

# 3D Camera Calibration Process

BRAIN CORPORATION

Version 3.1  
May 10, 2023

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## Change Record

| Revision | Date      | Changes                                                                                    | Completed by |
|----------|-----------|--------------------------------------------------------------------------------------------|--------------|
| 3.0      | 5/3/2023  | Updated with new screens, revised side camera calibration process, and new document format | M. Lucash    |
| 3.1      | 5/10/2023 | Added acceptable range of testing box sizes, added Brain Support contact info              | M. Lucash    |
|          |           |                                                                                            |              |

## Brain Support Information

**Hours: 5am – 5pm PT Mon-Fri**

**Phone: 1-619-333-5590**

**Email: OEM.Support@Braincorp.com**

# Front 3D Camera Calibration Process

## Applies to:

All Gen 2 Brain powered autonomous robots.

## When to perform this process:

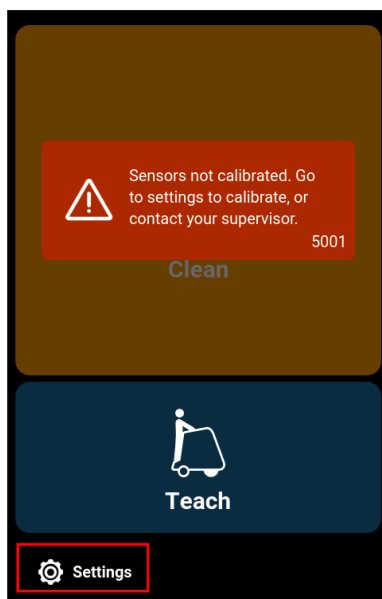
After replacement of the front 3D camera, the calibration procedure must be performed to ensure the software is programed for the new camera.

## Procedure Summary:

1. Complete the replacement of the front 3D camera and re-assemble the robot.
2. Calibrate the front 3D camera by:
  - a. Training a new 5-minute route.
  - b. Apply the calibration.
  - c. Restart the robot.
3. Validate the front 3D camera calibration by running a test route to verify autonomy.
4. During the test route:
  - a. Place a box in the robot's path to verify it will avoid the box.
  - b. Block the robot's path completely to verify it will stop and post an assist.

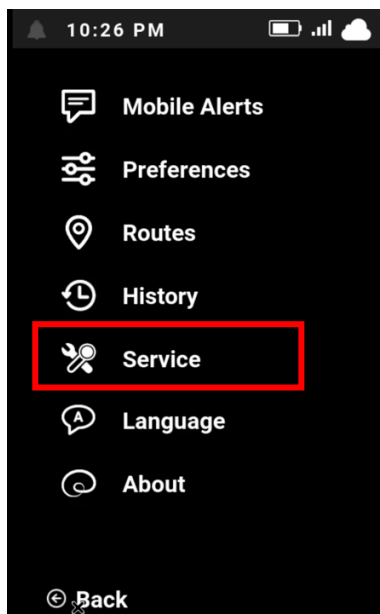
## Procedure Details:

1. Replace the faulty 3D camera using the machine's service manual for guidance.
2. Reinstall any covers removed during the replacement.
3. Turn on the key to apply power to the robot.
4. Log into the User Interface (UI). The main screen may show a warning about sensors not being calibrated.

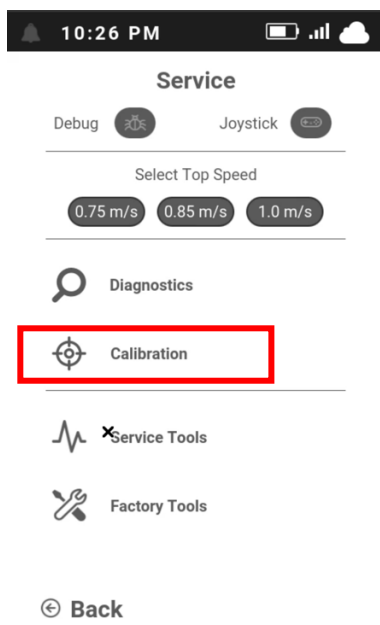


5. Select "Settings" at the bottom of the screen (see above).

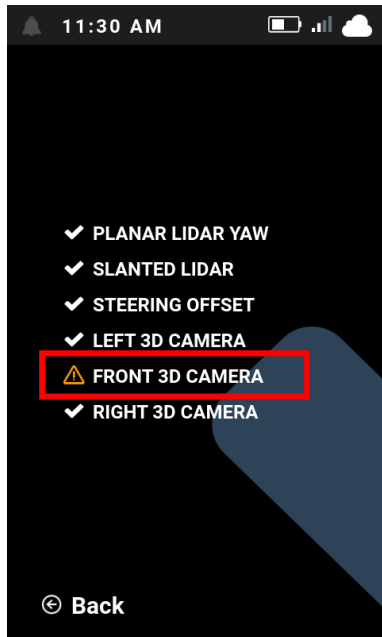
6. Select the Service menu. Enter the Service PIN when prompted. If you need the service PIN, contact your support.



7. Select “Calibration”.

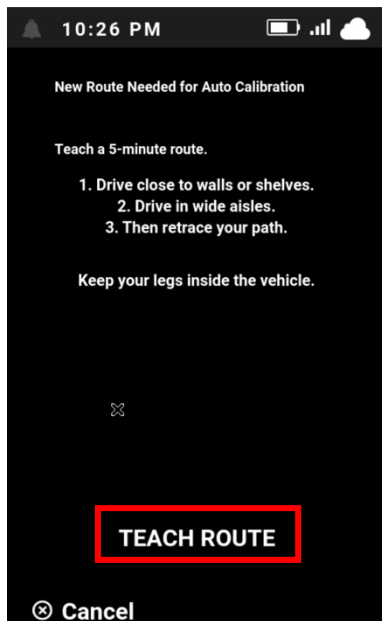


8. On the Calibration menu, select the “Front 3D Camera”.



Note the orange triangle with an exclamation point indicates this sensor needs calibration.

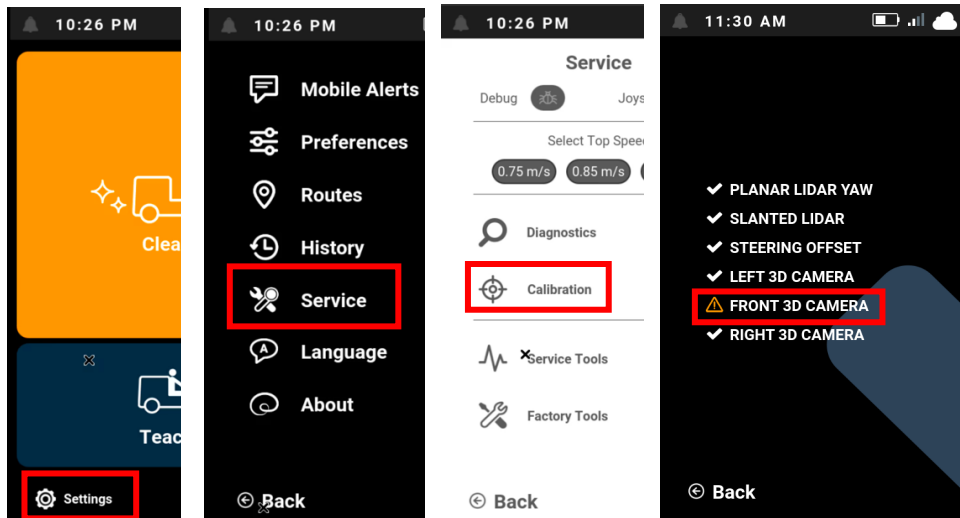
9. To complete the calibration, you will need to train a new 5-minute route following the directions on the screen. Press “Teach Route” to begin the process.



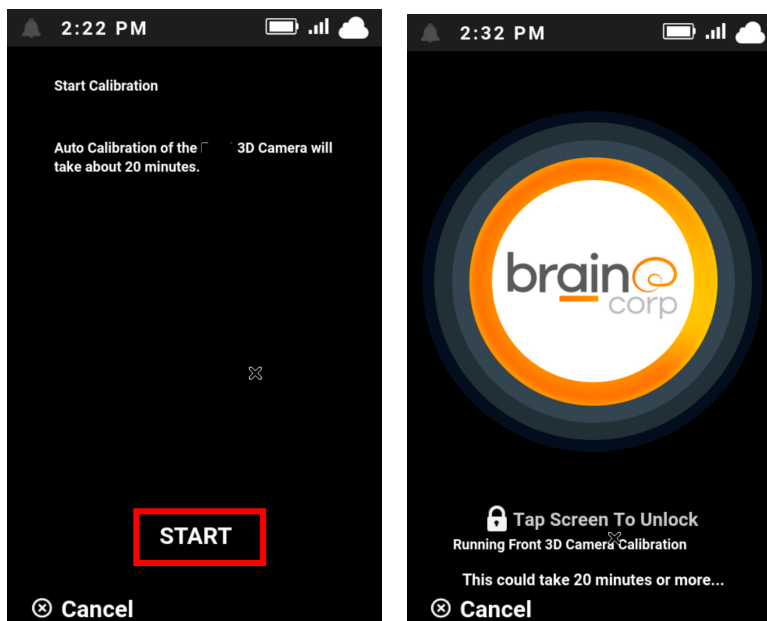
10. Begin teaching a route by:
  - a. Driving to a home marker (or using a printed home marker)
  - b. Selecting an open slot to save the route.
  - c. Do not train an Area Fill route.
  - d. Train the 5-minute route. Some tips for the route:
    - i. Do not perform cleaning during the route, just drive the route.
    - ii. Drive toward objects so the front 3D camera can see them.
    - iii. Drive in open areas and down aisles.
    - iv. Retrace your path.
    - v. Keep hands and feet within the vehicle to avoid errors
11. After the 5-minute route is complete, drive back to the home marker and “Save” the route.



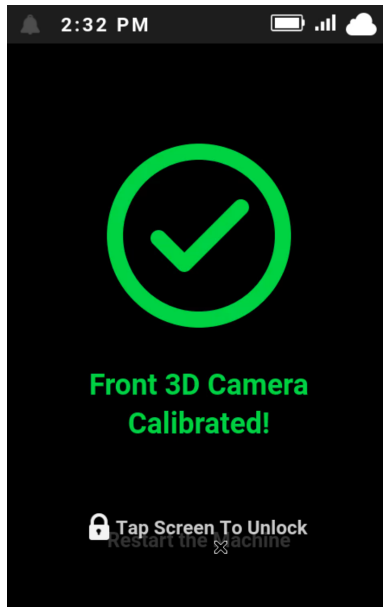
12. After the route is saved, return to the “Calibration” menu by going to “Settings” -> “Service” -> “Calibration” and selecting the “Front 3D Camera”.



13. On the Front 3D camera calibration page there will be a “Start” button to begin the calibration process. Press the “Start” button. Note this can take up to 20 minutes to complete.



14. When the calibration completes, enter the operator unlock code, verify the calibration completed successfully, then key off the robot. Note it will be completely powered off when you hear the fans stop. Leave it powered off for 30 seconds before continuing.



15. Power on the robot and log into the UI once available.
16. Drive to the home marker used for the calibration route.
17. Autonomously run the newly trained route and verify the front 3D Camera calibration by:
  - a. Witnessing the robot runs normally without sudden starting and stopping.
  - b. The robot will avoid a box or object placed in its path (object must be 6" tall or larger)
  - c. When the robot's path is completely blocked it will stop and post an assist request after 45 seconds to a minute.

# Side 3D Camera Calibration Process

## Applies to:

All Brain Gen 2 powered autonomous robots.

## When to perform this process:

After replacement of either the left or right-side 3D camera, the tech must perform the side 3D camera calibration process, open floor calibration, and verify the side safety calibration.

## Required Setup Preparation:

Prior to starting the calibration, ensure there is an area available with at least 2 meters (6ft) of empty / open space to the side of the machine. There shouldn't be any markings, tape, change in paint/floor color, or obstacles in this area. Do not attempt this calibration outside.

An ideal space to do this calibration on would be a gray or light-colored floor. This process will not work on black tiles and may not work on darker colored flooring.

## Tools needed:

1 - box 12"(L) x 10"(W) x 8"(H)\*

\* length and width can be plus or minus 2", height must be at least 7"

1 - tape measure or blank sheet of white paper

## Procedure Summary:

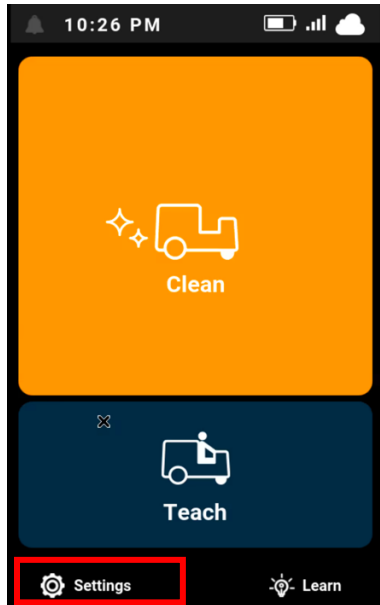
1. Complete the replacement of the side 3D camera and re-assemble the robot.
2. Perform the side IFM camera calibration for the side that was replaced. This requires training a new 5-minute route and restarting the robot.
3. From the "Factory Tools" app, select "Floor Calibration".
4. Run the calibration option for the side where the 3D camera was replaced.
5. After successful completion, exit the factory tools and key off the robot.
6. Autonomously run the recently trained route from the calibration steps above.
7. During the route, slowly slide a box toward the side where the camera was replaced at the mid-point of the body. Slide the box until it touches the body. Verify the robot stops.
8. Slowly slide the box away from the robot until the robot starts to move again.
9. Measure and record the distance from the body to the box required to allow the robot to resume running the route. This distance should be between 4" and 8".
10. Repeat steps 7-9 one additional time to validate the measurement.
11. Complete any addition validation tests requested by support.

## Procedure Details:

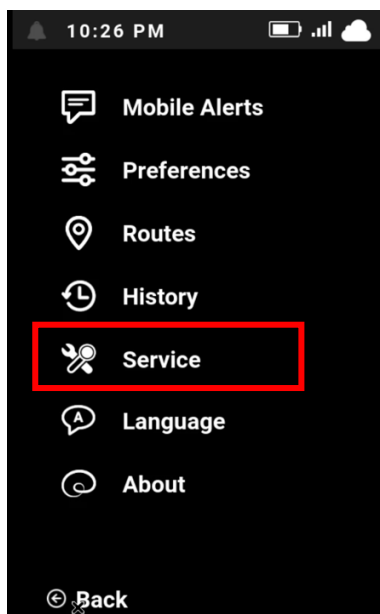
### Part 1 – Calibrating the side 3D Camera

Have machine powered up and ready for normal operation prior to beginning these steps. If you have any questions during the process, please contact Brain Support for assistance.

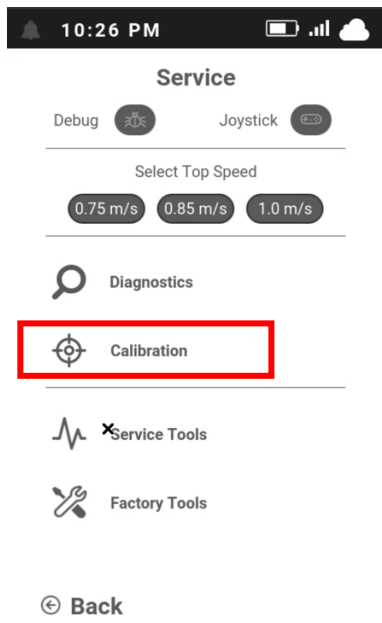
1. On the UI, press “Settings” on the Clean & Teach page.



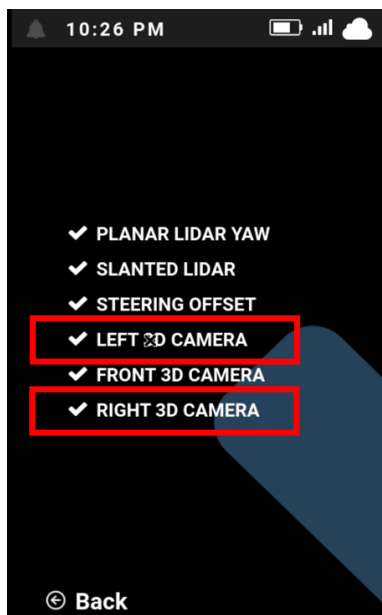
2. Select the Service menu. Enter the Service PIN when prompted. If you need the service PIN, contact your support.



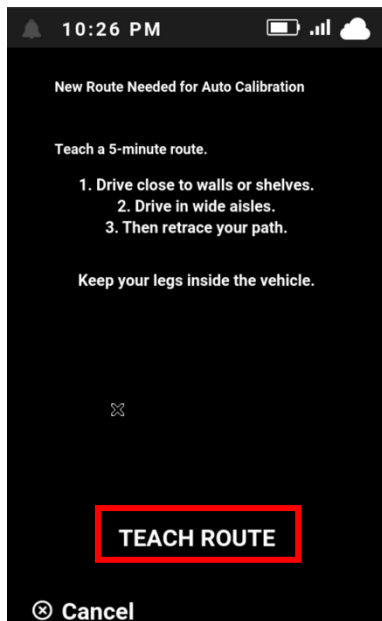
3. Select “Calibration”.



4. On the Calibration menu, select either the “Left 3D Camera” or “Right 3D Camera” depending on which one was replaced.



5. To complete the calibration, you will need to train a new 5-minute route following the directions on the screen. Press “Teach Route” to begin the process.

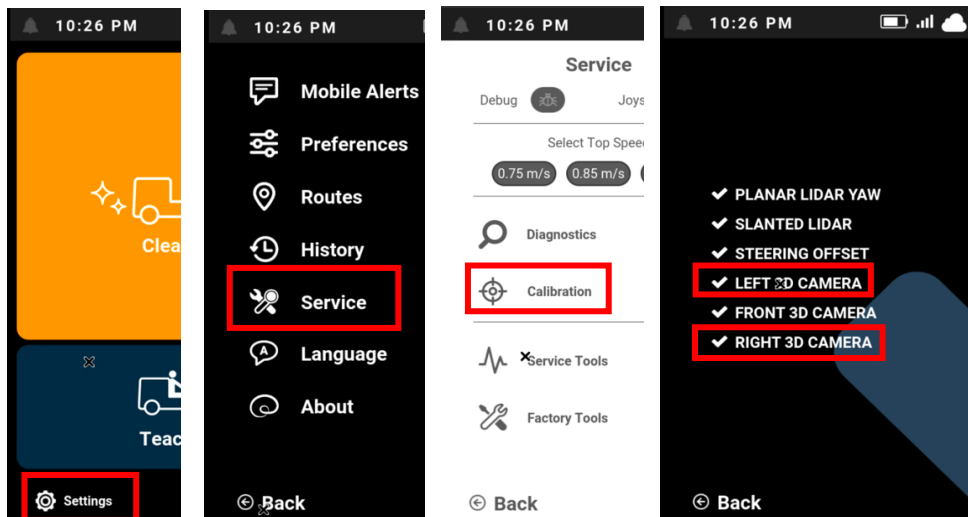


6. Begin teaching a route by:
  - a. Driving to a home marker (or using a printed home marker)
  - b. Selecting an open slot to save the route.
  - c. Do not train an Area Fill route.
  - d. Train the 5-minute route. Some tips for the route:
    - i. Drive the route without cleaning.
    - ii. On the initial pass, drive close (8-10” away) to walls or shelves on the side that is being re-calibrated.
    - iii. Retrace your path.
    - iv. Move further away from the walls or shelves for 2 passes then repeat as necessary to create a 5-minute route.
    - v. Keep hands and feet within the vehicle to avoid errors.

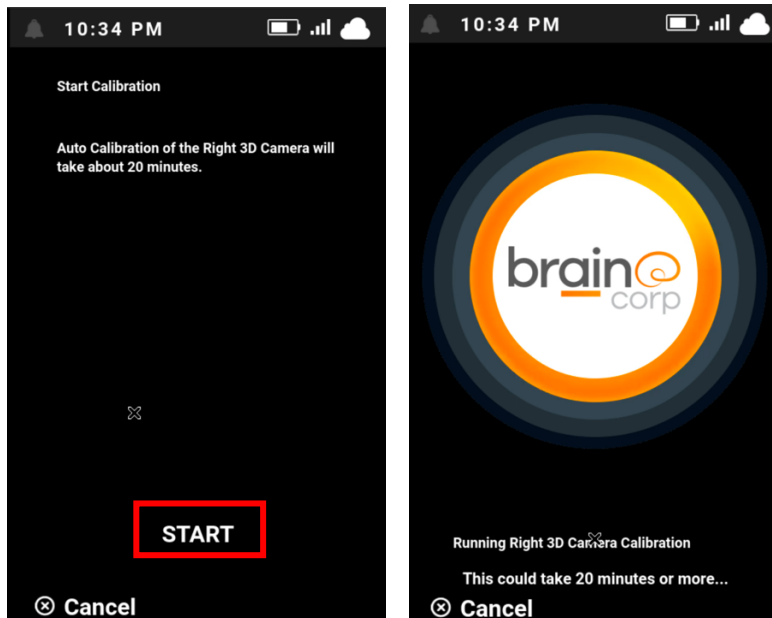
- After the 5-minute route is complete, drive back to the home marker and “Save” the route.



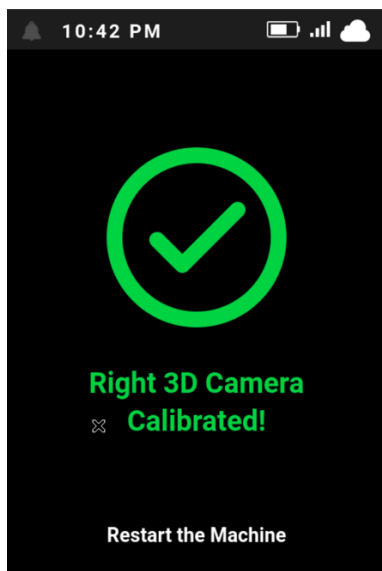
- After the route is saved, return to the “Calibration” menu by going to “Settings” -> “Service” -> “Calibration” and selecting the side 3D Camera to calibrate.



9. On the side camera calibration page there will be a “Start” button to begin the calibration process. Press the “Start” button. Note this can take up to 20 minutes to complete.



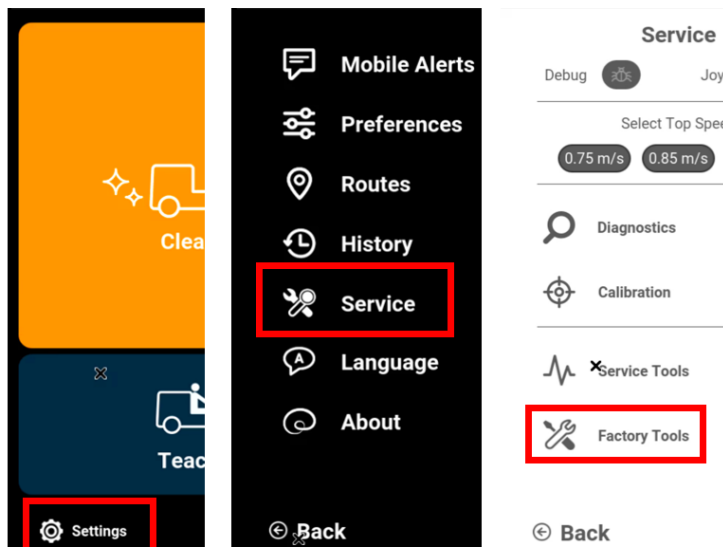
10. When the calibration completes, enter the operator unlock code, verify the calibration completed successfully, then key off the robot. Note it will be completely powered off when you hear the fans stop. Leave it turned off for 30 seconds before continuing to the next section.



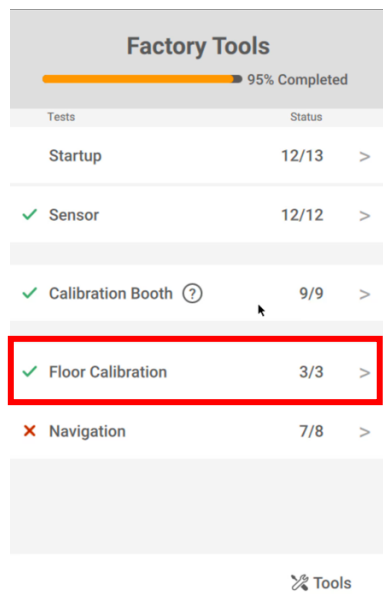
## Part 2 – Perform the Open Floor Calibration

This step sets the open floor calibration for the newly replaced 3D camera. It must be completed when the left or right 3D camera is replaced.

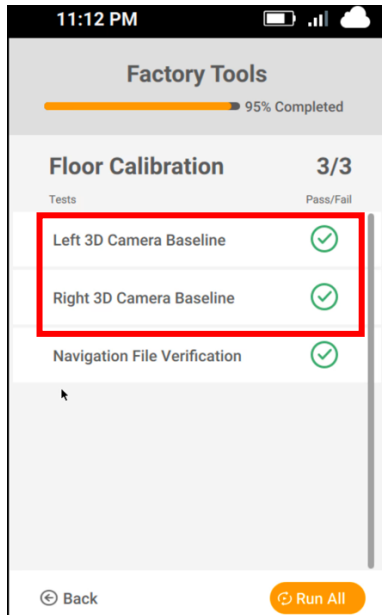
1. Power on the robot and drive to the open area identified to perform the floor calibration. The area must have 6 feet of clear space to the side of the robot being calibrated.
2. On the User Interface, go to Settings -> Service -> Factory Tools.



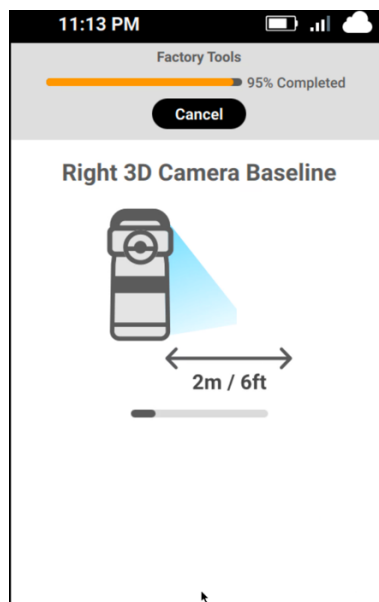
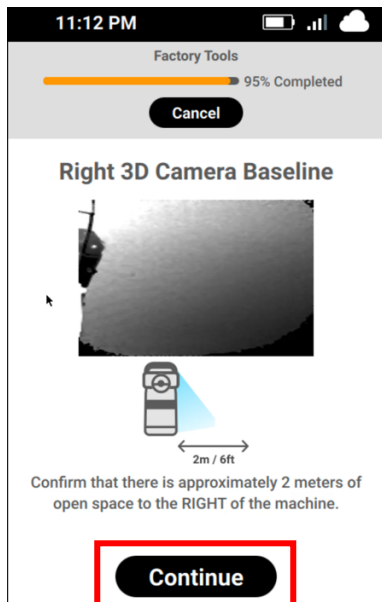
3. After the Factory Tools app starts, choose the “Floor Calibration” option.



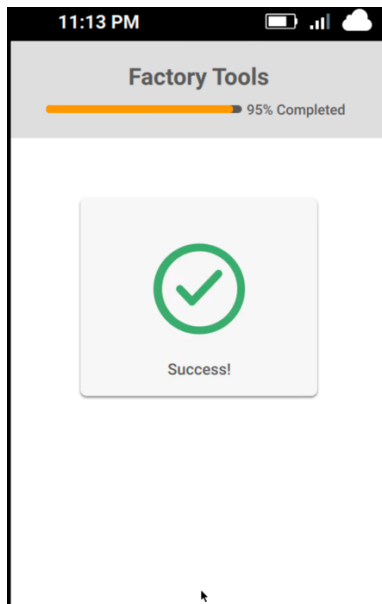
4. Select only the calibration option for the side camera that was replaced. Do not run the “Navigation File Verification” test as that is only valid in the factory and will report an error stating “Missing Depth Dumps”.



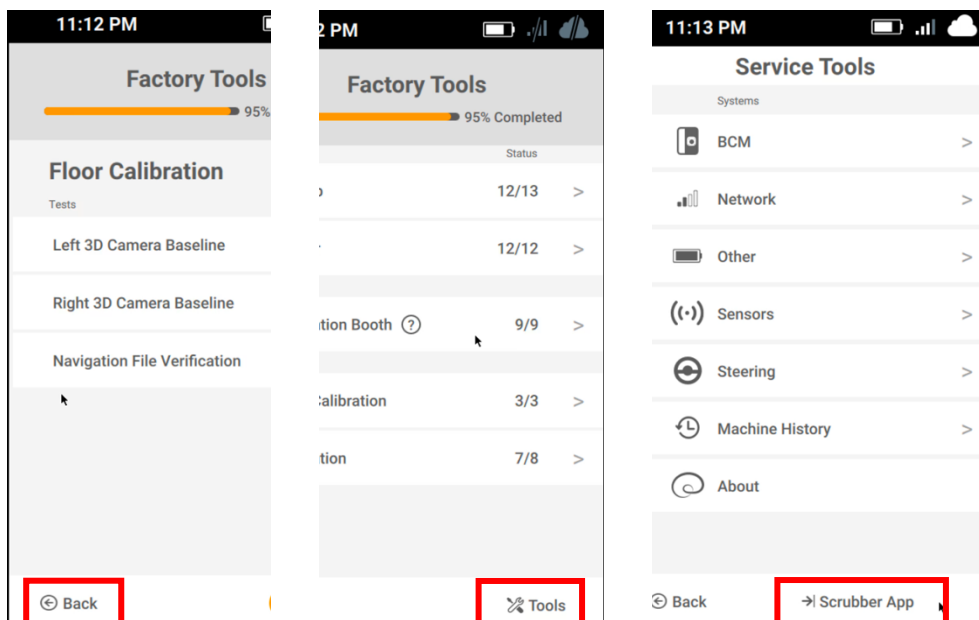
5. After selecting the side to calibrate, make sure the area is clear of any objects. Note the camera view is shown for a quick check of the area. When ready, press “Continue” to begin the calibration process.



6. If the calibration fails or identifies an object in its view, verify there is nothing around the robot. If no objects are found, try to move the robot over a couple of feet or change it's orientation before trying again from step 4. If you continue to have problems, please contact Brain Support for assistance.
7. The calibration process should complete in less than a minute.



8. Exit the Factory Tools by pressing “Back” on the “Floor Calibration” menu, then “Tools” on the “Factory Tools” menu, and finally “Scrubber App” on the “Service Tools” page.



9. Once the UI boots back into the Scrubber Application, key off the robot and wait for the fans to stop. Leave it powered off for 30 seconds before continuing.



10. This completes the Open Floor Calibration process. Continue to the next section.

### Part 3 – Calibration Testing / Confirmation

This step requires the robot to run an autonomous route in order to confirm the side calibration is complete. A short non-cleaning test route or the side camera calibration route should be used for this test. Make sure the robot is not cleaning during the route.

The description of this test is that as the robot is running along a straight path, the tester will slide a box from the side toward the mid-point of the robot's body until it stops. Once it stops, push the box directly against the body. Start to pull the box away from the robot until it starts to move again. Measure this distance with either ruler or a sheet of paper and record the measurement. The robot should start moving when the box is 4" to 8" away from the side.

When pushing the box toward the side of the robot, it should be moved slowly as introducing it too quickly could cause a critical safety stop which will need to be cleared before conducting the test again. If all the lights on the vehicle's control panel are flashing in unison, the robot will not continue until the Operator PIN is entered and the Start/Pause button is pressed.

This step requires:

1 - box 12"(L) x 10"(W) x 8"(H)\*

\* length and width can be plus or minus 2", height must be at least 7"

1 - tape measure or blank sheet of white paper (folding provides a reference point)

#### Procedure:

1. Train a short test route if needed. The route should have a 10-to-20-foot straight run for this test. If the previously trained calibration route has a long straight, it can be used.
2. Identify a position on the long straight where the tech can wait for the robot to pass that allows access to the side where the 3D camera was replaced.
3. Start the robot on its autonomous route.

4. Place the box on the ground so the closed side is facing up. As the robot starts to approach, slowly slide the box toward the center of the robot.



**NOTE** - If the robot quickly stops and all the lights on the vehicle's control panel are flashing in unison, the robot will not continue until the Operator PIN is entered and the Start/Pause button is pressed. You will need to repeat step 4 and slide the box in slower.

5. Verify the robot slows down then stops as the box gets close to the body.
6. Push the box so it is touching the robot body/scrub deck.



7. Start pulling the box away until the robot starts to move. You will hear the contactor click indicating it detected the box is now a safe distance away as the robot starts to pull away.



Note: The edge of the paper started out at against the scrub deck but as the robot started moving again, it moved away from the box making the gap.

The measurement is made from where the box starts against the robot to the point the robot starts to move again.

8. When the robot does start to move, measure the distance you needed to move the box from the side for this to occur and record it. It should be between 4 and 8 inches. In the above picture, the box was at the fold line on the paper (about 5.5") when the robot started to move again.
9. Repeat the test one more time to verify the results.
10. Record the measurement results in your service ticket.
11. Cancel the route and complete any additional tests required by support.