

Bravo Platform

Quick Guide



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About this guide

This guide summarizes the operator instructions in the [Bravo Platform User Guide](#).

This guide assumes the following:

- The Bravo Platform is installed correctly. For details, see the [Bravo Platform Safety and Installation Guide](#).
- The device profile for the specific Bravo configuration is already created and the teachpoints are already set. For setup instructions, see the [Bravo Platform User Guide](#).
- You are familiar with the VWorks Automation Control software. See the [VWorks Automation Control Quick Start](#). For detailed instructions, see the [VWorks Automation Control User Guide](#).

Where to find the user documentation

To access the user guides for Agilent Automation Solutions products, do one of the following:

- From within VWorks software, select **Help > Knowledge Base** or press F1.
- From the Windows desktop, select **Start > Agilent Technologies > VWorks Knowledge Base**.
- Go to the online VWorks Knowledge Base at www.agilent.com/chem/askb.

Contacting Agilent Technologies

Web: <https://www.agilent.com>

Contact page: <https://www.agilent.com/en/contact-us/page>

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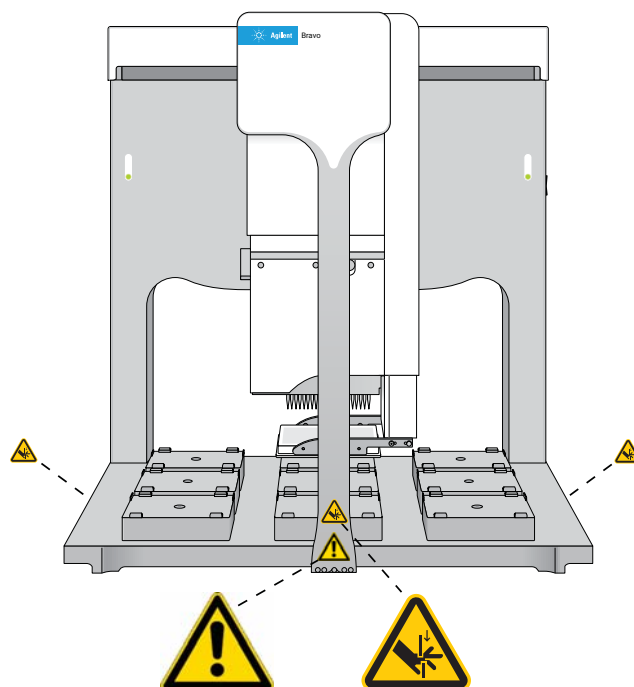
Safety guidelines

WARNING

Using controls, making adjustments, or performing procedures other than those specified in the user documentation can expose you to moving-parts hazards and hazardous voltage. Before using the Bravo Platform, make sure you are aware of the potential hazards and understand how to avoid being exposed to them.

Ensure that you are trained in the safe operation of the device and that you have read the [Agilent Automation Solutions Products General Safety Guide](#) and the safety section of the [Bravo Platform Safety and Installation Guide](#).

Figure Safety label locations on Bravo Platform (front view)



The Bravo Platform has moving parts that are accessible at the front, sides, and rear of the device, if not protected by the Bravo light curtain and shields. For a description of the moving parts, see [“Axes of motion” on page 6](#).

For the emergency-stop procedure, see [“Emergency stops” on page 11](#).

WARNING

If you touch any of the moving parts or attempt to move labware while the Bravo Platform is in operation, the device could pinch, pierce, or bruise you. Keep your fingers, hair, clothing, and jewelry away from the device while it is in motion.

WARNING

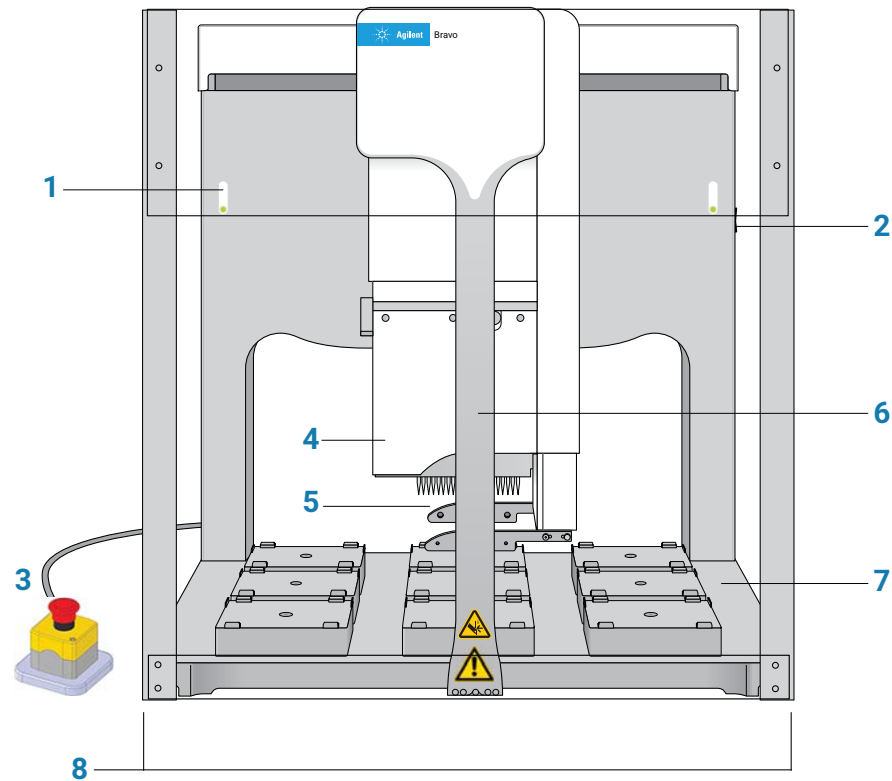
The Bravo head z-axis motor is particularly powerful. It might not stop immediately in a collision and a pipette tip could pierce your hand. Keep away from the Bravo Platform when the Bravo head is moving or about to move, especially in the z-axis direction.

Hardware components and axes of motion


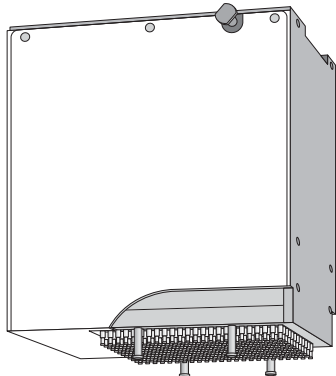
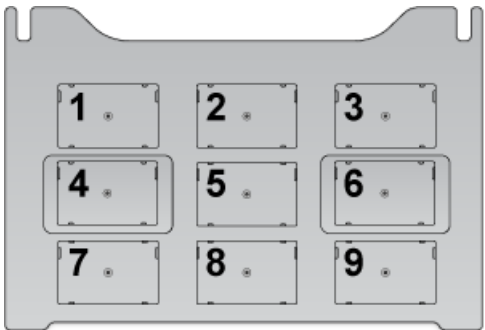
Primary hardware components

The following figure and table describe the primary hardware components.

Figure Bravo Platform components (front view)



Item	Feature	Description
1	Indicator lights	<p>The two light panels that display color-coded status of the Bravo Platform:</p> <ul style="list-style-type: none">● (solid blue). The Bravo Platform is turned on and in standby mode.● (flashing green). The software is running a protocol on the Bravo Platform.● (flashing orange). The software has initialized the Bravo Platform and Bravo Diagnostics is open.● (flashing red). The software has encountered an error while running a protocol or the interlock circuit is tripped.
2	Power switch	<p>The switch on the right side of the rear wall that turns on (I) and off (O) the Bravo Platform.</p>

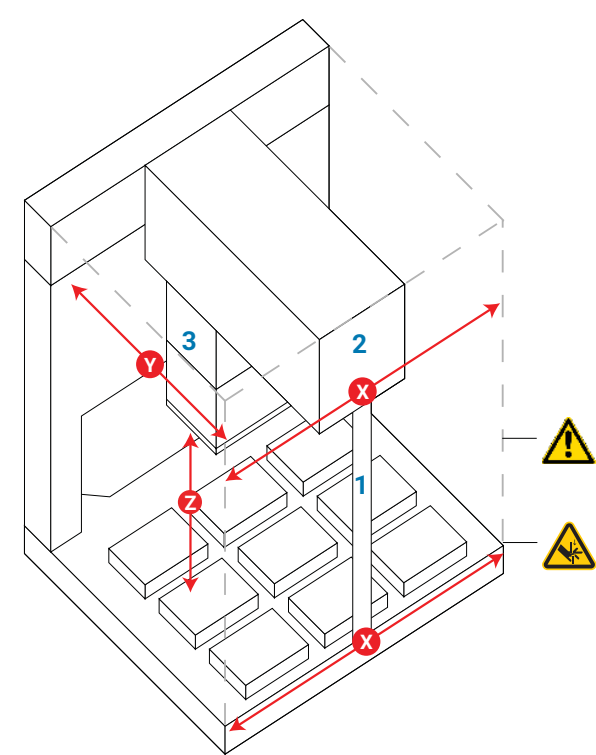
Item	Feature	Description
3	Emergency-stop pendant	<p>The pendant that contains the red emergency-stop button. To stop in an emergency, press the red button. All Bravo motion stops.</p> 
4	Liquid-handling head	<p>The platform uses interchangeable Bravo-compatible heads, including disposable-tip, pin tool, and the Bravo 96AM Head for AssayMAP cartridges.</p> <p>Figure Series III disposable-tip head</p> 
5	Gripper	An optional gripper that extends from the head mount to below the pipette head tips. The gripper picks and places labware on the deck.
6	Tie bar	The vertical bar at the front of the device that adds structural support to the Bravo head mount. The tie bar moves at high speed from side to side (x-axis) across the front of the Bravo deck whenever the head moves to a deck location.
7	Deck	The area that is accessible by the liquid-handling head. The nine labware locations are numbered 1–3 (back row), 4–6 (middle row), and 7–9 (front row).
		<p>Figure Nine deck locations for labware (top view)</p> 

Item	Feature	Description
8	Light curtain and front and side shields	<p>The safety equipment that prevents operator access to Bravo moving parts hazards:</p> <ul style="list-style-type: none">• <i>Light curtain.</i> Enables operator access to the Bravo deck while protecting operators from moving-parts hazards. If an object disrupts the light curtain, the motion of the Bravo head stops.• <i>Shields.</i> Clear plastic shields prevent operator access to sections of the Bravo not covered by the light curtain. <p>For more details on the Bravo safety equipment components, see the Bravo Platform Safety and Installation Guide.</p>

Axes of motion

The following figures and table show the Bravo moving parts. The Bravo light curtain and shields prevent operator access to moving-parts hazards.

Figure Bravo Platform primary axes of motion



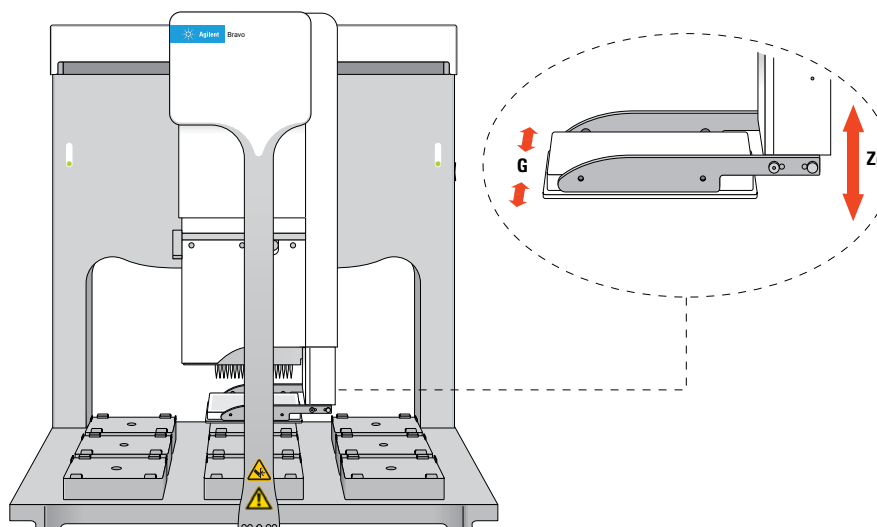
Item	Part	Axis of motion	Description
1	Tie bar	X	The tie bar is attached to the arm and moves side to side across the front of the deck.
2	Arm	X	The arm carries the head mount side to side across the deck.

Item	Part	Axis of motion	Description
3	Head mount	Y and Z	The liquid-handling head attaches to the head mount, which moves back and forth on the arm between the back and front of the deck. The head mount raises and lowers the liquid-handling head.

If the Bravo Platform is fitted with a gripper, the gripper moves with the Bravo head. In addition, the gripper has the following axes of motion:

- *G-axis*. The opening and closing distance of the gripper fingers, which enable the gripper to grip and release labware.
- *Zg-axis*. The vertical distance the gripper arm moves, which enables the gripper to extend beyond the pipette head.

Figure Bravo gripper assembly axes of motion



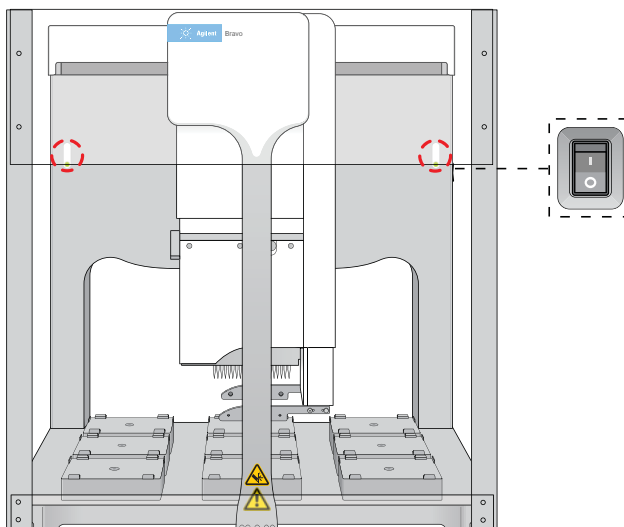
Starting up and shutting down

The following procedures describe how to start up and shut down the Bravo Platform when you are operating it as a standalone device. For instructions on how to turn on and turn off the Bravo Platform when it is integrated into a workstation or system, see the workstation or system user documentation.

Starting up the Bravo Platform

To start up the Bravo Platform:

- 1 Turn on any accessories, such as a Pump Module, and ensure that any tubing is connected. For a description of the Pump Module and autofilling reservoirs, see the [Pump Module User Guide](#).
- 2 Turn on the computer and the monitor. The Microsoft Windows operating system starts automatically.
- 3 On the side of the Bravo Platform, press the power switch to the **on** (I) position. The green light on the power switch is illuminated when the Bravo Platform is on.



- 4 Start the VWorks software.

Shutting down the Bravo Platform

Shut down the Bravo Platform before you remove or change the pipette head, clean the Bravo Platform, or perform any routine maintenance.

To shut down the Bravo Platform:

- 1 Make sure that the post-run cleanup procedure was followed after the last run. For details, see ["Cleaning up after the run" on page 10](#).
- 2 Shut down the computer.
- 3 Turn off any accessories, such as the Pump Module.
- 4 If using an autofilling reservoir, disconnect the bottles to prevent siphoning.
- 5 On the side of the Bravo Platform, press the power switch to the **off** (O) position.

Running a protocol

Preparing for the run

Before you start a run, make sure you review the protocol and ensure the following:

- The correct liquid-handling head is installed. If you need to install or change the head, see [“Changing the Bravo head” on page 17](#).
- The emergency-stop pendant is connected properly.
- The indicator lights on the front of the Bravo Platform are blue.
- The accessories and labware required for the protocol are where they should be positioned.
- The reservoirs or wash stations are filled.
- The waste bins or bottles are empty.

If the Bravo Platform is equipped with a Pump Module, the pumps should be primed before the first run of the day to ensure that the tubing from the source bottle is filled. Priming is typically part of the Startup Protocol. For information about the Pump Module, tubing connections, and setup of source and waste bottles, see the [Pump Module User Guide](#).

Starting a run

WARNING

When you initialize the Bravo Platform, the head and tie bar will move. To prevent potential injury, keep clear of the device while it is in motion.

You must initialize the Bravo Platform to establish communication between the device and the computer and to move the components to their home positions. When you open a protocol in the VWorks software, an initialization message appears automatically for any devices in the protocol that are not yet initialized.

To start a run:

- 1 In the VWorks software, ensure that simulation is off, and then open the protocol.
- 2 When the **Would you like to initialize the devices now?** message appears, click **Yes**.
- 3 If the **Verify that it is safe to home the W-axis (the aspirate/dispense axis)** message appears, and the tips do not contain fluid, click **Retry** to continue homing the w-axis. If the tips contain fluid, click **Ignore and continue**. When the **W-axis is not homed** message appears, click **Diagnostics** to open the Bravo Diagnostics software and use the diagnostics tools to home the w-axis over a waste position. For the homing procedure, see the [Bravo Platform User Guide](#).
- 4 If the **A microplate-in-gripper** error message appears, and the gripper is not holding labware, click **Ignore and Continue** to continue the homing process. If the gripper is holding labware, click **Abort** to cancel the initialization, and then remove the labware from the gripper. To use Bravo Diagnostics to open the gripper, see the [Bravo Platform User Guide](#). To restart initialization, open the device file (.dev), and then click **Initialize All Devices** in the VWorks window.
- 5 Click **Start** to start the run.

Cleaning up after the run

CAUTION

Use only the recommended cleaning materials. Using other cleaning solutions and materials can cause damage to the device. Do not use abrasive, corrosive cleaning agents. Do not use metal brushes.

Use standard laboratory wipes and a mild detergent or ethanol alcohol to clean the exterior painted white surfaces and the metal surfaces of dust, grime, chemical deposits, and other debris.

To clean up the Bravo Platform after a run:

- 1 Check the run log file for errors. For details on the VWorks run log, see the [VWorks Automation Control User Guide](#).
- 2 Ensure that the tips are ready for the next run:
 - *Disposable-tip pipette head.* You can use the Tips Off task in Bravo Diagnostics to remove any tips that remain on the barrels of the pipette head. For details, see [“Using Bravo Diagnostics to control the device” on page 13](#).
 - *Fixed-tip pipette head.* You can use the Wash Tips task in Bravo Diagnostics to wash the pipette tips.
- 3 Ensure all pipette head movement has stopped, and then remove any manually placed or unused labware, and clean up any spills or debris.
- 4 Wash the liquid reservoirs and wash stations.
- 5 If equipped with a Pump Module:
 - a *Optional.* Wash the tubing and reinstall the reservoirs or wash stations. Ensure that the tubing is connected to the correct pumps.
 - b Fill the fluid reservoir bottle, replace the cap, and attach the fluid line that pumps towards the Bravo Platform to the cap connector.
 - c Empty the waste container, replace the cap, and attach the fluid line that pumps away from the Bravo Platform to the cap connector.For connection details, see the [Pump Module User Guide](#).
- 6 If equipped with a Weigh Station, recalibrate it if you are changing the tubing connected to the reservoir, changing the liquid type used in the reservoir, or if more than two weeks have elapsed since the last Weigh Station calibration. For details, see the [Bravo Platform User Guide](#).

Stopping or pausing a run

Emergency stops

An emergency stop might be necessary to prevent a collision of the Bravo head with another object, such as misaligned labware. If you want to temporarily pause and then continue a run, see [“Pausing and continuing a run” on page 12](#).

To stop in an emergency:

Press the red button on the emergency-stop pendant. The Bravo head stops moving.

Note: Interrupting the light curtain also stops the motion of the Bravo head.

Figure Emergency-stop pendant



A Bravo Error dialog box opens and displays a **robot disable is active** error message.

To restore the Bravo device after an emergency stop:

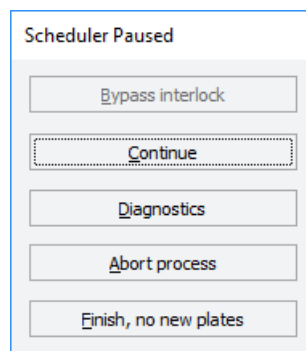
- 1 At the emergency-stop pendant, turn the red button clockwise. The spring-loaded button pops up.



- 2 Ensure that no object is interrupting the Light Curtain.
- 3 In the **Bravo Error** dialog box, click **Retry**. The Bravo Platform will attempt to resume the run where it left off.

To abort the run after an emergency stop:

- 1 In the **Bravo Error** dialog box, click **Abort**.
- 2 In the **Scheduler Paused** dialog box, click **Abort process**.



Pausing and continuing a run

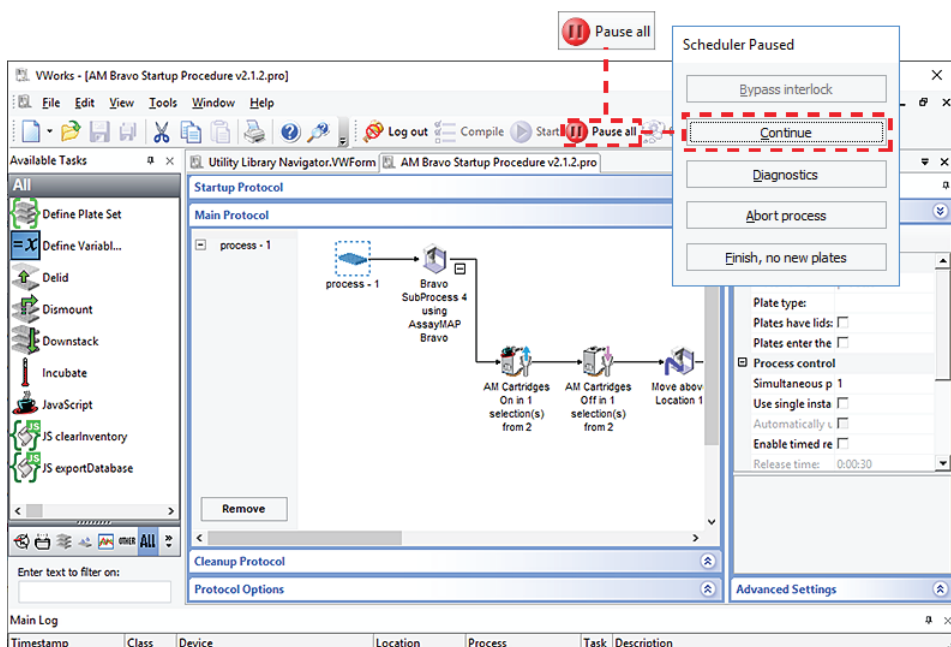
You can pause a run to introduce a labware that was forgotten during the setup, add reagents to a labware that is at risk of depleting, and so forth.

IMPORTANT

Attempting to pause a running protocol to change a setting can be detrimental to the protocol.

To pause and then continue a run:

- 1 In the VWorks window, click **Pause all**.
The task currently in progress finishes before the protocol pauses. The Scheduler Paused dialog box opens.
- 2 While the Bravo device is idle, make the necessary changes to your run, for example, adjusting a labware position or volume.
- 3 To resume the run, click **Continue** in the **Scheduler Paused** dialog box.



To abort a run:

- 1 In the VWorks window, click **Pause all**.
- 2 In the **Scheduler Paused** dialog box, click **Abort process**.

Using Bravo Diagnostics to control the device

To control the Bravo Platform when you are not running a protocol, you use Bravo Diagnostics. For example, you can use Bravo Diagnostics to run a single task, such as to eject tips, to open and close the gripper, and to change the pipette head.

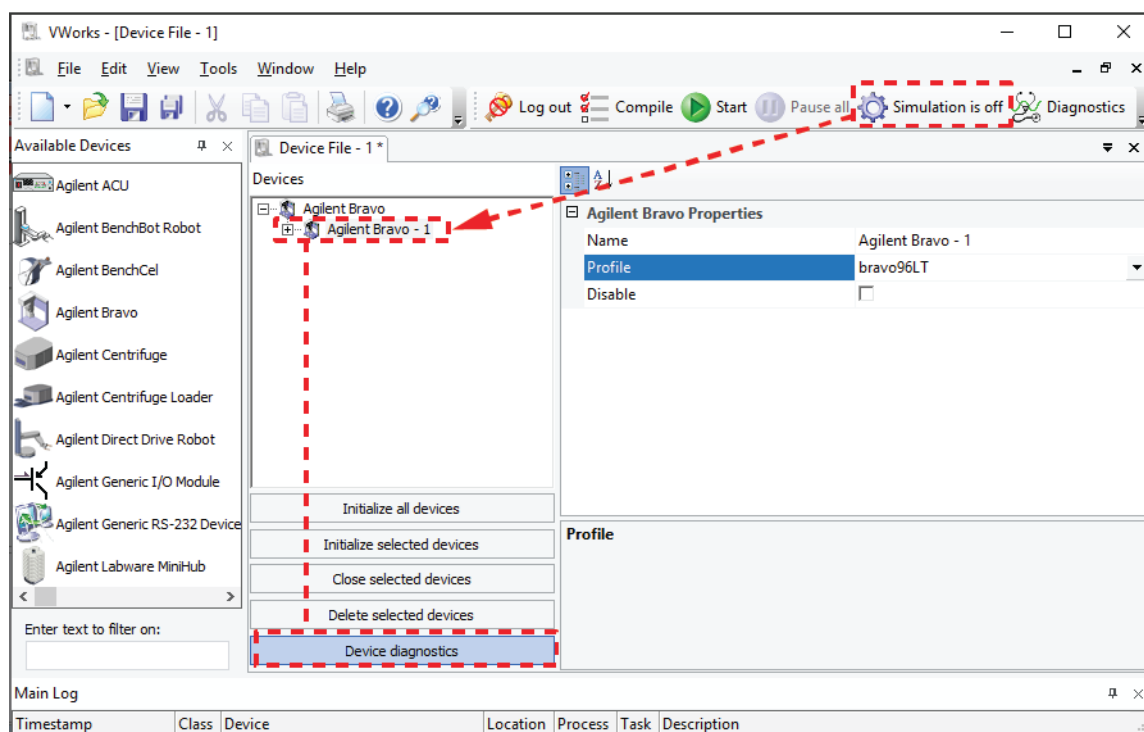
IMPORTANT

Some of the Bravo Diagnostics features are available only if you have VWorks administrator- or technician-level privileges. For details, see your lab administrator.

Opening Bravo Diagnostics

To open Bravo Diagnostics:

- 1 In the VWorks window, ensure that simulation is off and the correct device file (*.dev) is open.
- 2 In the **Devices** area, highlight the device name, and then click **Device diagnostics**. The Bravo Diagnostics dialog box opens for the selected device type.



Initializing the device in Bravo Diagnostics

Before you can use Bravo Diagnostics to control the Bravo Platform, you must initialize an appropriate profile in Bravo Diagnostics.

WARNING

When you initialize the Bravo Platform, the head and tie bar will move. To prevent potential injury, keep clear of the device while it is in motion.

CAUTION

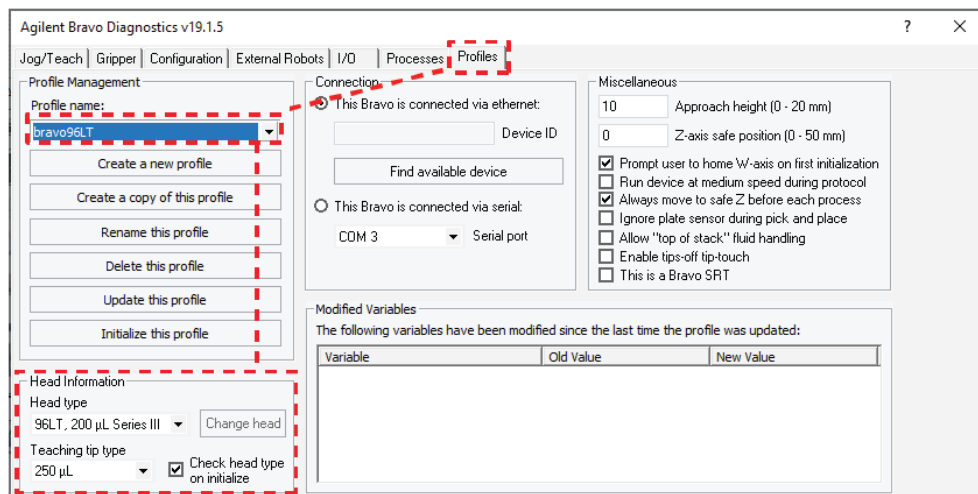
To prevent potential equipment damage, ensure that the deck is clear of any obstacles before using the Bravo Platform.

CAUTION

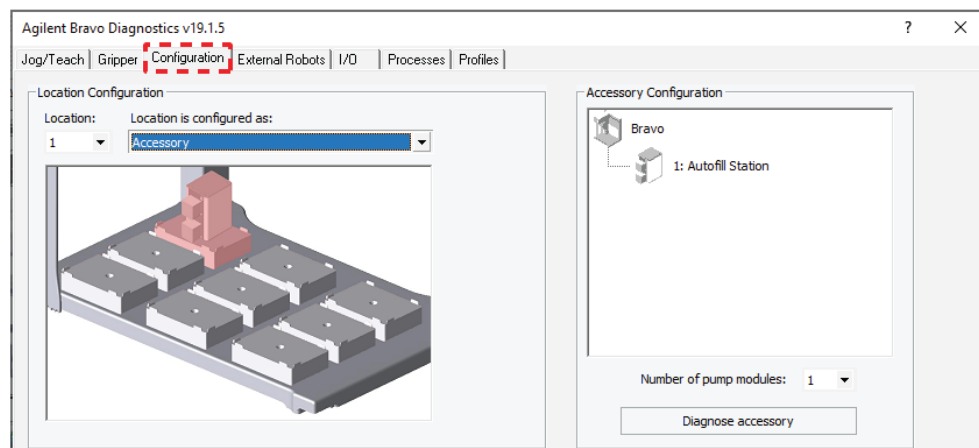
Using an incorrect profile can damage the Bravo Platform. Ensure that the profile is correct for the head type and deck configuration.

To initialize a profile in Bravo Diagnostics:

- 1 In the **Profiles** tab, ensure that the correct profile for the installed head and Bravo deck configuration is selected in the **Profile name** list.



- 2 Verify that the selected **Head type** matches the installed head.
For example, if a Series III pipette head is installed, the Bravo Platform requires a profile for the Series III head type.
- 3 Click the **Configuration** tab, and make sure the **Location Configuration** matches the physical layout on the Bravo deck.



IMPORTANT

If the Location Configuration differs from the physical deck layout, ensure that you select the correct profile in the Profiles tab.

- 4 In the **Profiles** tab, click **Initialize this profile** to start initializing the selected profile.

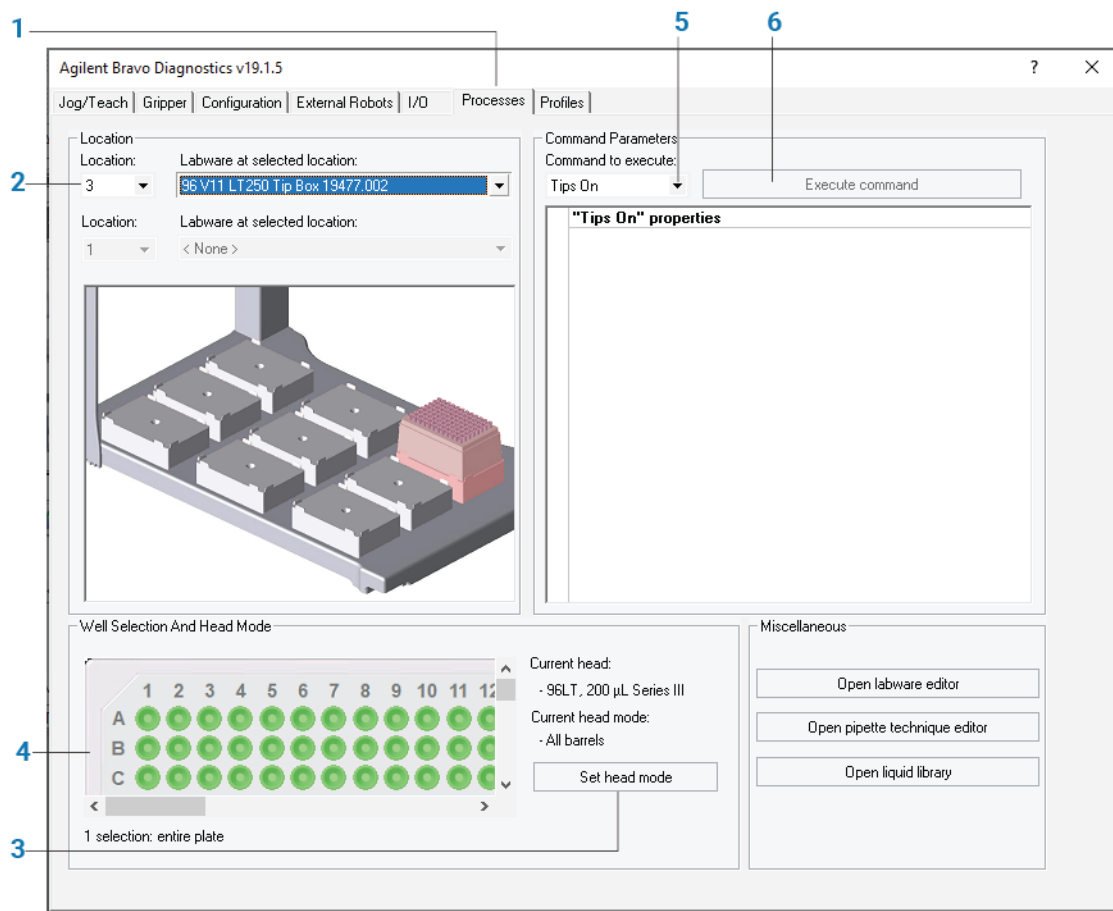
Running a task using Bravo Diagnostics

Before you start:

- Place the labware for the task at the Bravo deck location or locations.
- Ensure that the correct profile is initialized in Bravo Diagnostics. See [“Initializing the device in Bravo Diagnostics” on page 13](#).
- Ensure that the emergency-stop pendant is connected properly.

Refer to the following figure for this procedure.

Figure Task workflow in Agilent Bravo Diagnostics dialog box

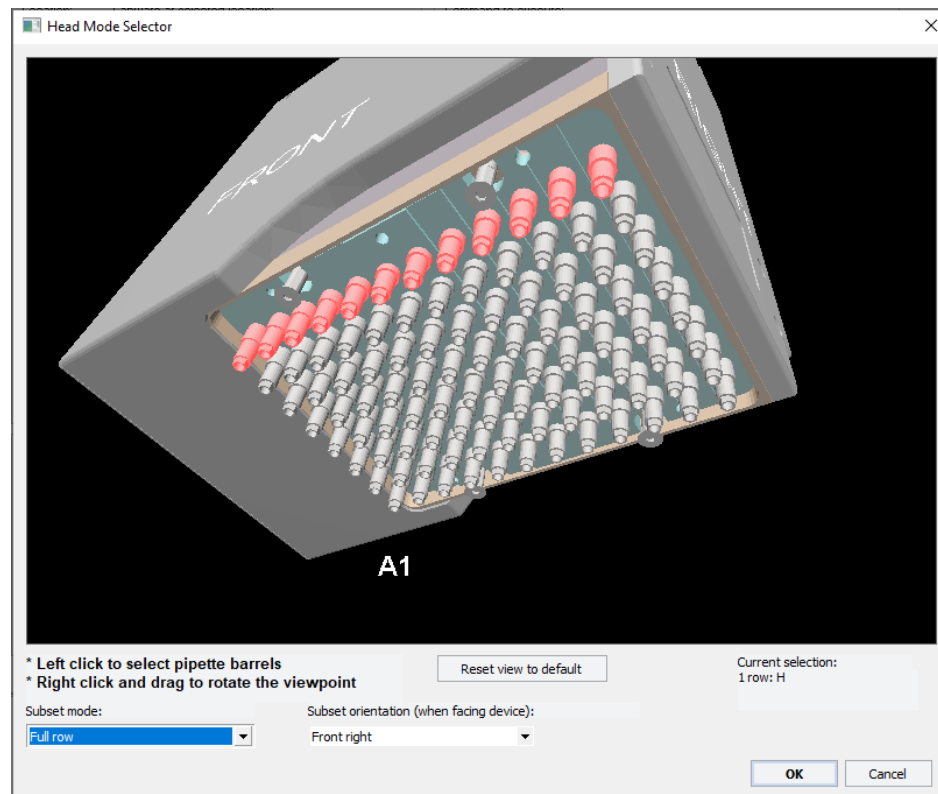


To use Bravo Diagnostics to run a task:

- 1 In the Agilent Bravo Diagnostics dialog box, click the **Processes** tab.
- 2 Under **Location**, do the following:
 - a In the **Location** list, select the deck location of the labware that you placed on the deck.
Alternatively, click the location in the graphical display.
 - b In the **Labware at selected location** list, select the type of labware.
 - c If the task involves two locations, repeat this step for the second location.

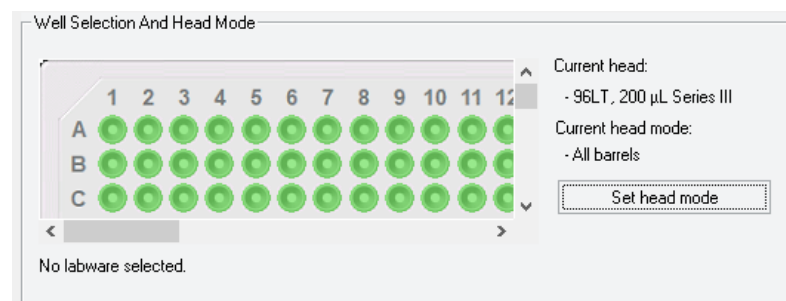
- 3 If you are using a subset of the barrels in the head, select the barrels as follows:
 - a Click **Set head mode**.
 - b In the **Head Mode Selector** dialog box, select the barrels, and then click **OK**.

Figure Head Mode Selector dialog box



Note: If you select a single row on a disposable-tip head, make sure you retract the head stripper pins. For details, see the [Bravo Platform User Guide](#).

- 4 If the head has fewer tips than the plate has wells or you are using the head in serial mode, select the quadrant or quadrants in the **Well Selection and Head Mode** area. Click a representative well in the plate graphic to select the corresponding quadrant of wells. The selection appears below the plate graphic.



- 5 In the **Command Parameters** area:
 - a Select the task from the **Command to execute** list.
 - b Set the parameter values for the command. For details on setting the parameter values, see the [Bravo Platform User Guide](#) or the [VWorks Automation Control User Guide](#).
- 6 To start the task, click **Execute command**.

Changing the Bravo head

Use the following procedure to remove the currently installed head, install a different head, and adjust the corresponding settings in the VWorks software.

Before you start

WARNING

AssayMAP Bravo Platform only. To prevent potential injury from exposure to chemical spills, ensure that the syringes in the Bravo 96AM Head are empty before uninstalling the head. For instructions on how to change the 96AM Head, see the [AssayMAP Bravo Platform Getting Started Guide](#).

CAUTION

Always turn off the Bravo Platform before removing a head. Failure to turn off the Bravo Platform before changing the head can damage the head electronics.

CAUTION

Do not rest the bottom of a liquid-handling head on any surface. Doing so can damage the barrels, pins, or probes.

CAUTION

To prevent potential contamination, do not touch the liquid-handling head barrels, tips, or probes with your hands.

IMPORTANT

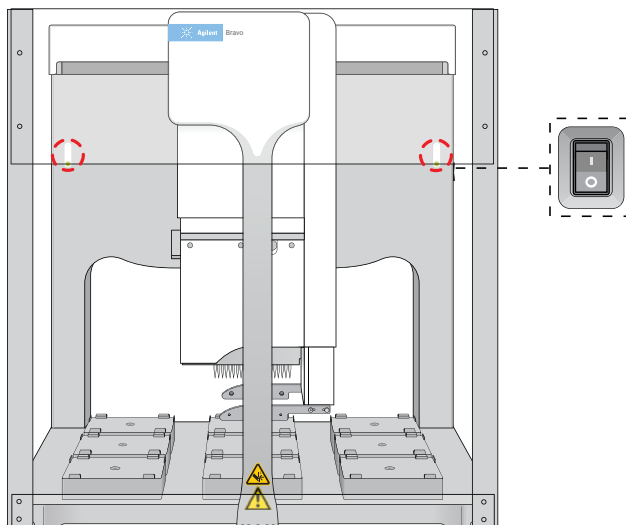
If a head is being used for the first time, make sure you have an appropriate profile and device file for the new head. If necessary, contact your lab administrator to create a new profile and device file before starting the following procedure.

Ensure that the currently installed head does not have tips on the barrels. If necessary, use the Tips Off command in Bravo Diagnostics to remove the tips before removing the head. For details, see [“Running a task using Bravo Diagnostics” on page 15](#).

Changing the mounted head

To uninstall the mounted Bravo head:

- 1 On the side of the Bravo Platform, press the power switch to the **off (O)** position.

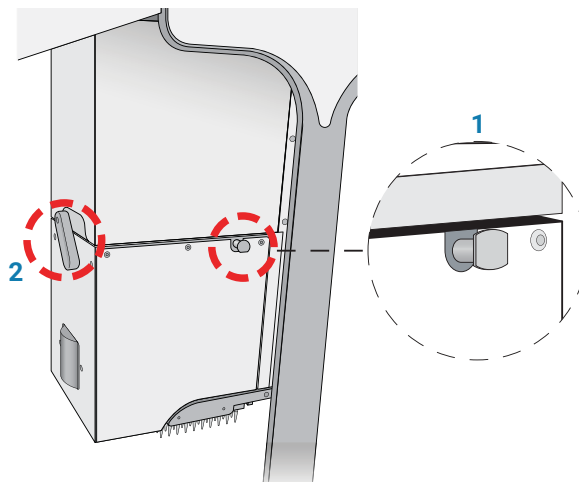


- 2 Make sure that the head mount is at its home position above deck location 5, as the preceding figure shows.
If necessary, manually move the head to the center of the deck.
- 3 To unlock the mounted head, refer to the following figure:
 - a Pull out and twist the (1) two head-retainer pins one-quarter turn (90°) so that they remain retracted.

Note: The straight edge of the retainer pins should be horizontal.

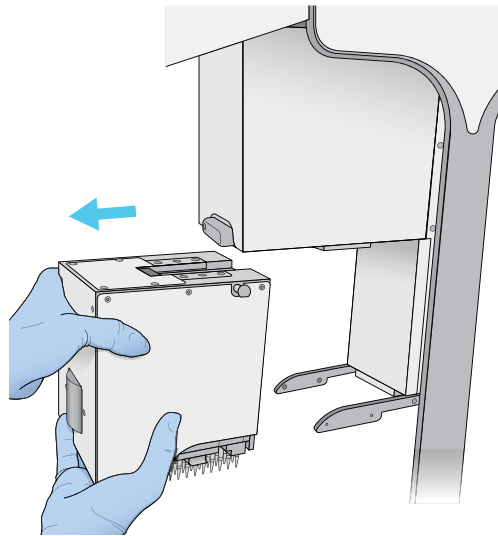
 - b Turn the (2) head lock counterclockwise until it clicks into position.

Figure Installed Bravo head: (1) retainer pin and (2) head lock



- 4 Reaching from the left side of the Bravo tie bar, grasp the head firmly as the following figure shows:
 - a With your left hand firmly grip the left side of the head.

- b** Place your right hand under the flat area just to the left of the barrel or syringe array to support the weight of the head.



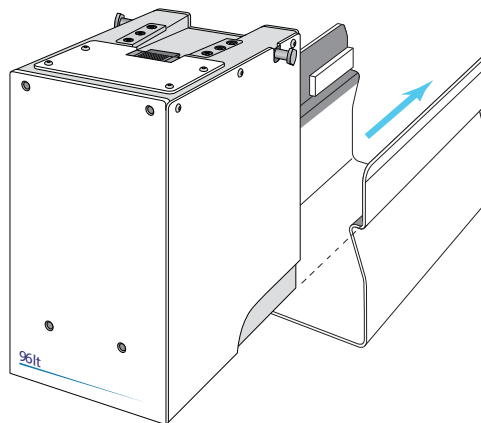
- 5** While supporting the head with your hands, slide the head to the left and out of the Bravo head mount.

CAUTION

Support the head securely without touching the barrels, probes, or pins. Dropping the head or bumping the barrels, probes, or pins will damage the head.

- 6** Carefully place the head into the storage stand, as follows:
 - *Disposable-tip heads.* Rest the bottom of the stand on a clean, dry surface. Slide the head into the stand, with the barrels facing down, as the following figure shows.

Figure Series III disposable-tip head and storage stand

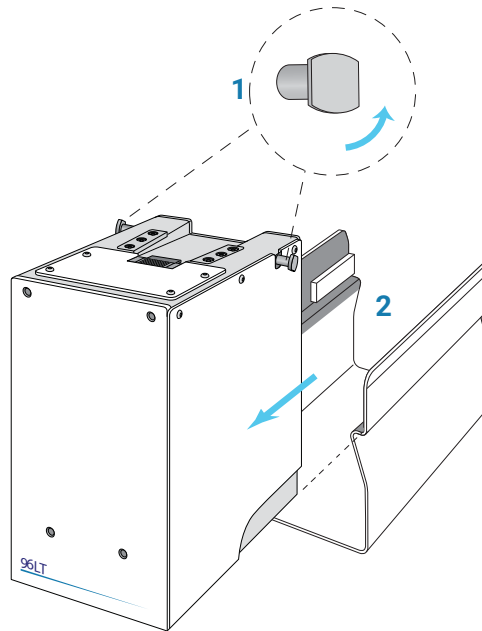


- *Pin Tools.* Rest the top of the head on a clean, dry surface with the pins facing up. Slide the stand onto the head.

Store the head top-side up and resting in the head stand.

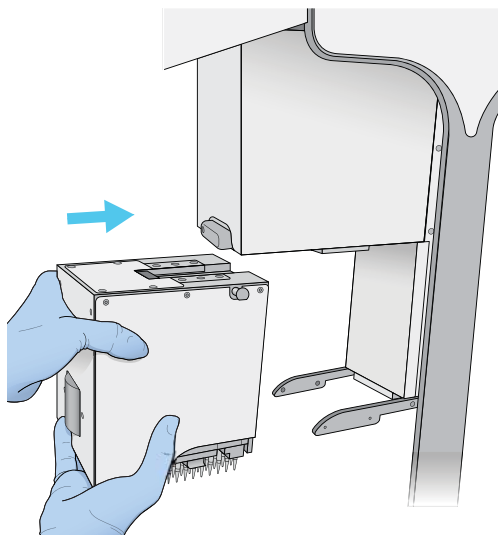
To install a Bravo liquid-handling head:

- 1 Make sure that the Bravo Platform is turned off and that the Bravo head mount is in its home position, which is centered above deck location 5.
- 2 While the head remains seated in the head stand, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.
- 3 Remove the head from the stand as follows:
 - *Disposable-tip heads.* Rest the bottom of the stand on a clean, dry surface. Slide the head out of the stand as the following figure shows, so that the barrels are facing down.



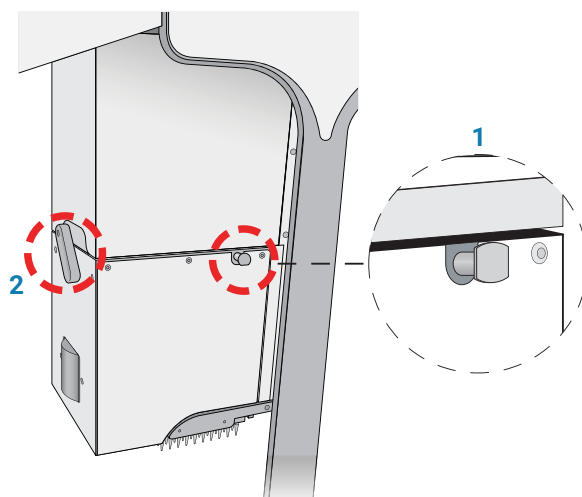
- *Pin Tools.* Ensure that the top of the head is resting on a clean, stable surface so that the pins are facing up. Slide the stand off of the head.
- 4 With your left hand, firmly grip the left side of the head. Place your right hand under the flat area just to the left of the array to support the weight of the head.
 - 5 While supporting the head with your hands, slide the head onto the Bravo head mount. Press the head firmly into place to ensure the head is plugged into the connector receptacle on the head mount. You should hear the click when the retaining pins snap into place.

Figure Installing a head in the Bravo head mount

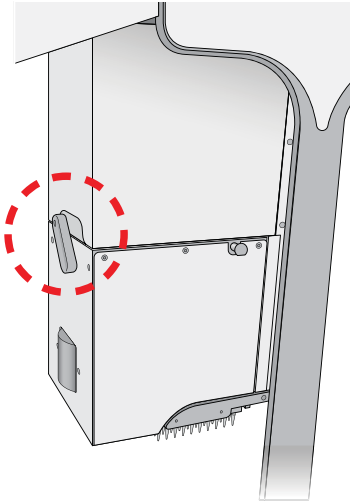


Note: If you do not hear the pins snap into place, check that the straight edges of the retainer pins are in the vertical position, as the following figure shows. Attempt to rotate the pins to ensure that they are in the locked position. The pins should not rotate freely.

Figure Installed head: (1) retainer pin and (2) head lock



- 6 To lock the head, rotate the head lock clockwise until it reaches its hard stop. This ensures that the head is fully seated and does not shift position during operation.



CAUTION

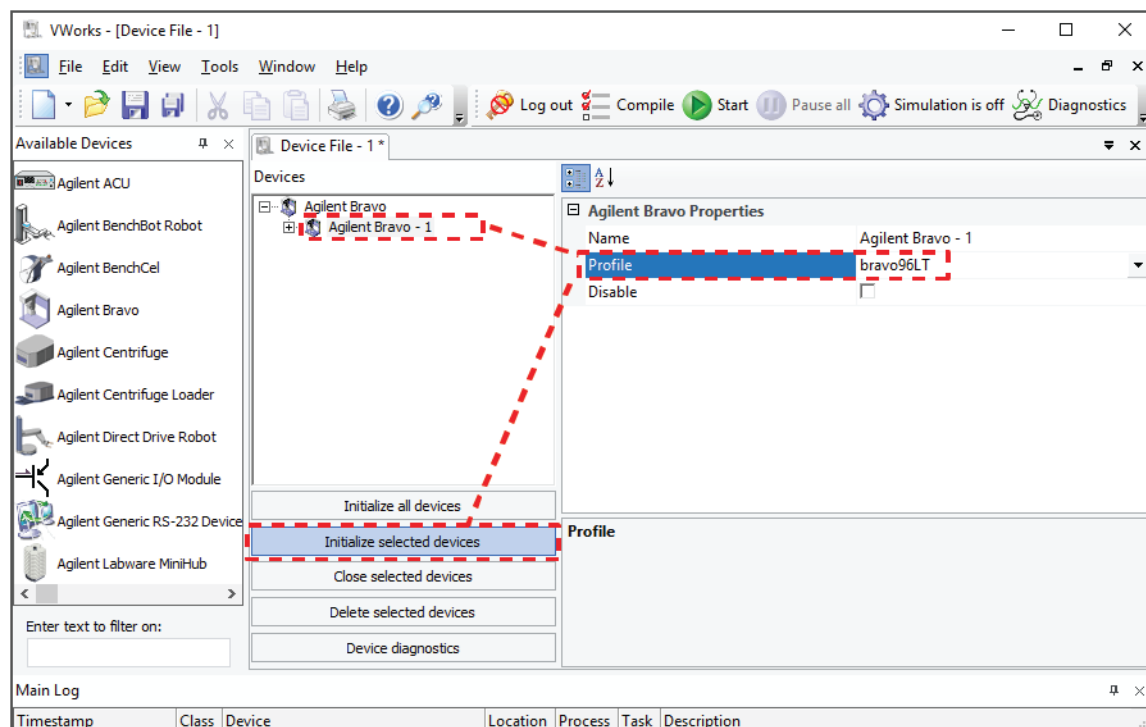
Dropping the head or bumping the barrels or probes will damage the head. If the Bravo head is not properly secured in place, it could drop unexpectedly. Ensure that the head is securely locked into the head mount.

Adjusting VWorks settings for a different Bravo head

After installing a different Bravo head, you must ensure that the Bravo device in the VWorks software is linked to the correct profile for the head.

To adjust VWorks settings for a new Bravo head:

- 1 In the VWorks window, ensure that simulation is off and the correct device file (*.dev) is open.
- 2 In the **Devices** area, highlight the device name, and then ensure that the profile selected under **Agilent Bravo Properties** is correct.



If the device file contains more than one device profile for the same Bravo Platform, ensure that you disable the unused devices in the device file. For details, see the [VWorks Automation Control User Guide](#).

- 3 To initialize the Bravo Platform, click **Initialize selected devices** or **Initialize all devices**.

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