Bravo Automated Liquid Handling Platform

Quick Guide
Original Instructions
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Bravo Automated Liquid Handling Platform Quick Guide

This guide contains the following topics:

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- “Changing the Bravo head” on page 13
About this guide

This guide summarizes the operator instructions in the Bravo Automated Liquid Handling Platform User Guide.

This guide assumes the following:

- The Bravo Platform is installed correctly. For installation instructions, see the Bravo Automated Liquid Handling 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 Automated Liquid Handling 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.

If you are using another lab automation system software, see the user documentation for that software.

For user information about related products, you can search the product knowledge base or download the latest version of a PDF file from the Agilent Technologies website at www.agilent.com/chem/askb.

Safety information

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 you have read the Bravo Automated Liquid Handling Platform Safety and Installation Guide and are trained in the safe operation of the device.

Figure  Bravo Platform (front view)
Hardware components and axes of motion

Primary hardware components

The following figure and table describe the primary hardware components. In addition, the Bravo Platform has shields and a Light Curtain to protect you from moving-parts hazards. For a description of the safety equipment, see the Bravo Automated Liquid Handling Platform Safety and Installation Guide.

**Figure**  Bravo Platform components (front view)

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicator lights</td>
<td>The two light panels that display color-coded status of the Bravo Platform:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <em>(solid blue).</em> The Bravo Platform is turned on and in standby mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <em>(flashing green).</em> The software is running a protocol on the Bravo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Platform.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <em>(flashing orange).</em> The software has initialized the Bravo Platform and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bravo Diagnostics is open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <em>(flashing red).</em> The software has encountered an error while running a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>protocol or the interlock circuit is tripped.</td>
</tr>
<tr>
<td>2</td>
<td>Power switch</td>
<td>The switch on the right side of the rear wall that turns on (I) and off (O)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the Bravo Platform.</td>
</tr>
<tr>
<td>Item</td>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>3</td>
<td>Robot-disable pendant</td>
<td>The pendant that contains the Bravo robot-disable button, which is red, raised, and illuminated. To stop in an emergency, press the red button. The power is cut from the motors, causing all motion to stop.</td>
</tr>
</tbody>
</table>
| 4    | Liquid-handling head | The platform uses interchangeable Bravo-compatible heads, including disposable-tip, fixed-tip, pin tool, and the Bravo 96AM Head for AssayMAP cartridges.  
*Note:* The fixed-tip heads and the Series II disposable-tip heads are not designed for use with the Bravo gripper. |
| 5    | 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. |
| 6    | 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. |
| 7    | Deck | The area that is accessible by the liquid-handling head. The deck supports nine deck locations that are numbered 1–3 (back row), 4–6 (middle row), and 7–9 (front row). |

*Figure*  Series III disposable-tip head  

*Figure*  Nine deck locations (top view)
Axes of motion

The Bravo Platform has components that move in the $x$-, $y$-, and $z$-axes, as the following figure shows.

*Figure*  Bravo Platform primary axes of motion

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 8.
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 (0) position.

Running a protocol

Preparing for the run

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

- The robot-disable button on the pendant is activated (red indicator light).
- The indicator lights on the front of the Bravo Platform are blue.
- The correct pipette head is installed. If you need to install or change the head, see “Changing the Bravo head” on page 13.
- 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 can 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 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 Automated Liquid Handling Platform User Guide.
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 Automated Liquid Handling Platform User Guide*. To restart initialization, open the device file (.dev), and then click **Initialize All Devices** in the VWorks window.

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 9.
   - **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:
   - **Optional.** Wash the tubing and reinstall the reservoirs or wash stations. Ensure that the tubing is connected to the correct pumps.
   - Fill the fluid reservoir bottle, replace the cap, and attach the fluid line that pumps towards the Bravo Platform to the cap connector.
   - 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 Automated Liquid Handling Platform User Guide*. 
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 Tips Off, to open and close the gripper, and to change the pipette head.

**IMPORTANT** Some of the Bravo Diagnostics features may be 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 Diagnostics diagnostics dialog box opens for the selected device type.

**Initializing the Bravo Platform in 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 can 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 see if 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 Bravo Platform in Diagnostics” on page 9.
- Ensure that the robot-disable button on the pendant is activated (red indicator light is on).

Refer to the figure below for the following procedure.

Figure  Task workflow in Bravo Diagnostics dialog box

To use Bravo Diagnostics to run a task:

1. In the 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 **Series III disposable-tip heads and Bravo 96AM Head only.** 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

![Head Mode Selector](image)

**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 Automated Liquid Handling 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.

![Well Selection and Head Mode](image)

5 In the **Command Parameters** area:
   a Select the task from the **Command to execute** list.
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**

**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.

**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. See “Running a task using Bravo Diagnostics” on page 11.

**Changing the mounted head**

To change 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 shown in the preceding figure. 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 two head-retainer pins (1) one-quarter turn so that they remain retracted.
   b Turn the head lock (2) counterclockwise until it clicks into position.

4 Grasp the head firmly using care not to touch the barrels, probes, tips, or pins. While supporting the head with your hands, use your thumbs to push the head from side to side and slide it out of the Bravo head mount.

CAUTION Carefully support the head without touching the barrels, tips, or pins. Dropping the head or bumping the barrels, tips, or pins will damage the head.
5 Carefully place the head into the head stand to protect the barrels, tips, or probes for storage as follows:

- *Disposable-tip pipette 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

- *Fixed-tip pipette heads and pin tools*. Rest the top of the head on a clean, dry surface with the tips or pins facing up. Slide the stand onto the head as the following figure shows.

  **Figure** Fixed-tip head and storage stand
• **Bravo 96AM Head.** Ensure that the top of the head is resting on a clean, stable surface so that the probes are facing up.

Carefully place the stand onto the head, guiding the side cutouts onto the two side tabs on the head. Use care to avoid touching the probes.

*Figure*  Bravo 96AM Head and storage stand

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

6 On the head to be mounted, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

7 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.

8 To lock the head:
   a 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.
   b Twist the two head-retainer pins so they snap in, securing the head on the mount.
On the side of the Bravo Platform, press the power switch to the **on (I)** position.

**CAUTION** Do not touch the pipette head barrels, tips, pins, or probes with your hands.

**CAUTION** If the Bravo head is not properly secured in place, it could drop unexpectedly. Dropping the head, or bumping the barrels, tips, pins, or probes will damage the head. Contact Automation Solutions Technical Support if you suspect a damaged head.

9 On the side of the Bravo Platform, press the power switch to the **on (I)** position.
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 software 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.