Bravo Platform

User Guide

Original Instructions

Notices

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Preface

This guide describes how to use the Bravo Automated Liquid Handling Platform, also known as the Bravo Platform.

This preface contains the following topics:

- "About this guide" on page viii
- "Accessing product user information" on page x

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 covers the description, setup, operation, and maintenance of the Bravo Platform.

This guide also describes how to install and configure accessories.

What is new in this edition

Feature and description	See…
Copying teachpoints from one profile to other profiles (VWorks software v14.1)	"Copying teachpoints from one profile to other profiles" on page 50
Configuring the Plate Pad Offset accessory (VWorks software v14.1)	"Configuring a height offset for a platepad" on page 150

Software version

This guide is applicable for the following software:

• Bravo Diagnostics version 19.3.0, which is included in VWorks software 14.0 or later versions.
• Bravo Diagnostics version 19.1.*x*, which is included in VWorks software 13.1.*x*.

These applications require the Microsoft Windows 10 64-bit operating system.

Related guides

Use this guide in conjunction with the following:

- *G5562A, G5563A Bravo Platform Safety and Installation Guide*. Describes potential safety hazards and how to avoid them, how to install the device, and how to install the Light Curtain and shields.

- *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.

- VWorks software guides:

  - *VWorks Automation Control Setup Guide*. Explains how to define labware and labware classes, liquid classes, and pipetting techniques, how to set up labware inventory and experiments databases.

    The VWorks 14.0 edition also explains the VWorks compliance features and how to set up an experiments database.

  - *VWorks Automation Control User Guide*. Explains how to create protocols, and set task parameters for each device in the system.

- *Bravo Platform Quick Guide*. The quick guide summarizes the instructions in this user guide.

If you are using the Bravo 96AM Head, see the *AssayMAP Bravo Platform Getting Started Guide*.

If the Bravo Platform is a device in a third-party system, see the relevant third-party system guides.

Related information

For more information about...	See...
How to access different formats of this user guide	"Accessing product user information" on page x
Reporting problems	"Reporting problems" on page 91

Accessing product user information

About this topic

This topic describes the different formats of user information and explains how to access it for the Agilent Automation Solutions products.

Where to find user information

The user information is available in the following locations:

*   *Knowledge base.* The help system for the Automation Solutions products is available from:

    –   Help menu within the VWorks software: Select **Help** > **Knowledge Base** or press F1.

    –   From the Windows desktop: Select **Start ( )** > **All Apps** > **Agilent Technologies** > **VWorks Knowledge Base.**

    For guidelines on using the VWorks context-sensitive help and knowledge base features, see *Using the knowledge base*, below.

*   *PDF files*. The PDF files of the user guides are installed with the VWorks software (C:\Program Files (x86)\Agilent Technologies\VWorks\UserGuides) and are available in the VWorks Knowledge Base.

*   *Website*. You can search the online VWorks Knowledge Base or download the latest version of any PDF file from the Agilent website at www.agilent.com/chem/askb.

Accessing safety information

Safety information for the Agilent Automation Solutions devices appears in the *Automation Solutions Products General Safety Guide* and in the corresponding device safety guide or user guide.

You can also search the knowledge base or the PDF files for safety information.

Using the knowledge base

Knowledge base topics are displayed using web browser software such as Microsoft Edge.

Note: If you want to use Microsoft Internet Explorer to display the topics, you might have to allow local files to run active content (scripts and ActiveX controls). For instructions, see the Microsoft user documentation.

Opening the help topic for an area in the VWorks window
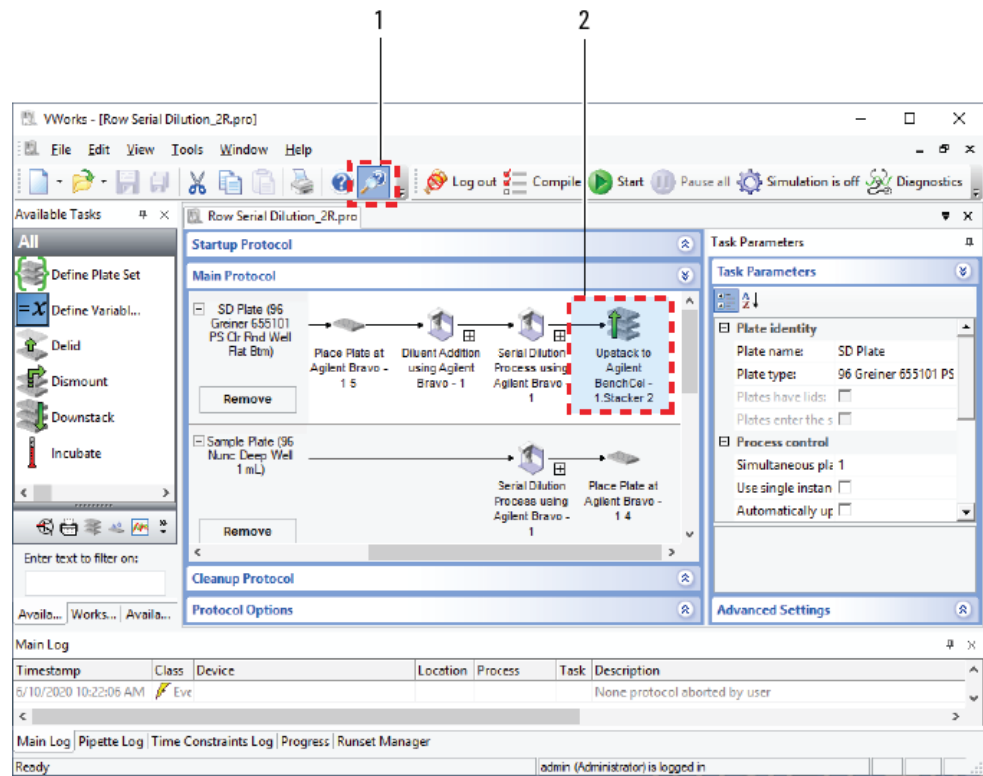
To access the context-sensitive help feature:

1 In the main window of the VWorks software, click the help button [icon]. The pointer

changes to [icon]. Notice that the different icons or areas are highlighted as you move the pointer over them.

2 Click an icon or area of interest. The relevant topic or document opens.

Features in the Knowledge Base window
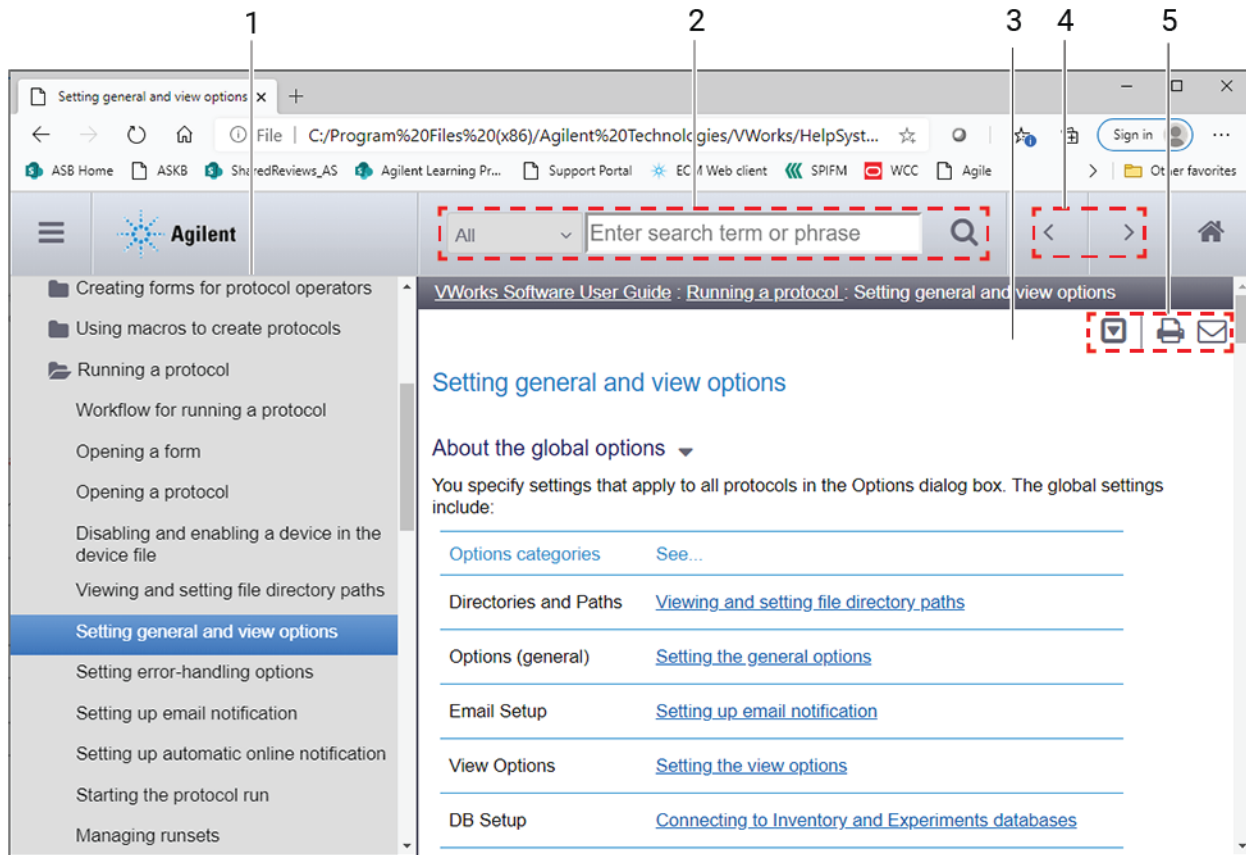
Step	For this task...
1	*Contents pane*. Lists all the books and the table of contents of the books.
2	*Search*. Allows you to search the Knowledge Base (all products or selected products) using keywords.
3	*Topic area*. Displays the selected online help topic.
4	*Navigation buttons*. Enable you to navigate through the next or previous topics listed in the Contents tab.
5	*Toolbar buttons*: Enable you to: • Expand or collapse all the sections in a topic that has drop-down headings. • Print the topic. • Send feedback by email for a given topic.

1 Introduction

This chapter gives you an overview of the Bravo Platform and contains the following topics:

Safety notes

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

Ensure you have read the *G5562A, G5563A Bravo Platform Safety and Installation Guide* and are trained in the safe operation of the device.

Figure   Bravo Platform (front view)
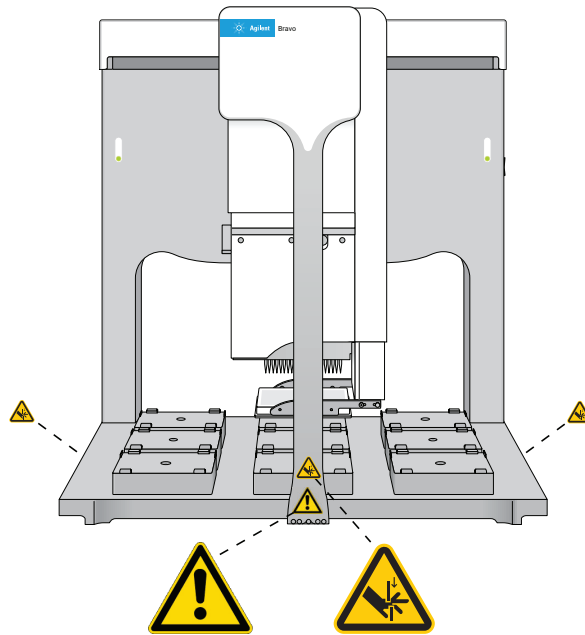
Related information

For more information about…	See…
Safety precautions	• *Automation Solutions Products General Safety Guide* • *G5562A, G5563A Bravo Platform Safety and Installation Guide*
Stopping in an emergency	"Emergency stops" on page 62

About the Bravo Platform

Product description

The Bravo Platform is a versatile liquid handler with a nine plate-location deck that is suitable for handling 96-well, 384-well, and 1536-well microplates (plates). The platform uses interchangeable liquid-handling heads.

Figure   Bravo Platform front view with optional gripper holding a microplate
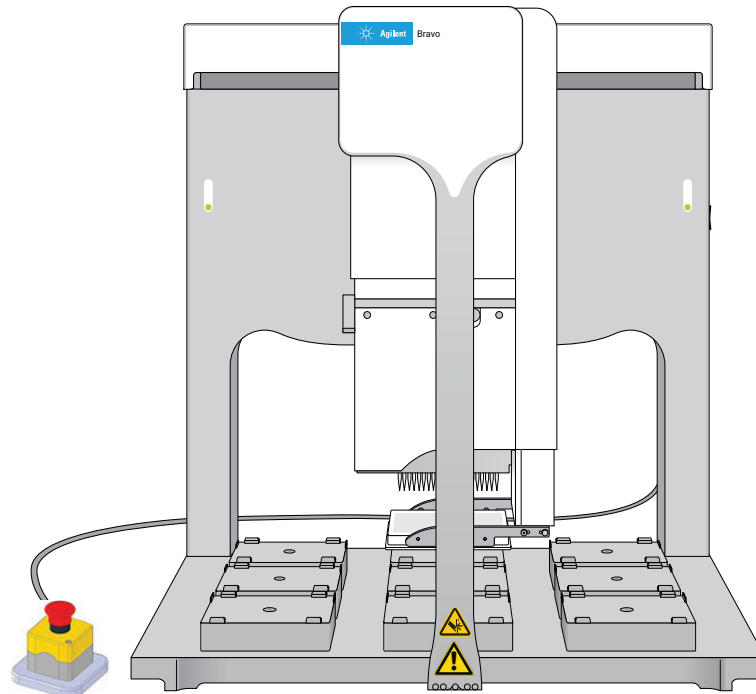
Ways to use the device

The Bravo Platform can be used in the following ways:

• As a single device controlled by a computer
• Integrated with other devices in a lab automation system

For example, when used as a single device, it can be placed in a laminar flow hood for use with cell-based applications or handling potentially hazardous materials.

As an integrated device in a lab automation system, it can be used to prepare microplates for high-throughput screening or other automated process. Note that when used with other devices, you can take advantage of the gripper feature to automate microplate pickup and placement.

Related information

For information about...	See...
Pipette head	"Liquid-handling heads" on page 11

For information about...	See...
Components	"Hardware overview" on page 5
Accessories	"Bravo accessories overview" on page 110
Laboratory requirements	*G5562A, G5563A Bravo Platform Safety and Installation Guide*
Safety	• *Automation Solutions Products General Safety Guide* • *G5562A, G5563A Bravo Platform Safety and Installation Guide*

Hardware overview

About this topic

This topic describes the Bravo Platform primary hardware components and the axes of motion.

Primary hardware components

The following figure and table describe the primary Bravo hardware components.
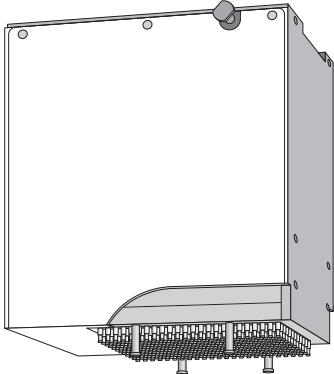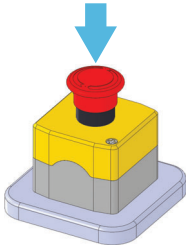
Figure   Bravo Platform components (front view)

Item	Feature	Description
1	Indicator lights	The two light panels that display color-coded status of the Bravo Platform: • *(solid blue)*. The Bravo Platform is turned on and in standby mode. • *(flashing green)*. The software is running a protocol on the Bravo Platform. • *(flashing orange)*. The software has initialized the Bravo Platform and Bravo Diagnostics is open. • *(flashing red)*. The software has encountered an error while running a protocol or the interlock circuit is tripped.

Item	Feature	Description
2	Power switch	The switch on the right side of the rear wall that turns on (I) and off (O) the Bravo Platform.
3	Head mount	The fixture that provides the mechanical connections and communication inferface for the liquid-handing head. The head mount attaches to an arm that extends from the Bravo rear wall of the tie bar. The head mount travels along the arm between the front and back of the deck (*y*-axis). The arm moves the head mount from side to side across the deck (*x*-axis). For details, see Axes of motion.
		You can move the head mount manually while the Bravo Platform is turned off.
4	Tie bar	The vertical bar at the front of the device that adds structural support to the Bravo head mount. The tie bar moves at high speed from side to side (*x*-axis) across the front of the Bravo deck whenever the head moves to a deck location.
5	Liquid-handling head	The platform uses interchangeable Bravo-compatible heads, including disposable-tip heads, the Bravo 96AM Head for AssayMAP cartridges, and pin tools.
		The following figure shows an example of a disposable-tip head.
		Figure Series III disposable-tip head
6	Emergency-stop pendant	The pendant that contains the red emergency-stop button. To stop in an emergency, press the red button. All Bravo motion stops.
7	Gripper	An optional gripper that extends from the head mount to below the pipette head tips. The gripper picks and places labware on the deck.

Item	Feature	Description
8	Deck	The area that is accessible by the liquid-handling head. The deck supports nine deck locations that are numbered 1–3 (back row), 4–6 (middle row), and 7–9 (front row).
		Each deck location holds a platepad or an accessory. The Bravo Platform ships with nine platepads, one on each location. You may remove a deck-mounted platepad to install certain accessories.

Figure   Nine deck locations (top view)

Item	Feature	Description
9	Light curtain and front and side shields	The safety equipment that reduces the risk of injury to users from Bravo moving parts. If an object disrupts the light curtain, the motion of the Bravo head stops. For details on the Bravo safety equipment, see the *G5562A, G5563A Bravo Platform Safety and Installation Guide*.

Axes of motion

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

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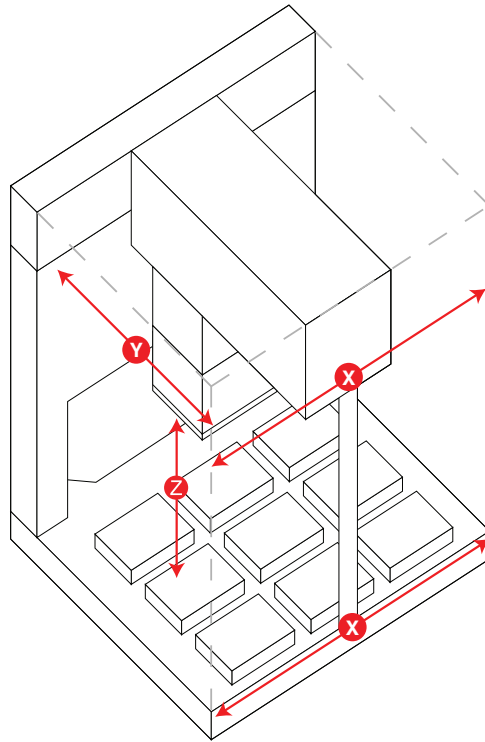
If the Bravo Platform is fitted with a gripper, the gripper moves with the Bravo head. In addition, the gripper has the following axes of motion:

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

Figure   Bravo gripper assembly axes of motion
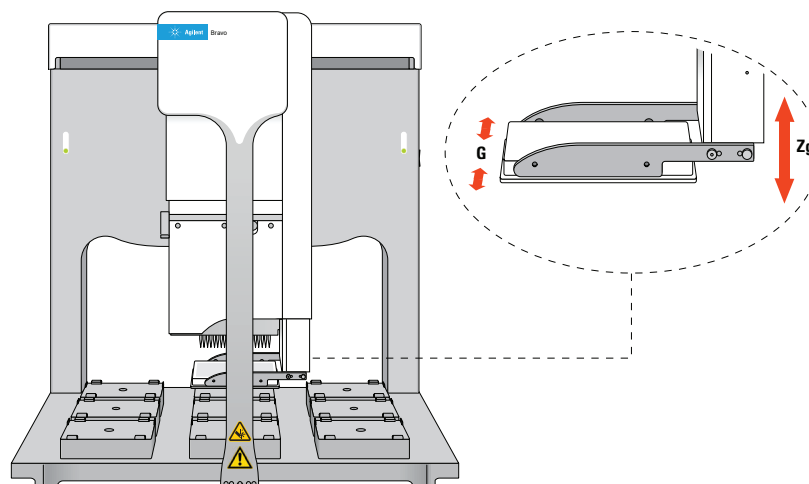
The motion of the displacement of the pipettor inside a liquid-handling head is referred to as the *w*-axis (not shown).

Related information

For information about...	See...
Pipette head	"Liquid-handling heads" on page 11
Connection panel	"Connection panel description" on page 9
Accessories	"Bravo accessories overview" on page 110
Laboratory requirements	*G5562A, G5563A Bravo Platform Safety and Installation Guide*
AssayMAP Bravo Platform	*AssayMAP Bravo Platform Getting Started Guide*

Connection panel description

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
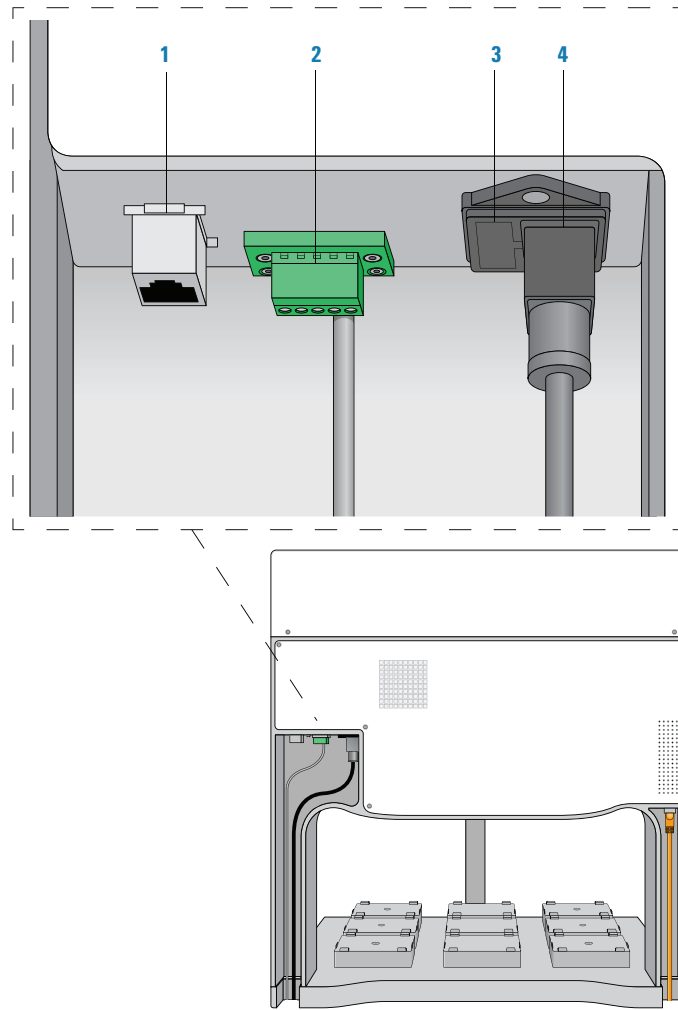
Item	Feature	Description
1	Ethernet port	Connects the Ethernet card in the controlling computer to the Bravo Platform.
2	Pendant port	Connects the emergency-stop pendant and a Bravo light curtain to the Bravo safety interlock circuit. The connection is made through an emergency-stop control, such as 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)
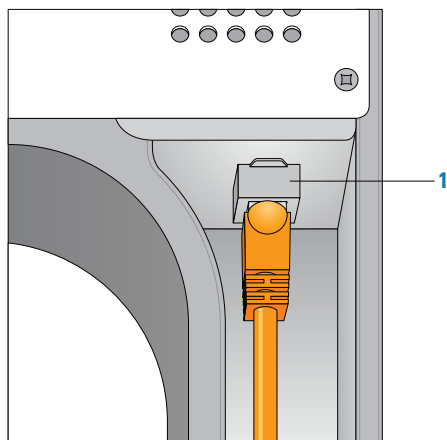
Item	Feature	Description
1	Pump I/O port	An RJ-45 I/O port that connects the Pump Module to the Bravo Platform. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable.
		IMPORTANT This is not an Ethernet port.

Related information

For more information about...	See...
Installing and connecting the Bravo Platform	*G5562A, G5563A Bravo Platform Safety and Installation Guide*

Liquid-handling heads

About this topic

The Bravo Platform uses interchangeable liquid-handling heads. This topic describes the disposable-tip heads.

The Bravo 96AM Head is designed for running protocols that use the AssayMAP Bravo cartridges. For details on the Bravo 96AM Head, see the *AssayMAP Bravo Platform Getting Started Guide*.

The Bravo Platform can also mount a variety of pin tools for performing low-volume transfers of fixed volumes. Contact your Agilent customer representative for details.

Disposable-tip heads

Disposable-tip heads allow you to change pipette tips during a run to prevent cross-contamination. The following table lists the disposable-tip heads available for the Bravo Platform.

Head type (Series III)	Max volume	Dispense into…
96LT	250 µL	96-well, 384-well microplates; single column (8 wells) or row (12 wells)
96ST	70 µL	96-well, 384-well, 1536-well microplates; single column (8 wells) or row (12 wells)
384ST	70 µL	384-well, 1536-well microplates; single column (16 wells) or row (24 wells)

The 96- and 384-barrel heads can dispense fluid into all the wells in a microplate simultaneously or into a single column, single row, or single well in the microplate.

The 96LT head use large transfer (LT) tips to dispense up to 250 µL per well. The 96ST and 384ST heads use small transfer (ST) tips to dispense up to 70 µL per well.

IMPORTANT   The microplate compatibility and maximum volume for a given head is dependent on the pipette tip, for example, the ST 70 µL tip is not compatible with a 1536-well microplate. For more details on the tips available for each type of head, go to http://www.agilent.com/en-us/products/automation-solutions/automated-liquid-handling/disposable-pipette-tips.

Figure   384-well disposable-tip head

Retainer pin

Pipette barrel

Tip box stripper pins
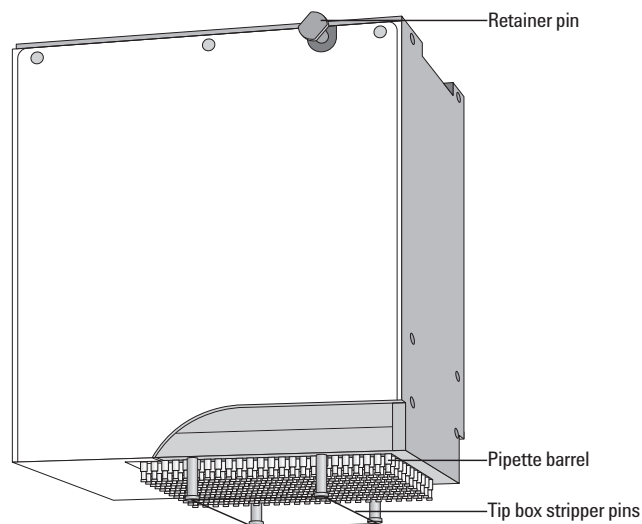
Serial dilution capabilities

You can use the 96- and 384-barrel heads for serial dilution tasks to dispense fluid into single columns or single rows of a microplate. You do not need to change heads during the task.

Note: When using the disposable-tip heads in serial-dilution mode, certain deck locations are not accessible. For more details on serial dilution, see the *VWorks Automation Control User Guide*.

Controlling the liquid-handling head

You use the VWorks software to control the disposable-tip heads and pin tools for performing such tasks as:

- Calibrating volumes
- Controlling pipette speed
- Enabling tip touching
- Enabling dynamic tip extension and retraction

Related information

For more information about...	See...
Removing one liquid-handling head and mounting a different head	"Changing the Bravo head" on page 69
Bravo 96AM Head for AssayMAP applications	*AssayMAP Bravo Platform Getting Started Guide*

Software overview

About this topic

This topic describes the software components that you use to operate the Bravo Platform.

Note: For a description of the software interface that you use to run the AssayMAP Bravo Platform, the Bravo Metabolomics Sample Prep Platform, or BenchCel Workstations see the Literature Library page in the corresponding workbench software.

VWorks software 13.1.x

VWorks v13.1.x enables you to:

- Set up user accounts and privileges
- Set up your devices
- Define labware, liquid classes, and pipetting techniques
- Manage labware inventory

- Create protocols and forms, and run the protocols

VWorks 13.1.x uses the Windows Registry to store records, such as labware definitions and device profiles, and uses the local file system to store VWorks files, such as device files and protocols.

VWorks software 14.1 and later versions

VWorks 14.1 and later versions are available as VWorks Standard and VWorks Plus. VWorks Plus is a compliance-enabled edition that supports compliance with Part 11 of Title 21 of the Code of Federal Regulations (21 CFR Part 11).

All editions include the following components:

- OpenLab for VWorks
- VWorks software

OpenLab for VWorks components

- **Control Panel** and **Shared Services**. Control Panel is the user interface for Shared Services, which are set of administrative services. An administrator uses Control Panel to configure VWorks user access, software licenses, storage, e-signature levels, and audit trail settings.

- **Storage types**. Shared Services uses a different storage type for each VWorks edition:

  – *VWorks Plus*. Uses **Content Management** to store VWorks files, records of interest, and audit trails. A system administrator can use the **Content Browser** to view and edit the project structure and contents.

  – *VWorks Standard*. Uses the local file system. Shared Services stores the files in a predefined VWorks Project folder `/VWorks Projects/VWorks`.

  Note: Unlike earlier versions, the Windows Registry is not used for storing records, such as labware definitions and device profiles.

VWorks software

The VWorks software provides the instrument control for Agilent automation devices. You create labware definitions and liquid classes, set up your devices and create device profiles, and create and run protocols.

VWorks Plus only. The VWorks software logs audit trails for records of interest, tracks records by record state (In Development, In Validation, and Released), and performs tamper detection on the records.

Figure   VWorks window
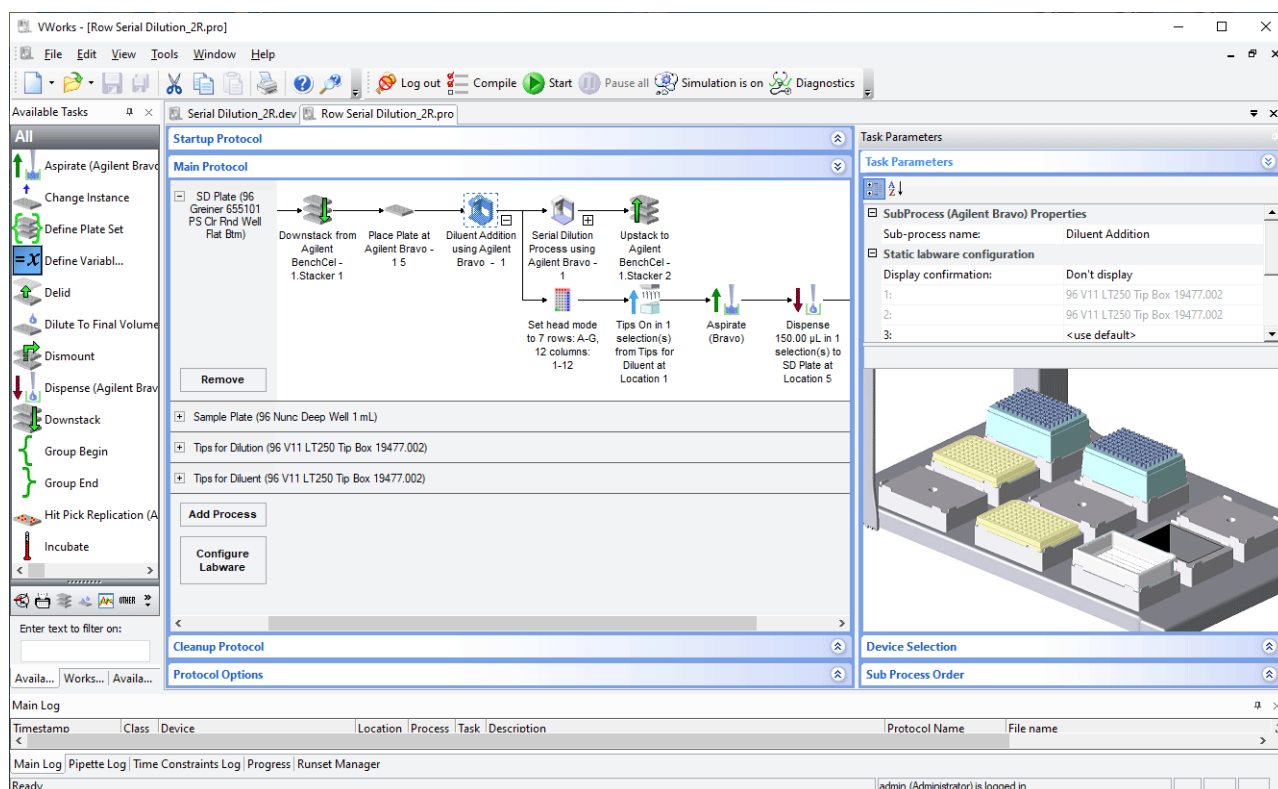
Bravo Diagnostics

Bravo Diagnostics is software that you open from within the VWorks software. You use Bravo Diagnostics to do the following:

- Create Bravo profiles. Each profile specifies the following:
  - Ethernet connection for the LAN communication
  - Type of liquid-handling head
  - Teachpoint settings. The teachpoints ensure the positional accuracy of the pipette head and gripper, if included, at each deck location
  - Deck configuration
  - Whether the Bravo robot and an external robot can operate on the Bravo deck concurrently
- Establish communication with the Bravo device using a Bravo profile.
- Verify that the device functions properly and troubleshoot problems. The controls enable you to:
  - Run tasks individually. For example, you can perform a Tips On or Tips Off task independently of a protocol.
  - Home the head and send the head to home position.
  - Control the motions of an individual axis or disable the motors of selected axes for manual moves.

Figure   Bravo Diagnostics window
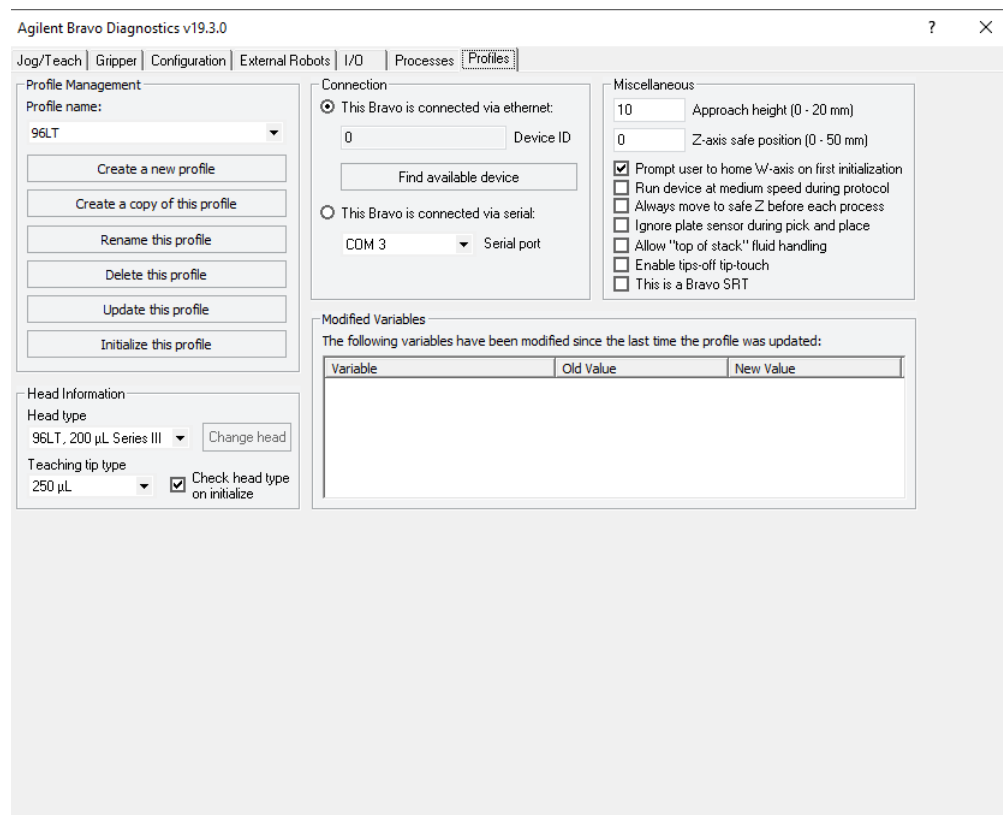
Related information

For more information about...	See...
Using Bravo Diagnostics	"Using diagnostics software" on page 93
VWorks software	• *VWorks Automation Control Setup Guide* • *VWorks Automation Control User Guide*

2 Setting up the Bravo Platform

This chapter contains the following topics:

Agilent

Workflow for setting up the Bravo Platform

About this topic

This topic outlines the procedures to set up the Bravo Platform.

If you have an AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

Workflow

The general workflow for setting up the Bravo Platform is as follows:

Step	Procedure	See…
1	Start up the Bravo Platform.	"Starting up and shutting down" on page 19
2	Create a VWorks device file that includes the Bravo device.	"Creating or adding a Bravo device" on page 21
3	Create a Bravo profile for the specific Bravo Platform.	"Creating and managing profiles" on page 28
4	Initialize the device profile in Bravo Diagnostics to verify communication with the device.	"Initializing the device" on page 34
5	Verify that the deck configuration in the Bravo profile matches the physical deck layout of platepads and accessories. Configure any accessories, such as an autofilling reservoir.	"Bravo accessories overview" on page 110
6	Edit or set teachpoints for the specific Bravo Platform.	"Setting teachpoints" on page 37
7	If the Bravo Platform includes a gripper, verify the gripper *y*-axis offset.	"Verifying the gripper setup" on page 44
8	If the Bravo Platform is integrated with external robots, specify the deck locations that the external robots can access and whether to allow concurrent operations.	"Configuring external robot access" on page 53
9	Save any changes that you made in steps 3–8 in the Bravo profile.	"Creating and managing profiles" on page 28

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
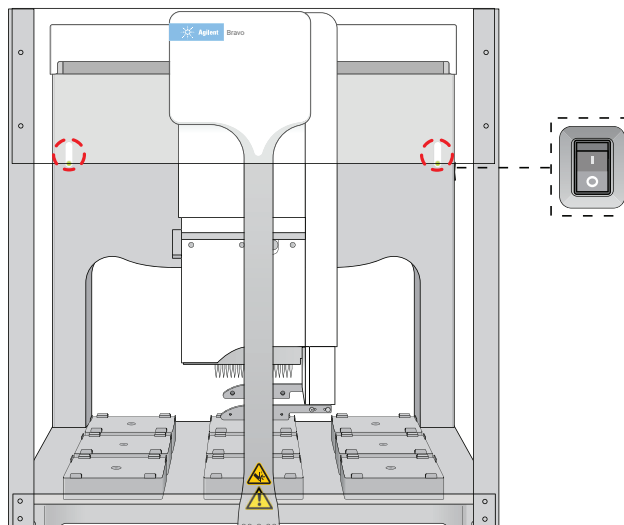
6   Start the VWorks software.

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, 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...
Initializing the Bravo device	"Initializing the device" on page 34
Turning on or off Bravo accessories	"Bravo accessories overview" on page 110
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

Creating or adding a Bravo device

About this topic

Read this topic if you are an administrator responsible for managing Agilent devices that are controlled by the VWorks software. This topic describes how to add and delete new Bravo devices in the VWorks software.

The VWorks software uses the information in a device file to communicate with and operate the Bravo device.

- *If your computer was configured by Agilent Technologies*. The correct device configuration is already set up for communication with the Bravo Platform. You are not required to create a new Bravo device in the software unless you want to reference different profiles. To establish communication, you must initialize the device.

- *If you configured your own computer*. You must add a device in the VWorks software for each Bravo Platform in the system.

Devices and device files defined

A device is an item in your lab automation system that has an entry in a VWorks software device file. A device can be a robot, an instrument, or a location in a lab automation system that can hold a piece of labware.

The device file (*.dev) stores information for all the devices in an integrated system, including:

- Type of device (for example, Bravo device)
- Device configuration information (for example, approach height, allowed or prohibited labware, and so on)
- Profile to use

VWorks Plus. The software logs audit trails for device files, which are records of interest.

Creating a device file

If you are setting up the Bravo Platform for the first time, you will create a device file. You add the Bravo device and the external devices to the device file.

To create a device file:

1   In the VWorks window, select **File > New > Device.** A Device File tab appears.
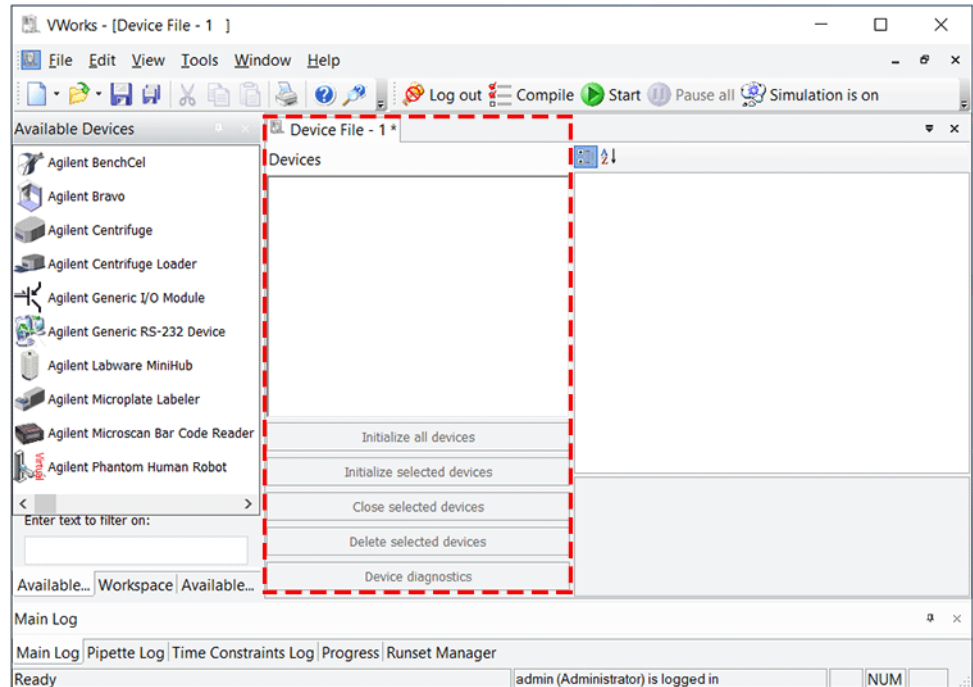
2   Select **File > Save** to save the device file.

3   In the **Save File As** dialog box, select the storage location, type the file name, and then click **Save**.
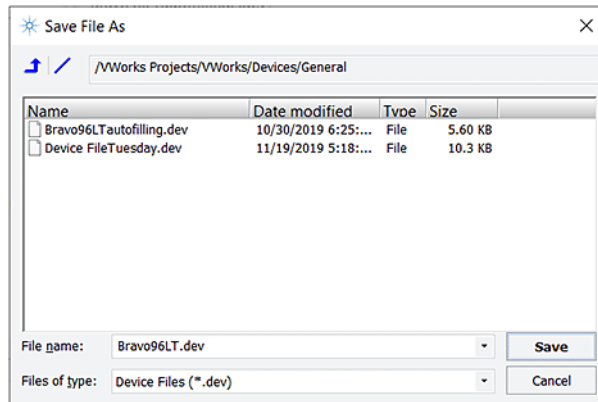
4   *VWorks Plus only*. If an audit trail is being logged for records in the development state, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Adding the Bravo device to a device file

Before you begin:

•   Ensure that any devices are physically networked to the computer.

•   Turn on the devices.

To add devices to a device file:

1   In the VWorks window, verify that the correct device file is open.

To open a device file, choose **File** > **Open > Device**. In the **Open File** dialog box, locate and select your device file (*.dev), and then click **Open**.

2   In the **Available Devices** area, double-click the **Agilent Bravo** icon. Or, drag the icon to the **Device File** tab.

Note: To show or hide the list of available devices, choose **View > Available Devices**.
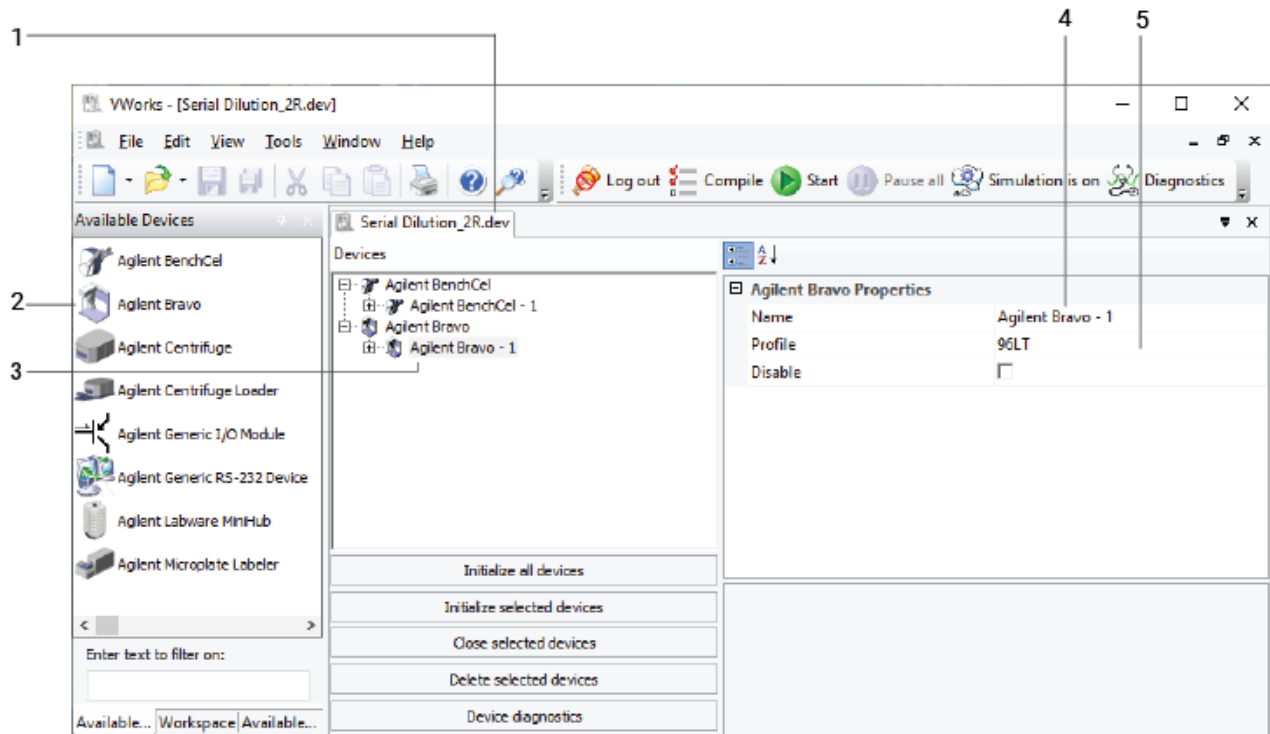
3   In the **Device File** tab, select the **Agilent Bravo-*n*** icon.

4   Under **Agilent Bravo Properties**, type a **Name** for the device.

Note: By default, the software assigns Bravo-*n*, and increments the number for each Bravo device that you add.

To identify the specific Bravo, you can include the device serial number in the device name.

5   In the **Profile** list, select a profile for the device.

If the **Profile** list is empty, open Bravo Diagnostics and create a profile. Then return to the **Profile** list under Bravo **Properties** and select the new profile.

IMPORTANT   To use different configurations of the same device in different protocols, you can save time by creating a different device file for each configuration. For example, if you change the liquid-handling head on your Bravo Platform, you can simply open the device file that contains the device with the appropriate profile instead of editing the profile selection in the device file.

6 On the **Device File** tab, expand the Bravo device icon to show the list of deck locations, and then click the location **1** icon. The corresponding location properties appear.
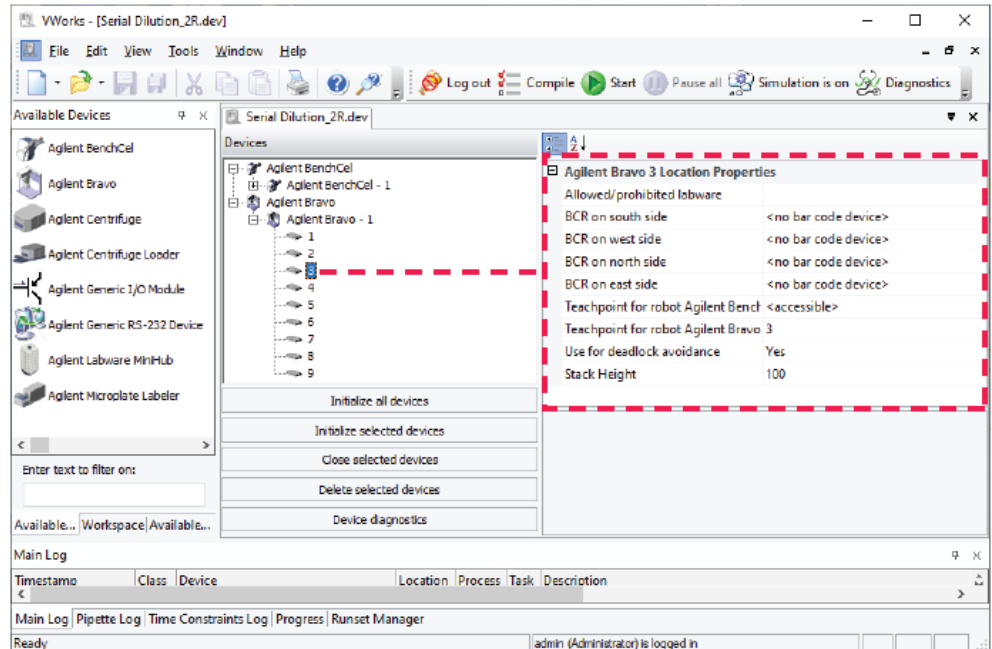
Set the desired values for the following properties. Use the default values for the remaining properties.

Property	Description
Allowed/prohibited labware	*Optional.* Click [...] if you want to specify labware restrictions for this location. The Allowed/prohibited labware dialog box appears. For details on the labware classes, see the *VWorks Automation Control Setup Guide*. *Note:* If the [...] button is not visible, click the empty field.
BCR on side	If a barcode reader is set up at this location, you specify the side.
Teachpoint for robot *<robot name>*	If the device is integrated with an external robot, specify whether the robot can access this location. In Bravo Diagnostics, specify whether the Bravo head should move to a safe location or can perform operations at other deck locations concurrently. Carefully plan which locations the external robot can access.
Teachpoint for robot Agilent Bravo	The Bravo deck location teachpoint identity. For example, the deck location 3 identity is 3.

Property	Description
Use for deadlock avoidance	Option to permit the location to be used for deadlock avoidance.
	Select Yes to permit labware to be moved to this location to avoid a deadlock in the system.
	Select No if you do not want to move random labware to this location to avoid deadlock.
Stack Height	Type the maximum height (mm) for a labware stack at this location.

IMPORTANT   Do not change the default value of the Teachpoint for robot Agilent Bravo property. For example, the deck location 1 teachpoint identity is 1, the identity of deck location 2 is 2, and so forth.

Repeat this step for each deck location.

7   Select **File** > **Save**.

If you are creating a new device file, the Save File As dialog box appears so that you can specify a name and location for your device file.

Alternatively, you can select **File** > **Save All** to save the device file and the current protocol file at the same time.

VWorks Plus only. If an audit trail is being logged for records in the development state, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

IMPORTANT   If an external robot will access the Bravo deck, ensure that you carefully plan which locations can be accessed and where the Bravo head can be during the external robot's access. See "Configuring external robot access" on page 53.

Related topics

For more information about…	See…
Initializing the device	"Initializing the device" on page 34
Relationship of VWorks components, such as device files, profiles, teachpoints, and labware	*VWorks Automation Control User Guide*
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Profiles	"Creating and managing profiles" on page 28
Planning and configuring external robot access on the Bravo deck	"Configuring external robot access" on page 53
Audit trails and records of interest	*VWorks Automation Control Setup Guide* for version 14

Opening Bravo Diagnostics

About this topic

To establish communication between the host computer and the device, you initialize the device. You can initialize the device in the following ways:

- **Diagnostics**. To control the device using the Diagnostics software.
- **VWorks window**. To use VWorks to control the device, for example, to run a protocol, you initialize the devices in the VWorks window.

This topic describes what happens during initialization.

Procedure

To open Diagnostics:

1 In the VWorks software window, ensure the correct device file is open.

   To open a device file, choose **File > Open**, and then select the appropriate device file (*.dev) in the **Open** dialog box.

2 In the **Devices** area of the opened device file tab, highlight the device icon, and then click **Device diagnostics**.

   Alternatively, you can double-click the device icon.
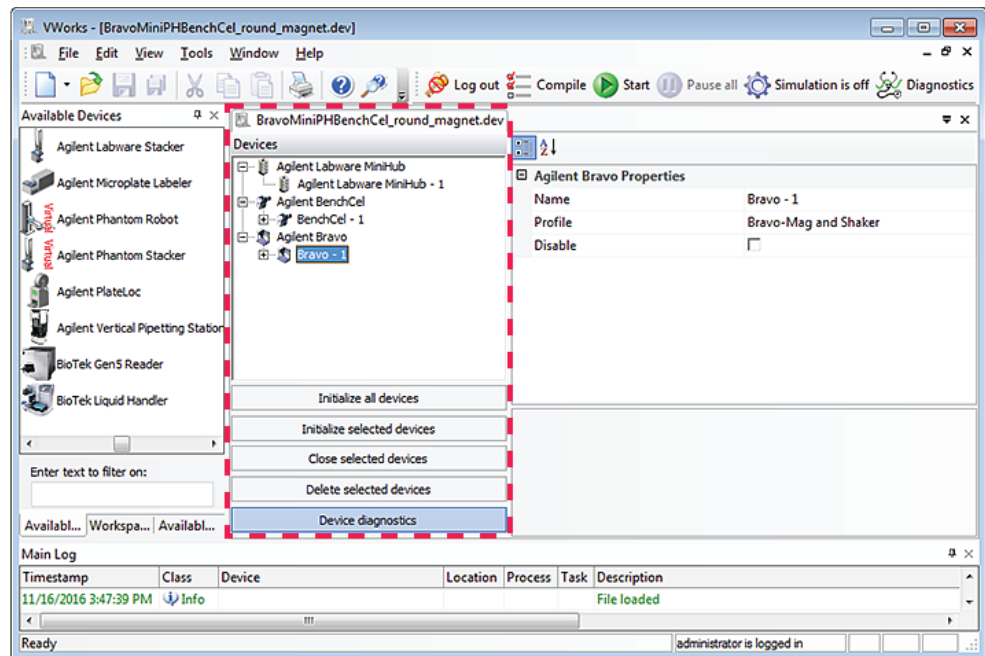
The device's diagnostics dialog box opens.

Figure Agilent Bravo Diagnostics dialog box
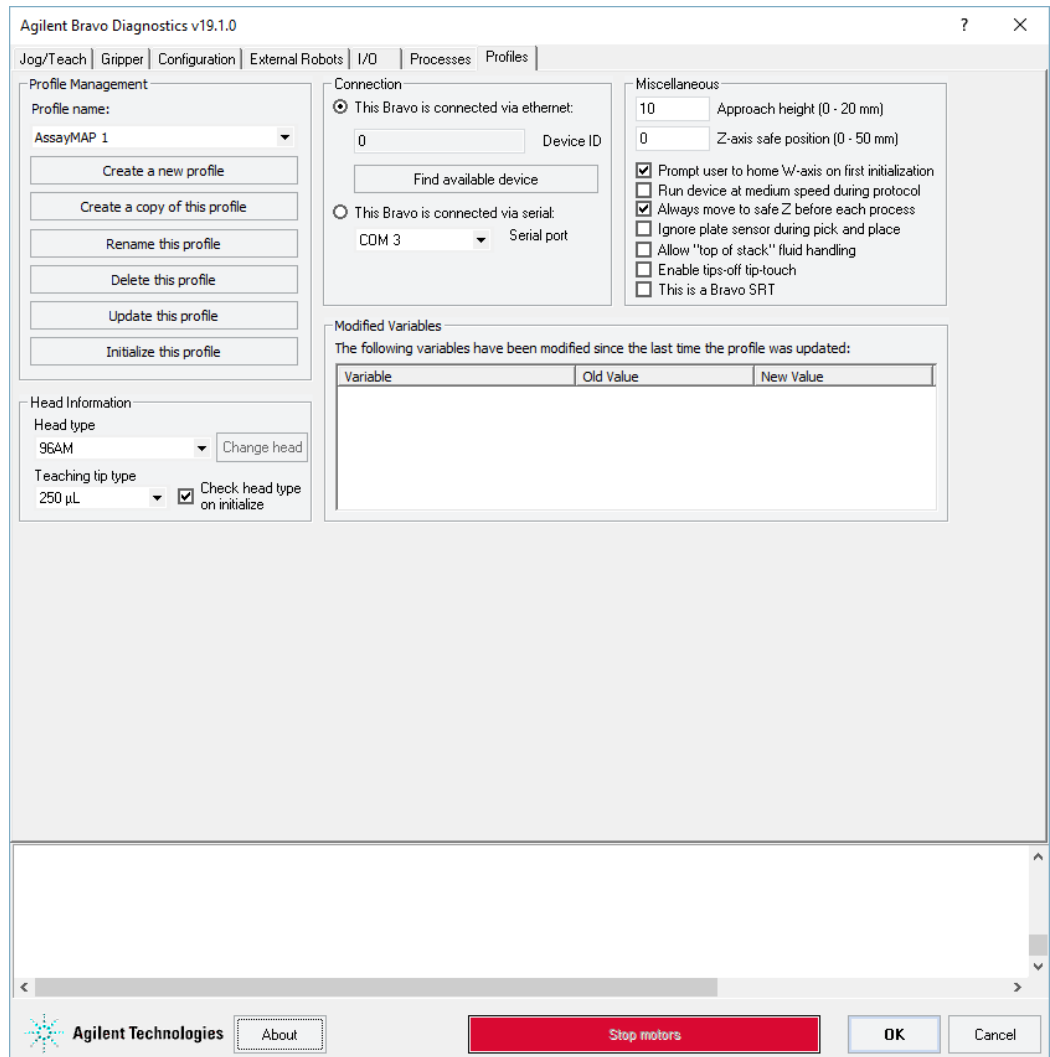
Related information

For information about...	See...
Profiles	"Creating and managing profiles" on page 28
Teachpoints	"Setting teachpoints" on page 37
Bravo Diagnostics	"Using diagnostics software" on page 93

Creating and managing profiles

About this topic

VWorks users with Administrator or Technician privileges (advanced users) can create and manage profiles for the Bravo Platform.

Profiles defined

IMPORTANT   Each Bravo Platform that you install requires a unique profile, which enables communication settings specific to the given instrument.

A device profile is a collection of settings that manage how you connect to a device. A Bravo profile does the following:

- Specifies the IP address used to establish communication between the device and the controlling computer.
- Specifies which liquid-handling head is being used
- Specifies the configuration of deck platepads and accessories
- Stores teachpoints for the liquid-handling head
- Stores the gripper *y*-axis offset
- Identifies deck locations to be accessed by external robots and specifies whether concurrent operation is allowed

Each combination of Bravo instrument, liquid-handling head, gripper, and deck layout requires a profile that defines the specific configuration. If the configuration changes, a modified profile or a new profile is required. For example, if you add an accessory such as a Orbital Shaking Station to the Bravo deck, you must modify the profile or create a new profile that includes the new deck layout and the teachpoint for the accessory.

If you have more than one Bravo Platform of the same configuration and you may copy the profile, but you must verify that the teachpoints are correct for each of the platforms.

CAUTION   **Using a profile that is associated with teachpoints from a different Bravo Platform can result in a hardware collision and cause equipment damage. Ensure that you verify the profile and associated teachpoints for each specific Bravo Platform.**

Note: VWorks software v14.0 and later versions store the profile in an XML file. VWorks software v13.1.x stores the profile in the Windows Registry.

VWorks Plus. The software logs audit trails for device profiles, which are records of interest.

Before you start

The profile is referenced by a VWorks device file. The device file must be open before you can create or modify a profile.

CAUTION   Each profile can be used by multiple protocols. Deleting, renaming, or changing the parameters for a profile based on one protocol can invalidate other protocols that use the profile.

For information about device files, see "Creating or adding a Bravo device" on page 21. For a detailed description of the relationships between the device file, profile, and teachpoints, see the *VWorks Automation Control User Guide*.

About managing profiles

You use the Profiles tab in Bravo Diagnostics to manage the Bravo device profiles.

Figure   Bravo Diagnostics Profiles tab
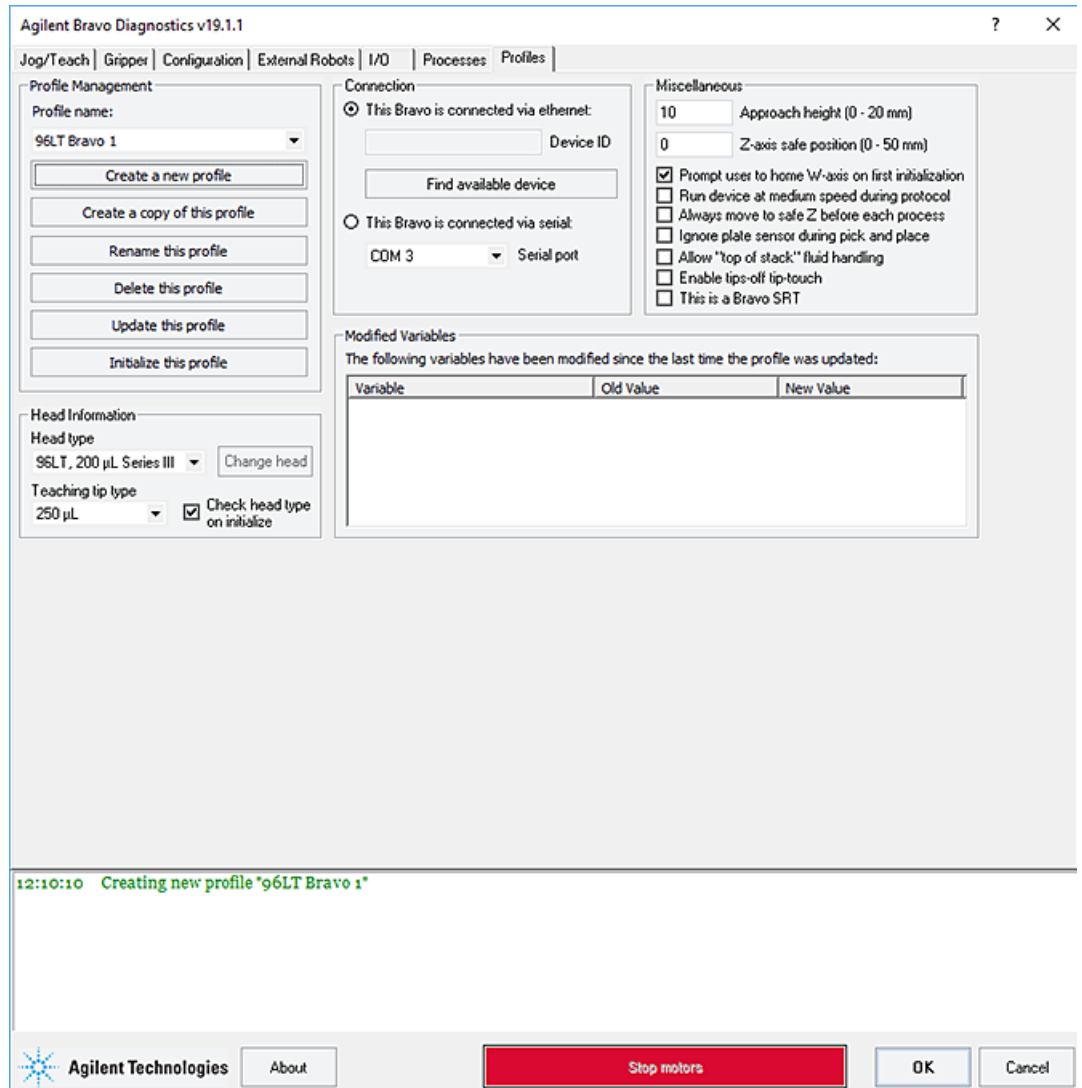
The Profiles tab enables you to:

- Create a new profile
- Copy a profile to use for creating a profile

- Rename, update, or delete a profile
- Initialize a profile

A log of these events appears in the box at the bottom of the Bravo Diagnostics window. The VWorks software records these events and stores the information in the Main log.

Creating a profile

A Bravo profile consists of a combination of parameters that you set in the Profiles tab, Configuration tab, Jog/Teach tab, Gripper tab, and the External Robots tab of Bravo Diagnostics.

To create a new profile:

1   In **Bravo Diagnostics**, click the **Profiles** tab.

2   Click **Create a new profile**.

3   In the **Create Profile** dialog box, type a name for the new profile, and click **OK**.

Use a profile name that identifies the specific configuration. For example, include the liquid-handling head type and serial number in the profile name. If this computer controls multiple Bravo Platforms, also identify the device, for example, the device serial number.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

4   Under **Connection**, select **This Bravo is connected via ethernet**, and then click **Find available devices**.

Note: If you have an earlier model, you may select **This Bravo is connected via serial**, and then select which **COM** port on the computer you are using.

5   In the **Discovered BioNet Devices** dialog box that appears:

a   Click the **Select the Ethernet adapter to use from the list below**, and select the correct adapter for the device connection.

b   In the list of devices that appear, select the Bravo device. If multiple Bravo devices are on the network, use the **MAC Address** to identify the Bravo device for this profile. To successfully communicate with the Bravo device, the **Status** column must display **New** or **Matched**.

c   Click **OK**.

a b   c
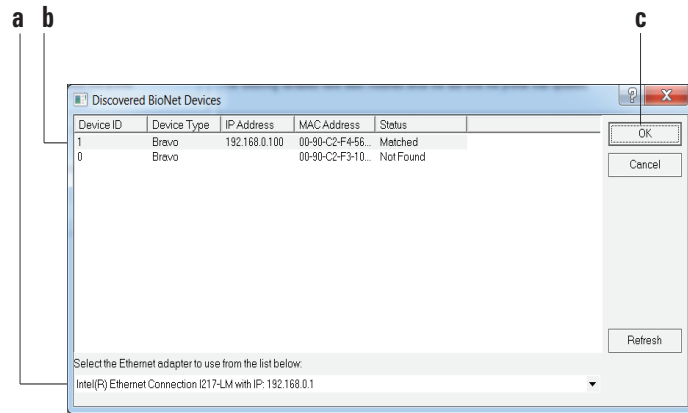
6   Under **Head Information**, configure the following:
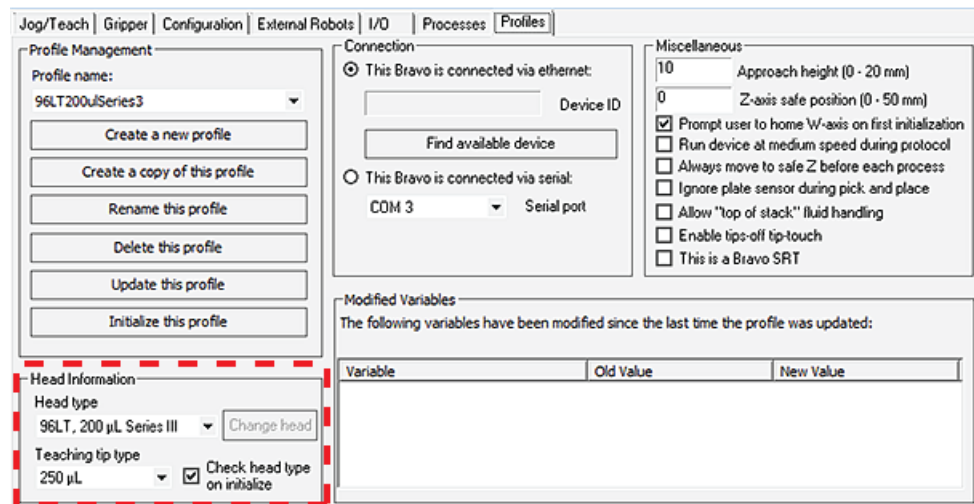
a   Select the **Head type** from the list.

b   Select the **Teaching tip type** from the list.

CAUTION   **Selecting the wrong Teaching tip type can result in a head crash. Ensure that you select the correct Teaching tip type.**

IMPORTANT   Disposable pipette tips must be an Agilent brand.

c   Ensure that the **Check head type on initialize** check box is selected.

Note: If the Check head type on initialize check box is cleared, the *w*-axis controls in the Jog/Teach tab will be disabled even when the device is initialized.

CAUTION	If this check box is cleared, the Bravo Platform will run with any head installed. Therefore, if the profile specifies a 96-channel head type, but a 384-channel head is installed, the head will crash.

7   *Optional.* In the **Miscellaneous** area, verify the settings to be applied during a protocol run. If you are unsure of which values to set, start with the default values. You can change them later if necessary.

For more details, see "Miscellaneous area" on page 229.

8   Verify the list of changes in the **Modified Variables** area, and then click **Update this profile** to save the current selections and settings.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

The Modified Variables area clears, and the update is logged in the box at the bottom of the Bravo Diagnostics window and in the VWorks Main Log.

9   To initiate communication with the Bravo Platform using the new profile, click **Initialize this profile**.

WARNING	When you initialize the Bravo Platform, the head can move. Keep clear of the Bravo head while it is in motion. Do not 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.

Steps to finish creating the profile

Verify the following settings, which are saved with the given profile.

Step	Task	See...
1	In the Configuration tab, verify that the deck configuration matches the physical deck layout of platepads and accessories.	"Bravo accessories overview" on page 110
2	Use the Jog/Teach tab to set and verify teachpoints.	"Setting teachpoints" on page 37
3	*If applicable.* Use the Gripper tab to verify the gripper *y*-axis offset.	"Verifying the gripper setup" on page 44
4	*If applicable.* Use the External Robots tab to specify the deck locations that the external robots can access.	"Configuring external robot access" on page 53

Related information

For information about...	See...
Relationship of VWorks components, such as device files, profiles, teachpoints, and labware	*VWorks Automation Control User Guide*

For information about...	See...
What to do if the Bravo Platform device does not appear in step 5	"Troubleshooting hardware problems" on page 84
Concurrent motion settings for an integrated Bravo Platform	"Configuring external robot access" on page 53
Profiles tab in Bravo Diagnostics	"Profiles tab quick reference" on page 228
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Audit trails and records of interest	*VWorks Automation Control Setup Guide* for version 14

Initializing the device

About this topic

To establish communication between the computer and the Bravo Platform, you initialize the Bravo device. You can initialize the Bravo Platform in the following ways:

- *Bravo Diagnostics*. To control the Bravo Platform using Bravo Diagnostics, initialize the profile in Bravo Diagnostics.
- *VWorks window*. To control the Bravo Platform from the VWorks window, for example, to run a protocol, initialize the device in the VWorks window.

Before you start

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

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

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

Ensure that you have added the Bravo device to a VWorks device file and that you have a valid Bravo profile.

Initializing the device in Diagnostics

To initialize a profile in Bravo Diagnostics:

1   In the **VWorks** window, open the device file for the profile that you want to initialize.

  To open a device file, choose **File > Open**. In the **Open** dialog box, ensure the file type is **Device Files (*.dev)**, select the file, and then click **Open**.

2   Click **No** when the **Would you like to initialize devices now?** message appears.

3   In the device file tab, select the device, and then click **Device diagnostics** to open the Bravo Diagnostics dialog box.

4   In the **Profiles** tab, ensure that the correct profile for the installed head and Bravo deck configuration is selected in the **Profile name** list.
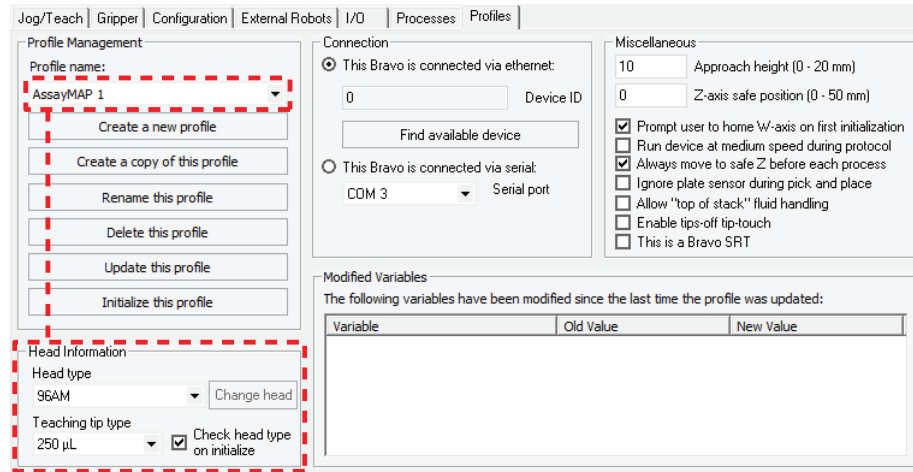
5 Verify that the selected **Head type** matches the installed head.

For example, if the 96LT head is installed, the Bravo Platform requires a profile for the 96LT head type.

6 Click the **Configuration** tab, and verify that the **Location Configuration** and **Accessory Configuration** matches the physical layout on the Bravo deck.
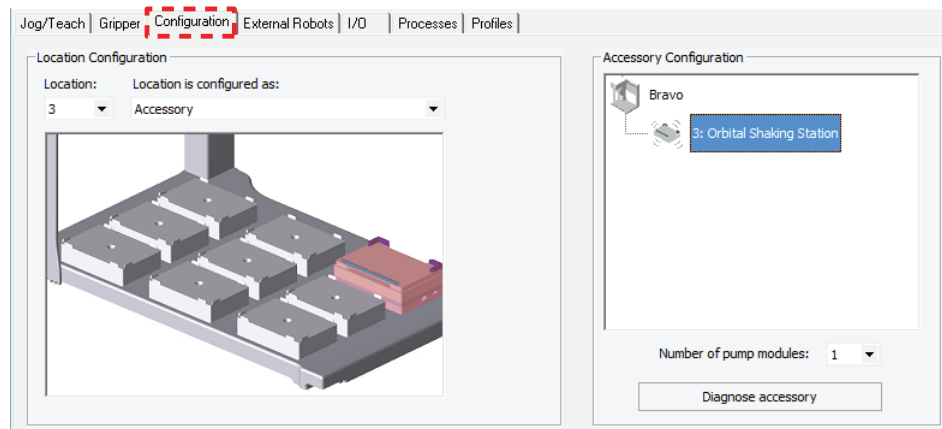
IMPORTANT If the software configuration differs from the physical deck layout, ensure that you select the correct profile in the Profiles tab.

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

8 If the Bravo Error message appears stating **There appears to be a plate present**, verify that Bravo gripper is not holding labware, and then click **Ignore and Continue, leaving device in current state** to continue the initialization. During the homing process, the gripper opens and closes.

If the gripper is holding labware, the gripper will drop the labware during this process. If necessary, click **Abort** to cancel the initialization. See the instructions for manually opening the gripper to remove the labware before you attempt to initialize the device.

9 If the **Please verify that it is safe to home the W-axis** message appears, do one of the following:

- *If the tips do not contain fluid*. Click **Retry** to continue homing the *w*-axis.

- *If the tips contain fluid*. Click **Ignore**. When the **W-axis is not homed** message appears, use the tools in the Jog/Teach tab in the Bravo Diagnostics dialog box to home the *w*-axis over a waste location. Homing the *w*-axis will empty the tips.
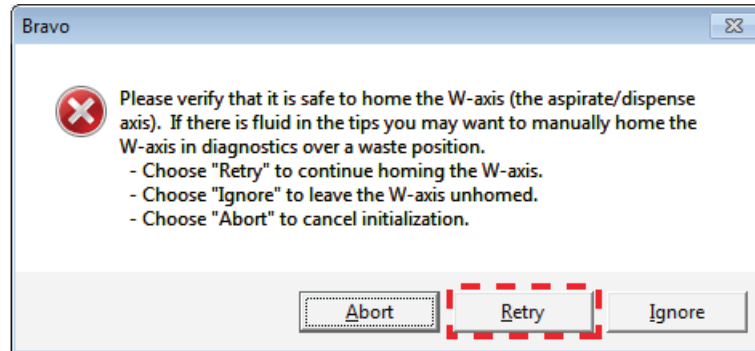
Note: The Miscellaneous profile settings include the Prompt user to home W-axis on first initialization option and the Ignore plate sensor during pick and place option. For an explanation of the options, see "Miscellaneous area" on page 229.

Initializing the device in the VWorks software

To initialize the device from the VWorks window:

1 In the VWorks window, choose **File > Open > Device**. In the **Open File** dialog box, locate and select the device file, and then click **Open**.

A list of the devices appears in the Device File tab.

2 In the **Devices** area, highlight the device or devices that you want to establish communication with, and verify that the correct profile is selected in the Bravo **properties** area.

3 Click **Initialize selected devices** or **Initialize all devices**.
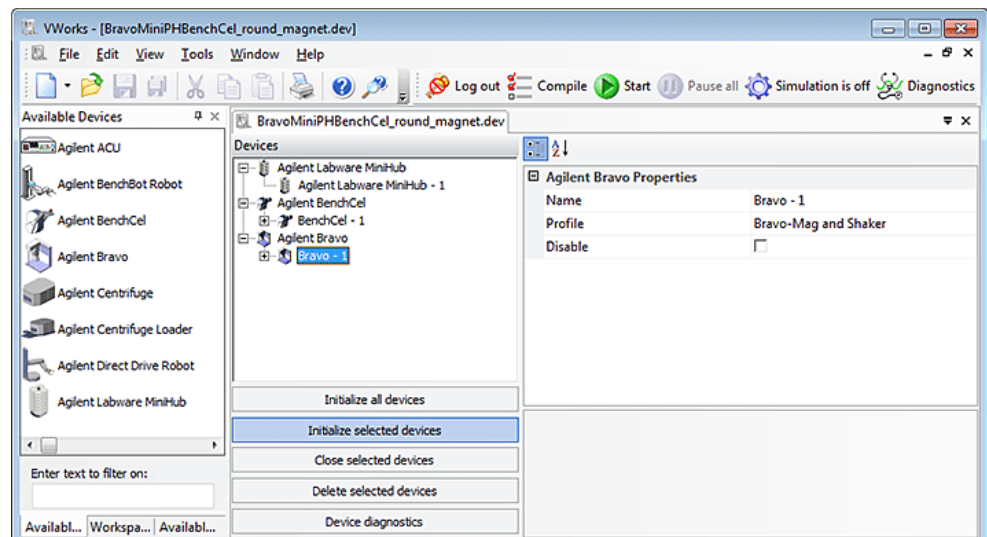
4 If the Bravo Error message appears stating **There appears to be a plate present**, verify that Bravo gripper is not holding labware, and then click **Ignore and Continue, leaving device in current state** to continue the initialization.

If the gripper is holding labware, click **Abort** to cancel the initialization, and then see instructions for manually opening the gripper to remove the labware.

5   If the **Please verify that it is safe to home the W-axis** message appears, do one of the following:

- *If the tips do not contain fluid*. Click **Retry** to continue homing the *w*-axis.

- *If the tips contain fluid*. Click **Ignore and continue**. When the **W-axis is not homed** message appears, use the tools in the Jog/Teach tab in the Bravo Diagnostics dialog box to home the *w*-axis over a waste location. Homing the *w*-axis will empty the tips. Make sure you home the *w*-axis before beginning a protocol.

Related information

For information about…	See…
Adding more devices to a device file	"Creating or adding a Bravo device" on page 21
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Profiles	"Creating and managing profiles" on page 28
Manually opening the gripper	"Manually opening the gripper" on page 82

Setting teachpoints

About this topic

This topic explains how to set teachpoints.

If you are teaching the AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

You must set or edit teachpoints anytime the following occurs:

- You are using a new liquid-handling head for the first time

- The existing teachpoint files are lost or damaged

- You first set up your Bravo Platform

- You change the teaching tip type in the profile

- You add an accessory

CAUTION   **Using a profile that is associated with teachpoints from a different Bravo Platform can result in a hardware collision and cause equipment damage. Ensure that you verify the profile and associated teachpoints for each specific Bravo Platform.**

Teachpoint defined

A teachpoint is a set of axial coordinates that define a location to which the liquid-handling head moves. Each of the nine locations on the Bravo deck has a default teachpoint that can be edited in Bravo Diagnostics. The default teachpoints are set so that well A1 is at the back left corner of each deck location.

Before you start

Make sure you do the following:

- Remove all labware from the Bravo deck locations.
- Verify that the correct liquid-handling head is installed and the corresponding profile is initialized.

WARNING	**To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should perform the procedures in this topic.**

WARNING	**The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the pendant.**

If you are teaching a pin tool, see "Workflow for non-tip-box locations" on page 38.

Workflow for non-tip-box locations

CAUTION	**To prevent the liquid-handling head from crashing into an accessory, be sure to start the accessory teaching process from the safe z-axis point above the accessory location. This is especially important if you select the option to Set all teachpoints based upon selected teachpoint.**

Step	For this task...	See...
1	Set the first teachpoint. Use a deck location that is easy to access, for example, deck location 1, 4, or 7.	"Setting the first teachpoint" on page 39
2	Set teachpoints for the remaining locations by doing one of the following: • Automatically set the remaining teachpoints based on the first teachpoint.	"Setting other teachpoints based on one teachpoint" on page 41
	• For more precise teachpoints (384- or 1536-well plates), repeat step 1 for each deck location.	"Setting the first teachpoint" on page 39
3	Verify each teachpoint.	• "Verifying teachpoints for disposable-tip heads" on page 42 • "Verifying teachpoints for pin tools" on page 43

Step	For this task...	See...
4	Edit the teachpoint, as required, for any accessory locations, such as the Weigh Station or an Orbital Shaking Station.	The procedure can vary depending on the accessory. For details, see "Bravo accessories overview" on page 110.

Workflow for a tip box location

Pressing pipette tips on the liquid-handling head requires a high degree of precision in the positioning of the head relative to the tip box, especially for 384-well tip boxes. Use the following workflow for deck locations where you plan to place either a tip box.

Step	For this task...	See...
1	Determine the platepad requirements for the tip box location:	
	• Standard Bravo Platform – *ST tip box*. Use an Alignment Station instead of a standard platepad at the deck locations where you perform tip box operations. The Alignment Station helps provide greater tip-loading precision.	"Installing and configuring a platepad or Alignment Station" on page 147
	– *LT tip box*. If using a 250-µL tip box, you can use a standard platepad or an Alignment Station. *Note:* If using a 200-µL tip box, use a standard platepad and an LT insert for tip loading.	–
	– *Nested tip box*. Install and configure the Nested Rack Insert.	"Installing and setting up a Nested Rack Insert" on page 158
	• SRT Bravo Platform – *ST tip box*. Use an ST tip loading station. – *250-µL tip box*. Install the 250-µL platepad and configure the deck location.	"(Bravo SRT only) Setting up an LT tip box location" on page 184
2	Set the teachpoint for the location.	"Setting the first teachpoint" on page 39
3	*ST tip box locations*. Verify the labware definition for the tip box.	"Verifying teachpoints for disposable-tip heads" on page 42
4	Verify the teachpoint. If tip-box operations are not precise enough, repeat this step.	"Verifying teachpoints for disposable-tip heads" on page 42

Setting the first teachpoint

If you are using a:

- Disposable-tip head, place the teaching tip type that you specified in the profile on the A1 barrel or probe to set the teachpoint.
- Bravo 96AM Head, see the *AssayMAP Bravo Platform Installation Guide*.

- Pin tool, set the teachpoint according to the A1 needle.

To set the first teachpoint:

1   In **Bravo Diagnostics**, click the **Profiles** tab, and initialize the desired profile.

2   *Disposable-tip heads*. Place a pipette tip firmly on the head barrel that corresponds to the A1 well of the labware you are using.

CAUTION   **Make sure the disposable tip is an Agilent tip and is the same type that you specified as the Teaching tip type in the profile.**

3   Click the **Jog/Teach** tab.

4   In the **Location** list, select the deck location. If you are setting up the first teachpoint, select location **1**, **4**, or **7**.

   Note: The teachpoint coordinates for the selected location are displayed under the Location list.

5   Set the **Approach height above teachpoint** to a safe distance, such as 20 mm, and then click **Approach.**
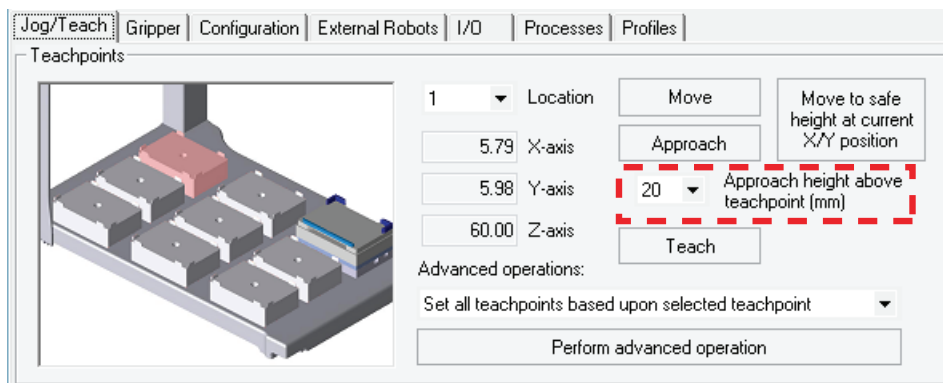
6   Use the **Jog Axes** controls to move the liquid-handling head to the correct teachpoint as follows:
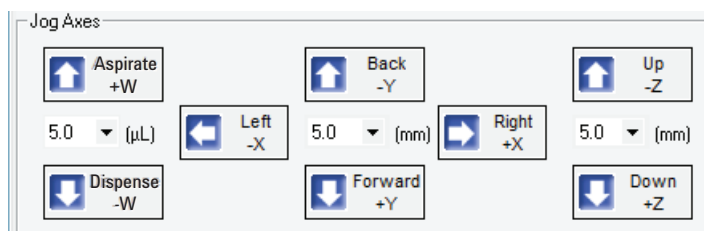
CAUTION   **Jogging the head down too far will damage the tip. Be careful not to jog the head down too far.**

CAUTION   **When jogging down in the z-axis, a warning might appear stating that you are about to exceed the set teachpoint, which could cause a crash. Before you click OK, verify that enough space remains to continue jogging down.**

a   Jog the head down (*z*-axis) until the A1 tip is approximately 2 mm above the platepad.

Reduce the increment value when the tip gets close to the deck.

b   Jog the head in 0.05 mm increments in the *x* and *y* directions, until the tip is positioned directly above the crosshair mark on the platepad.

c   To achieve paper-thin *z*-axis clearance, slide a sheet of paper between the tip and the platepad. Set the *z*-axis increment to 0.05 mm increments. Jog the head down until the paper is barely pinched, and then jog up by 0.05 mm.

7   When the tip is in the correct position (directly over the crosshair mark with paper-thin clearance), click **Teach.**

Verify the information in the message box before you click **OK.**

Figure   Pipette tip A1 position over the platepad crosshair mark
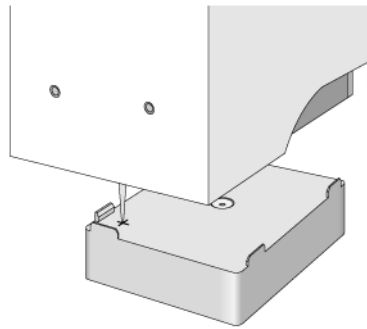
8   To save the teachpoint, click the **Profiles** tab and click **Update this profile.**

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Setting other teachpoints based on one teachpoint

After setting the first teachpoint, you can have the VWorks software calculate the other eight teachpoints based on the selected teachpoint. Typically, this is done upon initial setup of a new liquid-handling head.

IMPORTANT   For optimal performance, teach each of the nine locations independently using the procedure, "Setting the first teachpoint" on page 39.

To set the other eight teachpoints:

1   In the **Jog/Teach** tab, verify that the teachpoint you just taught ("Setting the first teachpoint" on page 39) is set in the **Location** list.
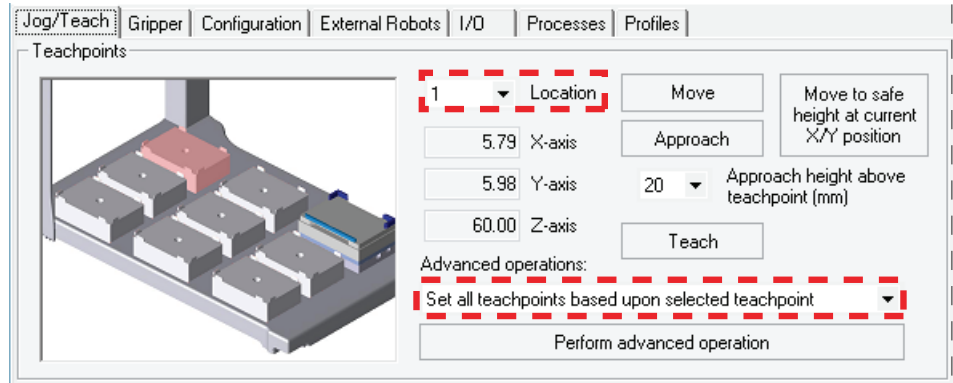
The teachpoint for the other locations will be set based on this one.

2   In the **Advanced operations** list, select **Set all teachpoints based upon selected teachpoint**.

3   Click **Perform advanced operation.**

The VWorks software calculates the teachpoints for the other eight locations, keeping the *z*-axis coordinate the same and changing the *x* and *y* coordinates according to their spacing.

4   Readjust the *z*-axis height for any positions that are taller than a standard platepad, such as the Orbital Shaking Station.

5   To save the teachpoints, click the **Profiles** tab and click **Update this profile.**

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Verifying teachpoints for disposable-tip heads

Verify the following:

- The labware definition for the tip box contains the correct column-wise and row-wise teachpoint-to-well values.

- The teachpoint is accurate for proper tips-on and tips-off operations.

To verify the tip box labware definition:

1   Open the **Labware Editor**.

2   In the **Pipette/Well Definition** tab, verify the following values for the tip box labware definition:

Large transfer (LT) tips	Small transfer (ST) tips
Row-wise teachpoint to well (mm) = 0	Row-wise teachpoint to well (mm) = 2.25
Column-wise teachpoint to well (mm) = 0	Column-wise teachpoint to well (mm) = 2.25

To verify the teachpoint accuracy:

CAUTION

For disposable-tip heads, make sure you use a full set of tips to verify each teachpoint.

1   Open **Bravo Diagnostics**, and click the **Jog/Teach** tab.

2   Click **Move to safe height at current X/Y position** to move the head up so that you have enough room to remove the single pipette tip from the head barrel.

3   Place a tip box full of tips on the tip box location that you are verifying. Make sure the tip box is sitting level on the platepad.

4   Perform a tips-on operation as follows to ensure the tips are loaded properly:

   a   Click the **Processes** tab.

   b   In the **Command to Execute** list, select **Tips On**.

   c   Click **Execute Command**. The head presses down to install the tips, and then moves back up.

5   Remove the empty tip box from the deck location.

6   In the **Jog/Teach** tab, click **Move**. The head moves to the teachpoint you set in "Setting the first teachpoint" on page 39. You might notice that the A1 tip is not quite in the correct position.

7   Use the **Jog Axes** controls to move the head A1 tip to the correct position (directly over the crosshairs with paper-thin clearance).

8   When you are finished, click **Teach**. Verify the information in the message box before you click **OK**.

9   Repeat step 6 to step 8 for each deck location.

10 To save the changes, click the **Profiles** tab and click **Update this profile**.

   VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Verifying teachpoints for pin tools

After setting and saving teachpoints, you should verify each teachpoint.

To verify a teachpoint:

1   In the **Jog/Teach** tab, set the **Location** field to the location you want to check.

2   Click **Approach**.

3   Use the following table to decide your next step:

If the A1 needle is ...	Then ...	
Above the crosshairs at the approach height	a	Click **Move** to move the A1 needle to the teachpoint.
	b	Visually check the position. The tip of the needle should be directly over the crosshairs with a clearance of about the thickness of a sheet of paper. (If it is not, repeat "Setting the first teachpoint" on page 39.)

If the A1 needle is …	Then …
Not above the crosshairs or appears to be closer to the deck than the approach height	There is a problem with the teachpoint. Repeat "Setting the first teachpoint" on page 39.

4   Repeat the above steps for each teachpoint.

Related information

For information about…	See…
The workflow this procedure belongs to	"Workflow for setting up the Bravo Platform" on page 18
Creating and initializing a profile	"Creating and managing profiles" on page 28
Changing the liquid-handling head	"Changing the Bravo head" on page 69

Verifying the gripper setup

About this topic

You should read this topic if the Bravo Platform includes a gripper.

This topic describes:

- Adjusting the gripper y-axis offset. You should check the gripper *y*-axis offset when you first set up your Bravo Platform. If necessary, you adjust the *y*-axis offset to ensure that the gripper fingers are centered at a platepad. This *y*-axis offset is saved with the given profile.

- Checking the gripper pick-and-place operations. Use this procedure to ensure the gripper performs the pickup and placement of labware smoothly.

Before you start

Make sure that:

- You have labware definitions for the labware that you are using for the procedures.

- The Bravo gripper fingers are in good condition and aligned with the head. Perform a visual inspection to ensure the gripper fingers are not bent.

- The pair of gripper pads (black rubber) on the interior side of each gripper finger are in place and in good condition. Ensure the gripper pads are not partially ripped off or pulled askew.

Figure   Gripper pads on interior side of gripper finger
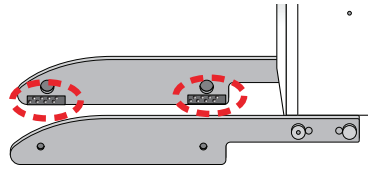
- The correct profile is initialized in Bravo Diagnostics.

  In **Bravo Diagnostics**, click the **Profiles** tab, and initialize the profile that you are checking.

Adjusting the gripper y-axis offset

IMPORTANT   Before you adjust the gripper *y*-axis offset, ensure that the pipettor teachpoints (*x*-, *y*-, and *z*-axes) have been verified for the given profile and no pipette tips or cartridges are installed on the head.

IMPORTANT   Ensure that you use a standard platepad for the following procedure.

To adjust the gripper y-axis offset:

1   In Bravo Diagnostics, click the **Gripper** tab.

2   In the **Labware** list, select **None**.

3   In the deck image, click a deck location where a standard platepad is installed. The location should be easily accessible, for example in the front row or a corner.
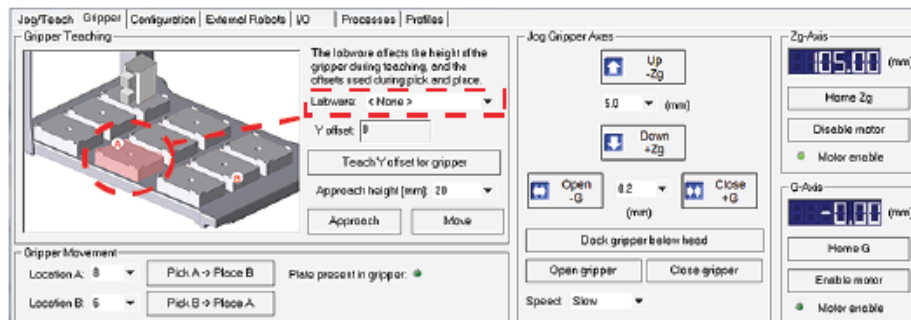
4   Click **Move** to move the gripper to the previously saved teachpoint for the selected location.

The Bravo head moves above the deck location, and the gripper assembly extends down (*Zg*-axis) so that the gripper fingers are just above the top surface of the platepad.
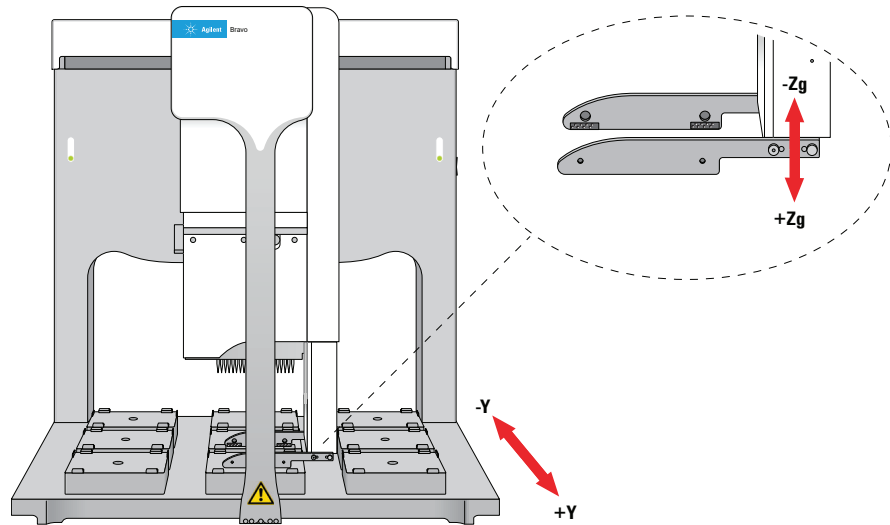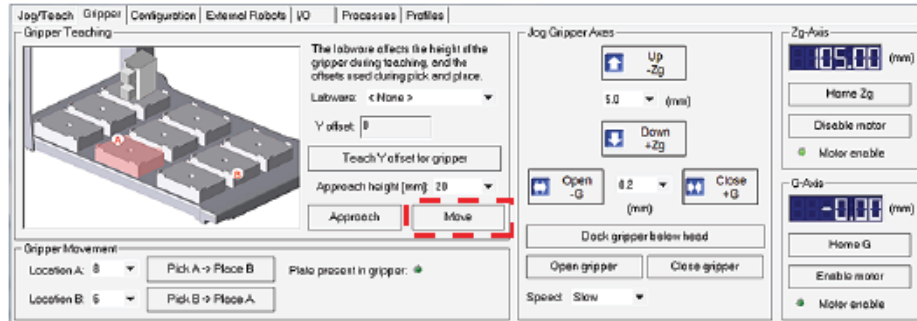
5   Visually inspect the spacing between the black rubber gripper pads and the sides of the platepad (*y*-axis). Make sure that all the gripper pads have clearance so that the gripper can move down without colliding with the platepad.

Figure   Gripper pad clearance from sides of platepad (top view)
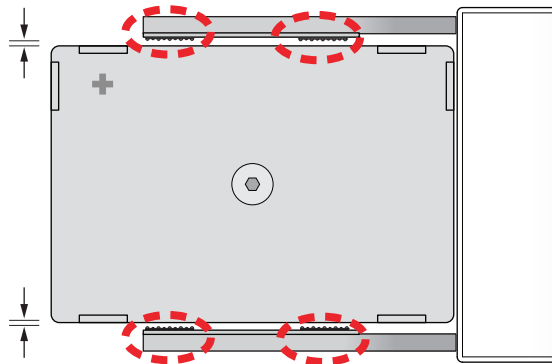
6   If the gripper pads are touching or overlapping on one side of the platepad, do the following to adjust the clearance:

a   Click the **Jog/Teach** tab, and ensure that the deck location you selected in step 3 is still selected.

b   Under **Jog/Axes**, set the **Back -Y/Forward +Y** increment to a small enough size, such as 0.2 mm.

CAUTION Make sure you use small enough jog increments to prevent any gripper collisions, which could damage the gripper.
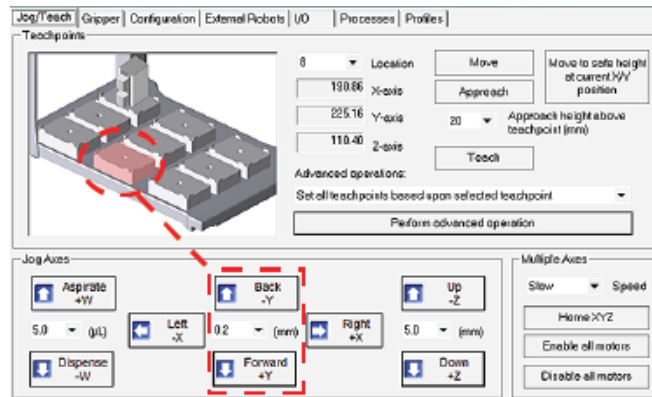
c Click **Back -Y** or **Forward +Y** as required to adjust the gripper *y*-axis position so that the gripper pads will clear the sides of the platepad when you jog down in the next step.

When the following message appears, click **OK**.
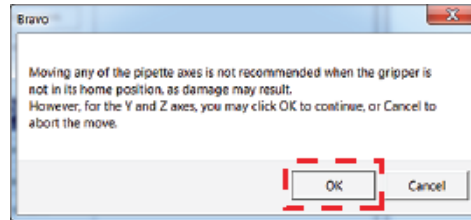
7 After ensuring that the gripper pads will not collide with the platepad, set the **Down +Z** increment to **5.0 mm**, and then click **Down +Z**.

CAUTION **Make sure you do not jog the gripper down more than 5.0 mm at this stage. Jogging down farther will result in a gripper collision with the setscrew on the platepad, which could damage the gripper.**

When the following message appears, click **OK**.
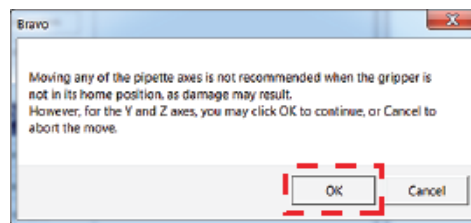
At this stage, the gripper fingers should be next to the sides of the platepad.

8 Fine tune the gripper alignment as follows:

a In the **Gripper** tab, set the **Close +G** increment to a small value, such as 0.2 mm, and then click **Close +G** so that you can clearly see the alignment of the gripper pads with the platepad.
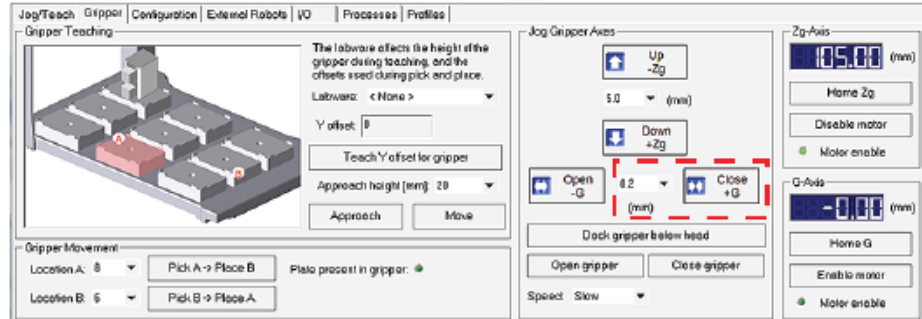
IMPORTANT   **Do not** click **Close gripper**. Otherwise, you must redo the procedure.

b In the **Jog/Teach** tab, set the *y*-axis increment to 0.2 mm, and then use the **Back -Y** and **Forward +Y** buttons to position the gripper so that the fingers are at equal distances around the platepad.

Ensure the pair of gripper pads on each side are as close as possible to the sides of the platepad without actually touching the platepad.

Note: If a gripper finger is not perfectly straight, one of its gripper pads may be closer than the other to the side of the platepad, as the following figure shows. In this case, adjust the *y*-axis using the gripper pad closest to the platepad and the diagonally opposite gripper pad for reference.

Figure   Example of diagonally opposite gripper pads (top view)
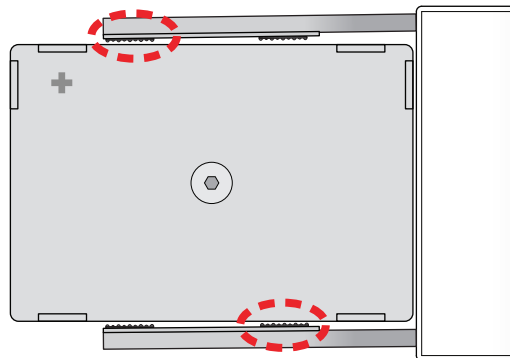
9   In the **Gripper** tab, click **Teach Y offset for gripper**.

10 In the **Profiles** tab, click **Update this profile**.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Checking the gripper pick-and-place operations

To pickup and place labware correctly, the *y*-axis offset gripper fingers must be positioned at equal distances from the sides of the labware.

To test the gripper pick-and-place operations:

1   Place a microplate on a platepad at the deck location where you are starting the test.

2   In Bravo **Diagnostics**, click the **Gripper** tab.

3   In the **Labware** list, select the name of the labware type you are using.

4   Select the location for the move:

    a   In the **Location A** list, select the current deck location of the labware.

    b   In the **Location B** list, select the deck location to which the labware will move.

5   Set the **Speed** to **Slow**.

6   Click **Pick A -> B** to pick up the microplate from deck location A and place it on deck location B. Click **Pick B -> A** to pick up the microplate from deck location B and place it on deck location A.
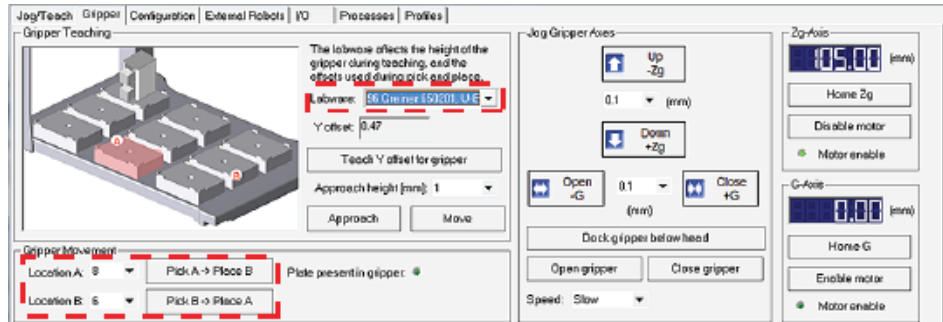
7   Repeat steps 4 and 6 for the remaining deck locations where the gripper will be transferring labware.

8   Set the **Speed** to **Fast**, and repeat steps 4, 6, and 7.

9   Make sure that the gripper holds the microplate securely and keeps it level while moving the microplate from location to location.

Related information

For information about…	See...
The workflow this procedure belongs to	"Workflow for setting up the Bravo Platform" on page 18
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Gripper tab	"Gripper tab quick reference" on page 225
Setting teachpoints	"Setting teachpoints" on page 37
Reporting problems	"Reporting problems" on page 91

Copying teachpoints from one profile to other profiles

About this topic

This topic is applicable to VWorks 14.0 and later versions only:

- VWorks 14.0 enables copying teachpoints from one profile to another profile.
- VWorks 14.1 or later enables copying teachpoints from one profile to multiple profiles.

Before you start

VWorks Administrator or Technician privileges are required to modify profiles for the Bravo Platform.

The profile to be copied and the destination profiles must share the same head type and teaching tip type.

The copied teachpoints include the following:

- Pipette head teachpoints (*x*- , *y*-, and *z*-axes) for all nine deck locations
- Gripper *y*-axis offset

VWorks Plus. The profiles to be updated cannot be in the Released state. The software logs audit trails for device profiles (.xml file type), which are records of interest.

> **CAUTION** **Using a profile that is associated with teachpoints from a different Bravo Platform can result in a hardware collision and cause equipment damage. Ensure that you verify the teachpoints for each specific Bravo instrument.**

Procedure

To copy teachpoints from one profile to other profiles:

1   In **Bravo Diagnostics**, initialize the profile that contains the teachpoints that you want to copy.

2   In the **Jog/Teach** tab, under **Advanced operations**, select **Copy teachpoints to other Profiles**, and then click **Perform advanced operation**.
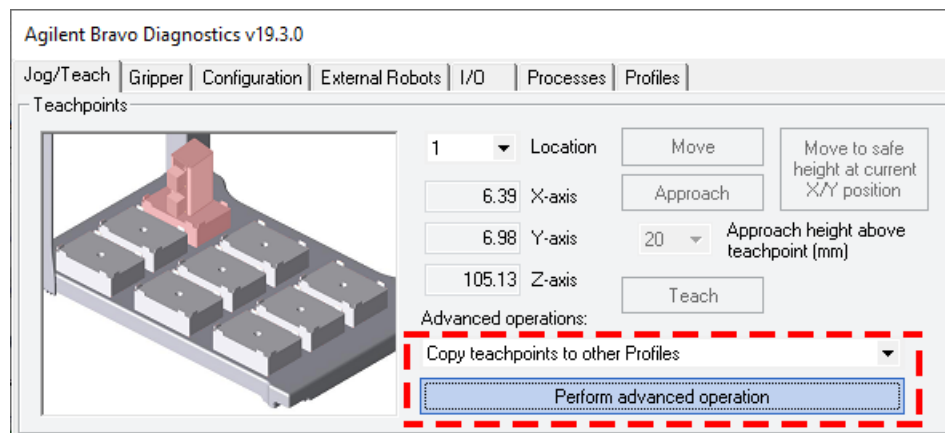
A message appears and warns you that the software must inspect every Bravo profile before providing a list of eligible profiles. Click **Yes** to proceed.
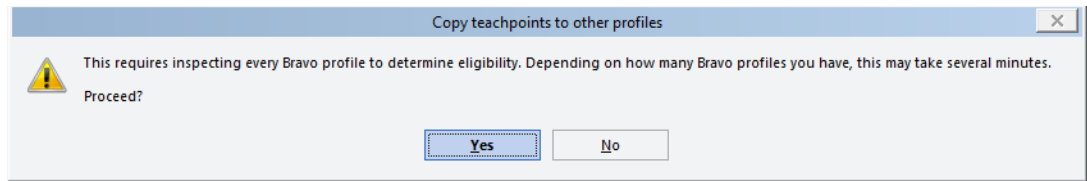
3   In the **Copy teachpoints to other Profiles** dialog box, select the **Destination profiles** from the list, and then click **OK**.
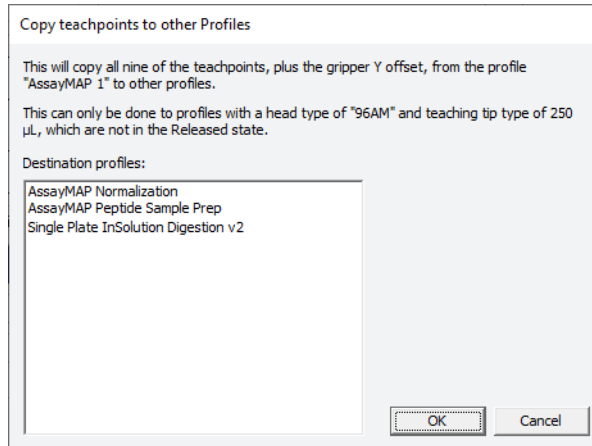
4   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment for all the profiles to be updated, and then click **OK**.

5   Click **OK** when the confirmation message appears.
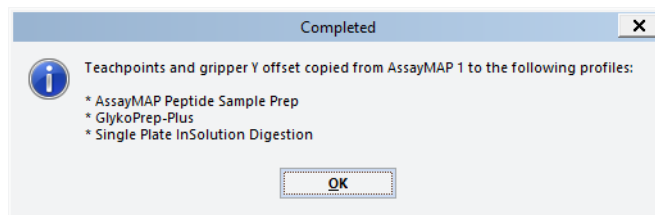
6   Verify the teachpoints in the modified profiles:

- "Verifying teachpoints for disposable-tip heads" on page 42
- "Verifying teachpoints for pin tools" on page 43

7   Verify the gripper y-axis offset in the modified profile. See "Checking the gripper pick-and-place operations" on page 48.

Related information

For information about...	See...
Setting teachpoints	"Setting teachpoints" on page 37
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Initializing the Bravo profile	"Initializing the device" on page 34
Audit trails and records of interest	*VWorks Automation Control Setup Guide* for version 14

Configuring external robot access

About external robot access options

For a Bravo Platform that is integrated in a system with other plate-handling robots, you can configure one of the following features in the Bravo profile:

- Permit only one robot to operate on the Bravo deck at any given time. While an external robot accesses the Bravo deck, the Bravo head moves to a specified safe location and Bravo operations pause for the duration.

- Allow the Bravo robot and one or more external robots to operate on the Bravo deck concurrently. For each external robot, you must specify the deck locations that are not available (blocked) to the Bravo robot during concurrent operations.

VWorks Plus. The software logs audit trails for device profiles (.xml file type), which are records of interest.

This topic describes:

- "Workflow" on page 53
- "Planning the robot access locations" on page 54
- "Preventing concurrent operation during external robot access" on page 57
- "Allowing concurrent operations during external robot access" on page 59

Workflow

Perform the following steps to configure an external robot's access on the Bravo deck. This workflow assumes that you have already verified the Bravo Platform teachpoints.

Step	For this task...	See...
1	Carefully plan which deck locations the external robots can access and where the Bravo head can be during the external robots' access.	"Planning the robot access locations" on page 54
2	Ensure that the device file specifies that the Bravo deck locations are accessible by the external robots.	"Creating or adding a Bravo device" on page 21
3	In the Bravo profile, configure the external robot access, and then update and re-initialize the profile.	• "Preventing concurrent operation during external robot access" on page 57 • "Allowing concurrent operations during external robot access" on page 59
4	Set each external robot's teachpoints at the appropriate Bravo deck locations.	Relevant user documentation, such as the *BenchCel Microplate Handler User Guide*.

Step	For this task...	See...
5	Perform a dry run at slow speed to verify that there are no potential hardware collisions.	"About performing mock or test runs" on page 64
	Ensure that the emergency-stop pendants are within easy reach in case you need to abort a robot movement.	

Planning the robot access locations

CAUTION

Ensure that you plan the external robot access locations carefully to prevent potential hardware collisions. A collision between an external robot and the Bravo Platform can damage the Bravo Platform, the external robot, or both robots.

Careful planning of the deck locations that the Bravo robot and any external robots can access will optimize your throughput and prevent hardware collisions.
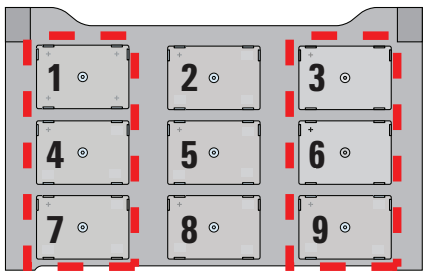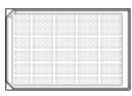
Physical factors to consider

Make sure you consider the following factors when you plan the deck locations that an external robot may access or when selecting a safe location for the Bravo head.

Physical factors	Description
External robot direction of approach and Bravo *x*- and *y*-axes of motion	The Bravo tie bar moves along the x-axis across the front of the Bravo deck whenever the head moves to a deck location.
	If the Bravo head is at a location in the back row, the tie bar will block another robot's approach from the front to the other deck locations in that column. For example, if the Bravo head is at location 2, the tie bar blocks a front approach to locations 5 and 8.

Figure   Bravo head mount and tie bar motion (front view) and (side view)

Physical factors	Description
External robot physical reach	Some robots can reach any Bravo deck location, while other robots can access a subset of deck locations. For example, the BenchCel robot approaches the Bravo Platform from the left or right side only and can access only the left-most and right-most deck locations. *Figure* BenchCel robot reach on Bravo deck (top view) Front
External robot orientation for gripping labware: landscape or portrait	Landscape and portrait gripper orientations require different space allocations on the Bravo deck. Some robots can grip using either orientation. • Landscape • Portrait
External robot's approach path	The approach path of the external robot can affect which Bravo deck locations must be blocked for the Bravo head during the external robot's access. For example, the following figure shows two variations of an external robot's approach path to deck location 7. The blue locations are where the Bravo head could potentially continue operations concurrently while the external robot is accessing the deck: • *Example A*. The external robot is accessing location 7. However, locations 1 and 4 are also blocked to prevent the tie bar from being in the path of the external robot when it accesses location 7. The Bravo head can access the remaining deck locations (blue) without risking a collision with the external robot during its approach to location 7. • *Example B*. In addition to locations 1, 4, and 7, the Bravo head is blocked from accessing location 8. The Bravo head cannot access location 8 without risking a potential collision with the external robot during its approach to location 7.

Physical factors	Description
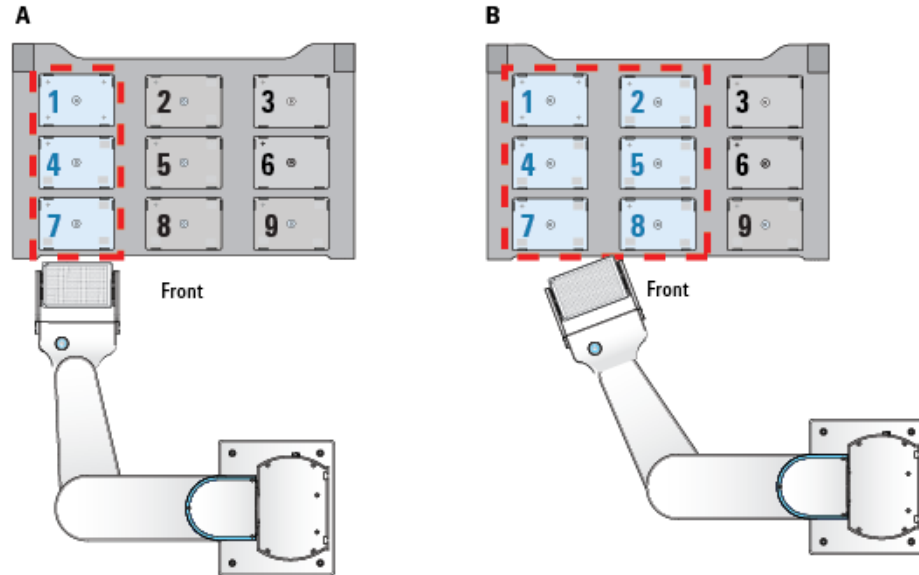
Software scheduling conflicts

The software resolves conflicts, where both the Bravo robot and external robot are scheduled to approach a blocked location, as follows:

- If the Bravo robot is at a blocked location when an external robot is scheduled to approach, the Bravo robot will complete the task in progress before moving to a different location. After the Bravo robot completes the move from the blocked location, the external robot can approach the target location.

- If the Bravo robot and the external robot are both scheduled to approach a blocked location, the software gives priority to the request that it receives first.

  For example, the Bravo robot would get priority, regardless of whether the location is configured as blocked, if the software receives the Bravo robot's request for access before receiving the request from the external robot.

Example scenario 1: Two BenchCel robots and the Bravo robot operating concurrently

In this example, three robots can move concurrently at the Bravo deck:

- *BenchCel robot 1*. Downstacks labware to deck location 1. The Bravo head is also blocked from location 4 during the external robot access to prevent a potential collision with the opened BenchCel gripper arms.

- *BenchCel robot 2*. Upstacks labware from deck location 6. The Bravo head is also blocked from locations 3 and 9 during the external robot access to prevent a potential collision with the opened BenchCel gripper arms.

- *Bravo robot*. Performs operations at locations 2, 5, 7, and 8 while the two BenchCel robots simultaneously access the other deck locations. For example, the Bravo robot could move a tip box from location 7 to 8, perform a Tips On task at location 8, and then aspirate and dispense at the labware on deck locations 2 and 5.

The following figure shows the deck location designations for the two BenchCel robots and the Bravo robot.

Figure   Deck locations for Bravo robot (blue) and BenchCel robot (gray) operations
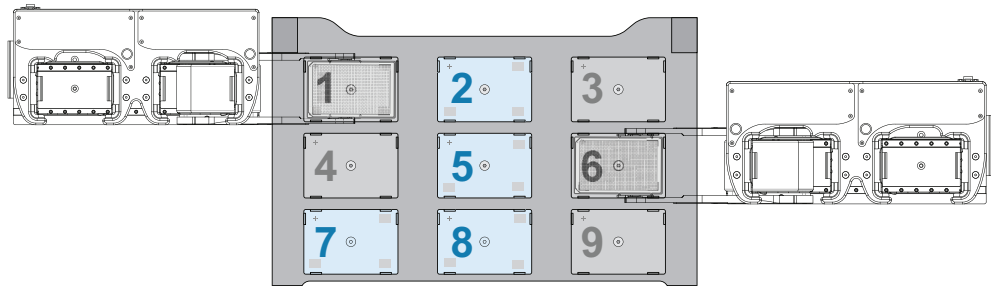
Example scenario 2: The Bravo robot, BenchBot Robot, and Direct Drive Robot operating concurrently

In this example, three robots can move concurrently at the Bravo deck:

- *BenchBot Robot with a landscape grip*. Approaches location 1 from the rear opening in the Bravo backplate. To be conservative, location 2 is also reserved for the BenchBot Robot and blocked for access by the Bravo robot.

  However, if you are certain that the external robot's approach path would not cross within the area that the Bravo head requires to access location 2, location 2 could be unblocked to optimize usage.

- *Direct Drive Robot with a portrait grip*. Approaches location 3 at the right side of the Bravo deck. To be conservative, location 6 is also reserved for this robot and blocked for access by the Bravo robot.

- *Bravo robot*. Continues operations at deck locations 4, 5, 7, 8, and 9.

The following figure shows the deck location designations for each of the three robots.

Figure   Deck locations for the Bravo robot (blue), BenchBot robot (gray), and Direct Drive Robot (gray) operations
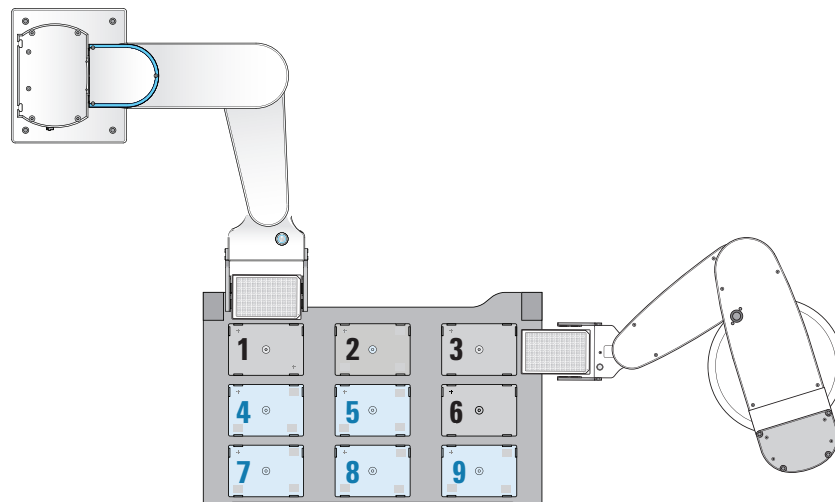
Preventing concurrent operation during external robot access

You can use the safe location feature to prevent Bravo operations while an external robot is accessing the Bravo deck. The safe location feature does the following:

- Allows one robot to access the Bravo deck at any given time. For example, if the Bravo robot is performing a liquid-handling task, the external robot will wait for the Bravo robot to finish before approaching the deck. If the external robot is placing or removing labware from a deck location, the Bravo robot will move to its safe location wait for the external robot to finish.

- Enables the Bravo robot to move to a specified deck location (safe location) whenever the external robot approaches the deck to perform a task. For example, if you specified deck location 1 as the safe location, the Bravo robot will always move to deck location 1 whenever the external robot approaches.

CAUTION

You can specify any deck location as the Bravo safe location. However, to prevent potential hardware collisions, you should determine the relative position of the external robot and its approach before specifying the Bravo safe location.

For guidelines on how to select the safe location, see "Planning the robot access locations" on page 54.

To prevent concurrent operation during external robot access:

1   In **Bravo Diagnostics**, click the **Profiles** tab and select the profile that you want to update.

2   Click the **External Robots** tab, and ensure that the select **Prevent Bravo operation during external robot access** check box is selected.
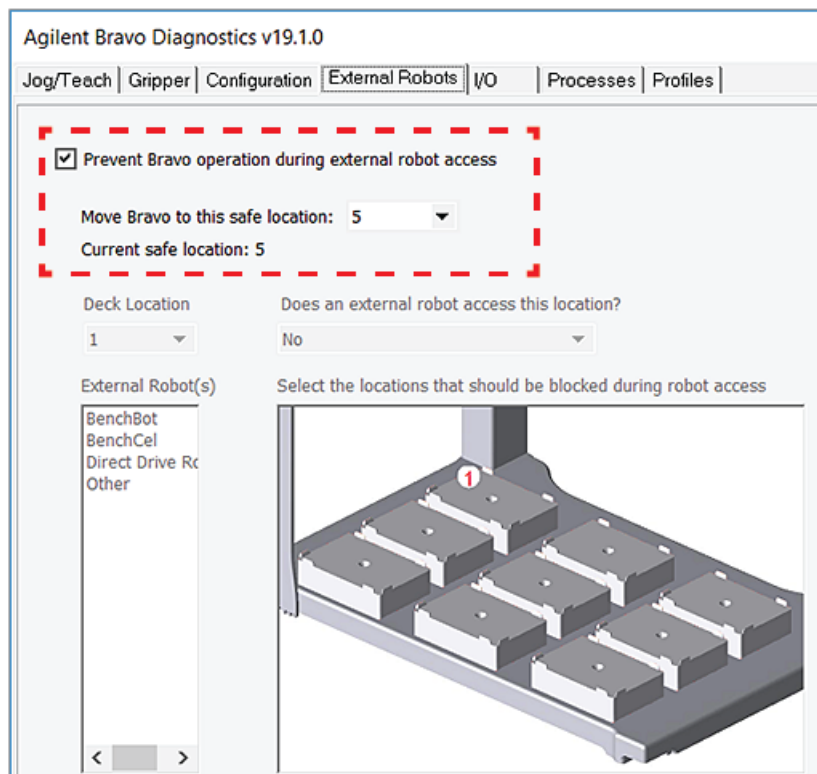
3   In the **Move** Bravo **to this safe location** box, select the deck location number where the Bravo head should move for the duration while the external robot is accessing the Bravo deck.

Note: Location 5 is the default safe location.

4   In the **Profiles** tab, click **Update this profile**.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Allowing concurrent operations during external robot access

CAUTION   **To prevent potential hardware collisions, ensure that you plan the external robot access locations carefully. For guidelines, see** "Planning the robot access locations" on page 54**.**

To allow concurrent operation during external robot access:

1   In **Bravo Diagnostics**, click the **Profiles** tab and select the profile that you want to update.

2   Click the **External Robots** tab.

3   Clear the **Prevent Bravo operation during external robot access** check box.

4   To configure a location for one or more robots, do the following:

a   In the **Deck location** box, select the location number.

b   In the **Does an external robot access this location** box, select **Yes**.

c   In the **External robot** list, select the robot or robots that may access this location.

In the deck image, highlights appear at additional deck locations to be blocked. The Bravo robot cannot access blocked locations while the external robot is accessing the target location. The software proposes the most conservative layout for avoiding potential collisions.
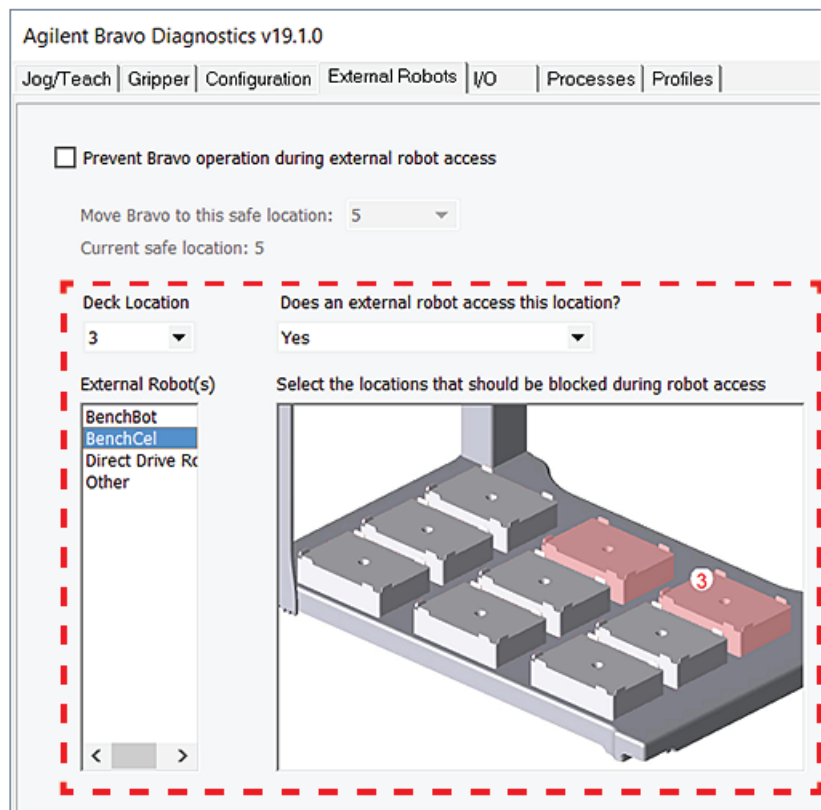
Note: The software makes assumptions about the approach direction and robot gripper orientation when proposing blocked locations. For example, the software assumes a portrait orientation and an approach from the side of the deck for external robot access at deck locations 1, 3, 4, and 6. For locations 7 and 9, the software proposes blocked locations for either a side approach and portrait orientation or a front approach and landscape orientation.

d Verify that the proposed blocked locations in the deck image are appropriate. To block or to clear a blocked location, click the location in the deck image.

If you are certain that the external robot's approach path will not intersect with the Bravo head at the given deck location, you can unblock proposed locations to optimize the layout.

5 Repeat step 4 for other deck locations that may be accessed by external robots.

6 In the **Profiles** tab, click **Update this profile**.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Related information

For information about...	See...
Profiles	"Creating and managing profiles" on page 28
Editing teachpoints	"Setting teachpoints" on page 37
Opening diagnostics	"Opening Bravo Diagnostics" on page 26

3 Preparing for a protocol run

Before you start a protocol run, you should check the Bravo Platform teachpoints and the protocol to ensure optimum operation.

This chapter contains the following topics:

Workflow for preparing a protocol run

The workflow for preparing a protocol run is as follows:

Step	For this task...	See...
1	Review how to operate safely and how to stop in an emergency.	• *G5562A, G5563A Bravo Platform Safety and Installation Guide* • "Emergency stops" on page 62
2	Plan for the protocol run.	"Planning for the protocol run" on page 63
3	Perform a dry run.	"About performing mock or test runs" on page 64

Emergency stops

When to use the emergency stop procedure

Use this procedure to:

• Abort a head movement immediately

• Abort a run in an emergency situation

If the emergency-stop button is pressed while the head is aspirating or dispensing, the pipetting accuracy might be impaired. To pause and then continue a run, use the Pause button in the VWorks software.

Procedures

To stop the head motion in an emergency:

1 Press the red button on the emergency-stop pendant. The Bravo motion stops.
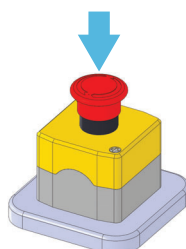
2 Turn the red button on the emergency-stop pendant clockwise to release it.
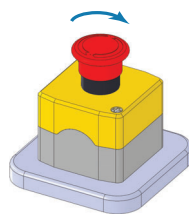
3 In the VWorks message box, click one of the action buttons to re-enable the motors in the head.

If you want to…	Then click…
Abort the command or task	Abort
Attempt re-execution of the command or task	Retry
Ignore the current command or task and proceed to the next command or task	Ignore

Related information

For information about…	See…
Pausing and continuing a run	*VWorks Automation Control User Guide*
Safety hazards	• *Automation Solutions Products General Safety Guide* • Safety and installation guide for your model Bravo Platform, for example, *G5562A, G5563A Bravo Platform Safety and Installation Guide*
Reporting problems	"Reporting problems" on page 91

Planning for the protocol run

Reviewing the protocol

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

• The correct liquid-handling head is installed.

  To avoid variability problems, use only Agilent Technologies brand tips.

• The accessories and labware required for the protocol are where they should be positioned.

• The reservoirs that must be filled.

• The waste bins or bottles that should be emptied.

Related information

For information about...	See...
Creating or revising protocols	*VWorks Automation Control User Guide*
Performing dry runs	"About performing mock or test runs" on page 64

About performing mock or test runs

What is a mock run?

A dry run uses empty labware and a mock run uses water-filled labware. A dry or mock run allows you to troubleshoot a protocol or a component of the system without wasting valuable reagents and samples. You should always perform a dry or mock run to check a new protocol.

Correcting teachpoint errors

After setting the teachpoints, be sure to perform a dry or mock run as a final check for any teachpoint errors.

Preparing for a dry or mock run

You prepare for a dry or mock run the same way you would prepare for a real protocol run, except that you use empty labware for a totally dry run or labware containing water for a mock run.

See "Planning for the protocol run" on page 63.

Related information

For information about...	See...
Stopping the device in an emergency	"Emergency stops" on page 62
Writing protocols	*VWorks Automation Control User Guide*
Preparing for a run	"Workflow for preparing a protocol run" on page 62

Maintenance and troubleshooting

This chapter tells you how to keep your Bravo Platform in good working order through cleaning, inspection, and maintenance. It also explains what to do when you encounter a problem.

This chapter contains the following topics:

CAUTION	Improper use of the Direct Profile Edit utility by untrained personnel can yield unexpected results and potentially result in damage to the Bravo platform. Only trained Agilent representatives may use the Direct Profile Edit utility. For details on utility, Agilent field service should refer to the device service guide.

Routine maintenance and cleaning

About this topic

This topic provides guidelines for cleaning and periodic routine maintenance.

Agilent recommends that you schedule an annual preventative maintenance. Preventive maintenance is an important part of keeping the Bravo Platform running smoothly and error free. To schedule the annual preventive maintenance service, contact Agilent Technical Support.

WARNING **To prevent potential injury, always shut down the Bravo Platform before performing any maintenance procedure.**

Cleaning up spills and periodic cleaning

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

CAUTION **Alcohol and alcohol-based solutions can damage the gripper pads. Use a soft cloth dampened with water to clean the gripper pads.**

Use a clean soft cloth to clean up spills on any part of the device immediately after a protocol run.

Clean the Bravo Platform weekly or as needed. Use standard laboratory wipes and a mild detergent or isopropyl alcohol to clean the exterior painted white surfaces and the metal surfaces of dust, grime, chemical deposits, and other debris.

Also see "Cleaning up after a run" on page 68.

Routine inspection and maintenance

IMPORTANT Your inspection and maintenance schedule might vary depending on the frequency of use.

Inspection or maintenance task	Schedule	Symptoms
Inspect the Bravo Platform for wear.	Monthly	Corrosion and loose screws and bolts
		To resolve these issues, contact Agilent Technical Support.
Inspect moving parts to ensure they are not rubbing against each other.	Monthly	Rub marks or noises that might indicate rubbing
		To resolve these issues, contact Agilent Technical Support.

Inspection or maintenance task	Schedule	Symptoms
Verify teachpoint accuracy for each deck location. Reset the teachpoints as required.	Every 6 months, or sooner	Any of the following: • Issues when pressing on or removing pipette tips • Tips that appear off-center in the wells, or inaccurate pipetting at specific deck locations • Improper labware placement by the gripper *Note:* Issues other than teachpoint accuracy can also cause these symptoms. For details, see "Troubleshooting hardware problems" on page 84.
Pump Module. If applicable, inspect the tubing. Change out the tubing as necessary. For instructions on routing the tubing, see the *Pump Module User Guide*.	Monthly	Tube deterioration, or liquid fails to pump or fails to drain properly
Weigh Station. If applicable, verify that the configured empty and full weights are still valid. See "Setting up a Weigh Station" on page 194 for instructions on how to configure the Weigh Station.	Bimonthly	Deterioration of liquid-level accuracy in reservoir

Related information

For information about...	See...
Cleaning between protocol runs	"Cleaning up after a run" on page 68
Cleaning the Bravo Platform	"Routine maintenance and cleaning" on page 66
Setting teachpoints	"Setting teachpoints" on page 37
Reporting a problem	"Reporting problems" on page 91

Cleaning up after a run

About this topic

This topic describes the post-run tasks you perform after a protocol run before running the next protocol.

Cleaning up after a run

To clean up the device after a run:

1 Ensure the tips are clean or fresh.

2 If a message appears and asks whether to release all racks, click **Yes**.

3 Remove used sample plates from the locations.

4 Ensure all Bravo head movement has stopped, and then remove any manually placed labware, and clean up any spills or debris.

5 Wash the liquid reservoirs and wash trays.

6 If the system has a Pump Module:

    a (Optional) Wash the tubing and reinstall the reservoirs or wash trays. Ensure that the tubing is connected to the correct pumps.

    b Fill the fluid reservoir bottle, replace the cap, and attach the fluid line that pumps towards the Bravo Platform to the cap connector.

    c Empty the waste container, replace the cap, and attach the fluid line that pumps away from the Bravo Platform to the cap connector.

    d To prime the fluid lines between the pump and reservoirs, use Diagnostics to fill the lines with the appropriate fluid.

7 Check the run log file for errors. For details on the run log, see the *VWorks Automation Control User Guide*.

8 (Weigh Station only) Recalibrate the Weigh Station if:

• Moving the reservoir, wash station, and Weigh Station

• Changing the tubing connected to the reservoir or wash station

• Changing the liquid type used in the reservoir or wash station

• More than two weeks have elapsed since the last Weigh Station calibration

Related information

For information about...	See...
Running logs, saving protocols, or using the Log toolbar	*VWorks Automation Control User Guide*
Running a task	"Performing a task using Bravo Diagnostics" on page 105
Shutting down	"Starting up and shutting down" on page 19

Changing the Bravo head

About this topic

This topic describes how to uninstall and install a liquid-handling head, other than the Bravo 96AM Head, and how to adjust the corresponding settings in the VWorks software.

Before you start

WARNING	*AssayMAP Bravo Platform only*. **To prevent potential injury from exposure to chemical spills, ensure that you empty the syringes before uninstalling the Bravo 96AM Head. For instructions, see the** *AssayMAP Bravo Platform Getting Started Guide*.
WARNING	**Put on gloves to protect your hands from potential exposure to any residual contaminants.**
CAUTION	**Always turn off the Bravo Platform before installing or uninstalling a liquid-handling head. Failure to do so can damage the head electronics.**
IMPORTANT	If a head is being used for the first time, make sure you have a profile specifically for that head. If necessary, create a new profile before starting the following procedure. For details, see "Creating and managing profiles" on page 28.
	If disposable tips are loaded on the currently installed head, use Diagnostics to dispense any liquid and remove the tips before removing the head. For instructions, see "Performing a task using Bravo Diagnostics" on page 105.
	Make sure that the head mount is in its home position above deck location 5. If necessary, click the Jog/Teach tab in Diagnostics, and then click Home XYZ to reposition the head mount.
IMPORTANT	If you are changing the currently installed head for the same type of head and want to edit the profile, you may use the Change head wizard. Otherwise, use the following procedure.

Uninstalling the liquid-handling head

To uninstall the liquid-handling head:

1   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 status lights (front) and power switch (right side)
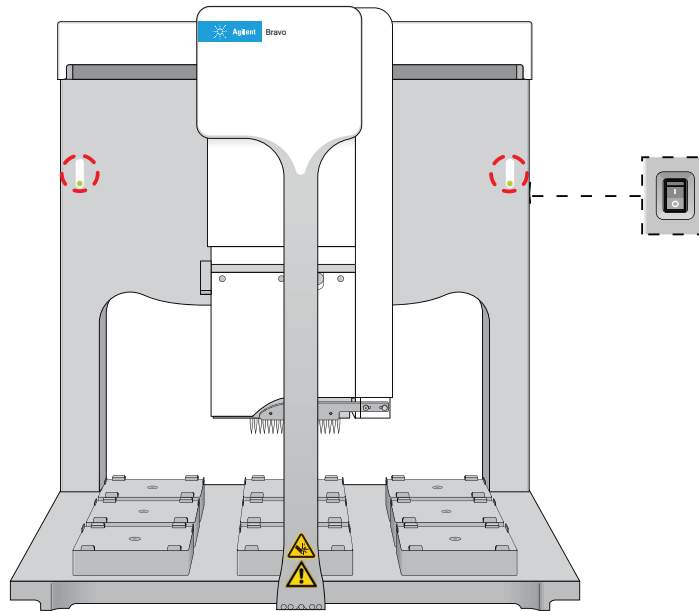
2 Make sure that the head mount is at its home position above deck location 5, as shown in the preceding figure.

If necessary, manually move the head to the center of the deck.

3 To unlock the mounted head, refer to the following figure:

a Pull out and twist the (**1**) two head-retainer pins one-quarter turn (90°) so that they remain retracted.

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

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

Figure Installed Bravo head: (1) retainer pin and (2) head lock
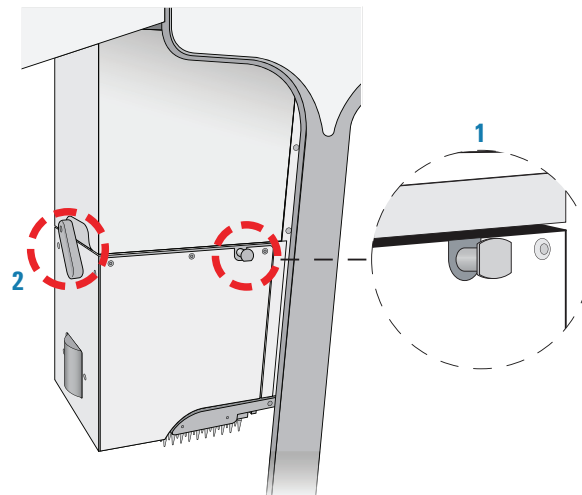
4 Reaching from the left side of the Bravo tie bar, grasp the head firmly as the following figure shows:

a With your left hand firmly grip the left side of the head.

b Place your right hand under the flat area just to the left of the barrel or syringe array to support the weight of the head.
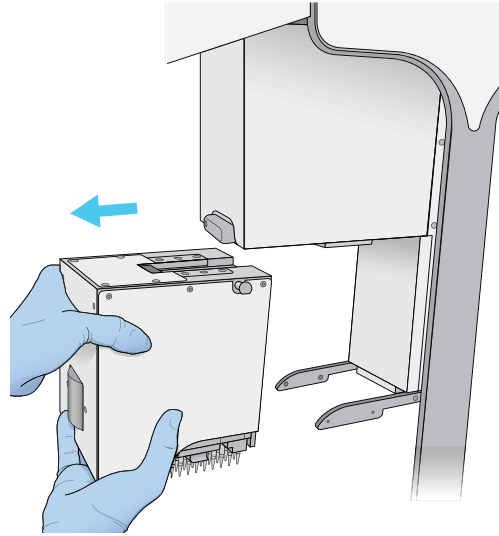
5 While supporting the head with your hands, slide the head to the left and out of the Bravo head mount.

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

6 Carefully place the head into the storage stand to protect the barrels, probes, as follows:

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

  Figure Series III disposable-tip head and storage stand
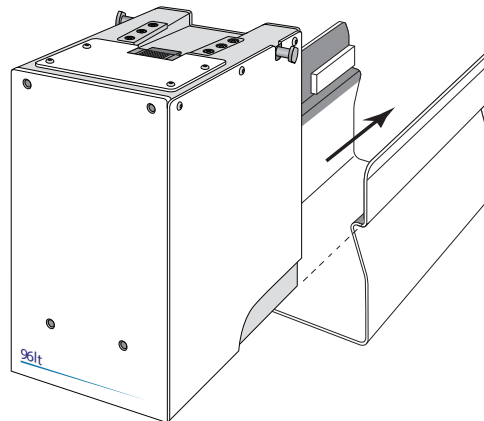
- *Pin Tools*. Rest the top of the head on a clean, dry surface with the pins facing up. Slide the stand onto the head

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

Installing the liquid-handling head

To install a Bravo liquid-handling head:

1   Make sure that the Bravo Platform is turned off and that the Bravo head mount is in its home position, which is centered above deck location 5.

Note: If the device is off, you can use your hands to move the head mount gently into position.

Figure   Bravo deck locations (top view)
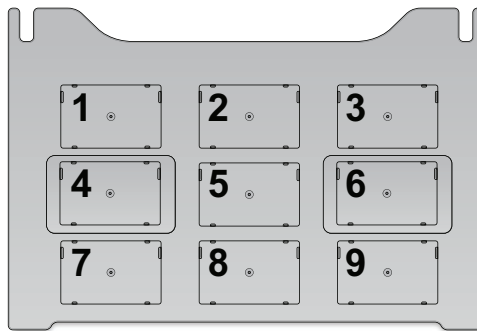
2   While the head remains seated in the stand, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

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.**

3   Remove the head from the stand as follows:

- *Disposable-tip heads.* Rest the bottom of the stand on a clean, dry surface. Slide the head out of the stand as the following figure shows, so that the barrels are facing down.
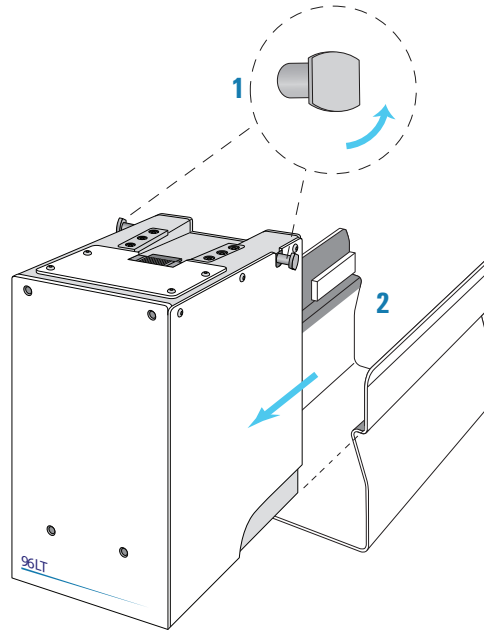
- *Pin Tools.* Ensure that the top of the head is resting on a clean, stable surface so that the pins are facing up. Slide the stand off of the head.

4   With your left hand, firmly grip the left side of the head. Place your right hand under the flat area just to the left of the array to support the weight of the head.

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

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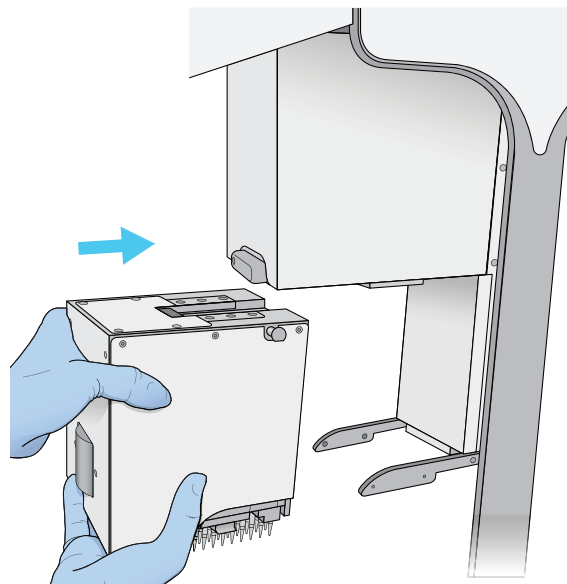
Note: If you do not hear the pins snap into place, check that the straight edges of the retainer pins are in the vertical position, as the following figure shows. Attempt to rotate the pins to ensure that they are in the locked position. The pins should not rotate freely.

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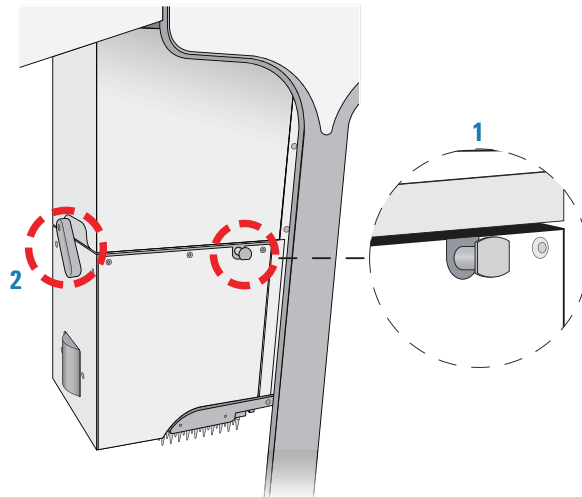
6 To lock the head, rotate the head lock clockwise until it reaches its hard stop. This ensures that the head is fully seated and does not shift position during operation.
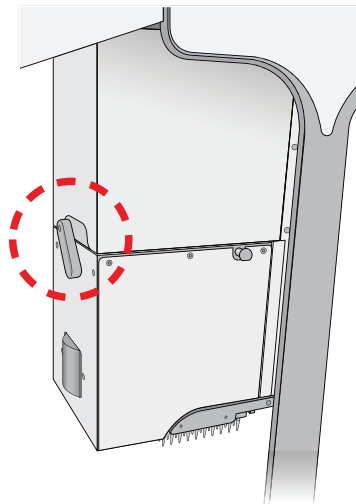
> **CAUTION**   Dropping the head or bumping the barrels or probes will damage the head. If the Bravo head is not properly secured in place, it could drop unexpectedly. Ensure that the head is securely locked into the head mount.

Adjusting VWorks settings

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

To adjust the VWorks settings for a different Bravo head:

1 In the VWorks window, ensure the correct device file is open for this Bravo device, and then ensure that the profile selected under **Bravo Properties** is correct.

IMPORTANT   If this is the first time to use this Bravo head with this device, you must create a profile for the new Bravo head.

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

3   To initialize the Bravo Platform, click **Initialize selected devices** in the device file.
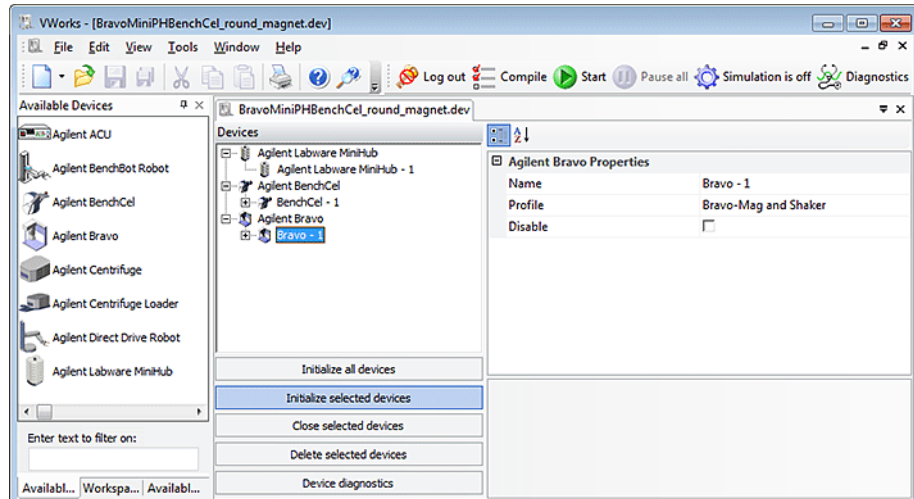
4   Open Diagnostics, and in the **Jog/Teach** tab, make sure that a value is displayed for each axis.

This confirms communication between the Bravo Platform and VWorks software.

5   If you opened an existing device file in , go to the **Configuration** tab in Diagnostics and verify that the location configuration graphic matches what you actually have on the Bravo deck.

Related information

For information about...	See...
Tips Off task in Bravo Diagnostics	"Performing a task using Bravo Diagnostics" on page 105
Initializing the Bravo Platform	"Initializing the device" on page 34
Homing the Bravo head	"Homing the liquid-handling head" on page 94
Available Bravo heads	"Liquid-handling heads" on page 11
Changing the profile	"Creating and managing profiles" on page 28

Testing the safety equipment

The Bravo interlock circuit must be closed for the Bravo Platform to operate. The Light Curtain and the pendant are connected to the Bravo interlock circuit. Use the following procedure to verify that the Bravo motion stops abruptly when you press the emergency-stop button on the pendant or interrupt the Light Curtain.

Before you start

Ensure that you have an appropriate Bravo profile.

Procedure

To test the pendant and Light Curtain:

1 In **Bravo Diagnostics**, initialize the profile.

2 Use the diagnostics controls to command the Bravo head to move from one deck location to another, as follows:

    a In the **Jog/Teach** tab, select a deck location from the **Location** box.

    b Verify that the **Approach height above teachpoint** value is set to a safe height, such as **50**, to provide clearance for any obstacles on the deck.

    c Click **Approach**.
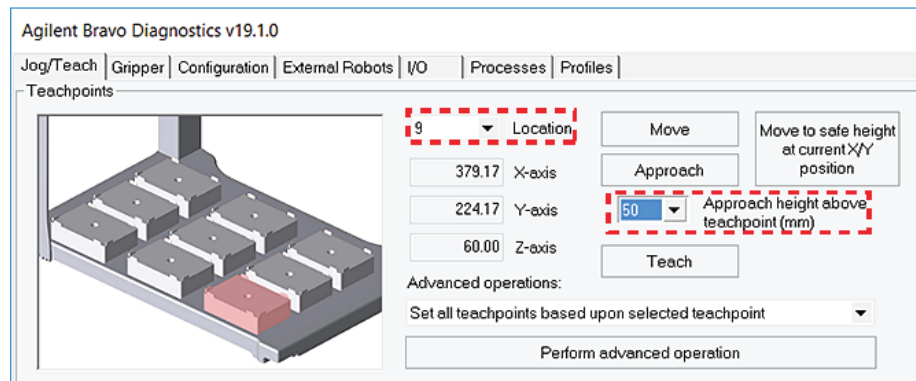
3 While the Bravo head is in motion, press the red button on the pendant, and ensure that the Bravo head stops moving.
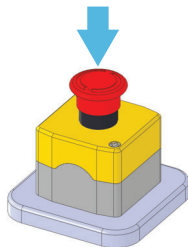
4 To reactivate the pendant, turn the red button clockwise. The spring-loaded button pops up.
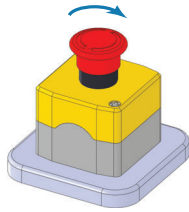
5   Repeat step 2.

6   While the Bravo is in motion, interrupt the Light Curtain and ensure that the Bravo head stops moving.

Related information

For information about...	See...
Initializing the Bravo Platform	"Initializing the device" on page 34
Tips Off task in Bravo Diagnostics	"Performing a task using Bravo Diagnostics" on page 105
Bravo safety equipment	Safety and installation guide for your model Bravo Platform, for example, *G5562A, G5563A Bravo Platform Safety and Installation Guide*

Replacing the fuse

About this topic

This topic describes how to replace the main fuse in the Bravo Platform.

Before you start

CAUTION	**A blown fuse can indicate more serious problems. If the new fuse blows after replacement, contact Agilent Technical Support.**

CAUTION	**Using an incorrect fuse can damage the Bravo Platform. Ensure that you have the correct fuse for the device.**

For fuse specifications, see the corresponding safety and installation guide for your Bravo model:

- *G5562A, G5563A Bravo Platform Safety and Installation Guide*
- Earlier model Bravo Platform: *Bravo Automated Liquid Handling Platform Safety and Installation Guide*

You can order fuses from Agilent Technologies.

Procedure

To replace the fuse in the power switch:

1   Shut down the Bravo Platform, and unplug the power cable from the rear panel connector.

2   At the rear panel power switch enclosure, use a small flat-head screwdriver (2.5 mm) to pry open the tab on the fuse enclosure and open the enclosure cover.
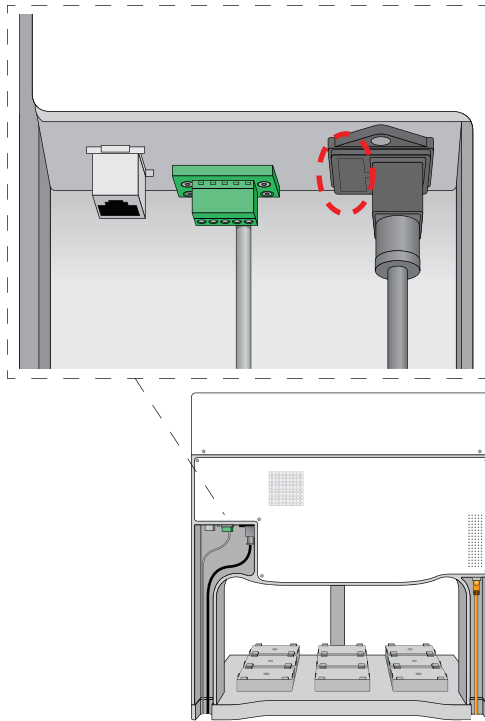
3   Insert the screwdriver head in the enclosure notch to dislodge the fuse cartridge. Slide the fuse cartridge all the way out of the enclosure.

4   Replace the fuse in the cartridge.

5   Slide the fuse cartridge back into the fuse enclosure.

6   Press the enclosure cover securely into the closed position.

7   Plug in the power cable at the rear panel connector, and then start up the Bravo Platform.

Related information

For information about...	See...
Hardware components	"Hardware overview" on page 5
Safety guidelines	• *Automation Solutions Products General Safety Guide*
	• *G5562A, G5563A Bravo Platform Safety and Installation Guide*
How to report a problem	"Reporting problems" on page 91

Retracting tip box stripper pins

About this topic

This topic describes how to retract and release the tip box stripper pins on a disposable-tip pipette head. Read this topic if you are using the pipette head to pipette in single rows.

Tip box stripper pins described

The disposable-tip pipette heads have four stripper pins that prevent the tip box from raising off the deck when tips are being applied.

However, you can retract the stripper pins to perform a task where the pins will interfere. For example, if you are using a 96ST pipette head in a 384-tip box, retracting the stripper pins can help prevent tips from touching other tips during a tips-on task.

Figure   Pipette head components

Front

Back

Retainer pin

Pipette barrel
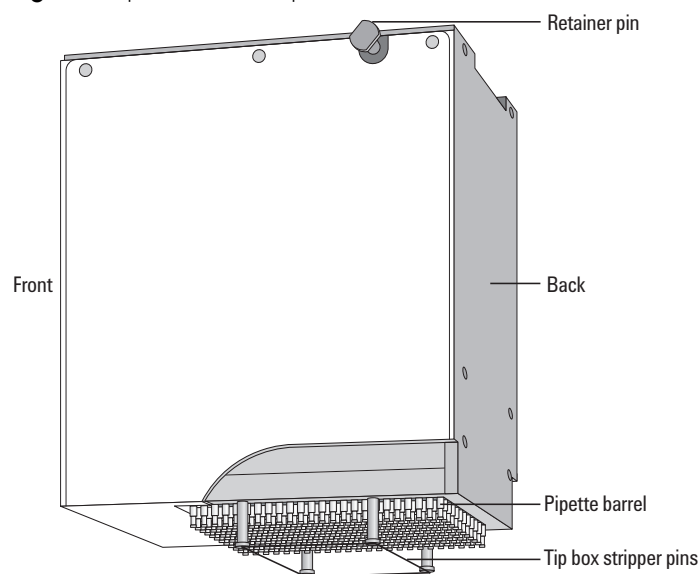
Tip box stripper pins

The pins are spring-loaded and should retract until the pin head is nearly flush with the surface of the pipette head. The tip of each pin, which is hidden within the pipette head housing, has a semi-circle-shaped locking mechanism that aligns with a dowel inside the pipette head to lock the pin in the retracted position.

Retracting tip box stripper pins

CAUTION   **If you apply too much force when pressing down or rotating the pin to retract it, the locking mechanism at the tip of the pin can bend or break. A damaged pin cannot lock in the retracted position. Use only gentle pressure to push down and rotate the pin to lock it into place.**

To retract the tip box stripper pins:

1   Place the pipette head upside down on a stable surface, so that the barrels are facing up and the front of the pipette head is facing you as the following figure shows.

   If directional arrows appear on the pins, gently rotate the pins so that the arrows are facing you.
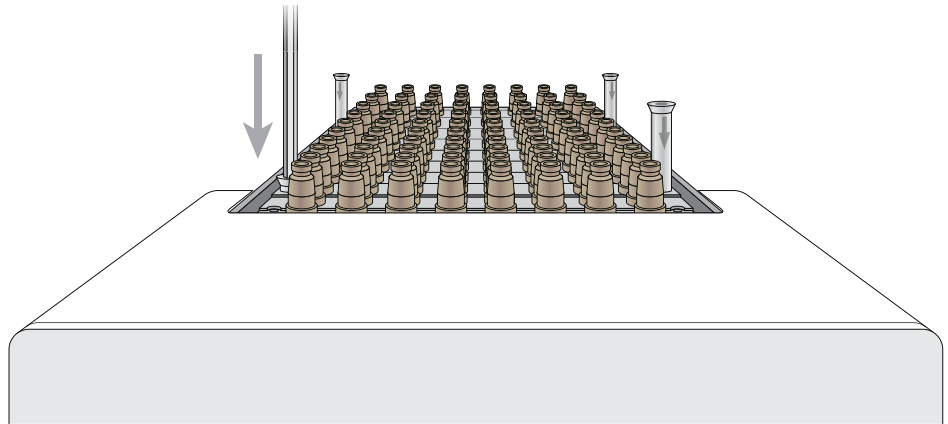
2   Insert the end of a 2-mm hex wrench into the head of one of the pins, and very gently push the pin down into the pipette head until you feel the pin stop.

   Verify that the pin is properly seated, as the preceding figure shows. If the pin has an arrow, the square end of the arrow should disappear or be barely visible.

IMPORTANT   If the pin hits a stop before it retracts completely, the pin locking mechanism is above instead of below the locking dowel. While removing any downward pressure on the pin head, gently rotate the pin in quarter-turn increments until you feel the pin drop into the seated position.

3   When the pin is properly seated, rotate it counterclockwise no more than 180° until it locks.

4   Repeat this procedure for the other pins.

Releasing tip box stripper pins

To release the retracted tip box stripper pins:

1   Insert a 2-mm hex wrench into the pin head.

2   Turn the wrench clockwise to release the pin.

3   Repeat this procedure for the other pins.

Related information

For information about...	See...
Using the serial dilution task	*VWorks Automation Control User Guide*
Setting the head mode to pipette by row	• *VWorks Automation Control User Guide* • "Performing a task using Bravo Diagnostics" on page 105
Removing and installing a liquid-handling head	"Changing the Bravo head" on page 69

Manually moving the head or gripper

About this topic

This topic describes how to disable the axis servo motors, so that you can move the head manually. For example, you might want to move the head position when changing liquid-handling heads or cleaning the Bravo Platform.

CAUTION   Moving the Bravo head or gripper in any of its axes without first disabling the servo motors can damage the device.

Manually moving the head in the x-axis and y-axis

To move the head manually in the x-axis and y-axis:

1   Disable the motors in one of the following ways:

•   Press the emergency-stop button on the pendant.

•   In Bravo **Diagnostics**, click **Disable all motors** on the **Jog/Teach** tab.

2   Use your hands to gently move the head along the *x-axis* and *y*-axis.

IMPORTANT   The *z*-axis brake engages when the *z*-axis is disabled, preventing you from moving the head manually in the *z*-axis.

3   After you complete the manual moves, re-enable the motors in one of the following ways:

•   If the emergency-stop is engaged, release the red button on the pendant by turning it clockwise.

•   If the motors are disabled, click **Enable all motors** in the **Jog/Teach** tab of Bravo **Diagnostics**.

Manually opening the gripper

If you perform an emergency stop while the gripper is holding labware, you can use the following procedure to open the gripper manually.

IMPORTANT The Zg-brake engages when the *Zg*-axis is disabled, preventing you from moving the gripper assembly manually in the *Zg*-axis.

To open the gripper manually:

1 Disable the *G*-axis motor in one of the following ways:

- Press the emergency-stop button on the pendant.
- In Bravo **Diagnostics**, click the **Gripper** tab. In the **G-Axis** area, click **Enable motor** to disable the motor. Ensure that the **Motor enable** light is off.

2 On the rear-facing surface of the gripper assembly, locate the access hole for the *G*-axis lead screw.

IMPORTANT The lower gripper must be extended in the *Zg*-axis to expose the access hole.

3 While ensuring that one hand is free to support the labware held by the gripper, use a 2.5-mm flat-blade screwdriver to turn the *G*-axis lead screw counterclockwise to open the gripper and release the labware.
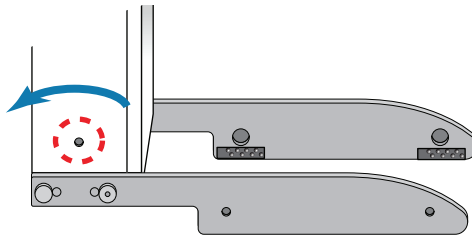
4 To re-enable the motors, do one of the following:

- If the emergency-stop is engaged, release the red button on the pendant by turning it clockwise.
- In Bravo **Diagnostics**, click the **Gripper** tab. In the **G-Axis** area, click **Enable motor** to re-enable the motor. Ensure that the green **Motor enable** light is on.

Related information

For information about...	See...
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

For information about...	See...
Moving the Bravo head using Diagnostics	• "Homing the liquid-handling head" on page 94 • "Jogging the liquid-handling head" on page 96 • "Using the Move and Approach commands" on page 99

Recovering from a head collision

About this topic

Occasionally, the Bravo head might collide with an accessory or labware on a deck location because the accessory or labware has been misplaced or mistaught.

This topic describes what to do after a head collision has occurred.

Before you start

Before you start the inspection of the Bravo Platform, clean up any spills that might have occurred as a result of the collision.

Inspecting for signs of damage

To inspect the Bravo Platform:

1   Inspect the impacted parts for visible signs of damage.

Look carefully for any subtle signs of damage.

2   If contact was made to the pipette barrel or tip:

   a   Compare the impacted region to the surrounding barrels or tips.

   Dented barrels can affect tip sealing.

   b   Replace damaged tips or barrels if disposable.

3   If contact was made with a:

   a   Standard platepad, make sure the alignment tabs did not become damaged and still allow plates to be easily picked or placed.

   b   Alignment Station, make sure the rollers and springs are not damaged and still allow plates to be easily picked and placed.

   c   Other deck locations, make sure the alignment tabs are not damaged and still allow plates to be easily picked and placed.

Make sure the specific functionality of the deck location is not compromised. If the operation is hindered, contact Agilent Technical Support. Be ready to describe how the collision occurred.

Verifying components are still working

To verify system components are still working:

1   Jog each axis back and forth and listen for any new noise.

    If new noises are present or if any axis movement is impaired, contact Agilent Technical Support.

2   Make sure the Bravo Platform alignment was not compromised:

    a   If the liquid-handling head was impacted side-to-side, re-install the head.

    b   Attach the correct pipette tip type.

    c   Move to the location you taught (typically location 5).

    d   Check the alignment of the *x*- and *y*-axes.

    If the *x*- or *y*-axis are not aligned, contact Agilent Technical Support.

    Misalignment could be the result of a shift in the *x* or *y* screw in their mounts. Re-homing would reset the teach positions correctly but the mounts would still need to be retightened.

3   If the contact occurred in the vertical direction:

    a   Attach the correct tip type

    b   Move to location 8.

    c   Check the alignment of the *z*-axis.

    If the *z-axis* is out of alignment, contact Agilent Technical Support.

    The tie bar may need adjustment to align the *y* arm to be parallel with the deck.

Related information

For information about...	See...
Removing and installing a liquid-handling head	"Changing the Bravo head" on page 69
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
How to report a problem	"Reporting problems" on page 91

Troubleshooting hardware problems

About this topic

This topic lists some potential hardware problems that you might encounter when using the Bravo Platform. If you encounter a problem, locate the problem under one of the following categories, and try the recommended solution to resolve the problem.

If you cannot resolve the problem or do not find the problem listed in this topic, see "Reporting problems" on page 91.

For error messages, see "Troubleshooting hardware-related error messages" on page 89.

Communication or power problems

Problem	Potential cause	Solution
The Bravo Platform does not turn on.	The device electrical requirements are not met	Ensure that the site meets all the electrical requirements for the Bravo Platform. See the *G5562A, G5563A Bravo Platform Safety and Installation Guide*.
	The device is not connected to the power source, or the power cord is damaged.	Ensure that you are using the Agilent-supplied country-specific power cord and plug. Inspect the power cord and connections, and ensure that the device is connected to the power source.
	The AC inlet fuse is bad.	See "Replacing the fuse" on page 77. If the fuse blows immediately after replacement, stop using the device and contact Agilent Technical Support.
The Bravo Platform cannot be initialized.	The communications cable is not properly connected, or the wrong cable is being used.	Check the Ethernet cable connections. If necessary, power cycle the device and then try initializing again.
	The Bravo profile is not configured correctly for the device or the IP address setting is incorrect.	In the software, ensure that the device is configured correctly. See "Creating and managing profiles" on page 28. If necessary, power cycle the device and then try initializing again.

Bravo gripper problems

Problem	Potential cause	Solution
The gripper holds the labware loosely, does not keep it level, or drops the labware while moving between locations.	The labware definition has errors.	Verify that the labware definition is correct. See the *VWorks Automation Control Setup Guide*.
	The gripper pads (black rubber) on the interior side of each gripper finger are dirty, worn, or partially out of alignment.	Gently clean the gripper pads using a soft cloth dampened with water. Inspect the gripper pads for wear and ensure they are aligned. If necessary, contact Agilent Technical Support to replace the gripper pads.
	The gripper fingers are bent or misaligned.	Perform a visual inspection to ensure the gripper fingers are aligned and are not bent. If necessary, contact Agilent Technical Support.
The robot attempts to grip too high or low on the labware.	If this problem occurs at all Bravo locations, the Bravo gripper range in the labware definition requires adjustment.	Verify that the labware definition is correct. See the *VWorks Automation Control Setup Guide*.
	If the problem is specific to a particular Bravo location, the location might require a teachpoint adjustment.	Verify that the location teachpoint is correct. See "Setting teachpoints" on page 37.
The labware does not sit level within the platepad.	An obstruction is preventing proper seating of the labware.	Verify that the setscrews in the platepad tabs are recessed and not protruding into the plate nest. A protruding setscrew will prevent proper seating of the labware.
The gripper cannot pick or place labware at a location.	The labware does not match the specified labware definition, or the labware might be damaged or deformed.	Verify that the correct labware is on the deck, in good condition, and corresponds to the selected labware definition.
	The location requires a gripper teachpoint adjustment.	See "Setting teachpoints" on page 37.
The head or gripper movement is rough or strained, or rubbing or scraping noises are audible during moves.	The Bravo Platform might require service.	Contact Agilent Technical Support.

Pipetting or teachpoint problems

Problem	Potential cause	Solution
The Bravo head fails to put tips on.	The tips are damaged or deformed.	Repeat the operation using a fresh box of good tips.
	The labware definition for the tip box is incorrect.	Verify that the correct tip box is in the correct location and that the labware definition is correct.
	The deck location teachpoint is incorrect for the installed liquid-handling head. An Alignment Station might be required for Tips On operations.	See "Setting teachpoints" on page 37. **IMPORTANT** Pressing pipette tips on the head requires a high degree of precision in the positioning of the head relative to the tip box, especially for 384-well tip boxes. The Alignment Station provides greater tip-loading precision than a platepad.
The tip box raises off the platepad during Tips On operations.	The tip box stripper pins on the liquid-handling head are retracted.	Release the tip box stripper pins on the liquid-handling head. See "Retracting tip box stripper pins" on page 79.
Tips Off operations are not successful.	*Stacked tips on a barrel*. Static electricity is causing the tip to cling to the barrel during Tips Off operations, and then a second tip is pressed on during Tips On operations.	To resolve Tips Off problems caused by static electricity, select the **Enable tips-off tip-touch** option in the profile.
	Dropped tips. Static electricity is causing tips to cling to the barrels during Tips Off operations. As the Bravo head moves, these tips drop on top of a tip box or on the deck.	To resolve Tips Off problems caused by static electricity, select the **Enable tips-off tip-touch** option in the profile.
Tips are askew in the tip box or not returned to their designated well locations after Tips Off operations.	The tip box on the deck does not match the labware definition specified in the protocol.	Verify that the correct tip box is in the correct location.
	The tip box location requires a teachpoint adjustment.	See "Setting teachpoints" on page 37.
The pipetting accuracy is inconsistent or poor.	The bias table in the liquid class requires adjustment for your pipetting device.	See the Calibrating the pipettor topic in the *VWorks Automation Control Setup Guide*.
	The liquid-handling head might have damaged barrels or require an O-ring replacement.	Contact Agilent Technical Support.
Liquid fails to pump into or drain from an autofilling reservoir.	The Pump Module tubing has deteriorated or is not connected properly.	Inspect the tubing and the connections, and replace, if necessary.

Problem	Potential cause	Solution
The liquid in the wash trays or reservoirs is overflowing causing flooding.	The tubing is kinked or the Weigh Station might require recalibration.	Inspect the tubing. If necessary, recalibrate the Weigh Station.

Related information

For information about...	See...
Laboratory requirements and safety guidelines	*G5562A, G5563A Bravo Platform Safety and Installation Guide*
Stopping in an emergency	"Emergency stops" on page 62
Reporting a problem	"Reporting problems" on page 91

Troubleshooting hardware-related error messages

About this topic

This topic describes the most common error messages that might be encountered with the Bravo Platform and provides some possible solutions.

Troubleshooting table

Error message/problem	Cause	Recommended actions
The **Verify that it is safe to home the W-axis** message appears during initialization.	The **Prompt user to home W-axis on first initialization** option is selected in the profile.	If you are certain that no liquid is in the pipette tips, click **Retry** to continue homing the *w*-axis For a description of the profile options, see "Miscellaneous area" on page 229.
The **There appears to be a plate present** error message appears during initialization.	The **Ignore plate sensor during pick and place** option is not selected in the profile.	If the gripper is not gripping labware, click **Ignore and Continue** to continue the homing process.
Error message related to communication problems or failure.	Communications are interrupted.	• Turn off the Bravo Platform off, and then turn it back on. • Initialize the Bravo Platform.
The Bravo Platform does not appear in the Discovered BioNet Devices dialog box. (Diagnostics > Profiles > Find available device).	Bravo Platform is not communicating with VWorks software.	***To re-establish communication:*** **1** Click **Refresh** in the Discovered BioNet Devices dialog box. **2** Turn off the Bravo Platform, and then turn it back on. **3** Click **Refresh** again. If the problem persists, try one or more of the following. • Check the Ethernet cables between the Bravo Platform and computer (and to and from hub if applicable). • On the computer (and the hub, if applicable), check that the link light next to the Ethernet cable is on and green. • In the Discovered BioNet Devices dialog box, check that the Select the Ethernet adapter... list is set appropriately. • Make sure the Ethernet firewall is turned off. If the problem persists, contact Agilent Technical Support.

Error message/problem	Cause	Recommended actions
Motor power fault error.	Problems with the Bravo servo motors	***To clear the fault:*** **1** Turn off and then turn on the power switch. **2** Initialize the device. If the problem persists, contact Agilent Technical Support.

Related information

For information about...	See...
Discovered BioNet Devices dialog box	"Creating and managing profiles" on page 28
Turning on or off the Bravo	"Starting up and shutting down" on page 19
Preparing the Bravo for a run	"Workflow for preparing a protocol run" on page 62
Hardware components	"Hardware overview" on page 5
Connecting Ethernet cables	*G5562A, G5563A Bravo Platform Safety and Installation Guide*

Reporting problems

About this topic

If you have a technical problem that you cannot resolve after reading the maintenance and troubleshooting instructions, read the information in this topic for how to report hardware, software, and user guide 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-us/contact-us/page.

Note: You can also send a software bug report from within the VWorks software.

Reporting hardware problems

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

Reporting software problems

When you contact Agilent Technical Support, make sure you provide the following:

- Short description of the problem
- Software version number
- Error message text (or screen capture of the error message dialog box)
- Screen capture of the About VWorks software dialog box
- Relevant software files

To find the VWorks software version number:
In the VWorks software, select **Help > About VWorks.**

To find the Diagnostics software version number:

1   Open Diagnostics.

2   Read the version number on the title bar of the diagnostics window.

To send compressed protocol and associated files in VZP format:
In the VWorks software, select **File > Export** to export and compress the following files:

- Protocol file
- Device file (includes the device profile and teachpoint file)
- Labware definitions
- Liquid classes
- Pipette techniques
- Hit-picking files
- Plate map files
- Barcode files

- Error library
- Log files
- Form file (*.VWForm)

Reporting user guide problems

If you find a problem with this user guide or have suggestions for improvement, send your comments using one of the following methods:

- Click the feedback button (✉) in the online help.

- Send an email to documentation.automation@agilent.com.

Related information

For information about...	See...
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
Software error messages	*VWorks Automation Control User Guide*
Stopping in an emergency	"Emergency stops" on page 62
Shutting down	"Starting up and shutting down" on page 19

5 Using diagnostics software

This chapter explains how to use Bravo Diagnostics to control the Bravo Platform. Only administrators and experienced personnel should use the procedures in this chapter to diagnose errors with the Bravo Platform.

This chapter contains the following topics:

Homing the liquid-handling head

About this topic

This topic describes when and how to home the liquid-handling head.

| **WARNING** | To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls. |

| **WARNING** | The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the emergency-stop pendant. |

About homing

The liquid-handling head has a defined home position for each axis of motion. Homing sends the head to the home position for the axes. Home the liquid-handling head to reset the axes. For example, if you notice the Bravo Platform is not moving to locations or teachpoints accurately, home the head.

Homing the liquid-handling head is typically done automatically on first initialization after startup.

There are four homing axes.

Homing in this axis …	Moves the liquid-handling head …
X	To home position in the horizontal (left-right) axis. This position is near the middle of the x-axis range.
Y	To home position for the horizontal (forward-backward) axis. This position is near the middle of the y-axis range.
Z	To home position in the vertical (up-down) axis. This position is near the top of the z-axis range.
W	Internal pipetting mechanism to its home position in the vertical aspirate-dispense axis. This position is near the low-to-mid w-axis range.

Homing the liquid-handling head

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

CAUTION Before homing an individual axis, home the z-axis first so that the head avoids potential obstacles on the deck. A collision between the head and obstacles on the deck can result in equipment damage.

To home an individual axis:

1 In Diagnostics, click the **Jog/Teach** tab.
2 Click the corresponding **Home** button for the given axis (w, x, y, or z).

To home the liquid-handling head in the x, y, and z axes:

1 In Diagnostics, click the **Jog/Teach** tab.
2 Click **Home XYZ**.

The liquid-handling head moves to the home position.

The axis order of homing is *z—> x—> y.*
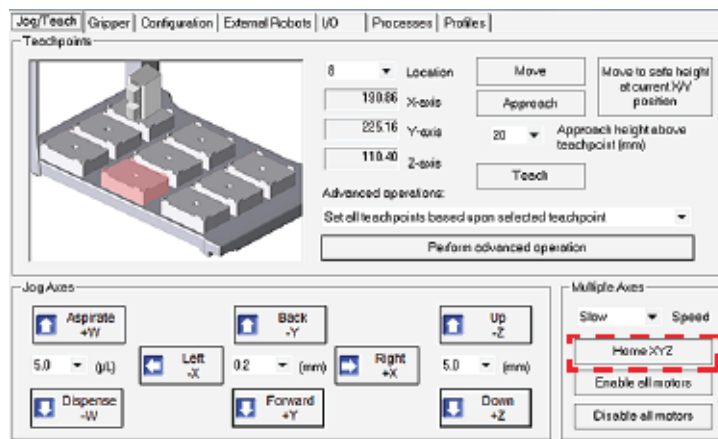
Related information

For information about...	See...
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Moving the liquid-handling head manually	"Manually moving the head or gripper" on page 81
Changing the liquid-handling head	"Changing the Bravo head" on page 69

Jogging the liquid-handling head

About this topic

Jogging the liquid-handling head moves it in small precise increments. You can jog the liquid-handling head in the *x-axis*, *y-axis*, *z-axis*, or *w*-axis.

Jogging is useful when setting teachpoints and performing maintenance activities.

WARNING	**To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

WARNING	**To perform an emergency stop, press the red button on the emergency-stop pendant.**

CAUTION	**To prevent damage to the gripper and other hardware components, do not dock the gripper if you want to jog the liquid-handling head along the y-axis and z-axis.**

Axes of motion

You can use the Jog/Teach tab controls to jog the Bravo head in the following four directions.

Axis	Description
X	The horizontal distance (left-to-right) in millimeters, along the rail from the *x*-axis home position.
Y	The horizontal distance (front-to-back), in millimeters, along the rail from the *y*-axis home position.
Z	The vertical distance, in millimeters, from the *z*-axis home position.
W	The vertical distance, in microliters, from the *w*-axis home position.

Figure   Bravo Platform primary axes of motion
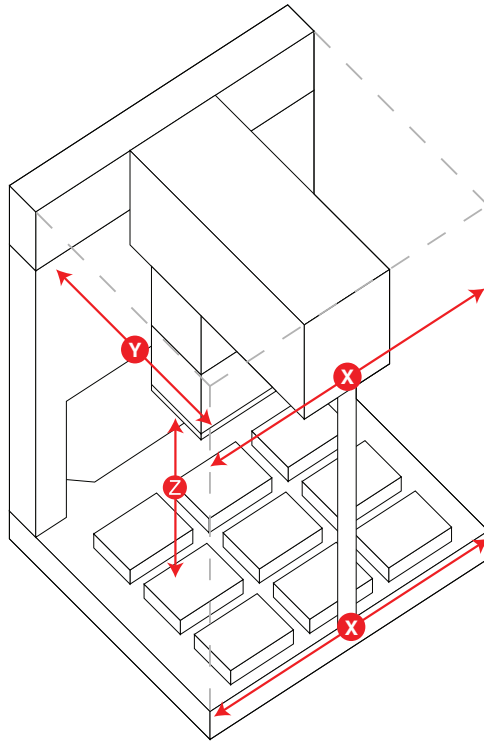
Jogging the liquid-handling head

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

CAUTION   Before you jog the liquid-handling head, remove objects from its path. Move the head slowly and keep the jog increment small until you are certain that there is no obstruction.

To jog the liquid-handling head:

1   Open Diagnostics and click the **Jog/Teach** tab.

2   In the **Jog Axes** area, select the jog increments in the appropriate list.
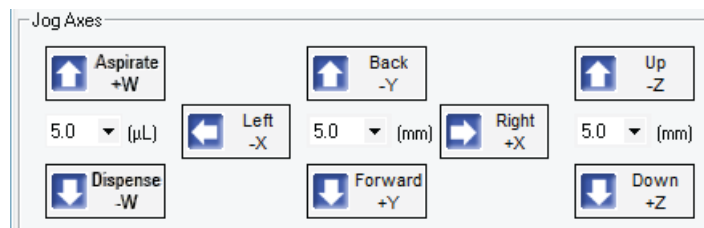
3   Click a direction button to move the head.

4 Monitor the current position of the liquid-handling head by checking the **W-Axis**, **X-Axis**, **Y-Axis**, and **Z-Axis** displays.

When the given axis is at the home position, a value of 0.00 displays.

When the liquid-handling head is not in the home position, the position is displayed as the distance from the home position for each axis.

Note: The teachpoint coordinates for the selected location are displayed under the Location list.
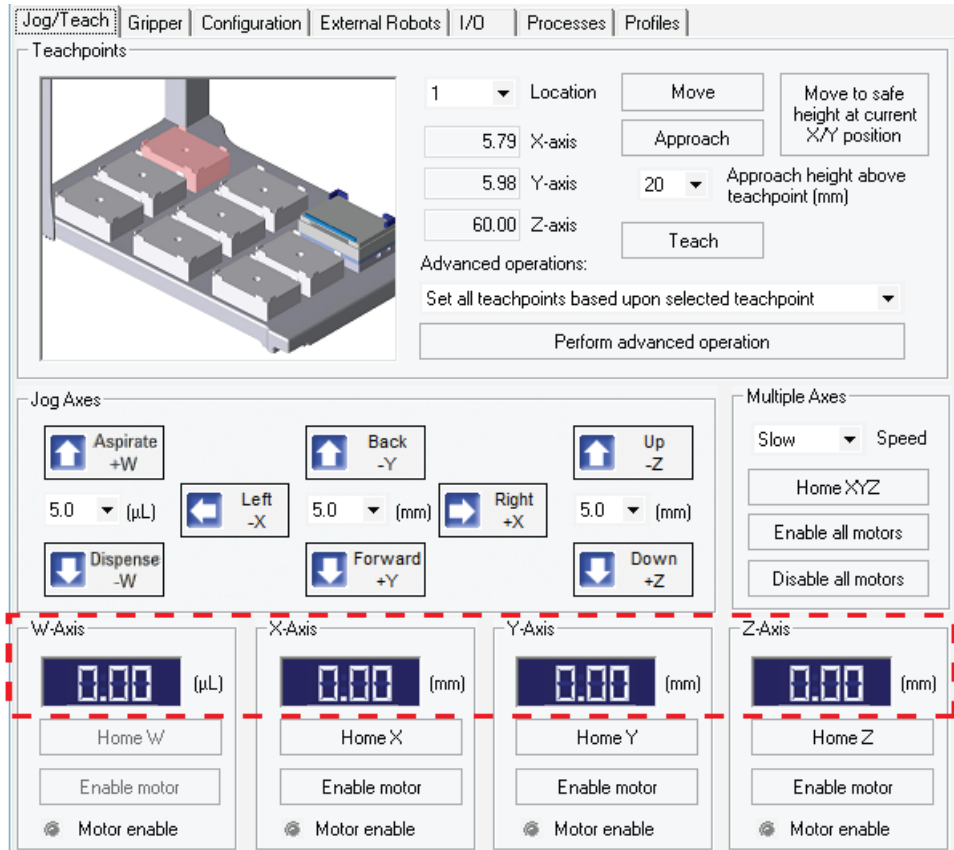
Related information

For information about...	See...
Teachpoints	"Setting teachpoints" on page 37
Opening diagnostics	"Opening Bravo Diagnostics" on page 26
Jog/Teach tab	"Jog/Teach tab quick reference" on page 220
Moving the liquid-handling head manually	"Manually moving the head or gripper" on page 81
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

Using the Move and Approach commands

About this topic

The Bravo Move and Approach commands let you quickly move the liquid-handling head to any of nine locations on the deck.

Typically, these commands are used when editing teachpoints. This topic describes how to move to and approach locations on the Bravo deck using these commands.

WARNING   **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

WARNING   **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the emergency-stop pendant.**

Commands defined

- *Move*. Instructs the liquid-handling head to move to the teachpoint for the selected location.
- *Approach*. Instructs the liquid-handling head to move to the teachpoint for the selected location, with a vertical offset equal to the value specified in the Approach height above teachpoint box.

  Note: The Approach height parameter in the profile is the height above the labware when pipetting.

Before you start

Make sure no labware is on the Bravo deck and that the liquid-handling head has been taught with the same type of tips used in the profile.

WARNING   **Before you command the Bravo head to move, make sure that everyone is clear of the Bravo Platform.**

CAUTION   **Before using the Move or Approach command, make sure the path is clear of any obstacles that you have not defined in the profile. The move-to-position commands present a higher damage risk to the liquid-handling head, because the head can move in large increments.**

Procedure

To use the Move command:

1   Open Diagnostics, and then click the **Jog/Teach** tab.

2   Select a deck location from the **Location** box.

Note: The teachpoint coordinates for the selected location are displayed under the Location list.

3 Click **Move**.

The liquid-handling head moves to the teachpoint for the selected location.

To use the Approach command:

1 Repeat step 1 and step 2 from the above procedure.

2 If necessary, change the **Approach height above teachpoint** value.

3 Click **Approach**.

The liquid-handling head moves to the selected location's approach height.

Related information

For information about...	See...
Jog/Teach tab	"Jog/Teach tab quick reference" on page 220
Using the Jog/Teach tab controls to move the head	• "Homing the liquid-handling head" on page 94 • "Jogging the liquid-handling head" on page 96
Moving the head manually	"Manually moving the head or gripper" on page 81
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing a teachpoint	"Setting teachpoints" on page 37
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

Using the gripper controls

About this topic

If your Bravo Platform has a gripper, you can use the controls in Diagnostics to move the gripper and troubleshoot problems.

See "Verifying the gripper setup" on page 44 for instructions on how to:

- Test the gripper pick-and-place function
- Adjust the *y*-axis offset

This topic describes how to use the controls in the Gripper tab in Diagnostics to do the following:

- "Jogging the gripper" on page 101
- "Opening and closing the gripper" on page 102
- "Changing the gripper speed" on page 102
- "Homing the gripper" on page 103
- "Docking the gripper" on page 103
- "Disabling and enabling the gripper motors" on page 103

Using the Move and Approach commands

The gripper Move and Approach commands are used when verifying teachpoints. In the Gripper Teaching area:

- Click **Move** to quickly move the liquid-handling head to a teachpoint above a selected deck location and lower the gripper to the surface of the platepad.
- Select the **Approach height (mm)**, and then click **Approach** to lower the gripper to the approach (offset) height. The offset height is the distance above the teachpoint.

Jogging the gripper

You can use the controls in the Gripper tab to jog the gripper in the Zg and the G axes of motion.
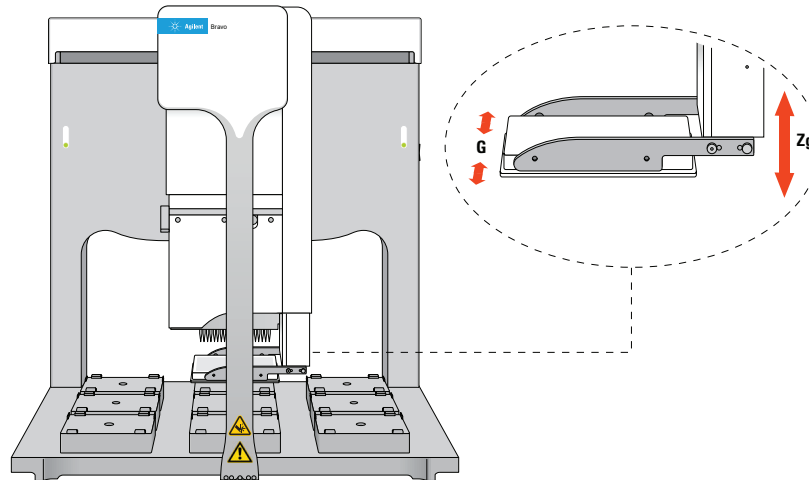
To jog the gripper:

1   In the **Jog Gripper Axes** area, specify the distance (mm) to jog.

2   Click the direction button to move the gripper.

3   In the **Zg-Axis** and **G-Axis** areas, check the new distance from the home position.
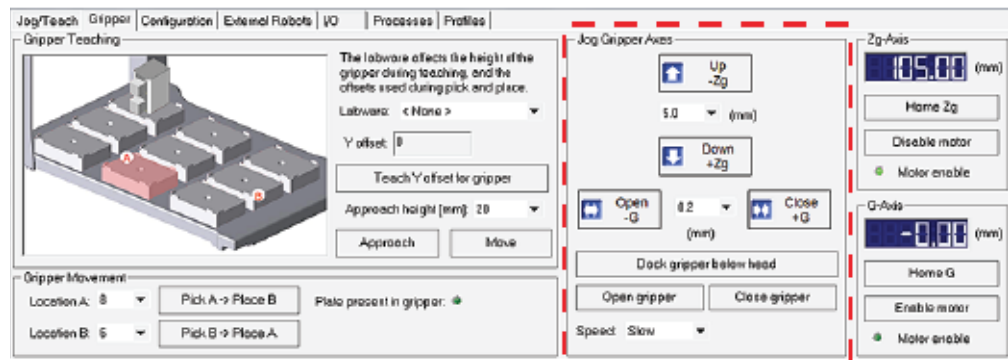
Opening and closing the gripper

To verify that the gripper is able to open and close properly, in the **Jog Gripper Axes** area, click **Open gripper** and **Close gripper.** Watch the gripper movement as you do so.

Changing the gripper speed

Under normal operating conditions, you do not need to change the gripper speed. However, for troubleshooting purposes, you might want to change the speed when you check other gripper functions.

To set the gripper speed:

In the **Jog Gripper Axes** area, select the desired speed (Slow, Medium, or Fast) in the **Speed** list.

Note: The speed setting applies only for Diagnostics and does not apply to the closing grip action.

Homing the gripper

The gripper has a defined home position for each axis of its motion. Homing sends the gripper to the home position of the axes.

Homing the gripper is done automatically during startup. However, you might want to home the gripper during troubleshooting processes.

To home the gripper:

In the **Zg-Axis** or **G-Axis** areas, click **Home Zg** or **Home G.** The gripper moves to the predefined position on the corresponding axis.
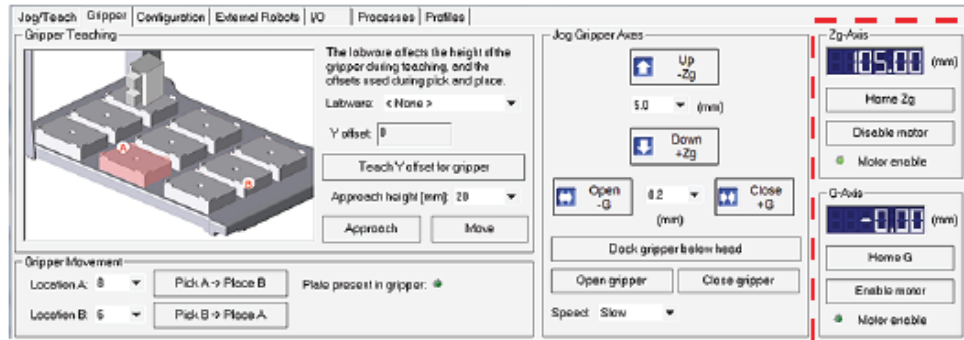
Docking the gripper

During troubleshooting or verification procedures, you might want to dock the gripper.

To dock the gripper:

In the **Jog Gripper Axes** area, click **Dock gripper below head.** The gripper moves upward and rests in the recess under the liquid-handling head.

Disabling and enabling the gripper motors

When you disable the Zg-axis (vertical direction) or the G-axis (opening-closing direction) motor, the motor remains disabled until a command is issued to enable the gripper motor.

To disable the gripper motors:

In the **Zg-Axis** or **G-Axis** area, click **Disable motor**. The corresponding Motor enable light goes out.
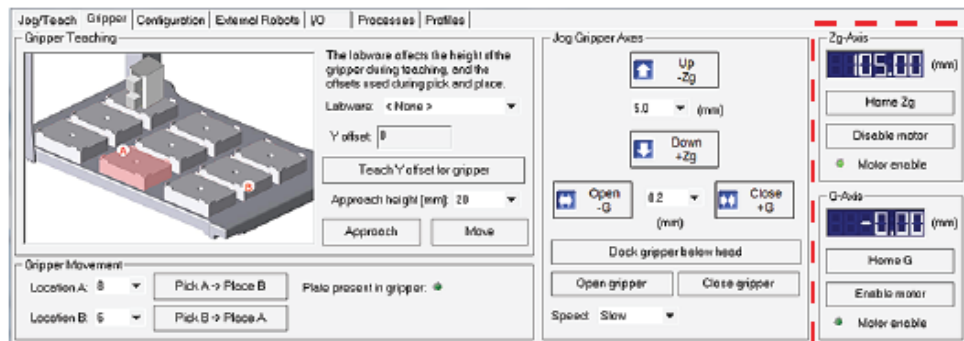
To enable the gripper motors:

In the **Zg-Axis** or **G-Axis** area, click **Enable motor**. The corresponding Motor enable light turns bright green.

Related information

For information about...	See...
Gripper tab quick reference	"Gripper tab quick reference" on page 225
Using the Jog/Teach tab controls to move the liquid-handling head	• "Homing the liquid-handling head" on page 94 • "Jogging the liquid-handling head" on page 96
Moving the liquid-handling head manually	"Manually moving the head or gripper" on page 81
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26

Performing a task using Bravo Diagnostics

About this topic

You can use Bravo Diagnostics to perform tasks, such as Tips On, Aspirate, Mix, and Dispense. Performing these tasks in Bravo Diagnostics can be useful for development and troubleshooting purposes.

WARNING **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the emergency-stop pendant.**

Before you start

Do the following:

- Initialize the profile in Bravo Diagnostics, and then click the **Processes** tab.
- Verify that the correct labware is positioned on the Bravo deck.
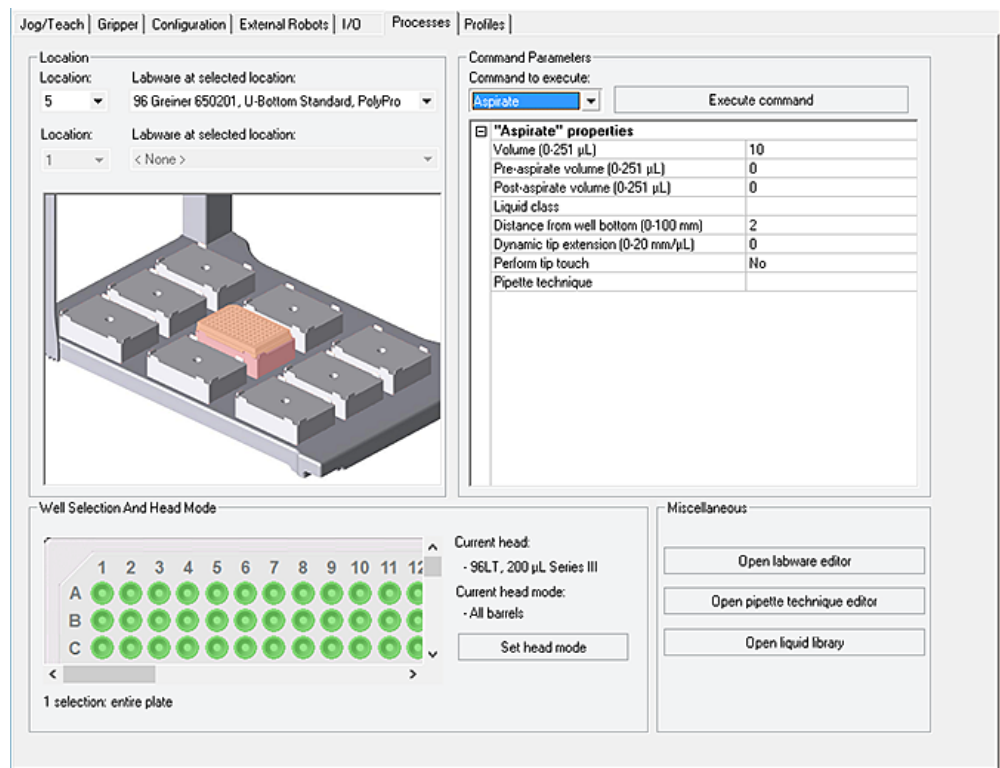
Procedure

Performing a task requires that you:

- Choose a location
- Select a task and task parameters
- Select labware

To perform a task:

1 Select a location. You can do one of the following:

- Click the location in the graphical display.
- Select from the **Location** list.

2 Select the labware from the **Labware at selected location** list.

3 If the task involves two locations, repeat step 1 and step 2.

For example, if you select the Assemble Vacuum task for a Vacuum Filtration Station, you could have a collection plate at Location 1 and a filter plate at Location 2.

4 *Series III disposable-tip heads and Bravo 96AM Heads only*. To use one row or column of channels instead of all channels in the head:

a Click **Set head mode**.

b In the **Head Mode Selector** dialog box, select the barrels, and then click **OK**.
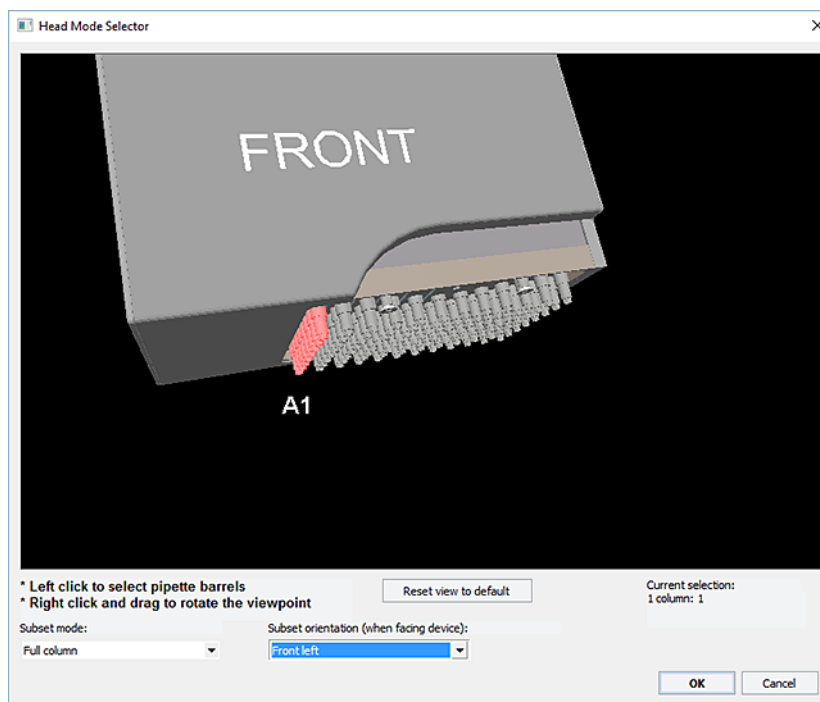
Note: If you select a single row on a disposable-tip head, make sure you retract the head stripper pins.

5 If you are using the head in serial mode or the head has fewer tips than the plate has wells, select the quadrant or quadrants in the **Well Selection and Head Mode** area.

Click a representative well in the plate graphic to select the corresponding quadrant of wells. The selection message appears below the plate graphic.

6   In the **Command Parameters** area:

a   Select the process from the **Command to execute** list.

b   Set the parameter values for the command.

Command to execute	Parameter description
Aspirate	"Aspirate task parameters" on page 236
Assemble Vacuum Disassemble Vacuum	"Vacuum Filtration Station task parameters" on page 250
Dispense	"Dispense task parameters" on page 239
Dispense to Waste	"Dispense to Waste task parameters" on page 241
Mix	"Mix task parameters" on page 244
Pump Reagent	"Pump Reagent parameters" on page 247
Shake	"Shake task parameters" on page 248
Tips On Tips Off	No parameter settings
Move and Filter Plate	"Vacuum Filtration Station task parameters" on page 250
Wash Tips	"Wash Tips task parameters" on page 253
Pin Tool	"Pin Tool task parameters" on page 257

Note: Other commands may be available depending on the installed accessories. For a complete description of task parameters, see the liquid-handling task descriptions in the *VWorks Automation Control User Guide*.

c   To start the process, click **Execute command**.

To stop a process before completion, click **Stop motors** to stop the movement of the Bravo head. To re-enable the motors, click **Enable all motors** on the **Jog/ Teach** tab.

Alternatively, you may click the emergency-stop button on the pendant to stop the diagnostic process.

Related information

For information about...	See...
Bravo task parameters	"Processes tab quick reference" on page 232
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

A Accessories and platepads

This chapter describes the accessories platepads that can be used with the Bravo Platform and provides the installation and removal procedures.

This chapter contains the following topics:

For details on how to set up accessories on the AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

Agilent

Bravo accessories overview

Description

You can add accessories to the Bravo Platform to enhance existing functions and facilitate operation. The accessories and platepads include:

Accessory	Description	See…
Alignment Station	Positions 1536-well microplates for precise pipetting and ST tip boxes for precise tips-on operations. The Alignment Station can also be used for 384-well microplates.	"Installing and configuring a platepad or Alignment Station" on page 147
Autofilling accessories	Consists of the following: • Pump Module • Auto Filling Reservoir, Tip Wash Station, or Open Wash Tray • Weigh Station (optional)	"Autofilling accessories" on page 187.
Barcode Reader	Consists of a platepad with a barcode reader and a mirror that can be installed in place of a platepad at any deck location.	"Setting up the Barcode Reader" on page 197
Lid hotel (delidding option in Diagnostics)	Enables you to configure a platepad in the software to accept a lid in a delidding process. You use Diagnostics to configure this option.	"Configuring a platepad for delidding" on page 144
Filter Plate Holder	Provides a location for a filter plate while awaiting assembly of the Vacuum Filtration Station and when disassembling the station.	"Setting up a Trash or Filter Plate Holder accessory" on page 139
Heating Shaking Station (Teleshake 95)	Provides heating and fluid mixing across a microplate. The station uses the Inheco Single TEC Control (STC) or Multi TEC Control (MTC).	"Installing a Heating Shaking Station" on page 168
Light Curtain	Pauses or stops the operation if the operator reaches into the Bravo Platform during a run.	*G5562A, G5563A Bravo Platform Safety and Installation Guide*
Magnetic Bead Accessory	Designed to separate smaller volumes (up to 350 µL).	"Installing and configuring a Magnetic Bead Accessory" on page 154

Accessory	Description	See…
Manual Fill Reservoir	Supplies reagents to 96- and 384-tip heads. This reservoir requires manual refilling and emptying.	"Using the Manual Fill Reservoir" on page 161
Peltier Thermal Station (CPAC Ultraflat)	Uses Peltier technology to provide temperature control uniformly across a microplate. The station uses the Inheco Single TEC Control (STC) or Multi TEC Control (MTC).	"Installing and configuring the Peltier Thermal Station" on page 178
Plate Pad Offset (option in Diagnostics)	Configures a height offset at a platepad.	"Configuring a height offset for a platepad" on page 150
Nested Rack Insert	Provides stability for a stack of nested tip boxes to ensure precision during a tips-on process.	"Installing and setting up a Nested Rack Insert" on page 158
Orbital Shaking Station	Mixes labware contents using a shaking motion.	"Installing and setting up an Orbital Shaking Station" on page 112
SRT platepad for 250-µL tip boxes	Enables tips on and tips off tasks using the 250-µL tip box on the shorter SRT Bravo Platform.	"(Bravo SRT only) Setting up an LT tip box location" on page 184
Thermal Station (chiller)	Uses a fluid-filled thermal block to provide temperature control uniformly across a microplate.	"Setting up the Thermal Station (cooling pad)" on page 162
Trash location	Installs in a deck location 4 or 6 cutout to provide through-deck access to a trash container underneath the deck.	"Setting up a Trash or Filter Plate Holder accessory" on page 139
Vacuum Filtration Station	Uses vacuum to filter the contents of a microplate.	"Installing and setting up a Vacuum Filtration Station" on page 119

Related information

For information about…	See…
Pipette heads	"Liquid-handling heads" on page 11
AssayMAP Bravo Platform accessories	*AssayMAP Bravo Platform Installation Guide*
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*

For information about…	See…
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing and setting up an Orbital Shaking Station

Description

The Orbital Shaking Station is a microplate shaker that can be installed at any deck location on top of a short adapter pad instead of a platepad. The Orbital Shaking Station has the option of using its own control module, or an Inheco Single TEC controller (STC) or Multi TEC controller (MTC). For a full description of the Orbital Shaking Station, see the manufacturer's documentation.

Figure Orbital Shaking Station with its own control module and an adapter pad
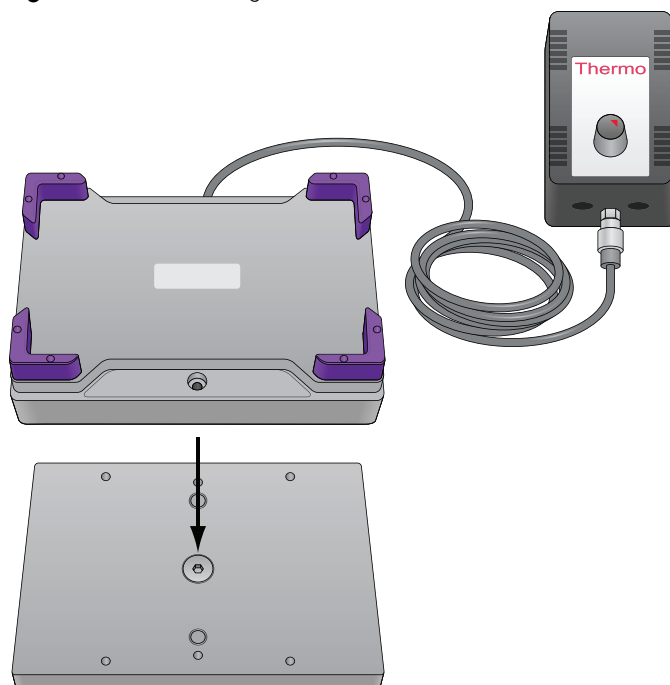
Setup workflow

Step	Procedure	See…
1	Install the Orbital Shaking Station.	"Installing the Orbital Shaking Station" on page 113
2	Configure the station in Diagnostics.	"Configuring the Orbital Shaking Station in Bravo Diagnostics" on page 116

Step	Procedure	See…
3	Test the station operation.	"Testing the Orbital Shaking Station" on page 117
4	Edit the teachpoint using the pipettor teach plate. Be sure to consider the 10-mm thickness of the teach plate when you edit the teachpoint.	"Adjusting the teachpoint using a teach plate" on page 118

Installing the Orbital Shaking Station

Before you start

Make sure you have the following:

- Orbital Shaking Station with adapter pad and attachment screws

- Hex wrenches: M2, M4, and M5

If the Orbital Shaking Station does not have its own control module, make sure that you have an Inheco Single TEC controller (STC) or Multi TEC controller (MTC).

WARNING   **To prevent a potential injury, turn off the Bravo Platform before you install or remove the accessory.**

Ensure that you remove the platepad from the deck location where you plan to install the Orbital Shaking Station.

To install the Orbital Shaking Station:

1 Position the adapter pad at the target deck location aligning the dowel pins with the corresponding holes in the deck.

Make sure the adapter pad sits level on the deck.

2 Insert the M6 x 12-mm flathead screw into the center of the adapter pad and tighten the screw.
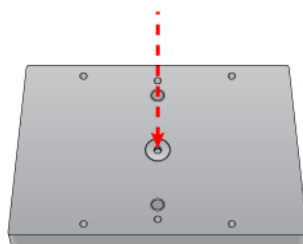
3 Place the Orbital Shaking Station atop the adapter pad so that the cable is towards the back of the Bravo deck.

Make sure the station is completely centered on top of the adapter and sits level.

4 Insert the two M3 x 18-mm socket-head cap screws into the holes at the front and back end of the adapter pad and use a 2.5-mm hex driver to tighten the screws.

Tighten screws evenly to ensure the feet on the bottom of the Orbital Shaking Station are pressed evenly into the adapter pad and the pad remains level.

Note: The feet of the Orbital Shaking Station are compressible, and these screws do not reach a hard stop as a result.
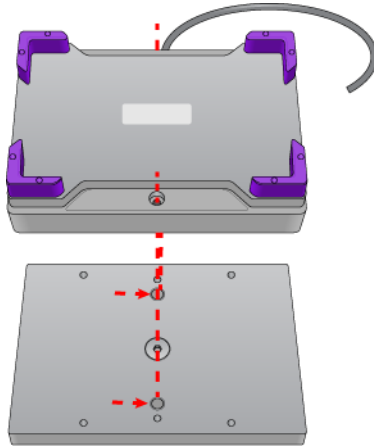
CAUTION	The Orbital Shaking Station can shift slightly when tightening. Ensure that the sides of the Orbital Shaking Station are parallel to the sides of the adapter plate. If the Orbital Shaking Station is rotated, it could cause the Bravo gripper to collide with the accessory.

Connecting the Orbital Shaking Station

Connecting a station that uses the STC or MTC Controller

To connect a station that uses the Inheco STC or MTC Controller:

1   Connect the cable from the station to the Controller.

2   Connect the STC or MTC Controller to the computer using the provided USB cable.

Connecting a station that has its own control module

If the station that has its own control module, you connect the serial cable from the speed control (on the power cord) to the serial port on the Bravo computer, as described in the following procedure.

To connect an Orbital Shaking Station that has its own control module:

1   Route the Orbital Shaking Station cable off the deck and connect it to the control module that contains the power plug. See following figure, item **1**.

2   Connect the serial cable with the red stripe to the leftmost port on the control module (figure, item **2**). Connect the other end of the cable to the serial port, if available, on the controlling computer.

IMPORTANT   Connecting the Orbital Shaking Station to a serial port on the computer provides more reliable communication than using a USB-to-serial adapter. If a serial port is not available, use a USB-to-serial adpater.

3   On the control module, ensure that the knob is turned fully counterclockwise so that the red arrow (**3**) is pointing to the RS-232 setting.

4   Connect the power cable (**4**) from the control module to an AC outlet with a grounded circuit.

5   Turn on and test the Orbital Shaking Station as follows:

a   On the control module, turn the knob clockwise to the maximum position, and verify that the Orbital Shaking Station vibrates.

b   Slowly, turn the knob back counterclockwise to the minimum position until the station stops vibrating but is not fully off.

6   Place a sample microplate on the Orbital Shaking Station. Verify that the microplate fits within the four corner tabs but has no extra space.

If necessary, use the supplied hex driver to adjust the fit of the four corner tabs for your microplate.

Note: Before the accessory is ready for use, you will verify the deck configuration in the corresponding Bravo profile and set the teachpoint for the accessory location.

Uninstalling the Orbital Shaking Station

To uninstall the station:

1   Disconnect the Orbital Shaking Station power cord from the AC outlet.

2   Disconnect the control module serial cable from the Bravo computer.

3   Using the M2 hex wrench, remove the two socket-head screws in the Orbital Shaking Station.

4   Remove the Orbital Shaking Station from the adapter pad.

5   Using the M5 hex wrench, remove the screw in the center of the adapter pad, and then remove the adapter pad.

Next steps:

1 Install a platepad or accessory at this deck location.

2 In Diagnostics, select the appropriate profile, and then click the **Configuration** tab and reconfigure this location.

3 Adjust the teachpoint of the location.

Configuring the Orbital Shaking Station in Bravo Diagnostics

To configure the Orbital Shaking Station:

1 In Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2 In the **Configuration** tab, select the **Location** of the Orbital Shaking Station.
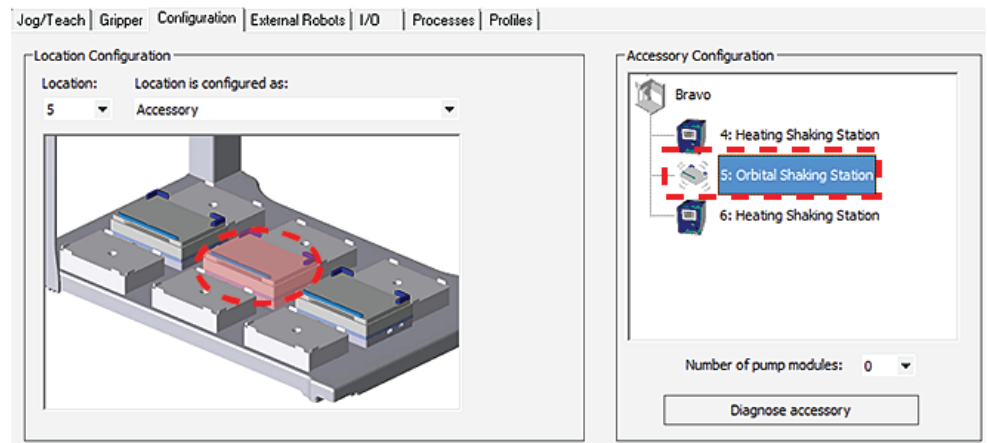
3 Under **Location is configured as**, select **Accessory**. The Bravo Accessories Wizard opens.

4 Follow the instructions in the **Accessories Wizard** to:

a Verify the **Location** of the installed Orbital Shaking Station.

b Choose the **Orbital Shaking Station** accessory.

c Select the controlling computer **Serial Port** that connects to the Orbital Shaking Station.

Note: The Serial Port parameter is automatically defined when a USB-to-serial adapter is connected to the computer. You might need to look up the port number assigned to this device in the Microsoft Windows Device Manager.

Note: Occasionally, a port number is reassigned for a USB-to-serial connection if you disconnect and reconnect the accessory. If this happens, you must verify that the correct Serial Port is set in each profile.

d Select the **Module number** that indicates the position of the Orbital Shaking Station you are configuring.

For example, select 1 if the station is connected directly to the controlling computer. Select 2 for a station that is connected to the first station, and so on.

5 Click **Finish**.

6 When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height. You must set the teachpoint after completing this procedure.

7 In the **Profiles** tab, click **Update this profile**.

8   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Test the station operation using the following procedure, and then verify and adjust the teachpoint for the accessory location. See "Adjusting the teachpoint using a teach plate" on page 118.

Testing the Orbital Shaking Station

Ensure that the profile is initialized in Bravo Diagnostics before you perform the following procedure.

To test the Orbital Shaking Station:

1   In the **Accessory Configuration** area, click the Orbital Shaking Station icon, and then click **Diagnose accessory**. The Bravo Accessory Diagnostics dialog box opens.
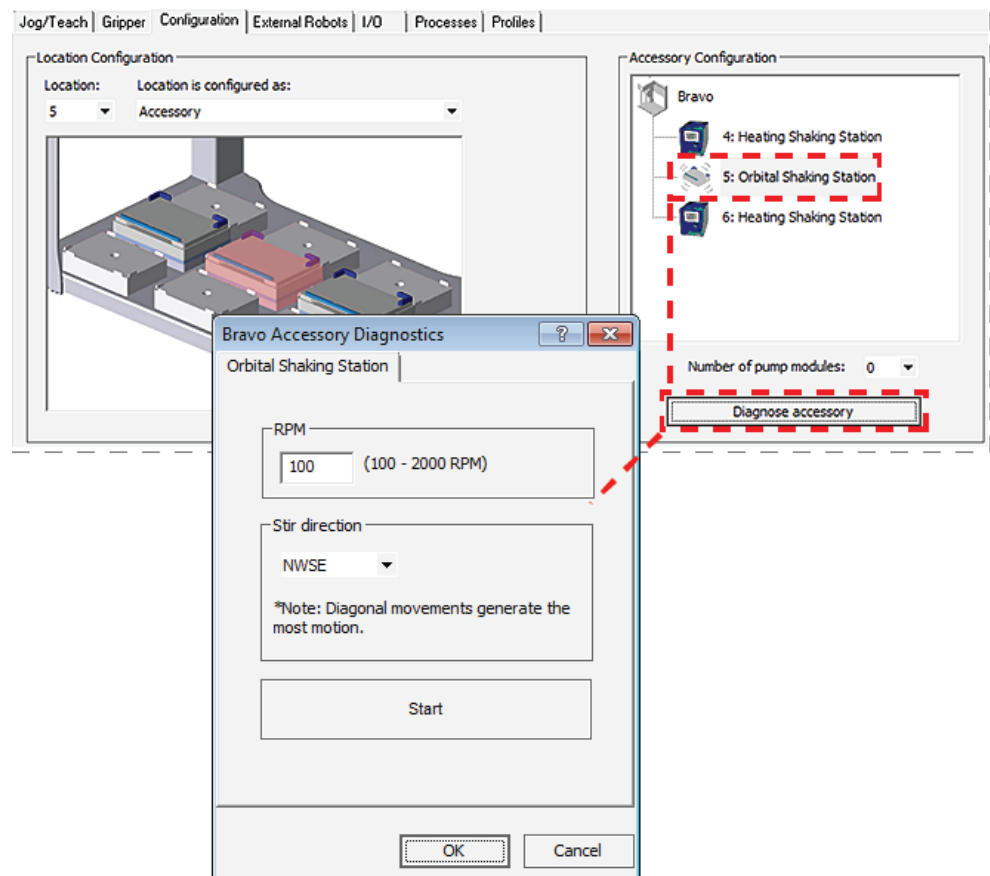
2   Type the **RPM**, select the **Stir direction**, and then click **Start**.

3   At the Orbital Shaking Station on the deck, verify that the accessory operates correctly.

4   In the Bravo **Accessory Diagnostics** dialog box, click **Stop**, and then click **OK**.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Adjusting the teachpoint	"Using the teach plate to set the teachpoint for an accessory" on page 118
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Using the teach plate to set the teachpoint for an accessory

About this topic

The teach plate is a 10 mm thick metal plate that fits in the plate nest of an accessory, such as the Orbital Shaking Station. The teach plate has a crosshairs in one corner, as the following figure shows. You use the teach plate to set the pipettor teachpoint for an accessory that does not have a crosshairs for alignment.

Figure   Teach plate
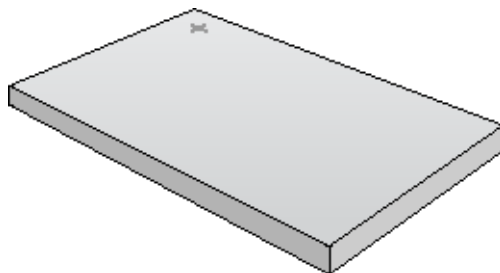
Adjusting the teachpoint using a teach plate

IMPORTANT   When editing the teachpoint for the accessory, you must account for the teach plate height before setting the teachpoint.

To set a teachpoint using the teach plate:

1   Place the teach plate on the accessory installed at the given deck location.

2   In Diagnostics, click the **Jog/Teach** tab.

3   In the **Location** list, select the deck location of the accessory.

4   In the **Jog/Teach** tab, use the controls to jog the head so that the A1 pipette tip is in the correct position (directly over the crosshairs with paper-thin clearance). For details, see "Setting the first teachpoint" on page 39.

5   Jog the head up in the *z*-axis so that you have enough room to remove the teach plate. Remove the teach plate.

6   In the **Jog/Teach** tab, use the controls to jog the head down in the *z*-axis until there is paper-thin clearance between the end of the tip and the station's top surface.

7   Click **Teach** to set the teachpoint.

8   In the **Profiles** tab, click **Update this profile**.

9   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Related information

For information about...	See...
Hardware components	"Hardware overview" on page 5
Editing teachpoints	"Setting teachpoints" on page 37
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Installing and setting up a Vacuum Filtration Station

About this topic

This topic describes how to set up the Vacuum Filtration Station on the Bravo Platform. This topic contains the following information:

- "Before you start" on page 119
- "Component descriptions and options" on page 120
- "Supported stacking configurations" on page 122
- "Installing the station" on page 123
- "Connecting to house vacuum with the pinch-valve module" on page 125
- "Connecting and configuring the Agilent VARIO Vacuum Pump" on page 129
- "Uninstalling the Vacuum Filtration Station" on page 132
- "Configuring the Vacuum Filtration Station in Bravo Diagnostics" on page 133
- "Testing the Vacuum Filtration Station" on page 135

Before you start

The Vacuum Filtration Station may be installed on a standard Bravo Platform and is compatible with the Series III disposable-tip heads only. Agilent Technologies recommends installing the station on a short platepad (SRT platepad). The Vacuum Filtration Station is not supported on the SRT Bravo Platform.

The following table presents the workflow for setting up and automating the assembly and disassembly processes for the Vacuum Filtration Station.

Step	For this task...	See...
1	Determine which components of the Vacuum Filtration Station are required for your labware.	• "Component descriptions and options" on page 120 • "Supported stacking configurations" on page 122 • Vacuum Filtration Station Labware Compatibility Matrix
2	Install the Vacuum Filtration Station.	"Installing the station" on page 123
3	In Diagnostics, configure the Vacuum Filtration Station in the device profile.	"Configuring the Vacuum Filtration Station in Bravo Diagnostics" on page 133
4	In the VWorks Labware Editor, ensure that the labware definitions are correct for the filter and collection plates that will be placed on the Vacuum Filtration Station during a protocol run. Set the microplate parameters and the Bravo gripper offset for the labware.	*VWorks Automation Control Setup Guide*
5	In the VWorks software, add one or more pairs of the vacuum assembly and disassembly tasks in the protocol.	*VWorks Automation Control User Guide*

Component descriptions and options

The Vacuum Filtration Station applies vacuum to filter the contents of microplates placed on the station. The station consists of a collar and a manifold base that can be assembled and disassembled automatically. The following figure shows the primary components.

Figure Vacuum Filtration Station components: A collar options, B base and optional inserts

Item	Name.	Description
1	Collar with blue gasket and clear gasket frame support	The top of the vacuum manifold, which can be placed in different stacking configurations, as described in the following section.
		The collar is available in standard and deep-well models. The deep-well collar is required to accommodate plate-on-plate stacking for deep-well microplates. The Bravo device profile configuration specifies the collar size.
		IMPORTANT If the assembled vacuum configuration includes a filter plate on top of the collar, ensure that the clear plastic frame is seated in the blue gasket to reinforce it.
		Note: Different types of gasket frame inserts are available. See the manufacturer's user documentation for a detailed description.

Item	Name.	Description
2	Black gaskets for collar	The same collar as item 1, except the flexible blue gasket is replaced with two black gaskets that are held in place by an adhesive. One black gasket adheres to the top of the collar, and the second black gasket adheres to the underside surface of the collar top to maintain the correct spacing underneath the collar.
		Use the black gaskets instead of the blue gasket in the following configurations:
		• If the type of filter plate cannot be seated on the blue gasket fitted with the clear gasket frame, you may replace the blue gasket with the two black gaskets to accommodate the filter plate. In this case, adhere one black gasket on top and one black gasket on the underside of the collar.
		• If the filter plate nozzles are too short to reach the wells in the collection plate underneath the collar, you may omit the black gasket on the underside of the collar. If you do this, ensure that you specify the collar option in the Bravo device profile as **Black gasket on top side only**.
3	Inserts	The white plastic spacers that can be placed in the base manually before starting the protocol, if required, to raise the height of a collection plate that sits underneath the collar. Two sizes are available. You may use multiple inserts in combination for a combined height of 15 mm, maximum.
4	Base	The bottom of the vacuum manifold that connects to the vacuum source. The base should be installed on a short platepad to compensate for the height of the assembled station including labware.

For more details about the Vacuum Filtration Station collar and base, see the Millipore user documentation.

IMPORTANT   Ensure that the base of the station is installed on a short platepad (SRT platepad). If the Vacuum Filtration Station configuration is too tall for the Bravo gripper to assemble without the risk of a collision, an error will occur during the run.

Supported stacking configurations

In addition to the basic configuration of the collar stacked on the station base, other configurations can be automatically assembled and disassembled during a protocol run. The common configuration options are as follows:

• *Configuration A*. The filter and collection plates are part of the station assembly.

   Note: Double-filtration is possible in configuration A by including one filter plate as part of the station assembly and a second filter plate on top of the vacuum collar.

• *Configuration B*. The filter plate is not part of the station assembly. The robot will move the filter plate to the station during the protocol run after the assembly process is finished.

- *Configuration C.* The filter plate is not part of the station assembly. The robot will move the filter plate to the station during the protocol run after the assembly process is finished.

A

Collar

Filter plate

Collection plate

Base

Platepad

B

Filter plate

Collar

Collection plate

Base

Platepad

C

Filter plate

Collar

Base
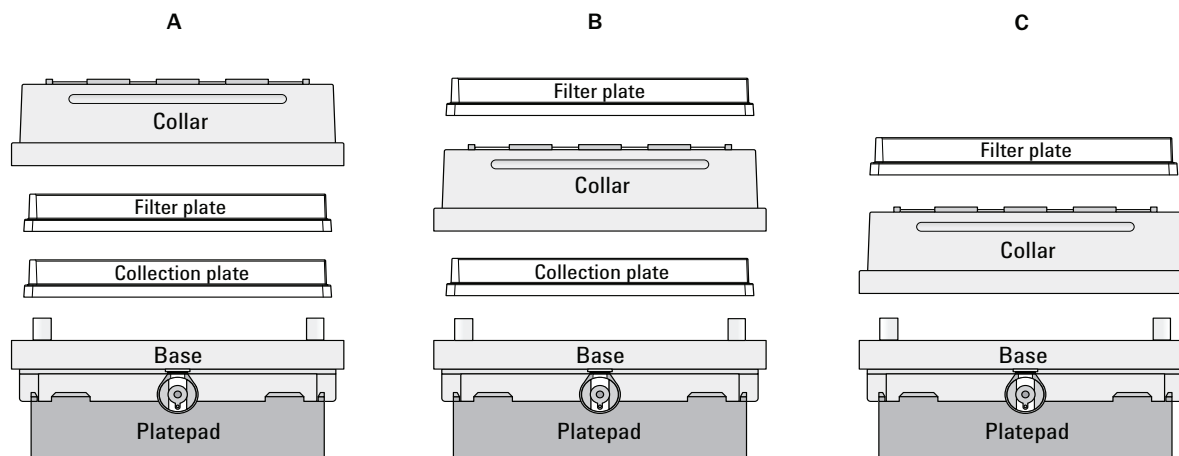
Platepad

Installing the station

Before you start

WARNING
To avoid potential injury and damage to the device, turn off the device before installing or removing an accessory.

IMPORTANT
An SRT platepad is typically required to provide clearance for the height of the assembled vacuum stack.

Make sure you have the following:

- Vacuum Filtration Station kit. Contains the vacuum manifold base and collar, tubing for robotic and manual setups, waste bottle, and filter.
- M1.5 hex wrench
- Vacuum source. Use one of the following:
  - House vacuum and pinch-valve module

IMPORTANT
The house vacuum must be regulated to a maximum of 286.49 mbar (8.46 inHg), because the pinch-valve tubing will collapse with higher vacuum pressure.

  - Agilent ME4C NT VARIO Pump
    For detailed information, see the ME4C NT VARIO Pump manual at https:// www.vacuubrand.com.
- Available serial port on the controlling computer

IMPORTANT	Inspect the Vacuum Filtration Station base to ensure that it is ready for robotic use: (1) Remove the plug, if present, that blocks the vacuum port from within the base. (2) Unscrew the four rubber feet if installed on the base.

Figure   Removal of (1) plastic plug from vacuum port and (2) rubber feet from base
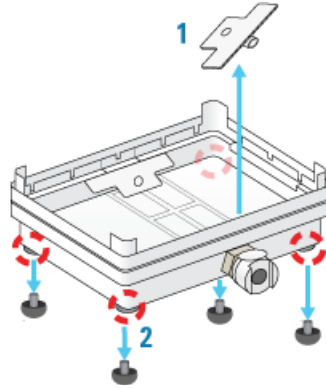
Determining the installation location

Make sure that the installation location for the Vacuum Filtration Station base enables routing of the tubing.

For example, on the Bravo deck, you can install the Vacuum Filtration Station on a platepad at deck location 1, 2, or 3 if you want to route the tubing out the rear opening.

Figure   Installation options on the Bravo deck: location 1, 2, or 3 on the back row
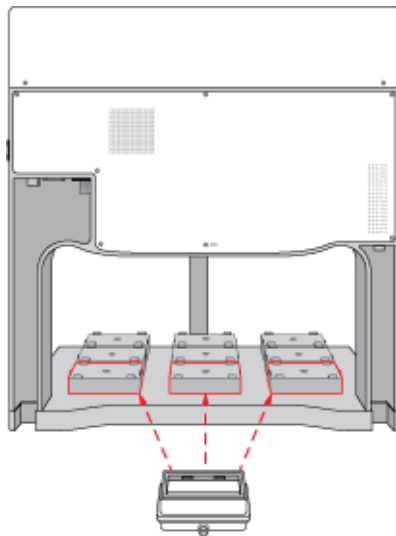
Installing the station

To install a Vacuum Filtration Station:

1   Place the base of the Vacuum Filtration Station on the platepad (typically, an SRT platepad).

   Ensure that the base sits level and that the vacuum port faces in the correct orientation for the tubing exit.

2   To secure the base, use a M1.5 hex wrench to tighten the setscrew in the platepad tab.

3   Connect the Vacuum Filtration Station as required for the type of vacuum source:
   • House vacuum with pinch-valve module.
   • Agilent VARIO Pump.

Connecting to house vacuum with the pinch-valve module

Perform the following tasks to connect the pinch-valve module to the house vacuum source.

Step	For this task...	See...
1	Connect the manual vacuum pressure control-valve-and-gauge assembly.	"Connecting the control-valve-and-gauge assembly" on page 125
2	Connect the pinch-valve tubing and cables.	"Connecting the pinch valve tubing" on page 126
3	Set the pressure using the manual vacuum control-valve and gauge.	"Setting the vacuum pressure" on page 128

Connecting the control-valve-and-gauge assembly

Refer to the following figure to connect the manual pressure control-valve-and-gauge assembly.
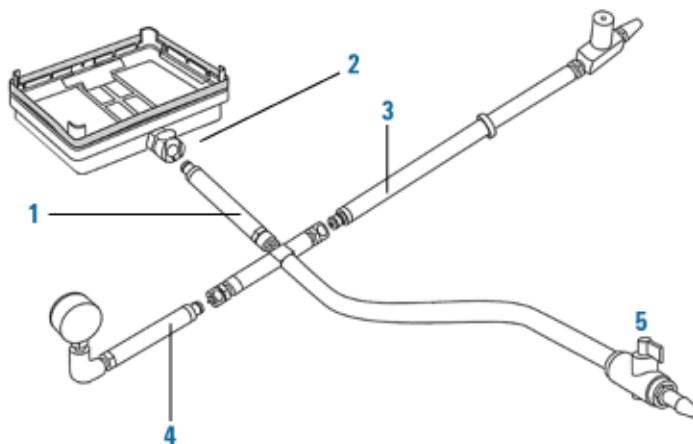
To connect the pressure control-valve-and-gauge assembly:

1   Ensure that the base (manifold) of the Vacuum Filtration Station is installed on the Bravo platepad.

2   Connect the coupling insert on the end of the four-way connector (1) to the quick-disconnect fitting (2) on the base. Push the coupling insert until it clicks.

3   Connect the coupling insert on the end of the manual vacuum control valve tubing (3) to the quick-disconnect fitting on the short arm of the four-way connector.

4   Connect the coupling insert on the end of the vacuum pressure gauge tubing (4) to the quick-disconnect fitting on the long arm of the four-way connector.

5 *Optional.* Disconnect the manual on/off toggle switch (5) from the end of the tubing. This toggle switch is not required for the setup.

Connecting the pinch valve tubing

IMPORTANT The house vacuum must be regulated to a maximum of 286.49 mbar (8.46 inHg), because the pinch-valve tubing will collapse with higher vacuum pressure.

Note: The pinch-valve tubing can collapse with regular use over time, resulting in inadequate vacuum flow for the Vacuum Filtration Station. Replace the tubing periodically to keep the Vacuum Filtration Station functioning as intended.

The following figure shows the connections from the Vacuum Filtration Station to a vacuum source via a pinch-valve module.

Figure Vacuum Filtration Station connections for a pinch-valve module
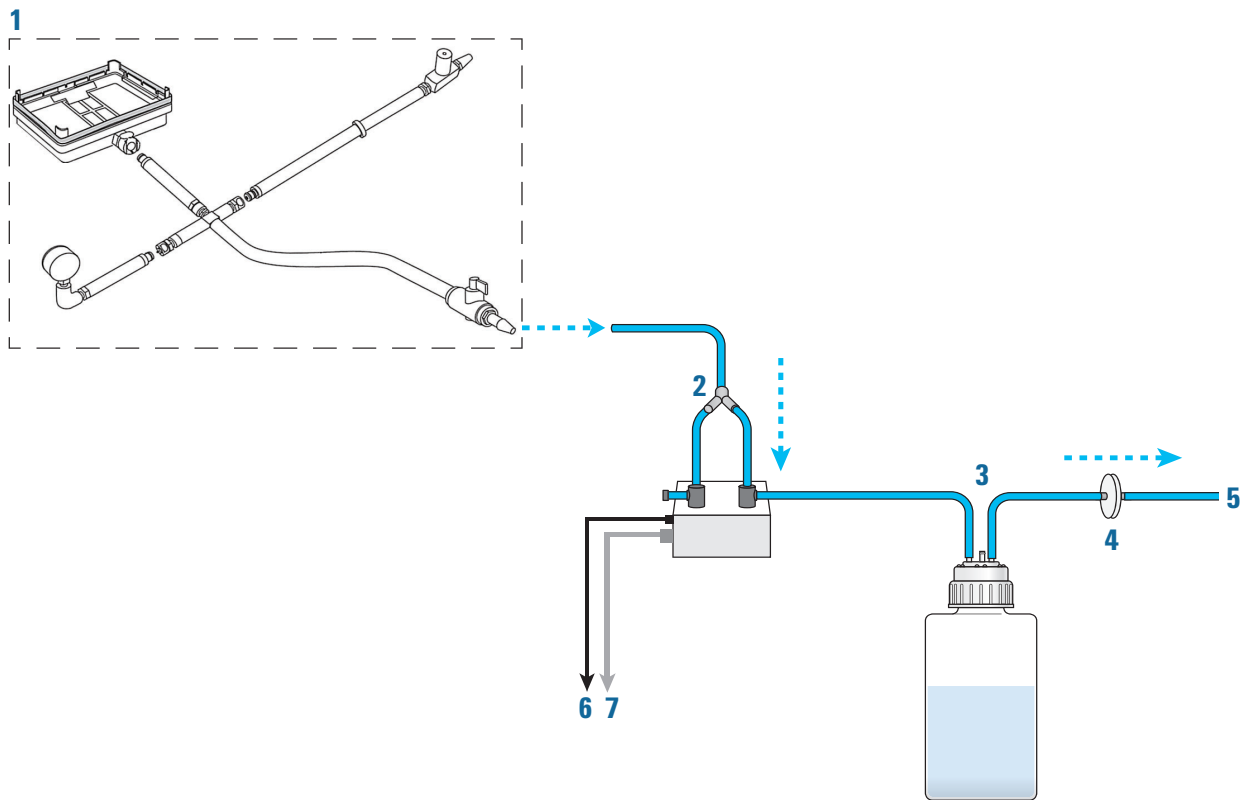
Item	Name	Description
1	Vacuum control valve-and-gauge assembly	Helps regulate the vacuum pressure to prevent the pinch-valve module tubing from collapsing.
2	Pinch-valve module assembly	
	• 3-way connector	Branches the tubing from the Vacuum Filtration Station base to the vent and valve ports on the pinch-valve module.

Item	Name	Description
	• Pinch-valve module	Houses the electronics that communicate with the software to automatically open, close, or vent the vacuum pressure.
	• Vent port	Routes the vent tubing on the pinch-valve module.
	• Valve port	Routes the tubing from the vacuum source to the Vacuum Filtration Station through the waste bottle.
3	Waste bottle and tubing	Collects the waste solution from the filtration process.
4	Filter	Prevents particulates from the entering the vacuum supply.
5	House vacuum	Provides the vacuum supply for the filtration process.
6	Power cord	Connects the pinch-valve module to an AC outlet.
7	Communication cable, serial	Connects the pinch-valve module to the com port on the controlling computer.

To connect the *Vacuum Filtration Station* **using the pinch-valve module:**

1 Ensure that the vacuum source is turned off.

2 Connect the tubing from the vacuum control valve-and-gauge assembly (1) to the open three-way connector tubing on the pinch-valve module assembly (2).

IMPORTANT   If you are installing the control valve-and-gauge assembly with the optional on/off toggle switch, ensure that the toggle switch is in the on position (handle in line with valve body), as the following figure shows.
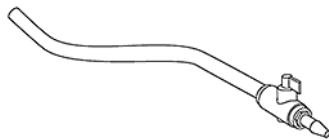
Note: The remaining tubing from the three-way connector is pre-assembled: One tube connects to the vent port, and the second tube connects through the valve port.

3 Connect the open end of the pinch-valve tubing from the valve port (2) to a port on the waste bottle (3).

4 Connect tubing between the second port of the waste bottle (3) and an in-line filter (4).

5 Connect the tubing between the in-line filter and the vacuum source (5).

6 Connect the power cable (6) from the pinch-valve module to an AC outlet.

7 Connect the communications cable (7) from the pinch-valve module to a com port on the controlling computer.

Setting the vacuum pressure

To set the regulated vacuum pressure for the pinch valve:

1   Place a solid-bottom collection plate or the teach plate on top of the installed collar on the Vacuum Filtration Station.
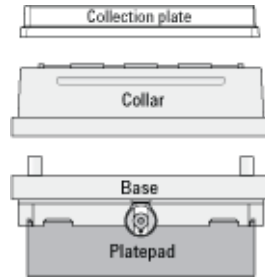
2   At the vacuum control valve, turn the knob fully counterclockwise (CCW) so that the valve is completely open, preventing any vacuum pressure in the tubing.
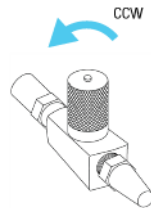
3   Turn on the vacuum source.

4   While observing the manual pressure gauge, slowly turn the control-valve knob clockwise (CW), gradually closing the line and increasing the vacuum until you achieve the desired vacuum pressure (8.46 inHg, maximum).
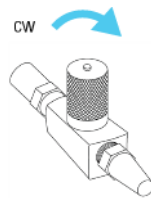
If the vacuum pressure exceeds 8.46 inHg, the pinch valve tubing may collapse. If this occurs, turn off the vacuum source to the pinch valve and turn the control-valve knob counterclockwise to eliminate the vacuum pressure. You may need to massage the tubing slightly to open it up again.

Now you are ready to configure the Vacuum Filtration Station in the software. See "Configuring the Vacuum Filtration Station in Bravo Diagnostics" on page 133.

Connecting and configuring the Agilent VARIO Vacuum Pump

The following figure shows the Agilent ME4C NT VARIO Vacuum Pump.

Figure   Agilent ME4C NT VARIO Vacuum Pump
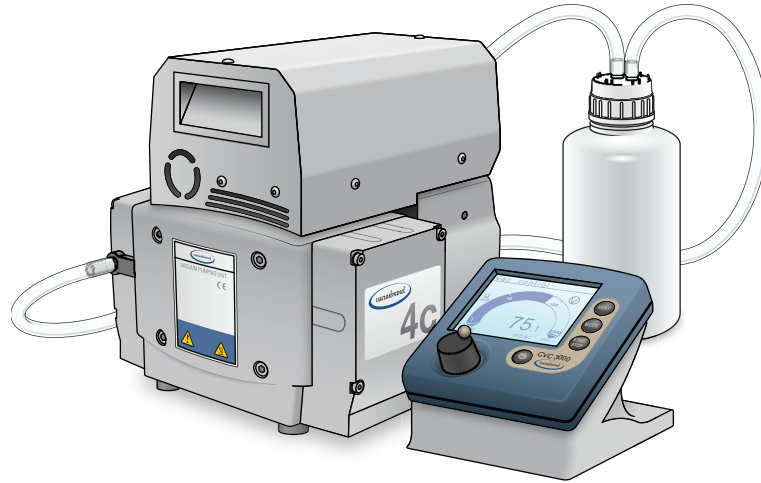
For detailed instructions about the VARIO pump, see the manufacturer's Instructions for use, provided with the pump.

The following figure shows the connections for a Vacuum Filtration Station that uses the ME4C NT VARIO Vacuum Pump.

Figure   Vacuum Filtration Station connections for ME4C NT VARIO Vacuum Pump
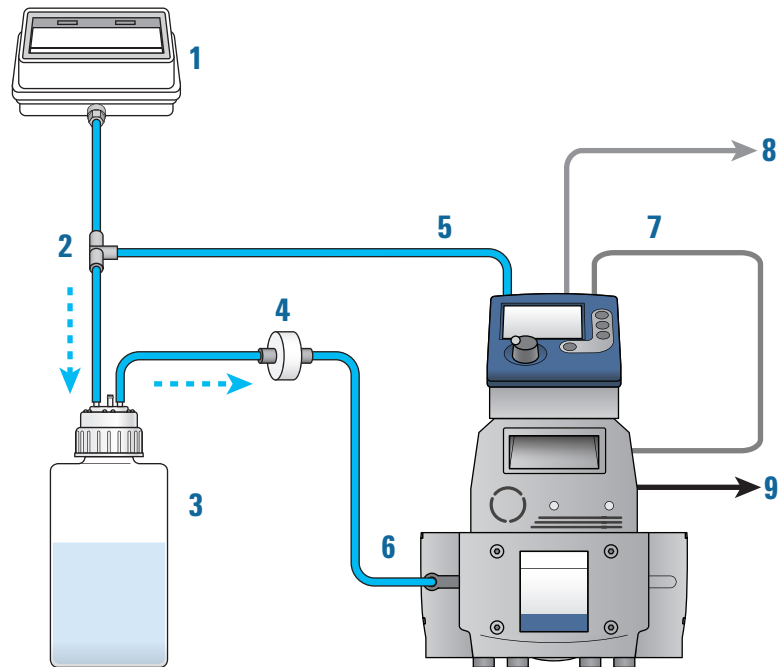
Item	Name	Description
1	Vacuum Filtration Station	Contains a vacuum port on that base that connects to the tubing.

Item	Name	Description
2	Three-way connector	Branches the tubing from the station's base to the pump and the waste bottle.
3	Waste bottle	Collects the waste solution from the filtration process.
4	Filter	Prevents particulates from the entering the vacuum supply.
5	Controller	Controls the pump unit. **IMPORTANT** To prevent potential siphoning, ensure that the controller is located at a higher level than the waste bottle and the Vacuum Filtration Station.
6	Pump unit	Provides the vacuum supply to the station.
7	Power supply cable	Routes power between the pump and the controller.
8	Communication cable, serial	Connects pump controller to a com port on the controlling computer.
9	Power cord	Connects the pump to an AC outlet.

To connect the Vacuum Filtration Station to the ME4C NT VARIO Vacuum Pump:

1   Make sure the Vacuum Filtration Station base is installed on the platepad.

2   Using the three-way tubing connector:

   a   Connect the tubing with the quick-disconnect fitting to the port on the station base (1), and connect the other end to the three-way connector (2).

   b   Connect the input tubing from the waste bottle (3) to the three-way connector.

   c   Connect tubing from the three-way connector to the port on the back of the controller (5).

3   Connect the output tubing from the waste bottle (3) to the filter (4), and connect the output tubing from the filter to the inlet on the front of the pump (6).

4   Carefully, connect the pump's power supply cable (7) to the 4-pin connector on the back of the controller (5).

CAUTION   **Do not try to force the cable connector into the port on the controller. Doing so can damage the connector.**

5   Connect the communications cable (8) from the pump controller to a com port on the controlling computer.

6   Connect the power cord (9) from the pump to an AC outlet.

7   Configure the controller communication settings as described in the following procedure.

8   Turn on the controlling computer.

9   At the back of the pump, press the power switch to the **on** (I) position.

10 Configure the com port for the Vacuum Filtration Station and other settings in Bravo Diagnostics. For instructions, see .

To configure the controller communication settings for the pump:

1 At the controller panel, locate the power button (1) and the selection knob (2), as the following figure shows.
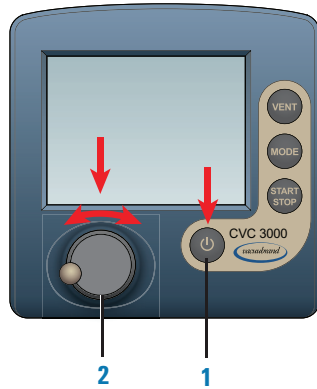
IMPORTANT   In the following steps, the display will reset after 20 seconds of inactivity. If this happens, repeat the steps to access the configuration display and make the selections.

2 If the controller power is off, press the power button to turn on the display.

Note: The controller display will turn on automatically if the controller power button was already set to on.

3 Access the controller configuration display as follows:

a Press the selection knob to display the settings menu. Turn the knob to move the selector to **Configuration**, and then press the knob to make the selection.

b In the Configuration display, turn the knob to move the selector to **RS-232**, and then press the knob to make the selection.

c In the **RS-232** configuration display, ensure that the parameters are set as follows:

RS-232 parameters	Values
Baud	9600
Parity	8-N-1
Handshake	None
Remote	Off
	Note: Later, after you initialize the Vacuum Filtration Station in your automation software, the Remote setting will change to On automatically.

To change a value, turn the selection knob to the desired parameter, press the knob to access the value, and then turn the knob to change the value. Press the knob again to confirm the new setting.

d Use the selection knob to move the selection to **Back**, and press the knob to exit each display until you exit the Configuration display.

4 Ensure that the controller displays **Vac control**.

The PC icon 🖥️ will appear after you initialize the Vacuum Filtration Station in your automation software, indicating that the pump is under remote control.

WARNING   **Before using the VARIO pump, refer to the safety information in the manufacturer's user documentation.**

Note: While the PC icon appears on the controller display, the Vacuum Filtration Station is under the control of the computer, and you can no longer control the pump locally using the controller display.

If you want to reset the controller, press the power button to turn it off, set the power switch on the back of the pump to off. Wait a minute, and then turn on the pump and turn on the controller again.

For additional information on the VARIO pump, see the manufacturer's user documentation.

Uninstalling the Vacuum Filtration Station

WARNING   **To avoid potential injury and damage to the device, turn off the device before installing or removing an accessory.**

To uninstall the station:

1   Turn off the vacuum.

2   Disconnect the pump controller or pinch-valve communications cable from the com port on the computer.

3   If applicable, disconnect the pinch-valve module from the vacuum source.

4   Disconnect the tube from the Vacuum Filtration Station.

5   Remove the set screw that is holding the station base to the platepad.

6   Remove the Vacuum Filtration Station from the platepad.

Configuring the Vacuum Filtration Station in Bravo Diagnostics

To configure the Vacuum Filtration Station:

1   In Bravo Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Locations** list, select the deck location of the Vacuum Filtration Station base.

4   In the **Location is configured as** list, select **Accessory.** The Accessories Wizard opens.

5   In the **Location** list, confirm the deck location of the Vacuum Filtration Station base, and then click **Next.**

6   In the **Accessory** list, select **Vacuum Filtration Station,** and then click **Next.**

7   In the **"Vacuum Filtration Station" properties** table, set the following:

   a   **Serial Port.** The com port on the controlling computer to which the communications cable from the pinch-valve module or the pump connects.

   b   Select one of the **Configuration** options:

     •   **Always assembled**. The station consists only of the base and the collar, or the robot will not assemble or disassemble the station components during a protocol run. If you select **Always assembled**, select the **Collar type**. The options are **Standard (38 mm)** or **Deep (67.5 mm)**.

     •   **Start disassembled.** The station components are at different deck locations and you want to use the Assemble Vacuum and Disassemble Vacuum tasks during a protocol run.

   c   **Pump connected**. Choose one of the following:

Pump	Description
Standard	Select this option if the station is connected to the pinch-valve module.
ME4CVario	Select this option if the station is connected to the ME4C NT VARIO Vacuum Pump. If you select **ME4CVario**, set the **Pump Pressure Units** to match the unit setting on the VARIO pump controller. The options are mbar, Torr, and hPa.
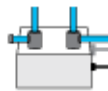
Click **Next**.

8   *Starts disassembled configuration only*. Select the following:

    a   In the **Location for Vacuum Filtration Collar** list, select the deck location at which the collar is located, and then click **Next.**

    b   In the **Vacuum Filtration Collar properties** table, specify the following, and then click **Next.**

Pump	Description
Collar type	Specify the size of the collar: Standard (38 mm) or Deep (67.5 mm).
Black gasket on top side only	If the collar has the blue gasket or two black gaskets, select No (default).
	If you have omitted the black gasket on the underside of the collar, select Yes.

9   Click **Finish**.

Note: If you verified the accuracy of the platepad teachpoint before installing and configuring the Vacuum Filtration Station, no further adjustment to the teachpoint should be required.

10   In the **Profiles** tab, click **Update this profile**.

11   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Testing the Vacuum Filtration Station

Before you start, ensure that you initialize the correct profile in Bravo Diagnostics.

Testing the Pump Standard option

If you selected the Standard connection option when configuring the Vacuum Filtration Station, use the following procedure to test the vacuum supply to the station.

To test the Standard connection for a Vacuum Filtration Station:

1   Verify that the pre-assembled Vacuum Filtration Station is in place on the target deck location and connected via the pinch-valve module.

2   In Diagnostics, click the **Configuration** tab.

3   In the **Accessory Configuration** area, highlight **Vacuum Filtration Station**, and then click **Diagnose accessory**.
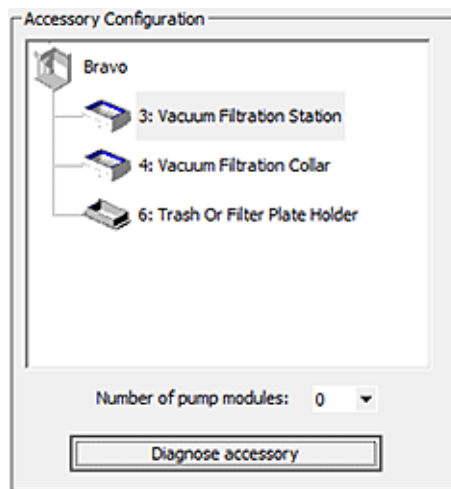
4   In the **Accessory Diagnostics** dialog box, start the vacuum as follows:

   a   Set the **Vent valve** to **Closed**.

   b   Set the **Vacuum valve** to **Open**.

   c   Click **Execute**.

   Figure   Accessory Diagnostics dialog box for the Standard connection
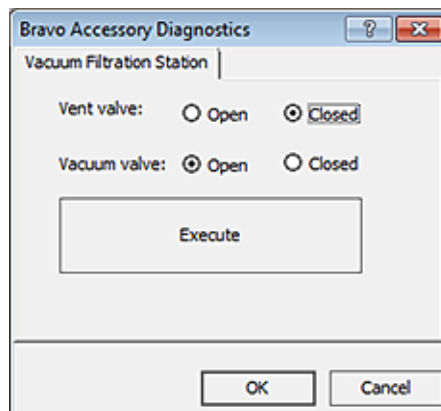
5   To stop the vacuum:

    a   Set the **Vent valve** to **Open**.

    b   Set the **Vacuum valve** to **Closed**.

    c   Click **Execute**.

6   Click **OK**.

Configuring the ME4C NT VARIO Vacuum Pump and testing the vacuum

If you selected the ME4C Vario connection when configuring the Vacuum Filtration Station, use the following procedure to configure the pump settings and test the vacuum supply to the station.

For more details on the ME4C NT VARIO Vacuum Pump, see the manufacturer's user guide.

To configure the ME4C NT VARIO Vacuum Pump and test the station:

1   Verify that the pre-assembled Vacuum Filtration Station is in place on the target deck location and connected to the VARIO Vacuum Pump.

2   In Diagnostics, click the **Configuration** tab.

3   In the **Accessory Configuration** area, highlight **Vacuum Filtration Station**, and then click **Diagnose accessory**.
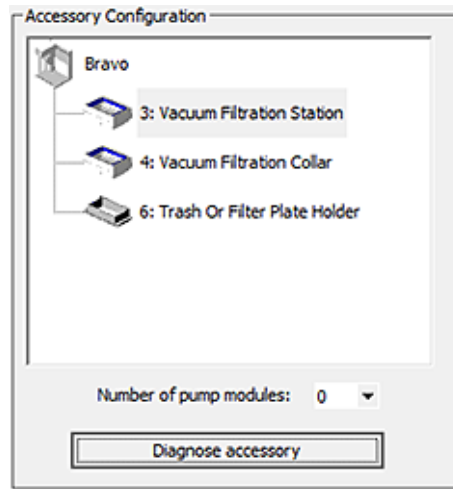
The Accessory Diagnostics dialog box opens.

Figure   Accessory Diagnostics dialog box for the ME4C NT VARIO Vacuum Pump
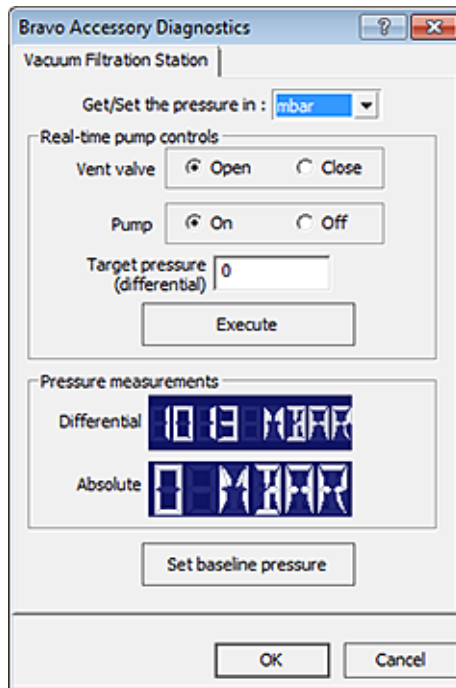
4   To configure the pump:

   a   In the **Get/Set the pressure in** list, select the desired unit of measure (mbar, Torr, hPa, mmHg, cmHg, and inHg). If the selected units differ from the configuration, the software will convert the values.

   b   Set the **Vent valve** to **Open**.

   c   Set the **Pump** to **Off**.

   d   Type the **Target pressure (differential)**.

   e   Click **Set baseline pressure**.

5   To start the vacuum:

   a   Set the **Vent valve** to **Close**.

   b   Set the **Pump** to **On**.

   c   Set the **Target pressure**.

   d   Click **Execute**.

6   To stop the vacuum:

   a   Set the **Vent valve** to **Open**.

   b   Set the **Pump** to **Off**.

   c   Click **Execute**.

Related information

For information about...	See...
Creating or updating labware definitions for filter and collection plates used with the Vacuum Filtration Station, including specifying the gripper offset	*VWorks Automation Control Setup Guide*
The protocol liquid-handling tasks for the Vacuum Filtration Station	*VWorks Automation Control User Guide*

Setting up a Trash or Filter Plate Holder accessory

About this topic

This topic describes how to set up a deck location as one of the following:

*   Trash position for disposal of pipette tips

    Note: If you are discarding lids to trash, see "Configuring a platepad for delidding" on page 144.

*   Filter Plate Holder for use with the Vacuum Filtration Station

    You can use this accessory as the filter plate location during the Vacuum Assemble, Move and Filter Plate, and Vacuum Disassemble tasks in the VWorks protocol.

The following figure shows the Tip Trash Bin accessory, which can also be used as a Filter Plate Holder.

Figure   Agilent Tip Trash Bin or Filter Plate Holder accessory
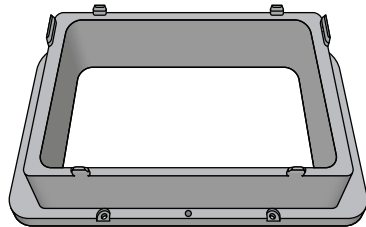
Before you start

The accessory can be installed at Bravo deck locations 4 and 6, which have cutouts for through-deck access.

Figure   Bravo Platform on deck risers and top view of deck location cutouts
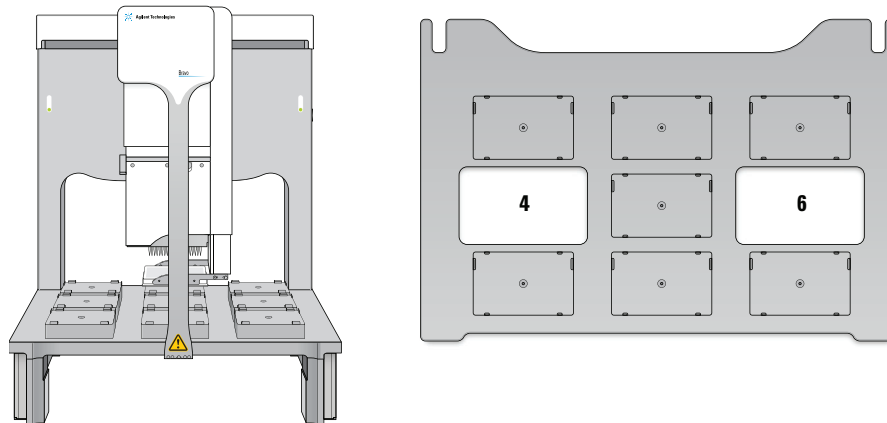
The hardware setup requirements vary depending on how the accessory is to be used.

*   *Tip Trash Bin.* In this case, deck risers (146 mm) are required to provide the extra height for trash collection below the deck in a trash receptacle (customer-supplied). In addition, a cutout may be required in the table below this deck location. For installation details, contact Agilent Technical Support.

- *Filter Plate Holder*. If the accessory is used as a location for placing labware, the Bravo Platform does not require deck risers. The cutout in the center of the accessory is sufficient to provide the extra space for the filter plate wells to protrude beyond the bottom edges of the filter plate skirt.

Use the following procedure to install the accessory.

Installing the Filter Plate Holder accessory

Ensure that you have the following:

- Wrenches

  Depending on the instrument, M2 and M4 hex wrenches or T10 and T30 wrenches are required.

- Filter Plate Holder accessory

To install the Filter Plate Holder accessory:

1 Uninstall the platepad, if applicable, from Bravo deck location 4 or 6.

  To uninstall a platepad, remove the M6 flathead screw from the center of the platepad. Remove the platepad.

2 Remove the four M3 screws that attach the cutout cover to the deck. Lift the cutout cover out of the deck.

Figure   Side view of cutout cover on the Bravo deck
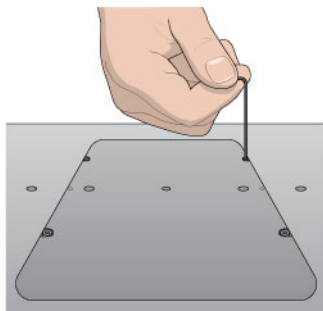
3 Position the Filter Plate Holder in the cutout, aligning the two dowel pins in the holes.

4 Install the four M3 screws that secure the Filter Plate Holder to the deck.

Figure   Filter Plate Holder front view
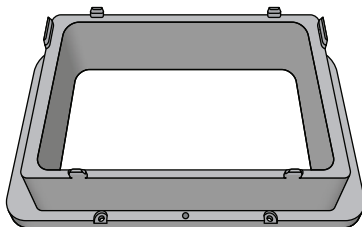
Configuring the Filter Plate Holder in the software

To configure the Filter Plate Holder:

1 In Bravo Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Locations** list, select the deck location of the installed accessory.

Only deck location 4 or 6 are options for this accessory.

4   In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

5   In the **Location** list, confirm the deck location of the accessory, and then click **Next.**

6   In the **Accessory** list, select Filter Plate Holder, and then click **Next**.

7   Click **Finish.**

8   When a message appears and asks whether to move the teachpoint to a safe Z height, do one of the following:

- Click **No** if you verified the accuracy of the platepad teachpoint before installing and configuring the accessory, no further adjustment to the teachpoint should be required.

- Click **Yes** if you plan to reteach this location.
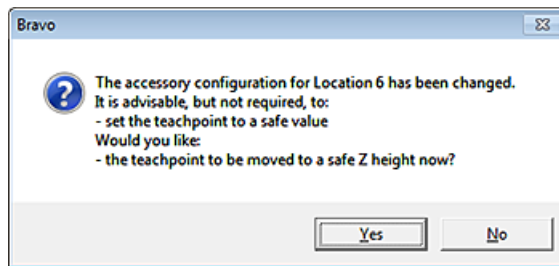
The image of the accessory appears at the specified deck location in the Configuration tab, as the following figure shows.

Figure   Filter Plate Holder in the Configuration tab
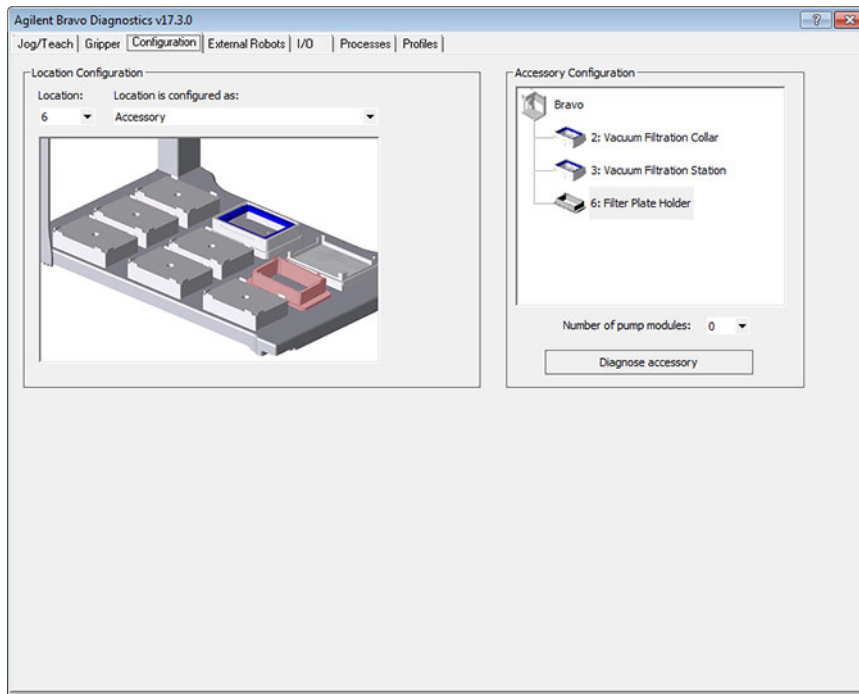
9   In the **Profiles** tab, click **Update this profile**.

10 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

When authoring protocols in the VWorks software, use the Place Plate task in the Bravo Subprocess to move filter plates or other microplates to this Bravo accessory location. You may specify which Labware Class is allowed at this location. For example, you might want to allow only filter plates at this location. For more details on Labware Classes, see the *VWorks Automation Control Setup Guide*. For more details on how to create a protocol, see the *VWorks Automation Control User Guide*.

Configuring the Trash location in the software

If you plan to use the accessory for a trash location only, no trash configuration is required in Bravo Diagnostics. Instead, you configure the accessory location as static labware in the protocol Bravo Subprocess. In the Configure Labware dialog box, ensure that you select a tip trash "labware" at the corresponding deck location. In the Bravo Subprocess, use the Tips Off task to eject the pipette tips at the Tip Trash Bin accessory. The following figure shows an example protocol. For more details, see the *VWorks Automation Control User Guide*.

Figure   Example of VWorks protocol with static labware configuration for tip trash at deck location 6
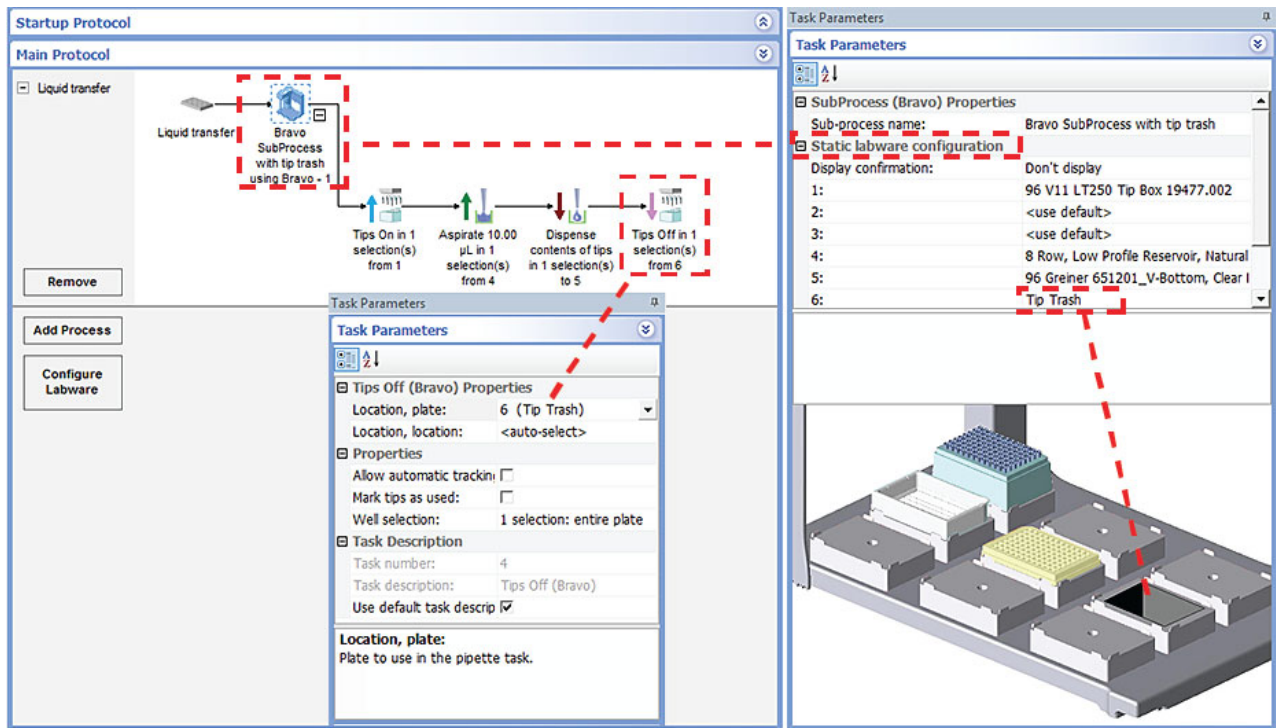
Related information

For information about…	See…
Editing teachpoints	"Setting teachpoints" on page 37
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Configuring a platepad for delidding

About this topic

This topic explains how to use Bravo Diagnostics to configure a platepad to accept a lid in a delidding process.

Before you start

- Make sure you install a platepad at the desired deck location.
- Do not install another accessory at this deck location.

Configuring a platepad for delidding

To configure a platepad for delidding:

1 In Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.

3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4 Follow the instructions in the Accessories Wizard to:

- Choose the **Location** on which you want to place the microplate lid.

  Note: Your selection in the Accessories Wizard overrides the selection in the Configuration tab.

- Select the **Lid hotel** accessory to indicate that you want to use the Delid and Relid tasks.

- Set the Lid hotel properties:
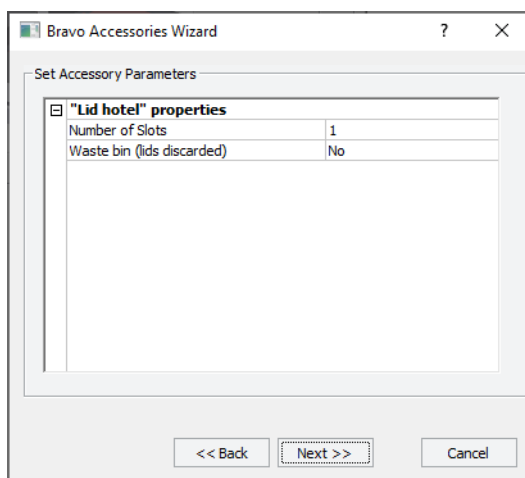
Property	Description
Number of Slots	Because you can place only one lid on the designated platepad, is set to **1**.

Property	Description
Waste bin (lids discarded)	If you do not want lids discarded, select **No**.
	If you plan to discard lids to waste, select **Yes**.
	• The Bravo instrument must be configured with a waste location before you can use this option. See "Hardware setup for discarding lids" on page 145.
	• In the VWorks protocol, you simply use the Delid task to specify the trash location on the Bravo deck.

5 When the accessory configuration message appears, do one of the following:

- If you have not yet edited the teachpoint, click **Yes**. After the software initializes the accessory, edit the teachpoint.
- If you have already verified the teachpoint, click **No**.

6 In the **Profiles** tab, click **Update this profile**.

7 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Hardware setup for discarding lids

Note: If you are discarding pipette tips to trash, see "Setting up a Trash or Filter Plate Holder accessory" on page 139.

Bravo deck locations 4 and 6 have cutouts for through-deck access. Bravo deck risers (146 mm) are required to provide the extra height for trash collection below the deck in a trash receptacle (customer-supplied).

In addition, a cutout may be required in the table below this deck location. For installation details, contact Agilent Technical Support.

Figure Bravo Platform on deck risers and top view of deck location cutouts
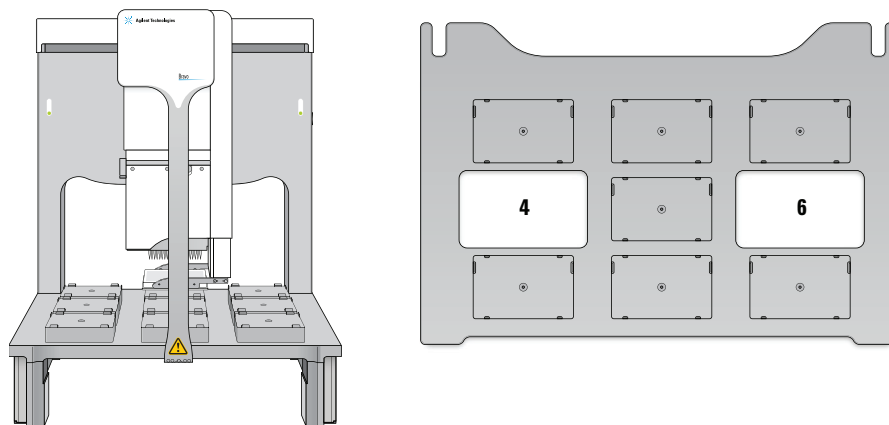
To remove the cutout cover from the deck:

1 Uninstall the platepad, if applicable, from Bravo deck location 4 or 6.

To uninstall a platepad, remove the M6 flathead screw from the center of the platepad. Remove the platepad.

2   Remove the four M3 screws that attach the cutout cover to the deck. Lift the cutout cover out of the deck.

Figure   Cutout cover on the Bravo deck

Related information

For information about...	See...
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing teachpoints	"Setting teachpoints" on page 37
Using the Delid and Relid tasks in a protocol	*VWorks Automation Control User Guide*

Installing and configuring a platepad or Alignment Station

About this topic

This topic describes how to install and configure a standard platepad and the Alignment Station.

Descriptions

Standard platepad

The standard platepad can accommodate any microplate-sized labware. The platepad has a crosshairs (1) in one corner, as the following figure shows, which is used when setting pipettor teachpoints.
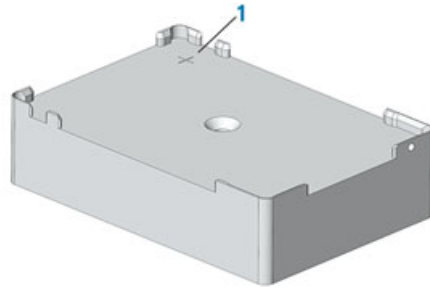
Alignment Station

An Alignment Station is a platepad that has three spring rollers on two of the sides. The spring rollers are designed to push a microplate into the opposing corner, securing the microplate position and ensuring precise pipetting. Like the other platepads, it contains a crosshairs (1) for setting pipettor teachpoints.
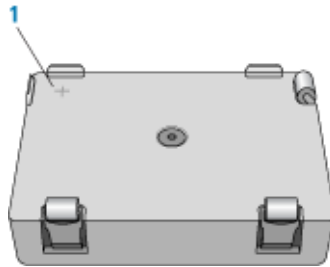
The Alignment Station can accommodate 1536-well microplates, small-transfer (ST) tip boxes, and any other microplate requiring precision location.

Before you start

Make sure you have the following:

- Alignment Station or platepad
- M5 hex wrench
- 1.5-mm hex wrench

When installing the platepad or Alignment Station, ensure that you orient the crosshairs towards the northwest corner of the deck, as the following figure shows.

Figure   Crosshairs orientation on the Bravo deck (top view)
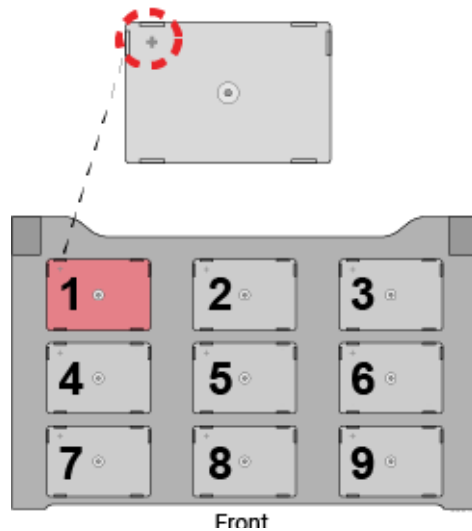
Installing a platepad or Alignment Station

CAUTION   **Turn off the Bravo Platform before you install or remove the accessory.**

To install a platepad or Alignment Station:

1   If a different platepad is already installed at the target installation location, remove it as follows:

   a   Uninstall the screw from the center of the platepad.

   b   Lift off the platepad ensuring that the dowel pins under the platepad remain in the deck.

2   Position the platepad or Alignment Station at the target deck location. Make sure the crosshairs are towards the northwest corner of the deck. Ensure that the platepad or Alignment Station sits level on the deck.

3   Install the supplied flathead cap screw into the center of the platepad or Alignment Station.

4   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
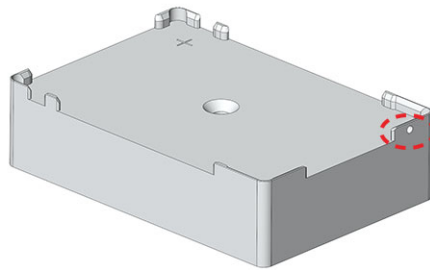
Configuring the deck location in the software

To configure the deck location in the software:

1   Initialize the profile in Bravo **Diagnostics**.

2   Click the **Configuration** tab, and verify that the deck location is configured as a Standard Platepad.
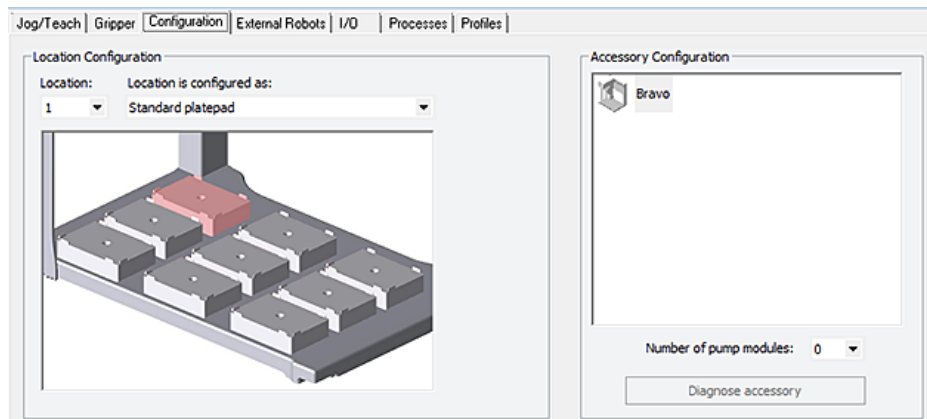
3   Verify the teachpoint for this location. For instructions, see "Setting teachpoints" on page 37.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Editing teachpoints	"Setting teachpoints" on page 37

Configuring a height offset for a platepad

About this topic

This topic explains how to use Bravo Diagnostics to configure the Plate Pad Offset accessory.

When to configure this accessory

You can configure the Plate Pad Offset accessory at a platepad where

- The platepad teachpoint is at a different altitude than where the labware will be seated, for example, if a plate riser or insert is seated on the platepad.
- The tabs on the side of a labware locator are taller than normal, requiring extra clearance when picking and placing labware.

For example, your application might require that you place a Bravo Plate Riser atop the platepad at a given deck location. The Bravo Plate Riser raises the teachpoint z-axis coordinate by 28.5 mm, approximately. You can either set the teachpoint for the location including this extra height, or you can configure the height offset in the profile. In this case, configuring the Plate Pad Offset might provide more flexibility if you want to copy the teachpoints from one profile to another.

Figure   Bravo Plate Riser
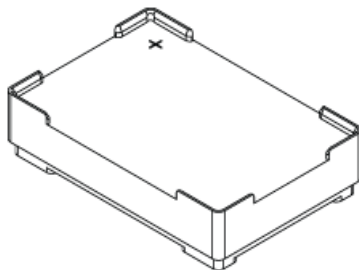
Before you start

Ensure that you have calipers to measure the height accurately.

Configuring the deck location in the software

To configure a height offset for a platepad:

1   In Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Location is configured as** list, select **Accessory.**
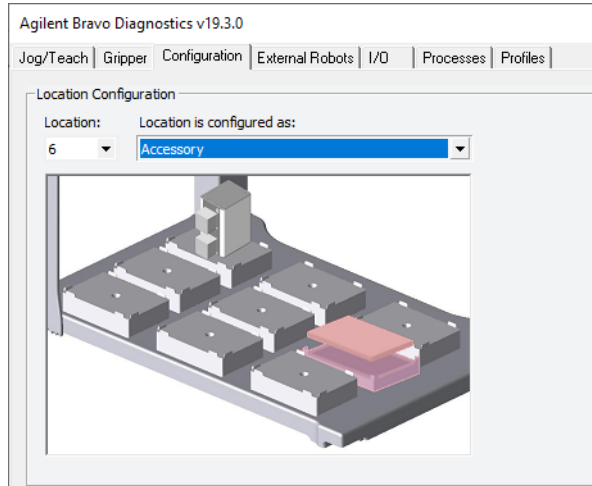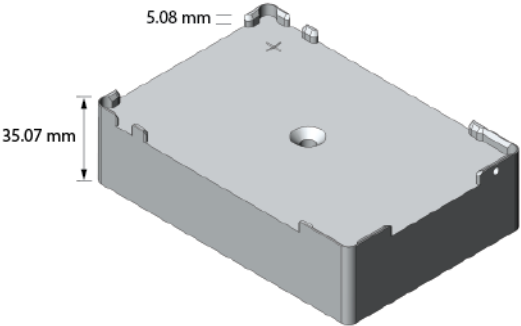
4 When the Bravo Accessories Wizard opens, follow the instructions to:

- Choose the **Location**.

  Note: Your selection in the Accessories Wizard overrides the selection in the Configuration tab.

- Select the **Plate Pad Offset** accessory.

- Set the following properties.

Property	Description
Insert height in milllimeters	Specify the height (mm) of the plate riser or plate insert seated on the platepad.
	Measure from the lowest point that rests on the platepad to the top surface of the plate riser or insert, not including any positioning tabs. For example, if you are place the Bravo Plate Riser on a standard platepad, you would enter 28.5 mm, approximately
	For any setting greater than zero, all operations involving the location (for example, pick, place, and pipetting) will behave as though the teachpoint for that location is the specified height (mm) above where it was actually taught.
Clearance height offset in millimeters	If the plate locator at the deck location has extra-high positioning tabs, specify the clearance height (mm) as the difference between
	• How high the locator tabs reach above the bottom of labware at the location, and
	• The height of standard platepad tabs (5.08 mm, approximate)
	The following figure shows a standard platepad.
	If this deck location does not require additional clearance for taller tabs, set this property to zero.
	For any setting greater than zero, all pick operations involving that location will lift the labware the specified clearance offset (mm) before moving it sideways, and all place operations will position the labware that many millimeters higher before lowering it onto the location.

5   Click **Next**, and then click **Finish**.
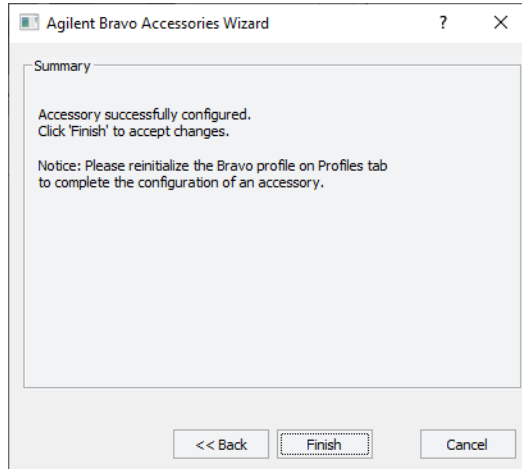
6   When the accessory configuration message appears, do one of the following:

- If you have not yet edited the teachpoint, click **Yes**. After the software initializes the accessory, edit the teachpoint.

- If you have already verified the teachpoint, click **No**.

7   In the **Profiles** tab, click **Update this profile**.

8   *VWorks compliance-enabled edition*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Editing teachpoints	"Setting teachpoints" on page 37
Copying teachpoints to another profile	"Copying teachpoints from one profile to other profiles" on page 50

Installing and configuring a Magnetic Bead Accessory

About this topic

This topic describes how to set up the Magnetic Bead Accessory on a standard platepad.

Figure   Magnetic Bead Accessory
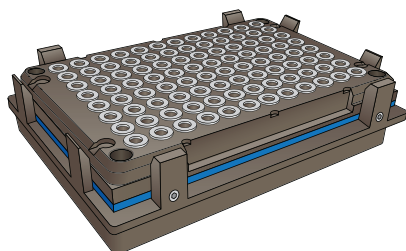
WARNING	**To avoid potential injury and damage to the device, only personnel trained in how to set up Magnetic Bead Accessory and teach the Bravo Platform should perform the following procedures.**

Before you start

Make sure you have the following:

• Magnetic Bead Accessory

• 1.5 mm hex wrench

• Standard platepad installed at the target deck location

Use the following workflow.

Step	For this task...	See...
1	Prepare the accessory for installation.	"Preparing the Magnetic Bead Accessory for installation" on page 154
2	Configure the accessory in the profile.	"Configuring the accessory in Bravo Diagnostics" on page 155
3	Teach the accessory location.	"Teaching the Magnetic Bead Accessory" on page 155

Preparing the Magnetic Bead Accessory for installation

To prepare the Magnetic Bead Accessory:

1 Place the Magnetic Bead Accessory on a flat surface, and press down on the top of the magnet and then release it to determine if the springs have been removed.

• If the magnet does not spring back up after release, skip to step 3.

- If the magnet springs up again after you release it, proceed to step 2.

2 Perform the following steps to securely mount the magnet to its backing plate without the springs to eliminate any warping:

    a Remove the four corner screws from the magnet (item **1** in the following figure.

    b Remove the springs from between the black plastic magnet mounting (figure, item **2**) and metal backing plate (item **3**).
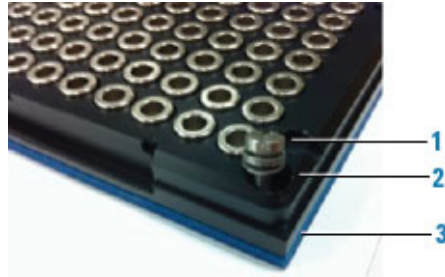
    c Replace the screws with shorter ones, or use small washers (size M3 works well) to fill the gap and allow the screws to be tightened so that they press the plastic magnet mounting firmly onto backing with the stickerless side facing down.

3 Set the Magnetic Bead Accessory aside temporarily.

In subsequent procedures, you will set the teachpoint at the platepad crosshairs, secure the Magnetic Bead Accessory in place atop the platepad, and then adjust the teachpoint for the accessory.

Configuring the accessory in Bravo Diagnostics

The Magnetic Bead Accessory dimensions are greater than the standard platepad in length (*x*-axis) and depth (*y*-axis). To ensure that the software takes the dimensions of the accessory into account during automated moves, you should configure the deck location for this accessory in Bravo Diagnostics.

To configure the deck location in the profile:

1 In Diagnostics, click the **Profiles** tab, and verify that the correct profile is open.

2 Click the **Configuration** tab.

3 In the **Locations** list, select the deck location of the accessory.

4 Verify that **Standard platepad** is selected in the **Location is configured as** list.

5 If you made any changes, click the **Profiles** tab, and then click **Update this profile**.

6 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Teaching the Magnetic Bead Accessory

To set the deck location teachpoint for the Magnetic Bead Accessory:

1 At the target installation location, make sure that a standard platepad is installed and ensure the Magnetic Bead Accessory is removed from the platepad. Set it aside temporarily.

2 Set the teachpoint to the crosshairs of the platepad. For instructions, see "Setting the first teachpoint" on page 39.

IMPORTANT	The 29.6 mm height will accommodate the accessory height only if installed on a standard platepad.

3   Raise the head up in the *z*-axis by 29.6 mm using the **Jog Axes** controls in the **Jog/ Teach** tab.

Click **Teach**.

4   Click **Move to safe height at current X/Y position**.
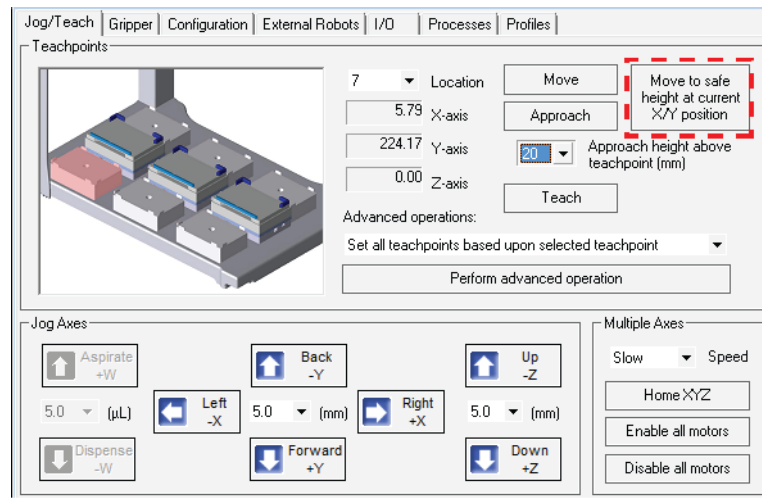
5   Reposition the Magnetic Bead Accessory on the platepad, as shown in the following figure (**1**). Ensure that the accessory is fully seated on the platepad.

Figure   Magnetic Bead accessory on top of a standard platepad
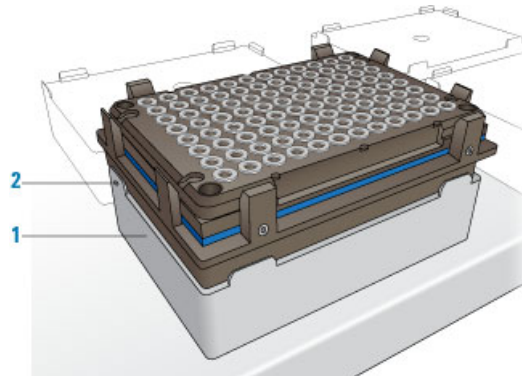
6   Using the 1.5 mm wrench, tighten the set screw in the tab, as shown in preceding figure (**2**), to secure the base to the platepad.

7   In the **Jog/Teach** tab image of the Bravo deck, click the accessory **Location**.

8   In the **Approach height above teachpoint** list, select **2 mm**, and then click **Approach**.

The Bravo head moves to the deck location and moves down so that the pipette tip is approximately 2 mm above the Magnetic Bead Accessory.

9   Verify that the pipette tips are centered above the magnet rings in the *x*- and *y*-axes.

If necessary, adjust the *x*- and *y*-axes at this point, and then jog the head down by 2 mm to the teachpoint *z*-axis and click **Teach**.

10 In the **Profiles** tab, click **Update this profile** to save the changes.

11 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

| IMPORTANT | Verify the this accessory teachpoint for your microplate type using a full set of tips. For guidance, contact Agilent Technical Support. |

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Editing teachpoints	"Setting teachpoints" on page 37

Installing and setting up a Nested Rack Insert

About this topic

You should install the Nested Rack Insert if you are using nestable tip racks on the Bravo Platform. The insert ensures the stability of a nestable tip rack during tips-on and tips-off tasks. Up to five nestable tip racks can be stacked on a single platepad using the Nested Rack Insert.

After you install the Nested Rack Insert, you configure the software to automatically select the location in VWorks during tips-on and tips-off tasks.

This topic describes how to install and configure the Nested Rack Insert.

Figure   Nested Rack Insert installed on a Bravo platepad
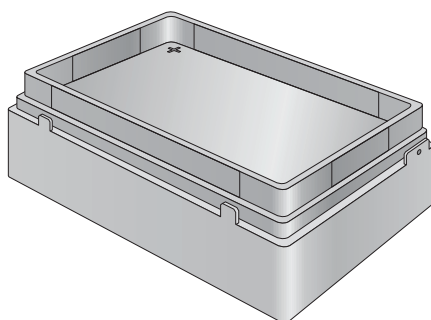
Before you begin

Make sure you do the following before installing the Nested Rack Insert:

* Ensure that the labware definition specifies a nested tip box as follows:

  In the **Labware Editor**, click the **Plate Properties** tab. In the **Requires insert** list, select Nested Rack Insert.

* Set the teachpoints for all deck locations.

* Verify that the gripper *y*-axis offset is correct. See "Verifying the gripper setup" on page 44. In Bravo Diagnostics, perform a place plate task to move a nested tip box and ensure the gripper *y*-axis offset is correct.

* Obtain a 1.5 mm hex wrench for installing the insert.

Installing the Nested Rack Insert

To install the Nested Rack Insert:

1 On the Bravo deck, locate the platepad where you plan to do tips-on and tips-off tasks. Place the Nested Rack Insert on the platepad, making sure to align the crosshairs on the insert (1) directly above the platepad crosshairs.

2 To secure the Nested Rack Insert, use a 1.5 mm hex wrench to tighten the platepad screw (2).
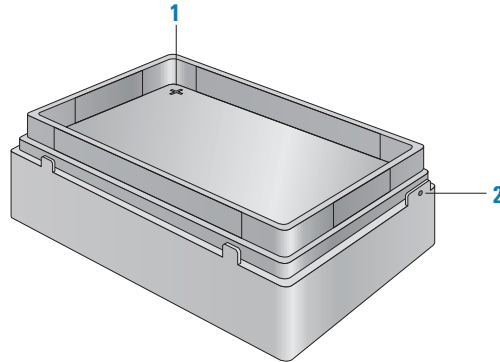
Configuring the Nested Tip Rack Insert

To configure the Nested Tip Rack Insert:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.
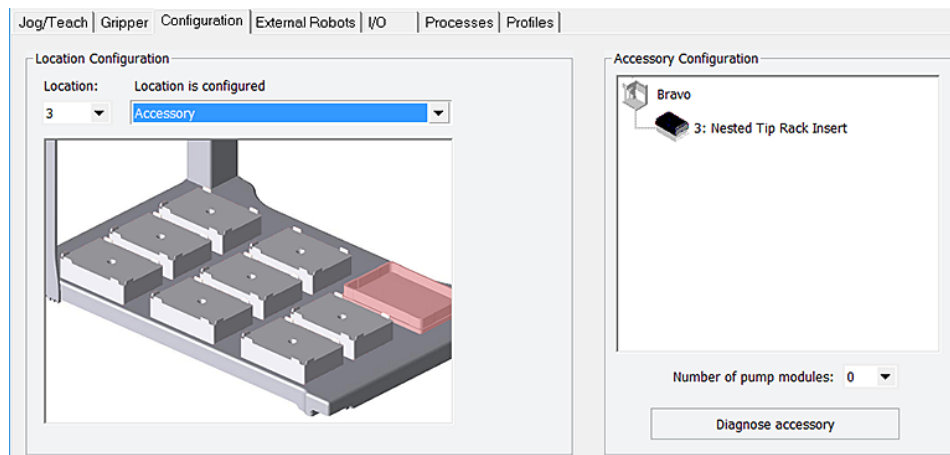
3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4 Follow the instructions in the **Accessories Wizard** to:

   a Specify the **Location** of the installed insert.

   Note: Your selection in the Accessories Wizard overrides the default selection in the Configuration tab.

   b Choose the **Nested Tip Rack Insert**.

5   When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height.

6   Set the teachpoint for the Nested Rack Insert using the same procedure that you would for a platepad.

    The Nested Rack Insert is approximately 5 mm taller than a standard platepad.

7   In the **Profiles** tab, click **Update this profile**.

8   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

9   To verify the setup, perform a tips-on task.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Gripper *y*-axis offset	"Verifying the gripper setup" on page 44
Editing teachpoints	"Setting teachpoints" on page 37
Setting up labware definitions	*VWorks Automation Control Setup Guide*
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Using the Manual Fill Reservoir

About this topic

This topic describes the Manual Fill Reservoir.

Description

The Manual Fill Reservoir is an open tray that you can install on a platepad to supply reagents to 96- and 384-channel pipette heads. You must manually refill and empty the reservoir.

Automation Solutions reservoirs are approved for use with most reagents and solvents. If you have questions on the use of a particular chemical or solvent in a Automation Solutions reservoir, contact Agilent Technical Support prior to use.

Figure   Two types of Manual Fill Reservoirs: 96-well and 384-well options

96-   384-
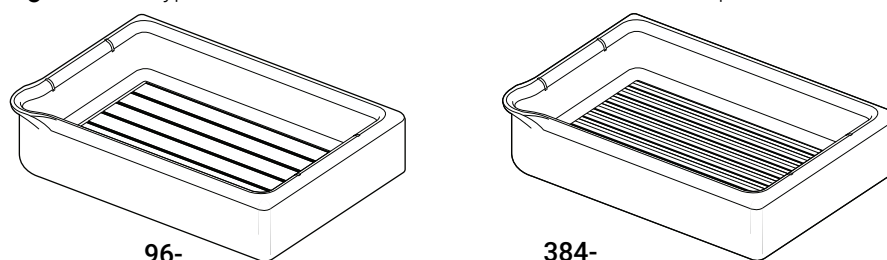
Using the reservoir

Before using the reservoir:

1   In the **Labware Editor**, ensure a labware definition is set up with the Reservoir base class.

2   Specify the deck location as configured labware in the VWorks software.

To use a Manual Fill Reservoir:

1   Fill the reservoir and place it on a deck location. The reservoir can be in any orientation.

2   To empty the reservoir, lift it from the deck location and discard the fluid according to applicable regulations.

Related information

For information about…	See…
Safety guidelines	*G5562A, G5563A Bravo Platform Safety and Installation Guide*
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up the Thermal Station (cooling pad)

About this topic

This topic describes how to install the Thermal Station (cooling pad) on a Bravo deck location.

The Thermal Station uses a fluid-filled thermal block to provide temperature control of ±0.1°C uniformly across a microplate. The Thermal Station consists of the following:

- A deck positioner (figure, 1) that attaches to the deck
- A cold plate (figure, 2) that installs on the deck positioner
- A liquid chilling unit and tubing (not shown) that supplies the chilled fluid to the Thermal Station.
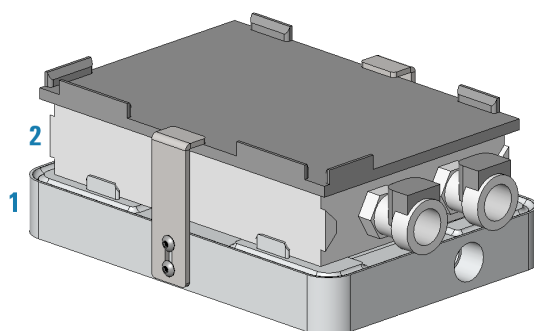
The Thermal Station is available with the drain ports on the short end or long side of the accessory. Typically, the drain ports are on the short end and the tubing is routed off the side of the Bravo deck. A Thermal Station that has the drain ports on the long end may be installed in the back row of the Bravo deck with the tubing routed out the rear. Use the following procedure to install either option.

WARNING   **Routing the Thermal Station tubing out the front of the Bravo deck will interfere with the Bravo Light Curtain. Operating the Bravo Platform without the Light Curtain can expose operators to moving-parts hazards. To prevent potential injury, ensure that no tubing or other accessory parts interfere with the operation of the Bravo Light Curtain.**

Setup workflow

Step	Procedure	See…
1	Install the Thermal Station at the Bravo deck location.	"Installing the Thermal Station" on page 163
2	Configure the deck location for this accessory in the Bravo profile.	"Configuring the deck location in the profile" on page 165

Step	Procedure	See…
3	Edit the teachpoint. *Note:* Earlier model cold plates may not have a crosshairs. In this case, use the teach plate. Be sure to consider the 10-mm thickness of the teach plate when you edit the teachpoint.	"Setting the first teachpoint" on page 39
4	Complete the hardware setup.	"Completing the hardware setup" on page 167

Installing the Thermal Station

Before you start

Make sure you have the following:

- Thermal Station, including the deck positioner and socket-head screw that fastens the deck positioner to the deck
- Hex wrenches: M1.5, M2, and M5
- Plumber's tape
- Liquid chilling unit, tubing, and manufacturer user documentation

WARNING   **To prevent a potential injury, turn off the Bravo Platform before you install or remove the accessory.**

Procedure

To install the Thermal Station:

1 If a platepad is installed at the target location, uninstall the platepad as follows:

Uninstall the M6 screw in the center of the platepad and then lift the platepad off of the deck.

2 Prepare the aluminum deck positioner, as follows:

a Using plumber's tape, install the appropriate plug in the corresponding drain hole on the deck positioner:

- Elbow plug (part G5550-24200) on short side
- Straight plug (part G5550-16025) on long side

b Set the plug angle slightly lower than parallel to the deck positioner to allow draining.

c Ensure that a plug is installed in the unused drain hole using plumber's tape. For example, if you installed the elbow plug on the short side, ensure that the drain on the long side is plugged.

Note: For easier access to the bracket screws, you may prefer to temporarily install the side brackets on deck positioner before performing the next step.

Figure   Deck positioner with elbow plug installed on the short end
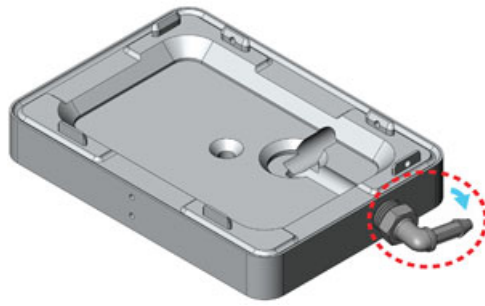
3   Install the deck positioner at the target deck location:

a   Orient the deck positioner so that the elbow plug is on an outside edge of the deck and facing the direction of the tubing path.

b   Align the deck positioner dowel pins with the holes on the deck, and make sure the deck positioner sits level on the deck.

Note: If necessary, use a rubber mallet to tap the deck positioner until it sits level on the deck.

c   Insert the screw into the center of the deck positioner and tighten. See the following figure, item 1.

d   Ensure that the setscrews in the deck positioner tabs (figure, 2) are recessed. Use a M1.5 hex wrench to back out any protruding setscrews.
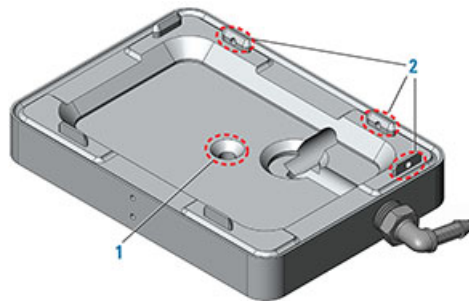
4   Inspect the cold plate to ensure no bowing is visible along its length at the top and bottom.
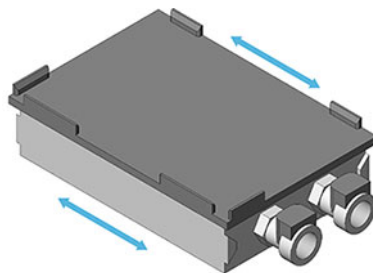
5   Place the cold plate on top of the deck positioner. Make sure the cold plate is level and fully seated on the deck positioner.

6   Using an M1.5 hex wrench, tighten the setscrews on the deck positioner tabs as follows:

    a   Tighten the setscrew on the end tab.

    b   Tighten the setscrews in the two side tabs.

7   Install the side brackets as follows:
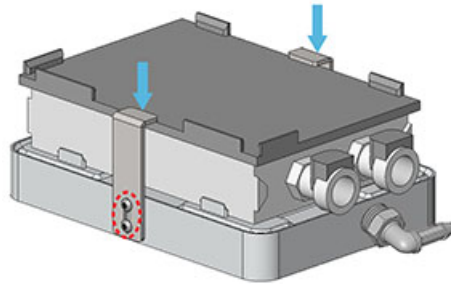
    a   Position the brackets, aligning the slots in the brackets with the screw holes in the deck positioner.

    b   Install the two hex screws in each bracket, and then apply downward pressure on the bracket tops while tightening the hex screws.

Ensure that both brackets are holding the cold plate securely in place.

Configuring the deck location in the profile

CAUTION   **To prevent a potential collision, make sure that you configure the deck location as a** Thermal Station **in the profile.**

Configuring this deck location as a Thermal Station enables the Bravo gripper to safely transfer labware to and from that location even if a thermal plate insert is seated on the Thermal Station. During a transfer, the Bravo gripper raises the labware 30 mm (z-axis) before moving it from the Thermal Station.

To configure the deck location:

1   In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is selected.

2   In the **Configuration** tab. **Location is configured as** list, select **Accessory**.
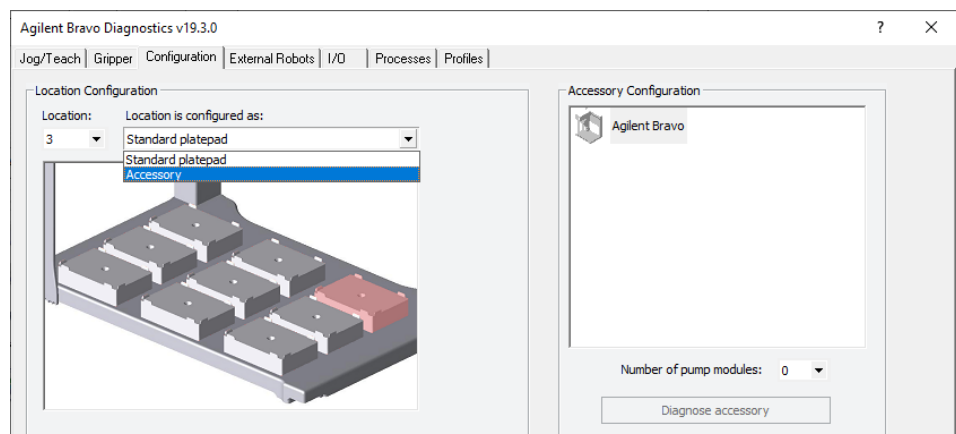
3   Follow the instructions in the **Accessories Wizard** to:

a Specify the **Location** of the installed accessory.

Note: Your selection in the Accessories Wizard overrides the default selection in the Configuration tab.

b Select **Thermal Station** in the Accessory list.
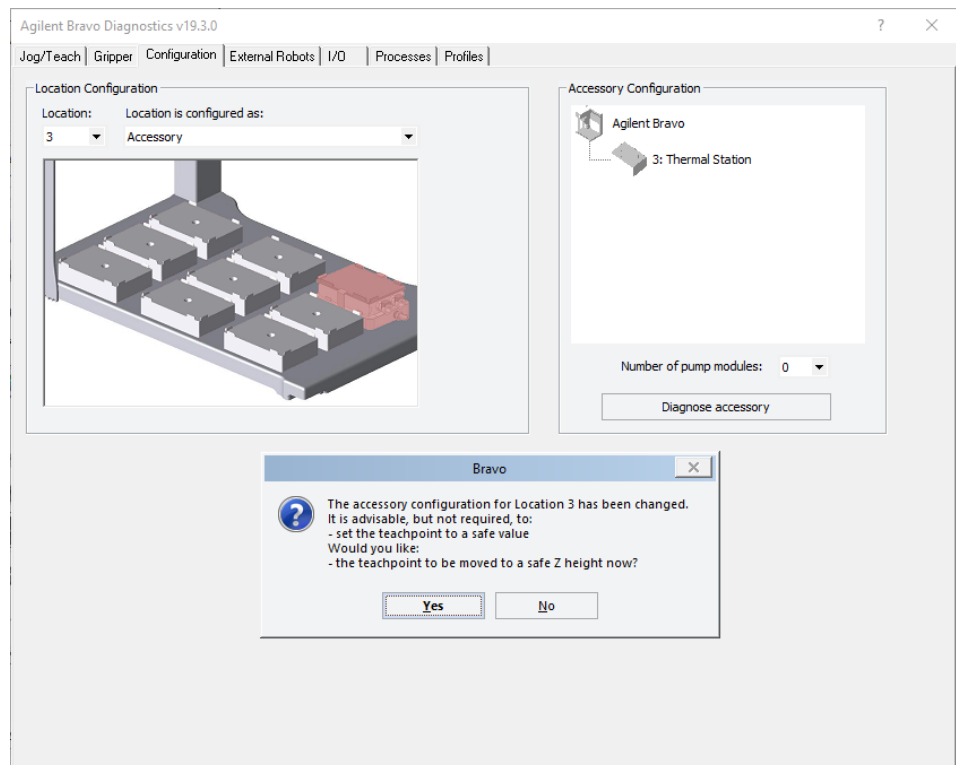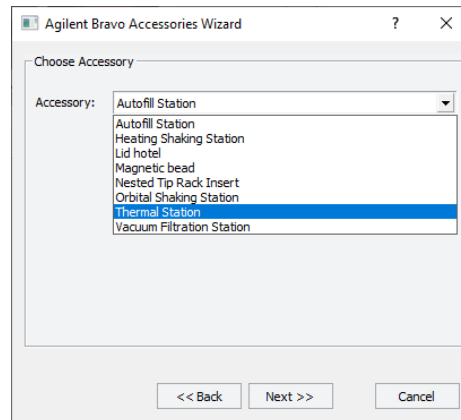
4 In the configuration message, click **Yes** to move the teachpoint to a safe height.

5 Set the teachpoint for the Thermal Station using the same procedure that you would for a platepad.

Note: This accessory configuration accounts for the extra height of the Thermal Station, which is approximately 20 mm taller than a standard platepad

6 In the **Profiles** tab, click **Update this profile**.

7 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Completing the hardware setup

After installing the Thermal Station and adjusting the teachpoint, the following setup tasks must be completed before the accessory is ready for use.

Step	Procedure	See…
1	Connect one end of the marprene tubing to the cooling unit drain and place the other end in a waste container.	Liquid chilling unit manufacturer's user documentation
2	Install the straight ends of the thermal tubing into the Thermal Station, and connect the other ends into the cooling unit.	Liquid chilling unit manufacturer's user documentation
3	Connect the power cord from cooling cube to an AC outlet.	Liquid chilling unit manufacturer's user documentation
4	Fill the liquid chilling unit as follows: **a** Turn on the unit. **b** Watch for the **Liquid Level Low** message to display on the front panel. **c** Turn off the unit and fill it with 25% EtOH or cooling fluid recommended by manufacturer. **d** Repeat steps a to c. The unit should hold 600 to 700 mL.	Liquid chilling unit manufacturer's user documentation
5	Make sure the unit is on, and set the temperature on the front display. Press ENTER and then press START/STOP to start the cooling. Verify that the Thermal Station gets cold.	Liquid chilling unit manufacturer's user documentation

Related information

For information about…	See…
Verifying and setting the teachpoint for the accessory	• "Using the teach plate to set the teachpoint for an accessory" on page 118 • "Setting teachpoints" on page 37
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Installing a Heating Shaking Station

About this topic

This topic describes how to install the Heating Shaking Station and presents the workflow for configuring the accessory in the software.

Description

The Heating Shaking Station provides fluid mixing and heating for microplates. The Heating Shaking Station uses a short adapter pad to attach to the Bravo deck. The station uses the Inheco Single TEC Control (STC) or Multi TEC Control (MTC) to connect to the computer and power source.

Figure   Heating Shaking Station and adapter pad
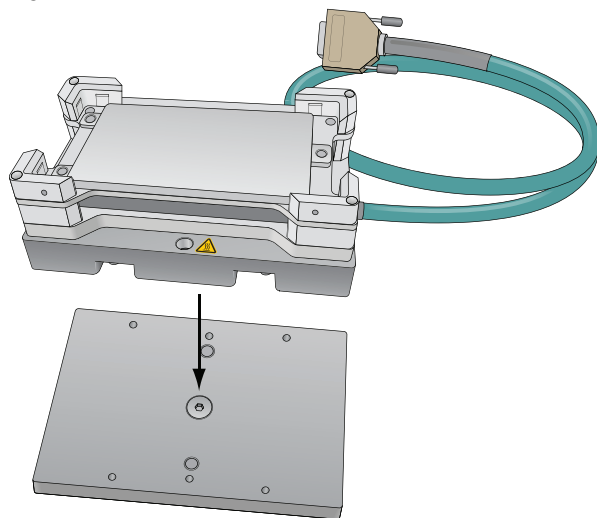
Figure   STC and MTC Controllers
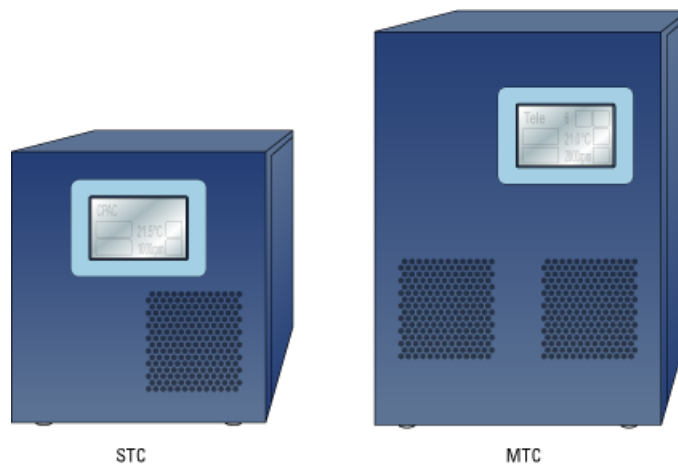
Before you start

WARNING	**To prevent potential injury and damage to the device, turn off the Bravo Platform before you install or remove an accessory.**

The Heating Shaking Station may be installed at any deck location using the short adapter pad instead of a platepad.

- Heating Shaking Station, including adapter pad, M6 x 12 flathead screw (to attach the adapter pad), and two M3 x 18 socket-head cap-screws
- 2.5-mm and M5 hex wrenches
- Inheco STC or MTC Controller with the corresponding PCA installed for the Heating Shaking Station, power and communication cables, and Inheco user documentation

Use the following workflow.

Step	For this task...	See...
1	Set up the Inheco MTC or STC Controller. For guidance, contact Agilent Technical Support.	Manufacturer documentation
2	Install the Heating Shaking Station on the Bravo deck.	"Installing the Heating Shaking Station" on page 169

3	Set up the station in the software:
	  a Configure the station in the Bravo profile.
	  b Test the station functioning.
	  c Set the teachpoint.
		"Setting up thermal and shaking stations (Inheco controller)" on page 171

Installing the Heating Shaking Station

To install the Heating Shaking Station:

1 Remove the M6 screw in the center of the platepad. Remove the platepad.

2 Position the adapter pad in the predetermined deck location aligning the dowel pins in the corresponding holes on the deck.

   Make sure the adapter pad sits level on the deck.

3 Insert the M6-x-12-mm flathead screw into the center of the adapter pad and tighten the screw.
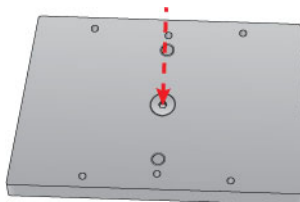
4 Place the Heating Shaking Station on top of the adapter pad.

Ensure that the station sits level on the adapter pad and the safety label ⚠ faces the front of the workspace.

5 Insert the two M3-x-18-mm socket-head cap screws into the holes at the front and back end of the adapter pad and use the 2.5-mm hex wrench to tighten the screws.
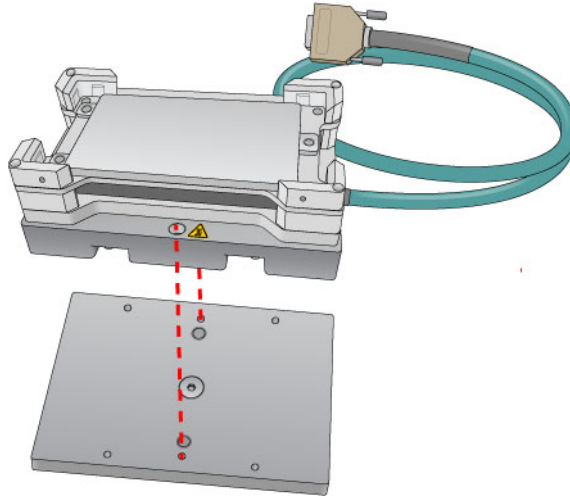
6 Determine if the pairs of alignment tabs (figure, item 1) in each corner of the plate nest require adjustment as follows:
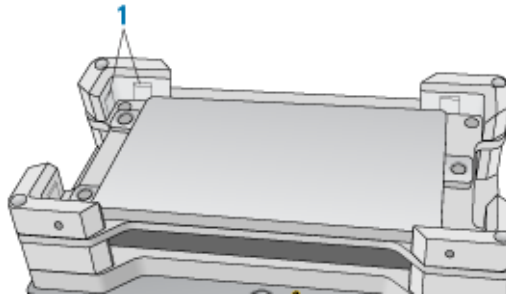
a Position a labware in the plate nest, ensuring that it is fully seated.

b Make sure that the labware fits in the nest so that it is not too loose or too tight. To test the fit, lift the labware and re-seat it several times.

c If necessary, use a flathead driver to adjust the setscrews so that the tabs are recessed or extended, as needed.

7 Connect the cables:

a Connect the cable from the Heating Shaking Station to the Inheco STC or MTC Controller.

Note: The accessory cable is color-coded to match the card installed in the STC or MTC.

b Connect the STC or MTC Controller power and communication cables. See the Inheco user documentation for details on how to connect the STC or MTC.

c Press the STC or MTC Controller power switch to the **on (|)** position.

Figure   MTC Controller (front and back views)

After installing the accessory, you configure it in the Bravo profile, establish communication, and set the teachpoint for the location.

Related information

For information about…	See…
Configuring and teaching the Heating Shaking Station	"Setting up thermal and shaking stations (Inheco controller)" on page 171
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up thermal and shaking stations (Inheco controller)

About this topic

This topic describes how to configure the Bravo thermal and thermal shaking accessories that are controlled by the Inheco Single TEC Controller (STC) or Multi TEC Controller (MTC). The Inheco STC and MTC controlled accessories include the following:

Accessory name	Corresponding Inheco name
Peltier Thermal Station	CPAC Ultraflat
Heating Shaking Station	Teleshake 95

The STC can control a single Inheco device, and the MTC can control multiple Inheco devices. For a detailed description of the Inheco STC or MTC, see the Inheco STC or MTC user documentation.

Figure   Inheco STC and MTC Controllers
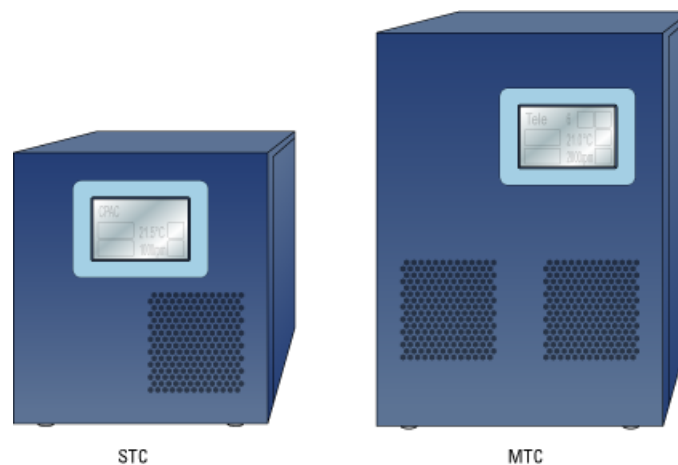
Configuring an Inheco station

To configure an Inheco station in Bravo Diagnostics:

1   In Bravo Diagnostics, click the **Profiles** tab, and verify that the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Location is configured as** list, select **Accessory.** The Accessories Wizard opens.

4   In the **Accessories Wizard**, select the **Location** of the installed accessory. In the **Choose Accessory** page, select Heating Shaking Station.

5   Enter the following values in the accessory parameters page.

   a   In the **MTCSTC Id** box, select the ID number of this device. The ID number identifies the specific device for the VWorks software.

   Note: The ID number is set using a DIP switch control on the rear panel of the Inheco STC or MTC Control. See the Inheco user documentation for a description of how to set the ID for each slot on the STC or MTC device.

   b   Select the **MTCSTC Type**, either STC or MTC.

   c   In the **Slot Id** box, select the slot number on the Inheco STC or MTC rear panel where the accessory's cable is connected.

   Note: The STC has only one slot.

6   Click **Finish**.

7   When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height.

8   In the **Profiles** tab, click **Update this profile**.

9   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

10   Edit the location's teachpoint for the accessory. See "Teaching a thermal or thermal shaking station" on page 174.

Testing a thermal or thermal shaking station

<table>
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WARNING

</td><td>

Burn hazard. During the heating process, the thermal stations can have hot surfaces that can cause a burn injury. Allow the thermal stations to cool before attempting to touch them.

</td></tr>
</table>

The following warning symbol appears on the thermal stations, warning you of the potential burn hazard.

To test the station:

1   Ensure that the connected STC or MTC power switch is set to the On position.

2   In Diagnostics, ensure the correct profile is initialized, and then click the **Configuration** tab.

3   In the **Accessory Configuration** area, select the Heating Shaking Station, and then click **Diagnose accessory**.
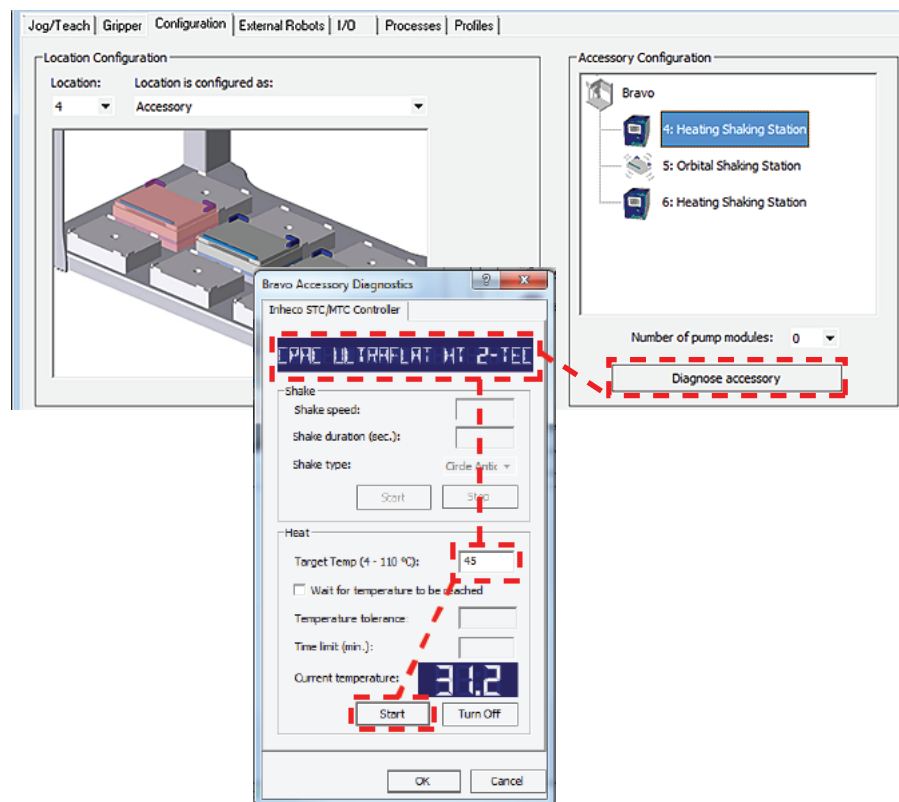
4   In the **Bravo Accessory Diagnostics** dialog box, verify that the correct device appears in the display at the top.

Note: The software obtains the device name from the STC or MTC, and then the Inheco name of the device appears in the display of the dialog box, for example, CPAC Ultraflat or Teleshake 95.

5   *Shaking accessories only*. Set the parameters in the **Shake** area:

   a   In the **Shake speed** box, type the shaking speed.

   b   In the **Shake duration** box, type the time duration (seconds).

   c   In the **Shake type** box, select the type of stirring motion.

   d   Click **Start** to test the shake parameter settings. At the device, verify that the accessory operates correctly.

   Click **Stop** to turn off the shaking feature.

6   *Thermal accessories only*. In the **Heat** area, set the parameters to test the temperature function:

   a   In the **Target temp** box, type the temperature (°C).

   b   To specify a time limit within which to reach the target temperature, select the **Wait for temperature to be reached** check box, and then set the following:

   •   In the **Temperature tolerance** box, type the ±°C.

   •   In the **Time limit** box, type a time limit (minutes).

   c   Click **Start** to test the Heat parameter settings. At the device, verify that the accessory operates correctly.

   Click **Turn Off** to stop the heating or cooling.

7   Click **OK** to close the dialog box.

Teaching a thermal or thermal shaking station

The teaching procedure can vary depending on the combination of microplate, plate nest, and adapter. The procedures in this section are for the following configurations on a Bravo Platform with a disposable-tip head:

•   Peltier Thermal Station with generic plate nest and adapter

•   Heating Shaking Station

IMPORTANT   If you have a Peltier Thermal Station with a custom plate nest and adapter, Contact Agilent Technical Support for guidance on how to teach your combination of microplate, plate nest, and adapter.

The microplate bottom surface configuration affects how it sits in the station's plate nest. The following figure shows a skirted microplate in a Peltier Thermal Station that has a generic plate nest and adapter. In the figure, the well bottoms rest on the top of the adapter (1), and the skirt rests on the top of the plate nest's lower surface (2).

Figure   Skirted microplate sitting in Peltier Thermal Station with generic plate nest and adapter (cut-away side view)
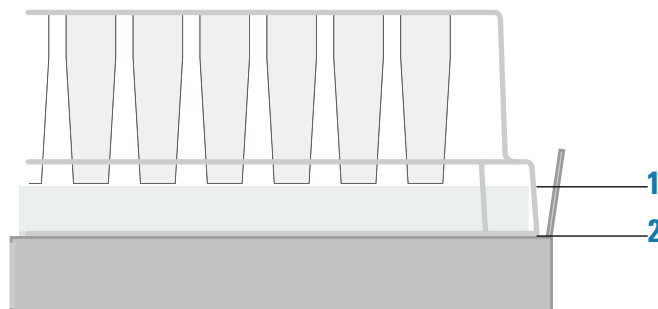
As the figure shows, the height difference between the adapter top (1) and the plate nest top (2) enables a skirted microplate to nest in the station. The well bottoms must sit directly on the adapter top to enable an efficient temperature transfer. However, the teachpoint must account for this height difference to ensure that the Bravo robot grips the microplate at the correct position and performs pipetting tasks at the correct height.

> **CAUTION** | **If your microplate does not sit in the plate nest as the figure shows, contact Agilent Technical Support for guidance on whether your microplate requires a custom plate nest and adapter.**

> **CAUTION** | **Use the following procedure only on a Bravo Platform with a disposable-tip head.**

To set the teachpoint for a generic Peltier Thermal Station or Heating Shaking Station:

1   Place the microplate securely in the plate nest of the thermal station. Verify that the microplate sits in the plate nest so that the well bottoms are resting on the adapter and the skirt rests in the plate nest bottom surface. Remove the microplate.

2   Using calipers, measure the height difference between the adapter top (1) and the plate nest top (2) on all four sides of the plate nest interior. Make a note of the smallest number. Later in the procedure, you will add this value to the *z*-axis value for the teachpoint.

3   Place the teach plate in the plate nest.

Note: Alternatively, you can use a 384-well microplate instead of the teach plate to set the teachpoint *xy* coordinates. In this case, you set the *xy* coordinates based on the center of the A1 well quadrant, as the following figure shows.
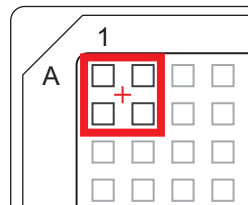
4   In **Bravo Diagnostics**, click the **Profiles** tab, and initialize the desired profile.

5   In **Bravo Diagnostics**, click the **Processes** tab, select a tip box, and perform a **Tips On** command. For details, see "Performing a task using Bravo Diagnostics" on page 105.

> **CAUTION** | **Using the wrong tip for teaching can result in a head crash. Make sure the disposable tip is an Agilent tip and is the same as the Teaching tip type specified in the profile.**

6   In **Bravo Diagnostics**, click the **Jog/Teach** tab, and set the initial teachpoint as follows:

   a   Select the deck location of the station from the **Location** list.

   b   Use the controls to jog the head so that the A1 pipette tip is directly over the crosshairs with paper-thin clearance. For details, see "Setting the first teachpoint" on page 39.

    c   Click **Teach** to set the teachpoint.

    d   In the **Profiles** tab, click **Update this profile**.

    e   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

7   Adjust the teachpoint *z*-axis value for the teach plate height as follows:

    a   Jog the head up in the *z*-axis so that you have enough room to remove the teach plate. Remove the teach plate.

    b   In the **Jog/Teach** tab, use the controls to jog the head down in the *z*-axis until there is paper-thin clearance between the end of the tip and the top surface of the adapter.

        Note: When the *z*-axis error message appears, you may click Ignore.

    c   Click **Teach** to set the teachpoint.

    d   In the **Profiles** tab, click **Update this profile**.

    e   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

8   In **Bravo Diagnostics**, click the **Processes** tab, select the empty tip box, and perform a **Tips Off** command. For details, see "Performing a task using Bravo Diagnostics" on page 105.

9   Adjust the teachpoint *z*-axis value for the height difference between the adapter and the plate nest as follows:

> **CAUTION**   **Before you perform this step, ensure that the tips are off. Otherwise, a crash can occur between the tips and the station.**

> **CAUTION**   **After adjusting the teachpoint to account for the height difference between the adapter and the plate nest, do not use tips to verify the teachpoint. Otherwise, a crash can occur between the tips and the station.**

    a   In the **Jog/Teach** tab, select the deck location of the station, and click **Move.**

    b   Jog the head down in the *z*-axis by the measured value from step 2.

    c   Click **Teach** to set the teachpoint.

    d   In the **Profiles** tab, click **Update this profile**.

    e   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

To verify the teachpoint by performing a pick and place:

1   In Diagnostics, click the **Gripper** tab.

2   Select the **Labware** from the list.

3   In the **Location A** list, select a deck location.

4   In the **Location B** list, select the thermal station location.

5   Place a test microplate on deck location A, and then click the following:

    •   **Pick A -> B** to pick up the microplate from deck location A and place it on deck location B.

    •   **Pick B -> A** to pick up the microplate from deck location B and place it on deck location A.

6 Make sure that the gripper holds the microplate securely and keeps it level while moving the microplate from location to location. Ensure that the gripper places, but does not drop the microplate at the destination location.

Related information

For information about…	See…
Heating Shaking Station	"Installing a Heating Shaking Station" on page 168
Peltier Thermal Station	"Installing and configuring the Peltier Thermal Station" on page 178
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Installing and configuring the Peltier Thermal Station

About this topic

This topic describes how to install the Peltier Thermal Station and presents the workflow for configuring the accessory in the software.

Description

The Peltier Thermal Station uses Peltier technology to provide temperature control uniformly across a microplate. The station can be fitted with a variety of plate nests and adapters to provide efficient temperature control for different types of microplates.

This accessory requires the Bravo risers to raise the Bravo deck surface and accommodate the height of the accessory below the deck. To install Bravo risers, contact Agilent Technical Support.

The following figure shows the Peltier Thermal Station fitted with the custom plate nest.

Figure   Peltier Thermal Station with custom plate nest
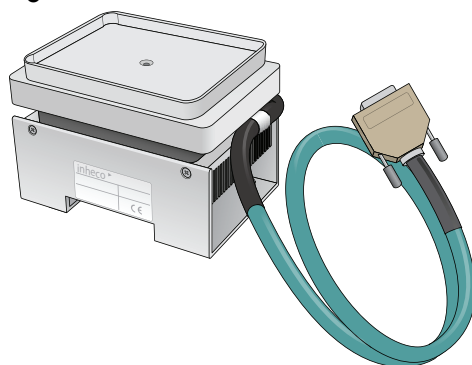
IMPORTANT   Ensure that you have the correct plate nest and adapter for the requirements of your assay. Your microplate must nest in the station correctly to ensure efficient heat transfer. For more information, contact Agilent Technical Support.

Before you start

CAUTION
Ensure that the connector end of the cable on the Peltier Thermal Station does not knock against the metallic table top or other areas as it could get permanently damaged. Handle the Peltier Thermal Station cable with care during all stages of installation.

Ensure you have the following:

*   Bravo Platform with risers installed

    The Peltier Thermal Station is too tall to sit at deck level and must be installed in a deck cutout at deck location 4 or 6, as the following figure shows.
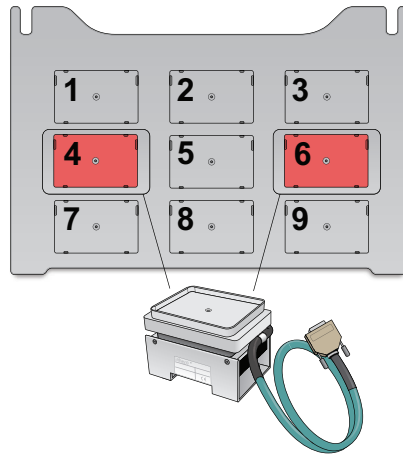
*   Peltier Thermal Station assembly, including four M2.5 bolts and one M3 flathead cap screw
*   Hex drivers
*   Inheco STC or MTC Controller with PCA installed for Peltier Thermal Station, power and communication cables, and Inheco user documentation

Use the following workflow.

Step	For this task...	See...
1	Set up the Inheco MTC or STC Controller. For guidance, contact Agilent Technical Support.	Manufacturer documentation
2	Install the Peltier Thermal Station on the Bravo deck.	"Installing the Peltier Thermal Station" on page 180
3	Set up the station in the software: **a** Configure the station in the Bravo profile. **b** Test the station functioning. **c** Set the teachpoint.	"Setting up thermal and shaking stations (Inheco controller)" on page 171

Installing the Peltier Thermal Station

To install the Peltier Thermal Station:

1   Uninstall the platepad, if applicable, from either deck location 4 or 6.

To uninstall a platepad, remove the M6 flathead screw from the center of the platepad. Remove the platepad from the deck.

2   Remove the four M3 screws that attach the cutout cover to the deck.

Figure   Cutout cover on the Bravo deck
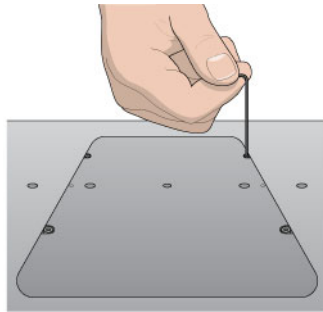
3   Uninstall the plastic interface from the top of the Peltier Thermal Station by removing the four screws located at the four corners.

Figure   Plastic interface on the top of the Peltier Thermal Station
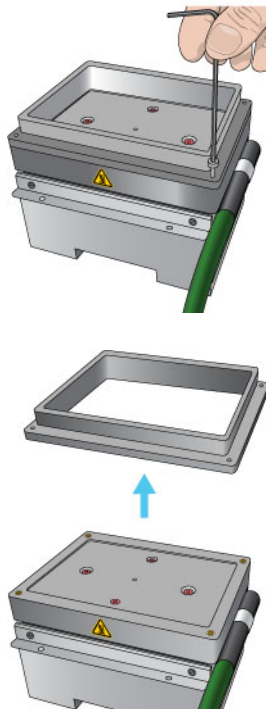
4   Refer to the following figure, and then place the Peltier Thermal Station assembly into the cutout hole as follows:

Figure   Placing the Peltier Thermal Station into the deck hole
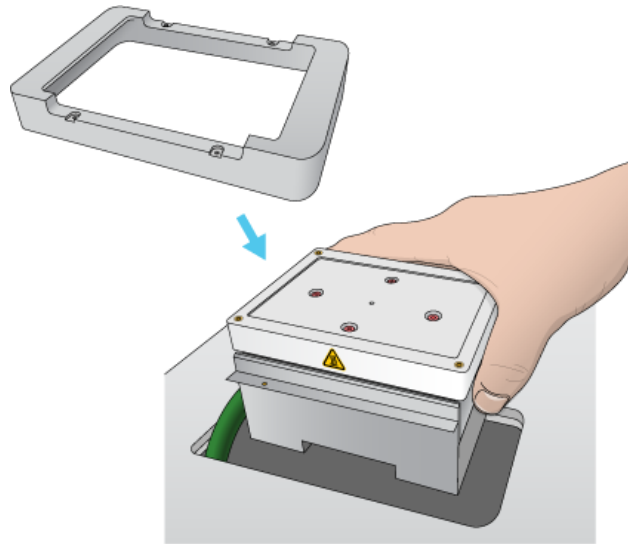
a   Carefully slide the cable into the cutout hole first before you place the Peltier
Thermal Station assembly into the cutout.

b   Ensure that the safety label ⚠️ faces the front of the Bravo deck.

c   Press and hold from the bottom to squeeze in the metal as you insert the
Peltier Thermal Station assembly into the hole.

d   Position the bracket around the outside edges of the top area of the assembly.

e   If there is slight resistance when fitting the assembly into the cutout or when
positioning the bracket, you may use a rubber mallet to tap the metallic base or
bracket into place.

CAUTION   **Using too much force to tap the base into place can damage the Peltier Thermal
Station.**

Figure   Tapping the Peltier Thermal Station bracket in place
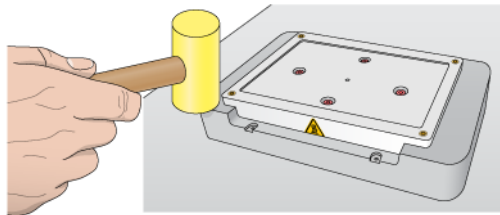
f   Ensure that the Peltier Thermal Station sits flush in the cutout and that the
bracket is seated on the Bravo deck.

5   Install the four M2.5 bolts that secure the bracket to the deck.

Figure Securing the Peltier Thermal Station to the deck
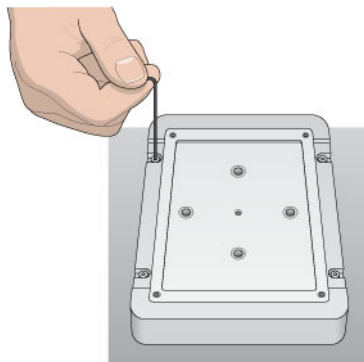
6 Install the custom plate nest on the plastic top of the Peltier Thermal Station as follows:

a Position the plate nest and ensure that it is fully seated.

b Install the M3 screw in the center of the plate nest to secure it to the Peltier Thermal Station.

Figure Installing the custom plate nest
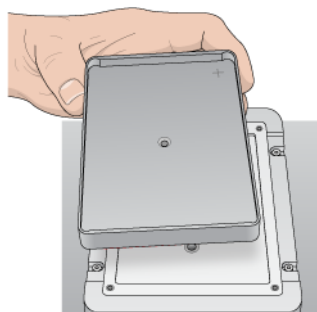
7 Connect the cables:

a Connect the cable from the Peltier Thermal Station to the Inheco STC or MTC Controller.

Note: The accessory cable is color-coded to match the card installed in the STC or MTC.

b Connect the STC or MTC Controller power and communication cables. See the Inheco user documentation for details on how to connect the STC or MTC.

c Press the STC or MTC Controller power switch to the **on (I)** position.

Figure   MTC Controller (front and back views)

After installing the accessory, you configure it in the Bravo profile, establish communication, and set the teachpoint for the location.

Related information

For information about…	See…
Configuring the Peltier Thermal Station in the Bravo profile and setting the teachpoint	"Setting up thermal and shaking stations (Inheco controller)" on page 171
Using the accessory in a protocol	*VWorks Automation Control User Guide*

(Bravo SRT only) Setting up an LT tip box location

About this topic

Read this topic if you have a Bravo SRT Platform and you are using the 250-µL tips. The height limitation on the Bravo SRT requires a special platepad and a deck location configured for the 250-µL tip box operations.

The following figure shows the SRT platepad options for tip operations.

Figure   SRT platepads: (A) ST tip loading station, and (B) SRT platepad for 250 µL LT tip boxes

A   **B**
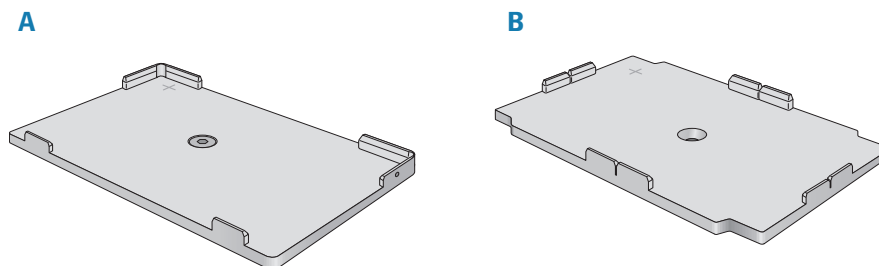
Before you start

CAUTION   **To prevent potential hardware crashes when using 250-µL tips, make sure you understand the following limitations of the z-axis clearance on the Bravo SRT.**

- Be aware that the Bravo SRT has insufficient clearance to move labware if the 250-µL tips are installed on the liquid-handling head. The Bravo SRT can move labware only if 250-µL tips are not on the liquid-handling head.

- Limit tips on and tips off tasks to deck locations where an SRT 250-µL tip box platepad is physically installed and configured in the Bravo Diagnostics software. This special platepad provides additional *z*-axis clearance, and is designed for a tip box that holds 96 250-µL tips.

- Use labware classes for each deck location so that the 250-µL tip box operations are not attempted at deck locations with insufficient *z*-axis clearance.

- Use VWorks Task Groups to ensure that tips on and tips off tasks are performed before plate movement tasks in the protocol.

Ensure that you have the following:

- M5 hex wrench for removing a standard SRT platepad
- SRT platepad for 250-µL tip box
- Star-head screw and wrench for installing the SRT 250-µL tip box platepad

Workflow

Step	For this task...	See...
1	Install an SRT platepad for 250-µL tip boxes at any deck location where you plan to do tips on and tips off tasks.	"Installing the 250-µL tip box platepad on the Bravo SRT" on page 185
2	In Bravo Diagnostics, configure the location and set the teachpoint.	"Configuring the platepad in Bravo Diagnostics" on page 185
3	In the Labware Editor, set up appropriate labware classes. For example, limit the tip box location to a labware class that uses the SRT platepad for 250-µL tip boxes, and other locations to a class that uses a standard SRT platepad.	*VWorks Automation Control Setup Guide*
4	In the VWorks software, edit the device file to specify the appropriate labware class for each deck location.	"Creating or adding a Bravo device" on page 21
5	In the VWorks software, use Task Groups to ensure that tips on and tips off tasks are performed before plate movement tasks in the protocol	*VWorks User Guide*

Installing the 250-µL tip box platepad on the Bravo SRT

To install the SRT platepad for 250-µL tip boxes:

1 Remove the M6 screw in the center of the platepad, and remove the standard SRT platepad.
2 Position the SRT platepad for 250-µL tip boxes so that the crosshairs are at the back left side of the deck location.

   Make sure that the platepad sits level on the deck.
3 Insert the supplied star-head screw into the center of the 250-µL tip box platepad, and use the star-head wrench to tighten the screw.

Configuring the platepad in Bravo Diagnostics

To configure the SRT platepad for 250-µL tip boxes:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and open the profile for the given Bravo SRT platform.
2 In the **Profiles** tab, select the **This is a** Bravo **SRT** check box.
3 In the **Configuration** tab, select the **Location**.

4 In the **Location is configured as** list, select **(SRT only) platepad for 250 µL tips**.
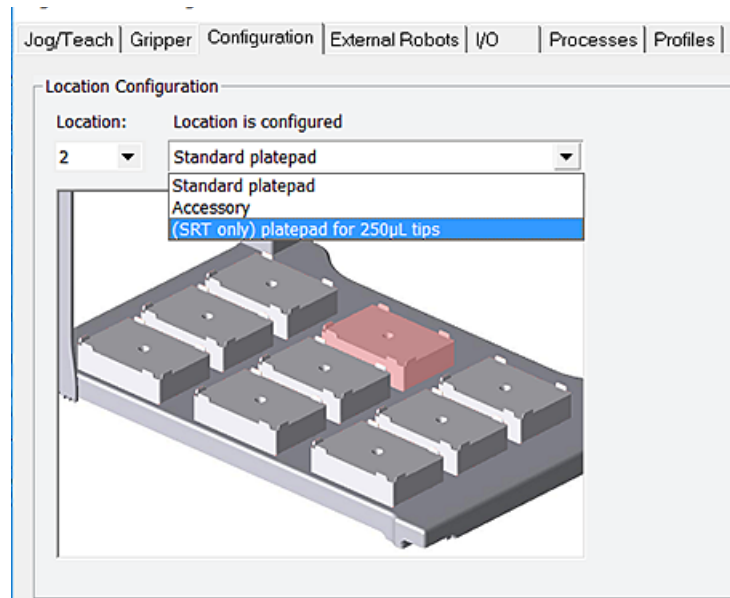
5 Click the **Jog/Teach** tab, and teach the deck location using the crosshairs on the platepad. See "Setting teachpoints" on page 37.

If you previously taught this deck location using the **Set all teachpoints based upon selected teachpoint** feature, you can:

a Select the platepad **Location**, and click **Move** to go to the preset teachpoint.

b Using small increments, jog down in the z-axis until you have paper-thin *z*-axis clearance between the pipette tip and the crosshairs.

c When the tip is in the correct position (directly over the crosshairs with paper-thin clearance), click **Teach.**

Note: Although the 250-µL tip box actually sits on the Bravo SRT deck, the software makes an adjustment in the *z*-axis to compensate for the height difference.

6 In the **Profiles** tab, click **Update this profile.**

7 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Related information

For information about...	See...
Starting Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing teachpoints	"Setting teachpoints" on page 37

B Autofilling accessories

This chapter describes the autofilling accessories that can be used with the Bravo Platform and provides the installation and removal procedures. This chapter contains the following topics:

For details on how to set up accessories on the AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

Autofilling station overview and setup workflow

About this topic

An autofilling station is a location on the Bravo Platform where a reservoir can be automatically filled with liquid. This topic describes the components and provides the workflow for setting up an autofilling station.

Autofilling accessories

Accessory	Description
Pump Module	Pumps fluids to and from one of the Agilent autofilling type reservoirs.
Agilent autofilling type reservoirs	Includes the Tip Wash Station (formerly, MicroWash Reservoir), the Auto Filling Reservoir, and the Open Wash Reservoir.
Weigh Station	*Optional*. Works with a Pump Module to provide precise liquid-level control for the Auto Filling Reservoir or Tip Wash Station.

For more details on the autofilling accessories, see the *Pump Module User Guide*.

Workflow to set up an autofilling station

Step	Procedure	See…
1	If applicable, install the Weigh Station.	*Pump Module User Guide*
2	Install the Pump Module and reservoir.	*Pump Module User Guide*
3	In Diagnostics, configure the autofilling function.	"Configuring an autofilling station for the Bravo Platform" on page 189
4	If applicable, calibrate the Weigh Station.	"Calibrating a Weigh Station" on page 194
5	If applicable, verify the teachpoint accuracy for the Weigh Station.	"Setting teachpoints" on page 37

Related information

For information about…	See…
Other Bravo accessories	"Accessories and platepads" on page 109
Bravo Barcode Reader	"Setting up the Barcode Reader" on page 197
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Configuring an autofilling station for the Bravo Platform

About this topic

An autofilling station consists of a Pump Module and an autofilling reservoir or wash station. This topic describes how to configure a basic autofilling location.

Connect the Pump Module, Weigh Station, and an Agilent autofilling type reservoir.

For details on how to install a basic autofilling station, see the *Pump Module User Guide*.

IMPORTANT If you are installing an autofilling station on an AssayMAP Bravo Platform, see the *AssayMAP Bravo Platform Installation Guide*.

Configuring the autofilling function

To configure an autofilling station:

1 In Diagnostics, click the **Profiles** tab, and select the profile that you want to change.

2 In the **Configuration** tab, select the location in the **Location** list, or click the location in the graphic display.

3 In the **Location is configured** list, select **Accessory**.
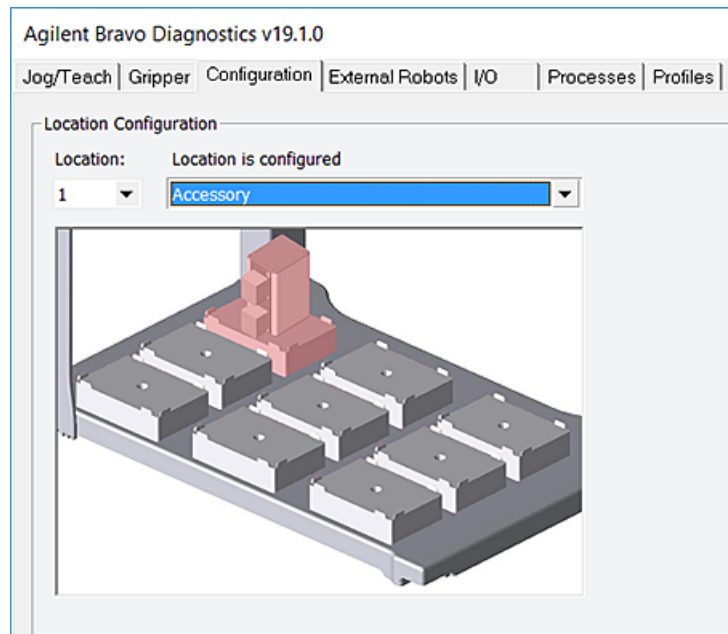
4 In the **Accessories Wizard**, do the following:

a In the **Location for accessory** list, verify the location and then click **Next**.

b In the **Accessory** list, select **Autofill Station**, and then click **Next**.

c In the **Number of pump modules** box, select the total number of Pump Modules connected to this device, and then click **Next**.

For example, if only one Pump Module is connected to this Bravo Platform, select **1**. If two Pump Modules are connected to this Bravo Platform, select **2**, and so forth.

Note: To make a change, click the number to display a list of options.

d In the **Autofill Station properties** table, set the following parameters.

Parameter	Settings
Fill module	Specify the Pump Module that this deck location uses. For example, select 1 if only one Pump Module is connected to the device. One Pump Module can function as both the Fill module and Empty module.
Pump for filling	Select which of the two pumps on the Pump Module will fill the container, where, • Pump 1 controls the upper pump. • Pump 2 controls the lower pump.
Direction for filling	Select the pumping direction, where, • Forward moves the pumped fluid in the forward direction of the pump. • Reverse moves the fluid in the opposite direction.

Parameter	Settings
Empty module	Specify the Pump Module that this deck location uses. For example, select 1 if only one Pump Module is connected to this device. One Pump Module can function as both the Fill module and Empty module.
Pump for emptying	Select which of the two pumps on the given Pump Module will empty the container on the deck location, where, • Pump 1 controls the upper pump. • Pump 2 controls the lower pump.
Direction for emptying	Select the pumping direction: Forward or Reverse.
Use Weigh Station?	If you are using a Weigh Station at this location, select Yes.
Weigh Station module number	If connecting the Weigh Station serial cable to the Pump Module SHELF A input port, select 1. If more than one Weigh Station is connected, the module number corresponds to the order in which they are connected to the controlling computer. *Note:* Agilent Technologies recommends using one Pump Module for each pairing of reservoir and Weigh Station.

   e Click **Next**, and then click **Finish** on the **Summary** page.

5 When the accessory configuration message appears and advises you to set the teachpoint to a safe value, do one of the following:

• If you are using a Weigh Station at this location, click **Yes** to move the teachpoint to a safe value.

On the **Profiles** tab, click **Initialize this profile**, and then reset the teachpoint for the installed Weigh Station.

• If you are placing the reservoir on a standard deck location, click **No** to preserve the existing teachpoint.

On the **Profiles** tab, click **Update this profile** to save the settings.

VWorks Plus only. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Testing the autofilling function

To test the autofilling and auto-emptying functions, you can use Diagnostics to run the pumps in real time.

To test autofilling:

1 In Diagnostics, initialize the profile, and then click the **Configuration** tab.

2 In the **Accessory Configuration** area, highlight the **Autofill Station** icon, and then click **Diagnose accessory**.

Note: The Autofill Station is represented by a Pump Module graphic in the software.
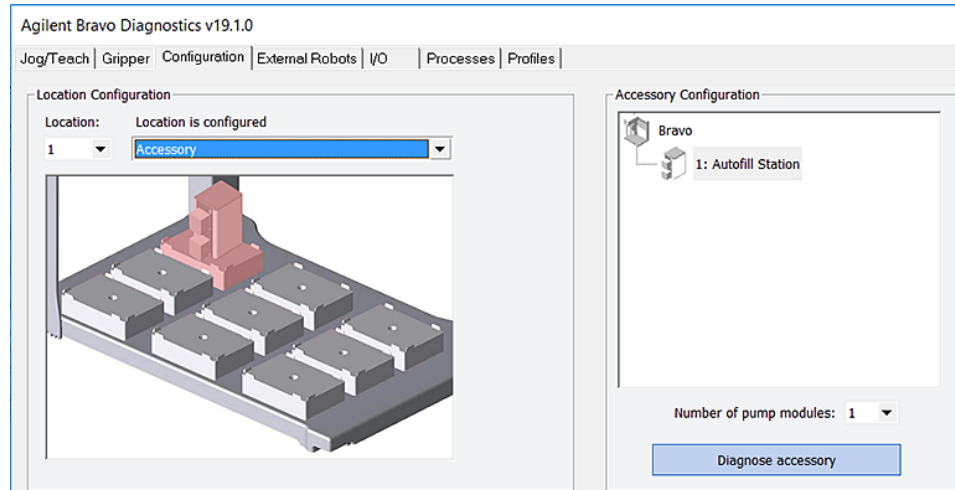
3 In the **Accessory Diagnostics** dialog box, verify the following settings.
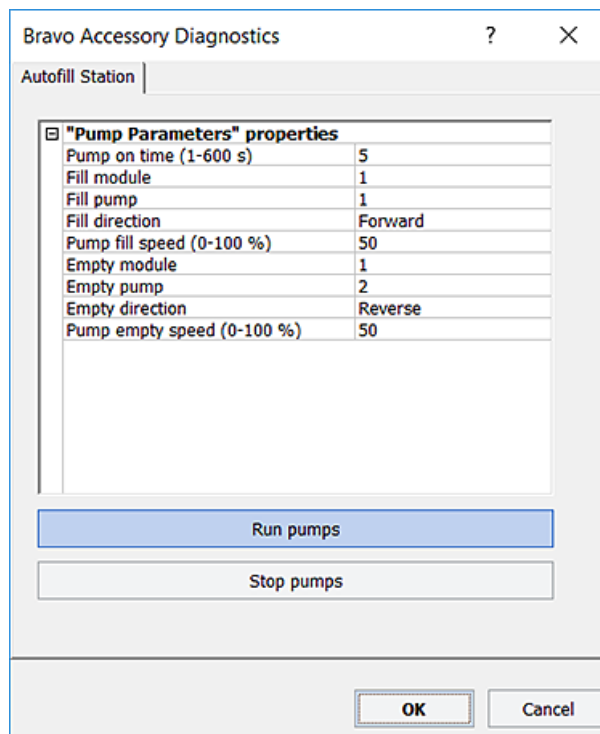
Control	Description
Pump on time (s)	Specifies the duration that the selected pump on the Pump Module runs when you click Run pumps.
Fill module	Specifies the Pump Module that this deck location uses. One Pump Module can function as both the Fill module and Empty module. For example, select 1 if only one Pump Module is connected.

Control	Description
Fill pump	Specifies which of the two pumps on the Pump Module to use for filling the container, where
	1 controls the upper pump.
	2 controls the lower pump.
Fill direction	*Forward*. Moves the pumped fluid in the forward direction of the pump.
	Reverse. Moves the fluid in the opposite direction.
Pump fill speed (0–100%)	Specifies how quickly the pump moves the fluid, where 100% is the fastest setting.
Empty module	Specifies the Pump Module that this deck location uses. One Pump Module can function as both the Fill module and Empty module. For example, select 1 if only one Pump Module is connected.
Empty pump	Specifies which of the two pumps on the Pump Module to use for emptying the container, where
	1 controls the upper pump.
	2 controls the lower pump.
Empty direction	*Forward*. Moves the pumped fluid in the forward direction of the pump.
	Reverse. Moves the fluid in the opposite direction.
Pump empty speed (0–100%)	Specifies how quickly the pump moves the fluid, where 100% is the fastest setting.
Run pumps	Starts the pumps on the selected Pump Module in real time.
Stop pumps	Stops the pumps in real time.

4 Click **Run pumps** and verify that the pump is functioning properly.

5 Click **Stop pumps**, and then click **OK**.

Related information

For information about…	See…
Starting up and shutting down the Bravo Platform	"Starting up and shutting down" on page 19
Installing a Pump Module	*Pump Module User Guide*
Calibrating a Weigh Station	"Setting up a Weigh Station" on page 194
Draining or filling a reservoir using the Pump Reagent process	"Performing a task using Bravo Diagnostics" on page 105
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Setting up a Weigh Station

About this topic

This topic provides calibration instructions for the Weigh Station.

For a description of the Weigh Station and installation instructions, see the *Pump Module User Guide*.

Crosshairs for setting teachpoint
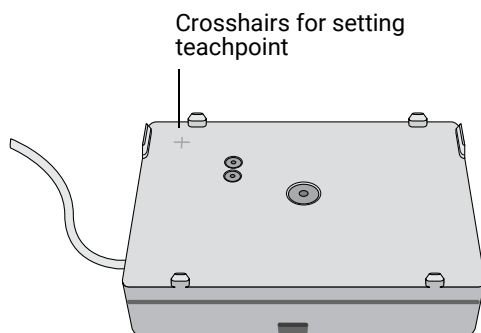
Calibrating a Weigh Station

Before you begin

- Make sure the Pump Module is set up and connected to the Weigh Station. See the *Pump Module User Guide*.
- Verify that the Autofill Station accessory is configured in Bravo Diagnostics. See "Configuring an autofilling station for the Bravo Platform" on page 189.

Procedure

Before the Weigh Station is ready for use in a protocol, you must calibrate the empty and full settings. When you calibrate the Weigh Station, you must use the reservoir type that will be weighed.

To calibrate a Weigh Station:

1   In Diagnostics, click the **Profiles** tab and make sure the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Accessory Configuration** area, highlight **Autofill Station**, and then click **Diagnose accessory**.

    Note: The Autofill Station is represented by a Pump Module graphic in the software.
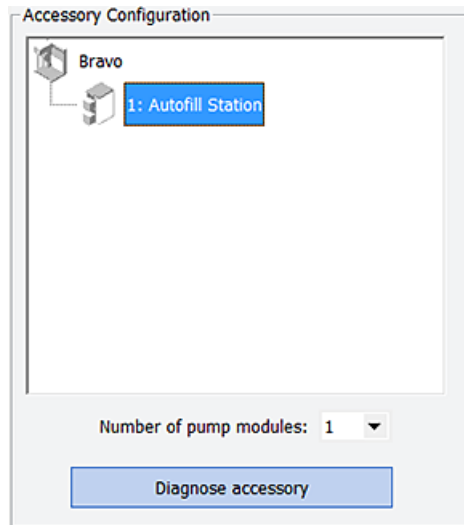
4 In the **Accessory Diagnostics** dialog box, click the second tab.
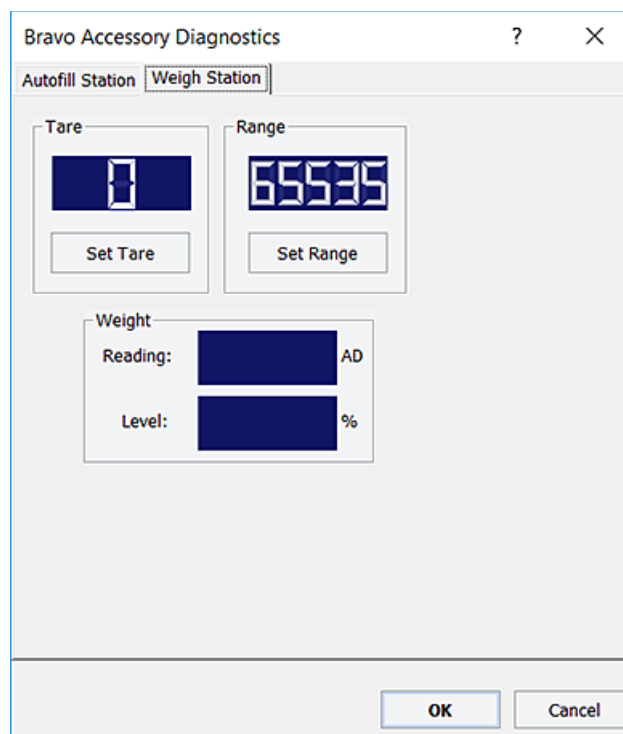
5 At the Bravo Platform, place the reservoir on the Weigh Station. Make sure the reservoir is empty.

6 In the **Accessory Diagnostics** dialog box, click **Set Tare** to configure the empty setting.

7 To configure the full setting for the reservoir:

   a Fill the reservoir to the desired full level.

   You can use the Pump Reagent command on the Processes tab to fill or drain the reservoir.

    b   In the **Accessory Diagnostics** dialog box, click **Set Range**.

          The digital display shows a sensor reading that corresponds to the current weight of the reservoir that is on the Weigh Station.

IMPORTANT To avoid overfilling the reservoir, ensure that the full range is set while the fluid level is below the top of the reservoir.

8 Verify that the **Level** reading decreases as the liquid level decreases while you run the designated empty pump to remove any liquid from the reservoir.

9 Click **OK**.

10 On the **Profiles** tab, click **Update this profile**.

11 *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

Related information

For information about…	See…
Starting up and shutting down the Bravo Platform	"Starting up and shutting down" on page 19
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Installing the Pump Module	*Pump Module User Guide*
Configuring the autofilling function	"Configuring an autofilling station for the Bravo Platform" on page 189
Editing teachpoints	"Setting teachpoints" on page 37
Using an accessory in a protocol	*VWorks Automation Control User Guide*

C Setting up the Barcode Reader

This section contains the following topics:

About setting up the Barcode Reader

About this topic

This topic describes the Barcode Reader and provides the workflow for setting up the Barcode Reader. To operate the Barcode Reader, see the *VWorks Automation Control User Guide*.

Barcode Reader description

The Barcode Reader consists of a platepad with a barcode reader sensor head (under the platepad) and a mirror. The Barcode Reader can be installed in place of a platepad at any deck location and is designed to scan barcodes on the east or west side of microplates.

Figure Barcode Reader oriented to scan barcodes on the east side of microplates

Mirror

Platepad

Barcode reader sensor head
(under the platepad)
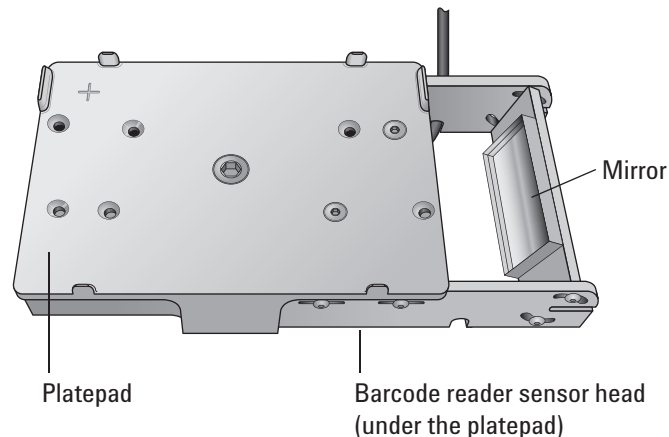
The following table presents the workflow for installing and setting up the Barcode Reader.

Step	Procedure	See...
1	Verify the barcode requirements.	"Barcode label specifications" on page 199
2	Install the Barcode Reader.	"Installing or removing the Barcode Reader" on page 200
3	Add the Barcode Reader device and create a profile for the Barcode Reader.	"Adding a device and creating a profile for the Barcode Reader" on page 202
4	Specify the Barcode Reader location in the Bravo device file.	"Setting the Barcode Reader properties and device location" on page 204
5	Adjust the Barcode Reader for optimal scanning.	"Testing and optimizing barcode scanning" on page 207

Barcode label specifications

The Barcode Reader can read barcodes that meet the following requirements:

Characteristic	Microscan requirements
Barcode symbology	Code 39 Codabar Code 128 Interleaved 2 of 5 Code 93 Code 2 of 5
Barcode height	3.34 mm (0.13 in) or taller
Print contrast	25% at 650 nm
Quiet zone	10 times the dimension of the narrowest element in the barcode or 0.25 in, whichever is greater

Note: The symbology must be stored in the Barcode Reader in order for the Barcode Reader to decode the barcode symbol.

Related information

For information about...	See...
Setting up other accessories	• "Accessories and platepads" on page 109 • "Autofilling accessories" on page 187
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing or removing the Barcode Reader

Before you start

Make sure you have the following:

- Barcode Reader
- M4 hex wrench

Installing the Barcode Reader

WARNING   **Turn off the Bravo Platform before you install or remove the accessory.**

To install the Barcode Reader:

1   If a platepad is already installed at the target installation location, uninstall the platepad.

2   Place the Barcode Reader on the deck surface at the target deck location. Ensure that the Barcode Reader is oriented correctly to scan barcodes on the west side or the east side of microplates. Make sure it sits level on the deck.

3   Insert the supplied flathead cap screw into the center of the Barcode Reader platepad and use the M4 hex wrench to tighten the screw.

4   Connect the Barcode Reader power and communications cable.

   If a serial port is not available on the host computer, use a USB-to-serial adapter. Ensure that you install the driver for the adapter.

5   Install the small cover to shroud the mirror from excess light:

   Note: Fluorescent light can cause interference with barcode scanning operations.

   a   Position the cover over the mirror, as the following figure shows.

   b   Ensure that the cover is pushed against the sides of the barcode reader bracket. This will help ensure that it will block out any excess light.

   c   If the cover fits too loosely, pinch the cover side tabs.

Cover
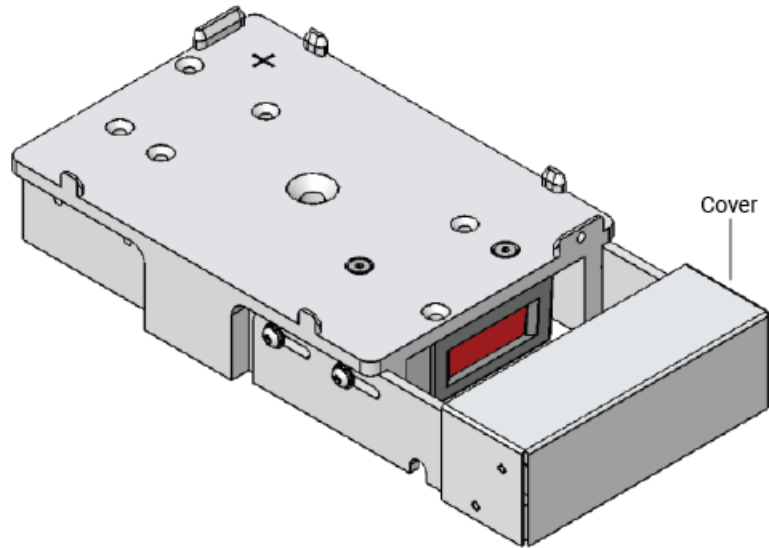
6   Edit the teachpoint for this location.

Uninstalling the Barcode Reader

To uninstall the Barcode Reader:

1   Disconnect the Barcode Reader power and communications cable.

2   Using the M4 hex wrench, remove the screw in the center of the Barcode Reader and remove the Barcode Reader.

3   Place a platepad at the same deck location.

4   Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 198
Creating a profile for the Barcode Reader	"Adding a device and creating a profile for the Barcode Reader" on page 202
Specifying the Barcode Reader location in the device file	"Setting the Barcode Reader properties and device location" on page 204
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 207

Adding a device and creating a profile for the Barcode Reader

About this topic

This topic explains how to add the Barcode Reader device, and then create and initialize a profile for the Barcode Reader.

For details on creating a device file or adding devices to a device file, see "Creating or adding a Bravo device" on page 21.

Procedure

To add the Barcode Reader device and create a profile:

1 In the VWorks window, create a new or open an existing Bravo device file.

2 In the **Available Devices** area, double-click the Microscan Barcode Reader. The Microscan Barcode Reader icon appears in the Devices area.
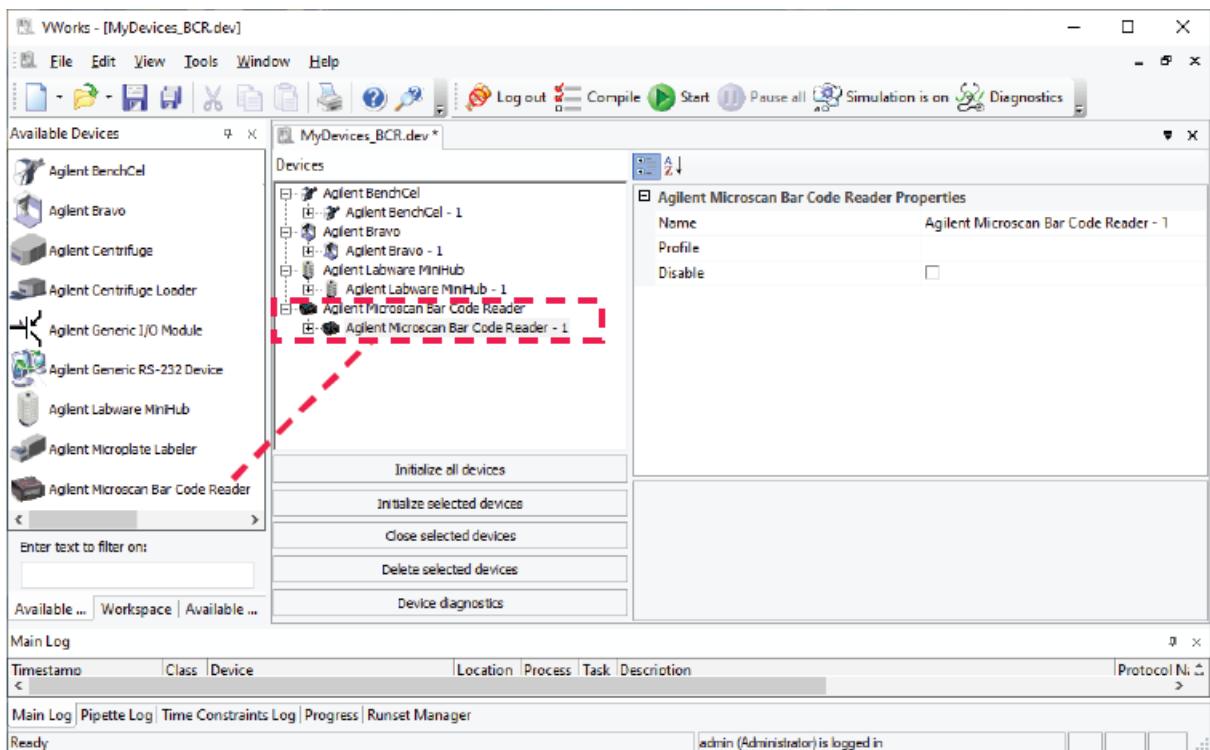
3 In the **Devices** area, select the **Microscan Bar Code Reader** icon, and click **Device diagnostics**. The Microscan Barcode Reader Diagnostics window opens.

Figure   Microscan Bar Code Reader Diagnostics window
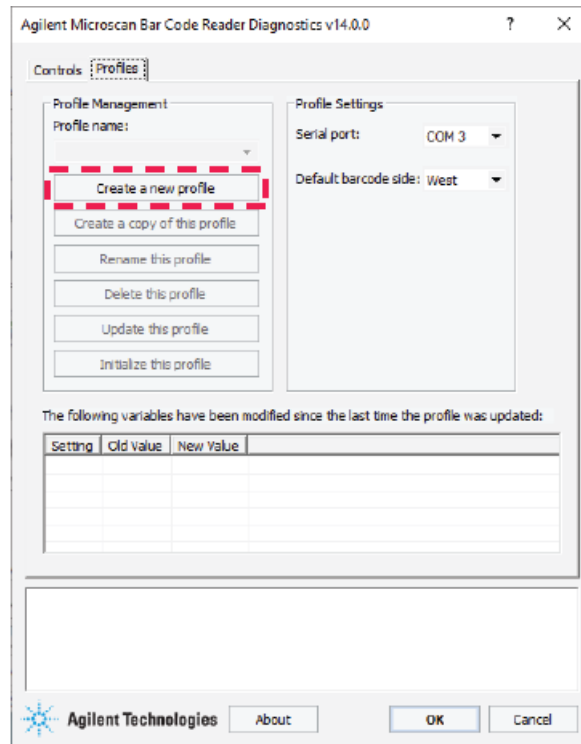
4   In the **Profiles** tab under **Profile Management**, click **Create a new profile.** The Create Profile dialog box opens.

   a   Type a name for the new profile and click **OK.** The new profile name appears in the Profile name list.

   b   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

5   In the **Profile Settings** area, select the **Serial port** that is connected to the Barcode Reader.

6   In the **Default barcode side** list, select **East** or **West** to indicate the side of the labware that has the barcode label.

   Note: The Bravo Barcode Reader can scan barcode labels on the labware east and west sides only.

7   To save the newly created profile.

   a   Click **Update this profile**.

   b   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

8   Click **Initialize this profile** to establish communication with the Barcode Reader.

9   Close Microscan Barcode Reader Diagnostics, and then do the following in the VWorks window:

   a   In the **Devices** area, click the **Microscan Bar Code Reader** icon, and then select the **Profile** in the **Properties** area.

   b   Click **File > Save**.

   c   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

To finish setting up the Barcode Reader in the device file, see "Setting the Barcode Reader properties and device location" on page 204.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 198
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 200
Specifying the Barcode Reader location on the Bravo Platform	"Setting the Barcode Reader properties and device location" on page 204
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 207
Setting up other accessories	• "Accessories and platepads" on page 109 • "Autofilling accessories" on page 187

Setting the Barcode Reader properties and device location

About this topic

Use the following procedure to set the properties for the Barcode Reader device and specify the location of the Barcode Reader in the Bravo device file.

Procedure

To set the Barcode Reader properties and device location in the *Bravo* ***device file:***

1   Ensure that the Bravo device file that contains the Barcode Reader device is open in the VWorks window.

2   In the **Devices** area, expand the Microscan Bar Code Reader list and select **Stage**.
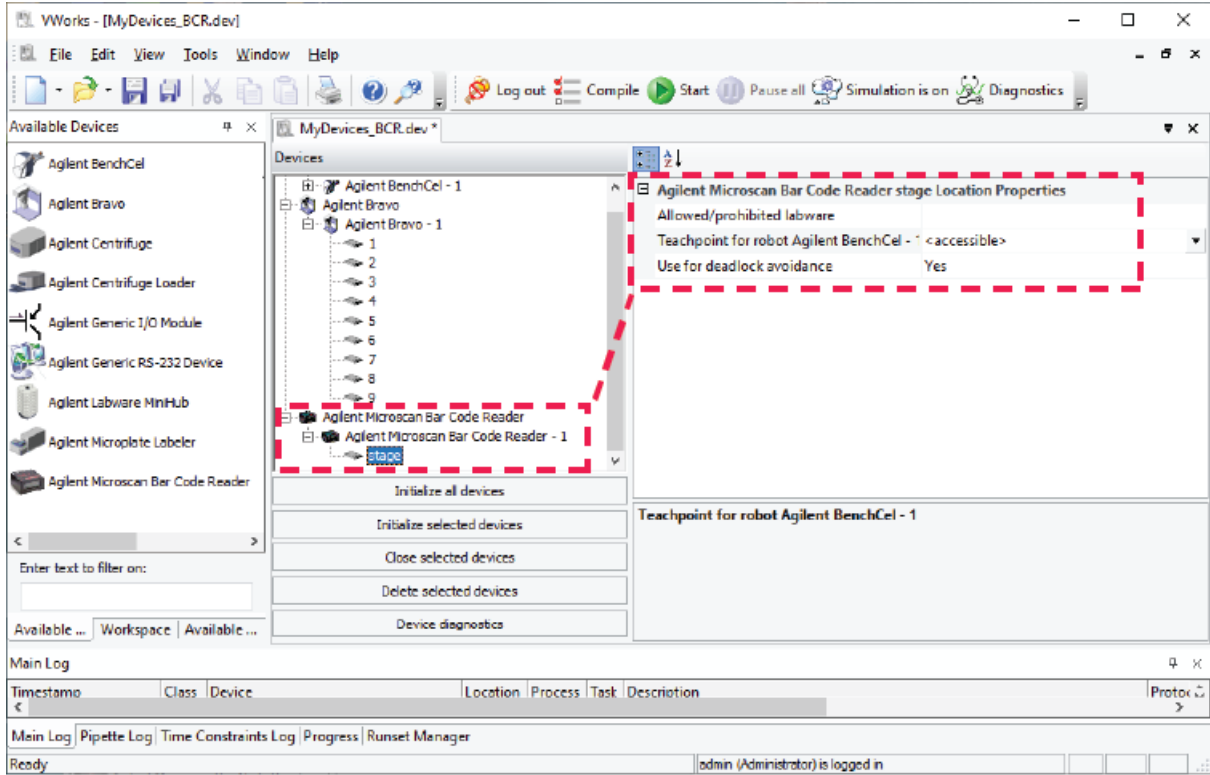
3   Under **Microscan Bar Code Reader Stage Location Properties**, set the following:

Property	Description
Allowed/prohibited labware	Permitted labware class for the selected location. Use this field only if you want to limit the labware types. For details on labware classes, see the *VWorks Automation Control Setup Guide*.
Teachpoint for robot *<robot name>*	The option for the Microscan Barcode Reader stage to be accessed by the robot configured in the workstation.
Use for deadlock avoidance	The option to use the Microscan Barcode Reader as a location to avoid a deadlock when executing a protocol.

4   In the **Devices** area, expand the Bravo device. The list of deck locations appear.

5   Select the deck location at which you installed the Barcode Reader. In the following figure deck location 7 is selected.
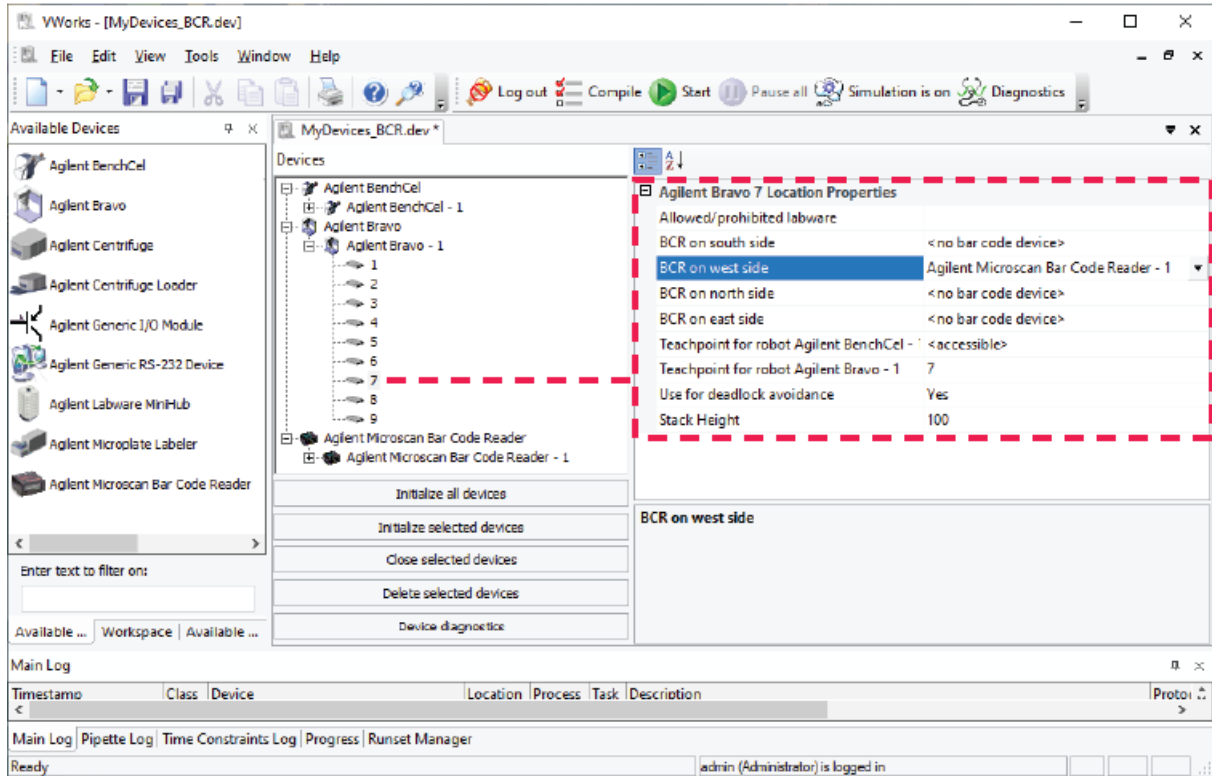
6   In the **Location Properties** table, select one of the following:

  •   **BCR on west side**

  •   **BCR on east side**

  Note: The Bravo Barcode Reader can scan barcode labels on the labware east and west sides only.

  In the figure, the Barcode Reader is set to scan barcodes on the west side of microplates at deck location 7.

7   To save the changes:

  a   Click **File > Save**.

  b   *VWorks Plus only*. If an audit trail is being logged, the Audit Comment dialog box opens. Select or type the audit comment, and then click **OK**.

8   Click **Initialize selected devices** or **Initialize all devices** to re-establish communication with the Bravo and use the updated device file.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 198
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 200

For information about...	See...
Creating a profile for the Barcode Reader	"Adding a device and creating a profile for the Barcode Reader" on page 202
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 207
Setting up other accessories	• "Accessories and platepads" on page 109
	• "Autofilling accessories" on page 187

Testing and optimizing barcode scanning

About this topic

This topics describes:
- "Using diagnostics to test the barcode scanning" on page 207
- "Adjusting the scan angle" on page 209
- "Troubleshooting" on page 210

Before you start

Make sure you have the following:
- M2 hex wrench
- Spare microplate that has a barcode label

Using diagnostics to test the barcode scanning

Use the following procedure to test the barcode scanning.

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

WARNING **Laser emission from the reader does not automatically turn off if the sensor head is disassembled. Do not disassemble the barcode reader sensor head.**

To test the barcode scanning:

1   Place the spare microplate on the Barcode Reader platepad and make sure the barcode label faces the Barcode Reader mirror.

2   Open **Microscan Bar Code Reader Diagnostics.**

3   In the **Profiles** tab, select the profile from the **Profile** list, and click **Initialize this profile**.
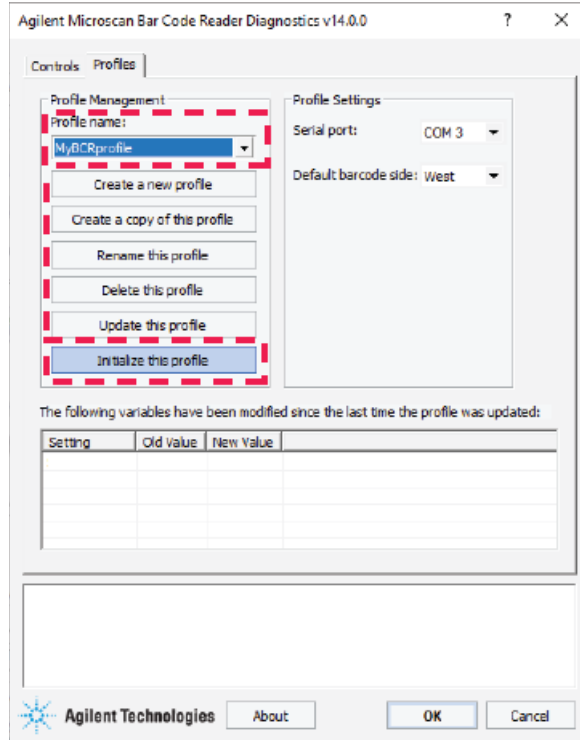
4   In the **Controls** tab, click **Scan.**
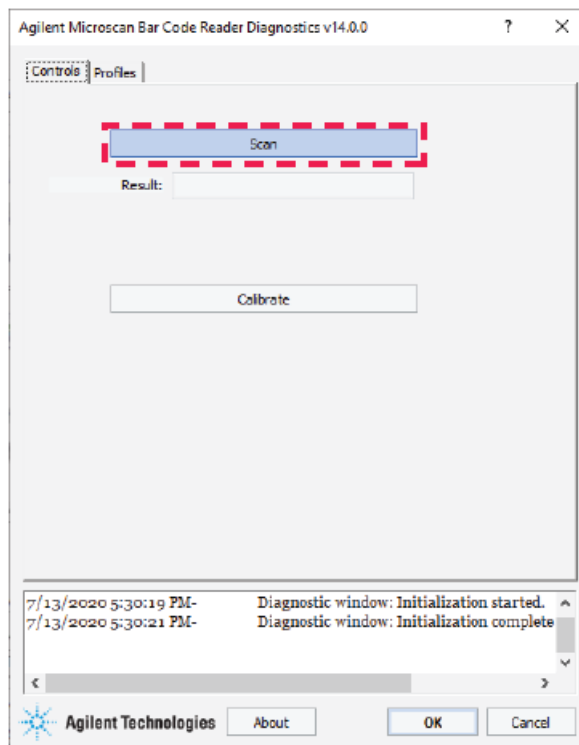
The Barcode Reader laser turns on briefly to scan the barcode label. One of the following messages appears next to Result:

Scan result message	Description	Next step
<barcode text>	The barcode was successfully scanned.	The setup is complete. No further adjustment is required.
No barcode found	Barcode scanning was not successful.	Proceed to step 5.

5   If the No barcode found message appears, click **Scan** again, and check that the Barcode Reader laser beam is projected onto the vertical center of the barcode label.

If the laser beam is not at the vertical center of the label, adjust the scan angle of the Barcode Reader mirror.

6   To optimize the scanner settings, click **Calibrate**.

Note: During the calibration process, the scanner attempts various settings to determine the optimum decode rate for the given conditions.

Adjusting the scan angle

To adjust the scan angle of the Barcode Reader:

1   Loosen the screws on both sides of the Barcode Reader mirror.
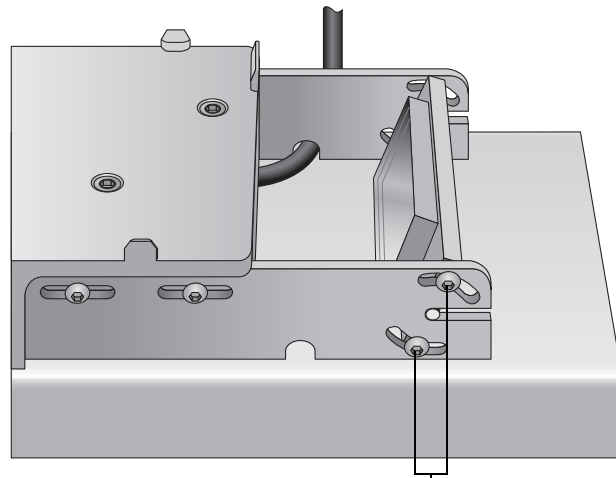
Loosen the screws on both sides of the

2   Tilt the Barcode Reader mirror slightly. If the angle is set up properly, you can see the laser beam at the vertical center of the barcode label each time you click Scan barcode.
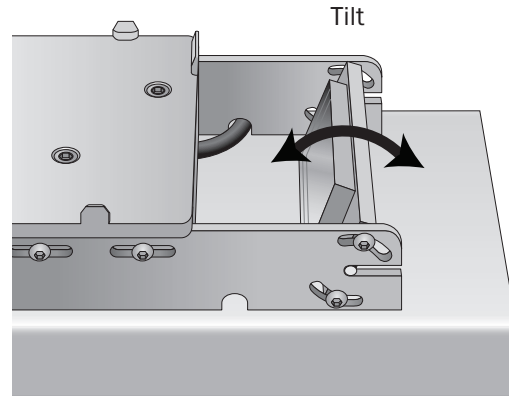
Tilt

3   Tighten the screws on both sides of the barcode reader sensor head.

4   Repeat the procedures to test the barcode scanning and adjust the scan angle until the reader is able to scan the barcode successfully (the barcode text appears next to Scan result).

Troubleshooting

If the reader is unable to scan the barcode after many adjustments, try one or more of the following:

•   Make sure the barcode label is applied properly onto the microplate.

•   Make sure the microplate is sitting level on the Barcode Reader platepad.

•   Make sure the barcode meets the requirements. See "Barcode label specifications" on page 199.

•   Repeat the adjustment process using a new spare microplate.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 198
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 200
Creating a profile for the Barcode Reader	"Adding a device and creating a profile for the Barcode Reader" on page 202
Specifying the Barcode Reader location in the device file	"Setting the Barcode Reader properties and device location" on page 204
Setting up other accessories	• "Accessories and platepads" on page 109 • "Autofilling accessories" on page 187

D Diagnostics quick reference

This appendix contains the following topics:

Agilent

Bravo Diagnostics dialog box

About this topic

This topic provides a quick reference for the Bravo Diagnostics dialog box.

Buttons

WARNING

The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the emergency-stop pendant.

Button	Description
About	Displays the version numbers of Diagnostics and, if initialized, the Bravo firmware.
Stop motors (keyboard SPACEBAR)	Disables all the motors that drive the Bravo head and engages the brakes to stop the motion. To re-enable the head movement, click Enable all motors on the Jog/Teach tab.

Tabbed pages

Tabbed page	Description
"Configuration tab quick reference" on page 213	Provides controls for configuring accessories at specified deck locations and for testing the accessories.
"External Robots tab quick reference" on page 217	Provides controls for configuring where the Bravo head can be when an external robot accesses the deck and whether operations can occur concurrently.
"IO tab quick reference" on page 218	Provides controls and indicators for clearing motor faults and checking the head type.
"Jog/Teach tab quick reference" on page 220	Provides controls for jogging the liquid-handling head and setting teachpoints.
"Gripper tab quick reference" on page 225	Provides controls for fine-tuning the gripper movements.
"Processes tab quick reference" on page 232	Provides controls for running diagnostic tasks in real time.
"Profiles tab quick reference" on page 228	Provides controls for managing and creating profiles and changing the liquid-handling head.

Configuration tab quick reference

About this topic

This topic provides a reference for the Configuration tab in Bravo Diagnostics.

Procedures

The Configuration tab enables you to configure and test accessories. For the procedures, see:

- "Accessories and platepads" on page 109
- "Autofilling accessories" on page 187

Contents

The Configuration tab in Bravo Diagnostics contains the following areas:

- "Location Configuration area" on page 213
- "Accessory Configuration area" on page 214

Location Configuration area
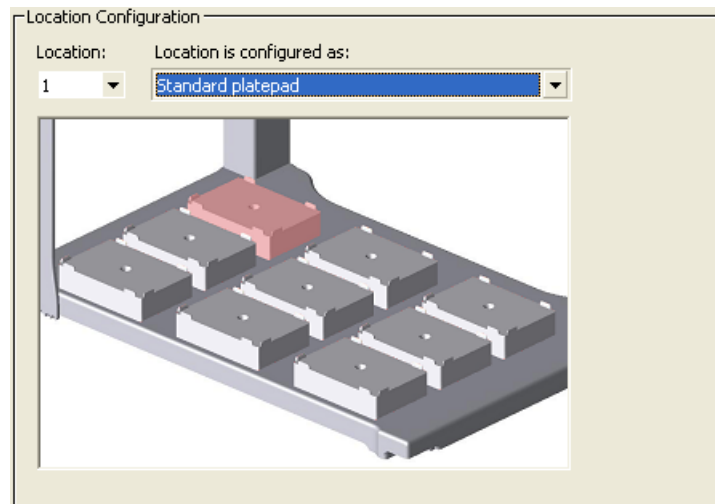
Control or indicator	Description
Location	A list that specifies the deck location. The deck layout graphic highlights the selected location.
Graphical display of Bravo deck	An interactive display that provides the following: • Alternative way to specify the location that you want to configure. • Visual display of the type of accessory configured for each location.

Control or indicator	Description
Location is configured as	Specifies the function of the selected location as either: • *Standard platepad*. Designates a generic pad. • *(SRT only) platepad for 250 uL tips*. Available only for the shorter model Bravo SRT for use with the 250-µL tip boxes. See "(Bravo SRT only) Setting up an LT tip box location" on page 184. • *Accessory*. Displays the Accessory Wizard, which steps you through specifying a configured accessory at the specified position.

Accessory Configuration area
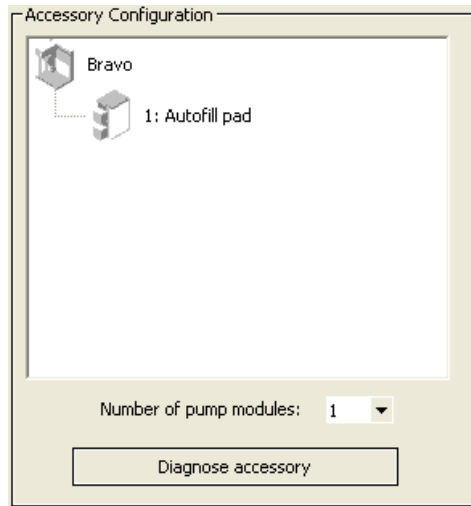
Control or indicator	Description
Graphical display of configured accessories	Displays icons of the Bravo Platform and any configured accessories associated with specific deck locations.
Diagnose accessory	Displays the Accessory Diagnostics dialog box for the selected accessory. Click the accessory icon in the graphic to display the corresponding dialog box. See "Accessory Diagnostics dialog box" on page 216.
Number of pump modules	Specifies the total number of Pump Modules for the given Bravo Platform. Each Pump Module contains two peristaltic pumps.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Setting up accessories	"Bravo accessories overview" on page 110
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
Reporting a problem	"Reporting problems" on page 91

Accessory Diagnostics dialog box

About this topic

This topic provides a quick reference for the Accessory Diagnostics dialog box.

Accessory Diagnostics dialog box procedures

The Accessory Diagnostics dialog box provides controls for testing the functioning of an accessory that is configured in Diagnostics. The tabbed pages in the dialog box change depending on which accessory you select.

The tabbed pages in the dialog box contain controls for:

- "Testing the autofilling function" on page 191
- "Calibrating a Weigh Station" on page 194
- "Testing the Orbital Shaking Station" on page 117
- "Testing the Vacuum Filtration Station" on page 135
- "Testing a thermal or thermal shaking station" on page 173

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Setting up accessories	"Bravo accessories overview" on page 110
Troubleshooting problems	"Troubleshooting hardware problems" on page 84 "Troubleshooting hardware-related error messages" on page 89
Reporting a problem	"Reporting problems" on page 91

External Robots tab quick reference

About this topic

This topic provides a reference for the External Robot tab in Diagnostics. Read this topic if you have a Bravo Platform that is integrated in a system with other plate-handling robots.

Procedures

The External Robot tab provides the controls for configuring how an external robot can access the Bravo deck. You can configure whether to permit only one robot to operate on the Bravo deck at any given time or to allow concurrent operation.

For configuration procedures, see "Configuring external robot access" on page 53.

Contents

The External Robot tab contains the following controls and indicators:

Control or indicator	Description
Prevent Bravo operation during external robot access	Enables and disables the concurrent operation of the Bravo robot while an external robot accesses the Bravo deck. • Select the check box to disable concurrent operation and to move the Bravo head to a specified safe location on the deck during the external robot access. • Clear the check box to enable concurrent operation.
Move Bravo to this safe location	Allows you to specify the deck location where the Bravo head will move if an external robot is accessing the Bravo deck.
Current safe location	Displays the selected safe location.
Deck location	Selects a location on the Bravo deck.
Does an external robot access this location?	Specifies whether the selected deck location may be accessed by an external robot.
External robots	Specifies which external robots may access the selected deck location.
Select the locations that should be blocked during robot access	Allows you to specify locations on the Bravo deck where the Bravo robot is prohibited from moving during the external robot access.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
How to configure locations for external robot access	"Configuring external robot access" on page 53
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
Reporting a problem	"Reporting problems" on page 91

IO tab quick reference

About this topic

This topic provides a reference for the IO tab in Diagnostics.

Contents

The IO tab in Diagnostics contains the following controls and indicators:

Control or indicator	Description
Robot disable	Lights bright green when the emergency-stop is activated.

Head present	Lights to indicate the status of a detected liquid-handling head:
	
	• *Green*. The head type specified in the initialized profile matches the installed liquid-handling head.
	
	The Head is attached message displays.
	
	• *Red*. The software detects one of the following conditions:
	  – No liquid-handling head is installed. In this case, the No head attached message displays.
	  – The installed head does not match the head type specified in the initialized profile. The Incorrect head is attached message displays.

Head type	Displays the actual head type detected.

Control or indicator	Description
Go button is pressed	Available only for the robot-disable pendant model that has a Go button in addition to the emergency-stop button. This indicator lights bright green when the Go button on the pendant is pressed.
Plate present in gripper	Available only for a Bravo Platform that has a gripper. This indicator lights bright green when the plate presence sensor detects a plate in the gripper.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
Reporting a problem	"Reporting problems" on page 91

Jog/Teach tab quick reference

About this topic

This topic provides a quick reference for the Jog/Teach tab in the Bravo Diagnostics dialog box.

WARNING   **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

WARNING   **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the emergency-stop pendant.**

Procedures

The Jog/Teach tab enables you to:

Procedure	See…
Home the liquid-handling head	"Homing the liquid-handling head" on page 94
Set teachpoints	"Setting teachpoints" on page 37
Copy teachpoints from one profile to another profile	"Copying teachpoints from one profile to other profiles" on page 50.
Move the liquid-handling head to a safe distance above a teachpoint, or move to a teachpoint	"Using the Move and Approach commands" on page 99
Move the liquid-handling head incrementally in each of its axes	"Jogging the liquid-handling head" on page 96

Contents

The Jog/Teach tab contains the following:

- "Teachpoints area" on page 220
- "Jog and Home Axes areas" on page 222

Teachpoints area

The Teachpoints area contains the following controls and indicators.

Controls and indicators

Control or indicator	Description
Graphical display of Bravo deck	Provides an interactive display that enables you to specify deck locations and monitor the liquid-handling head movement. The highlighted location indicates the location of the liquid-handling head. You can move the head in real time by right-clicking a location and selecting a command.
Location	Specifies the deck location for the liquid-handling head movement or to set a teachpoint.
	You can use either the deck graphical display or the Location list to specify the location.
X-axis, Y-axis, and Z-axis displays	Provide the current teachpoint coordinates for the selected deck location.
Move	Moves the liquid-handling head to the teachpoint for the selected deck location.
Approach	Moves to the specified approach height above the teachpoint, or configured accessory, for the selected deck location.
Approach height above teachpoint/accessory (mm)	Specifies a vertical offset that is used when you click Approach to move the liquid-handling head above a teachpoint.
	If an accessory was configured in Diagnostics at the selected location, the software adds the vertical offset to the stored height of the accessory.
Move to a safe height at current X/Y position	Moves the liquid-handling head to the z-axis safe position that is specified in the profile.
Teach	Saves the teachpoint coordinates for the deck location.

Control or indicator	Description
Advanced operation	Specifies one of the following options:
	• *Apply Z-axis teachpoint to all locations*. Adjusts all the location teachpoints using the *z*-axis coordinate from the teachpoint at the selected location.
	• *Set all teachpoints based upon selected teachpoint*. Applies the saved teachpoint (*x*-, *y*-, and *z*-axis coordinates) from the selected Location to all the other deck locations.
	• *Reset teachpoints to defaults for current head type*. Changes all location teachpoints to the default coordinates for the selected liquid-handling head type.
	• *(VWorks 14.0 and later only) Copy teachpoints to another Profile*. Enables you to copy the teachpoints for the 9 deck locations and the gripper Y offset from the currently initialized profile to another profile.
Perform advanced operation	Initiates the procedure that you selected in the Advanced operation list.

Jog and Home Axes areas

The Jog Axes, Multiple Axes, and Home Axes areas contain the following controls and indicators.
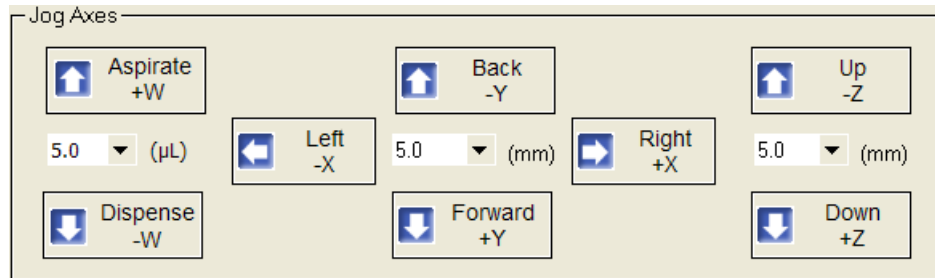
Control or indicator	Description
Jog Axes area	
Aspirate +W, Dispense −W buttons and increment (µL) list	Enables you to select the incremental distance (µL) to move the liquid-handling head, and then move the head the specified distance in the *w*-axis.
Left −X, Right +X, Back −Y, Forward +Y buttons and increment (mm) list	Enables you to select the incremental distance (mm) to move the liquid-handling head, and then move the head the specified distance along the *x*- or *y*-axis.

Control or indicator	Description
Up −Z, Down +Z buttons and increment (mm) list	Enables you to select the incremental distance (mm) to move the liquid-handling head, and then move the head the specified distance along the z-axis.
Multiple Axes area	
Speed	Sets the velocity (Slow, Medium, or Fast) of Bravo head movement in the side-to-side (x), forward-backward (y), and vertical (z) axes while using Diagnostics. For example, you might want to use a slow speed when setting teachpoints.
Home XYZ	Homes the Bravo head in the side-to-side (x), forward-backward (y), and vertical (z) axes.
Enable all motors/Disable all motors	Activates the Bravo head motors and turns off the head motors. For example, you must disable the motors before moving the head manually.
W, X, Y, and Z Axis areas	
Digital display	Displays 0.00 when the liquid-handling head is in the axis home position. Displays the distance from the axis home position when the liquid-handling head is not in the home position.
Home	Homes the liquid-handling head in the selected axis. The home position is near the low-to-mid w-axis range.
Enable motor, Motor enabled	Enables or disables the motor for the selected axis. The Motor enabled indicator lights when the motor for the axis is turned on.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Stopping in an emergency	"Emergency stops" on page 62
Editing teachpoints	"Setting teachpoints" on page 37
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89

For information about…	See…
Reporting a problem	"Reporting problems" on page 91

Gripper tab quick reference

About this topic

The Bravo gripper can pick up labware and move it from one location to another on the Bravo deck. If the Bravo Platform includes a gripper, you use the controls on the Gripper tab to configure the gripper movements.

WARNING   **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the emergency-stop pendant.**

Procedures

You can use the Gripper tab to fine-tune the gripper movements using the following procedures:

- "Verifying the gripper setup" on page 44
- "Using the gripper controls" on page 101

Gripper Teaching area

Control or indicator	Description
Labware	Specifies the labware to be used during a move operation as defined in the Labware Editor.
Y offset	Specifies the offset to the *y*-axis teachpoint at each location to center the gripper about the labware.
Teach Y offset for gripper	Calculates the offset from the selected location teachpoint to where the gripper is and applies it as the y-offset.
Approach height (mm)	Specifies a vertical offset (safe distance) above the labware.
Approach	Moves the gripper to the specified approach height.
Move	Moves the gripper to the teachpoint.

Gripper Movement area

Control or indicator	Description
Location A Pick A -> Place B	Specifies the origin and destination locations for the gripper to move the labware.
Location B Pick B -> Place A	Specifies the origin and destination locations for the gripper to move the labware.

Control or indicator	Description
Plate present in gripper	Lights when the plate sensor detects labware in the gripper.

Jog Gripper Axes area

Control or indicator	Description
Up -Zg, Down +Zg and increment (mm) list	Enables you to set an incremental distance (mm) to move the gripper, and then move it the specified distance along the *Zg*-axis. The gripper holds and moves labware along the *Zg*-axis from one location to another.
Open -G, Close +G and increment (mm) list	Enables you to set an incremental distance (mm) to move the gripper, and then open or close it the specified amount. The gripper grips the labware along the *G*-axis.
Dock gripper below head	Moves the gripper to the docked position to ensure that there is not interference when moving the liquid-handling head.
Open gripper/Close gripper	Opens and closes the gripper, respectively.
Speed	Sets the velocity of each gripper movement. For example, you might want to use a slow speed when setting the *y* offset.

Zg-Axis and G-Axis areas

Control or indicator	Description
Digital display (mm)	Displays the distance (mm) from the axis home position when the gripper is not in the home position.
Home	Homes the gripper along the selected axis.
Enable motor, Motor enabled	Enables or disables the motor for the selected axis. The Motor enabled indicator lights when the motor for the axis is turned on.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26

For information about…	See…
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware problems" on page 84
Reporting a problem	"Reporting problems" on page 91

Profiles tab quick reference

About this topic

This topic provides a reference for the Profiles tab in Bravo Diagnostics.

Procedures

The Profiles tab enables you to:

Procedure	See…
Create a profile, or manage the available profiles	"Creating and managing profiles" on page 28
Initialize a profile	"Initializing the device" on page 34
Change the liquid-handling head	"Changing the Bravo head" on page 69

Contents

The Profiles tab contains the following:

- "Profile Management area" on page 228
- "Connection area" on page 229
- "Log area" on page 232

Profile Management area

The Profile Management area contains the following controls.

> **CAUTION**
>
> **Each profile can be used by multiple protocols. Deleting, renaming, or changing the parameters for a profile based on one protocol can invalidate other protocols that use the profile.**

Control	Description
Profiles name list	Specifies the active profile. Select the profile that you want to use from the list.
Create a new profile	Displays the Create Profile dialog box so that you can name the new profile. To add a profile, see "Creating and managing profiles" on page 28.
Create a copy of this profile	Creates a copy of the profile selected in the Profiles name list. The new profile name has the prefix, *Copy of*.

Control	Description
Rename this profile	Displays the Rename Profile dialog box so that you can rename the profile selected in the Profile name list.
Delete this profile	Confirms the profile to be deleted, and then deletes the selected from the Profile name list.
Update this profile	Saves changes to the selected profile. The Modified Variables area displays the unsaved variables until the Update this profile button is activated, which clears the Modified Variables area.
Initialize this profile	Initiates communication with the Bravo Platform using the selected profile.

Connection area

The Connection area contains the following controls.

Control	Description
This Bravo is connected via ethernet	Specifies an Ethernet communication connection between the device and the computer.
Device ID	Displays the device number of the Bravo device that is communicating with the computer.
Find available device	Opens the Discovered BioNet Devices dialog box, which lists the connected Bravo devices that the software found.
This Bravo is connected via serial	*Available only for earlier model devices*. Specifies a serial communication connection between the device and the computer.
Serial port	Specifies the communication port on the computer.

Miscellaneous area

The Miscellaneous area contains the following controls.

Control	Description
Approach height	Specifies the *z*-axis distance or height (safety margin) above a microplate that the tips move to before moving to another quadrant of the microplate.

Control	Description
Z-axis safe position	Sets the safe z-axis distance or height of the liquid-handling head.
	A z-axis safe position of 0 is the highest position possible for the liquid-handling head. A z-axis safe position of 10 means the liquid-handling head is 10 mm below the highest point.
	If you select the **Always move to safe Z before each process** option, the Bravo Platform moves to the *z*-axis safe height when moving between labware locations. Increasing this value may shorten run times by minimizing the *z*-axis movement between tasks. Making this value too large causes the liquid-handling head to crash into labware when moving between plate locations.
Prompt user to home W-axis on first initialization	Enables a warning to display when the Bravo Platform is initialized and before the *w*-axis is homed.
	The warning allows time for you to make sure that liquid is not unexpectedly dispensed from tips during the homing.
Run device at medium speed during protocol	Sets the device speed to medium during a protocol run.
Always move to safe Z before each process	Moves the liquid-handling head to the specified z-axis safe position between processes.
	If you select this option, the Bravo head moves to the specified *z*-axis safe height when moving between labware locations. Select this option if you have not specified the labware on the deck.
	If you do not select this option, the Bravo Platform will automatically determine the safe *z*-axis point based on the labware specified, thereby optimizing the processing time.
	To prevent damage to the labware or the Bravo Platform components, do not select this option if you have not specified the labware.
Ignore plate sensor during pick and place	*Bravo Platform with gripper only*. Enables the software to ignore the microplate sensor during a pick-and-place movement.
	Select this option if the microplate sensor is broken but you still want to test the pick-and-place function.
Allow "top of stack" fluid handling	Permits fluid handling tasks to be performed in the labware at the top of a specified stack.
Enable tips-off tip-touch	Performs a tip touch in the tip box after a Tips Off task to ensure that the tips fall from the head into the tip box.

D Diagnostics quick reference
Profiles tab quick reference

Control	Description
This is a Bravo SRT	*Bravo SRT model only*. Specifies that this Bravo device is the SRT model, which is shorter than the standard model.
	If you are using 250-µL tips on the SRT model, select this check box, configure the tip box location, and install the special SRT platepad for 250-µL tip boxes to ensure greater *z*-axis clearance and prevent potential hardware crashes. See "(Bravo SRT only) Setting up an LT tip box location" on page 184.

Head Information area

The Head Information area contains the following controls.

Control	Description
Head type	Specifies the liquid-handling head type for the profile.
Change head	Starts the Change head wizard, which positions the liquid-handling head for easy access and provides prompts that step you through a procedure.
	IMPORTANT If you are changing the currently installed liquid-handling head for the same type of head and want to edit the profile, you may use the Change head wizard. Otherwise, see "Changing the Bravo head" on page 69.
	The Change head button is available only after you initialize a Bravo profile.
Teaching tip type	Specifies the type of pipette tip to use for setting the teachpoints.
	If you change the Teaching tip type in a profile, you must reteach the deck locations using the new tip type.
Check head type on initialize	Verifies that the liquid-handling head specified in the profile matches the head mounted on the Bravo Platform when the profile is used by a protocol.
	CAUTION If this check box is cleared, the Bravo Platform **will run with any liquid-handling head installed. Therefore, if the profile specifies a 96-channel head type, but a 384-channel head is installed, the head will crash.**
	Note: If this check box is cleared, the *w*-axis controls in the Jog/Teach tab will be disabled even when the device is initialized.

Log area

Indicator	Description
Modified Variables area	Lists the profile settings that have been modified since the last time the profile was updated. The software clears the table when you click Update this profile, and logs the information in the profiles activity log (text box) at the bottom of the page.
Activity log	Displays a running log of updates for the current diagnostics session. This activity log is recorded in the VWorks Main Log. For details on the Main Log, see the *VWorks Automation Control User Guide*.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing teachpoints	"Setting teachpoints" on page 37
Troubleshooting problems	• "Troubleshooting hardware problems" on page 84 • "Troubleshooting hardware-related error messages" on page 89
Reporting a problem	"Reporting problems" on page 91

Processes tab quick reference

About this topic

This topic provides a reference for the Processes tab in Diagnostics.

WARNING **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the emergency-stop pendant.**

Procedure

To run a process, see "Performing a task using Bravo Diagnostics" on page 105.

Contents

The Processes tab contains the following:

Location area

Note: If the selected Command to execute is Disassemble Vacuum, the controls in this area are unavailable. In this case the command controls the location.

Control or indicator	Description
Location (Collection)	Specifies the Bravo deck location to be used for the selected process command.
	If the selected Command to execute is Assemble Vacuum, this list is labeled Collection, and the selection controls the location for the Collection plate.
Labware at selected location (Collection)	Specifies the labware to be used for the selected process command.
	Note: To add a labware selection to the list, click Open labware editor, and use the Labware Editor.
Location 2 (Filter)	Specifies the Bravo deck location to be used for the selected process command.
	If the selected Command to execute is Assemble Vacuum, the list is labeled Filter and the selection controls the location for the Filter plate.
Labware at selected location (Filter)	Specifies the labware to be used at location 2 for the selected process command.
	Note: To add a labware selection to the list, click Open labware editor, and use the Labware Editor.
Graphical display of Bravo deck	An interactive display that provides the following: - Alternative way to specify the target location. - Visual display of the type of platepad and labware configured for each location.

Miscellaneous area

Control or indicator	Description
Open labware editor	Opens the Labware Editor.
Open pipette technique editor	Opens the Pipette Technique Editor.
Open liquid library	Opens the Liquid Library Editor.

Well Selection and Head Mode area

Control or indicator	Description
Plate graphical display	Provides an interactive display that changes based on your labware selection. For example, if you use a 96-tip head and a 96-well microplate, all the wells are selected (green) by default. If you use a 96-tip head and a 384-well microplate, only one quadrant of the wells are selected by default.
	To select a quadrant:
	Click a well in that quadrant. All the wells in that quadrant turn green, indicating the selected wells.
	Alternatively, right-click the graphical display to access the following shortcut menu commands:
	• Select all wells
	• Clear all selected wells
	• Select all wells in highlighted row
	• Clear all selected wells in highlighted row
	• Select all wells in highlighted column
	• Clear all selected wells in highlighted column
Set head mode	Opens the Head Mode Selector dialog box.
	Series III disposable-tip heads and Bravo 96AM Head only. To use one row or column of channels instead of all channels in the head, use the controls in the dialog box to select which channels on the head to use.

Command Parameters area

The Command Parameters area contains the following controls.

Parameter	Description
Command to execute	Provides the following list of tasks that you can run: • "Aspirate task parameters" on page 236 • "Dispense task parameters" on page 239 • "Dispense to Waste task parameters" on page 241 • "Mix task parameters" on page 244 • "Pump Reagent parameters" on page 247 • "Shake task parameters" on page 248 • Tips On and Tips Off • "Vacuum Filtration Station task parameters" on page 250 (Assemble Vacuum, Disassemble Vacuum, and Move and Filter Plate) • "Wash Tips task parameters" on page 253 • "Pin Tool task parameters" on page 257 *Note:* Other commands may be available depending on the installed accessories. For a complete description of task parameters, see the liquid-handling tasks in the *VWorks Automation Control User Guide*.
Execute command	Performs the selected task command. *Note:* To stop a task before it finishes running, click Stop motors. To resume movement of the head, you can use the Enable all motors button on the Jog/Teach tab.

Aspirate task parameters

About this topic

The Aspirate task draws liquid from a microplate or reservoir. This topic describes the task parameters.

To run the Aspirate task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter description

The Aspirate task has the following parameters.

Parameter	Description
Volume (0–251 µL)	The volume of liquid to be drawn into each pipette tip.
Pre-aspirate volume (0–251 µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Post-aspirate volume (0–251 µL)	The volume of air to be drawn after the liquid is drawn.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Distance from well bottom (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the Aspirate task. If you specify dynamic tip extension, this is the distance at the end of the Aspirate task. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.)

Parameter	Description
Dynamic tip extension (0–20 mm/μL)	The rate at which the pipette head moves during the Aspirate task. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change*. Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTE > 1/A
	• *Slower than the volume change*. DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{aspirated} * DTE) + Distance_{well\ bottom}$
	Note: Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.
Pipette technique	The pipette location offset you want to use for the Aspirate task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.

Parameter	Description
Tip touch horizontal offset (−9 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Dispense task parameters

About this topic

The Dispense task dispenses liquid into a microplate or reservoir. This topic describes the task parameters.

To run the Dispense task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter descriptions

The Dispense task has the following parameters.

Parameter	Description
Empty tips	The option to empty all liquid from the tips instead of using the dispense volume specification.
Volume (0–251 µL)	The volume of liquid to be dispensed from each pipette tip.
Blowout volume (0–251 µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the wells.
	Typically, the blowout volume is the same as the pre-aspirate volume.
	Note: Blowout only occurs in the last quadrant dispensed for a given Dispense task.
Liquid class	The pipetting speed and accuracy.
	IMPORTANT To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Distance from well bottom (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the Dispense task.
	If you specify dynamic tip retraction, this is the starting distance.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip retraction (0–20 mm/µL)	The rate at which to raise the pipette head during the Dispense task.
	Use dynamic tip retraction to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change.* Calculate dynamic tip retraction (DTR) as follows:
	DTR = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change.* DTR > 1/A
	• *Slower than the volume change.* DTR < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTR) + Distance_{well\ bottom}$
Pipette technique	The pipette location offset you want to use for the Dispense task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.
Tip touch horizontal offset (−9 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Dispense to Waste task parameters

About this topic

This topic describes the task parameters for the Dispense to Waste task, which is available only for a location with a Tip Wash Station (also known as a MicroWash Reservoir).

The Dispense to Waste task moves the pipettes by a horizontal offset and then dispenses used fluid in between the chimneys in the Tip Wash Station. The software calculates the horizontal offset automatically based on the labware definition for the Tip Wash Station.

To run the Dispense to Waste task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 105. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter descriptions

The Dispense to Waste task has the following parameters.

Parameter	Description
Empty tips	The option to empty all the liquid from the head into the wash station outside the chimneys.
Volume (0–250 µL)	The volume of liquid to be dispensed from each pipette.
Blowout volume (0–250 µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the wash station.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.

Parameter	Description
Override dispense flow rate from liquid class	The option to override the dispense velocity specified in the liquid class. Selecting this option enables you to specify a value for the dispense flow rate without changing the liquid class.
Dispense flow rate (0–500 μL/s)	The numerical value or the JavaScript variable that will override the dispense velocity setting in the liquid class.

A JavaScript variable enables the value to be assigned later, for example through a VWorks form. Using a VWorks form, an operator could easily change the flow rate for a dispense step in increments from as low as 1 μL/min up to 1001 μL/min using the same liquid class.

If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.

IMPORTANT   The software requires that the flow rate value be in microliters per second (μL/s) at run time. If you want an operator to enter the value in microliters per minute (μL/min), you can use scripting to convert the values for the software to use. |
| Distance from well bottom (mm) | The absolute distance between the end of the pipette tips and the bottom of the wash stationduring the Dispense to Waste task.

If you specify dynamic tip retraction, this is the starting distance.

IMPORTANT   The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom. |

Parameter	Description
Dynamic tip retraction (mm/µL)	The rate at which to raise the pipette head during the Dispense to Waste task.
	Use dynamic tip retraction to prevent spills as the pipette tips displace the liquid.
	To move the pipettes:
	• *At the same rate as the volume change*. Calculate dynamic tip retraction (DTR) as follows:
	DTR = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTR > 1/A
	• *Slower than the volume change*. DTR < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTR) + Distance_{well\ bottom}$
Perform tip touch on North/East side	The option to touch the tip on an outer side of the adjacent northeast chimney or wall in the wash stationafter performing the dispense.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the pipette tips to rise before performing the tip touch.
Tip touch horizontal offset (−9 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about...	See...
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26

For information about…	See…
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Mix task parameters

About this topic

The Mix task aspirates and dispenses liquid multiple times to mix it. You can specify different well-bottom distances for the aspirate and dispense actions. This topic describes the task parameters.

To run either task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter descriptions

The Mix task parameters include the following.

Parameter	Description
Volume (0–200 µL)	The volume of liquid to be mixed in each well.
Pre-aspirate volume (0–200 µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (0–200 µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the wells. Typically, the blowout volume is the same as the pre-aspirate volume.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Mix cycles ((0–100)	The number of times to repeat the aspirate-and-dispense cycle.

Parameter	Description
Aspirate distance (0–100 mm)	The distance between the end of the pipette tips and the well botttoms during the aspirate action. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.
Dispense at different distance	The option to dispense at a pipette tip height that is different than the aspirate distance. Select the check box to enter a value for the dispense distance.
Dispense distance (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the dispense action.
Dynamic tip extension (0–20 mm/μL)	The rate at which the pipette head moves during the Aspirate task. The software calculates the distance over which the tips will move without crashing. Use dynamic tip extension to prevent spills as the pipette tips displace the liquid. To move the tips: • *At the same rate as the volume change*. Calculate dynamic tip extension (DTE) as follows: DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls • *Faster than the volume change*. DTE > 1/A • *Slower than the volume change*. DTE < 1/A The starting and ending positions can be calculated as follows: $(V_{aspirated} * DTE) + Distance_{well\ bottom}$ *Note:* Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.
Pipette technique	The pipette location offset you want to use for the Dispense task. The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.

Parameter	Description
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.
Tip touch horizontal offset (−5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Pump Reagent parameters

About this topic

The Pump Reagent task fills or empties a reservoir or wash tray by pumping for a specified number of seconds. If the reservoir is on a Weigh Station, the pump stops fluid flow when the target weight is reached. This topic describes the task parameters.

Parameter descriptions

To run the Pump Reagent task, see "Performing a task using Bravo Diagnostics" on page 105.

The Pump Reagent task has the following parameters.

Parameter	Description
Reservoir mode	The action of the task: • Fill • Empty
Pump speed	The speed, in percent of maximum, at which to pump the reagent.
Pump on time	The duration of time, in seconds, to run the pump: If the Use weigh station/shelf option is selected, this value specifies the maximum time (seconds) to run the pump. If the pump runs for the full duration without reaching the weigh station/shelf threshold, an error occurs.
Use weigh station/shelf	The option to use the Weigh Station or Weigh Shelf.
Weigh station/shelf action threshold	The minimum fluid weight, in percent of the full weight that was calibrated on the Weigh Station or Weigh Shelf. For example, you can set the minimum threshold at 45% so that when the fluid reaches 45% of the full weight, fluid starts to pump into the reservoir.
Weigh station stop action threshold	The maximum fluid weight, in percent of the full weight that was calibrated on the Weigh Station or Weigh Shelf. For example, you can set the stop threshold at 60% so that when the fluid reaches 60% of the full weight, fluid starts to drain or pump out of the reservoir.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up an autofilling location	"Workflow to set up an autofilling station" on page 189
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Shake task parameters

About this topic

The Shake task instructs the Orbital Shaking Station to shake. This topic describes the task parameters.

To run the Shake task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter descriptions

The Shake task contains the following parameters.

Parameter	Description
Mode	The action of the task: • *On.* Turns on the Orbital Shaking Station. • *Off.* Turns off the Orbital Shaking Station. • *Timed.* Turns on the shaking timer. You must specify the length of time to shake.
RPM	The shake speed, in revolutions per minute.
Direction	The direction to shake. Select one of the direction combinations: NWSE, NESW, NS, EW, NW/SE, NE/SW.
Time for operation in Timed mode (s)	The length of time, in seconds, you want to leave the shaking on. At the end of the period, the shaking will turn off.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up the Orbital Shaking Station	"Installing and setting up an Orbital Shaking Station" on page 112
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Vacuum Filtration Station task parameters

About this topic

This topic describes the task parameters for the following:

- *Assemble Vacuum task*. Directs the robot to pick up the Vacuum Filtration Station components from designated deck locations and stack them in the order you specify.

- *Disassemble Vacuum*. Directs the robot to remove components from the Vacuum Filtration Station and place them back at the locations specified in the Assemble Vacuum task.

- *Move and Filter Plate*. Moves a plate to the Vacuum Filtration Station and turns on the vacuum.

To use the Assemble Vacuum and Disassemble Vacuum tasks, you must first set the Robot gripper offset value for the labware that will be placed on the Vacuum Filtration Station during a protocol run. You set the offset in the Labware Editor.

To run the Vacuum Filtration Station tasks, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter description: Assemble Vacuum task

Parameter	Description
Assembly order	The order, from bottom to top, in which you want to stack the station components. The selections are: • Base-Collection plate-Filter plate-Collar (configuration A) • Base-Collection plate-Collar (configuration B) • Base-Collar (configuration C) For details, see "Installing and setting up a Vacuum Filtration Station" on page 119.
Vacuum Filtration base	The location of the Vacuum Filtration Station base.

Parameter	Description
Insert height (0-15 mm)	The height of the white plastic spacer, if present, that can be placed in the base manually before starting the protocol. The insert is used to raise the height of the collection plate and reduce the spacing between the filter plate nozzles and the collection plate underneath. Measure the height (mm) from the bottom edge to the top edge of the insert. If you are using multiple inserts, measure the combined height of the stack of inserts. If no insert is in the base, use a value of 0.0 mm (default). **CAUTION** If the assembled stack of plates and inserts is too tall, the collar of the Vacuum Filtration Station **may not seal properly during the vacuum tasks, and the software will display an error message.**

Parameter description: Disassemble Vacuum task

Parameter	Description
Vacuum Filtration Assembly	The location of the assembled Vacuum Filtration Station.

Parameter description: Move and Filter Plate task

Parameter	Description
Mode	The action of the task. The options are On, Off, and Timed. • On and Off. If you are not timing the filtering process, add two Move and Filter Plate tasks in the protocol for each filtering operation. One task turns on the vacuum (Mode = On), and the other task turns off the vacuum (Mode = Off). • Timed. If you plan to time the filtering process, add only one Move and Filter Plate task. The task turns on the vacuum, and then turns off the vacuum automatically at the end of the time period.

Parameter	Description
When filtration timing begin *ME4C VARIO Vacuum Pump only*	The different options for when to start timing the filtration process: • When pressure is achieved • When the vacuum pump starts
Time for operation in Timed mode (s)	The duration, in seconds, that you want to leave the vacuum on. At the end of the period, the vacuum will turn off.
Hold or tap down filter plate *Bravo Platform only*	The different options for whether to have the Bravo gripper hold down the filter plate when the vacuum is turned on to ensure a secure vacuum seal: • None • Tap down. The Bravo gripper will hold down the filter plate from the top only for the time period specified in the Duration for tap down parameter. • Hold down. The Bravo gripper will hold down the filter plate from the top for the duration of the task. *Note:* If you select None or Tap down, the protocol can perform other tasks in parallel. Concurrent operation is not an option if you select Hold down.
Duration for tap down (1-30 s) *Bravo Platform only*	The length of time, in seconds, that the Bravo gripper will hold down the filter plate if the Tap down option is selected.
Time allowed to reach pressure(s) *ME4C VARIO Vacuum Pump only*	The length of time, in seconds, to allow the vacuum to reach the specified target pressure. An error message displays if the target pressure is not reached within the time specified.
Pressure units *ME4C VARIO Vacuum Pump only*	The desired unit of measure: mbar, Torr, hPa, mmHg, cmHg, or inHg. **IMPORTANT** The Pump Pressure Units setting in the profile configuration must match the units set at the VARIO pump controller in order for the software to convert the values to different pressure units.

Parameter	Description
Target pressure *ME4C VARIO Vacuum Pump only*	The difference between the pressure of the outside atmosphere above the filter and the pressure in the Vacuum Filtration Station manifold, including the enclosure beneath the filter. For example, if you set the Target pressure to 600 mbar and the ambient pressure displayed on the Vario pump is 1000 mbar, the vacuum will remain on until the reading on the Vario pump reaches 400 mbar.
Vent delay *ME4C VARIO Vacuum Pump only*	The length of time, in seconds, to wait for the air pressure under the filter to equalize with the ambient air pressure.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up the Vacuum Filtration Station	"Installing and setting up a Vacuum Filtration Station" on page 119
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Wash Tips task parameters

About this topic

The Wash Tips task washes pipette tips using a number of aspirate and dispense actions. This topic describes the task parameters.

To run the Wash Tips task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter descriptions

The Wash Tips task has the following parameters.

Parameter	Description
Empty tips	The option to empty the entire contents of the pipette tips, including fluid and air. The Volume parameter is ignored if this option is selected.
Volume (µL)	The volume of liquid to be dispensed from each pipette tip.
Pre-aspirate volume (µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (µL)	Specifies the volume of air to dispense after the main volume has been dispensed. Typically, the blowout volume is the same as the pre-aspirate volume. *Note:* Blowout only occurs in the last quadrant dispensed for a given dispense action.
Liquid class	The liquid class associated with this liquid. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Mix cycles	The number of times you want to aspirate and dispense. Each cycle consists of one aspirate action and one dispense action.
Distance from well bottom (mm)	The distance between the end of the pipette tips and the well bottoms during the Wash Tips task. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip extension (mm/(µL)	The rate at which the pipette head moves during the Wash Tips task. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change*. Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTE > 1/A
	• *Slower than the volume change*. DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTE) + D_{well\ bottom}$
	$(V_{aspirated} * DTE) + D_{well\ bottom}$
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which side to perform tip touch	The wall or walls for tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
	If you also select the Dispense to waste during wash option, the tip touch is performed on the northeast side only.
Tip touch retract distance	The vertical distance the pipette tips rise before touching the sides of the wells.
Tip touch horizontal offset	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	The value of the parameter determines the direction of movement:
	• *0*. Tips move a horizontal distance equal to the well radius.
	• *Great than 0*. Tips attempt to move past the well radius, which results in a more forceful tip touch.
	• *Less than 0*. Tips move a distance less than the radius of the well, resulting in a lighter tip touch.

Parameter	Description
Pump fill speed (%)	The speed, in percent of maximum speed, of liquid flow into the reservoir.
	For the MicroWash Reservoir, this value should be high enough for the washing liquid to just bubble over the tops of the chimneys.
Pump empty speed (%)	The speed, in percent of maximum speed, of liquid flow out of the reservoir.
	For the MicroWash Reservoir, this value should be slightly higher than that of the inflow pump to prevent an overflow.
Turn pumps off during dispense	The option to turn off the pumps while dispensing liquid during this task.
Dispense to waste during wash	The option to move the tips by a specified offset (defined in the Labware Editor) and dispense used fluid outside of the reservoir chimney.
	This option applies only to reservoirs that have chimneys.
Dispense to waste at height (mm)	The height at which the dispense action occurs.
	For example, during the dispense action, the tips move up to clear the chimneys, move the offset distance, and then lower to the distance you specified. If you want the lower the tips by 10 mm, specify −10 mm.

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

Pin Tool task parameters

About this topic

This topic describes the task parameters for the Pin Tool task.

To run the Pin Tool task, see "Performing a task using Bravo Diagnostics" on page 105.

Parameter descriptions

The Pin Tool task contains the following parameters.

Parameter	Description
Dwell time (s)	The time duration that the pins remain at the specified height (First distance or Second distance) within the well.
	For example, you might start with the following values:
	• Adsorb, Dispense into fluid, or Mix—0.5 s or longer for more viscous fluids
	• Blot—2 s, or longer for more viscous fluids
Descriptive label	A text label that you can add to the task icon in the protocol. Click the arrow in the Descriptive label box to choose an option.
	The options include:
	• Enter a JavaScript variable or script.
	• Use a predefined label: Adsorb, Dispense, Wash, Blot, or Mix
	• Type your own label in the box.
Liquid class	A parameter that you can use to control the accuracy and the speed of the pin tool as it moves into and out of the wells.
	IMPORTANT To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Pipette technique	The pipette location offset you want to use for the Pin Tool task.
	The list of pipette techniques are defined in the Pipette Technique Editor.

Parameter	Description
First distance (mm)	The first height for the pin tool during the Pin Tool task. The value is the distance between the pin tips and the well bottoms.
	For example, during an adsorb step, you might set this value to 0 mm so that the pin tips touch the bottom of the wells. This parameter can affect the quantity adsorbed.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the pins at the correct distance from the well bottom.
Use two distances	The option to specify a second height for the pins during the Pin Tool task.
	For example, you could cycle the pin positions between two heights within the wells repeatedly to perform mixing or to wash the pins.
	Default: Not selected
Second distance (mm)	The distance between the pin tips and the well bottoms at the second height for the pins.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the pins at the correct distance from the well bottom.
Cycles	Available if you select the Use two distances option. The Cycles parameter sets the number of times to move the pins repeatedly to the two heights, for example to perform mixing or to wash the pins.
Perform tip touch	The option to touch the pins on one or more sides of the well, or to enable the pins to make lateral stirring moves inside the fluid, for example during a wash task.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.

Parameter	Description
Tip touch retract distance (mm)	The vertical distance for the pins to move before moving laterally within the well, where • 0 is the vertical distance equal to the well bottom • > 0 is the vertical distance the pins rise above the bottom • < 0 is the vertical distance the pins attempt to move past the well bottom
Tip touch horizontal offset (mm)	The horizontal distance that the pins move. The value is based on the well diameter specified by the labware definition, where • 0 is a distance equal to the well radius • > 0 is the distance the pins attempt to move past the well radius, which results in a more forceful tip touch • < 0 is a distance less than the radius of the well, resulting in a lighter tip touch or no tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

AM Aspirate task parameters

About this topic

This topic describes the task parameters for the AM Aspirate task, which is available only for the Bravo 96AM Head.

The AM Aspirate task is designed for aspirating fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head. In addition to the parameters for the Aspirate task, the AM Aspirate task allows you to override the flow rate from liquid class.

To run the AM Aspirate task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 105. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Aspirate task has the following parameters.

Parameter	Description
Volume (0–250 µL)	The volume of liquid to be drawn into each probe, cartridge, or tip.
Pre-aspirate volume (0–250 µL)	The volume of air to be drawn before the probes, cartridges, or tips enter the liquid.
Post-aspirate volume (0–250 µL)	The volume of air to be drawn after the liquid is drawn.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override aspirate flow rate from liquid class	The option to override the aspirate velocity in the specified liquid class. Selecting this option enables you to specify a value for the aspirate flow rate without changing the liquid class.

Parameter	Description
Aspirate flow rate (1e-05 – 500 µL/s)	The numerical value or the JavaScript variable that will override the aspirate velocity setting in the liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for an aspirate step in increments from as low as 1 µL/min up to 2000 µL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (µL/s) at run time. If you want an operator to enter the value in microliters per minute (µL/min), you can use scripting to convert the values for the software to use.

Parameter	Description
Distance from well bottom (-20–100 mm)	The distance between the tips of the probes, cartridges, or disposable tips and the *well bottoms* during the AM Aspirate task.
	If you specify dynamic tip extension, this is the distance at the end of the AM Aspirate task.
	Use a positive number for tasks that are performed with mounted cartridges, mounted tips, or bare probes at labware other than a cartridge rack.
	If the task is performed in the upper cup of unmounted cartridges, you can use a negative number for the parameter value. In this case, the *well bottom* is the top of the cartridge cup, as shown in the following figure.
	For example, a negative number enables a cup wash step while the cartridges are in the cartridge rack before they are mounted on the Bravo 96AM Head.
	IMPORTANT You can use a negative number for this parameter only if the AM Aspirate task is performed in cartridges that are located in a cartridge rack.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip extension (0–20 mm/µL)	The rate at which the Bravo 96AM Head moves during the AM Aspirate task. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change*. Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTE > 1/A
	• *Slower than the volume change*. DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{aspirated} * DTE) + Distance_{well\ bottom}$
	Note: Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.
Pipette technique	The pipette location offset you want to use for the AM Aspirate task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.

Parameter	Description
Tip touch horizontal offset (−5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition. For example, if you set a value of: • 0, the tips move a horizontal distance equal to the well radius • > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch • < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

AM Dispense task parameters

About this topic

This topic describes the task parameters for the AM Dispense task, which is available only for the Bravo 96AM Head.

The AM Dispense task is designed for dispensing fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head. In addition to the parameters for the Dispense task, the AM Dispense task allows you to override the flow rate from liquid class.
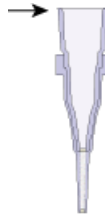
To run the AM Dispense task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 105. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Dispense task has the following parameters.

Parameter	Description
Empty tips	The option to empty all liquid from the probes, cartridges, or tips instead of using the dispense volume specification.
Volume (0–250 µL)	The volume of liquid to be dispensed from each probe, cartridge, or tip.
Blowout volume (0–250 µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the probes, cartridges, or tips are still in the wells. Typically, the blowout volume is the same as the pre-aspirate volume. Note: Blowout occurs only in the last quadrant dispensed for a given AM Dispense task.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override dispense flow rate from liquid class	The option to override the dispense velocity in the selected liquid class. Selecting this option enables you to specify a value for the dispense flow rate without changing the liquid class.

Parameter	Description
Dispense flow rate (1e05–500 µL/s)	The numerical value or the JavaScript variable that will override the dispense velocity setting in the liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for an aspirate step in increments from as low as 1 µL/min up to 2000 µL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (µL/s) at run time. If you want an operator to enter the value in microliters per minute (µL/min), you can use scripting to convert the values for the software to use.

Parameter	Description
Distance from well bottom (-20–100 mm)	The distance between the tips of the probes, cartridges, or disposable tips and the *well bottoms* during the AM Dispense task.
	If you specify dynamic tip extension, this is the distance at the end of the AM Dispense task.
	Use a positive number for tasks that are performed with mounted cartridges, mounted tips, or bare probes at labware other than a cartridge rack.
	If the task is performed in the upper cup of unmounted cartridges, you can use a negative number for the parameter value. In this case, the *well bottom* is the top of the cartridge cup, as shown in the following figure.
	For example, a negative number enables a prewetting step before mounting and priming the cartridges.
	IMPORTANT You can use a negative number for this parameter only if the AM Dispense task is performed in cartridges that are located in a cartridge rack.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip retraction (0–20 mm/µL)	The rate at which to raise the pipette head during the Dispense task.
	Use dynamic tip retraction to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change*. Calculate dynamic tip retraction (DTR) as follows:
	DTR = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTR > 1/A
	• *Slower than the volume change*. DTR < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTR) + Distance_{well\ bottom}$
Pipette technique	The pipette location offset you want to use for the AM Dispense task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the probes, cartridges, or tips on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the probes, cartridges, or tips to rise before touching the sides of the wells.
Tip touch horizontal offset (−5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

AM Mix task parameters

About this topic

This topic describes the task parameters for the AM Mix task, which is available only for the Bravo 96AM Head.

The AM Mix task is designed for aspirating and dispensing fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head.

To run the AM Mix task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 105. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Mix task has the following parameters.

Parameter	Description
Volume (0–250 µL)	The volume of liquid to be mixed in each well.
Pre-aspirate volume (0–250 µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (0–250 µL)	The volume of air to dispense after the main volume has been dispensed while the tips are still in the wells. Typically, the blowout volume is the same as the pre-aspirate volume.
Liquid class	The pipetting velocity and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override flow rates from liquid class	The option to override the aspirate and dispense velocity in the selected liquid class. Selecting this option enables you to specify a value for the flow rate without changing the liquid class.

Parameter	Description
Aspirate/dispense flow rate (1e-05–500 μL/s)	The numerical value or the JavaScript variable that will override both the aspirate and dispense velocity in the selected liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for a mix step in increments from as low as 1 μL/min up to 2000 μL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (μL/s) at run time. If you want an operator to enter the value in microliters per minute (μL/min), you can use scripting to convert the values for the software to use.
Mix cycles (0–100)	The number of times to repeat the aspirate-and-dispense cycle.
Dynamic tip extension (0–20 mm/μL)	The rate at which the Bravo 96AM Head moves during the aspirate action. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change*. Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change*. DTE > 1/A
	• *Slower than the volume change*. DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{aspirated} * DTE) + Distance_{well\ bottom}$
	Note: Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.

Parameter	Description
Pipette technique	The pipette location offset you want to use for the Mix task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Aspirate distance (0–100 mm)	The distance between the end of the pipette tips and the well botttoms during the aspirate action.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.
Dispense at different distance	The option to dispense at a pipette tip height that is different than the aspirate distance.
	Select the check box to enter a value for the dispense distance.
Dispense distance (0–100 mm)	The distance between the tips of the probes, cartridges, or disposable tips and the well bottoms during the dispense action.
Perform tip touch	The option to touch the tips on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (−20 to 50 mm)	The vertical distance for the tips to rise before touching the sides of the wells.
Tip touch horizontal offset (−5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about…	See…
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 105
Reporting a problem	"Reporting problems" on page 91

In This Guide

This guide includes procedures for setup, operation, and maintenance of the Bravo Platform.

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