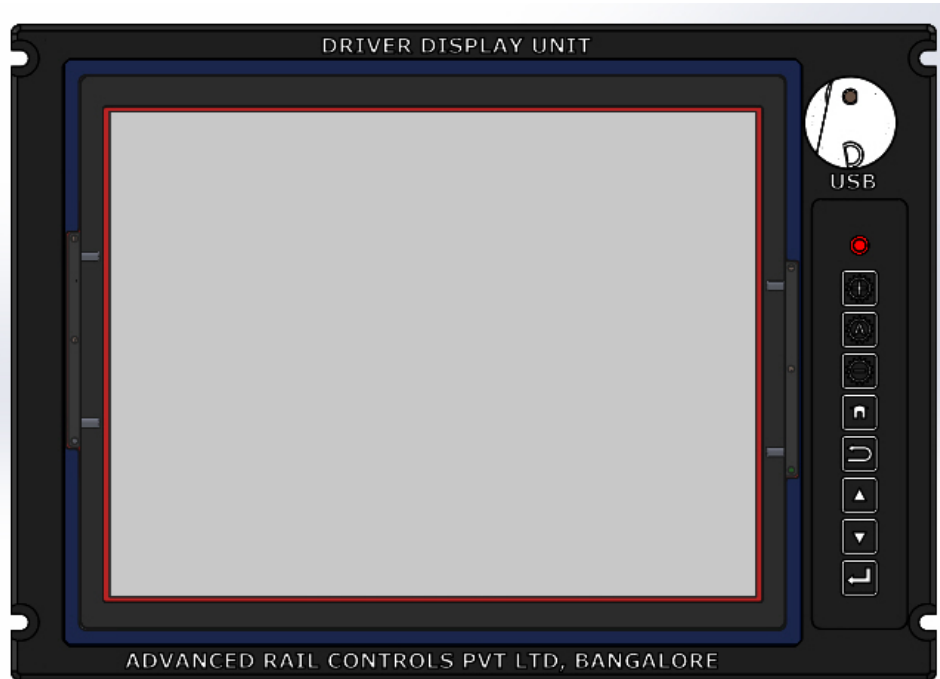# MVB BASED GRAPHICAL DRIVER DISPLAY

ARC/DDU/V2.1-B

USER MANUAL

December 20, 2017

RELEASE 1.0

Advanced Rail Controls Private Limited

Bangalore-560092

INDEX

1.0   SCOPE

This document describes the technical details of Graphic Driver Display Unit (DDU) used in 3-Phase Electric Locomotives of WAP5, WAP7, WAG9 & WAG9H classes being operated by Indian Railways. The DDU is a man machine interface device able to communicate with locomotive control system through MVB. The LED backlit 10.4" XGA LCD screen provides better readability even during daylight conditions, thanks to brightness control. The DDU has various pre-defined screens which can be used for investigative monitoring.

2.0   KEY DESIGN FEATURES

The key design features incorporated in this DDU are listed below

SL.No.	Features	Values/Conformace
1	LCD Display Size	10.4 inch, XGA
2	Overall outer dimensions	302 X 82 X 214 in mm
3	Brightness Control Auto/Manual	Available
4	Multiple Screen Selection	Available
5	MVB Connectivity	EMD
6	Isolated RS-485/RS-422	Available
7	Isolated RS-232	Available
8	USB Interface	Available
9	Ethernet	Available
10	Ingress Protection	Totally enclosed (IP-65)
11	Cooling	Natural Chassis cooling
12	Keypad	Membrane, Functional keys
13	LCD screen resolution	1024x768
14	Operating Temperature	-25 to +70˚ C
15	Operating Voltage	70V DC to 137.5V DC
16	Memory	1GB NAND Flash, 1GB DDR3 RAM
17	Processor	ARM CORTEX-A8
18	Operating System	LINUX
18	Normative Standard Conforming	IEC-60571
19	Touch screen	Available, P-CAP

3.0   MECHANICAL DESIGN

The driver display is made from Aluminium material and exterior is hard anodised black. The special function keys are located on the right side of the facia. The USB interface is provided on the right-side top, just above the special function key pad.
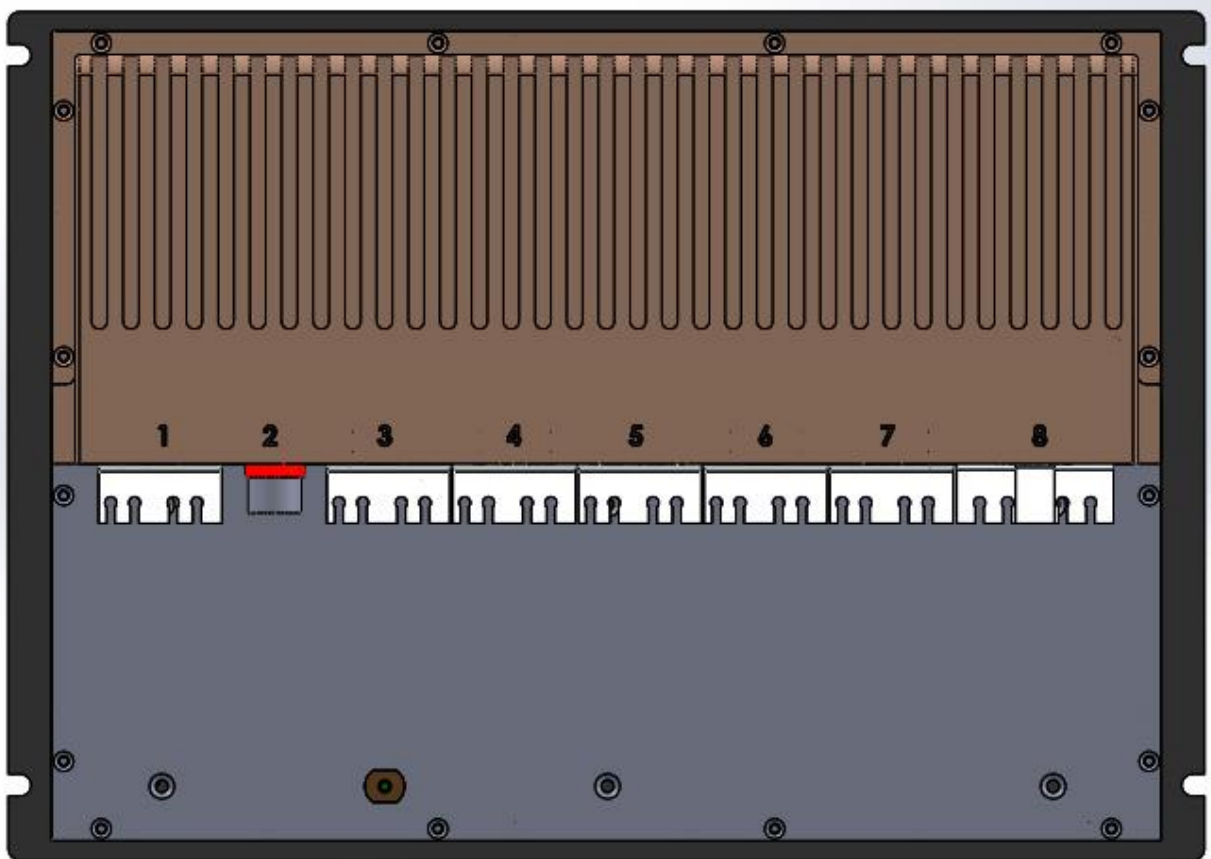
The rear side of the driver display uses a milled structure with in-built heat sink for chassis cooling. The heat generated internally by the heat producing elements like the DC-DC converters and processor is directly transferred to the chassis. The heat generated by other small components is transferred to the chassis indirectly through convection using internal circulating fan.

All the field interface connectors are terminated on the rear plate below the heat sink as shown in Figure above.

3.1 INTERFACE DETAILS

Sl. No	Interface Details	Connector Type
1	MVB	9 pin D-SUB Male connector
2	Ethernet	M12 circular connector
3	MVB	9 pin D-SUB Female connector
4	N/W Selection	9 pin D-SUB Female connector
5	RS-485/RS-422	9 pin D-SUB Male connector
6	CAN	9 pin D-SUB Male connector
7	RS-232	9 pin D-SUB Male connector
8	Power supply 110V DC	FMT 3W 3P-K120 Male, 3pin

The equipment can be directly mounted on the C-Panel using screws and the fully assembled C-Panel can be mounted on the driver desk. The mechanical dimensional drawings and mounting instructions are given at the end.

4.0 OPERATOR CONTROLS
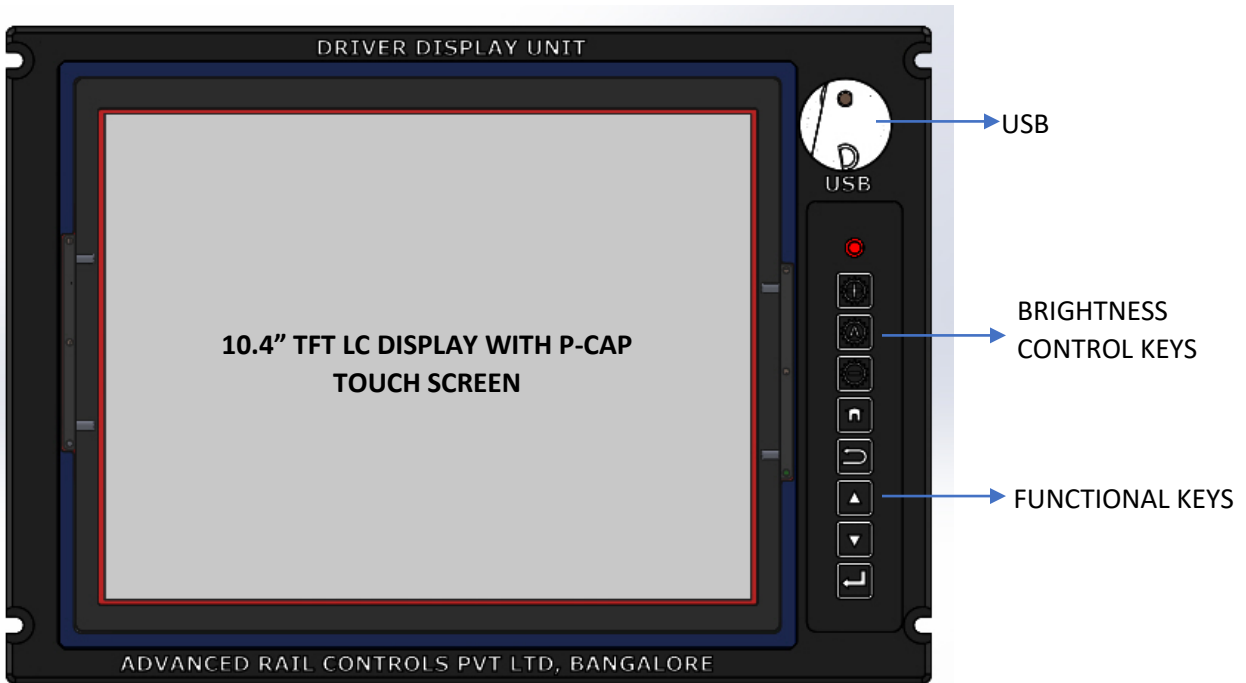
The Driver Display has a rugged membrane keyboard on the right hand side. These keys are known as "Function" keypad and "Brightness Control" keypad. The "Function" keypad has 5 keys, each assigned to a separate function, and the "Brightness Control" key pad has 3 keys, each assigned to a separate function.

4.1 BRIGHTNESS CONTROL KEYS

The Brightness control keypad has 03membrane keys of rugged type. The keys are protected from direct ingress of dust and moisture. The keys are suitable for operation by fingers. The function assigned to each key is given below:
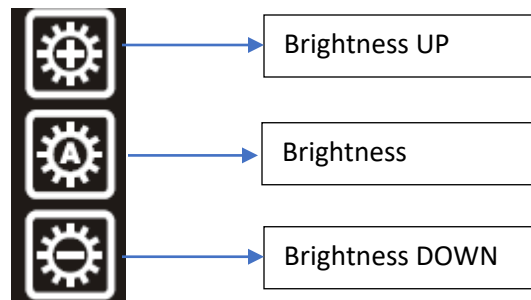
4.2 FUNCTION KEYS

The function keys are 05 in number and are used for invoking special functions and screens as detailed below:

🏠	HOME
↰	BACK
△	UP ARROW
▽	DOWN ARROW
↵	ENTER
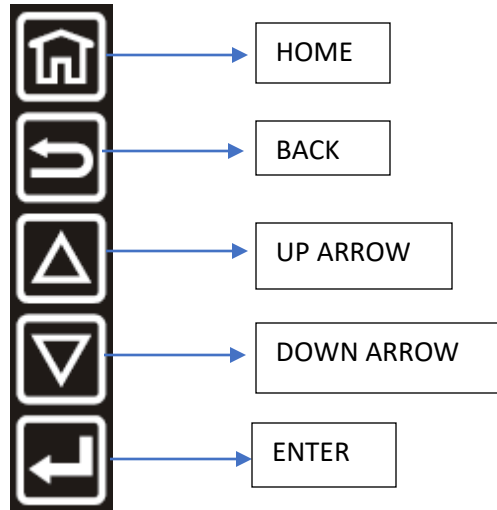
5.0 SCREENS

The Driver display has pre-defined dedicated screens to monitor real time process variables pertaining to a section or sub-system of the locomotive. However, such screens are meant for online monitoring by technical staff whenever required. The locomotive driver, however, needs to view the default screen only most of the times. The screens have been designed to take care of the specification requirement. The details of the screens are explained below.

HOME SCREEN

Clicking on each of the locomotive diagram displays its respective sub-system status (sub sysytem status is only a brief display in the home screen).

SUB-SYSTEMS HOME

| HOME | PROCESS INFO | DIAGNOSIS | 🔒MAINTENANCE | MENU | ⚠ Fault |

LOCO 1

SS01 Main Power	SS02 Traction Bogie 1	SS03 Traction Bogie 2	SS04 Harmonic Filter	SS05 Hotel Load
SS06 Aux. Converter 1	SS07 Aux. Converter 2	SS08 Aux. Converter 3	SS09 Battery Charger	SS10 Brake System
SS11 Auxiliaries HB1	SS12 Auxiliaries HB2	SS13 Cab 1	SS14 Cab 2	SS15 Fire Detection
SS16 Speedometer	SS17 Processor FLG1	SS18 Processor FLG2	SS19 Trainbus	ALL

19-12-2017   14:33:06

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆   CLEAR
⬇   ENTER

Displayed when clicked on sub-system status from home screen.
Clicking on any sub-system that is isolated, displays its respective fault(s) as shown in the next screen.
Clicling on "ALL" displays faults related to all the isolated sub-systems.

SUB-SYSTEMS BROWSE

| HOME | PROCESS INFO | DIAGNOSIS | 🔒MAINTENANCE | MENU | ⚠ Fault |

MESSAGES   <<

Time	SubSystem	Code	Messages
08/12/2017 13:27:56	Loco {0:00000} ; SS01:Main power	F1801P2	Loco {0:00000} ; SS01:Main powerTRANSFORMER OIL TEMP. OR PRESSURE NOT OKTE/BE reduction or VCB trip'sTry to close the VCB if open …
08/12/2017 13:27:56	Loco {0:00000} ; SS01:Main power	F1801P2	Loco {0:00000} ; SS01:Main powerTRANSFORMER OIL TEMP. OR PRESSURE NOT OKTE/BE reduction or VCB trip'sTry to close the VCB if open …
08/12/2017 13:27:56	Loco {0:00000} ; SS01:Main power	F1801P2	Loco {0:00000} ; SS01:Main powerTRANSFORMER OIL TEMP. OR PRESSURE NOT OKTE/BE reduction or VCB trip'sTry to close the VCB if open …
08/12/2017 13:27:56	Loco {0:00000} ; SS01:Main power	F1801P2	Loco {0:00000} ; SS01:Main powerTRANSFORMER OIL TEMP. OR PRESSURE NOT OKTE/BE reduction or VCB trip'sTry to close the VCB if open …

19-12-2017   14:33:13

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆   CLEAR
⬇   ENTER

PROCESS INFO - NODE INFORMATION

Node Information

Node Information	
Node code Master ICP1	0
Node code Master subchart ICP1	715
Node code VIU1	?????
Node code ALG1	????
Node code Master subchart ICP2	?????
Node code VIU2	?????
Node code ALG2	????

Node Information
Energy Consumption
Simulation Mode
Motor Temperatures
Software Version
Inching Mode
Set Date/Time
🔒 Condition Data
Motor Converter

19-12-2017   14:34:05

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

CLEAR   ENTER

PROCESS INFO - ENERGY CONSUMPTION

Energy Counter	
Loco Number	0
Consumed	0 kWh
Regenerated	0 kWh

Node Information
Energy Consumption
Simulation Mode
Motor Temperatures
Software Version
Inching Mode
Set Date/Time
🔒 Condition Data
Motor Converter

19-12-2017   14:34:09

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

CLEAR   ENTER

PROCESS INFO - SIMULATION MODE

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Node Information

Energy Consumption

Simulation Mode

Simulation Mode	
Status:	⚫
UPRIM:	0 kV
VACT:	0.0 km/h
TE/BE Demand:	0 kN
FLG1:	12
SLG1:	?????

Motor Temperatures

Software Version

Inching Mode

Set Date/Time

🔒 **Condition Data**

Motor Converter

19-12-2017   14:34:15

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR

⬇ ENTER

PROCESS INFO - MOTOR TEMPERATURES

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Node Information

Energy Consumption

Simulation Mode

Motor Temperatures		
Motor 1	???	*C
Motor 2	???	*C
Motor 3	???	*C
Motor 4	???	*C
Motor 5	???	*C

Motor Temperatures

Software Version

Inching Mode

Set Date/Time

🔒 **Condition Data**

Motor Converter

19-12-2017   14:34:19

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR

⬇ ENTER

PROCESS INFO - SOFTWARE VERSION

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Software Versions	
ICP1	49.00
ICP2	????
VIU1	????
VIU2	????
ACI1	????
ACI2	????
ACI3	????
Gateway	2.1
DDU1*	3.6
DDU2	?????

* This DDU

Node Information
Energy Consumption
Simulation Mode
Motor Temperatures
Software Version
Inching Mode
Set Date/Time
🔒 Condition Data
Motor Converter

19-12-2017   14:34:22

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR
⬇ ENTER

PROCESS INFO - INCHING MODE

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Inching Mode	
Active	●
Actual Speed	0.0 km/h
Set Speed	0.8 km/h

Node Information
Energy Consumption
Simulation Mode
Motor Temperatures
Software Version
Inching Mode
Set Date/Time
🔒 Condition Data
Motor Converter

19-12-2017   14:34:24

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR
⬇ ENTER

Set Speed can be modified using the up and down arrows given in the bottom part of the screen.

PROCESS INFO - SET DATE AND TIME
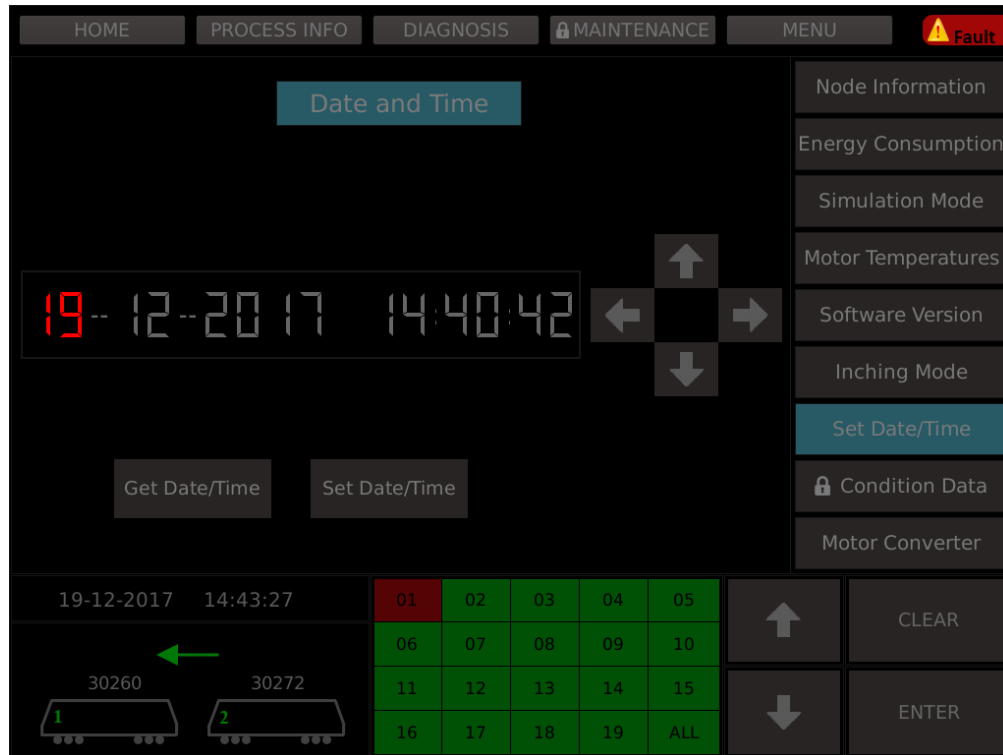
Date displayed as date – month—year. Time displayed as hours:minutes:seconds.

Up and Down arrows used to increment and decrement respectively the date/time values.

Left and right arrows used to navigate to each part of date and time i.e date,month,year,hour,minute and second.

PROCESS INFO - CONDITION DATA PASSWORD ENTRY
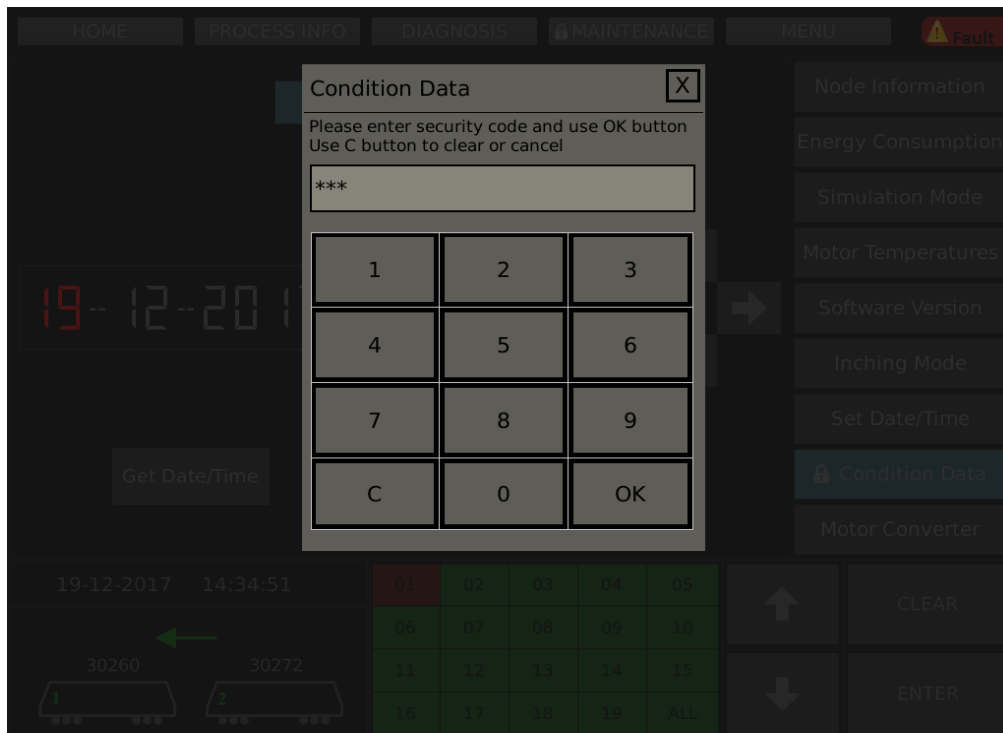
Password has to be entered to display condition data screen.

PROCESS INFO - CONDITION DATA

| HOME | PROCESS INFO | DIAGNOSIS | 🔒MAINTENANCE | MENU | ⚠Fault |

Condition Data				
Locomotive Number	31295	-	Edit	Node Information
Bogie 1 Motor M1	0	mm	Edit	Energy Consumption
Bogie 1 Motor M2	0	mm	Edit	Simulation Mode
Bogie 1 Motor M3	0	mm	Edit	Motor Temperatures
Bogie 2 Motor M1	0	mm	Edit	Software Version
Bogie 2 Motor M2	0	mm	Edit	Inching Mode
Bogie 2 Motor M3	0	mm	Edit	Set Date/Time
Energy Consumed	0	kWh	Reset	🔓 Condition Data
Energy Regenerated	0	kWh	Reset	Motor Converter

Save Changes   Discard Changes

19-12-2017   14:35:00

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR
⬇ ENTER

Edit button can be used to alter the values.
Reset button can be used to only reset values to "0" where altering values is not allowed.

PROCESS INFO CONDITION DATA EDIT VALUES

| HOME | PROCESS INFO | DIAGNOSIS | 🔒MAINTENANCE | MENU | ⚠Fault |

Condition Data   [X]

LOCO

30260

1	2	3
4	5	6
7	8	9
C	0	OK

PROCESS INFO - CONDITION DATA AFTER EDITING VALUE

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Condition Data				Node Information
Locomotive Number	30260	-	Edit	Energy Consumption
Bogie 1 Motor M1	0	mm	Edit	Simulation Mode
Bogie 1 Motor M2	0	mm	Edit	
Bogie 1 Motor M3	0	mm	Edit	Motor Temperatures
Bogie 2 Motor M1	0	mm	Edit	Software Version
Bogie 2 Motor M2	0	mm	Edit	Inching Mode
Bogie 2 Motor M3	0	mm	Edit	Set Date/Time
Energy Consumed	0	kWh	Reset	
Energy Regenerated	0	kWh	Reset	🔓 Condition Data

Save Changes	Discard Changes	Motor Converter

19-12-2017   14:35:32

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR
⬇ ENTER

PROCESS INFO - MOTOR CONVERTER

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

Motor Converter				Node Information
Motors	Status	Click to change status		Energy Consumption
1	?	Enabled	Enable	Disable	Simulation Mode
2	?	Enabled	Enable	Disable	Motor Temperatures
3	?	Enabled	Enable	Disable	Software Version
4	?	Enabled	Enable	Disable	Inching Mode
5	?	Enabled	Enable	Disable	Set Date/Time
6	?	Enabled	Enable	Disable	🔒 Condition Data

Motor: 123   456

Apply Changes	Discard Changes	🔒 Reset Locked Motor Conv.	Motor Converter

19-12-2017   14:35:40

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

⬆ CLEAR
⬇ ENTER

DIAGNOSIS

| | | HOME | PROCESS INFO | DIAGNOSIS | MAINTENANCE | MENU | Fault |

DIAGNOSIS Database to USB Details

Position	Time ON	Time OFF	Proc	Sub	Fault Message
06/12/2...	06/12/2017 10:10:08	06/12/2017 10:10:10	RBU3	SS12	Transformer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08	06/12/2017 10:10:10	RBU3	SS12	Transformer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08	06/12/2017 10:10:10	RBU3	SS12	Transformer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08	06/12/2017 10:10:10	RBU3	SS12	Transformer pump 2 MCB open

19-12-2017   14:35:50

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

CLEAR   ENTER

DIAGNOSIS - DDS DOWNLOAD

| | | HOME | PROCESS INFO | DIAGNOSIS | MAINTENANCE | MENU | Fault |

DIAGNOSIS DOWNLOAD

Filename :	*.XML
Destination :	Insert USB Memory Stick
Number Of Records :	249(total) / 249(new)
Status :	Ready to start
Progress :	

Save All   Save New   Delete All   <<

19-12-2017   14:35:56

30260   30272

01	02	03	04	05
06	07	08	09	10
11	12	13	14	15
16	17	18	19	ALL

CLEAR   ENTER

DIAGNOSIS - DETAILS SYMPTOMS

DIAGNOSIS - DETAILS CAUSE

DIAGNOSIS - DETAILS ADVICE

	HOME	PROCESS INFO	DIAGNOSIS	🔒MAINTENANCE	MENU	⚠️Fault

DIAGNOSIS DETAILS

Time ON	Time OFF	Proc	Sub	Fault Message
06/12/2017 10:10:08	06/12/2017 10:10:10	RBU3	SS12	Transformer pump 2 MCB open

Signal Name	09--_0901-MMCBPumpT2

Symptoms	No effect on normal operation. If transformer temperature increases then power may be reduced or shut down.
Cause	
Advice	

<<

19-12-2017 14:36:07	01	02	03	04	05	⬆️	CLEAR
	06	07	08	09	10		
30260 30272	11	12	13	14	15	⬇️	ENTER
1 2	16	17	18	19	ALL		

MAINTENANCE - PASSWORD ENTRY

	HOME	PROCESS INFO	DIAGNOSIS	🔒MAINTENANCE	MENU	⚠️Fault

DIAGNOSIS

Maintenance	X

Please enter security code and use OK button
Use C button to clear or cancel

```
***
```

1	2	3
4	5	6
7	8	9
C	0	OK

Position	Time ON	...	Fault Message
06/12/2...	06/12/2017 10:10:08		...rmer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08		...rmer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08		...rmer pump 2 MCB open
06/12/2...	06/12/2017 10:10:08		...rmer pump 2 MCB open

19-12-2017 14:36:25	01	02	03	04	05	CLEAR
	06	07	08	09	10	
30260 30272	11	12	13	14	15	ENTER
1 2	16	17	18	19	ALL	

MAINTENANCE - DDU DISPLAY

MAINTENANCE - DDU LOGGING

MAINTENANCE - MVB TELEGRAM BINARY

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

MVB TELEGRAM

DDU Display

DDU Logging

Port number: 1   Port type: Sink Port
Status: OK   Freshness: 20

MVB Telegram

Port
1
4
5
7
8
19
37
40
41
43
44
103
104

Binary

	FEDCBA98	76543210
0X00	00000000	00000000
0X02	00000000	00000000
0X04	00000000	00000000
0X06	00000000	00000000
0X08	00000000	00000000
0X0A	00000000	00000000
0X0C	00000000	00000000
0X0E	00000000	00000000

Byte

Word

MVB Freshness

MVB Variables

System

VCU

Close

30240 :??
1

19-12-2017   14:36:45   DDU1

MAINTENANCE - MVB TELEGRAM BYTE

HOME	PROCESS INFO	DIAGNOSIS	🔒 MAINTENANCE	MENU	⚠ Fault

MVB TELEGRAM

DDU Display

DDU Logging

Port number: 1   Port type: Sink Port
Status: OK   Freshness: 20

MVB Telegram

Port
1
4
5
7
8
19
37
40
41
43
44
103
104

Binary

Byte

Word

	00	01	02	03	04	05	06	07
0X00	00	00	00	00	00	00	00	00
0X08	00	00	00	00	00	00	00	00

MVB Freshness

MVB Variables

System

VCU

Close

30240 :??
1

19-12-2017   14:36:48   DDU1

MAINTENANCE - MVB TELEGRAM WORD

MAINTENANCE - MVB FRESHNESS

MAINTENANCE - MVB VARIABLES

Sel	Telegram	Process Variable	Type
☐	ICP1-1	14XX*Bit0	BIT
☑	ICP1-1	CmdOpMode	BYTE
☑	ICP1-1	14XX*Bit1	BIT
☑	ICP1-1	14XX*Bit2	BIT
☑	ICP1-1	14XX*Bit3	BIT
☑	ICP1-1	14XX*Bit4	BIT
☑	ICP1-1	14XX*Bit5	BIT
☑	ICP1-1	14XX*Bit6	BIT
☐	ICP1-1	14XX*Bit7	BIT

MVB PROCESS VARIABLES — Selected: 7

HOME   PROCESS INFO   DIAGNOSIS   MAINTENANCE   MENU   ⚠ Fault

DDU Display | DDU Logging | MVB Telegram | MVB Freshness | MVB Variables | System | VCU | Close

Clear Selection | Filter | Load File | Save File | Display

30240 :??
1
19-12-2017   14:37:25   DDU1

MAINTENANCE - MVB VARIABLES FILTER

HOME   PROCESS INFO   DIAGNOSIS   MAINTENANCE   MENU   ⚠ Fault

MVB PROCESS VARIABLES — Selected: 0

Sel	Telegram	Process Variable	Type
☐	ICP1-1	14XX*Bit0	BIT

FILTER PROCESSOR

☐ ALL	☑ ACI1	☐ ACI2	☐ ACI3	☐ DDU1
☐ DDU2	☐ ICP1	☐ ICP2	☐ IGW	☐ RBU1
☐ RBU2	☐ RBU3	☐ RBU4	☐ RIOM1A	☐ RIOM1B
☐ RIOM2A	☐ RIOM2B	☐ VIU1	☐ VIU2	

Ok | Cancel

| ☐ | ICP1-1 | 14XX*Bit7 | BIT |

DDU Display | DDU Logging | MVB Telegram | MVB Freshness | MVB Variables | System | VCU | Close

Clear Selection | Filter | Load File | Save File | Display

30240 :??
1
19-12-2017   14:37:42   DDU1

Only required processors whose details has to be viewed can be checked from the filter processor area (obtained on-click on Filter button).

MAINTENANCE - MVB VARIABLES FILTERED PROCESSOR DETAILS

Details of filtered processor.

MAINTENANCE - MVB VARIABLES LOAD FILE

On-click on Load File button the above screen is displayed with which details pertaining to required file can be viewed in the screen specified below.

MAINTENANCE - MVB VARIABLES LOADED FILE DISPLAY

HOME	PROCESS INFO	DIAGNOSIS	⛏ MAINTENANCE	MENU	⚠ Fault

MVB SELECTED PROCESS VARIABLES   `<<`

ICP1-1 CmdLeadingDir	
ICP1-1 14XX*LebZeichZum	
ICP1-1 14XX*RelKont45	
ICP1-1 14XX*Word3	
ICP1-1 14XX*BVirtSlave	

- DDU Display
- DDU Logging
- MVB Telegram
- MVB Freshness
- MVB Variables
- System
- VCU
- Close

30240 :??
1

19-12-2017   14:39:03   DDU1

Displays the signal status of selected file.

MAINTENANCE - MVB VARIABLES SAVE FILE

HOME	PROCESS INFO	DIAGNOSIS	⛏ MAINTENANCE	MENU	⚠ Fault

MVB PROCESS VARIABLES   Selected: 4

Sel	Telegram	Process Variable	Type
✓	ICP1-1	14XX*Bit0	BIT
✓	ICP1-1	CmdOpMode	BYTE
✓	ICP1-1	14XX*Bit1	BIT

SAVE FILE

1	2	3	4	5	6	Cancel

	ICP1-1	14XX*Bit5	BIT
	ICP1-1	14XX*Bit6	BIT
	ICP1-1	14XX*Bit7	BIT

Clear Selection	Filter	Load File	Save File	Display

- DDU Display
- DDU Logging
- MVB Telegram
- MVB Freshness
- MVB Variables
- System
- VCU
- Close

30240 :??
1

19-12-2017   14:39:29   DDU1

Details of telegram(s) that are checked/ticked to be saved into any of the files specified in the save file area.

MAINTENANCE - MVB VARIABLES CHECKED PROCESS VARIABLES

MAINTENANCE - MVB VARIABLES CHECKED PROCESS VARIABLES DISPLAY

Displays checked process variables from the above screen on-click on Display button.

MAINTENANCE - VCU RIOM IO

MAINTENANCE - VCU RIOM INFO

VCU 1 RIOM A Version Information

RIOM Extension	Firmware Application	Default parametres	Saved Parametres	MVB D 2000 Configuration
0	1.15.0	2.0.0	2.0.0	1.18.0
1	1.15.0	2.0.0	2.0.0	-
2				
3				
4				
5				
6	1.10.0	1.10.0	1.10.0	-
7				

FAULT DISPLAY

FAULT DISPLAY - DRIVER ADVICE

Remaining driver advice can be viewed using navigation keys i.e up and down keys.

ERROR DISPLAY

6.0. DIMENSIONAL DRAWING

7.0 SPARE ITEMS & ACCESSORIES

SL.No.	Item name	UID NUMBER	Quantity /Unit
1	Processor board,ARM CORTEX-A8, 1GB NAND flash and 1GB DDR3 RAM	2222131006	One
2	10.4" TFT Display with in-built touch screen (P-CAP)	1113141114	One
3	Power supply Board (70V DC to 137.5 V DC nominal 110V DC, protection against surge and short circuit)	331013161K	One
4	MVB Controller Board with EMD physical medium	331013101M&331013101L	One
5	Processor base board	331013101O	One
6	8 keys membrane key board	2220101207	One
7	Set of Connectors Sub-D 9 Male	11121523CW	Four
7	Set of Connectors Sub-D 9Female	111215235R	Two
8	Power Connector	11121515ES	One
9	M12 Ethernet connector	111215237N	One