

3D Depth Sensor Troubleshooting Guide for OEM

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Table of Contents

Revision History	4
Definitions, Acronyms, and Abbreviations	4
Overview	5
When To Use It	5
How To Use It	5
Assist Diagnosis	7
UI based diagnostics (OS version 3.1.x +)	12
Hardware Inspection	16
Up Trunk	16
Front 3D Depth Sensor Inspection	17
Side 3D Depth Sensor Inspection	19
Voltage Check	19
Power at 3D Depth Sensor	19
Continuity Tests	20
Appendix A - Tech Solution Codes	22
UPTRUNK-01	22
POWERTRUNK-01	22
3D Depth Sensor-01	22
3D Depth Sensor-02	22
Appendix B – Field Tech Troubleshooting Checklist	23
Appendix C – How to Replace Front 3D Depth Sensor	25
Appendix D- Replacing the Side 3D Depth Sensor	28

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 3D Depth Sensor 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 below:

Assist Codes: 103, 104, 216, 219, 226, 227, 230, 231, 302, 303, 304, 305, 306, 307, 308, 309, 507, 508, 6002 and 8800

Error Codes: 5001, 5002, 5003, 5004, 5005, 5013, 5014, 5015, 5021, 5022, 5023, 5024, 5025, 5026, 5027, 5028 and 5029

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

OEM Error Code Doc

The latest OEM error code document is located in the Zendesk Guide webpage

How To Use It

The 3D Depth Sensor Troubleshooting Guide walks you through several important steps in troubleshooting 3D Depth Sensor related issues for any autonomous floor scrubbers powered by BrainOS:

1. Part 1: Assist Diagnosis
2. Part 2: UI Based Diagnostics
3. Part 3: Hardware Inspections
4. Part 4: Voltage Check
5. **Part 5: Solution Code Table Appendix A**

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. It is essential to collect pictures and take notes throughout the process.

Required Tool List

The following is the list of tools needed to service 3D Depth Sensor 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	

Assist Diagnosis

Below are some example assists that you might run into when having 3D Depth Sensor issues.

1. Go to the ROC Portal and review the assists for that specific machine. The following are some common assist codes when running into 3D Depth Sensor issues (100, 103, 104, 216, 219, 302, 303, 304, 305, 306, 307, 308, 309, 507, 508, 8800). When reviewing each assist it is really important to look at the images and assist replay to see what triggered this assist to happen. By reviewing assists it allows us to get a better understanding of what type of issues the machine could be having. For the latest list of assist codes please reference the most updated Error Code Reference document.

- a. **Check for front 3D Depth Sensor “Spray” pattern**

- i. When reviewing the assist, watch the assist replay to check if there is an unusual spray pattern being displayed in front of the machine (pink spray). This is usually caused by the framerate being set incorrectly.

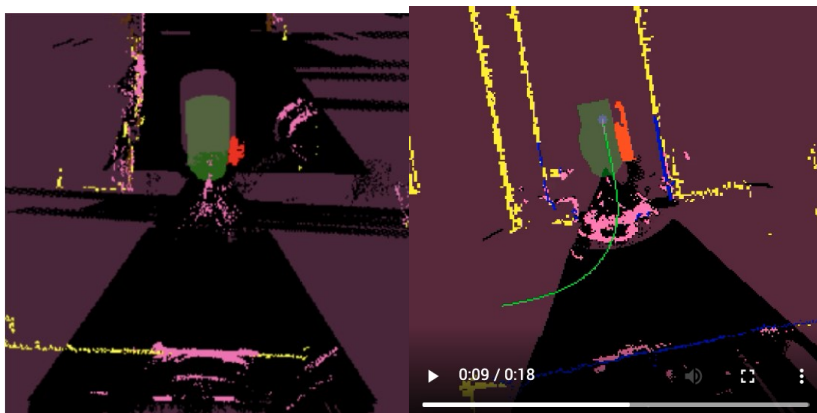


Figure 1 : Example of spray pattern

- ii. If you are receiving lots of Path Blocked and see the unusual spray pattern from the assists, please have a Brain TSE check the Frame Rate of the front 3D Depth Sensor.

a. Check for false path blocked assists

- i. False path blocked assist can be generated if something is in the field of view of the sensor. When reviewing this assist ensure nothing is blocking



the view of the sensors.

Figure 2: 3D Depth Sensor View of bag hanging from left side

- ii. These can also be caused by reflections. The example below shows reflection from a vest.
- iii. Path blocked assist can be caused by an aisle being too small, it will not enough space to navigate around any small obstacle



Figure 3: 3D Depth Sensor View of bag hanging from left side

b. Check for obstacles hanging from the machine

- i. When reviewing assists ensure nothing is blocking the view of the sensors. Hanging objects such as keychain, lanyards or keytring can block the view of the sensors.



Figure 4: Obstacles hanging from the machine

c. Check for 8300 - Sensor Errors

- i. 8300 errors can be generated when a 3D Depth Sensor sensor is disconnected or not responding
- ii. If you see consistent 8300 errors please send tech onsite to perform the Field Tech 3D Depth Sensor Troubleshooting Guide.

Device Type ↓	Code	Reason	Start Time (EDT) ↓	Customer	Site	Version
BCM-scrubber	8300	Sensor Error	03/23/2021, 7:46:46 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3
BCM-scrubber	8300	Sensor Error	03/23/2021, 7:36:39 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3
BCM-scrubber	8300	Sensor Error	03/23/2021, 7:35:17 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3
BCM-scrubber	8300	Sensor Error	03/23/2021, 7:33:42 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3
BCM-scrubber	106	Machine is Off Path	03/23/2021, 7:28:33 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3
BCM-scrubber	8300	Sensor Error	03/23/2021, 7:21:01 AM	Kroger, Tennant	Kroger F4L-CA	release-big-2.21.3

Figure 5: 8300 Sensor Errors

d. Review 3D Depth Sensor Images

- i. When reviewing each assist it's important to view all 3D Depth Sensor/depth images. If you see consistent 3D Depth Sensor images being distorted/frozen please have tech confirm Frame Rate. (Please see tech section for Sensor Status option) This should be set to 25
- ii. Link to example assist:
<https://tenant.prod.roc.braincorp.com/assists/23BYBSX613KWMHYDV5G1M9NNPS>

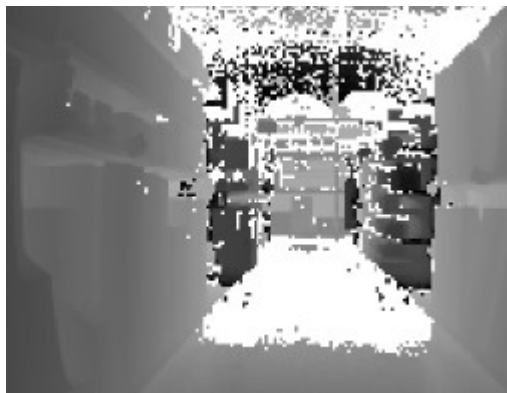


Figure 6: Distorted/Frozen 3D Depth Sensor Image

e. Dirty 3D Depth Sensor

- i. Please ensure all sensors and sensors are cleaned properly with a microfiber cloth.

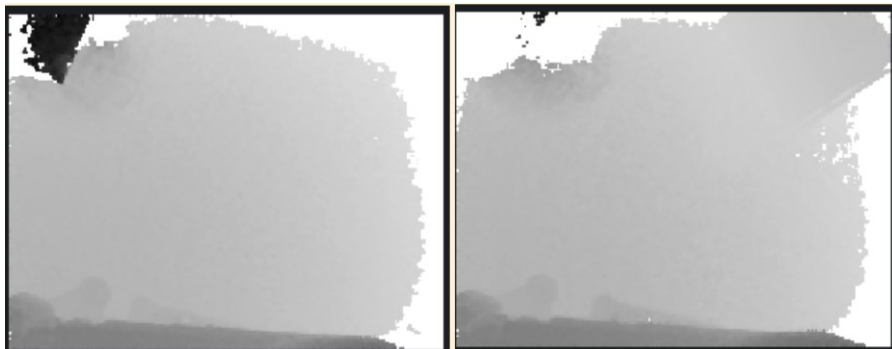


Figure 7: Dirty 3D Depth Sensor

f. Sunlight Example

- i. When reviewing the 3D Depth Sensor depth images it's important to keep in mind that sunlight can interfere with the sensor and sensors.
- ii. Please note that autonomous floor scrubbers powered by BrainOS are only designed to be used indoors only.
- iii. Link to example assist:
 1. <https://tenant.prod.roc.braincorp.com/assists/34JGQSER4GKE57DCP2Q4XV8JER>
 2. <https://tenant.prod.roc.braincorp.com/assists/2R4S328YPHD4HWHBF RD3QPNNW0>
 3. <https://tenant.prod.roc.braincorp.com/assists/2TXV8QRFWYJAVCH9M PSWAKQHVA>

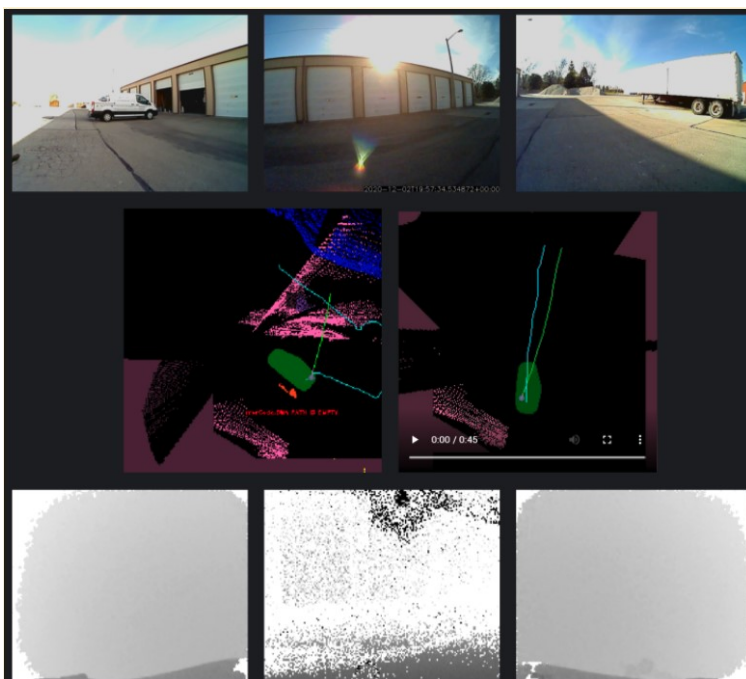


Figure 8: Sunlight Example

Field Tech Section

UI based diagnostics (OS version 3.1.x +)

Tech will need to click the following path to get to the sensor tests

Settings → Service → Service Tools → Confirm to Launch Service tools



Figure 9: Menu

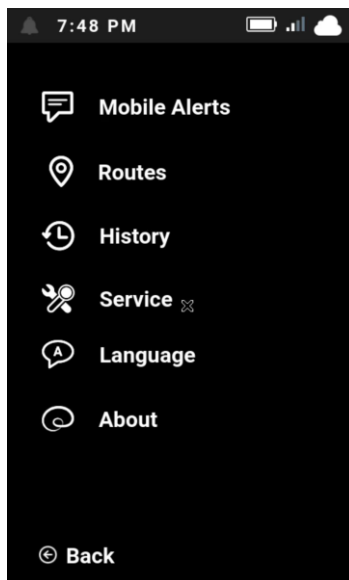


Figure 10: Settings Menu

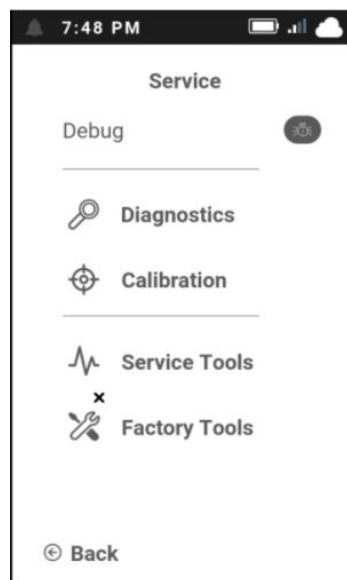


Figure 11: Service Menu

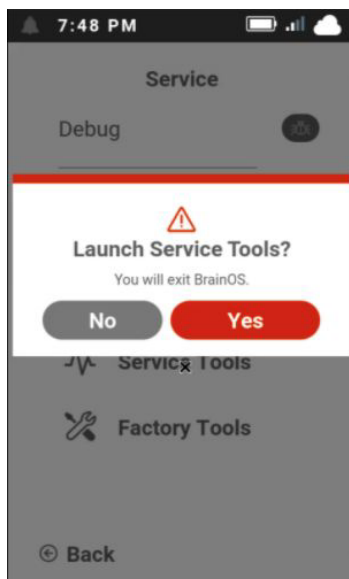


Figure 12: Confirm Y/N



Figure 13: Brain Screen

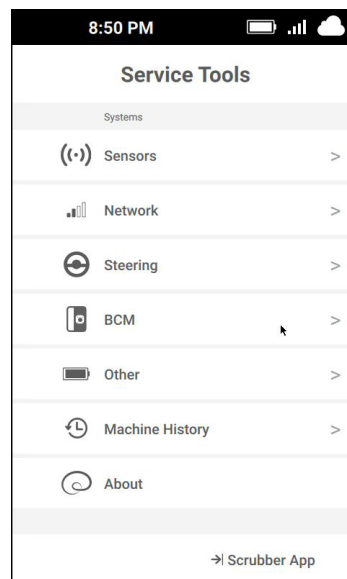


Figure 14: Service Tools

Click Sensors → You will now see all the SENSORS.

Tech can choose RUN on the first screen (Figure 7) which will run all tests for all the sensors. Or the tech can choose the specific sensor he wants to test (Figure 8). We will be doing the front 3D Depth Sensor. Choose the Sensor and click run. This will give us a pass/fail on tests. You will be able to interact with the error messages.

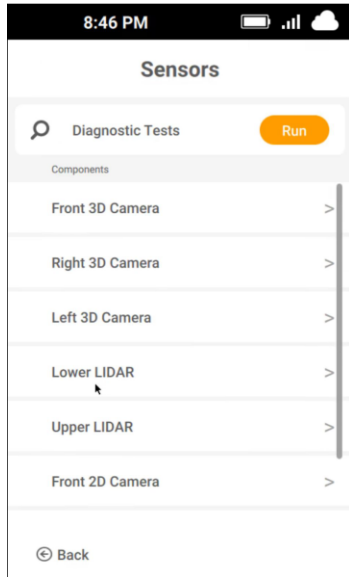


Figure 15: Sensors

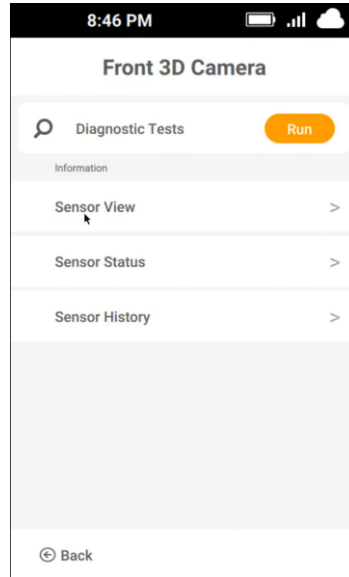


Figure 16: Front 3D

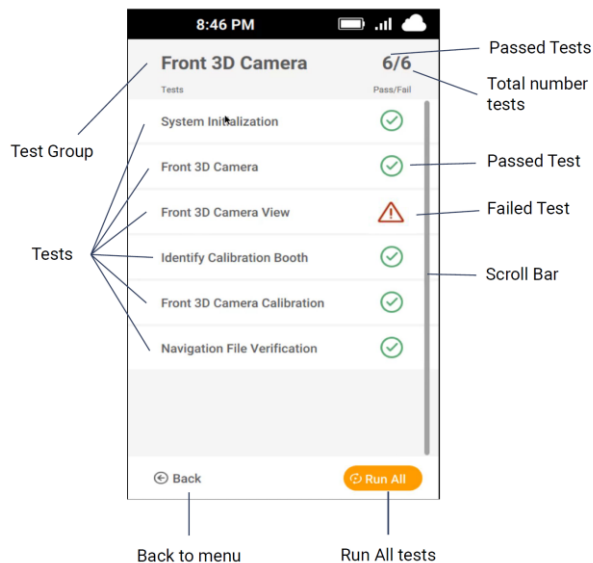


Figure 17: View of error after tests complete

Options on Sensor menu

Click **Sensor View**. (From Figure 8). This will show you what the sensor can see. Two modes. Intensity shows more human friendly and Depth shows what the machine can see.

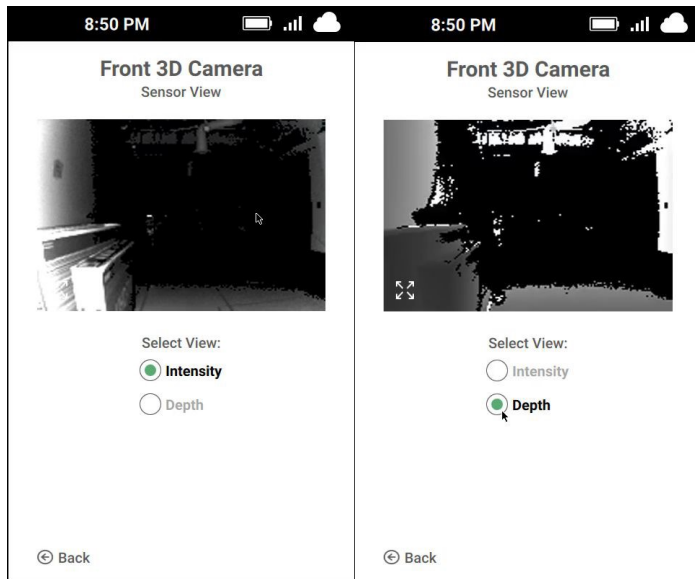


Figure 18: Intensity View

Figure 19: Depth View

Click **Sensor Status** (From Figure 8). Take picture of this screen for tech support

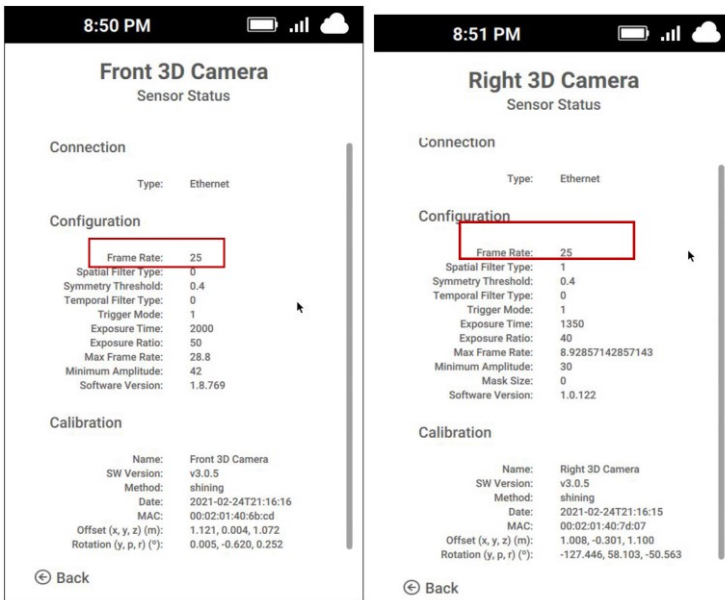


Figure 20: Sensor Status

Click Sensor History (From Figure 8). This screen will provide a history for the selected sensor

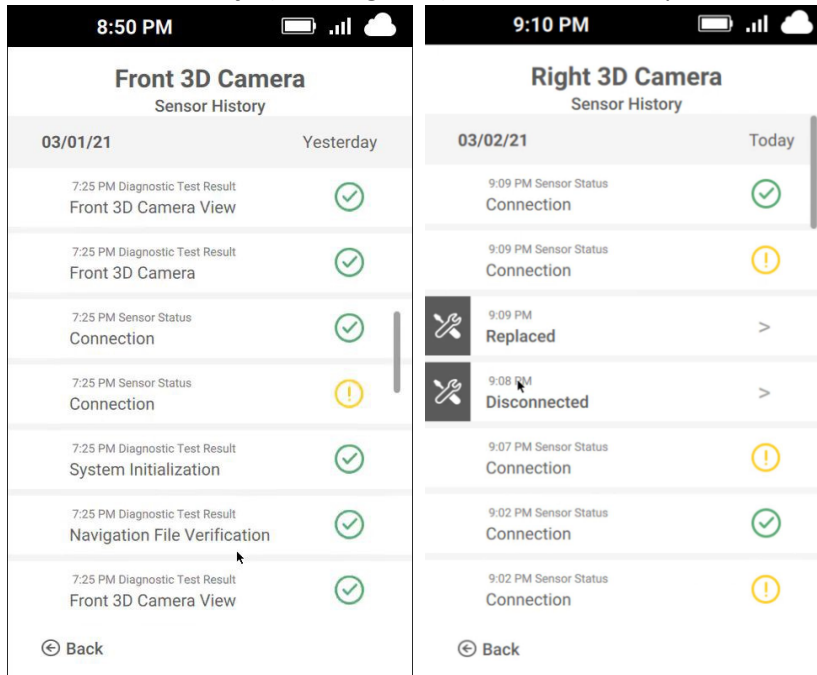


Figure 21: Sensor History

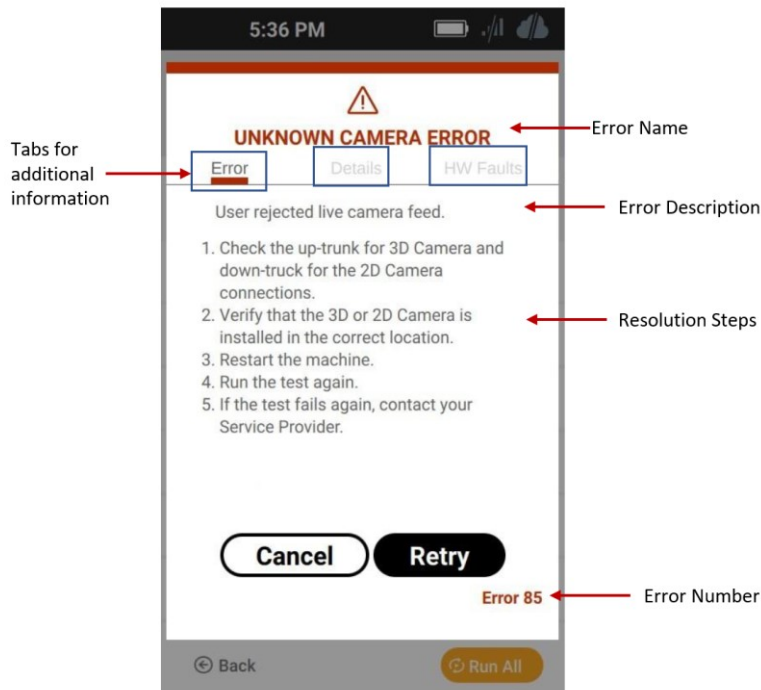


Figure 22: Example of error

Tech should photograph all error screens

Hardware Inspection

Up Trunk

1. Turn off the machine.
2. Raise the seat and decouple the red Anderson connector.

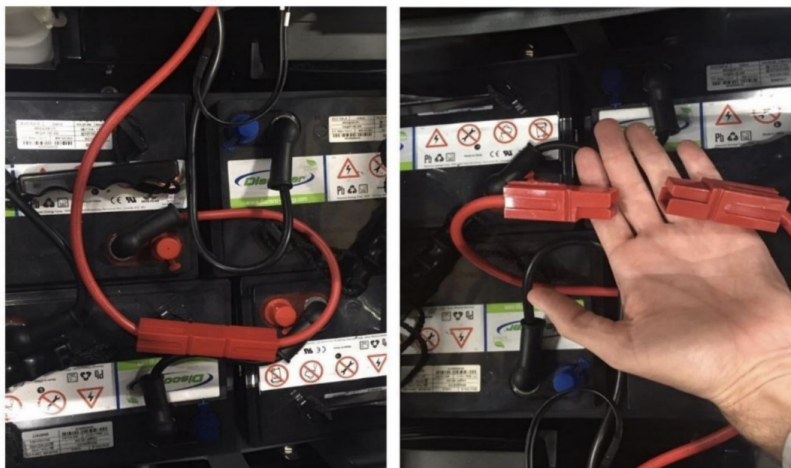


Figure 23: Anderson Connector

3. Check the connections to see if the cable is loose or unplugged.
4. Unscrew the up trunk (connection #2) and power trunk (connection #4), check pins, and rescrew. inspect wiring for physical issues.
 - a. If the up trunk cable has an pins or wiring damaged (bent, missing pins), please go ahead and replace up trunk

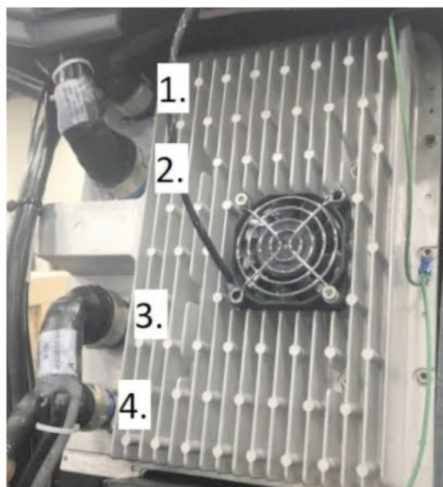


Figure 24: BCM Connections

5. 📷 Take pictures of the up trunk male connector on the BCM side and the condition of the pins 📷

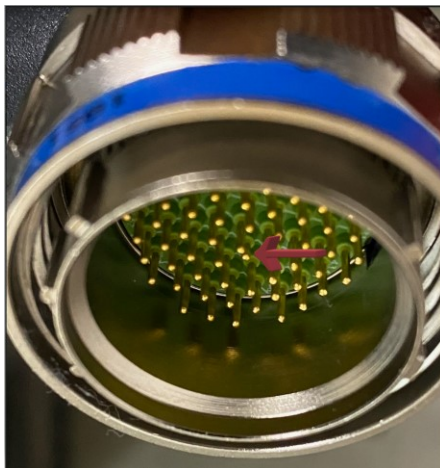


Figure 25: Example of Up Trunk with pushed pins

Front 3D Depth Sensor Inspection

1. Check if the front 4 infrared LEDs are blinking
 - a. If LED is not flashing, please perform a power voltage check
2. Inspect the 3D Depth Sensor sensor for scratches, dents, and other damage. If damaged, report to Brain TSE and send pictures
3. 📷 Take pictures of the condition of the front 3D Depth Sensor 📷
4. Unscrew the 8 screws holding the casing in order to get access to the wires to the sensor you need to reseal (as seen in Figure 18)



Figure 26: Front 3D Depth Sensor Case

5. Remove the two screws, slide the 3D Depth Sensor and heatsink out of metal housing to

access the cables in the back of the sensor.

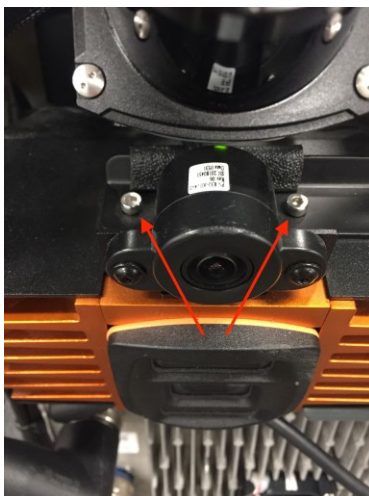


Figure 27: 3D Depth Sensor Mounted

6. Check if the cables are loose or unplugged.
7. Disconnect, inspect and reconnect the 2 cables.
 - a. If the cables are damaged, please use solution code [POWERTRUNK-01](#) for power cable and [UPTRUNK-01](#) data cable. Have tech schedule a site visit once part has been received.



Figure 28: Front 3D Depth Sensor Cables

8. If LED is blinking or lit and you are still seeing the front 3D Depth Sensor related issues, reconnect/reseat the data cable that connects Up Trunk harness to 3D Sensor.
9. If LED is not blinking or lit, then perform a [Voltage Check](#) (see section below)

Side 3D Depth Sensor Inspection

1. Check if the 3D sensor is powered and boots up.
2. Inspect the 3D Depth Sensor sensor for scratches, dents, and other damage.
3. Look at the sensor and notice if the RED LED is lit or blinking.



Figure 29: LED Blinking



Figure 30: LED Not Blinking

4. If LED is blinking or lit (See Figure 21) and the user is still seeing the side 3D Depth Sensor related issues reconnect/reseat the data cable that connects Up Trunk harness to 3D Sensor.
5. If LED is still blinking but no change in symptoms then use solution code [UPTRUNK-01](#)
6. If LED is not blinking or lit (See Figure 1-2) then proceed to perform the [Voltage Check](#) section below.

Voltage Check

Power at 3D Depth Sensor

1. Remove Display or Control panel (depending on which side 3D Depth Sensor is problematic) and check voltage on POWER TRUNK cable that connects to 3D Depth Sensor power.



Figure 31: 3D Depth Sensor Power Cable

2. Please note the voltage measurement should be close to ~24V; moreover, the number should be the same on both sides (Right and Left 3D Depth Sensor). (PIN 1 - 24V, PIN 3 - GND.)

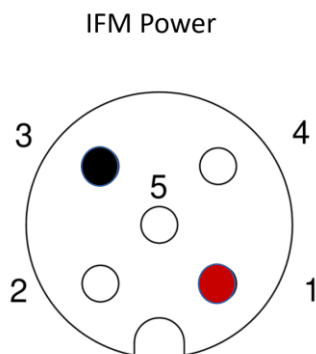


Figure 32: 3D Depth Sensor power cable PINs

3. If voltage values are different between Right and Left 3D Depth Sensor or the affected side has no power (0V), tech will need to perform the Continuity tests.

Continuity Tests

1. Set your meter to Ohms and make sure you don't have an open circuit.
 - a. Power down machine and then disconnect the Power Trunk cable.

- b. Check 3D Depth Sensor power Cable Pin 1 (3D Depth Sensor you are troubleshooting) to BCM Power Trunk
 - i. Front 3D Depth Sensor = PIN D
 - ii. Right 3D Depth Sensor = PIN C
 - iii. left 3D Depth Sensor = Pin E
 - c. Check 3D Depth Sensor power cable Pin 3 to
 - i. Front 3D Depth Sensor = PIN D
 - ii. Right 3D Depth Sensor = PIN C
 - iii. left 3D Depth Sensor = Pin E
 - d. If the power trunk fails connectivity testing please reference solution code [POWERTRUNK-01](#) else go to the next step.
 2. Perform power check on the BCM
 - a. Set you multimeter to Volts DC
 - b. Check and report the voltage found for the 3D Depth Sensor you are troubleshooting.
 - i. Front 3D Depth Sensor PIN E and PIN F
 - ii. Right 3D Depth Sensor PIN C and PIN B
 - iii. Left 3D Depth Sensor PIN D and PIN A
 - c. Voltage should be ~24V. If it is not, report this to the Brain TSE that a BCM replacement is suspected. Brain will confirm.
 3. If voltage measurements are ~24V and LED is NOT lit or blinking on the affected side then go to solution code [3D Depth Sensor-02](#) (side 3D Depth Sensor) and [3D Depth Sensor-01](#) (Front 3D Depth Sensor)

Appendix A - Solution Codes

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

Solution Codes

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 (ICE part number: 8350263)
POWERTRUNK-01	If no power at 3D Depth Sensor, confirm power is available at the power trunk connection on the BCM. • LEFT 3D Depth Sensor Check power at PIN E (P24V) and F (GND) • FRONT 3D Depth Sensor Check power at PIN D (P24V) and A (GND) • RIGHT 3D Depth Sensor Check power at PIN C (P24V) and B (GND) • If power at BCM connector, please order new Power Trunk (ICE part number: 8350265)
3D Depth Sensor-01	If the front 3D Depth Sensor has blinking LED without connectivity or the pins or wiring (3D Depth Sensor side) 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) Request a new front 3D Depth Sensor 3) Please schedule the next site visit based on the tracking information for the part. 4) Replace the 3D Depth Sensor and perform 3D Depth Sensor calibration (for more information please reference the 3D Depth Sensor Calibration document).
3D Depth Sensor-02	If the side 3D Depth Sensor has blinking LED without connectivity or the pins or wiring (3D Depth Sensor side) 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) Request a new side 3D Depth Sensor 3) Please schedule the next site visit based on the tracking information for the part. 4) Replace the 3D Depth Sensor and perform 3D Depth Sensor calibration (for more information please reference the 3D Depth Sensor Calibration document).

Appendix B – Field Tech Troubleshooting Checklist

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

Description	Completed? (Yes/No)	Results (Pass/Fail/Measurements)
Examine 3D Depth Sensors for dirt and damage		Dirty? Damaged?
Clean 3D Depth Sensors		
Check for LED(s)		
Check for loose cables. Inspect and reseat the cables on the sensor side and BCM side		
Voltage Check at 3D Depth Sensor PIN 1 & 3 ● If you have voltage call Brain Corp ● If no power at 3D Depth Sensor ○ Power off and disconnect batteries ○ Reseat Power Trunk ○ Check voltage again		
Check power from BCM		
Power off and disconnect batteries		
Disconnect power trunk		
Power on machine		
Right 3D Depth Sensor C = P24V B = Grnd		
Left 3D Depth Sensor E = P24V F = Grnd		
Front 3D Depth Sensor D = P24V A = Grnd		

Schedule Onsite Visit

Please have a Field Tech go onsite once you have finished reviewing assists and the entire document. Ensure to provide them with a copy of the Field Tech 3D Depth Sensor Troubleshooting Guide and have tech complete the Field Tech checklist.

3D Depth Sensor 3D Depth Sensor Field Calibration

Please note that when replacing any 3D Depth Sensor 3D sensor it is necessary to perform a field calibration after. For more information please reference the 3D Depth Sensor Field Calibration procedure document.

Appendix C – How to Replace Front 3D Depth Sensor

1. Power down the unit and disconnect the red battery coupling.



2. Remove the six 2.5mm hex screws that secure the top black cover.



3. Remove the top black cover. Remove the Slanted LIDAR top left screw completely, but only loosen the other three. Then lift out the Slanted LIDAR and decouple the two rear cables.



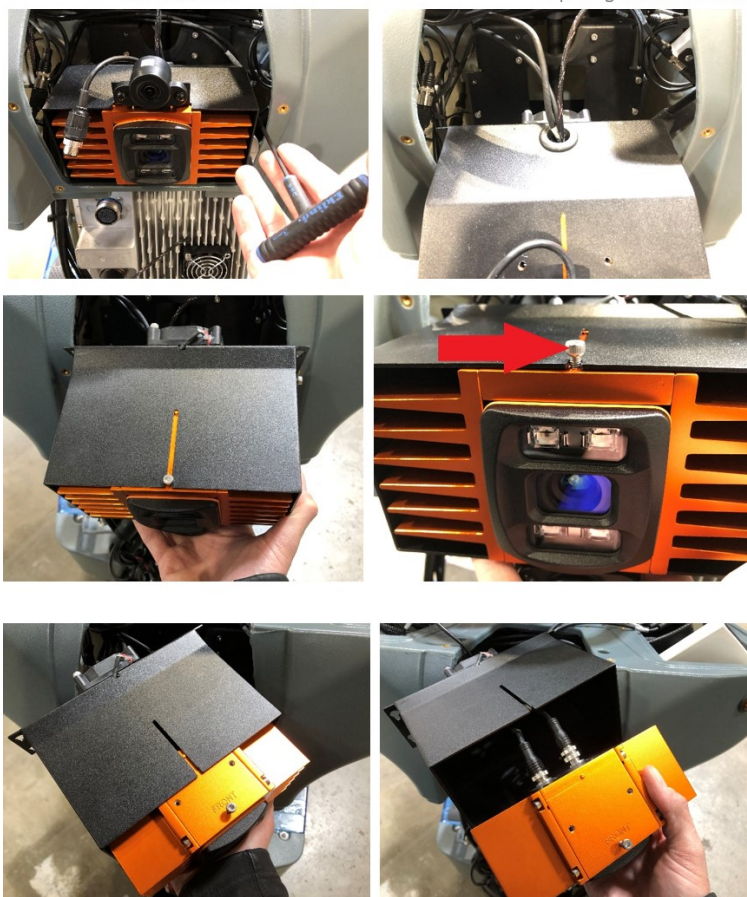
4. Carefully place the Upper LIDAR to the side. Be mindful to avoid resting the plastic lens on any rough or abrasive surface.
5. Remove the slanted LIDAR, but be VERY careful not to damage or scratch the lens. Disconnect the Front USB Cam coupling.



6. Remove the screws that hold the modem antennae. Move the antennae bracket to the right and tuck it temporarily up and out of the way.



7. Remove the Front 3D Depth Sensor. It will need to be removed from the scrubber, the bottom screw loosened and then the sensor slid out of its shield. The cables may then be accessed.



8. Take great care not to drop, scratch or damage the front 3D Depth Sensor sensor.
9. Reverse the steps to reassemble the scrubber.. Make sure the Front 3D Depth Sensor and Slanted LIDAR are screwed in level and secure.

10.  After replacement, please perform 3D Depth Sensor Calibration. 

Appendix D- Replacing the Side 3D Depth Sensor

The Side 3D Depth Sensor sensor is one of five sensors responsible for autonomous navigation. Once replaced, it must be calibrated.

Power down the unit and disconnect the red battery coupling beneath the seat.

1. Use a 2.5 mm hex key to remove the five screws that secure the control panel and/or the five screws that secure the UI touch screen.



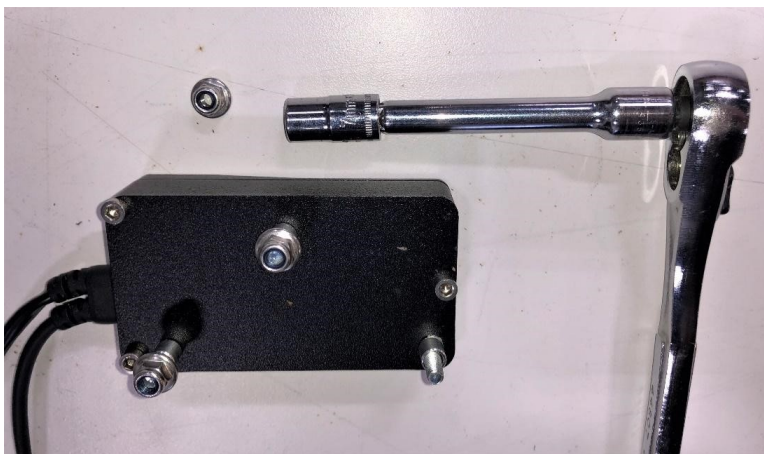


Left

Right



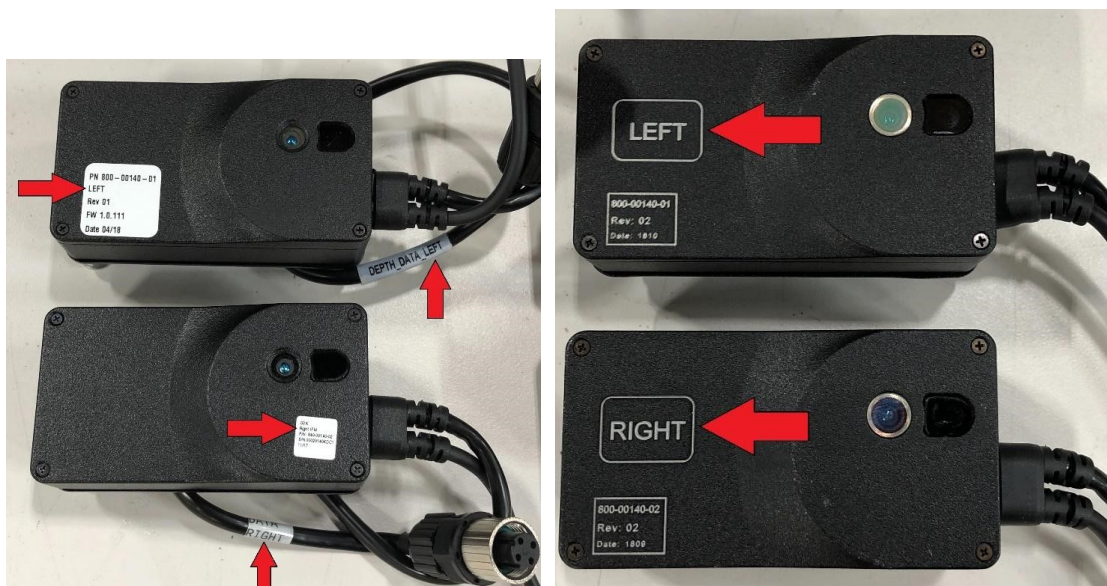
2. Use a 7 mm ratchet to remove the three locking nuts. This will free the side 3D Depth Sensor assembly to be removed from the scrubber body. Decouple the two plugs that connect the power and signal to the Up Trunk.



3. Use a 2.5 mm hex key to remove the two screws that secure the mounting plate to the 3D Depth Sensor.



4. The Left and Right Side 3D Depth Sensor each have a unique IP address and may not be used interchangeably. Their designation may be found on the sensor itself or the label adhered to the cable. (The designation of Left and Right is from the perspective of an individual sitting in the driver's seat.)



5. Once the mounting plate is secured, place the spacing washers before installing the Side 3D Depth Sensor.



6.  After replacement, please perform 3D Depth Sensor Calibration. 