Bravo Automated Liquid-Handling Platform

Safety and Installation Guide

Original Instructions

Agilent Technologies

Notices

User Guide Part Number

G5409-90007

Edition

Revision 00, June 2011

Contact Information

Agilent Technologies Inc.
Automation Solutions
5301 Stevens Creek Blvd.
Santa Clara, CA 95051
USA

Technical Support: 1.800.979.4811
or +1.408.345.8011
service.automation@agilent.com

Customer Service: 1.866.428.9811
or +1.408.345.8356
customerservice.automation@agilent.com

European Service: +44 (0)1763850230
euroservice.automation@agilent.com

Documentation feedback:
documentation.automation@agilent.com

Web:
www.agilent.com/lifesciences/automation

Acknowledgements

Adobe and Acrobat are trademarks of Adobe Systems Incorporated.

Microsoft and Windows are registered trademarks of the Microsoft Corporation in the United States and other countries.

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 (June1987) 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

Preface

This preface contains the following topics:

About this guide

Who should read this guide

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

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

What this guide covers

This guide describes the following:

- Potential safety hazards of the Bravo Platform and how to avoid them.
- Installation instructions, including specifications and site requirements for the Bravo Platform.

Related guides

The *Bravo Automated Liquid Handling Platform Safety and Installation Guide* should be used in conjunction with the following user documents:

- *Bravo Automated Liquid Handling Platform User Guide*. Explains how to set up and operate the Bravo Platform and accessories.
- *VWorks Automation Control Setup Guide*. Explains how to define labware and labware classes, liquid classes, and pipetting techniques, and how to track and manage labware in storage.
- *VWorks Automation Control User Guide*. Explains how to add devices, create protocols, and set task parameters for each device in the system.
- *VWorks Software Quick Start.* Provides an overview of how to use the VWorks Automation Control software.
- *Third-party device user documents.* Explain how to set up and use the third-party devices.

For unpacking instructions, see the *Bravo Platform Unpacking Guide*.

Accessing Agilent Technologies Automation Solutions user guides

You can search the online knowledge base or download the latest version of any PDF file from the Agilent Technologies web site at www.agilent.com/lifesciences/automation.

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.

Related topics

For information about...	See...
Reporting problems	"Reporting problems" on page vii
Safety precautions	"Safety guidelines" on page 1
How to install the Bravo Platform	"Installing the Bravo Platform" on page 17

Reporting problems

Contacting Automation Solutions Technical Support

If you find a problem with the Bravo Platform, contact Automation Solutions Technical Support at one of the following:

Europe

Phone: +44 (0)1763850230

email: euroservice.automation@agilent.com

US and rest of world

Phone: 1.800.979.4811 (US only) or +1.408.345.8011

email: service.automation@agilent.com

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, ActiveX control 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.

Related topics

For information about...	See...
What this guide covers	"About this guide" on page vi
Safety precautions	"Safety guidelines" on page 1
How to install the Bravo Platform	"Installing the Bravo Platform" on page 17

1 Safety guidelines

This chapter contains the following topics:

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.

Intended product use

WARNING **Do not remove the Bravo Platform exterior covers or otherwise disassemble the system or device. Doing so can expose you to hazards that could cause serious injury and damage the Bravo Platform.**

WARNING **Using controls, making adjustments, or performing procedures other than those specified in the user guide can expose you to moving parts, hazardous voltage, and laser radiation.**

Agilent Technologies products must only be used in the manner described in the Agilent Technologies product user guides. Any other use may result in damage to the product or personal injury. Agilent Technologies is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments or modifications to the products, failure to comply with procedures in Agilent Technologies product user guides, or use of the products in violation of applicable laws, rules or regulations. Except as otherwise expressly provided in Agilent Technologies product user guides, any alteration, adjustment or modification to the products will void the product warranty and may invalidate the safety compliance certification.

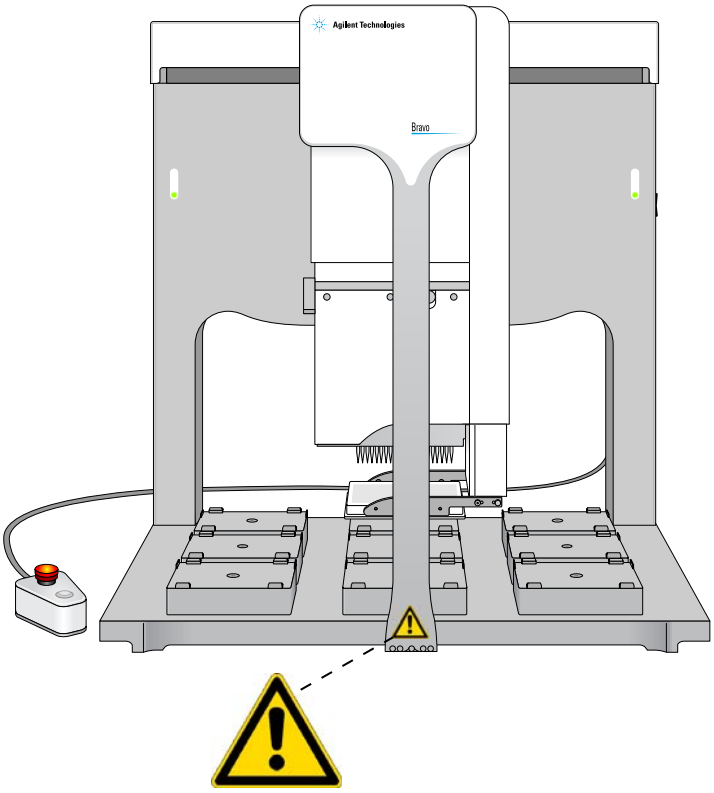
The Bravo Platform is not intended or approved for diagnosis of disease in humans or animals. You assume full responsibility for obtaining any regulatory approvals required for such use and assume all liability in connection therewith.

Safety labels

Pay attention to any safety labels affixed to your device. A safety label consists of a warning symbol that indicates a risk of danger. A description of the warning and information that will help you to avoid the safety hazard are provided in this user guide.

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

Figure Bravo Platform warning label location



Warnings in the user documentation or on the device must be observed during all phases of operation, service, and repair of this device. Failure to comply with these precautions violates safety standards of design and the intended use of the product. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

The following table lists the common symbols you might find on the device. The symbol on the label indicates the risk of danger. A description of the warning and information that will help you avoid the safety hazard are provided in this guide.

Symbol	Description
	Indicates that you must read the accompanying instructions (for example, the safety guide) for more information before proceeding.
	Indicates hazardous voltages.
	Indicates pinch, crush, and cut hazard.
	Indicates laser hazard.

Symbol	Description
	Indicates hot surface hazard.
	Indicates protective conductor terminal, which is bonded to conductive parts of an equipment for safety purposes.
	Indicates that you must not discard this electrical/ electronic product in domestic household waste.

Related information

For information about...	See...
Stopping the Bravo Platform in an emergency	“Emergency stops” on page 7
Moving parts hazards	“Mechanical hazards” on page 8
Hazardous voltage	“Electrical hazards” on page 11
Chemical hazards	“Chemicals” on page 12
Lifting hazard	“Ergonomics” on page 13
Laser hazard	“Laser hazard” on page 14
Reporting problems with the Bravo Platform	“Reporting problems” on page vii

Safety and regulatory compliance

Compliance standards

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 standards listed in the following table.

Regulatory Compliance	Standard
EMC	
European Union	EMC Directive 2004/108/EC
	IEC 61326-1:2005 / EN 61326-1:2006
Canada	ICES/NMB-001:2004
Australia/New Zealand	AS/NZS CISPR 11:2004
Safety	
European Union	Machinery Directive 2006/42/EC
	Low Voltage Directive 2006/95/EC
	IEC 61010-1:2001 / EN61010-1:2001
Canada	CAN/CSA-C22.2 No. 61010-1-04
USA	ANSI/UL 61010-1:2004

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 27779:1991.

Schalldruckpegel: LP < 70 dB nach EN 27779:1991.

Related information

For information about...	See...
General safety	“General safety information” on page 2
Stopping the Bravo Platform in an emergency	“Emergency stops” on page 7
Moving parts hazards	“Mechanical hazards” on page 8
Hazardous voltage	“Electrical hazards” on page 11
Chemical hazards	“Chemicals” on page 12
Lifting hazard	“Ergonomics” on page 13
Laser hazard	“Laser hazard” on page 14
Reporting problems with the Bravo Platform	“Reporting problems” on page vii

Emergency stops

Procedure

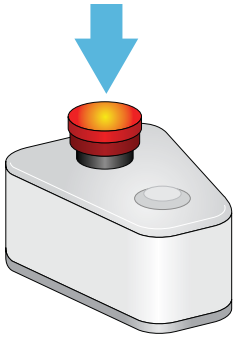
WARNING **If the Bravo Platform is integrated with other devices in a system, Agilent Technologies recommends that you install a main emergency stop button to cut power to all devices simultaneously. In addition, all operators must be instructed in the emergency stop procedure.**

CAUTION If the red button on the pendant is pressed while the pipette head is aspirating or dispensing, the pipetting accuracy might be impaired. Do not use the pendant to pause and continue a run.

To stop in an emergency:

Press the red button on the robot-disable pendant. The power is cut from the motors, causing all motion to stop.

Figure Robot-disable pendant



Related information

For information about...	See...
General safety	“General safety information” on page 2
Regulatory compliance	“Safety and regulatory compliance” on page 5
Moving parts hazards	“Mechanical hazards” on page 8
Hazardous voltage	“Electrical hazards” on page 11
Chemical hazards	“Chemicals” on page 12
Lifting hazard	“Ergonomics” on page 13
Laser hazard	“Laser hazard” on page 14
Reporting problems with the Bravo Platform	“Reporting problems” on page vii

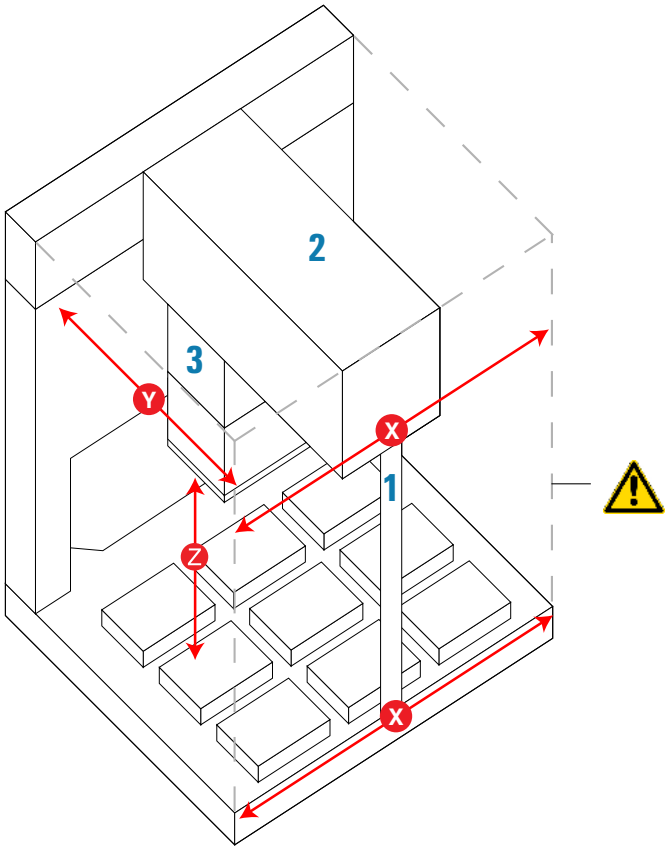
Mechanical hazards

Moving parts hazard

The Bravo Platform has moving parts that are accessible at the front, sides, and rear of the device.

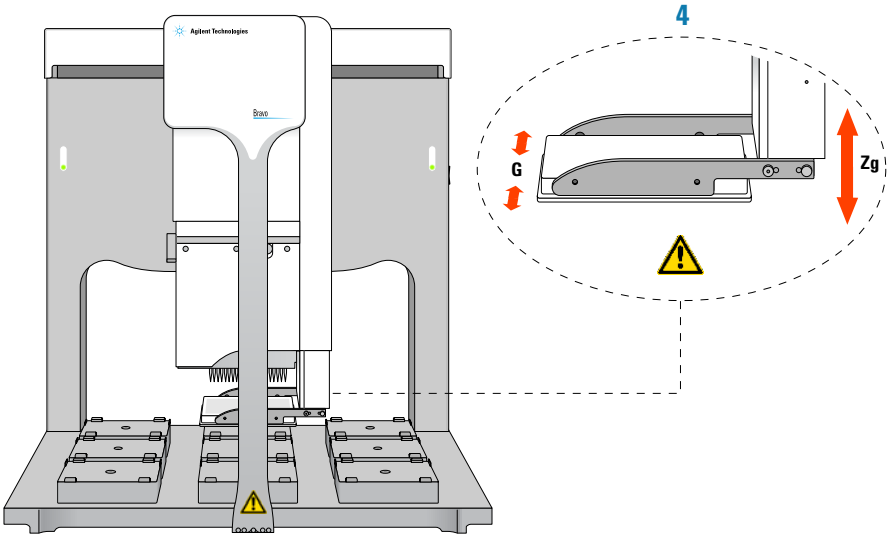
The following figures and tables show the potential moving-parts hazards.

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



Item	Part	Axis of motion	Description
1	Tie bar	*x*-axis	The tie bar is attached to the arm and moves side to side across the front of the deck.
2	Arm	*x*-axis	The arm carries the head mount side to side across the deck.
3	Head mount	*y*-axis	The pipette head attaches to the head mount, which moves back and forth on the arm between the back and front of the deck.
		z-axis	The head mount raises and lowers the pipette head.

Figure Moving parts on Bravo gripper assembly



Item	Part	Axis of motion	Description
4	Gripper assembly	*G*- axis	The grippers close and open to grip and release labware.
		Zg- axis	The grippers 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.

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 instantly. Agilent Technologies highly recommends that you connect the Bravo 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. See “Installing the Light Curtain and front and side shields” on page 32 and “Installing the rear shield” on page 44.

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.**

WARNING **The pipette head's 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.**

Related information

For information about...	See...
General safety	"General safety information" on page 2
Regulatory compliance	"Safety and regulatory compliance" on page 5
Stopping the Bravo Platform in an emergency	"Emergency stops" on page 7
Hazardous voltage	"Electrical hazards" on page 11
Chemical hazards	"Chemicals" on page 12
Lifting hazard	"Ergonomics" on page 13
Laser hazard	"Laser hazard" on page 14
Reporting problems with the Bravo Platform	"Reporting problems" on page vii

Electrical hazards

Hazardous-voltage electronics

Hazardous-voltage electronics can be found within the Bravo Platform. Under normal operating conditions, you are protected from exposure to the hazardous voltage.

WARNING **Do not try to gain access to the interior of the Bravo Platform. Do not remove panels for any reason. Exposure to the interior electronics of a device can cause severe injury.**

Hazardous-voltage electronics can also be found in the computer. See the computer manufacturer documentation for the hazard warnings. Make sure you follow the instructions on the safe operation of the computer.

WARNING **Ensure that the power cords are in good condition and are not frayed. Use of frayed or damaged power cords can cause injury. Use of incorrect power cords can cause damage to the device.**

WARNING **Shut down the Bravo Platform and unplug the power cord before cleaning, performing maintenance, or installing accessories on the device.**

Related information

For information about...	See...
General safety	"General safety information" on page 2
Regulatory compliance	"Safety and regulatory compliance" on page 5
Stopping the Bravo Platform in an emergency	"Emergency stops" on page 7
Moving parts hazards	"Mechanical hazards" on page 8
Chemical hazards	"Chemicals" on page 12
Lifting hazard	"Ergonomics" on page 13
Laser hazard	"Laser hazard" on page 14
Reporting problems with the Bravo Platform	"Reporting problems" on page vii

Chemicals

Chemical hazards

Some chemicals used when working with the Bravo Platform can be hazardous. Make sure you:

- Follow standard laboratory procedures and cautions when working with chemicals.
- Follow your local, state, and federal safety regulations when using and disposing of the chemicals.

WARNING **Some chemicals used when working with the Bravo Platform can be hazardous. Wear gloves when cleaning unknown substances from the Bravo deck.**

Related information

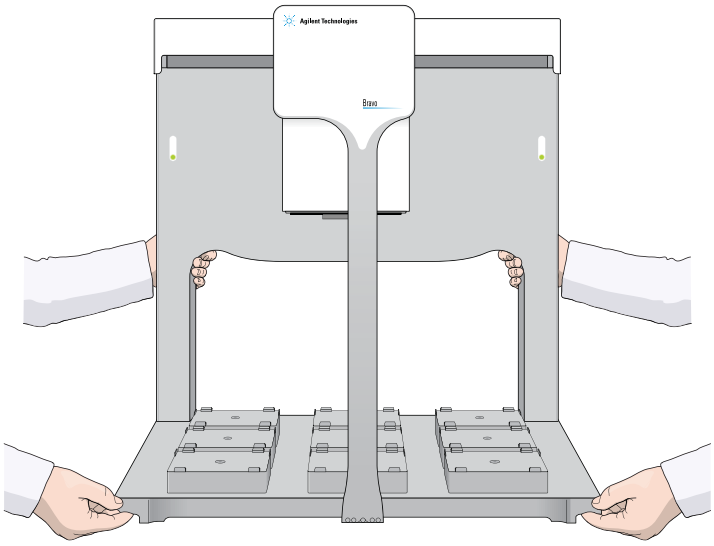
For information about...	See...
General safety	"General safety information" on page 2
Regulatory compliance	"Safety and regulatory compliance" on page 5
Stopping the Bravo Platform in an emergency	"Emergency stops" on page 7
Moving parts hazard	"Mechanical hazards" on page 8
Hazardous voltage	"Electrical hazards" on page 11
Lifting hazard	"Ergonomics" on page 13
Laser hazard	"Laser hazard" on page 14
Reporting problems with the Bravo Platform	"Reporting problems" on page vii

Ergonomics

About lifting the Bravo Platform

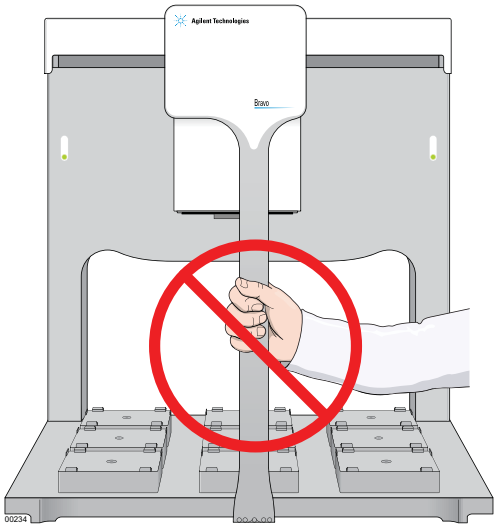
WARNING **The Bravo device weighs approximately 52.1 kg (114.9 lb). Attempting to move the Bravo device without assistance could cause personal injury. Request assistance and use proper lifting techniques when moving the Bravo device.**

Figure Correct lifting technique



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

Figure Incorrect lifting or handling technique



Related information

For information about...	See...
General safety	“General safety information” on page 2
Regulatory compliance	“Safety and regulatory compliance” on page 5
Stopping the Bravo Platform in an emergency	“Emergency stops” on page 7
Moving parts hazard	“Mechanical hazards” on page 8
Hazardous voltage	“Electrical hazards” on page 11
Chemical hazards	“Chemicals” on page 12
Laser hazard	“Laser hazard” on page 14
Reporting problems with the Bravo Platform	“Reporting problems” on page vii

Laser hazard

Optional barcode reader

If your Bravo Platform is fitted with a barcode reader, make sure you understand the potential hazard. The barcode reader on the Bravo Platform might contain a laser used to read barcodes. The laser beam will not harm your skin, so there is no danger in exposing your arms or hands to the beam. However, you could damage your eyes if you stare directly into the beam.

Barcode readers emit light for up to 0.5 seconds only when taking a reading. The potential hazard is present only during protocol runs. When a microplate is being read, the beam should not pass beyond the microplate.

WARNING **Class II laser hazard. Do not look directly at the laser beam. Looking directly at the laser beam can result in serious eye injury.**

WARNING **Do not disassemble the barcode reader sensor heads. Laser emission from the reader is not automatically stopped if the sensor head is disassembled.**

Related information

For information about...	See...
General safety	“General safety information” on page 2
Regulatory compliance	“Safety and regulatory compliance” on page 5

For information about...	See...
Stopping the Bravo Platform in an emergency	“Emergency stops” on page 7
Moving parts hazard	“Mechanical hazards” on page 8
Hazardous voltage	“Electrical hazards” on page 11
Chemical hazards	“Chemicals” on page 12
Lifting hazard	“Ergonomics” on page 13
Reporting problems with the Bravo Platform	“Reporting problems” on page vii

2 Installing the Bravo Platform

This chapter contains the following topics:

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.

Step	For this task...	See...
1	Verify that the installation location meets the site requirements.	"Laboratory setup requirements" on page 19 For unpacking instructions, see the *Bravo Platform Unpacking Guide*.
2	Connect the Bravo Platform.	"Connecting the Bravo Platform" on page 21
3	Install the pipette head.	"Installing the pipette head" on page 26
4	Install the Light Curtain and the front and side shields, if applicable.	"Installing the Light Curtain and front and side shields" on page 32
5	Install the rear shield, if applicable.	"Installing the rear shield" on page 44
6	Install the automation control software, if not already installed.	*VWorks Automation Control Setup Guide*

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:

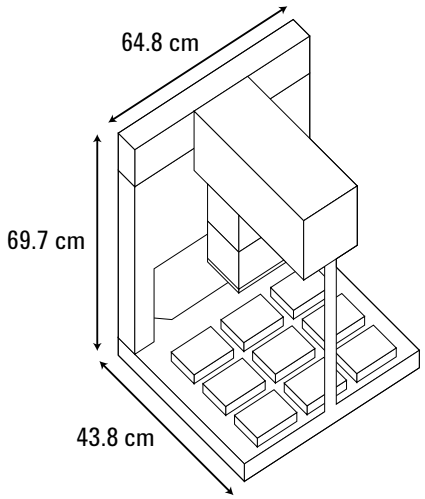
- Proximity to power outlet
- Enough space to accommodate the Bravo Platform, computer, monitor, pendant, and accessories
- A fixed bench (without wheels) that can support the weight of the Bravo Platform without excessive shaking or movement
- Access so that you can quickly disconnect the power to the 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:

Dimension	Standard Bravo Platform	SRT Bravo Platform
Height	69.7 cm (27.4 in)	61.7 cm (24.3 in)
Width	64.8 cm (25.5 in)	64.8 cm (25.5 in)
Depth	43.8 cm (17.2 in)	43.8 cm (17.2 in)
Weight	52.1 kg (114.9 lb)	51.5 kg (113.5 lb)

Figure Dimensions of a standard Bravo Platform



Electrical requirements

The Bravo Platform has the following electrical requirements:

Requirement	Value
Voltage	100–240 V~
Frequency	50/60 Hz
Current	11.5 A at 115 V~ 6.5 A at 230 V~
Fuse	250 V, 10 A, 5 mm x 20 mm, fast acting

Environmental operating requirements

The Bravo Platform has the following environmental requirements:

Requirement	Value
Temperature	0–40 °C
Relative humidity	0–95% RH, non-condensing
Elevation	1–2000 m

Computer requirements

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

Related information

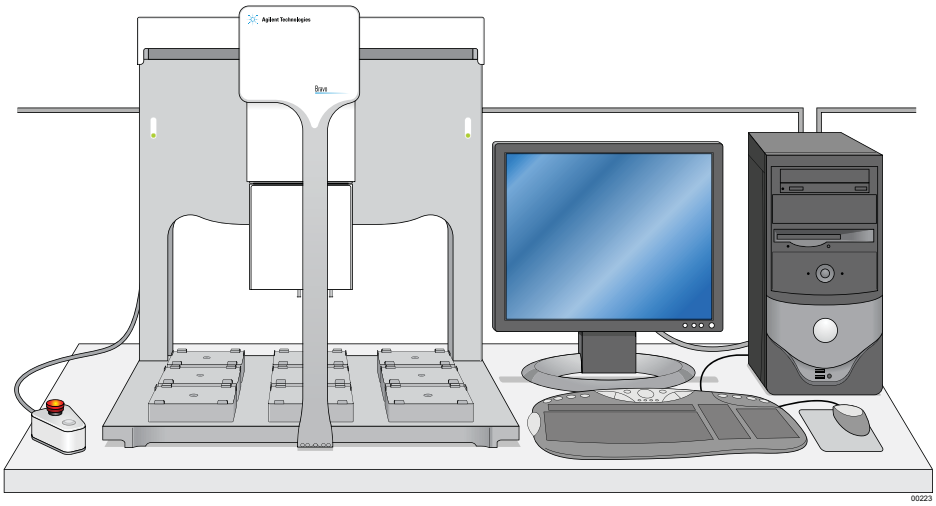
For information about...	See...
Unpacking the Bravo Platform	*Bravo Platform Unpacking Guide*
Installing the Bravo Platform	"Workflow for installing the Bravo Platform" on page 18
Installing the Light Curtain and shields	• "Installing the Light Curtain and front and side shields" on page 32 • "Installing the rear shield" on page 44

Connecting the Bravo Platform

About this topic

This topic provides basic connection instructions for the Bravo Platform.

Figure Bravo Platform basic connections

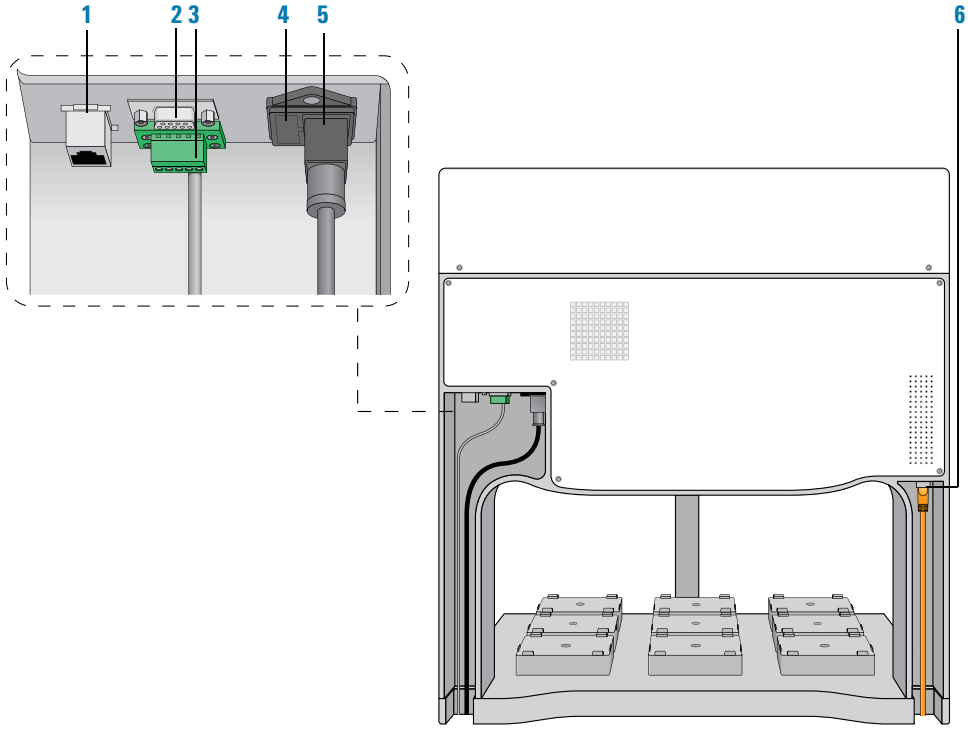


Before you start

- Make sure the laboratory setup requirements have been met. For details, see "Laboratory setup requirements" on page 19.
- 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.

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



Item	Feature	Description
1	Ethernet port	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.
2	Serial port (RS-232)	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.
3	Pendant port	Connects the pendant to the safety interlock circuit. The safety interlock circuit must be closed for the Bravo Platform to operate. The pendant's disable button interrupts this circuit. The safety interlock circuit can also be fitted with the Light Curtain to shut off power to the Bravo Platform if the light boundary is breached.
4	Fuse holder	Contains the main fuse and a place for a spare fuse. For details on the fuse type, see "Electrical requirements" on page 20.
5	AC power entry	Connects the Bravo Platform power cord to an AC outlet with a grounded circuit.

Item	Feature	Description
6	Pump I/O port (RJ-45)	Enables you to connect a peristaltic pump to the Bravo Platform. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable. **IMPORTANT** This is not an Ethernet port and should be used to connect only the Automation Solutions accessories to the Bravo Platform.

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. Instead, 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:

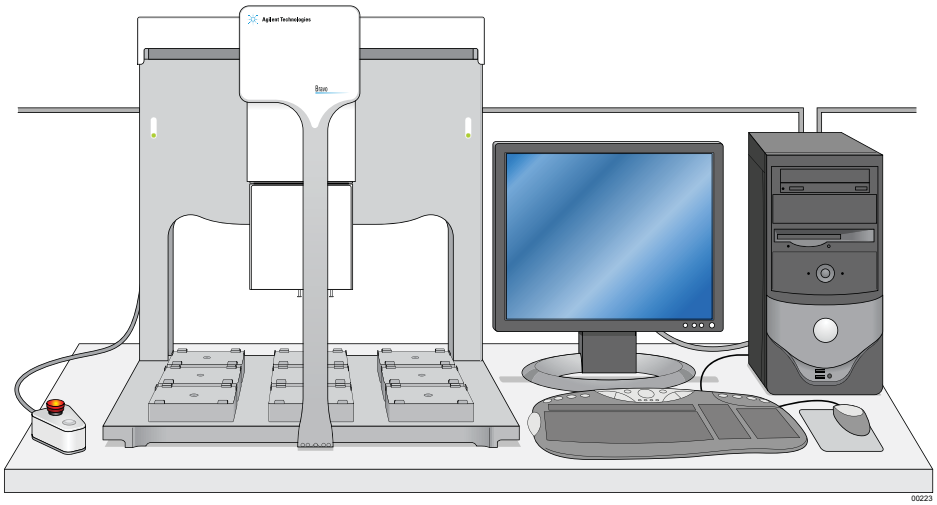
1. Connect one end of the power cord to the AC power entry on the back of the Bravo Platform. Connect the other end of the cord to an AC outlet with a grounded circuit.
2. Connect the pendant to the pendant port on the back of the Bravo Platform.

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 24.
- *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 Automation Solutions 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.

b Connect one end of the Ethernet cable (black) into any Ethernet port on the switch, and connect the other end of the cable to an Ethernet port on the computer.

2 Connect the Bravo Platform to the switch as follows:

a Connect one end of a second Ethernet cable to a port on the Ethernet switch.

b Connect the other end of the cable to the Ethernet port on the Bravo Platform.

Connecting additional devices

You can connect as many devices to the network as there are Ethernet ports available.

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.

About configuring the computer's network card (Ethernet only)

The Automation Solutions configured computer is already set up to communicate with the Bravo Platform. No change to the network card IP address is required.

If you are using a computer other than an Automation Solutions configured computer, make sure the value of the network card IP address and subnet mask are as follows:

- IP address: 192.168.0.1
- Subnet mask: 255.255.255.0

If your computer will be connected to your LAN, make sure the computer has a second network card. The second network card can have a dynamic IP address.

Related information

For more information about...	See...
Ethernet switch	Ethernet switch user documentation
IP addresses	Microsoft Windows user documentation
Installing the pipette head	"Installing the pipette head" on page 26
Installing the VWorks software	*VWorks Automation Control Setup Guide*
How to establish communication and use the Bravo Platform	*Bravo Automated Liquid Handling Platform User Guide*
Safety	"Safety guidelines" on page 1
Resolving problems	"Reporting problems" on page vii

Installing the pipette head

About this topic

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

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 pipette 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 pipette head to the Bravo Platform.

Before mounting a pipette head, familiarize yourself with the features of the dovetail interface on the pipette 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

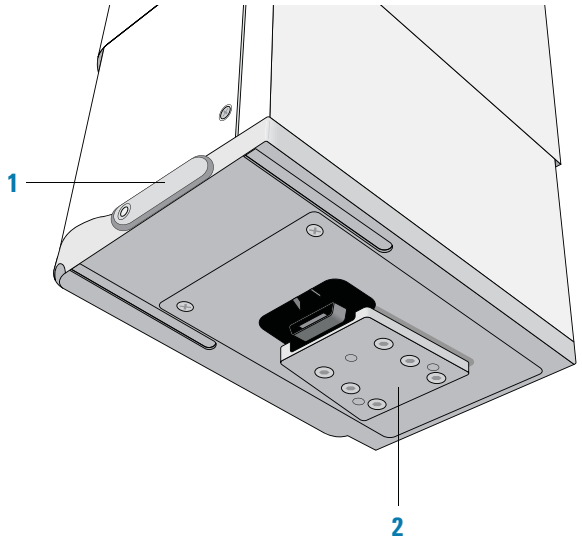
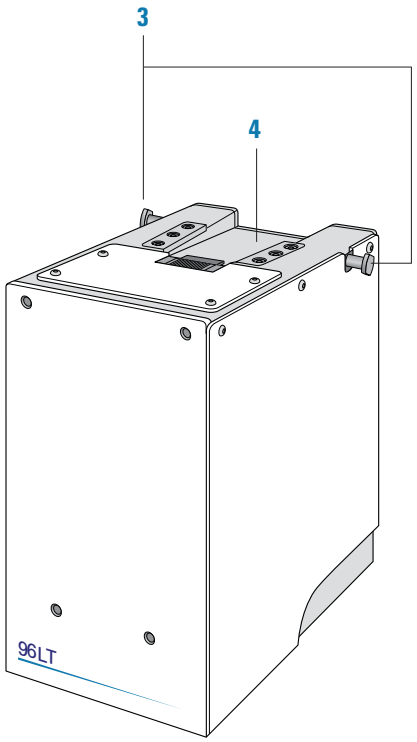


Figure Series III pipette head with (3) retainer pins and (4) dovetail interface



Procedure

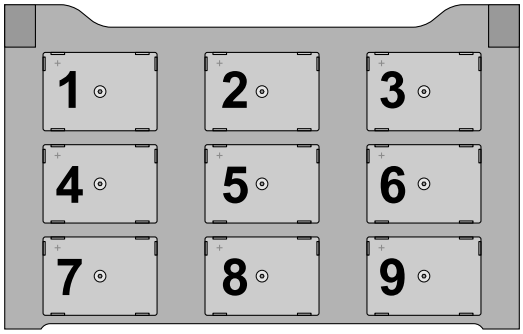
CAUTION Always turn off the Bravo Platform before installing or uninstalling a pipette head. Failure to do so can damage the pipette head electronics.

To mount a Bravo pipette 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.

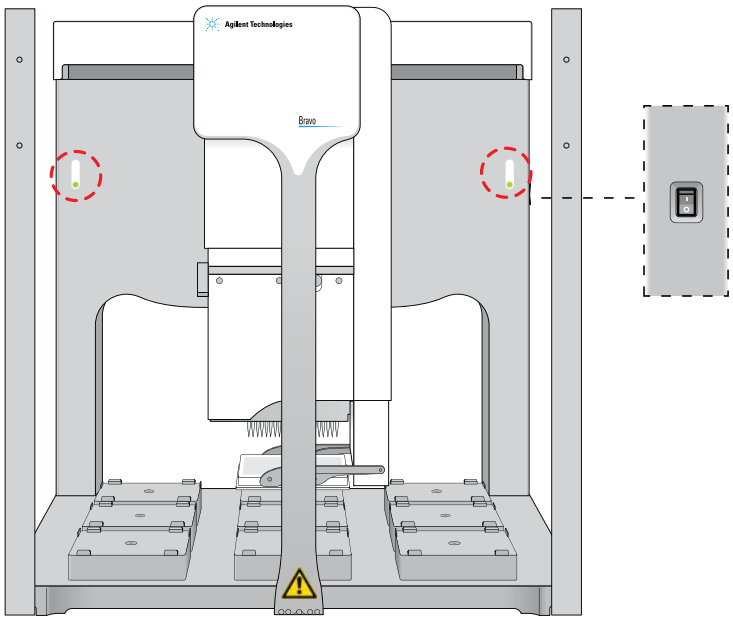
Note: If the Bravo Platform is already initialized, you can use Bravo Diagnostics to move the head mount to the home position.

Figure Bravo deck locations (top view)



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)



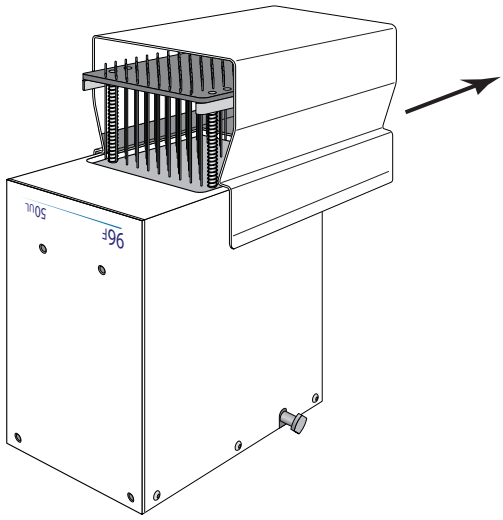
3 Carefully remove the pipette head and protective stand from the packaging. While the pipette head is seated in the stand, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

CAUTION Do not rest the bottom of a pipette head on any surface. Doing so can damage the barrels, tips, or pins.

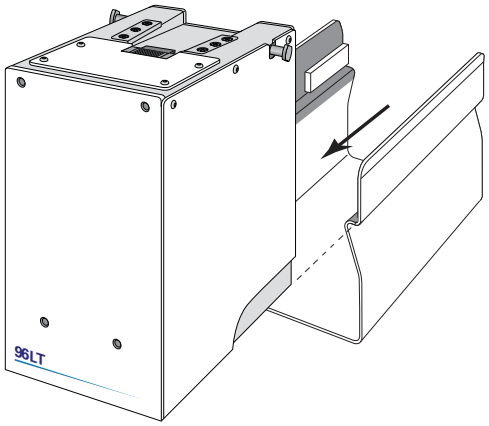
CAUTION Do not touch the pipette head barrels, tips, or pins with your hands.

4 Remove the pipette head from the stand as follows:

- *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 off the head as the following figure shows.

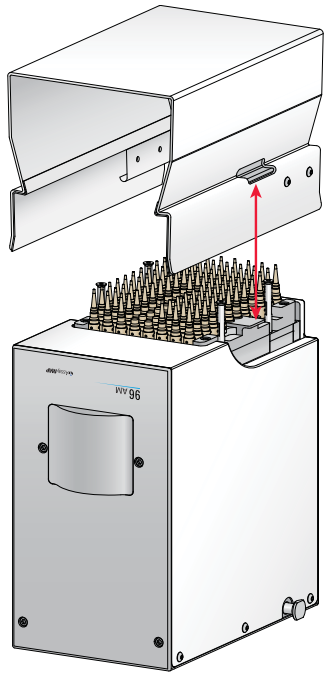


- *Disposable-tip pipette heads*. Rest the bottom of the stand on a clean, dry surface. Slide the head out of the stand as the following figure shows, so that the barrels are facing down.

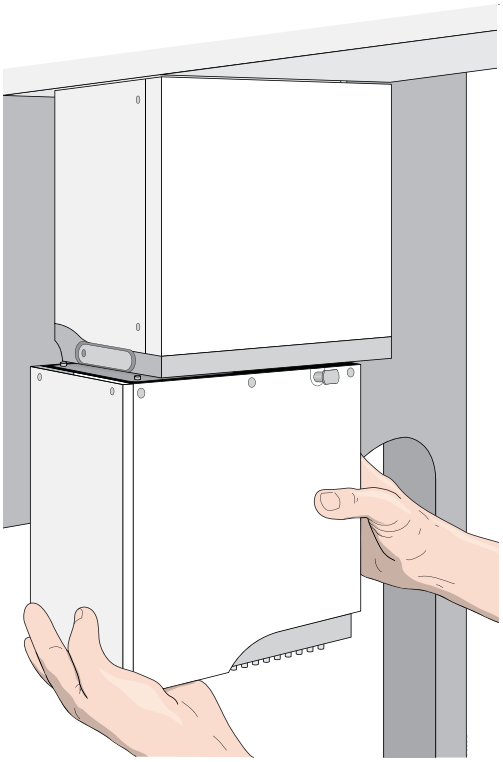


- *Bravo 96AM Head.* Ensure that the top of the head is resting on a clean, stable surface so that the probes are facing up.

  Carefully lift the stand off of the head while guiding the head's side tabs out of the stand's side cutouts. Use care to avoid touching the probes.



5 Slide the pipette head onto the Bravo head mount as the following figure shows.

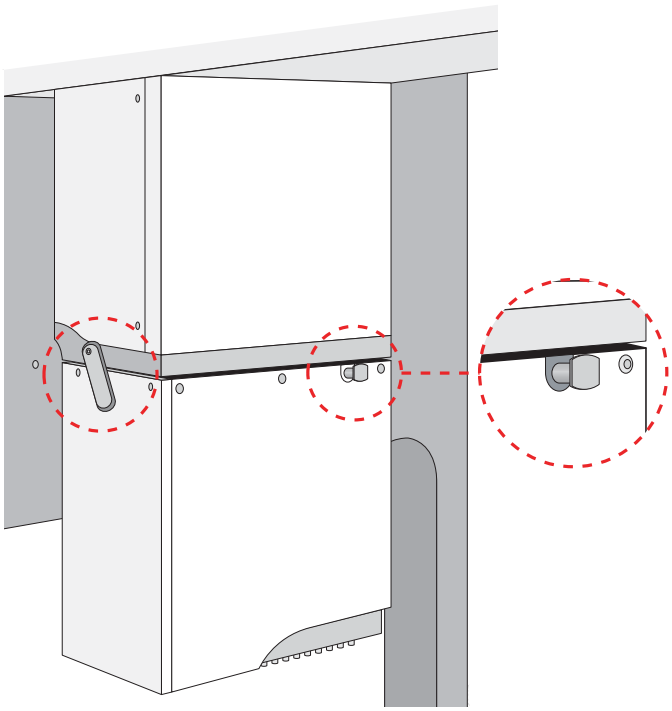


6 Rotate the head lock clockwise until it reaches its hard stop.

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 pipette head on the mount.

Figure Mounted pipette head with head lock and retainer pin



Related information

For information about...	See...
Controlling a pipette head	• *Bravo Automated Liquid Handling Platform User Guide* • *VWorks Automation Control User Guide*
Setting up and operating the Bravo Platform	*Bravo Automated Liquid Handling Platform User Guide*
Installing the Light Curtain	"Installing the Light Curtain and front and side shields" on page 32
Safety	"Safety guidelines" on page 1

Installing the Light Curtain and front and side shields

About this topic

Read this topic if you have a Bravo Platform that you plan to operate outside an enclosure. This topic provides installation instructions for the Light Curtain and the front and side shields. For details on the rear shield, see "Installing the rear shield" on page 44.

You should install the Light Curtain and shields to 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 provides protection to the operator, the Light Curtain and shields are not required.

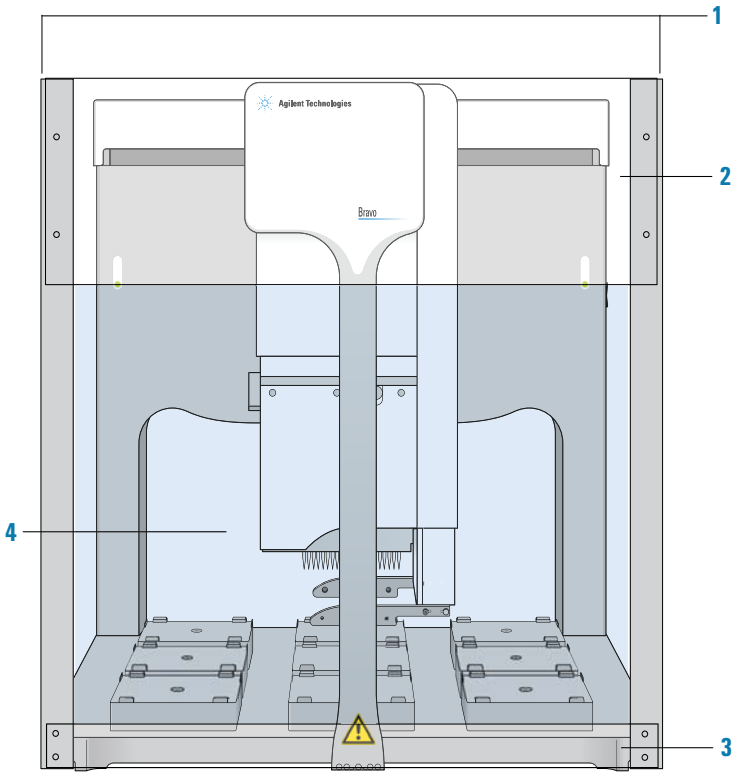
WARNING **Ensure that the Bravo safety interlock circuit is connected to a light curtain or an enclosure with an interlock switch to reduce the risk of injury from moving parts.**

Light Curtain and shield description

As part of the safety interlock circuit, the Light Curtain works in a manner similar to the robot-disable pendant. Two lightposts mounted at the front of the Bravo Platform project light beams across the front of the device. If an object disrupts the light beams, the safety interlock circuit disables the head motors.

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)



Item	Name	Description
1	Lightposts	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.
2	Upper front shield	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.
3	Lower front shield	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.
4	Light shield (invisible)	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.

Item	Name	Description
5	Side and rear shields (not shown)	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. For details about the rear shield, see "Installing the rear shield" on page 44.
6	Junction box or Accessories Hub (not shown)	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 Bravo safety interlock circuit.
7	Cable, extension (not shown)	The extension cable connects the Bravo pendant port to the junction box or the Accessories Hub.

Before you start

Safety warnings and caution

WARNING **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.**

WARNING **The Light Curtain light beams extend across the front of the Bravo Platform only. Access to moving parts from the sides or back of the device may be possible and cannot be detected by the Light Curtain. If access from the sides or back is possible, install the side and rear shields, as applicable.**

CAUTION Handle the lightposts with care to prevent any damage to the glass panels. Avoid touching the glass panels with your fingers. Fingerprints or dirt on the glass can interfere with the Light Curtain operation.

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:

Step	Procedure	See...
1	Install the lightposts on the Bravo Platform.	"Installing the lightposts" on page 35
2	Connect the Light Curtain to the Bravo Platform.	"Connecting the Light Curtain" on page 36
3	Align the light beams.	"Aligning the light beams" on page 39
4	Install the front and side shields.	• "Installing the front shields" on page 41 • "Installing the side shields" on page 42

Installing the lightposts

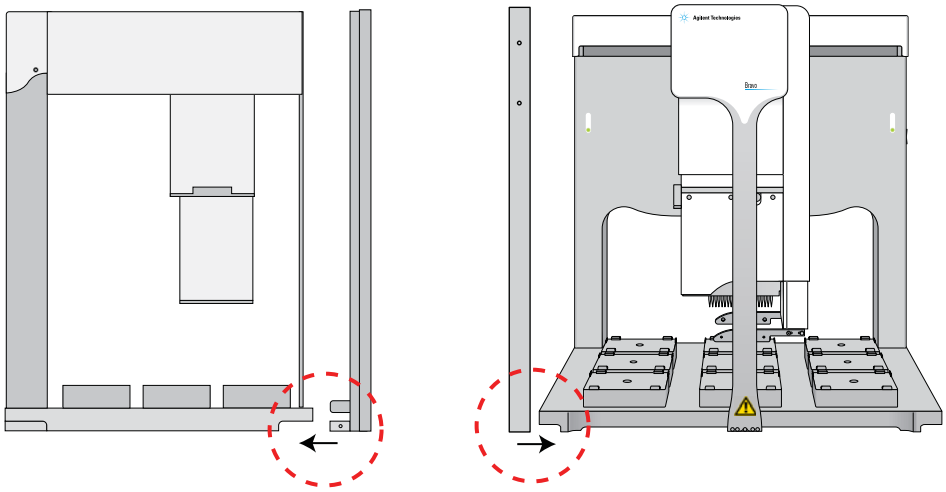
To install the lightposts:

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.

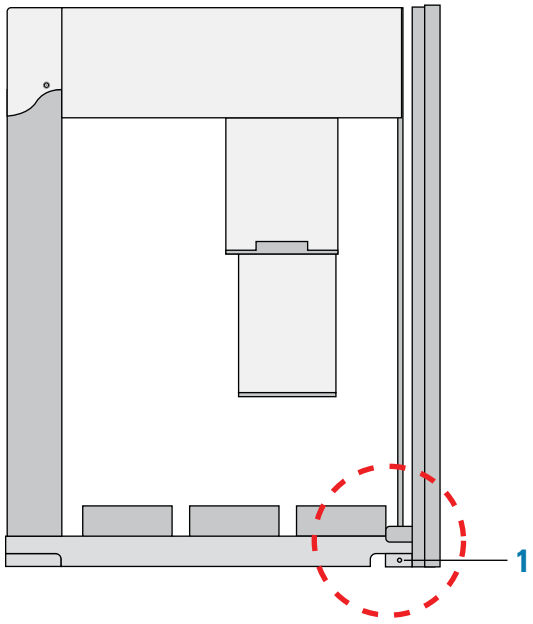
IMPORTANT Ensure that the lightpost foot fits completely onto the Bravo base handle without any gaps in space. Otherwise, you will not be able to align the light beams correctly.

Figure Positioning a lightpost (side view and front view)



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 Lightpost setscrew (Bravo Platform side view)



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

Connecting the Light Curtain

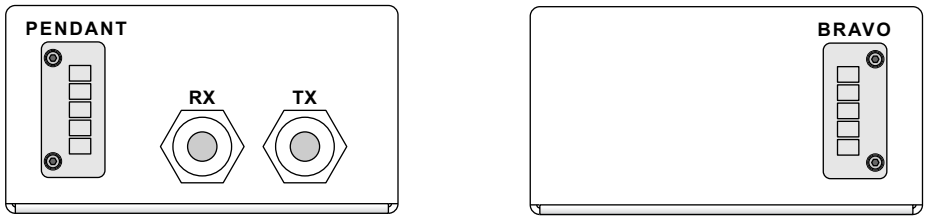
You can connect the Light Curtain to the Bravo Platform in either of the following ways:

- "Using a junction box" on page 37.
- "Using the Accessories Hub" on page 38.

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.

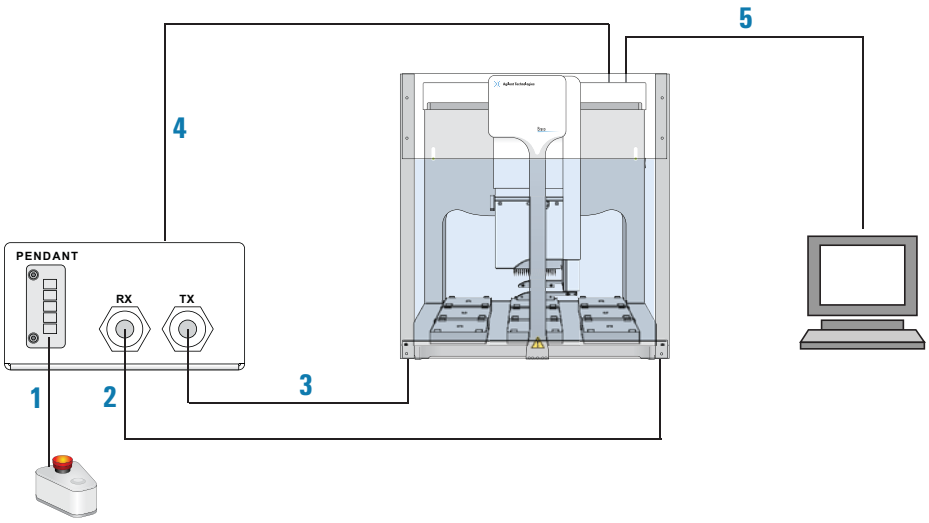
Figure Junction box connections (front view and back view)



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

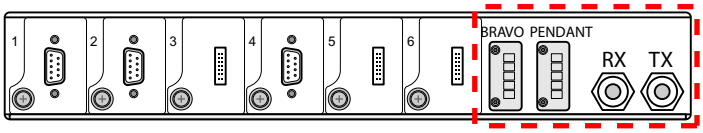


Item	Description	From	To
1	Pendant cable	Pendant	Junction box: PENDANT port (front)
2	Lightpost cable, black	Lightpost receiver	Junction box: RX port (back)
3	Lightpost cable, gray	Lightpost transceiver	Junction box: TX port (front)
4	Extension cable	Pendant port on the Bravo connection panel	Junction box: BRAVO port (back)
5	Ethernet cable	Bravo connection panel	Controlling computer

Using the Accessories Hub

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

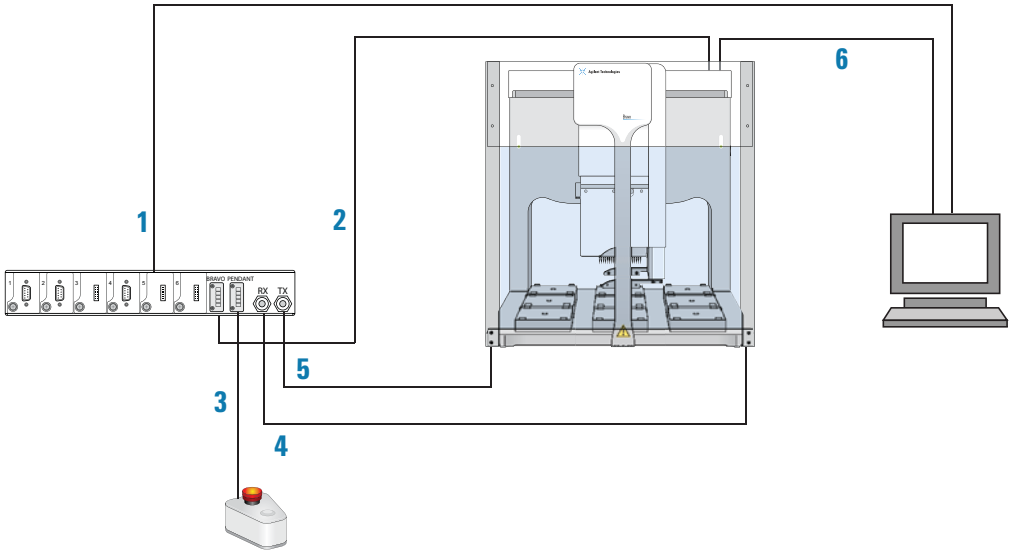
Figure Light Curtain ports on the Accessories Hub (front view)



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



Item	Description	From	To
1	USB cable	Controlling computer	Accessories Hub: USB port (back)
2	Extension cable	Pendant port on the Bravo connection panel	Accessories Hub: BRAVO port (front)
3	Pendant cable	Pendant	Accessories Hub: PENDANT port (front)
4	Lightpost cable, black	Lightpost receiver	Accessories Hub: RX port (front)
5	Lightpost cable, gray	Lightpost transceiver	Accessories Hub: TX port (front)
6	Ethernet cable	Bravo connection panel	Controlling computer

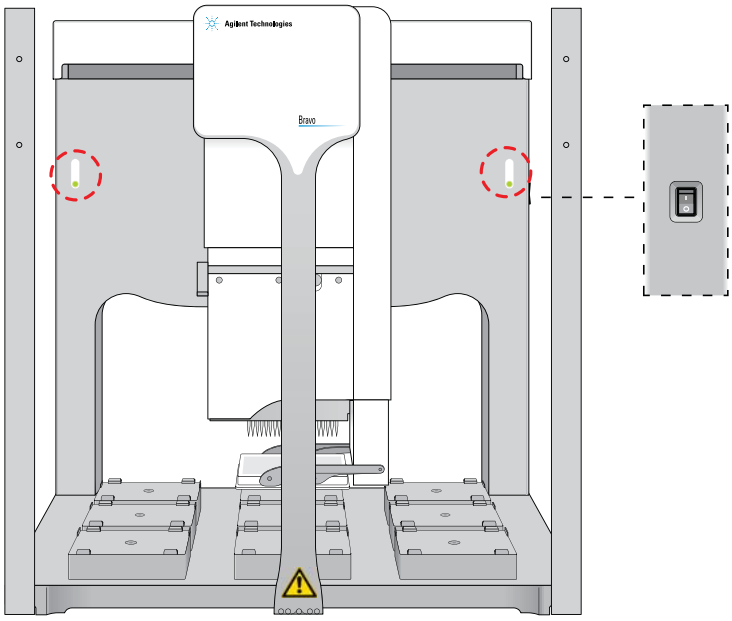
Aligning the light beams

To align the light beams:

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

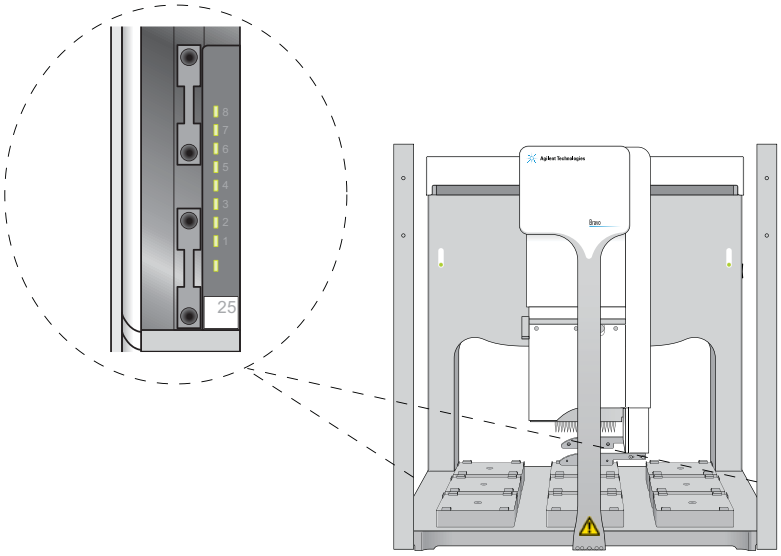
The two indicator lights on the front of the Bravo backplate illuminate, indicating that the Bravo Platform is on, and the Light Curtain activates.

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.

Figure Lightpost LED lights



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.

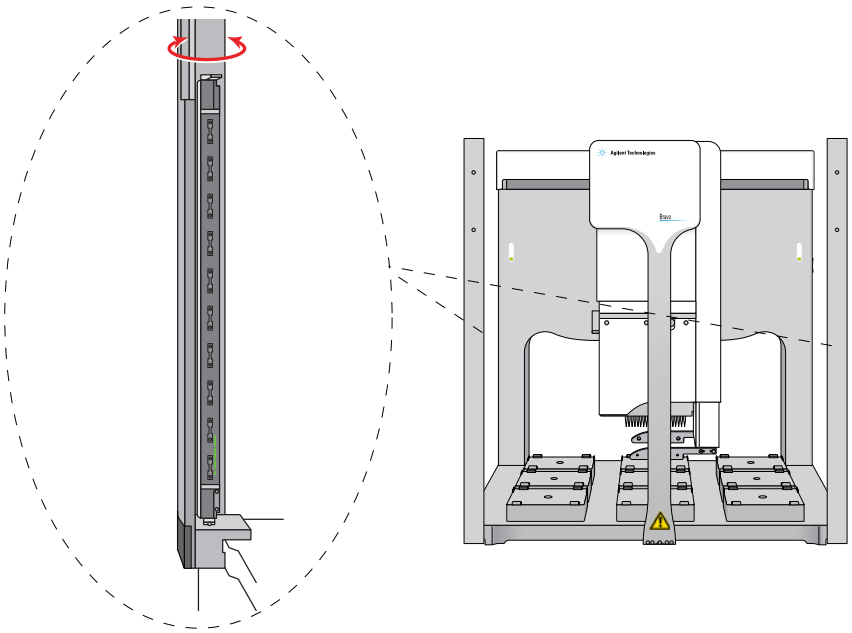
CAUTION Avoid touching the glass panels with your fingers. Fingerprints or dirt on the glass can interfere with the Light Curtain operation.

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.

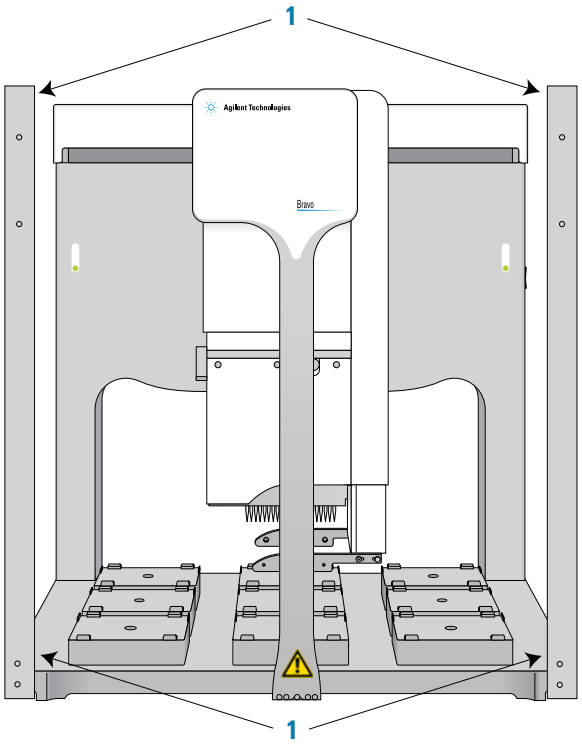
IMPORTANT If any of the LEDs on the lightpost panel are partial green or blinking, the light beams are not completely aligned. On the front of the Bravo backplate, the two indicator lights are red if the light beams are not aligned.

Figure Rotating the LED panels to align the light beams



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 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.

b Verify that the entire column of LEDs on each lightpost are solid green and not blinking.

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.

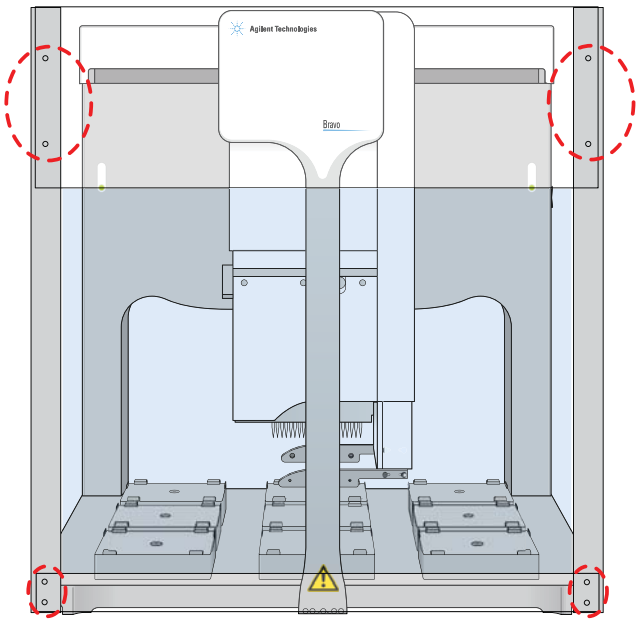
2 Secure the upper front shield to the top of the two lightposts using the four screws provided.

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



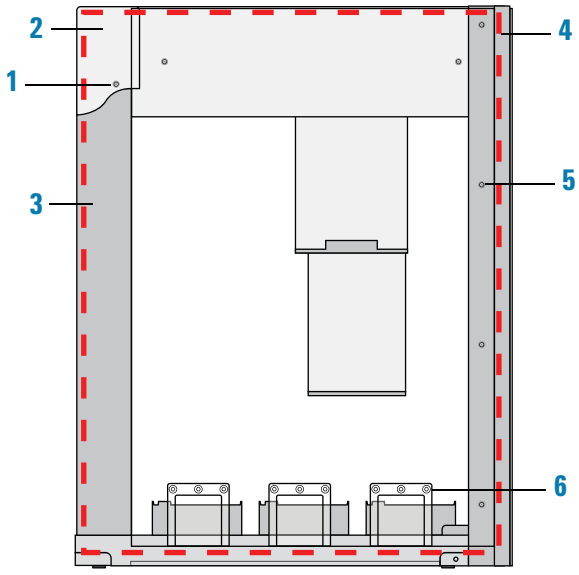
Installing the side shields

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 an 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.

Figure Full-size side shield installed on Bravo Platform (side view)



Item	Description
1	Attachment screw
2	Top cover
3	Backplate
4	Shield attachment screws (four)
5	Lightpost (Light Curtain)
6	Shield platepad-access windows (three)

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.

Related information

For information about...	See...
Rear shield	"Installing the rear shield" on page 44
Connection port locations on the back of the Bravo Platform	"Connecting the Bravo Platform" on page 21

For information about...	See...
Moving-parts hazards	"Mechanical hazards" on page 8
How to set up and operate the Bravo Platform	*Bravo Automated Liquid Handling Platform User Guide*

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 **Turn off the Bravo Platform and disconnect the power cord before you install or remove any accessory.**

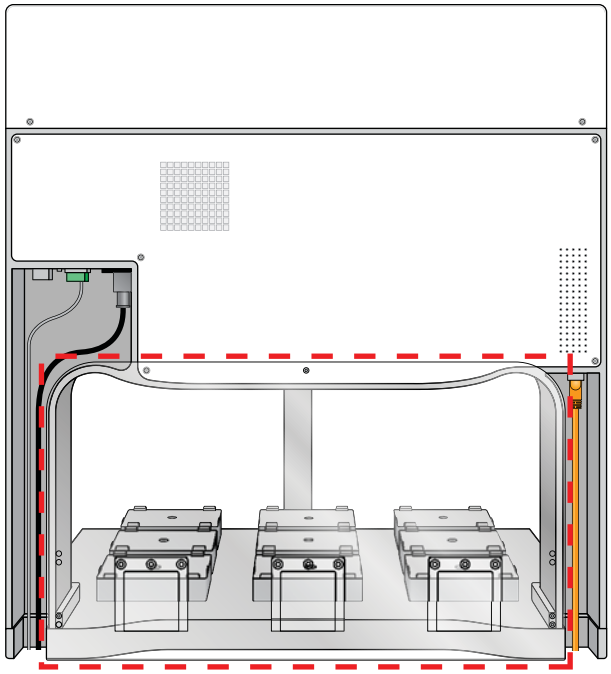
Make sure that you have the following:

- 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.

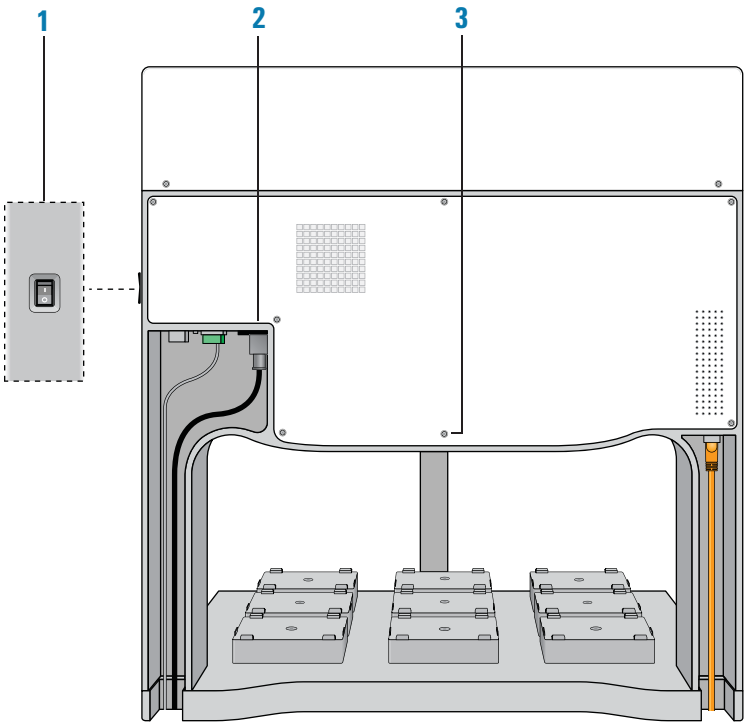
Figure Bravo Platform with rear shield installed



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.

Figure Bravo Platform rear view



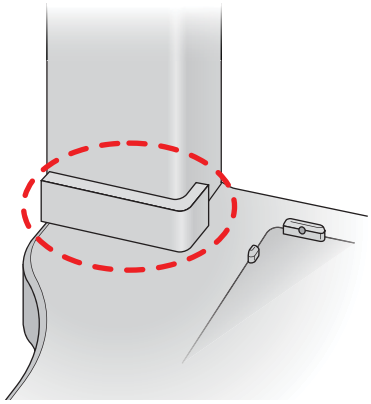
2 At the back of the Bravo Platform, remove the flathead screw from the center lower edge of the rear cover (3).

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.

Figure Shield clamp in position on Bravo backplate post (view from interior)

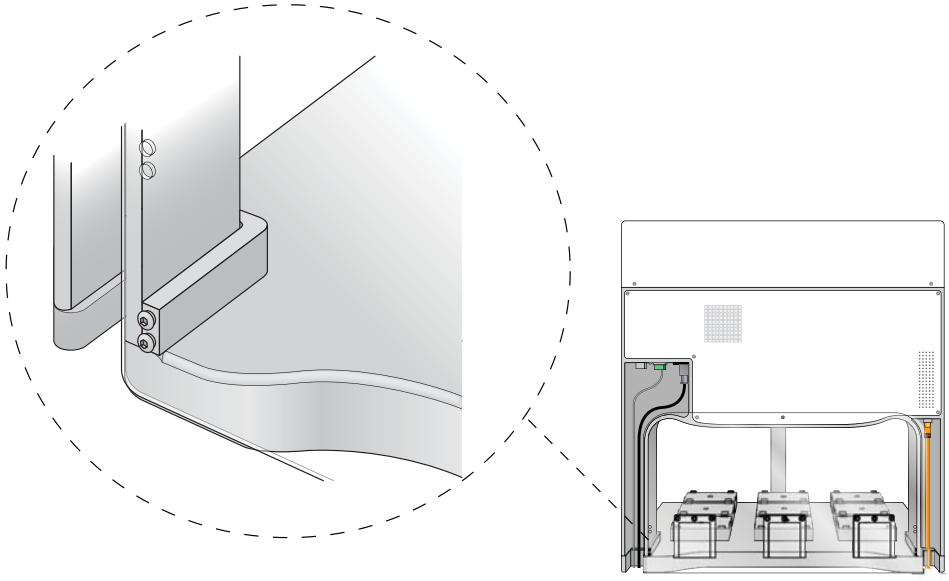


Note: The clamps are secured in place after the shield screws are installed in the next step.

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.

Figure Screws installed in a shield clamp



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.

Related information

For information about...	See...
Light Curtain and front and side shields	"Installing the Light Curtain and front and side shields" on page 32
Moving-parts hazards	"Mechanical hazards" on page 8
How to set up and use the Bravo Platform	*Bravo Automated Liquid Handling Platform User Guide*

Agilent Technologies

Safety and Installation Guide

G5409-90007

Revision 00, June 2011