

Modem Troubleshooting Guide for BrainOS Version 06

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.

©2023 Brain Corporation. All rights reserved.

Brain Corporation

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

Contact Information
+1-619-333-5590, 5 am – 5pm PST
oem.support@braincorp.com

Table of Contents

Revision History	4
Definitions, Acronyms, and Abbreviations	4
Overview	5
Required Tools	5
Testing Requirements	5
Perform a Hard Reset	6
Check the Modem & Antenna	9
Brain Corp Communications Module	11
Modem and Antenna Related Issues	12
Modem Connectivity Check	13
Swap Modem with Right 2D Camera	14
Modem Voltage Check	15
Modem Up Trunk Continuity Test	16
Additional Steps	19
Appendix A - Solution Tables	20
Modem Replacement	20
MODEM-01	20
Antenna Replacement	20
ANTENNA-01	20
BCM Replacement	21
BCM-01	21
Up Trunk Replacement	21
UPTRUNK-01	21
Appendix B – Troubleshooting Checklist	22

Revision History

Revision	Date	Description
01	11/06/20	Initial Release
02	1/2/21	New UI Screens Updated
03	6/5/23	Review and updates
04	6/14/23	Added additional Steps section
05	6/14/23	Removed BCM voltage test
06	7/1/23	Update modem to 2D camera swap process

Definitions, Acronyms, and Abbreviations

Term	Definition
BCM	Brain Control Module
DMM	Digital Multimeter
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 checklist!

To assist with troubleshooting, there is a troubleshooting checklist on the last page of this document ([Appendix B](#)). This checklist needs to be printed, filled out, and submitted 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.

Required Tools

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

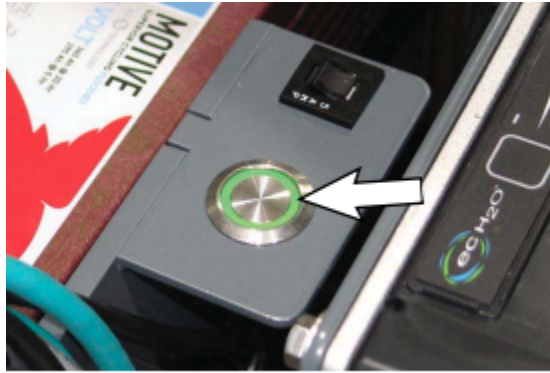
- Service manual for the equipment
- Hex Drivers
 - 2 mm
 - 2.5 mm
 - 3 mm
- 7 mm socket wrench
- Cable Tie Cutter
- Digital Multimeter (DMM, Fluke 101 Model or equivalent)
- Fine Test Leads (Model MICTL-013 or equivalent) or back probes.

Testing Requirements

Make sure the machine is in a good cellular network reception area. That is usually an area near a door, open loading dock door, or just outside the building in the parking lot. Don't try to perform the connectivity tests in the back area of the store or an area with poor cell phone coverage.

Perform a Hard Reset

- 1) Turn the machine off:
 - a) Key the machine off
 - b) If a scanning tower is installed, lift the seat and verify the ring around the button is dark. If it is solid green or flashing green, press the silver button for 3 seconds to initiate a shutdown



- c) Wait 2 minutes for the systems to shutdown.
- 2) Lift the seat or access the area where the batteries are located.
- 3) Locate the red Anderson battery connector and decouple it for 3 minutes.



Figure 1: Red Anderson Battery Connector

- -
 -
 - 4) After waiting for the required time, reconnect the Anderson connector and close the battery compartment.

- 5) Restart the machine:
 - a) Turn the key to the “On” position
 - b) If a scanning Tower is installed, press the silver under seat button for 3 seconds to initiate power on
 - c) Wait 3 minutes for the Security PIN screen to appear.
- 6) Look at the top of the display screen for the Battery, LTE and cloud icons.
- 7) Check the Cloud icon to determine if it is gray and crossed out which indicates not connected or it is a white cloud which indicates a connection. The below example shows no connection to the cloud.



Figure 2: Security PIN screen and Cloud Connection Status

- 8) If the machine does not reboot to the Security PIN screen, the icons will not update or show the correct status. In this situation, wait 5 more minutes for the boot to complete. If the Security PIN screen doesn't show up, repeat the above process from step 1.
- 9) If the cloud shows a connection
 - a) Verify the robot is online by either checking with Brain support or confirm the number of pending uploads at the top of the display screen is decreasing.
 - b) If the modem is working, troubleshooting is completed.
- 10) If the cloud shows disconnected (grayed out with line through the cloud), type in the security PIN for the machine.

NOTE: If the machine has a scan tower, the LTE bars will be crossed out and the machine will run off wifi.

- 11) Go to Settings -> About page to display the machine information. Take a photo of this page.

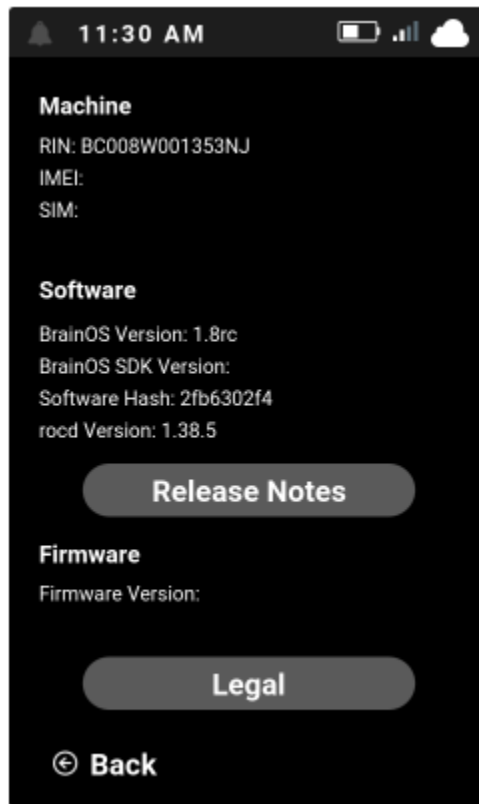


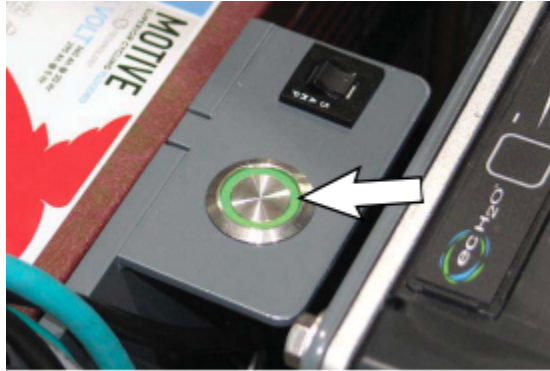
Figure 3: About Screen

- 12) Continue on to the next section.

Hardware Inspections

Check the Modem & Antenna

- 1) Turn the machine off:
 - a) Key the machine off
 - b) If a scanning tower is installed, lift the seat and verify the ring around the button is dark. If it is solid green or flashing green, press the silver button for 3 seconds to initiate a shutdown



- c) Wait 2 minutes for the systems to shutdown.
- 2) Lift the seat or open the area where the batteries are located.
- 3) Locate the red Anderson battery connector and decouple it



Figure 4: Anderson Connector

- 4) Use a 2.5 mm hex driver to remove the control panel screws.



Figure 5: Control Panel

- 4) Lift up the control panel to expose the modem mounted on the underside of the panel.
Note - Refer to the service manual for the machine you are working with to confirm the location of the modem.

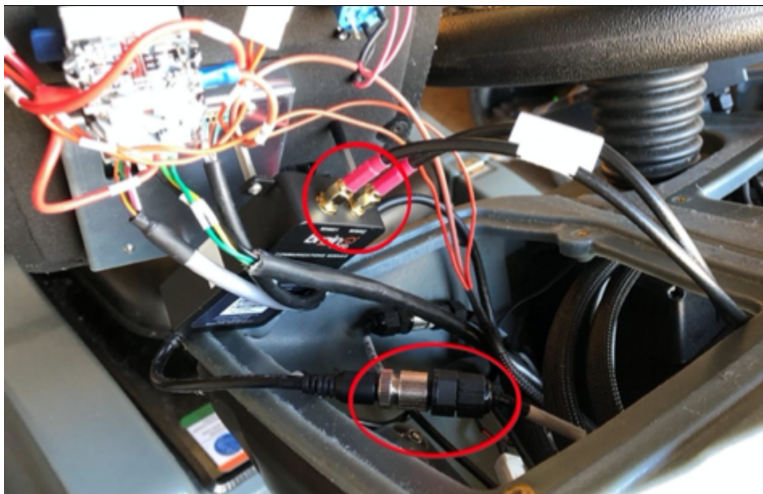


Figure 6: Modem Mounted underneath Control Panel

- 5) All current modems are labeled “Brain Corp Communications Module”.

Brain Corp Communications Module

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).

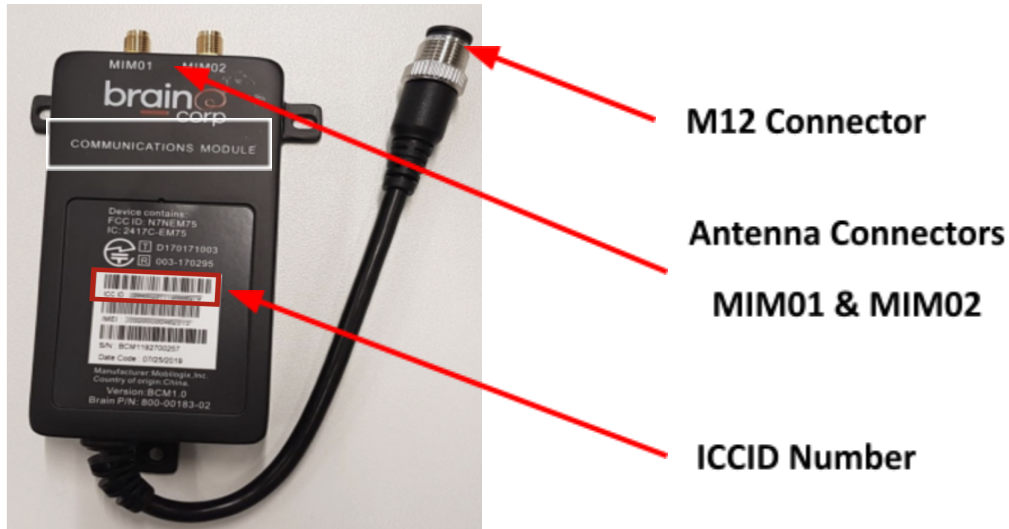


Figure 7: Brain Communication Module

- 6) Inspect the modem for physical issues; damage, broken cables, loose connections.
- 7) Disconnect and inspect the cables from the modem to the antenna (MIM01 and MIM02), and the power cable (from the up trunk/upper harness to the modem). Note any connector damage, broken or burnt wires, and any sharp bends in the cables.
- 8) 📷 Take a picture of the modem label to include the ICCID number as shown in the example above. 📷
- 9) Compare the ICCID on the modem to the picture taken of the About screen. The ICCID should match. If it doesn't match, note this in your ticket and inform Brain Support.
- 10) Trace the antenna cables (MIM01 & MIM02) from the modem down to the antenna. Note the antenna is normally under the left side display screen but on some machines it may be in a different location. The display panel or other panels will need to be removed to access the antenna.
- 11) If the modem or antenna cables are damaged, see the next section for “Modem and Antenna Related Issues”.
- 12) Reconnect the cables making sure to hand tighten them to avoid damaging the modem.
- 13) Go to page 13 and complete the “Modem Connectivity Test” section.

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 9: Modem MIM connectors (indicated by orange lines) should not spin

Antenna wiring damaged

If the cables make a sharp 90 degree bend out of the modem, feel the wiring for possible internal breakage. If the wiring to the antenna is damaged, refer to solution code [ANTENNA-01](#).

Modem Connectivity Check

- 1) Return to the seat / battery area and reconnect the Anderson connector.



Figure 12: Anderson Connector

- 2) Turn on the machine by turning the key.
- 3) If a scanning Tower is installed, press the silver under seat button for 3 seconds to initiate power on
- 4) Wait 3 minutes for the machine to fully boot up to the Security PIN screen.
- 5) Look at the top of the display screen for the Battery, LTE and cloud icons.
- 6) After the machine displays the PIN Code request, wait about 3 minutes.
- 7) If the machine does not reboot to the Security PIN screen, the icons will not update or show the correct status. In this situation, wait 5 more minutes for the boot to complete. If the Security PIN screen doesn't show up, key off the machine, wait 5 minutes, then restart the process from step 2 above.
- 8) If the cloud shows a connection, verify the robot is online by either:
 - a) Confirming the number of pending uploads at the top of the display screen is decreasing.
 - b) Running the modem test under Service Tools (Settings > Service Tools > Network > Cloud Connection and Modem/Antenna tests)
 - c) Contacting Brain Support for connection confirmation
- 9) If the modem is working, troubleshooting is completed.
- 10) If the cloud shows disconnected (grayed out with line through the cloud), type in the security PIN for the machine.
- 11) If the issue persists, proceed to the next section.

Swap Modem with Right 2D Camera

As a test, the modem can be connected to the right 2D camera port to verify it is working.

- 1) Key off the machine and wait for it to power off.
- 2) Locate the modem and disconnect the M12 connector going to it.
- 3) Locate the right 2D camera in the same area as the modem and disconnect the M12 connector going to the camera.
- 4) Connect the modem to the right 2D camera cable. Tighten the connector hand tight.
- 5) Leave the right 2D camera disconnected.
- 6) Key on the machine and wait for it to power up.
- 7) Log in with the PIN code and wait 3 minutes for the modem to connect.
- 8) Look at the top of the display screen for the Battery, LTE and cloud icons to determine if the modem is connecting.
- 9) If the cloud shows a connection, verify the robot is online by doing one of the following:
 - a) Confirm the number of pending uploads at the top of the display screen is decreasing.
 - b) Run the modem test under Service Tools (Settings > Service Tools > Network > Cloud Connection and Modem/Antenna tests)
 - c) Contact Brain Support for connection confirmation
- 10) If the modem is not connecting, it is most likely failed and should be replaced.
- 11) If the modem is connecting, the modem is functional and no replacement is needed.
- 12) Key off the machine and wait for it to power off.
- 13) Reconnect the modem cable to the modem and the right 2D camera cable to the right 2D camera.

Modem Voltage Check

- 1) With the machine turned on, unplug the M12 power connector going to the modem.

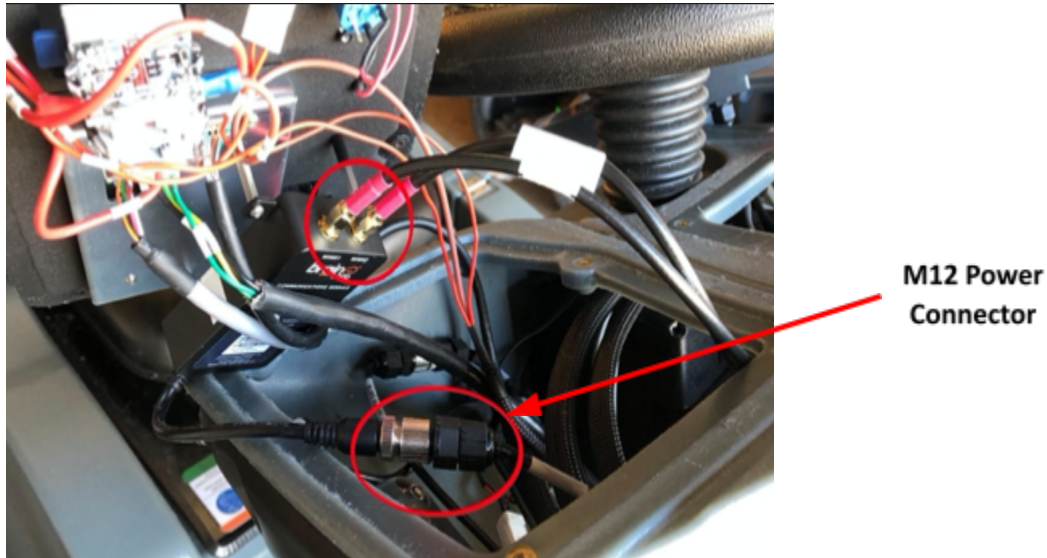


Figure 14: M12 Power Connector

- 2) Using the Digital Multimeter (DMM) set to DC voltage, measure the voltage across pins 2 (+) and 4 (-) on the M12 female connector as shown on the next page (note the location of the M12 notch). You may need to use short wires or smaller probes to make contact with the connector.

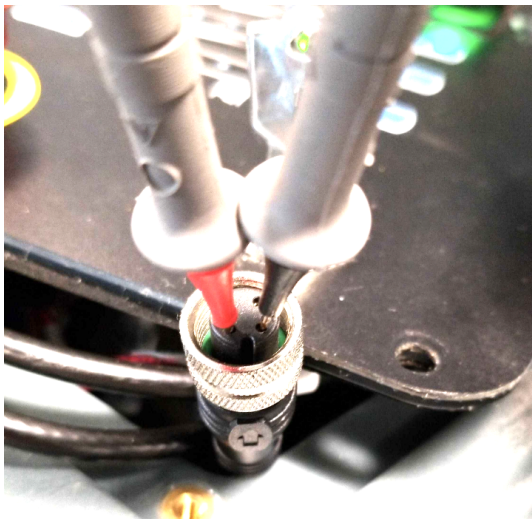


Figure 15: Red voltmeter probe on pin 2

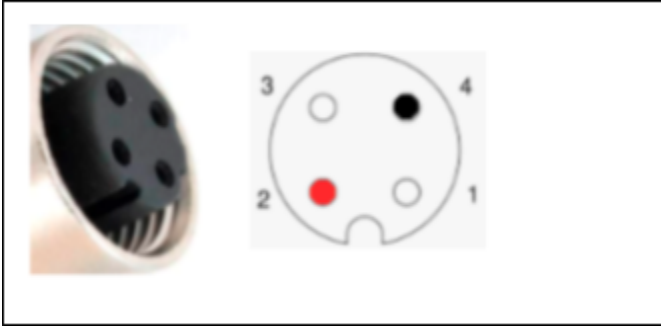


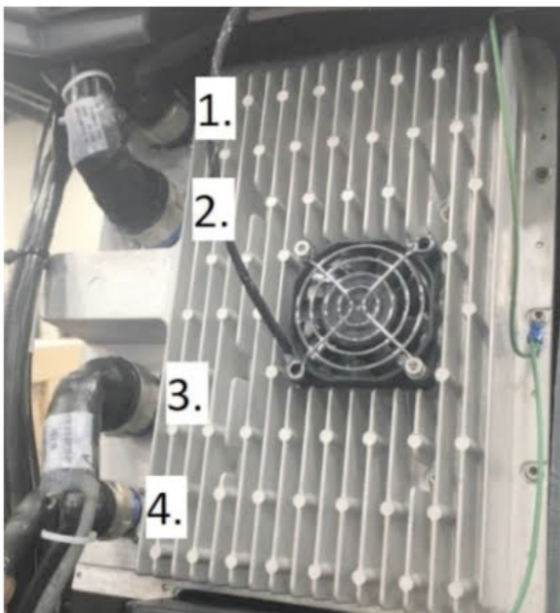
Figure 16: M12 Female Connector and Pin Numbering

- 3) There should be 5vdc present across these pins with the key switch on.
- 4) If there is 5vdc present, reconnect the M12 cable to the modem then contact Brain Corp Technical support with the modem ICCID number to request further assistance.
- 5) If there is no voltage reading across these pins, then proceed to the next section.

Modem Up Trunk Continuity Test

1. Key off the machine and let it completely shutdown (Wait 2 minutes).
2. Access the battery compartment and disconnect the Anderson connector.
3. Remove the front panel covering the Brain Control Module (BCM).
4. With the trunk cables on the left side of the BCM when viewed from the front, remove the 2nd trunk cable from the top by unscrewing it counter-clockwise.

 **Note that the BCM can be installed with the trunk cables on the right side which makes the Up Trunk the 3rd cable down from the top. Refer to the machine's service manual.**



5. Inspect the trunk cable for any bent, loose, or pushed pins. Any damaged pins will require a new trunk cable.

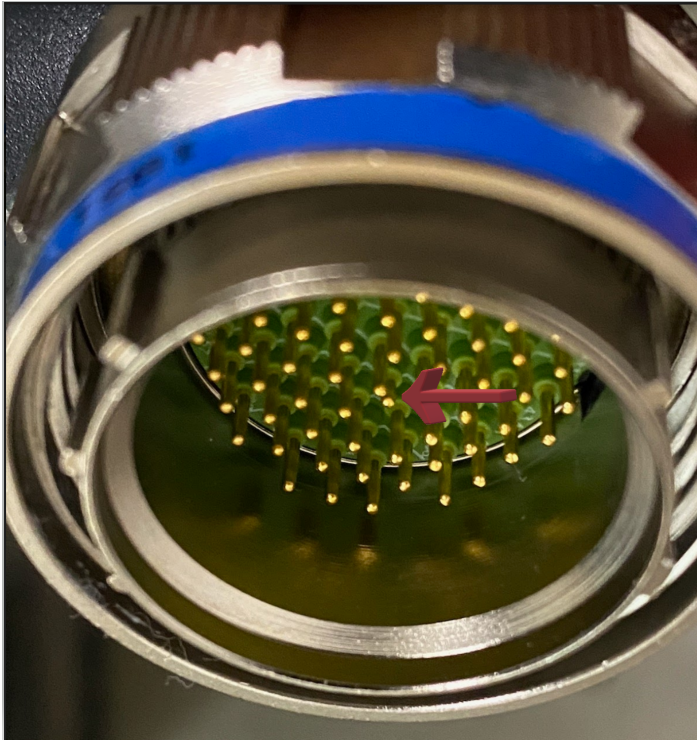


Figure 16: Example of Up Trunk with a pin shorter than surrounding pins (Pushed Pin)

6. With the Digital MultiMeter (DMM) set to test continuity or ohms, test continuity from the BCM connector back to the modem M12 connector on the following pin pairs. See next page for connector pin outs.

BCM Connector	Modem M12 Connector	Continuity Yes / No
Pin 10	Pin 1	
Pin 17	Pin 2	
Pin 11	Pin 3	
Pin 18	Pin 4	

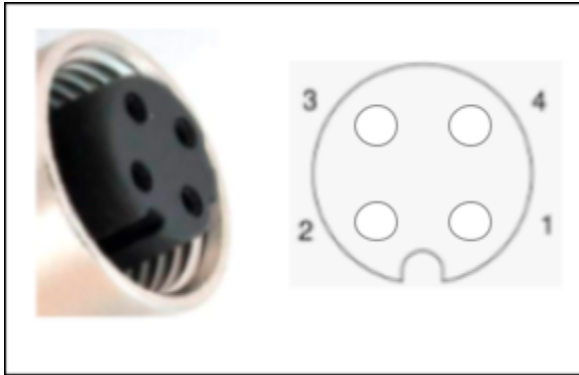


Figure 17: Modem M12 Pin Outs

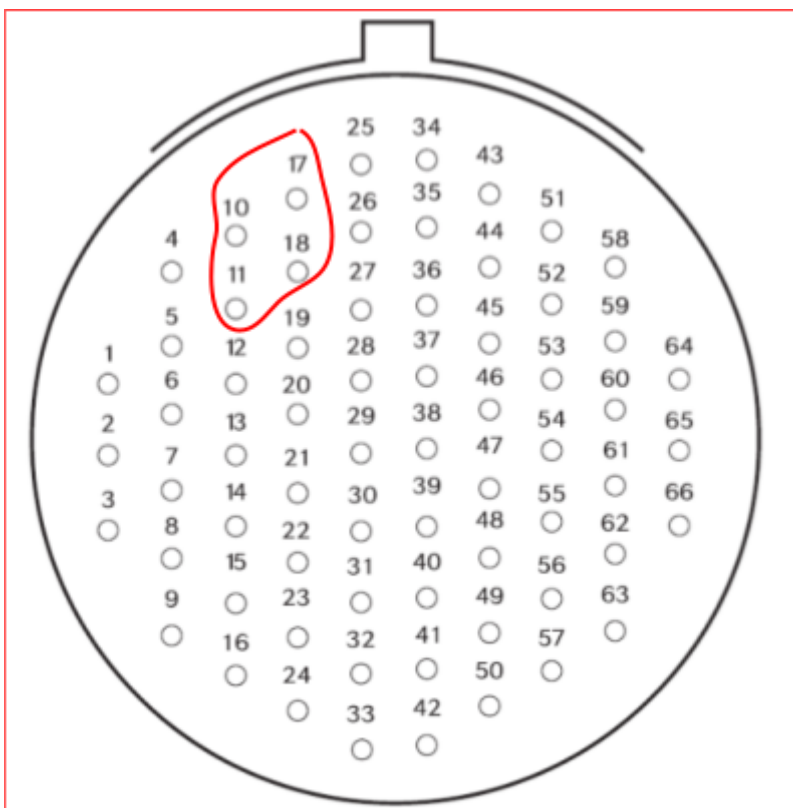


Figure 18: Up Trunk harness connector pin outs

7. When probing the pins, you may need a wire jumper or smaller probes in order to make a connection.
8. If any of the connections do not show connectivity or any pins are damaged, the up trunk cable needs to be replaced. Refer to [UPTRUNK-01](#).
9. If no problems were found with the cable, continue to the next section.

Additional Steps

Voltage and cables test good but still not connecting

If there is still no connectivity but all checks have passed try the below steps to get a connection.

1. Drive the machine outside or to an outdoor entrance (as close to the outside as permissible) to get the best signal.
2. Extract the modem's antenna from the body of the machine (don't disconnect it) and lay it on the seat or the top of the machine. Then, with the machine on, observe if signal strength improves.

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) 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 2) Please schedule the next site visit based on the tracking information for the part. 3) 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) Place an order for an antenna. 2) Schedule the next site visit based on the tracking information for the part. 3) Replace the antenna.

BCM Replacement

Solution code	Recommended actions
BCM-01	If a BCM replacement is recommended, perform the following steps: 1) Take photo of BCM status LEDs and BCM serial number label. 2) Send any photos, notes, and/or a filled out Troubleshooting Checklist to Brain Corporation using the e-mail address specified in the work order. 3) Inform Brain Corporation as to what troubleshooting has been completed to determine the BCM failure.

Up Trunk Replacement

Solution code	Recommended actions
UPTRUNK-01	If the up trunk cable has no continuity measured on any of the four sets of wires or the 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.

Appendix B – 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: Modem Troubleshooting Checklist

Description	Completed? (Yes/No)	Result (Pass/Fail/Measurements)
Cloud Connectivity Check 1		Cloud icon: LTE Signal strength icon:
Hard Reset Performed		Did the cloud icon illuminate?
Modem & Antenna Check		Damage to cabling? Which cable?: Damage to device? Which device?:
Modem right 2D camera swap		Did the modem connect?
Cloud Connectivity Check 2		Cloud icon: LTE Signal strength icon:
Voltage Check: Brain Communication Module connector M12 (Up Trunk)		Voltage between pins 2 and 4 :
Continuity Test: Up trunk to modem pins		Continuity on pins from BCM connector to modem connector: - BCM pin 10 to Modem pin 1 - BCM pin 17 to Modem pin 2 - BCM pin 11 to Modem pin 3 - BCM pin 18 to Modem pin 4