ACCEPTANCE TEST PROCEDURE
OF
EXTERNAL NAVIGATION CONSOLE
(ENC)
DP254

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AMENDMENTS RECORD SHEET

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LIST OF ABBREVIATIONS

SBC	Single Board Computer
RS232	Recommended Standard 232
OS	Operating system
RAM	Random Access Memory
HDMI	High-Definition Multimedia Interface
USB	Universal Serial Bus
SSDs	Solid State Drives
DDR	Double Data Rate
LED	Light Emitting Diode
AI	Analog Input
DO	Digital Output
DI	Digital Input
GUI	Graphical User Interface

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1. INTRODUCTION:

This document describes the Acceptance Test Procedures (ATP) for External Navigation Console (ENC). The console houses the hardware required for the operation and control of equipment. ENC unit consists of a structural framework holding rugged monitor with bezel keys, SBC, membrane Keyboard, joystick, GPS, Rotary Switches, electrical connectors along with user interfaces and controls.

2. TECHNICAL SPECIFICATION:

Sl No	Parameter	Specification	Remarks
1	Processor	Intel i7 14th Gen Intel(R) Core (TM) i7-14700	
2	RAM	8GB (DDR5)	
3	Ethernet	2no's	
4	Storage	256GB	
5	I/O Port	RS232/RS422: 01 no RS232: ≥ 01 no's USB: ≥ 02 no's, Audio port: 01 Analog:08 channel, 10bit resolution Digital input: 16 channels,Digital output: 08channels	
6	OS	Ubuntu 22.04	
7	Monitor	17.3",1920 x 1080 resolution with 28 bezel keys	
8	Joystick	01no	
9	Rotary Switch	3POS- 4QTY	
10	GPS	01no	
11	AI Card	08 channel, 10bit resolution : 01no	
12	DO Card	08channels : 01no	
13	DI Card	16 channels : 1no	
GENERAL SPECIFICATIONS			
14	Power	18-32V DC	
15	Operating Temperature	-20°C to +60°C	
16	IP Rating	IP65	
17	EMI/EMC	MIL STD 461F	
18	Environmental Spec	JSS 55555/ MIL STD 810F	
19	Dust Caps	Dust caps with Nylon beads to be provided for all external interfaces	

Table 1: Technical Specification of **EXTERNAL NAVIGATION CONSOLE**

3. SCOPE OF DOCUMENT:

This document describes the complete procedure to test the physical and functional aspects of the **EXTERNAL NAVIGATION CONSOLE**. This test includes complete testing of all the I/O viz. USB, GPS, RS232, RS232/RS422, Rotary switches &Ethernet etc.

4. TEST CASES:

S No	Test Cases	Description
01	Processor Test	It tests the processor, RAM and SSD storage detection using pass mark software.
02	Ethernet Test	It tests the 2 ports connected to laptop using the Ping operation.
03	USB Test	It validate the USB interface 0f 2 ports using a mouse & keyboard.
04	Serial Port Test	It test of 2 ports (RS232/RS422 & RS232) connected to DB9 Connector using mini com software.
05	Joystick Test	All the buttons including movement of joystick validation using test application.
06	Membrane Keyboard Test	It validates all the switches and LED's of the membrane keyboard using test application.
07	GPS Test	The GPS Navigation board is connected with the GNSS IRNSS Active Antenna 106 through SMA Connector.
08	Analog Input	Analog Input will Directly connected to the Analog Input card which will interface with motherboard
09	Digital Output	Digital Output will connected to the Digital Output card which will interface with Membrane Keyboard
10	Digital Input	Digital input will connected to the Digital input card which will interface with rotary switches and emergency switch.

Table 2: Test cases of **EXTERNAL NAVIGATION CONSOLE**

5. SYSTEM OVERVIEW:

This shows the complete view of the **EXTERNAL NAVIGATION CONSOLE.**

Figure 1: Isometric view of **EXTERNAL NAVIGATION CONSOLE**

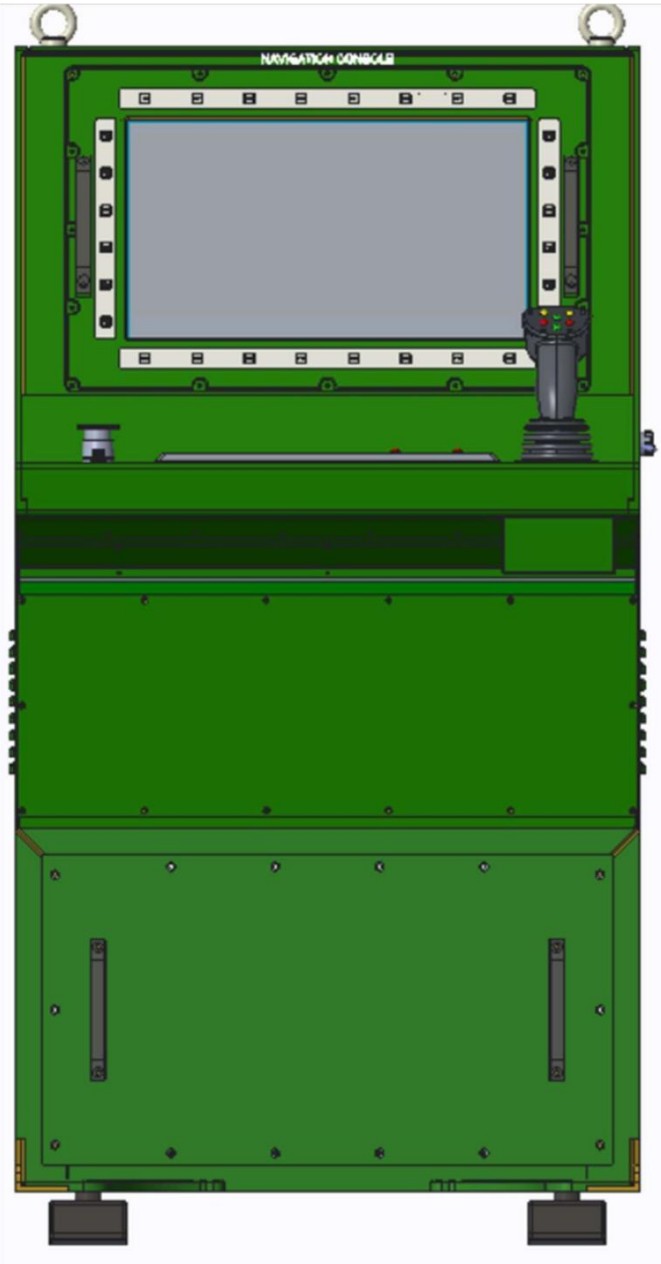

Figure 2: Front view of **EXTERNAL NAVIGATION CONSOLE**

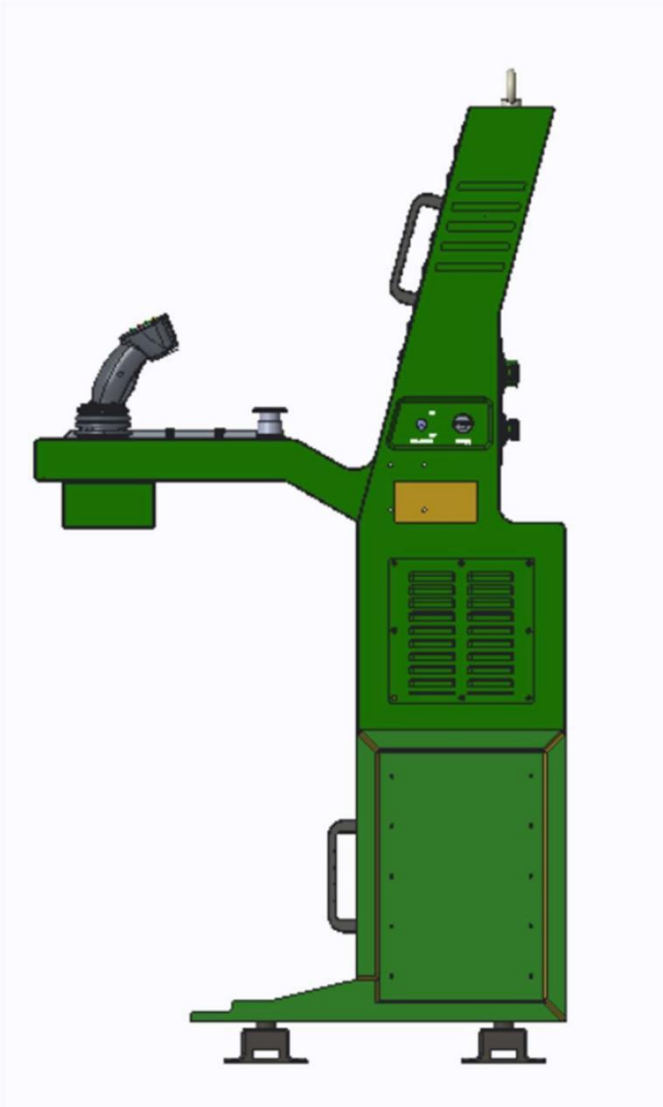

Figure 3: Side view of **EXTERNAL NAVIGATION CONSOLE**

6. GA DRAWINGS:

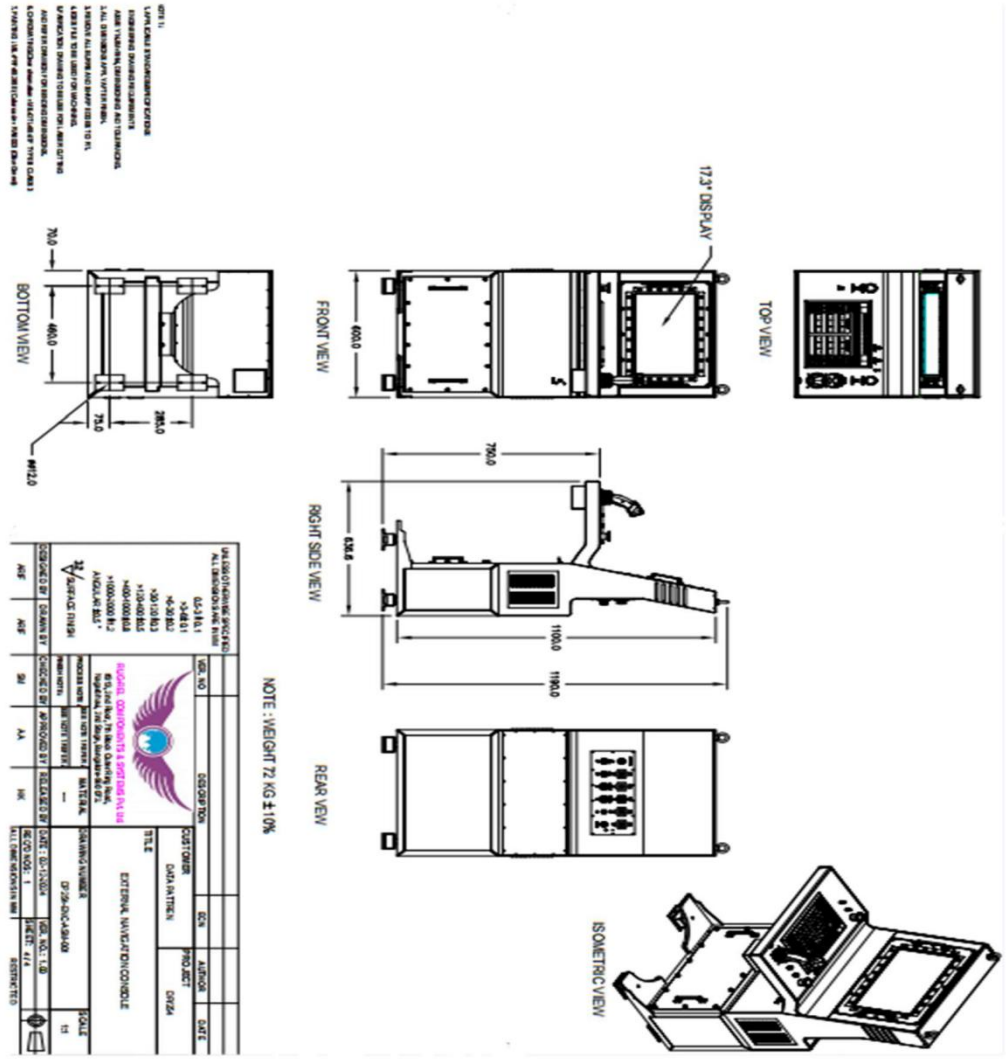

Figure 3: GA Drawings of **EXTERNAL NAVIGATION CONSOLE**

7. EXTERNAL INTERFACE DETAILS:

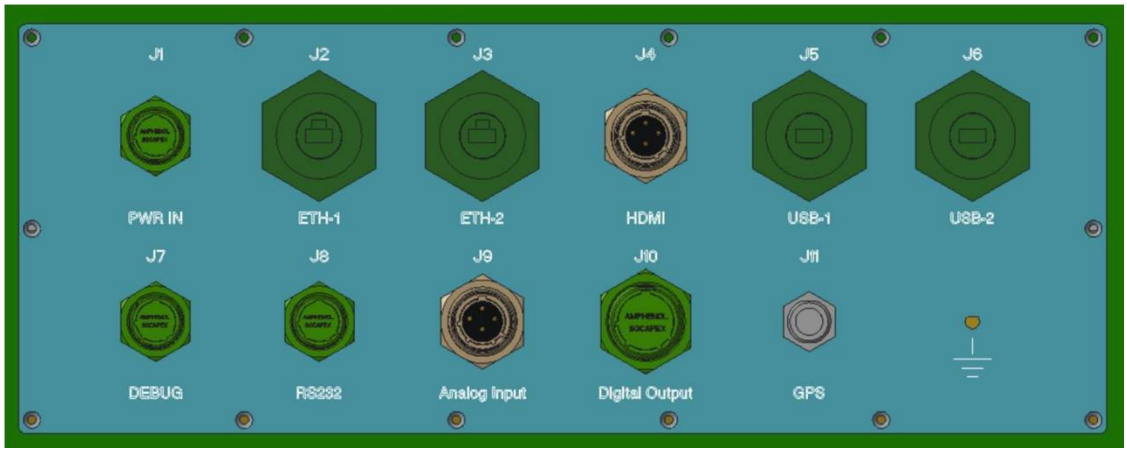

Figure 4: External interface details of **EXTERNAL NAVIGATION CONSOLE**

Sl No	*Connector Reference*	*Signal Type*	*Signal Name*	*Manufacturer Part No.*
1	J1	DC Power	I/P Power	D38999/24WB5PN
2	J2	Ethernet1	ETH-1	RJFTV7PEM1G
3	J3	Ethernet2	ETH-2	RJFTV7PEM1G
4	J4	HDMI	HDMI	D38999/24WC35SN
5	J5	USB-1	USB	D38999/24WDUSB-SB
6	J6	USB-2	USB	D38999/24WDUSB-SB
7	J7	RS232/RS422	RS232/RS422	D38999/24WB35SB
8	J8	RS232	RS232	D38999/24WB35SA
9	J9	Analog Input	AI	D38999/24WD35PN
10	J10	Digital Output	DO	D38999/24WC35PN
11	J11	GPS	-	132108

Table 3: Connector Details of **EXTERNAL NAVIGATION CONSOLE**

8. PHYSICAL INSPECTION:

a) Record the serial number and measure the Dimensions of the NAVIGATION CONSOLE unit and record the measured readings in Dimension measurements table.
b) Visual inspection to be carried out to check all the screws are properly intact and tightened.
c) Check all the Circular connectors are properly intact and tightened.
d) Check for any Physical damages on the chassis.

9. INTERNAL BLOCK DIAGRAM:

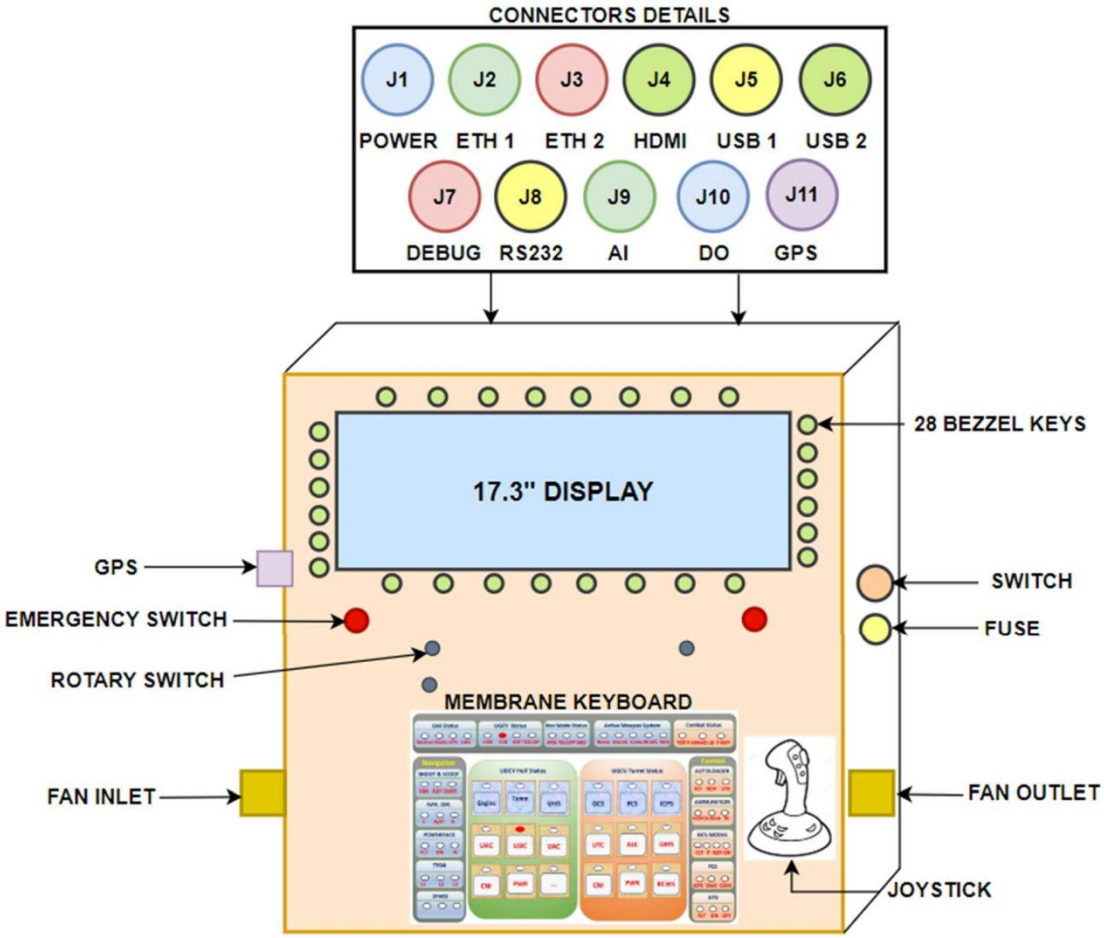

Figure 5: Internal Block Diagram of **EXTERNAL NAVIGATION CONSOLE**

10. TEST SETUP:

The test set up used in the Electrical/Functional tests of **EXTERNAL NAVIGATION CONSOLE** is as depicted in Figure 6.

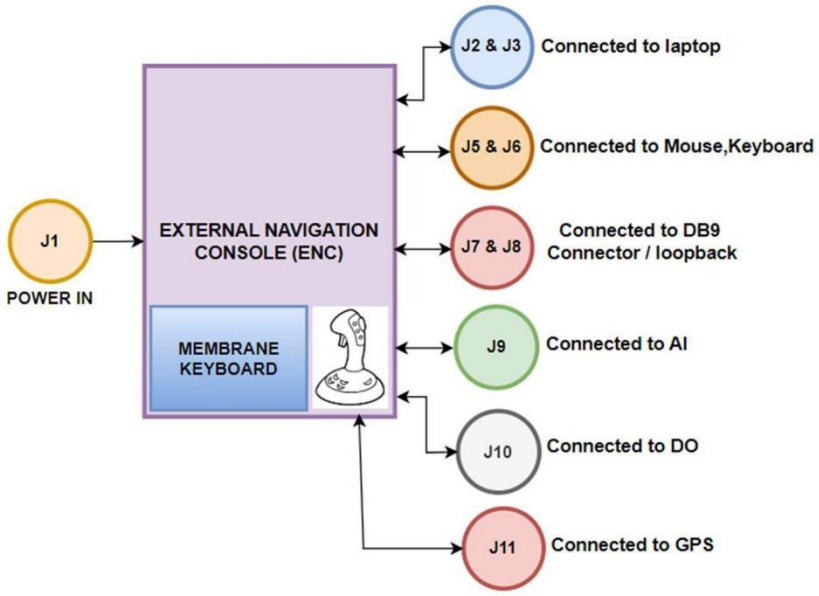

Figure 6: Test setup for functional test of **EXTERNAL NAVIGATION CONSOLE**

11. FUNCTIONAL TESTS:

Functional tests comprise of the full range of tests to be carried out on the **EXTERNAL NAVIGATION CONSOLE** to establish its Functional/ Specification compliance as per the Operational Requirements. The list of functional tests to be carried out and the test procedure is described in this Section.

11.1 Test Equipment and Accessories

List of the test equipment required for performing the acceptance tests are detailed as follows.

11.1.1 Testing Cables

SL. No.	Description	Quantity
1	Power connector Mating Cable assembly – J1	01 No.
2	Ethernet connector Mating Cable assembly – J2&J3	02 Nos.
3	HDMI connector Mating Cable assembly -J4	01 No.
4	USB connectors Mating cable assembly- J5 & J6	02 Nos.

5	RS232/RS422 connector Mating cable assembly- J7	01No.
6	RS232 connector Mating cable assembly-J8	01No.
7	AI connector Mating cable assembly- J9	01No.
8	DO connector Mating cable assembly- J10	01No.
9	GPS Connector mating cable assembly-J11	01No.

Table 4 : List of test cables

11.1.2 External Devices

SL. No.	External Devices Required	Quantity
1	External PC/ Laptop the following software installed: Ubuntu 22.04	1

Table 5: List of external devices

11.1.3 Drivers and software to be installed in CREW CONSOLE

SL. No.	Drivers/ Software
1	Minicom on Ubuntu (for serial ports testing)
2	Burn In Test Pass Mark software on SBC
3	Membrane keyboard test application
4	Joystick Test application

Table 6: List of Drivers/Software to be installed

12. EXTERNAL NAVIGATION CONSOLE TEST PROCEDURE

The below section describes the testing procedure of EXTERNAL NAVIGATION CONSOLE.

12.1 Power Testing

Testing of the Power involves detection and working of all functional cards.

12.1.1 Power ON test

1. **Test Objective**: To ensure the unit is turned on and the functionality is as per the expected results in the TDRS-3.
2. **Test Procedure**:
   a. Connect the power cable between power connector (J1) on External Interface Panel and DC power supply.
   b. Switch on the DC Power supply and ensure "**PWR ON**" led glows RED on the external Interface panel, which confirms that Power supply is reaching the Crew Console & remaining devices.

c. Switch on the toggle; the green LED on the external interface panel will glow, confirming that the system will begin the boot up process on the SBC.
d. The system boots up with Ubuntu on SBC which is displayed on the external monitor.
e. Check USB keyboard and mouse are working for SBC.
f. Note down the measured value in TDRS-3

***Note**:*

1) Unit to be cleaned of dust and dirt before start of test
2) Maintain Min.1U free space above the unit during testing for optimum thermal performance
3) This orientation to be maintained during all testing.

12.1.2 Power OFF test

1. **Test Objective**: To ensure the unit is turned OFF and expected results.
2. **Test Procedure**:
   a. Shutdown the SBC.
   b. Turn OFF the Power Switch.
   c. Note down the measured value in TDRS-3

12.2 SBC Testing (Ubuntu)

Test Objective: The objective of this test is
a. To ensure and display the detection of processor
b. To detect and detail the RAM configuration
c. To detect the 1Gb network port 1 and port 2
d. To detect the USB port
e. To detect the Serial Port
f. To detect the RS232/422

12.2.1 Configuration Settings

a. Connect J2 & J3 mating cable to laptop.
b. Assign IP address to Navigation Console.
c. Irrespective of IP address of Navigation Console and Laptop, the default gateway address should be the same on both Navigation Console and Laptop.
(E.g., For Ethernet1 (J2) - IP address: 192.168.1.20, Subnet Mask: 255.255.255.0)
For Ethernet2 (J3) - IP address: 192.168.1.20, Subnet Mask: 255.255.255.0)
d. Connect loop back cables assembly to the DB9 connector of RS232/ RS232/RS422 connector mating cable assembly-- J4 & J5.

12.2.2 Test Procedure for detection of processor, SSD Storage & RAM:

a. Log In to the root account.
b. Go to Path-Home-> download -> bitlinux4.1.1002.tar.gz (Extract the file) -> bitlinux4.1.1002->64bit->Right click on the "**Open in Terminal**" program.
c. Change the mode to 777 using command "**chmod 777 burnintest**" and press enter
d. Change your current working directory to "**burnintest**" by typing "**cd path_to_burnintest_folder**" (There is an easy way to copy path by dragging the **burnintest** icon into the terminal) and press enter
e. Open "BurnInTest" using command ". /bit_cmd_line_x64".
f. The test will take 15mins to complete. Result will be displayed on Screen after completion of test.
g. Note down the measured /observed values in TDRS-**4 &5**, against the respective portion of the tests

Note: *This procedure is invoked once with all options selected.*

12.3 RS232/RS422 – COM 3 PORT TEST (Ubuntu)

1. **Test Objective:** To detect and test the RS232/RS422 – ttyS2 port.
2. **Test Procedure:**
   a. Connect RS232/RS422 loopback cable assembly to the DB9 connector (RS232/RS422 port of SBC) of RS232/RS422 connector Mating cable assembly- J7
   b. Open **Terminal**.
   c. Start minicom by using command "**sudo minicom**".
   d. Enter Serial Port setup menu.
   e. Press "**A**" type "**/dev/ttyS2**".
   f. Save setup as dev_ttyS2 by selecting "**save setup as**" option.
   g. Exit from setup.
   h. Type keys to display.
   i. Record the observations in **TDRS-6**

12.4 RS232 – COM 1 PORT TEST (Ubuntu)

1. **Test Objective:** To detect and test the RS232 – ttyS0 port.
2. **Test Procedure:**
   a) Connect RS232 loopback cable assembly to the DB9 connector (RS232 port of SBC) of RS232 connector Mating cable assembly- J8
   b) Open **Terminal**.
   c) Start minicom by using command "**sudo minicom**".
   d) Enter Serial Port setup menu.
   e) Press "**A**" type "**/dev/ttyS0**".
   f) Save setup as dev_ttyS0 by selecting "**save setup as**" option.
   g) Exit from setup.
   h) Type keys to display.

12.5 JOYSTICK TEST (Ubuntu)

1. **Test Objective:** To detect and test the joystick.
2. **Test Procedure:**

1) Open **jstest-gtk** from the Application menu by double-clicking it. The application window appear as shown in below figure 7.

Figure 7: Testing for JOYSTICK application

2) Select the joystick device (**/dev/input/js0**) from the list. A new window will display.
   - The number of **Axis** and their positions.
   - The number of **Buttons** and their states.

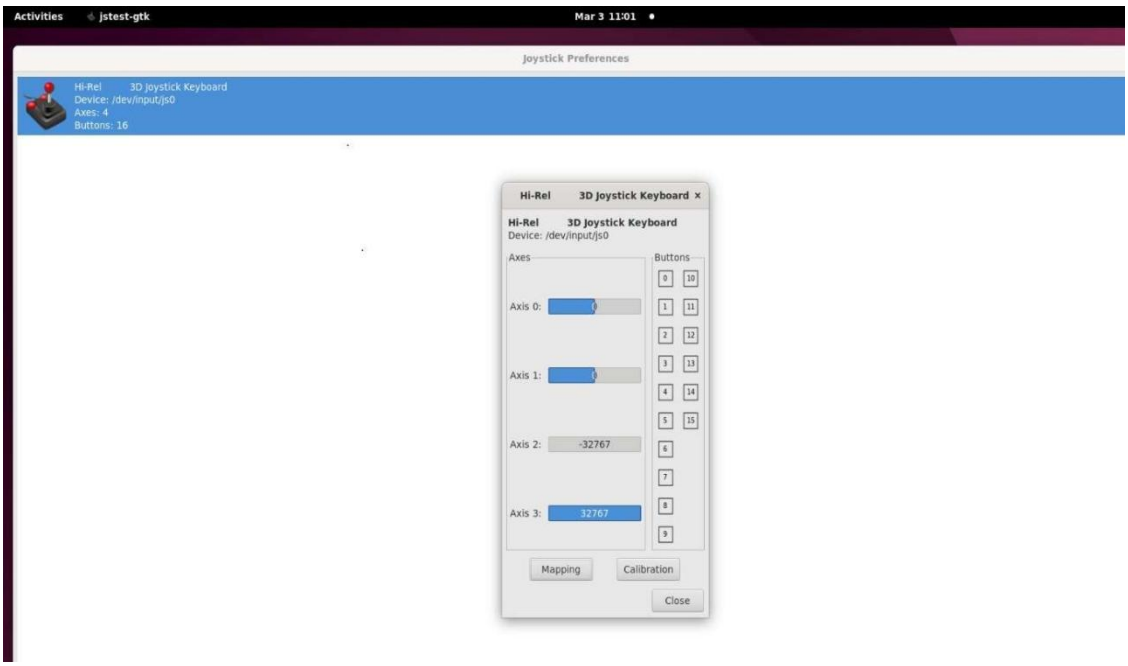

Figure a)

3) Move the joystick in all directions and observe axis values changing. Press all buttons and verify that their states toggle.

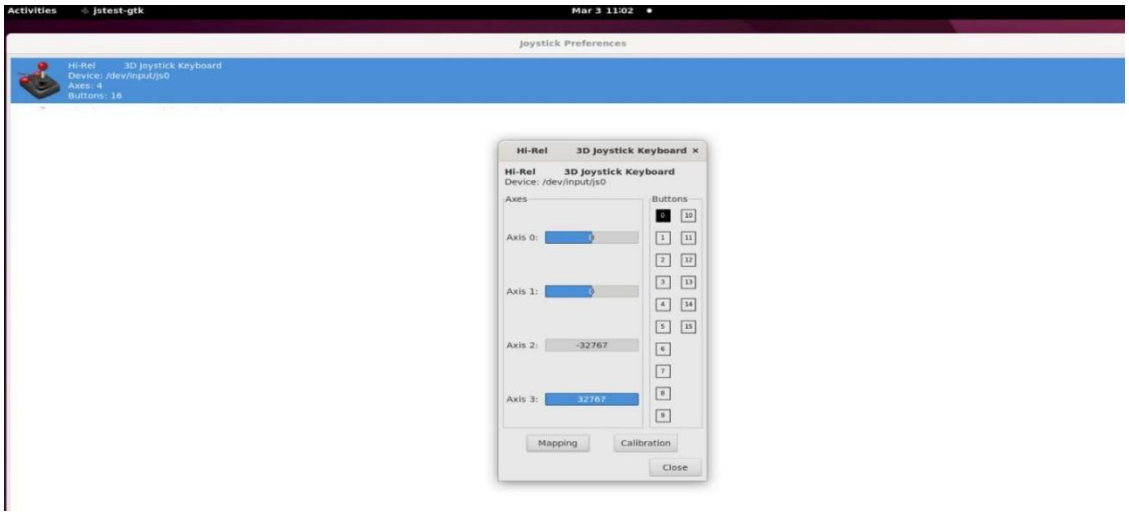

Figure b)

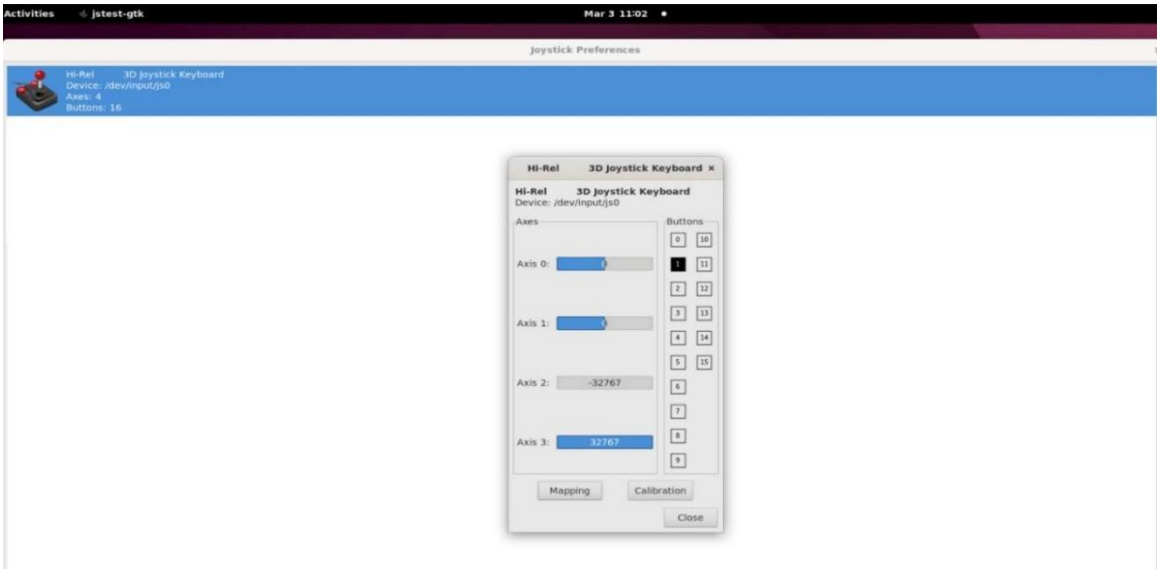

Figure c)

12.6 EMERGENCY BUTTON TEST:

1. **Test Objective:** To detect and test the Emergency Button.
2. **Test Procedure:**
   a) Navigate to the directory.
   Cd/Desktop → Right click on the "open in terminal" program.
   b) Run the compiled program " sudo gpioget gpiochip0 8 9"
   c) Password: root123

1. Press the EMERGENCY STOP SWITCH (L) & (R) button, observe that the state in the terminal logs, the expected output should be 1 for ON & 0 for OFF.
2. Release the EMERGENCY STOP SWITCH (L) & (R) button, observe that the state in the terminal logs, the expected output should be shown in below figure

12.7 MEMBRANE KEYBOARD TEST:

1. **Test Objective:** To detect and test the Membrane Keyboard.
2. **Test Procedure:**

    1. Open the server application by entering 127.0.0.1 in a web server.
    2. The login form will automatically appear once the server is running.
    3. The login form consists of two input fields and a button:
        a. **Username :** admin
        b. **Password:** 123

4. After successful login, the main GUI interface will load as shown in below figure.

Figure 9: Main GUI Interface

APPENDIX 'A'-FUNCTIONAL TEST DATA RECORDS

TEST DATA RECORD SHEET – 1

VISUAL INSPECTION

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

S.No	Specification	Observed Value	Remarks
Dimensions:			
a	Length:436mm		
b	Width:600mm		
c	Height:1190mm		
d	Weight: 72Kg		
Connector Description:			
e	J1(D38999/24WB5PN)		
f	J2(RJFTV7PEM1G)		
g	J3(RJFTV7PEM1G)		
h	J4(D38999/24WC35SN)		
i	J5(D38999/24WDUSB-SB)		
j	J6(D38999/24WDUSB-SB)		
k	J7(RE38999/24WB35SB)		
l	J8(RE38999/24WB35SA)		
m	J9(RE38999/24WC35PN)		
n	J10(RE38999/24WC35PN)		
o	J11(132108)		

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TEST DATA RECORD SHEET – 2

ISOLATION TEST

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Sl No	Test Description	Specified values	Observed Value	Remarks
a	J1 (A & C) +28V	No continuity should come		
b	J1 (B & D) GND	No continuity should come		
c	J1 (A & E) Earth	No continuity should come		

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TEST DATA RECORD SHEET – 3

Power ON & OFF Test

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Power ON test:

Sl No	Test Description	Specified values	Observed Value	Remarks
1	Switch ON DC	PWR_ON LED RED glows		
2	"PWR SW" in ON position	SBC booted with Ubuntu 22.04		

Power OFF test:

Sl No	Test Description	Specified values	Observed value	Remarks
1	Switch OFF DC	PWR_ON RED LED OFF		
2	Power supply OFF position	SBC - No output on monitor		

Power Consumption test:

	Voltage (V)	Current (A)	Remarks
18V			
24V			
32V			

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TEST DATA RECORD SHEET – 4

SBC Testing (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Processor Detection test

Sl No	Test Name	Specified values	Observed Value	Remarks
1	Processor	CPU Detected		
2	CPU manufacturer	Genuine Intel		
3	CPU Type	14th Gen Intel(R) Core (TM) i7-14700		
4	CPUID	Family 6, Model 186, Stepping 3		
5	Physical CPU's	1		
6	Cores per CPU	10		
7	Sockets supported	FCLGA1700		
8	CPU speed	1700.0 MHz		

RAM Detection test

Sl No	Test Name	Specified values	Observed Value	Remarks
1	RAM Test	RAM detected		
2	Total Physical Memory	7718 MB		
3	Memory devices			
3.1	Channel A-D	8192 MB, DDR5, 4800 MT/s		

SSD Storage detection test

Sl No	Test Name	Specified values	Observed Value	Remarks
1	SSD storage detection	SSD detected		
2	Disk drive:	256GB		

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TEST DATA RECORD SHEET – 5

SBC Testing (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Network Ports test

Test Setup for ETH Ping:

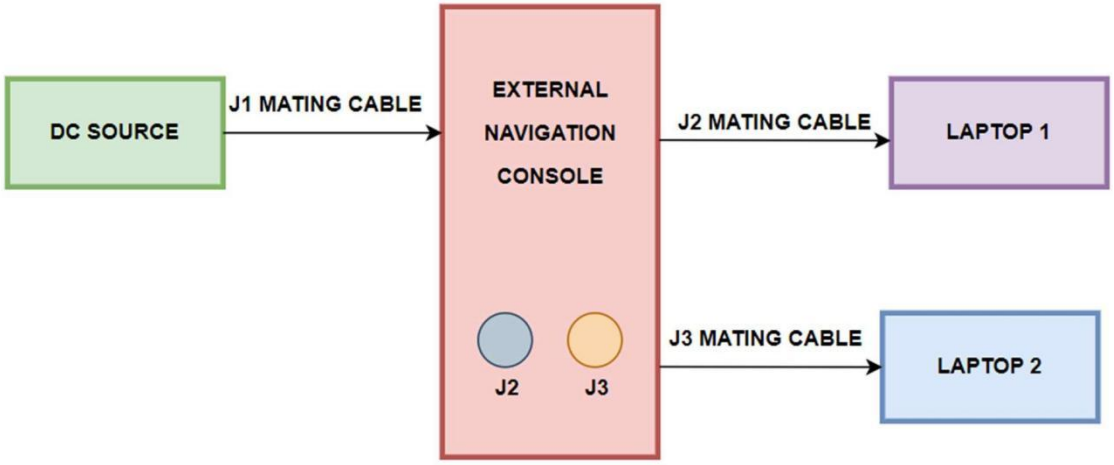

Figure 10: Test setup of Eth ping Test

Ethernet Port 1 Test

Sl No	Test Name	Specified values	Observed Value	Remarks
1	Ethernet Port	Ethernet Port detected		
2	Network	Intel(R) I210 Gigabit Network Connection		
3	IPv4	Assign any IP address		
4	Speed	1000Mb/s		

Ethernet Port 2 Test

Ethernet Port 2 is connected to the Ethernet switch through backplane internally. Check for the port speed showing 1000Mbps.

Sl No	Test Name	Specified values	Observed Value	Remarks
1	Ethernet Port	Ethernet Port detected		
2	Network	Intel(R) I210 Gigabit Network Connection		
3	IPv4	Assign any IP address		
4	Speed	1000Mb/s		

Procedure for ping test:

a. Connect J2 mating cable to laptop.
b. Assign IP address and gateway in network setting as shown above.
c. Open the "Open in terminal".
d. Type "ping" in the black box and hit the space bar.
e. Type the IP address you'd like to ping (e.g., 10.XXX.X.X).
f. Ping reply should be received.

RS232-COM1 Port test:

Sl No	Test Name	Specified values	Observed Value	Remarks
1	COM Port	COM Ports detected		
2	Communications Port:	ttyS0		
3	Serial Port: ttyS0	Result: PASS		

USB port test

Sl No	Test Name	Specified values	Observed Value	Remarks
1	USB Ports	USB Ports detected		
2	USB Ports	USB x HCI Compliant Host Controller		

Note: The above results are obtained when USB key board or joystick is connected.
Check for the working of Keyboard.

TEST DATA RECORD SHEET – 6

RS232/RS422– COM 3 PORT TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

RS422 - COM3 port test (Ubuntu)

Sl No	Test Name	Specified values	Observed Value	Remarks
1	RS422	RS232/RS422 Port detected		
2	RS422	Keys pressed on the keyboard to be shown on GUI of Minicom. E.g.: 00 AA EE WW.		

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TEST DATA RECORD SHEET – 7

RS232– COM 1 PORT TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

RS422 - COM3 port test (Ubuntu)

Sl No	Test Name	Specified values	Observed Value	Remarks
1	RS232 Port	RS232 Port detected		
2	RS232 Port	Keys pressed on the keyboard to be shown on GUI of Minicom. E.g.: 00 AA EE WW.		

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TEST DATA RECORD SHEET – 8

MEMBRANE KEYBOARD TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Membrane Keyboard LED Test:

Sl No	Test Description	Observed Value	Remarks
1	Click the "Turn All ON" button. All LEDs in the GUI will turn ON		
2	Click the "Turn All OFF" button. All LEDs in the GUI will turn OFF		

Membrane Keyboard Test:

Sl No	Bezel Keys Name	Observed Value	Remarks
1	Press the button on the physical membrane keyboard, the button in the GUI will ON & OFF Condition		

Note: Repeat the same procedure for all the button on the membrane keyboard.

Bezel Key Test:

Sl No	Test Description	Observed Value	Remarks
1	Press the button(e.g.,F1) on the physical membrane keyboard, the button in the GUI will ON&OFF Condition		

Note: Repeat the same procedure for all the button on the Bezel keys.

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TEST DATA RECORD SHEET – 9

JOYSTICK TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Joystick Test:

Sl No	Test Description	Observed Value	Remarks
1	Press the button(e.g., B1) on the physical Joystick, the button will ON & OFF Condition		
2	Move the joysticks in all directions and the axis values changing from -32767 to 32767		

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TEST DATA RECORD SHEET – 10

DISPLAY TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Display test:

Sl No	Test Description	Specified values	Observed Value	Remarks
1	Resolution	1920 x 1080		
2	Touch	Checking the interact with a device or system through physical touch		

Rug-Rel Rep **DP Rep**

TEST DATA RECORD SHEET – 11

EMERGENCY BUTTON TEST (Ubuntu)

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Emergency Button Test:

Sl No	Test Description	Observed Value	Remarks
1	Press the EMERGENCY STOP SWITCH Button,"Check in the GPIOCHIP0 1 OR 0 ".		
2	Press the EMERGENCY STOP SWITCH Button,"Check in the GPIOCHIP0 1 OR 0 ".		

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APPENDIX 'B' - PERFORMANCE CHECK

TEST DATA RECORD SHEET – 1

Initial Checks

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Test No.	*Name of the Test*	*Status*	*Remarks*
1	VISUAL INSPECTION		
2	ISOLATION TEST		
3	POWER ON TEST		
4	POWER OFF TEST		
5	SBC TESTING		
5.1	PROCESSOR DETECTION TEST		
5.2	RAM DETECTION TEST		
5.3	SSD STORAGE DETECTION TEST		
5.4	NETWORK PORT TEST		
5.5	SERIAL COMMUNICATION PORTS TESTS		
5.6	USB PORTS TEST		
6	RS232/RS422 – COM 3 PORT TEST (Ubuntu 22.04)		
7	RS232 – COM 1 PORT TEST (Ubuntu 22.04)		
8	MEMBRANE KEYBOARD TEST		
9	JOYSTICK TEST		
10	DISPLAY TEST		
11	EMERGENCY BUTTON TEST		

TEST DATA RECORD SHEET – 2

Final Checks

Project : DP254 **Date:**
DUT : External Navigation Console
Serial No. : **Test Condition:**

Test No.	*DP test*	*Status*	*Remarks*
1	VISUAL INSPECTION		
2	ISOLATION TEST		
3	POWER ON TEST		
4	POWER OFF TEST		
5	SBC TESTING		
5.1	PROCESSOR DETECTION TEST		
5.2	RAM DETECTION TEST		
5.3	SSD STORAGE DETECTION TEST		
5.4	NETWORK PORT TEST		
5.5	SERIAL COMMUNICATION PORTS TESTS		
5.6	USB PORTS TEST		
6	RS232/RS422 – COM 3 PORT TEST (Ubuntu 22.04)		
7	RS232 – COM 1 PORT TEST (Ubuntu 22.04)		
8	MEMBRANE KEYBOARD TEST		
9	JOYSTICK TEST		
10	DISPLAY TEST		
11	EMERGENCY BUTTON TEST		

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