RTOS Functional Test Procedure
Revision D
PCBA 1224980

Revision Table

Revision	Changes	Engineer	Date
A	Initial Version	BAP	2022/08/02
B	• Change Supply voltage in section 2 to 12V • Removed 17 through 19 of section 8 • Remove reference to J5-22 in section 9	BAP	2022/08/11
C	• Fix typo in FRAM test section – Result is 0x35 instead of 0x53 • Section 7, update the acceptance criteria for step 3	BAP	2022/10/13
D	• Fixed typo in 4.2.3 procedure • Change mdown ? command to espump ? command • Fixed CAN data syntax in section 4 step 2 • Fixed chapter numbering	RDH	2023/05/23

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1. Setup:

A fixture has connections with the Drago Standard user interface for the membrane, and with pogo

pins for all other necessary points. Test commands are sent to the board using the RS232 serial debug interface. This is an RS232 level UART with the baud rate set to 115200. The board executes the commands and returns status over the same interface.

2. Test Sequence:

1. Install user interface assembly in machine.
2. Turn power on. Power supply is set to 12.0V and should be capable of driving a 1A load. Power is applied as indicated: COM goes to J1-4. +12V goes to J1-1.

3. USB Check

1. Connect USB (J8) from the DUT to the test computer
2. The DUT must enumerate as "Blank M20"

4. Firmware Rev Check:

1. Read the firmware revision by sending the following command over the debug interface: **"system ?"** DUT will return a response similar to the following:

```
>system ?

sysmgr_Software_Version(cM_USER_INTERFACE) = 1.31
sysmgr_Hardware_Version(cM_USER_INTERFACE) = 0.00
sysmgr_Software_Version(cM_SCRUB_CONTROLLER_A) = N/A
sysmgr_Hardware_Version(cM_SCRUB_CONTROLLER_A) = N/A
sysmgr_Software_Version(cM_SCRUB_CONTROLLER_B) = N/A
sysmgr_Hardware_Version(cM_SCRUB_CONTROLLER_B) = N/A
sysmgr_Software_Version(cM_TELEMETRY) = N/A
sysmgr_Hardware_Version(cM_TELEMETRY) = N/A
```

2. The User Interface Hardware Version shall match the revision number listed in the released drawing of 1224980. The User Interface Software Version may differ. Also check the Scrub or Sweep Controller Software Version against the correct revision. This confirms CAN interface operation.

If no scrub board is in the fixture, it is necessary to simulate the scrub board CAN commands via a computer.

1. Test the UI transmit capability. Read CAN message ID 0x701 via a computer. This is the UI heartbeat message and shows the operational state, the data field shall have a non-zero value.
2. Send the CAN message 0x542 with a data field of 0x 00 00 A0 01 00 00 00 00 via a computer. Message interval is every 1 second. This sends the scrub motor current to the UI board.
3. Read the scrub motor current by sending the following command via the debug interface: **"espump ?"**.
4. DUT will return a response similar to:

IL_ES_Pump_Current() = 416

IL_ES_Pump_Current_Raw() = 0

IL_ES_Pump_Current_Offset() = 0

IL_ES_Pump_Current_Average() = 0

IL_ES_Pump_State() = Power Up

IL_ES_Pump_Clipped_Pulses() = 0

IL_ES_Pump_Duty_Cycle() = 0.0

IL_ES_Pump_Faults() = 0

IL_ES_Pump_Configured_Current_Limit() = 0

IL_ES_Pump_Configured_Soft_Start_Time() = 0

IL_ES_Pump_Configured_Shorted_Threshold() = 0

IL_ES_Pump_Configured_Shorted_Time() = 0

IL_ES_Pump_Configured_Overcurrent_Threshold() = 0

IL_ES_Pump_Configured_Overcurrent_Time() = 0

IL_ES_Pump_Configured_Open_Threshold() = 0

IL_ES_Pump_Configured_Open_Time() = 0

IL_ES_Pump_Configured_Hardware_Fault_Threshold() = 0

IL_ES_Pump_Configured_Hardware_Fault_Time() = 0

5. The response must include:

   IL_ES_Pump_Current() = 416

5. Serial Flash Test and Serial Number write:

1. Write the board serial number to FRAM.
   - The Serial Number is entered as a string and is 29 characters long.
   - Send the following command over THE DEBUG INTERFACE: **memory w 499 [SN]**
   - Response must include:

     ++++++Memory Data Write++++++

     max_size() = 30

     size() = 29

     Write successfully.

     ------Memory Data Write------

6. FRAM Test:

1. Write test string to the serial flash by sending the following command over the debug interface: "**memory w 2 78 53**".

2. Read the data back from the serial flash by sending the following command over the debug interface: "**memory r 2**". The response must include:

data[0] = 0x4E
data[1] = 0x53

Data Bytes 2 through 13 are not critical and can vary. The total response will be similar to:

++++++Memory Data Read++++++
data[0] = 0x4E
data[1] = 0x35
data[2] = 0x00
data[3] = 0x00
data[4] = 0x03
data[5] = 0xF3
data[6] = 0x02
data[7] = 0x00
data[8] = 0xB0
data[9] = 0xF0
data[10] = 0x03
data[11] = 0x00
data[12] = 0x29
data[13] = 0x3F
------Memory Data Read------

7. Potentiometer Test

1. Apply 3.3V to pin 26 of connector LCD1.
2. The voltage at pin 8 of U8 shall be 0.77V +/- 0.1V
3. The voltage at pin 1 of U8 shall be 0.52V +/- 0.1V

8. Display Supply Test

1. Measure pin 1 WRT common with a DMM. Must measure 5.0V±1V.
2. Apply a 50Ω 1W load between pins 1 and 2 of connector LCD2
3. Measure pin 1 WRT common with a DMM. Must measure 3.27±0.5V.
4. Remove load from connector LCD2

9. <u>Switch Matrix Test:</u>

1. Read membrane status inputs by sending the following command over the debug interface: **"inputs ?".** DUT will return a response similar to the following:

>inputs ?

inputs_State(IN_HORN:0) = False
inputs_State(IN_RIGHT_WATER:1) = False
inputs_State(IN_LEFT_WATER:2) = False
inputs_State(IN_ONE_STEP:3) = False

inputs_State(IN_MINUS:4) = False
inputs_State(IN_PLUS:5) = False
inputs_State(IN_LEFT_SCROLL:6) = False
inputs_State(IN_RIGHT_SCROLL:7) = False
inputs_State(IN_DOWN_PRESSURE:8) = False
inputs_State(IN_ALTERNATE_SOLUTION:9) = False
inputs_State(IN_SQUEEGEE:10) = False
inputs_State(IN_SIDE_SCRUB:11) = False
inputs_State(IN_MAIN_SWEEP:12) = False
inputs_State(IN_DUST_VACS:13) = False
inputs_State(IN_SIDE_SWEEP:14) = False
inputs_State(IN_MAIN_SCRUB:15) = False
inputs_State(IN_HOPPER_DOOR_OPEN:17) = False
inputs_State(IN_HOPPER_DOOR_CLOSE:18) = False
inputs_State(IN_HOPPER_LIFT:19) = False
inputs_State(IN_HOPPER_LOWER:20) = False
inputs_State(IN_FILTER_SHAKER:21) = False

2. Connect J4-1 to J4-5. Read status inputs by sending the following command over the debug interface: **"inputs ?".**
3. Response must include leading "0 "State=True" on the same output line. There may be other text in output.

   inputs_State(IN_HORN:0) = True
4. Disconnect J4-1 from J4-5.
5. Connect J4-2 to J4-6. Read status inputs by sending the following command over the debug interface: **"inputs ?".**
6. Response must include leading "5" and "State=True" on the same output line. There may be other text in output.

   inputs_State(IN_PLUS:5) = True
7. Disconnect J4-2 from J4-6.
8. Connect J4-3 to J4-7. Read status inputs by sending the following command over the debug interface: **"inputs ?".**
9. Response must include leading "10" and "State=True" on the same output line. There may be other text in output.

   inputs_State(IN_SQUEEGEE:10) = True
10. Disconnect J4-3 from J4-7.
11. Connect J4-4 to J4-8. Read status inputs by sending the following command over the debug interface: **"inputs ?".**
12. Response must include leading "14" and "State=True" on the same output line. There may be other text in output.

    inputs_State(IN_SIDE_SWEEP:14) = True
13. Disconnect J4-4 from J4-8.
14. Connect J4-8 to J4-9. Read status inputs by sending the following command over the debug interface: **"inputs ?".**
15. Response must include leading "15" and "State=True" on the same output line. There may be

other text in output.

inputs_State(IN_MAIN_SCRUB:15) = True

16. Disconnect J4-8 from J4-9

10. <u>Membrane LED Test:</u>

1. The test setup should have a 330 ohm load resistor from each LED output LED1 through LED32 to +3.3V.
2. Turn off all LEDs by sending the following command over THE DEBUG INTERFACE: **"led en"**
3. Confirm that all LEDs are turned off, Pins J5-1 through J5-21.
4. Turn on LED 8 by sending the **"led on 3"** command over THE DEBUG INTERFACE.
5. Confirm that J5-8 is turned on.
6. Turn off LED 8 by sending the **"led off 3"** command over THE DEBUG INTERFACE.
7. Confirm that J5-8 is turned off.
8. Turn on LED 9 by sending the **"led on 4"** command over THE DEBUG INTERFACE.
9. Confirm that J5-9 is turned on.
10. Turn off LED 9 by sending the **"led off 4"** command over THE DEBUG INTERFACE.
11. Confirm that J5-9 is turned off.
12. Turn on LED 10 by sending the **"led on 5"** command over THE DEBUG INTERFACE.
13. Confirm that J5-10 is turned on.
14. Turn off LED 10 by sending the **"led off 5"** command over THE DEBUG INTERFACE.
15. Confirm that J5-10 is turned off.
16. Turn on LED 21 by sending the **"led on 6"** command over THE DEBUG INTERFACE.
17. Confirm that J5-21 is turned on.
18. Turn off LED 21 by sending the **"led off 6"** command over THE DEBUG INTERFACE.
19. Confirm that J5-21 is turned off.
20. Turn on LED 20 by sending the **"led on 7"** command over THE DEBUG INTERFACE.
21. Confirm that J5-20 is turned on.
22. Turn off LED 20 by sending the **"led off 7"** command over THE DEBUG INTERFACE.
23. Confirm that J5-20 is turned off.
24. Turn on LED 19 by sending the "**led on 8**" command over THE DEBUG INTERFACE.
25. Confirm that J5-19 is turned on.
26. Turn off LED 19 by sending the "**led off 8**" command over THE DEBUG INTERFACE.
27. Confirm that J5-19 is turned off.
28. Turn on LED 15 by sending the "**led on 9**" command over THE DEBUG INTERFACE.
29. Confirm that J5-15 is turned on.

30. Turn off LED 15 by sending the "**led off 9**" command over THE DEBUG INTERFACE.
31. Confirm that J5-15 is turned off.
32. Turn on LED 2 by sending the "**led on 10**" command over THE DEBUG INTERFACE.
33. Confirm that J5-2 is turned on.
34. Turn off LED 2 by sending the "**led off 10**" command over THE DEBUG INTERFACE.
35. Confirm that J5-2 is turned off.
36. Turn on LED 6 by sending the "**led on 11**" command over THE DEBUG INTERFACE.
37. Confirm that J5-6 is turned on.
38. Turn off LED 6 by sending the "**led off 11**" command over THE DEBUG INTERFACE.
39. Confirm that J5-6 is turned off.
40. Turn on LED 16 by sending the "**led on 12**" command over THE DEBUG INTERFACE.
41. Confirm that J5-16 is turned on.
42. Turn off LED 16 by sending the "**led off 12**" command over THE DEBUG INTERFACE.
43. Confirm that J5-16 is turned off.
44. Turn on LED 1 by sending the "**led on 13**" command over THE DEBUG INTERFACE.
45. Confirm that J5-1 is turned on.
46. Turn off LED 1 by sending the "**led off 13**" command over THE DEBUG INTERFACE.
47. Confirm that J5-1 is turned off.
48. Turn on LED 7 by sending the "**led on 14**" command over THE DEBUG INTERFACE.
49. Confirm that J5-7 is turned on.
50. Turn off LED 7 by sending the "**led off 14**" command over THE DEBUG INTERFACE.
51. Confirm that J5-7 is turned off.
52. Turn on LED 14 by sending the "**led on 15**" command over THE DEBUG INTERFACE.
53. Confirm that J5-14 is turned on.
54. Turn off LED 14 by sending the "**led off 15**" command over THE DEBUG INTERFACE.
55. Confirm that J5-14 is turned off.
56. Turn on LED 3 by sending the "**led on 16**" command over THE DEBUG INTERFACE.
57. Confirm that J5-3 is turned on.
58. Turn off LED 3 by sending the "**led off 16**" command over THE DEBUG INTERFACE.
59. Confirm that J5-3 is turned off.
60. Turn on LED 17 by sending the "**led on 17**" command over THE DEBUG INTERFACE.
61. Confirm that J5-17 is turned on.
62. Turn off LED 17 by sending the "**led off 17**" command over THE DEBUG INTERFACE.
63. Confirm that J5-17 is turned off.
64. Turn on LED 18 by sending the "**led on 18**" command over THE DEBUG INTERFACE.
65. Confirm that J5-18 is turned on.
66. Turn off LED 18 by sending the "**led off 18**" command over THE DEBUG INTERFACE.
67. Confirm that J5-18 is turned off.
68. Turn on LED 11 by sending the "**led on 19**" command over THE DEBUG INTERFACE.
69. Confirm that J5-11 is turned on.
70. Turn off LED 11 by sending the "**led off 19**" command over THE DEBUG INTERFACE.
71. Confirm that J5-11 is turned off.
72. Turn on LED 12 by sending the "**led on 20**" command over THE DEBUG INTERFACE.
73. Confirm that J5-12 is turned on.
74. Turn off LED 12 by sending the "**led off 20**" command over THE DEBUG INTERFACE.

75. Confirm that J5-12 is turned off.
76. Turn on LED 13 by sending the "**led on 21**" command over THE DEBUG INTERFACE.
77. Confirm that J5-13 is turned on.
78. Turn off LED 13 by sending the "**led off 21**" command over THE DEBUG INTERFACE.
79. Confirm that J5-13 is turned off.
80. Turn on LED 4 by sending the "**led on 22**" command over THE DEBUG INTERFACE.
81. Confirm that J5-4 is turned on.
82. Turn off LED 4 by sending the "**led off 22**" command over THE DEBUG INTERFACE.
83. Confirm that J5-4 is turned off.
84. Turn on LED 5 by sending the "**led on 23**" command over THE DEBUG INTERFACE.
85. Confirm that J5-5 is turned on.
86. Turn off LED 5 by sending the "**led off 23**" command over THE DEBUG INTERFACE.
87. Confirm that J5-5 is turned off.

LED Pin Mapping

J5 pin number	Net name	LED command index
8	LED_8	3
9	LED_9	4
10	LED_10	5
21	LED_21	6
20	LED_20	7
19	LED_19	8
15	LED_15	9
2	LED_2	10
6	LED_6	11
16	LED_16	12
1	LED_1	13
7	LED_7	14
14	LED_14	15
3	LED_3	16
17	LED_17	17
18	LED_18	18
11	LED_11	19
12	LED_12	20
13	LED_13	21
4	LED_4	22
5	LED_5	23

88. END OF TEST