G5562A, G5563A Bravo Platform

Safety and Installation Guide

Original Instructions

Notices

Manual Part Number

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Safety Notices

Contents

Contents

Preface

This preface contains the following topics:

![Agilent]

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 device before it is used.
Integrator	Configures hardware and writes software.
Lab manager, administrator, or technician	• Manages the automation system that contains the device • 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 device and solves routine problems.

What this guide covers

This guide describes the following for the G5562A, G5563A Bravo Platform:

- Potential safety hazards of the Bravo Platform and how to avoid them

  For general safety information, see the *Automation Solutions Products General Safety Guide*.

- Site requirements for the Bravo Platform

  Use this information to plan the space for the Bravo Platform. Make sure your site meets the requirements outlined in this guide before installing the device.

- Installation instructions for the Bravo Platform and the safety equipment

What is new in this edition

Revision description	See...
Revised the light curtain installation procedure to specify the 3-Port Robot Disable Hub instead of the Junction Box.	• "Standard Light Curtain and shield components" on page 29 • "Wraparound Light Curtain and shield components" on page 32 • "Installing the Standard Light Curtain and shields" on page 35

Related user instructions

Use this guide in conjunction with the following:

- *Automation Solutions Products General Safety Guide*. Provides general safety information and describes potential safety hazards that you might encounter when using Agilent Automation Solutions products. A copy of this safety guide is included with your shipment.

- *Bravo Platform Unpacking Guide*. Describes how to unpack the Bravo device from the shipping container.

- *Bravo Platform User Guide*. Describes how to set up, operate, and maintain the Bravo Platform and accessories.

- *Pump Module User Guide.* Describes how to install the Pump Module for autofilling accessories.

- *VWorks Automation Control Setup Guide*. Explains how to define labware, liquid classes, and pipetting techniques, and how to track and manage labware in storage.

- *VWorks Automation Control User Guide*. Explains how to create protocols, set task parameters, and run protocols.

Note: For instructions on how to install and set up the G5571AA AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

Where to find user information

The Agilent Automation Solutions user information is available in the following locations:

- *VWorks knowledge base*. The help system that contains information about all the Agilent Automation Solutions products is available from the Help menu within the VWorks software.

  To open the VWorks knowledge base:

  – Within the VWorks software, select **Help > Knowledge Base** or press F1.

  – From the Microsoft Windows **All Apps** menu, select **Agilent Technologies > VWorks Knowledge Base**.

- *PDF files*. The PDF files of the user guides are installed with the VWorks software and are on the software CD that is supplied with the product. A PDF viewer is required to open a user guide in PDF format. You can download a free PDF viewer from the internet. For information about using PDF documents, see the user documentation for the PDF viewer.

- *Online knowledge base*. You can search the online Agilent Automation Solutions knowledge base or download the latest version of a PDF file from the following website: www.agilent.com/chem/askb

Reporting problems

Contacting Technical Support

If you find a problem with the Bravo Platform, contact Agilent Technical Support. For contact information, go to https://www.agilent.com/en/contact-us/page.

Reporting hardware problems

When contacting Agilent Technologies, make sure you have the serial number of the device ready. You can find the Bravo serial number on the serial number label located on the front right corner of the deck and on the back of the device.

Reporting software problems

When you contact 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:

Agilent

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
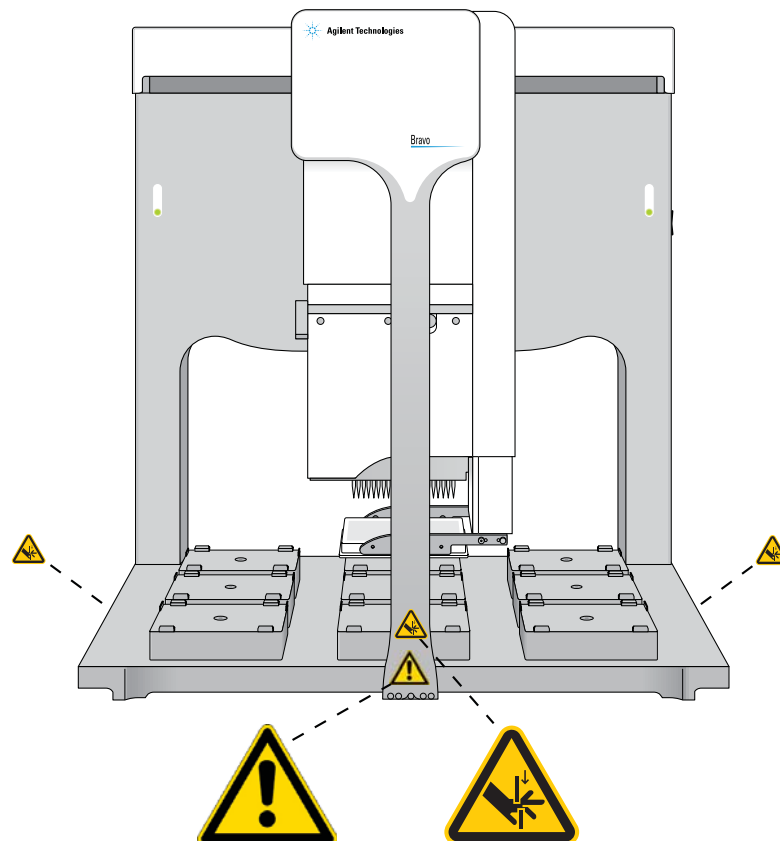
Safety and regulatory compliance

The Bravo Platform, when completely assembled with the liquid-handling head, the light curtain, and other components specified in the Declaration of Conformity, complies with the applicable EU Directives and bears the CE marking. The Bravo device alone, without the specified components, is considered a *partly completed machine*. In this case, the device has no CE marking and comes with a Declaration of Incorporation, because it is intended to be incorporated into a compliant system.

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.

Regulatory Compliance	Standard
EMC	
European Union	EMC Directive 2014/30/EU
	IEC 61326-1:2012/EN 61326-1:2013
Canada	ICES/NMB-001:2006
Australia/New Zealand	AS/NZS CISPR 11:2011
RoHS	
European Union	RoHS Directive 2011/65/EU
Safety	
European Union	Machinery Directive 2006/42/EC
	Low Voltage Directive 2014/35/EU
	IEC 61010-1:2010/EN61010-1:2010 IEC 61010-2-081:2015/EN 61010-2-081:2015
Canada	CAN/CSA-C22.2 No. 61010-1-12 CAN/CSA-C22.2 No. 61010-2-081-15
USA	ANSI/UL 61010-1-2012 ANSI/UL 61010-2-081:2015

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.

South Korea EMC Declaration

The following EMC declaration applies to:

1 All models that were registered on or after 7 December 2016, but

2 Not to models included in a product family or series that was registered before 7 December 2016 (even if the model was added to the product family or series on or after 7 December 2016).

EMC declaration for South Korea

This equipment has been evaluated for its suitability for use in a commercial environment. When used in a domestic environment, there is a risk of radio interference.

EMC 선언

다음 EMC 선언은

1 2016년 12월 7일 자 또는 이후에 등록된 모든 모델은,

2 2016년 12월 7일 이전에 등록된 제품군 또는 시리즈를 포함한 모델은 2016년 12월 7일 자 또는 이후에 제품군 또는 시리즈에 추가되었을지라도 적용 되지 않습니다

사용자안내문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다 .

※ 사용자 안내문은 " 업무용 방송통신기자재 " 에만 적용한다 .

Sound emission declaration

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

Schalldruckpegel: Lp < 70 dB nach EN ISO 779:2010.

Emergency stops

WARNING   If the Bravo Platform is integrated with other devices in a system, Agilent Technologies recommends that you install a main emergency-stop unit, such as the Robot Disable Hub, 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 VWorks software.

Stopping in an emergency

To stop in an emergency:

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

Figure   Emergency-stop pendant

Recovering from an emergency stop

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 pendant by turning it clockwise.
3   In the VWorks 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 a light curtain.

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

Figure   Bravo Platform (top front view) showing moving-parts hazards
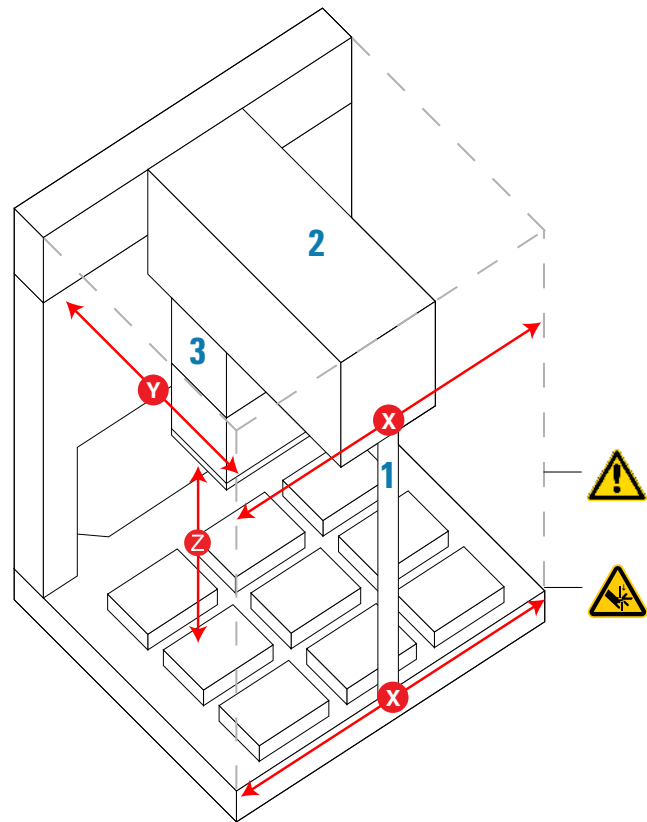
Item	Part	Axis of motion	Description
1	Tie bar	x-axis	The tie bar is attached to the arm and moves side to side across the front of the deck.
2	Arm	x-axis	The arm carries the head mount side to side across the deck.
3	Head mount	y-axis	The liquid-handling head attaches to the head mount, which moves back and forth on the arm between the back and front of the deck.
		z-axis	The head mount raises and lowers the liquid-handling head.

Figure   Moving parts on Bravo gripper assembly
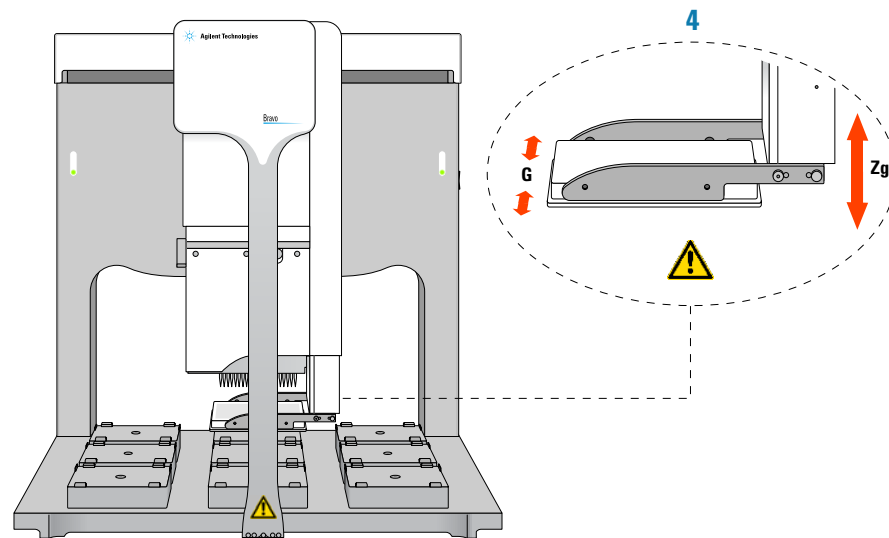
Item	Part	Axis of motion	Description
4	Gripper assembly	*G*-axis	The gripper fingers close and open to grip and release labware.
		Zg-axis	The gripper moves up to provide clearance when the head is moving across the deck, and down to extend beyond the liquid-handling head to pick and place labware.

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. Agilent Technologies highly recommends, and workplace safety laws in many countries require, that you connect the Bravo Platform safety interlock circuit to a Bravo 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, a Bravo light curtain and safety shields are required to prevent operator access to moving-parts hazards. For details, see "Light curtains and shields" on page 28.

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

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 accidentally 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.
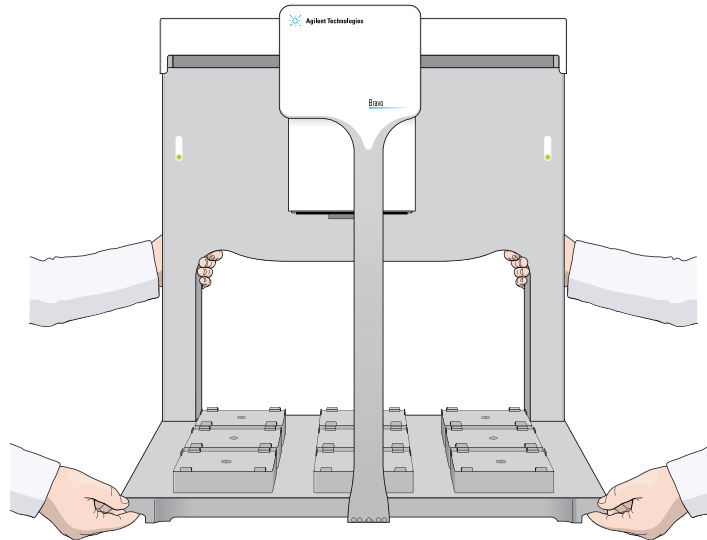
Ergonomics

About lifting the device

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.
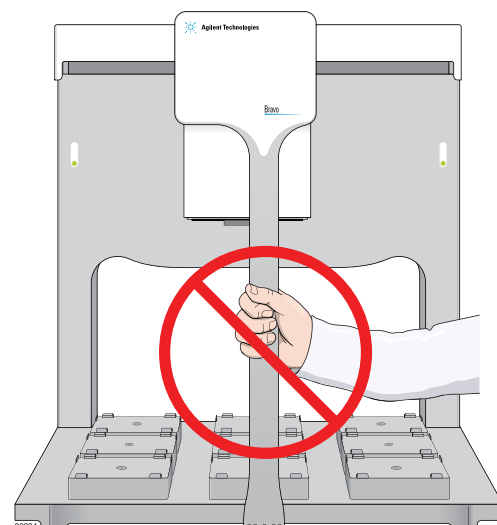
Figure   Correct lifting technique

CAUTION   Tugging on the tie bar or using it to lift the device can damage the device. Do not tug on the tie bar or use it to lift the device.

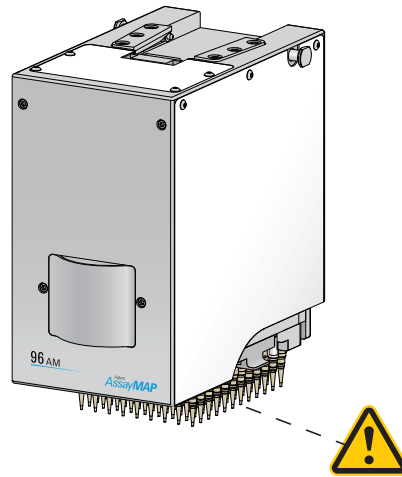*Figure*   Incorrect lifting or handling technique

Cut hazard

WARNING The probes of the AssayMAP 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.

Figure AssayMAP Bravo 96AM Head

2 Installing the Bravo Platform

This chapter contains the following topics:

Agilent

Installation workflow

Before you start

The Bravo Platform can be installed as a single device controlled by a computer or integrated with other devices in a lab automation workstation.

For either configuration, ensure that you connect the Bravo safety interlock circuit to a Bravo 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 Bravo safety equipment, as described in the following workflow.

Workflow

Step	For this task...	See...
1	Verify that the installation location meets the site requirements.	"Laboratory setup requirements" on page 13
2	Unpack the computer and connect the monitor, power, mouse, and keyboard.	Manufacturer's instructions
3	Install the VWorks software.	Software release notes
4	Unpack the Bravo Platform. **IMPORTANT** If you are installing risers (step 5), do not remove the *y*-axis shipping stop from the head mount until after you have installed the risers.	*Bravo Platform Unpacking Guide*
5	If required, install the risers to elevate the height of the deck. After the risers are installed, remove the *y*-axis shipping stop from the Bravo head mount.	Agilent Automation Solutions Technical Support
6	Install the platepads on the Bravo deck.	"Installing the platepads" on page 17
7	If applicable, install the deck accessories.	*Bravo Platform User Guide*
8	Connect the Bravo Platform.	"Connecting the Bravo Platform" on page 18
9	Install the liquid-handling head.	"Installing the liquid-handling head" on page 22
10	Install the safety equipment.	"Light curtains and shields" on page 28
11	*Optional*. Install the dust cover.	"Installing the dust cover" on page 47
12	Set up the Bravo device profile and set the teachpoints.	*Bravo Platform User 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.
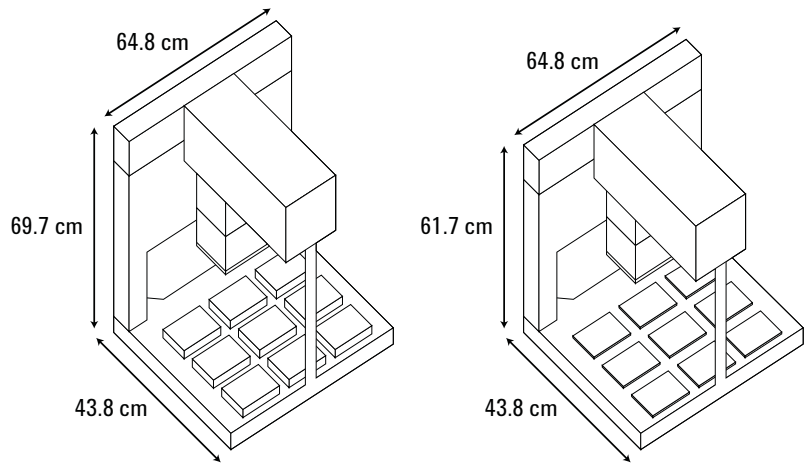
Space and bench requirements

Device dimensions and weight

The Bravo Platform is available in two sizes:

- Standard Bravo Platform
- SRT Bravo Platform

Figure   Dimensions of a standard Bravo Platform (left) and the SRT Bravo Platform (right)

The following table and figures provide details for the standard Bravo Platform.

Table   Standard Bravo Platform dimensions

Dimension	Bravo Platform	Bravo Platform with Standard Light Curtain	Bravo Platform with Wraparound Light Curtain
Height	69.7 cm (27.4 in)	69.7 cm (27.4 in)	69.7 cm (27.4 in)
with risers	84.3 cm (33.2 in)	84.3 cm (33.2 in)	84.3 cm (33.2 in)
Width	64.8 cm (25.5 in)	66.5 cm (26.2in)	78.0 cm (30.7 in)
Depth	43.8 cm (17.2 in)	52.5 cm (20.7in)	47.4 cm (18.7in)
Weight	52.1 kg (114.9 lbs)	60.7 kg (133.5 lbs)	61.9 kg (136 lbs)

Figure   Dimensions of a standard Bravo Platform with Standard Light Curtain
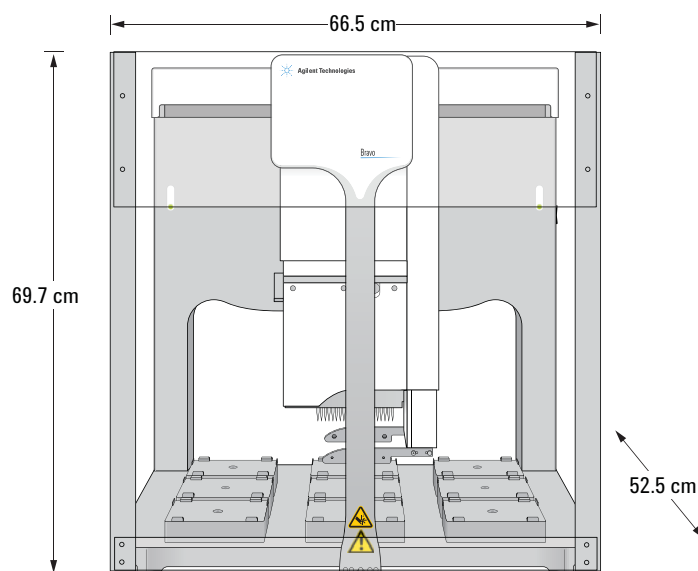
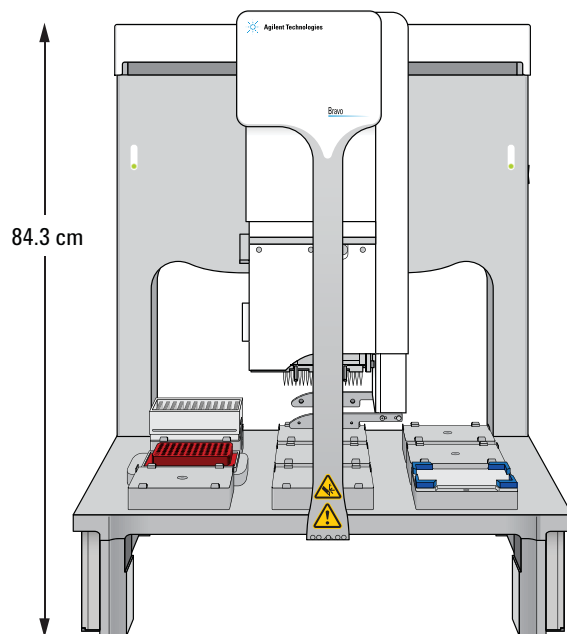

Figure   Example of Standard Bravo Platform on risers

Table   SRT Bravo Platform dimensions

Dimension	SRT Bravo Platform	SRT Bravo Platform with Standard Light Curtain	SRT Bravo Platform with Wraparound Light Curtain
Height	61.7 cm (24.3 in)	61.7 cm (24.3 in)	61.7 cm (24.3 in)
with risers	76.3 cm (30 in)	76.3 cm (30 in)	76.3 cm (30 in)
Width	64.8 cm (25.5 in)	66.5 cm (26.2in)	78.0 cm (30.7 in)
Depth	43.8 cm (17.2 in)	52.5 cm (20.7in)	47.4 cm (18.7in)
Weight	51.5 kg (113.5 lb)	60.1 kg (132.5 lb)	61.3 kg (135 lb)

Laboratory table or bench requirements

The laboratory table must:

- Have enough space to accommodate the Bravo Platform, computer, monitor, pendant, and accessories.
- Support the weight of the Bravo Platform and other components without excessive shaking or movement.
- Be fixed in place, for example, casters that lock.
- Have proximity to a power outlet, and allow rear access to enable quickly disconnecting the power to the Bravo Platform if the need arises.

  The supplied power cord is 1.83 m (6 ft) long.
- Allow access to the rear of the Bravo Platform for maintenance.

  Note: If the Bravo Platform is outside an enclosure, the Bravo rear shield prevents rear access to the device's moving parts while still allowing easy access to the rear power connections.

The table must be level in the direction of the width and the depth of the platform. Using a traditional bubble level, the table should be leveled such that the bubble is centered between the two limit lines of the level.

The table surface must have a thickness relative to the material that will prevent warping when the Bravo Platform and computer are set upon the table.

The table surface must be attached to the table frame.

The table frame must have:

- A leveling mechanism in the feet or casters.
- Dimensions that enable support of the table surface without overhang.

Electrical requirements

The Bravo Platform has the following electrical requirements:

Requirement	Value
Voltage	100–240 V~
Frequency	50/60 Hz
Power, maximum	300 VA
Fuse	250 V, 6.3 A, 5 mm x 20 mm, time delay

Environmental operating requirements

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

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

Operating	Specification
Pollution degree	2
Installation category	II
Temperature	4–40 °C
Humidity	10–90% RH, non-condensing
Altitude	1–2000 m

Computer requirements

Ensure that the computer contains the following software versions at a minimum.

- Microsoft Windows 10 64-bit operating system
- VWorks Automation Control software v13.1

See the VWorks software release notes for installation instructions and additional computer requirements. You can also go to the VWorks knowledge base at www.agilent.com/chem/askb.

Installing the platepads

The Bravo deck has nine labware locations. A platepad or accessory is installed at each of the nine locations to hold the labware in position. Several types of platepads are available for the Bravo Platform: standard, tall, and short. Each platepad has a crosshairs in one corner, which is used to set the pipettor teachpoint for the deck location. The following figure shows a standard platepad.

Figure   Standard platepad with crosshairs (1)
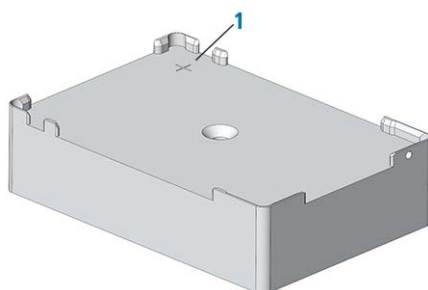
Before you start

Make sure you have the following:

- Platepad
- Flathead cap screw, M6 x 40 mm

IMPORTANT   Debris on the bottom surface of the platepad can prevent it from sitting level on the deck. Ensure that the platepad is clean before you install it.

Procedure

To install a platepad:

1   With the crosshairs oriented toward the device rear, align the pins in the bottom of the platepad with the holes on the deck.

Figure   Platepad crosshairs orientation on the Bravo deck (top view)
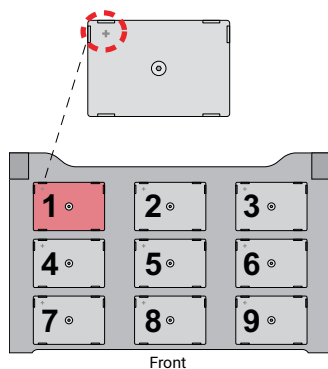
Make sure the pins are inserted correctly and the accessory sits level on the deck.

2   Secure the platepad to the deck using the screw provided.

3 Ensure that the setscrews in the platepad tabs are recessed and not protruding into the plate nest. Use a 1.5-mm hex wrench to back out any protruding setscrews.

IMPORTANT A protruding setscrew will prevent proper seating of the labware in the platepad.
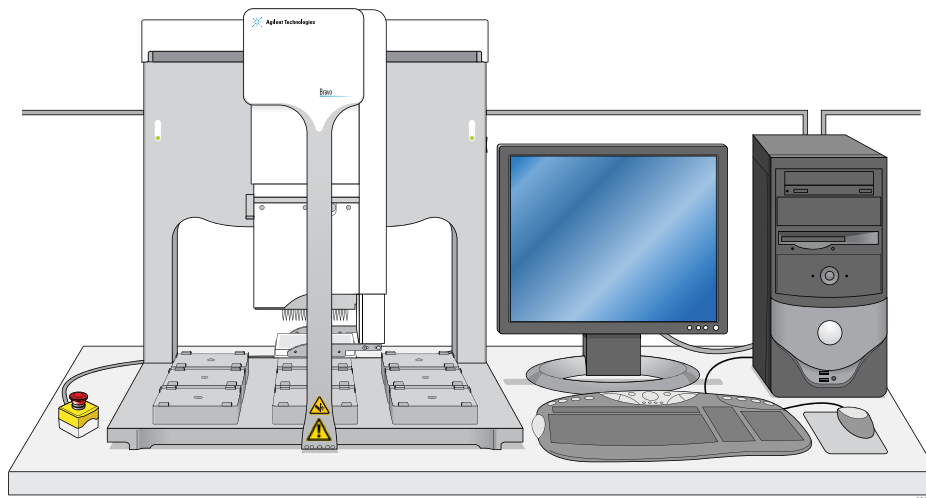
Figure Setscrew in platepad tab
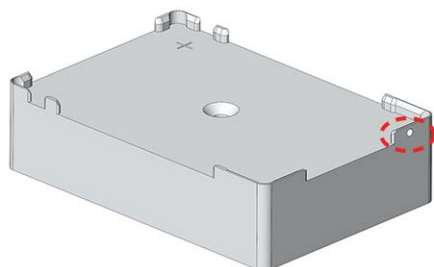
Connecting the Bravo Platform

About this topic

This topic provides basic connection instructions for the Bravo Platform.

*Figure* Example of Bravo Platform basic connections

Before you start

• Make sure the laboratory setup requirements have been met.

• Determine the placement of the Bravo Platform and computer. If the Bravo Platform is integrated in a workstation, determine the Bravo deck location for the external robot to hand off labware.

- 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.

Bravo rear connection panel

The following figure and table describe the connection panel at the rear of the Bravo Platform.

Figure   Connection panel on back of Bravo Platform
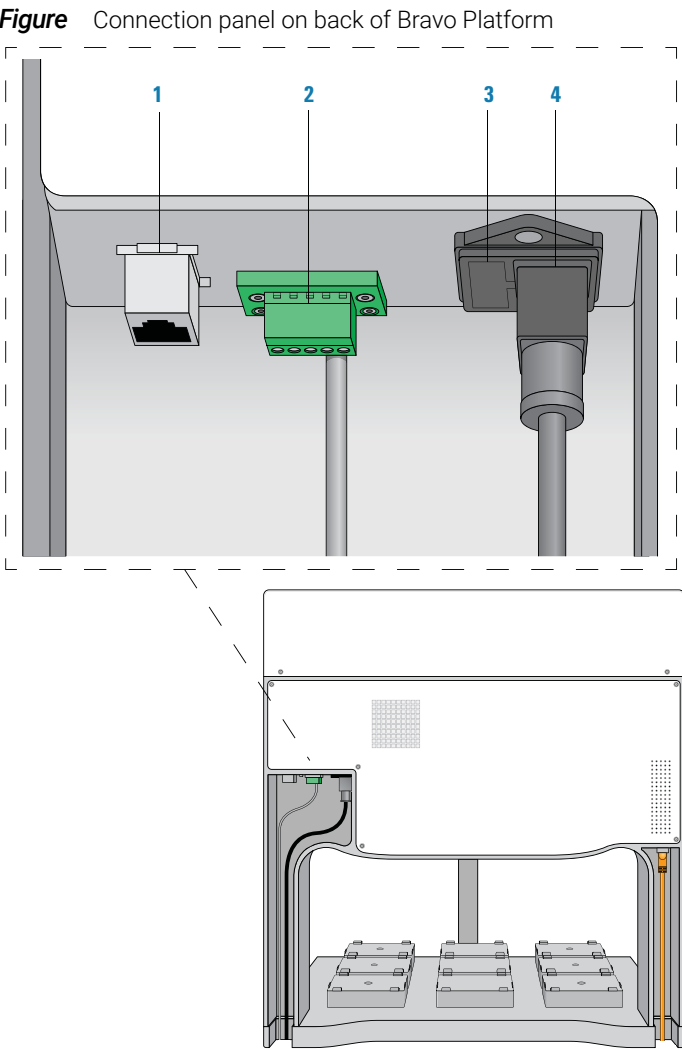
Item	Feature	Description
1	Ethernet port	Connects the Ethernet card in the controlling computer to the Bravo Platform.

Item	Feature	Description
2	Pendant port	Connects the emergency-stop pendant and a Bravo light curtain to the Bravo safety interlock circuit.
		The connection is made through an emergency-stop control, such as the Robot Disable Hub.
		IMPORTANT The safety interlock circuit must be closed for the Bravo Platform to operate.
3	Fuse holder	Houses the AC inlet fuse and a spare fuse for the Bravo Platform.
4	AC power entry	Connects the Bravo power cord to an AC outlet with a grounded circuit.

Pump I/O port

The following figure shows the Pump I/O port on the back of the Bravo Platform. The table below describes the Pump I/O port in detail.

Figure   Pump I/O port (Bravo Platform back view)
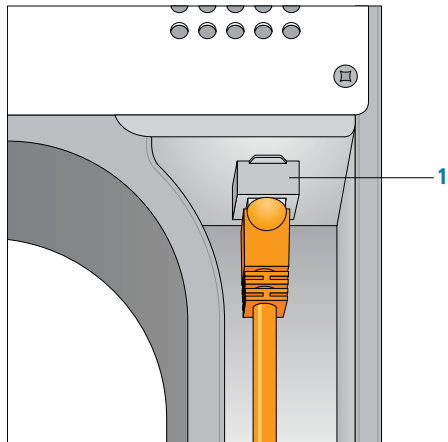
Item	Feature	Description
1	Pump I/O port	An RJ-45 I/O port that connects the Pump Module to the Bravo Platform. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable.
		IMPORTANT This is not an Ethernet port.

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.**

You will reconnect the power cord and pendant during the Bravo light curtain installation procedure. However, you should connect the power cord and pendant at this step to ensure that the Bravo Platform functions before installing a Bravo light curtain.

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 use Ethernet to connect a Bravo Platform to the computer in one of the following ways:

•   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 use one port to connect to the Bravo Platform. The second Ethernet port may be used to connect to your LAN. Verify the computer LAN connection to the Bravo Platform before connecting any other networks.

WARNING   **Connecting the Bravo Platform to a company or general network can potentially cause injury. Remote computer operators might accidentally 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.**

Connecting directly to the computer

To connect directly to the computer using Ethernet:

1   Connect one end of the Ethernet cable to the Ethernet port on the Bravo Platform.

2   Connect the other end of the cable to the Ethernet port on the computer.

Connecting through an Ethernet switch

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.

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

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

For the Agilent-configured computer, no change is required to the network card IP address.

If you are using a computer other than an Agilent-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.

Note: The Bravo device has a default IP address of 192.168.0.8. If you need to change the default IP address, contact Agilent Automation Solutions Technical Support.

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 disposable-tip heads (Series III), pin tools, and the AssayMAP Bravo 96AM Head.

Note: If you want to install a Series II disposable-tip 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 head.

Before you start

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

Before installing a liquid-handling head, familiarize yourself with the features shown in the following figures:

• Bravo head mount contains a head lock (**1**) and a dovetail connector (**2**), as the following figure shows.

• Each liquid-handling head contains two head-retainer pins (**3**) and a dovetail interface (**4**) that attaches to the dovetail connector on the Bravo head mount.

The dovetail interface connects the liquid-handling head electronics to the Bravo Platform. The two head-retainer pins and the head lock secure the liquid-handling head to the Bravo Platform.

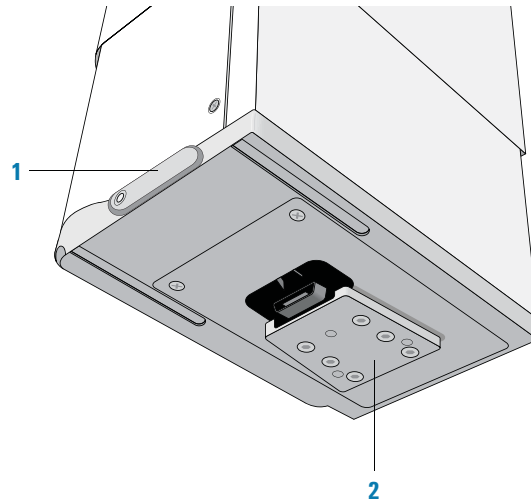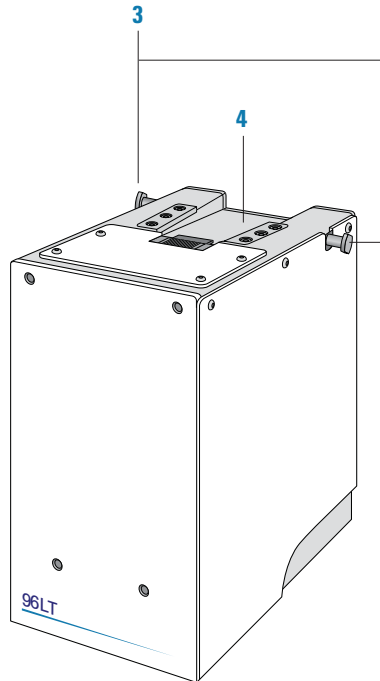*Figure* Bravo head mount with (1) head lock and (2) dovetail connector (bottom view)

Figure Disposable-tip head with (3) retainer pins and (4) dovetail interface


Procedure

To install 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. If the Bravo Platform is turned off, 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.
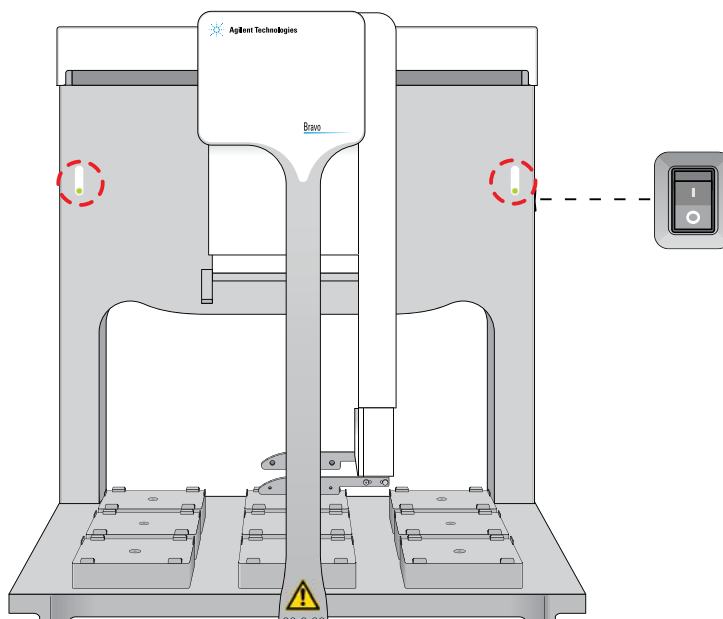
Figure   Bravo deck locations (top view)
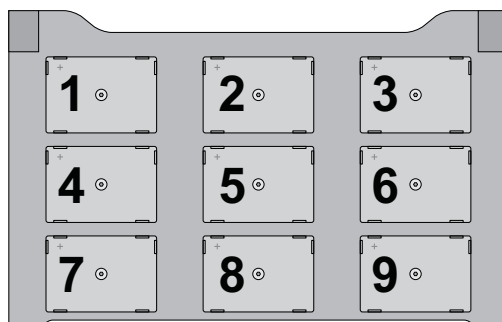
Front

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 remains seated in the stand, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted. See the following figure.

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

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

4   Remove the head from the stand as follows:

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

   Figure   Disposable-tip head: (1) retainer pins and (2) stand
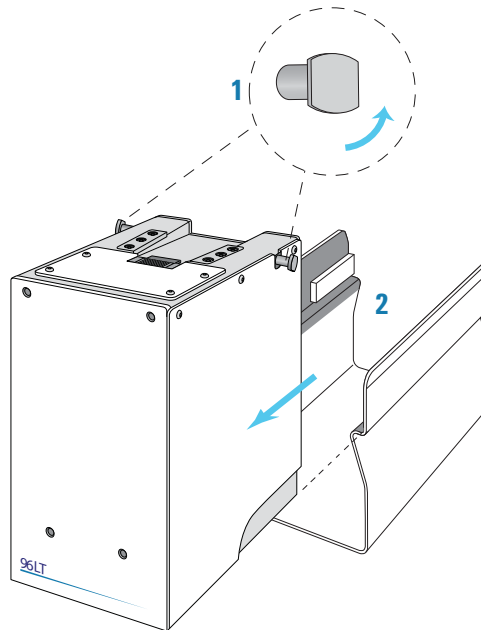
- *Bravo 96AM Head.* Ensure that the top of the head is resting on a clean, stable surface so that the probes are facing up.

WARNING   **The probes of the AssayMAP 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.**

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*   Bravo 96AM Head: (1) stand cutouts and (2) head tabs
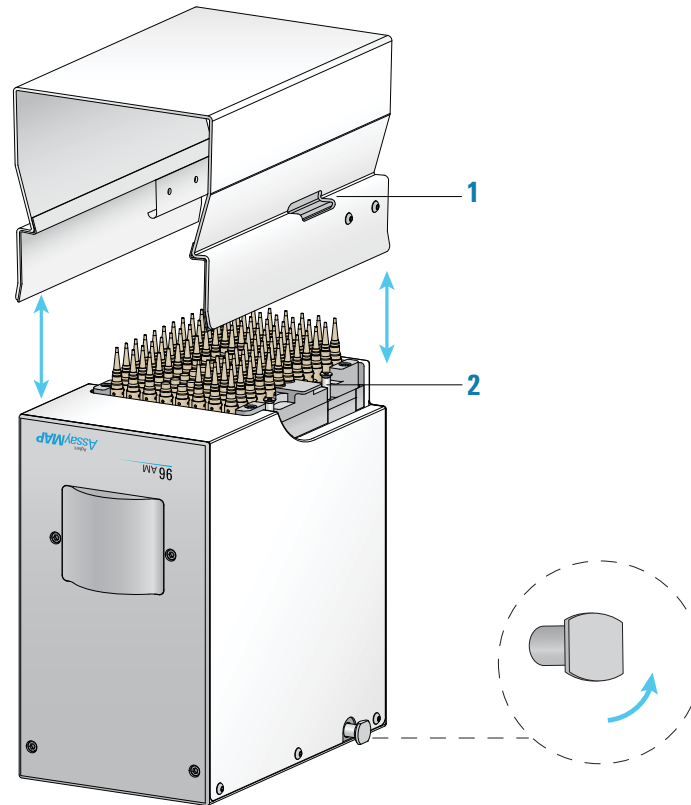
5   With your left hand, firmly grip the left side of the head. Place your right hand under the flat area just to the left of the array to support the weight of the head.

6   While supporting the head with your hands, slide the head onto the Bravo head mount. Press the head firmly into place to ensure the head is plugged into the connector receptacle on the head mount. You should hear the click when the retaining pins snap into place.

*Figure*   Installing the Bravo 96AM Head in the Bravo head mount
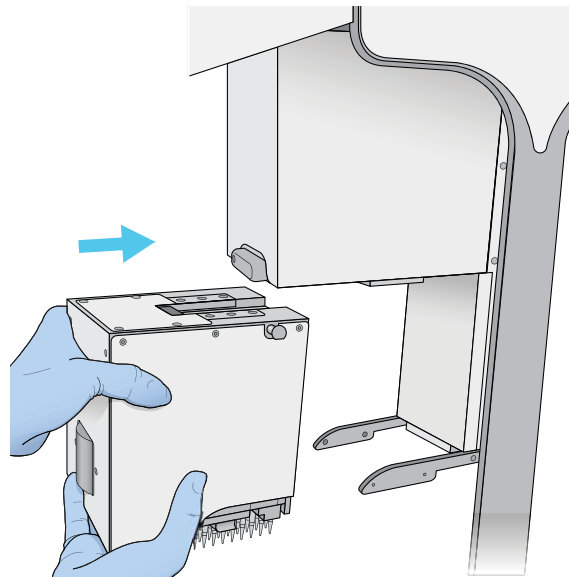
Note: If you do not hear the pins snap into place, check that the straight edges of the retainer pins are in the vertical position, as the following figure shows. Attempt to rotate the pins to ensure that they are in the locked position. The pins should not rotate freely.

Figure   Installed Bravo 96AM Head: (1) retainer pin and (2) head lock
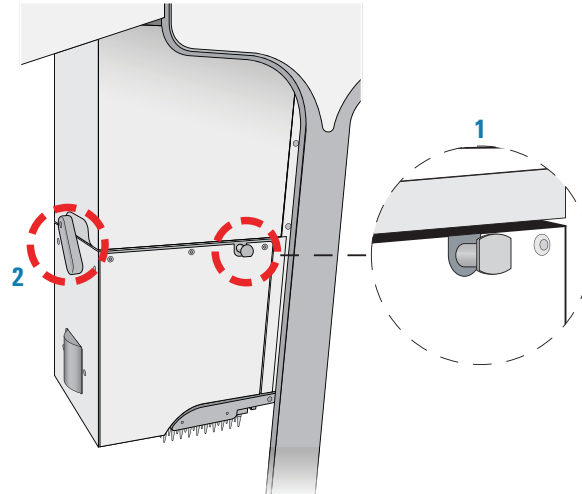
7   To lock the head, rotate the head lock clockwise until it reaches its hard stop. This ensures that the head is fully seated and does not shift position during operation.
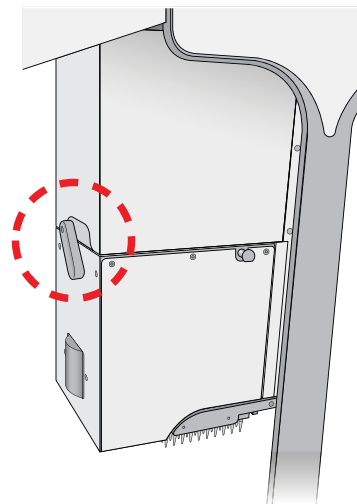
CAUTION   **Dropping the head or bumping the barrels or probes will damage the head. If the Bravo head is not properly secured in place, it could drop unexpectedly. Ensure that the head is securely locked into the head mount.**

Light curtains and shields

About this topic

This topic provides an overview of the Bravo light curtains and shields. 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 Bravo safety interlock circuit and you determine that the enclosure provides adequate protection to the operator, the enclosure can replace the Bravo light curtain and shields.

> **WARNING**   **Changing or modifying the Bravo 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.**

This topic includes:

- "Types of light curtains" on page 28
- "Standard Light Curtain and shield components" on page 29
- "Wraparound Light Curtain and shield components" on page 32
- "Cleaning the light curtains and shields" on page 34

Types of light curtains

The following light curtains are for use on a Bravo Platform only:

- *Standard Light Curtain*. Enables operator access to the front of the Bravo deck while protecting operators from moving-parts hazards. A Bravo Platform with the Standard Light Curtain can be integrated with other devices that access the Bravo deck from the sides, such as the BenchCel Microplate Handler.

    The Standard Light Curtain is available for a standalone Bravo Platform or a Bravo Platform that has devices integrated externally at either side of the deck.

- *Wraparound Light Curtain*. Enables operator access to the front and sides of the Bravo deck while protecting operators from moving-parts hazards. Maintaining the openings at the sides and the front enables more airflow to the Bravo deck, which may be a requirement for installation inside a laminar flow hood.

    The Wraparound Light Curtain is available only for a standalone Bravo Platform or a Bravo Platform that has no devices integrated externally from the Bravo deck. In addition, any deck accessory cabling or tubing must be routed through the Bravo rear opening.

Standard Light Curtain and shield components

The Standard 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 is tripped and the motion of the Bravo head stops.

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

For installation instructions, see "Installing the Standard Light Curtain and shields" on page 35.

*Figure*   Bravo Platform with Standard Light Curtain and shields (front view)
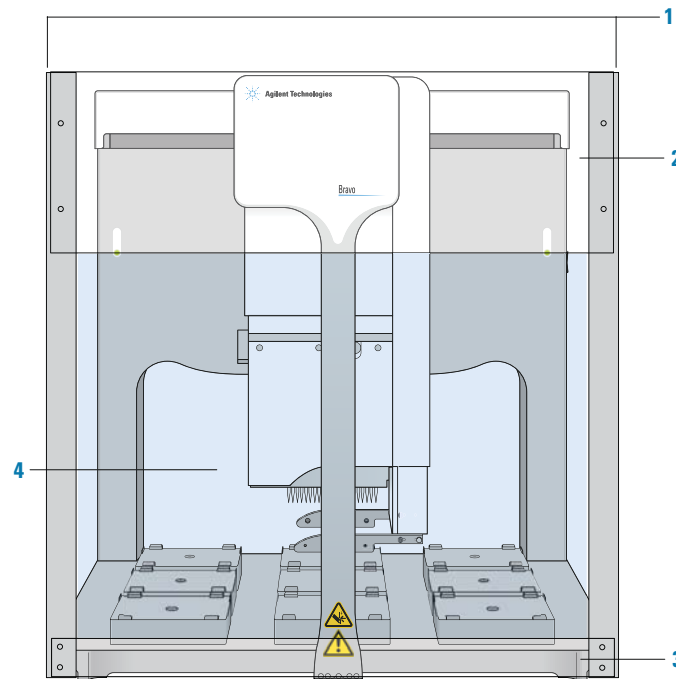
Item	Name	Description
1	Lightposts	The two lightposts that mount on each end of the Bravo base and contain the transmitter and receiver that project the light beams, detect disruptions in the beam, and transmit signals to the safety interlock circuit.
2	Upper front shield	A clear plastic shield that attaches to the two lightposts to prevent access at the front between the top of the light shield and the Bravo top.
3	Lower front shield	A clear plastic shield that attaches to the two lightposts to prevent access at the front between the bottom of the light shield and top of the Bravo deck.
4	Light shield (invisible)	The invisible light shield that the Standard Light Curtain generates, which spans the area between the two lightposts across the front of the Bravo Platform.

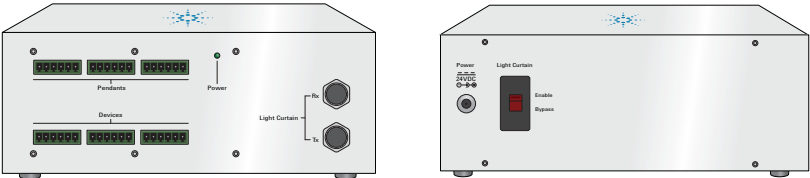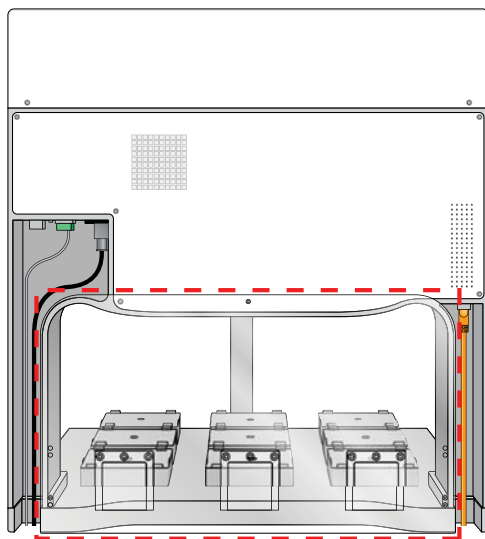| Item	Name	Description
5	Side shields (See the following figure for an example.)	The clear plastic shields that prevent access through the sides openings of the Bravo Platform. Each side shield attaches to a lightpost and the Bravo backplate. Each shield has deck-access windows with removable covers for routing cabling and tubing off the deck, as the following figure shows.
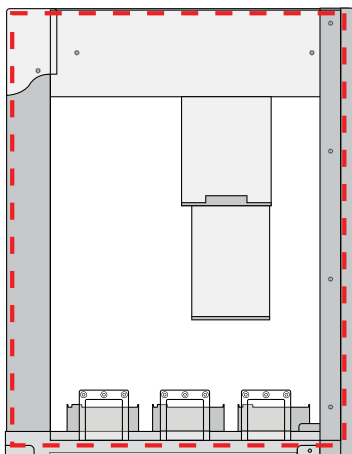
A side shield might not be required if the Bravo Platform is integrated with another device on a given side.

Item	Name	Description
6	Rear shield (See the following figure.)	A clear plastic shield that prevents access through the rear opening of the Bravo Platform. The shield has three access windows for routing cabling and tubing off the deck, as the following figure shows.

A rear shield might not be required if the Bravo rear opening is not accessible to operators.

Item	Name	Description
7	Robot Disable Hub (See the following figure.)	The main emergency-stop connections for the Bravo device, pendant and light curtain. The 3-Port Robot Disable Hub can connect the interlock circuits of up to three devices, three pendants, and a light curtain.

Figure Robot Disable Hub, 3-port (front and rear views)

Item	Name	Description
8	Cable, extension (not shown)	The extension cable that connects the Bravo pendant port to the Robot Disable Hub.

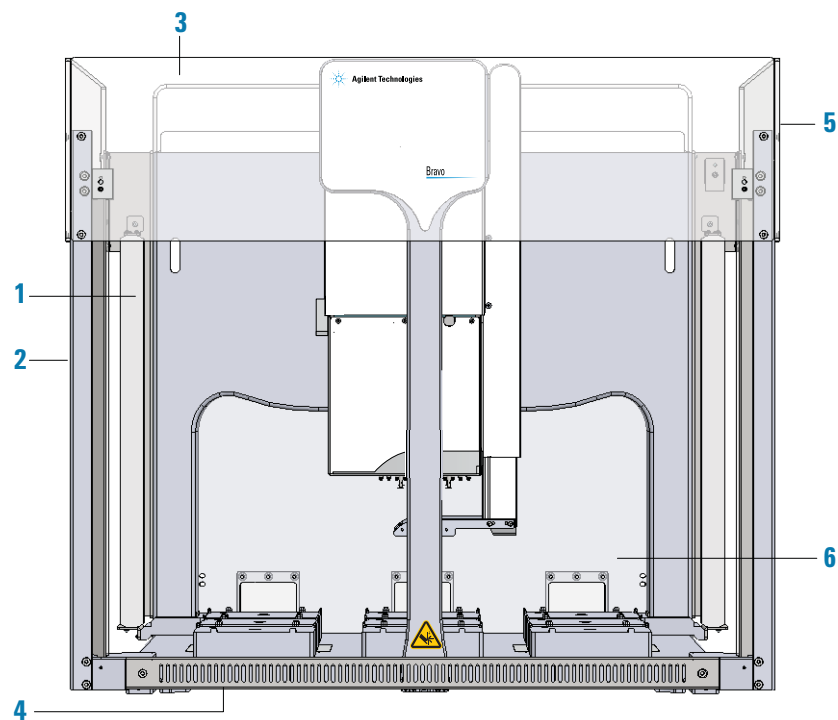## Wraparound Light Curtain and shield components

The Wraparound Light Curtain contains two lightposts that project light beams and two mirrorposts that reflect the projected light around the side and front openings of the Bravo Platform. If an object disrupts the light beams, the safety interlock circuit is tripped and the motion of the Bravo head stops. Front, side, and rear shields cover the remaining Bravo openings to protect operators from moving-parts hazards.

The following figure and table provide details on the Bravo Wraparound Light Curtain and shields.
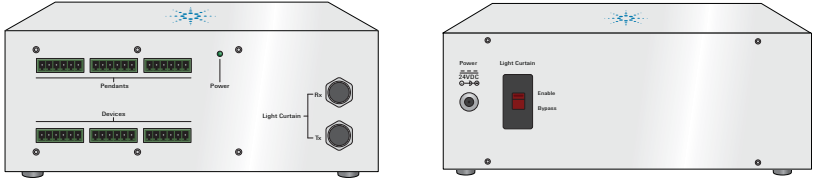
IMPORTANT   Only Agilent field service personnel may install the Bravo Wraparound Light Curtain.

Figure   Bravo Platform with Wraparound Light Curtain and shields

Item	Name	Description
1	Lightposts	The two lightposts that mount on each end of the Bravo rear:
		• Transmitter lightpost (left rear) projects the light beams across the Bravo left side opening to the left mirrorpost, which reflects the light beams across the front opening.
		• Receiver lightpost (right rear) detects the light beams reflected across the Bravo right side opening.
		The lightposts are connected to the safety interlock circuit through the Robot Disable Hub. The lightposts detect any disruptions in the light beams. A column of LEDs on the lower front of each lightpost indicate the light curtain status.
		• LED lights turn green when the light beams are aligned and no disruptions are detected.
		• LED lights turn red if the receiver does not detect the light beams. Improperly aligned mirrorposts or disruptions in the light beams cause the LED lights to turn red.
2	Mirrorposts	The two mirrorposts that mount on the front left and front right corners of the Bravo base.
		• The left front mirrorpost receives the light beams projected across the left side opening from the transmitter lightpost, and then reflects the light beams across the Bravo front opening.
		• The right front mirrorpost reflects the light beams across the right side opening to the receiver lightpost.
3	Upper front shield	A clear plastic shield that attaches to the two front mirrorposts to prevent access at the front between the top of the light shield and the Bravo top.
4	Bottom front metal guard	A ventilated metal shield that attaches to the two front mirrorposts to prevent access at the front between the bottom of the light shield and top of the Bravo deck.
5	Side shields	The clear plastic shields that prevent access through the upper left and right side openings above the light shield.
6	Rear shield	A clear plastic shield that prevents access through the rear opening of the Bravo platform. The shield has three access windows for routing cabling and tubing off the deck.
		A rear shield might not be required if the Bravo rear opening is not accessible to operators.
7	Light shield (invisible)	The invisible light shield that the light curtain generates, which spans across the Bravo side and front openings.

Item	Name	Description
8	Robot Disable Hub (See the following figure.)	The unit that provides the main emergency-stop connections for the Bravo device, pendant and light curtain. The Robot Disable Hub can connect the interlock circuits of up to three devices, three pendants, and a light curtain.

Figure   Robot Disable Hub, 3-port (front and rear views)

Item	Name	Description
9	Cable, extension (not shown)	The extension cable that connects the Bravo pendant port to the Robot Disable Hub.

Note: For installation instructions, Agilent field-service personnel should refer to the *Bravo Wraparound Light Curtain Installation Guide*.

Cleaning the light curtains and shields

CAUTION **Fingerprints or dirt on the light curtain glass and mirrors can interfere with the operation. Avoid touching the glass and mirror panels with your fingers.**

To clean the shields and the light curtain glass and mirror surfaces:
Use a soft, lint-free cloth and a mild detergent diluted with water, or use isopropyl alcohol.

Installing the Standard Light Curtain and shields

Before you start

The light curtain and shields may be installed only on a Bravo Platform by Agilent service personnel who have been trained in the procedure.

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 Standard Light Curtain. The Standard Light Curtain is an additional safety feature to be used with the emergency-stop pendant.**

WARNING **The light beams of the Standard Light Curtain 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 Standard Light Curtain. If access from the sides or rear 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 Standard Light Curtain operation.**

Required components and tools

Make sure that you have the following:

- Standard Light Curtain components (lightposts and extension cable)
- Shields
- Robot Disable Hub, power supply, and power cord
- 2.5-mm and 3-mm hex wrenches
- Cross-tip screwdriver
- T10 and T20 Torx drivers
- Gloves to protect the lightpost glass from fingerprints and smudges

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 36
2	Connect the Standard Light Curtain to the Bravo Platform.	"Connecting the Standard Light Curtain" on page 37
3	Align the light beams.	"Aligning the light beams" on page 38

Step	Procedure	See…
4	Install the front and side shields.	• "Installing the front shields" on page 41 • "Installing the side shields" on page 42
5	Install the rear shield	"Installing the rear shield" on page 44

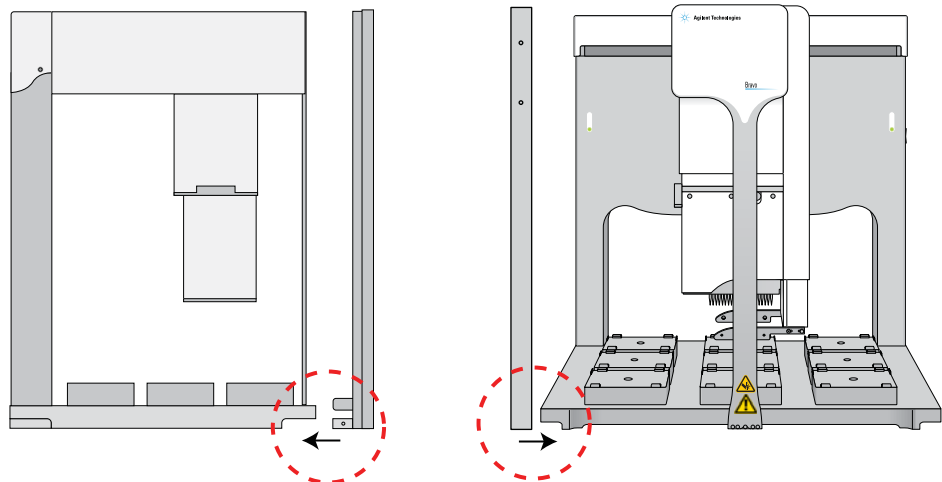## Installing the lightposts

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 in position, as the following figure shows (**1**).

Figure   Lightpost setscrew (Bravo Platform side view)
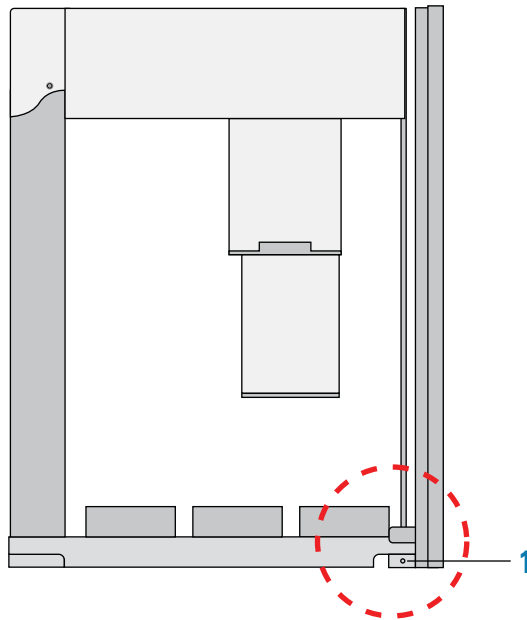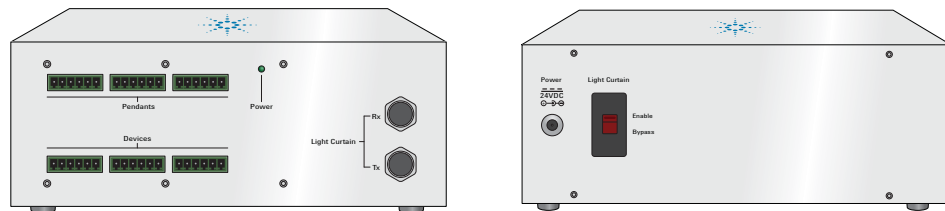

3   Repeat steps 1 and 2 to mount the front right lightpost.

Connecting the Standard Light Curtain

Use the following procedure to connect the Standard Light Curtain to a Bravo Platform using the Robot Disable Hub.

The Robot Disable Hub has the following connectors, controls, and indicators:

*Figure*   Robot Disable Hub connections (front and back views)

- **Pendants** connectors accommodate the Bravo pendant and up to two additional pendants.
- **Devices** connectors accommodate the Bravo device and up to two other devices with interlock circuits.
- **Light Curtain** connectors connect to the corresponding light curtain receiver (Rx) and transceiver (Tx) cables.
- **Power** status indicator lights green when the unit is connected to power.
- **Power** entry port connects to the supplied 24W power adapter, which in turn connects to the power cord.
- **Light Curtain Enable/Bypass** switch enables or disables the light curtain. You set the switch to Bypass during the installation. After installing the light curtain and connecting all the devices, you set the switch to Enable.

To connect the Standard Light Curtain using the Robot Disable Hub:

Refer to the following figure and table for the connections.

***Figure***   Connections for Standard Light Curtain and pendant
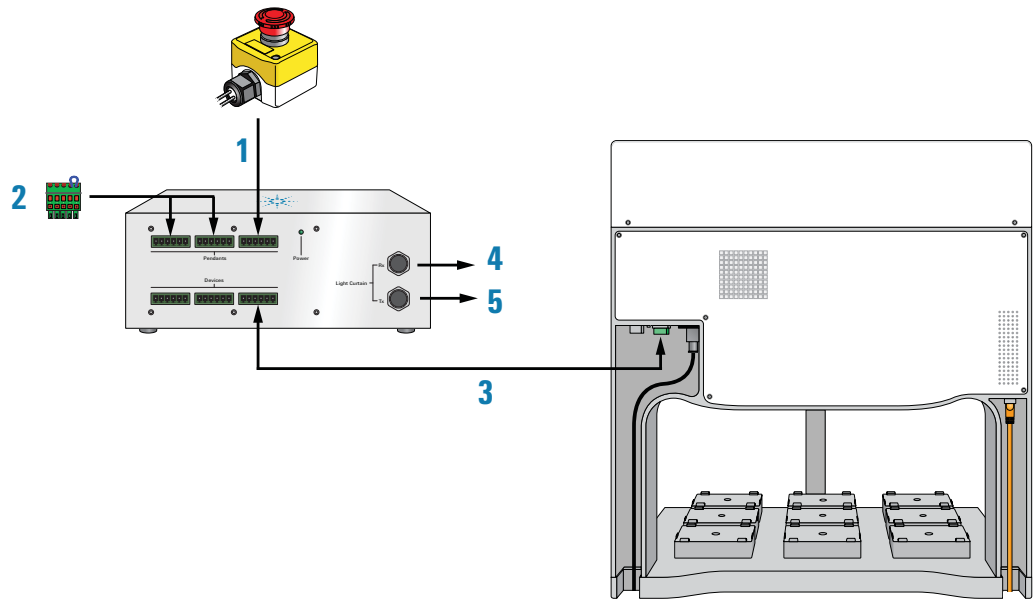
Item	Description	From...	To Robot Disable Hub
1	Pendant cable	Pendant	Pendants connector
2	Jumper	Jumper	Pendants connectors
3	Extension cable	Bravo Pendant port	Devices connector
4	Lightpost cable, black	Lightpost receiver	RX port
5	Lightpost cable, gray	Lightpost transceiver	TX port

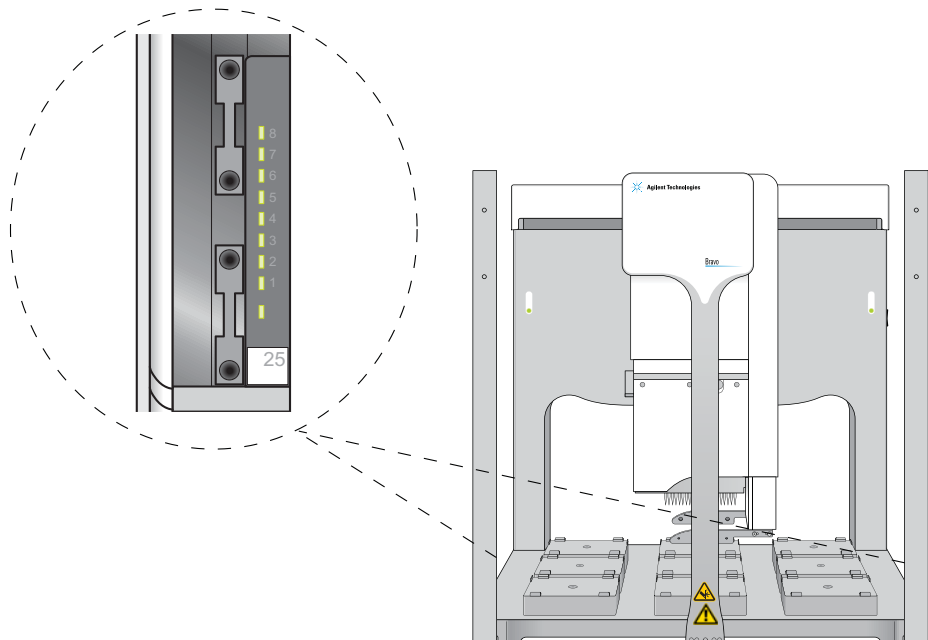## Aligning the light beams

To align the light beams:

1   Ensure that the Light Curtain switch on the Robot Disable Hub is set to Enable.

2   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 Standard Light Curtain activates.

Figure   Bravo Platform status lights (front) and power switch (right side)
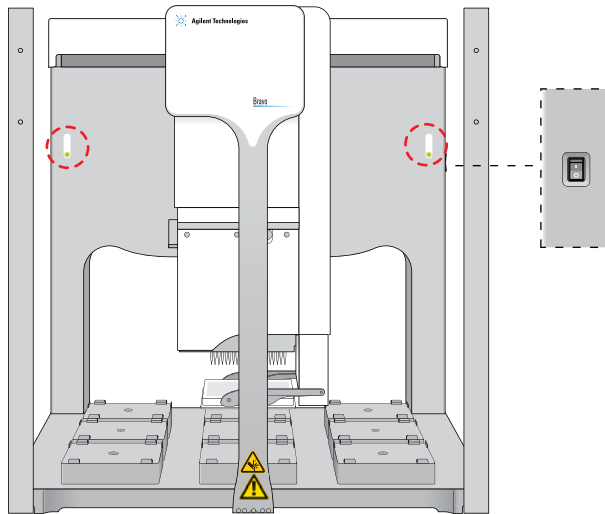
3   On the lower inside panel of each lightpost, verify that the column of LEDs turn on.

Figure   Lightpost LED lights

4   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 Standard Light Curtain operation.

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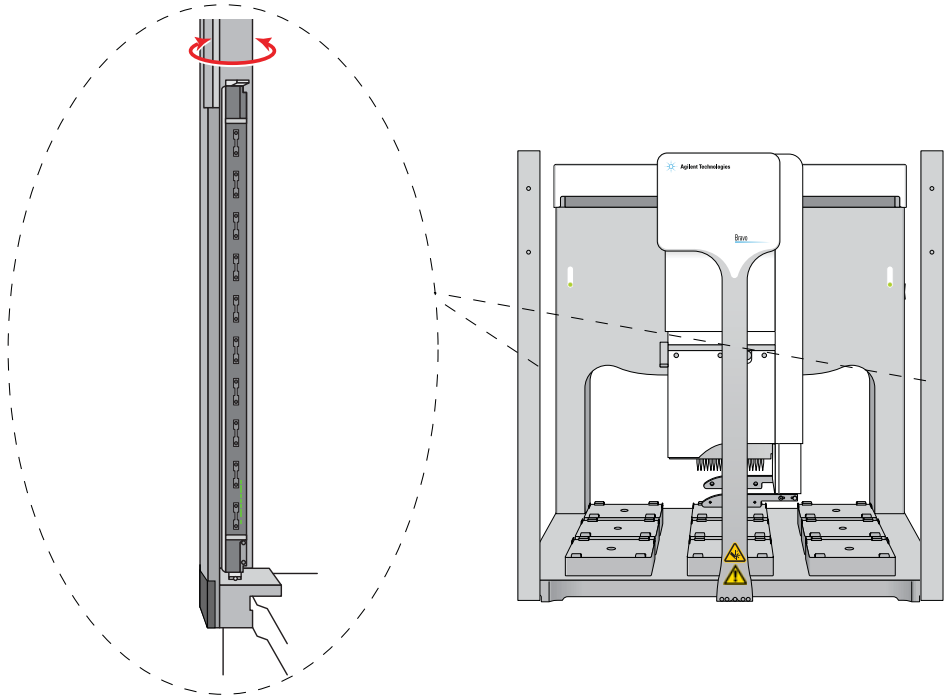
6 Use a 2.5-mm hex wrench to tighten the two adjustment screws located near the top and bottom of each lightpost's interior-facing side, as the following figure shows (**1**).

Figure   Adjustment screws (1) on the lightpost interior top and bottom
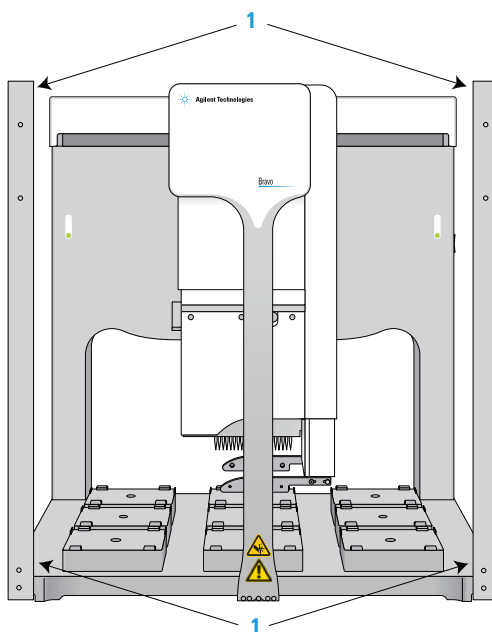
7   To verify the adjustment:

a   Press the Bravo power switch to the **off (o)** position, wait a minute, and then press the power switch to the **on (l)** position.

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

Installing the front shields

Before you start

Remove the protective backing from the shields.

If necessary, use a soft, lint-free cloth and isopropyl alcohol to clean the 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.

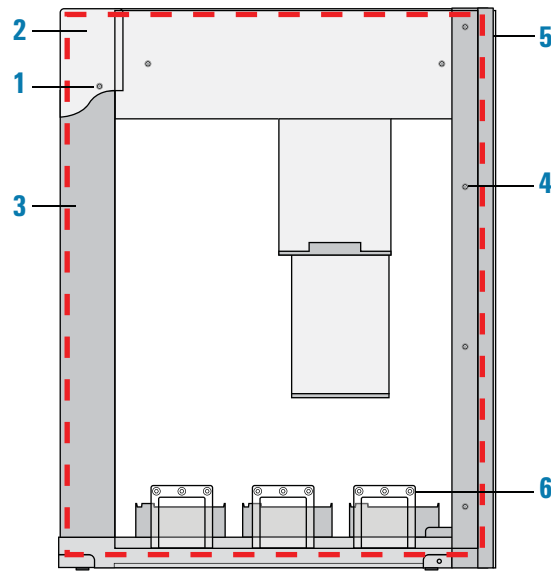*Figure*   Bravo Platform front shield attachment screws
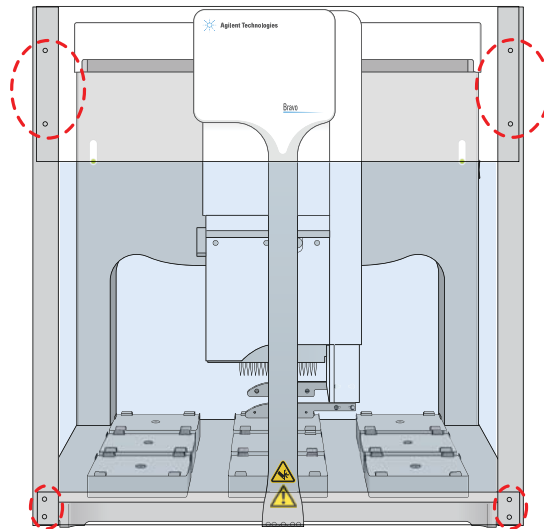
Installing the side shields

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.

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

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

To install the side shield:

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

2   Use the screw provided with the side shield 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   Install covers on up to three deck-access windows (**6**) in the shield unless tubing or cabling access is required through the given window. Three T20 M4 8-mm screws secure each window cover to the rear shield to prevent access through the window opening.

   If applicable, route tubing or cables through a deck-access window where no cover is installed.

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 opening of the Bravo Platform is not accessible to operators, for example, if the back opening is against a wall.

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
- Cross-tip screwdriver
- 2.5-mm and 3-mm hex wrenches
- T10 and T20 Torx drivers

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 Bravo backplate.
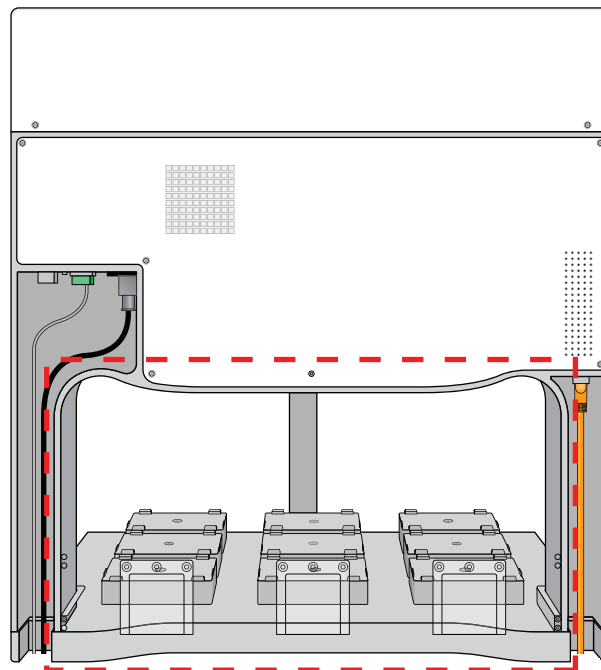
To install the rear shield:

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
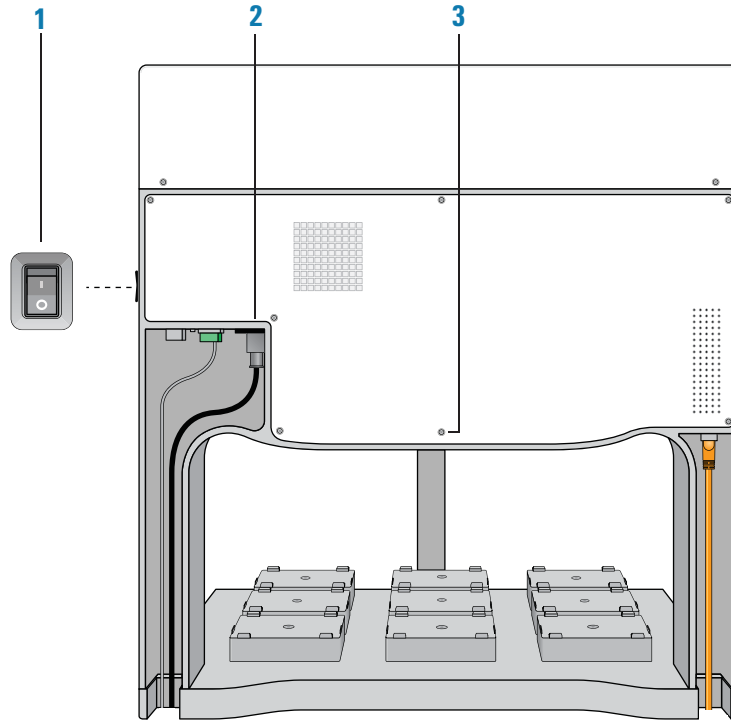
2   At the back of the Bravo Platform, remove the screw from the center lower edge of the rear cover (**3**), as the preceding figure shows.

Save the screw for future use in case the shield is removed.

3   If applicable, route tubing or cables from any on-deck accessories through one of the three deck-access windows in the rear shield.

4   While holding the shield in place to cover the rear deck opening, use a T10 driver to install the screw (M3) at the top center of the shield into the screw hole in the Bravo backplate.

5 At the bottom of each Bravo backplate post, position a shield clamp on the interior. See the following figure.

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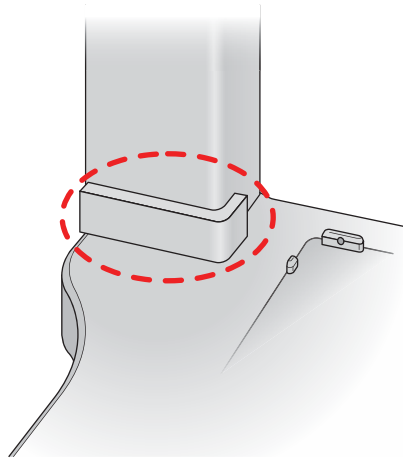

Note: The clamps are secured in place after the shield screws are installed in the next step.

6 Using a T20 driver, install the two M4 screws in the rear-facing end of each clamp to secure the shield to the clamps, as the following figure shows.

Note: The preferred location for the rear shield 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*   Detail of screws installed in clamp on rear post
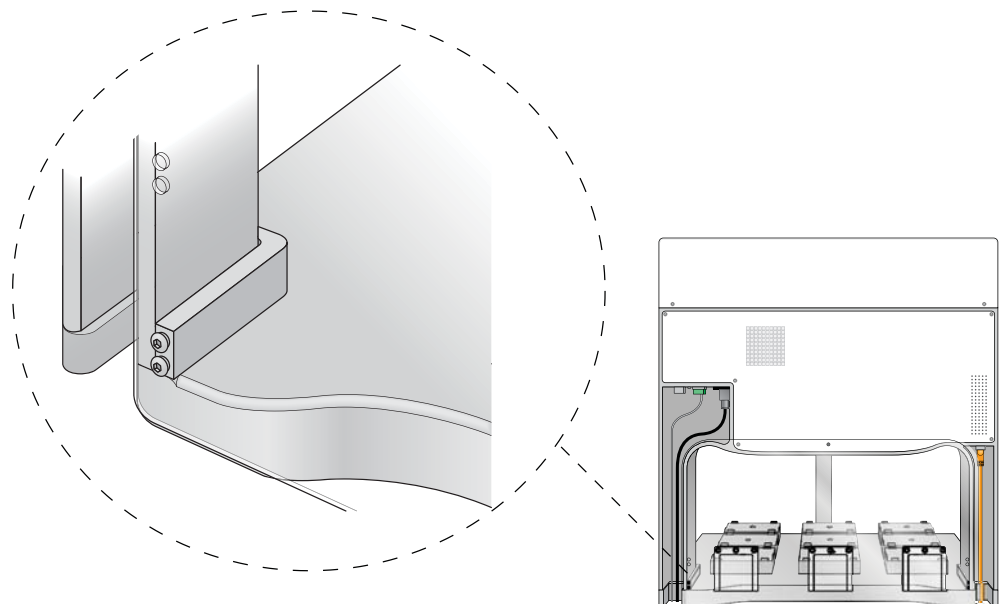
7 Use a T20 driver to install the covers on the three deck-access windows in the rear shield, unless tubing or cabling access is required. Three M4 8-mm screws secure each window cover to the rear shield to prevent access through the window opening.

Installing the dust cover

About the Bravo dust cover

The Bravo dust cover is a clear plastic cover that sits atop a Bravo Platform fitted with the Standard Light Curtain.

Figure   Dust cover (**1**) top view, and (**2**) installation on a Bravo Platform with Standard Light Curtain
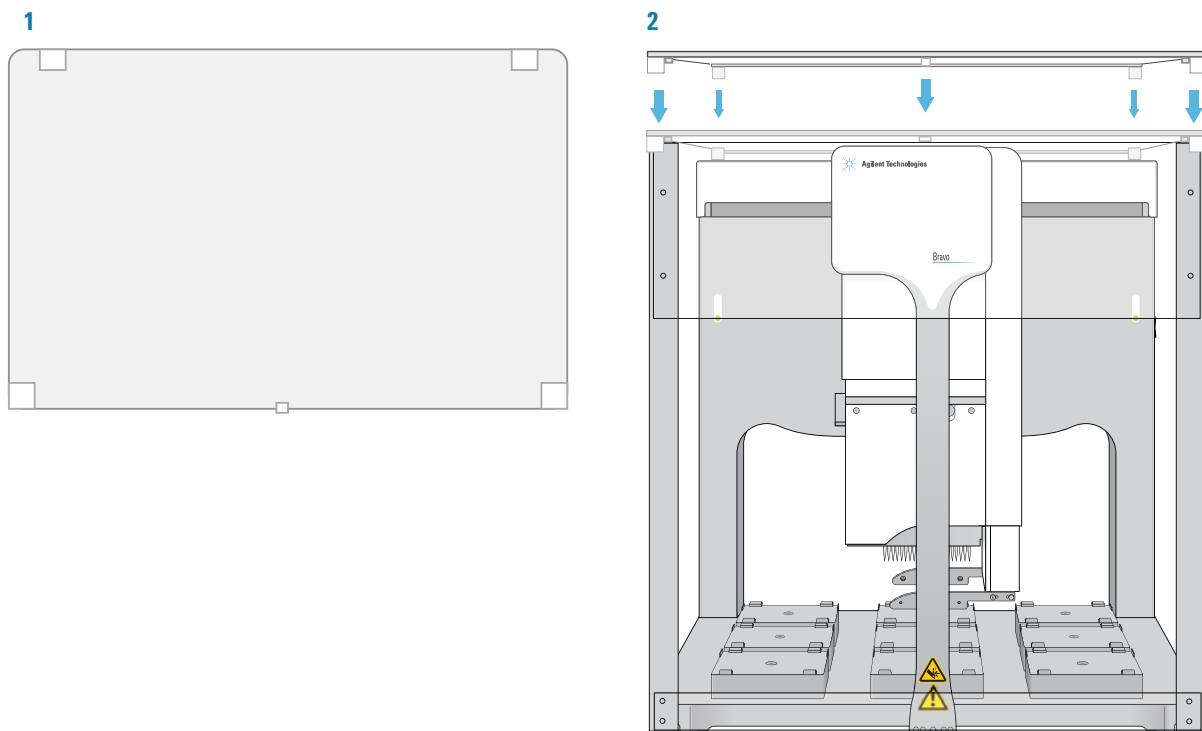
Installing the dust cover

To install the dust cover:

1 Ensure that the Bravo power switch is set to the **off (o)** position.

2 Orient the dust cover so that the side with the middle spacer is at the front of the Bravo Platform.

3 Position the dust cover on top of the Bravo Platform as follows:

- The two corner spacers rest on top of the lightpost corners, which are installed at the front of the Bravo deck. The middle spacer rests on top of the front shield.

- The two rear spacers rest on the top cover of the Bravo backplate.

Removing the dust cover

To remove the dust cover:

1 Ensure that the Bravo power switch is set to the **off (o)** position.

2 Lift the dust cover up and off of the Bravo Platform.

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

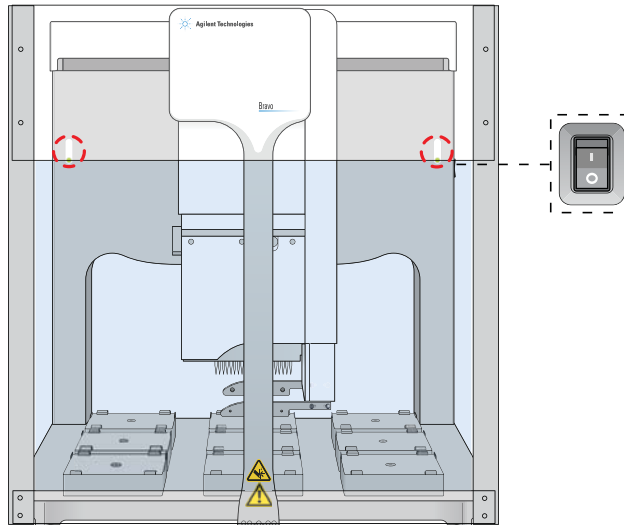| CAUTION	Always turn off the Bravo Platform before installing or uninstalling a liquid-handling head. Failure to do so can damage the head electronics.

To start up the Bravo Platform:

1 Ensure that the main power cable and Ethernet are plugged into the connection panel.

2 Turn on any accessories, for example, Pump Module.

3 Turn on the computer and the monitor, and start the Microsoft Windows operating system.

4 If you have not already done so, install the liquid-handling head.

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

The front panel status lights turn blue.

Note: If the emergency-stop pendant is pressed or absent, the status lights will turn red.

Figure   Bravo status lights and power switch

6   Start the VWorks software.

Shutting down the Bravo Platform

Shut down the Bravo Platform before you:

- Clean the Bravo Platform
- Change the liquid-handling head
- Install accessories
- Move the Bravo Platform

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

To shut down the Bravo Platform:

1 If removing the liquid-handling head, ensure that the disposable tips are removed.
2 Optionally, home the liquid-handling head.
3 Shut down the computer.
4 Turn off any accessories, for example, the Pump Module.
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.
7 If applicable, uninstall the liquid-handling head.

Related information

For information about...	See...
Setting up and using the Bravo Platform	*Bravo Platform User Guide* For details on how to access this guide, see "Where to find user information" on page vii.

In This Book

This book describes the following for the G5562A and G5563A Bravo Platform:

- Potential safety hazards of the Bravo Platform and how to avoid them
- How to install the Bravo Platform
- How to install the Standard Light Curtain and shields.

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