

405™ LS

Getting Started Guide



Quick Start

Here are guidelines for quickly getting up and running with the 405™
Microplate Washer LS:



Install the 405 LS **page 7**
Follow instructions for removing shipping hardware and installing the instrument.



Optimize performance **page 29**
Review the best practices for optimal performance.



Review the Safety Information **page 89**



Copy the 405 LS Operator's Manual to your computer to make it easy to find reference information in the future. The complete operator's manual is delivered on the USB flash drive shipped with the instrument.



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Notices

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998

Winooski, Vermont 05404-0998 USA

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Contact Information

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998
Winooski, Vermont 05404-0998 USA

Customer Service and Sales

Internet: www.biotek.com
Phone: 888-451-5171 (toll free in the U.S.)
802-655-4740 (outside the U.S.)
Fax: 802-655-7941
E-Mail: customercare@biotek.com

Service/TAC

Phone: 800-242-4685 (toll free in the U.S.)
802-655-4740 (outside the U.S.)
Fax: 802-654-0638
E-Mail: tac@biotek.com

European Coordination Center/Authorized European Representative

BioTek® Instruments GmbH
Kocherwaldstrasse 34
D-74177 Bad Friedrichshall
Germany

Internet: www.biotek.de
Phone: +49 (0) 7136 9680
Fax: +49 (0) 7136 968 111
E-Mail: info@biotek.de

BioTek's Customer Resource Center

BioTek's Customer Resource Center (CRC) continues our tradition of superior service and support. After an easy registration process, you can access lots of useful information about your BioTek microplate instrumentation and software. On the secure CRC website, you can:

- Track orders
- Access warranty information, user manuals and software updates
- Download technical and application information
- Maintain equipment inventory (product registration)
- Request service and technical support
- View service history
- And much more!

Register at <https://customer.biotek.com>

Warnings



Operate the instrument on a level, stable surface away from excessive humidity.

When operated in a safe environment, according to the instructions in this document, there are no known hazards associated with the 405 LS. However, the operator should be aware of certain situations that could result in serious injury; these vary depending on the instrument type. See **Hazards** and **Precautions** (*as described on page 90*).

Strict adherence to instrument maintenance and qualification procedures is required to ensure accurate dispense volumes and risk-free operation.

Install the 405 LS

Follow the instructions in this section to install your instrument.

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Unpack and Inspect the Instrument

Important: Save all packaging materials. If you need to ship the instrument or accessories to BioTek for repair or replacement, you must use the original packaging. Using other forms of commercially available packaging is not recommended and can void the warranty. Improper packaging that results in damage to the instrument may lead to additional charges. Refer to the operator's manual for repacking instructions.

Inspect the shipping box, packaging, instrument, and accessories for signs of damage.

If the 405™ Microplate Washer LS is damaged, notify the carrier and your BioTek representative. Keep the shipping cartons and packing material for the carrier's inspection. BioTek will arrange for repair or replacement of your instrument immediately, before the shipping-related claim is settled.

1. Unpack the boxes containing the instrument and other equipment:
 - 405™ Microplate Washer LS and accessories
 - Vacuum Pump and accessories
 - Vacuum Filtration Accessory Kit
 - Additional 192-tube washer manifolds for 384-well plate processing.
2. Place all packing materials back into the shipping boxes for reuse if necessary.

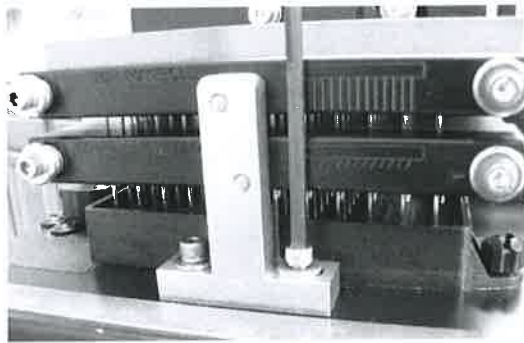
Refer to the Package Contents on page 115 to make sure you have all expected equipment.

Remove the Shipping Hardware

The 405 LS is shipped with a protective manifold shipping bracket. Remove this bracket before using the washer and reinstall it prior to shipping to avoid irreparable damage to the manifold. Failure to remove and reinstall the shipping bracket may void your warranty.

Keep in mind that you must reinstall the shipping hardware and use the original shipping material if it is necessary to return the instrument to BioTek for service or repair.

Remove the manifold shipping bracket



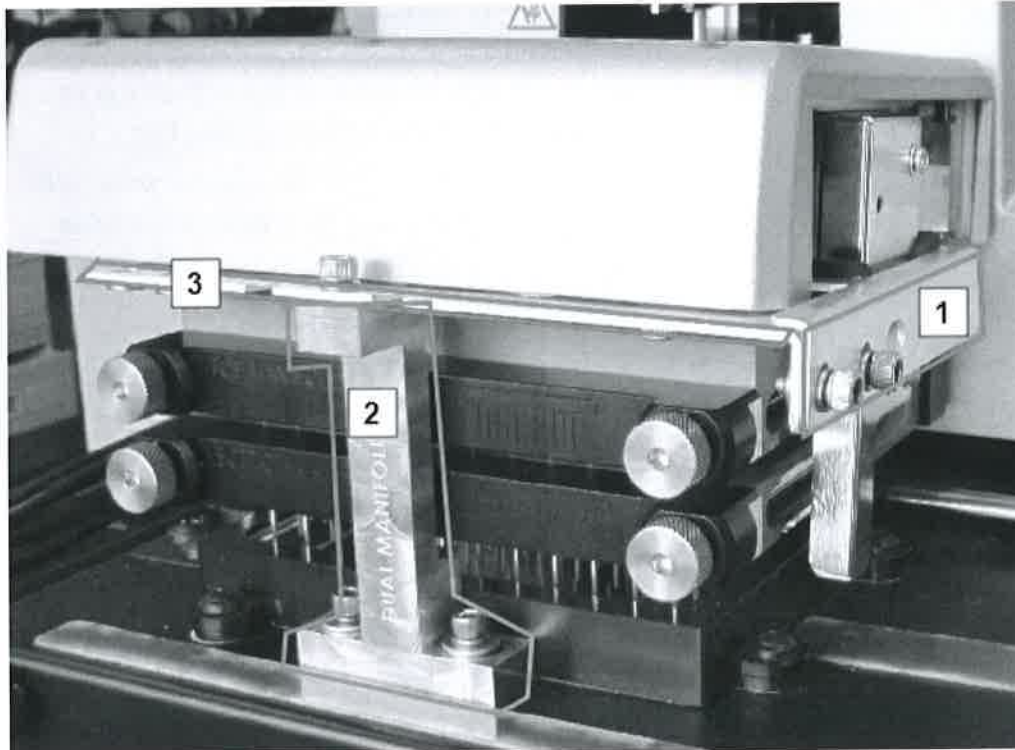
1. Use the 9/64" (3.57 mm) hex wrench to unscrew the cap screws at the base of the shipping bracket and remove it.
2. Slide the bracket towards you and remove.

- Most brackets are black, unlike the one shown here.



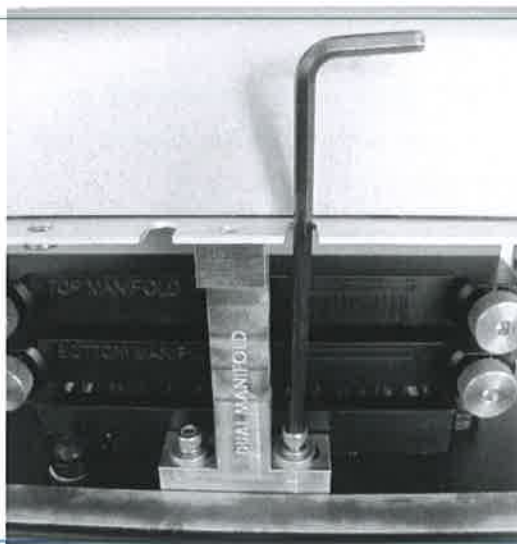
3. Store the bracket: mount it on the back panel, on the studs provided.

405 LS with Verify™ Technology



"Q" Models

"Q" Models have three shipping brackets: remove two before powering up, and the last one after start up.

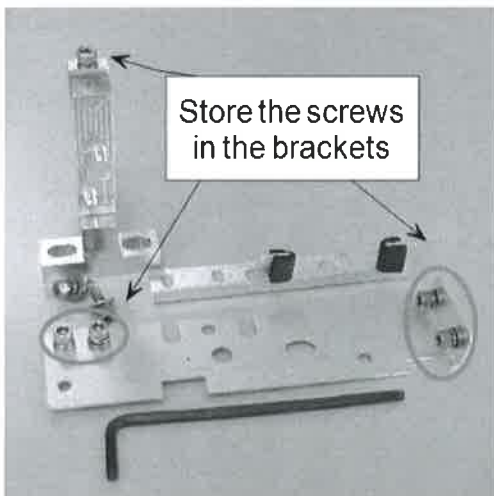


1. Use the 9/64" hex wrench to unscrew the cap screws and remove the bracket on the side of the wash manifold that holds the Verify sensor in place.
2. Remove the large bracket in front holding the wash manifold: Remove the three screws. Slightly lift the manifold(s) to release the bracket from the base, and pull it away from the manifold(s).
3. Set the brackets, screws and washers aside.

Follow instructions to set up the washer, e.g. install the vacuum pump and tubing. Then, perform Step 4, below.

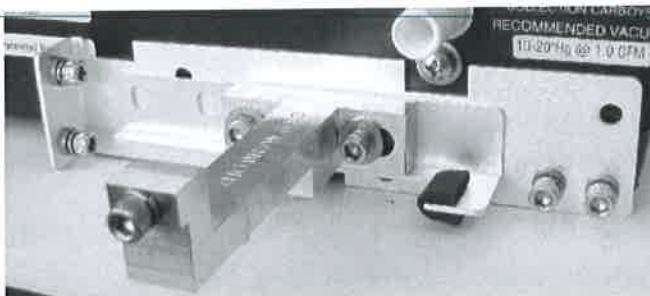


4. When you're ready to power up the instrument, plug it in and turn it on. Release the latch on the left side of the Verify™ sensor unit, and to lift it up to remove the third shipping bracket.
5. For safe keeping, put the cap screws and washers for the two thin brackets in the studs provided on the longest, last-removed bracket.
6. Put the manifold bracket's top screw back in its hole. Save the two longer screws for storing all the brackets on the back of the instrument.





Layer the brackets on top of each other on the studs on the back.



7. Store the brackets: mount them on the back panel on the studs provided. Beginning with the longest (3rd) bracket, layer the brackets on top of each other, and use the longest screws to secure them in place.

Setting Up the 405 LS

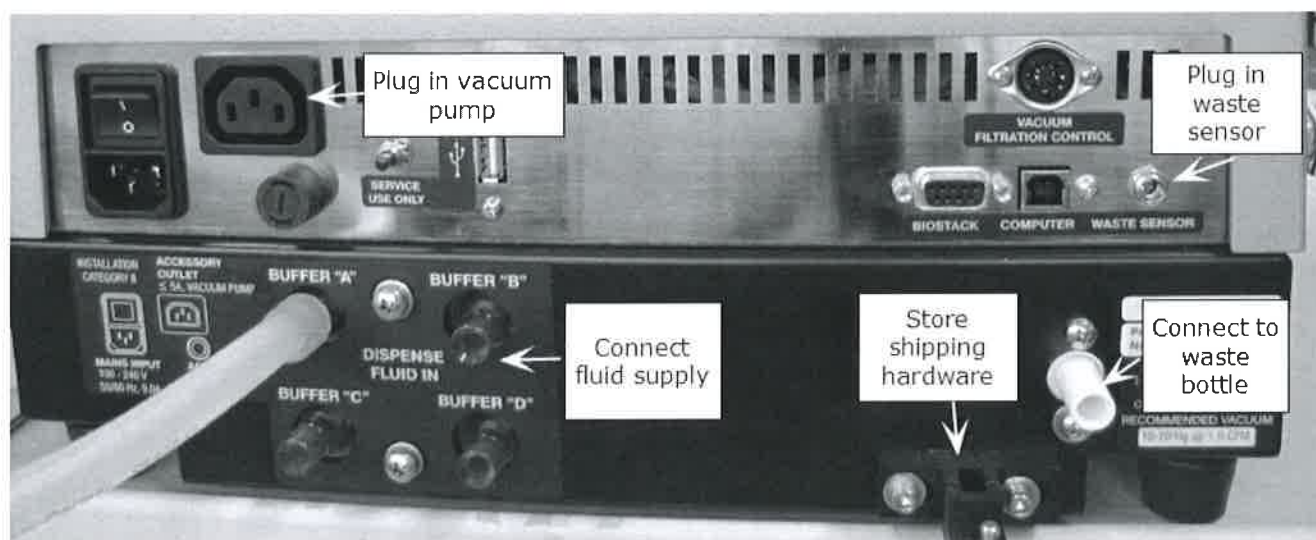
Important: Avoid **excessive humidity**. Condensation directly on the sensitive electronic circuits can cause the instrument to fail internal self checks.

Install the instrument on a level, stable surface in an area where ambient temperatures between 10°C (50°F) and 40°C (104°F) can be maintained.

The instrument should be operated in a non-condensing humid environment having a maximum relative humidity of 80% at temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

Connect the Vacuum Pump, Tubes, and Bottles

For optimal operation of the 405 LS, all tubing, cables, and fittings for the fluid supply and waste systems must be properly connected. This image illustrates the rear panel of the instrument and the locations of the ports and connections for the fluid supply and waste systems.



Rear Panel

Waste System



Caution! Pump Installation. Do not plug the vacuum pump cable into a wall outlet! Connect it to the **Accessory Outlet** on the back of the instrument. This allows the 405 LS to regulate the pump, turning it on and off

as specified by the protocol.

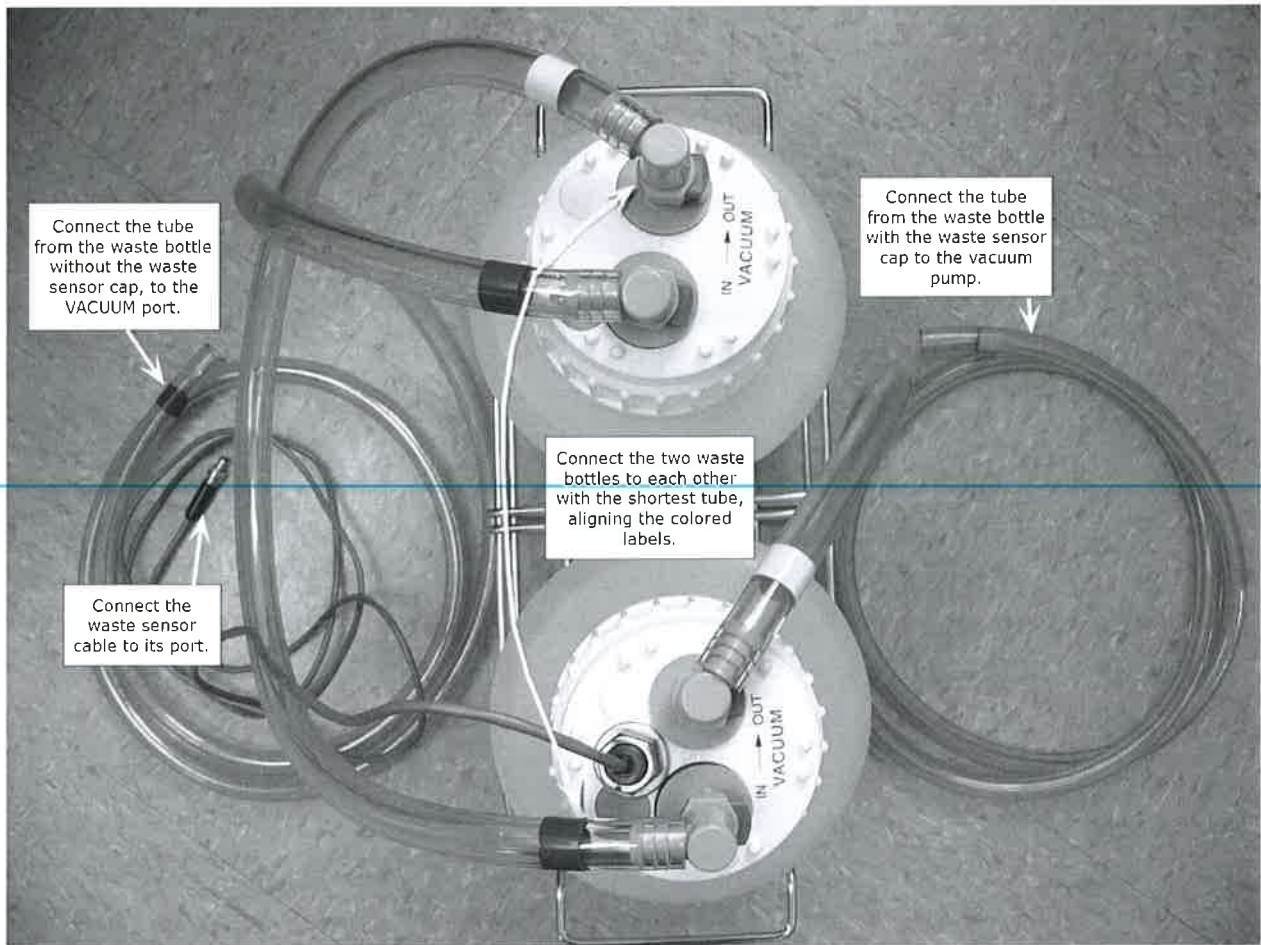


When using a standard pump (rather than the high flow pump), set the instrument's **Vacuum Dissipation Delay** to prevent the pump from drawing excess current and blowing the 5-amp fuse. See Define Instrument Settings on page 21.

- **Note:** The waste tubes have colored bands that match similarly colored dots next to the inlet/outlet ports on the waste bottle caps to ensure the correct connection of the tubing.
 - BioTek strongly recommends installing the vacuum line filter to protect your vacuum pump: See Install the Vacuum Line Filter on page 15.
-

Direct Drain Waste System: Follow instructions provided with the direct drain module (and included on the operator's manual USB stick) to install the direct drain waste system, if purchased.

Standard Waste System - 4L, 10L, or 20L Bottles



Standard Waste System

Three lengths of tubing are shipped with the waste module:

Tubing:

Short tube with yellow and green bands



Connects:

The two waste bottles to each other

Long tube with green bands on both ends



Bottle without sensor to vacuum **port**

Long tube with yellow and orange bands



Bottle with waste sensor to the vacuum **pump**

1. Locate the quick-release caps shipped inside the waste bottles and attach the tubing to them as follows:
2. Connect the waste bottles to each other using the shortest length of tubing, matching the colored bands on the tubing to colored dots on the caps.
3. Attach the waste sensor cable to the **Waste Sensor** port on the back of the washer.

4. Attach the tube from the **waste bottle with the waste sensor** in its cap to the vacuum pump.
5. Attach the tube from the **waste bottle that does NOT have the waste sensor** in its cap to the **Vacuum** port on the back of the instrument.
6. **Important!** When installing BioTek's vacuum pump, connect the pump's AC power cable to the vacuum pump **Accessory Outlet** on the back of the instrument. (Use the accessory outlet adapter provided, if applicable.)
7. Place the waste bottles and vacuum pump on the same horizontal plane as the instrument or below it, such as the floor beneath the work surface. This will help optimize performance.
8. Make sure the waste bottle's caps are well sealed.

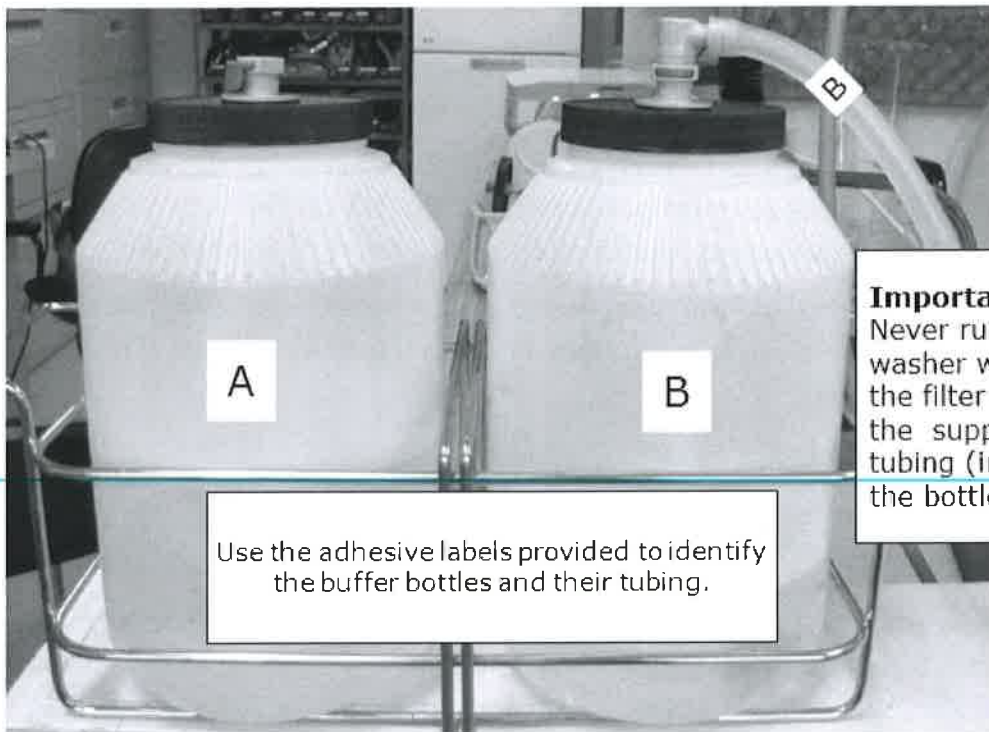
Install the Vacuum Line Filter

The optional vacuum line filter (PN 48294) can be installed halfway between the last waste bottle (overflow bottle) and the vacuum pump.

To do this, cut the tubing and insert the filter, noting the direction of flow. Point the flow arrow on the filter **toward the vacuum pump**.

In the event of a fluid overflow, the filter should prevent the destruction of the vacuum pump's internal components. If an overflow does occur, check the filter for trapped fluid. If fluid is found in the filter, remove the filter and drain using the small white nut on top of the filter. Tighten the white nut and reinstall the filter.

Install the Fluid Supply System



Use the adhesive labels provided to identify the buffer bottles and their tubing.

Important:
Never run the washer without the filter on the supply tubing (inside the bottle).

Prepare the supply bottles and tubing:

1. Remove the **Quick Release Connector** from its bag inside the supply bottle and connect it to the raw supply tubing provided.
 - You may need to cut the tubing to the desired length.
2. Snap the connector into the top of the supply bottle.





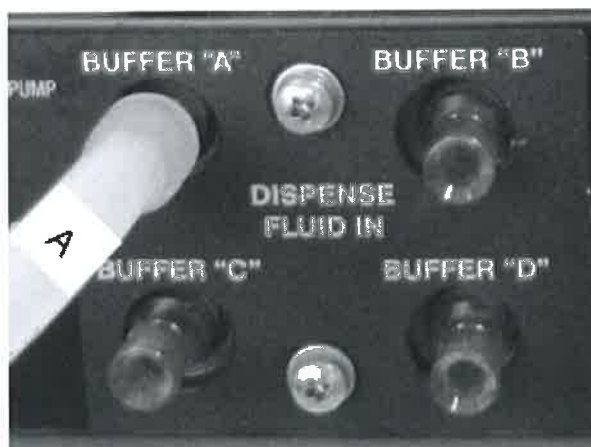
Make sure you hear the connector click!

Attach the labels provided with the washer to identify the buffer bottles.

Note: To avoid spilling fluid when refilling bottles or changing reagents, first release the Quick Connector from the bottle cap, use a paper towel to sop up the few drops in the cap. Then, refill the bottle.

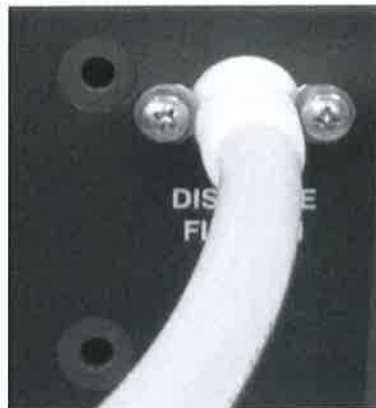
With Buffer Switching (4 Buffers):

1. Place the four supply bottles on the same surface as the instrument.
2. Connect the tubing from one of the supply bottles to the "A" port on the back of the washer.
3. Repeat step 2 with the other three supply bottles for "B," "C," and "D" Buffers.



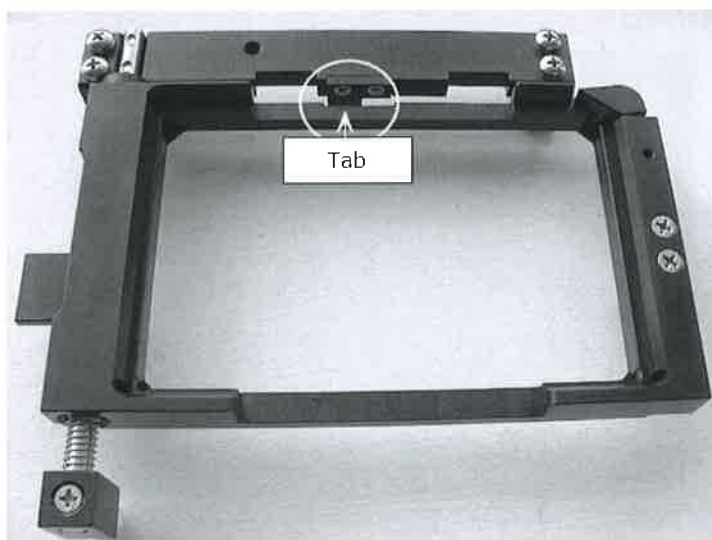
Without Buffer Switching (1 Buffer)

1. Place the supply bottle(s) on the same horizontal plane as the instrument.
2. Connect one the tubes to the Dispense Fluid In port.



Install the Microplate Carrier

- Make sure the serial number on the underside of the plate carrier matches the washer's serial number. If the numbers do not match, call BioTek TAC immediately.



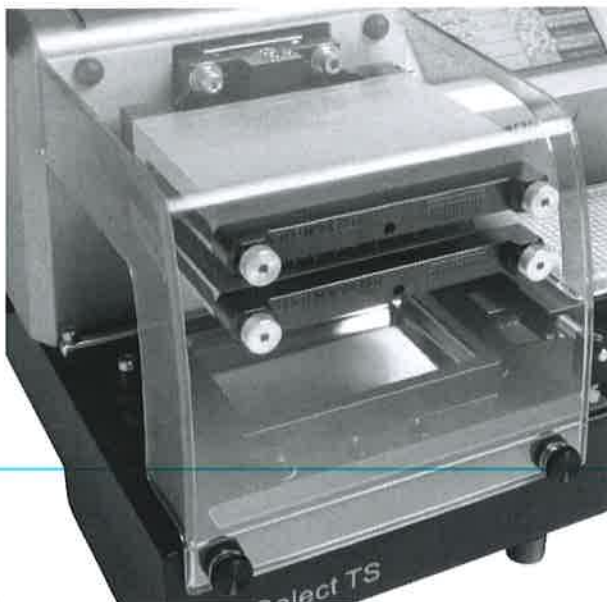
1. Line up the tab on the underside of the carrier with the slot on the carrier transport block.
2. Put the two carrier rail guides onto the transport rail. The tab should sit in the slot.

Final Check

- Verify that the tubing was not crimped during installation.
- Ensure that there are no loose fittings or cable connections.

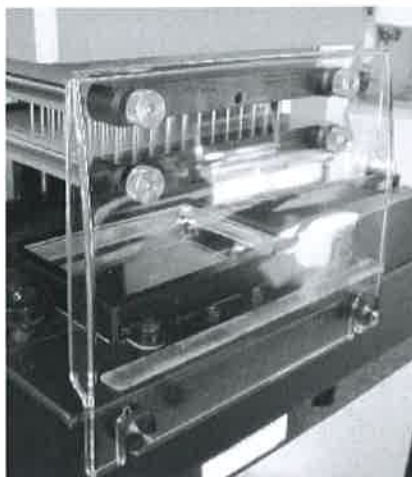
Attach the Mist Shield

1. Loosen the two thumbscrews in the front base of the instrument, directly in front of the washer manifold and priming trough.
2. Position the mist shield so the gaps align with the thumbscrews. One side of the mist shield rests on the instrument base. The top rests on the two rubber pads above the manifold.
3. Finger-tighten the two thumbscrews to hold the shield in place.



Always lift the mist shield straight up, **not** towards you, when removing it.

405 LSs equipped with Verify™ Clog Detection Technology ("Q" models) have a smaller mist shield.



Install Software/Connect to Computer

If you purchased BioTek's Liquid Handling Control™ (LHC) Software to control the 405 LS using your personal computer (PC), please refer to the LHC Installation Guide for complete installation and setup instructions.

Connect to Host Computer

Using the USB cable: Plug one end into the **USB** port labeled Computer on the instrument and the other end into an available port on the computer.

Important: Follow the instructions provided on the LHC software flash drive in the "USB Driver" folder to install the necessary drivers and identify the Com Port number.

- The keypad must be displaying its "Main Menu" for the LHC to communicate with the instrument.



Technical Note: Only one of the two communication ports (COM port) on the instrument can be used at a time. They cannot be used simultaneously. You can use USB to connect the 405 LS to the computer or the RS232 serial port to connect to a BioStack or similar robotic device. But you cannot use both ports simultaneously, i.e. make sure only one cable is plugged in at a time.

Connect Power Cable



Warning! Power Rating. The 405 LS must be connected to a power receptacle that provides voltage and current within the specified rating for the system. Use of an incompatible power receptacle may produce electrical shock and fire hazards.



Warning! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the 405 LS. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the system power cord directly to a three-prong receptacle with a functional ground.

The 405 LS supports voltage in the range of 100-240 V~ at 50-60 Hz.

1. Plug the power cable into the power cable socket in the rear panel of the 405 LS.
2. Insert the three-prong plug into an appropriate receptacle.

Define Instrument Settings

LHC Users Only



When using the LHC to control the 405 LS, an important first step is defining your instrument's settings. After installing the LHC, you can use the desktop icon or the Windows Start button to launch the LHC:



> **All Programs**> **BioTek**> **Liquid Handling Control**

1. Click the **Name** link on the main page and, if required, select the 405 LS.
2. Specify the COM **Port** used to connect the 405 LS to the computer (use the drop-down list to select the port) and click **Test Communication**.
 - **Pass**: proceed to the next step.
 - **Fail**: check the Com Port setting. See "About Com Ports" in the LHC Help.
3. In the Target Instrument Settings dialog that opens, click Get actual settings now, and click **OK**.

Standard Vacuum Pump Users

-
- **Do not** perform this step when using the **High Flow** vacuum pump. High flow pumps are recommended when aspirating 384- and 1536-well plates with non-surfactant wash buffers (e.g., pure deionized or distilled water).
-



Perform this step **ONLY** if you are using the "standard" vacuum pump: increase the **Vacuum Dissipate Delay** to match your waste container: 1 second per liter. For example, if you have a 10 L waste bottle, set the delay to 10 seconds.

Using the LHC	Using the Keypad
<ol style="list-style-type: none"> 1. Select Tools>Instrument Utilities. 2. Under General Settings, increase the Vacuum Dissipate Delay to match your waste container: 1 second per liter. 3. Click Send to download this new setting to the instrument. 4. Click Exit to return to the main screen. 	<ol style="list-style-type: none"> 1. Press Setup Menu. 2. → Select the arrow (for more options) then, ADVANC. 3. Select VACDIS. 4. Use the number pad to set the Vacuum Dissipate Delay to match your waste container: 1 second per liter. 5. Press Main Menu upon completion.

Define Startup Preferences (LHC users only)

You can save enormous time creating protocols by following these steps to define a **New Protocol** template and use it at startup.

Create a protocol template

1.  Click the **New** button or select **File>New**.
2. Click **Name**. Select the 405 LS and define its **Port** and **Settings**.
3. *Highly Recommended:* select the **Plate Type**, fill in the text fields, and add any steps that you want all new protocols to include.
4.  Click **Save** and assign a unique name, e.g. Template.LHC.
5. Select **Tools>Preferences>New Protocol**.
6. ⦿ Select the button for Protocol selected below to use as a template.
7. Click **selected** and select the protocol you created as a template.

Define startup behavior:

8. After completing the steps above, select the Startup Options tab.
9. Select the button for **New Protocol**.
10. Click **OK** to save your new preferences.

Verify Performance

Before using the 405 LS for the first time, verify that it is operating properly.

- When using the LHC, make sure the 405 LS is connected to the PC and both are powered up.
- When running standalone, turn on the 405 LS.

Using the keypad:

1. Select **UTILS** at the main menu.
2. Select **TESTS > SLFCHK**.

Using the LHC:

1. Click the **Name** link on the main page and, if required, select the 405 LS.
2. Define the COM **Port** used to connect the 405 LS to the computer and **Test Communication**.
3. In the Target Instrument Settings dialog that opens, click Get actual settings now, and click **OK**.
4. Select **Tools>Instrument Utilities**
5. On the General Settings tab, click the Perform **Self-Check** link.

Test results:

- **Pass:** no error message is displayed.
- **Fail:** an error message is displayed. If this happens, note the error code and refer to Troubleshooting on page 99 to determine its cause. If the problem is something you can fix, turn off the instrument, fix the problem, and then turn the instrument back on. Otherwise, contact BioTek's Technical Assistance Center.

The Qualification Chapter in the operator's manual provides Installation and Operational Qualification procedures to perform after the instrument is installed and *before* the instrument is used in a laboratory environment.

-
- **Important!** Before operating the instrument, review Optimize Performance on page 29. The guidelines include necessary steps to perform before running a protocol, and issues to consider when creating or editing protocols.
-

Verify the Washer

1. Fill the washer's supply bottle (bottle "A" for buffer switching models) with approximately one liter of deionized water.

LHC	Keypad
<ol style="list-style-type: none"> 1. Select File > Open. 2. Open the 405 LS and the Prime and Maintenance Protocols folders. Open the applicable "Buffer" folder, and then open W-DAY_RINSE.LHC You <i>may</i> need to reset the Com Port. 3. When ready, click the Run button to prime the tubing and manifold with deionized water. 4. When finished, close the program. 	<ol style="list-style-type: none"> 1. Select RUN at the main menu. 2. Run DAY_RINSE: Press ENTER to confirm selection of the protocol and press START to run the protocol. (Press the Options key to scroll to the protocol if necessary.) 3. When the protocol is completed, press Main Menu.

If leaks were detected, tighten all tube fittings and re-run the program. If leaks are still detected, contact BioTek's Technical Assistance Center.

Run the Verify Test ("Q" Models Only)

If your 405 LS is equipped with BioTek's Verify™ Technology, run the test:

Important! Before running the test:

Make sure the 405 LS is primed and ready to run:

- Fully prime the tubing/system, e.g. run **Day Rinse**.
- If necessary, empty waste vessel and tighten waste bottle cap.

Prepare to run the Verify test:

- Fill the supply vessel with at least **100 mL** dH₂O or DI water or buffer solution¹.

¹Do not use highly viscous fluids or wash buffers that are prone to leave significant residue on the plate.

Run the Verify test:**LHC**

1. Select **Tools>Instrument Utilities>Verify Manifold** and click **Run** a new Test.

- **Buffer:** Select the bottle to use, if applicable.
- **Prime:** optionally, prime the manifold tubes to correct for evaporation loss. 40 mL of fluid is dispensed.
- **%CV Threshold:** optionally, change the %CV to match your lab's standard for QC tests: 5-15%. The default value of 5% is recommended.

2. Press **Start** to run the test.

3. Assess the results: **Verify Results**. (Refer to the operator's manual for a complete description of the Verify Technology process and procedure.)



Do not discard the **Verify Test Plate**. Reuse it for as long as possible.

Contact BioTek TAC if any of the tests fail.

Basic Operation

This section introduces the basics of operating the 405 LS. For more detailed and comprehensive instructions, please refer to the operator's manual on the CD shipped with this guide.

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Basic Operation

Two ways to control the 405 LS

You can control the 405 LS using its built-in keypad or with BioTek's Liquid Handling Control™ (LHC) software.

To use the LHC to control the instrument, it must be attached to and communicating with your personal computer (PC), and its main menu must be displayed. Basic protocols can be created or modified using the LHC, and then downloaded to the instrument for stand-alone operation. Learn about transferring protocols from the LHC to the instrument in the LHC Help system: select the **Help** menu or click a **Help** button in a window.

- Find instructions for using the LHC beginning on **page 46**.
- Keypad instructions begin on **page 31**.

Two ways to wash a plate

The 405 LS offers two ways to wash a plate:

- **Quick Wash:** using the keypad you can wash a plate by defining a few parameters like fluid volume and number of wash cycles and rely on default parameters for the more advanced options.
- **Run a Wash Protocol:** using either the keypad or the LHC you can run a wash protocol to wash a plate. You can run a predefined protocol or define your own protocol to specify the optimal parameters for your assay. See RUN: Running Predefined Protocols on page 40.

Optimize Performance

Here are some guidelines to ensure optimal performance and to prevent problems.

Keep the devices clean and the tubing wet

The most critical factor for ensuring optimal performance is to adhere to the Recommended Maintenance Schedule on page 79. Enable **AutoPrime** to keep tubes from clogging.

Prime the tubing to remove air bubbles

- See 405 Recommendations for Priming the Washer on the next page

Best Practices for all 405 LS Devices

- Fill the supply bottles with sufficient fluid. Never run the 405 LS without the fluid filter installed (on the end of the tubing inside the supply bottle).
- **Note:** To avoid spilling fluid when refilling bottles or changing reagents, first release the Quick Connector from the bottle cap, use a paper towel to sop up the few drops in the cap. Then, refill the bottle.
- Make sure the bottles, solutions, and tubing are clean and do not contain any particles or mold. Solutions that are recycled over several days will grow algae, bacteria, molds, or other undesirable organisms.
- Prime before dispensing. Priming the tubing is the most critical factor in assuring optimal performance.
- Empty the waste bottles and firmly seat the bottles' caps and quick release connectors. To make sure fluid does not back up into the vacuum pump during operation keep the waste sensor cable installed and the waste detection sensor activated. If fluid collects in the overflow bottle, thoroughly rinse the fluid-level switch and bottle.
- Check the external tubing connections for kinks and clogs.
- When equipped with BioTek's Verify™ Technology ("Q" models), before processing your assay plates, take five minutes to run the Verify routine to ensure the manifold tubes are not clogged. Also, enable the Plate sensor (Instrument>Options>Plate Detection) to ensure a plate is present on the carrier before a run begins.
- Put microplates on the carrier with well A1 in the left rear corner as you face the instrument, and firmly seat the plate in the carrier.
- To more quickly dispense to 384- and 1536-well plates, use the Instrument Utilities to change the **Dispense Pattern** to Row. If precision is more important than speed, keep the pattern set to Column.

405 Recommendations for Priming the Washer

These recommended prime volumes are required to achieve 95% or higher purity when changing wash buffers.

Model	Buffer Switching	One Buffer
405 TS/LS	300	250
HT	300	250

Buffer Switching models have four buffer valves; otherwise, only one reagent bottle may be connected to the washer. For Select models (with Cell Wash (CW) capability), the recommended prime volume is the same with and without Buffer Switching.

Model	Quick Prime	Prime step	
Select	300	Main	Low Flow
		150	150

Manifold Prime: 50 mL is recommended to clear air from the manifold only and to wet the tips. This is recommended before running a protocol to correct fluid loss due to evaporation.

Dead Volume

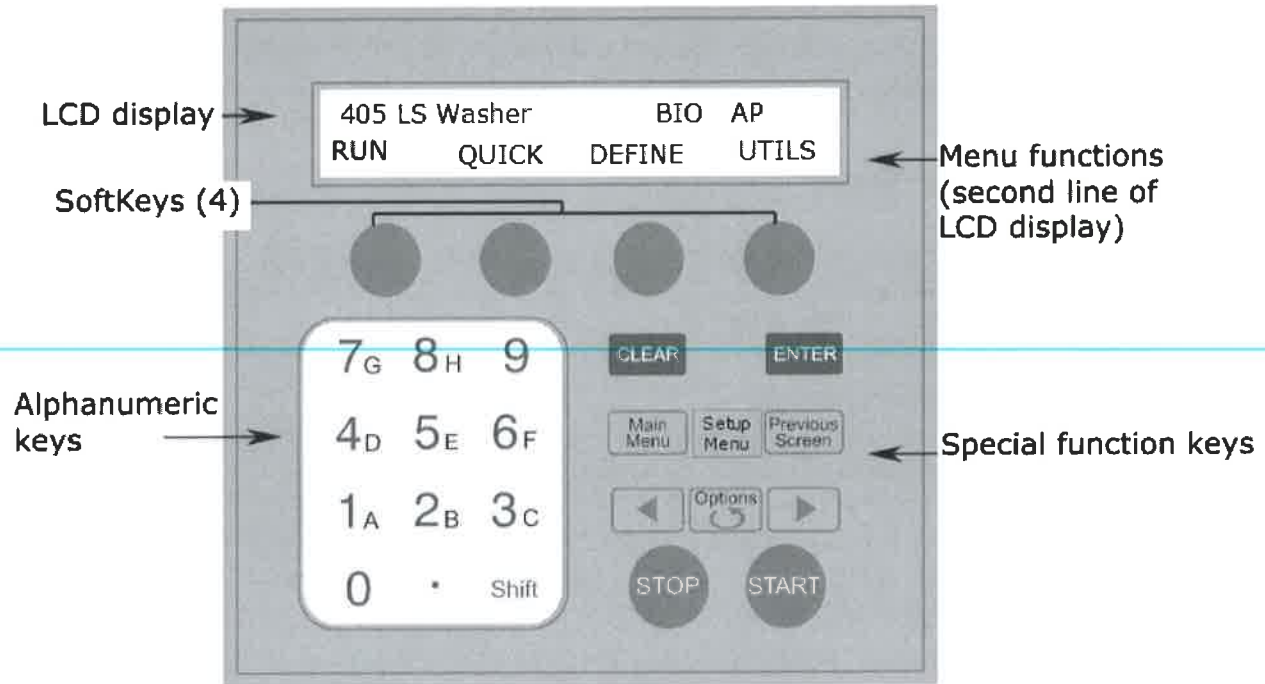
BioTek's recommended prime volumes are based on purity testing and measured dead volumes. Generally, priming with three times the dead volume assures purity.

Model	Dead Volume
405 TS/LS	108 mL
HT	108 mL
Select	129 mL

For models with buffer switching tubing, dead volume is ± 2 mL additionally.

Introducing the 405 LS Keypad

The keypad on the 405™ Microplate Washer LS features 26-keys and a 2 x 24-character LCD. The main menu is shown below.



Starting at the top of the keypad, note the main menu and the **Soft-keys**. Use the Soft-keys to make selections. To return to the main menu, press the **Main Menu** key.

At the main menu, the top line displays **AP** when AutoPrime is enabled and **BIO** when the washer is set to interface with and control the BioStack.

- **RUN** - to run a previously defined protocol. Use the **Options** key to select a protocol or enter its number. See Predefined Protocols Listing on page 42.
- **Turn On/Turn Off the Vacuum Pump** to drain the priming trough. At the Quick menu:
 - Press Shift+1 to turn on the vacuum pump.
 - Press Shift+2 to turn off the vacuum pump.
 - Use these key sequences to manually control the vacuum pump when dispensing fluid. At times the priming trough fills up and is not emptied automatically. This option gives you control in that situation.
- **QUICK** - leads to simplified wash, prime and Ultrasonic Advanatage™ options.
- **DEFINE** - leads to the protocol creation and editing mode: Create or Edit a Protocol on page 33.

- **UTILS** – to run system tests, the Adjust Utility, and to define AutoPrime parameters.
- **Setup Menu**: press this key to access the instrument’s general settings and the settings for the BioStack.
- The **Options** key (and sometimes the arrow keys) scroll through the available options or settings for the current focus. Shift+Options reverses the scrolling direction.

Quick Wash (Keypad only)

Select **QUICK>WASH** at the main menu to perform a quick wash.

96	WASH:003	VOL:0300 A
PLATE	CYCLE	BUFFER

Quick Wash Menu

- Only options applicable to your model are displayed.
- **96** in the above example is the plate type. Select **PLATE** to change it; scroll through the compatible choices for plate washing with the currently installed hardware and press Enter to select the desired plate.
- **WASH:003** is the number of wash cycles (one aspirate and dispense step per cycle). Select **CYCLE** to change the number of cycles to perform.
- **VOL:0300 uL** shows the dispense volume per well in microliters.



To change the dispense volume, use the arrow keys to move the cursor to the desired number position. The cursor appears to underline a number: 0010. When the correct position is selected, use the number pad to enter the desired value. Or, press Options to increment the value, Shift+Options to decrease the value.

- **Buffer** is offered on washers with Buffer Switching to select the buffer valve. The current selection is displayed in the top right corner of the LCD.
- **PLATE** lets you change the selected plate type and define a partial plate run, if applicable.



When the desired values are entered, put a plate on the carrier and press **Start** to run the routine.

If Quick Wash is too limited to satisfy your assay requirements, use the LHC or the keypad to define a wash protocol. All wash parameters can be defined during protocol creation, including those designed for special assays.

Quick Prime (Keypad only)

Priming removes air bubbles from the tubing, ensuring optimal performance. Fluid is dispensed to and aspirated from the priming trough. You can use Quick Prime to comply with the daily maintenance recommendations.

Select **QUICK>FULPRM** or **MANPRM** to prime the washer.

FULL PRIME	VOL:0300	A
BUFFER	(300...999)	

Quick Prime Menu

- Choose **FULPRM** to flush all the tubing, when changing fluids, for example. The valid volume range is displayed, 300 to 999 mL in the above example.
- Choose **MANPRM** prior to running a protocol to correct for evaporation, i.e. to normalize the dispense tips and remove any air from the manifold.
- **VOL:0300 mL** shows the dispense volume per well in milliliters.



To change the dispense volume, use the arrow keys to move the cursor to the desired number position. The cursor appears to underline a number: 0010. When the correct position is selected, use the number pad to enter the desired value. Or, press Options to increment the value, Shift+Options to decrease the value.

- **Buffer** is offered on washers with Buffer Switching to select the buffer valve. The current selection is displayed in the top right corner of the LCD.



When the desired values are entered press **Start**.

See 405 Recommendations for Priming the Washer on page 30.

Create or Edit a Protocol (Keypad Only)

At the main menu:

1. Select **DEFINE**, and then, **CREATE** or **EDIT**.

CREATE

2. **Name** the protocol and select the **Plate Type**. Press **Enter** after making selections to proceed. See How to name a protocol (Keypad only) on page 39

EDIT

Select the protocol to edit: enter its number or use the **Options** key to scroll through the stored protocols to select one. Then, you can edit the name and plate type, if desired. Press **Enter** to proceed.

3. Define or modify the plate type using the Previous and Next buttons to scroll through the supported Plate Types (if applicable).
 4. Select **ADD** to define the first step: then, select the wash action or **SHAKE** to mix or soak the plate's contents. **EDIT** the first step or press the **Options** key to scroll to the step you want to change in a multi-step protocol.
 5. Define the step's parameters. Press **Enter** to proceed.
 6. Keep Added Step? | Save Step Changes?
Select **Yes** or **No** using the Soft-keys to save or discard your inputs for the current step.
- * Press **Main Menu** to end the session at any time. Then, select **RUN** and select the protocol to run it.

Wash Step Parameters Table

Minimally, a wash step includes an aspirate step followed by a dispense step. Select and define each option to customize the parameters for your assay.

Keypad name	Option	Description/Values range	Default values
CYCLES	Number of wash cycles:	Each wash cycle first aspirates and then dispenses fluid to and from the plate.	3
ASPIR	Aspirate	Vacuum Filtration: Select standard aspiration (Top) or Vac for filtration.	
	Filtration Time:	When applicable, specify duration of vacuum filtration in seconds. 5-999	30

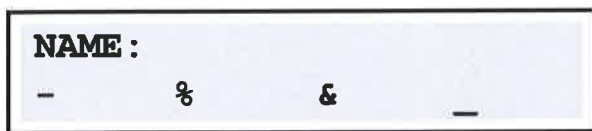
Keypad name	Option	Description/Values range	Default values
	Travel Rate:	The rate at which the washer manifold travels down into the wells. The selection range is 1 to 5 for non-cell-based assays, from slowest to fastest. With these rates, the tubes slow their descent as they approach the defined aspirate height (Z Position) to aid complete evacuation of the well.	3
		For delicate, cell-based assays, the range is 1CW (cell wash) to 4CW and 6CW. These rates minimize turbulence in the wells. The tubes descend at a constant rate to the specified height. Rate 6CW creates the least disturbance and performs fastest.	
	Delay:	Amount of time the tubes stay at the aspirate height before lifting out of the wells. Define a delay between 0 - 5000 ms. Increasing the delay may improve evacuation of the wells.	0
	Positioning:	X- and Y- horizontal axes, Z- height (vertical) axis can be adjusted to improve performance. Default Z-axis for 384-well plates is 22 steps, 2 for 384-well PCR plates.	Z = 29 for 96-well plates; X & Y = 0
	Secondary aspirate:	Also called Crosswise Aspiration. First the wells are aspirated using the position defined above. The aspirate tubes rise and then descend to the secondary position to aspirate again.	No
DISP	Dispense		

Keypad name	Option	Description/Values range	Default values
	Flow Rate: 96-tube & 192-tube manifolds	The rate at which the fluid is dispensed from the tubes. For cell-based assays, use rate 1 or 2 for gentle washing with the 96-tube manifold only. For normal dispensing, the range is 3-11, 3 is slowest and 11 is fastest.	7
	Volume:	$\mu\text{L}/\text{well}$ dispensed range: 96-tube manifold: 50-3000 192-tube manifold: 25-3000	$\mu\text{L}/\text{well}$: 96= 300 384= 100
	Buffer:	Buffer bottle selection. A-D	A
	Positioning:	X- and Y- horizontal axes, Z- height (vertical) axis can be adjusted to improve performance. Default Z-axis for 384-well plates is 120 steps; 83 for 384-well PCR plates.	Z = 121 for 96-well plate
	Vacuum Delay	Suspends the vacuum pump until a certain volume is dispensed. This feature is critical to cell wash operations. It delays normal aspiration until the specified volume has been dispensed to the wells. The range is 10 to 350 $\mu\text{L}/\text{well}$.	10
OPTS	Options		
	PRE	Pre-wash options: Pre-dispense, Bottom wash (if applicable)	
	MIDCYC	Mid-cycle options: Shake, Soak, Pre-dispense between cycles,	
	POST	Post-wash option: Final Aspirate	
	FORM	Format for washing 384-well plates: Plate or Sector	
PRE	Pre-wash	Actions performed before the wash cycles begin	

Keypad name	Option	Description/Values range	Default values
	Pre-dispense	Quick, small prime to condition the tips before dispensing.	No
	Flow Rate:	96-tube & 192-tube manifolds: The range is 3-11, 3 is slowest and 11 is fastest.	9
	Volume:	$\mu\text{L}/\text{tube}$ dispensed range: 96-tube manifold: 50-3000 192-tube manifold: 25-3000	$\mu\text{L}/\text{tube}$: 96 = 50 192 = 25
	Bottom wash	Bottom washing adds an initial wash cycle to the specified number of cycles. Fluid is simultaneously dispensed and aspirated to create cleaning turbulence (at the specified height). The manifold descends to aspirate again and ends with a final dispense to fill the wells.	No
	Rate:	Valid range is 3-11. The cell wash rates, 1 CW and 2 CW, which use low-flow tubing, are available but not recommended. Cell wash options are designed for gentle washing, while bottom wash is designed for vigorous washing.	
	Wash Volume:	25-3000 $\mu\text{L}/\text{well}$ dispense	250
	Positioning:	X- and Y- horizontal axes, Z- height (vertical) axis can be adjusted. Repositioning the tubes to harder-to-reach areas of the wells may improve results.	
MIDCYC	Between cycles		
	Shake	To mix the contents of the plate.	No
	Duration	From one second to one hour.	5 sec.

Keypad name	Option	Description/Values range	Default values					
	Intensity	<table border="1"> <tr> <td>Intensity</td> <td rowspan="4">Variable cycles through the other levels of intensity</td> </tr> <tr> <td>Slow</td> </tr> <tr> <td>Medium</td> </tr> <tr> <td>Fast</td> </tr> </table>	Intensity	Variable cycles through the other levels of intensity	Slow	Medium	Fast	Medium
Intensity	Variable cycles through the other levels of intensity							
Slow								
Medium								
Fast								
	Soak	Delays wash for the duration to allow fluids in the plate to steep or incubate.	No					
	Duration	From one second to one hour.	30					
	Home carrier	To perform the shake or soak in the home position or not. But, the plate carrier is moved home when the total duration of the shake and/or soak exceeds 1 minute. The vacuum pump is turned off in this scenario. Moving the plate home prevents contaminating it with drops from the manifold.	No					
	Pre-dispense between cycles	To wet or condition the manifold tubes between cycles, which is only needed after a long soak. Same parameters as regular pre-dispense.	No					
POST	Post wash	When all cycles are completed.						
	Final Aspirate	A final aspiration is performed to completely evacuate the wells. Same parameters as regular aspirate step.	Yes					
FORM	Wash format	Manner of processing large-format plates	Plate					
	Sector	Performs the entire wash step on one sector of the plate before it moves to the next sector.						
	Plate	Performs each cycle to the entire plate before it starts the next cycle.						

How to name a protocol (Keypad only)



At the **Name** screen when you are creating or editing a protocol, you can enter up to 16 alphanumeric characters to name the protocol:

- Press **Shift** + the number key for **A-H**, or scroll through the alphabet with the **Options** key for **A-Z**.
 - Press **Shift + Options** to reverse direction.
 - Use the arrow keys ◀ ▶ on either side of the **Options** key to move the cursor within the display.
 - Press its Soft-key to add one of the four symbols (- % & _) in the display to the protocol name.
 - Press **ENTER** when you are finished to store the protocol name.
-
- If the name already exists, an Invalid Protocol Name message displays and you must enter a unique name.
-

How to enter negative numbers (Keypad only)

Some protocol parameters, like Horizontal Dispense Position (X-axis), require inputting a negative number to improve performance.

To enter a negative value:

1. Using the number pad, start at 00 (zero) and press **Shift + Options** to display the minus sign.
2. Use the number pad to enter the desired value. The minus sign will remain, making it a negative value.

How to copy a protocol

You can save significant time creating protocols by copying a protocol that shares some of the same protocol parameters and then editing the copy to meet your needs.

LHC users: Open the protocol you want to copy and select **File>Save As**. Assign unique file and protocol names to it. Consult the Help to learn more.


Keypad users:

1. Select **DEFINE** at the main menu.
2. Select **Copy**.
3. Choose the type of protocol you want to copy.
4. Use the **Options** key or enter the protocol number to select it.
5. Enter a unique name for the new protocol you are creating.
6. Select **Yes** to copy the protocol. Then, you can edit the protocol, as needed.

RUN: Running Predefined Protocols

BioTek provides numerous predefined protocols for maintaining the instrument in top condition and for qualifying its performance. Review the **Predefined Protocols on page 42**.

To run a defined protocol:

LHC	Keypad
<ol style="list-style-type: none"> 1.  Select Open and locate the 405 LS folder. 2. Open the 405 LS folder to access the more folders. Find the desired protocol for your instrument model. <p>Important: Be sure to Customize the Predefined Protocols on page 48</p>	<ol style="list-style-type: none"> 1. At the main menu, press RUN. 2. Press Options to scroll to the desired protocol or use the arrow and number keys to enter its number. 3. Press ENTER and follow the prompts.

Creating Protocols: Washing, Aspirating and Dispensing Fluid

In addition to the quick routines available from the keypad's main menu, you can define and run protocols. Protocols offer more parameters, giving you the ability to fine-tune instrument performance, and perform more complex processing.

Keypad Control

Find instructions for creating and modifying protocols using the keypad beginning on **page 33**.

Liquid Handling Control™ (LHC) Software



Launch the LHC software to create or modify protocols, see **page 46**.

Predefined Protocols Listing

Keypad Users: The protocol names onboard the washer do not include the W- prefix and some protocols include the model name, e.g. 405HT or 405Select, when appropriate.

Maintenance Protocols

Daily Maintenance	Description
W-DAY_RINSE	Simple one-step protocol to fully flush the system with water or reagent to keep the manifold tubes clog-free. Defined for use with Buffer A; 500 mL total volume.
W-OVERNIGHT_LOOP	Protocol designed to keep the manifold in a wetted condition overnight or for a long downtime period; manifold tubes are submerged in fluid for 4-hour intervals between primes in this virtually endless loop. Defined to use Buffer A.
W-RINSE_AND_SOAK	Identical to W-DAY_RINSE with one addition, the manifold tubes are submerged and soaked for 5 minutes in the fluid.

Periodic Maintenance

W-Decontaminate DECON (onboard)_STEP1, STEP2, STEP3	Two/three stage protocol to decontaminate the washer, first flushing lines with disinfectant and then rinsing them with deionized or distilled water. Buffer switching models flush and then rinse all four lines. Manifold tubes are submerged and soaked for 20 minutes during each pass. Prompts guide the user through the process.
W-LONG_SHUTDOWN PURGE_WITH_AIR (onboard)	Helps implement the recommended procedure for preparing the instrument for storage. This protocol includes prompts for running disinfectant from Buffer A, then water from Buffer B, and lastly, air through the system - remove bottle from Buffer C valve.
W-CLEAN_w-BUFFER (LHC Only)	Combines priming and AutoClean steps to clean and rinse the manifold. For units with the Buffer Switching module it is defined to obtain cleaning fluid from Buffer B, and rinse fluid from Buffer A. Units without Buffer Switching are prompted to change fluids.
W-PRIME_250/300	Simple prime routine; defined for Buffer valve A only. For LHC only.

Periodic MaintenancePRIME_ALL_
BUFFRS

Consecutively primes each of the Buffer Switching valves beginning with D. Designed for use in the annual instrument verification test of the Buffer Switching module.

QC (Quality Control) Protocols

Manifold-Specific	
96_DISP_TEST	Dispense precision test protocol for 96-tube wash manifold.
96_EVAC_TEST	Evacuation efficiency test protocol for 96-tube wash manifold.
QC_192_DISP_TEST	Dispense precision test protocol for 192-tube manifold.
QC_192_EVAC_TEST	Evacuation efficiency test protocol for 192-tube manifold.
QC_96_VAC30_TEST	Vacuum filtration evacuation efficiency test for 96-well filter plates and also recommended for use in maintenance procedures.
QC_384_VAC10_TEST	Vacuum filtration evacuation efficiency test for 384-well filter plates and also recommended for use in maintenance procedures.

Predefined Sample Protocols

The "Sample" protocols are provided to facilitate learning. Some samples are model specific.

Keypad Users: The protocol names onboard the washer do not include the W- prefix and some protocols include the model name, e.g. 405HT or 405Select, when appropriate.

Serial dilutionsP-96_
DILUTION

Peri-pump serial dilution protocol dispenses 20 µL to 240 µL in 20 µL increments to each column of the plate. 20 µL to column 1; 40 µL to column 2; 60 µL to column 3; and so on till 240 µL to column 12.

P-384_ DILUTION	Serial dilution protocol dispenses 2 μ L to 94 μ L in 2 μ L increments to each column of the plate. 2 μ L to column 1; 4 μ L to column 2; and so on till 94 μ L to column 24.
S-96_ DILUTION	Syringe dispenser serial dilution protocol dispenses 240 μ L to 20 μ L in 20 μ L increments to each column of the plate. 240 μ L to column 1; 220 μ L to column 2; 200 μ L to column 3; and so on till 20 μ L to column 12. Defined for Syringe A.
S-384_ DILUTION	Serial dilution protocol dispenses 98 μ L to 6 μ L in 4 μ L increments to each column of the plate. 98 μ L to column 1; 94 μ L to column 2; 90 μ L to column 3; and so on till 6 μ L to column 24. Defined for Syringe A.
Cell Wash	
W&P-96_ CELL_WASH	Cell wash-dispense protocol uses the special low-flow tubing, optimal dispense and aspirate heights, and vacuum delay during the wash step. Following the wash, the Peri-pump dispenses 200 μ L to each well.
W- CELLWASH_ 96	Cell wash protocol designed to minimize cell layer disturbance in 96-well plates. Aspirate height increased to 50 steps (approx. 6.35 mm above plate carrier) resulting in increased residual, approximately 100 μ L.
W- CELLWASH_ 384	Cell wash protocol designed to minimize disturbance to cells in 384-well plates. Aspirate height increased to 50 steps (approx. 6.35 mm above plate carrier) will cause increased residual volume but help to preserve the cell monolayer.
Microplate Manufacturers	
W- COSTAR Corning_ FLAT	Standard wash protocols modified to best position the manifold tubes for dispensing and aspirating to Corning Costar flat-bottomed and round-bottomed wells.
W- COSTAR Corning_ ROUND	


W-NUNC_ 384	Standard wash protocols modified to best position the manifold tubes for dispensing and aspirating to Nunc® flat-bottomed wells, round-bottomed wells, and 384-well plates.
W-NUNC_ FLAT	
W-NUNC_ ROUND	
Bead Assays - Biomagnetic Separation and Bottom Filtration	
W-Luminex_ MAG_plate_ 96	Biomagnetic separation wash protocols designed for optimal bead recovery in 96-well round- or flat-bottomed plates and 384-well plates when using BioTek's Flat magnets. Begins by soaking the plate for 1 minute to let the beads settle at the bottom of the wells, then performs a 2 cycle wash with 30 second soaks between cycles. Recommendation: Determine Magnet Height Offset on page 65 and apply it for the plate you are using, especially when using 384-well plates.
W-Luminex_ MAG_384	
W-Luminex_ VAC_96	Vacuum filtration wash protocols for Luminex® xMap polystyrene bead assays using filter-bottom plates, 96- and 384-well. Protocol begins with a 5 second bottom aspiration, followed by a 200 µL dispense for 96-well plates and 75 µL dispense for 384-well, and a two cycle 200/75 µL wash.
W-Luminex_ VAC_384	

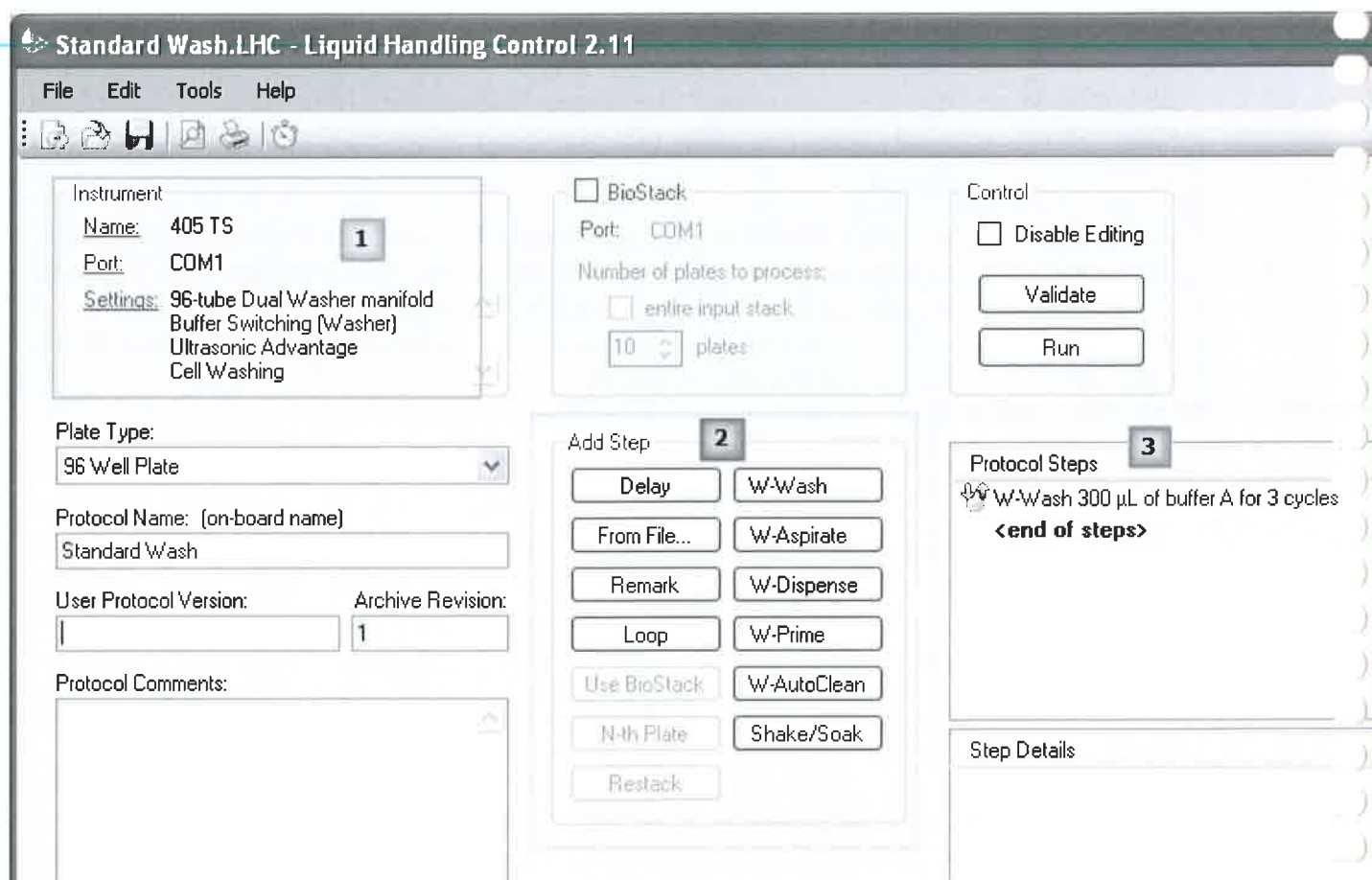
Using LHC to Control the 405™ Washer

BioTek's Liquid Handling Control (LHC) software offers another way to design protocols and control the instrument. The washer must be attached to and communicating with your personal computer (PC) for the LHC to function.

Predefined Protocols

BioTek provides predefined protocols for maintenance routines, instrument qualification, and other purposes like serial dilutions.

 Click the **Open** button and locate the **405 LS** folder to open a predefined protocol. Learn how to Customize the Predefined Protocols on page 48.



1 Instrument Settings: Click the **Name** link and select your instrument.

2 **405 Steps on the facing page**

3 Define a Protocol: select **Help>Help Topics** to learn how.

405 Steps

Click the action button and define the parameters to add that step to the protocol:

W-Wash	W- for steps performed by the Washer .
W-Aspirate	
W-Dispense	
W-Prime	
W-AutoClean	
Shake/Soak	Shake and soak

Each step is executed sequentially. Specific sequences are required when using the BioStack. Any errors will be identified when you press the **Validate** button.

Communications Port

Click the Port link in the main screen

The LHC needs to know the COM Port - Communications Port: USB or Serial component on the instrument used to connect the washer-dispenser to the computer.

- Make sure the 405 LS is connected to the computer, turned on, and not busy.
- Learn more **About COM Ports** in the **LHC Installation Guide** or select **Help>Help Topics**.


Click **Test Communications** after entering the number to verify its accuracy. The LHC will display a message.

If communication is unsuccessful:



- **Check the cabling:** make sure you're using a new/undamaged BioTek-supplied cable and it is properly inserted into the instrument's USB or serial port.
- **Turn on the washer-dispenser:** make sure the instrument is on and not busy processing a plate, running AutoPrime, or performing a system test, for example.
- **Retry:** contact BioTek TAC if you are still unable to establish communication between the instrument and the PC.

LHC Users Only: Customize the Predefined Protocols


BioTek provides predefined protocols for maintenance routines and instrument qualification tests. You can quickly customize the protocols for regular use.

 The LHC keeps track of the last-used COM port for an instrument type. For example, when an EL406 runs a protocol, the LHC logs the COM port used and the next time an EL406 is used, the LHC applies the same COM port setting. You can disable this feature by defining your Ports preference: select **Tools>Preferences>Ports**. To correct the COM port for the current protocol, click the **Port** link and use the drop-down list to select the correct value. The LHC stores the COM port value in the protocol file.

With the 405 LS connected to and communicating with the host computer (i.e. make sure the instrument is turned on and not busy):

1.  Click the **Open** button, locate the **405 LS** folder and click **Open**.
2. Open the **Maintenance** or other folder and select the desired protocol.
3. Port: Change the COM port if necessary: click **Port** and enter the correct value or select from the drop-down list.
4. Settings: Click **Settings**, which opens the Instrument Settings dialog.
5. Under Get settings from: click the **instrument** link.
6.  Click **Validate**.

A "Validation successful" message is displayed unless the protocol cannot be run on your instrument.

7.  Save the protocol.

Upload-Download Protocols (LHC Only)

The LHC lets you transfer protocols from your computer to your instrument and back again.

Limitation: Protocols must contain only instrument-supported action steps to qualify for download. That is, the protocol cannot contain any of the LHC provided steps like Delay and Loop (buttons in the left column of the Add Step box in the main view). And, a Protocol Name is required.

- The instrument's main menu must be displayed for the LHC to communicate with it.

1. Select **Tools>Transfer Protocols**.
 2. Make sure the desired protocols are displayed: check the **Protocol Folder** path for This computer. Refresh the list of protocols onboard the Instrument by clicking the **Settings** link.
 3. Highlight one or more protocols in a display box. (Hold the Ctrl or Shift key to simultaneously select multiple files.)
 4. Optionally, at the top left corner of the screen, choose to Disable Editing of transferred protocols to lock the protocols from editing or deleting when they are onboard the instrument.
 5. Click the applicable **Upload** or **Download** button.
- The LHC will confirm the transfer or prompt you for more information. When the transfer is complete, you can manipulate the files as you normally would in their new location.

Verify Performance

- **LHC Required for "Q" models:** you must use BioTek's Liquid Handling Control (LHC) software to run the Verify™ Technology clog detection feature.

Tools>Instrument Utilities>Verify Manifold>Run a New Test

BioTek's Verify™ Technology quickly detects clogged aspirate or dispense tubes.

Important! Before running the test:

Make sure the 405 LS is primed and ready to run:

- Fully prime the tubing/system, e.g. run **Day Rinse**.
- If necessary, empty waste vessel and tighten waste bottle cap.

Prepare to run the Verify test:

- Fill the supply vessel with at least **100 mL** dH₂O or DI water or buffer solution¹.

Run the Verify test:

LHC

1. Select **Tools>Instrument Utilities>Verify Manifold** and click **Run** a new Test.

- **Buffer:** Select the bottle to use, if applicable.
 - **Prime:** optionally, prime the manifold tubes to correct for evaporation loss. 40 mL of fluid is dispensed.
 - **%CV Threshold:** optionally, change the %CV to match your lab's standard for QC tests: 5-15%. The default value of 5% is recommended.
2. Press **Start** to run the test.
 3. Assess the results: Verify Results. (Refer to the operator's manual for a complete description of the Verify Technology process and procedure.)



Do not discard the **Verify Test Plate**. Reuse it for as long as possible.

¹Do not use highly viscous fluids or wash buffers that are prone to leave significant residue on the plate.

Frequency:

5 Minutes: Gain complete confidence that your plates will be processed correctly by spending five minutes to run the Verify test before running your assay!

Develop a schedule for running the Verify routine based on the type of wash buffer you are using, how frequently you use the washer, and your maintenance habits:

- **Daily:** When using PBS, protein, and other fluids that easily crystallize and harden, potentially clogging the tubes, run the Verify routine every day and/or after prolonged downtimes to ensure the tubes are not clogged.
- **Weekly:** When using TRIS and other low-salt buffers and when adhering to the recommended maintenance schedule, you can confidently run the Verify routine less frequently, e.g. before new assay runs.



Replace the **Verify Test Plate** (according to the prescribed procedure) if it is damaged, scratched, warped, etc.

Manage Test Results



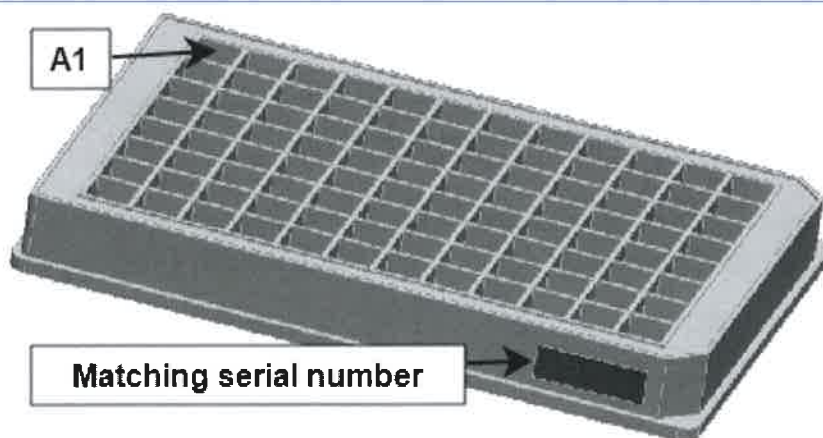
Immediately after a test is run, its results are displayed. The test data file is named with the date and time. You can view previous results using the drop-down list of tests. The most recent test results are at the top of the list.

View Report file: to open a text file of the current test results. Report file names are appended with Passed/Failed results.

Configure settings: to specify a text file folder. See **Configure Verify Test Settings** for other useful info.

Handling the Verify Test Plate

The Verify Test Plate ships in its own special box. The plate is labeled with the serial number of the 405 LS that has been calibrated for its use.

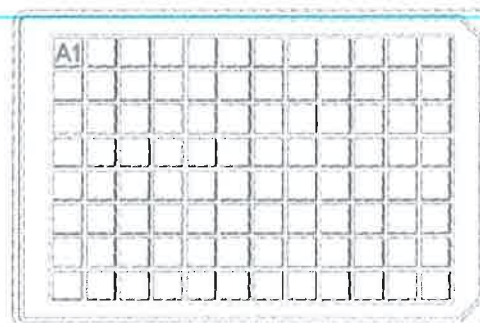


Verify Test Plate

- Well A1 is opposite the chamfered or beveled edges.
- The plate is labeled with the washer's serial number.
- When the plate is on the carrier in the proper orientation, the "Front" label is visible.

Important guidelines:

- Always put the plate on the carrier with well A1 in the back, left corner of the carrier.
- Clean the plate after each use if you are using wash buffer to run the test.
- Fully dry the plate after each use and before putting it back in its foam-lined box.
- Inspect the plate regularly for damage, e.g. scratches, chips, warping.
- Replace the plate when it is damaged. See **Replacement Procedure for Verify Test Plate** in the operator's manual.



Operating with the BioStack

If you purchased BioTek's BioStack Microplate Stacker to operate with the 405 LS, here is some important information about running it:

Keypad Control:

- The Quick Wash option does not function with the BioStack, i.e. the BioStack will not deliver a plate. You must create a protocol to process plates using the BioStack.
- You can use the Quick **Prime** option. This is recommended especially prior to processing plates, to remove air from the tubing.
- To process plates with lids (a BioStack4 feature), LHC must control the BioStack.

LHC Control:

- LHC users: connect both the BioStack and the 405 LS to the computer and control them with the LHC.
- Design protocols that integrate BioStack controls with 405 LS steps. LHC protocols must contain a BioStack loop.
- In the LHC, select **Help>Tutorials**, click **Sections** in the toolbar for a drop-down menu, select **Controlling the Bio-Stack with LHC**. It only takes a couple minutes to complete this interactive demo. It is a great way to learn about the special BioStack features offered with the LHC.

Install and Align the BioStack:

1. Set up the BioStack according to instructions in your BioStack Operator's Manual to interact with the 405 LS. Connect the BioStack to the:
 - Host computer (PC) when using the LHC to control the 405 LS.
 - 405 LS when using the keypad for instrument control.
2. Align the BioStack's gripper with the 405 LS's plate carrier:

LHC:	Keypad:
<ol style="list-style-type: none"> 1. Select Tools> BioStack Utilities. 2. Use the Alignment Utility. Click the Help button for detailed instructions. 	<ol style="list-style-type: none"> 1. Press Setup Menu. 2. Select → 3. Select BIOSTK. 4. Select ALIGN.

3. Set the BioStack operating mode:

<p>LHC:</p> <p><input checked="" type="checkbox"/> BioStack <u>Port:</u> COM1</p> <p><input type="checkbox"/> Use Lids</p> <p><u>Process:</u> 10 plates</p> <p><u>Plate stacked height:</u> default</p>	<p>Keypad:</p> <ol style="list-style-type: none"> 1. Press Setup Menu. 2. Select → 3. Select BIOSTK. 4. Select CONF. 5. Select BIOSTACK.
<p>Fill the BioStack checkbox in the main view to enable the BioStack action buttons and use them to design a protocol that delivers and retrieves plates.</p>	<p>Important: When using LHC to control the 405 LS and the BioStack, the instrument's BioStack configuration setting must be set to MANUAL, not "BIOSTACK."</p>

- To Restack or not? Yes: to keep plates in the same order. No: to save time when the plate sequence is unimportant.

4. **Verify** the setup: perform a protocol with 1 or 2 plates.

At the start of the day, power up the BioStack first, and then the 405 LS. **BIOSTACK2WR:** Lift the BioStack's gripper before turning it on.

Robotics integrators: CAD drawings of the physical dimensions of the 405 LS are available upon request. Contact BioTek customer service.



Technical Note: Only one of the two communication ports (COM port) on the instrument can be used at a time. They cannot be used simultaneously. You can use USB to connect the 405 LS to the computer or the RS232 serial port to connect to a BioStack or similar robotic device. But you cannot use both ports simultaneously, i.e. make sure only one cable is plugged in at a time.

Keypad Control: When the BioStack is connected to your 405 LS, you are controlling both instruments using the keypad. Before connecting the 405 LS to your computer to download basecode or for other reasons, you must first disconnect the BioStack from the 405 LS and change the Instrument Setting for the BioStack: Press **Setup Menu**> →> **BIOSTK**> **CONF**>**MANUAL**.

Cell Wash

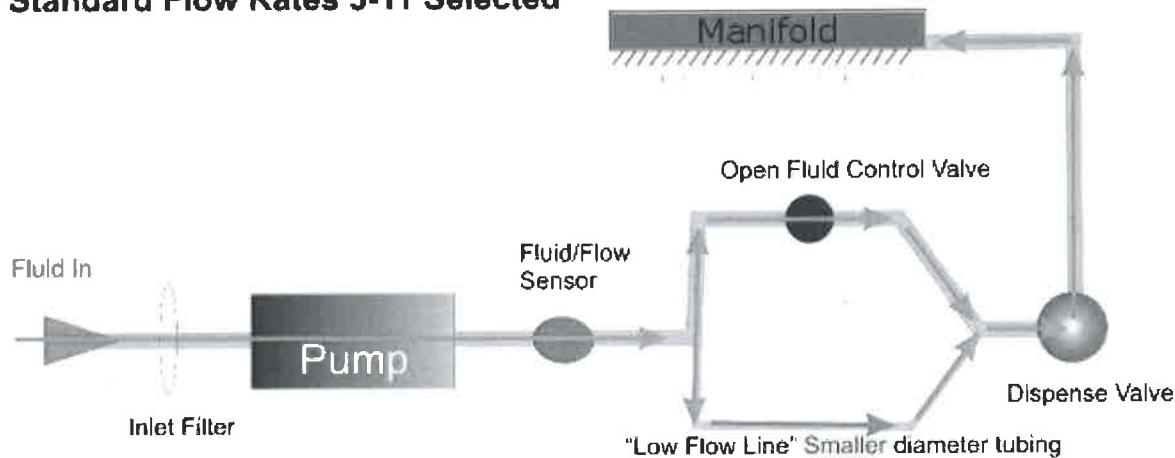
- Not all 405 LS models support cell wash assays. The dual 96-tube wash manifold must be installed.

See how to **Define a Cell Wash Protocol on the next page.**

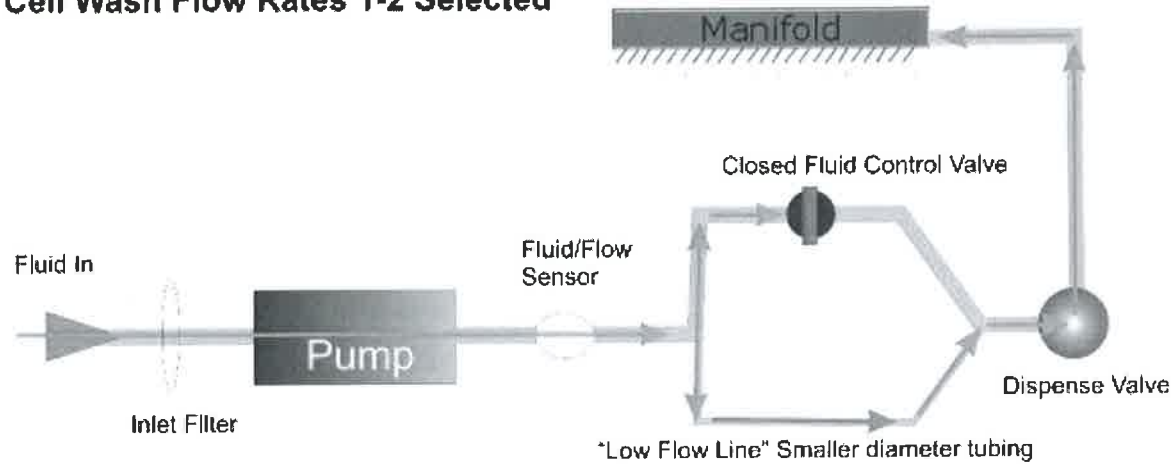
Low-flow Fluid Path

The 405 LS supports cell-based assays that require the addition and removal of buffer solution without disrupting the cells in the wells of the microplate. Cells are often dislodged when fluid is dispensed at too high a pressure and lost during subsequent aspiration of the fluid from the well unless counter measures are taken. The 405 LS is equipped with a low-flow fluid path that provides a "cell wash" alternative for cell-based assays.

Standard Flow Rates 3-11 Selected



Cell Wash Flow Rates 1-2 Selected



The low-flow tubing is used during a wash step when the Flow Rate is set to 1 or 2. It dispenses fluid to the wells slowly enough to avoid damaging the cells. Note that the low flow line is always open, i.e. some fluid flows through the tubing during normal dispenses. For this reason, priming the low flow tubing is recommended for all Prime steps.

Additional Techniques



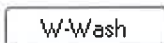
Delay Aspiration: Also critical to cell-based assays is delaying aspiration to allow the slower dispense process to finish before beginning fluid removal from the well. This option, offered as part of the dispense step, is called Delay Start of Vacuum.

Adjust the Aspirate Travel Rate and Aspirate Height: when defining the aspirate step select one of the specially designed travel rates that minimize turbulence in the wells. Increase the aspirate height to leave more residual fluid in the wells to protect the cell layer. Also, consider using a secondary aspiration.

Adjust the Dispense Flow Rate, Height and Position: when defining the dispense step be sure to select one of the special Flow Rates that trigger use of the low-flow tubing, 1 or 2 CW. Also reposition the dispense tubes to aim the fluid at the side of the wells to further minimize turbulence. See Cell Wash Strategies on the facing page.

Define a Cell Wash Protocol

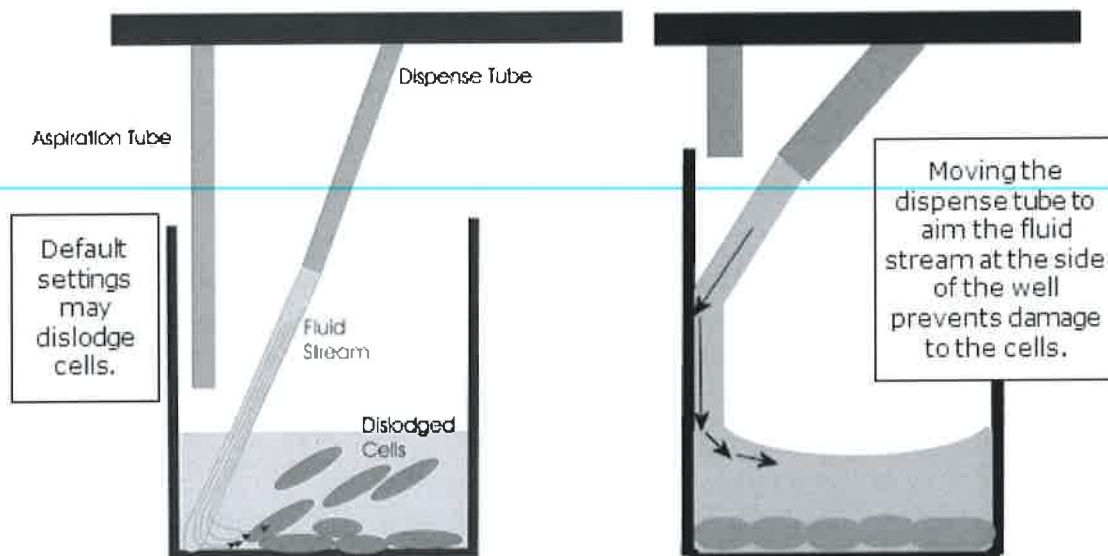
Adjust the volumes recommended in this procedure to meet your specific needs.

1.  Create a new protocol.
2.  Add a **Prime** step, especially when the lines are empty or when changing fluids.
3.  Add a **Wash** step and define it as you normally would, except with these special parameters:
 - Set the Aspiration **Travel Rate** to **6 CW** and the Delay to **0**.
 - Set the Dispense **Flow Rate** to **1** or **2**.
 - Select the Dispense [Advanced Options](#) link and enable the **Delay start of Vacuum** until sufficient fluid has been dispensed. For small dispense volumes, BioTek recommends setting the delay volume to equal your dispense volume.
 - Reposition the dispense tubes to aim fluid at the side of the wells to reduce turbulence and change the aspirate height to increase the amount of residual fluid left in the well to protect the cell layer. See Cell Wash Strategies on the facing page.

Be sure to check the parameters for Final Aspiration.

Cell Wash Strategies

To give you a starting point for optimizing your own assays, here are some recommendations for improving your cell wash assays:



Repositioning the dispense and aspirate tubes helps minimize turbulence in the wells, preserving more cells.

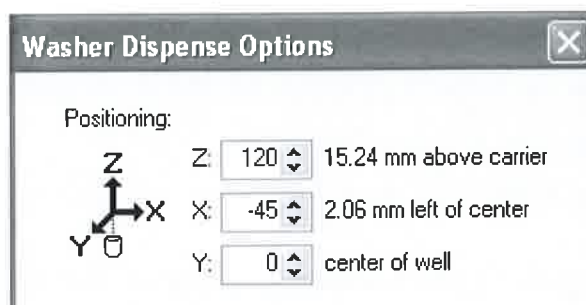
Using a standard 96-well Corning Costar plate, best results were achieved with these values:

Dispense Step Settings:

Z - height = 120 steps

X - horizontal position = -45

Y - horizontal position = 0



Aspirate Step Settings:

Z = 46 steps

X = 35

Y = 0

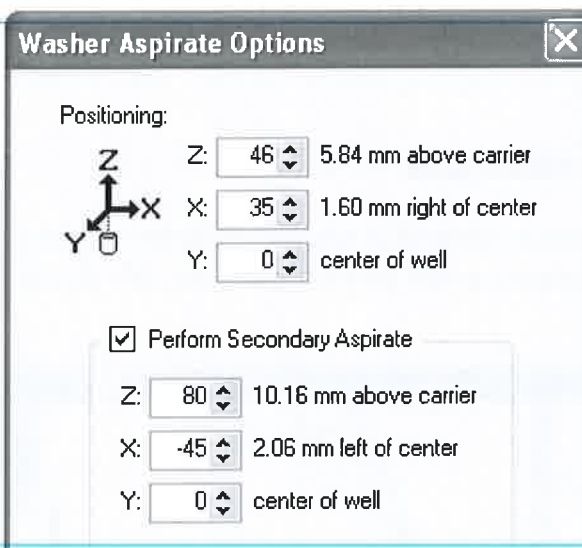
Secondary Aspirate:

Z = 80 steps

X = -45

Y = 0

About 40 μ L/well residual fluid is retained using these values.



For loosely adherent cells, the best performance was seen by increasing the aspirate height and using both a standard and secondary (or crosswise) aspiration. Moving the aspirate tubes from one side of the well to the other prevents a fluid stream from forming and dislodging the cells. Increased residual in the well means increased cell retention.

Best practice:

- Use the Align toolAdjust Utility to determine the optimal X, Y, and Z axis adjustments needed to best position the manifold above the wells during the wash routine.
- Test the protocol settings by running the protocol using only water and an empty plate before actually running your assay to make sure the fluid stream hits the wells as desired.

Delay Aspiration or Vacuum-On Volume Control

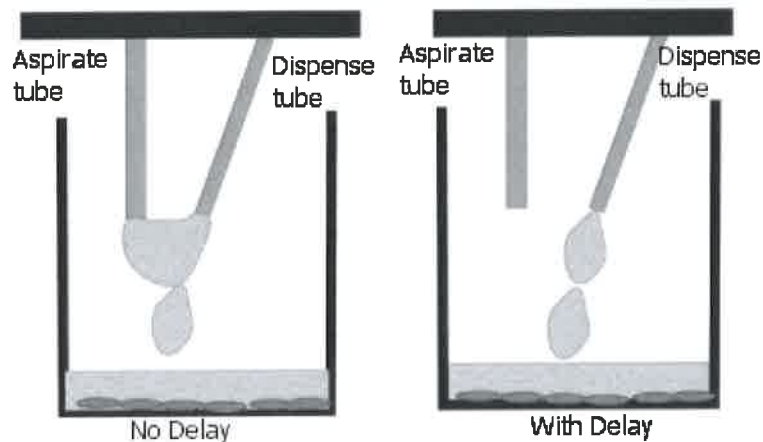
LHC: Open the Wash or Dispense Step>Advanced Options

Keypad: Edit the Wash or Dispense Step>Press Enter till Vacuum Delay Vol:

Delay start of Vacuum for cell washing until

Volume dispensed: 10 μ L/well

During regular plate washing, aspiration and dispensing occurs simultaneously. This allows "overflow" dispensing, because the fluid is aspirated before overflowing the plate. But, the low-flow tubing used in cell wash protocols dispenses fluid so slowly that aspiration must be delayed to allow the fluid to reach the well.



Use this control to turn on the vacuum pump and begin aspiration only after the specified volume is dispensed. For cell wash assays, specify at least 10 μL /well. For small dispense volumes or to disable aspiration for the entire dispense duration, set the vacuum-on volume to equal your dispense volume. Refer also to application notes on the BioTek web site for more information (www.biotek.com).

Biomagnetic Separation - Magnetic Bead Assays

The microplate carrier supports placement of a magnet under the microplate. The magnet induces magnetic beads to settle at the bottom of the wells to help retain them during a wash protocol's aspirate cycle.

The 405 LS supports standard microplates and these magnets available for purchase from BioTek:

Plate Type	Magnet	PN
96-well	96 Flat Magnet	7103016
	96 Ring Magnet	7102216
384-well	384 Flat Magnet	7103017
	384 Ring Magnet	7102215

You can use a different magnet if it fits in the carrier and accommodates your plates. Contact BioTek TAC or visit the Customer Resource Center at www.biotek.com to obtain a drawing of the carrier with its dimensions.



Persons with pacemakers/implants should avoid direct contact.

Keep all magnetic media, watches, and sensitive electronic devices away from the magnets. Credit cards, tapes, and disks can be erased in the presence of a magnetic field. Bodily harm [pinching of hands and skin] can result if magnets are not handled correctly. Maintain distance between two or more magnets.

Handling and Cleaning the Magnets

For best magnet strength and bead retention, the bottom of the microplate must be as close to the magnet as possible. We recommend using flat-bottom plates with minimal support “webbing” between the sides of the outer wells and the plate skirts.

Handle the magnets with care. Avoid direct contact with the magnet material. Keep loose ferrous material away and do not attempt to disassemble.

The magnet should be stored in a cool, dry environment and should be cleaned with a damp cloth and mild detergent when exposed to harsh solvents. Do not autoclave.

To install the magnet in the proper orientation:

- Flat magnet: place in the plate carrier so the text on the side of the magnet is readable;

- Ring magnet: place in the plate carrier with the small round magnets visible, facing upwards.

Realign the BioStack with the Magnet Installed

Using the magnet increases the effective height of the carrier surface (generally by at least 71 mm). This shift in the plate position requires a comparable adjustment to the BioStack's gripper movement. Realign the BioStack before using it with the magnetic bead assays.

Refer to the BioStack Operator's Manual for detailed instructions of the alignment procedure. To help get you started:

1. Place the magnet in the carrier and a microplate on top of it.
2. Launch the **BioStack Alignment Utility**:

LHC	Keypad
Tools > BioStack Utilities > Alignment Utility	SETUP > → BIOSTK > ALIGN

3. HOME the BioStack and Begin Realignment.
4. Lower the claw until a 0.050" (1.3 mm) gap between the bottom of the plate and the top of the gripper fingers is achieved and save the gripper position.
5. Put the microplate in the input stack and Verify the alignment.

 Remember to realign the BioStack for non-bead assays, when applicable.

Perform Magnetic Bead Assays

For the best results when performing biomagnetic separation assays:

- Use the Manifold Stop Screw Adjustment Kit on page 66, if necessary.
- Realign the BioStack with the Magnet Installed on page 61
- Change the Magnet Height Offset on page 64
- Optimize Magnetic Bead Protocols below

Optimize Magnetic Bead Protocols

Here are some suggestions to consider for optimizing your magnetic bead assays:

- **Plate Type:** Flat-bottom plates are recommended for magnetic bead assays because more of their well surface sits closer to the magnet, resulting in increased magnet strength, than with other plate formats. If you must use round-bottom plates, increase the between-cycle soak time to improve bead separation

during processing.

- **Magnet Adapter Height Offset:** Deploy this offset to increase the Z-axis or height setting in all processing options to accommodate the increased height of the magnet. See Determine Magnet Height Offset on page 65. Use of this feature may eliminate the need to "Adjust the Aspirate height" described below.
- **Shake/Soak Step:** Begin the protocol with a delay to let the magnetic beads settle. Also, specify a mid-cycle soak to let the beads settle after fluid is dispensed to the plate, e.g. include a 60 second soak before and between cycles.

▼ Include a 1 second Shake in the first step to best position the plate.

- **6CW Aspirate Travel Rate:** select 6CW for the aspirate travel rate. The CW travel rates are designed to minimize disruption to cell layers on the bottom of the well. The same principle applies to magnetic bead assays.
- **Adjust the Aspirate height:** increase the aspirate height setting (Z-axis) which will increase the residual fluid in the wells but also preserve the beads. Good results were obtained when keeping the aspirate height around 18.0 mm above the plate carrier for all but a last Final Aspirate (disabled between cycles).
- **Adjust the Aspirate position:** When using Flat Magnets below, position the aspirate tubes near the sides of the wells (X-axis), if possible, to improve bead retention.
- As always, before running assays, we recommend testing new protocols using deionized or distilled water and a little Tween[®] 20 with the desired microplate and a magnet installed.

Flat Magnets

Use this information about the flat magnets to fine-tune wash protocol settings:

96F Magnet	7103016
384F Magnet	7103017

The 96- and 384-well magnets are structured differently. Their force fields traverse the magnet in opposite directions. Magnetic beads in the wells will be drawn to the center. For the best bead retention, reposition the aspirate tubes in the proper axis:

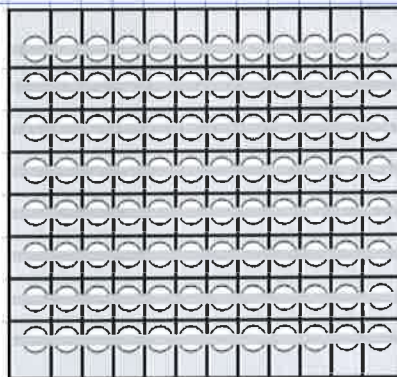
96-well Flat Magnet PN 7103016

The magnetic force (approx. 6800 Gauss) is distributed in a horizontal pattern, row-wise, across the plate. Magnetic beads are pulled to the center, across the well in flat-bottom plates and to the button in round-bottom plates.

Increasing the aspirate height to increase the amount of residual in the well may improve performance.

Aspirate Settings:

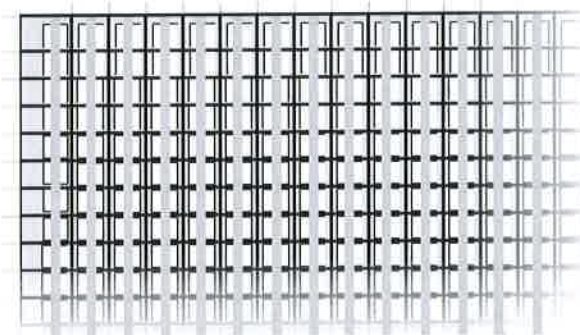
Adjust the Y Position to align the aspirate tubes near the well walls, if available. Increase the Aspirate Height (Z axis), leaving more residual volume in the wells.



384-well Flat Magnet PN 7103017

The magnetic force (approx. 4300 Gauss) is distributed in a vertical pattern, column-wise, across the plate.

Adjust the X Position to align the aspirate tubes away from the center of the well, near the well walls.



Ring Magnets

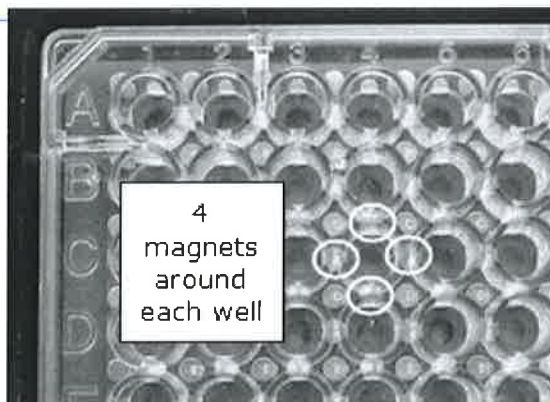
Use this information about the VP magnets to fine-tune wash protocol settings:

96 Ring Magnet	7102216
384 Ring Magnet	7102215

96 Ring Magnet

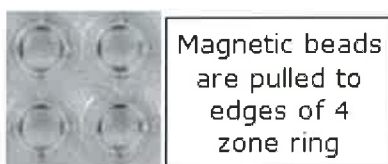
PN: 7102216

This magnetic bead separator uses 329 of VP's 52 MGO magnets (7094 Gauss). The magnets are arranged around each well, pulling the magnetic beads to the bottoms and edges of the wells. Aspirate from the center of the well (the default position), when using this magnet.

**384 Ring Magnet**

PN: 7102215

This magnetic bead separator uses 425 of VP's 52 MGO magnets (6994 Gauss). The magnets are aligned with the intersections of the wells, pulling the magnetic beads to the bottoms and edges of the wells. Every well is circled by 4 magnets.



Aspirate from the center of the well (the default position), when using this magnet.

Magnet Height Offset

When performing magnetic bead assays/biomagnetic separation, this offset setting is a real time saver. It increases the height or Z-axis for all processing options to accommodate the increased height of the plate when the magnet is installed.

This setting eliminates the need to modify individual protocol parameters to adjust the dispense and aspirate heights and enables Quick Wash (without adjustments) when the magnet is used. It applies the specified height value as an offset to all relevant steps.

Custom or non-standard microplates and special adapters for labware may benefit from this setting, too. If a vessel's height has been its only limitation to processing with the 405

LS, i.e. the vessel's geometry permits the manifold tips to successfully address its wells, this setting can be used to simplify protocol development.

For the best results, measure the height of the plate you are using with the magnet. BioTek has determined that Nunc flat bottom plates are about 3 mm taller than a similar Corning plate, for example.

The "In use" checkbox/option lets you specify and retain a height setting. Set the value once and then use the control to switch it on and off: fill the checkbox (keypad users: say Yes) when using a magnet, empty the checkbox (keypad: No) to disable the offset.

LHC

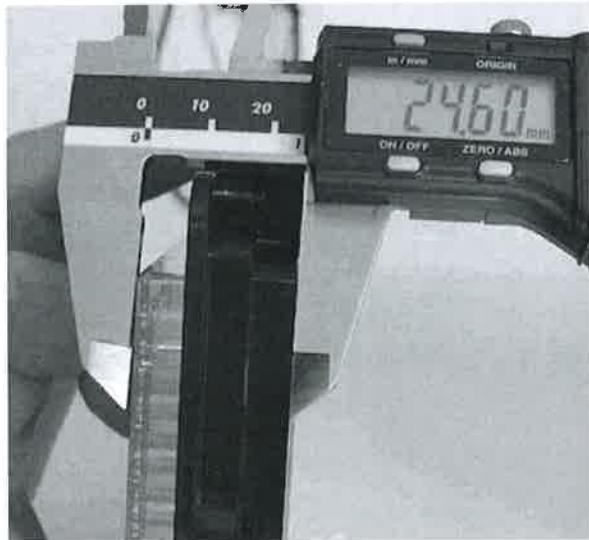
1. Tools > **Instrument Utilities > General**
2. Fill the In use checkbox and set the Magnet Adapter height to the correct offset.
3. Click the **Send** link.

Keypad

1. **SETUP > more > MAGNETHT**
2. Select **YES**.
3. Enter the desired offset value and press Enter.

Determine Magnet Height Offset

Use calipers for the best results or another measuring device.



Quick instructions:

1. Measure the combined height of the plate, magnet, and carrier in millimeters.
2. Measure the plate and the carrier.
3. Calculate the offset: (plate + magnet + carrier) - (plate + carrier) = Magnet Height Offset

Explicit instructions:

1. Remove the carrier from the washer.
2. Put a magnet in the carrier and the type of plate you will be using on top of it.

3. Measure the distance from the bottom of the carrier to the top of the plate in millimeters (mm).
4. Remove the magnet, and measure the plate and carrier combined.
5. Subtract the plate and carrier measurement from the measurement value of the total combined elements. This is the offset value to use.

Example:

24.6 mm = 96-well Corning microplate + 96-well flat magnet + plate carrier

- 22.7 mm = 96-well Corning microplate and plate carrier

1.9 mm = Magnet Height Offset

Manifold Stop Screw Adjustment Kit

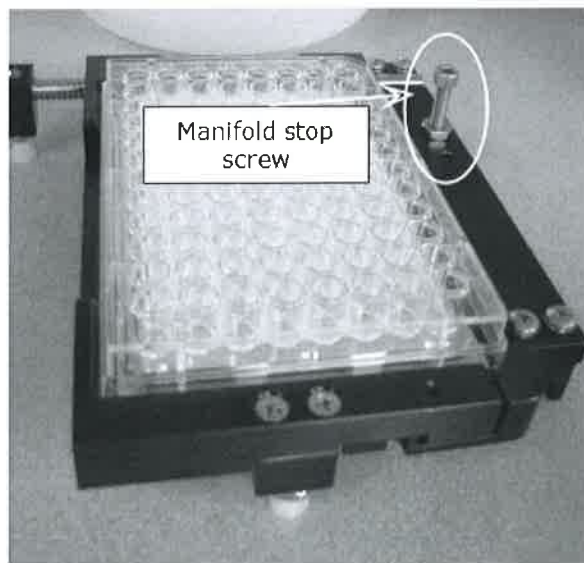
For Magnetic Bead Assays and 384-Well PCR Plate Processing

To successfully perform these assays, 405 LS Select and HT models may need to adjust the height of the manifold stop screw. The adjustment kit, PN 1170011, is shipped with instruments with a dual manifold.

The manifold stop screw prevents the bottom manifold from touching the microplate during operation. Sometimes the screw installed at the factory is too tall or too short to permit desired processing:

- a taller screw is needed to support a magnet under the plate for magnetic bead assays
- a shorter screw is needed to support processing of 384-well PCR plates that have a very low profile

Two stop screws can reside in the plate carrier, making it easier to swap between them.



Microplate Carrier

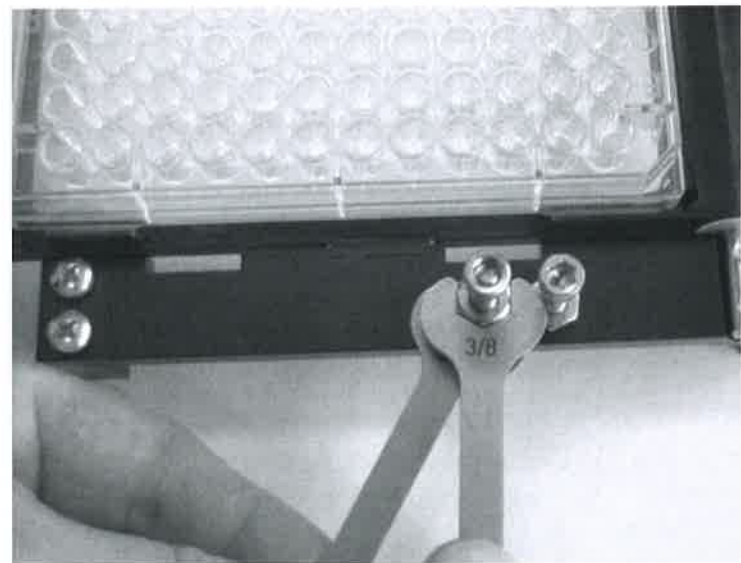
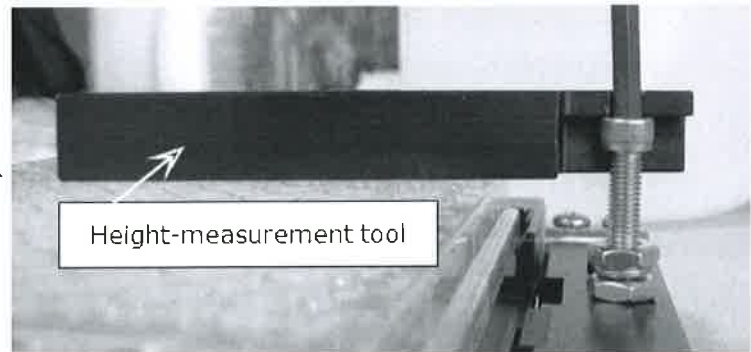
Kit Contents:

- Screw height measurement tool (jig)
- Two stop screws with adjustable nuts and lock washer
- 5/32" Allen (hex) wrench
- Two wrenches - 5/16" and 3/8"



Remove the carrier to perform most of these steps but always perform the measurement steps with the plate carrier installed correctly on the 405 LS.


1. In the carrier's empty hole, insert the taller stop screw when using a magnet or the shorter screw when using PCR plates.
2. Put the magnet and microplate or the 384-PCR plate in the carrier on the instrument. Place the height-measurement tool (or jig) on top of the microplate, with the notched end above the screw.
3. Hold the jig level on top of the microplate and raise or lower the stop screw so its head touches the bottom of the notch.
4. Set the jig aside. Using your fingers, hold the stop screw in place and screw the bottom nut down until it touches the microplate carrier.
5. Using the two supplied wrenches, tighten the bottom nut to secure the screw, then tighten the top nut to fully compress the washer between them. This will lock the nuts in place and allow you to easily remove/replace the screw without affecting its height setting.
6. Verify the height with the jig and repeat steps 3-6 if necessary.



Vacuum Filtration for Filter Plate Assays

With the optional vacuum filtration accessory kit, you can process most standard-size filter-bottom microplates.

- Install the side bracket
- Set up the Vacuum Filtration module
- Install Vacuum Filtration Plate Carrier on page 71

 Take advantage of the sample vacuum filtration protocols shipped onboard the 405 LS. Copy W-Luminex_Vac_96, for example, and modify the parameters to suit your assay requirements.

Recommendations for best performance:

Here are some guidelines to achieve the best performance of your filter plate assays:



- Do not use dry filter plates. If dry plates are required by the assay kit instructions, turn off the Vacuum Filtration sensor to avoid process interruptions.
- Shake the plate to suspend the beads before aspiration. Enable the wash cycle option to shake the plate after the dispense and before aspiration. Also consider creating a multi-step protocol that begins by shaking the plate.
- Experiment with the two parameters, aspiration time and vacuum level, to determine the best combination of settings for your assay. Start with a brief time period and low vacuum to avoid lodging the beads in the filter material.
- Maintain consistent vacuum during the process with a tight seal:
 - Use new or defect-free filter plates and make sure they are seated perfectly in the carrier;
 - Make sure all tubing is connected correctly, and leak-free.

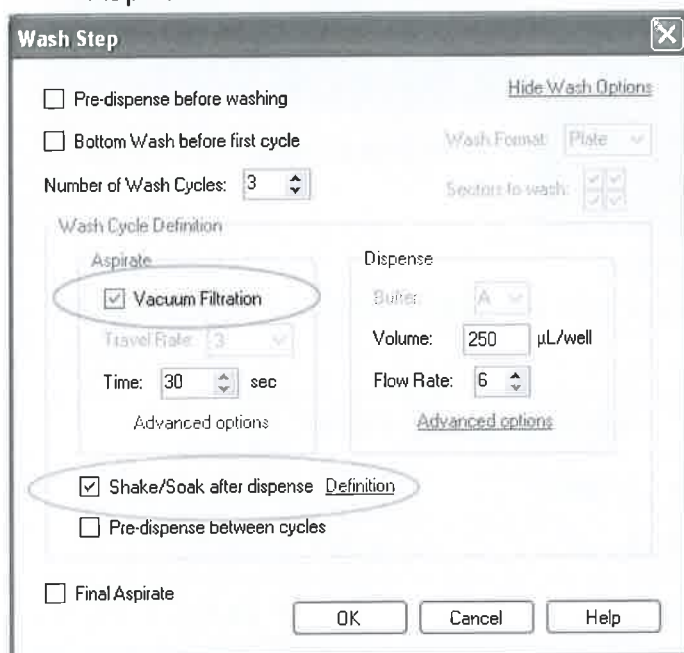
Expect to spend some time experimenting with different pressure settings. Follow the filter plate manufacturer's recommendations, if available. Generally, bead assays prefer low pressure and DNA separation assays prefer higher pressure. The best performance in tests at BioTek were seen when the pressure was set to 2.5 inHg.

Create a Vacuum Filtration Protocol

 You may want to begin the protocol with a Shake step to suspend the beads.

LHC:

1. Click  (or select File>New).
2. Select the plate type.
3. Specify a Protocol Name.
4. Click .
5. Click **Show Wash Options**
6. Fill the checkbox for Vacuum Filtration and specify the vacuum duration, Time. Optionally, do the same for the Final Aspirate.



7. Fill the checkbox for Shake/Soak and specify the shake duration.

Experiment with different settings to determine the optimal parameters to meet your goals.

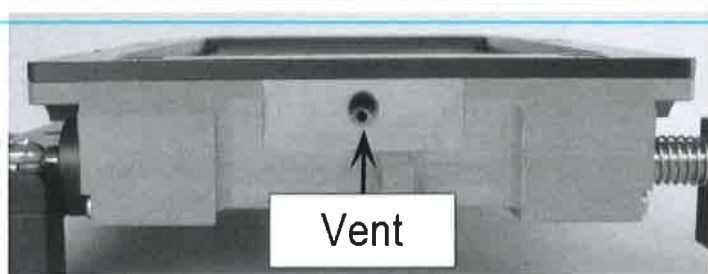
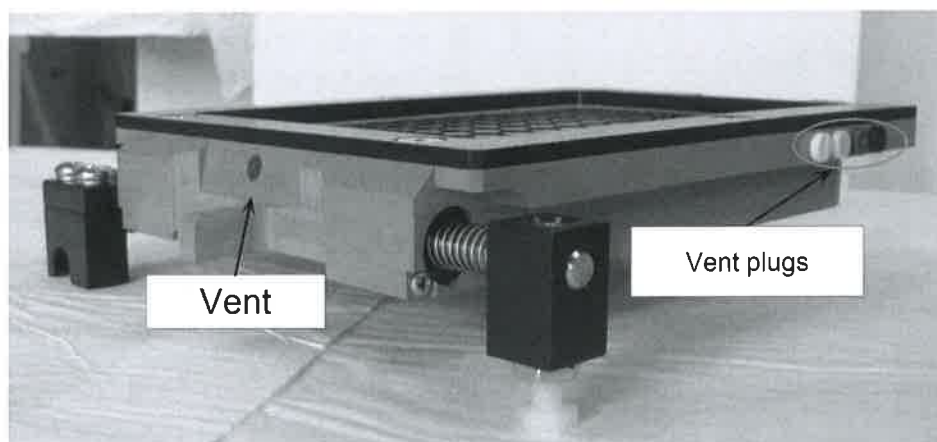
- **Important:** Be sure to change the Plate Carrier setting to match the installed carrier.

Remember to specify the type of aspiration to perform in a Final Aspirate. Keypad users: select **OPTS>POST** at the Wash Step Parameters menu.

Keypad:

1. At the main menu, select **DEFINE>CREATE** and assign a unique name to the protocol.
2. Select the plate type.
3. Select **ADD>WASHR>WASH**
4. Select **ASPIR>VAC**
5. Specify the duration to apply vacuum.
6. Select **OPTS>MIDCYC** and add a **Shake** duration to follow each dispense to suspend the beads before applying the vacuum.
7. Select **OPTS>POST** to either disable the Final Aspirate or make sure it is defined for vacuum filtration.
8. Experiment with other parameters, like number of cycles, to optimize the protocol for your assay.

Control the Vacuum Level



Vent plugs stored on side of carrier

Change the vent plug to control the vacuum level

The vacuum filtration plate carrier has a vent and ships with four vent plugs to vary the vacuum levels:

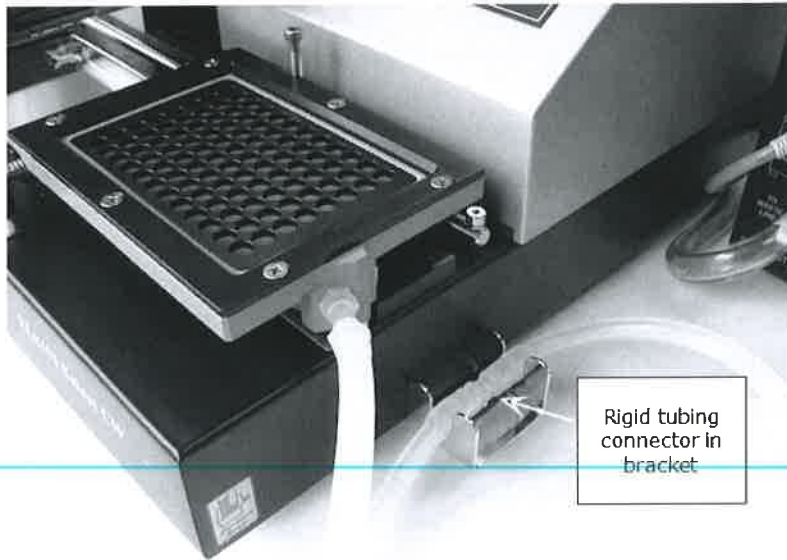
Plug	Vent Diameter	Vacuum Level	mmHg	kPa
No plug	0.067" (1.70 mm)	Lowest	-32	-4.3
Beige with hole	0.047" (1.19 mm)	Low	-118	-15.7
Gray	0.032" (0.81 mm)	Medium	-187	-24.9
Black	0.020 (0.51 mm)	High	-382	-50.9
Beige (solid)	0.00	Highest	-567	-75.5

Leave the vent open for the least amount of vacuum. Insert one of the plugs to increase vacuum.

- Vacuum pressure is affected by several factors like relative humidity, barometric pressure, and mechanical tolerances, as well as, filter plate pore size

Testing at BioTek confirmed expectations: small pore filter plates and highly viscous fluids require increased vacuum and/or longer aspiration durations to evacuate the wells.

Install Vacuum Filtration Plate Carrier



Vacuum Filtration Plate Carrier (and bracket for holding tubing)

1. Locate the longest length of tubing shipped with the module. It is made from two tubes joined by a rigid connector.
2. Connect the shorter end to the special plate carrier for vacuum filtration.
3. Connect the longer end to the control module port labeled **To Vacuum Filtration Carrier**.
4. Tuck the rigid connector into the bracket you installed on the side of the instrument.
5. Change the instrument setting:

LHC	Keypad
<ol style="list-style-type: none"> 1. Select Tools> Instrument Utilities. 2. For Plate Carrier Selection, select Vacuum Filtration. 	<ol style="list-style-type: none"> 1. Press Setup Menu > MORE > CARR 2. Select VAC.


Note: Make sure Vacuum Filtration is "enabled" to select the special plate carrier: **Setup Menu> →>ADVANC>VACFIL**

Important: Always set the carrier selection to match the installed hardware, regardless of the type of plate processing you are doing. You can perform a regular wash (non-filter plates) using the vacuum filtration carrier.

Changing the Instrument's Settings

About the Onboard Settings

The instrument's onboard settings dictate its behavior. Certain settings, like Plate Clearance, can improve performance. Other settings are critical to its performance. For example, the manifold setting must match the installed manifold type.

 **LHC users:** do not confuse the LHC's Target Instrument Settings assigned to each protocol with the onboard settings! Review the Help topic: LHC Protocols Explained to learn the distinctions.

To change the onboard settings:

LHC	Keypad
<ol style="list-style-type: none"> 1. Select Tools>Instrument Utilities 2. Choose the applicable tab and modify settings as desired. 3. Click Send after changing a setting to update the instrument. 	<ol style="list-style-type: none"> 1. Press the Setup Menu key (in the center of the keypad). 2. Select the applicable device and the setting you want to change. <ul style="list-style-type: none"> • Alternatively, select UTILS at the main menu for AutoPrime, the Adjust Utility and system tests.

Washer Settings

Manifold Selection

After physically changing the manifold, tell the 405 LS which manifold is installed:


- 96-tube: single manifold for 96-well plates only or dual manifolds to process 96- and 384-well plates.
- 192-tube: only 384-well plates.
- 128-tube: only 1536-well plates.

Magnet Adapter Height Offset

When performing magnetic bead assays/biomagnetic separation, this offset setting is a real time saver. It increases the height or Z-axis for all processing options to

accommodate the increased height of the plate when the magnet is installed.

This setting eliminates the need to modify individual protocol parameters to adjust the dispense and aspirate heights and enables Quick Wash (without adjustments) when the magnet is used. It applies the specified height value as an offset to all relevant steps.

 Custom or non-standard microplates and special adapters for labware may benefit from this setting, too. If a vessel's height has been its only limitation to processing with the 405 LS, i.e. the vessel's geometry permits the manifold tips to successfully address its wells, this setting can be used to simplify protocol development.

Sensors Enabled

- **Important:** The washer must be primed, tubes filled, prior to a run.
- These sensors cannot detect the depletion of fluid in the supply vessel during a protocol step. Fill the supply bottle(s) with sufficient fluid to fully prime the system and complete the protocol.
- Fluid Detection:** measures the fluid level at the beginning and completion of a wash cycle, dispense and AutoClean step. An error before the run suggests insufficient fluid to begin. An error at the end of the run may indicate that less volume than specified was dispensed.
- Flow Detection:** monitors fluid flow during the run and issues a warning if the pump is interrupted. An error indicates a problem with the pump.
- Vacuum Detection:** built into the vacuum filtration module, this sensor detects errors in the setup of the vacuum filtration system, including disconnected tubing, loose bottle cap, missing filter plate, non-functioning internal vacuum pump and extremely low vacuum. This sensor is disabled by default.
- Plate Detection:** washers with Verify™ Technology offer this sensor to detect the presence of a microplate on the plate carrier before every protocol run. BioStack users: the sensor checks for the first plate in the stack only.

BioTek recommends keeping the detection systems activated. Exceptions:

- When vacuum filtration assays need to be performed at very low vacuum levels, e.g. no plug, but the washer displays an error, deactivate the sensor: LHC - "Filter Vacuum" or Keypad - "Vac Fil".
- When running the system using air instead of fluid to dry out the components before shipping or long-term storage, if error messages interrupt the procedure, deactivate the fluid and flow sensors.

CW+ Control

This setting is applicable only to cell wash assays that use dispense flow rates 1 CW and 2 CW. Generally, the optimal instrument configuration for cell wash assays includes installation of the CW+ Dispense Manifold and enabling this control with the default 100 msec setting. If the CW+ Dispense manifold is not installed, better performance may be achieved by disabling this setting. Additionally, a minor adjustment to the duration setting may improve the performance of certain instruments.

Service Functions

Position the wash manifold to install the **shipping bracket**: prior to packing up the instrument, click the link and install the manifold shipping bracket.

AutoPrime

LHC: Tools>Instrument Utilities> AutoPrime

Keypad: Select UTIL at the main menu, then AUTPRM

Recommended for optimum performance, AutoPrime keeps the tubing wet in between runs and can be an essential part of your daily maintenance routine.

About AutoPrime

AutoPrime automatically primes the tubing whenever the instrument is idle for a specified time. Keeping the tubes wet prevents clogging and mitigates fluid evaporation at the tips. AutoPrime's submerge feature lets you soak the tubes for extended periods, which is an effective maintenance option.

Specify the Interval and AutoPrime Parameters

AutoPrime runs when the instrument has been idle for a specified interval.

To set the **AutoPrime Interval**:

LHC:	Keypad:
<ol style="list-style-type: none">1. Select Tools>Instrument Utilities> AutoPrime tab.2. Specify the idle-time interval that will trigger an AutoPrime; up to 24 hours.3. Enable and define the parameters. Remember to set a Submerge Duration to employ this option.4. Click Send to transfer the settings to the instrument.	<ol style="list-style-type: none">1. Select UTILS at the main menu and select AUTPRM.2. Specify the idle-time interval that will trigger an AutoPrime; up to 24 hours in minutes and press Enter.3. Set the Submerge Duration, if desired.4. "Enable AutoPrime."5. Define the AutoPrime parameters: rate, volume, and buffer valve, if applicable. Press Enter at each screen to advance to the next.

Maintenance

Regular maintenance is required to achieve optimal performance with the 405 LS. This section provides guidelines and instructions for basic daily maintenance and the Recommended Maintenance Schedule. Find comprehensive instructions for performing regular maintenance in the operator's manual.

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Removing Protein Residuals and Fungi Growth	85

Overview

A **Preventive Maintenance (PM)** regimen for the 405 LS includes rinsing and soaking the fluid path and cleaning and/or autoclaving the various components. The level of maintenance required to keep the instrument performing as expected is dependent on several factors, including the type of fluid dispensed, the frequency of use, and the work habits employed.

The Recommended Maintenance Schedule on the facing page summarizes BioTek's recommended maintenance tasks, and indicates approximately how often each task should be performed. Daily and periodic routines and minimal guidelines for frequency are listed. Beyond that, it is difficult for BioTek to recommend a fixed frequency for each task to be performed. The frequency of conducting these tasks must be based on the risk and performance factors of your assays.

Develop a maintenance schedule for your 405 LS based on the characteristics of the fluids used and the activity level. Here are some guidelines:

Washer

- When using fluids prone to dry and harden quickly, the washer's dispense and aspirate tubes can clog quickly, and must be rinsed frequently and cleaned regularly. Run **AutoClean** ultrasonic cleaning regularly, when available.
- If the washer will be idle for several hours or days at a time, soak the tubes to keep them in a "wetted" state. Enable **AutoPrime** if the washer is idle for more than 3 hours.
- Wash solutions affect the rinse frequency. If the solution does **not** contain surfactant, consider rinsing (or running **AutoPrime**) at least once an hour.

Recommended Maintenance Schedule

Keypad Users: The protocol names onboard the washer do not include the W- prefix and some protocols include the model name, e.g. 405HT or 405Select, when appropriate.

Tasks	Frequency				
	Daily	Overnight/ Multi-Day	Weekly	Periodic/ Monthly	Before storage/ shipment
Washer					
Run W-DAY_RINSE	✓	✓			
Run AutoPrime	✓				
Run W-OVERNIGHT_LOOP (LHC Only)		✓			
Run W-RINSE_AND_SOAK		✓			
Run Verify™ clog detection test	✓				
Run AutoClean				✓	✓
Components					
Remove protein residuals and fungi growth, (if necessary)	✓		✓	✓	
Check/empty waste bottles Direct Drain bottles: Clean direct-drain waste bottle filter	✓				✓
Clean bottles				✓	✓
Clean plate carrier system			✓		✓
Clean washer manifold				✓	✓
Clean aspirate and dispense tubes				✓	✓
Clean exterior surfaces and mist shield			✓		
Clean buffer bottle fluid filter				✓	✓

Tasks	Frequency				
	Daily	Overnight/ Multi-Day	Weekly	Periodic/ Monthly	Before storage/ shipment
Clean vacuum filtration system				✓	✓
Clean the Verify™ level sensor				✓	✓
Decontaminate					
Decontaminate external surfaces				✓	✓
Run W-DECONTAMINATE				✓	✓
Decontaminate vacuum filtration system				✓	
Prepare for Storage or Shipment					
Run W-LONG_SHUTDOWN					✓
Replace/Repair Components					
Replace the Verify Test Plate	As Needed				

Daily Maintenance

Daily maintenance involves flushing the washer and dispensers with an appropriate reagent or deionized water throughout the day. Routine rinsing helps to prevent the aspirate and dispense tubes from clogging between runs. Flushing the devices with deionized water is recommended at the end of the day for most applications.


The recommended **rinsing frequency** depends on the solutions currently in use:

- When a solution containing surfactant is used throughout the day, perform the rinsing procedure when the device is idle for more than 3 hours.
- When the solution does **not** contain surfactant, consider rinsing at least once an hour.

Run these protocols and enable **AutoPrime** to satisfy the daily maintenance requirements:

- DAY_RINSE

Make sure the supply bottles contain sufficient rinse solution and that the waste bottles are empty before running the protocols.

 Also see the additional maintenance procedures required when dispensing protein solutions: Removing Protein Residuals and Fungi Growth on page 85.

AutoPrime

AutoPrime automatically conditions the dispense tubes, priming them with the specified volume, after a user-specified amount of idle time.

- Press the **STOP** button to interrupt the AutoPrime routine when it is underway.
- Any interaction with the instrument via the keypad or the LHC resets the interval clock.
- AutoPrime only runs when the main menu, quick menu, or run completion message is displayed on the keypad.

Overnight/Multi-Day Maintenance

Overnight/multi-day maintenance involves flushing all solutions out of the instrument, and then periodically rinsing and soaking the tubes to keep them moist. Here are three recommendations for accomplishing the task. Employ the method that best suits your work flow:

Overnight Loop

To keep the wash manifolds in a wetted condition, you can run these predefined protocols to soak the tubes for several hours at a time:

- **OVERNIGHT_LOOP**: requires the washer to remain turned on.
- **RINSE_AND_SOAK**: alternatively, run this protocol and turn off the instrument after the soak begins. The tubes will soak in the priming trough until the instrument is turned on again.

AutoClean the Washer

W-AutoClean

Learn About AutoClean below

Some models of the 405 LS feature BioTek's Ultrasonic Advantage™ for easy and thorough cleaning of the wash manifold. Instruments with AutoClean capability are easily identified by the stainless steel priming reservoir built into the instrument's base, under the wash manifold.



Warning! Ultrasonic energy is present in the cleaning reservoir when the AutoClean program is running. Do not put your fingers in the bath! Ultrasonic energy can harm human tissue.

-
- **Important!** Ensure there is adequate room in the waste bottle and sufficient volume in the supply bottle **before** running AutoClean!

Tip: Detergent such as Terg-A-Zyme® added to deionized water in the supply bottle helps to break down the water's surface tension and enhances the cleaning process. Terg-A-Zyme also contains protease enzyme for assimilating proteinaceous residue such as bovine serum albumin (BSA).

About AutoClean

BioTek's **Ultrasonic Advantage™** is a built-in ultrasonic cleaner that provides enhanced maintenance capabilities by using ultrasonic pulses in a water bath to clean the manifold tubes. Ultrasonic energy causes cavitation forces within the water bath, which in turn cause tiny vapor bubbles to be created. The formation and subsequent collapse of these bubbles is the mechanism that cleans the manifold tubes submerged in the bath.

The cleaner consists of a stainless steel reservoir with an ultrasonic transducer bonded to the bottom of the reservoir. The reservoir is mounted under the washer manifold and also functions as the priming trough.

- Do not try to remove the ultrasonic cleaner! Only BioTek authorized service personnel should remove the ultrasonic cleaner for maintenance or repair.

While the program is running, the ultrasonic cleaner will pulse on and off approximately every ten seconds, and you will hear a periodic hissing sound that indicates the ultrasonic energy is present.

- Not all 405 LS models are equipped with this feature.

Quick Clean (Keypad Only)

Select **Quick>Sonic**

Take advantage of the 405 LS's "Ultrasonic Advantage" to make sure the manifold tubes are clean and clog-free.

1. Connect a bottle with detergent or an appropriate solution for your assay. The 405 LS primes the system with 300 mL/305 mL for CW models and fills the trough with 93 mL for the sonicator. Buffer Switching models: specify the **CLNBUF** (Clean Buffer) valve it is connected to; non-Buffer Switching models will be prompted to change buffer bottles.
2. Fill the "Rinse Buffer" bottle with at least 305 mL of deionized or distilled water or with a wash buffer to leave the instrument primed and ready for use. Buffer Switching models: specify the **RINBUF** (Rinse Buffer) valve.
3. Set the desired duration in minutes, up to 4 hours, to soak the tubes and run the sonicator: use the arrow or Options key.
4. When you're ready, press **Start**.



Warning! Ultrasonic energy is present in the cleaning reservoir when the AutoClean program is running. Do not put your fingers in the bath! Ultrasonic energy can harm human tissue.

- **Important!** Ensure there is adequate room in the waste bottle and sufficient volume in the supply bottle **before** running AutoClean!

Create an AutoClean protocol

Create an **AutoClean** protocol for regular use. Make sure it begins by priming the tubing with the cleaning fluid. Approximately **93 mL** of fluid fills the reservoir during each run.

General Recommendation: Run **AutoClean** for 1 hour. Follow with a full prime using deionized water to remove the detergent from the system and/or with a wash buffer to leave the instrument primed and ready for use.

LHC

Keypad

W-AutoClean

DEFINE>CREATE>NAME>PLATE>ADD>WASHER→>ACLEAN

Define the cleaning protocol:

1. First, add a **Prime** step to fully prime the tubing with the cleaning fluid (or water).
2. Add an **AutoClean** step to the protocol.
3. Buffer Valve: select the supply bottle containing the desired cleaning fluid if Buffer Switching is installed.
4. Duration: enter the duration, up to 4 hours. Input the time in minutes when using the keypad; hours and minutes when using LHC.
5. Click **OK** to add a cleaning step to the protocol.

Protocol Steps

W-Prime 600 mL
 W-AutoClean for 01 hrs, 00 min
 <end of steps>

Submerge and Shutdown

An overnight/multi-day maintenance option for soaking the tips and turning off the instrument for overnight and weekend maintenance.

You can soak the 405 LS dispense manifolds by filling the priming troughs and turning off the instrument after the soak begins. The tubes will soak in the priming troughs until the instrument is turned on again.

1. Run **RINSE_AND_SOAK**.
2. When the wash manifold is submerged, turn off the instrument.

Run a System Self-Test to empty the washer's priming trough when restarting the instrument.

Removing Protein Residuals and Fungi Growth



Important! Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the 405 LS's performance over time unless a strict maintenance regime is adhered to. Do not use isopropyl alcohol or DI water to flush out BSA or similar fluids.

When using protein solutions or similar fluids, BioTek recommends performing the following additional Maintenance procedures to thoroughly flush out protein particles and other contaminants from the fluid path.

Daily Practice with buffer and deionized water:

If the 405 LS will be idle between plates for longer than 45 minutes, flush the proteins using buffer. Use buffer for the AutoPrime, as well, for immediate reuse of the instrument. Otherwise, if the tubes will be allowed to dry, flush the system with DI water to remove the buffer:

1. Fill a supply bottle with buffer solution. Connect the bottle to the washer. (Buffer valve "A" for Buffer Switching models.)
 2. Run the DAY_RINSE protocol.
 3. Enable AutoPrime for 60-minute intervals.
-
- Flush the buffer from the system using DI water when the device will be idle for an extended period, i.e. repeat steps 1 and 2 using water.
-

At the end of the day:

1. Fill a supply bottle with buffer. Connect the bottle to the washer. (Buffer valve "A" for Buffer Switching models.)
2. Run the DAY_RINSE protocol three times.
3. Fill a supply bottle with deionized water. And repeat steps 1 and 2.
4. Perform your regular Overnight/Multi-Day Maintenance routine.

Weekly or As Needed use NaOH and HCl to remove proteins:

1. Flush the system with 0.1-0.5 N* NaOH (sodium hydroxide), followed by neutralization with an equivalent normality (0.1-0.5 N) of HCl (hydrochloride).
2. Rinse well with deionized water to remove the HCl.
3. Run the DAY_RINSE protocol three times with deionized water if you plan to use the device immediately.

-
- * N = Normal solution, which contains 1 'gram equivalent weight' (gEW) of solute per liter of solution. The gram equivalent weight is equal to the molecular weight expressed as grams divided by the 'valency' of the solute.
-

Alternatively use an Enzyme-Active Detergent:

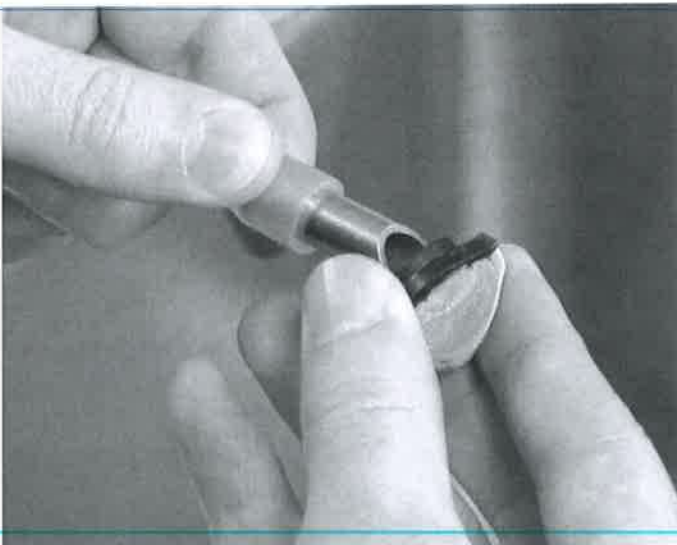
1. Mix an enzyme-active detergent according to the manufacturer's directions to fill a four-liter supply bottle. Connect the bottle to the washer's Buffer valve A. Connect a bottle of deionized or distilled water to Buffer valve B to rinse the tubing.
2. Run the **DECONTAMINATE** protocol, as appropriate.
3. **LHC users:** Respond to the Delay message, "Connect a bottle of water...", leave the detergent bottle connected and when ready, press **Continue**.
4. When the protocol is completed, connect a bottle containing four liters of deionized water and run DAY_RINSE three times to flush the system.

Clean the Buffer Bottle Filter

Periodically clean the buffer bottle filter and direct-drain waste bottle filter (PN 01310):

-
- Perform this task when the buffer bottle is empty or over a sink to catch spillage.
-
- **Direct Drain Waste Bottle Filter:** Handle with care! When cleaning the waste bottle filter, be aware of any potential biohazard and handle appropriately.
-

1. Open the buffer bottle and lift the cap and its tubing up and out of the bottle.
2. Remove the fluid filter at the bottom of the tubing.
3. Wash the filter with hot water and a soft-bristled brush, if necessary.
4. Rinse the filter and reinstall it.



Safeguards and Troubleshooting

This section lists warnings and precautions that must be taken when operating the 405 LS. It also includes guidelines for error recovery and troubleshooting performance problems.

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Hazards and Precautions

Hazards

The following hazards are provided to help avoid injury:



Warning! Power Rating. The instrument's power supply or power cord must be connected to a power receptacle that provides voltage and current within the specified rating for the system. Use of an incompatible power receptacle may produce electrical shock and fire hazards.

Warning! Electrical Grounding. Never use a plug adapter to connect primary power to the external power supply. Use of an adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power cord directly to an appropriate receptacle with a functional ground.

Warning! Service. Only qualified technical personnel should perform service procedures on internal components.

Warning! Accessories. Only accessories which meet the manufacturer's specifications shall be used with the instrument.

Warning! Lubricants. Do not apply lubricants to the microplate carrier or carrier track. Lubricant on the carrier mechanism will attract dust and other particles, which may obstruct the carrier path and cause the instrument to produce an error.

Warning! Liquids. Avoid spilling liquids on the instrument; fluid seepage into internal components creates a potential for shock hazard or instrument damage. If a spill occurs while a program is running, abort the program and turn the instrument off. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

Warning! Unspecified Use. Failure to operate this equipment according to the guidelines and safeguards specified in this manual could result in a hazardous condition.

Warning! Direct Drain Waste. If installed, the direct drain waste system pumps waste fluids from the washer directly into a sink or tank, and, potentially into public waste water systems. Because the waste may be a biohazard, you must ensure that you are in compliance with your local or national government's laws regarding safe disposal of the waste.

Warning! Ultrasonic Energy. Ultrasonic energy is present in the ultrasonic cleaner reservoir (if equipped) when AUTOCLEAN/Quick Clean programs are running. Avoid putting your fingers in the bath. Ultrasonic energy can be destructive to human tissue.

Warning! Software Quality Control. The operator must follow the manufacturer's assay package insert when modifying software parameters and establishing washing or dispensing methods. **Failure to conduct quality control checks could result in erroneous test data.**



Warning! Internal Voltage. Always turn off the power switch and unplug the power supply before cleaning the outer surface of the instrument.



Warning! Potential Biohazards. Some assays or specimens may pose a biohazard. Adequate safety precautions should be taken as outlined in the assay's package insert. This hazard is noted by the symbol shown here. Always wear safety glasses and appropriate protective equipment, such as chemically resistant rubber gloves and apron.



Warning! Pinch Hazard. Some areas of the instrument or its components can present pinch hazards when the instrument is operating. Depending on the instrument or component, these areas are marked with the symbol shown here. Keep hands/fingers clear of these areas when the instrument is operating.

Precautions

The following precautions are provided to help avoid damage to the instrument:



Caution: Service. The instrument should be serviced by BioTek authorized service personnel. Only qualified technical personnel should perform troubleshooting and service procedures on internal components.

Caution: Spare Parts. Only approved spare parts should be used for maintenance. The use of unapproved spare parts and accessories may result in a loss of warranty and potentially impair instrument performance or cause damage to the instrument.

Caution: Environmental Conditions. Do not expose the instrument to temperature extremes. For proper operation, ambient temperatures should remain within the range listed in the **Specifications** section. Performance may be adversely affected if temperatures fluctuate above or below this range. Storage temperature limits are broader.

Caution: Sodium Hypochlorite. Do not expose any part of the instrument to the recommended diluted sodium hypochlorite solution (bleach) for more than 20 minutes. Prolonged contact may damage the instrument surfaces. Be certain to rinse and thoroughly wipe all surfaces.

Caution: Buffer Solution. Although many precautions have been taken to ensure that the instrument is as corrosion-proof as possible, the instrument is not sealed and liquids can seep into sensitive components. Make sure that any spilled buffer solution is wiped off the instrument. Prolonged exposure to salt solution may corrode parts of the microplate carrier, movement rail, springs, and other hardware.

Caution: Chemical Compatibility. Some chemicals may cause irreparable damage to the instrument. The following chemicals have been deemed safe for use in the instrument: buffer solutions (such as PBS), saline, surfactants, deionized water, 70% ethyl, isopropyl, or methyl alcohol, 40% formaldehyde, and 20% sodium hydroxide. Never use acetic acid, DMSO, or other organic solvents. These chemicals may cause severe damage to the instrument. Contact BioTek for more information and prior to using other questionable chemicals.

Caution: Bovine Serum Albumin. Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the instrument's performance over time unless a strict maintenance protocol is adhered to. See **Maintenance** procedures regarding BSA.

Caution: Power Supply. Only use the power supply shipped with the instrument. Operate this power supply within the range of line voltages listed on it.

Caution: Disposal. Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)," or local ordinances.

Caution: Warranty. Failure to follow preventive maintenance protocols may **void the warranty**.

Caution: Shipping Hardware. All shipping hardware (e.g., shipping bracket etc.) must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

Caution: High Flow Pump Installation. DO NOT plug the High Flow vacuum pump cable into a wall outlet! Use the adapter provided with the pump to connect the pump to the accessory outlet on the back of the washer. See the **Installation** instructions.

Caution: Waste Sensor Port on 405 LS. (For customers who have purchased the BioStack Microplate Stacker.) Although the waste sensor port on the back of the 405 LS is the same type as the 24-VDC power connector on the back of the BioStack, if an external 24-VDC power supply is plugged into the 405 LS's port, **it will permanently damage internal components.**

Caution: Do not run the Peri-pump without a cassette installed on the pump.

Caution: Electromagnetic Environment. Per IEC 61326-2-6 it is the user's responsibility to ensure that a compatible electromagnetic environment for this instrument is provided and maintained in order that the device will perform as intended.

Caution: Electromagnetic Compatibility. Do not use this device in close proximity to sources of strong electromagnetic radiation (e.g., unshielded intentional RF sources), because these may interfere with the proper operation.

CE Mark



Based on the testing described below and information contained herein, this instrument bears the CE mark.

- **Note:** See the Declaration of Conformity for specific information.
-

Directive 2014/30/EU: Electromagnetic Compatibility

Emissions—Class A

The system has been type-tested by an independent, accredited testing laboratory and found to meet the requirements of EN 61326-1: Class A for Radiated Emissions and Line Conducted Emissions.

Verification of compliance was conducted to the limits and methods of EN 55011 (CISPR 11) Class A. In a domestic environment it may cause radio interference, in which case, you may need to mitigate the interference.

Immunity

The system has been type-tested by an independent, accredited testing laboratory and found to meet the requirements of EN 61326-1 and EN 61326-2-6 for Immunity. Verification of compliance was conducted to the limits and methods of the following:

EN 61000-4-2, Electrostatic Discharge

EN 61000-4-3, Radiated EM Fields

EN 61000-4-4, Electrical Fast Transient/Burst

EN 61000-4-5, Surge Immunity

EN 61000-4-6, Conducted Disturbances from RFI

EN 61000-4-11, Voltage Dips, Short Interruptions and Variations

Directive 2014/35/EU Low Voltage (Safety)

The system has been type-tested by an independent testing laboratory and was found to meet the requirements of this Directive. Verification of compliance was conducted to the limits and methods of the following:

EN 61010-1, "Safety requirement for electrical equipment for measurement, control and laboratory use. Part 1, General requirements."

EN 61010-2-081, "Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes."

Directive 2012/19/EU: Waste Electrical and Electronic Equipment

Disposal Notice: Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)" or local ordinances.

Directive 98/79/EC: In Vitro Diagnostics (if labeled for this use)

- Product registration with competent authorities.
- Traceability to the U.S. National Institute of Standards and Technology (NIST).

EN61010-2-101 Particular requirements for in vitro diagnostic (IVD) medical equipment.

Electromagnetic Interference and Susceptibility

USA FCC CLASS A

RADIO AND TELEVISION INTERFERENCE

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment

generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their own expense.

In order to maintain compliance with FCC regulations shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and television reception.

Canadian Department of Communications Class A

This digital apparatus does not exceed Class A limits for radio emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'émet pas de bruits radioelectriques dépassant les limites applicables aux appareils numerique de la Class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

Intended Use Statement

- The 405™ Microplate Washer LS provides microplate priming, washing, and dispensing for ELISA™, fluorescence and chemiluminescence immunoassays, cellular and agglutination assays.
- If the instrument has an "IVD" label it may be used for clinical and non-clinical purposes, including research and development. If there is no such label the instrument may only be used for research and development and non-clinical purposes.

User Safety

This device has been type-tested by an independent laboratory and found to meet the requirements of the following:

- **Underwriters Laboratories UL 61010-1** "Safety requirements for electrical equipment for measurement, control and laboratory use; Part 1: general requirements."
- **Canadian Standards Association CAN/CSA C22.2 No. 61010-1** "Safety requirements for electrical equipment for measurement, control and laboratory

use; Part 1: general requirements.”

- EN 61010 Standards, see CE Mark on page 93.

Quality Control

It is considered good laboratory practice to run laboratory samples according to instructions and specific recommendations included in the assay package insert for the test to be conducted. Failure to conduct Quality Control checks could result in erroneous test data.














Warranty and Product Registration




Please take a moment to review the Warranty information that shipped with your product. Please also register your product with BioTek to ensure that you receive important information and updates about the product(s) you have purchased.

You can register online through BioTek’s Customer Resource Center (CRC) at www.biotek.com or by calling 888/451-5171 or 802/655-4740.

Safety Symbols

Some of these symbols appear on the instrument or accessories:

	Alternating current Courant alternatif Wechselstrom Corrientealterna Correntealternata		Both direct and alternating current Courant continu et courant alternatif Gleich - und Wechselstrom Corriente continua y corrientealterna Corrente continua e correntealternata
	Direct current Courant continu Gleichstrom Corriente continua Corrente continua		Earth ground terminal Borne de terre Erde (Betriebserde) Borne de tierra Terra (difunzionamento)
	On (Supply) Marche (alimentation) Ein (VerbindungmitdemNetz) Conectado Chiuso		Protective conductor terminal Borne de terre de protection Schutzleiteranschluss Borne de tierra de protección Terra diprotezione
	Off (Supply) Arrêt (alimentation) Aus (TrennungvomNetz) Desconectado Aperto (sconnessionedallaretediaalimentazione)		Caution (refer to accompanying documents) Attention (voir documents d'accompagnement) AchtungsieheBegleitpapiere Atención (vease los documentosincluidos) Attenzione, consultare la doc annessa
	Warning, risk of electric shock Attention, risque de choc électrique Gefährlicheelektrischeschlag Precaución, riesgo de sacudidaeléctrica Attenzione, rischiodiscossaelettrica	 	Warning, risk of crushing or pinching Attention, risqued'écrasement et pincement Warnen, Gefahr des Zerquetschens und Klemmen Precaución, riesgo del machacamiento y sejección Attenzione, rischiodischiacciareedintrappolarsi
	Warning, hot surface Attention, surface chaude Warnen, heißeOberfläche Precaución, superficiecaliente Attenzione, superficiecalda		Warning, potential biohazards Attention, risquesbiologiquespotentiels Warnung! MoeglichebiologischeGiftstoffe Atención, riesgosbiológicos Attenzione, rischibiologico

	<p>In vitro diagnostic medical device Dispositif médical de diagnostic in vitro Medizinisches In-Vitro-Diagnostikum Dispositivo médico de diagnóstico in vitro Dispositivo medico diagnostico in vitro</p>		<p>Separate collection for electrical and electronic equipment Les équipements électriques et électroniques font l'objet d'une collecte sélective Getrennte Sammlung von Elektro- und Elektronikgeräten Recogida selectiva de aparatos eléctricos y electrónicos Raccolta separata delle apparecchiature elettriche ed elettroniche</p>
	<p>Consult instructions for use Consulter la notice d'emploi Gebrauchsanweisung beachten Consultar las instrucciones de uso Consultare le istruzioni per uso</p>		

Troubleshooting

Error recovery:

First Response: Run a System Test (restart the instrument) to give the instrument an opportunity to restore its initial settings and communication capability.

LHC Users: Reboot your Computer and Instrument: When you cannot run a system test, e.g. LHC is not responding, or when running a system test doesn't resolve the issue, turn off your computer and 405 LS, check all the cabling, i.e. make sure your serial or USB cable is in good condition and is properly connected to the PC and instrument, and then, power them on. This should refresh the devices and reset communication parameters.

Error Codes

To find a specific error code:

- Software Error Codes (6000-6200) - protocol errors
- System Error Codes (0000-A500) - hardware errors

Most error conditions generate an error message that is displayed on the computer screen or keypad.

The most common error for new 405 LS users is easily fixed:

306	Peri-pump Pump Cover is open. Close the pump cover and re-run protocol.
-----	---

To run the Peri-pump, its pump cover must be closed, protecting both the pump and the operator.

401	Carrier Y motor failed positional verify
-----	--

If the plate carrier is not installed correctly, this instrument error will be displayed. Make sure the back right corner of the carrier is correctly seated in the little black knob attached to the transport rail. A slit on the bottom of the carrier allows it to fit into place.

6045	Serial write error
------	--------------------

LHC Users: A potentially common error, especially when using the Predefined Protocols, a "serial write" error, is easily fixed by correcting the COM port setting defined in the protocol.

810D	To communicate, instrument must be at main menu/Home screen.
------	--

LHC Users: Similarly, the 810D message appears when the instrument is busy, for example when AutoPrime is running. The LHC can only talk to the instrument when

its main menu is displayed. Press the **Stop** button, if desired, to end the current process and reestablish communication with the LHC.



Technical Note: Only one of the two communication ports (COM port) on the instrument can be used at a time. They cannot be used simultaneously. You can use USB to connect the 405 LS to the computer or the RS232 serial port to connect to a BioStack or similar robotic device. But you cannot use both ports simultaneously, i.e. make sure only one cable is plugged in at a time.

Keypad Control: When the BioStack is connected to your 405 LS, you are controlling both instruments using the keypad. Before connecting the 405 LS to your computer to download basecode or for other reasons, you must first disconnect the BioStack from the 405 LS and change the Instrument Setting for the BioStack: Press **Setup Menu> →> BINSTK> CONF>MANUAL**.

Washer Troubleshooting

Review these suggestions to correct problems your washer is having:

- Vacuum Pump Problems on page 108
- Fluid Aspiration on page 102
- Fluid Delivery on page 104
- Fluid Leakage on page 106
- Washer Manifold Movement on page 107
- Verify Technology Level Sensor Troubleshooting on page 108

Microplate Carrier Movement

Problem	Possible Cause	What To Do
Aspiration tubes not entering wells correctly.	Microplate not properly seated or strips not level.	Reseat microplate in carrier or strips in holder. Make sure the carrier is clean. Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.
	Aspirate tubes position is too wide for a movement.	Change the horizontal, X- or Y-axis aspirate position in the protocol.
	Aspirate tubes bent.	Contact BioTek TAC.
Loud, annoying noise during operation.	Plate carrier is rubbing against glide strip.	Thoroughly clean the microplate carrier and exterior surface as recommended in the maintenance procedure.
384-well plates not properly washed.	Microplate carrier not moving correctly in the Y-axis.	Clean the plate carrier system. If problems persist, contact TAC for assistance cleaning the carrier transport arm.
Uneven performance.	Plate carrier leveling feet damaged.	Replace plate carrier: contact BioTek TAC for assistance. Note: "Q" model washers with Verify™ Technology must recalibrate the Verify test plate after installing the new carrier.

Fluid Aspiration

Problem	Possible Cause	What To Do
Poor or uneven aspiration.	Insufficient or no vacuum.	Firmly seat the waste bottle covers. Ensure tubing is connected properly.
		Check all external tubing and in-line filter for kinks or clogs. If you are using an in-line vacuum filter, it may need to be replaced.
		With the vacuum pump on, remove the vacuum pump tubing from the back of the instrument. Put your finger over the port; if there is no vacuum, contact BioTek TAC.
	Clogged aspiration tubes on the washer manifold.	Remove and clean the washer manifold
		Make sure the microplate carrier is level and the waste valve is not touching the bench.
	Aspirate height adjustment too high or too low.	Change the aspiration height (Z-axis position) in the protocol. Similarly, make sure the Magnet Adapter Height offset is disabled or not too high.
	Vacuum pump failure.	Contact BioTek TAC.

Problem	Possible Cause	What To Do
Uneven aspiration of water buffer. Some wells left full.	No surfactant in the buffer, such as Tween [®] 20.	Add surfactant to the buffer. If this is not possible, continue below.
	Insufficient vacuum.	BioTek offers a high-flow pump for assays using only water for the wash fluid. Contact BioTek for more information.
	Protocol settings not optimized.	Optimize protocols to improve evacuation
	Aspiration tubes not properly positioned horizontally in wells.	If none of the tubes are bent, try adjusting the horizontal aspirate position (X-/Y-axis) in the protocol.
	Microplate not level in carrier, or strips not level in holder.	Reseat microplate in carrier or strips in holder. Make sure the carrier is clean. Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.
Too much residual left in wells after aspiration.	Clogged vacuum filter.	If you are using an in-line vacuum filter (PN 49943), the filter may need to be cleaned or replaced.
	Waste bottle cover not properly sealed or fittings not properly connected.	Firmly seat the waste bottle stopper. Make sure tubing is connected properly.
	Manifold out of alignment or not moving freely.	Check for obstructions. If none are found, contact BioTek TAC.
	Protocol requires optimization.	Optimize protocols to improve evacuation.
	Aspirate tubes are bent.	Contact BioTek TAC.

Fluid Delivery

Problem	Possible Cause	What To Do
Unable to dispense fluid — models without the Buffer Switching module.	Inlet tube not connected.	Make sure all tubing is connected properly. Check all external tubing for kinks or clogs.
	Clogged fluid inlet filter.	Clean the fluid inlet filter inside the supply bottle.
	Clogged valve	Create a protocol with several small primes, e.g. 10 mL, to try to unclog valve.
	Clogged dispense tubes on the washer manifold.	Remove and clean the washer manifold
	No wash or rinse fluid.	Fill bottles with appropriate fluid. Ensure bottles are clean and do not contain particles or organic material.
Unable to dispense fluid — models without the Buffer Switching module.	System not primed. Large air pockets in tubing.	Run W-DAY_RINSE multiple times.
	Insufficient suction, clogged tubing, or faulty valve.	Perform Washer Maintenance; If the problem persists, contact BioTek TAC.
Unable to dispense fluid — models with the Buffer Switching module.	System not primed. Large air pockets in tubing.	Run W-DAY_RINSE multiple times.
	External valve module not connected to washer, or supply tubing set up incorrectly.	Check valve module cable and tubing.
	Solenoid valve not	Ensure module cable is plugged into the

Problem	Possible Cause	What To Do
	opening.	Valve Control port on the instrument's back panel. If plugged in, contact BioTek TAC.
Plate overfills (floods).	Dispense height too high. The aspirate tubes are too far above the wells to prevent overflow.	Lower the dispense height (Z-axis position) in the protocol.
	Dispense flow rate too low.	Define a higher dispense Flow Rate in the protocol.
	Cell wash flow rate 1 or 2 is used with 384-well plates.	Specify a non-CW dispense Flow Rate when using 384-well plates.
	Aspiration tubes hit bottom of trough during Prime or Maintenance.	Manifold may not be properly seated or mounted. Contact BioTek TAC.
	In-line vacuum filter plugged.	Replace or remove the in-line vacuum filter.
	Loose covers on waste bottles.	Firmly tighten waste bottle covers.
	Dispense rate too fast for volume selected.	Specify slower dispense Flow Rate or lower volume.
	Faulty vacuum pump.	Contact BioTek TAC.
	Insufficient or no vacuum.	Firmly seat the waste bottle covers. Check all external tubing for kinks or clogs. When the program begins, you should be able to hear the vacuum pump turn on. If it is not turning on, contact BioTek TAC. If the vacuum pump turns on, remove the vacuum tubing from the back of the instrument and put your finger over the port. If there is no vacuum, contact BioTek TAC.

Problem	Possible Cause	What To Do
Uneven dispensing of fluid; wells not filled.	Clogged dispense tubes on the washer manifold.	Remove and clean the washer manifold
	Manifold or tubing not adequately primed.	Run W-DAY_RINSE once or twice.
	Dispense flow rate too low. Flow rate 1 or 2 CW is used with 384-well plates.	Define a higher dispense Flow Rate.
	Microplate aspiration height adjustment too high or too low.	Change the aspirate height (Z-axis position) in the protocol.
Dripping dispense tubes	Dispense tubing routed incorrectly.	Connect the fluid supply bottle tube to the bottom port of the syringe pump. Contact BioTek TAC if the problem persists.

Fluid Leakage

Problem	Possible Cause	What To Do
Fluid leaking from manifold.	Defective seals.	Replace Washer Manifold O-rings and Seals Contact BioTek TAC
	Aspiration tubes only: vacuum too low.	Check waste connector tubes; make sure they are properly connected. If you are using an in-line vacuum filter, check the filter for clogging, and replace if necessary. Check seal of waste bottle covers. Check for air leaks in the waste tubing and bottles. Use a slower Aspiration Travel Rate.
	Uneven (not level) surface.	Make sure the washer sits on a perfectly level surface.

Problem	Possible Cause	What To Do
Fluid leaking from underneath the instrument.	Defective tubing connector or inlet tubing.	Contact BioTek TAC.
	Leaking valve.	Contact BioTek TAC.
Fluid leaking from external tubing connector.	Defective connector.	Replace connector.
	Worn tubing.	Replace tubing or cut back tubing one inch (to remove worn section).
	Worn seal (inlet or vacuum fitting).	Replace filter or seal.

Washer Manifold Movement

Problem	Possible Cause	What To Do
Manifold position error.	Manifold movement is blocked.	Check orientation of microplate; A1 should be in the left rear corner of the plate carrier as you face the instrument. Check for and remove any obstructions. Ensure the manifold is installed properly.
	Incorrect manifold selected.	Make sure the washer manifold setting matches the installed manifold (96-, 192- or 128-tube). LHC: Tools>Instrument Utilities>Washer>Manifold Selection. Keypad: Setup Menu>WASH→>MANIF

Vacuum Pump Problems

Problem	Possible Cause	What To Do
Vacuum pump does not start, or shakes when turned on.	Vacuum pump is not turned on.	Flip the switch on the side of the vacuum pump to turn it on.
	Vacuum pump accessory cable not installed correctly.	Plug the vacuum pump accessory cable into the back of the instrument, Accessory Outlet.
	Too much residual vacuum force for pump.	Release the vacuum by loosening the waste bottle stopper. Reconnect and start again.
	Blown fuse in accessory outlet.	Plug the vacuum pump accessory cable into the back of the instrument, Accessory Outlet, not into a wall outlet.
		Increase vacuum dissipation delay. LHC: Tools>Instrument Utilities>Vacuum Dissipation Delay. Keypad: Setup Menu>→ADVANC→VACDIS
		Replace fuse (PN 46055), Replace the Vacuum Pump Fuse
Repeated blown fuses.	Vacuum Dissipate Delay is set too low for the volume of the waste bottle.	See above. If not enough time is allowed for the vacuum to dissipate, the pump will try to start while it is under a vacuum. The pump draws excessive current and blows the fuse.
	Pump has been flooded.	Remove the head from the pump and inspect it for corrosion, crystalline buildup or liquid. Contact BioTek TAC for information on pump rebuilding kits.

Verify Technology Level Sensor Troubleshooting

For 'Q' model washers with BioTek's Verify™ Technology, here are general guidelines for fixing performance problems.

- Test fluid: use DI water or a non-foaming wash buffer like PBS.
- Prime the tubing: make sure the system is fully primed before running the test.

- **Verify Test Plate only:** use a calibrated test plate with a serial number that matches the instrument.
- **Correctly seat test plate:** make sure the test plate is properly oriented, with well A1 in the back, left corner of the carrier and the "Front" label facing front.
- **Check level sensor:** Remove, clean, and re-seat the collimator: Clean the Verify™ Level Sensor.
- **Recalibrate the test plate:** If error codes like 6123 persist, you may need to recalibrate the test plate: See **Replacement Procedure for Verify Test Plate** in the operator's manual.

Specifications and Part Numbers

For your convenience this section contains commonly sought reference information. Consult the operator's manual on CD for more complete information.

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Physical Specifications

Labware	
Microplates	96-well, 384-well that comply with ANSI/SLAS microplate standards 1-2004, 2-2004, 3-2004, and 4-2004.
Microstrips	1 x 8, 1 x 12
Microwells	Flat, round, "V" bottom

Hardware & Environmental	
User Interface	2-line x 24 character LCD screen, 26 alphanumeric soft keys
Power Supply	The instrument uses two internal power supplies: 24-volt 60 watt and 48-volt 60 watt. These supplies are compatible with 100-240 V~; 50-60 Hz.
Accessory Outlet	≤ 5.0 A, used for vacuum pump
Dimensions (W x D x H)	14 x 17 x 10 inches (36 cm x 43 cm x 25 cm)
Weight (≤)	32 lb (14.5 kg)/36 lb with Buffer Switching (16.3 kg)
Operating Conditions	10° - 40°C (50° - 104°F)
Relative Humidity	The instrument should be operated in a non-condensing humid environment having a maximum relative humidity of 80% at temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

Manifold Type	
96-tube	Single or Dual manifold with 96 sets of aspirate and dispense tubes arranged in an 8x12 array. Single manifolds can only process 96-well microplates; dual manifolds can process 96- and 384-well plates.
192-tube	Dual manifold with 192 sets of aspirate and dispense tubes arranged in a 16 x 12 array can only process 384-well plates.

Waste bottle volume	4, 10, or 20 liters, depending on the accessory package, (2 bottles, one with sensor)
Supply bottle volume	Two 4L or 10L bottles (4 bottles w/ Buffer Switching)

Performance Specifications

Washer

Average Residual Volume (Evacuation Efficiency)

96-Tube Manifold (Single and Dual)	Average residual volume in the microwells is $\leq 2 \mu\text{L}$ per well after a 3-cycle wash, when 300 μL of deionized water with 0.1% Tween 20 [®] , or buffer equivalent, is dispensed per well into a Costar [®] 96-well flat-bottom plate. The aspirate height adjustment is optimized for the plate prior to testing.
192-Tube Manifold	Average residual volume in the microwells is $\leq 2 \mu\text{L}$ per well after a 3-cycle wash, when 100 μL of deionized water with 0.1% Tween 20, or buffer equivalent, is dispensed per well into a Costar 384-well flat-bottom plate. The aspirate height adjustment is optimized for the plate prior to testing.

Vacuum Filtration Evacuation Efficiency

96-Well Filter Plates	Average increased weight of the plate is ≤ 1.2 grams after dispensing 300 μL of deionized water per well into a Millipore [®] MSHVN4450 96-well 0.45 μm plates (PN 98258) and vacuum aspirated for 30 seconds and blotted on a paper towel.
384-Well Filter Plates	Average increased weight of the plate is ≤ 4.0 grams after dispensing 80 μL of deionized water per well into a Millipore [®] MZFCN0W10 384-well 1.2 μm plates (PN 98287) and vacuum aspirated for 10 seconds and blotted on a paper towel.

Dispense Precision	
96-Tube Manifold	≤ 3.0% CV when dispensing 300 µL per well of deionized water with 0.1% Tween 20, with FD&C #1 blue dye at rate 6 into a Costar 96-well flat-bottomed plate. The absorbance of the solution is read at 630 nm and 450 nm reference.
192-Tube Manifold	≤ 4.0% CV when dispensing 80 µL per well of deionized water with 0.1% Tween 20, with FD&C #1 blue dye at rate 7 into a Costar 384-well flat-bottomed plate. The absorbance of the solution is read at 630 nm and 450 nm reference.

Verify™ Clog Detection Technology	
Timing	A Verify test shall be completed in less than 5 minutes from initiation until test results are displayed.
Performance	The Verify level sensor measurement shall have a repeatability standard deviation of $\sigma_{\text{measurement}} < 0.14 \text{ mm}$ (9.0 µL for 8X8 square well plate), where the $\sigma_{\text{measurement}}$ applies to a relative volume measurement, i.e. the delta between two volumes.

Package Contents

- Part numbers and package contents are subject to change and vary according to instrument model. Please contact BioTek Customer Care if you have any questions.

Description	PN
Power cord (part numbers vary by country of use)	Varies
USB cable	75108
Microplate carrier	Varies
Mist shield	1172017
Accessory kit	1170012
Stylus: for cleaning washer manifold aspirate tubes	7102108
Stylus: for cleaning 192-tube dispense manifold	7102139
Shipping bracket - model dependent	7102138 1242018 or 1242021 1242032 and 1242019
Hex wrench: 9/64"	48434
Spare fuses (5)	46055
Verify Test Plate for "Q" models only	01588
Manifold Stop Screw Kit (Required for Vacuum Filtration, 384-Well PCR processing and magnetic bead assays.)	1170011
405™ LS Getting Started Guide (and operator's manual on USB - PN 1171040)	1171014

- Some components are model specific, they ship only with certain instrument models.

Waste and Dispense System Accessories

Part Number	Description	
Standard Vacuum Pump Systems:		
1170530	Complete Dispense/Waste System 115V/230V, 4L Bottles, including:	
	7100746	Waste: 4L bottles (2, one with sensor)
	1170529	Dispense: 4L bottles with filters (2)
7100746	Complete Waste System 115V/230V, 4L Bottles, including:	
	7100543	Waste: 4L bottles (2, one with sensor)
	7103024 or 7103034	Vacuum pump 115V/230V
1170535	Complete Dispense/Waste System 115V/230V, 10L Bottles, including:	
	1170534	Waste: 10L bottle (1), 4L bottle with sensor (1)
	1170528	Dispense: 10L bottles (2)
1170534	Complete Waste System 115V/230V, 10L Bottles, including:	
	7100582	Waste: 10L bottle (1), 4L bottle with sensor
	7103024 or 7103034	Vacuum pump 115V/230V
High Flow Vacuum Pump Systems:		
1170532	Complete Dispense/High Flow Waste System 115V/230V, 4L Bottles, including:	
	7100753	Waste: 4L bottles (2, one with sensor)
	1170529	Dispense: 4L bottles with filters (2)
7100753	Complete High Flow Waste System 115V/230V, 4L Bottles, including:	
	7100543	Waste: 4L bottles (2, one with sensor)
	7100754	High-flow vacuum pump 115V/230V
1170533	Complete Dispense/High Flow Waste System 115V/230V, 10L Bottles, including:	
	1170531	Waste: 10L bottle (1), 4L bottle with sensor

Part Number	Description
	1170528 Dispense: 10L bottles (2)
1170531	Complete High Flow Waste System 115V/230V, 10L Bottles, including:
	7100754 High-flow vacuum pump 115V/230V
	7100582 Waste: 10L bottle (1), 4L bottle with sensor (1)
Direct Drain Vacuum Pump Systems:	
1170560	Complete Dispense/Direct Drain Waste System with standard vacuum pump
1170562	Complete Dispense/Direct Drain Waste System with high-flow vacuum pump
1170561	Direct Drain Waste System Upgrade Kit (to replace standard waste system)
Notes:	
1) Models with Buffer Switching receive a dispense system. Only a waste system must be ordered separately.	
2) High-flow waste system may be necessary for 384-well washing with buffers not containing surfactant.	

Optional Accessories

General Instrument Accessories

Description	PN
BioTek liquid testing solutions for instrument qualification tests	Wetting Agent 7773002
	Blue Test Dye 7773001
Liquid Handling Control™ Software	LHC2
BioStack™ Microplate Stacker and integration kit	Biostack
Installation-Operational-Performance Qualification (IQ-OQ-PQ) package	1170543

Magnetic Bead Assay Accessories

Accessory	PN
Magnet Adapter Kit	7180011
Magnets:	
384-well Flat Magnet	7103017
384-well Ring Magnet	7102215
96-well Flat Magnet	7103016
96-well Ring Magnet	7102216

Vacuum Filtration Kit

Description	PN
Vacuum Filtration Kit	7180029
-- 96-well Only	1170008
-- 96- and 384-well	1170009

Verify™ Technology Accessories

Description	PN
Verify Test Plate Replacement Kit	1240001

Miscellaneous Accessories

Description	PN
96-tube Manifold Kit - Replacement kit for 405 Select to support 384-well non-surfactant buffer washing (Tube-in-Tube).	1172046S
96-Tube 7-Degree Dual Manifold Upgrade Kit - Additional manifold for 405 HT for 96-well washing. (Tube-in-Tube)	1170010
4L Dispense Bottle w/filter	1173031
Cap for 4L Dispense Bottle w/filter	1173003
10L Dispense Bottle w/filter	1173000

Description	PN
Cap for 10L Dispense Bottle w/filter	1173002
Dispense Tubing Set - 1 Buffer	7100538
Dispense Tubing Set - 4 Buffers (For Buffer Switching models.)	7100537
4L Waste Bottle	7100534
Cap for Waste Bottle, 4L (Also fits 10L and 20L bottles.)	7100531
Waste Bottle with Level Sensing, 4L	7100542
Cap for Waste Bottle with Level Sensing, 4L	7100544
10L Waste Bottle and Tubing	7100557
20L Waste Bottle and Tubing	7100556
Waste Tubing Set	7100533
Vacuum Line Filter for Waste Tubing	48294
Vacuum Gauge/Regulator (For use with house vacuum.)	4030551
Silencing Muffler for Vacuum Pump (For use with PNs 7103024 or 7103034 pump.)	01113
Fluid filter for dispense bottles (does not include stainless steel adapter 1172031)	01310

Note: Check our website for a complete list of accessories: www.biotek.com

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405 TS/LS Chemical Compatibility Chart

Table 1: Material/Where Used List

#	Material	Where Used
1	304 Stainless Steel	Inlet screen, feeder tube to manifold, vacuum switch, direct-drain inlet screen
2	316 Stainless Steel	Dispense and aspirate tubes, feeder tube to manifold, spring in bottle fittings
3	Acetal	Vacuum-filtration plug
4	Aluminum (anodized)	Microplate carrier, vacuum-filtration carrier grill and retainer
5	CPVC (Chlorinated Polyvinyl chloride)	Manifold, vacuum-filtration carrier
6	Nylon	Inlet fitting, vacuum switch adjustment screw, carrier leveling feet
7	PTFE (polytetrafluoroethylene) Teflon	Optional check valves (PN: 68098) for fluid pump, fluid path
8	EPDM (Ethylene Propylene)	Inlet valve, vacuum filtration 3-way valves, vacuum switch diaphragm
9	Neoprene	Manifold channel-end seals
10	PPO (polyphenylene Oxide) Noryl®	Vacuum switch internal disc
11	Polycarbonate	Vacuum switch body, Vacuum-filtration intermediate waste bottle
12	Polyethylene	Buffer bottle
13	Polypropylene	Outlet fitting, fittings in bottles, inline fittings, float ball, bottle caps, vacuum-filtration module bulkhead fittings, direct-drain module fittings
14	Polystyrene	Flow sensor, mist shield, assay plates
15	PVC (Polyvinyl chloride)	Inlet valve, waste sensor, flow sensor ball retainer, waste tubing, vacuum-filtration plug, direct-drain bottle sensor
16	PPS (polyphenylenesulfide) Ryton®	Fluid pump, vacuum-filtration plug, inlet valve (serial # less than 207137), direct-drain fluid pump
17	Thermoplastic elastomer Santoprene®	Fluid pump check valves, direct-drain pump check valves
18	Silicone	Inlet tubing, outlet tubing, o-rings, vacuum-filtration carrier gasket, vacuum-filtration module tubing, direct-drain module tubing
19	Ultem (polyetherimide)	Outlet valve, CW inlet valve, vacuum-filtration module valves, direct-drain module valves
20	Viton	Outlet valve, CW inlet valve, direct-drain valves

Table 2: Chemical Compatibility Ratings

Key A - Excellent B - Good C - Fair D - Severe effect/Poor ND - No data	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	304 S.Steel	316 S.Steel	Acetal	Aluminum	CPVC	Nylon	PTFE Teflon	EPDM	Neoprene	PPO (Noryl)	Polycarbon.	Polyethylene	Polypropyl.	Polystyrene	PVC	PPS Ryton	Santoprene	Silicone	Ultem	Viton

Chemical	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acetic Acid, 5%	D	A	D	B	A	D	A	ND	B	A	A	A	A	D	D	A	C	C	A	B
Acetic Anhydride	B	A	D	A	D	A	A	A	B	D	D	C	B	D	D	A	A	A	ND	D
Acetonitrile	ND	A	ND	B	D	A	A	C	ND	ND	D	A	A	D	D	A	ND	D	D	D
Ammonia 10%	A	A	D	A	A	A	A	ND	A	A	D	N	A	B	B	A	A	D	D	D
Benzyl Alcohol	B	B	A	B	A	B	A	B	C	D	ND	A	A	D	D	A	A	A	ND	A
Chloroform	A	A	A	B	D	A	A	D	D	D	D	D	C	D	D	A	D	D	D	A
Detergents 1%	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A
Dimethylformamide	A	B	D	A	D	A	A	B	D	D	C	A	A	D	D	A	D	A	ND	C
DMSO (Dimethylsulfoxide)	ND	A	ND	A	D	A	A	B	ND	ND	D	A	A	D	D	A	D	C	D	D
Ethyl Alcohol 70%	A	A	A	A	B	A	A	A	A	A	B	B	A	A	B	A	B	B	A	B
Ethylene Oxide	B	B	D	D	C	D	A	C	D	A	C	A	D	C	C	D	ND	A	ND	C
Formaldehyde 37%	A	A	A	B	A	A	A	A	B	A	A	D	A	ND	A	A	ND	C	A	A
Hexane	A	A	A	A	B	B	A	D	B	B	D	A	B	D	B	A	ND	D	A	A
Hydrochloric Acid 20%	D	D	C	D	A	D	A	A	C	B	B	A	B	C	A	D	A	D	A	A
Hydrofluoric Acid 20%	D	D	D	D	C	C	A	C	B	C	D	A	A	ND	B	A	A	D	ND	A
Hydrogen Peroxide 10%	B	B	D	A	A	A	A	A	B	A	A	A	A	A	A	C	ND	A	A	A
Isopropyl Alcohol 70%	B	A	A	A	B	D	A	A	B	A	A	B	A	A	B	A	ND	A	A	A
Methyl Alcohol 70%	A	A	A	A	A	B	A	A	A	A	B	A	A	ND	A	A	B	A	A	A
Methylene Chloride	B	B	B	C	D	C	A	ND	D	D	D	D	B	D	D	A	D	D	D	B
Phosphoric Acid >40%	D	D	D	C	A	B	A	A	B	A	A	A	A	B	B	A	A	C	A	A
Propylene Glycol	B	B	B	B	C	A	A	ND	C	ND	B	A	A	A	C	A	ND	A	ND	A
Sodium Chlorate	A	B	A	C	A	D	A	ND	A	A	A	N	A	ND	A	A	A	C	ND	A
Sodium Hydroxide 20%	B	B	A	D	A	A	A	B	B	A	A	A	A	A	A	A	ND	A	A	A
Sodium Hypochlorite <20%	C	C	D	D	A	D	A	B	C	A	C	A	A	A	A	C	ND	B	B	A
Sodium Hypochlorite 0.5%	B	B	ND	D	A	ND	A	B	C	ND	C	A	A	A	A	C	ND	B	A	A
Sulfuric Acid <10%	D	B	D	B	A	A	A	A	B	A	A	A	A	A	A	A	A	C	A	A
Trichloroethylene	B	B	D	D	C	A	A	ND	D	D	ND	D	C	D	D	A	D	D	D	A
Virkon 10%	ND	A	ND	D	A	A	ND	A	ND	ND	A	A	A	A	A	A	ND	A	ND	A

This ratings information was obtained from several reputable sources and our own experience at BioTek, but your experience may differ due to variations in concentration, temperature, and other factors. Consult the reagent/solvent manufacturer before use to verify its compatibility with instrument components.

405 LS Customer Training Guide

Instrument

Hardware

- Review flow routing and tubing connection for Supply and Waste (page 12)
- Review Mist Shield installation and cleaning
- Show location of washer aspirate/dispense tubes, describe method of operation and manifold design
- Show location and function:
 - priming trough
 - carrier
 - vacuum pump outlet
 - fuse and describe how to replace it
- Review ports:
 - USB
 - Vacuum Filtration
 - waste monitor
- Demonstrate Verify Technology (page 50)
- Review Chemical Compatibility

Onboard Software

- Show startup and priming procedure
- Show **Quick** options:
 - Prime
 - Wash
 - Clean: Sonicate Manifold
- Select and run a protocol (page 40)
- Create a protocol (page 33):
 - Wash
 - Aspirate
 - Dispense
 - Soak/Shake
 - BioStack (page 53)
- Show how to use **Align** utility
- Explain/recommend AutoPrime (page 74)
- Review end of day procedures

BioStack Interface

As applicable

- Alignment kit, 90 or 0, or -90 degree wrist, 50-plate stacks (if applicable)
- Enable BioStack
- Align gripper/claw
- Potential issues with non-SBS compliant microplates; microplate stack adjustment
- Demonstrate operation, instrument control
 - Instrument control
 - LHC Control
- Settings/Restack

LHC Software

- Show how to establish communication
- Review the options in the Target Instrument Settings
- Create and run a simple protocol
- Review the Instrument Utilities dialog options

Preventive Maintenance

- Recommended maintenance schedule (page 79)
- Cleaning in-bottle filter (page 86)
- Review programs:
 - Day Rinse
 - Overnight Loop
 - Rinse and Soak
 - Long Shutdown
- Decontamination
- Manifold cleaning procedures
 - Stylus manifold
- Carrier cleaning procedures

Special Applications

As applicable

- Cell wash assays: define a protocol (page 55)
- Magnetic bead assays: review accessories; Magnet Adapter Height setting (page 60)
- Vacuum filtration assays: review accessories; enable module; Plate Carrier setting; define a protocol (page 68)

Exercises

As applicable

- Create a protocol for:
 - ELISA
 - BioStack
- Run a Quick Wash:
 - Buffer: D
 - Cycles: 2
 - Volume: 250 μ L

Reference Material

- 405 LS Operator's Manual (on USB flash drive)
- LHC Help
- BioStack Operator's Manual

