Bravo Automated Liquid-Handling Platform

Safety and Installation Guide

Original Instructions

Agilent Technologies
Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as “Commercial computer software” as defined in DFAR 252.227-7014 (June 1995), or as a “commercial item” as defined in FAR 2.101(a) or as “Restricted computer software” as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies’ standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>v</td>
</tr>
<tr>
<td>About this guide</td>
<td>vi</td>
</tr>
<tr>
<td>Reporting problems</td>
<td>vii</td>
</tr>
<tr>
<td>1. Safety guidelines</td>
<td>1</td>
</tr>
<tr>
<td>General safety information</td>
<td>2</td>
</tr>
<tr>
<td>Safety and regulatory compliance</td>
<td>3</td>
</tr>
<tr>
<td>Emergency stops</td>
<td>5</td>
</tr>
<tr>
<td>Mechanical hazards</td>
<td>5</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>8</td>
</tr>
<tr>
<td>Cut hazard</td>
<td>9</td>
</tr>
<tr>
<td>2. Installing the Bravo Platform</td>
<td>11</td>
</tr>
<tr>
<td>Workflow for installing the Bravo Platform</td>
<td>12</td>
</tr>
<tr>
<td>Laboratory setup requirements</td>
<td>13</td>
</tr>
<tr>
<td>Connecting the Bravo Platform</td>
<td>15</td>
</tr>
<tr>
<td>Installing the liquid-handling head</td>
<td>19</td>
</tr>
<tr>
<td>Installing the Light Curtain and front and side shields</td>
<td>25</td>
</tr>
<tr>
<td>Installing the rear shield</td>
<td>36</td>
</tr>
<tr>
<td>Starting up and shutting down</td>
<td>39</td>
</tr>
</tbody>
</table>
Preface

This preface contains the following topics:

- “About this guide” on page vi
- “Reporting problems” on page vii
About this guide

Who should read this guide

This user guide is for people with the following job roles:

<table>
<thead>
<tr>
<th>Job role</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installer</td>
<td>Unpacks, installs, and tests the Bravo Platform before it is used.</td>
</tr>
<tr>
<td>Integrator</td>
<td>Configures hardware and writes software.</td>
</tr>
<tr>
<td>Lab manager, administrator, or technician</td>
<td>• Manages the automation system that contains the Bravo Platform</td>
</tr>
<tr>
<td></td>
<td>• Develops the applications that are run on the system</td>
</tr>
<tr>
<td></td>
<td>• Develops training materials and standard operating procedures for operators</td>
</tr>
<tr>
<td>Operator</td>
<td>Performs the daily production work on the Bravo Platform and solves routine problems</td>
</tr>
</tbody>
</table>

What this guide covers

This guide describes the following:

- Potential safety hazards of the Bravo Platform and how to avoid them. For general safety information, see the *Automation Solutions Products General Safety Guide*.
- Installation instructions, including specifications and site requirements for the Bravo Platform.

What is new in this revision

<table>
<thead>
<tr>
<th>Revision description</th>
<th>See...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added a safety warning for the AssayMAP Bravo head</td>
<td>“Cut hazard” on page 9</td>
</tr>
</tbody>
</table>

Related user instructions

Go to the Automation Solutions knowledge base located at [www.agilent.com/chem/askb](http://www.agilent.com/chem/askb) for information on how to do the following:

- Set up and operate the Bravo Platform and accessories.
- Define labware and labware classes, liquid classes, and pipetting techniques, and how to track and manage labware in storage.
- Add devices, create protocols, and set task parameters for each device in the system.
• Use the automation control software.
• Set up and use the third-party devices.

For unpacking instructions, see the Bravo Platform Unpacking Guide. Safety information for the devices appears in the corresponding device user guide. You can also search the knowledge base or the PDF files for safety information.

Reporting problems

Contacting Automation Solutions Technical Support

If you find a problem with the Bravo Platform, contact Automation Solutions Technical Support. For contact information, see Notices on the back of the title page.

Reporting hardware problems

When contacting Agilent Technologies, make sure you have the serial number of the device ready. You can find the serial number on the Bravo Platform serial number label.

Reporting software problems

When you contact Automation Solutions Technical Support, make sure you provide the following:
• Short description of the problem
• Relevant software version number (for example, automation control software, diagnostics software, and firmware)
• Error message text (or screen capture of the error message dialog box)
• Relevant files, such as log files

Reporting user guide problems

If you find a problem with this user guide or have suggestions for improvement, send your comments in an email to documentation.automation@agilent.com.
1

Safety guidelines

This chapter contains the following topics:

•  “General safety information” on page 2
•  “Safety and regulatory compliance” on page 3
•  “Emergency stops” on page 5
•  “Mechanical hazards” on page 5
•  “Ergonomics” on page 8
•  “Cut hazard” on page 9
General safety information

Before installing and using the Bravo Platform

Before installing and using the Bravo Platform, make sure you are aware of the potential hazards and understand how to avoid being exposed to them. You must be properly trained in the correct and safe installation and operation of the device. For the intended product use statement and safety label descriptions, see the *Automation Solutions Products General Safety Guide*.

**WARNING** Changing or modifying the Bravo Platform safety equipment may prevent the safe operation of the Bravo Platform, invalidate its safety compliance, and lead to personal injury or property damage. Any customer who does not use the supplied safety equipment or who modifies the supplied safety equipment assumes full responsibility for providing an appropriate level of safety for its operators and for providing the applicable safety compliance marking and documentation.

The following figure shows the location of the warning labels on the Bravo Platform.

*Figure*  Bravo Platform warning label location
Safety and regulatory compliance

The Bravo Platform complies with the applicable EU Directives and bears the CE mark. See the Declaration of Conformity or Declaration of Incorporation, as applicable, for details. The Bravo Platform is designed to comply with the regulations and standards listed in the following table.

<table>
<thead>
<tr>
<th>Regulatory Compliance</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EMC</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 61326-1:2005 / EN 61326-1:2006</td>
</tr>
<tr>
<td>Canada</td>
<td>ICES/NMB-001:2004</td>
</tr>
<tr>
<td>Australia/New Zealand</td>
<td>AS/NZS CISPR 11:2004</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td></td>
</tr>
<tr>
<td>European Union</td>
<td>Machinery Directive 2006/42/EC</td>
</tr>
<tr>
<td></td>
<td>Low Voltage Directive 2006/95/EC</td>
</tr>
<tr>
<td></td>
<td>IEC 61010-1:2001 / EN61010-1:2001</td>
</tr>
<tr>
<td>Canada</td>
<td>CAN/CSA-C22.2 No. 61010-1-04</td>
</tr>
<tr>
<td></td>
<td>CAN/CSA-C22.2 No. 61010-2-081-04</td>
</tr>
<tr>
<td>USA</td>
<td>ANSI/UL 61010-1:2004</td>
</tr>
</tbody>
</table>

**Electromagnetic compatibility**

If the Bravo Platform causes interference with radio or television reception, which can be determined by turning the device off and on, try one or more of the following measures:

- Relocate the radio or television antenna.
- Move the device away from the radio or television.
- Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
- Make sure that all peripheral devices are also certified.
- Make sure that appropriate cables are used to connect the device to peripheral equipment.
- Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

**Sound emission declaration**

Sound pressure: Lp < 70 dB according to EN ISO 779:2010.

South Korean Class A EMC declaration

A 급 기기 (업무용 방송통신기자재)

This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바랍니다. 가정외의 지역에서 사용하는 것을 목적으로 합니다.
Emergency stops

Procedure

**WARNING** If the Bravo Platform is integrated with other devices in a system, Agilent Technologies recommends that you install a main emergency stop button that will stop all devices simultaneously. In addition, all operators must be instructed in the emergency stop procedure.

**CAUTION** You might not be able to resume a protocol after an emergency stop. Do not use an emergency stop to pause a run. To pause and continue a run, use the appropriate commands in the automation software.

*To stop in an emergency:* Press the red button on the robot-disable (emergency-stop) pendant. The Bravo head stops immediately.

*Figure* Robot-disable pendant

*To recover from an emergency stop*

1. Remove any labware that was dropped and clean up any spills.
2. Release the red button on the robot-disable pendant by turning it clockwise.
3. In the automation software message box, select one of the options to abort, retry, or continue. This will re-enable the axes motors.

Mechanical hazards

**Moving parts hazard**

The Bravo Platform has moving parts that are accessible at the front, sides, and rear of the device, if not protected by shields and the Light Curtain.

The following figures and tables show the potential moving-parts hazards. Note that the moving parts hazard area includes a piercing hazard.
### Mechanical hazards

**Figure** Bravo Platform (top front view) showing moving-parts hazards

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Axis of motion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tie bar</td>
<td>x-axis</td>
<td>The tie bar is attached to the arm and moves side to side across the front of the deck.</td>
</tr>
<tr>
<td>2</td>
<td>Arm</td>
<td>x-axis</td>
<td>The arm carries the head mount side to side across the deck.</td>
</tr>
<tr>
<td>3</td>
<td>Head mount</td>
<td>y-axis</td>
<td>The pipette head attaches to the head mount, which moves back and forth on the arm between the back and front of the deck.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>z-axis</td>
<td>The head mount raises and lowers the pipette head.</td>
</tr>
</tbody>
</table>
Mitigating the risk to users

**WARNING** To reduce the risk of injury from moving parts, ensure that the Bravo safety interlock circuit is connected to a light curtain or an enclosure with an interlock switch.

The Bravo Platform has a safety interlock circuit that must be closed for the device to operate. Interrupting the safety interlock circuit will stop the motion of the robot head. Agilent Technologies highly recommends, and workplace safety laws in many countries require, that you connect the Bravo Platform safety interlock circuit to a light curtain or an enclosure with an interlock switch to mitigate the risk from moving parts.

If the Bravo Platform is operated outside an enclosure, you should install safety shields, as appropriate, in addition to a light curtain at the front of the device. For more information, contact Automation Solutions Technical Support. See “Installing the Light Curtain and front and side shields” on page 25 and “Installing the rear shield” on page 36.

It is the responsibility of every operator to follow the warnings and safety labels and to keep away from the Bravo Platform whenever the device is likely to move.

**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.

### Table: Moving parts on Bravo gripper assembly

<table>
<thead>
<tr>
<th>Item</th>
<th>Part</th>
<th>Axis of motion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Gripper assembly</td>
<td>$G$-axis</td>
<td>The gripper fingers close and open to grip and release labware.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$Zg$-axis</td>
<td>The gripper moves up to provide clearance when the head is moving across the deck, and down to extend beyond the pipette head to pick and place labware.</td>
</tr>
</tbody>
</table>
1 Safety guidelines

Ergonomics

**WARNING** The pipette 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 pipette head is moving or about to move, especially in the z-axis direction.

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

**WARNING** Connecting the Bravo Platform to a company or general network can potentially cause injury. Remote computer operators might accidently initiate an operation that causes the robot to move unexpectedly, possibly injuring nearby lab personnel. Avoid connecting the Bravo Platform to a company or general network. Ensure that anyone with access to the Bravo Platform is trained in the potential hazards and how to avoid them.

### Ergonomics

#### About lifting the Bravo Platform

**WARNING** The Bravo device weighs approximately 52.1 kg (114.9 lb). Attempting to move the Bravo device without assistance could cause personal injury. Request assistance and use proper lifting techniques when moving the Bravo device.

*Figure* Correct lifting technique

**CAUTION** Tugging on the tie bar or using it to lift the device can damage the device.
Cut hazard

**WARNING** The probes of the AssayMAP head (Bravo 96AM Head) are sharp and can scratch you if they brush across your hand. A probe scratch can expose you to any contaminants remaining on the probes. Wear gloves and use extreme caution to avoid brushing against the probes.
1 Safety guidelines

Cut hazard
2 Installing the Bravo Platform

This chapter contains the following topics:

- “Workflow for installing the Bravo Platform” on page 12
- “Laboratory setup requirements” on page 13
- “Connecting the Bravo Platform” on page 15
- “Installing the liquid-handling head” on page 19
- “Installing the Light Curtain and front and side shields” on page 25
- “Installing the rear shield” on page 36
- “Starting up and shutting down” on page 39
Workflow for installing the Bravo Platform

Before you begin

The Bravo Platform can be installed in the following configurations:

- A single device controlled by a computer
- Integrated with other devices in a lab automation system

For either configuration, ensure that you connect the Bravo safety interlock circuit to a light curtain or an enclosure with an interlock switch to mitigate the risk to users from moving parts.

If the Bravo Platform will be operated outside of an enclosure, install the Light Curtain and shields, as described in the following workflow.

![WARNING]

To reduce the risk of injury from moving parts, ensure that the Bravo safety interlock circuit is connected to a light curtain or an enclosure with an interlock switch.

Workflow

To install the Bravo Platform, perform the following procedures in the order listed.

<table>
<thead>
<tr>
<th>Step</th>
<th>For this task...</th>
<th>See...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Verify that the installation location meets the site requirements.</td>
<td>“Laboratory setup requirements” on page 13 For unpacking instructions, see the Bravo Platform Unpacking Guide.</td>
</tr>
<tr>
<td>2</td>
<td>Connect the Bravo Platform.</td>
<td>“Connecting the Bravo Platform” on page 15</td>
</tr>
<tr>
<td>3</td>
<td>Install the liquid-handling head.</td>
<td>“Installing the liquid-handling head” on page 19</td>
</tr>
<tr>
<td>4</td>
<td>Install the Light Curtain and the front and side shields, if applicable.</td>
<td>“Installing the Light Curtain and front and side shields” on page 25</td>
</tr>
<tr>
<td>5</td>
<td>Install the rear shield, if applicable.</td>
<td>“Installing the rear shield” on page 36</td>
</tr>
<tr>
<td>6</td>
<td>Install the automation control software, if not already installed.</td>
<td>VWorks Automation Control Setup Guide</td>
</tr>
</tbody>
</table>
Laboratory setup requirements

About this topic

This topic describes the lab requirements for the Bravo Platform. Read this topic before you unpack and install the Bravo Platform.

Space and bench requirements

Place the Bravo Platform in a location that has the following:

- Proximity to power outlet
- Enough space to accommodate the Bravo Platform, computer, monitor, pendant, and accessories
- A fixed laboratory bench or table that can support the weight of the Bravo Platform without excessive shaking or movement
- Access so that you can quickly disconnect the power to the Bravo Platform if the need arises

If the Bravo Platform is outside an enclosure, you can install a rear shield to prevent rear access to the device’s moving parts while still allowing easy access to the rear power connections.

The Bravo Platform has the following physical specifications:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Standard Bravo Platform</th>
<th>SRT Bravo Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>69.7 cm (27.4 in)</td>
<td>61.7 cm (24.3 in)</td>
</tr>
<tr>
<td>Width</td>
<td>64.8 cm (25.5 in)</td>
<td>64.8 cm (25.5 in)</td>
</tr>
<tr>
<td>Depth</td>
<td>43.8 cm (17.2 in)</td>
<td>43.8 cm (17.2 in)</td>
</tr>
<tr>
<td>Weight</td>
<td>52.1 kg (114.9 lb)</td>
<td>51.5 kg (113.5 lb)</td>
</tr>
</tbody>
</table>
Electrical requirements

The Bravo Platform has the following electrical requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>100–240 V~</td>
</tr>
<tr>
<td>Frequency</td>
<td>50/60 Hz</td>
</tr>
</tbody>
</table>
| Current     | 10 A at 115 V~  
|             | 5 A at 230 V~  |
| Fuse        | 250 V, 10 A, 5 mm x 20 mm, fast acting |

Environmental operating requirements

Ambient environment

The Bravo Platform is for indoor use only. The following table lists the operating and storage specifications.

If you have integrated devices, your system might require additional cooling depending on the number and types of integrated devices.

<table>
<thead>
<tr>
<th>Operating</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Installation category</td>
<td>II</td>
</tr>
<tr>
<td>Temperature</td>
<td>0–40 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>10–90% RH, non-condensing</td>
</tr>
</tbody>
</table>
Computer requirements

The requirements of the controlling computer depend on the lab automation software you are using. See the software release notes or the Automation Solutions knowledge base at www.agilent.com/chem/askb. For third-party automation software, see the user documentation supplied with the product.

Connecting the Bravo Platform

About this topic

This topic provides basic connection instructions for the Bravo Platform.

**Figure** Bravo Platform basic connections

<table>
<thead>
<tr>
<th>Operating</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude</td>
<td>1–2000 m</td>
</tr>
</tbody>
</table>

Before you start

- Make sure the laboratory setup requirements have been met.
- Follow the instructions included with the computer for setting up the computer. Ensure that the computer and Bravo Platform are turned off.
- Make sure you have the supplied Ethernet cables or RS-232 DB9 serial cable.

See the following figure and table for the connection locations on the device.
Connecting the Bravo Platform

**Figure**  Power and communication connections on the Bravo Platform (back view)

<table>
<thead>
<tr>
<th>Item</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ethernet port</td>
<td>Provides an Ethernet connection to the Bravo Platform. If you connect the Bravo Platform using the Ethernet port, you do not need to connect using the serial port.</td>
</tr>
<tr>
<td>2</td>
<td>Serial port (RS-232)</td>
<td>Provides serial connection to the Bravo Platform. If you connect the Bravo Platform using the serial port, you do not need to connect using the Ethernet port.</td>
</tr>
<tr>
<td>3</td>
<td>Pendant port</td>
<td>Connects the pendant to the safety interlock circuit. The safety interlock circuit must be closed for the Bravo Platform to operate. The pendant’s robot-disable button interrupts this circuit. The safety interlock circuit can also be connected to the Light Curtain to stop the Bravo Platform if the light boundary is breached.</td>
</tr>
<tr>
<td>4</td>
<td>Fuse holder</td>
<td>Contains the main fuse and a place for a spare fuse.</td>
</tr>
<tr>
<td>5</td>
<td>AC power entry</td>
<td>Connects the Bravo Platform power cord to an AC outlet with a grounded circuit.</td>
</tr>
</tbody>
</table>
About connecting the power and pendant

**WARNING** To reduce the risk of injury from moving parts, ensure that the Bravo safety interlock circuit is connected to a light curtain or an enclosure with an interlock switch.

If you are installing the Light Curtain, do not connect the power cord and pendant at this step. You will connect the power cord and pendant during the Light Curtain installation procedure.

**To connect the power cord and pendant without a Light Curtain:**

1. Connect one end of the power cord to the AC power entry on the back of the Bravo Platform. Connect the other end of the cord into an AC outlet with a grounded circuit.

2. Connect the pendant into the pendant port on the back of the Bravo Platform.

Connecting the Bravo Platform to the controlling computer

You can connect the computer to the Bravo Platform using either of the following:

- **Ethernet connection.** If using an Ethernet connection, see “Using an Ethernet connection” on page 18.

- **Serial connection.** If using a serial connection:

  Connect one end of the supplied RS-232 DB9 serial cable to a COM port on the computer, and connect the other end of the cable to the serial port on the back of the Bravo Platform.
Using an Ethernet connection

You can use Ethernet to connect a Bravo Platform to the computer:

- Directly
- Through an Ethernet switch

If you are setting up a standalone Bravo Platform, you can use either method. If you are setting up a local area network (LAN) that has other devices on it, use an Ethernet switch.

The Agilent configured computer has two Ethernet ports. You can use one port to connect to the Bravo Platform and the other port to connect to your LAN.

**Connecting directly to the computer**

A red crossover Ethernet cable is provided for connecting the computer directly to the Bravo Platform.

**To connect directly to the computer using Ethernet:**

1. Connect one end of the red crossover Ethernet cable to the Ethernet port on the Bravo Platform.
2. Connect the other end of the cable to the Ethernet port of the computer.

**Connecting through an Ethernet switch**

An Ethernet switch connects the single cable from the computer to one or more cables that lead to one or more devices.

**IMPORTANT** Do not use a crossover cable with an Ethernet switch. The switch performs the crossover function.

If you are adding the Bravo Platform to an existing LAN, step 1 of the following procedure should already be done.

**To connect through an Ethernet switch:**

1. Connect the switch to the computer as follows:
   - a. Connect the power cord to the switch.
Installing the liquid-handling head

About this topic

This topic describes how to mount the liquid-handling head when you first set up the Bravo Platform. The procedure is for the current Bravo liquid-handling heads, including the fixed-tip heads, disposable-tip heads (Series III), pin tools, and the AssayMAP head (Bravo 96AM Head).

Note: If you want to install a Series II pipette head on a Bravo Platform that has a gripper, you must ensure that the gripper is lowered from the docked position before attempting to install the pipette head.

About the head mount

Each Bravo liquid-handling head contains a dovetail interface, that attaches to the dovetail connector on the Bravo head mount. Two head-retainer pins and a head lock secure the liquid-handling head to the Bravo Platform.
Before mounting a liquid-handling head, familiarize yourself with the features of the dovetail interface on the liquid-handling head top and the connector underneath the head mount. See the following figures.

**Figure**  Bravo head mount with (1) head lock and (2) dovetail connector

![Bravo head mount with (1) head lock and (2) dovetail connector](image1.png)

**Figure**  Series III disposable-tip head with (3) retainer pins and (4) dovetail interface

![Series III disposable-tip head with (3) retainer pins and (4) dovetail interface](image2.png)
 Procedure

CAUTION Always turn off the Bravo Platform before installing or uninstalling a liquid-handling head. Failure to do so can damage the pipette head electronics.

To mount a Bravo liquid-handling head:

1 Make sure that the Bravo head mount is in its home position, which is centered above deck location 5. You can use your hands to move the head mount gently into position.

   Note: If the Bravo Platform is already initialized, you can use Bravo Diagnostics to move the head mount to the home position.

   Figure  Bravo deck locations (top view)

   Front

2 Ensure that the Bravo Platform is turned off. Check that the power switch located on the right side is set to off (o) and the status lights on the device front are not lit.

   Figure  Bravo Platform status lights (front) and power switch (right side)
3 Carefully remove the liquid-handling head and protective stand from the packaging. While the head is seated in the stand, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

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

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

4 Remove the head from the stand as follows:

- *Fixed-tip 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 off the head as the following figure shows.

![Fixed-tip heads and pin tools](image1)

- *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.

![Disposable-tip heads](image2)

- *Bravo 96AM Head.* Ensure that the top of the head is resting on a clean, stable surface so that the probes are facing up.
Using both hands, carefully lift the stand off of the head while guiding the stand’s side cutouts (1) off the head side tabs (2). Use care to avoid touching the probes.

**Figure**  Removing or inserting the stand on the head

5 Slide the liquid-handling head onto the Bravo head mount as the following figure shows.

**WARNING**  The probes of the AssayMAP head (Bravo 96AM Head) are sharp and can scratch you if they brush across your hand. A probe scratch can expose you to any contaminants remaining on the probes. Wear gloves and use extreme caution to avoid brushing against the probes.
6 Rotate the head lock clockwise until it reaches its hard stop. This ensures that the head is fully seated and will not shift position during operation.

7 Twist the two head-retainer pins so they snap in, securing the head on the mount.

Figure  Mounted head with (1) head lock and (2) retainer pin
Installing the Light Curtain and front and side shields

About this topic

The Light Curtain and shields protect operators from moving-parts hazards while the Bravo Platform is in operation. If the Bravo Platform is integrated within an enclosure that connects to the device's safety interlock circuit and you determine that the enclosure provides adequate protection to the operator, the enclosure can replace the Light Curtain and shields.

**WARNING** Ensure that the Bravo safety interlock circuit is connected to a light curtain or an enclosure with an interlock switch to reduce the risk of injury from moving parts.

Light Curtain and shield description

The Light Curtain contains two lightposts mounted at the front of the Bravo Platform that project light beams across the front of the device. If an object disrupts the light beams, the safety interlock circuit stops the motion of the Bravo head.

The following figure and table provide details on the Light Curtain and the front and side shields.

**Figure**  Bravo Platform with Light Curtain and shields (front view)
## 2 Installing the Bravo Platform

### Installing the Light Curtain and front and side shields

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lightposts</td>
<td>The two lightposts, which mount on each end of the Bravo base, contain the transmitter and receiver that project the light beams, detect disruptions in the beam, and transmit signals to the safety interlock circuit.</td>
</tr>
<tr>
<td>2</td>
<td>Upper front shield</td>
<td>A clear plastic shield, which attaches to the two lightposts, prevents access at the front between the top of the light shield and the Bravo top.</td>
</tr>
<tr>
<td>3</td>
<td>Lower front shield</td>
<td>A clear plastic shield, which attaches to the two lightposts, prevents access at the front between the bottom of the light shield and top of the Bravo deck.</td>
</tr>
<tr>
<td>4</td>
<td>Light shield (invisible)</td>
<td>After the light beams are aligned, the Light Curtain generates an invisible light shield that spans the area between the two lightposts across the front of the Bravo Platform.</td>
</tr>
<tr>
<td>5</td>
<td>Side and rear shields (not shown)</td>
<td>Clear plastic shields prevent access through the sides and rear opening of the Bravo platform. Each clear plastic side shield attaches to a lightpost and the Bravo backplate. A side shield might not be required if the Bravo Platform is integrated with another device on a given side.</td>
</tr>
<tr>
<td>6</td>
<td>Junction box or Accessories Hub (not shown)</td>
<td>You can use either the junction box or Accessories Hub to provide the electrical and communication connection point for the lightposts and to connect the robot-disable pendant and integrate the Light Curtain into the safety interlock circuit of a standalone Bravo Platform. If the Bravo Platform is integrated with other devices, you use the Automation Control Unit to provide the central connection point for the safety interlock circuit.</td>
</tr>
<tr>
<td>7</td>
<td>Cable, extension (not shown)</td>
<td>The extension cable connects the Bravo pendant port to the junction box or the Accessories Hub.</td>
</tr>
</tbody>
</table>

### Before you start

#### Safety warnings and caution

**WARNING** To prevent potential injury, shut down the Bravo Platform and unplug the power cord before installing the Light Curtain.

**WARNING** Do not replace the pendant with the Light Curtain. The Light Curtain is an additional safety feature to be used with the pendant.
Installing the Light Curtain and front and side shields

**Required components and tools**

Make sure that you have the following:

- Light Curtain components (lightposts and extension cable)
- Shields
- Junction box (provided with the Light Curtain) or Accessories Hub
- 2.5-mm and 3-mm hex wrenches
- Cross-tip screwdriver

**Workflow overview**

Make sure that you perform the procedures in the following order:

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
<th>See…</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Install the lightposts on the Bravo Platform.</td>
<td>&quot;Installing the lightposts&quot; on page 27</td>
</tr>
<tr>
<td>2</td>
<td>Connect the Light Curtain to the Bravo Platform.</td>
<td>“Connecting the Light Curtain” on page 28</td>
</tr>
<tr>
<td>3</td>
<td>Align the light beams.</td>
<td>“Aligning the light beams” on page 31</td>
</tr>
<tr>
<td>4</td>
<td>Install the front and side shields.</td>
<td>“Installing the front shields” on page 34&lt;br&gt;“Installing the side shields” on page 34</td>
</tr>
</tbody>
</table>

**Installing the lightposts**

To install the lightposts:

1. Position the foot of the left lightpost onto the Bravo front left base handle. To ensure a snug fit, press the lightpost foot firmly from the front and the side.

   *Note:* The glass panel of the lightpost should face toward the Bravo center front.

   **IMPORTANT** Ensure that the lightpost foot fits completely onto the Bravo base handle without any gaps in space. Otherwise, you will not be able to align the light beams correctly.
Installing the Light Curtain and front and side shields

2 On the outer side of the lightpost foot, install the setscrew to lock the lightpost into position, as the following figure shows (1).

Figure  Positioning a lightpost (side view and front view)

3 Repeat step 1 to step 2 to mount the front right lightpost.

Connecting the Light Curtain

You can connect the Light Curtain to a standalone Bravo Platform in either of the following ways. If the Bravo Platform is integrated with an Automation Control Unit, see the Automation Control Unit User Guide for connection instructions.

- “Using a junction box” on page 29.
- “Using the Accessories Hub” on page 30
Using a junction box

The ports for the pendant cable and the two lightpost cables are on the front of the junction box. The Bravo port for the extension cable is on the back of the junction box. The following figure shows the junction box connections.

Figure Junction box connections (front view and back view)

To use a junction box to connect the Light Curtain:

Use the following figure and table to connect the junction box and Light Curtain.

Figure Light Curtain connections using a junction box

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pendant cable</td>
<td>Pendant</td>
<td>Junction box: PENDANT port (front)</td>
</tr>
<tr>
<td>2</td>
<td>Lightpost cable, black</td>
<td>Lightpost receiver</td>
<td>Junction box: RX port (back)</td>
</tr>
<tr>
<td>3</td>
<td>Lightpost cable, gray</td>
<td>Lightpost transceiver</td>
<td>Junction box: TX port (front)</td>
</tr>
<tr>
<td>4</td>
<td>Extension cable</td>
<td>Pendant port on the Bravo connection panel</td>
<td>Junction box: BRAVO port (back)</td>
</tr>
<tr>
<td>5</td>
<td>Ethernet cable</td>
<td>Bravo connection panel</td>
<td>Controlling computer</td>
</tr>
</tbody>
</table>
Using the Accessories Hub

The following figure shows the Light Curtain ports on the Accessories Hub.

**Figure** Light Curtain ports on the Accessories Hub (front view)

To use the Accessories Hub to connect the Light Curtain:

Use the following figure and table to connect the Accessories Hub and Light Curtain.

**Figure** Light Curtain connections using the Accessories Hub

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USB cable</td>
<td>Controlling computer</td>
<td>Accessories Hub: USB port (back)</td>
</tr>
<tr>
<td>2</td>
<td>Extension cable</td>
<td>Pendant port on the Bravo connection panel</td>
<td>Accessories Hub: BRAVO port (front)</td>
</tr>
<tr>
<td>3</td>
<td>Pendant cable</td>
<td>Pendant</td>
<td>Accessories Hub: PENDANT port (front)</td>
</tr>
<tr>
<td>4</td>
<td>Lightpost cable, black</td>
<td>Lightpost receiver</td>
<td>Accessories Hub: RX port (front)</td>
</tr>
<tr>
<td>5</td>
<td>Lightpost cable, gray</td>
<td>Lightpost transceiver</td>
<td>Accessories Hub: TX port (front)</td>
</tr>
<tr>
<td>6</td>
<td>Ethernet cable</td>
<td>Bravo connection panel</td>
<td>Controlling computer</td>
</tr>
</tbody>
</table>
Aligning the light beams

To align the light beams:

1. On the side of the Bravo Platform, press the power switch to the on (|) position.

   The two indicator lights on the front of the Bravo backplate illuminate, indicating that the Bravo Platform is on, and the Light Curtain activates.

   **Figure** Bravo Platform status lights (front) and power switch (right side)

2. On the lower inside panel of each lightpost, verify that the column of LEDs turn on.
Installing the Bravo Platform
Installing the Light Curtain and front and side shields

3 While facing the front of the Bravo Platform, slowly rotate the LED panels forward as far as possible, so that the LED panels are angled to face toward you.

The LED lights at the bottom of the glass panels turn red, indicating that the light beams are not aligned.

**CAUTION** Avoid touching the glass panels with your fingers. Fingerprints or dirt on the glass can interfere with the Light Curtain operation.

4 Slowly rotate the LED panels backwards again until the entire column of LEDs on each panel turns solid green, indicating that the light beams are aligned.

The two indicator lights on the front of the Bravo backplate turn blue.

**IMPORTANT** If any of the LEDs on the lightpost panel are partial green or blinking, the light beams are not completely aligned. On the front of the Bravo backplate, the two indicator lights are red if the light beams are not aligned.

---

**Figure** Lightpost LED lights
5 Use a 2.5-mm hex wrench to tighten the two adjustment screws located near the top and bottom of each lightpost’s interior-facing side, as the following figure shows (1).

Figure  Adjustment screws (1) on the lightpost interior top and bottom

6 To verify the adjustment:

a Press the Bravo power switch to the off (o) position, wait a minute, and then press the power switch to the on (|) position.
Installing the front shields

**To install the front shields:**

1. At the front of Bravo Platform, position the upper front shield so that the side with the countersink screw holes is facing away from the device.
2. Secure the upper front shield to the top of the two lightposts using the four screws provided.
3. Position the lower front shield so that the side with the countersink screw holes is facing away from the device.
4. Secure the lower front shield to the two lightposts using the four screws provided.

After installation, the flat screw heads should be flush with the shield surface.

**Figure** Bravo Platform front shield attachment screws

Installing the side shields

The Bravo side shield configurations can vary depending on whether the Bravo Platform is integrated with another device at a given side. The options include:

- *Full-size side shield.* Prevents access to the Bravo moving parts from the side. The full-size shield is used on a side where no device is integrated.
- *Upper side shield.* Prevents access to the Bravo moving parts at the upper side only. For example, the upper shield could prevent an operator from reaching over a device with a low profile that is integrated at the side of the Bravo Platform.
- *Partial-width shield.* Prevents access from the side to certain deck locations only. For example, if a device is integrated at the side aligned with the back row of platepads, a partial side shield can prevent access to the other rows of platepads that are not blocked by an integrated device.

The procedure in this section describes how to install the full-size side shield. Refer to the following figure and table for this procedure.
To install the side shield:

1. At the side of the Bravo Platform, remove the crosshead screw (1) that attaches the Bravo top cover (2) to the Bravo backplate (3).

2. Use the crosshead screw from step 1 to secure the side shield to the Bravo top cover.

3. Using the four attachment screws (4) provided, secure the side shield to the lightpost (5).

4. If tubing access is required at the side, use a 2.5-mm hex wrench to remove the appropriate platepad-access window (6) from the shield.
Installing the rear shield

About this topic

Read this topic if you have a Bravo Platform that will be operated in an area where access to the moving parts is possible through the rear opening in the backplate. This topic describes how to install the rear shield to protect operators from moving-parts hazards while the device is in operation. The rear shield is not necessary if the back of the Bravo Platform is next to a wall or if the device is operated inside an enclosure.

Before you start

**WARNING**  To prevent potential injury, turn off the Bravo Platform and disconnect the power cord before you install or remove any accessory.

Make sure that you have the following:
- Rear shield kit, including two clamps, one M3 screw and four M4 screws
- Cross-tip screwdriver
- 2.5-mm and 3-mm hex wrenches

Installing the rear shield

The following figure shows the installed rear shield, which is a clear panel that blocks rear access to the deck through the opening in the backplate.

*Figure*  Bravo Platform with rear shield installed
To install the rear shield:

1. On the side of the Bravo Platform, press the power switch to the off (o) position (1), and unplug the power cord (2). See the following figure.

2. At the back of the Bravo Platform, remove the flathead screw from the center lower edge of the rear cover (3), as the preceding figure shows. Save the screw for future use in case the shield is removed.

3. While holding the shield in place to cover the rear deck access, install the screw (M3) at the top center of the shield into the empty screw hole in the Bravo backplate.

4. At the bottom of each backplate post, position a shield clamp on the interior. See the following figure.
2 Installing the Bravo Platform

Installing the rear shield

5 Install the two screws (M4) in the rear-facing end of each clamp to secure the shield to the clamps, as the following figure shows.

The preferred location for the clamps is at deck level. If something interferes with the deck-level position of a clamp, you can use the optional attachment holes on the shield to position the clamp higher on the post. In this case, you should keep the second clamp at deck level if possible.

Note: The clamps are secured in place after the shield screws are installed in the next step.

6 If tubing or cabling access is required at the deck's rear, use a 2.5-mm hex wrench to remove the appropriate platepad-access window from the shield. Three screws secure each of the three platepad-access windows in the rear shield.
Starting up and shutting down

About this topic

This topic describes 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. Ensure that the main power cable and Ethernet or serial cables are plugged into the connection panel.
2. Turn on any accessories, for example, Pump Modules.
3. Turn on the computer and the monitor, and start the Microsoft Windows operating system.
4. On the side of the Bravo Platform, press the power switch (1) to the on (1) position.
   The green light on the switch is illuminated when the Bravo Platform is on.
5. Start the automation software, for example, the VWorks software.
Shutting down the Bravo Platform

Shut down the Bravo Platform before you:

- Clean the Bravo Platform
- Change the pipette head
- Install accessories
- Move the Bravo Platform

To shut down the Bravo Platform:

1. If removing the pipette head, ensure that the disposable tips are removed or that fixed tips are clean.
2. Optionally, home the pipette head.
3. Shut down the computer.
4. Turn off any accessories, for example, Pump Modules.
5. If using an Auto Filling Reservoir, disconnect the bottles to prevent siphoning.
6. On the side of the Bravo Platform, press the power switch to the off (o) position.

Related information

<table>
<thead>
<tr>
<th>For information about...</th>
<th>See...</th>
</tr>
</thead>
</table>
| Setting up and using the Bravo Platform | • The Help menu from within the automation software controlling the Bravo Platform  
• The online knowledge base at www.agilent.com/chem/askb |