
	SHORT LEV.,SELECTOR SWITCH,3P, MAINT.,BLK	1	MAC
		1	BN LTS CNTRL
		1	BD LTS CNTRL
	BLIND PLUG,GRY	5	BLIND PLUGS
NDTC-ECC_SECTION-C_MCB PANEL DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
B	MCB,2POLE,440VDC,8A	1	PANTO & MC
		1	CAB OCCUPY CONTROL
		1	ECN1
		1	ECN12
		1	ETB
		1	DCU LEFT
		1	DCU RIGHT
		1	NDTC
		1	PCU
		1	MAC
		1	PB
		1	EBCU1
		1	EBCU2
		1	BATTERY CONTROL
		1	BATT. CHARGER

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
	MCB,2POLE,440VDC,8A	1	HLS
		1	EMY BRAKE
		1	PAS
		1	BN LIGHTS
		1	BD LIGHTS
		1	EOL EBL
		1	FDS
		1	BMS
		1	PIS
		1	SDBU
		1	IFTCU
		1	NVR
		1	MAR
		1	CCTV_T1
		1	CCTV_T2/3
NDTC-ECC_SECTION -D_BOTTOM SIDE CONNECTORS AND CABLE ENTRY FRAMES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
D	CONNECTOR MALE	2	71-X06 (BATT. & EBCU Interface) 71-X07(EBCU Interface2)
	CONNECTOR FEMALE		
	CRIMP CONTACT, MALE		
	CONTACTS FEMALE		
	HOUSING		
	HOOD TOP ENTRY		
	GUIDE PIN		
	GUIDE BUSH		
	HOUSING	2	71-X08 (SPARE) 71-X130 (SPARE)
	HOUSING	1	71-X09 (SPARE)
	CABLE ENTRY FRAMES BOTTOM OF ECC	1	SENSOR
		1	COMMUNICATION
		1	415V & 230V
NDTC-ECC SECTION -E_RIGHT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
E	CONTACTOR,3P,110VDC,9A	1	BN LIGHTS
		1	BD LIGHTS
	INSTAN. RELAY WITH COIL OVP,4P, 110VDC	1	LDSLR
		1	LDSRR
		1	EBL BYPASS
		1	EMY VALVE
		1	LOCAL_EB1
		1	LOCAL_EB2
		1	PB RELEASE
		1	PB APPLY
		1	PAS
		1	FIRE1
		1	FIRE2

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
E	INSTAN. RELAY WITH COIL OVP,4P,110VDC	1	EBL1
		1	EBL2
		1	EBL3
	AUX.CONTACTOR,4NO	1	PB APPLIED
	AUX.CONTACTOR,2NO+2NC	1	ANOTHER CAB OCCUPY
		1	ANOTHER CAB OCCUPY(R)
	INSTAN.RELAY WITH COIL OVP,8P,110VDC	1	CAB OCCUPY1(M)
		1	CAB OCCUPY2(M)
		1	CAB OCCUPY3(M)
NDTC-ECC SECTION-F_LEFT DOOR BACK SIDE COMPONENTS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
F	RMPU CONTROL UNIT	1	RMPU
	4 CONDUCTOR THROUGH TERMINAL BL	172	70-X11 (EBCU1 TB) 70-X12 (EBCU2 TB)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,ORANGE	2	
	END STOP FOR DIN35 RAIL, GREY	4	
NDTC-ECC_SECTION - G_CAR CONTROL, NVR & TB DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
G	CAR CONTROL UNIT	1	CAR CONTROL
	SHORT LEV.,SELECTOR SWITCH, 2P,MAINT.,BLK	1	ECC SPOT LT
	SPOT LIGHT FOR TOILETS - 1.5W	1	ECC SPOT LIGHT
	4 THROUGH TERMINAL BLOCK	20	70-X06 (BN LTS TB) 70-X16 (BD EMY LTS TB)
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE	2	
	END STOP FOR DIN35 RAIL, GREY	4	
G	4 THROUGH TERMINAL BLOCK	6	70-X09 (110VDCBDdistribution TB)
	END AND INTERMEDIATE PLATE	1	
G	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	18	70-X10 (110VDC BN distribution)
	FTTB,2WAY,0.2TO16SQ.MM,GRY	2	
	WAGO GROUP MARKER	1	
	END AND INTERMEDIATE PLATE	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	18	70-X05 (TL TB)
	FTTB,2WAY,0.2TO16SQ.MM,GRY	28	
	WAGO GROUP MARKER	3	
	WAGO END PLATES	1	
	WAGO END PLATES	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	28	70-X19 (PIS TB) 70-X07 (Comm. TB)
	WAGO GROUP MARKER	2	

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
G	WAGO END PLATES	6	70-X19 (PIS TB) 70-X07 (Comm. TB)
	4-CONDUCTOR GROUND TB,GRN-YEL	2	
	FTTB,2WAY,0.08-2.5MM2,GRY	27	
	2-CONDUCTOR GROUND TB,GREEN-YLW	14	
	END STOP FOR DIN35 RAIL, GREY	4	
	4 THROUGH TERMINAL BLOCK	2	70-X20 (230V Distribution)
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	NVR	1	NVR
	IFTCU	1	Infotainment Control Unit
	GIGA BIT ETHERNET SWITCHES	2	PIS/CCTV Network
	MAR	1	MAR(Event recording)
NDTC-ECC SECTION H_PCU, GIGA BIT ETHERNET SWITCH & IFTCU			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
	PCU	1	PCU
H	CHM	1	CHM(Event recording)
	Shunting panel	1	Shunting purpose
NDTC-ECC_SECTION – I_MPCB, CONTACTORS, EBCU AND ECN SWITCHES DETAILS			
SECTION	**MATERIAL DESCRIPTION**	**QTY**	**APPLICATION**
I	MPCB 3P,28A	1	MAC(Main Air Compressor) MPCB
	CONTACTOR,3P,110VDC,38A	1	MAC(Main Air Compressor) CONT
	ECN	2	ECN 1&2
	ETB Repeater	1	ETB
	EBCU	2	EBCU1 & 2
	FTTB,2WAY,0.2TO16SQ.MM,GRY	9	70-X14 (MAC TB)
	WAGO GROUP MARKER	1	
	END & INTERMEDIATE PLATE,GRY	1	
	END STOP FOR DIN35 RAIL, GREY	2	

Chapter 7

DRIVER DESK LAYOUT EQUIPMENT

7.1 MC_P1/MC2/TC_P1-Panel Description

One End Wall panel (P1) is located at the right side of driving end or ECC End on MC and TC coach. P1 panel consists of MC houses Terminal Blocks & MCBs. Equipment layouts are shown in below section.

7.2 Panel P1 Detailed View of MC/MC2 Coach

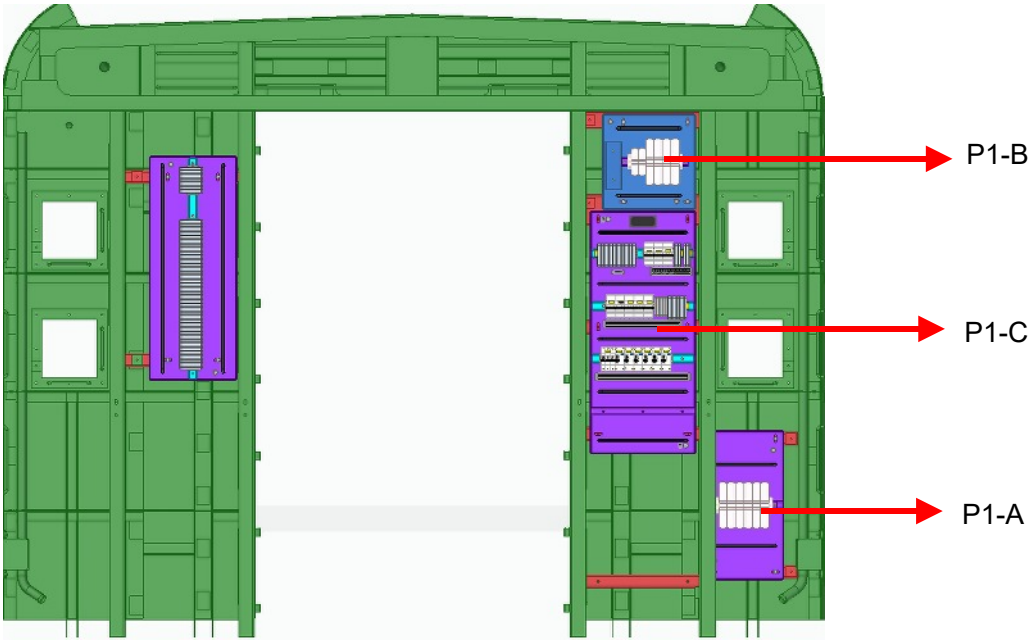


Fig. 7.2 Panel P1 Detailed View of MC/MC2 Coach

7.2.1 Panel P1-A (Section A)

Fig. 7.2.1 Panel P1-A (Section A)

7.2.2 Panel P1-B (Section B)

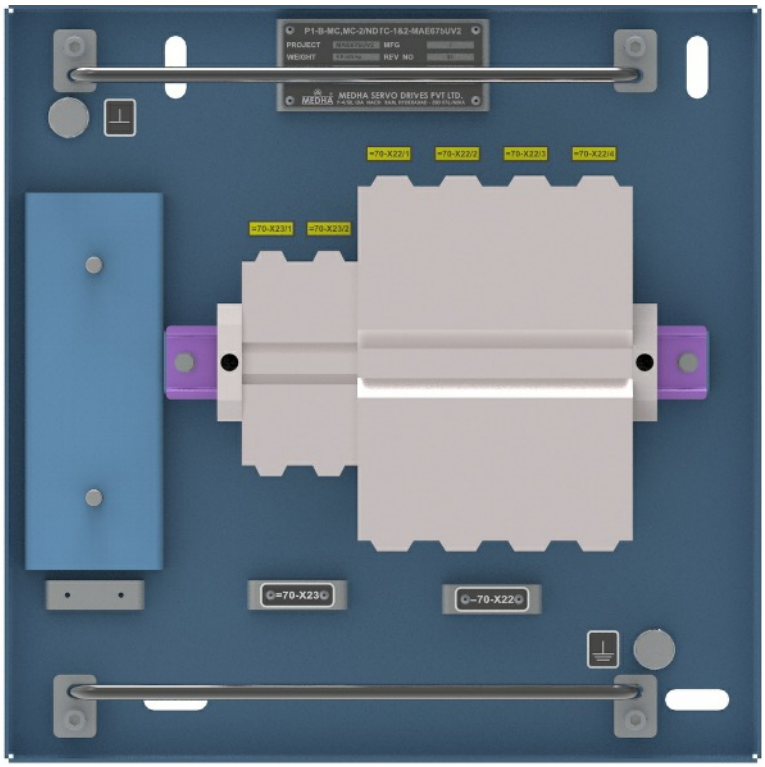


Fig. 7.2.2 Panel P1-B (Section B)

7.2.3 Panel P1-C (Section C)

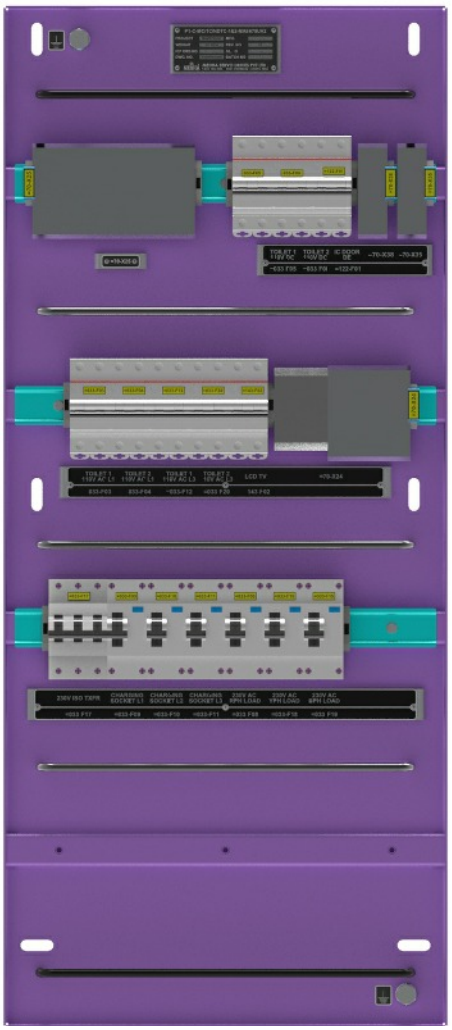


Fig. 7.2.3 Panel P1-C (Section C)

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A	TERMINAL BLOCK	6	415VAC DISTRIBUTION TB FOR IV COUPLER
	END BRACKETS FOR TB	2	
B	TERMINAL BLOCK	4	BN TB
	END BRACKETS FOR TB	2	
	TEMINAL BLOCK	2	BD TB
	END BRACKETS FOR TB	2	
C	MCB,2P,440VDC,10A	5	TOILET1 110V L1
			TOILET2 110V L1
			TOILET1 110V L3
			TOILET2 110V L3
			LCD TV
	MCB,2POLE,440VDC,8A	3	TOILET1 110V DC
			TOILET2 110V DC
			IC DOOR DE
	RCBO,1 POLE+N,40A,230V AC	3	230V AC RPH LOAD
			230V AC YPH LOAD
			230V AC BPH LOAD
	RCBO,1 POLE+N,20A,230V AC	3	CHARGING SOCKET L1
			CHARGING SOCKET L2
			CHARGING SOCKET L3
	MCB,3 POLE,63 A,400V AC	1	230V ISO TXFR
	4 THROUGH TERMINAL BLOCK	24	230V &110V AC O/P
	MARKER CARDS	1	
	END STOP FOR DIN35 RAIL,GREY	2	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	FTTB,2WAY,0.2TO10SQ.MM,BLUE	6	230V &110V AC DISTRIBUTION
	4 THROUGH TERMINAL BLOCK	12	
	MARKER CARDS	1	
	END STOP FOR DIN35 RAIL,GREY	2	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
	4 THROUGH TERMINAL BLOCK	2	IC DOOR CB
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	4 THROUGH TERMINAL BLOCK	10	230V AC O/P
	MARKER CARDS	1	
	END STOP FOR DIN35 RAIL,GREY	2	
	END AND INTERMEDIATE PLATE	1	

7.3 NDTC_P1-Panel Description

One End Wall panel (P1) is located in left side of non driving end or toilet end on NDTC coach. P1 panel consists of NDTC houses Terminal Block, MCBs & contactor. Equipment layouts are shown in below section.

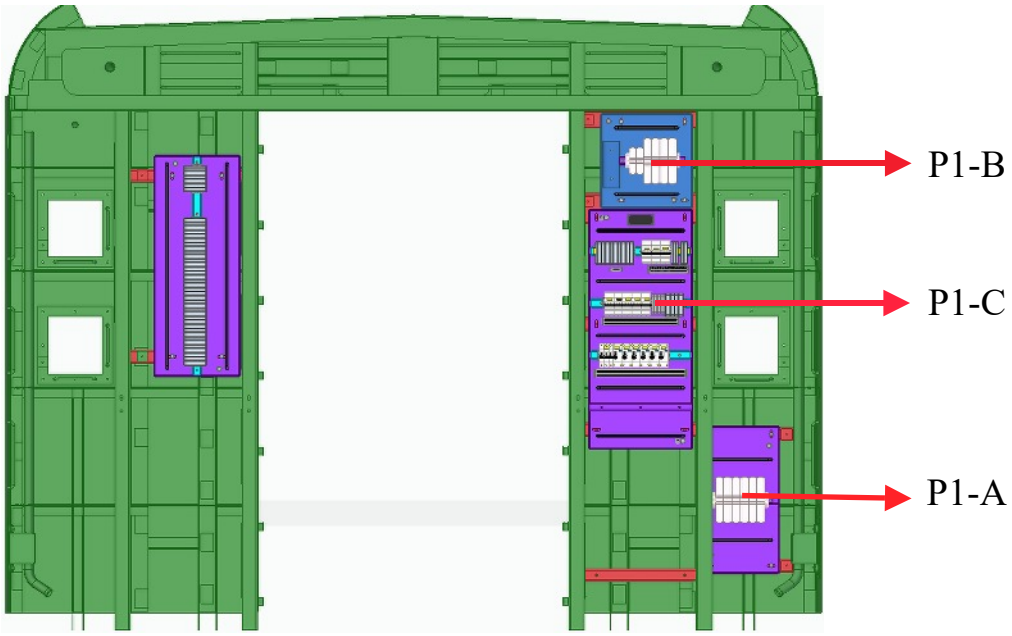


Fig. 7.3.1 Panel Arrangement in NDTC coach

7.3.1 Panel P1-A (Section-A)

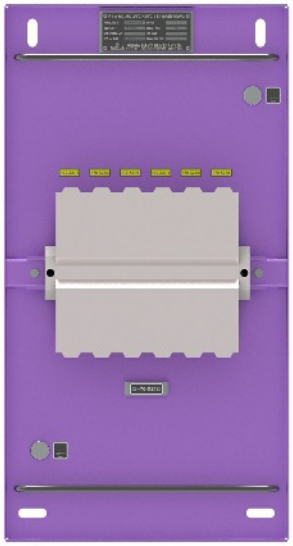


Fig. 7.3.2 Panel P1-A (Section-A)

7.3.2 Panel P1-B (Section-B)

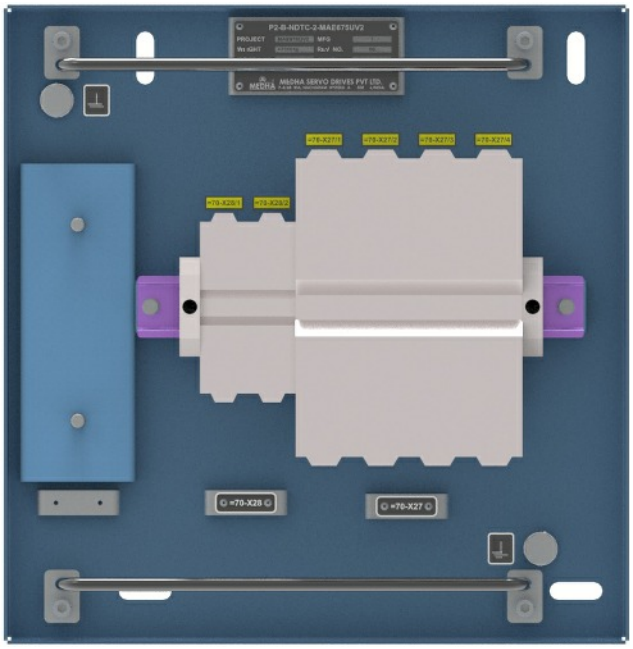


Fig. 7.3.3 panel p1-B(Section-B)

7.3.3 Panel P1-C (Section-C)

Fig. 7.3.4 panel p1-c (section-c)

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
P1-A	TERMINAL BLOCK	6	P1 415V AC TB=70-X21
	END BRACKETS FOR TB	2	
P1-B	TERMINAL BLOCK	4	P1 BN TB =70-X22
	END BRACKETS FOR TB	2	
	TERMINAL BLOCK	2	P1 BN TB =70-X23
	END BRACKETS FOR TB	2	
P1-C	FTTB,2WAY,0.2 TO 6SQ.MM,GRY	6	P1 230V & 110V AC DISTRIBUTION =70-X24
	4-CONDUCTOR THROUGH TB,GRY	12	
	MARKER CARDS	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END & INTERMEDIATE PLATE,GRY	1	
	END AND INTERMEDIATE PLATE	1	
	4-CONDUCTOR THROUGH TB,GRY	24	P1 230V & 110V AC O/P =70-X25
	MARKER CARDS	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END AND INTERMEDIATE PLATE	1	
	4-CONDUCTOR THROUGH TB,GRY	10	230V AC O/P =70-X35
	MARKER CARDS	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END AND INTERMEDIATE PLATE	1	
	4-CONDUCTOR THROUGH TB,GRY	2	IC DOOR I/P =70-X38
	MARKER CARDS	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END AND INTERMEDIATE PLATE	1	
	MCB,3 POLE,63A,400VAC	1	230V ISO TXFR =033-F17

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
P1-C	RCBO,1POLE+N,20A,230VAC	3	CHARGING SOCKET L1 =033-F09
			CHARGING SOCKET L2=033-F10
			CHARGING SOCKET L3=033-F11
	RCBO,1POLE+N,40A,230VAC	3	230V AC RPH_LOAD =033-F08
			230V AC YPH_LOAD =033-F18
			230V AC BPH_LOAD =033-F19
	MCB,2P,440VDC,10A	5	TOILET1 110V AC_L1 =033-F03
			TOILET2 110V AC_L1 =033-F04
			TOILET1 110V AC_L3 =033-F12
			TOILET2 110V AC_L3 =033-F07
			LCD TV =143-F02
	MCB,2POLE,440VDC,8A	3	TOILET1 110V DC =033-F05
			TOILET2 110V DC =033-F06
			IC DOOR DE =121-F03

7.4 DTC_P2-Panel Description

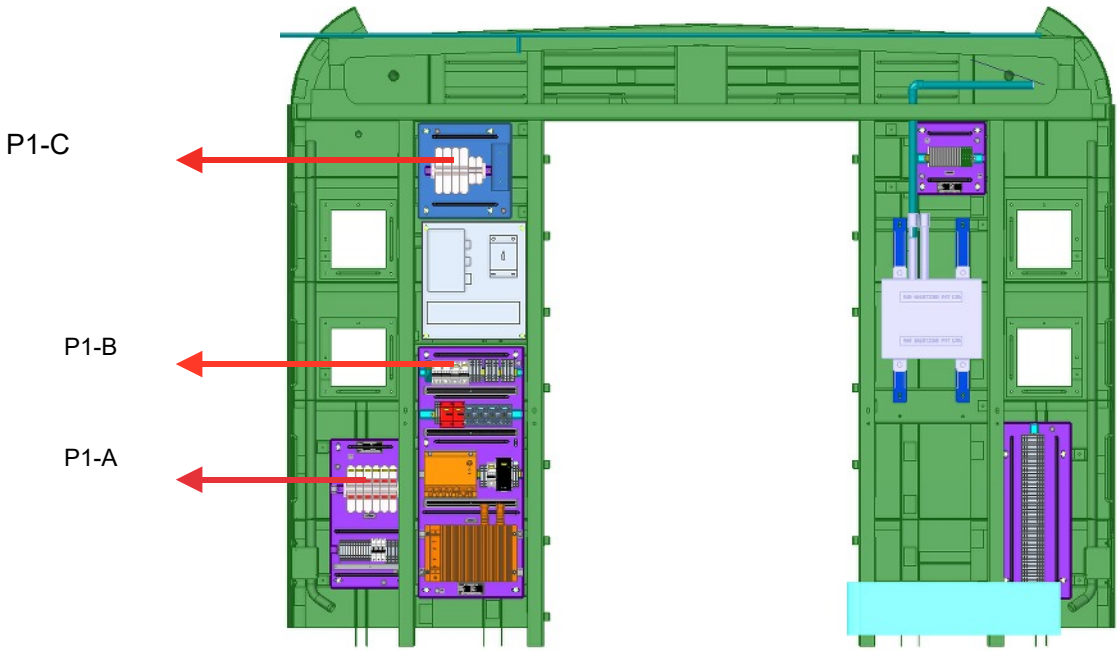


Fig. 7.4.1 P2-Panel Arrangement in DTC Coach

7.4.1 Panel P2-A (Section-A)

Fig. 7.4.2 **Panel P2-A (Section-A)**

7.4.2 Panel P2-B (Section-B)

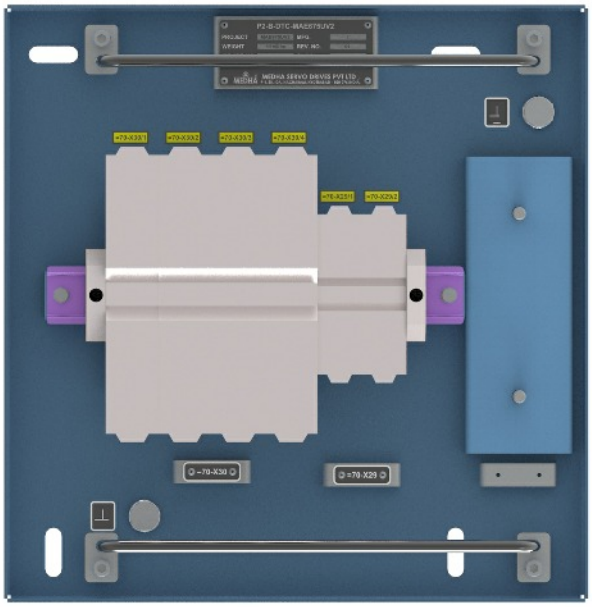


Fig. 7.4.3 **Panel P2-B (Section-B)**

7.4.3 Panel P2-C (Section-C)

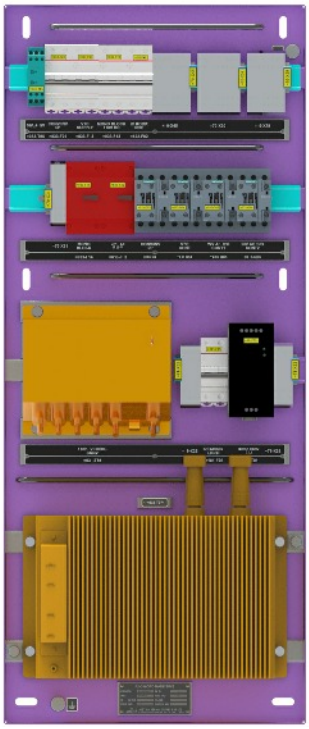


Fig. 7.4.4 **Panel P2-C (Section-C)**

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A	TERMINAL BLOCK	6	415V AC DISTRIBUTION TB FOR IV COUPLER =70-X35
	END BRACKETS FOR TB	2	
B	TERMINAL BLOCK	4	BN Distribution for iv coupler =70-X30
	END BRACKETS FOR TB	2	
	TERMINAL BLOCK	2	BD Distribution for iv coupler =70-X29
	END BRACKETS FOR TB	2	
C	4 THROUGH TERMINAL BLOCK	8	Reading light MCB input =70-X33
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	FTTB,2WAY,0.2TO16SQ.MM,GRY	9	415AC DISTRIBUTION TB =70-X31
	MARKER CARDS	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END AND INTERMEDIATE PLATE	1	
	ADJACENT JUMPER,GRAY	3	
	WAGO GROUP MARKER	1	
	4 THROUGH TERMINAL BLOCK	3	MON BLOCK MCB INPUT & OUTPUT =70-X32
	MARKER CARDS	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	4 THROUGH TERMINAL BLOCK	8	Reading light MCB output =70-X34
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	ADJACENT JUMPER,GRAY	6	
	4 THROUGH TERMINAL BLOCK	4	P2 DC DISTRIBUTION =70-X38
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	12	230V TXFR O/P 70-X37
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
C	ADJACENT JUMPER,GRAY	6	
	READING LIGHT CONVERTOR		READING LTS CONV =033-T02
	MONO BLOCK CONTROLLER		MONO BLOCK CONTROLLER =033-T03
	MPCB 3P,4A	1	MONO BLOCK MCB =033-F12
	MCB,3POLE,440V,40A	1	230VAC TRANSFROMER I/P SUPPLY =033-F01
	MCB,2POLE,440VDC,8A,	3	MONO BLOCK 110VDC =032-F11
			IC DOOR SUPPLY NDE =122-F02
			READING LIGHTS =033-F13

7.5 MC/TC/NDTC_P2-Panel Description

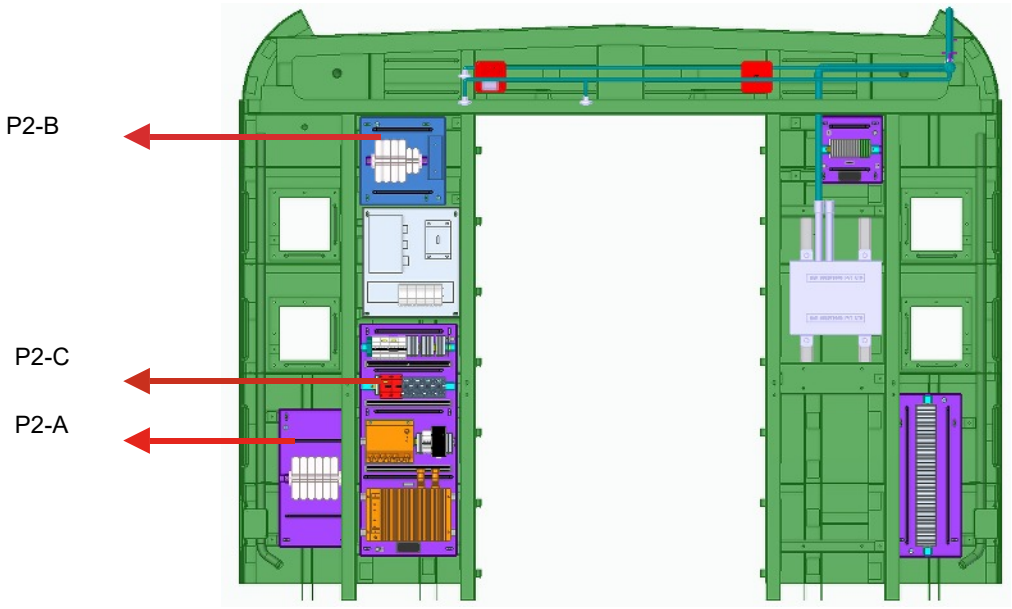


Fig. 7.5.1 **MC/TC/NDTC_P2-Panel Description**

7.5.1 Panel P2 -A(Section A)

Fig. 7.5.2 Panel P2 -A(Section A)

7.5.2 Panel P2-B (Section B)

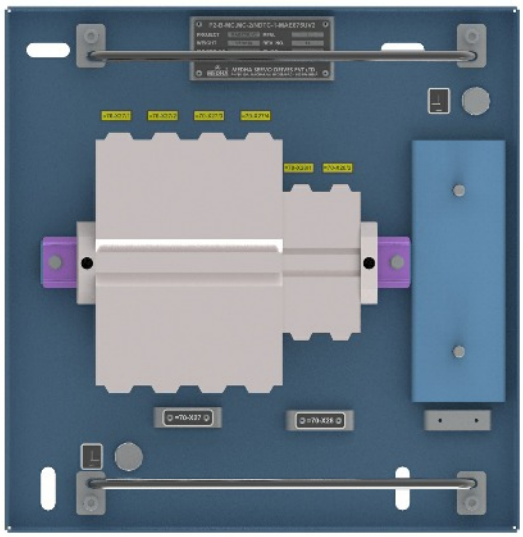


Fig. 7.5.3 Panel P2 -B(Section B)

7.5.3 Panel P2-C (Section C)

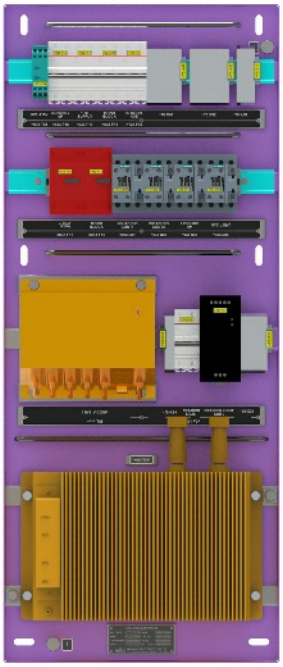


Fig. 7.5.4 Panel P2-C (Section C)

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A	TERMINAL BLOCK	6	415VAC Distribution TB for IV coupler
	END BRACKETS FOR TB	2	
B	TERMINAL BLOCK	4	BN TB
	END BRACKETS FOR TB	2	
	TERMINAL BLOCK	2	BD TB
	END BRACKETS FOR TB	2	
C	MCB,2POLE,440VDC,8A	3	MCB,2POLE,440VDC,8A,5SL5 208-7RC
			MONO BLOCK 110VDC
			IC DOOR SUPPLY NDE
	MPCB 3P,4A,	1	MONO BLOCK
	CONTACTOR,3POLE,400VAC,225A	2	CHANGEOVER CNT1, `CHANGEOVER CNT2
	4 THROUGH TERMINAL BLOCK	4	110V DC I/P DIST
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	6	MONO BLOCK INPUT & MONO BLOCK OUTPUT
	MARKER CARDS	2	
	END STOP FOR DIN35 RAIL, GREY	4	
	WAGO GROUP MARKER	2	
	END & INTERMEDIATE PLATE,GRY	2	
	4 THROUGH TERMINAL BLOCK	8	READING LIGHTS OUTPUT
	ADJACENT JUMPER,GREY,32A	2	
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	
	4 THROUGH TERMINAL BLOCK	10	CHANGE OVER CONT INTF
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	

7.6 Panel P3 Description Of All Coaches

One End Wall panel (P3) is located at the right side of non driving end or toilet end on all the coaches (DTC/ MC/ TC/ NDTC). P3 panel consists of P3 houses Terminal Blocks. Equipment layouts are shown in below section.

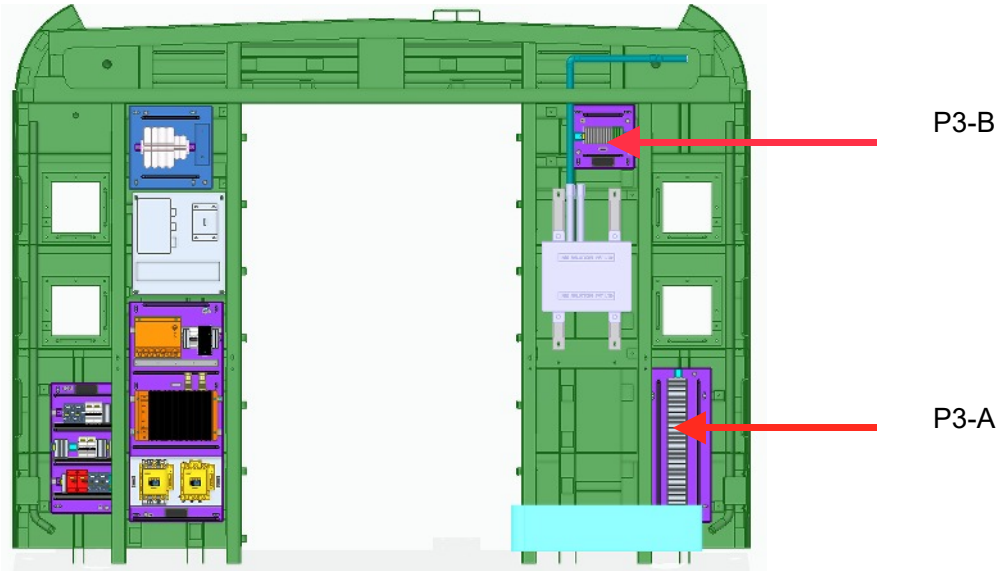


Fig. 7.6.1 Panel P3 Description of all coaches

7.6.1 Detailed View of MC/TC/NDTC/ P3- A

Fig. 7.6.2 Detailed View of MC/TC/NDTC/ P3- A

7.6.2 Detailed view of MC / TC/ NDTC_P3-B

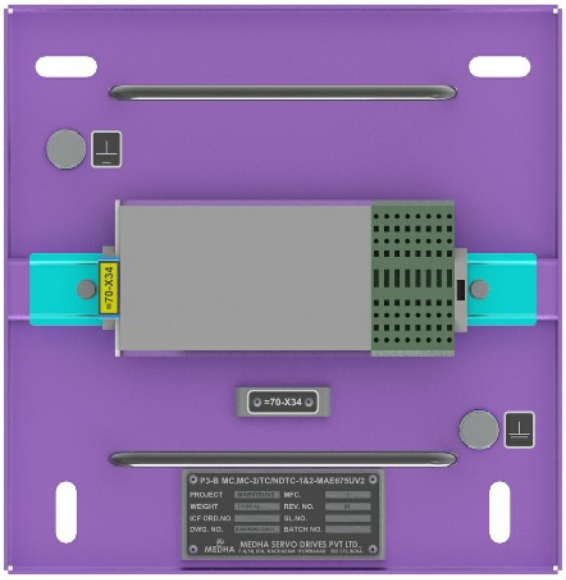


Fig. 7.6.3 Detailed view of MC / TC/ NDTC_P3-B

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A&B	4 THROUGH TERMINAL BLOCK	97	TRAIN LINES 70-X34 (TL EWP2) (F1&F2—97 nos , A&G COUPLER—32nos) Total-129 no's
	4-CONDUCTOR THROUGH TB,GRY	24	
	4-CONDUCTOR GROUND TB,GRN-YEL	8	
	END & INTERMEDIATE PLATE,GRY	1	
	ADJACENT JUMPER,GREY,32A	3	
	MARKER CARDS	1	
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	2	
	WAGO GROUP MARKER	4	
	END STOP FOR DIN35 RAIL, GREY	4	

7.7 Panel P3 Description Of DTC COACH

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A&B	4 THROUGH TERMINAL BLOCK	92	TRAIN LINES 70-X33 (TL EWP2) (F1&F2—92 nos , A&G COUPLER—34nos)
	4 CONDUCTOR THROUGH TERMINAL BL	25	
	4-CONDUCTOR GROUND TB,GRN-YEL	9	
	WAGO END PLATES	2	
	MARKER CARDS	1	
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	2	
	WAGO GROUP MARKER	4	
	END STOP FOR DIN35 RAIL, GREY	4	

7.8 MC/TC/NDTC_Panel-P4 Detailed View

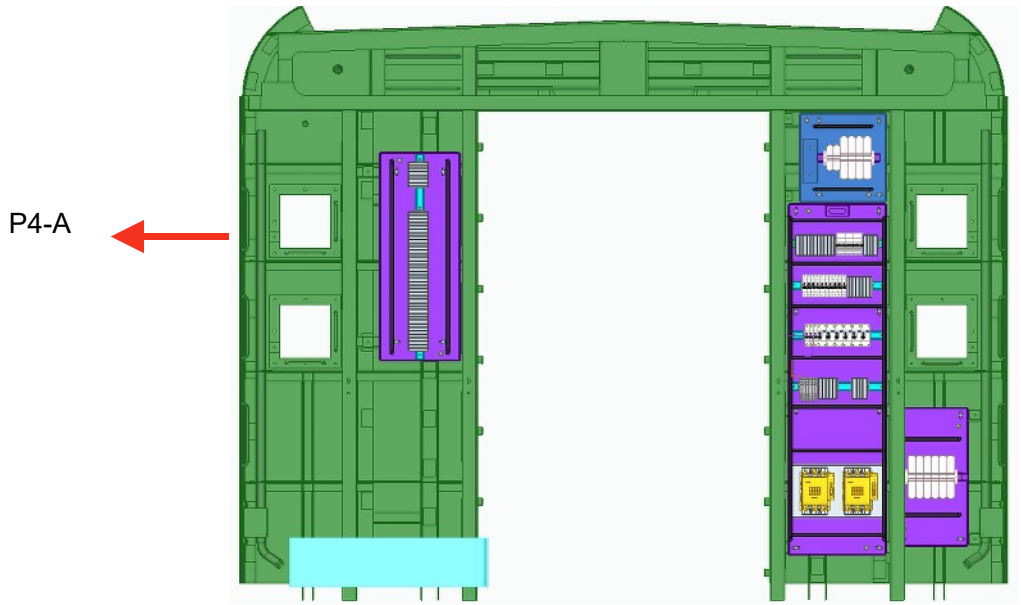


Fig. 7.8.1 MC/TC/NDTC_Panel-P4 Detailed View

Fig. 7.8.2 MC/TC/NDTC_Panel-P4 Component Details

SECTION	MATERIAL DESCRIPTION	QTY	APPLICATION
A	4 THROUGH TERMINAL BLOCK	97	TRAIN LINES 70-X33 (TL EWP1) (F1&F2–97nos , A&G COUPLER—32nos) TOTAL-129NO'S
	4-CONDUCTOR THROUGH TB,GRY	24	
	4-CONDUCTOR GROUND TB,GRN-YEL	8	
	END & INTERMEDIATE PLATE,GRY	1	
	MARKER CARDS	1	
	MARKER CARDS	1	
	END AND INTERMEDIATE PLATE	1	
	WAGO GROUP MARKER	1	
	END STOP FOR DIN35 RAIL, GREY	2	

Chapter 8

SHUNTING PANEL

Shunting panel is a small panel used to drive the individual basic unit. This panel consists of few important switches which are required to move the Basic unit. This shunting panel is located in NDTC ECC panel. This panel has an open cable end with assembled connector to get interfaced with NDTC ECC panel.

Main components of the shunting panel are:

- Direction selection switch
- Cab occupation switch
- Drive Push button
- Brake push button
- Emergency OFF push button.

Fig. 8.1

Chapter 9

AUXILIARY POWER SUPPLY

9.1 INTRODUCTION

Auxiliary power supply consists of auxiliary converter and Battery Box.

9.1.1 Auxiliary Converter

The Auxiliay converter is available in each basic unit mounted under slung in TC coach. These auxiliary converters generates two 415 Vac outputs and 110Vdc to provide supply to various loads. A 20 kVA isolation transformer is provided in each coach to convert 415Vac supply to 230 Vac and 110 Vac. 230 Vac supply is used for pantry related loads and toilet related loads like shaver and hand drier. 110 Vac supply is used for laptop and mobile charging for passengers.

9.1.2 Battery Box

Battery Box is available in each basic unit, mounted under slung in DTC/NDTC coach.

Battery Box consists of

- Battery Charger.
- Battery Management System(BMS).
- Battery

Battery Charger is to charge the battery. BMS is to monitor the battery current, battery cell voltages and temperature during charging and discharging conditions

9. 2 Auxiliary Converter technical details

9.2.1 AC1 Electrical Data

Requirements	Parameters
Input Voltage	Single phase 285 Vac to 450 Vac input from Auxiliary secondary winding of main transformer.
Control Supply	77 V to 137.5 V DC from battery (110 Vdc nominal)
Output capacity	**Output:** 186 kVA, 415 V±5% (L-L), 50 Hz±3%, 3 Phase, Sine wave (at >19 kVac OHE) At <19 kVac OHE, output voltage shall drop by maintaining V/F ratio constant.
Short time rating	For 415 Vac output: 150% of rated current for 10 seconds without increasing active power.
Efficiency	> 94%
Noise Level	< 80 dB(A)
Voltage - THD	< 8%

Table 9.1

9.2.2 AC2 & DC Converter Electrical Data

Requirements	Parameters
Input Voltage	Single phase 285 Vac to 450 Vac input from auxiliary secondary winding of main transformer
Control Supply	77 V to 137.5 Vdc from battery (110 Vdc nominal)
Output capacity	**Output-1:** 186 kVA, 415 V±5% (L-L), 50 Hz±3%, 3 Phase, Sine wave (at >19 kVac OHE) At <19 k Vac OHE, output voltage shall drop by maintaining V/F ratio constant. **Output-2:** 110 to 125 V DC (It is varying as per DC load sharing current requirement) DC Power: 30.5 kW at 110 V DC (BN, BD and Battery charger loading on this).
Short time rating	For 415 Vac output: 150% of rated current for 10 seconds without increasing active power. For 110 Vdc output: 37.5kW for 20 seconds.
Efficiency	> 94%
Noise Level	< 80 dB(A)
Voltage - THD	< 8%

Table 9.2

9.2.3 Auxiliary Converter Cubicle Climatic and Environmental Data

Requirements	Parameters
Operating Temperature	Outside ambient temperature: -10ºC - 50ºC
Cooling	Forced cooling by build in blower
Type of mounting	Under-slung
Ingress Protection	Electronics zone is fully IP65 protected. Magnetics are provided at force air cooling path. Cubicle is protected from water for dipping up to 650mm above rail level. Above 650mm of rail level magnetics zone is IP20 protected.

Table 9.3

9.2.4 Battery Box Technical Details Battery Charger Data

Requirements	Parameters
Input Voltage	115 V to 125 Vdc (From BN Bus or BD output of ACU)
Control Supply	77 V to 137.5 V DC from battery (110 Vdc nominal)
Output capacity	77 V to 117 Vdc (It varies as per battery charging current requirement) Charging current: 60 A (charging current limit is provided at 60 A)
Short time rating	Current limit topology is used. So there will not be any short time rating.
Efficiency	> 94%
Noise Level	< 75 dB(A)

Table 9.4

9.2.5 Battery Box Climatic & Environmental Data

Requirements	Parameters
Operating Temperature	Outside ambient temperature: -10ºC to +50ºC
Cooling	Natural Cooling
Type of mounting	Under-slung
Ingress Protection	IP-65

Table 9.5

9.2.6 Battery

Requirements	Parameters
Battery Type	Lithium Ion (LFP) CATL
Battery Configuration	3P8S
Battery Voltage	103V - 116V
Battery Capacity	3x228 Ah

Table 9.6

9.3 Functional Description

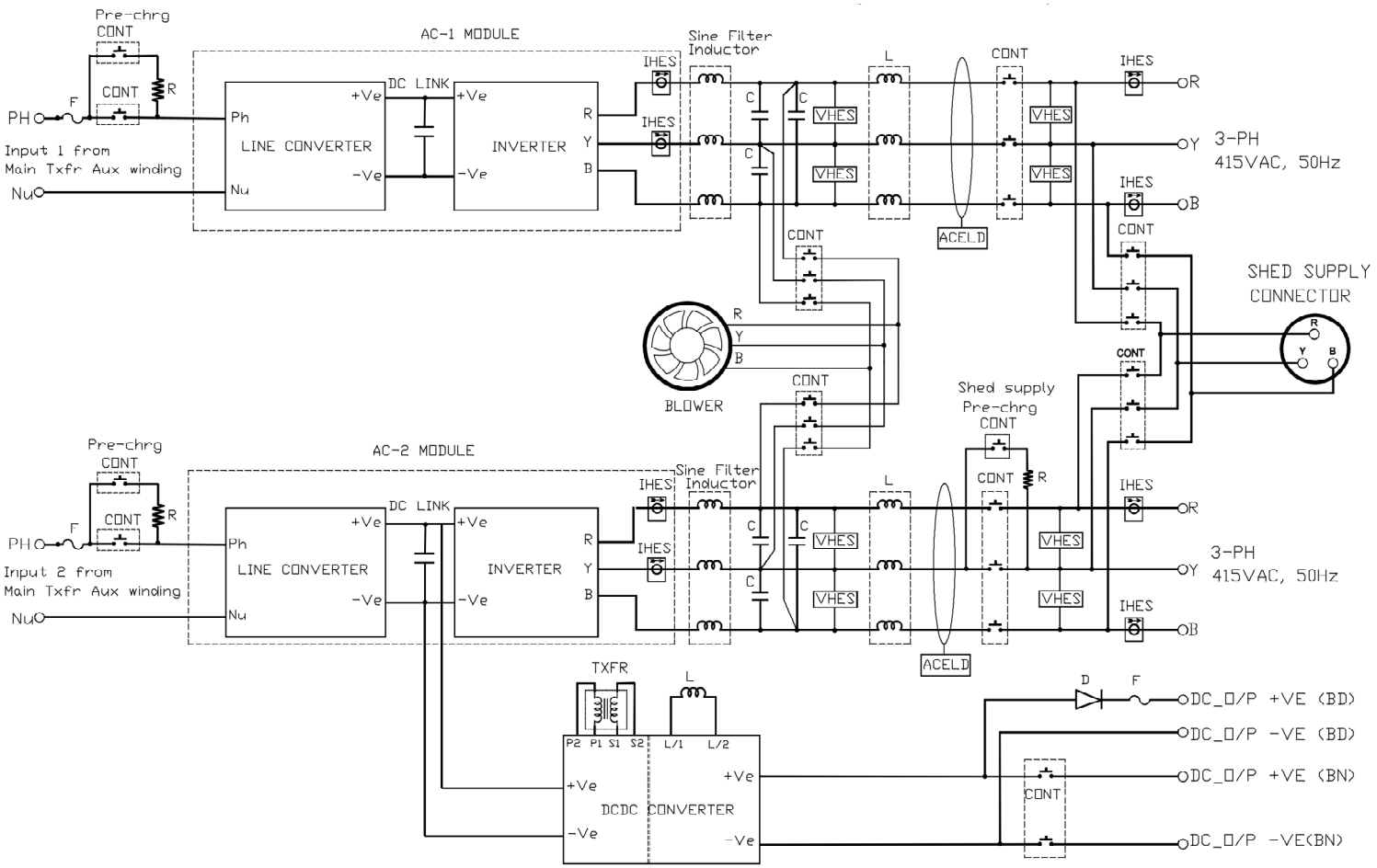
Auxiliary power supply consists of two physical cubicles

1. **Auxiliary Converter Unit (ACU)** : ACU is mounted under frame of TC coach. Each ACU consists of two 415 Vac 3-phase inverter modules (AC1 and AC2) and one 110 VDC converter module.

2. **Battery Box** : Battery box is mounted under frame of DTC/NDTC Coach. It consists of Battery charger, Battery and BMS.

9.3.1 Auxiliary Converter Unit (ACU)

ACU consists of below functional sections.



9.3.1.1 Input section

Input of the auxiliary converter is taken from the auxiliary secondary windings of main transformer. Input section consists of input fuse and input isolation contactor. The purpose of input fuse is to protect converter from over current. Input isolation contactor is used to isolate the converter from input, in case of any failure occurred inside the converter. One pre-charging circuit is used to charge DC link capacitors during initial start up condition.

9.3.1.2 Line converter

Line converter converts variable single phase AC input to fixed DC-link by controlling pulses of IGBTs using DSP controller. Line converter maintains unity power factor at AC input. There are two line converters provided in each aux inverter unit. Output of two line converters is connected in parallel to share the total DC link power. Inverter and DC-DC converter modules are connected to the common DC link.

Power scheme of one line converter is shown in Fig. 9.1

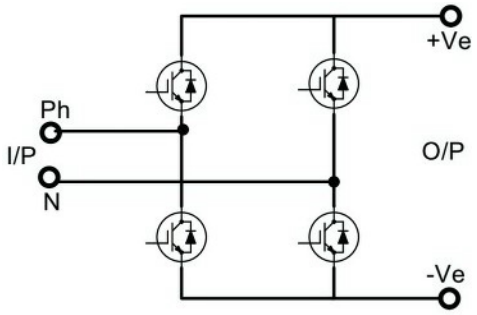


Fig. 9.1

9.3.1.3 3-Phase Inverter

3-Phase inverter converts DC-link voltage to 415 Vac,3-phase output by controlling pulses of IGBTs using DSP controller. Inverter output maintains V/F constant. Inverter module has pulse to pulse short circuit protection.

Power scheme of inverter is shown in Fig. 9.2

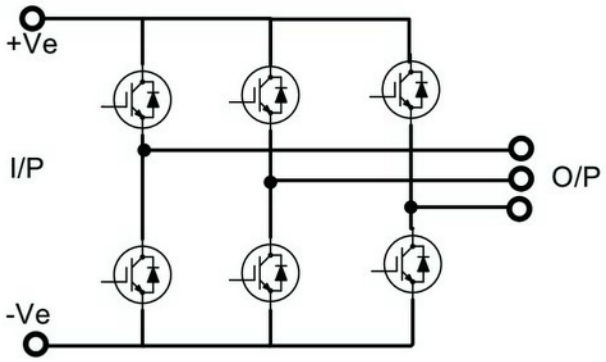


Fig. 9.2

9.3.1.4 3-Phase Sine filter

3-Phase sine filter is provided at output of 3-phase inverter to get a pure sine wave output. Inductors and capacitors are used to build sine filter.

9.3.1.5 DC Converter

DC converter takes supply form DC-link of AC2 and converts DC-link voltage to isolated and regulated 110 Vdc output by controlling pulses of IGBTs using DSP controller. DC converter consists of H-bridge converter, isolation transformer, rectifier and filter. DC converter also regulates output voltage to maintain current share at output.

Power scheme of DC converter is shown in Fig 9.3.

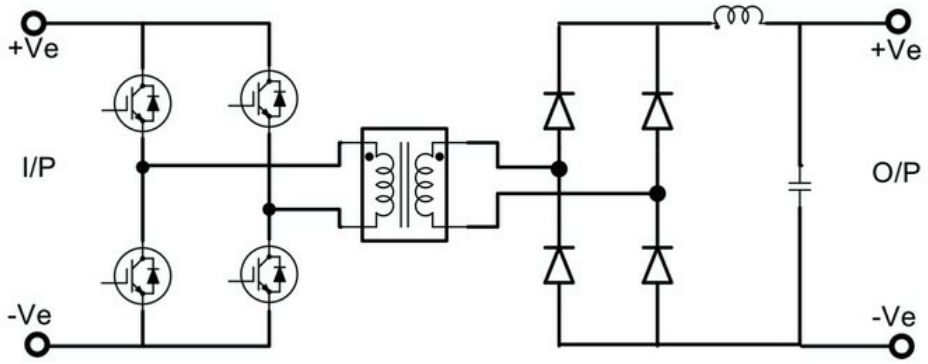


Fig. 9.3

9.3.1.6 Output Section

Contactors are provided in 415 Vac and 110 VDC output to isolate ACU from loads, in case of failure. Voltage, current, and ELD sensors are provided to monitor and control ACU parameters and to protect it.

9.3.1.7 Shed Supply

There is an external connector provision to provide 415 Vac Shed supply to AC output. Shed supply section consist of 3-phase monitoring circuit, Shed supply contactor, precharging contactor and precharging resistor.

9.3.1.8 Controller Module

Controller module controls the line converter and inverter. It is also responsible for monitoring and protecting the complete auxiliary inverter and record the faults in the memory. It also interfaces with TCMS to get commands and send status to display at driver cabin.

9.3.1.9 Cooling system

Forced air cooling is provided for auxiliary converter unit, by using blower inside the auxiliary converter enclosure. This blower is used for cooling all IGBT based modules and magnetics. It sucks air from the air inlet and forces through all IGBT module heat sinks and all magnetics and then leaves out to air outlet. This blower takes 3-phase 415 V AC supply from inverter (AC1 or AC2) internal supply.

9.4 Battery Box Functional Details

Input of the battery box is taken form the BN bus or BD output of ACU. Input section consists of fuse at BD path and contactor at BN path.

Battery Box consists of

1. Battery charger.
2. Battery Management System (BMS).
3. Battery

9.4.1 Battery Charger

Battery charger is a PWM based IGBT converter, which gets supply from BN bus or BD and charge the battery with constant voltage and constant current limit topology.

There is a reverse flow diode in battery charger, which conducts at the time of battery back-up.

There is a controller module, which is responsible for monitoring and protecting the complete battery charger and record the faults in the memory. It also interfaces with TCMS to get commands and to send status to display at driver cabin.

Battery charger unit is made with natural cooled design.

Power scheme of battery charger module is shown in Fig 9.4.

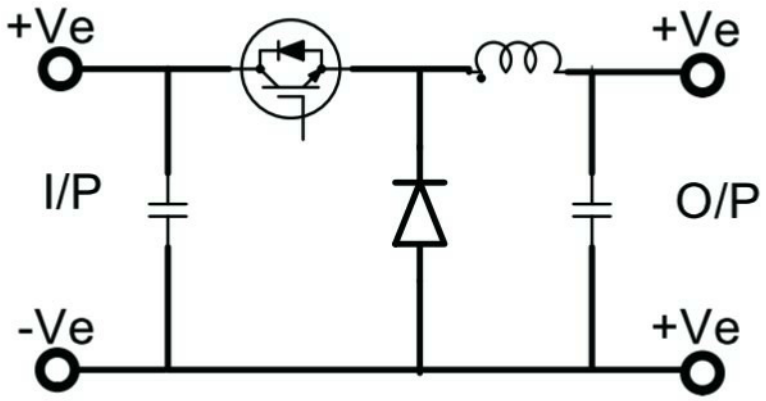


Fig. 9.4

9.4.2 Battery Management System (BMS)

BMS monitors Battery parameters like current, cell voltages, temperature during charging and Discharging conditions. It protects battery from over charging and over discharging. It sends Battery parameters like voltage, current, cell temperature and SOC to Battery charger to share with TCMS.

Chapter 10

BRAKE SYSTEM DESIGN

Following are the different types of brake systems present in TrainSet:

1. Regenerative brake or electro dynamic brake
2. Pneumatic brake or auto brake
3. Electro-pneumatic brake
4. Parking brake

10.1 Auto Brake

Auto brake is a pneumatic brake and is controlled by Auto brake handle provided in DTC. Whenever auto brake handle is moved, BP pressure drops and equivalent difference in pressure is developed in brake cylinder by triple valve of EP unit. Hence braking effort, equivalent to brake cylinder pressure gets developed.

10.2 Service Brake

Service brake is a combination of ED (Electro Dynamic/Regeneration) and EP (Electro Pneumatic) braking. Based on MCH brake command requested by motor man, CCU calculates total required Braking Effort (BE) and this is distributed among various basic units for final brake application. Based on the braking effort received at MCU, MCU further performs brake blending among ED brake and EP brake for final brake application.

Following are the components or control systems used for incorporation and actuation of service brake:

10.2.1 Master controller

Master controller is an interface to motor man for issuing motoring request, braking demand, forward & reverse directions, dead man handle & emergency brake. Generally, occupied cab master controller will be active to issue command.

10.2.2 TPWS Interface

At present, there is no TPWS interface in TrainSet. But provision is given to incorporate this feature in future. Two TPWS brake application related digital inputs are interfaced with CCU to know the brake status/request of TPWS. One digital input gives information about service brake request and the second digital input gives information about emergency brake applied information. In case of service brake request given by TPWS through digital input, CCU considers it as full service brake request.

10.2.3 CCU1 and CCU2

CCU1 and CCU2 is redundant control system located in DTC and interfaced with Master controller for reading brake commands. It also calculates the brake force based on the train weight (load sensors), availability of different EP units and regenerative brake force available. Then it redistributes all the brake force among different basic units for brake application through ETB.

10.2.4 MCU and MCUR

MCU receives total brake force to be applied from CCU through ETB. After that MCU calculates the available regenerative brake force and remaining are considered as EP brake. So always priority is given to ED brake while applying the service brake. Remaining brake effort is applied as EP brake in trailer coaches first, then in MC coach. Normally MCU will act as EP brake master and communicates with both EBCUs of that coach. In case of failure of MCU as EP brake master, MCUR will take over as EP brake master and communicates with EBCUs for EP brake application.

EP brake force = Total brake force - Available regenerative brake force

10.2.5 Application and holding valve

Application and holding valves are solenoid valves which are available in EP brake unit. Application valve is energized to open solenoid valve. It is used to charge the air into brake cylinder for application of EP brake. Similarly holding solenoid valve is energized to close valve. It is used to discharge the air from brake cylinder for release of EP brake.

Chapter 11

HIGH VOLTAGE SYSTEM OVERVIEW

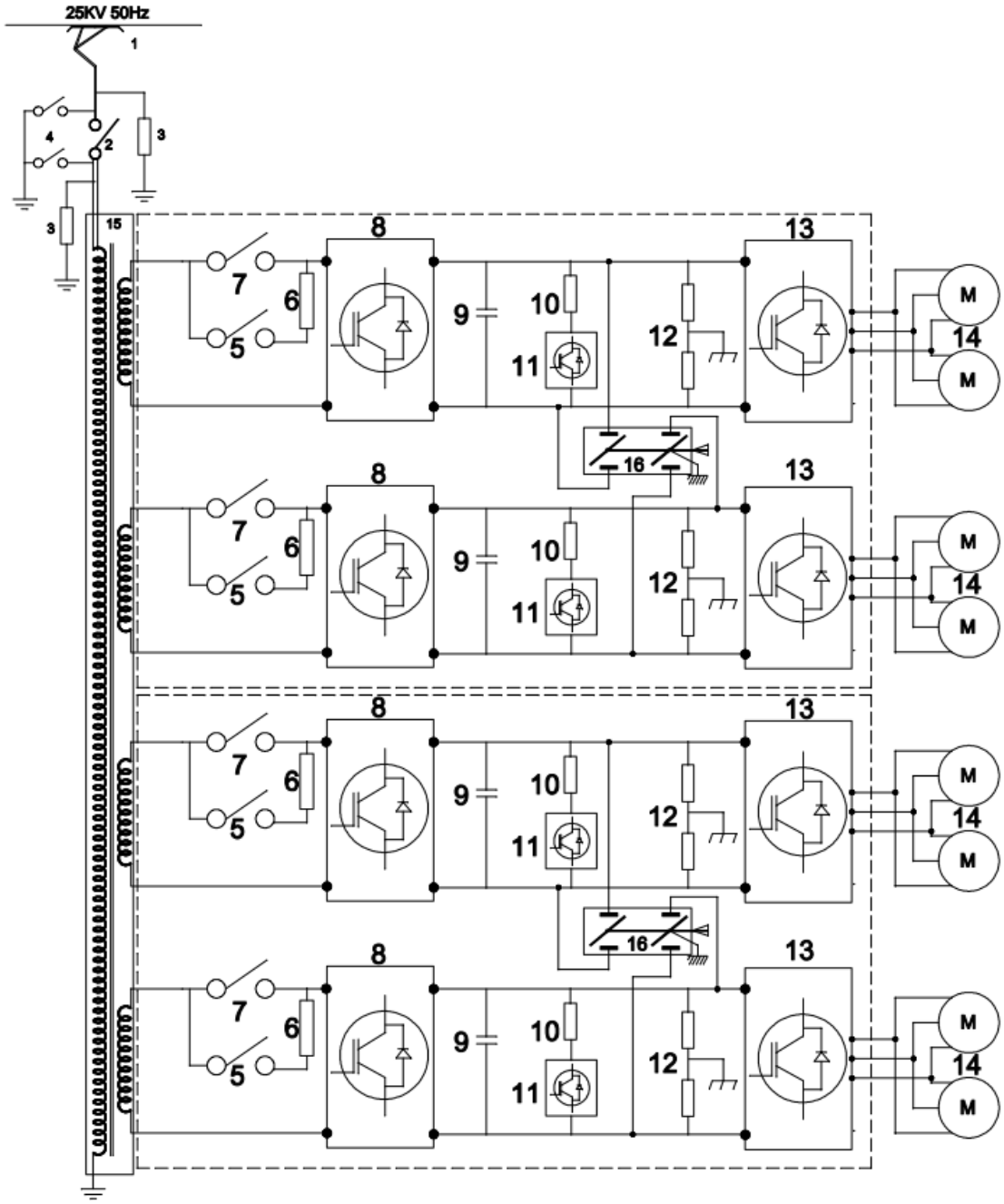


Fig. 11.1

S.NO	Details
1	Pantograph
2	Vacuum Circuit Breaker (VCB)
3	Surge arrester
4	HV Earthing switch
5	Pre-charging Contactor
6	Pre-charging Resistor
7	Line Contactor
8	Line Converter
9	DC Link Capacitor Bank
10	Brake chopper resistor
11	Brake chopper IGBT
12	Earth fault detection resistors
13	Traction Inverter
14	Traction Motors
15	Traction Transformer
16	DC Link Earthing Switch

Transformer secondary has 4 traction windings rated at 326.6 kVA each and 2 auxiliary windings rated at 234 kVA each. Transformer is oil cooled with help of oil pump and blowers which cool the radiator through which oil is circulated using the oil pump.

There are two liquid cooled Line and Traction converter cubicles per each MC. Each Line and Traction converter cubicle consists of one line converter, DC link and one traction inverter. The line converter interfaces with transformer secondary traction winding on one side and DC link on the other side.

The line converter consists of single-phase full bridge rectifier with IGBTs as active switching devices. The DC link consists of earth leakage detection circuit, DC link capacitor bank, and brake chopper circuit (for over voltage protection).

The traction inverter consists of a 3-phase full bridge inverter with IGBTs as active switching devices.

The line converter has control computer, which control and protect the converter and similarly Inverter also has it's control computer for control and protection. Line and Traction Control Unit (LTCU) controls both the line converter and traction inverter and then communicates with the Main Control Unit (MCU) through Ethernet interface.

Chapter 12

PANTOGRAPH CONTROL

On driver desk Panto mode selector switch is provided with 3 selection positions to select Panto 1-5 mode or Panto 2-6 mode or 1-6 mode.

- Based on the selection, corresponding Pantos will be made UP.
- In case of position 1 is selected, Panto 1 and Panto 5 will be made UP. In this case, the distance between the 2 pantos will be approximately 192 meters.
- In case of position 2 is selected, Panto 2 and Panto 6 will be made UP. In this case, the distance between the 2 pantos will be approximately 192 meters.
- In case of position 3 is selected, Panto 1 and Panto 6 will be made UP. In this case, the distance between the 2 pantos will be approximately 264 meters.
- In case of one panto failure of corresponding mode, “NOT ALL PANTO UP” lamp becomes blinking, on driver desk.
- In case of two panto failure of corresponding mode, “NOT ALL PANTO UP” lamp becomes ON, on driver desk.
- Based on this driver need to move the switch to other position to select the other 2 pantos.
- In corresponding position two train line will be generated, which can be used during RDM mode.

Chapter 13

VCB CONTROL

13.1 Purpose

VCB is used as a line circuit breaker to close and open the power circuit and also to break the circuit under overload and short circuit conditions. It provides connection between catenary and propulsion equipment. It is placed in roof of TC coach.

It is an electro pneumatic control. MCC drives one digital output to energize VCB on relay, only if pantograph has already raised, providing supply to electro pneumatic valve for VCB close operation.

13.2 Train Level VCB Control

In case of normal mode, CCC derives VCB close or open commands and send to all basic unit MCC units for final action.

In case VCB momentary switch is operated toward 'ON' position in the occupied cab, CCC derives VCB close command by checking the 'ON' digital input signal pulse status and sends to all MCC units through ETB communication for final action.

Similarly In case VCB momentary switch is operated toward 'OFF' position in the occupied cab, CCC derives VCB open command by check the 'OFF' digital input signal pulse status and sends to all MCC units through ETB communication for final action.

At the same time corresponding train lines are generated from occupied cab. MCC also determines VCB close, open commands through train lines. But MCC ignores these commands in case of normal mode, but considers only in RDM mode.

The following logical diagram shows train level VCB command derivation.

13.2.1 Basic unit level VCB control

Based on VCB related commands received from ETB (in case of normal mode) or panto related commands derived from train lines (in case of RDM mode), MCC drives VCB ON digital output by considering following conditions.

- No EOL loop condition triggered
- No Panto low pressure switch is detected
- Panto up command detected
- No basic unit isolation is selected and
- No VCB contactor stuck at high-level condition occurred.

MCC opens VCB based on the VCB open command detected or any of the above condition are satisfied.

In case VCB trip condition occurs in the basic unit, MCC opens VCB.

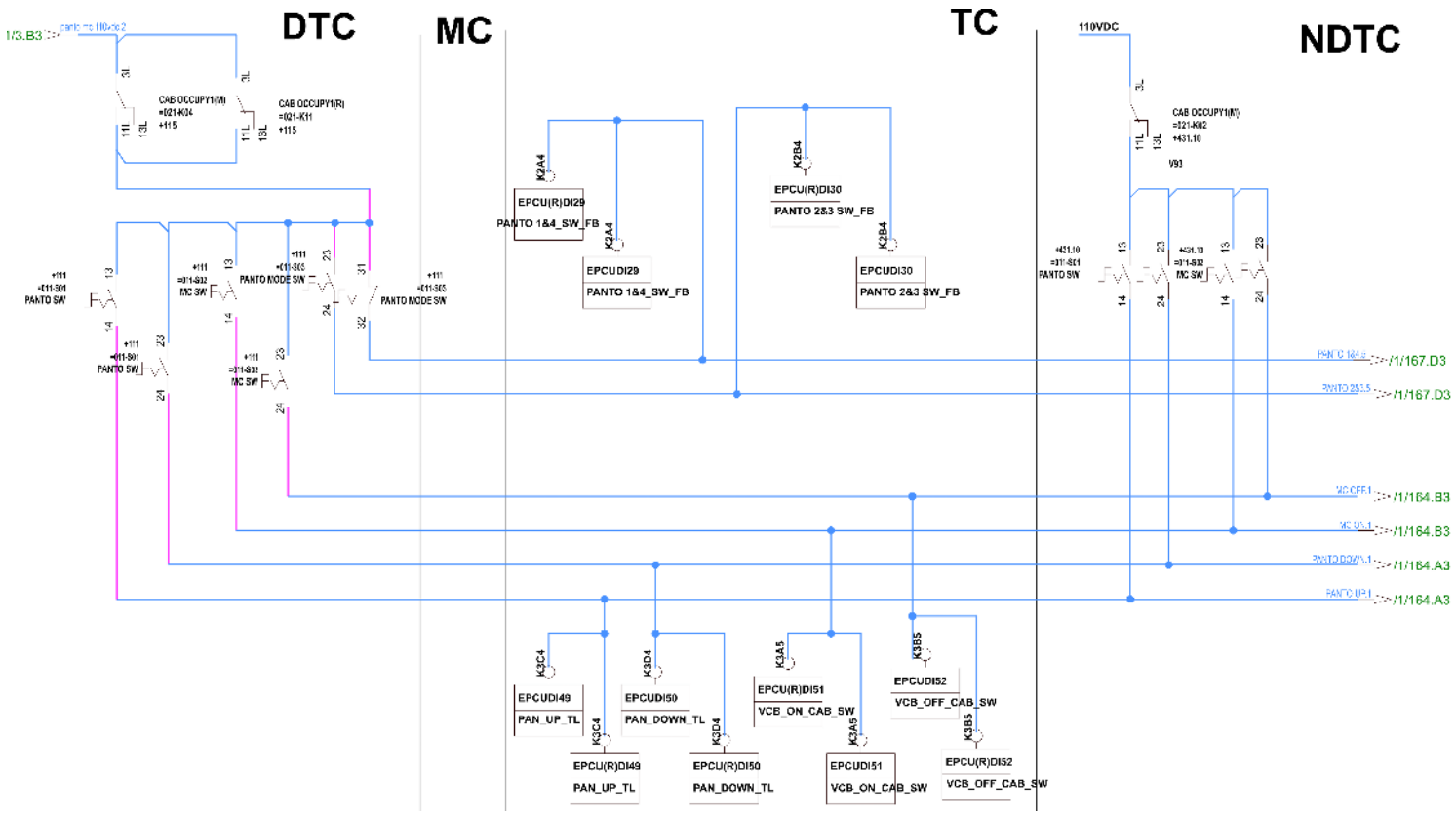


Fig. 13.1

The following logical diagram gives information about basic unit level VCB control

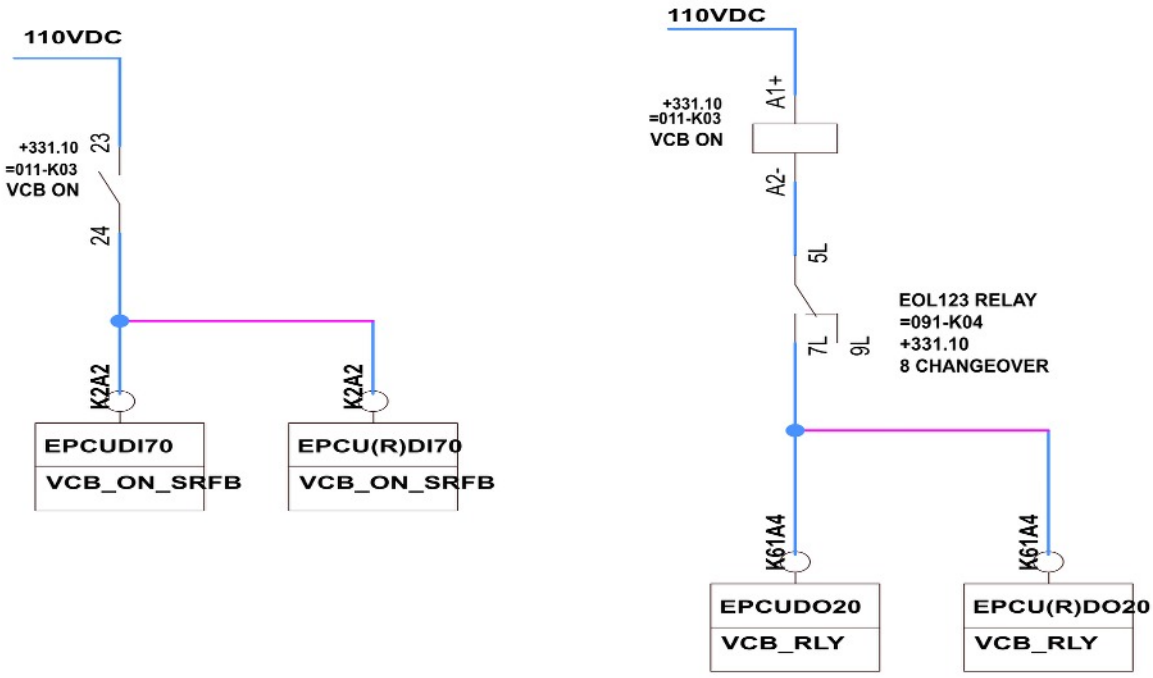


Fig. 13.2

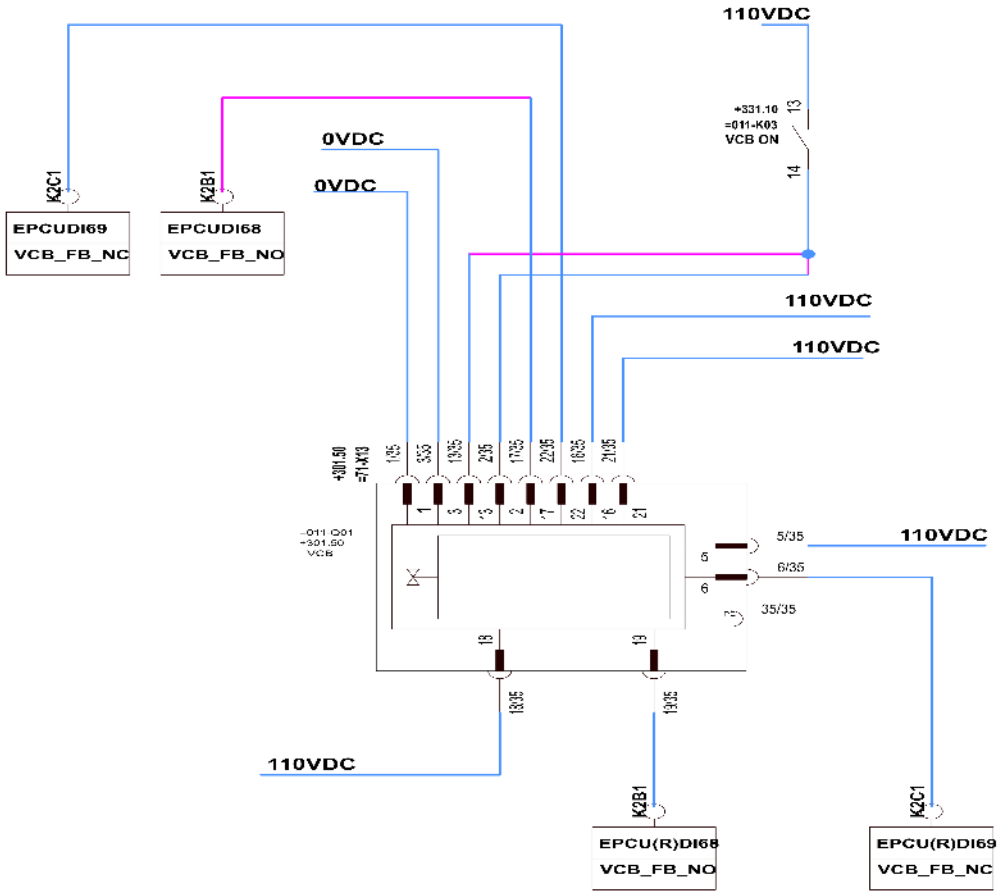


Fig. 13.3

13.2.1.1 VCB Status Indication Lamps

In driver desk one lamp is available related to VCB on status name it as ‘Min 1 VCB close. This lamp is driven through state of VCB hard-wired train line.

This state of VCB hardwired train line is driven by any of MCC unit in TC coach based on VCB on feedback status.

In DDU rake screen, individual basic units screens, VCB symbol is available. DDU gets each basic unit VCB status from MCC, based on this VCB status will be displayed on DDU.

MCC will know the status of VCB by read redundant feedback auxiliary NO, NC contacts.

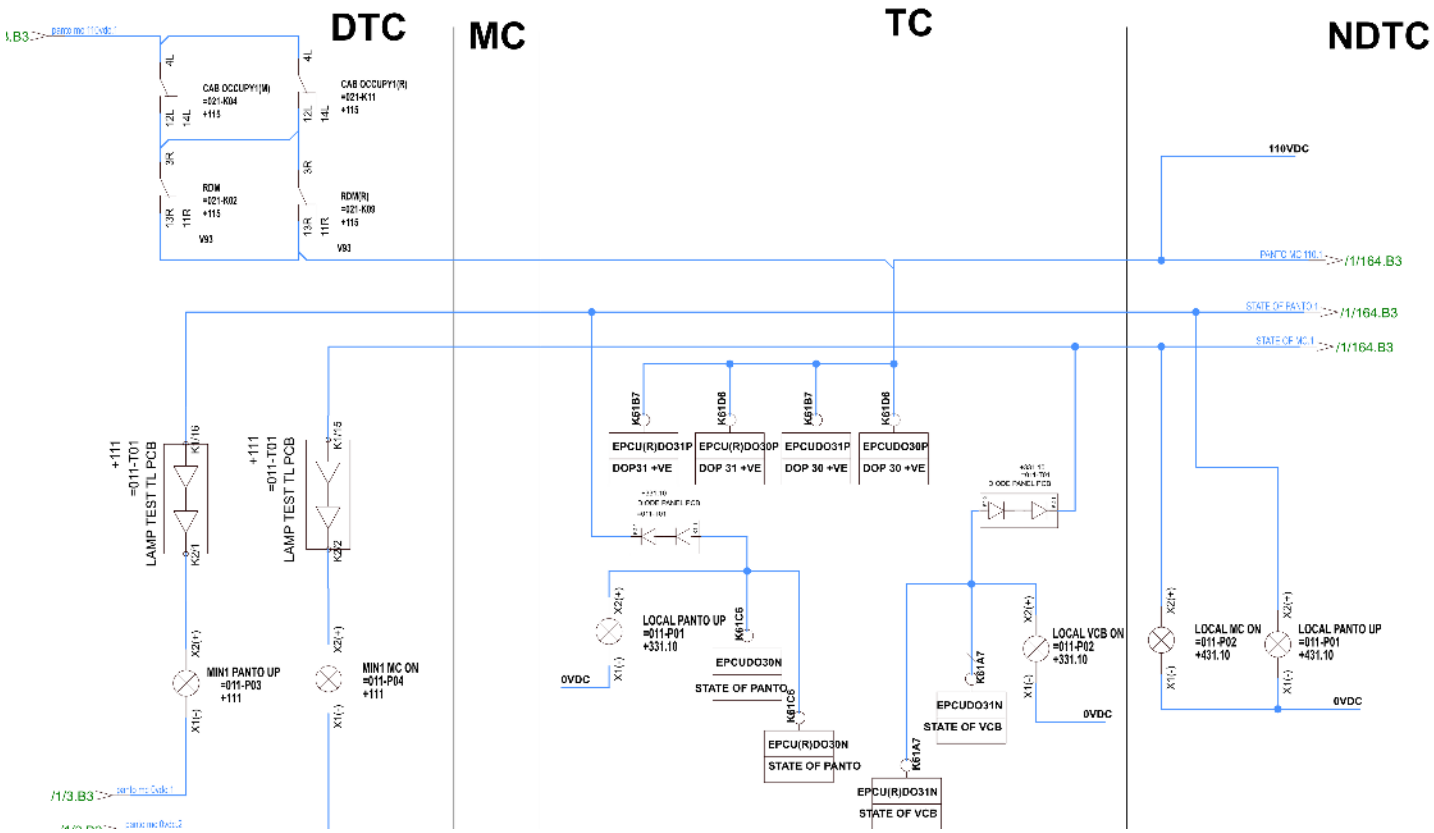


Fig. 13.4

Chapter 14

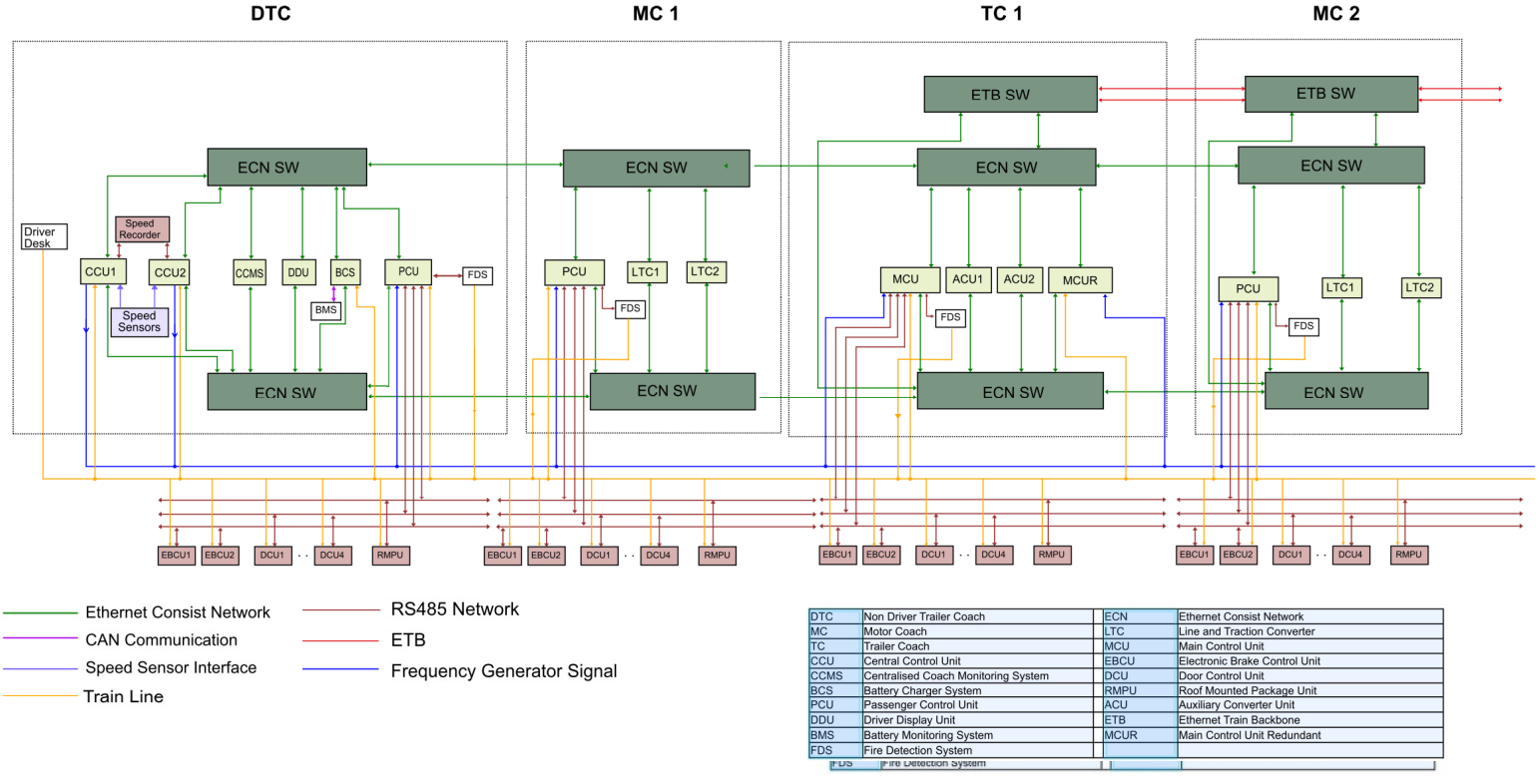
TCMS

Train Control and Management System (TCMS) consists of following subsystem:

- Two redundant CCUs in DTC for train level control.
- MCUs in TC coach for basic unit level control.
- PCU for passenger related load control, main air compressor control and parking brake control.
- Frequency generator for distributing TE/ BE % through train line. In case of special RDM mode, this will be used by MCU/ MCUR for TE/ BE calculation.
- Redundant ETB and ECN communication.

Fig 14.1 shows interconnection of different control units of Train Control and Management System (TCMS). CCU1 and CCU2 acts as interface to loco pilot and receives all the driver inputs, analyzes it and transmits control data to MCUs using ETB network, used for motor control. MCU analyzes this received control data and finally updates the control data to different units connected to it i.e.,

- Passenger comfort related commands to PCU1, PCU2 of DTC and MC coach.
- Auxiliary control unit is also communicated using ECN communication

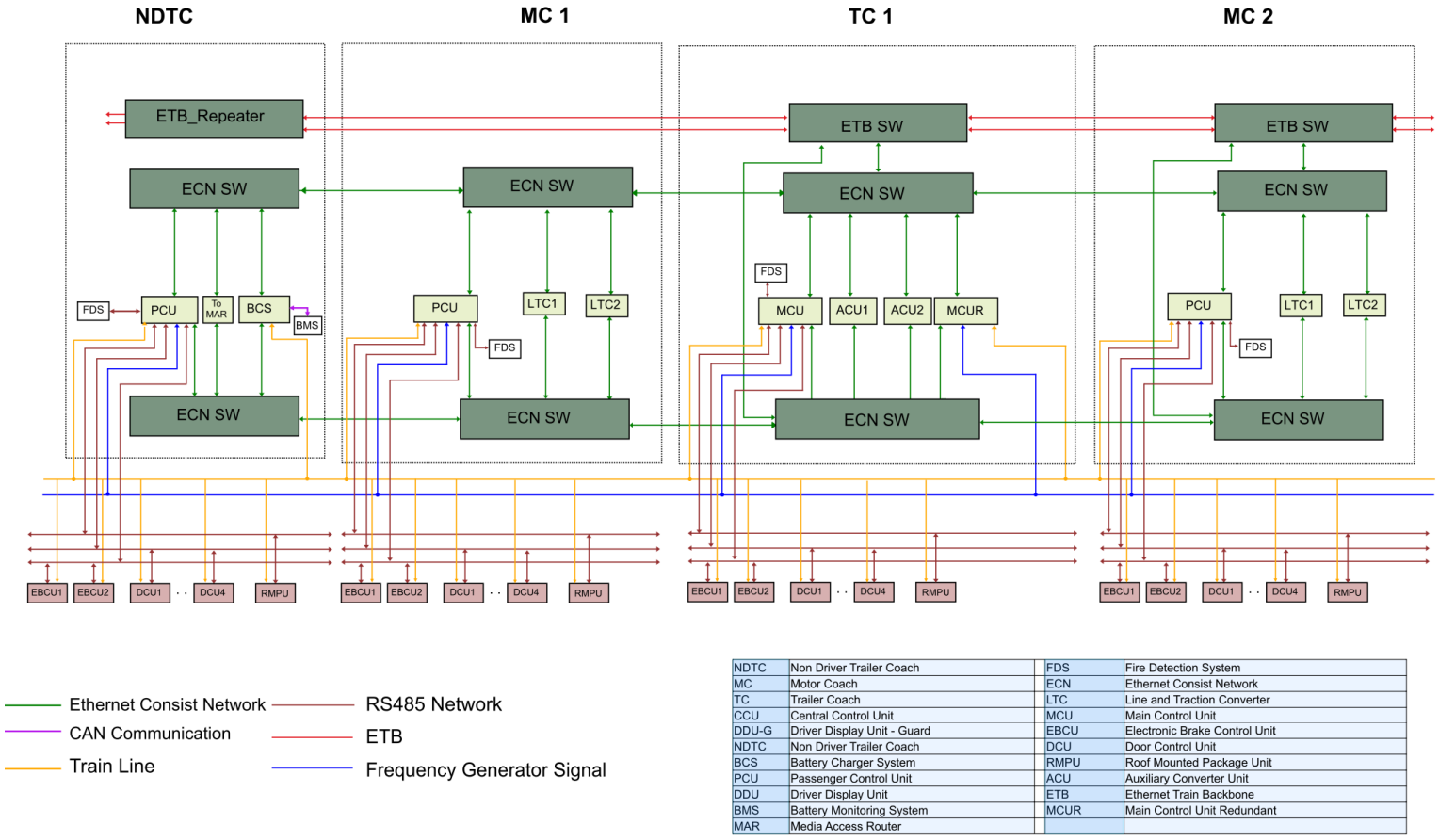


DTC	Non Driver Trailer Coach	ECN	Ethernet Consist Network
MC	Motor Coach	LTC	Line and Traction Converter
TC	Trailer Coach	MCU	Main Control Unit
CCU	Central Control Unit	EBCU	Electronic Brake Control Unit
CCMS	Centralised Coach Monitoring System	DCU	Door Control Unit
BCS	Battery Charger System	RMPU	Roof Mounted Package Unit
PCU	Passenger Control Unit	ACU	Auxiliary Converter Unit
DDU	Driver Display Unit	ETB	Ethernet Train Backbone
BMS	Battery Monitoring System	MCUR	Main Control Unit Redundant
FDS	Fire Detection System		

Fig. 14.1. Interconnection of Different Control Units in End Basic Unit

All these interfaces communicate with MCU to update their status for data recording purpose by DMC and for performing closed loop control action by MCU using the same medium in response to the control data received from MCU. Finally, this status data is routed to CCU from MCU using ETB. CCU uses this status data for fine control of traction and braking parameters of the train and also sends the same data to MCU for recording data in local flash.

Fig 14.2 shows the inter connectivity of different control units in the middle basic unit. These units perform the same function of end basic unit.



NDTC	Non Driver Trailer Coach	FDS	Fire Detection System
MC	Motor Coach	ECN	Ethernet Consist Network
TC	Trailer Coach	LTC	Line and Traction Converter
CCU	Central Control Unit	MCU	Main Control Unit
DDU-G	Driver Display Unit - Guard	EBCU	Electronic Brake Control Unit
NDTC	Non Driver Trailer Coach	DCU	Door Control Unit
BCS	Battery Charger System	RMPU	Roof Mounted Package Unit
PCU	Passenger Control Unit	ACU	Auxiliary Converter Unit
DDU	Driver Display Unit	ETB	Ethernet Train Backbone
BMS	Battery Monitoring System	MCUR	Main Control Unit Redundant
MAR	Media Access Router		

Fig 14.2 Interconnection of Different Control Units in Middle Basic Unit

14.1 Sub System Overview

Following are subsystems of TCMS

14.1.1 Central Control Unit (CCU)

CCU is a dual redundant system located in DTC and is part of integrated control system provided for TrainSet. CCU is used as complete control master for entire EMU formation. All the control related calculations are done by CCU & it is distributed to different control systems in other coaches through dual redundant ETB communication for final action. There are two CCUs in each driving trailer coach working in active-standby mode for central control and monitoring. So in one rake formation, there will four CCUs present, out of which one CCU in occupied DTC will be working as Master, other CCU in occupied DTC as active-standby and remaining two CCUs in non-occupied DTC will be working as slave.

14.1.2 Driver Display Unit (DDU)

Driver Display Unit (DDU) is based on TFT LCD and is a human interface through which user interacts with the system. There are two displays in the train, one in each end driver cab of DTC (Cab1, Cab2). Display module gets the data from all the basic units MCUs through redundant ECN communication. It provides user with the necessary data of what exactly is going within the system and it has a user friendly menu driven operation.

Driver display unit serves the following functions:

- Viewing of entire train operational status
- Viewing of individual basic unit operational status
- Fault announcements, wherever driver information/ intervention is required
- Viewing of active faults information
- Viewing of fault/ event history
- Viewing of train energy consumed and regenerated information
- Self test modes
- Software versions of the sub modules of the system
- Individual bogie isolation feature
- Individual pantograph and VCB opening feature
- Train configuration information etc

14.1.3 Main control Unit (MCU)

Two MCUs are provided in each TC coach. Normally MCU1 is master. In case of any failure in MCU, MCU2 becomes master. MCU performs all control related calculations on the basis of data received from CCU and data read through digital inputs and analog inputs for that particular basic unit. All the control related calculation for TC are done by MCU and it is communicated to other control systems such as TIC & LIC (control computers of Traction Converter) through dual redundant CAN communication for final action. This is available in each TC coach of each basic unit. Normally MCU is responsible for EP Brake control, door control, RMPU control of corresponding coach, It monitors various power transformer related parameters such as flow, pressure, temperature and controls cooling blowers. MCUR will take over control function only when MCU is not healthy.

14.1.4 Passenger Comfort Unit (PCU)

PCU is provided in DTC, NDTC and MC coaches. PCU system will be responsible for controlling all passenger comfort related functions in the TrainSet rake mainly, coach lighting, RMPU control, door control. In addition to this, PCU will also control change-over contactors of Auxiliary Power Supply (coach to coach change-over contactors used when one Auxiliary Converter fails), Main compressor & parking brake as per the commands received from CCU through ETB and ECN.

14.2 TCMS Redundancy Concept

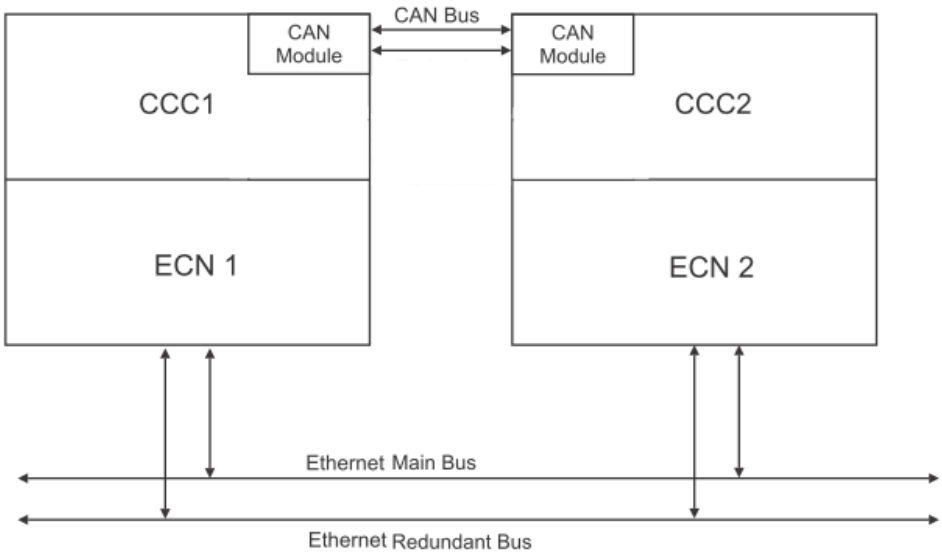


Fig 14.3 CCU interconnection Diagram

14.2.1 Redundancy in CCU

Each DTC of Trainset train will consist of two CCUs, each CCU acting as the redundant system in-case of failure of the other CCU.

All Inputs and outputs connection are exactly same for both CCU. So all critical inputs required for train control such as master controller TE/BE%, various master controller position such as Key-ON, RDM, drive, brake, coast, forward, reverse, emergency brake are completely duplicated in both CCUs. In addition to this all train related commands such as Pantograph control, VCB control, parking brake control, light and RMPU control, ventilation Control are also duplicated in both the CCUs.

The train is controlled by either one of the CCUs called the Master CCU based on Cab Occupation and Health of the CCU (If both CCUs of occupied cab are healthy, priority is given to CCU with lower Serial No.) and the other healthy CCU of the same DTC will become Active-standby CCU and will do all the control calculations but doesn't send control data to MCUs of different basic unit for final control.

The two CCUs in non occupied coach will work as slave CCU after ETB Inauguration and these slave CCUs only monitor the inputs and update them to the master CCU

Two CCUs of same cab communicate with each other and exchange their health status via two ECN channels. So each CCU knows the exact health status of the other CCU. In addition to this, CCUs also exchanges all digital inputs status read along with their health & master controller TE/BE % through dual redundant CAN communication. So in case of input channel failure or input card failure, corresponding channel status can be taken from healthy CCU. Similarly in case of failure or wrong reading of master controller TE/BE% by any CCU, same can be corrected by value read through ECN communication from other CCU.

If there is any critical failure in Master CCU and it detects that the Active-standby CCU is healthy, then Master CCU relinquishes its mastership, and hence Active-standby CCU of same occupied cab will become master.

If there is any critical failure in Master CCU and it detects that the Active-standby CCU is healthy, then Master CCU relinquishes its mastership, and hence Active-standby CCU of same occupied cab will become master.

14.2.2 Redundancy ETCN communication

For communication between control systems of different basic units dual redundant ETB communication is provided. Both medium of ETB network carries the same information on network. In case of failure of any one medium or noise on any one medium, transition to healthy medium is done automatically without loss of data.

For communication between different control systems inside basic unit, dual redundant ECN communication is provided. Both medium of ECN network carries the same information on network. In case of failure of any one medium or noise on any one medium, transition to healthy medium is done automatically without any loss of data.

14.2.3 Redundancy in communication with LTC unit

Redundant CAN communication is provided between MCU and Line converter and Traction Converter (LTC) control unit for transfer of various traction & control related commands. In case of failure of any one medium or noise on any one medium, transition to healthy medium is done without any loss of data.

14.2.4 Hard wired Train Line wires

In addition to control data exchange through redundant ETB/ECN communication, hard-wired train lines are maintained for all essential control signals such as drive, brake coast, forward, reverse, TE/ BE% frequency, emergency brake loop, brake release loop, emergency off loop, VCB and pantograph control line etc.

During normal mode of operation, data is taken from ECN control packet. In case of rescue drive mode (RDM), train line status are used for train movement with limited features.

14.2.5 Main Control Unit _ Redundant (MCUR)

Unit level redundancy is provided for MCUs in TC coach. All the functions (i.e. passenger comfort related functions like door control, RMPU control, brake control with EBCU) are executed by redundant MCU, in case of main MCU is failure.

Chapter 15

FAILURE MODES WITHIN TCMS SUBSYSTEMS

S.No	Sub system	Module/ Failure	Effect on TrainSet Operation	Redundancy Operation
1	CCU	Digital Input card Channel failure	No effect on TrainSet operation	No need to change the CCU Mastership. Channel fault can be identified through fault diagnostic. Faulty channel status can be taken from healthy CCU of same cab through ECN communication. Both CCUs exchange digital inputs, digital outputs & analog input status along with their respective health status through ECN communication periodically.
2	CCU	Digital Input card failure	No effect on TrainSet operation	No need to change the CCU Mastership. Channel fault can be identified through fault diagnostic. Faulty channel status can be taken from healthy CCU of same cab through ECN communication. Both CCUs exchange digital input, digital output & analog input status along with their respective health status through ECN communication periodically.
3	CCU	Digital Output card failure	No effect on Train-Set operation	CCC2 Takes over mastership to drive outputs
4	CCU	TE/BE Analog input failure	No effect on Train-Set operation & TE/ BE% can be deduced correctly	No need to change the CCU mastership. CCC2 also monitors TE/BE frequency and the same will be communicated to CCC1 through ECN communication.
5	CCU	TE/BE frequency input failure	No effect on Train-Set operation & TE/BE% can be deduced correctly	No need to change the CCU mastership. CCC2 also monitors TE/BE frequency and the same will be communicated to CCC1 through ECN communication.

S.No	Sub system	Module/ Failure	Effect on TrainSet Operation	Redundancy Operation
6	CCU	One ETB channel/ cable failure	No effect on Train-Set operation	No need to change the CCU mastership. System can run on healthy ETB network and all control & status data exchange can happen normally.
7	CCU	One CCU failure/ one power supply failure	No effect on Train-Set operation	Healthy CCU of same occupied cab will detect the failure of other CCU when it does not get any heartbeat through ECN communication. With this healthy CCU of occupied cab will become master & controls the train without any deterioration.
8	CCU	Both CCU of occupied cab fail	in occupied cab driving is not possible due to non avialability of VCD functionality	MCU & MCUR will start working on train line Train can be run in RDM mode (fixed TE/BE) or Special RDM mode (TE/BE still controlled by Master Controller).
9	MCU	Digital Input card channel failure	No effect on Train-Set operation	No master ship change over. All the DIP data is exchanged between MCU1 and MCU2.
10	MCU	Digital Input card failure	No effect on Train-Set operation	No master ship change over. All the DIP data is exchanged between MCU1 and MCU2.
11	MCU	Digital output channel failure	No effect on Train-Set Operation	No mastership change over will happen, Redundant unit will drive the same outputs in parallel.
12	MCU	One ETB cable failure	No effect on Train-Set operation	MCU will keep receiving control data through healthy ETB cable.
13	MCU	MCU control card failure	No effect on Train-Set operation	Mastership changeover to MCU2. All the functions are executed by MCU2
14	MCU	MCU analog input channel failure related to EP brake	No effect on Train-Set operation. Traction & all braking can happen normally	No mastership changeover. All the analog IO data is exchanged between MCU1 and MCU2.
15	MCU	CAN comm fail between MCU and LTC	No effect on Train-Set operation	No mastership change over. All the traction related functions are executed with redundant CAN communication.
16	MCU	Both CAN comm fail between MCU and LTC	No effect on Train-Set operation	Traction Will not occur for that MC coach, Overall TE Force will reduce.
17	MCU	MCU analog input failure related to load weighing system	No effect on Train-Set operation.	Load weighing sensors are redundant & connected to MCUR also. MCU will receive weight information & spring deflection information from MCUR through ECN communication.

S.No	Subsystem	Module/ Failure	Effect on TrainSet Operation	Redundancy Operation
18	MCU	Frequency input failure for TE/BE%	No effect on TrainSet operation. Traction & all braking can happen normally	All functionality can be achieved in Normal & RDM mode of Operation.
19	MCU	One ECN cable failure	No effect on TrainSet operation.	Through redundant ECN communication MCC gets commands from CCC and MCC sends status data to CCUs.
20	MCU	Both ECN cable failure or TCN card failure	Traction Will not occur for that MC coach,Overall TE Force will reduce.	Traction Will not occur for that MC coach, Overall TE Force will reduce.
21	PCU	Digital Input card card failure	No effect on passenger comfort functions	Faulty channel health will be detected by fault diagnostic. Failed digital input status will be ignored & will be driven to default state. All passenger comfort functions, Main Air compressor & parking brake work as per the command received from MCU through ECN.
22	PCU	Digital Input card failure	No effect on passenger comfort functions	No mastership change over. Sharing available from adjacent coach
23	PCU	Digital output channel failure	No effect on TrainSet Operation.	No mastership change over will happen, Sharing available from adjacent coach
24	PCU	PCU analog input channel failure related to Load sensor	No effect on load Measurement & spring deflection.	As per current scheme of MRVC phase II, if two pressure sensors are provided per bogie, it can be connected to two different analog inputs. So failure of one analog input will not affect load measurement & spring deflection measurement.
25	PCU	One ECN channel/ cable failure	No effect on Passenger related load operations	PCU will automatically switchover to redundant ECN network. All passenger comfort functions, Main Air compressor & parking brake work as per the command received from MCU through ECN.
26	PCU	Both ECN channels / cable failure or card failure	No effect on TrainSet operation	Sharing available from adjacent coach.
27	PCU	PCU control card failure/ power supply failure	No effect on TrainSet operation.	Sharing available from adjacent coach.

S.No	Sub system	Module/ Failure	Effect on Train-Set Operation	Redundancy Operation
28	DDU	One ECN Cable failure	No effect on TrainSet operation	DDU is connected to both ECNs in DTC coach. All the functions will done through redundunt cable.
29	ACU	One ECN Cable failure	No effect on TrainSet operation	ACU is connected to both ECNs in MC coach. All the functions will done through redundunt cable.
30	ECN-DTC	ECN switch failure	No effect on TrainSet operation	All the functions are executed with redundant ECN switch.
31	ECN-MC	ECN switch failure	No effect on TrainSet operation	All the functions are executed with redundant ECN switch.
32	ECN-TC	ECN switch failure	No effect on TrainSet operation	All the functions are executed with redundant ECN switch.
33	ECN-NDTC	ECN switch failure	No effect on TrainSet operation	All the functions are executed with redundant ECN switch.
34	ECN-TC1	ECN switch failure	No effect on TrainSet operation	All the functions are executed with redundant ECN switch.

Chapter 16

KEY INTERLOCKING SYSTEM

Purpose of key interlocking system is to prevent staff from accidental working with line voltage equipment without grounding the line voltage components. The general idea of the key interlocking system is based on the principle that, a number of safety actions be carried out in the correct order and every action performed properly releases a key, that is used in the next action until the high voltage under slung converter cubicles doors are safely opened for inspection and maintenance work. The high voltage equipment i.e, pantograph, line circuit breaker, earthing switch are directly or indirectly part of the key interlocking system.

Step 1: Down the pantograph by operating the deactivation switch in driver's cab.

Step 2: Ground LCB with the earthing switch. The blue Key–A from the pantograph air isolating cock is inserted into the lock of the earthing switch and the operating handle of the earthing switch is turned to earth position.

Step 3: The yellow Key–B from the earthing switch removed after grounding LCB is inserted in DC link earthing switch unit. The DC link earthing switch unit is common for both LHS and RHS LTC units. DC link earth switch is operated to the earth position to ground the DC link. It is however recommended to wait for 5 minutes until the capacitors become discharged through the bleeder resistors/ discharging resistors after the pantograph is lowered.

Step 4: The released Green key from the DC link earthing switch can be used to open either the LHS or RHS LTC unit doors.

16.1 Convert the vehicle to RDM

When TCN failure lamp becomes ON and/ or event no 12324/ 45092 is active (TCN failure rake runs in special RDM mode, if rake is unable to run or move the key to RDM position) and/or rake is unable to run in normal mode, move the key to RDM position.

- To use this mode, rake should be run to clear the section.
- In this mode, speed is restricted
- Driver display unit may not function.

Chapter 17

PIS

17.1 INTRODUCTION

- The Passenger Information System for Train set gives required information to the passengers in a train throughout the journey in both visual and audio information.
- It has provision for public announcement where driver/guard can address all the passengers in the train, Inter Communication (IC) between Driver and Guard communication.
- The main aim of this system is to provide convenience to the passengers by providing the station information and other required information.
- Main Communication Panel (MCP) is the master for the entire PIS system.
- The MCP and all the devices in PIS network communicates through Ethernet.
- The MCP in the Trailing coach behaves as Global Master based on direction of the journey and other MCP becomes Follower.
- The leading and trailing Coaches consist of
    - ❑ Man Machine Interface Unit (MCP) with GPS Antenna,
    - ❑ One Head Code,
    - ❑ One Car Control (CC) with built in audio amplifier unit,
    - ❑ Two Side Destination Board Displays (SDBD),
    - ❑ Two ANMs,
    - ❑ One cab speaker,
    - ❑ Four Emergency Talk Back Units (ETBU),
    - ❑ Two LCD displays (common for PIS and infotainment),
    - ❑ Six Saloon Loud Speakers and One microphone.

  All other coaches other than leading and trailing coaches have
    - ❑ Two Side Destination Board Displays (SDBD),
    - ❑ One Car Control (CC) with built in audio amplifier unit,
    - ❑ Four Emergency Talk Back Units (ETBU),
    - ❑ Two LCD displays (common for PIS and infotainment),
    - ❑ Two ANM
    - ❑ SIX Saloon Loud Speakers.
- The **6 watt** r.m.s. speaker of reputed **make Ahuja/Philips/Boston** is being used.

17.2 Block diagram

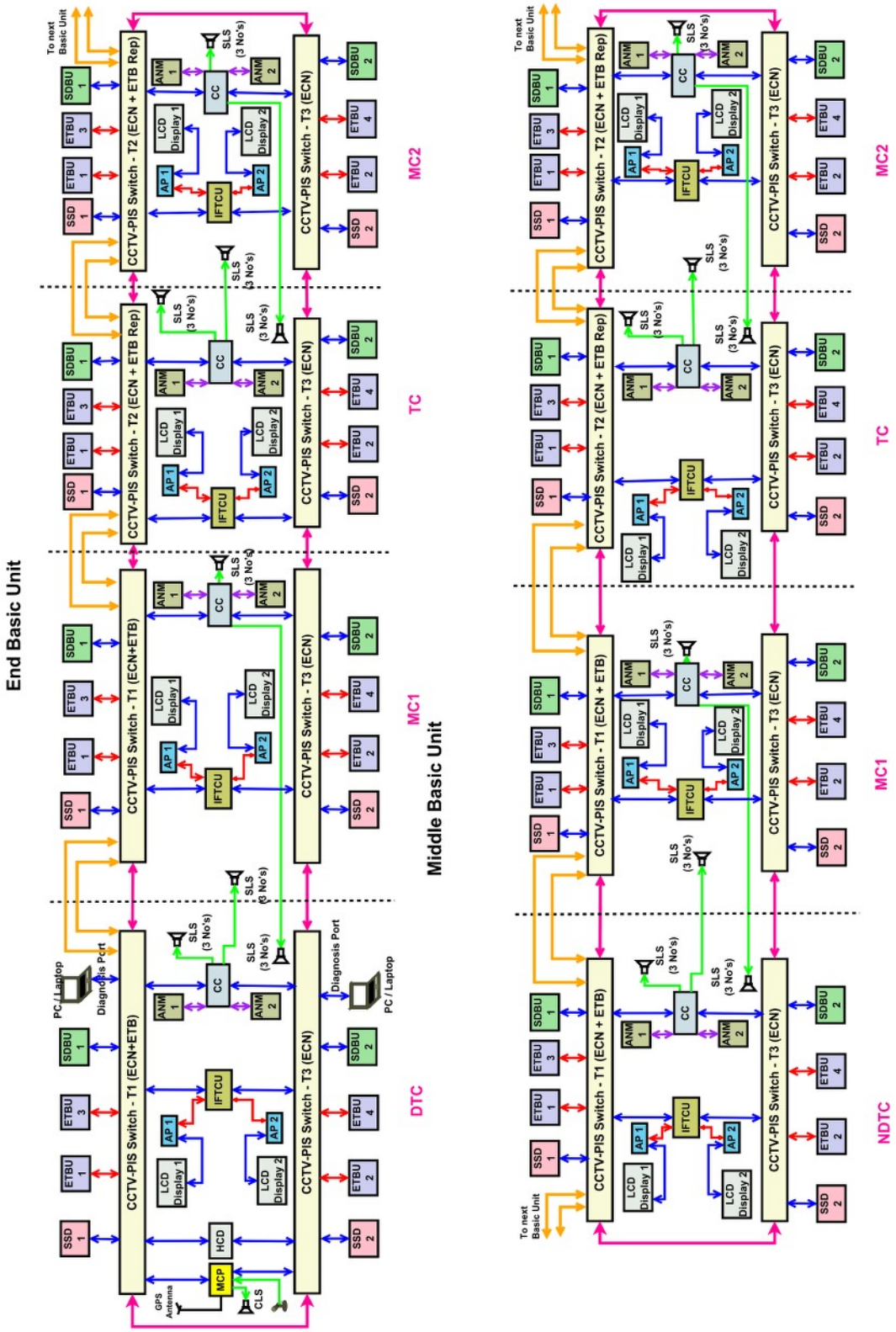


Fig. 17.1

17. 3 SCOPE OF SUPPLY

S.No	Sub-System	DTC (02 nos.)	MC 1 (4 nos.)	TC (4 nos)	MC 2 (4 nos)	NDTC (02 nos)	16-Car Total
1	Main communication panel (MCP)	1	x	x	x	x	2
2	Car controller (CC)	1	4	4	4	4	16
3	Emergency talk back unit	4	2	2	2	2	64
4	Side destination board	2	x	x	x	x	32
5	Head code display	1	2	2	2	2	2
6	LCD Display	2	2	2	2	2	32
7	Single Side Display	2	2	2	2	2	32
8	Ambient Noise measurement (ANM)	2	6	6	6	6	32
9	Saloon Loud Speakers(SLS)	6	2	2	2	2	96
10	Cab Loud Speaker (CLS)	1	x	x	x	x	2
11	GPS module	1	x	x	x	x	2
12	Microphone	1	x	x	x	x	2

- In coach LCD display is a part of infotainment system

17.4 Main Communication Panel

- MCP has **7" touch screen** based **TFT LCD** Display for user interface.
- This Module is mounted on the driver desk.
- This module is mainly used for
  - Route selection
  - Displaying the route information to the user (Driver/Guard)
  - Displaying the Menu Options
  - Accessing the audio features like PA,IC and ETBU
  - Displaying complete PIS System health

Fig. 17.2

- It has GPS interface to get real time GPS co-ordinates.
- Train route database of the PIS system is stored in MCP.
- It has Ethernet interface with CCTV Display through Ethernet switch for displaying
    - ❑ Near by cameras when ETBU is operated and
    - ❑ To show the rear view camera when station is arrived.
- It has RS422 interface with Train Radio for future purpose.
- It has an interface with Microphone to enable the PA, IC and ETB feature.
- It records the audio conversation of ETBU call with GPS time stamp and sends the data to MAR system to store the data.

17.5 Car Control Unit (CC)

- The Car Control (CC) unit acts as an amplifier for driving the Saloon loud speakers which are placed in each car of the train.
- It gets the information from MCP for announcement.
- It has an interface with two ANM's to capture the ambient noise level in the coach.
- Based on the ambient noise level in the coach, the volume is adjusted automatically.
- Speakers are routed from CC in each coach by 50% audio sharing from next coach.

Fig. 17.3

17.6 Head Code Display (HCD)

- The Head Code Display comprises of LED boards.
- HCD is provided at the front end of the driving coach (leading and trailing) above the lookout glass.
  - ❑ LED Matrix size: 16 x128.
- It is placed at the front side of each end of the Driving Coach (Leading and Trailing).

Fig. 17.4

- It will display the following information in Hindi, English and regional languages
  - ❑ Destination station.
- In case of communication failure to HCD, destination can be selected from TCMS display.

17.7 Side Destination Board Display Unit (SDBD)

- Side Destination Board Display System is provided at each side of the coach.
- It displays the following information in two windows
  - ❑ in one window, Coach number and Train number,
  - ❑ In second window, Train name, Source to Destination, Via stations in English,Hindi and Regional language.
- LED Matrix size: 16x128.

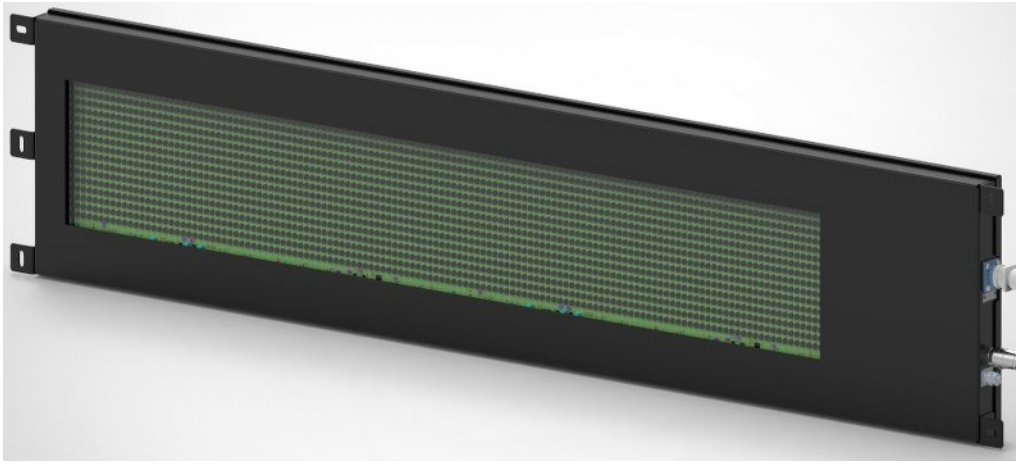


Fig. 17.5

17.8 Single Side Display

- The In-coach LED Display unit comprises of 16x144 matrix Multi Colour LED boards.
- It displays the route related information like present station and next station to the passengers throughout the journey.
- In addition to the route related data, it will display Coach ID, Speed of the train.
- It receives the journey information from MCP.

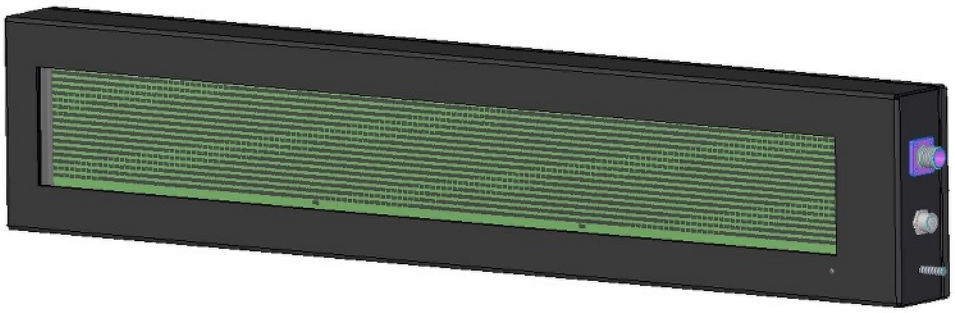


Fig. 17.6

17.9 In coach LCD Display

- In-coach displays are **32" LCD** displays.
- They are interfaced to IFTCU unit through Ethernet interface.
- They are used to display the following information to the passengers sitting inside the coach.
  - ❑ Default Welcome and farewell messages
  - ❑ Originating and destination station
  - ❑ Current Date & Time
  - ❑ Current location of the train
  - ❑ Name of approaching station
  - ❑ Current and next Halting Station
  - ❑ Next interchange point
  - ❑ Running speed
  - ❑ Platform side
  - ❑ Advertisements
  - ❑ Safety Messages
  - ❑ Dynamic Route Map
  - ❑ Onboard facilities
  - ❑ Approximate distance to next station

17.10 Emergency Talk Back Unit

- The purpose of Emergency Talk Back Unit is to provide the emergency communication between Driver/Guard and Passengers.
- When a Emergency Talk Back Unit is operated by passenger in any particular coach, an indication of the location of the operated device will be given on MCP.
- The Driver/Guard will acknowledge the ETBU request by pressing 'Accept' icon in MCP to enable the communication with passenger.
- When ETBU request is received to MCP, MCP will give the information to CCTV display to enable the nearby cameras of the ETBU.

Fig. 17.7

17.11 Ambient Noise Measurement Module (ANM)

- ANM is basically a noise measurement module to adjust the announcements volume level in passenger area based on the surrounding noise with comprised microphone.
- It detects the background noise, measures the noise level and sends the same to CC.
- The CC will adjust the volume level based on the background noise received from ANM.
- It is operated at 110V DC supply.

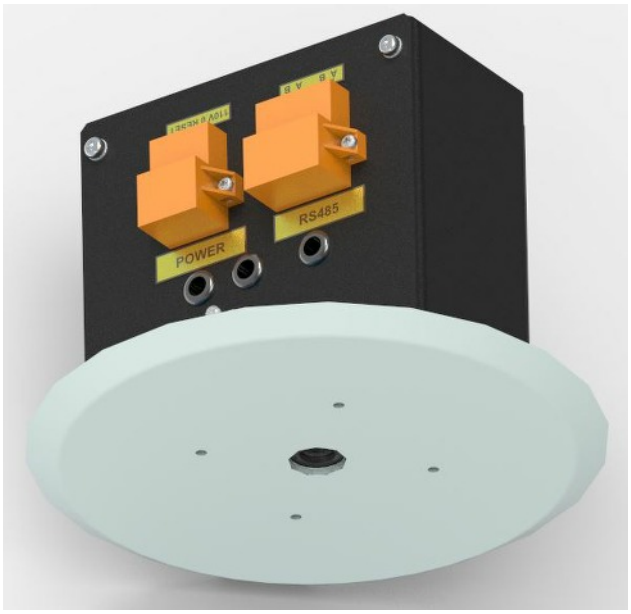


Fig. 17.8

17.12 Saloon and Cab Loudspeakers

- The 6 watts r.m.s. speaker of reputed make Ahuja is used in the system.
- 50% of sharing is provided for the speakers between coaches in case of single power amplifier failure, at least half of the speakers are still operative in the coach.
- Speakers are distributed in equal distance diagonally for even coverage of the sound in the coach.

Fig. 17.9

17.13 Microphone

- Microphone is a professional high quality goose neck microphone.
- It is suitable for various PA applications.
- It is interfaced to MCP for PA, IC, ETBU operations.
- Driver can talk through the microphone.

Fig. 17.10

17.14 GPS Module

- A rugged GPS module with inbuilt antenna is located on the roof of DTC.
- GPS module has RS485 communication with MCP unit for acquiring
  - ❑ Latitude,
  - ❑ Longitude,
  - ❑ Date & time information.
  - ❑ Speed

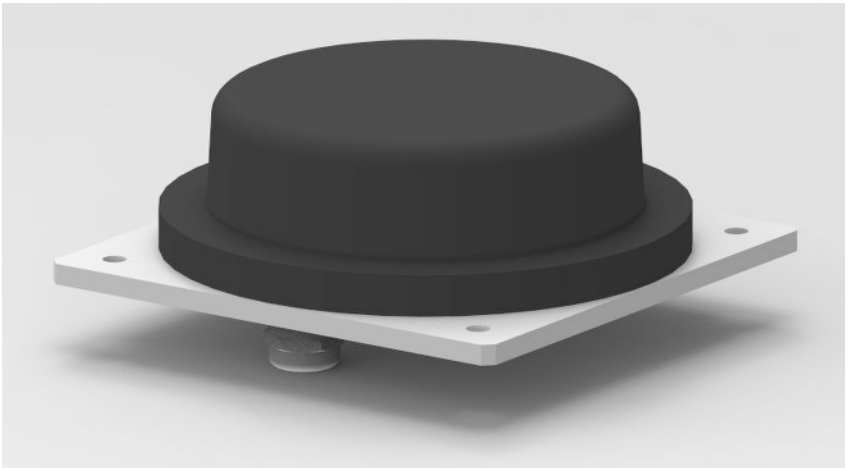


Fig. 17.11

17.15 Menu Screens

17.15.1 Power-Up & Initialization

After Powering up the system, MCP Menu screen appears as shown in Fig.17.12.

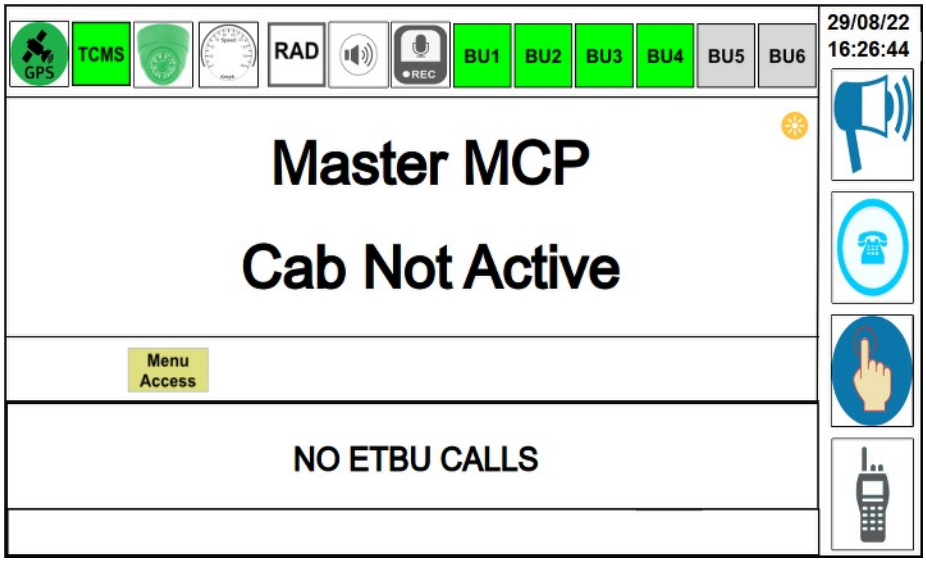


Fig. 17.12

After pressing **Menu Access** button on the above screen, then MCP Menu screen appears as shown in Fig.17.13.

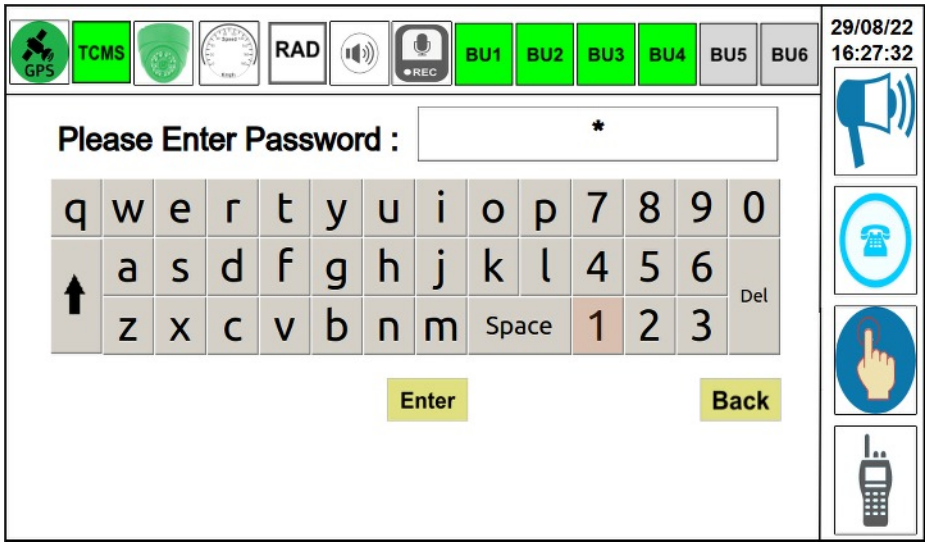


Fig. 17.13

Enter the Password (Ex:1) and press the **Enter** Button, then MCP Screen appears as shown in Fig.17.14.

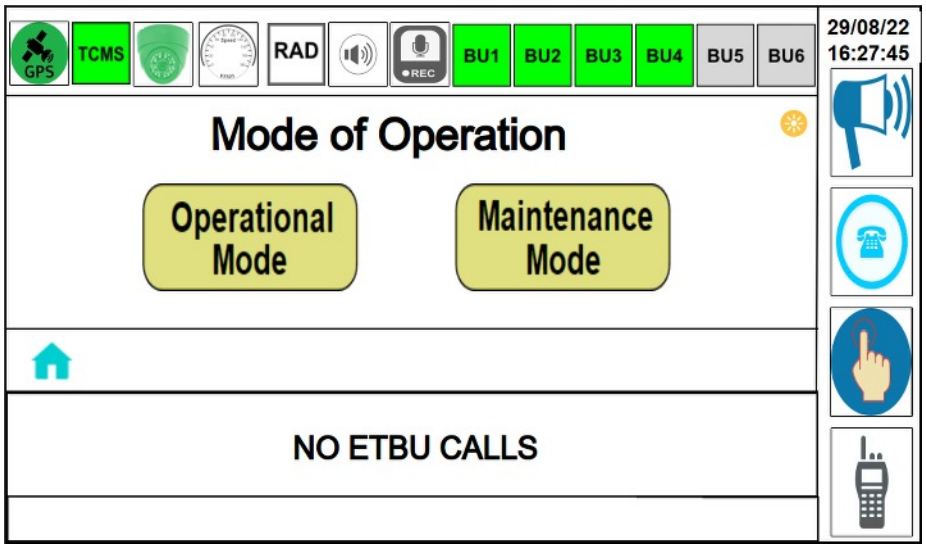


Fig. 17.14

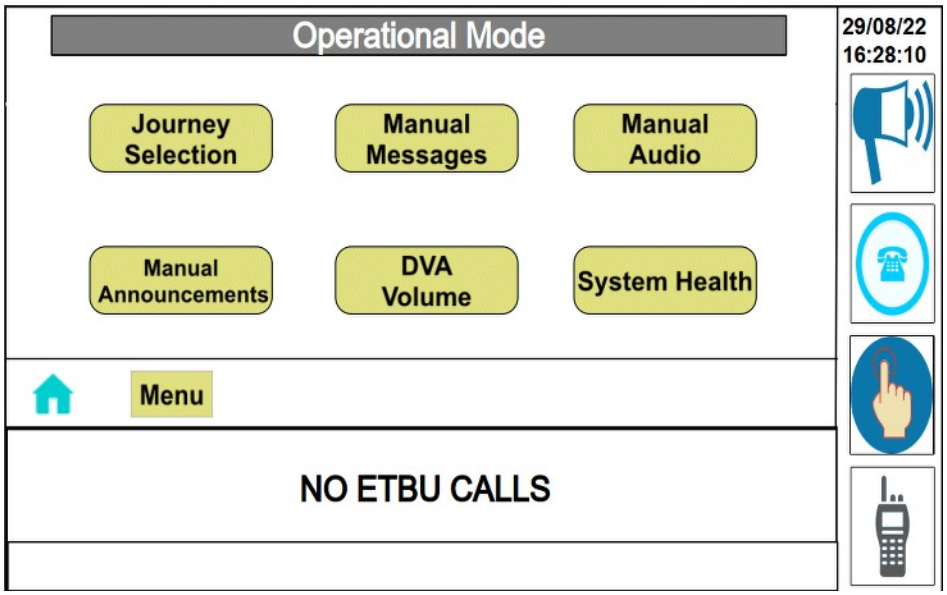


Fig. 17.15

17.15.2 Manual Messages:

After selecting the O**perational Mode** button then the default screen appears as shown in Fig. 17.16.

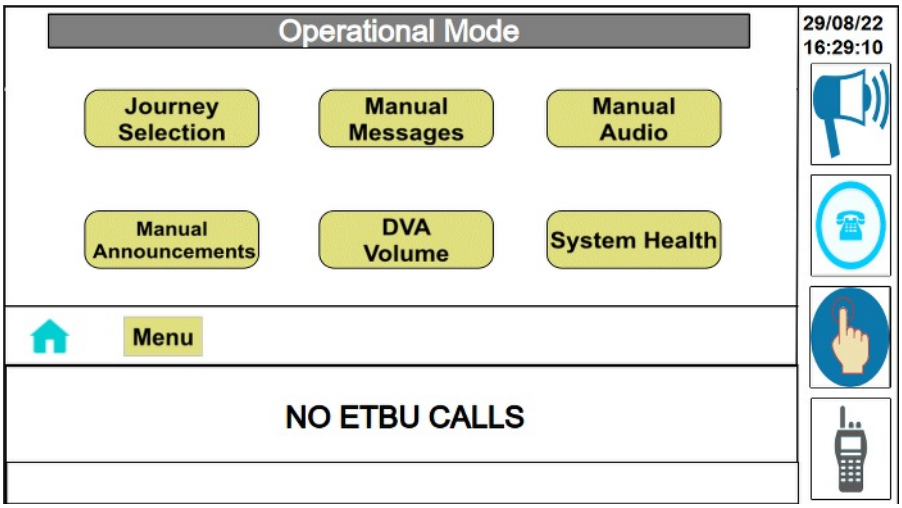


Fig. 17.16

Select **Manual Message** on the MCP and verify the MCP Screen

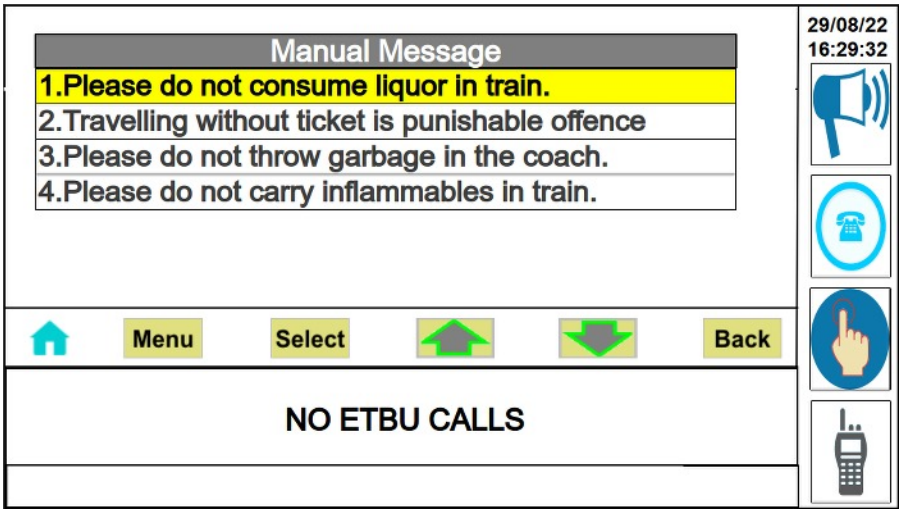


Fig. 17.17

Press on **Select** option (select **Manual Message** by using Up & Down Arrows) as shown in Fig. 17.18.

Observe the selected manual message displaying in ICD - LCD/SSD display.

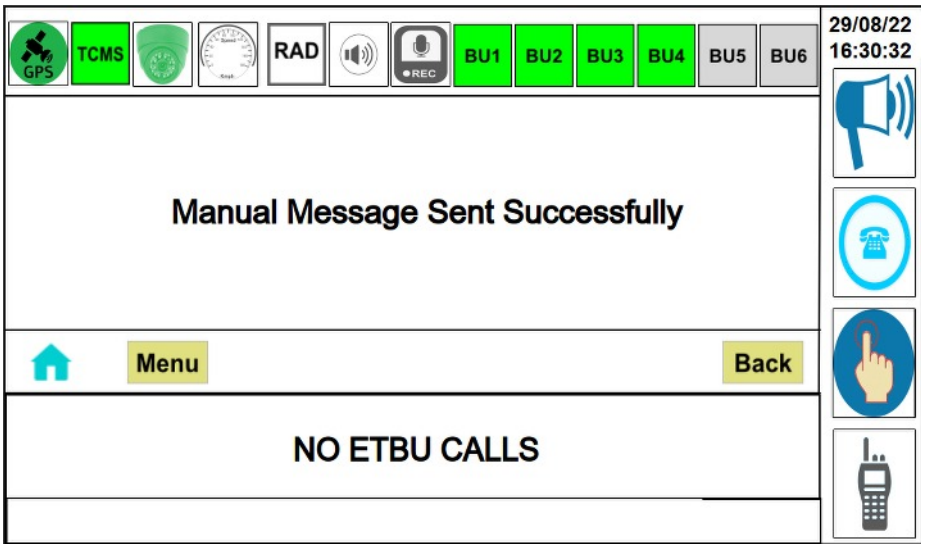


Fig. 17.18

17.15.3 Manual Audio :

After selecting the **Operational Mode** button then default screen appears as shown in Fig.17.19.

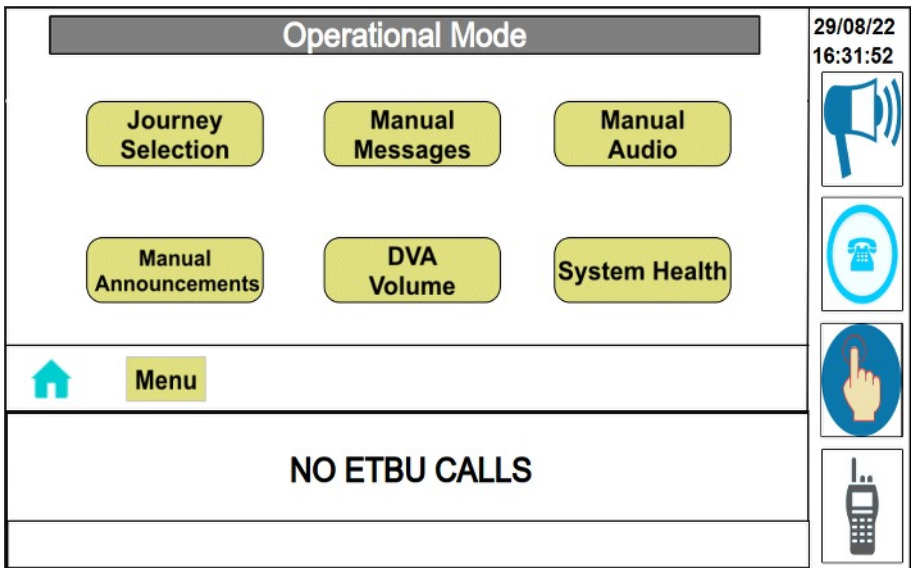


Fig. 17.19

Select **Manual Audio** message on the MCP and verify the MCP Screen

Press on **Select** option and verify the MCP Screen (select **Manual Audio** by using Up & Down Arrows) as shown in Fig. 17.20.

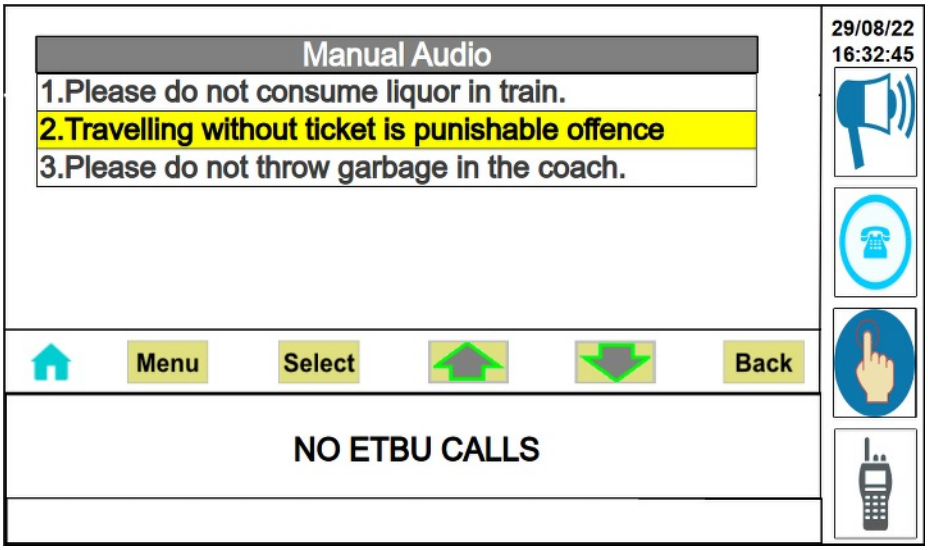


Fig. 17.20

Observe the manual message on ICD - LCD/SSD display and listen manual audio messages over saloon speakers.

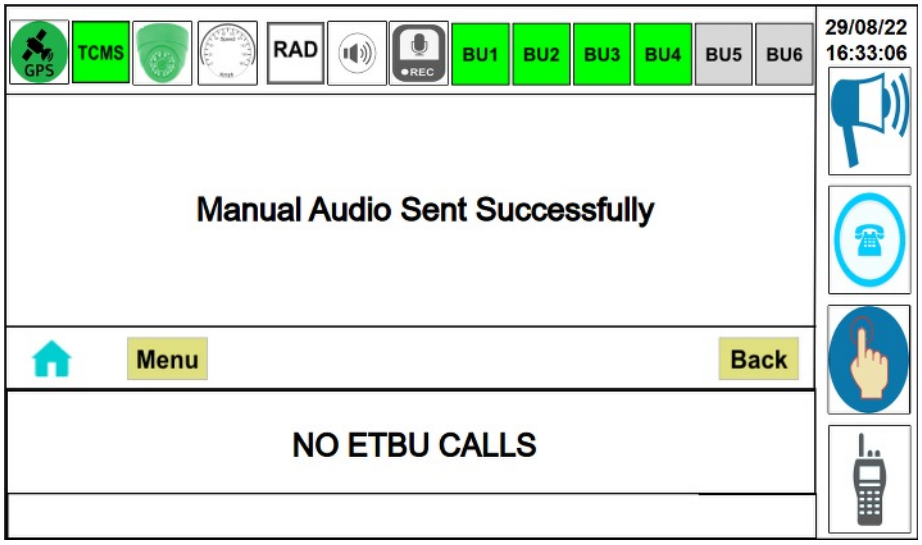


Fig. 17.21

17.15. 4 DVA Volume Control Selection

After selecting the **operational mode** button then default screen appears as shown in Fig. 17.22.

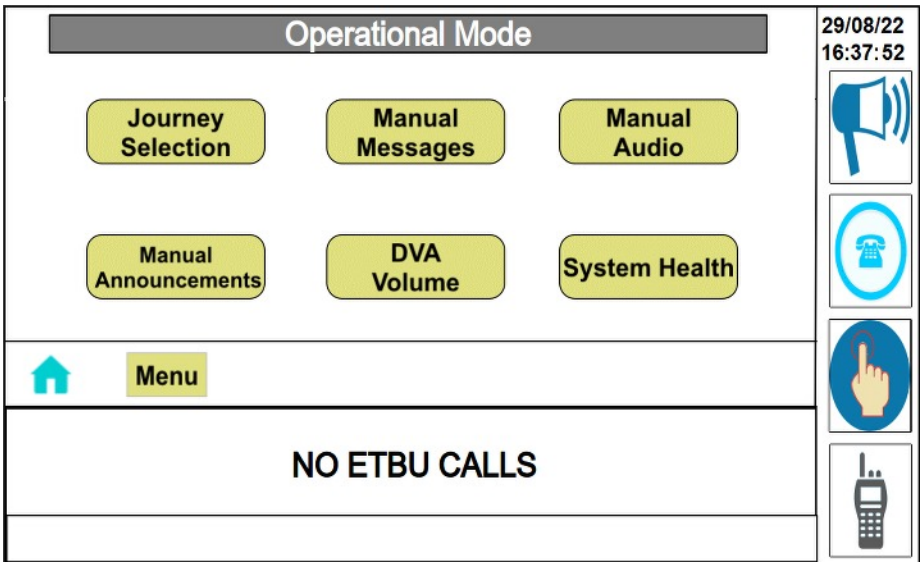


Fig. 17.22

select **DVA Volume** Option on the MCP then MCP Screen appears as shown in Fig. 17.23.

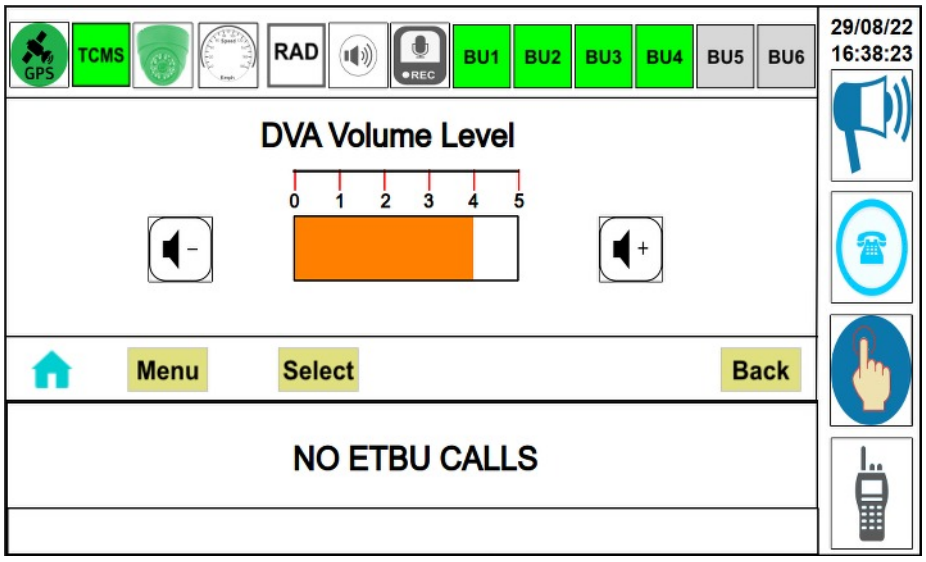


Fig. 17.23

Change the Volume level by pressing + and - symbols then Press the Select button on MCP shown in Fig. 17.24., based on that volume, level will vary in Saloon speaker.

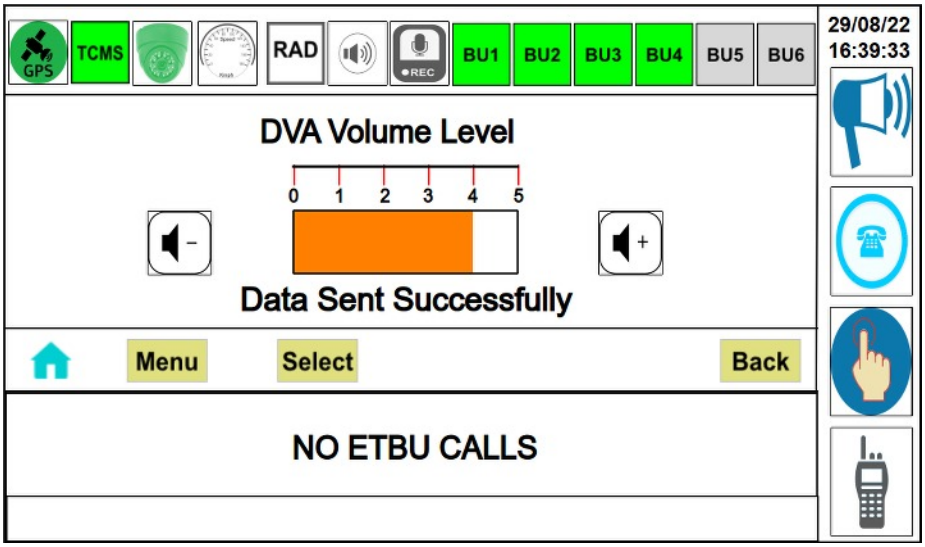


Fig. 17.24

17.15.5 Public Announcement

After selecting the O**perational Mode** button then the default screen appears as shown in Fig. 17.25.

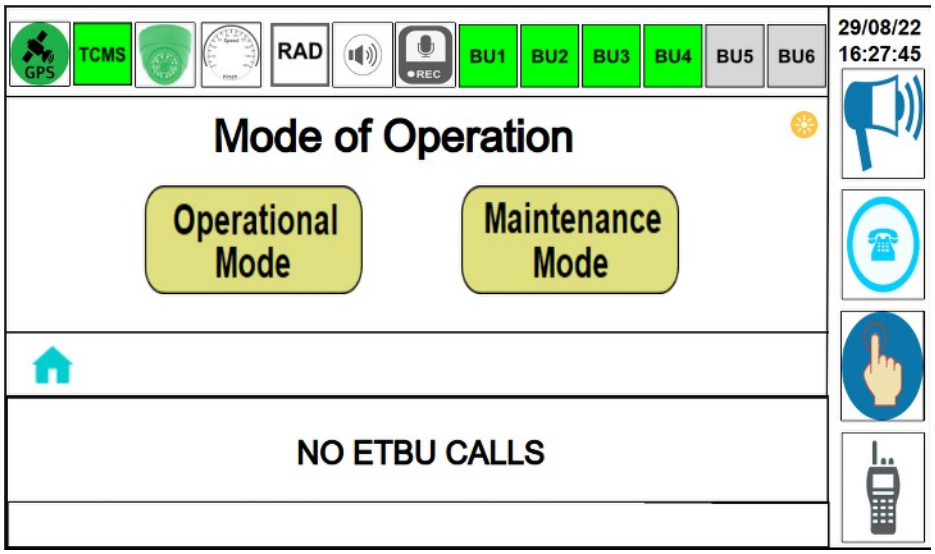


Fig. 17.25

Press **PA** option on the MCP Screen shown in Fig. 17.26 

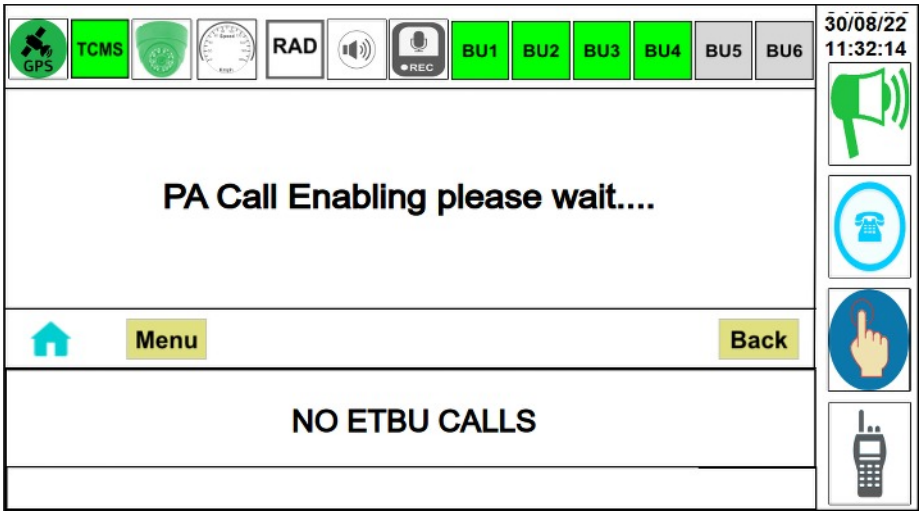


Fig. 17.26

During **PA** Enable MCP screen appears as shown in Fig.17.27.

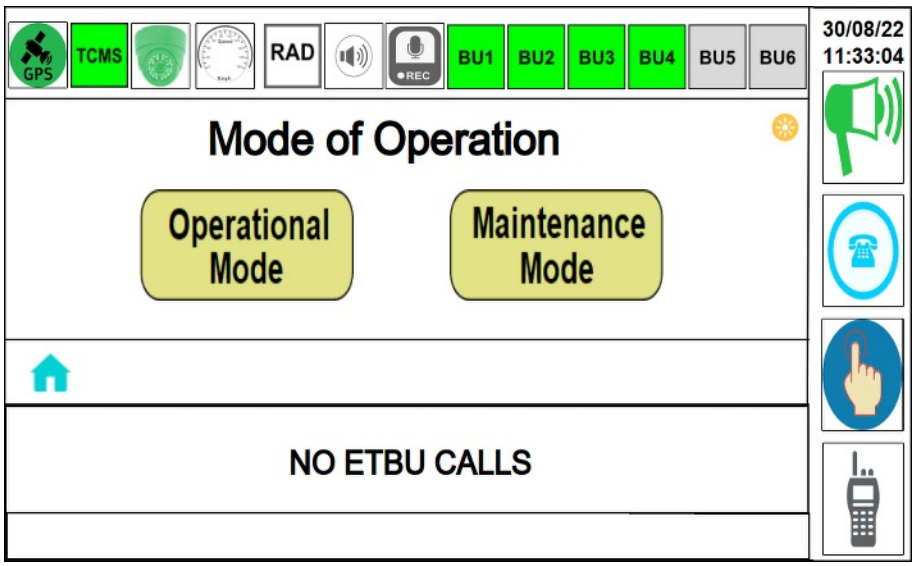


Fig. 17.27

On Both MCP's, PA Indication options is changed to Green Color and Jingle Sound is played from other end Cab and all Saloon Loudspeakers.

Speak through enable side of MCP Microphone.

Voice is heard from Cab loudspeaker of other cab and Saloon loudspeakers of all coaches

Press **PA** button again on MCP then the MCP Screen as shown in Fig.17.28.

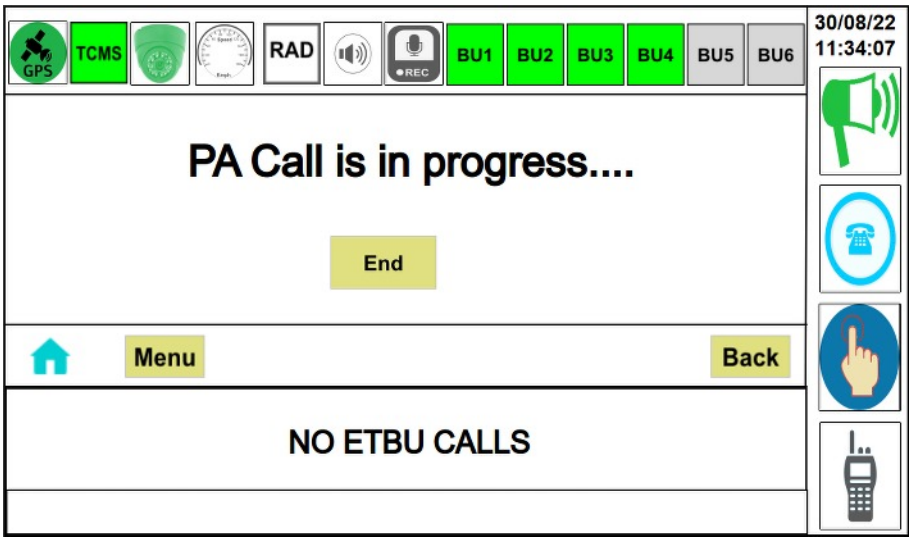


Fig. 17.28

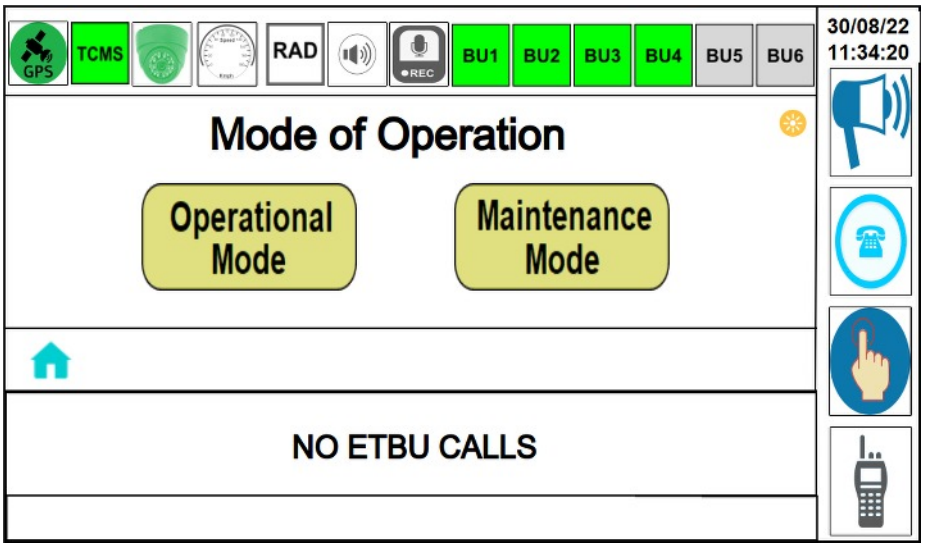


Fig. 17.29

Press the **End** option on MCP and observe the MCP Screen. After PA call end then the MCP screen appears as shown in Fig. 17.29.

Speak through disable side of MCP Microphone and observe no voice is heard from any of the Cab and Saloon loudspeakers.

17.15.6 IC Communication (Cab - Cab Communication)

After selecting the **Operational Mode** button then the default screen appears as shown in Fig.17.30.

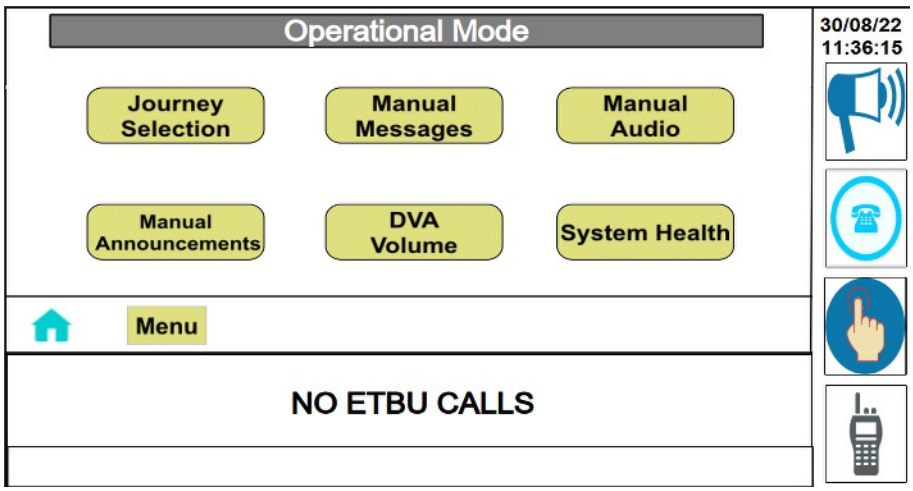


Fig. 17.30

Press **IC** option on the MCP Screen shown in Fig.17.31. 

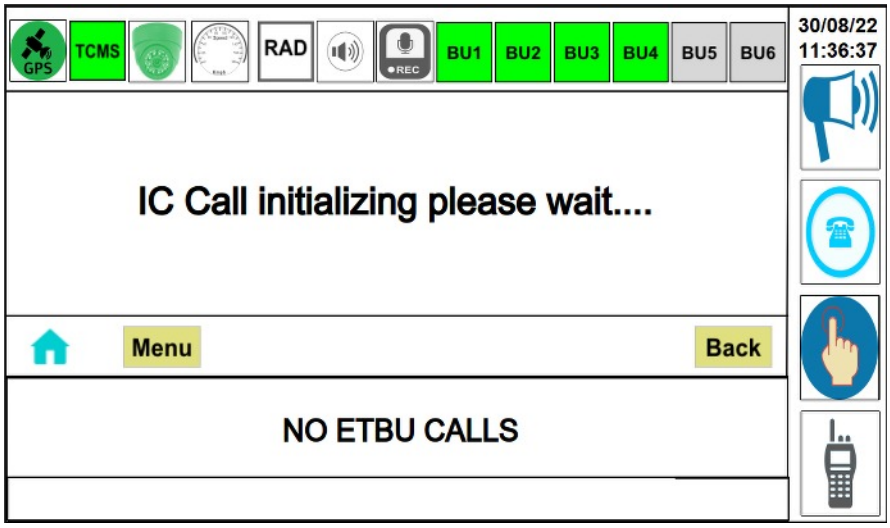


Fig. 17.31

Jingle Sound is played from both the Cab Loudspeakers.

During IC Call, both MCP IC Indication option is changed to green color as shown in Fig. 17.32.

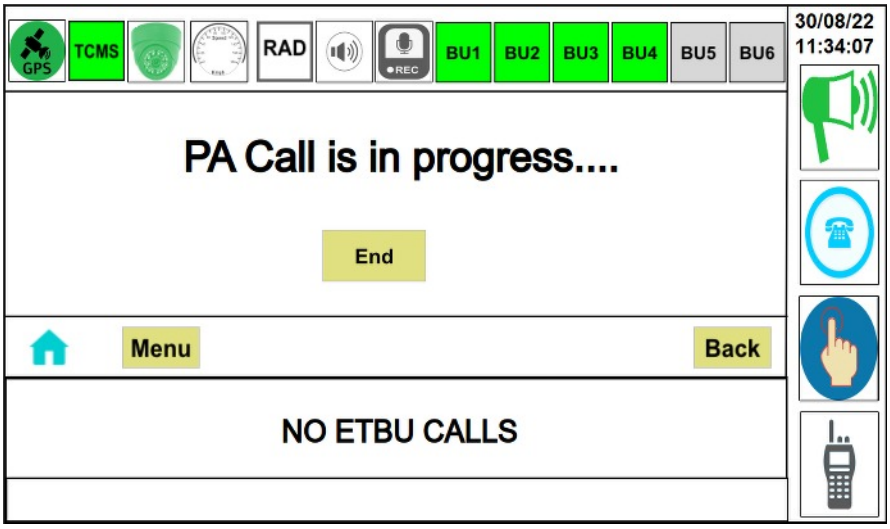


Fig. 17.32

Speak through Cab 1 of MCP Microphone. Voice is heard from Cab-2 loudspeaker. Speak through Cab 2 of MCP Microphone. Voice is heard from Cab-1 loudspeaker.

17.15.7 Press the IC option on MCP and Press on End option

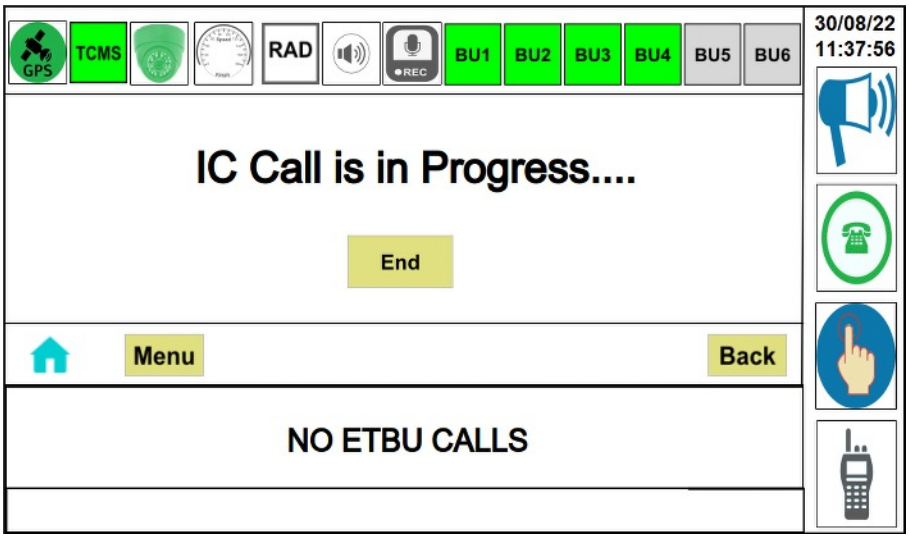


Fig. 17.33

After ending the 'IC' call then, both MCP IC Indication option is changed to default color as shown in Fig. 17.34..

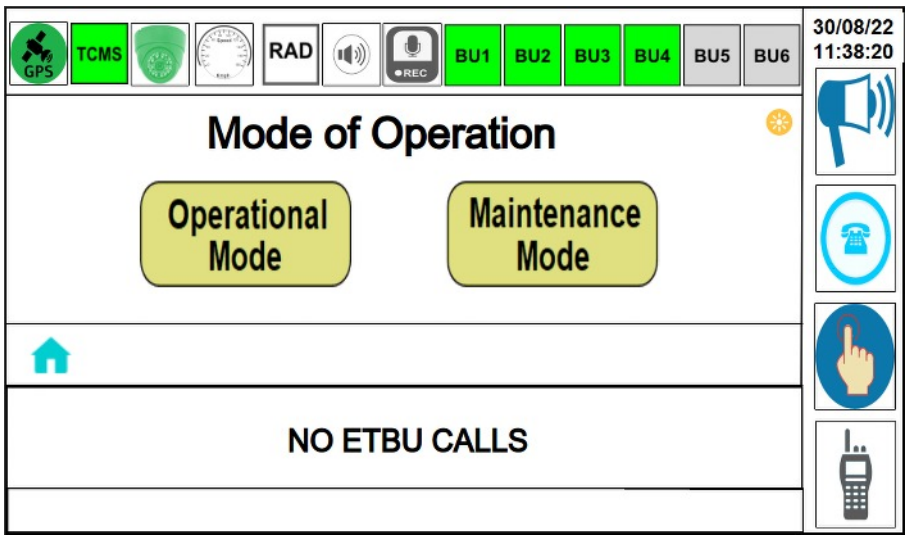


Fig. 17.34

Speak through Microphone of Cab 1 and Cab 2, No Voice is heard from any of the Cab loudspeakers.

17.15.8 Emergency Talk Back Unit check (Guard - Passenger Communication)

After selecting the O**perational Mode** button Check the default screen appears as shown in Fig. 17.35.

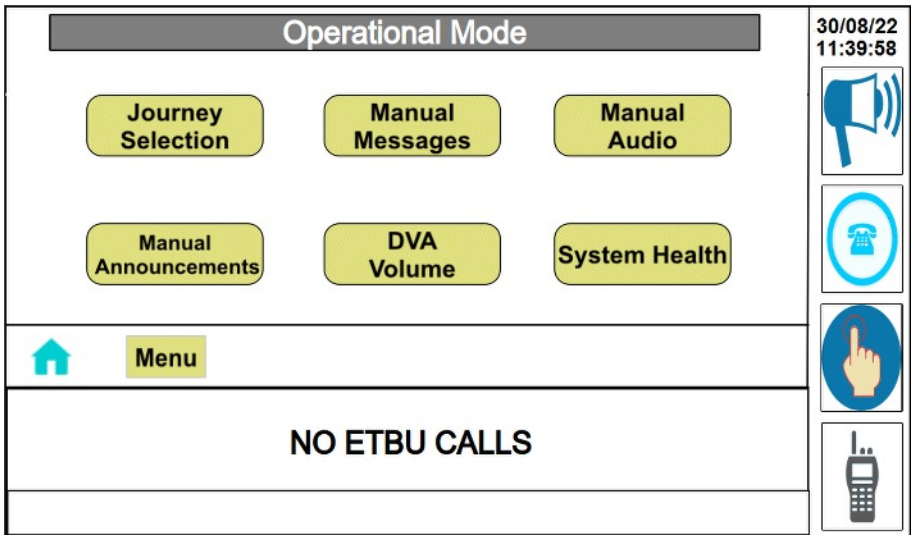


Fig. 17.35

Press Push to Talk switch on ETBU any one of cars and verify the MCP screen ETBU Option as shown in Fig. 17.35.

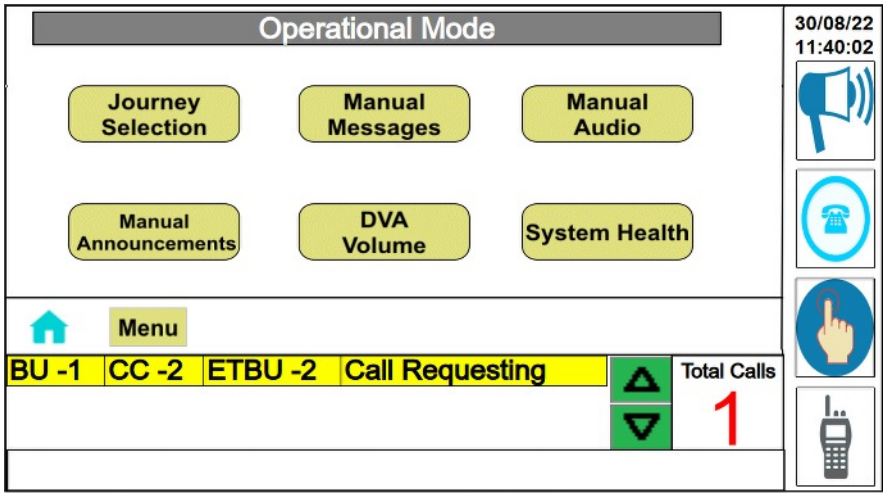


Fig. 17.35

Press **ETBU** option on the MCP of Cab 1 

The MCP of Cab 1 appears as shown in Fig. 17.36.

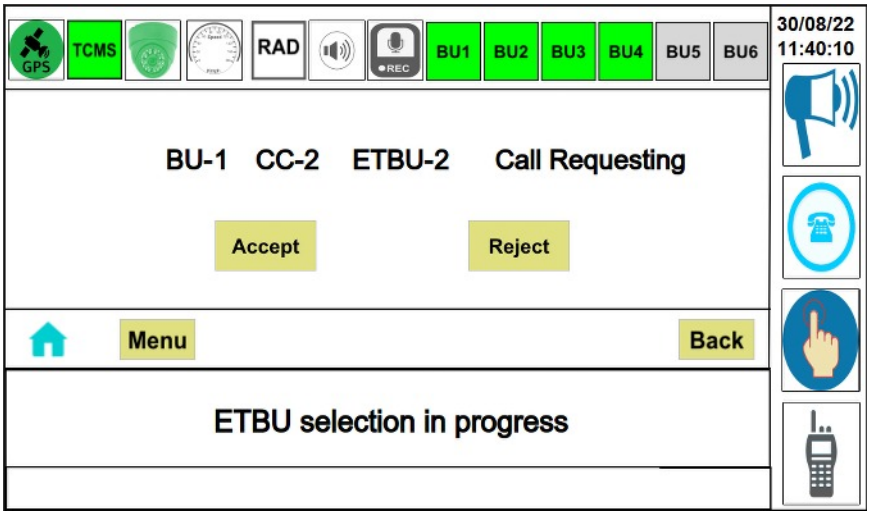


Fig. 17.36

After accepting the ETBU call verify the MCP screen of Cab 1 appears as shown in Fig.17.37.

ETBU option on MCP is changed to green color and ETBU LED also changes to green color.

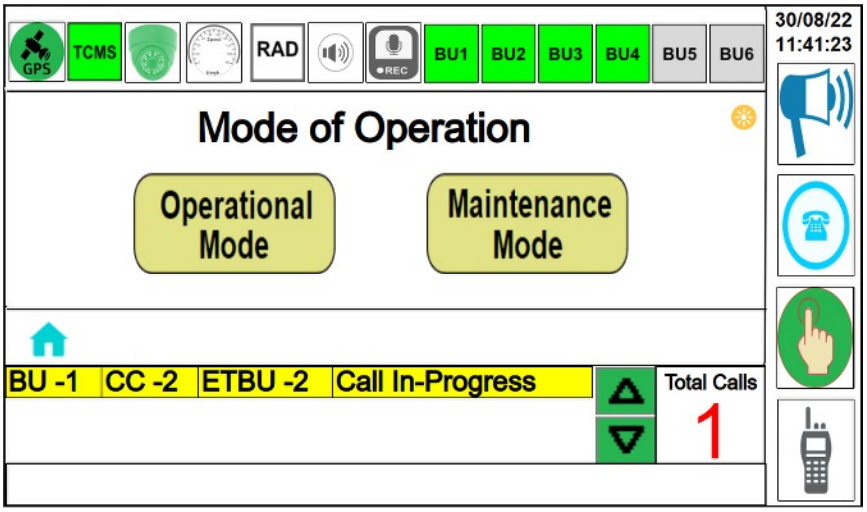


Fig. 17.37

Press the **ETBU** option again on MCP to End the ETBU call, to end the ETBU call Press on **End** button and verify the MCP Screen appears as shown in Fig.17.38.

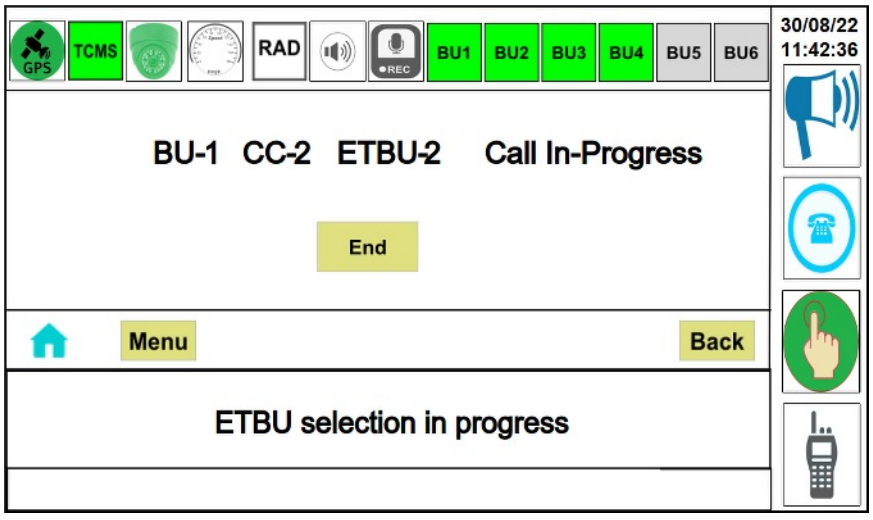


Fig. 17.38

Verify the default Screen of MCP appears as shown in Fig.17.39.

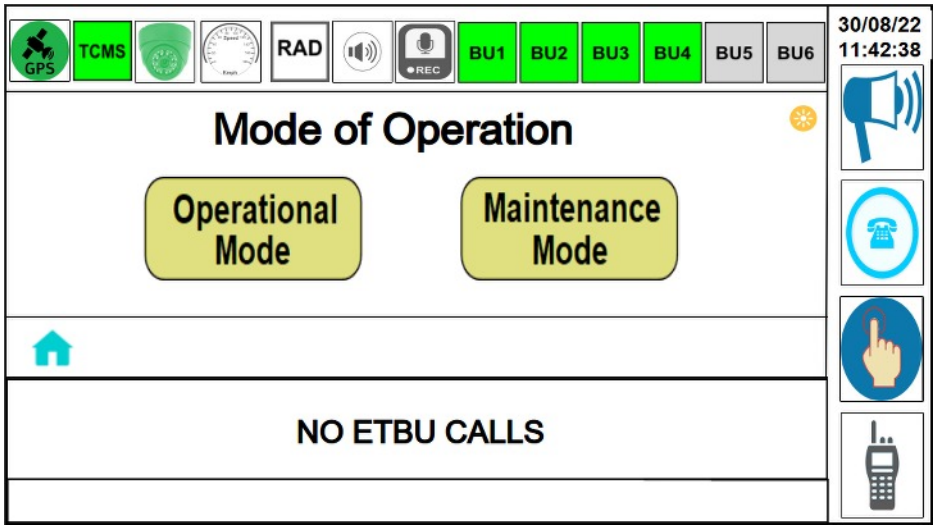


Fig. 17.39

Once ETBU call is rejected or ended the data related to that particular ETBU call is removed from the Queue list and ETBU option on MCP changes to normal state and ETBU LED also changed to OFF state.

Press Push to Talk switch on ETBU of any coach and verify the MCP screen as shown in Fig.17.40.

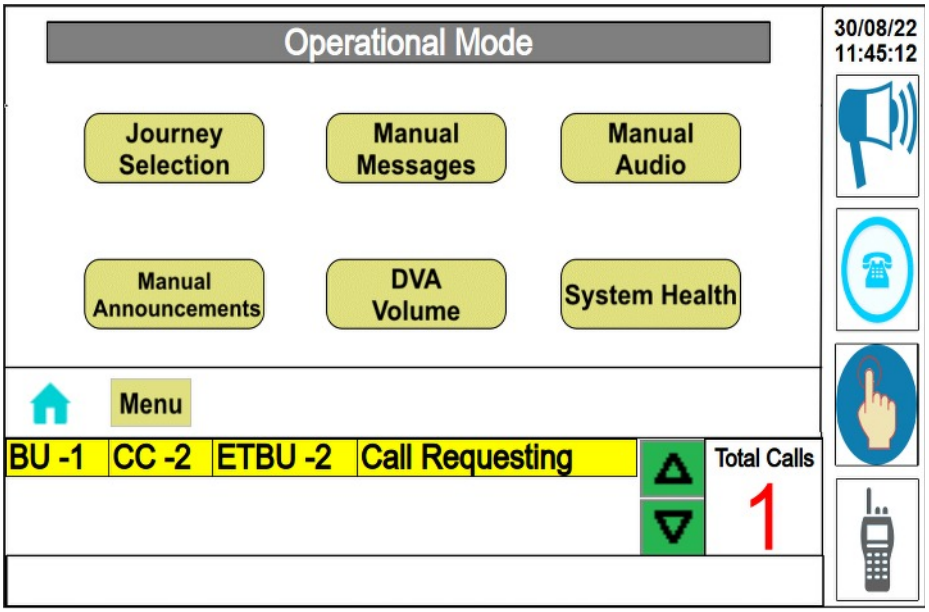


Fig. 17.40

Press **ETBU** option on the MCP as shown in Fig.17.41.

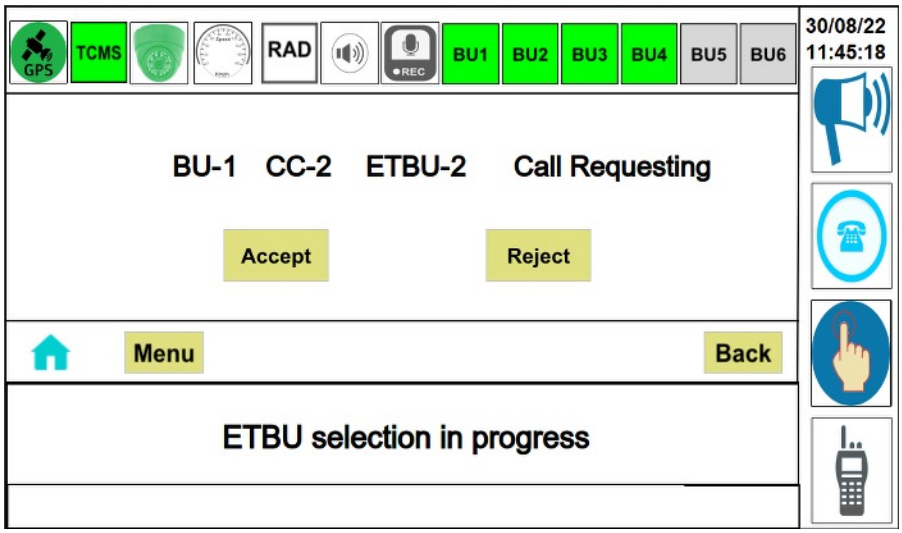


Fig. 17.41

Press on **Reject** option on MCP and observed the Screen appears as shown in Fig.17.42.

ETBU call is rejected or Ended the data related to that particular ETBU call is removed from the Queue list and ETBU option on MCP changed to normal state and ETBU LED also changed to OFF state.

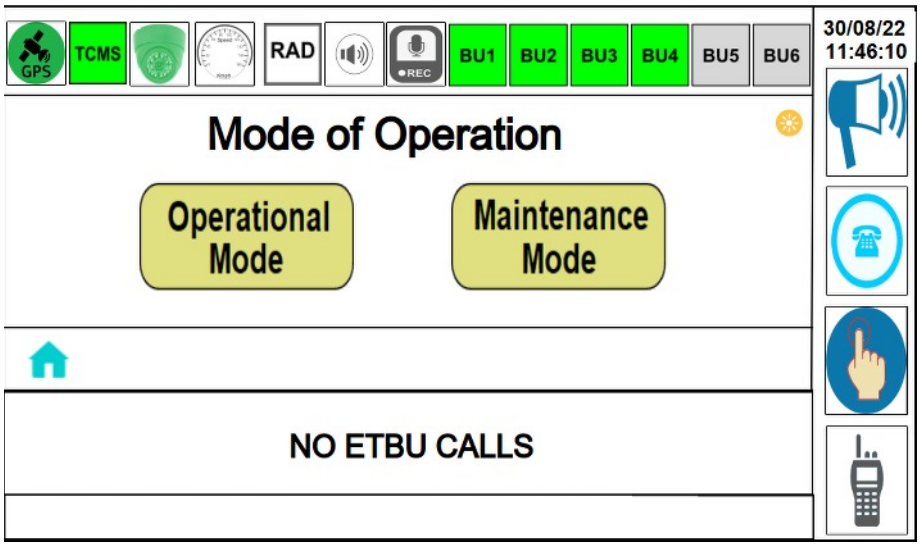


Fig. 17.42

17.15.9 Journey Selection

After selecting the **Operational Mode** button Check the default screen appears as shown in Fig.17.43.

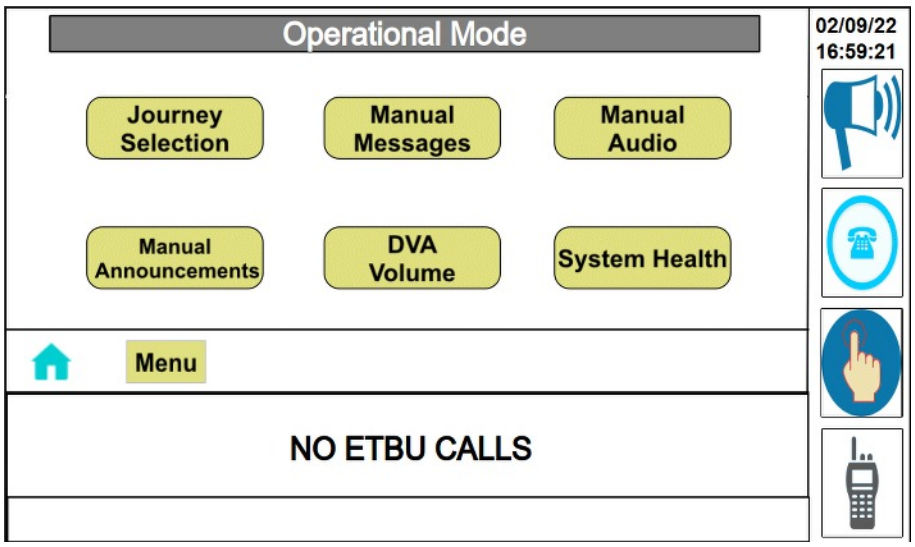


Fig. 17.43

Press **Journey Selection** Option on MCP then the MCP Screen appears as shown in Fig.17.44

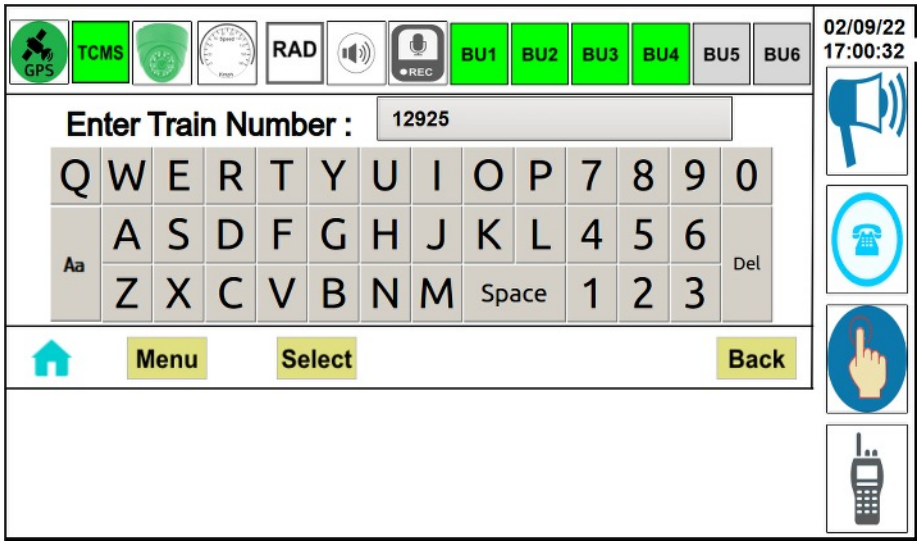


Fig. 17.44

Enter the train no and Press on **Select** button and verify MCP screen appears as shown in Fig. 17.45.

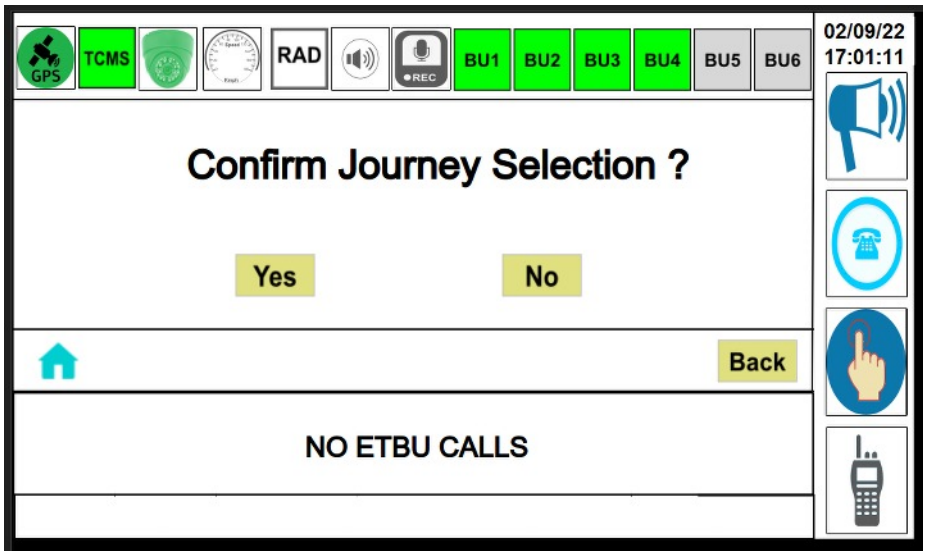


Fig. 17.45

Press on Yes button to continue the journey selection.

Verify MCP screen after route selection appears as shown in Fig.17.46.

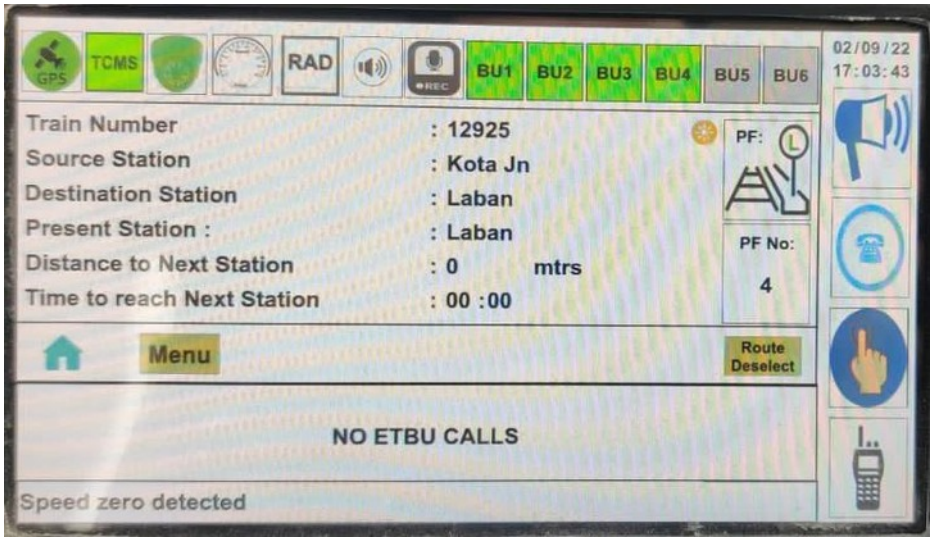


Fig. 17.46

Verify the announcements and Display messages after route selection.

Route start messages :

Played Audio:

Route start messages is played from all saloon loudspeakers in English, Hindi and Regional Language.

Example:

“Welcome To Kota Junction Laban Vande Bharat Express”.

ICD-LCD:

Route Start Messages is displayed in English, Hindi and Regional Language followed by Dynamic Route Map, Facilities and Advertisements.

Head Code Display:

Destination Station Name is displayed in English, Hindi and Regional Language

Side Destination Boards :

Source Station Name, Destination Station Name, via station names and Train Name is displayed in English, Hindi and Regional Language and Train number followed by Coach Commercial abbreviation is displayed (Alpha numerical) in English.

NOTE :

Language sequence and regional language will vary based on user railways.

Chapter 18

INFOTAINMENT

18.1 INTRODUCTION

The main function of the System is streaming of Wi-Fi based entertainment Content on Demand (CoD) for passengers using their personal gadgets like Laptop / Tab / Mobile phone and LCD / LED displays for Travel Information.

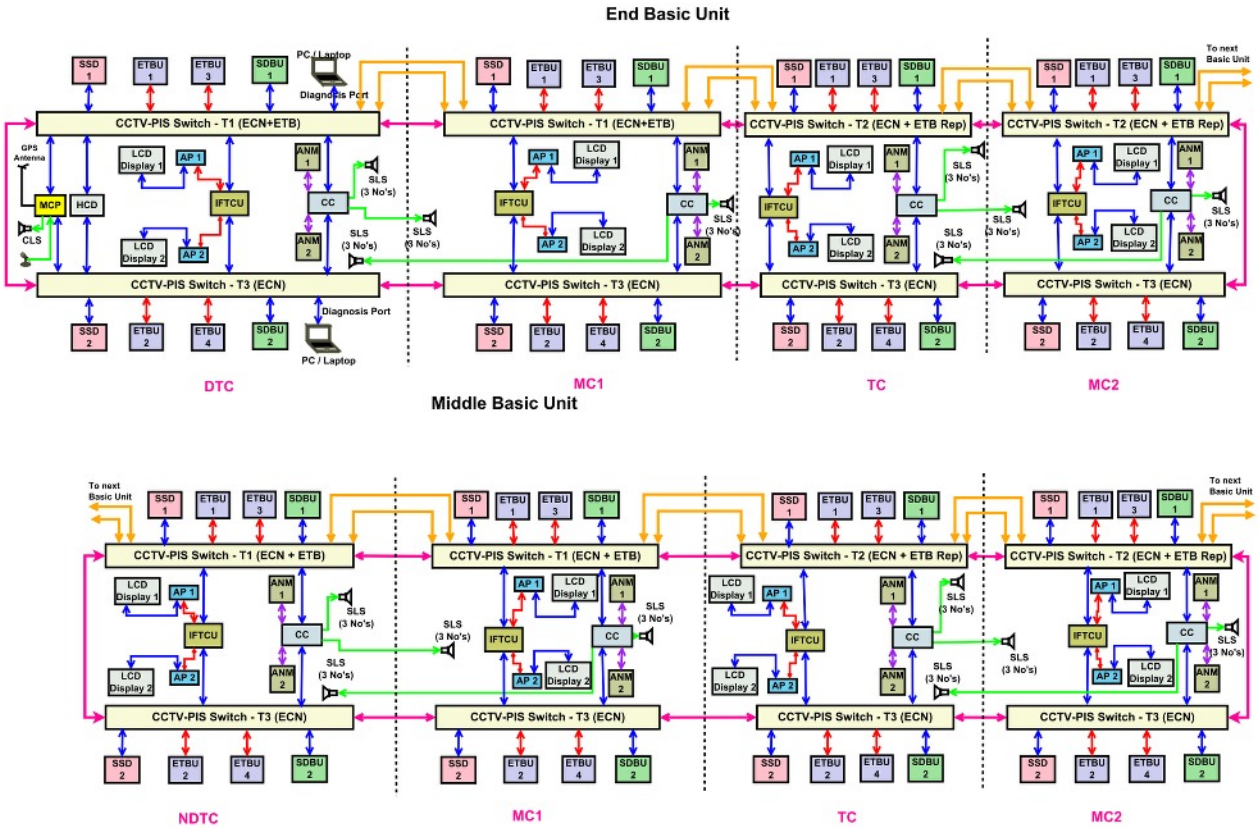


Fig. 18.1

S.No	Sub-System	DTC (02 Nos.)	NDTC (02 Nos.)	MC (08 Nos.)	TC (04 Nos.)	16-Car Total
1	Infotainment Control Unit(IFTCU)	1	1	1	1	16
2	WiFi Access Points	2	2	2	2	32
3	LCD Display	2	2	2	2	32

- The system supports to play
    - Movies in at least 4 languages (Hindi, English and 2 regional languages
    - Animation movies for kids
    - Songs in at least 4 languages (Hindi, English and 2 regional languages)
- The W-Fi System has GPS based train information such as
    - Current location,
    - Next location,
    - Estimated Time of Arrival,
    - Delay, and
    - Speed.
- Provision for on board assistance services for Meals, Linen, Cleanliness etc., over Wi-Fi
- Emergency messaging services over Wi-Fi for Medical emergencies, security and any untoward incidences will be provided
- Multiple streaming solution to support content play on Laptop, Android devices and iOS devices are provided
- The system is having Browser based solution which is commonly used on all devices
- Provision for Video and static advertisement insertion options
- Content protection methods is provided to avoid any illegal content downloads by the passengers
- Provision to upload content from one place to other even though the coaches work independently without inter coach couplers
- Provision of Internet support, which can be enabled whenever the system is connected to external internet service provide (I) Provision of Internet support, which can be enabled whenever the system is connected to external internet service provider.
- Provision of 2 LCD/LED displays of 32”size (supply of all the 02 LCD/LED displays will be of same size) in each coach to display
- Entertainment,
- Advertisement
- Travel information on these screens
- Two Wi-Fi Access Points provided in each car to for streaming audio and video.

IFTCU consists of System On Module (SOM) with high-end processor and DDR RAM.

IFTCU has SATA based 512GB SSD storage for audio and video contents.

32” LCD/LED Displays are interfaced with Ethernet Through Wifi Access Points

It has PoE based GbE (Giga bit Ethernet) port for communicating with Wi-Fi Access Points.

Fig. 18.2

It will receive following travel related information from the MCP through Ethernet switch

- Default welcome and farewell messages
- Originating & Destination station/Route map
- Date and time
- Speed
- Current and next station
- Onboard facilities available
- Approximate distance to next station
- Late running status
- Train arrival and departure times with route map
- Safety messages
- Time to Next Station
- Next Interchange Points
- Platform Side
- Passenger related Safety Information
- Pictures/ Video Messages for Advertisement or other purposes

Each coach consists of two WiFi Access points for streaming the content to passengers mobile / laptops.

WiFi access point is connected through IFTCU using PoE (Power Over Etherent).

Fig. 18.3

Wireless Features	Wireless speed	300 Mbps
	Frequency	2.4GHz/5GHz
	Network standard	IEEE 802.11b/g/n/ac

18.2 Infotainment Login

- User need to connect mobile / tab / laptop to the Wi-Fi provided, after successful connection a captive portal browser will be opened for accepting terms and conditions.
- After Accepting the terms and conditions user can able to use the Infotainment WebApp.
- User can use any standard browser like Chrome, Firefox, Safari for accessing the Infotainment WebApp provided with a domain name.
- User do not need any user name and password for accessing Wi-Fi and WebApp.
- Infotainment available options
- After opening the Infotainment WebApp the following options available for user
- Home screen with genre wise videos
- Language wise Video, Music selections
- Video Playback
- Pre-Roll Ads
- Banner Ads
- Music Playback
- Genre wise content filter
- Train Information
- Onboard Assistance

18.2.1 Login by user

User connects to mobile Wi-Fi with SSID as www.myinfotain.com, after successful connection, Use Browser for accessing the Infotainment WebApp provided with a domain name.

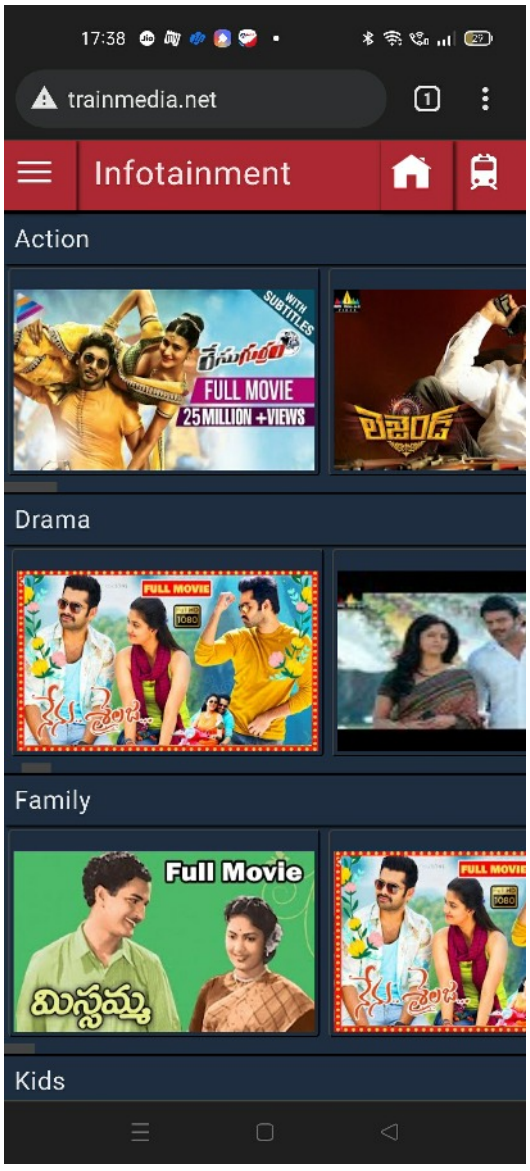


Fig. 18.1

18.2.2 Select and play random video file

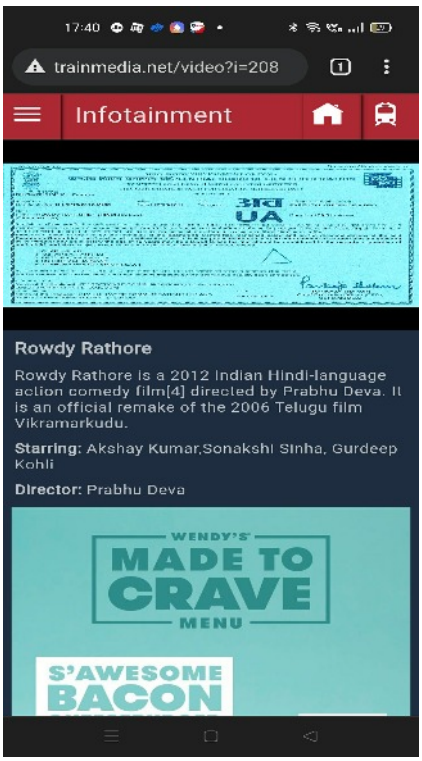


Fig. 18.2

18.2.3 Select and play random audio file

Fig. 18.3

18.2.4 Select Language wise Video & Music

Select and play any of the video and music in selected language

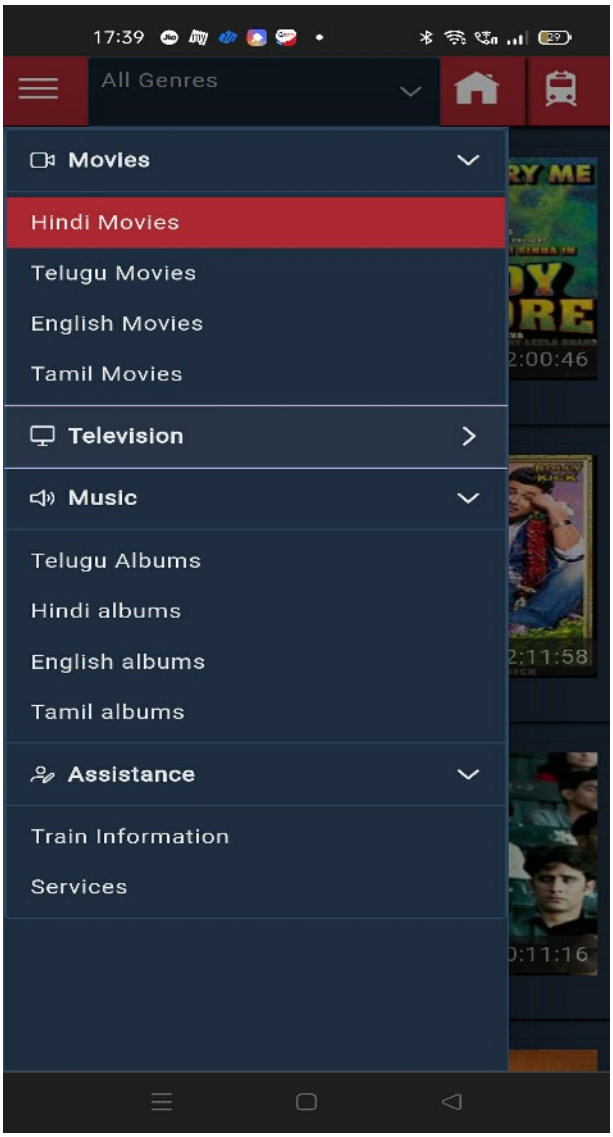


Fig.18.4

18.2.5 Select train information details

Select train information details then view the following Journey information details:

- Last updated time,
- Source Station name,
- Destination Station name,
- Current location,
- Next location,
- speed

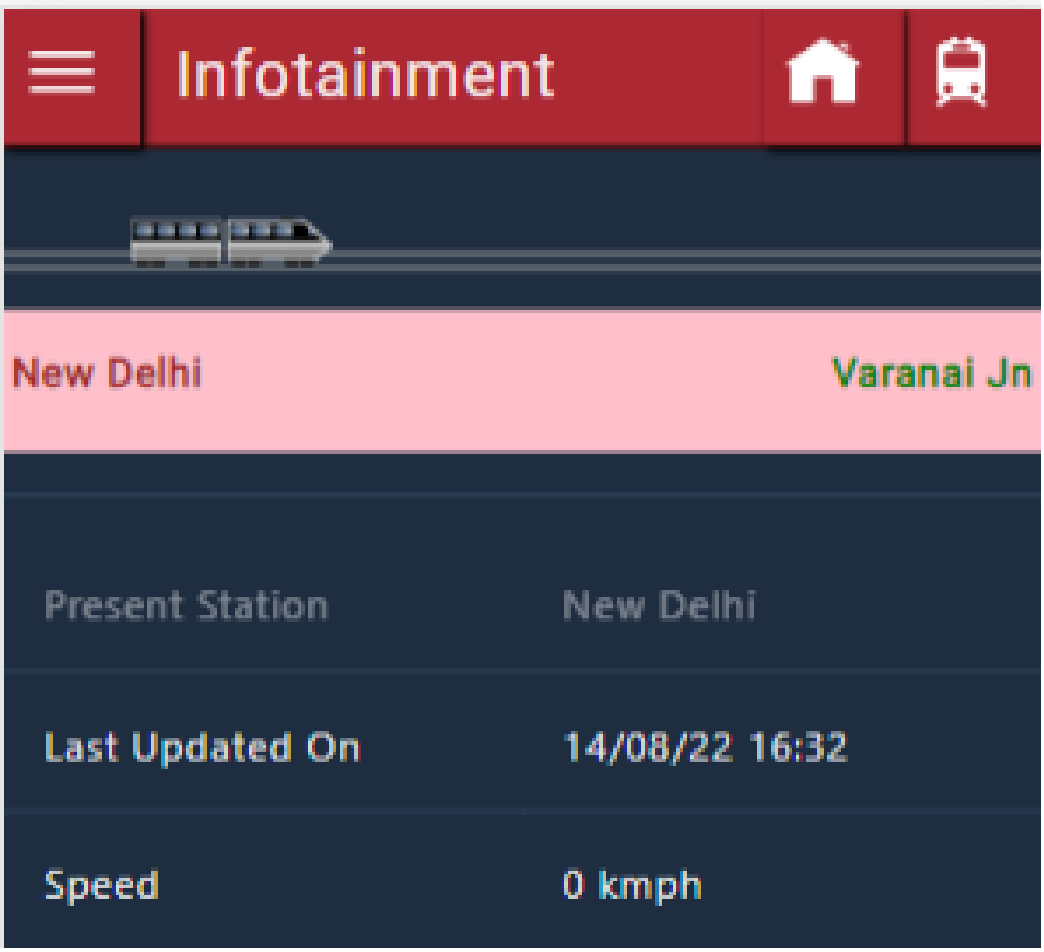


Fig. 18.5

Pre-Roll Video Ads and Banner Ads this come before every actual video playback a random pre-roll ad video played with skip ad/without skip ad options.

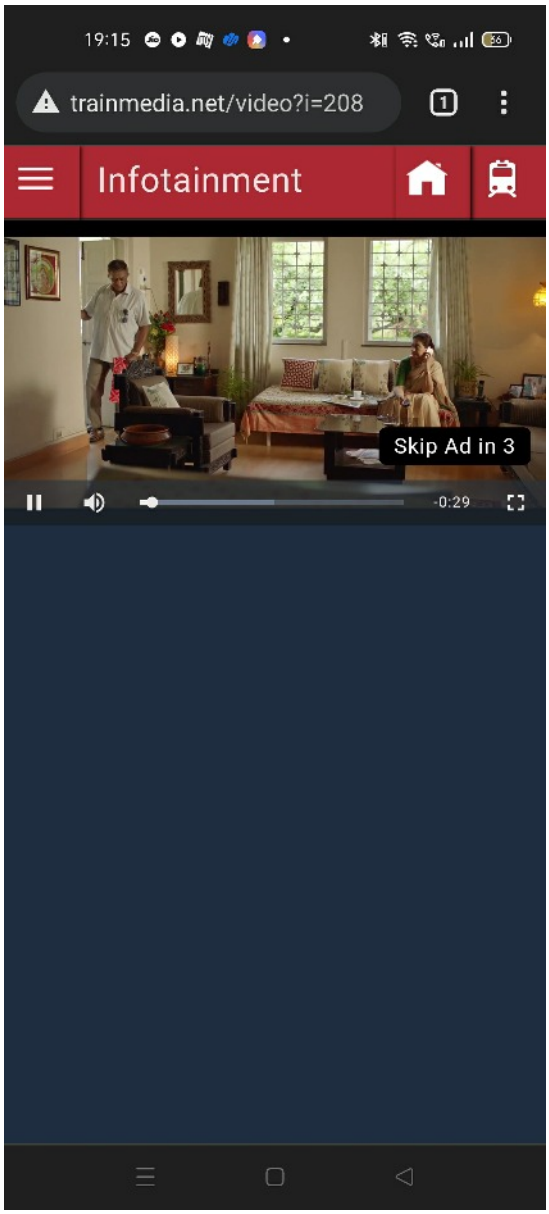


Fig. 18.6

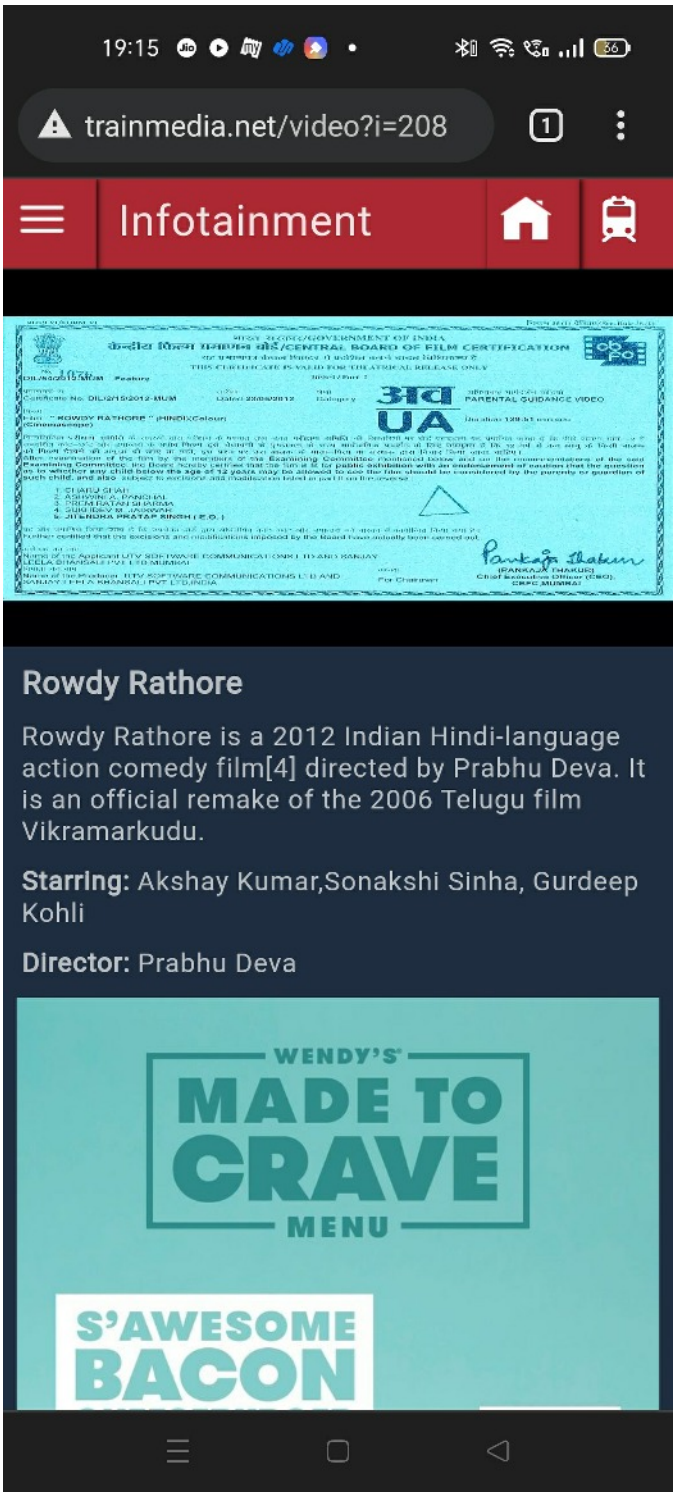

19:15
trainmedia.net/video?i=208
Infotainment
UA
Rowdy Rathore
Rowdy Rathore is a 2012 Indian Hindi-language action comedy film[4] directed by Prabhu Deva. It is an official remake of the 2006 Telugu film Vikramarkudu.
Starring: Akshay Kumar,Sonakshi Sinha, Gurdeep Kohli
Director: Prabhu Deva
WENDY'S
MADE TO CRAVE
MENU
S'AWESOME BACON

Fig. 18.7

18.2.6 Onboard Assistance

Onboard Assistance like general services and emergency services provided by navigating to Assistance from Menu. User has to select any of the service and enter the Seat number and Name and click submit button to avail the service

Fig. 18.8

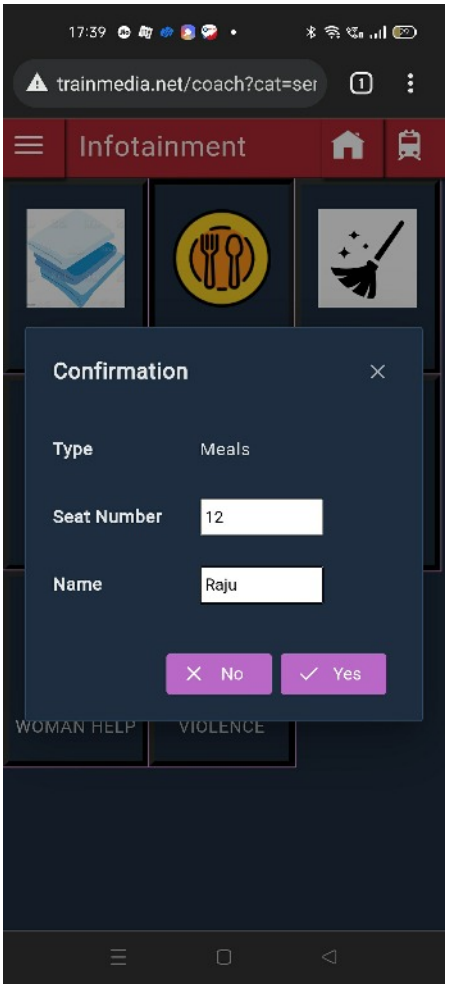

17:39
trainmedia.net/coach?cat=ser
Infotainment
Confirmation
Type
Meals
Seat Number
12
Name
Raju
No
Yes
WOMAN HELP
VIOLENCE

Fig. 18.9

18.2.7 Crew admin login

Crew admin can use any smart phone or laptop with standard browser like chrome, firefox, safari.

User need to connect to the Wi-Fi provided (myinfotain.com) , Notification appears after successful connection and browser will be opened for accepting terms and conditions. After Accepting the terms and conditions user can able to use the Infotainment Crew WebApp.

A domain name (crew.myinfotain.com) is provided to access the Crew Admin WebApp with browser, User has to login with

User name:**admin**

Password: **crew**

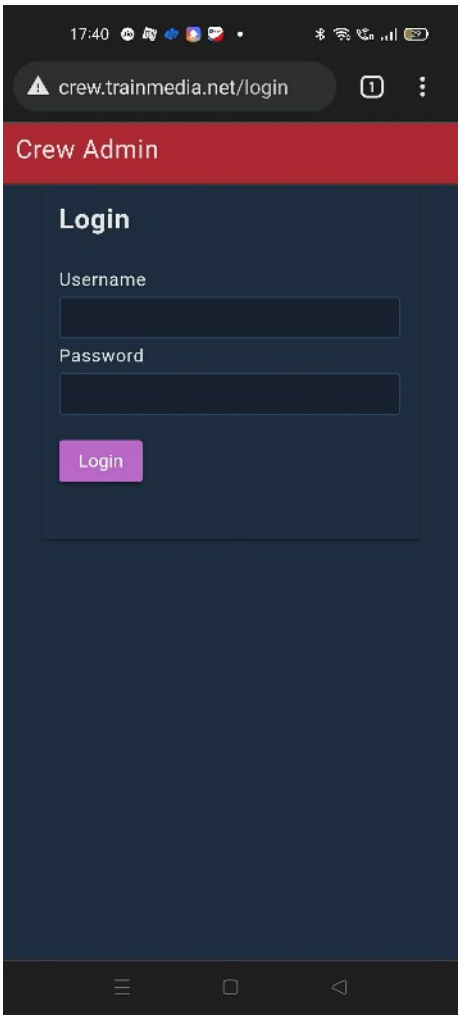


Fig. 18.10

The Dashboard screen consist of requests raised by the passengers, Crew Admin can change the status of the request from Pending to Completed or Rejected. Requests can be sorted based on fields like name, seat number, service, date time

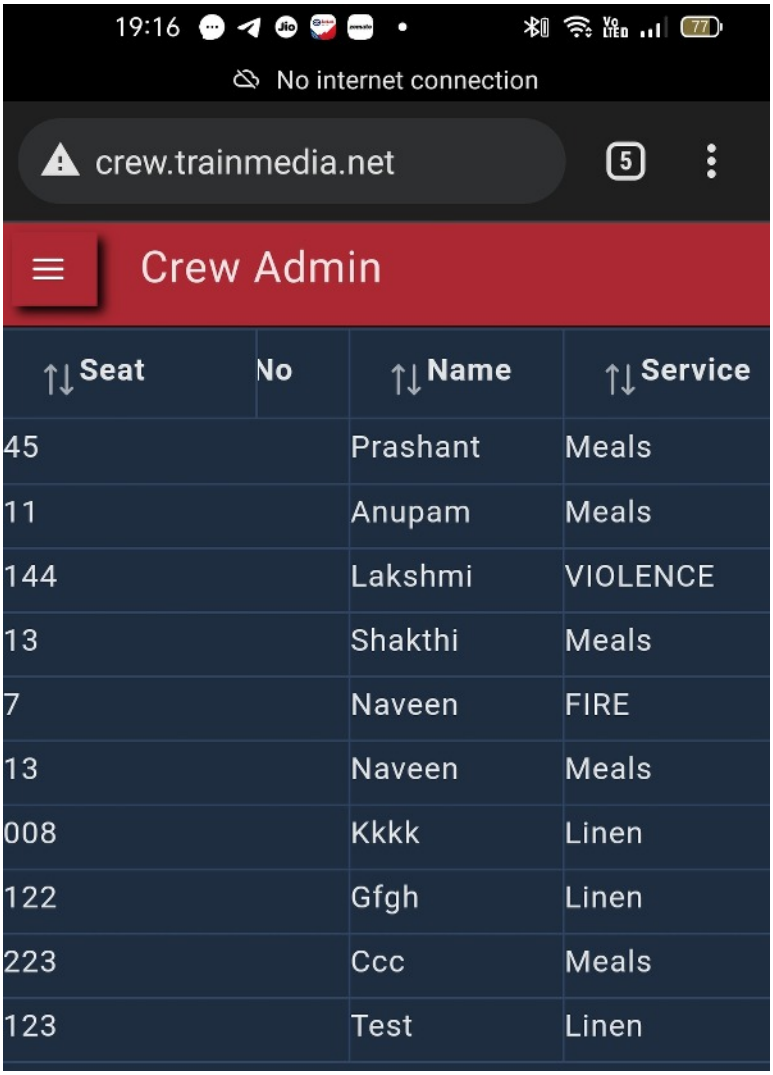


Fig. 18. 11

Crew Admin can update the request status after attending the request by clicking on the row of dashboard screen

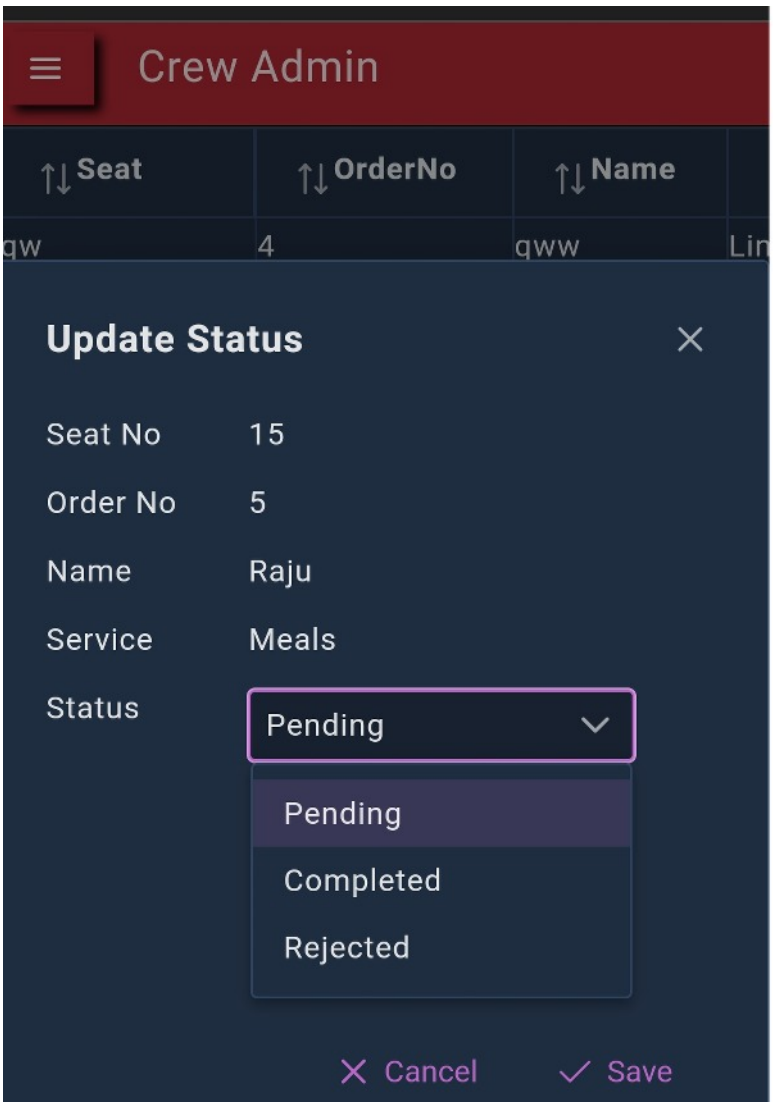


Fig. 18.12

Crew Admin can filter the requests by Request status and Request type

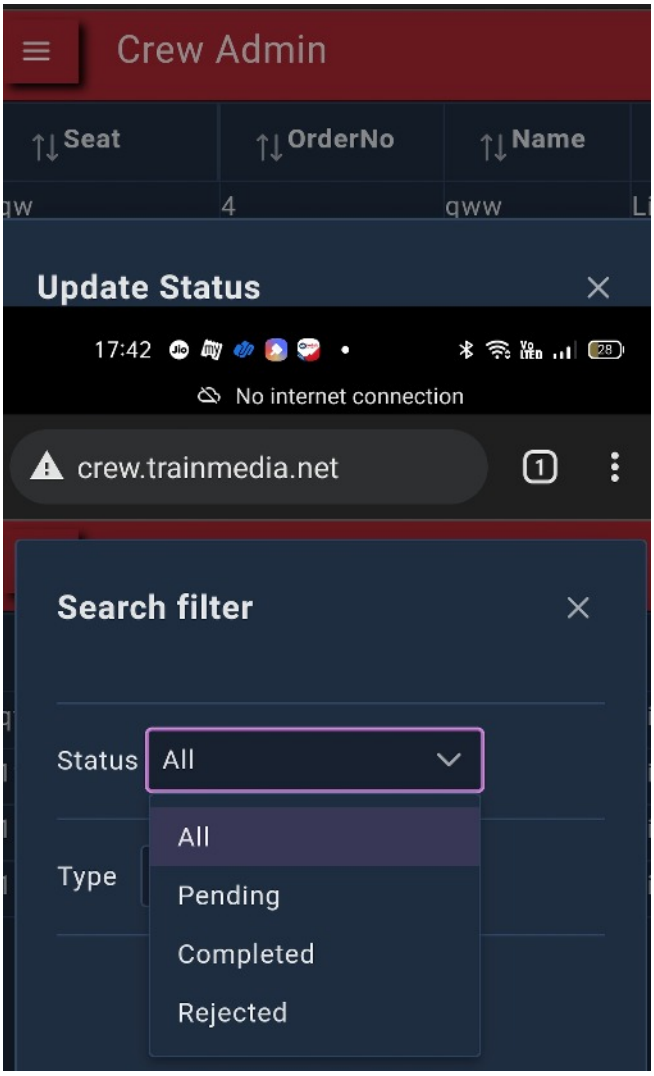


Fig. 18.13

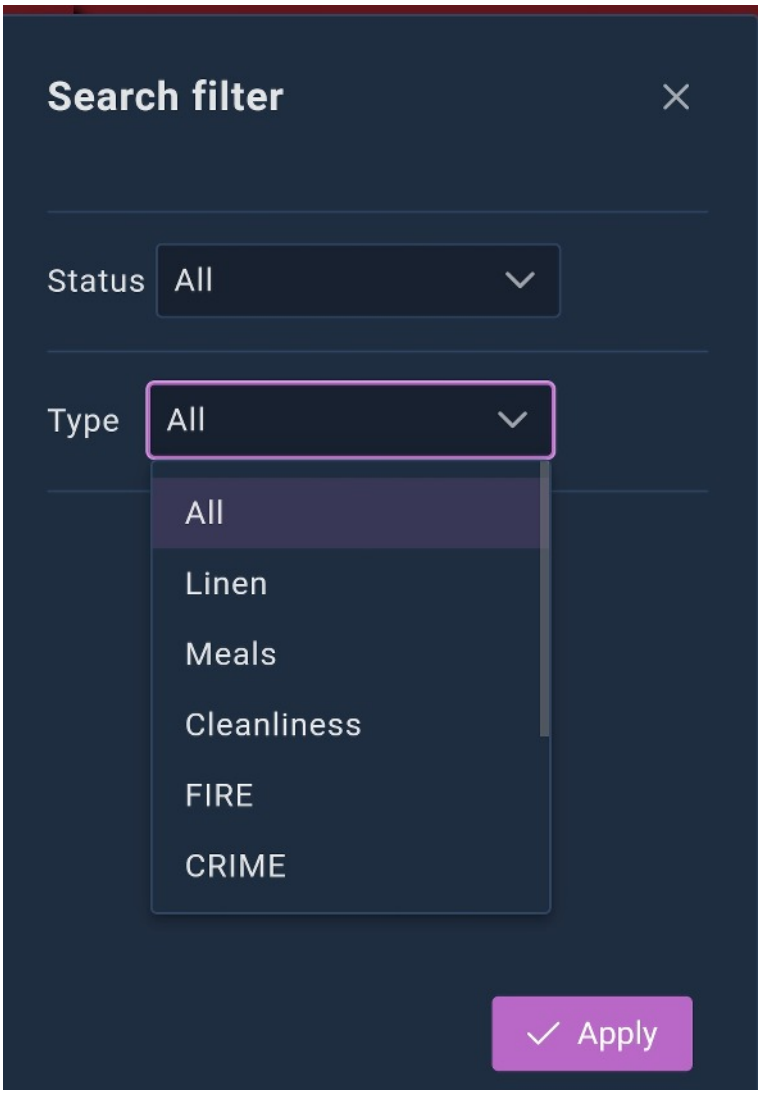

Search filter
Status
All
Type
All
All
Linen
Meals
Cleanliness
FIRE
CRIME
Apply

Fig. 18.14

Chapter 19

CCTV cum Guard's Display Unit

1. Introduction

10.4" LCD display will be provided in driver cab to display the live views from all cameras. This display software is developed for CCTV as primary functionality and there is a provision for TCMS and PIS functionality in case of emergency as mentioned below.

- Train overview
- Door system
- Comfort systems
- Emergency brake
- Passenger alarm system

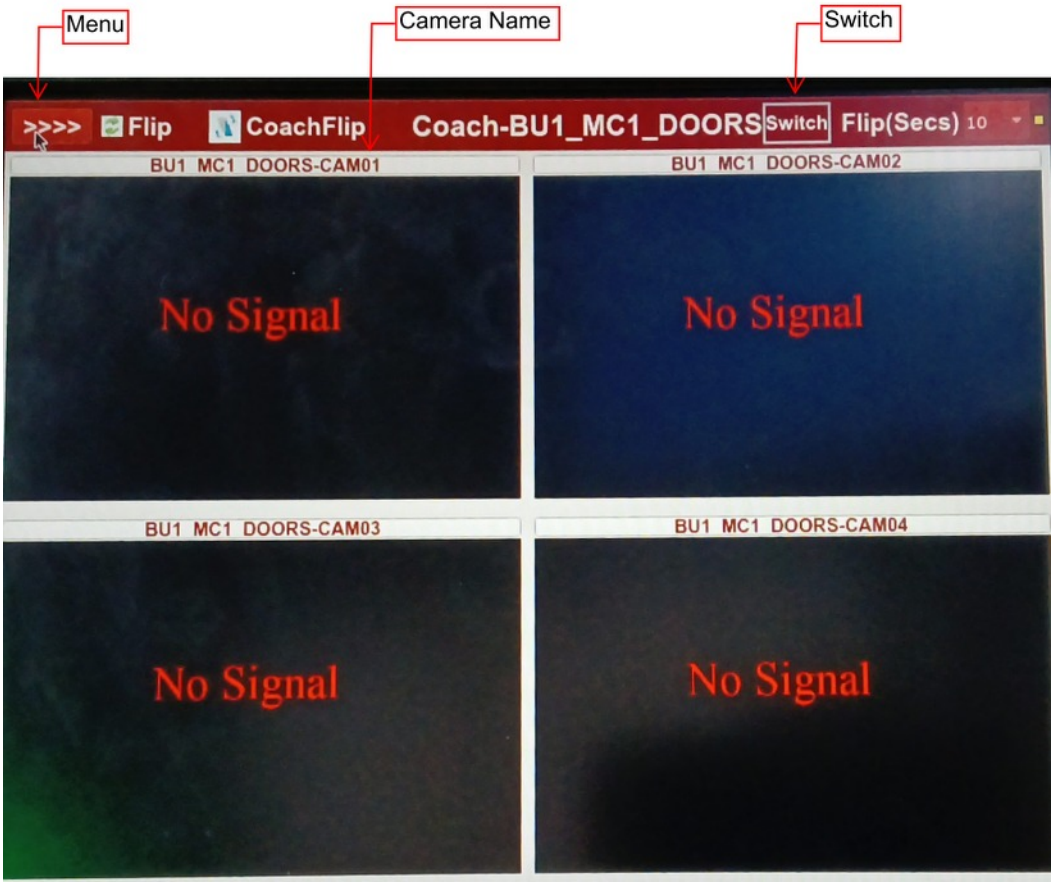


Fig:19.1 Main Screen Window

2. Options

2.1 Menu

Menu On Left side of the display shows two options,

- Coaches
- Diagnosis Screen

a) **Coaches**

- Shows the all coaches names.
- Live view page is four window split screen.

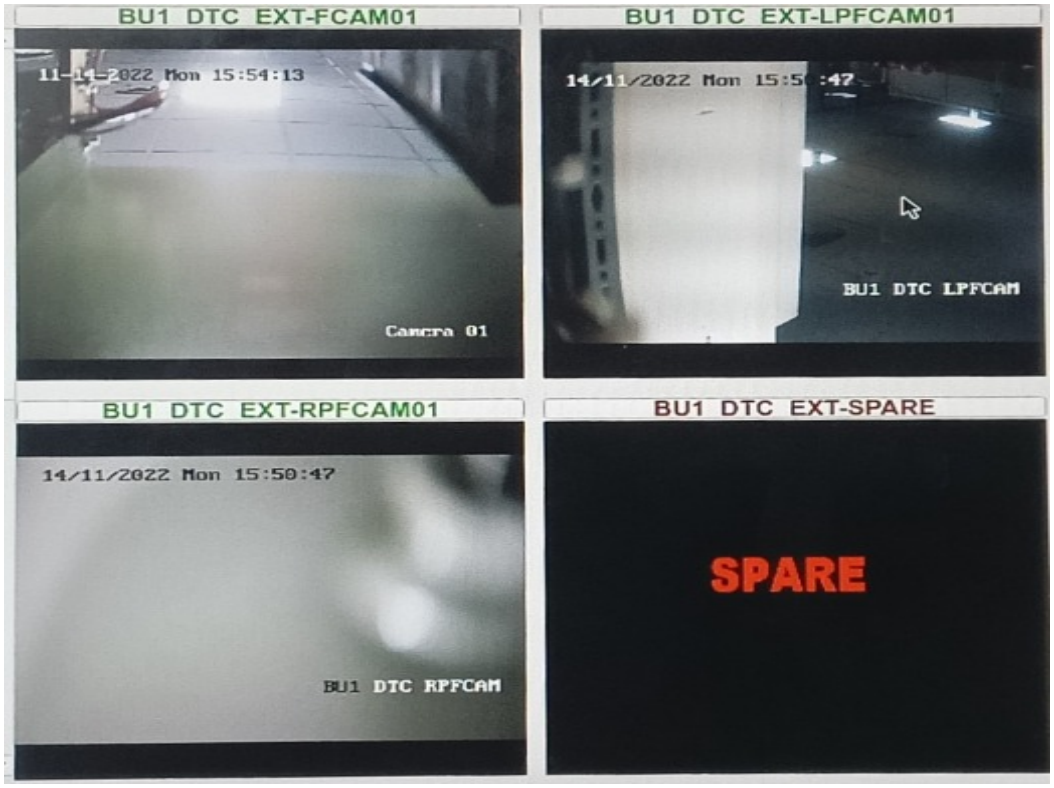


Fig:19.3 Screen Window

For particular coach cameras viewing, that particular coach need to be selected from coaches list.

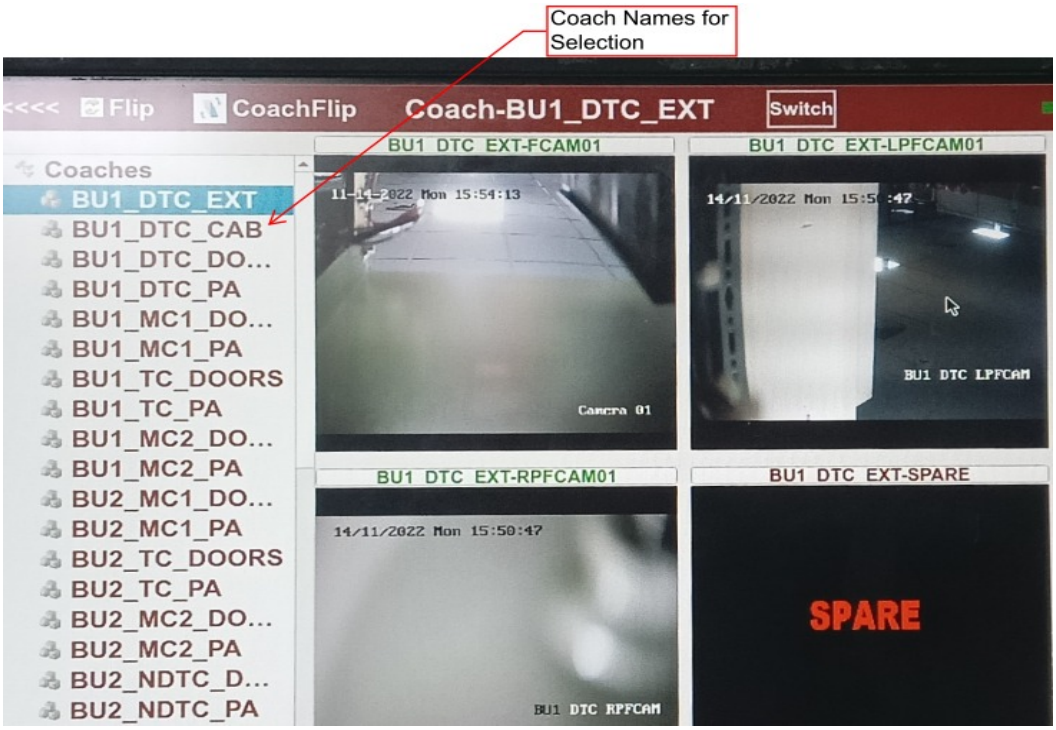


Fig: 19.3 *Coach Selection*

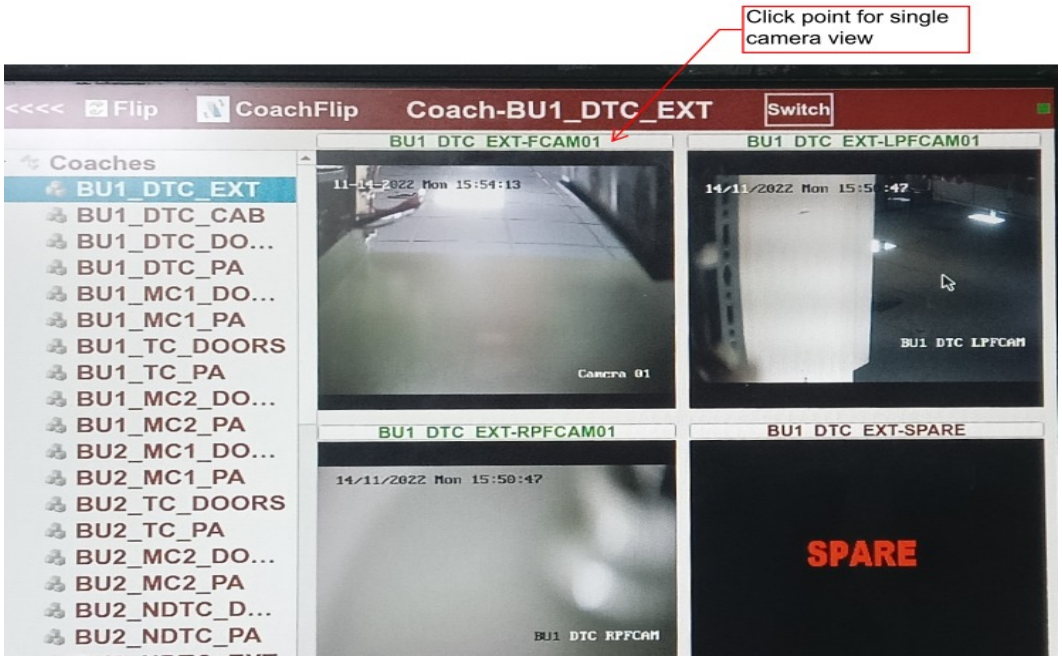


Fig: 19.4 Single Camera View Selection

Single camera can be viewed by clicking on that camera name which is on top of that camera live view screen.

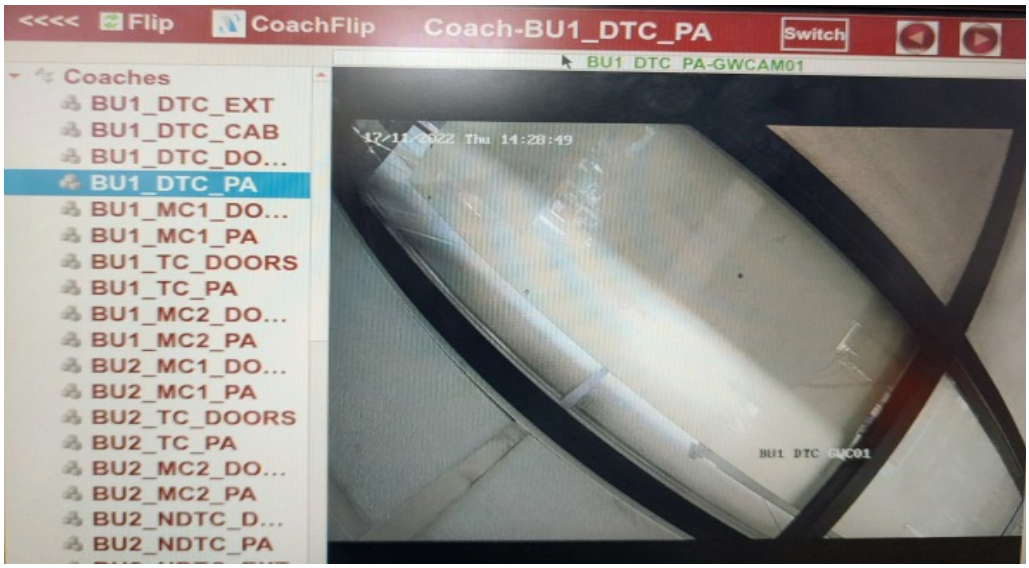


Fig: 19.5 Single Camera View

- Coach Names are denoted as below
- EXT – External Cameras(Track Monitoring Camera, Platform Monitoring Cameras)
- CAB – Cab Monitoring Cameras
- DOORS – Door Monitoring Cameras
- PA – Passenger Area Monitoring Cameras(Includes Gangway Monitoring Cameras)
- Camera Names are denoted as below
- GWCAM – Gangway Camera
- DWCAM – Doorway Camera
- PAC – Passenger Area Camera
- LPFCAM – Left Side Platform Camera
- RPFCAM – Right Side Platform Camera
- FCAM – Front/Track View Camera

b) **Diagnosis Screen**

- Network diagnosis screen will provide the health status of total CCTV system including Ethernet switch, NVR and cameras.
- Diagnosis is displayed in Coach level, By selecting particular BU and particular Coach diagnosis screen can be viewed.

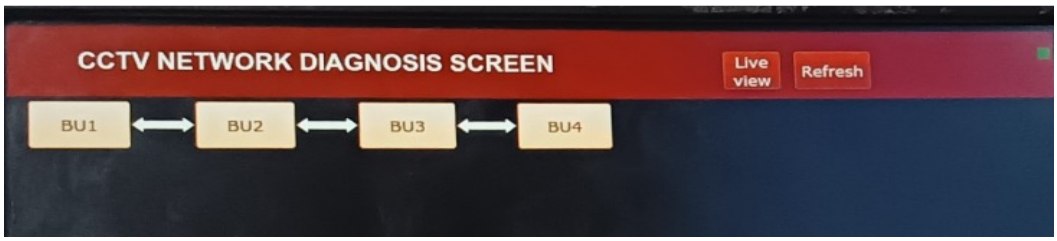


Fig: 19.6 BUs representation

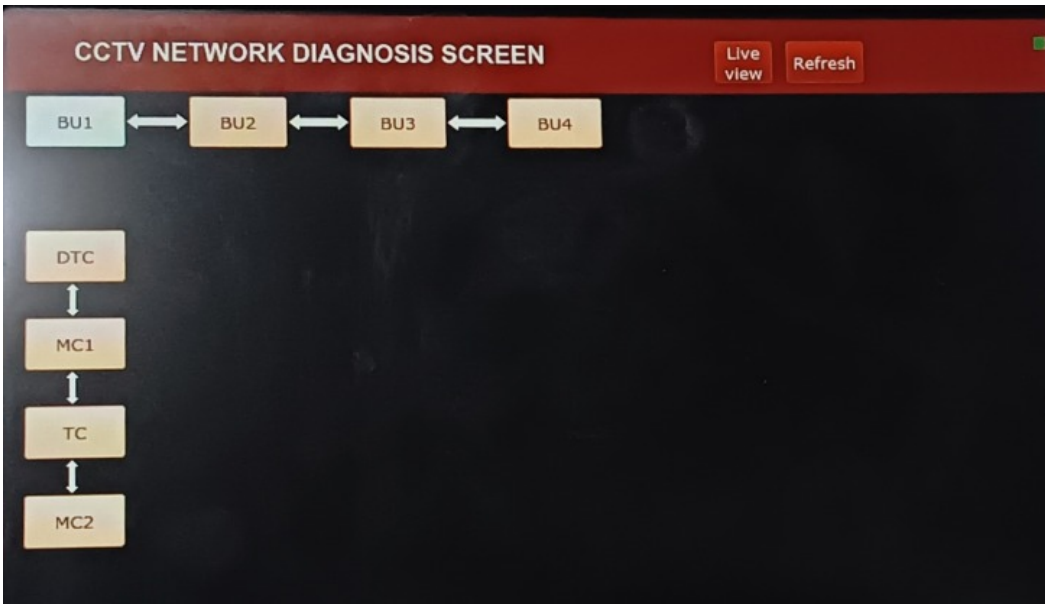


Fig: 19.7 Coaches representation

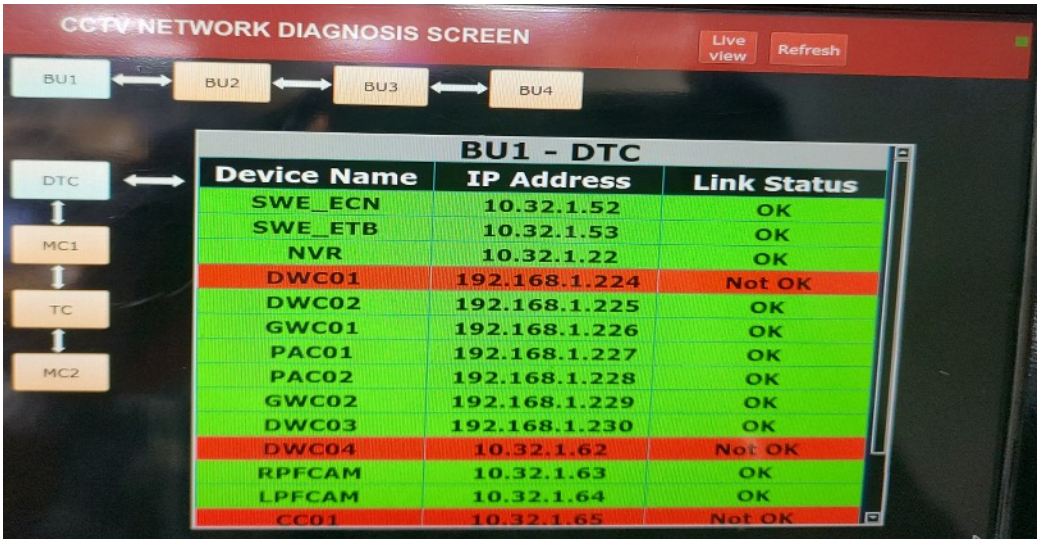


Fig: 19.8 Diagnosis Screen

- **Refresh**
  - This option is used to display the updated/Current status of diagnosis screen.
- **Live View**
  - This option is used to switch from Diagnosis screen to cameras live views window.

2.2 Flip

a) In flip mode, camera by camera will be displayed automatically with user defined time interval(Flip time).

b) For going back to normal mode, Normal option to be selected.

Fig:19.9 Flip Mode

2.3 Coach Flip

a) In coach flip mode, coach by coach cameras will be displayed automatically with user defined time interval(Flip time)

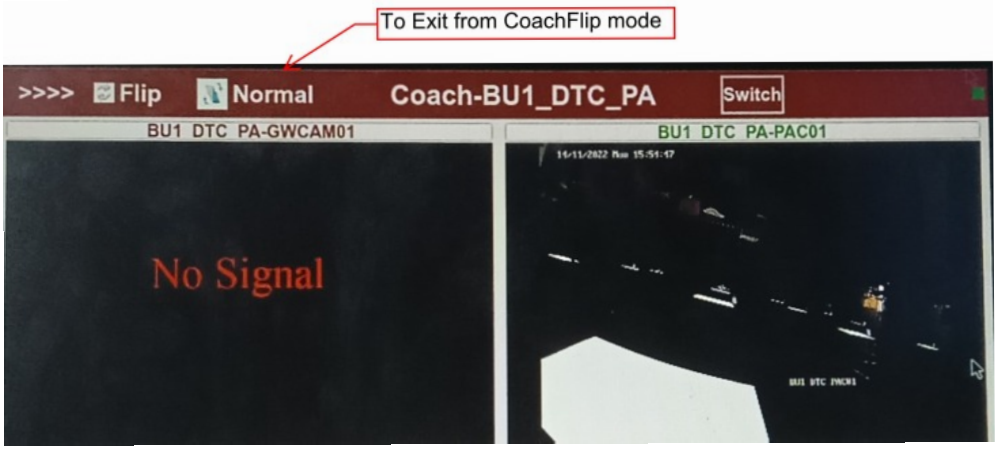


Fig: 19.10 Coach Flip Mode

2.4 *Flip Time*

a) This option is used for selecting time interval duration for flip and coach flip modes

2.5 *Next/Previous Button*

a) This option is enabled when viewing single camera.

b) This option is used to switch to Previous/Next camera view manually.

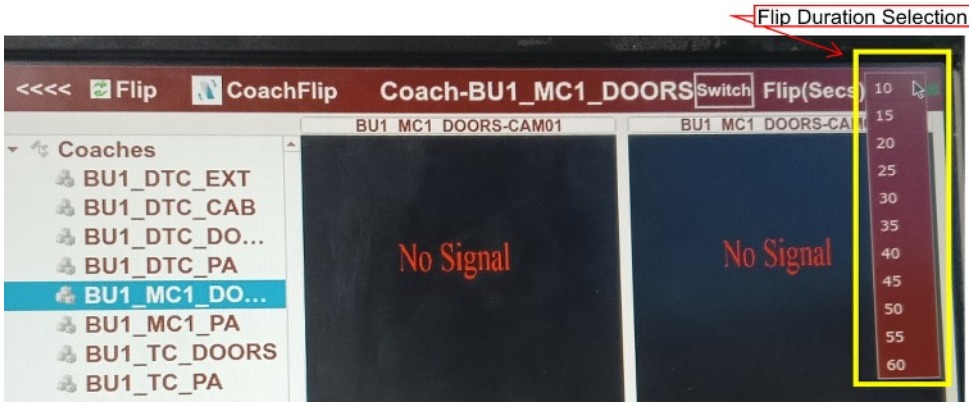


Fig: 19.11 Flip Duration Selection

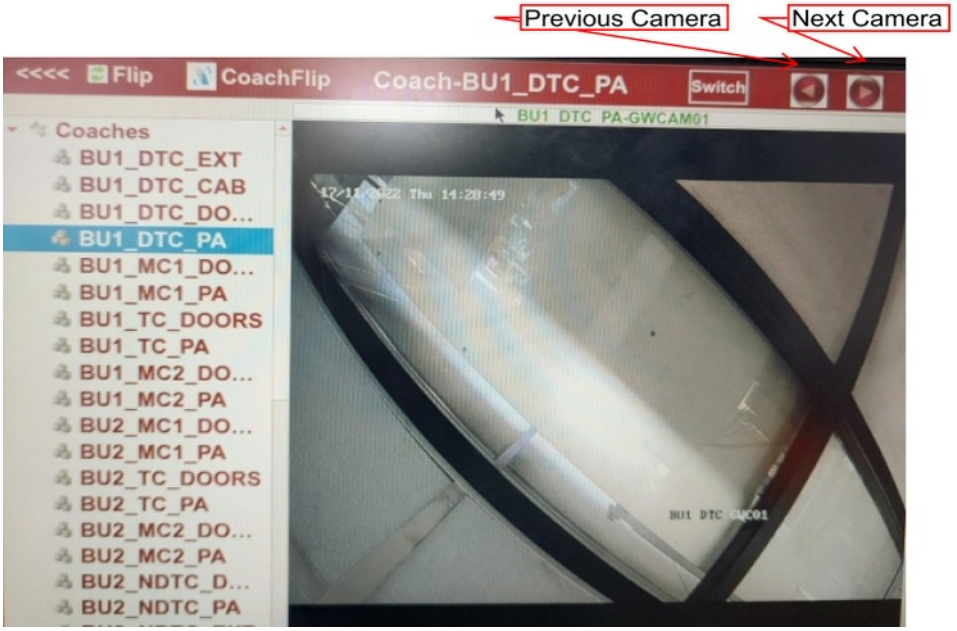


Fig: 19.`2 Selection of Previous/Next Camera

2.6 Switch

a) This option is used to switch from one application to other application

Present Running Application	Can Switch To
CCTV	TCMS or PA/PIS
TCMS	CCTV or PA/PIS
PA/PIS	CCTV or TCMS

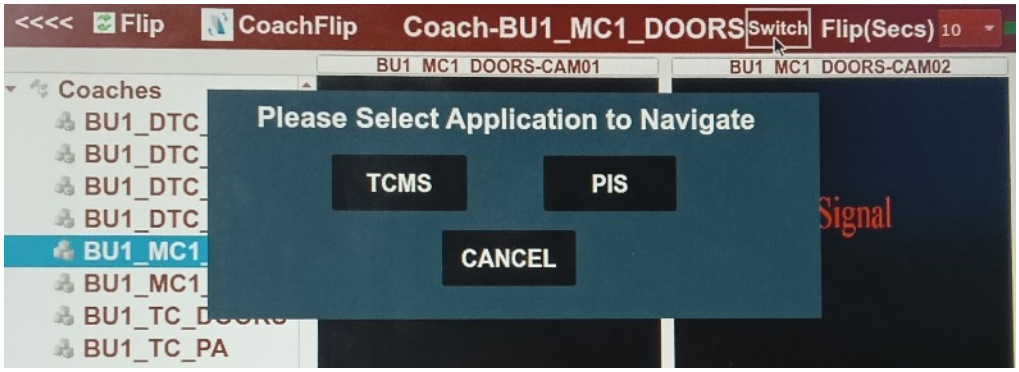


Fig: 19.13 Switching to another Application

2.7 Platform Cameras

1 Station arrival/departure information will be received from PIS system.

2 When station arrival information received to CCTV display, it will automatically switch to rear/platform(Left Side or Right Side) view cameras.

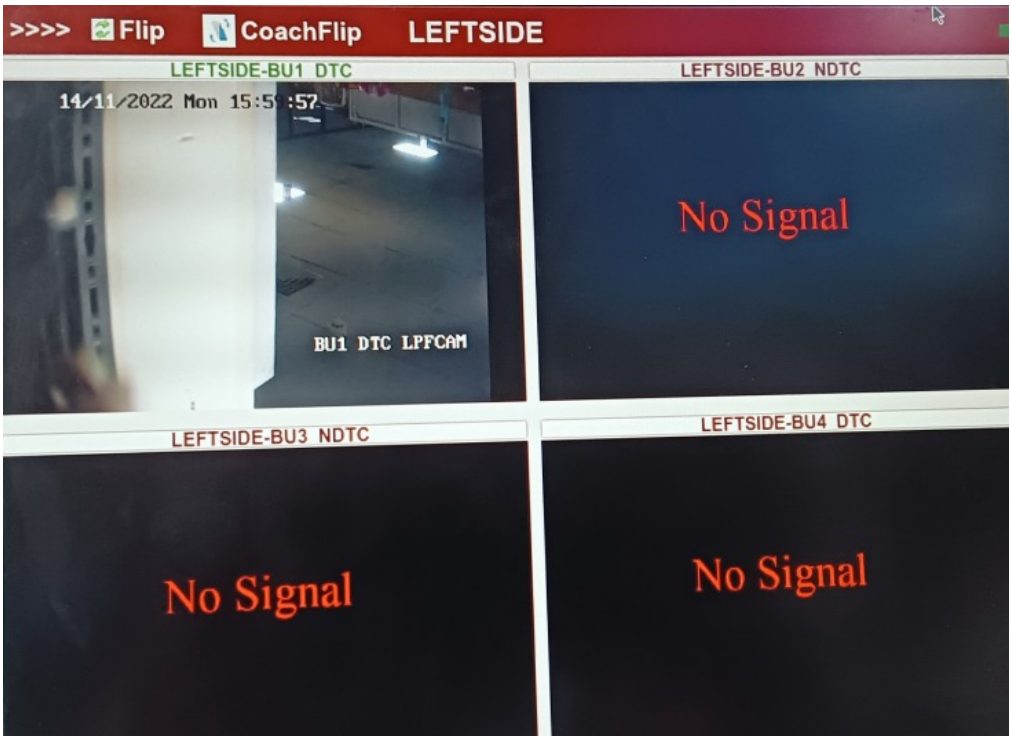


Fig. 19.14

1 When station departure information is received, display will go back to default mode.

2 Possibility of selecting other coach cameras is available in between station arrival and departure.

2.8 ETBU Cameras

1 If any ETBU(Emergency Talk Back Unit) is operated in any of the coach, immediately nearby two camera views are override on priority on CCTV display unit.

2 These ETBU near by camera views are displayed immediately after getting the call from passenger.

3 If driver /guard rejects the call, display will go back to the previous screen.

4 If driver/ guard accepts the call, ETBU nearby camera views are continuously displayed till the ETBU call ends.

5 Possibility of selecting other coach cameras is not available in between ETBU call.

Chapter 20

FIRE DETECTION SYSTEM

Automatic Smoke/Fire Detection with Alarm System

1. Train shall have automatic fire/smoke detection system. This shall be capable of detecting a smoke/fire in any Car. On detection of a possible smoke/fire by means of suitable detection, the system shall have different levels of response.
2. In the event of detection of a smoke/fire, the air conditioning system shall be controlled to minimize the spread of fire to promote the escape of passenger. In the event of detection of smoke outside the Train (may be part of air- conditioning), an alarm shall be provided to the Driver/Guard. The Driver/Guard shall then be able to remotely close the air conditioning system fresh air intake if not done automatically. The entire control panel is secured through mechanical keys & access to software is also secure through Access Keys/ Passwords. Communication of the data being monitored is being enabled through a RS485 and RS232 protocol board mounted on the Control Panel Motherboard.
3. The power supply to the Control Panel & ASD & Ancillary circuits within the control panel is ensured through a 110V ± 30% to 24V DC-DC converter designed & mounted within the Local control panel.
4. The field wiring for wiring of the control panel through the coach power supply circuit and the instrument cable required for connecting the audible alarm etc.

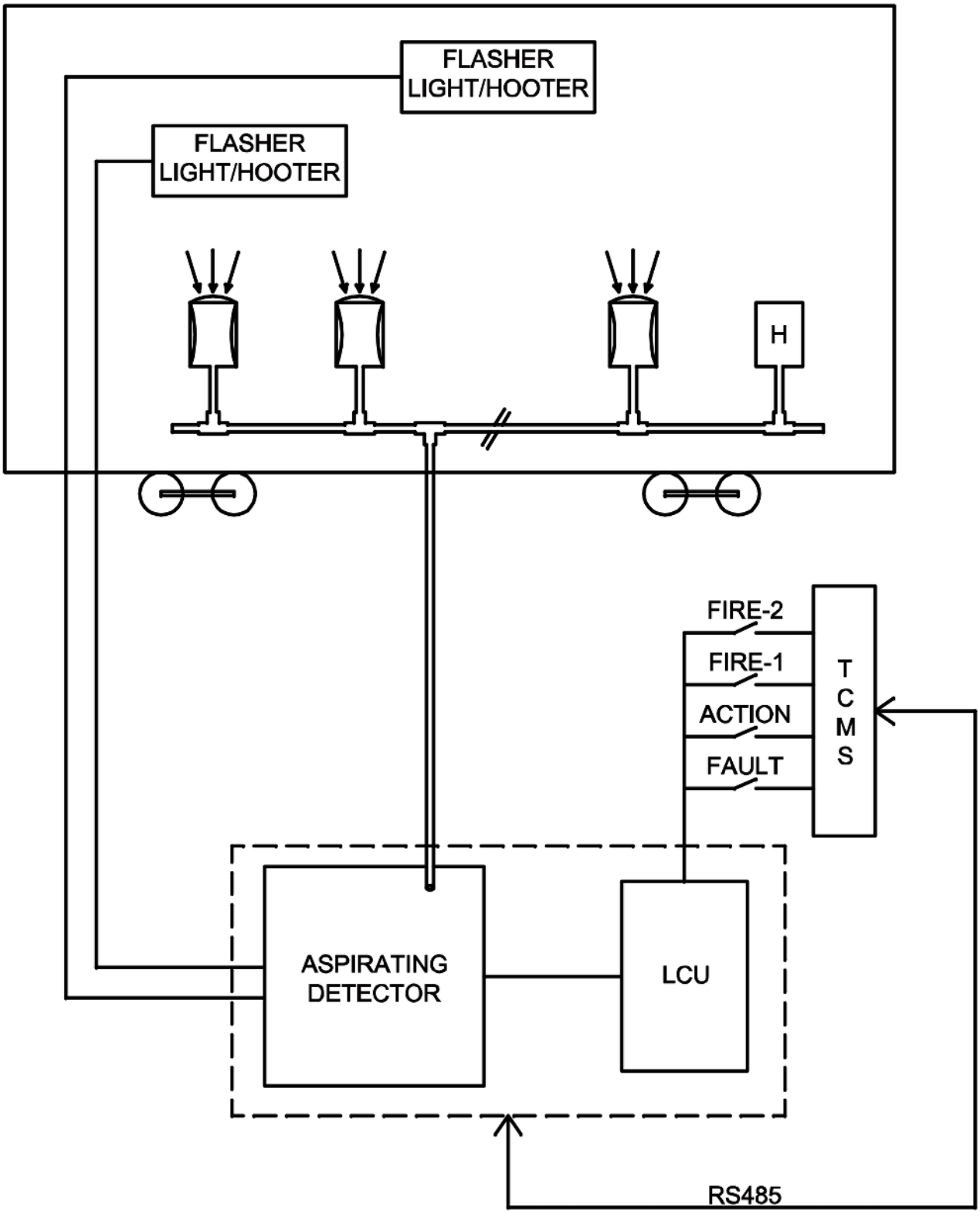

FLASHER
LIGHT/HOOTER
FLASHER
LIGHT/HOOTER
H
FIRE-2
FIRE-1
ACTION
FAULT
TCMS
ASPIRATING
DETECTOR
LCU
RS485

Fig. 20.1

Chapter 21

CENTRALIZED COACH MONITORING SYSTEM (CCMS)

Centralized Coach Monitoring System (CCMS) for monitoring, recording and control of the air-conditioning and other faults e.g. power supply failure etc. CCMS shall also run diagnostic routines on the AC plant and generate alerts like low gas pressure in compressors, faulty sensors etc. CCMS is available in Driver Trailer Car.

1. The CCMS shall have touch screen display and have suitable communication to micro controller of RMPUs of each Car. The CCMS can use the same communication backbone as of TCMS.
2. The CCMS shall also have GSM/GPRS based wireless modem through which information/alert to control center/maintenance staff shall be communicated. Information should also be available to the maintenance staff on a mobile application .
3. CCMS shall monitor the following:
   - Auto/bypassed mode working of Air Conditioning unit
   - Temperature (return air, supply air temperature and ambient temperature)
   - LP & HP tripping
   - Compressor tripping
   - AC motors tripping

   These data shall be transmitted to the control center through GPRS/GSM regularly at suitable intervals.

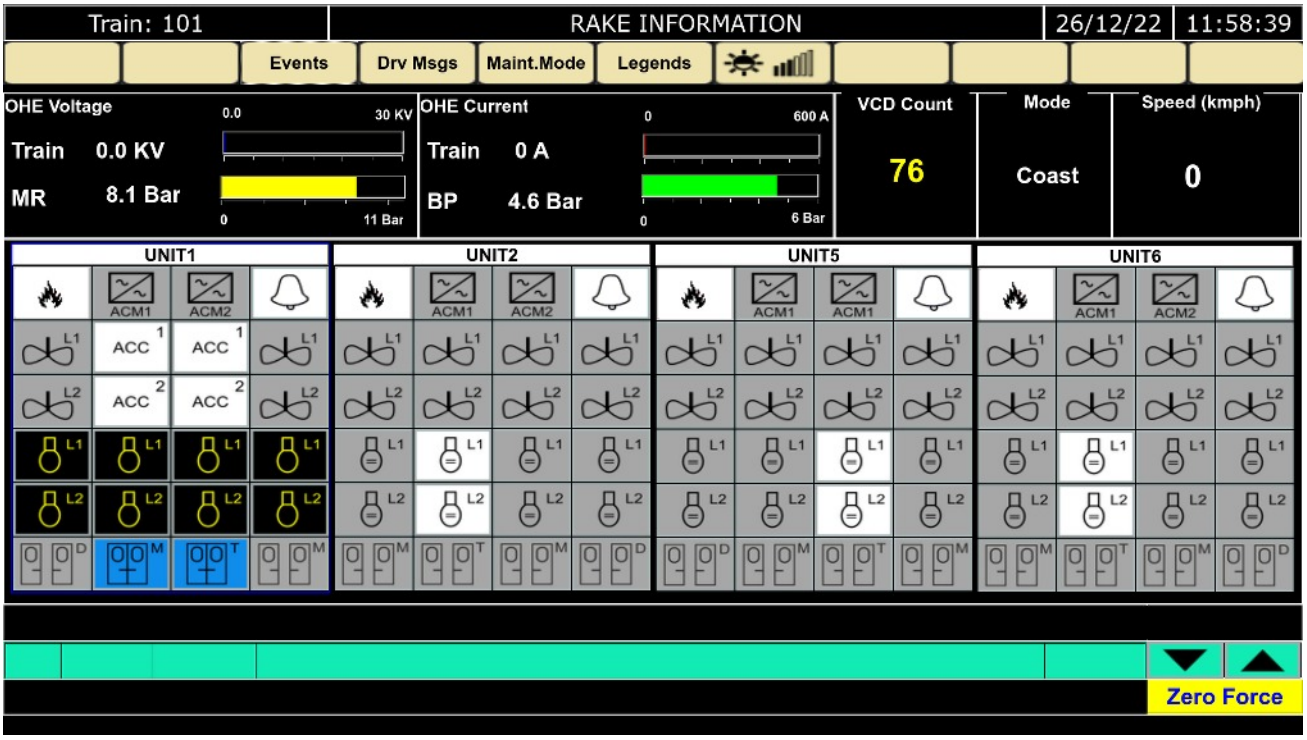

Train: 101
RAKE INFORMATION
26/12/22
11:58:39
Events
Drv Msgs
Maint.Mode
Legends
OHE Voltage
0.0
30 KV
Train 0.0 KV
MR 8.1 Bar
0
11 Bar
OHE Current
0
600 A
Train 0 A
BP 4.6 Bar
0
6 Bar
VCD Count
76
Mode
Coast
Speed (kmph)
0
UNIT1
UNIT2
UNIT5
UNIT6
ACM1
ACM2
ACC 1
ACC 2
Zero Force

Fig. 21.1

Maintenance Manual

25 kV AC THREE PHASE PROPULSION & OTHER EQUIPMENT FOR TRAIN SET

TYPE MAE675UV2 TRAIN SET

Medha Servo Drives Pvt. Ltd.

P- 4/5 B, I.D.A., Nacharam, Hyderabad - 500076. India.

www.medha.com