OEM - BCM Troubleshooting Guide

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Revision History

Revision	Date	Description
Draft	2/19/2021	Submitted for Peer Review
01	4/9/2021	Initial Release

Definitions, Acronyms, and Abbreviations

Term	Definition
BCM	Brain Control Module
DMM	Digital Multimeter
OEM	Original Equipment Manufacturer
	Examples of commands
	Caution, this might cause serious system problems. Stop and ensure you understand what is being asked.

Overview

This guide provides information on how to troubleshoot BCM related issues for any autonomous floor scrubbers powered by BrainOS. In order to effectively troubleshoot any issue, please review this troubleshooting guide in the order given to determine the proper resolution.

When To Use It

Please proceed with this document if you encounter any of the codes/errors/behavior below:

Assist Codes:

500 - E-Stop Pressed. (Only when excessive and button is not pressed by Operator)

40004 - Problem with the Gyroscope

Error Codes:

700/701 - App Communication error.

0,4 - Error. (Generic errors, not BCM specific)

Behavior:

Flashing control Panel.

Black Screen no fan noise/fan is not spinning.

Black screen with errors. (Not booting up)

Never ending Brain Logo spinner. (Not booting up)

Not booting directly to Scrubber UI.

USB or Ethernet Device not connected.

For more information on the error codes please refer to the OEM Error Code Reference Document

OEM Error Code Doc

https://docs.google.com/document/d/1hSLD42tbcDgnsBum_V72RseWqVDXh2krK0JTI91gT1k/edit?usp=sharing

How To Use It

The BCM Troubleshooting Guide walks you through several important steps in troubleshooting an Autonomous Scrubber:

Part 1: Check Emerging issues and KB.

Part 2: ROC Portal.

Part 3: Conditional. On-Robot troubleshooting. (SSH)

Part 4: Visual Inspection.

Print and update the checklist!

To assist with troubleshooting, there is a troubleshooting checklist on the last page of this document. This checklist needs to be printed, filled out, and submitted along with the pictures and notes.

Required Tool List

The following is the list of tools needed to service xxx related issues for any autonomous floor scrubbers powered by BrainOS.

Item	Image Details
Hex Drivers • 2 mm • 2.5 mm • 3 mm	
7 mm socket wrench	
Digital Multimeter (DMM, Fluke 101 Model or equivalent) Fine Test Leads (Model MICTL-013 or equivalent) or back probes.	 
Cable Tie Cutter	

OEM Diagnostics

Table 1 lists each LED in the left-to-right order found on the board. The power-on sequence lists the order in which the nine LEDs light when the key is turned on.

Table 1: BCM LEDs by color, sequence, and function

Ref. Des.	Color	Description and Function
D28	Red	Power On (PWR_ON)
D23	Green	P24V Ok
D32 (7th LED)	Green	P15V Ok – will not ignite on 124 and higher boards (Tennant, MM)
D31	Green	P12V Ok
D30	Green	P5V Ok
D29	Green	P3V3
D28	Green	S3V3 & S5V Ok – Always on when power applied
D27	Green	ComE Status Ok
D34	Green	Key in On State (KEY_ON

Field Tech Diagnostics

Device checks

Depending on the reported issue we need to verify if BCM is powered at all. This article describes how to read the Brain Control Module (BCM) status LEDs and take voltage measurements to determine the problem if the user interface (UI) screen is dark with the machine powered on. The measurements are taken with the machine powered on and off at different times.

Visual Inspection and Hardware check

This section lists the required steps and measurements to take if the screen remains dark when the machine is powered on.

1. If the machine is connected to the battery charger, disconnect the charger.

2. To turn on the machine, insert the ignition key and turn to the right (clockwise).

3. Verify that the screen remains dark.

4. Verify that the control panel LEDs are on.

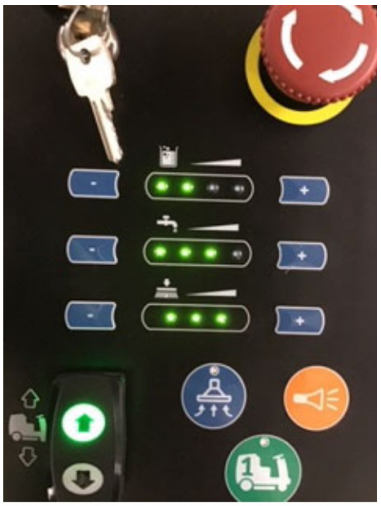


Figure 2: Control Panel with LEDs

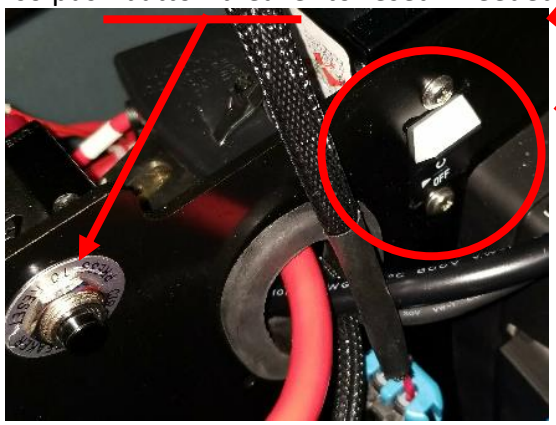
5. Turn off the machine by turning the ignition key to the left (counterclockwise).

6. Lift the operator seat.

7. Disconnect the battery coupling for at least two minutes. (Also known as Hard Reboot.)

8. While waiting, inspect the 20 A circuit breaker if it is not tripped.
If the circuit breaker is tripped, reset the circuit breaker by pressing the switch so that it is flush with the mounting wall.

Tripped Breaker. Note white switch visible. Also push button breaker to reset if needed.



Breaker shown in operable state, white switch is not visible.

9. Turn on the machine
10. If the screen is still dark remove the front panel to expose the BCM.
11. Use a phillips screwdriver to open the BCM side access panel located on the right.
12. Verify that the power sequence LEDs are lit.

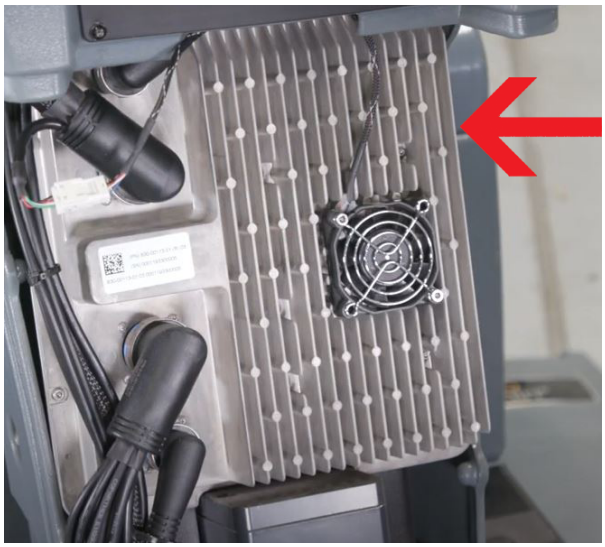


Figure 3: BCM side access panel location

Figure 4: Check the power sequence LEDs

13. Turn off the machine.
14. Verify that one LED remains lit with the machine powered off.

Figure 5: Single LED lit with the power off

17. Turn on the machine while watching the BCM LEDs.
18. Take a photo of the LED sequence.
19. If no LEDs are lit, check for 24 VDC across the red and black terminals immediately to the right of the Motor Amplifier Module (MAM). Either pair of terminals (left or right set) are ok to test.

Figure 6: Check the terminals for 24 VDC

20. If the voltage is low, verify that no circuit breakers in the battery compartment are tripped.
21. Disconnect the battery coupling.

22. Disconnect the BCM power trunk (lower) connector.

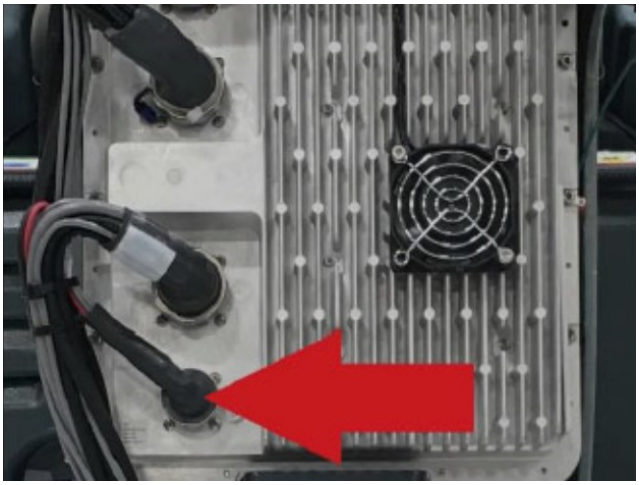


Figure 7: Disconnect the BCM power trunk (lower) connector

23. Reconnect the battery coupling to measure the connector voltage.

24. Using the digital multimeter, check the voltage across the two largest holes in the power trunk (lower) connector.

Figure 8: Check the power trunk voltage

25. Disconnect the battery coupling.

26. Reconnect the BCM power trunk (lower) connector.

27. Based on the measurements, take the applicable action below:

- If all LED power-on sequences are complete, replace the screen.

- If LED D28 is green but D34 never lights, verify the key switch operation and associated wiring. The BCM requires a +24V Key on “enable” input applied at pin 64 of the uptrunk via the key switch to turn on.
- If the LEDs start but do not complete the power-on sequence, replace the BCM.
- If power is measured at the terminal but not at the BCM connector, replace the power trunk cable.

Appendix A – Tech Troubleshooting Checklist

Use the following checklist to keep track of the troubleshooting results, referring to the relevant section in this document for details.

Table 2: BCM Troubleshooting Checklist

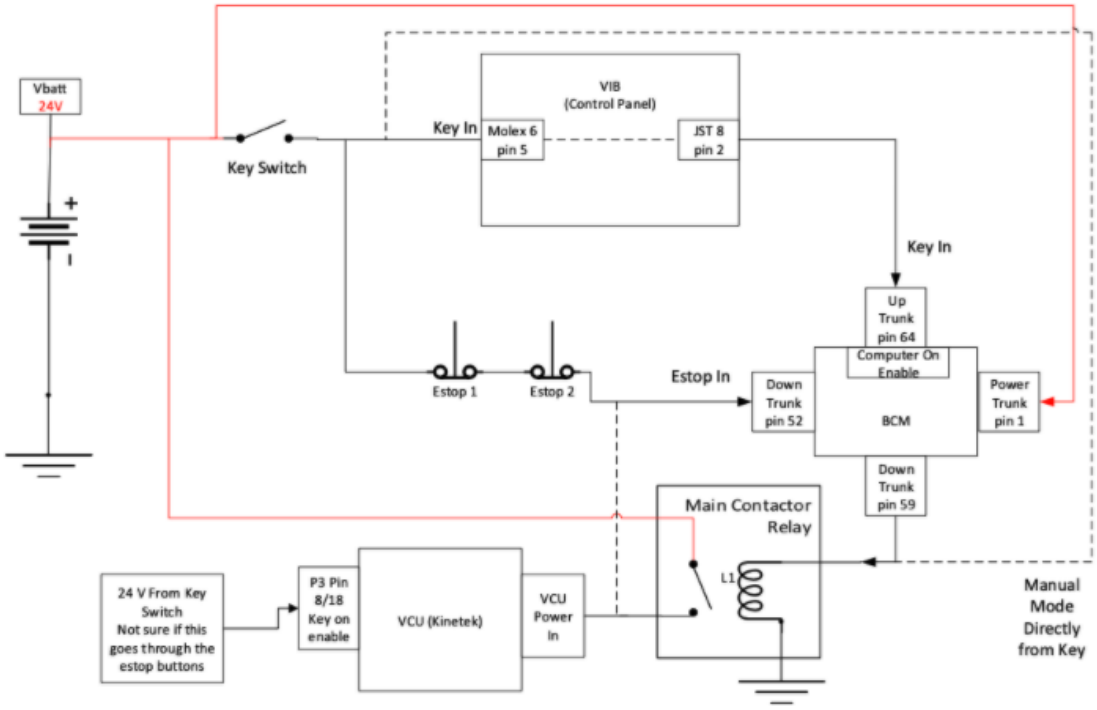
Description	Completed? (Yes/No)	Results (Pass/Fail/Measurements)
Power and LED sequence tested (Photo)		
Connectors and pins inspected		
Power Tests		
Trunks reseated		
Hard reboot performed		

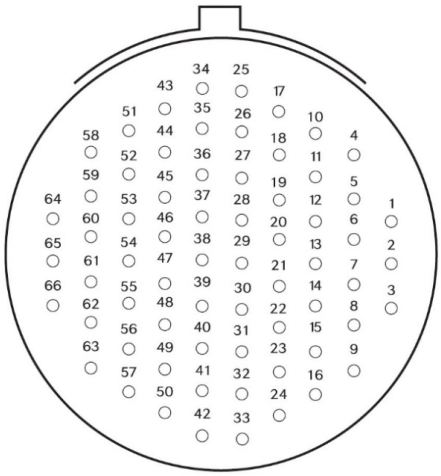
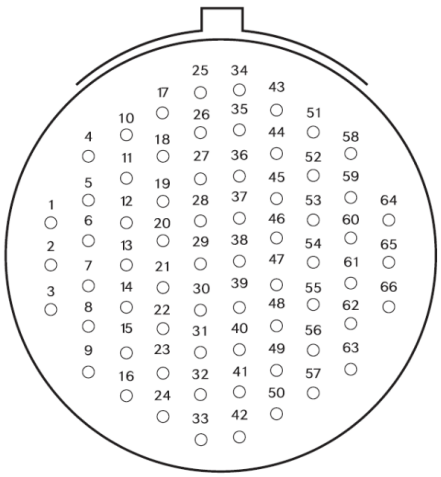
Appendix E -- E-Stop circuit Check

Intermittent or permanent E-Stop pressed alerts when E-Stop buttons depressed.

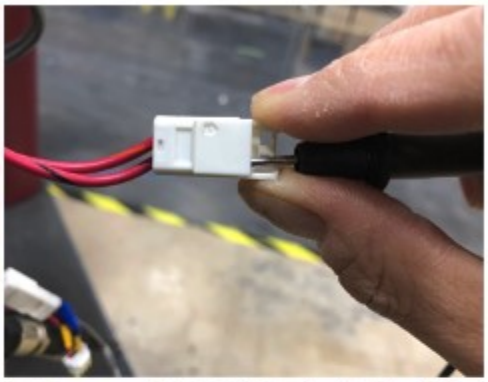
1. Confirm the estop buttons are depressed.
2. Confirm the selector switch is set to autonomous operation.
3. Reconnect the positive battery disconnect
4. Reconnect the power trunk from the BCM
5. Reconnect the down trunk from the BCM

To check the Estop circuit refer to the schematic below:



Down Trunk BCM – D38999 Pin Out	Down Trunk Harness – D38999 Pin Out
	

6. Turn the key to ON.
7. Locate Pins 59 and 52 on the down trunk.
8. Check for continuity (approximately 50 Ohms) from the Master Contactor pin 59 to Pin 59 on Down Trunk.
9. Check for continuity from the Scrubber side of the battery to Pin 52 on the Down Trunk. Continuity check and power 24V should be detected when Key is on.
10. Alternatively, can test E-Stop In/Out cable directly but this method will not show if Down Trunk is the issue.

Tennant	Minuteman
	
	

Line	Description	Values
ESTOP_IN	ESTOP Line In. Usually after ESTOP Button External Connector	24V when Estop Buttons released or Key Switch On 0V when Estop Button pressed or Key Switch Off
ESTOP_OUT	ESTOP Line Out, Usually goes into the Master Contactor Relay Coil External Connector	24V when ESTOP_IN is 24V AND (ESTOP Relay OR BYPASS Relay) are in closed position 0V when ESTOP_IN is 0V OR (ESTOP Relay AND Bypass Relay) are in opened position