Modem Troubleshooting Guide for BrainOS

ROBOTICS ⟩ BrainOS® Powered

This document contains information confidential and proprietary to Brain Corporation. It may not be transmitted, modified, duplicated, disclosed, or distributed without prior written permission of Brain Corporation. This document may only be viewed by third parties under an active non-disclosure agreement (NDA) with Brain Corporation covering the scope of the information herein. If you received or obtained this document outside of these requirements, please destroy all copies and report this error to legal@braincorp.com.

Brain Corporation

Corporate Headquarters
10182 Telesis Court Suite
San Diego, CA 92121 USA

Contact Information
+1-619-333-5590, 5 am – 5pm PST
techservices@braincorporation.com

Table of Contents

Revision History

Revision	Date	Description
01	11/24/20	Initial Release

Definitions, Acronyms, and Abbreviations

Term	Definition
BCM	Brain Control Module
DMM	Digital Multimeter
EMF	Electromotive Force
ICCID	Integrated Circuit Card Identifier
ICD	Interface Control Document
MIM	Mobile IP (Internet Protocol) Module
OEM	Original Equipment Manufacturer

Overview

This guide provides information on how to troubleshoot connectivity related issues for any autonomous floor scrubbers powered by BrainOS. In order to effectively troubleshoot any issue, perform the following:

1) **Print and update the** Troubleshooting Checklist**!**
   To assist with troubleshooting, print, fill out, and submit the following troubleshooting checklist along with the pictures and notes.

2) **Complete the steps in the order they are listed!**
   The following steps are intended to be performed in the exact order listed in this document. NOTE: It is essential to collect pictures and take notes throughout the process.

Troubleshooting Checklist

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

Table 1: Modem Troubleshooting Checklist

Description	Completed? (Yes/No)	Result (Pass/Fail/Measurements)
ROC Connectivity Check 1		ROC icon: LTE Signal strength icon:
Modem & Antenna Check		Damage to cabling? Which cable?: Damage to device? Which device?:
ROC Connectivity Check 2		ROC icon: LTE Signal strength icon:
Power Check: **LT1000 Modem <u>ONLY</u>**		PWR LED (ON/OFF?): STATUS LED:
Voltage Check: M12 (Up Trunk)		Pin 2, 1 : Pin 2, 4 : Pin 2, 3 :
Voltage Check: BCM		Pin 17, 18 : Pin 17, 10 :

Required Tools

The following is the list of tools needed to service the connectivity-related devices:

Table 2: Required Tools

Item	Image Details
Hex Drivers • 2 mm • 2.5 mm • 3 mm • 5 mm	
7 mm socket wrench	
Cable Tie Cutter	
Digital Multimeter (DMM, Fluke 101 Model or equivalent)	
Fine Test Leads (Model MICTL-013 or equivalent) or back probes.	

ROC Connectivity Check 1

1) Manually drive the machine near an outdoor area (such as store entrance or a covered area like a garden center, as applicable to the store). This is for cell reception purposes to avoid obstacles like concrete, EMF from other devices, etc. from interfering with the reception to the modem.
2) Turn off the machine.
3) Lift the seat and locate the red Anderson connector. Decouple the cables for 3 minutes (timed) then reattach the two ends.

Figure 1: Anderson Connector

4) Restart the machine and wait 2-3 minutes after the machine has fully booted up to the Security PIN screen and for the ROC and other icons to update to the correct status.
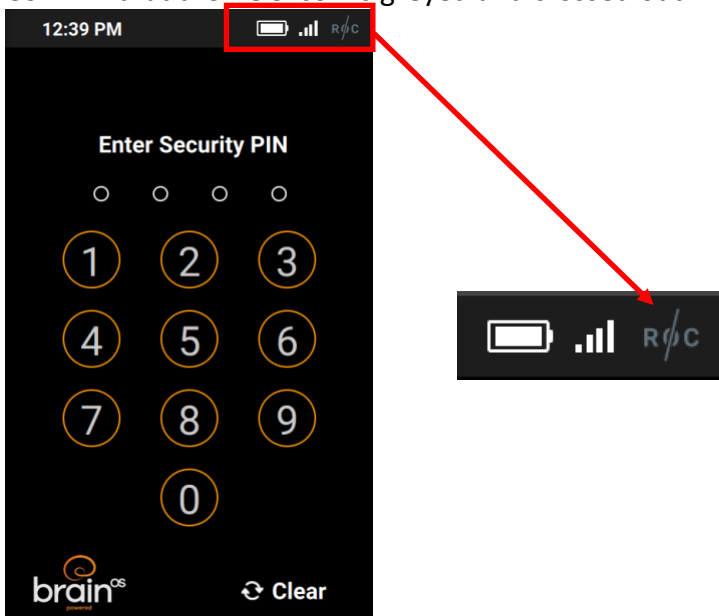5) Confirm that the ROC icon is greyed and crossed out.

Figure 2: Security PIN screen and ROC Connection Status

NOTE: If the machine does not boot to the Security PIN screen, the icons will not update and will not show the correct status.

6) Once ROC status is confirmed as disconnected, type in the security PIN for the machine.
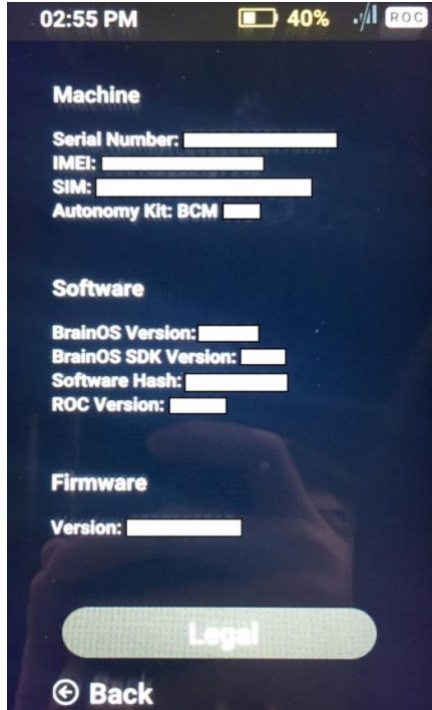7) Go to Settings -> About to display the machine information.

Figure 3: About screen

8) 📷 Take a photo of the information on the About screen. 📷
9) Continue on to the next section.

Hardware Inspections

Checking the Modem & Antenna

1) Turn off the machine.
2) Raise the seat and decouple the red Anderson connector (see Figure 1).
3) Use a 2.5 mm hex driver to remove the control panel screws.

Figure 4: Control Panel

4) Lift up the control panel to expose the modem mounted on the underside of the panel.
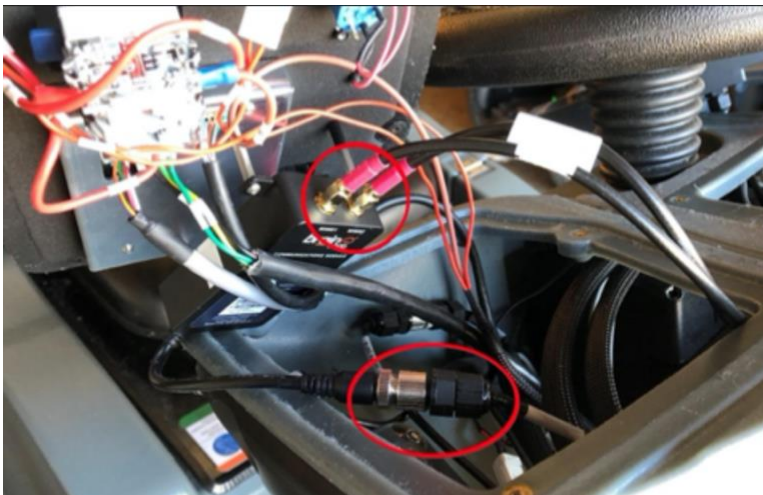

Figure 5: Modem Mounted underneath Control Panel

5) Note the modem type. It will either be a Brain Corp Communications Module or an LT 1000 Modem.

For the Brain Corp communication module, look for the "Communications Module" sign across the top of the device, underneath the Brain Corp logo. There are three connections which interface to the Brain Communication Module: M12 connector, 2 antenna connectors (MIM01 & MIM02).

M12 Connector

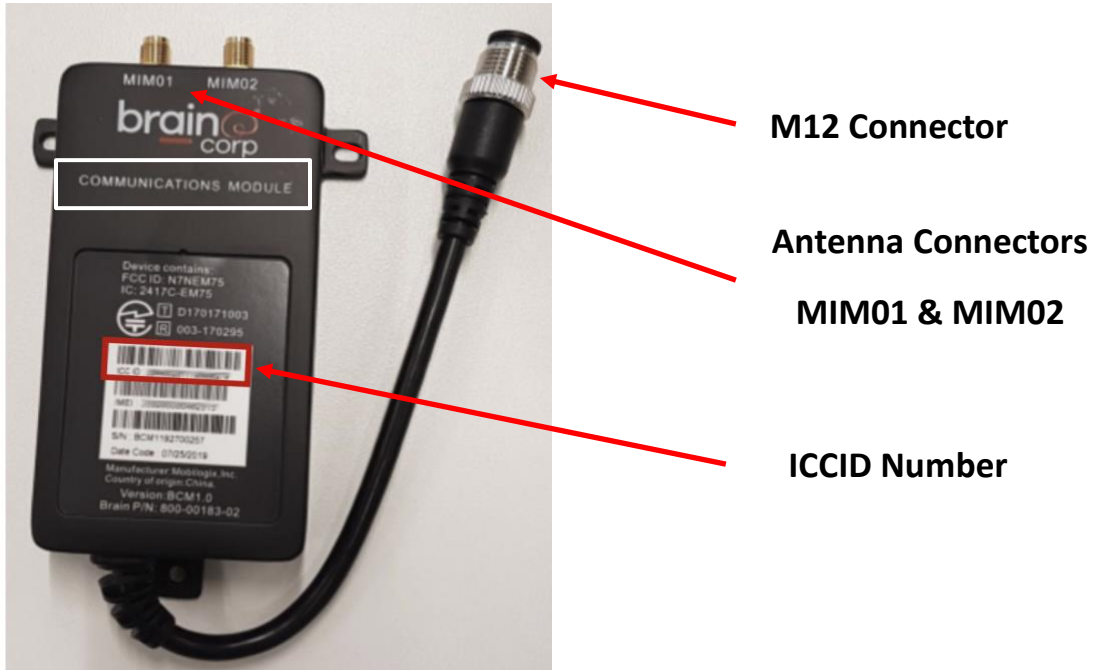**Antenna Connectors**

MIM01 & MIM02

ICCID Number

Figure 6: Brain Communication Module

1) Inspect the modem for physical issues.

2) Disconnect, inspect and reconnect the cables from the modem to the antenna (MIM01 and MIM02), and the power cable (from the up trunk/upper harness to the modem).

3) 📷 Take a picture of the ICCID number on the modem (example shown above). 📷

LT 1000 Modem

For the LT 1000 Modem, there are four connections which interface with the LT 1000 Modem: mini USB Power connector, micro USB Data connector and 2 antenna connectors: MIM01 and MIM02.
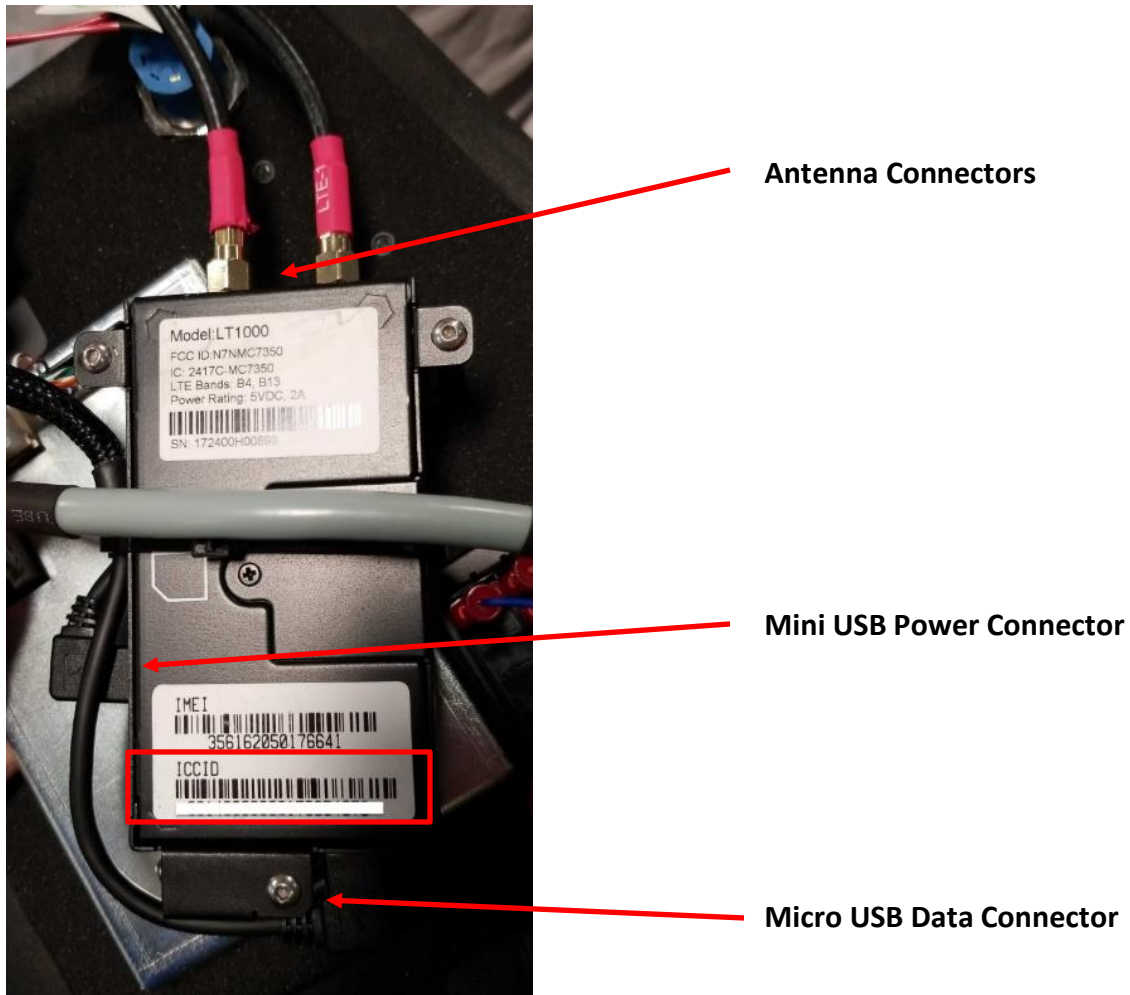

Figure 7: LT 1000 Modem

1) Inspect the modem for physical issues.

2) Disconnect, inspect and reconnect the cables from the modem to the antenna (MIM01 and MIM02), and the power cable (from the up trunk to the modem).

3) 📷 Take a picture of the ICCID on the modem (example shown above). 📷

Modem and Antenna related issues

This section addresses physical issues with the modem, antenna and cabling to the modem. If any of the issues below are applicable, reference the solution code and recommended actions in the solution table at the end of this document.

Modem Damaged

If the modem is visibly damaged (cut, torn or burnt wire, bent pins, etc.) or the MIM01 and MIM02 connectors on the modem spin, the modem needs to be replaced. Refer to solution code MODEM-01.

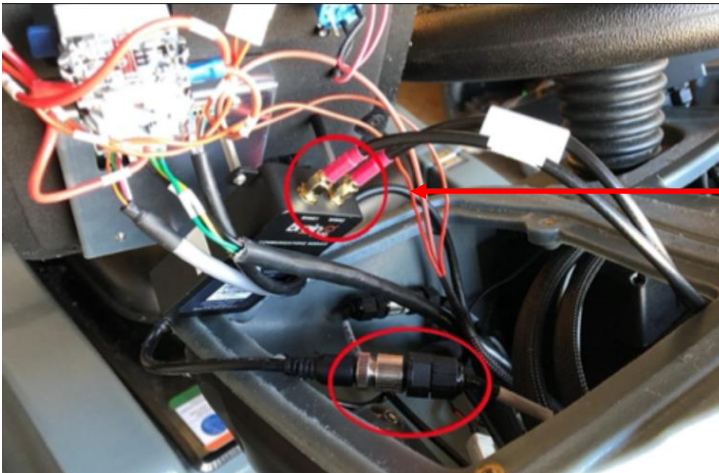**Figure 8: Modem MIM connectors (indicated by orange lines) should not spin**

Antenna wiring damaged

1) Locate the antenna under the touchscreen display.

Figure 9: Antenna location underneath touchscreen display

2) Ensure the antenna MIM01 and MIM02 cables connected to the modem are secure (hand tight).

MIM01, MIM02 Cables

Figure 10: Ensure antenna cables are secure

3) If the cables make a sharp 90 degree turn out of the modem, feel the wiring for possible internal breakage. If the wiring to the antenna is damaged (cut, torn or burnt wires, bent pins, etc.), refer to solution code ANTENNA-01.

ROC Connectivity Check 2

1) Return to the seat area.
2) Recouple the Anderson connector (see Figure 1).
3) Turn on the machine.
4) After the machine starts up and displays the PIN Code, wait about 3 minutes.
5) Verify if the connectivity issue is persisting (checking the ROC icon on the display). If connectivity is established, the ROC icon should be white. If there is still no connectivity, the icons will still be greyed out.

Figure 11: ROC Connection Status

6) If the issue persists, leave power to the machine ON and proceed to the next section.

Power and Voltage Check

Power LED Light Check (LT 1000 Modem ONLY)

1) Ensure the machine is powered on.

2) The modem has two LEDs labeled: **Status** and **PWR**. The **PWR** LED should stay on constantly once the machine is powered ON.

3) Check that the **PWR** LED is ON solid.

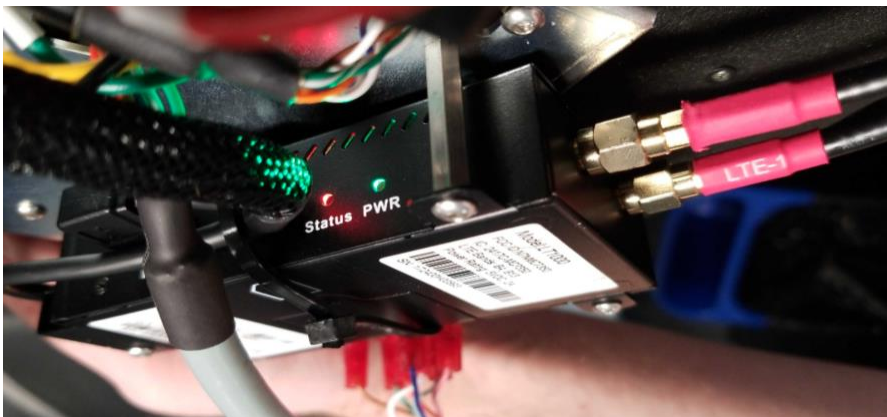

Figure 12: LT 1000 Modem LED Indicators

4) 📷 Take a picture of the LED lights on the modem 📷

5) The **Status** LED will change states according to the table below.

NOTE: The blink pattern of the **Status** LED.

Table 3: Status and LED State Table

Status	LED State
Power Up	OFF
Camping	ON
Searching Network	Flash (50% duty cycle, 2Hz)
Registered	ON
Data Transfer	Flash (20% on) 2Hz, 3Hz, 4Hz, 5Hz Increasing as transfer rate increases

6) **If both LEDs are OFF,** proceed to the next section.
7) **If both LEDs are ON**, note this on the Troubleshooting Checklist, and verify if the ROC icon is ON from the display. If not, please contact Brain Corp Tech Support.

Up Trunk- Modem- Side Voltage Check

1) Unplug the M12 power connector going to the modem.
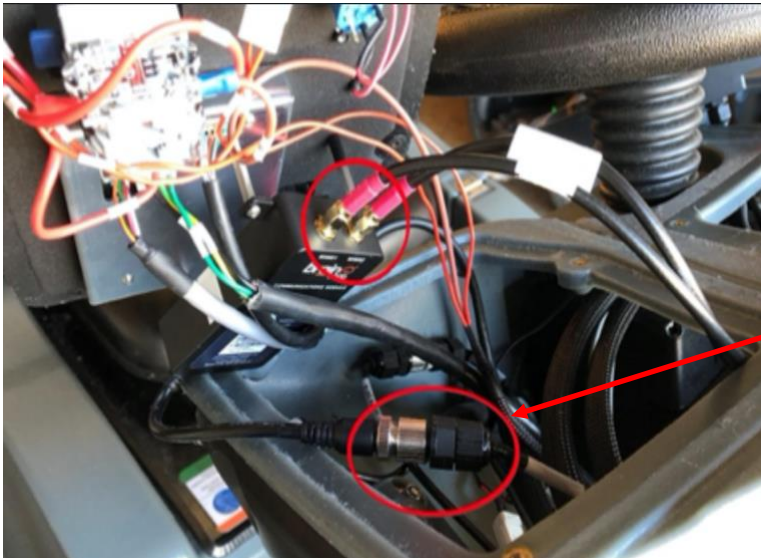
M12 Power Connector

Figure 13: M12 Power Connector

2) Using the Digital Multimeter (DMM), measure the voltage at the pins on the M12 female connector as shown below (note the location of the M12 notch).
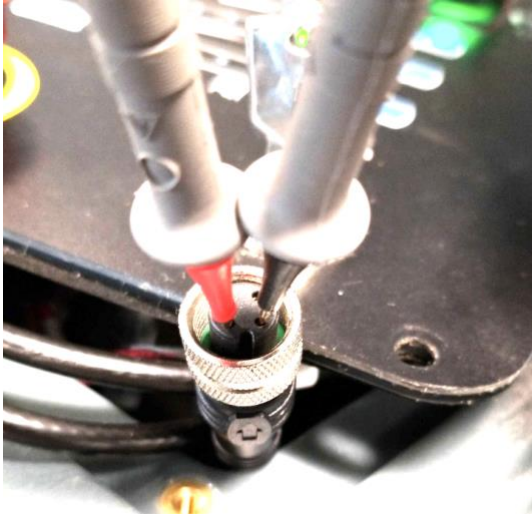
Figure 14: Red voltmeter probe on pin 2

    a) Measure voltage across pins 2 and 1. Expected voltage: About 5VDC. Record exact measured voltage in the checklist.

    b) Measure voltage across pins 2 and 4. Expected voltage: About 5VDC. Record exact measured voltage in the checklist.

    c) Measure voltage across pins 2 and 3. Expected voltage: About 5VDC. Record exact measured voltage in the checklist.
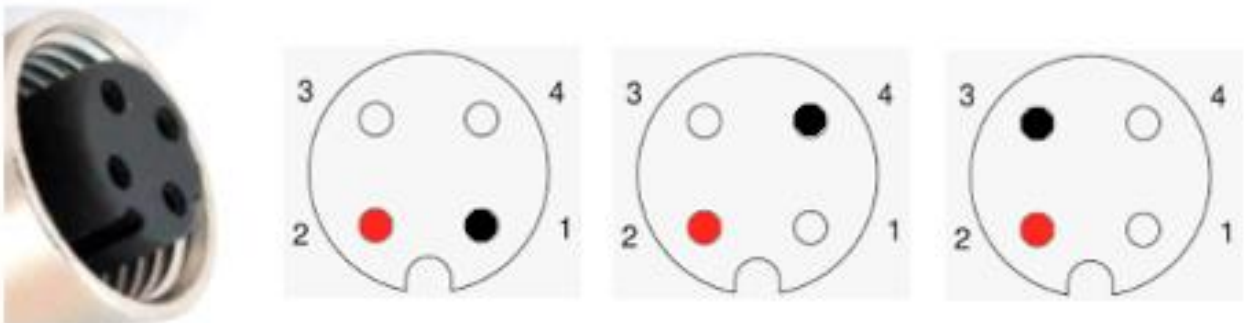

Figure 15: Female M12 Connector and Pin Voltage Measurements

3) If there is voltage measured across ALL of the three pins, call Brain Corp Tech Support for further assistance. NOTE: Ensure all pictures and the checklist are ready to be sent to Tech Support ahead of the call.

4) If there is no voltage reading across one of the three sets of pins, then proceed to the next section.

Brain Control Module (BCM) - Voltage Check

1) Turn off the machine, lift the seat and decouple the Anderson connector (see Figure 1).
2) Using a 5 mm hex driver, remove the front plastic shield.

Figure 16: Removing both access panels

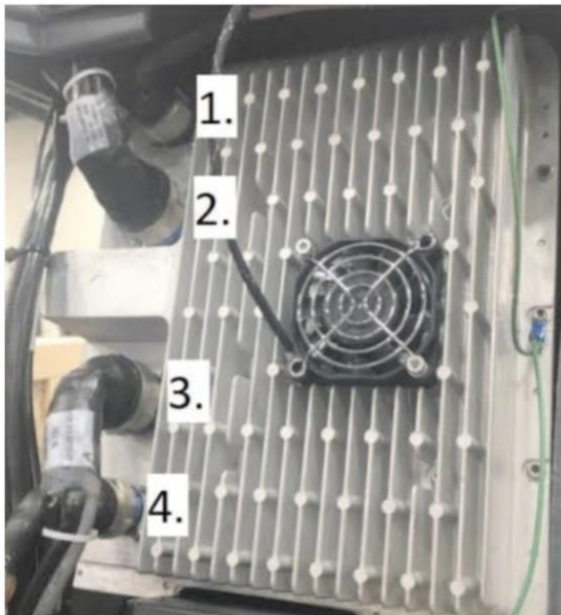3) Remove the up trunk (connection #2) to inspect wiring for physical issues.

Figure 17: BCM Connections

4) 📷 Take pictures of the up trunk male connector on the BCM side and the condition of the pins. 📷
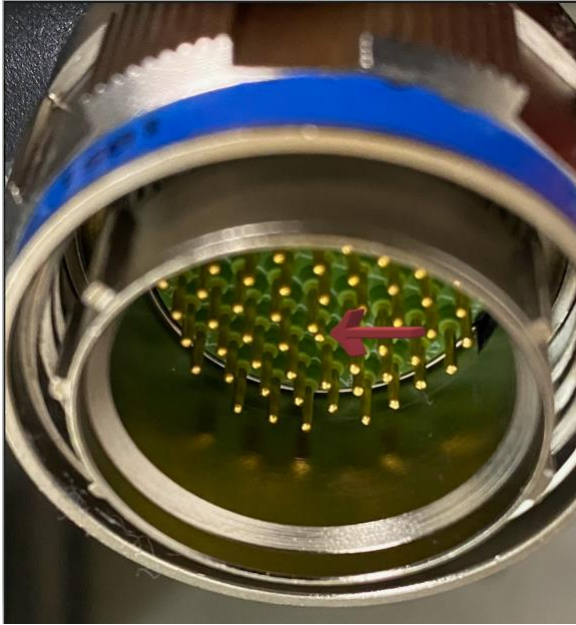
Figure 18: Example of Up Trunk with pushed pins

5) Recouple the Anderson connector and turn on the machine.
6) Measure the voltage directly at the BCM connector #2.

Figure 19: red voltmeter probe on pin 17

7) Measure voltage across pins 17 and 18. Expected voltage: About 5VDC. Record exact measured voltage in the checklist.
8) Measure voltage across pins 17 and 10. Expected voltage: About 5VDC. Record exact measured voltage in the checklist.

9) If you measure voltage on BOTH sets of pins, turn off the machine, reconnect the up trunk connector on the BCM side, then turn on the machine and go to the Up Trunk-Modem-Side Voltage Check section to perform voltage check on the M12 connector again.

10) If no voltage is measured on EITHER set of pins, continue to the next section.

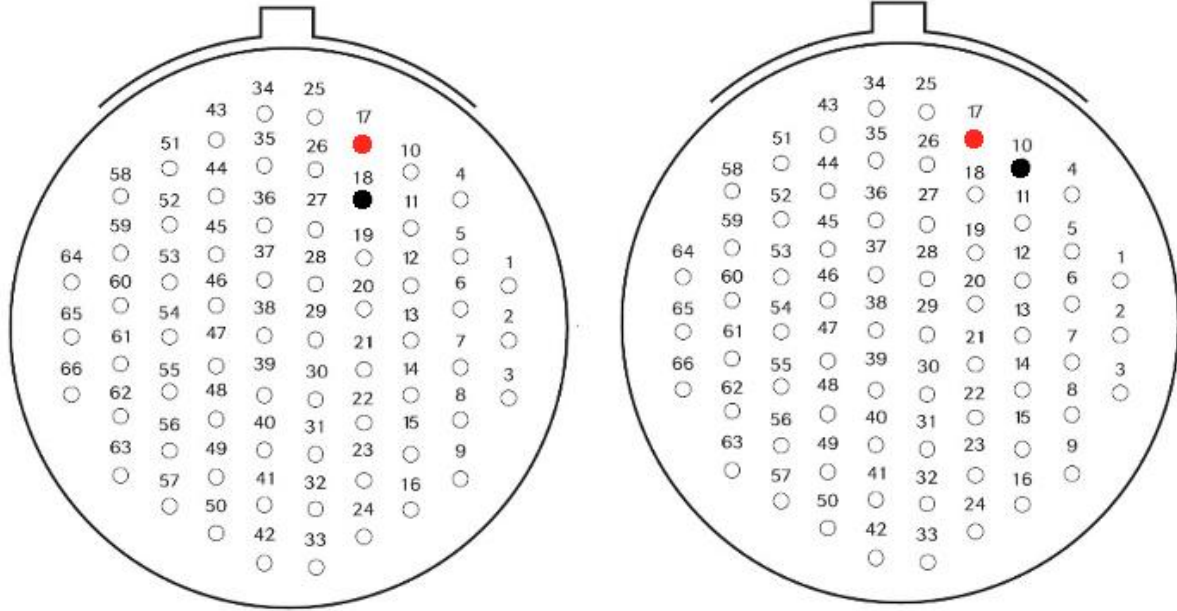**Figure 20: Example of BCM PIN with power**

Power Related issues

No power on BCM

If no voltage is measured at the BCM pins, refer to solution code BCM-02.

Up Trunk Cable damaged

If no voltage is measured on one of the three sets of pins or if bent pins are found, please refer to solution code UPTRUNK-01.

NOTE: If there is still no connectivity but all checks have passed, try bringing the machine outside or to an outdoor entrance (as close to the outside as permissible) and extracting the modem and antenna (retaining all power and communication interconnections) from the machine and resting them on a flat surface on the machine (e.g. the seat). Then, with the machine on, observe if signal strength optimizes.

Contacting Technical Support

Now that you have completed the checklist and taken all pictures, call Brain Corp Technical Support to discuss results. Submit the Troubleshooting Checklist and all pictures requested.

Appendix A - Solution Tables

The following tables are provided as individual solutions for issues that were identified in the preceding document.

Modem Replacement

Solution code	Recommended actions

MODEM-01	If the modem is visibly damaged (cut, torn or burnt wires, bent pins, etc.), or the MIM01 and MIM02 connectors spin and are not locking when tightened, please perform the following steps:
	1) Send any photos, notes, and/or a filled out Troubleshooting Checklist to Brain Corp using the e-mail address specified in the work order.
	2) Place an order for a modem.
	   a) If you are located in the Canada or Japan, order this part: Global CAN/JPN Modem
	   b) If you are located in the USA, Europe or Australia, order the following part: Global USA Modem
	3) Please schedule the next site visit based on the tracking information for the part.
	4) Replace the modem.

Antenna Replacement

Solution code	Recommended actions
ANTENNA-01	If the wiring to the antenna is damaged (cut, torn or burnt wires, bent pins, etc.) please perform the following steps: 1) Send any photos, notes, and/or a filled out Troubleshooting Checklist to Brain Corp using the e-mail address specified in the work order. 2) Place an order for an antenna. 3) Please schedule the next site visit based on the tracking information for the part. 4) Replace the antenna.

BCM Replacement

Solution code	Recommended actions
.BCM-02	If the BCM voltage readings are not present, perform the following steps: 1) Send any photos, notes, and/or a filled out Troubleshooting Checklist to Brain Corporation using the e-mail address specified in the work order. 2) Advise Brain Corporation that no voltage is measured at the BCM pins.

Up Trunk Replacement

Solution code	Recommended actions
.UPTRUNK-01	If the up trunk cable has no voltage measured in one of the three sets of pins or wiring is damaged (bent, missing pins), please perform the following steps: 1) Send any photos, notes, and/or a filled out Troubleshooting Checklist to Brain Corp using the e-mail address specified in the work order. 2) Place an order for a new up trunk. 3) Please schedule the next site visit based on the tracking information for the part. 4) Replace the up trunk.