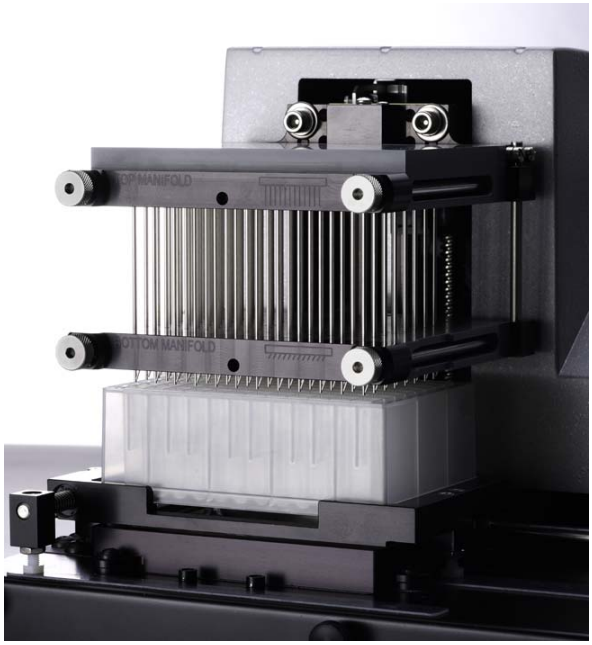
ELx405

Deep Well Microplate Washer

User Manual



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Notices

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Contents

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bio.tac@agilent.com

Instrument service and repair is available worldwide at one of our international service centers and in the field at your location.

UK Responsible Person UKRP

Agilent LD UK Ltd
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Cheadle Royal Business Park
Cheadle, Cheshire, SK8 3GR

Intended Use Statement

The ELx405 Deep Well is a microplate washer and system intended to provide automated washing and processing of microplates for the eventual examination of specimens to analyze their characteristics and impact on a variety of analytes.

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

Review the Warranty information that shipped with your product. Register your product to ensure you receive important information and updates about the products you have purchased.

Safety Notices

Refer to Appendix F for information in other languages.

Raadpleeg Bijlage F voor informatie in andere talen.

Reportez-vous à l'annexe F pour obtenir des informations dans d'autres langues.

Informationen in anderen Sprachen finden Sie in Anhang F.

Fare riferimento all'Appendice F per informazioni in altre lingue.

Consulte el Apéndice F para obtener información en otros idiomas.

Pay special attention to the following safety notices in all product documentation.

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

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

Warnings and Precautions

Electrical Hazards

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

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.

Chemical/Environmental

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. Always wear safety glasses and appropriate protective equipment, such as chemical-resistant rubber gloves and apron.

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 **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, stop the program and turn off the instrument. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

CAUTION **Liquids.** Do not immerse the instrument, spray it with liquid, or use a dripping-wet cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact Technical Support. Do not soak the keypad.

CAUTION **Environmental Conditions.** Do not expose the instrument to temperature extremes. For proper operation, temperature near the instrument should remain within the range in the ***Specifications*** section of this document. Performance may be adversely affected if temperatures fluctuate above or below this range

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

CAUTION **Lubricants.** Do not apply lubricants to moving parts. Lubricant on components in the carrier compartment will attract dust and other particles, which may cause the instrument to produce an error. Do not apply lubricants to manifold o-rings, channel-end seals, bottle cover seals, any tubing connection, or any surface that is a part of the fluid path.

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, and 20% sodium hydroxide. Never use acetic acid, DMSO, or other organic solvents. These chemicals may cause severe damage to the instrument.

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

Components

WARNING **Pinch Hazard.** Some areas of the instrument can present pinch hazards when the instrument is operating. These areas are marked with the symbol shown here. Keep hands/fingers clear of these areas when the instrument is operating.

WARNING **Ultrasonic energy.** "S" models. Ultrasonic energy is present in the cleaning reservoir when the AutoClean program is running. Do not put your fingers in the reservoir. Ultrasonic energy can harm human tissue.

WARNING **Accessories.** Only accessories that meet the manufacturer's specifications shall be used with the instrument.

CAUTION **Vacuum Pump Installation.** Do not plug the 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.

CAUTION **Waste Sensor Port.** For installations with the BioStack Microplate Stacker: Do not plug the BioStack's external power supply into the waste sensor port on the back of the washer. Doing so will permanently damage the washer's internal components.

CAUTION **Shipping Hardware.** All shipping hardware must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

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 **Use BioTek-Provided Bottles Only.** Do not substitute the fluid supply and waste bottles provided by BioTek with other commercially available bottles. BioTek provides bottles that perform well with our liquid handling systems, including the vacuum pressure of the waste system.

CAUTION **Service.** Only qualified technical personnel should perform service procedures on internal components.

Intended Product Use

WARNING **Software Quality Control.** The operator must follow the manufacturer's assay package insert when modifying software parameters and establishing washing methods. 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.

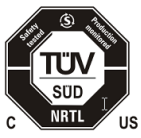
WARNING **User Evaluation.** The performance characteristics of the software have not been established with any laboratory diagnostic assay. Users must evaluate this instrument and software in conjunction with their specific assay(s). This evaluation must include the confirmation that performance characteristics for the specific assay(s) are met.

WARNING **Unspecified Use.** Failure to operate equipment according to the guidelines and safeguards specified in the product user documentation could result in a hazardous condition.

CAUTION Use of labware other than described in this document can result in positioning errors during program execution.

Symbols

	Caution, consult the instructions for use for important cautionary information such as warnings and precautions Voorzichtig, raadpleeg de gebruiksaanwijzing voor belangrijke voorzorgsinformatie zoals waarschuwingen en voorzorgsmaatregelen Attention, pour des informations de mise en garde importantes telles que des avertissements et des précautions, consultez le mode d'emploi. Achtung, lesen Sie die Gebrauchsanweisung für wichtige Vorsichtshinweise wie Warnungen und Sicherheitsvorkehrungen Attenzione, consultare le istruzioni per l'uso per importanti informazioni cautelative come avvertenze e precauzioni Precaución, consulte las instrucciones de uso para obtener información importante, como advertencias y precauciones
	Caution Voorzichtig Attention Achtung Attenzione Precaución
	Warning; Biological hazard Waarschuwing; biologisch gevaar Avertissement : Risque biologique Warnung; biologische Gefahr Avvertenza, rischio biologico Advertencia: peligro biológico
	Warning; Pinch hazard Waarschuwing; beknellingsgevaar Avertissement : risque de pincement Warnung; Quetschgefahr Avvertenza, rischio di pizzicamento Advertencia: peligro de atrapamiento
	Disposal Notice: Dispose of the instrument according to Directive 2012/19/EU, “on waste electrical and electronic equipment (WEEE)” or local ordinances Kennisgeving van verwijdering: Verwijder het instrument volgens Richtlijn 2012/19/EU betreffende afgedankte elektrische en elektronische apparatuur (AEEA) of lokale verordeningen Avis concernant la mise au rebut : mettez l'instrument au rebut conformément à la directive 2012/19/EU portant sur les déchets d'équipement électrique et

	électronique (DEEE) ou aux dispositions locales. Entsorgungshinweis: Entsorgen Sie das Gerät gemäß der Richtlinie 2012/19/EU „für Elektro- und Elektronik-Altgeräte (WEEE)“ bzw. den Landesvorschriften. Avviso per lo smaltimento: smaltire lo strumento in base alla Direttiva 2012/19/EU, sui "rifiuti di apparecchiature elettriche ed elettroniche (WEEE)" o le ordinanze locali Aviso de eliminación: elimine el instrumento de conformidad con la Directiva 2012/19/UE sobre residuos de aparatos eléctricos y electrónicos (RAEE) o las ordenanzas locales
CE	CE Marking – Indicates compliance with the requirements of the Directive 2014/30/EU on Electromagnetic Compatibility and the Directive 2014/35/EU on Low Voltage CE-markering – Geeft aan dat wordt voldaan aan de vereisten van Richtlijn 2014/30/EU inzake elektromagnetische compatibiliteit en Richtlijn 2014/35/EU inzake laagspanning Marquage CE – Indique la conformité aux exigences de la directive 2014/30/UE sur la compatibilité électromagnétique et de la directive 2014/35/UE sur la basse tension CE-Kennzeichnung – Zeigt die Einhaltung der Anforderungen der Richtlinie 2014/30/EU über elektromagnetische Verträglichkeit und der Richtlinie 2014/35/EU über Niederspannung Marcatura CE – Indica la conformità ai requisiti della Direttiva 2014/30/UE sulla Compatibilità Elettromagnetica e della Direttiva 2014/35/UE sulla Bassa Tensione Marcado CE: indica el cumplimiento de los requisitos de la Directiva 2014/30 / UE sobre compatibilidad electromagnética y la Directiva 2014/35 / UE sobre baja tensión
	Date of manufacture Productiedatum Date de fabrication Herstellungsdatum Data di produzione Fecha de fabricación
	TÜV SÜD Certification Mark – Type tested; production monitored TÜV SÜD certificeringsmerk - type getest; productie bewaakt TÜV SÜD Marque de certification – Type testé ; production contrôlée TÜV SÜD-Prüfzeichen – Typ geprüft; Produktion überwacht Marchio di certificazione TÜV SÜD: tipo testato, produzione monitorata Marca de certificación TÜV SÜD: tipo probado, producción controlada

	This product complies with environmental protection use period as defined in People's Republic of China Electronic Industry Standard SJ/T11364-2006. Toxic or hazardous substances will not leak or mutate under normal operating conditions for 40 years. Dit product voldoet aan de milieubeschermingsgebruiksperiode zoals gedefinieerd in de Electronic Industry Standard SJ/T11364-2006 van de Volksrepubliek China. Giftige of gevaarlijke stoffen zullen onder normale bedrijfsomstandigheden gedurende 40 jaar niet lekken of muteren. Ce produit est conforme à la période d'utilisation dans le cadre de la protection de l'environnement telle que définie par la norme de l'industrie électronique de la République populaire de Chine SJ/T11364-2006. Les substances toxiques ou dangereuses ne fuiront pas ou ne subiront pas de mutation dans des conditions de fonctionnement normales pendant 40 ans. Dieses Produkt entspricht der Umweltschutz-Nutzungsdauer gemäß der Definition im Electronic Industry Standard SJ/T11364-2006 der Volksrepublik China. Giftige oder gefährliche Stoffe werden unter normalen Betriebsbedingungen 40 Jahre lang nicht austreten oder mutieren. Questo prodotto è conforme al periodo di utilizzo della protezione ambientale come definito nello Standard del settore elettronico della Repubblica Popolare Cinese SJ/T11364-2006. Le sostanze tossiche o pericolose non fuoriescono o non subiscono mutazioni in condizioni operative normali per 40 anni. Este producto cumple con el periodo de uso de protección ambiental según el estándar SJ/T11364-2006 de la República Popular China para la industria electrónica. Las sustancias tóxicas o peligrosas no se filtrarán ni mutarán en condiciones de funcionamiento normales durante 40 años.
	UK Conformity Assessed marking is a certification mark that indicates conformity with the applicable requirements for products sold within Great Britain. De 'UK Conformity Assessed'-markering is een certificeringsmerk dat aangeeft dat producten die in Groot-Brittannië worden verkocht, voldoen aan de toepasselijke eisen. Le marquage UK Conformity Assessed est une marque de certification qui indique la conformité aux exigences applicables aux produits vendus en Grande-Bretagne. Die Kennzeichnung „UK Conformity Assessed“ ist ein Zertifizierungszeichen, das die Konformität mit den geltenden Anforderungen für in Großbritannien verkaufte Produkte anzeigt. Il marchio UKCA (conformità valutata del Regno Unito) è un marchio di certificazione che indica la conformità ai requisiti applicabili per i prodotti venduti in Gran Bretagna. El marcado UKCA (UK Conformity Assessed) es una marca de certificación que indica la conformidad con los requisitos aplicables para los productos vendidos en Gran Bretaña.

	EAC-MED is a certification mark to indicate products that conform to all the safety and quality requirements of the Eurasian Customs Union. It means that the EAC-MED marked products meet all requirements of the corresponding technical regulations and have passed all conformity assessment procedures. EAC-MED is een certificeringsmerk om producten aan te duiden die voldoen aan alle veiligheids- en kwaliteitseisen van de Euraziatische douane-unie. Dit betekent dat de producten met een EAC-MED-markering aan alle eisen van de desbetreffende technische voorschriften voldoen en alle conformiteitsbeoordelingsprocedures hebben doorlopen. EAC-MED est une marque de certification qui indique la conformité des produits à toutes les exigences de sécurité et de qualité de l'Union douanière eurasiatique. Cela signifie que les produits marqués EAC-MED satisfont à toutes les exigences des réglementations techniques correspondantes et ont passé toutes les procédures d'évaluation de la conformité. EAC-MED ist ein Zertifizierungszeichen zur Kennzeichnung von Produkten, die allen Sicherheits- und Qualitätsanforderungen der Eurasischen Zollunion entsprechen. Das bedeutet, dass die EAC-MED-gekennzeichneten Produkte alle Anforderungen der entsprechenden technischen Bestimmungen erfüllen und alle Konformitätsbewertungsverfahren bestanden haben. EAC-MED è un marchio di certificazione che indica prodotti conformi a tutti i requisiti di sicurezza e qualità dell'Unione doganale eurasiatica. Ciò significa che i prodotti con marchio EAC-MED soddisfano tutti i requisiti dei regolamenti tecnici corrispondenti e hanno superato tutte le procedure di valutazione della conformità. EAC-MED es una marca de certificación para indicar productos que cumplen con todos los requisitos de seguridad y calidad de la Unión Aduanera Euroasiática. Significa que los productos con la marca EAC-MED cumplen todos los requisitos de los reglamentos técnicos correspondientes y han superado todos los procedimientos de evaluación de conformidad.
	Product complies with Australian Communications Requirements EESS - The Regulatory Compliance Mark (RCM) ACMA Labeling Requirements Product voldoet aan de Australische communicatie-eisen EESS - De markering voor naleving van de regelgeving (RCM) ACMA-etiketteringsvoorschriften Le produit est conforme aux exigences australiennes en matière de communication EESS - Marque réglementaire de conformité (RCM) Exigences en matière d'étiquetage ACMA Das Produkt entspricht den australischen Kommunikationsanforderungen. EESS – Kennzeichnung „Regulatory Compliance Mark“ (RCM) ACMA-Kennzeichnungsanforderungen

	Il prodotto è conforme ai requisiti Australian Communications Requirements EESS: marchio di conformità alle normative Requisiti di etichettatura ACMA El producto cumple con los requisitos de comunicaciones de Australia. EESS: marcado RCM (Regulatory Compliance Mark) de cumplimiento de la normativa. Requisitos de etiquetado de ACMA

Conformance to Standards

The ELx405 Select meets the requirements of the following standards:

2014/35/EU – Low Voltage Directive

2014/30/EU – EMC Directive

2011/65/EU (with exemptions) and (EU) 2015/863 – RoHS Directives

2012/19/EU – WEEE Directive as amended by (EU) 2018/849

2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery

Standard	Description
IEC QC 080000	IEC Quality Assessment System for Electronic Components (IECQ System) - Hazardous Substance Process Management (HSPM) System Requirements
UL 61010-1	UL Standard for Safety Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements
EN 61010-1	Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use – Part 1: General Requirements
EN 61010-2-081	Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use – Part 2-081: Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes
CAN/CSA C22.2 No. 61010-1	Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use – Part 1: General Requirements
CAN/CSA C22.2 No. 61010-2-081	Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use – Part 2-081: Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes

EMC Information and Technical Description

The ELx405 conforms to:

Emissions:

EN55011/CISPR 11, Class A

CFR Title 47 FCC Part 15 Subpart B, Class A

ICES-001, Issue 5, Class A (CAN ICES-001(A)/NMB-001(A))

ACMA AS/NZS CISPR 11, Class A

Immunity:

EN/IEC 61326-1 and 61326-2-6

ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE

PART 1: GENERAL REQUIREMENTS FOR (NON IVD) LISTED PRODUCTS

Ingress Protection Code

IP 20. Protected against solid foreign objects of 12.5 mm diameter and greater. No protection against water.

Disposal

Dispose of the instrument according to Directive 2012/19/EU, "on waste electrical and electronic equipment (WEEE)" or local ordinances.

Chapter 1

Introduction

This chapter introduces the ELx405 and describes its variations, hardware and software features, and technical specifications.

Introduction

- ❖ This user manual provides instructions for use for ELx405 models that are currently available for purchase (see ***Instrument Models*** on the next page).
- ❖ This user manual also provides instructions for older ELx405 models that are no longer available for purchase.

Key capabilities and features:

- Programmable dispense volumes and dispense/aspirate flow rates provide for a wide range of washing capabilities, from gentle washing for cellular assays to vigorous washing for ELISA.
- A bottom washing option can lower the background absorbance, and a crosswise aspiration option can reduce residual volumes.
- The onboard software allows you to create and store up to 75 washer protocols. To run a protocol, simply select its name and follow the prompts. The washer can also be controlled using BioTek's Liquid Handling Control software ("LHC").
- Several predefined protocols are provided to simplify maintenance routines, which should be performed regularly to ensure optimum washer performance.
- Built-in sensors for fluid flow, fluid detection, and vacuum provide complete protection for unattended operation.
- An optional Buffer Switching module connects four reagent bottles with automatic switching between reagents.
- An optional direct drain waste system pumps the waste fluid directly into a sink or tank.
- The washer is compatible with BioTek's BioStack Microplate Stacker. All models include a robot accessible carrier and can be integrated with standard robotic systems. The BioStack does not support deep-well plates.
- "S" models equipped with BioTek's Ultrasonic Advantage provide extra cleaning power. Using ultrasonic pulses in a water bath, it removes residue from the manifold tubes, inside and out.

Instrument Models

Part Number	96-/384-well	Deep Well	Standard Height	Cell Washing	Buffer Switching	Ultrasonic	Biomagnetic separation *
ELX405-SN	•	•	•				•
ELX405S-SN	•	•	•			•	•
ELX405V-SN	•	•	•		•		•
ELX405VS-SN	•	•	•		•	•	•
ELX405C-SN	•	•	•	•			•
ELX405CS-SN	•	•	•	•		•	•
ELX405CV-SN	•	•	•	•	•		•
ELX405CVS-SN	•	•	•	•	•	•	•

* With available accessory module, sold separately. Biomagnetic separation compatible with standard height plates only.

Hardware Features

- Washes standard and deep well microplates <= 50 mm in height.
- Crosswise aspiration capability for optimizing washing performance
- Positive displacement pump that provides user-adjustable flow rates and volumes to make washing cellular assays and immunoassays equally convenient
- LCD display and membrane keypad
- Internal switching power supply
- Serial and USB ports (for most instruments)
- 5-amp accessory outlet for automatic vacuum pump control
- Stepper motors for accurate and repeatable carrier and manifold positioning
- Priming/soaking trough
- Mist shield for protection against contaminants
- Waste, fluid, flow, and vacuum detection sensors
- Plate carrier that is easily removed for cleaning
- Robot accessible carrier for all models
- BioStack accessible carrier

Software Features

- Easy-to-use, menu-driven interface
- Ability to create Wash, Prime, Dispense, and Aspirate programs for automated microplate washing. Wash parameters such as number of cycles, wash volume, flow rate and soak time are individually programmed as part of a wash program and recalled when needed.
- Ability to link up to 10 programs
- Ability to create Soak programs for inclusion in a linked series of programs
- Quick repeat of previously run program
- User-definable washer program names, resulting in the rapid recall of desired wash protocols and plate dimension set-ups
- Programs may be copied, edited or deleted
- Program parameters may be locked. Requires custom program; contact BioTek for more information
- Easy-to-update washer software
- Storage of up to 75 programs
- Preprogrammed maintenance programs
- Five shaking speeds for more intense washing
- Programmable aspiration height - ensures that the tubes do not touch the well bottom, allowing the handling of sensitive cell assays
- Support for the following languages: English, French, German, Italian, and Spanish. Contact BioTek for information on changing to a different language.

Package Contents

Description		PN
Power cord (part numbers vary according to country of use)		Varies
RS-232 serial cable (instrument-specific version is provided)		75053
		75034
USB cable (only shipped with compatible instruments)		75108
Microplate carrier (part numbers vary according to model)		Varies
Mist shield and thumbscrews – model dependent		7102209 7102239 19965
Dust cover		7342066
Storage case for accessory 96-tube manifold		7102136
Manifold shipping bracket	All models except Deep Well	7102152
	Deep Well models	7102240
Hardware for manifold shipping bracket	Screws (all models)	19143
	Flat washers (all models)	17054
	Lock washers (all models)	16016
9/64” (3.57 mm) hex wrench for removing shipping bracket, manifold		48434
Spare fuses for vacuum pump: 5A, 250V, 5x20mm, Slow-Blow (time delay)		46055
Stylus set – wire plungers for cleaning dispense and aspirate tubes		-
ELx405 User Manual on USB flash drive		7101000N

Optional Accessories

Description		PN
Complete dispense/waste system	115 volts, 4-liter bottles	7100547
	230 volts, 4-liter bottles	7100548
Complete dispense/waste system with High Flow vacuum pump (recommended for 384-well microplates)	115 volts, 4-liter bottles	7100565
	230 volts, 4-liter bottles	7100566
Auxiliary power cord for vacuum pump connection		75096
Vacuum tubing set		7100533
Dispense tubing set		7100538
Buffer Switching valve module with 4 separate supply bottles		7100540
Accessory 96-tube dual manifold (for HT models only)		7102064 7102068
10-liter dispense bottle		7100559
Waste bottles	10-liter waste bottle	7100557
	20-liter waste bottle	7100556
Standard vacuum pump – supports multiple voltages		7103035
High Flow vacuum pump – used when washing 384-well microplates with buffers not containing surfactants or where strong aspiration is required	115 volts	7100563
	230 volts	7100564
Vacuum in-line filter		48294
Muffler for standard vacuum pumps		01113
Muffler for High Flow vacuum pumps		68105
Manifold stop screw adjustment kit		7100061
Liquid testing solutions for Evacuation Efficiency or Dispense Precision tests	BioTek Wetting Agent Solution	7773002
	BioTek Blue Test Dye Solution	7773001
Liquid Handling Control Software		varies
BioStack Microplate Stacker		varies
Installation-Operational-Performance Qualification (IQ-OQ-PQ) package		7100567N
RS-232 serial cable (two instrument-specific varieties)		75053
		75034

Description		PN
Direct Drain Waste System	Complete system, including standard vacuum pump	1170560
	Complete system, including high-flow vacuum pump	1170562
	Upgrade kit (to replace an existing standard waste system)	1170561
Vacuum Filtration System (not supported by the models listed on page 2)	Control module, bracket, bottle and tubing	7100068
	96-well Vacuum Filtration plate carrier	7100713
	384-well Vacuum Filtration plate carrier	7100714
Magnets	96F LifeSep Biomagnetic Separator	7103016
	384F LifeSep Biomagnetic Separator	7103017
	VP 96 Ring Magnet	7102216
	VP 384 Ring Magnet	7102215

Specifications

Microplates	
96-well plates/strips	Deep Well ("D") models ELx405, Select, Select CW, HT2 (with the Dual/96 manifold installed)
384-well plates	Deep Well ("D") models Select, Select CW, all HT models
Most rigid 96- & 384-well filter plates	*Does not apply to Deep Well ("D") models* Vacuum Filtration models support rigid filter bottom plates with 0.45 µm to 1.2 µm filter pore size
96- & 384-format deep-well plates/cluster tubes, up to 50 mm tall	Deep Well ("D") models ELx405 Select, Select CW
Electrical	
Voltage Range:	100-240 volts AC @50-60 Hz
Accessory Outlet:	≤ 5.0 A, used for vacuum pump
Physical	
Dimensions:	Depending on model, up to: 17″ D x 14″ W x 11″ H (43.2 cm x 35.6 cm x 27.9 cm)
Weight:	≤ 30 lb (13.5 kg)

Environmental	
Temperature:	Operating: 15°C to 30°C Storage: -20°C to 50°C. The instrument should be drained of fluid.
Relative Humidity:	Operating: 10% to 85% (non-condensing) Storage: 10% to 80% (non-condensing)

Manifold Type	**Compatible with**
Single manifold with 96 sets of aspirate and dispense tubes arranged in an 8x12 array to process 96-well microplates. ('Single/96')	ELx405 (standard)
Two manifolds, one with 96 aspirate tubes (deep tubes for "D" models) and another with 96 dispense tubes to process 96- and 384-well plates. ('Dual/96')	Deep Well "D", Select, Select CW, and HT2
Two manifolds, one with 192 aspirate tubes and one with 192 dispense tubes to process 384-well plates. ('Dual/192')	All HT models

Other	
Waste bottle volume:	4, 10, or 20 liters, depending on the accessory package
Supply bottle volume:	3.7 liters
User interface (LCD):	2 line x 24-character LCD display, 25 alphanumeric keys

Performance Specifications – Deep Well "D" Models

Average Residual Volume (Evacuation Efficiency)

96 Well Plates. Average residual volume in the microwells shall be <2 ul per well after a 3 cycle wash, when 300 ul of deionized water with 0.1% Tween 20 solution is dispensed per well into a Costar flat bottomed plate. The aspirate height adjustment shall be optimized for the plate prior to testing.

Dispense Precision

96 Well Plates. Dispensing precision shall be <3%CV, when dispensing 300 ul per well of deionized water with 0.1% Tween 20 with FD&C #1 blue dye at a rate of 300 ul per well per second. The absorbance of the solution shall be read at 630 nm and 450 nm reference.

Performance Specifications – Other Models

Average Residual Volume (Evacuation Efficiency)		
Single/Dual 96-Tube Manifolds (including deep-tube manifolds)	ELx405 Select Select CW HT2	Average residual volume in the microwells is ≤ **2 µL** per well (or ≤ 5 µL for washer serial numbers < 204272), 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-bottomed plate. The aspirate height adjustment is optimized for the plate prior to testing.
Dual 192-Tube Manifold	All HT models	Average residual volume in the microwells is ≤ **2 µL** 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-bottomed plate. The aspirate height adjustment is optimized for the plate prior to testing.
Vacuum Filtration	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 0.45µm plates (PN 98258) and vacuum aspirated for 30 seconds at vent diameter 0.047" (no plug) and blotted on a paper towel.
	384-Well Filter Plates	Average increased weight of the plate is ≤ **04.0 grams** after dispensing 80 µL of deionized water per well into a Millipore® MZFCN0W10 384-well 1.2µm plates (PN 98287) and vacuum aspirated for 10 seconds at vent diameter 0.047" (no plug) and blotted on a paper towel.
Deep Well Model	96 Deep Well Plate	Average residual volume in the microwells shall be ≤ **2 uL** per well after a 3 cycle wash, when 2000 uL of deionized water with 0.1% Tween 20 solution is dispensed per well into a Corning® 96 Polypropylene Storage Block, part number 3960 or 3961.

Dispense Precision		
Single/Dual 96-Tube Manifolds (including deep-tube manifolds)	ELx405 Select Select CW HT2	≤ **3.0% CV** (or ≤ 4.0%CV for washer serial numbers < 204272), when dispensing 300 µL per well of deionized water with 0.1% Tween 20, with FD&C #1 blue dye at a rate of 300 µL per well, per second into a Costar 96-well flat-bottomed plate. The absorbance of the solution is read at 630 nm and 450 nm reference.
Dual 192-Tube Manifold	All HT models	≤ **4.0% CV** when dispensing 80 µL per well of deionized water with 0.1% Tween 20, with FD&C #1 blue dye at a rate of 102 µL per well, per second (rate 5) into a Costar 384-well flat-bottomed plate. The absorbance of the solution is read at 630 nm and 450 nm reference.

Technical Support

❖ See also **Contact Information** on page vii.

Please be prepared to provide the following information:

- Your name and company information, along with a daytime phone or fax number, and/or an e-mail address
- The product name, model, and serial number
- The software configuration information: start at the washer's Main Menu and select **`UTIL > TESTS > CHKSUM`**.
- For troubleshooting assistance or instruments needing repair, the specific steps that produce your problem and any error codes displayed on the screen (see also ***Appendix B, Error Codes***)

Returning Instruments for Service/Repair

If you need to return an instrument to BioTek for service or repair, please contact Technical Support *before* shipping the instrument.

Repackage the instrument properly; see ***Chapter 2, Installation***.

Chapter 2

Installation

This chapter provides instructions for unpacking and setting up the ELx405, installing its components, and repackaging the instrument for shipment.

Important Information

CAUTION **Shipping Hardware.** All shipping hardware must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

- This chapter contains installation and setup tasks for the washer and accessories. Perform the tasks in the order presented.
- Save all packaging materials. Be sure to use packaging materials supplied by the manufacturer when shipping the instrument. Using other forms of commercially available packaging, or failing to follow the repackaging instructions, may void your warranty.
- During the unpacking process, inspect the packaging, instrument, and accessories for shipping damage. If the instrument is damaged, notify the carrier and your BioTek representative. Keep the shipping boxes and the packaging materials for the carrier's inspection.

Unpack and Inspect the Instrument

Unpack the boxes containing the washer and other equipment.

1. Place the washer on a level surface.
2. Take note of the manifold shipping bracket and follow instructions on page 15 for removing the bracket.
3. If applicable, place the Buffer Switching module and its accessories on a level service and follow setup instructions.
4. Store all the shipping materials for the washer and the accessories in a safe place for potential future use.

Remove the Manifold Shipping Bracket

CAUTION **Shipping Hardware.** All shipping hardware must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

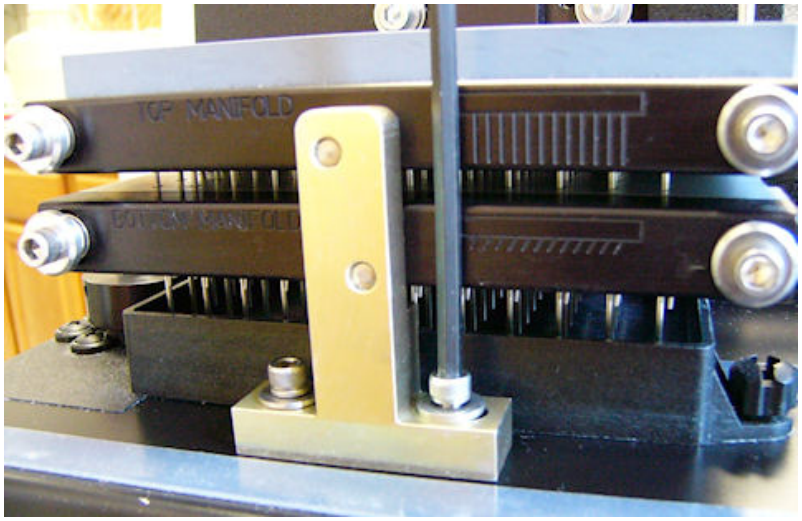


Figure 1: Removing the Manifold Shipping Bracket

1. Using the 9/64" (3.57 mm) hex wrench supplied, unscrew the cap screws at the base of the shipping bracket and remove it.
2. To store the bracket, mount it on the back of the instrument using the same screws.

Figure 2: Mount the shipping bracket on the back panel, on the studs provided next to the Fluid In port.

Set Up the Washer

Be sure to comply with the recommended guidelines for optimizing performance in **Chapter 3**, **Operation**, after installing the instrument and before running it.

Operating Environment

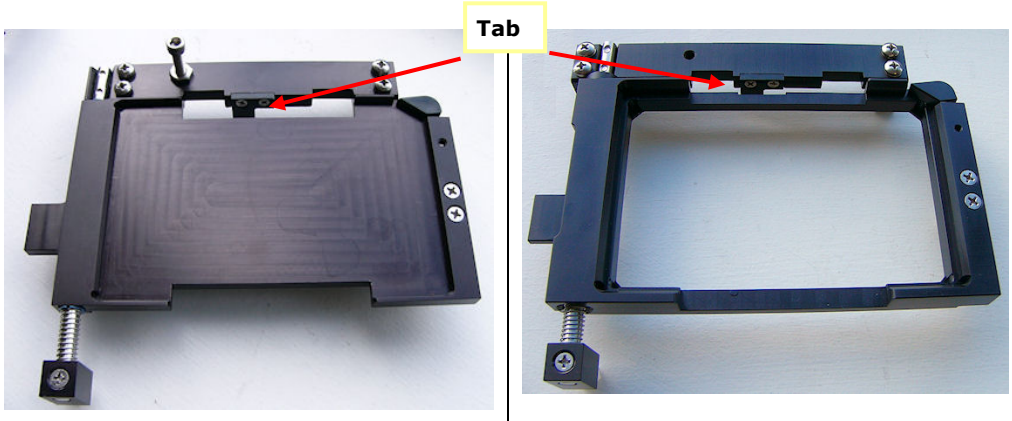
Avoid excessive humidity. Condensation directly on the sensitive electronic circuits can cause the instrument to fail internal self-checks.

The washer is sensitive to extreme environmental conditions. For optimal operation, install the washer on a level surface, in an area where temperatures between 15°C to 30°C (59°F to 86°F) can be maintained, away from excess humidity: 10% to 85% (non-condensing).

Install the Microplate Carrier

❖ The underside of the microplate carrier has a serial number which must match the washer's serial number. If the numbers do not match, contact Technical Support immediately.

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



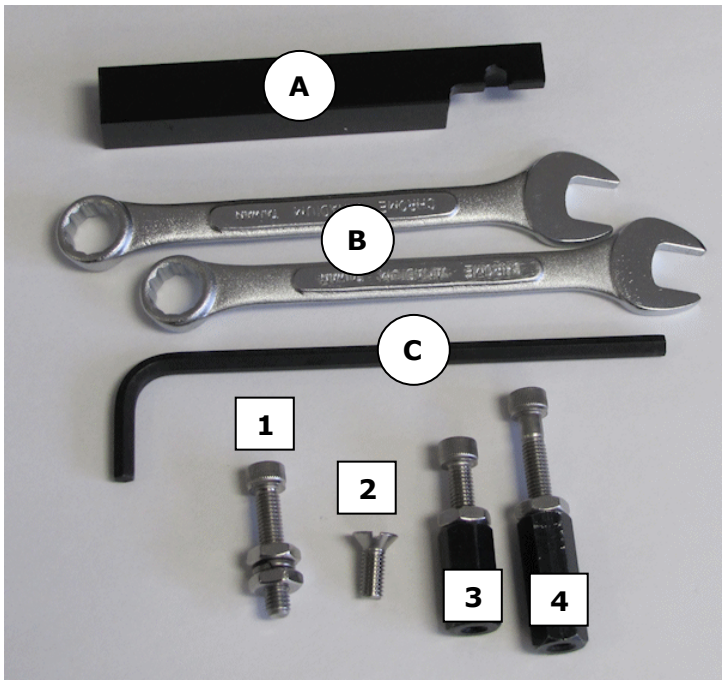
Standard plate carrier | Magnetic bead plate carrier

Deep Well Plates: Install the Manifold Stop Screw

The ELx405 needs a taller manifold stop screw when processing deep-well plates and typically to perform magnetic bead assays. Follow these instructions to install and adjust an additional stop screw. Locate the kit (PN 7100093) shipped with any ELx405 Deep Well microplate washer with a dual 96-deep-tube manifold.

❖ These instructions also apply to magnetic bead models.

This accessory kit includes:



A	Adjustment tool (jig) for positioning manifold stop screw
B	Two 3/8” wrenches
C	One 5/32” Allen wrench
1	Spare standard stop screw for magnetic-bead assays
2	Small Philips-head screw to support deep-well stop screws
3	Smaller deep-well stop screw
4	Taller deep-well stop screw

Three stop screws of varied heights are provided:

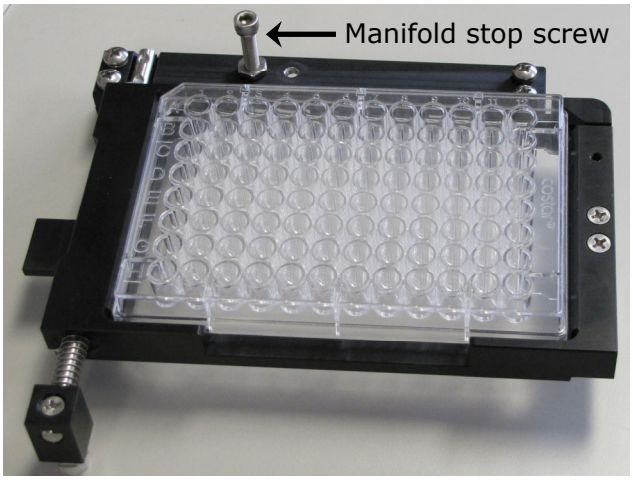
- One Spare Stop Screw: the shortest screw with two adjustable nuts and a lock washer is ideal for magnetic-bead assays in standard 96- and 384-well plates;
- Two Deep-Well Stop Screws: two screws on top of large spacers for processing deep well plates.

Philips-head screwdriver: you must provide a screwdriver to install the deep-well stop screws.

About the stop screw:

The washer’s microplate carrier is equipped with a manifold stop screw that prevents the bottom dispense manifold from contacting the microplate during operation.

The plate carrier ships with one screw installed for use with standard-height microplates (14.35 mm). When using significantly taller microplates and/or a magnet, a taller manifold stop screw (in most cases) must be used.



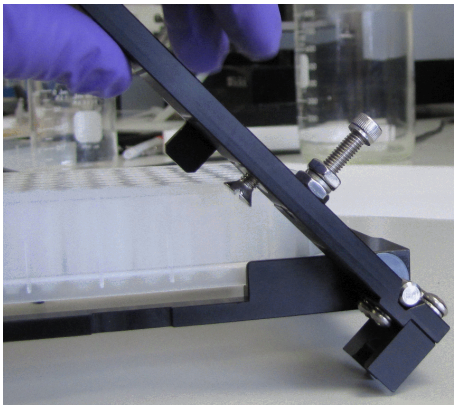
The additional stop screws are designed to make it easy to switch between setups for plates of different heights. Two stop screws can be installed at any time, allowing you to retain the standard height screw while installing and removing the taller screw to accommodate special plates/vessels.

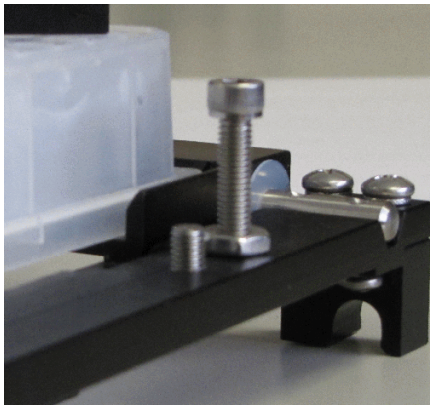
To determine the height of the manifold stop screw:

1. Pick the additional stop screw to use to support your microplate or vessel:

Plate Type	Stop Screw		Plate Height Range
Standard plates with magnet		Spare stop screw	Up to 19 mm
Deep well plates similar to Corning 384-well round-bottom Polypropylene block (PN 3964 and 3965)		Smaller deep well stop screw	19 mm – 29 mm
Deep well plates similar to Corning 96-well storage block (PN 3960 and 3961) and 96 Deep Well Cluster Tubes (PN 4410 and 4411)		Taller deep well stop screw	29 mm – 50 mm

2. Deep Well Stop Screws only: install the small Philips-head screw in the hole next to the standard stop screw to make a post on which to install a stop screw:





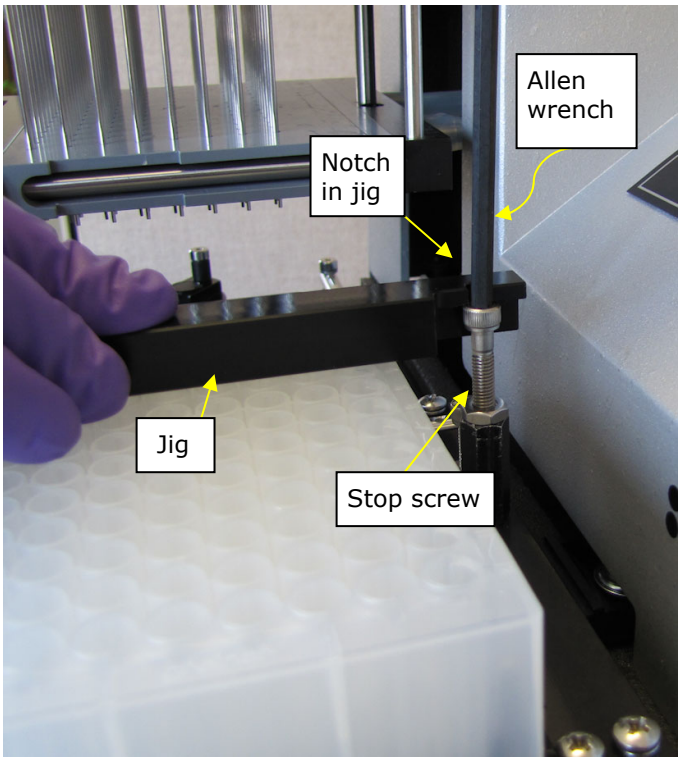
- Remove the carrier from the instrument.
- Lift the arm of the carrier that holds the stop screw to access the underside of the hole and insert the small screw.
- Use the Philips-head screwdriver to fully tighten the screw.
- Reinstall the microplate carrier on the instrument.

3. All Stop Screws: Install the spare stop screw in the spare hole, or for deep-well plates, on the screw (inserted in the previous step).

4. Insert the magnet and plate or the deep well microplate (or other special vessel) in the carrier.

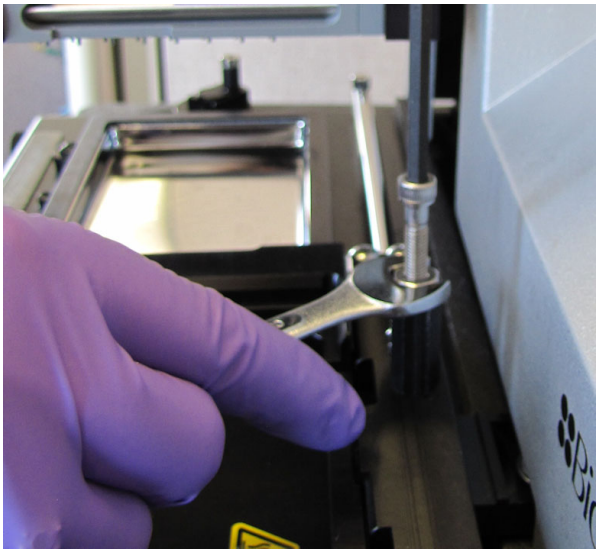
5. Place the adjustment tool or jig on top of the microplate/vessel, with the notched end above the additional stop screw.

6. Hold the jig level as you use the Allen wrench to raise or lower the screw head until it sits just below the notch in the jig.



The jig defines the proper height of the stop screw

7. Tighten the nut to secure the screw's position. This will "lock" the nuts in place and allow you to easily remove/replace the screw using just your fingers, without affecting its height setting. **Deep well stop screws:** release the spacer to remove it from the carrier.

Spare Stop Screw	Deep Well Stop Screw
 One wrench per nut to tighten top one	
Use the Allen wrench to hold the screw in place while you lower the bottom nut until it touches the carrier. Then, using the two wrenches, hold the bottom nut in place and turn the top nut clockwise to tighten it. Ensure the washer between the screws is fully compressed.	Use the Allen wrench to hold the screw in place while using a wrench to tighten the nut (on top of the spacer) to secure the screw's height.

Connect the Vacuum Pump, Tubes, and Bottles

CAUTION **Waste Sensor Port.** For installations with the BioStack Microplate Stacker: Do not plug the BioStack's external power supply into the waste sensor port on the back of the washer. Doing so will permanently damage the washer's internal components.

All tubing, cables, and fittings for the waste and supply systems must be properly connected. *Error! Reference source not found.* illustrates the instrument rear panel and the locations of the ports and connections for the waste and supply systems: top photo for instruments with basecode PN 7100227; bottom photo for instruments with basecode PN 7100242.

Before connecting the tubes and bottles: Rinse all waste and supply bottles with deionized or distilled water before connecting them to the waste and supply tubing. This rinsing eliminates particles that may have collected during packing or unpacking.

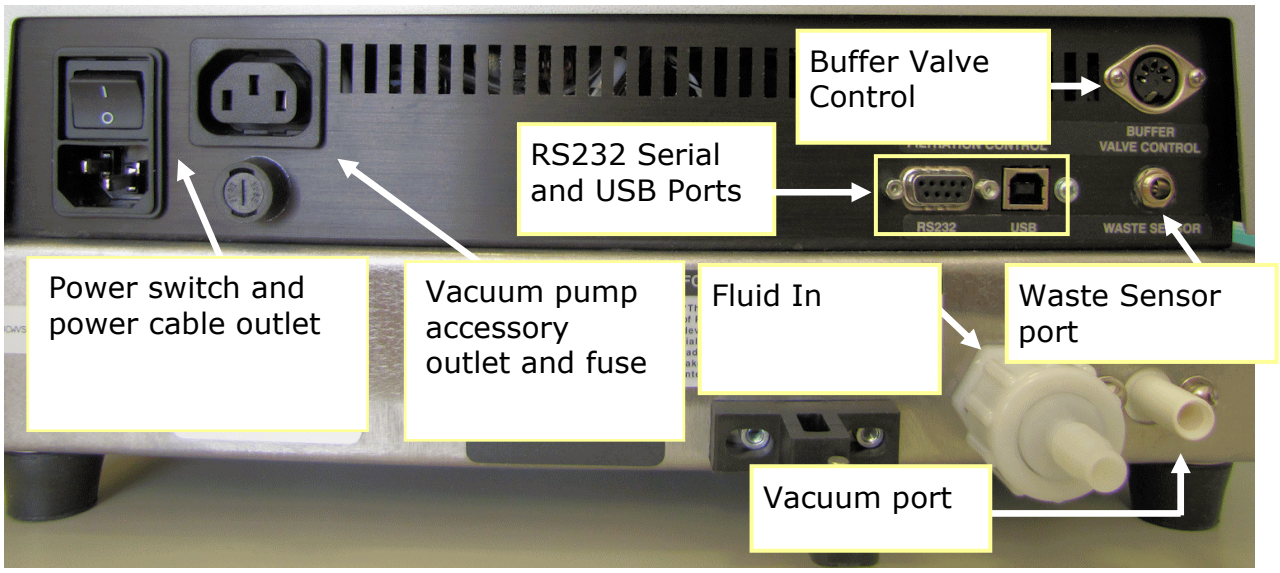


Figure 3: Rear Panel

Plug the:	**Into this outlet:**
ELx405 power cable	Power cable outlet (under power switch)
Vacuum pump power cable	Vacuum pump "accessory outlet"
Waste sensor cable from waste bottle connected to vacuum pump	Waste Sensor port
Tube from waste bottle without the waste sensor.	Vacuum port (in bottom right corner)
For vacuum filtration models, a Y-connector is used to connect its "intermediate waste system" to this main waste system.	
Optional:	
Computer cable: serial or USB	Appropriate COM port
BioStack serial cable	Serial COM port
Buffer Switching control cable	Valve Control or designated port
Vacuum Filtration control cable	Valve Control or designated port

Waste System

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. Always wear safety glasses and appropriate protective equipment, such as chemical-resistant rubber gloves and apron.

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.

CAUTION

Vacuum Pump Installation. Do not plug the 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.

- If you are installing the **Direct Drain Waste System,** refer to the installation instructions that came with the system.

- 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.

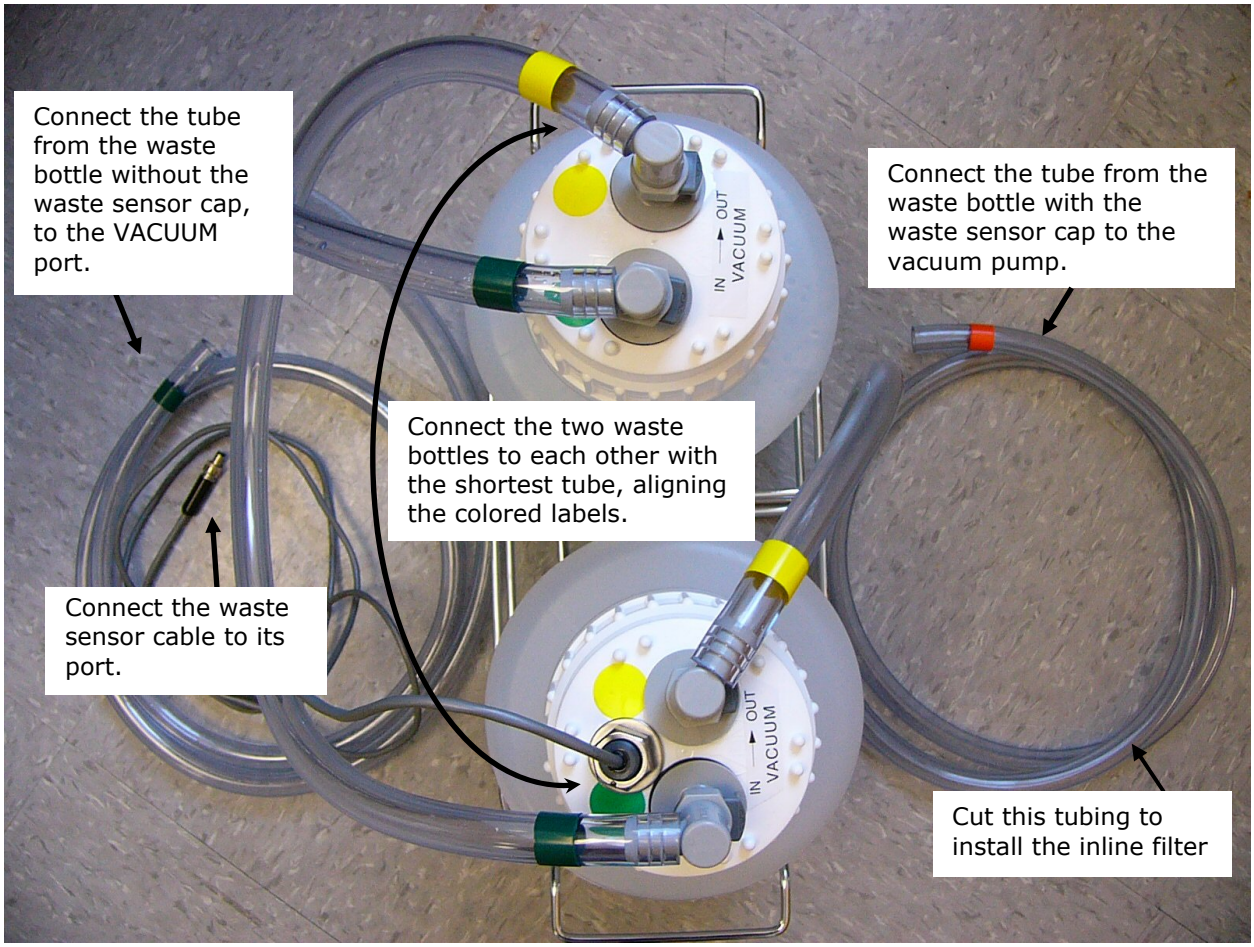


Figure 4: Waste System

Three lengths of tubing are shipped with the waste module:

Tubing:	**Connects:**
Short tube with yellow and green bands	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.

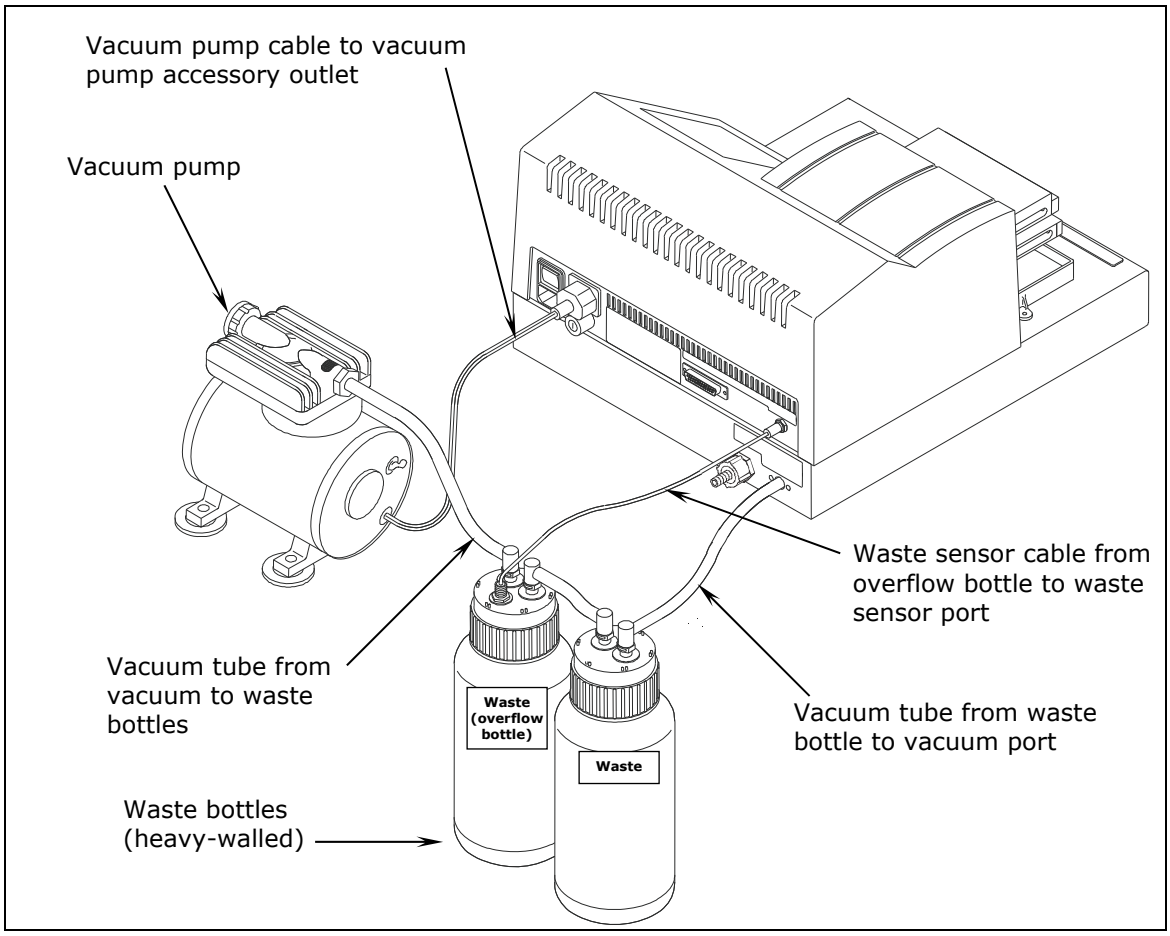


Figure 5: Washer with Vacuum Pump and Waste Tubing Connections

Install the Vacuum Line Filter (Optional)

Installing this inline vacuum pump filter is recommended to prevent fluids or vapors from reaching and damaging the vacuum pump. Install the hydrophobic filter between the overflow waste bottle (with the waste sensor) and the vacuum pump.

1. Cut the tubing approximately 4" to 6"from the vacuum pump end or half way between the waste bottle and the vacuum pump.
2. Note the flow direction arrow on the filter. Point it **toward the vacuum pump** and insert the filter in the tubing.

If the waste bottle overflows, check the filter for trapped fluid. If fluid is found in the filter, remove the filter and drain using the small white nut on the filter. Tighten the white nut and reinstall the filter.

Fluid Supply System with Buffer Switching (valve module)

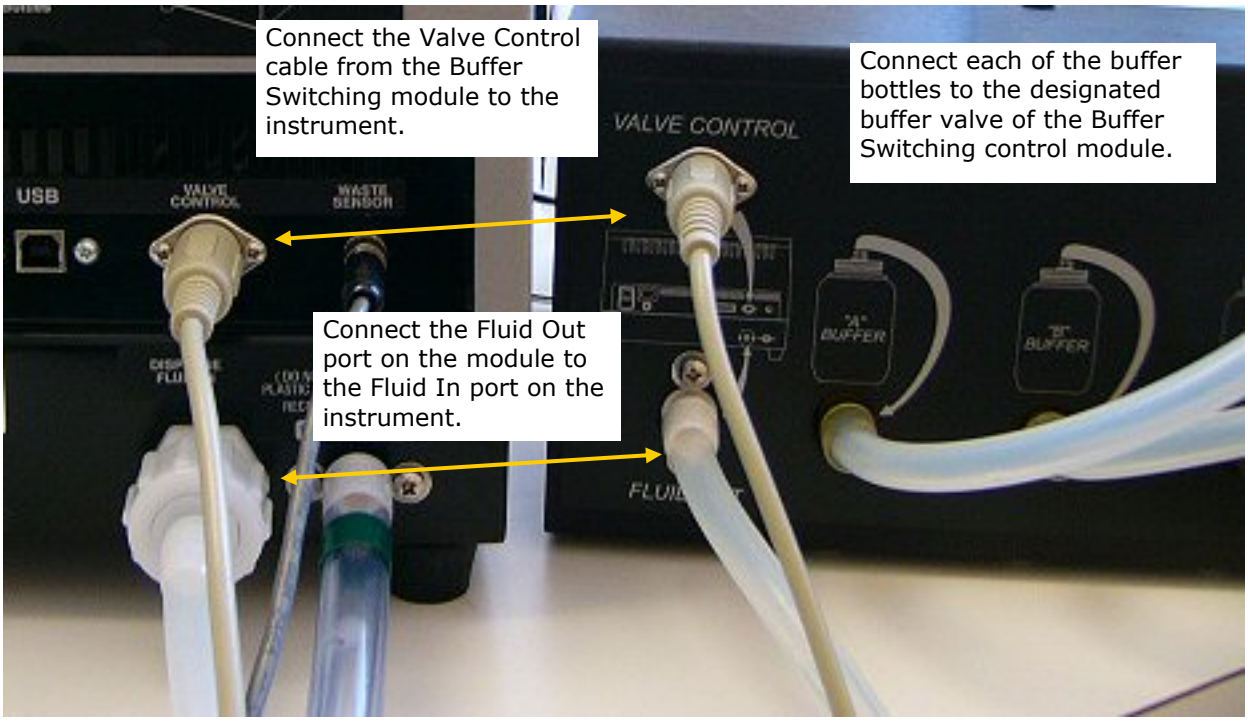


Figure 6: Buffering Switching System

1. Connect the module cable from the round **Valve Control** or **Buffer Switching** port on the module to the corresponding **Valve Control** or **Buffer Switching** port on the back of the instrument.
2. Place the four supply bottles and valve module on the same surface as the instrument to optimize performance.

3. Connect the tubing from one of the supply bottles to "A" Buffer in the valve module.
4. Repeat step 3 with the other three supply bottles for "B," "C," and "D" Buffers.
5. Connect the 6-foot (1.83 Meter) tubing from the valve box **Fluid Out** port to the **Dispense Fluid In** port on the instrument's rear panel. This tubing can be cut to the optimal length required for the installation.

Fluid Supply System (without Buffer Switching module)

1. There is one supply tube. Connect one end to the Dispense Fluid In port and the other end to the supply bottle.
2. Place the supply bottle on the same horizontal plane as the washer.
1. Connect the control module to the instrument.

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. Align the mist shield so the notches sit on the thumbscrews.
3. Finger-tighten the thumbscrews to hold the shield in place.

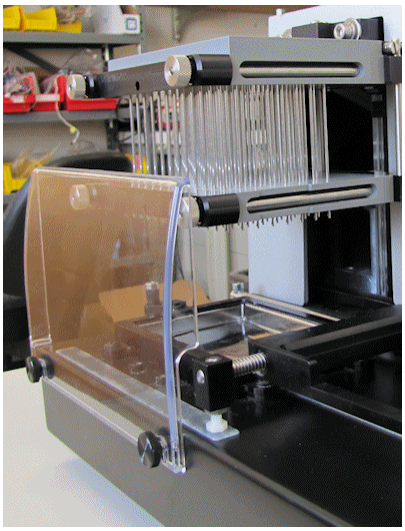


Figure 7: Attaching the Mist Shield

❖ Loosen the thumb screws and lift the mist shield straight up, **not** towards you, to remove it.

Connect the Power Cable

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.

1. Insert the power cable into the power cable socket in the rear panel of the washer.
2. Insert the three-prong plug into an appropriate three-prong receptacle that has a functional ground.

Install the LHC Software/Connect to Computer (Optional)

The ELx405 can be controlled with software for your personal computer (PC): **Liquid Handling Control (LHC) Software**. Please refer to information supplied with the software for installation and setup instructions.

Connect the USB or Serial Cable to the Host Computer

If using the serial cable:

Plug one end into the **RS232** serial port on the rear of the instrument and the other end into an available port on the computer.

If using the USB cable:

- Plug one end into the **USB** port on the rear of the instrument and the other end into an available port on the computer.
- Follow the directions provided on the LHC software flash drive in the "USB Driver" folder to install the necessary drivers and identify the Com Port number.

- ❖ The ELx405's keypad must be displaying its "Main Menu" for the LHC to communicate with it.
- ❖ Controlling the BioStack: Both the washer and the BioStack must be connected to the computer to use the LHC to control them.

Verify Performance

Before using the ELx405 for the first time, verify that it is operating properly.

- When using the LHC, make sure the ELx405 is connected to the PC and both are powered up.
- When running standalone, turn on the ELx405.

Using the keypad:

1. Select **UTIL** > **TESTS**> **SLFCHK**.

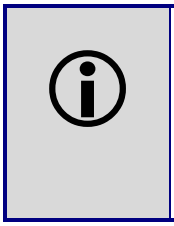
Using the LHC:

1. Click the Name link on the main page and select the ELx405.
2. Define the COM Port used to connect the ELx405 to the computer and 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 ELx405 Settings dialog that opens, specify the Model and Manifold Type that is installed, and click OK.
4. Select **Tools>Instrument Utilities**
5. On the General Settings tab, click the **Reset Instrument** button.

Test results

- **Pass**: a passing message is displayed.
- **Fail**: an error message is displayed. If this happens, note the error code and refer to ***Appendix B***, ***Error Codes*** to determine its cause. If the problem is something you can fix, turn off the instrument, fix the problem, and then turn the washer back on. Otherwise, contact Technical Support.

Chapter 5, Qualification provides recommended Installation and Operational Qualification procedures to be performed after the instrument is installed and set up as described in this chapter, and before the instrument is used in a laboratory environment.



Before operating the washer, review the ***Optimize Performance*** guidelines in ***Chapter 3, Operation***. They include mandatory steps to perform before running the instrument, and other important points to consider when creating or editing washer protocols.

Run 'Prime' and 'Wash' Protocols

To verify installation was completed successfully and there are no leaks in the system, run a prime protocol to remove air from the tubing, and then run a simple wash protocol.

You'll need about one liter of deionized (DI) water and a 96-well flat-bottom microplate (Corning Costar #3590 or similar).

1. Fill the supply bottle (bottle 'D' if Buffer Switching is installed) with approximately one liter of deionized water.
2. Place the microplate on the carrier, with well A1 in the left rear corner.

Using the keypad:

3. Run the **Prime** protocol:
   - From the main menu, select **RUN > PRIME**.
   - Press the **Options** key until **P_DAY_RINSE** appears, and then press the **ENTER** key to select it.
   - Press the **Start** key to run the protocol.
   - When priming is complete, press the **Main Menu** key.
4. Run the **Wash** protocol:
   - From the main menu, select **RUN > WASH**.
   - Select **COSTAR_FLAT** or **192NUNC_384** (HT models) (Press the **Options** key to cycle through the available protocols.)
   - Press **ENTER** to select it and then **Start** to run the protocol.
5. When washing is complete, press **Main Menu**.

Using the LHC:

3. Run the **Prime** protocol:
   - Select **File>Open** and open the **P_DAY_RINSE** protocol.
   - Click the **Run** button.
   - When priming is complete, close the protocol.

4. Run the **Wash** protocol:
   - From the main menu, select **File>Open** and open the **COSTAR_FLAT** or **92NUNC_384** (HT models) protocol.
   - Click the **Run** button.
5. When washing is complete, close the protocol.

Prepare the Washer to Operate with the BioStack

If you purchased the **BioStack Microplate Stacker**, it ships with special alignment hardware for the instruments in an accessory package (**PN 7310010**).

> ❖ Some ELx405 instruments need to be upgraded for BioStack compatibility. Refer to the ***BioStack User Manual*** for upgrade information, or contact BioTek for more information.
>
> ❖ Both the washer and the BioStack must be connected to the computer to use the LHC to control them. Otherwise, use the serial cable to connect the BioStack to the washer.

Install and configure the BioStack:

1. Set up the BioStack according to instructions in the ***BioStack Operator's Manual*** to interact with the ELx405. Connect it to the:
   - Host computer (PC) when using the LHC to control the ELx405.
   - Washer when using the keypad to control the ELx405.
2. Configure the washer to operate with the BioStack:

Using the keypad:

- Press **UTIL > SETUP > MORE**
- Select **BIOSTACK**
- Select **CONF**
- Select **BIOSTACK** when using the keypad to control the washer and the BioStack.

> ❖ Important: Set configuration to MANUAL when using the LHC to control the washer and the BioStack.

3. Align the BioStack's gripper with the ELx405's plate carrier:

Using the keypad:

- Press **UTIL > SETUP > MORE**
- Select **BIOSTK**
- Select **ALIGN**
- Find instructions in the ***BioStack User Manual***.

Using the LHC:

- Select **Tools> BioStack Utilities**.
- Use the **Alignment Utility**.
- Click the **Help** button for detailed instructions.

Repackaging and Shipping

Please read the information provided below before preparing the washer for shipment.

- Contact Technical Support before returning equipment for service.
- Decontamination prior to shipment is required by the U.S. Department of Transportation regulations.
- If the washer has been exposed to potentially hazardous material, decontaminate it to minimize the risk to all who come in contact with the instrument during shipping, handling, and servicing. The Maintenance chapter contains decontamination instructions.
- Ensure the microplate carrier is empty. Spilled fluids can damage the instrument.
- Install the shipping hardware (see next section).
- The instrument's packaging design is subject to change. If the instructions in this document do not apply to the packaging materials you are using, contact Technical Support for guidance.
- Be sure to use packaging materials supplied by the manufacturer. Other forms of commercially available packaging are not recommended and can void the warranty.
- If the packaging materials have been damaged or lost, or if the same set has been used more than four times, order replacements.

Install the Manifold Shipping Bracket

CAUTION **Shipping Hardware.** All shipping hardware must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

1. Run the **PARK** utility to position the manifold for installing the shipping bracket: Using the keypad: select UTIL > SETUP > MORE > **PARK**.
2. Turn the washer off and disconnect the power cord and all tubing.
3. Remove the mist shield and carrier, and set aside for packing. Screw the mist shield mounting screws back into the base.
4. Reinstall the **manifold shipping bracket** by reversing the instructions to remove and store it on page 15.

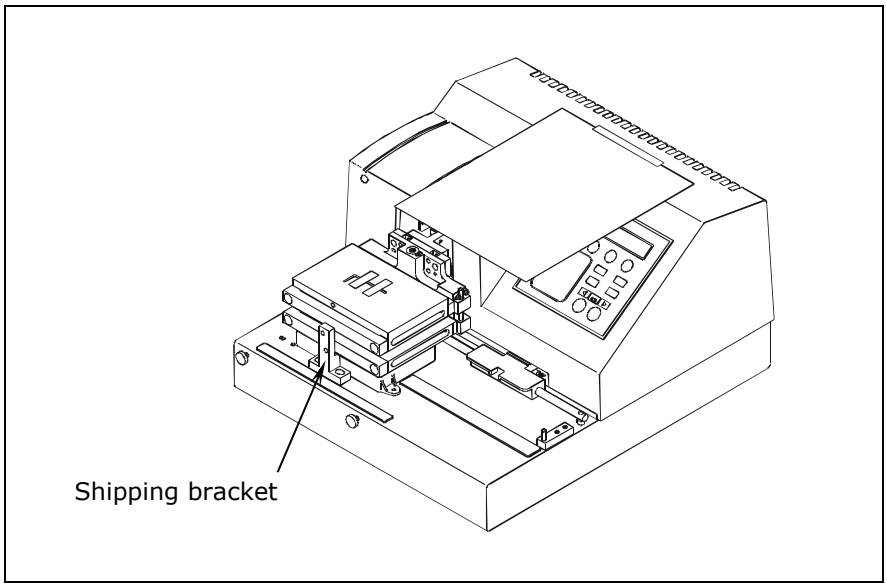


Figure 8: Install the manifold shipping bracket

Repackage the ELx405 and Accessories

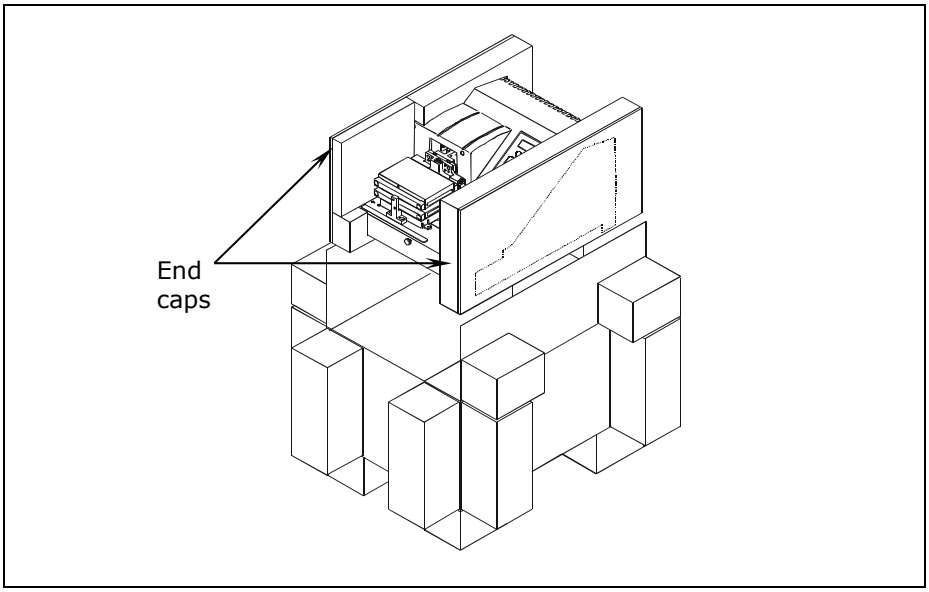


Figure 9: Pack the washer using the end caps

1. Place the washer into the original plastic bag.
2. Place the left and right end caps on the instrument, and lower it into the inner shipping box.
3. Wrap the mist shield in the supplied shipping material and place it into the box.
4. Insert the accessories tray on top of the washer and mist shield, and put the plate carrier, power cords and other accessories in their compartments.

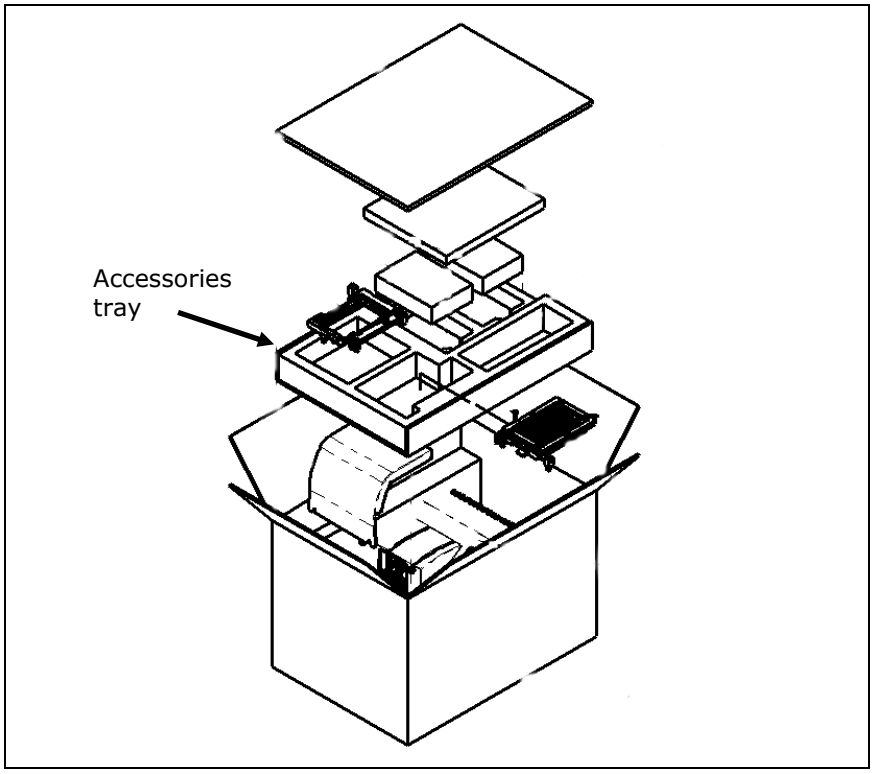


Figure 10: Pack the washer and accessories in inner box

5. Close and seal the inner box, put the foam corner blocks on the inner box and put it inside the outer shipping box. Close and seal the outer box.

Repackage the Buffer Switching Valve Module (if equipped)

1. Place the four supply bottles into the two wire bottle holders and lower them into bottom of the shipping container.
2. Place approximately two inches of foam or bubble wrap between the two wire bottle holders.
3. Wrap the valve module in bubble wrap and place it between the two wire bottle holders upside down as shown in Figure 11.

❖ The fluid ports should be above the wire bottle holder when in the box.

4. Place the remaining accessories inside the box.
5. Fill the remaining space with packing material (no Styrofoam peanuts, please) to secure the contents during shipment.
6. Close and seal the box.

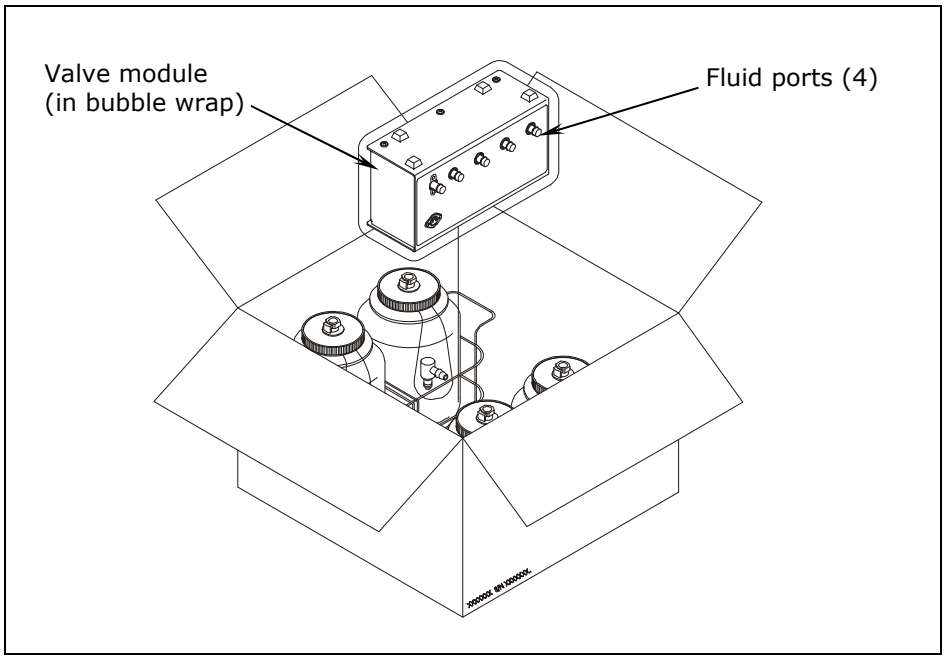


Figure 11: Repacking the Buffer Switching module in its shipping container

Chapter 3

Operation

❖ This chapter provides operating instructions for ELx405 models that are currently available for purchase (see ***Instrument Models*** in chapter 1). This includes references to Deep Well "D" and Select models. This chapter also provides instructions for older ELx405 models that are no longer available for purchase.

Basic Operation

Two ways to control the ELx405

You can control the ELx405 using its built-in keypad or with BioTek's **Liquid Handling Control (LHC)** software.

This section includes a quick introduction of the instrument's keypad, a complete description of keypad functionality is provided later in the chapter.

To use the LHC to control the ELx405, the instrument must be attached to and communicating with your personal computer (PC), and its main menu must be displayed. Basic protocols can be created and modified using the LHC, and then downloaded to the instrument for stand-alone operation.

Using the	Learn about the options:
Keypad	• **Introducing the Keypad** on page 45. • **Creating and Editing Protocols** using the keypad on page 54.
LHC	• Use the LHC Help system: select the **Help** menu or click a **Help** button in a window.

❖ When using the LHC, make sure the required software has been installed and other installation tasks have been completed.

System Startup

To turn on the ELx405, press the on/off switch on the washer's rear panel. The washer will perform a System Self Test, displaying the screens shown below until initialization is complete. During this time, all keys are inactive.

```
POWERUP SEQUENCE Vx.xx
INITIALIZING...
```

```
BIOTEK ELx405
SELF-TEST.....
```

If the Self Test fails, the washer will "beep" and the display will show an error code. Note the error code and then press the **STOP** key to stop the beeping. Refer to ***Appendix A***, ***Troubleshooting*** and ***Appendix B***, ***Error Codes***, to determine its cause. If the problem is something you can fix, turn off the washer, fix the problem, and then turn the washer back on. If the cause is not something you can fix, contact BioTek's Technical Assistance Center (see ***Chapter 1***), for further assistance with troubleshooting.

Optimize Performance

Follow these guidelines to ensure optimal performance and to prevent the problems described in the troubleshooting section, ***Appendix A, Troubleshooting***.

Important! Always fully prime the washer before running a wash or dispense program. Do not rely on **AutoPrime** to pre-prime the ELx405 for a protocol. AutoPrime is designed for maintenance purposes to keep the tubing in a wetted state in between runs.

Always prime the washer with dispense fluid before a run and when finished with the washer, flush the tubing by running a prime or maintenance program. Find guidelines in the Maintenance chapter.

Important! HT models with the **96-tube** manifold: Make sure the washer is configured for operation with the installed manifold (96 or 192). See ***Manifold Selection (MANIFLD)*** on page 94 for instructions. Failure to set the manifold type **before** operating the washer will result in poor performance of the instrument, and may damage the manifold and **void your warranty.**

Before Running the Washer

- Fill the supply bottles with sufficient fluid.
- Cut the end of the supply tube (similar to the drawing) to improve fluid flow. Make sure the tubing extends to the bottom of the supply bottle.

- ***Vacuum Dissipation Delay (VACUUM)*** on page 93.
  - **Standard vacuum pumps** and High Flow vacuum pumps shipped prior to December 2005: Increase the vacuum dissipation delay to prevent the pump from drawing excess current and blowing the fuse: **10** seconds when using 10 liter waste bottles or **20** seconds when using 20 liter bottles.
  - For High Flow vacuum pumps shipped December 2005 and later: The Vacuum Dissipation Delay can be reduced to a 1-second delay, enabling true high throughput processing of large wash runs.
- Empty the waste bottles and firmly seat the waste bottles' fittings. To ensure that fluid does not back up into the vacuum pump during operation, always operate the washer with the waste sensor cable installed and the waste detection sensor activated (refer to ***Sensor System***, page 90). If fluid collects in the overflow bottle, thoroughly rinse the level switch assembly and bottle.
- Check the external tubing connections for kinks and clogs.

- Make sure the bottles, solutions, and tubing are clean and do not contain any particles or mold. Water and dye solutions that are recycled over several days will grow algae, bacteria, molds, or other undesirable organisms.
- If there are large air pockets in the tubing, run a Prime protocol *before* running another program. Use the volumes specified in the ***Recommended Prime and Low Flow Prime Volumes*** on page 64.

> ❖ Do not use AutoPrime to pre-prime the washer. Refer to the section on AutoPrime in Chapter 4 to learn how to use of this feature.

- To avoid creating air bubbles every time the wash or rinse bottle is filled, make a mark halfway down the bottle and refill when the fluid level has dropped to that point. Unscrew the cap and let it hang over the side just enough to avoid emptying the inside tube and enough to refill the bottle.
- When placing a microplate on the carrier, make sure that well A1 is in the left rear corner as you face the front of the washer, and that the plate is firmly seated in the carrier. The microplate spring holds the microplate against the front edge of the carrier in most models.

Maintenance

Proper and regular maintenance is the key to keeping the washer performing its best. Rinse and soak the fluid path, clean and replace components, and decontaminate the washer as described in ***Chapter 4***, ***Maintenance***.

Plate Height Settings

The ELx405 offers several adjustable height parameters, including:

- **Protocol parameters**: Both the Dispense Height and Aspirate Height settings specify the position of the aspirate tubes during the dispense and aspirate steps, respectively. The default setting for dispense height is for overflow washing: excess fluid is removed by the aspirate tubes when the manifold is dispensing. You can customize the heights for normal wash cycles, bottom wash, and crosswise (secondary) aspiration to improve performance. The valid height range is 12 to 255, and up to 405 for deep-well models; at 12 the aspirate tubes are 1.52 mm above the carrier surface.
- **Plate Clearance:** Ensure that sufficient plate clearance is defined when using special washer models like magnetic bead and vacuum filtration, and for plates that are slightly taller than standard plates. For Deep Well (D) models two plate clear height settings are offered, one for standard plates and one deep-well plates/blocks.

Generally, when using standard microplates, the ELx405's default settings and parameters are optimal. But when using taller plates or performing special assays, like magnetic bead, it is often necessary to modify the settings to get the best performance. Always do a trial run using DI water to test your protocol parameters.

Z-axis - Maximum Height

You can modify the height settings to optimize performance, support non-standard plates, and improve throughput. An instrument's maximum height varies by model and is further limited by the plate carrier installed:

Model/Plate Carrier	**Maximum Height** Units (mm)	**Default Plate Clearance** Units (mm)
Auto/standard models	255 (32.39)	130 (16.5)
Select/HT models with standard plate carrier	251 (31.88)	130 (16.5)
with Magnetic Bead carrier	241 (30.61)	148 (18.8)
with Vacuum Filtration carrier	156 (19.81)	148 (18.8)
Deep Well models	405 (51.44)	405 (51.4)

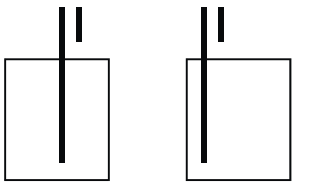
For all newly created protocols, the ELx405 sets the Dispense Height 10 units (1.27 mm) lower than the Plate Clear Height. However, this only applies to new protocols. Best practice is to always increase the plate clearance value when significantly increasing the dispense height.

❖ Older instruments are more restricted; they have a shorter Z-axis. The former maximum height was 180 steps. In addition, due to slight variances in hardware, certain Select models may not support the maximum height shown above. Contact Technical Support with questions.

Improve Evacuation

When a wash protocol leaves too much residual fluid in the wells:

- Aspirate the plate twice during each cycle and for the Final Aspirate by defining Crosswise Aspiration settings.
- When using 96-well plates, change the Horizontal Aspirate Position and Crosswise Horizontal Aspirate Position to best reach all areas of the well. For magnetic bead assays, change the Horizontal Y Aspirate Positions in a similar manner.



Horizontal Aspirate Position 10 **Crosswise Horizontal Position -40**

Use the Adjust Utility to determine the optimal values to use. Especially for square well plates, first address one-side of the well, then address the opposite

side of the well with the Crosswise aspirate. But beware of fluid bridging between the tip and the wall of the well.

❖ When using 384-well plates, adjust the Z-position, Aspirate Height, rather than the X and Y positions, and add one or more extra wash cycles to get better results.

- Decrease the aspirate Travel Rate; for non-cell-based assays do not use a cell wash rate, 6-10.
- Add a Delay to the aspirate step and/or Final Aspirate, e.g. 10 msec.
- Lower the Aspirate Height (Z-axis position): 12, the lowest valid setting, is 1.52 mm above the carrier surface.

Increase Residuals

To retain fluid in the wells:

- Increase the Aspirate Height (Z-axis position) of the Final Aspirate option, (under ASPIR on the keypad).
- Increase the aspirate Travel Rate; cell-based assays use rate 6.

Increase Throughput

For the most high throughput plate processing:

- Lower the Plate Clear Height. Use the Adjust Utility to determine how low the manifold can be positioned and still clear the plate during processing; then add a few steps to be safe.
- **HT models**: use the dual 192-tube manifold to process 384-well plates.
- Set the Aspirate Travel Rate to 5 for non-cell based or 6 for cell-based assays.
- Set the Dispense Flow Rate to 5 (for non-cell-based assays in 96-well plates).
- Follow recommendations below to improve efficiency.

Improve Efficiency/Automate Plate Processing

Take full advantage of BioTek's line of instruments and the ELx405's capabilities to improve efficiency and automate processing:

- Operate the ELx405 with a **BioStack Microplate Stacker** for speedy, walk-away plate processing.
- Create Link protocols that combine dispensing and washing, and other required steps, in one run.
- Use the LHC software in combination with the BioStack to develop multi-step protocols and semi-automated processes.

Deep Well Processing

ELx405 Deep Well "D" models support vessels up to 50 mm tall that have the same 96- or 384-well geometry as standard microplates. Here are some guidelines for performing assays in these deep-well vessels:

- **Plate Type**: You must select the proper plate type when defining a protocol for deep-well plates: 96D or 384D when using the keypad. The Plate Type tells the ELx405 which Plate Clear Height setting to apply (see page 93).
- **Dispense Height**: Be sure to specify the dispense height when creating deep-well protocols. Use the Adjust Utility to determine the optimal setting or measure the height of your vessel and set the dispense height no more than 1 mm higher than the actual height. This will position the aspirate tubes just above the wells during a dispense step. For example, test runs at BioTek resulted in an optimal dispense height setting of 354 (45 mm) for the Corning 96-well storage block.
- **384-Deep-Well Plate**: To speed up processing of 384-well vessels, modify the Deep Plate Clear Height Setting, which by default is set for the tallest deep-well vessels.

  Keypad UTIL → SETUP → MORE → MORE → **PLATE** → PLATE TYPE CATEGORY: DEEP

  LHC **Tools>Instrument Utilities>Configuration Data**

- **Manifold Stop Screw**: **Important!** Remember to insert the additional manifold stop screw (customized to perform with your deep-well vessels as described in Chapter 2, Installation) before processing deep-well plates and remove it before processing standard-size plates.

Additional Recommendations

The ELx405 offers special controls and options designed to improve performance for certain types of assays.

- Reduce background noise/non-specific binding: use the Bottom Wash feature for extra vigorous washing to remove a larger amount of unbound material from the wells, and lower backgrounds.
- Two options for incubating the plate at room temperature (on the washer): add a Soak period to each wash cycle or create a Link protocol that includes Wash and Soak protocols.
- Also find suggestions for these special assays:
  - Cell Wash on page 79.
  - Magnetic Bead Assays on page 82
  - Vacuum Filtration for Filter Plate Assays on page 87.

Introducing the ELx405 Keypad

The ELx405 Microplate Washer features a 25-key keypad and a 2-line x 24-character LCD display. The main menu is shown below.

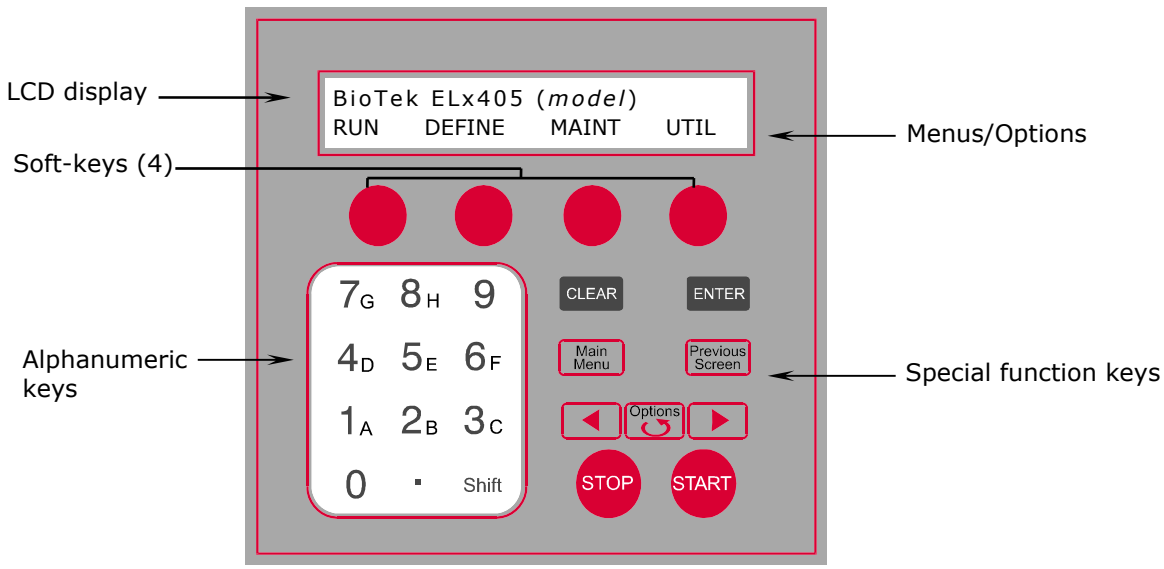
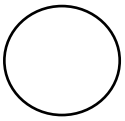


Figure 18: ELx405 Keypad

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.

- **RUN**—to run a previously defined Wash, Prime, Dispense, or Aspirate protocol. Use the **Options** key to select a protocol or enter its number. Review the list of predefined protocols in **Appendix D**.
- **DEFINE**—leads to protocol creation and editing mode, which is described on page 54.
- **MAINT**—to run a maintenance routine. Refer to Chapter 4, Maintenance for a complete description of the recommended procedures to perform.
- **UTIL**— to access the instrument's settings and the settings for the BioStack; to run system tests or the Adjust Utility. Turn to page 79 for details.



The ELx405 keypad has four **Soft-keys**, one below each selectable menu option. Press a Soft-key to choose an option. For example, at the **Main Menu**, press the leftmost Soft-key to select **RUN**, or the rightmost key to select **UTIL**.

CLEAR Press **CLEAR** to delete an entry.	**ENTER** Pressing **ENTER** generally saves the current screen settings and advances to the next screen in a series.
Main Menu Exit the current screen and return to the **Main Menu**. After defining a wash protocol, press the **Main Menu** key, and then YES to save the program.	**Previous Screen** To move to a previous menu, press the **Previous Screen** key.
◄ Press the ◄ (reverse) arrow to move the cursor to the left in the LCD display.	► Press the ► (forward) arrow to move the cursor to the right in the LCD display.

Options

To scroll through the different options within a program, press the **Options** key to move in one direction or the **Shift+Options** key combination to move in the reverse direction. Press the **ENTER** key to select the current option.

To enter a negative value, start at 00 (zero) and press Shift+Options to display the minus sign, then use the number pad to enter the value.

STOP To stop running (abort) a washer program, press the **STOP** key.	**START** To start running a washer program, press the **START** key.

Basic Keypad Tasks

How to name a protocol

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.

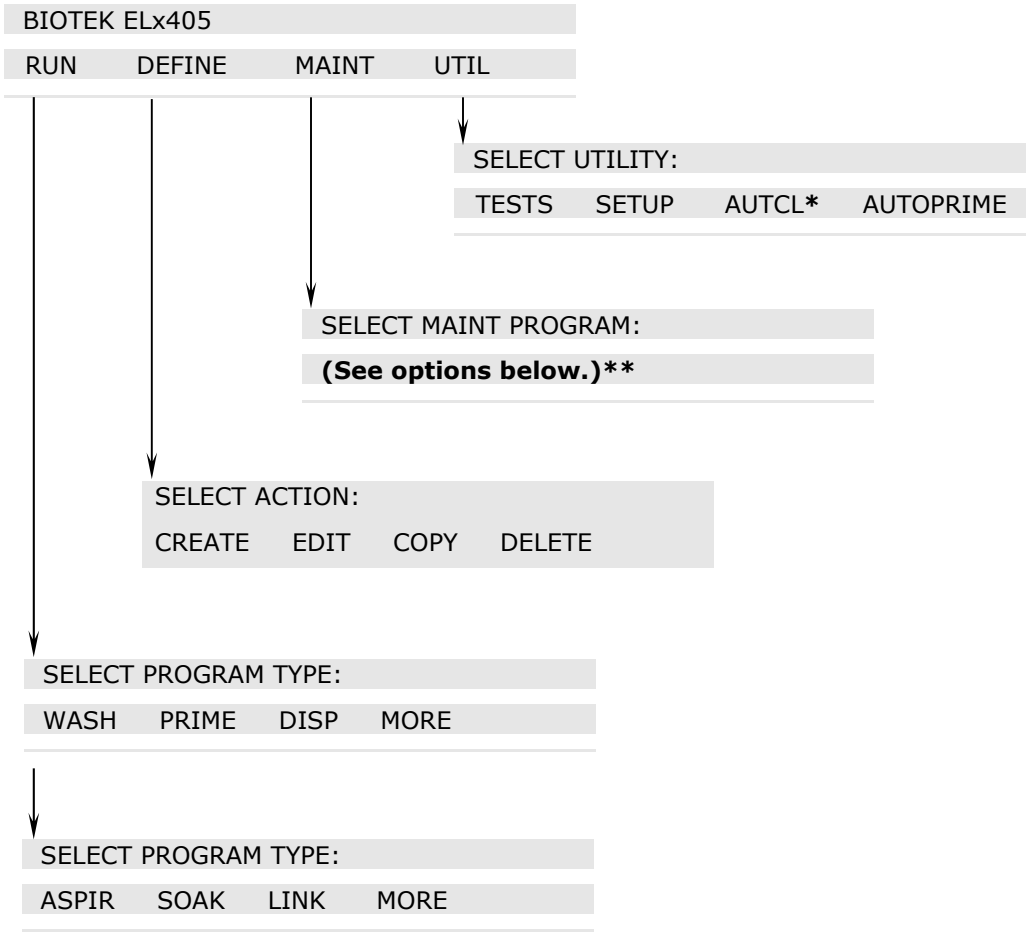
❖ If the program name already exists, an Invalid Protocol Name message displays and you must enter a unique name.

Main Menu

Following successful power-up of the ELx405, the **Main Menu** appears:

```
BIOTEK ELx405
RUN      DEFINE      MAINT      UTIL
```

The following options are available through the Main Menu. (See the ***ELx405 Menu Maps*** beginning on page 96 for a complete listing of menu options.)



* **AUTCL (AUTOCLEAN)** is available only in Ultrasonic Advantage™ models (models with the ultrasonic cleaner).

** **MAINT (MAINTENANCE)** options include: DECONTAMINATION, LONG_SHUTDOWN, OVERNIGHT_LOOP, RINSE_AND_SOAK, and DAY_RINSE.

Protocols

ELx405 microplate processing and certain maintenance routines are accomplished with protocols. Protocols can reside either onboard the instrument and initiated with the keypad or on your computer and controlled with the LHC.

Onboard the instrument, you can define wash, priming, dispense, or aspirate protocols. You can also use the Link feature to create a protocol that combines these processes into one protocol.

Type	Description	Page
WASH	A wash cycle includes at least one dispense and aspirate sequence. Other actions, like final aspirate and shaking the plate can be included in a wash protocol.	49
PRIME	Priming the tubing to remove air bubbles is critically important. Stand-alone priming can be performed in prime protocols and priming steps can also be included in a wash protocol.	64
DISPENSE	Create a dispense protocol to fill wells with a user-specified volume.	69
ASPIRATE	Create an aspirate protocol to evacuate all wells in a microplate.	72
SOAK/SHAKE	Protocols can include steps to delay processing to allow fluid to steep in the wells, and/or to mix fluid in the wells by shaking the plate.	74
LINK	Link up to 10 Wash, Prime, Dispense, Aspirate, and Soak/Shake steps to run sequentially.	77

Detailed instructions for creating and editing protocols using the keypad begin on page 54. To run a previously defined protocol, select **RUN** at the main menu and follow the prompts. See a listing of ready-to-run protocols in ***Appendix D***.

Manifold Illustrations

The figures on the following pages point to areas of the manifolds (such as Dispense Height) that are referenced by the protocols:

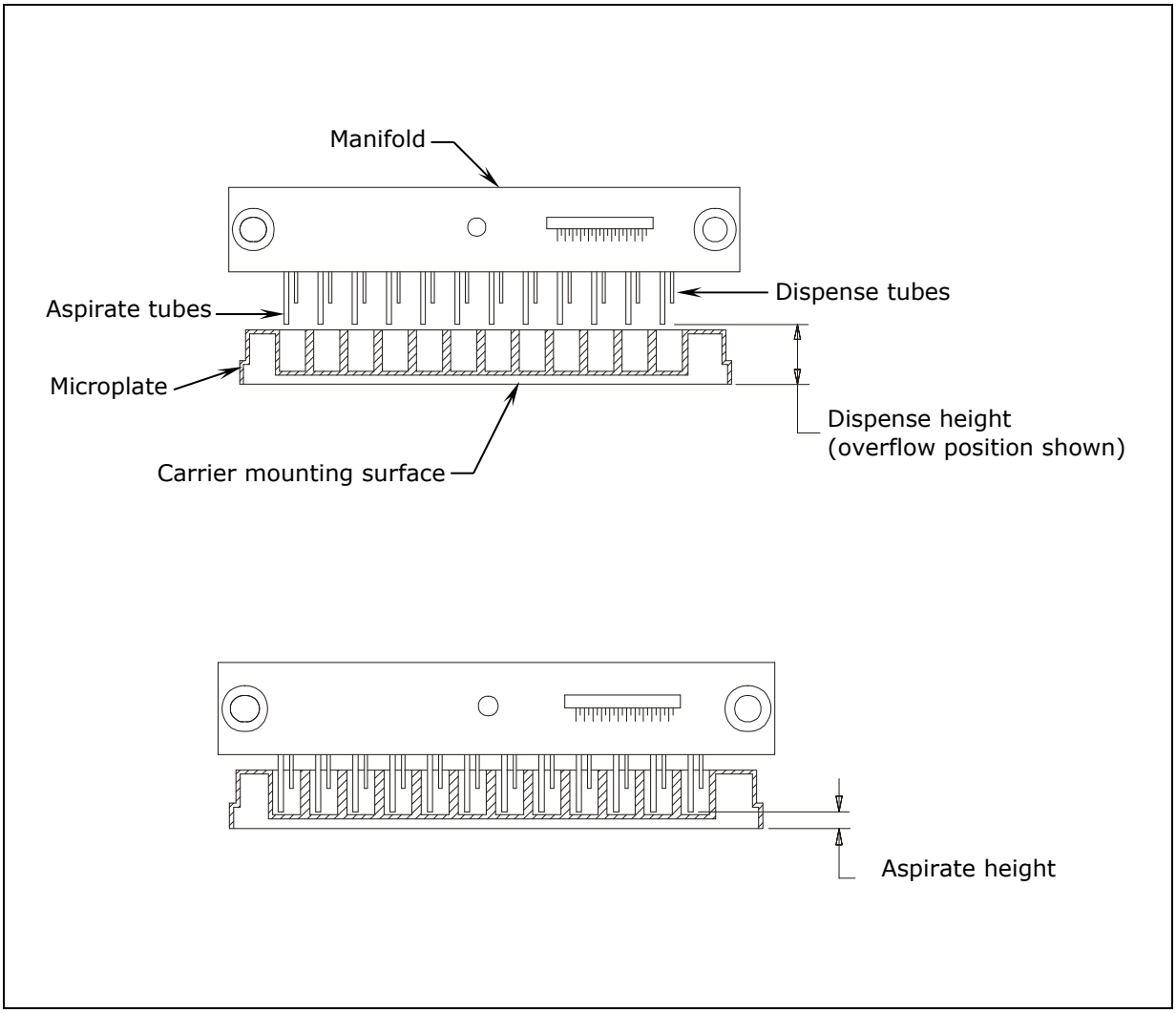


Figure 19: Dispense and Aspirate Heights for the ELx405 Model

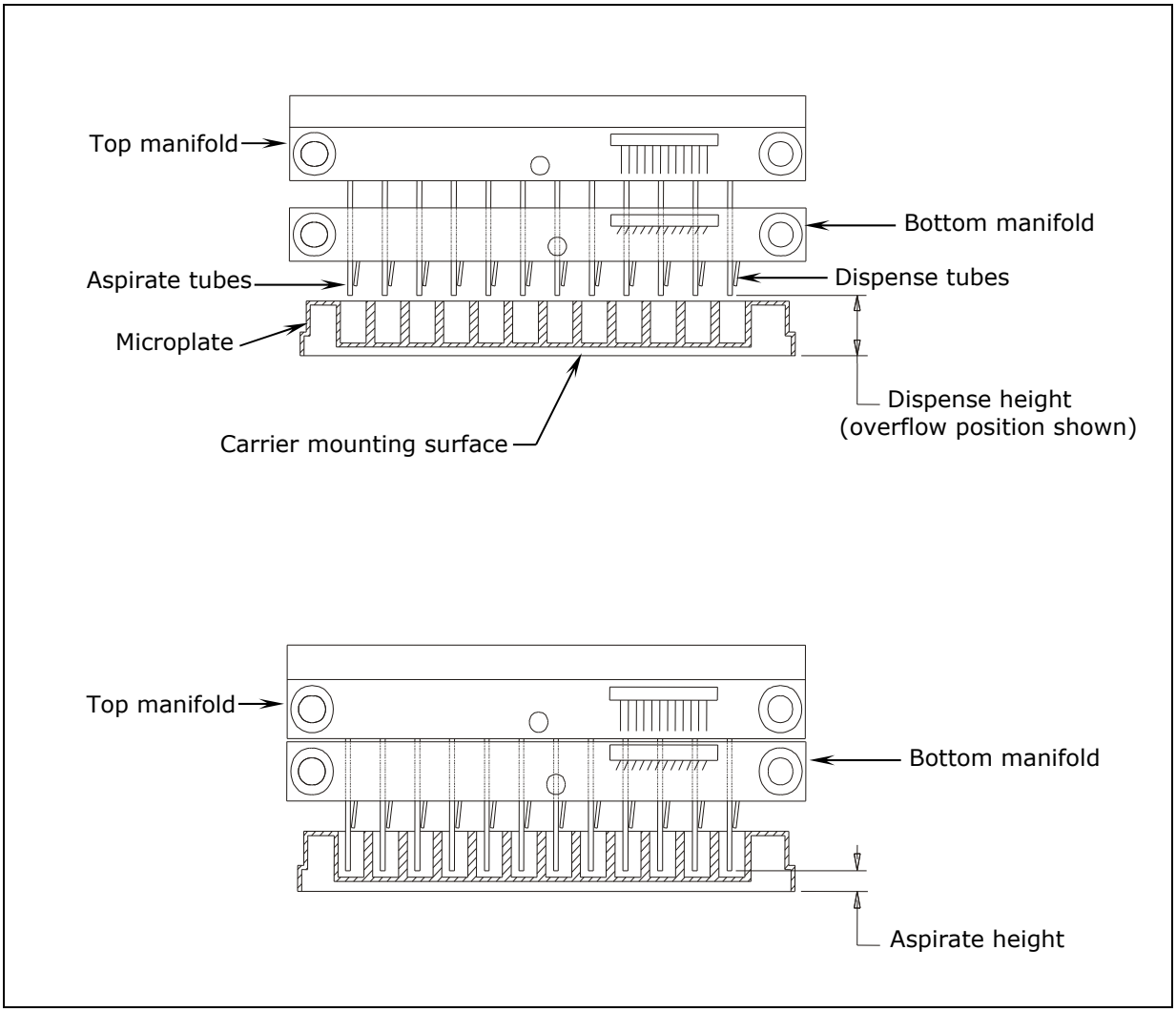


Figure 20: Dispense and Aspirate Heights for the Select, Select CW, and HT2 Models with Dual/96 Manifold

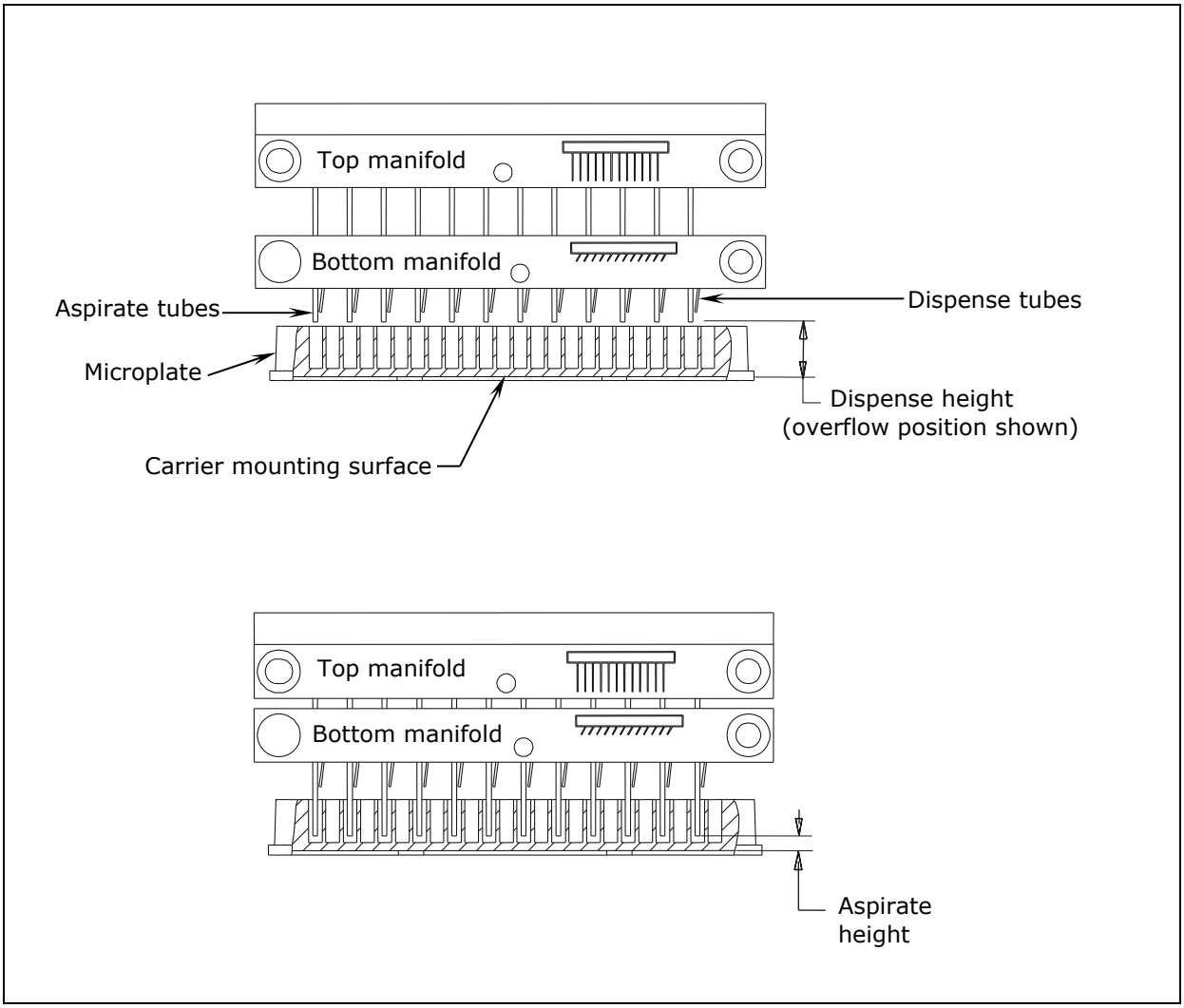


Figure 21: Dispense and Aspirate Heights for the HT Model

Operating with the BioStack

If you purchased the **BioStack Microplate Stacker**, refer to the instructions in your BioStack User Manual for setting up and configuring the washer to operate with it.

LHC Control

- LHC Users: connect both the BioStack and the ELx405 to the computer and control them with the LHC.
- The LHC lets you design protocols that integrate BioStack controls with wash steps.
- In the LHC, select **Help>Tutorials**, click **Sections** in the toolbar for a drop-down menu, select **Controlling the Bio-Stack with the LHC**, and spend a couple minutes with this interactive demo to learn about the BioStack's special features.
- Set the onboard BioStack Configuration to **MANUAL** when using the LHC to control the washer and BioStack.

Keypad Control

- Connect the BioStack directly to the washer to use the keypad to control both instruments.
- The BioStack delivers plates to the ELx405 when you run Wash, Dispense, Aspirate and Link protocols. Prime and Maintenance protocols run without engaging the BioStack; they flush the washer to keep the tubing clean and wetted, not to process plates.
- Use the ***BioStack Utilities (BIOSTACK)*** described on page 92 to access BioStack-specific washer options. Set the **CONF** menu mode to **BIOSTACK** for keypad control.

Wash a Plate

This section shows how to create, edit, copy and delete **Wash** protocols.

Run a Wash Protocol

> **Important!** Before running a wash, comply with the **Optimize Performance** section on page 39. Make sure the microplate is properly seated in the plate carrier.

To run a wash protocol, follow the menu path and respond to prompts:

RUN → WASH → To select a wash protocol, press **Options** or enter its number.

Prime the washer? → If Yes, select the **Prime** protocol. (This is recommended.)

Follow the prompts: Place Plate In Carrier or Connect Reagent Bottle (depending on model) and Press <Start> Key (when you are ready to run the protocol).

When the protocol is completed, you can rerun it or choose another protocol:

Wash program complete. **NEW/REPEAT** (Select New to run a different protocol.)

Create or Edit a Wash Protocol

❖ **Tip:** To quickly create a new wash protocol with some of the same parameters as an existing protocol, **copy** the existing one and then edit parameters as necessary. See Copy a Wash Protocol on page 63.

To create a new or modify an existing wash protocol, select:

DEFINE → CREATE or EDIT → WASH (press Enter to proceed to next screen)

NAME — assign a unique name when creating a new protocol. See page 47.

SELECT REAGENT BOTTLE — when the Buffer Switching module is installed.

PLATE TYPE — depending on model. Choose 96- or 384-well.

DEFINE WASH COMPONENT — Specify the protocol parameters beginning with the **METHOD** to define number of cycles and to Soak/Shake the plate. Then, select **DISP** to define the dispense parameters, including pre-prime and Bottom Wash (extra vigorous washing). Finally, select **ASPIR** to define aspirate parameters: Crosswise Aspiration and a Final Aspiration. Refer to the protocol parameters tables below.

Save the protocol: press the **MAIN MENU** key (at any time) to exit edit mode and follow the prompts to save your work.

Wash Protocol Parameters

METHOD	Models	Action/Comments
Number of Cycles Specify 1 to 10 wash cycles.	All	One wash cycle includes, at minimum, one aspirate and dispense sequence. Other options added to the protocol, like shake and soak, are also performed in each cycle. Pre-prime, when selected, is performed one time before the wash cycles. Bottom Wash adds another cycle to the protocol when enabled. Final Aspirate is done once after all cycles are completed.
Wash Format Specify how to process wells in a 384-well plate.	Select, Select CW, HT/96-tube	Only offered when **Plate Type** is 384. • **Plate Format** performs each cycle on the entire plate before it starts the next cycle. • **Sector Format** performs each cycle to one quarter of the plate before it moves to the next quarter (sector). This option is not compatible with vacuum filtration processing.
Soak/Shake? Enable soaking and/or shaking.	All	Choose **YES** to soak and/or shake the wash buffer in the microwells after the buffer has been dispensed.
Soak Duration Specify the time to steep the wash buffer in the wells before aspiration.	All	The duration range is from 0 to 600 seconds. A soak begins after the wash buffer is dispensed to the wells. In some applications it enhances washing by allowing unbound material to diffuse into the wash buffer. When washing wells in "plate format," define a soak that lasts as long as it takes to process one wash cycle of all wells.
Shake Before Soak? Specify the duration and intensity of shaking.	All	Before beginning the Shake step the manifold and carrier return to their home position.
Shake Duration	All	Valid range = 1 to 600 seconds.
Shake Intensity	All	Range = 1 to 5: 1 = least intense to 5 = most intense.
Prime After Soak?	All	Select **YES** or **NO** to prime the dispense tubes after a soak cycle.
Prime Volume	All	The volume range is 1 to 999 mL.
Prime Flow Rate The rate at which fluid is pumped into the tubes.	All	The flow rate options range from 1 to 9 (1 = Slowest, and 9 = Fastest).
How to save and close a protocol.	All	After wash parameters have been defined, press **Main Menu**, then select **YES** to save the program.

Wash METHOD Defaults and Ranges

Parameter	Units	Default	Range	Models
Number of Cycles		3	1-10	All
Wash Format		Plate	Plate/Sector	Select, Select CW, HT/96-tube
Soak/Shake?		No	No/Yes	All
Soak Duration	seconds	30 sec	0-600	
Shake Before Soak?		No	No/Yes	
Shake Duration	seconds	5	1-600	
Shake Intensity*		3	1-5	
Prime After Soak?		No	No/Yes	
Prime Volume	milliliters	40	1-999	
Prime Flow Rate		7	1-9	

Dispense Protocol Parameters

Option & Description	Models	Action/Comments
Dispense Volume The volume in microliters of fluid to dispense per well in each cycle or step.	ELx405, Select, Select CW, HT/96-tube	The volume range is 50 to 3,000 µL/well.
	HT/192-tube	The volume range is 25 to 3,000 µL/well.
Dispense Flow Rate The rate at which fluid is dispensed from the tubes.	All	For normal dispensing the flow rate options range from 1 to 9, where 1 is slowest and 9 is fastest.
	Select CW	For cell washing the flow rate options are 10 and 11 for gentle washing. Note: when using 384-well plates without surfactant in the wash buffer or plate wells, air bubbles may be trapped in the wells when using the low flow rates. Experimentation is required.
Vacuum on Volume Evacuation begins when the specified volume is dispensed.	Select CW	Delaying aspiration is critical to cellular assays to allow the slower dispense process to finish before removing fluid from the well. This setting turns off the vacuum pump until the specified volume is dispensed. When dispensing small volumes, make the vacuum-on volume equal to your dispense volume. Refer also to application notes on the BioTek website for more information (www.biotek.com).

Option & Description	Models	Action/Comments
Dispense Height (Overflow Position) The height between the bottom of the aspirate tubes and the carrier surface on which the plate rests during the dispense part of a wash cycle. The dispense tubes are shorter than the aspirate tubes.	All	Height options vary depending on model. See Z-axis – Maximum Height on page 40 to learn more. Note: When dispensing volumes greater than the well capacity, set a dispense height that positions the aspirate tubes at the top of wells to draw off any overflow. To visually determine the best offset parameters for a microplate or assay, use the Adjust Utility.
Horizontal Dispense Position The left and right (X-axis) position of the dispense tubes when the carrier is beneath the manifold.	ELx405	The range is –30 to 30.
	Select, Select CW, HT2	The range is –45 to 45 with 96-well plates.
	Select/ CW, HT	The range is –25 to 25 with 384-well plates.
	A negative offset positions the dispense tubes toward the left side of the well. A positive value positions the dispense tubes toward the right side of the well. The default setting of 0 indicates no offset. Note: A negative offset is recommended for "gentle washing," e.g. cell-based assays, to aim the fluid jet at the sides of the wells to reduce turbulence. To visually determine the best settings, use the Adjust Utility.	
Horiz Y Dispense Position The carrier Y axis position (front/back movement) to align the wells with the manifold tubes during a dispense.	Select, Select CW, HT2	The range is –20 to 20 with 96-well plates.
	Select/CW, HT	The range is –10 to 20 with 384-well plates.
	A **negative** offset positions the dispense tubes toward the front side of the well. A **positive** offset positions the dispense tubes away from the front side of the well. A setting of 0 indicates no offset.	
Disable Aspirate? This option turns off the aspirate manifold during the dispense step to prevent bead loss.	Vacuum filtration	Yes or No to disable the aspirate manifold during a dispense. Select Yes for filter plate assays.

Bottom Wash Options (for extra vigorous washing)		
Bottom Wash First? Bottom washing adds an initial aspirate-dispense sequence to the specified number of wash cycles. This option is intended to help lower backgrounds or remove more unbound material from the wells.	All	Specify bottom wash parameters to position the manifold deep in the well. For example, set the Bottom Disp Height to between 30-50 steps. Reagent is dispensed and aspirated simultaneously at this height to create cleaning turbulence. The plate is aspirated again and the process ends with a final dispense to fill the wells. In Vacuum Filtration models, when the aspirate step is defined as VAC, this method is used for the Bottom Wash, too.
Bottom Disp Volume	All	150-400 µL/well is typical
Bottom Flow Rate	All	1 - 9
Bottom Disp Height	All	30-50 steps is recommended
Bottom Horiz Pos	All	Same as Horizontal Position – X-axis.
Bottom Horiz Y Pos	All	Same as Horizontal Y Position.
Prime Before Start?	All	Select **YES** or **NO**.
Note: The shaded options above are not available for Dispense-only programs.		

DISPENSE Default Values and Ranges

Parameter	Units	Default	Range	Models
Dispense Volume (In a Dispense-only protocol, the default volume is 250.)	µL/well	300	50-3000	ELx405, Select, Select CW, HT/96-tube; Except Vacuum Filtration: 50 - 350
			25-3000	HT/192-tube; Except Vacuum Filtration: 25 - 350
Dispense Flow Rate		5	1-9	All
			CW flow rates 10-11	Select CW
Vacuum on Volume Only in the Select CW with rates 10 or 11.	µL/well	10	50-3000	Select CW
Dispense Height	See note below.	120	12 to 255 12 to 405	All Deep Well models

Notes:

- **Dispense Flow Rate - Select CW**: Flow rates 10 and 11 **are not** recommended for 384-well plates when the assay does not include surfactant of some variety.
- **Dispense Height**: The keypad shows the corresponding measurement in mm. Although the range is 12-255, the recommended highest value for some instruments is **175**, except deep-well models which extend the height to **405**.
- **Negative values**: To enter a negative value, start at 00 (zero) and press Shift+Options to display the minus sign, then use the number pad to enter the value.

Parameter	Units	Default	Range	Models
Horizontal Dispense Position	quarter steps	0	-30 to 30	ELx405
			-45 to 45 with 96-well plates	Select, Select CW, HT/96-tube
			-25 to 25 with 384-well plates	Select, Select CW, HT/96-tube HT/192-tube
Horizontal Y Dispense Position (Select, Select CW, HT only)	quarter steps	0	-20 to 20 with 96-well plates	Select, Select CW HT/96-tube
			-10 to 20 with 384-well plates	Select, Select CW HT/96-tube HT/192-tube
Bottom Wash First?		No	No/Yes	All
Bottom Dispense Volume	µL/well	300	50-3000	
Bottom Flow Rate		5	1-9	
Bottom Dispense Height		60	12-255 12-405 DW	

Notes:

- The shaded options above are **not** available for Dispense-only programs.
- **Horizontal Dispense Position** and **Horizontal Y Dispense Position**: For higher throughput using the HT with 384-well plates use the 192-tube manifold.

ASPIRATE (ASPIR) Parameters

Option & Description	Models	Action/Comments
Top or **VAC** Select the aspiration option to use for these special models.	Vacuum Filtration only	Select **Top** to use the standard aspirate manifold, or **VAC** to use vacuum filtration to process filter bottom plates. Specify a time period when using vacuum filtration.
Aspirate Height The height between the bottom of the aspirate tubes and the carrier surface when aspirating. The aspirate tubes are longer than the dispense tubes.	All	Height options vary depending on model. See Z-axis – Maximum Height on page 40 to learn more. The aspirate tubes must not touch the well bottoms. Use the Adjust Utility to determine when the aspirate tubes hit the bottom of the well, and choose a setting 2 to 4 steps higher in your wash protocol.
Horizontal Aspirate Positon The left and right (X-axis) position of the aspirate tubes when the carrier is beneath the manifold.	ELx405	The range is -30 to 30.
	Select, Select CW, HT2	The range is -55 to 55 with 96-well plates.
	Select, Select CW, HT	The range –25 to 25 with 384-well plates.
	A negative offset positions the aspirate tubes toward the left side of the well. A positive offset positions the tubes toward the right side of the well. The default setting of 0 indicates no offset. For best results position the aspirate tubes close to the sides of a flat-bottom well, and in the center of a round-bottom well.	
Horiz Y Aspr Pos Horizontal Y Aspirate Position represents the carrier y-axis position that aligns the microplate wells with the manifold tubes during aspiration.	Select, Select CW, HT2	The range is –55 to 55 with 96-well plates.
	Select, Select CW, HT	The range is –10 to 20 with 384-well plates.
	The washer shows the corresponding measurement in millimeters for each option. A negative offset positions the aspirate tubes toward the front side of the well. A positive offset positions the aspirate tubes away from the front side of the well. A setting of 0 indicates no offset.	

Option & Description	Models	Action/Comments
Aspirate Rate The rate at which the washer manifold travels down into the microwells while aspirating fluid.	All	The selection range is 1 to 10. When a rate is chosen, its corresponding mm/second value is displayed. The optimal rate depends on the type of assay being performed.
	The optimal rate depends on the type of assay. For most assays (non cell-based), a rate from 1 to 5, where 1 is slowest and 5 is fastest, is recommended. With these rates, the tubes slow their descent as they approach the defined Aspirate Height. For delicate, cell-based assays, rates 6 to 10 are designed to minimize turbulence in the wells. With these rates the tubes descend at a constant rate to the defined Aspirate Height. Rate 6 causes the least disturbance to the wells and is the fastest. Then, rates 7 to 10 increase from slowest to fastest. Viscous fluids may be more effectively aspirated using a slower rate.	
Aspirate Delay The time that aspirate tubes remain at the defined aspirate height.	All	The Aspirate Delay range is 0 to 5000 milliseconds. The delay applies to the normal (initial) aspiration when crosswise aspiration is disabled. If Crosswise Aspiration is enabled, the delay applies to the crosswise, not the normal initial, aspiration.
VAC Filtration Time	Vacuum Filtration	The range is 5-999 seconds. The default setting of 30 seconds. Experimentation is recommended to determine the optimal setting for your assays.
Crosswise (Secondary) Aspiration Performs a secondary or cross-wise aspiration during every cycle or only during the final aspiration. Crosswise aspiration is only recommended for flat-bottom plates. Lower residuals can often be achieved without crosswise aspiration by setting the horizontal aspiration position correctly.	All	Crosswise aspiration is a two-step aspiration, sometimes called secondary aspiration. The wells are first aspirated at the Horizontal Aspirate Position. The tubes rise, move to the Crosswise Horizontal Position and do a second aspiration.
	The purpose of crosswise aspiration is to eliminate residual sample or reagent from the wall perimeter. If the buffer is water without any wetting agent (such as Tween® 20), crosswise aspiration might aid in reducing higher than desired residual.	
Crosswise On Specify when to perform Crosswise Aspiration.	All	Select **ALL** to perform crosswise aspiration for every cycle and at the end, or **FINAL** to perform the crosswise on just the final aspiration. Make sure Final Aspirate is specified in the protocol to perform a secondary final aspiration.
Crosswise Height Same as Aspirate Height.	All	Positions the manifold for the Crosswise Aspiration.
Crosswise Horiz Pos Same as Horizontal Aspirate Position.	All	The recommended range is +10 to +35.

Option & Description	Models	Action/Comments
Crosswise Horiz Y Pos Same as Horizontal Y Aspirate Position.	Select, Select CW, HT	The range depends on the plate type.
Final Aspirate? Perform a final aspiration of the wells?	All	Select **YES** to designate a final aspiration, leaving the wells empty.
Final Aspir Delay Final Aspiration Delay is the time that the tubes remain at the defined aspiration height.	All	The Final Aspr Delay range is 0 to 5000 milliseconds.

Note: The shaded options above are not available for Aspirate-only programs.

ASPIRATE Default Values and Ranges

Parameter	Units	Default	Range	Models
Aspirate Height	quarter steps	24	12 to 255	ELx405, Select, Select CW, HT
		24	12 to 405	Deep Well
Horizontal Aspirate Position	quarter steps	0	-30 to 30	ELx405
			-55 to 55 for 96-well plates	Select, Select CW, HT/96-tube
			-25 to 25 for 384-well	Select, Select CW, HT/96-tube HT/192-tube
• **Aspirate Height**: Note, the highest value for some models is **175**.				
Horizontal Y Aspirate Position Select, Select CW, HT only	quarter steps	0	-55 to 55 for 96-well plates	Select, Select CW HT/96-tube
			-10 to 20 for 384-well	Select, Select CW, HT/96-tube, HT/192-tube
Aspirate Rate		3	1 to 10	All
Aspirate Delay	milliseconds	0	0-5000	All
VAC Filtration Time	seconds	30	5-999	Vacuum Filtration
Crosswise Aspirate?		No	No/Yes	All
Crosswise On		Final	Final, All	All
Crosswise Height		24	12-255 12-405	All Deep Well

Parameter	Units	Default	Range	Models
Crosswise Horizontal Position	quarter steps	0	-30 to 30	ELx405
			-55 to 55 for 96-well plates	Select, Select CW, HT/96-tube
			-25 to 25 for 384-well plates	Select, Select CW, HT/96-tube HT/192-tube
Crosswise Horizontal Y Position Select, Select CW, HT	quarter steps	0	-55 to 55 for 96-well plates	Select. Select CW, HT/96-tube
			-10 to 20 for 384-well plates	Select, Select CW, HT/96-tube HT/192-tube
Final Aspirate?		Yes	Yes/No	All
Final Aspirate Delay	milliseconds	0	0 to 5000	
• **Negative values**: To enter a negative value, start at 00 (zero) and press Shift+Options to display the minus sign, then use the number pad to enter the value.				

Copy Wash Program

To copy a Wash program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → COPY → SELECT PROGRAM TYPE →
WASH → **SELECT WASH PROGRAM → NAME → OK TO COPY?**

Copy Wash Program Options

Option & Description	Models	Action/Comments
Select Wash Program Select the Wash program you wish to copy.	All	Press the **Options** key to cycle through the available Wash Programs.
Name Enter a unique name for the new Wash program.	All	Use up to 16 alphanumeric characters.
OK To Copy?	All	Select **YES** to copy the program.

Delete Wash Program

To delete a Wash program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
WASH → **SELECT WASH PROGRAM → OK TO DELETE?**

Delete Wash Program Options

Option & Description	Models	Action/Comments
Select Wash Program Select the Wash program you wish to delete.	All	Press the **Options** key to cycle through the available Wash Programs.
OK To Delete?	All	Select **YES** to delete the program.

Prime

This section discusses how to run, define, edit, copy and delete **Prime** programs. (See ***Appendix D**, **Predefined and Onboard Protocols*** for a list of instantly available, ready-to-run protocols.)

Recommended Prime and Low Flow Prime Volumes

The following recommended volumes for priming the washer will yield better than 95% purity, when all the lines are empty or when changing fluids.

Models	Recommended Minimum Prime Volumes	
ELx405, Select, Deep well, HT	**<u>Without</u> the Buffer Switching valve module:**	
	200 mL Prime Volume	When all the lines are empty or when changing fluids.
	With Buffer Switching:	
	400 mL Prime Volume	When all the lines are empty or when changing fluids.
Select CW	**<u>Without</u> Buffer Switching:**	
	200 mL Prime Volume 150 mL Low Flow Prime Volume	When all the lines are empty.
	300 mL Prime Volume 200 mL Low Flow Prime Volume	When changing fluids.

Models	Recommended Minimum Prime Volumes	
	With Buffer Switching:	
	400 mL Prime Volume 300 mL Low Flow Prime Volume	When all the lines are empty.
	600 mL Prime Volume 400 mL Low Flow Prime Volume	When changing fluids.

Dead Volume

The recommended prime volumes are based on the ELx405's dead volume:

Model or Component	Dead Volume in mL
ELx405 – standard	111
ELx405 with Buffer Switching	140
Manifold	24
Internal tubing	19
Fluid supply tubing (72")	58
Tubing inside bottle (13")	10
Buffer Switching internal tubing	10
Buffer Switching external tubing	19

Run Prime Program

To run a Prime program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

RUN → SELECT PROGRAM TYPE → PRIME → **SELECT PRIME PROGRAM →**
CONNECT REAGENT BOTTLE AND PRESS <START> KEY →
PRIME PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →
PRIME PROGRAM COMPLETE. **NEW REPEAT**

Run Prime Program Options

Option & Description	Models	Action/Comments
Select Prime Program Select a Prime program to run.	All	Press the **Options** key to cycle through the available Prime programs.
New/Repeat Action to take after program is complete.	All	Select **NEW** to start a new program or **REPEAT** to repeat the last one. Press **Main Menu** key to return to the Main Menu.

Define Prime Program

To define a Prime program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → CREATE → SELECT PROGRAM TYPE →
PRIME → **SELECT REAGENT BOTTLE → NAME → PRIME VOLUME →**
LOW FLOW PRIME VOLUME → PRIME FLOW RATE →
SOAK AFTER PRIME? → SOAK DURATION → OK TO SAVE PROGRAM?

The following options appear only on the specified models:

- **SELECT REAGENT BOTTLE:** Washers equipped with Buffer Switching (excludes earlier models of the Select CW).
- **LOW FLOW PRIME VOLUME:** Select CW model.

Define Prime Program Options

Option & Description	Models	Action/Comments
Select Reagent Bottle Select the supply source for this program.	All	Select bottle **A**, **B**, **C** or **D**. Only appears if the washer is equipped with Buffer Switching.
Name Enter a unique name for the Prime program.	All	Use up to 16 alphanumeric characters.
Prime Volume The volume of the buffer or rinse used to prime the dispense.	All	The volume range is 1 to 999 mL. (See ***Recommended Prime and Low Flow Prime Volumes*** on page 64.)
Low Flow Prime Volume Only appears on the Select CW model, which is equipped with additional, low flow tubing.	Select CW	Specify the volume, in milliliters, of the solution used to prime the dispense tubes. The volume range is from 1 to 999 mL. **Note:** The program uses flow rate 10 (not editable by the user).
Prime Flow Rate The rate at which the priming fluid is pumped into the dispense tubes.	All	The flow rate options range from 1 to 9, where 1 = Slowest, 9 = Fastest.

Option & Description	Models	Action/Comments
Soak after Prime? Soak the manifold tubes after they have been primed?	All	Select **YES** or **NO**. After the dispense tubes have been primed, the soak solution is dispensed into the priming trough. The vacuum pump is turned off and the tubes are lowered into the trough to soak. After the specified Soak Duration, the vacuum pump is turned on and the trough is aspirated.
Soak Duration Represents the time to allow the dispense and aspirate tubes to be soaked in wash buffer, rinse, or disinfectant.	All	The range is from 1 minute to 18 hours.

PRIME Program Defaults and Ranges

Parameter	Units	Default	Range	Models
Parameter	milliliters	40	1-999	All
Low Flow Prime Volume	milliliters	0	1-999	Select CW (For the low flow tubing)
Prime Flow Rate		7	1-9	All
Soak After Prime?		No	No/Yes	
Soak Duration	HH:MM	00:01	1 minute to 18 hours	

Edit Prime Program

To modify a Prime program, follow the menu path shown below. Some of these items are options and some are prompts.

DEFINE → SELECT ACTION → EDIT → SELECT PROGRAM TYPE → PRIME →
SELECT PRIME PROGRAM → **SELECT REAGENT BOTTLE** →
"Edit program parameters"→ MAIN MENU KEY → OK TO SAVE PROGRAM?

SELECT REAGENT BOTTLE only appears if the washer is equipped with Buffer Switching.

Copy Prime Program

To copy a Prime program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → COPY → SELECT PROGRAM TYPE →
PRIME → **SELECT PRIME PROGRAM → NAME → OK TO COPY?**

Copy Prime Program Options

Option & Description	Models	Action/Comments
Select Prime Program Select the Prime program you wish to copy.	All	Press the **Options** key to cycle through the available Prime programs.
Name Enter a unique name for the new Prime program.	All	Use up to 16 alphanumeric characters.

Delete Prime Program

To delete a Prime program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
PRIME → **SELECT PRIME PROGRAM → OK TO DELETE?**

Delete Prime Program Options

Option & Description	Models	Action/Comments
Select Prime Program Select the Prime program you wish to delete.	All	Press the **Options** key to cycle through the available Prime programs.
OK To Delete?	All	Select **YES** to delete the program.

Prime Program: Prime_200

The predefined prime program **Prime_200** (included in all ELx405 models) cannot be edited like the other prime programs. This program is very convenient to use when 200 mL is the recommended Prime Volume (see ***Recommended Prime and Low Flow Prime Volumes***, page 64). The table below lists the program's default parameters. For washers with buffer switching, the default bottle is A, which can be changed.

❖ The Prime_200 program does **not** prime the Select CW model's Low Flow tubing.

Parameter	Units	Default	Models
Prime Volume	milliliters	200	All
Low Flow Prime Volume	milliliters	0	Select CW
Prime Flow Rate		7	All
Soak After Prime?		No	
Soak Duration		N/A	

Prime Program: Prime_CW

The predefined prime program **Prime_CW** (included in Select CW models only) may be edited. The table below lists the program's default parameters.

Parameter	Units	Default	Models
Prime Volume	milliliters	150	Select CW
Low Flow Prime Volume	milliliters	150	
Prime Flow Rate		7	
Soak After Prime?		No	
Soak Duration	HH:MM	00:01	

Dispense

This section discusses how to run, define, edit, copy and delete **Dispense** programs. (See ***Appendix D***, ***Predefined and Onboard Protocols*** for a list of instantly available, ready-to-run protocols.)

Run Dispense Program

To run a Dispense program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

RUN → SELECT PROGRAM TYPE → DISP → **SELECT DISP PROGRAM** →
PRIME THE WASHER? → NUMBER OF STRIPS →
PLACE PLATE IN CARRIER AND PRESS <START> KEY →
DISPENSE PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →
DISP PROGRAM COMPLETE. **NEW REPEAT**

Run Dispense Program Options

Option & Description	Models	Action/Comments
Select Disp Program Select a Dispense program.	All	Press the **Options** key to cycle through the available Dispense programs.
New/Repeat	All	Select **NEW** to start a new program or **REPEAT** to repeat the last one. Press the **Main Menu** key to return to the main menu.

Define Dispense Program

To define a Dispense program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described below the path.

DEFINE → SELECT ACTION → CREATE → SELECT PROGRAM TYPE →
DISP → NAME → **SELECT REAGENT BOTTLE** → **PLATE TYPE** →
DISPENSE VOLUME → DISPENSE FLOW RATE → **VACUUM ON VOLUME** →
DISPENSE HEIGHT → HORIZONTAL DISP POS → **HORIZ Y DISP POS** →
PRIME BEFORE START? → PRIME VOLUME → PRIME FLOW RATE →
OK TO SAVE PROGRAM?

The following options appear only on specified models:

- **SELECT REAGENT BOTTLE:** Washers equipped with Buffer Switching (an external valve module); (excludes earlier models of the Select CW).
- **PLATE TYPE:** Select, Select CW, and HT models with the accessory 96-tube manifold installed.
- **VACUUM ON VOLUME:** Select CW, if the CW dispense flow rates 10 or 11 were selected.
- **HORIZ Y DISP POS:** Select, HT, and Select CW.

Define Dispense Program Options

See ***Dispense Protocol Parameters*** (page 56) for a complete list of dispense program options. Note that the options in the shaded region are *not* available for Dispense-only programs.

Edit Dispense Program

To modify a Dispense program, follow the menu path shown below. Some of these items are options and some are prompts.

DEFINE → SELECT ACTION → EDIT → SELECT PROGRAM TYPE → DISP →
SELECT DISP PROGRAM → **SELECT REAGENT BOTTLE → PLATE TYPE →**
"Edit program parameters" → MAIN MENU → OK TO SAVE PROGRAM?

The following options appear only on the specified models:

- **SELECT REAGENT BOTTLE:** Washers equipped with Buffer Switching (excludes earlier models of the Select CW).
- **PLATE TYPE** only appears on the Select and Select CW models and HT models with the accessory 96-tube manifold installed.

Copy Dispense Program

To copy a Dispense program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → COPY → SELECT PROGRAM TYPE → DISP →
SELECT DISP PROGRAM → NAME → OK TO COPY?

Copy Dispense Program Options

Option & Description	Models	Action/Comments
Select Dispense Program Select the Dispense program you wish to copy.	All	Press the **Options** key to cycle through the available Dispense programs.
Name Enter a unique name for the new Dispense program.	All	Use up to 16 alphanumeric characters.
OK to Copy?	All	Select **YES** to copy the program.

Delete Dispense Program

To delete a Dispense program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
DISP → SELECT DISP PROGRAM → OK TO DELETE?

Delete Dispense Program Options

Option & Description	Models	Action/Comments
Select Dispense Program Select the Dispense program you wish to delete.	All	Press the **Options** key to cycle through the available Dispense programs.
Delete?	All	Select **YES** to delete the program.

Aspiration

This section discusses how to run, define, edit, copy and delete Aspiration programs. (See ***Appendix D***, ***Predefined and Onboard Protocols*** for a list of instantly available, ready-to-run protocols.)

Run Aspiration Program

To run an Aspiration program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

RUN → SELECT PROGRAM TYPE → MORE → ASPIR →

SELECT ASPIR PROGRAM →

PLACE PLATE IN CARRIER AND PRESS <START> KEY →

ASPIR PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →

ASPIR PROGRAM COMPLETE. **NEW REPEAT**

Run Aspiration Program Options

Option & Description	Models	Action/Comments
Select Aspir Program Select an Aspiration program.	All	Press the **Options** key to cycle through the available Aspiration programs.
New/Repeat	All	Select **NEW** to start a new program or **REPEAT** to repeat the last one.

Define Aspiration Program

To define an Aspiration program, follow the menu path shown below. Some of these items are options and some are prompts.

DEFINE → SELECT ACTION → CREATE → SELECT PROGRAM TYPE → MORE → ASPIR → NAME → **PLATE TYPE** → ASPIRATE HEIGHT → HORIZONTAL ASPR POS → **HORIZ Y ASPR POS** → ASPIRATE RATE → ASPIRATE DELAY → CROSSWISE ASPIR? → CROSSWISE HEIGHT → CROSSWISE HORIZ POS → **CROSS HORIZ Y POS** → OK TO SAVE PROGRAM?

The following options appear only on the specified models:

- **PLATE TYPE:** Select and Select CW models, and HT models with the accessory 96-tube manifold installed.
- **HORIZ Y ASPR POS** and **CROSS HORIZ Y POS:** Select, HT, and Select CW.

Define Aspiration Program Options

See ***ASPIRATE (ASPIR) Parameters*** (page 60) for a complete listing of Aspiration Program Options. Note that options in the shaded region are *not* available for Aspiration-only programs.

Edit Aspiration Program

To modify an Aspiration program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described below:

DEFINE → SELECT ACTION → EDIT → SELECT PROGRAM TYPE → MORE → ASPIR → SELECT ASPIR PROGRAM → **PLATE TYPE** → EDIT PROGRAM → MAIN MENU → OK TO SAVE PROGRAM?

PLATE TYPE only appears on the Select, Select CW, and HT models with the accessory 96-tube manifold installed.

Copy Aspiration Program

To copy an Aspiration program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → COPY → SELECT PROGRAM TYPE → MORE → ASPIR → **SELECT ASPIR PROGRAM → NAME → OK TO COPY?**

Copy Aspiration Program Options

Option & Description	Models	Action/Comments
Select Aspir Program Select the Aspiration program you wish to copy.	All	Press the **Options** key to cycle through the available Aspiration programs.
Name Enter a unique name for the new Aspiration program.	All	Use up to 16 alphanumeric characters.
OK to Copy?	All	Select **YES** to copy the program.

Delete Aspiration Program

To delete an Aspiration program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
MORE → ASPIR → **SELECT ASPIR PROGRAM → OK TO DELETE?**

Delete Aspiration Program Options

Option & Description	Models	Action/Comments
Select Aspir Program Select the Aspiration program you wish to delete.	All	Press the **Options** key to cycle through the available Aspiration programs.
OK to Delete?	All	Select **YES** to delete the program.

Soak

This section discusses how to define, edit, copy and delete **Soak** programs.

- A soak begins after the wash buffer is dispensed to the wells. In some assays, a soak cycle enhances washing by allowing extra reaction time for binding.
- A Soak program cannot run on its own; it must be included in a **Link** program (see page 77).
- Soak *parameters* can also be defined within a Wash program under Method.

Define Soak Program

To define a Soak program, follow the menu path shown below. Some of these items are options and some are prompts.

DEFINE → SELECT ACTION → CREATE → SELECT PROGRAM TYPE →
MORE → SOAK → NAME → SOAK DURATION → SHAKE BEFORE SOAK? →
SHAKE DURATION → SHAKE INTENSITY → OK TO SAVE PROGRAM?

Edit Soak Program

To modify a Soak program, follow the menu path shown below. Some of these items are options and some are prompts.

DEFINE → SELECT ACTION → EDIT → SELECT PROGRAM TYPE →
MORE → SOAK → SELECT SOAK PROGRAM →"Edit the soak parameters" →
OK TO SAVE PROGRAM?

Copy Soak Program

To copy a Soak program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → COPY → SELECT PROGRAM TYPE → MORE →
SOAK → **SELECT SOAK PROGRAM → NAME → OK TO COPY?**

Copy Soak Program Options

Option & Description	Models	Action/Comments
Select Soak Program Select the Soak program you wish to copy.	All	Press the **Options** key to cycle through the available Soak programs.
Name Enter a unique name for the new Soak program.	All	Use up to 16 alphanumeric characters.
OK to Copy?	All	Select **YES** to copy the program.

Delete Soak Program

To delete a Soak program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
MORE → SOAK → **SELECT SOAK PROGRAM → OK TO DELETE?**

Delete Soak Program Options

Option & Description	Models	Action/Comments
Select Soak Program Select the Soak program you wish to delete.	All	Press the **Options** key to cycle through the available Soak programs.
OK to Delete?	All	Select **YES** to delete the program.

Linking Programs

This section discusses how to run, define, and delete **Link** programs.

- Predefined Wash, Prime, Aspirate, Dispense, and Soak programs can be "linked" together and run sequentially and automatically.
- A Link program can contain up to ten Wash/Prime/Aspirate/Dispense/Soak programs, all of which must specify the same plate type (96 or 384).
- The linked program will not ask for a buffer if the external valve hardware is present. Each predefined program, within the linked program, will specify its own buffer.
- Once defined, a Link program can be viewed, run, or deleted; it cannot be edited or copied. The individual programs included in the Link program can be edited.
- Ensure a program/protocol is valid before including it in a Link.

Run Link Program

To run a Link program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

RUN → SELECT PROGRAM TYPE → MORE → LINK →

SELECT LINK PROGRAM →

PLACE PLATE IN CARRIER AND PRESS <START> KEY →

LINK PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →

LINK PROGRAM COMPLETE. **NEW REPEAT**

Run Link Program Options

Option & Description	Models	Action/Comments
Select Link Program Select a Link program.	All	Press the **Options** key to cycle through the available Link programs.
New/Repeat	All	Select **NEW** to start a new program or **REPEAT** to repeat the last one. Press the **Main Menu** key to return to the main menu.

Define Link Program

To define a Link program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → CREATE → SELECT PROGRAM TYPE →
MORE → LINK → **NAME → PLATE TYPE → SELECT LINK 01 TYPE**: →
SELECT LINK 02 TYPE: → **SELECT LINK 03 TYPE**: →(UP TO 10) →
OK TO SAVE PROGRAM?

PLATE TYPE only appears on the Select and Select CW, and HT models with the accessory 96-tube manifold installed.

Define Link Program Options

Option & Description	Models	Action/Comments
Name Enter a unique name for the new Link program.	All	Use up to 16 alphanumeric characters.
Plate Type Specify the microplate type.	Select, Select CW, HT/96-tube	Choose 96 or 384. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
Select Link (n) Type Select each Wash, Prime, Dispense, Aspirate, and/or Soak program to be included in the Link program.	All	Programs will be run in the order in which they are selected. If the **Plate Type** option is presented (see above), then only programs with the selected Plate Type will be accessible for inclusion in the Link program.
Press **Main Menu** to save**.**	All	Select **YES** to save the program.

Delete Link Program

To delete a Link program, follow the menu path shown below. Some of these items are options and some are prompts. The options are described in the table below:

DEFINE → SELECT ACTION → DELETE → SELECT PROGRAM TYPE →
MORE → LINK → **SELECT LINK PROGRAM → OK TO DELETE?**

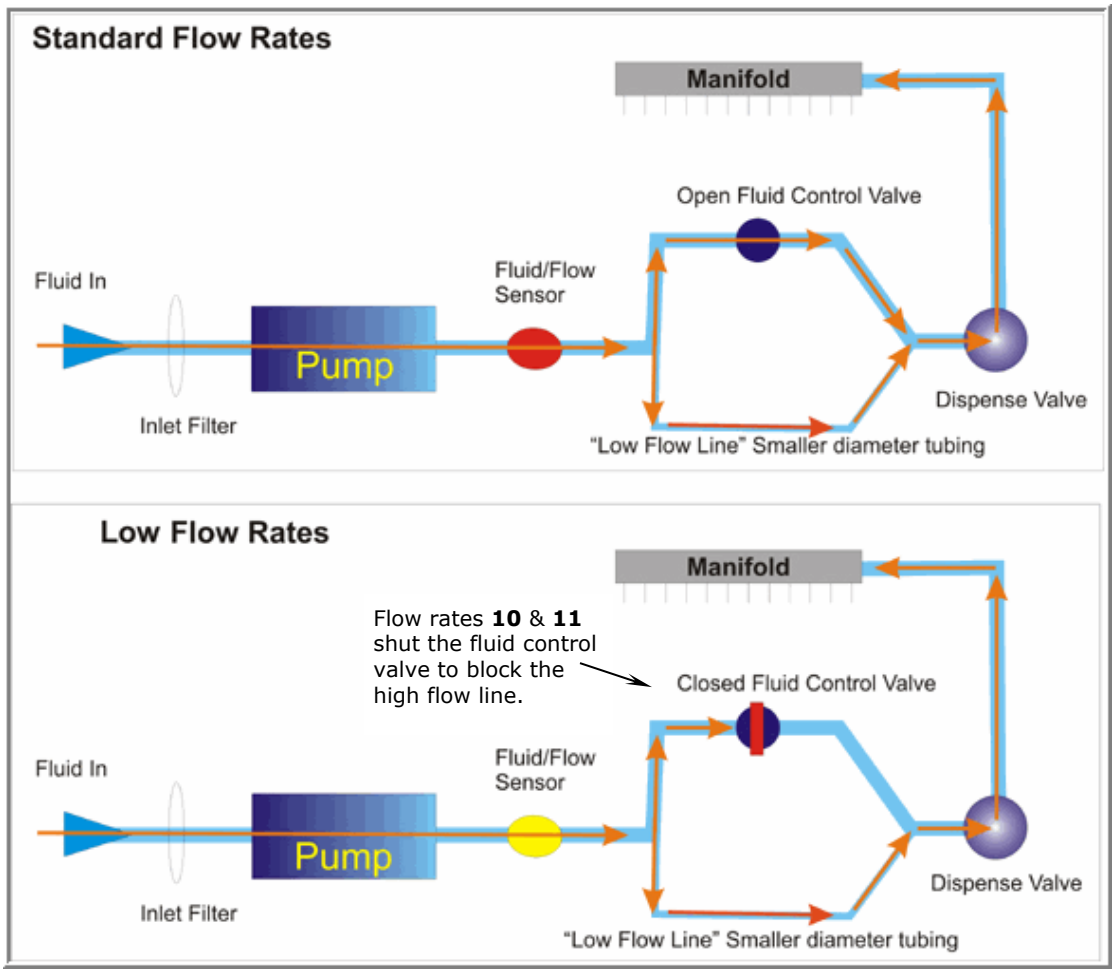
Special Applications

In addition to performing standard ELISA assays, some ELx405 models are designed to perform more specialized applications:

Model	Application	Page
ELx405 Select CW	Cell Wash Assays	See below
ELx405 MB	Magnetic Bead Assays	82
Vacuum Filtration	Filter Plate Assays	87
Deep Well	Processing deep well plates	43

Cell Wash Assays

Cell-based assays require adding and removing buffer solution without disrupting the cells in 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 ELx405 Select CW is equipped with a low-flow fluid path that provides a "cell wash" alternative for cell-based assays.



The low-flow tubing is used during a wash step when the Flow Rate is set to 10 or 11. 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.

For more details read the Application Note, "*Using the ELx405™ Select CW to Wash Loosely Adherent Tissue Culture Cells*" on BioTek's website: www.biotek.com.

Cell Wash Strategies

Delay Aspiration: 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 **Vacuum on Volume** because aspiration is delayed (the vacuum pump is not turned on) until the specified volume is dispensed.

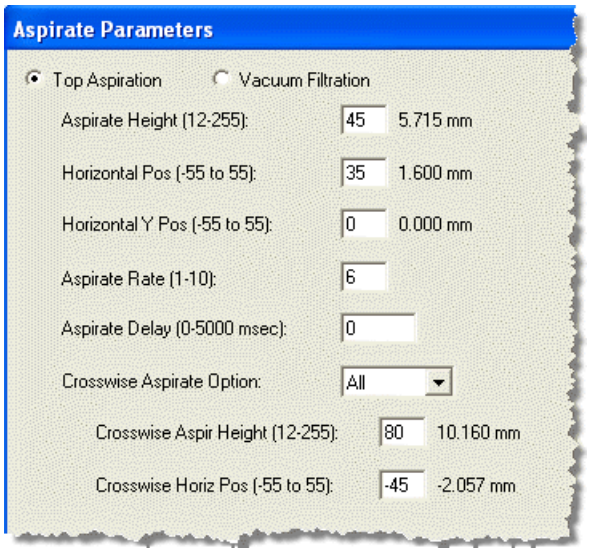
Aspirate Travel Rate and Aspirate Height: when defining the aspirate step select one of the specially designed travel rates that minimize turbulence in the wells: rates 6 – 10. Increase the aspirate height to leave more residual fluid in the wells to protect the cell layer. Also, for 96-well plates, consider using a Crosswise Aspirate or secondary aspiration to further minimize turbulence in the wells. Moving the aspirate tubes from one side of the well to the other prevents a fluid stream from forming and dislodging the cells.

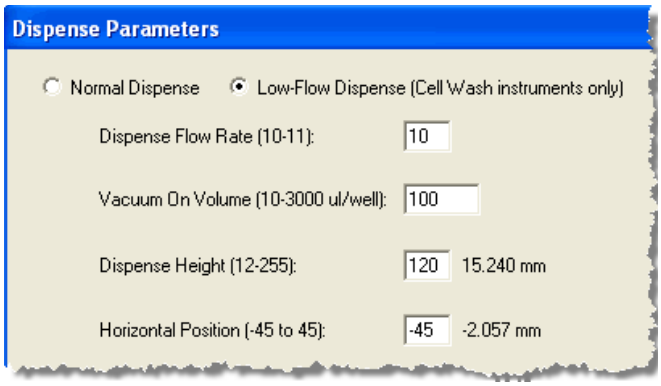
Dispense Flow Rate and Horizontal Position: when defining the dispense step, select one of the special Flow Rates, 10 or 11, to use the low-flow tubing, except when using 384-well plates. Air bubbles may be trapped in the wells with the low flow rates. Especially for 96-well plates, reposition the dispense tubes in the X-axis, Horizontal Pos, to aim the fluid jet at the sides of the wells instead of the center to further minimize turbulence. Experimentation is required.

CW+ Dispense Manifold: As a result of BioTek's continuous improvement effort for liquid handlers, the washer dispense manifold has evolved. The dispense tubes of the improved manifold ensure fluid hits higher on the walls of the well, minimizing damage to the cells, when repositioned as recommended. "CW+ Dispense Manifold" is engraved on the top of these special manifolds to make them easy to recognize. For best performance with this manifold, enable the Washer Setting: CW+ Control described on page 95.

If you do not have one of these manifolds, you may need to experiment with various protocol parameters (described below) to improve the performance of your cellular assays. Contact BioTek to obtain this special cell wash manifold.

Example Parameters: Using a 96-well Corning Costar plate, best results were achieved with these settings. Use these values as a starting point to determine the best settings for your assays:





The manifold dispense tubes are aimed at the sides of the wells with this Horizontal Position.

Sample cell wash parameters for a 96-well Corning Costar plate.

❖ 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.

Create a Cell Wash Protocol

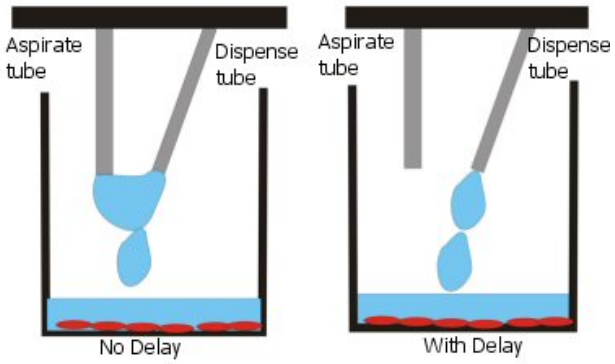
Adjust the volumes recommended in this procedure to meet your specific needs.

Add a **Prime** step, especially when the lines are empty or when changing fluids. Recommended volumes in mL:

	Regular Prime		Changing Fluids	
	Prime	Low Flow	Prime	Low Flow
With Buffer Switching	400	300	600	400
No Buffer Switching	200	150	300	200

Add a **Wash** step and define it as you normally would, except with these special parameters:

- Set the Aspiration **Travel Rate** to **6** (or try rates 7-10 when using highly viscous fluid) and set the **Delay** to **0**. (Consider increasing the height, changing the Horizontal Pos and enabling the Crosswise Aspirate option with the opposite horizontal position setting.)
- Set the Dispense **Flow Rate** to **10** or **11**, except when using 384-well plates, try flow rate **3**. (Change the Horizontal Pos to aim fluid at the side of the wells to reduce turbulence.)
- Set the **Vacuum on Volume** delay until sufficient fluid has been dispensed. For small dispense volumes, BioTek recommends setting the delay volume to equal your dispense volume.



When designing cell wash protocols for 384-well plates, the "Disable Aspiration during Dispense" option may function as a useful substitute for the Vacuum on Volume control, which is only available when using the low-flow rates. Low-flow rates are not recommended for 384-well plates.

Magnetic Bead Assays

The ELx405 Magnetic Bead (MB) model's microplate carrier supports placement of a magnet under the microplate. The design induces magnetic beads to settle at the bottom of the wells and remain fixed throughout a wash protocol's aspirate and dispense cycles. The magnet adapter supports standard microplates and these magnets available for purchase from BioTek:

Plate Type	With	PN
96-well	Dexter 96 Magnet	7103016
	VP 96 Ring Magnet	7102216
384-well	Dexter 384 Magnet	7103017
	VP 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.

Magnets: Warning, Handling, Cleaning

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.

Refer to the product literature supplied with the magnet for Warnings and Cautions.

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.

Installing and Removing the Magnet

To install the magnet in the proper orientation:

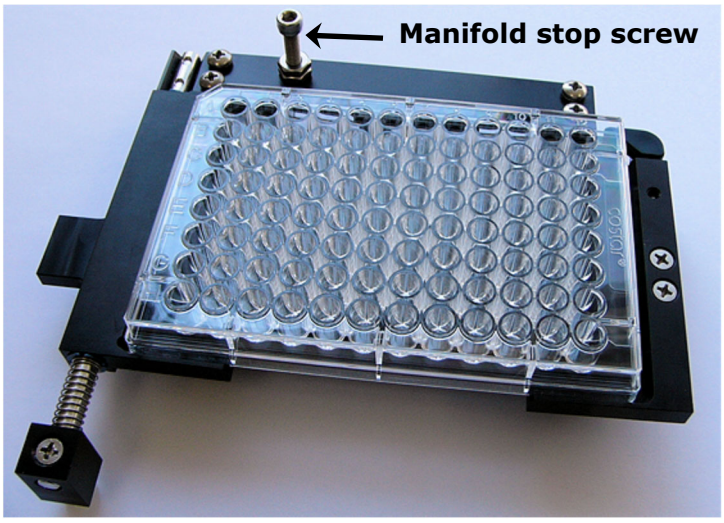
- Dexter magnet: put it inside the plate carrier so that the text on the side of the magnet is readable;
- VP ring magnet: put it inside the plate carrier so that the small round magnets are visible, facing upwards.

Make sure the magnet is level. Verify that the correct magnet (96 or 384) is installed for the plates you plan to use.

To remove the magnet, it is easier and safer to first remove the plate carrier, then, remove the magnet from the carrier.

Considerations when creating Magnetic Bead protocols

- The predefined, onboard protocols (e.g., COSTAR_ROUND, NUNC_FLAT), are designed for use **without** the magnet. Copy a predefined protocol and modify the copy for use with the magnet, if desired.
- When creating protocols for use with a magnet:
  - All models: Adjust the **Dispense Height** and **Aspirate Height**. The default values may position the manifold tubes too low when the magnet is installed. Likewise, if the protocol includes bottom wash and/or crosswise aspiration, adjust the **Bottom Disp Height** and/or **Crosswise Height** parameters. Use the Adjust Utility to determine the best dispense and aspirate heights (and other offsets) when the magnet is installed.
  - Models with the dual/96 or dual/192 manifold: The microplate carrier has a Manifold Stop screw that prevents the bottom manifold from contacting the microplate during aspirate/dispense operations. The Manifold Stop screw that ships with the washer is set for use with a standard-height microplate (14.35 mm tall) without a magnet inserted into the carrier. When using a magnet, the stop screw (in most cases) must be adjusted. For your convenience, a spare screw (supplied) can be preset and switched with the standard height screw when using a magnet in the carrier. Refer to the instruction sheet supplied with your washer's accessories or see Chapter 2, Installation: **Deep Well Models: Install the Manifold Stop Screw**.



- For magnetic bead models of the washer, the **Plate Clearance Height** is set to 148 to accommodate the use of a magnet in the carrier. This results in a slightly longer wash cycle duration when washing plates without a magnet (approximately 10 seconds for 384-well plates and 2 seconds for 96-well plates). If timing is a concern when operating without a magnet, set the clearance height to 130, but it MUST be reset to 148 prior to washing plates with a magnet.

Optimize Protocols for Magnet Bead Assays

Use this information about the magnets to modify wash protocol settings to retain the magnetic beads while evacuating as much unbound material as possible.

VP Magnetic Separators

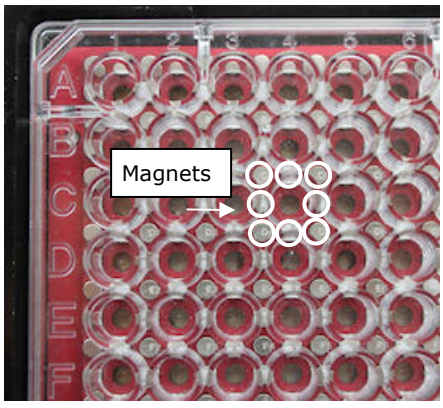
Use this information about the VP magnets to fine-tune wash protocol settings

VP 96 Ring Magnet	7102216
VP 384 Ring Magnet	7102215

VP 96 Ring Magnet PN: 7102216

This magnetic bead separator uses 329 of VP's 48 MGO magnets. The magnets are arranged in a pattern around each well, pulling the magnetic beads to the bottoms and edges of the wells. Every well is circled by 6 magnets.

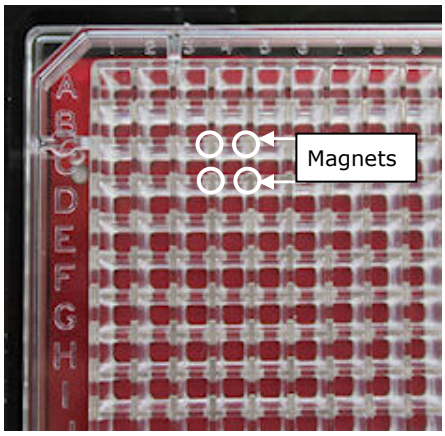
Make sure you are aspirating from the center of the well, which is the default position, when using this magnet.



VP 384 Ring Magnet PN: 7102215

This magnetic bead separator uses 425 of VP's 48 MGO magnets. When you lay an empty plate on top of the magnet you can see the magnets aligned at all the intersections of the wells, pulling the magnetic beads to the bottoms and edges of the wells. Every well is circled by 4 magnets.

Make sure you are aspirating from the center of the well, which is the default position, when using this magnet.



Dexter® LifeSep® Biomagnetic Separators

Use this information about the Dexter magnets to fine-tune wash protocol settings to retain the magnetic beads and to evacuate as much unbound material as possible:

Dexter 96F Magnet	7103016
Dexter 384F Magnet	7103017

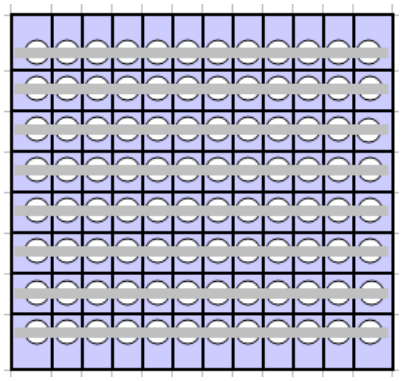
The 96- and 384-well magnets are structured differently. Their force fields traverse the magnet in opposite directions. Magnetic beads in the wells will be drawn to the center. For the best bead retention, reposition the aspirate tubes in the proper axis:

Increase Magnetic Bead Retention

96F LifeSep Biomagnetic Separators (PN 7103016): the magnetic force is distributed in a horizontal pattern, row-wise, across the plate.

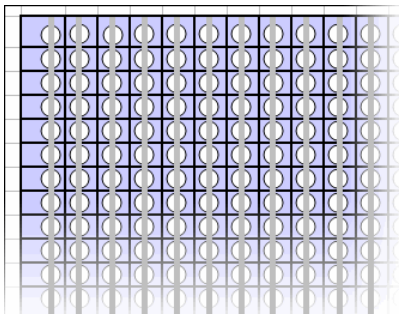
ELx405 Select and HT Mag Bead models: adjust the **Horizontal Y Position** to align the aspirate tubes near the well walls.

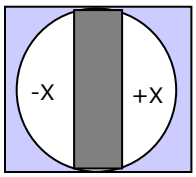
ELx405 MB models: increase the **Aspirate Height**, leaving approx. 30 µL fluid in the wells.



Magnetic beads will be concentrated in the center strip defined by the magnetic force. Increasing the aspirate height to increase the amount of residual in the well may improve performance.

384F LifeSep Biomagnetic Separators (PN 7103017): the magnetic force is distributed in a vertical pattern, column-wise, across the plate. ELx405 Select and HT Mag Bead models: adjust the **Horizontal Position** to align the aspirate tubes away from the center of the well, near the well walls.





Adjust the X-axis to avoid aspirating magnetic beads from the center. Aspirate Height may not need to be changed for most applications.

- Use the **Adjust Utility** to determine the optimal settings to use to best position the aspirate tubes.

- Before running assays on the washer, we recommend testing new protocols using deionized water plus .05% or .1% Tween® 20 with the desired microplate and a magnet installed.
- Especially when using 384-well plates and flow rate 3, consider using the **Disable Aspirate** option when defining the dispense step to prevent the beads being unintentionally aspirated while dispensing.
- Perform the instrument qualification tests (see Chapter 5) without a magnet installed in the carrier.

Considerations when operating the washer with the BioStack

All ELx405 MB models are compatible with the BioStack. During installation and setup, you will align the BioStack's claw/gripper with the washer's microplate carrier. This process ensures that the claw/gripper travels the correct distance to place/pick up plates.

When a magnet is **not** installed in the carrier, the vertical distance the claw/gripper must travel is greater than with a magnet installed. If you initially align the BioStack for use with a magnet in the carrier and then remove the magnet, you must perform the vertical alignment process again (and vice versa).

Instructions for aligning the claw/gripper with the ELx405 plate carrier are provided in the BioStack User Manual. If you are using BioTek's Liquid Handling Control™ (LHC) software, find instructions for using the Instrument Alignment Utility in the LHC help system.

Vacuum Filtration for Filter Plate Assays

ELx405 models with Vacuum Filtration capability can process most standard-size, rigid, filter-bottom microplates. Some initial preparation of the instrument is required, including installing the special plate carrier and vacuum filtration system. Refer to **Chapter 2, Installation** for instructions.

Prerequisite: Set Carrier Selection

After physically changing microplate carriers, from the standard magnetic bead carrier to the vacuum filtration carrier, or vice versa, you must tell the instrument which one is currently installed. Change the instrument setting:

Using the:	
Keypad	1. Select **UTIL → SETUP → MORE → MORE → MORE → CARRIER** 2. Set CARRIER SELECTION to **STD** or **VAC**
LHC	1. Select **Tools>Instrument Utilities** 2. Click **Configuration Data** 3. Select **Standard/Magnetic Bead** or **Vacuum Filtration**

This instrument setting must match the installed plate carrier. The Maintenance programs perform as expected in both configurations.

Recommendations for best performance:

- **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 or Link 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. Review the section below, ***Controlling the Vacuum Level***, and its effect on aspiration duration.
- **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 and bottle caps are clean, connected correctly, and leak-free.

Create a Vacuum Filtration Protocol

1. LHC: Click 
   Keypad: Select **DEFINE>CREATE>WASH**.

- ❖ LHC users may want to begin the protocol with a Soak step. Set the Soak duration to 0, enable Shake and define its duration.
- ❖ Keypad users can create a Link protocol that begins the assay with a Shake. See "How to create a Link protocol" on page 78.

2. Specify the **Dispense** parameters: volume, pre-prime, etc. Be sure to Disable Aspiration. This refers to the manifold's aspirate tubes during the dispense step.
3. Specify **Aspiration** parameters to use **Vacuum Filtration**. Input the duration for the aspiration, which applies to all aspirations performed during the protocol, including Final Aspirate, when enabled.

- ❖ Initially, try shorter aspiration times (e.g. 5 sec); increase the Vacuum Filtration time until suitable aspiration is achieved.

4. Specify **Soak/Shake** parameters to suspend the beads before aspiration:
   LHC: enable **Soak After Dispense?** to activate the control.
   Keypad: select **Method** to **Shake** the plate.
5. When all parameters have been defined, press **Main Menu** (at any time) to save the protocol and exit edit mode.

Controlling the Vacuum Level

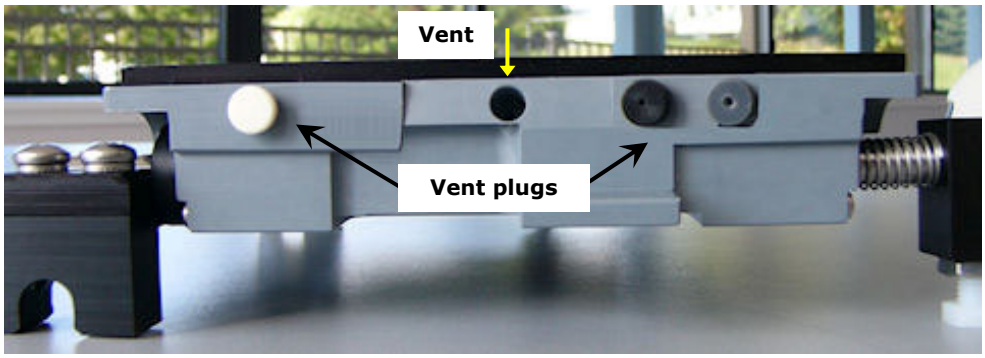


Figure 22: Change the vent plug to control the vacuum level

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

Plug	Vent Diameter	Vacuum Level	Average Pressure	
			(mmHg)	(kPa)
No plug	0.047" (1.19 mm)	Lowest	-120.56	-16.07
Gray	0.032" (0.81 mm)	Low	-215.89	-28.78

Plug	Vent Diameter	Vacuum Level	Average Pressure	
			(mmHg)	(kPa)
Black	0.020 (0.51 mm)	Medium	-361.33	-48.17
Beige	0.00	High	-446.33	-59.51

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.

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. Here are the results of our tests using 25% horse serum to give you a starting point for your experimentation.

Plate and Dispense Volume	Vent Plug	Aspiration Time
Millipore 96-well 0.45µM filter plate; 200 µL/well sample volume	No plug	12.9 sec
	Gray	8.8 sec
	Black	7.1 sec
	Beige	6.4 sec
Millipore 96-well 1.2 µM filter plate; 200 µL/well sample volume	No plug	6.2 sec
	Gray	4.7 sec
	Black	4.6 sec
	Beige	3.9 sec
Millipore 384-well 1.2 µM filter plate; 100 µL/well sample volume	No plug	8.9 sec
	Gray	6.5 sec
	Black	6.0 sec
	Beige	4.7 sec

Maintenance

The most critical factor in keeping the ELx405 in top condition is regular maintenance, which includes frequent rinsing and soaking of the tubing. Be sure to follow the guidelines provided in the ***Maintenance*** chapter.

Clean the Vacuum Filtration Plate Carrier: Use a damp (not soaking wet) cloth to wipe up any spills, especially if the fluid is prone to dry and harden quickly. If necessary, flush it out with warm water by holding it under a running faucet for a few seconds and dry it immediately and completely. Avoid getting water in the transport arm bearings.

❖ **Do not disassemble** or submerge the vacuum filtration plate carrier.

Decontamination Protocol: Run the predefined **Link** protocol for vacuum filtration, **VAC30_TEST**, with a disinfectant as the fluid supply. Conclude the process by running DI water through the system.

Setup Utilities/Configuration

To access the **SETUP** utilities:

Using the:	
Keypad	1. Select **UTIL → SETUP** 2. Select the option or **MORE**.
LHC	1. Select **Tools>Instrument Utilities** 2. Click **Configuration Data**

Note: The Adjust Utility is only available onboard, using the keypad.

RS-232 Settings (RS232)

The **RS232** utility allows the user to change the baud rate or view the fixed RS-232 settings (parity, stop-bits, data-bits). To change the baud rate or view other communication settings, follow the washer menu path below. (The default baud rate for the washer is 9600.)

UTIL → SETUP → **RS232** → SELECT BAUD RATE →

9600 1200 2400 9600 VIEW

Sensor System (SENSOR)

The **SENSOR** feature allows you to activate or deactivate the detection systems on the washer, however, BioTek recommends keeping the sensor detection systems **activated**.

Exception:

- If you wish to run a prime program using air instead of fluid, deactivate the vacuum detection, fluid detection, and flow detection sensors, to avoid getting errors.

To change the status of a detection system, follow the menu path below:

UTIL → SETUP → **SENSOR** → VACUUM DETECTION (YES/NO) →

WASTE DETECTION (YES/NO) → FLUID DETECTION (YES/NO) →

FLOW DETECTION (YES/NO) → FILTER VAC DETECT (YES/NO)

Adjust Utility (ADJUST)

The **ADJUST** utility allows the user to view the positions of the aspirate and dispense tubes in relation to the microwells, and "single-step" the carrier or manifold axes through their offset ranges to select the best offset. For example, use the Adjust Utility to determine the most effective setting for the Horizontal Dispense Position in a Wash program.

1. Place a microplate on the carrier.
2. To view aspirate/dispense tube positions or adjust an offset, follow the menu path below.

   UTIL → SETUP → ADJUST → PLATE TYPE →
   ADJUSTMENT POSITION → AXIS

3. From the **PLATE TYPE** screen, choose **96** or **384** for the Select, Select CW, and HT/96-tube manifold (PLATE TYPE does not appear in the standard ELx405 or HT with the 192-tube manifold installed.)
4. At the **ADJUSTMENT POSITION** screen, select a tube position: **ASPIR** (aspiration) or **DISP** (dispense). Only one tube position may be viewed at a time.
5. At the **AXIS** selection screen, choose an axis. The top line of the display indicates which axis is active, and the offset position of that axis. The axis options are model-dependent, as follows:

MAN	Manifold (up/down movement)	All models
CARX	Carrier x-axis (left/right movement)	All models
CARY	Carrier y-axis (front/back movement)	Select, Select CW, HT

6. Press the ◄ (reverse) key to single-step the offset in a negative direction, and the ► (forward) key to single-step the offset in a positive direction. See the examples in ***Figure 23***.
7. When the desired offset position is found, record the position number for later use when selecting an offset for a wash, dispense, or aspirate program.
8. To choose a different axis, press **Previous Screen**. To quit the Adjust utility, press **Main Menu**.

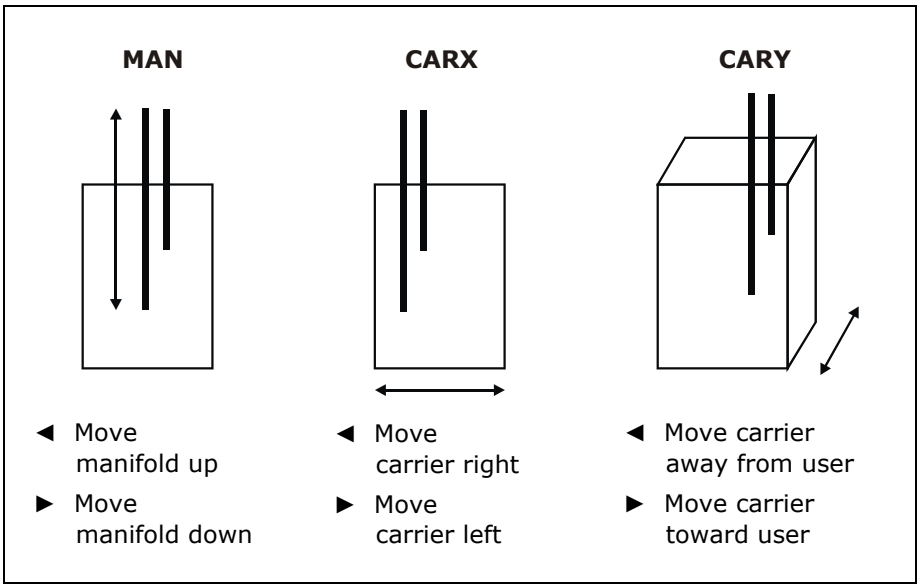


Figure 23: Using the Adjust Utility

Park Utility (PARK)

Before repackaging the instrument, the **PARK** utility must be used to position the manifold to the priming trough aspirate height in preparation for installing the manifold shipping bracket. To park the washer, start at the Main Menu and select the following; the manifold will immediately move to the Park or "pre-defined" position.

UTIL → SETUP → MORE → **PARK**

BioStack Utilities (BIOSTACK)

Select **BIOSTACK** to display the Stacker's **UTILITIES** screen. The washer can then be configured for proper operation with the BioStack, by selecting the **CONF** (Configuration), **ALIGN** (Alignment), and **VERIFY** (Verification) utilities. Refer to your BioStack Operator's Manual for instructions if you are operating the washer with the BioStack.

UTIL → SETUP → MORE → **BIOSTACK** → BIOSTACK UTILITIES →

CONF ALIGN VERIFY

❖ The BioStack **cannot** process plates when the Vacuum Filtration plate carrier is installed.

Delay After Dispense (DISP)

A **Delay After Dispense** feature enables you to change the value for the delay period between dispensing and aspirating in Wash programs. The delay range is 0 to 2000 msec, with a default value of 1000 msec.

To change the delay period, select the following:

UTIL → SETUP → MORE → MORE → **DISP** → DELAY AFTER DISP

Plate Clear Height (PLATE)

Plate Clearance Height represents the travel height when processing plates. It must be sufficient to raise the manifold tubes high enough above the plate to prevent crashes when the plate carrier moves. The valid height range varies depending on the instrument model. Learn more about Z-axis or height settings on page 40.

The plate clear height value also defines the default dispense height parameter in protocols. The dispense height is set 1.27 mm (10 steps) lower than the plate clear height when you create a protocol.

- Standard plate clear height: for processing standard plates, the valid height range is 12 (3.048 mm) to 255 (32.39 mm) but this maximum value is not appropriate for all instruments. This value is applied when the protocol's plate type is standard 96 or 384.
- Deep plate clear height: for processing deep-well plates, the default height value, 405 (51.44 mm) is sufficient for the tallest deep-well plates supported, 50 mm. This value is applied when the protocol's Plate Type is a deep-well plate.

To change the plate clearance height, select:

UTIL → SETUP → MORE → MORE → **PLATE** → PLATE TYPE CATEGORY: STD or DEEP

Vacuum Dissipation Delay (VACUUM)

The **Vacuum Dissipation Delay** feature enables you to change the value for vacuum dissipation delay at the completion of a program. The delay range is 1 to 50 sec with a default value of 5 seconds. Increasing the delay prevents the **High Flow vacuum pump** as well as **standard vacuum pumps** from drawing excess current and blowing the auxiliary 5-amp fuse (PN 46055).

- **High Flow vacuum pumps shipped in December 2005 and later:** The Vacuum Dissipation Delay should not need to be increased. In fact, this Delay can successfully be reduced to the 1-second minimum, to enable true high throughput processing of large wash runs.

- **High Flow vacuum pumps shipped before December 2005:** A delay of 10 seconds is recommended when using the High Flow pump with 10-liter bottles; a delay of at lest 20 seconds is recommended when using the High Flow Pump with 20-liter bottles.
- **Standard vacuum pumps:** Increase the delay to match your waste container, 1 second per liter. If you have a 10-liter waste bottle, set the delay to 10 seconds.

To change the vacuum dissipation delay, select the following:

UTIL → SETUP → MORE → MORE → **VACUUM** → VAC DISSIPATE DELAY

The **Delay After Dispense** and **Vacuum Dissipation Delay** features allow for overall faster plate processing, which may be useful for high-throughput microplate washing, for example, when the washer is used in conjunction with the BioStack or other automated system. For standalone use, BioTek does not recommend changing these parameters from the default setting, **unless** you are increasing the vacuum dissipation delay for the High Flow vacuum pump. If this is the case, please contact TAC if you need assistance with changing the these parameters.

Manifold Selection (MANIFLD)

For washers that support two types of manifolds:

- ELx405 HT2 models support the dual 192-tube manifold and the dual 96-tube manifold.
- ELx405 Select can be upgraded to an HT and then support the dual 192-tube manifold and the dual 96-tube manifold.
- To support Deep Well models, a third manifold type is selectable: 96-tube deep well manifolds.

This **Manifold Selection** parameter must be set to **96** or **192** to correctly process plates. This parameter must be changed each time the manifold is changed.

For example, the HT2 is shipped with the 192-tube manifold installed and the 96-tube packaged as an accessory. If the 192-tube manifold is removed and the 96-tube installed, the manifold selection parameter must be changed from 192 to 96. See ***Appendix E***, ***Changing the Manifolds*** for complete instructions.

To view or change the Manifold Selection parameter, select the following:

UTIL → SETUP → MORE → MORE → MORE → **MANIFOLD** →
MANIFOLD SELECTION 96 or 192 (96DEEP is for special models)

Carrier Selection (CARRIER)

For **Vacuum Filtration models,** after physically changing microplate carriers, from the standard magnetic bead carrier to the vacuum filtration carrier, or vice versa, you must tell the instrument which one is currently installed. When the special carrier with vacuum filtration capability is installed, choose **VAC**. Otherwise, select **Standard**.

UTIL → SETUP → MORE → MORE → MORE → **CARRIER** →
CARRIER SELECTION STD or VAC

Important: The vacuum filtration plate carrier can be used to process regular microplates. Always set the carrier selection to match the installed hardware, regardless of the type of plate processing you are doing.

CW+ Control (CW+)

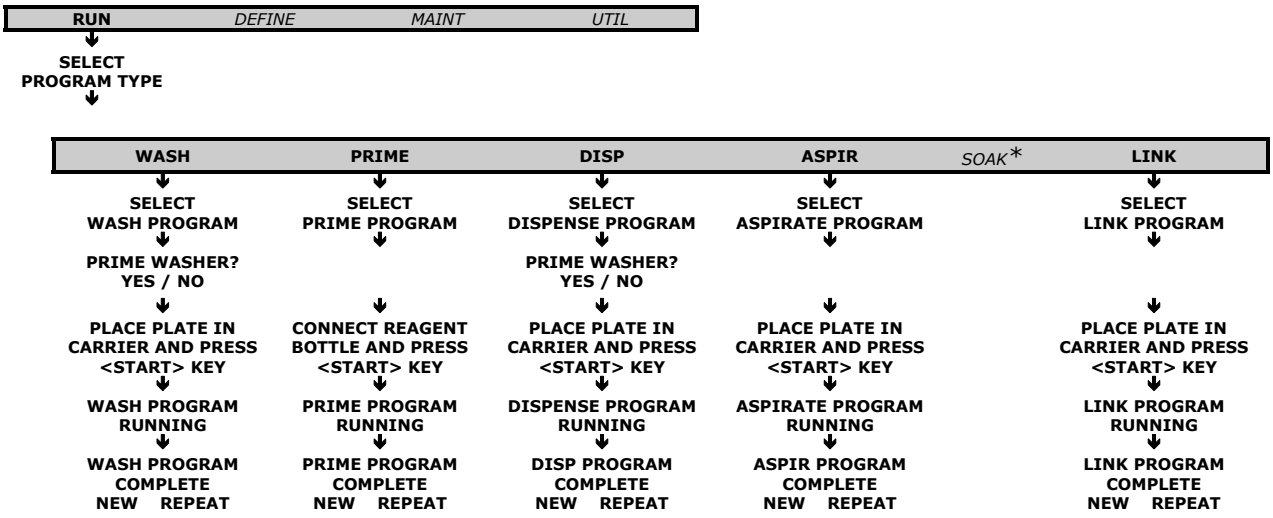
This setting is applicable only to Select CW cell wash models when using low flow dispense rates 10 CW and 11 CW. Generally, the optimal instrument configuration for cell wash assays includes installation of the **CW+ Dispense Manifold** and enabling this control with the default 100 msec setting. A minor adjustment to the duration setting may improve the performance of certain instruments.

On the contrary, if the CW+ Dispense manifold is not installed, better performance will be achieved by disabling this setting.

See Cell Wash Assays on page 79.

ELx405 Washer Menu Maps

Main Menu (RUN function path)



New or Repeat

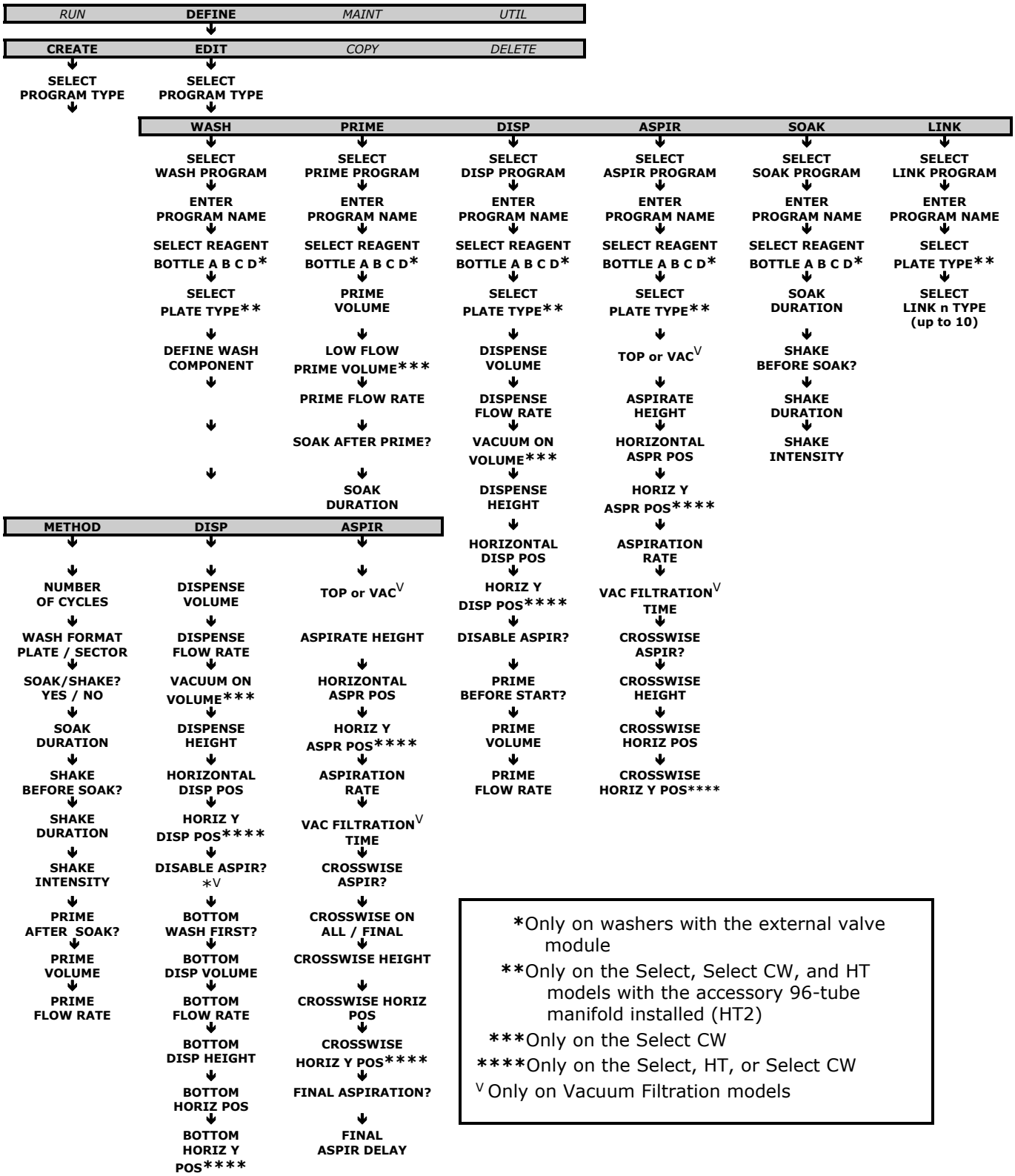
At the end of a run, the ELx405 offers **New** or **Repeat**.

When the **NEW** option is selected at the end of a run, control is returned to the corresponding "Select Program" screen. For example, when NEW is selected after a Wash, the program returns to the Select Wash Program screen.

When the **REPEAT** option is selected, the protocol is re-run.

> ❖ A Soak protocol cannot be run independently; it must be included in a Link program. A Soak/Shake step can be included in a Wash protocol or you can define a Soak protocol and then LINK it to other protocols.

Main Menu (DEFINE function path for Create and Edit)



*Only on washers with the external valve module

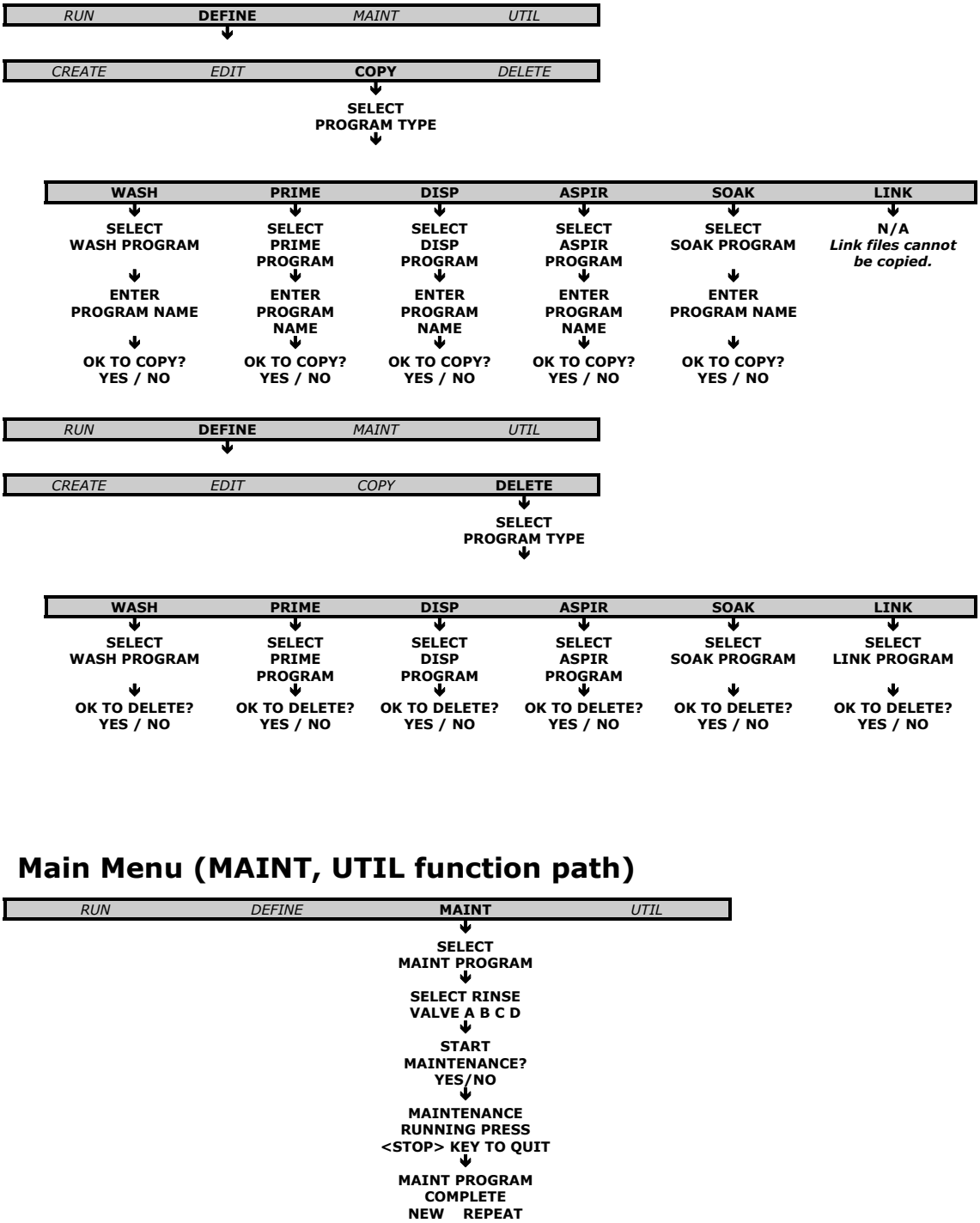
**Only on the Select, Select CW, and HT models with the accessory 96-tube manifold installed (HT2)

***Only on the Select CW

****Only on the Select, HT, or Select CW

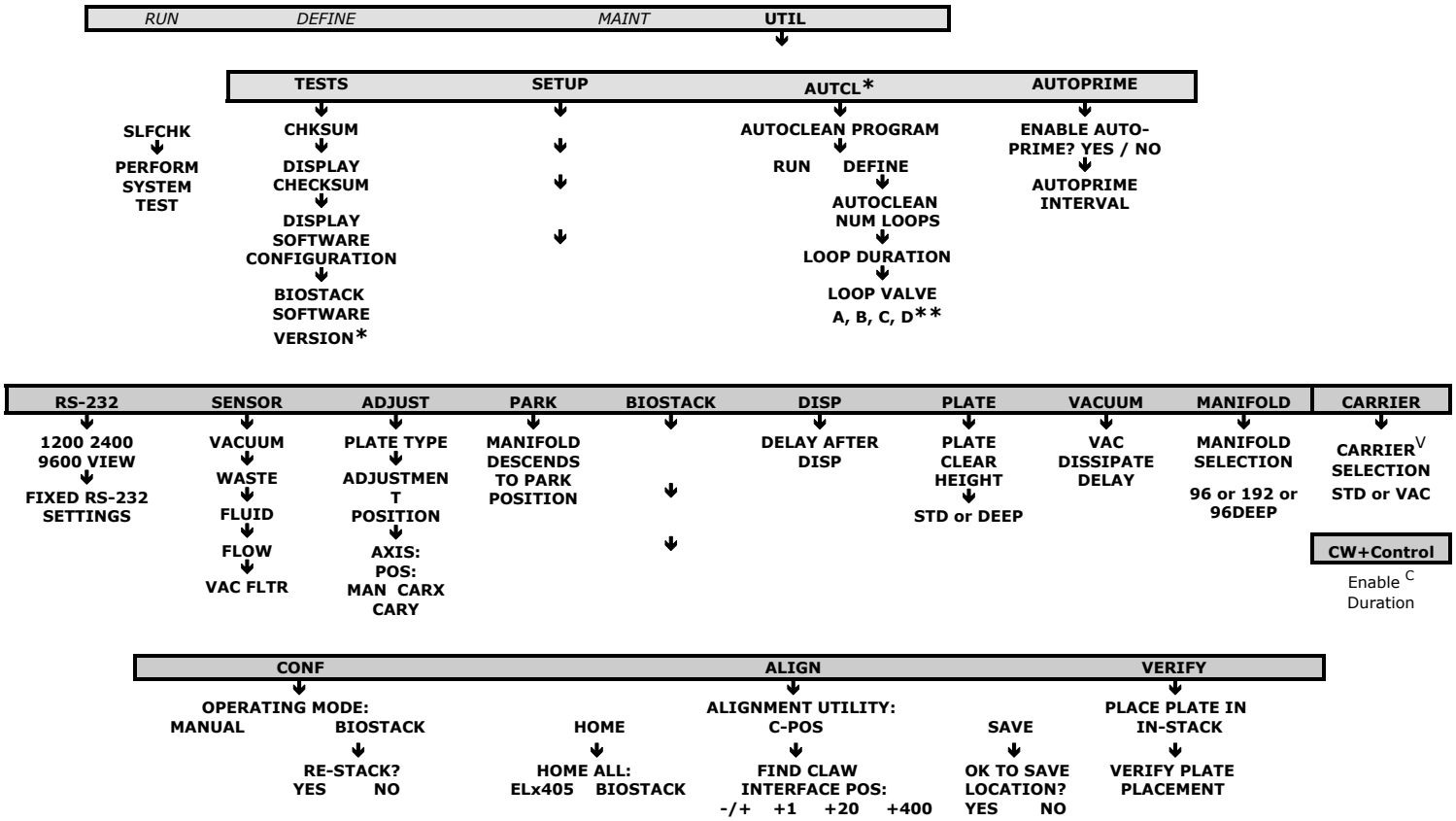
V Only on Vacuum Filtration models

Main Menu (DEFINE function path for Copy and Delete)



Main Menu (MAINT, UTIL function path)

Main Menu (UTIL function path)



*****AUTCL options available only in models with the Ultrasonic Advantage™ (ultrasonic cleaner)

******Only on washers with Buffer Switching

[V] Only on Vacuum Filtration models

[C]CW+ Control: For Select CW models only. Enable the option when the "CW+ Dispense Manifold" installed, otherwise, disable setting.

Chapter 4

Maintenance

This chapter describes how to maintain the ELx405, prepare it for storage or shipment, and decontaminate the instrument.

Overview

❖ This chapter provides instructions for maintaining ELx405 models that are currently available for purchase (see ***Instrument Models*** in chapter 1). This includes references to Deep Well "D" and Select models. This chapter also provides instructions for maintaining older ELx405 models that are no longer available for purchase.

The maintenance regimen for the ELx405 includes rinsing and soaking the fluid path and cleaning the washer's various components.

The chart on the next page summarizes BioTek's recommended maintenance tasks and 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 risk and performance factors of your assays should determine the frequency with which to conduct these tasks.

Therefore, BioTek recommends you develop a maintenance schedule for your washer based on the characteristics of the fluids used and the washer's activity level. Some questions you should consider are:

- **Are the fluids you're using prone to dry and harden quickly?** If yes, the dispense and aspirate tubes can clog quickly, and therefore they must be rinsed frequently and cleaned regularly.
- **Is the washer in use continuously, or does is it idle for several hours or days at a time?** If the washer will be sitting idle, the tubes should be soaked to keep them in a "wetted" state. The rinsing procedure (or the AUTOPRIME program) should be performed if the washer is idle for more than 3 hours.
- **Is a solution containing surfactant used throughout the day?** The wash solutions used affect the rinsing frequency. If the solution does not contain surfactant, consider rinsing (or running AUTOPRIME) at least once an hour.

Consider your wash buffer's properties and always use the same fluid or a compatible fluid to keep the tubing from clogging up. For example, use DI water to flush PBS from the system, and an enzyme-active detergent, like Terg-A-Zyme®, to remove proteins. Never use alcohol to flush out BSA.

Schedule

The following chart recommends maintenance tasks, the frequency with which each task should be performed, and the predefined onboard Maintenance program that should be run (if applicable).

- ❖ It is important to note that the risk and performance factors associated with your assays may require that some or all of the procedures be performed more frequently than presented in this schedule.
- ❖ Models with BioTek's **Ultrasonic Advantage**: The ultrasonic cleaner does not require maintenance.

Recommended Maintenance Schedule

TASKS	FREQUENCY				
	Daily	Overnight/ Multi-Day	Weekly	Periodic/ Monthly	Before Storage/ Shipment
Rinse/Soak the Fluid Path					
Run DAY_RINSE, p. 109	√	√			
Run AUTOPRIME, p. 110	√				
Run OVERNIGHT_LOOP, p. 111		√			
Run RINSE_AND_SOAK, p. 111		√			
Remove protein residuals and fungi growth, (if necessary), p. 112	√		√	√	
Clean Components					
Check/empty waste bottle, p. 114	√				√
Clean bottles, p. 114				√	√
Clean plate carrier system, p. 114			√		√
Clean carrier transport arm, p. 116			√		√
Clean manifold and mist shield, p. 117				√	√
Clean aspirate and dispense tubes, p. 118				√	√
Run AUTOCLEAN (Ultrasonic Advantage™), p. 122				√	√
Clean fluid inlet filter, p. 125				√	√
Decontaminate the Washer					
Decontaminate external surfaces, p. 126				√	√
Run DECONTAMINATION, p. 127				√	√
Prepare the Washer for Storage or Shipment					
Run LONG_SHUTDOWN, p. 130					√
Replace Components					
Replace o-rings, and channel-end seals, p. 132	*As Needed*				

Required Materials

For rinsing/soaking the fluid path, and for cleaning the components:

- Deionized or distilled water
- Sodium hypochlorite (NaClO or bleach)
- 70% isopropyl alcohol (or ethanol)
- Dispense and aspirate tube styluses (supplied with the washer)
- Phillips head screwdriver
- 9/64" (3.57 mm) hex wrench (supplied with the washer)
- Lint-free disposable towels
- Dish soap or other mild cleaner
- Soft-bristled brush
- Protective gloves, biohazard trash bags, lab coat, safety glasses, surgical mask

For replacing o-rings and channel-end seals:

- O-rings (PN 49941)
- Channel-end seals (PN 49486)

❖ In the following cleaning procedures, when not otherwise specified, "water" means use either deionized or distilled water.

❖ Unless otherwise instructed, **always** connect a supply bottle containing deionized or distilled water to the washer before running the Maintenance programs.

Warnings & Precautions

Please read the following before performing any Maintenance procedures:

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. Always wear safety glasses and appropriate protective equipment, such as chemical-resistant rubber gloves and apron.

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, stop the program and turn off the instrument. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

CAUTION **Liquids.** Do not immerse the instrument, spray it with liquid, or use a dripping-wet cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact Technical Support. Do not soak the keypad.

CAUTION **Lubricants.** Do not apply lubricants to moving parts. Lubricant on components in the carrier compartment will attract dust and other particles, which may cause the instrument to produce an error. Do not apply lubricants to manifold o-rings, channel-end seals, bottle cover seals, any tubing connection, or any surface that is a part of the fluid path.

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, and 20% sodium hydroxide. Never use acetic acid, DMSO, or other organic solvents. These chemicals may cause severe damage to the instrument.

Maintenance Programs

The following predefined **Maintenance programs** are stored onboard the ELx405 and the LHC installs replicas of them as protocols on your PC.

Run these programs **daily**:	Find complete descriptions on page:
DAY_RINSE	109
OVERNIGHT_LOOP	111
RINSE_AND_SOAK	111
Run these programs **as needed**:	
LONG_SHUTDOWN	130
DECONTAMINATION	128

❖ Read 'About the Maintenance Programs' in the LHC's Help to learn more.

To **run** a Maintenance program using the keypad:

1. From the washer's main menu, select **MAINT**.
2. Press the **Options** key to scroll through the available programs. Press the **ENTER** key to select a program.
3. If prompted for additional information (such as **RINSE VALVE** for models with the Buffer Switching valve module), make the appropriate selections.
4. When **START MAINTENANCE?** appears, press the **START** key to begin.

❖ To halt a Maintenance program in progress, press the **STOP** key.

5. When the program is complete, press **Main Menu** to return to the washer's main menu.

Vacuum Filtration Maintenance

Run the predefined link protocol **VAC30_TEST** with disinfectant as the fluid supply to clean the tubing and hardware used to perform filter plate assays.

Using the keypad:

1. Select **RUN>MORE>LINK**
2. Press **Options**, if necessary, until **VAC30_TEST** is displayed, and press **Enter**. When you are ready, press **Start** to run it.

Prime Programs

Each predefined Maintenance program runs a predefined **Prime program**. The charts below and on the following page show the default prime program parameters. Some of these parameters can be modified. To **view** or **edit** the parameters for a particular Prime program, follow this sequence from the washer's main menu:

DEFINE → EDIT → PRIME → SELECT PRIME PROGRAM

(press the **Options** key to cycle through the available programs)

Refer to ***Chapter 3***, ***Define Prime Program*** for more information on Prime programs and their parameters.

❖ **Note:** The Select CW model has smaller diameter "low flow" tubing for gentle cell washing. The Low Flow Prime Volumes specified in the charts below and on the following page are necessary to purge the low flow tubing.

Maintenance Program: DAY_RINSE	**Prime Program: P_DAY_RINSE**	
Parameter	**Default**	**Selectable Range**
Prime Volume	400 mL (All models except Select CW); 300 mL (Select CW)	1-999 mL
Low Flow Prime Volume (Select CW models only)	200 mL	1-999 mL
Flow Rate	7	1-9
Soak After Prime?	No; N/A for the Select CW	Yes/No

Maintenance Program: OVERNIGHT_LOOP	**Prime Program: P_RINSE_LOOP**	
Parameter	**Default**	**Selectable Range**
Prime Volume	60 mL (All models)	1-999 mL
Low Flow Prime Volume (Select CW models only)	0 mL	1-999 mL
Flow Rate	7	1-9
Soak After Prime?	Yes	Yes/No
Soak Duration	4 hours	1 minute to 18 hours

Maintenance Program: RINSE_AND_SOAK **Prime Program: P_RINSE_AND_SOAK**		
Parameter	**Default**	**Selectable Range**
Prime Volume	400 mL (All models except Select CW); 300 mL (Select CW)	1-999 mL
Low Flow Prime Volume (Select CW models only)	200 mL	1-999 mL
Flow Rate	7	1-9
Soak After Prime?	Yes	Yes/No
Soak Duration	5 minutes	1 minute to 18 hours

Maintenance Program: LONG_SHUTDOWN and DECONTAMINATION **Prime Program: P_DECON1**		
Parameter	**Default**	**Selectable Range**
Prime Volume	400 mL (All models except Select CW); 300 mL (Select CW)	1-999 mL
Low Flow Prime Volume (Select CW models only)	200 mL	1-999 mL
Flow Rate	7	1-9
Soak After Prime?	Yes	Yes/No
Soak Duration	20 minutes	1 minute to 18 hours

Maintenance Program: LONG_SHUTDOWN and DECONTAMINATION **Prime Program: P_DECON2**		
Parameter	**Default**	**Selectable Range**
Prime Volume	800 mL (All models except Select CW); 600 mL (Select CW)	1-999 mL
Low Flow Prime Volume (Select CW models only)	200 mL	1-999 mL
Flow Rate	7	1-9
Soak After Prime?	Yes	Yes/No
Soak Duration	2 minutes	1 minute to 18 hours

The LONG_SHUTDOWN and **DECONTAMINATION** programs prime and soak the washer with the Prime Volumes and Soak Durations specified in the P_DECON1 and P_DECON2 prime programs. The volume and flow rate parameters for these Prime programs can be edited for optimum cleaning. The Soak Duration cannot be edited.

Rinse/Soak the Fluid Path

Daily Maintenance

Daily maintenance involves flushing the washer with an appropriate reagent or deionized water throughout the day. Routinely rinsing the washer helps to prevent the aspirate and dispense tubes from clogging between washes.

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

- If a solution containing surfactant is used throughout the day, the rinsing procedure should be performed if the washer is idle for more than 3 hours.
- If the solution does not contain surfactant, consider rinsing at least once an hour.

The **DAY_RINSE** and **AUTOPRIME** programs described below and on the following page satisfy daily maintenance requirements.

DAY_RINSE

The DAY_RINSE Maintenance program primes the washer with the Prime Volume specified in the **P_DAY_RINSE** prime program. The parameters are listed at ***Prime Programs*** on page 107.

To run the DAY_RINSE program, follow this sequence:

Washers not equipped with **Buffer Switching:**

MAINT → SELECT MAINT PROGRAM: **DAY_RINSE** →
CONNECT RINSE AND PRESS **<START>** KEY

Washers equipped with **Buffer Switching:**

MAINT → SELECT MAINT PROGRAM: **DAY_RINSE** →
RINSE VALVE? **A B C** or **D** → START MAINTENANCE? **YES**

AUTOPRIME

The AutoPrime feature automatically primes the washer when it has been idle for a user-specified amount of time. The volume, buffer valve, flow rate, and soaking parameters are specified in the AUTOPRIME program. AUTOPRIME is recommended when the washer is used intermittently throughout the day, to keep the manifold tubes in a wetted condition.

- **"AUTPRM"** appears in models with Ultrasonic Advantage.
- AutoPrime **does not replace pre-priming** the washer before running a wash or dispense program.

The AutoPrime feature is disabled by default. To enable it:

1. Select **UTIL → AUTOPRIME** (or **AUTPRM**) **→ YES**.
2. Enter the **interval** from **10** to **600** minutes, to indicate how often you want the AutoPrime program to run.
3. Press **ENTER** and then return to the Main Menu.

The next time a program is run, AutoPrime will be enabled and priming will occur each time the washer has been idle for <**interval**> minutes.

- To disable the AutoPrime feature, select **UTIL → AUTOPRIME** (or **AUTPRM**) **→ NO.**
- To **halt** AutoPrime, press the **STOP** key.
- To **view** or **edit** the AUTOPRIME program parameters, select **DEFINE → EDIT → PRIME** and press the **Options** key to select **AUTOPRIME.** Edit the parameters as desired. The table below shows the AutoPrime program parameters and ranges.

Parameter	Default	Selectable Range
Prime Volume	60 mL	1 - 999 mL
Low Flow Prime Volume (Select CW models only)	0 mL	1 - 999 mL
Prime Flow Rate	7	1-9
Buffer Valve	A	A-D
Soak After Prime?	Yes	Yes/No
Soak Duration	3 hours, 50 minutes	1 minute - 18 hours
Interval*	10 minutes	10 - 600 minutes

* Define the interval duration in the Instrument Utilities.

Overnight/Multi-Day Maintenance

Overnight/multi-day maintenance involves flushing all wash solution out of the instrument, and then periodically rinsing and soaking the tubes to keep them moist. If the washer will be left idle for a period of time (such as overnight or over a weekend), run this program to soak the tubes for several hours at a time.

The **OVERNIGHT_LOOP** and **RINSE_AND_SOAK** programs described below and on the following page satisfy overnight/multi-day maintenance requirements.

> **Important!** Keep the manifold in a wetted condition to ensure proper evacuation of fluid. BioTek recommends changing the Soak Duration to 18 hours for overnights and weekends when the washer is not being used. This will decrease flow problems and is a more trouble-free way to operate the washer.

OVERNIGHT_LOOP

The OVERNIGHT_LOOP Maintenance program primes and soaks the washer with the Prime Volume and Soak Duration specified in the P_RINSE_LOOP program. To view the parameters in this program, see ***Prime Programs*** on page 107.

- The OVERNIGHT_LOOP program requires the washer to remain turned on.

To run OVERNIGHT_LOOP, follow this sequence:

Washers <u>not</u> equipped with **Buffer Switching:**

MAINT → SELECT MAINT PROGRAM: → **OVERNIGHT_LOOP** → CONNECT RINSE AND PRESS **<START>** KEY

Washers equipped with the **Buffer Switching valve module:**

MAINT → SELECT MAINT PROGRAM: → **OVERNIGHT_LOOP** → RINSE VALVE? **A B C** or **D** → START MAINTENANCE? **YES**

RINSE_AND_SOAK

The RINSE_AND_SOAK Maintenance program primes and soaks the washer with the Prime Volume and Soak Duration specified in the P_RINSE_AND_SOAK program. To view the parameters see ***Prime Programs*** on page 107.

To run RINSE_AND_SOAK, follow this sequence and turn off the washer after the soak begins:

Washers not equipped with the **Buffer Switching valve module:**

MAINT → SELECT MAINT PROGRAM → **RINSE_AND_SOAK** → CONNECT RINSE AND PRESS **<START>** KEY

Washers equipped with the **Buffer Switching valve module:**

MAINT → SELECT MAINT PROGRAM → **RINSE_AND_SOAK** → RINSE VALVE? **A B C** or **D** → START MAINTENANCE? **YES**

Removing Protein Residuals and Fungi Growth

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

BioTek recommends performing the following additional Maintenance procedures to thoroughly flush out protein particles and other contaminants from the washer's fluid path, if necessary:

Daily

Using PBS or an enzyme-active detergent:

If the washer will be idle between plates for longer than 45 minutes, flush the proteins from the washer:

1. Fill a supply bottle with **PBS** and connect it to the washer (Buffer Switching valve "A").
2. Run **DAY_RINSE**.
3. Enable **AUTOPRIME** for 60-minute intervals.

At the end of the day:

1. Fill a supply bottle with **PBS or an enzyme-active detergent** and connect it to the washer (Buffer Switching valve "A").
2. Run **DAY_RINSE** three times.
3. Fill a supply bottle with DI water and connect it to the washer (Buffer Switching valve "A").
4. Run **DAY_RINSE** three times.
5. Run **OVERNIGHT_LOOP**.

Weekly

Using 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 (Buffer Switching valve "A").
2. Run **RINSE_AND_SOAK**.
3. If you plan to use the washer immediately, run **DAY_RINSE** twice with deionized water and once with PBS.

❖ **Four-liter** volumes specified in the following are approximate amounts.

Periodically/Monthly

Using 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 (Buffer Switching valve "A").
2. Run the **DECONTAMINATION** program. When the program pauses and displays CONNECT RINSE BOTTLE AND PRESS <START> KEY, leave the detergent bottle connected and press the **Start** key to continue. Repeat this sequence until the bottle is empty.
3. Connect a bottle containing four liters of deionized water and run **DAY_RINSE** three times to flush the system.

Clean Components

❖ Read the **Warnings and Precautions** on page 105.

Periodic Maintenance

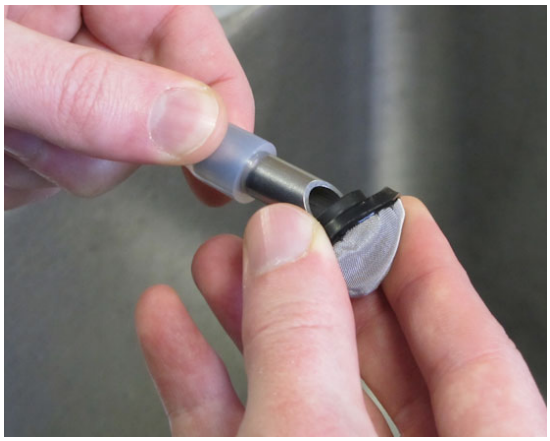
Periodic maintenance involves cleaning the washer components on a regular basis to keep the washer running efficiently and in compliance with instrument specifications. The recommended **frequency for cleaning washer components** is *at least monthly*. The risk and performance factors associated with your assays may require that some or all of the procedures be performed more frequently.

Cleaning the Bottles

- Clean and rinse the supply bottles with deionized water before the first use, before each refill, and, periodically, as necessary, to prevent bacteria growth.
- Empty the waste bottle often (at least daily), and firmly seat the waste bottle fittings.
- Rinse the covers every time the wash or rinse bottles are filled.
- Check the hex nuts securing the quick-disconnects to the bottle cap to ensure they are not loose or corroded.
- Accumulated algae, fungi, or mold may require decontamination. Decontamination is described on page 126.

❖ To ensure that fluid does not back up into the vacuum pump during operation, always operate the washer with the **waste sensor cable** installed and the **waste detection sensor** enabled (see ***Setup Utilities*** in ***Chapter 3***, ***Operation***). If fluid collects in the overflow bottle, thoroughly rinse the level-switch assembly and bottle.

- If applicable: Periodically clean the direct-drain waste bottle filter.
    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 bristle brush, if necessary.
    4. Rinse the filter and reinstall it.



Cleaning the Plate Carrier System

If liquid has overflowed onto the plate carrier, transport rail(s), or glide strips, some buildup may occur and prevent the microplate from seating correctly on the carrier. This can interfere with plate transport. Weekly cleaning is recommended.

1. Turn the washer on and wait for the System Self Test to complete. Turn the washer off when the manifold and tubes are resting above the priming trough ("home" position). Disconnect the power cable.
2. Carefully lift the carrier up and off the horizontal transport rail(s).
3. Clean the carrier, rails, and glide strips, using mild detergent and hot water, 70% isopropyl alcohol, or ethanol. Clean the priming trough as well, if necessary.

- **Select** and **HT** models: Take extra care to clean the spring-loaded transport arm that allows these models to move the plate forward and back (Y-axis). The arm fits into the left side of the plate carrier as you face the washer. If more intensive cleaning is required (for example, if reagent has spilled and dried on the stainless steel shaft), see ***Cleaning the Carrier Transport Arm*** below.
- **Vacuum Filtration** and **Magnetic Bead** models: handle the special plate carrier with care. **Do not submerge** it when extra cleaning is needed. Flush it out with warm water by holding it under a running faucet for a few seconds and dry it immediately and completely. Avoid getting water in the transport arm bearings.

4. If detergent was used, wipe the components with a cloth moistened with water. Use a clean, dry cloth to dry the components.
5. To replace the carrier, line up the pin on the underside of the carrier with the slot on the carrier transport. Snap the two carrier rail guides onto the rail. The pin should sit in the slot.

Cleaning the Carrier Transport Arm

This section only applies to the Select, Select CW, and HT Models.

For troubleshooting purposes, it may be necessary to disassemble and clean the spring-loaded carrier transport arm that allows the Select, Select CW, and HT models to move forward and back (along the y-axis) when washing 384-well plates. If reagent has spilled and dried on the stainless steel shaft of the arm, it may interfere with carrier movement. Cleaning the arm will resolve the problem.

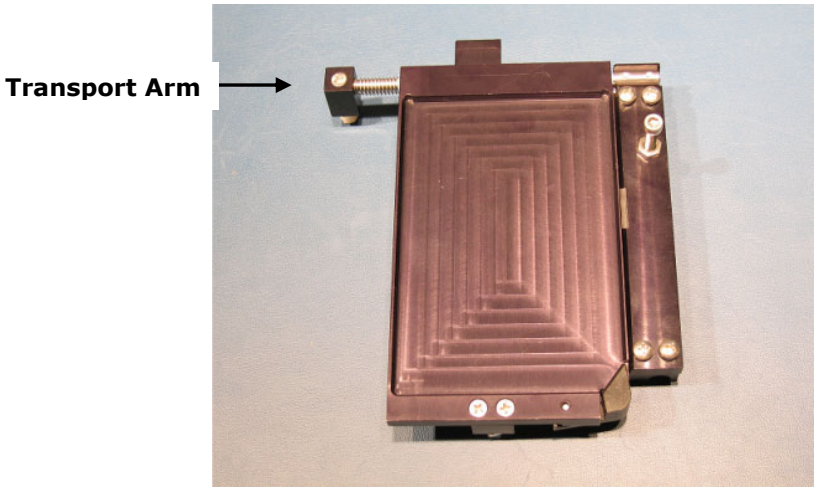


Figure 23: Position of the Transport Arm on the plate carrier

The transport arm fits into the left side of the plate carrier. Follow the instructions for removing, cleaning, and reassembling the transport arm.

1. Carefully lift the carrier straight up and off the transport rail.
2. Turn the carrier over and lay it face down to expose the two screws that hold the arm in place in the carrier (noted with an arrow in ***Figure 24***).

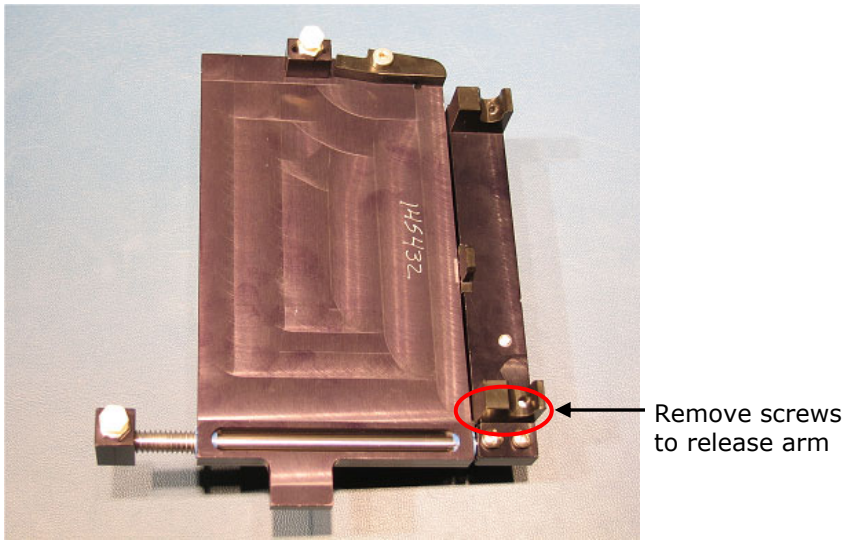


Figure 24: Plate carrier upside down to release Transport Arm

3 Remove the screws and washers and slide the arm free from the carrier.

❖ Observe the orientation of the arm to the plate carrier. Be sure to reassemble the components properly.

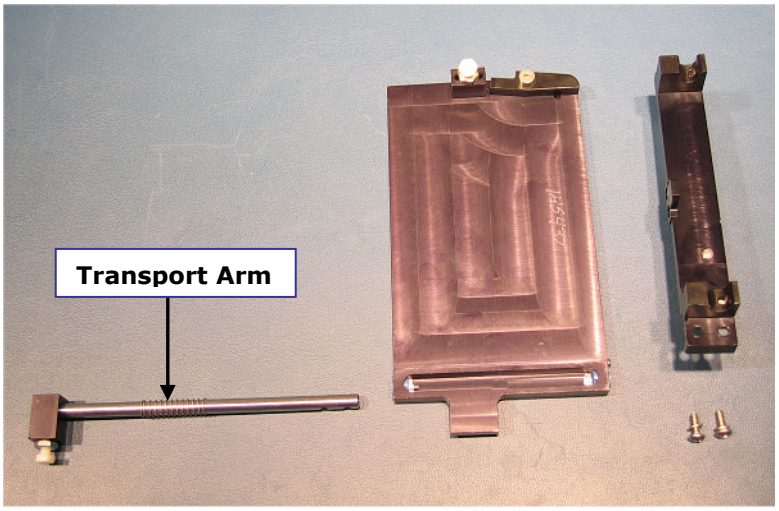


Figure 25: Transport Arm removed from the carrier

4 Clean the arm with a lint-free towel moistened with 70% isopropyl alcohol. Allow it to dry.

5 Reassemble the carrier:

- Slide the arm back into the open end of the plate carrier.
- Squeeze the arm spring against the carrier to expose the openings for the screws and washers, and reinstall them.

6 To replace the carrier, line up the pin on the underside of the carrier with the slot on the carrier transport rail. Snap the two carrier rail guides onto the rail. The pin should sit in the slot.

Cleaning the Manifold, Mist Shield, and Tubing

Regular rinsing helps to keep the manifold clean, the aspiration and dispense tubes clear, and extends the life of the tubing.

If you suspect a particular problem is related to the manifold (for example, clogged tubes can result in poor or uneven aspiration or dispensing), you should perform a thorough cleaning of the dispense and aspirate tubes and channels. When necessary, follow the DECONTAMINATION procedure on page 127 to disinfect the manifold and tubing.

To clean the manifold, mist shield, and tubing:

1. Run the system "dry":
   - Select **UTIL → SETUP → SENSOR** and set VACUUM DETECTION, FLUID DETECTION, and FLOW DETECTION to **NO**.
   - Connect an empty supply bottle and prime the washer until the tubing is empty.
   - **Important!** Set the vacuum, fluid, and flow detection sensors back to **YES**.
2. Turn off the washer and disconnect the power cable.
3. Moisten a lint-free disposable towel with water, or with water and mild detergent. **Do not soak the cloth**.

❖ Loosen the thumb screws and lift the mist shield straight up, not towards you, to remove it.

4. Remove the mist shield if it is attached. Wipe the inside and outside surfaces of the mist shield. Wipe the top surface of the instrument base, and all exposed surfaces of the instrument.
5. If detergent was used, wipe all surfaces with a cloth moistened with water.
6. Use a clean, dry cloth to dry all wet surfaces.

❖ Use extra care when removing the **Select**, **Select CW**, and **HT dual manifolds**. Hold the two manifolds together as a single unit when removing or replacing.

7. Using the 9/64" (3.57 mm) hex wrench, remove the screws, washers, and springs that hold the manifold(s) in place. Carefully remove the manifold(s) and end plates.

❖ Avoid pressing the stylus against the sides of the tubes during cleaning. This can cause the tubes to bend, which may negatively affect dispense precision.

8. Using a soft-bristled brush, thoroughly clean the outside of the manifold(s). Clean the insides of each tube with the appropriate stylus (aspirate/dispense). Flush hot water through the cross channels.
9. Rinse the manifold with deionized or distilled water. Check to see if water comes out of all dispense and aspirate tubes. If not, soak the manifold in hot, soapy water and repeat.

> **Important.** When reinstalling the manifold, only tighten the screw-washer-spring assembly that holds it in place until you feel the mechanical stop. You will damage the instrument if you continue tightening past this point, and will **void your warranty.**

10. When satisfied, reassemble the manifold and end plates, making sure that the two o-rings are in place prior to reassembly. **Do not overtighten the manifold screws.**
11. Re-attach the mist shield; finger-tighten the two thumbscrews.
12. Reconnect the power cable and turn on the washer.
13. Prime the system with deionized water by running DAY_RINSE or a similar Maintenance or Prime program. Watch for leaks. If fluid leaks out of the back of the instrument, firmly seat the tubing. If fluid leaks from the manifold, try disassembling and carefully reassembling.
14. Verify aspirate/dispense performance visually or by performing the ***Evacuation Efficiency Test*** and/or ***Dispense Precision Test*** in ***Chapter 5, Qualification***.

- Replace the o-rings as needed. Replace the 12 (or 24) channel-end seals (rubber plugs) if they show signs of cracking or drying out. See ***Replacing the O-Rings and Channel-End Seals*** on page 132.

- For additional cleaning, an ultrasonic bath may be used, or the AUTOCLEAN program may be run (models with the Ultrasonic Advantage only; see the AUTOCLEAN section on page 122).

  DO NOT AUTOCLAVE the manifold!

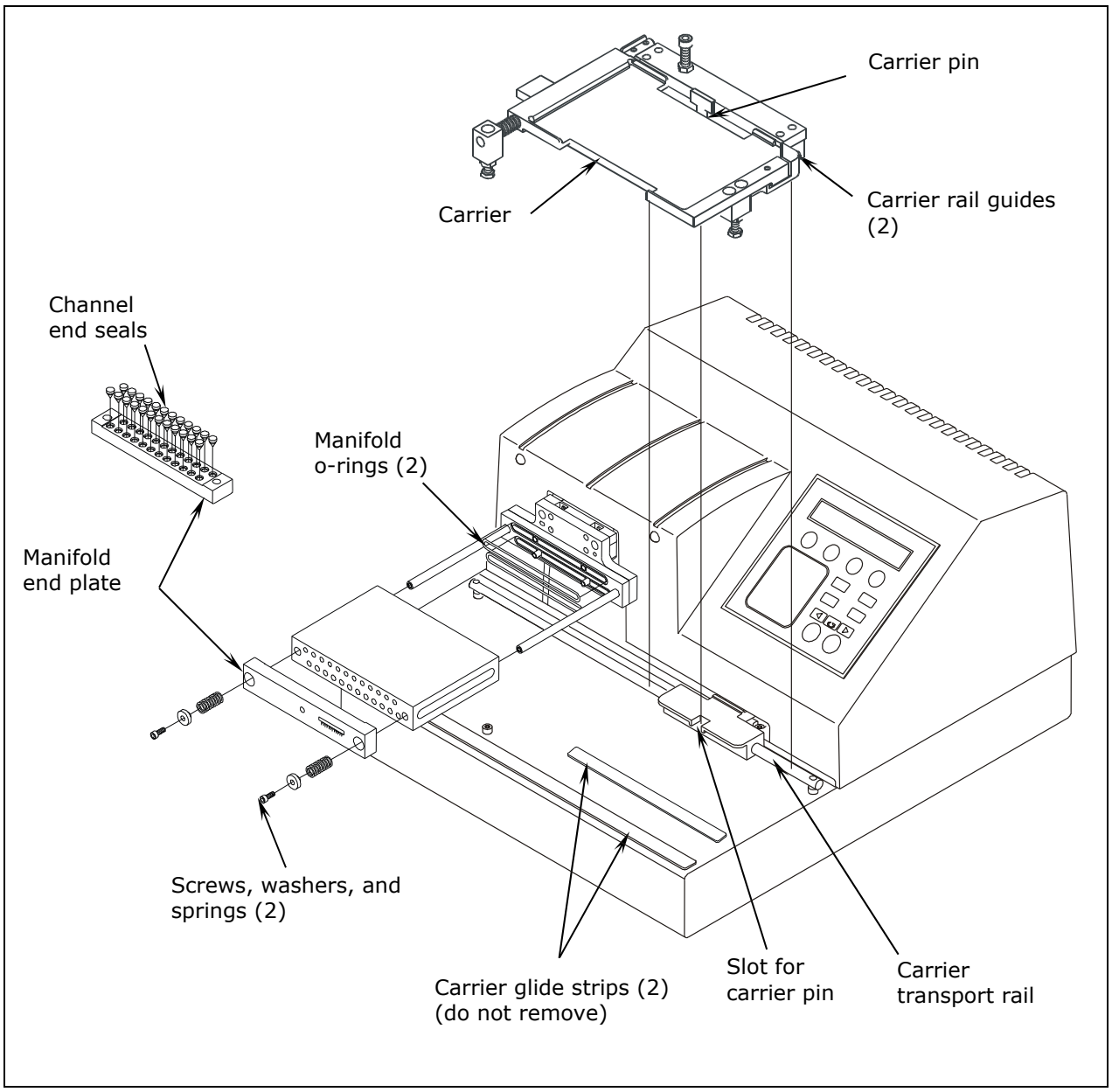


Figure 26: Carrier and Manifold Placement in the ELx405 Model

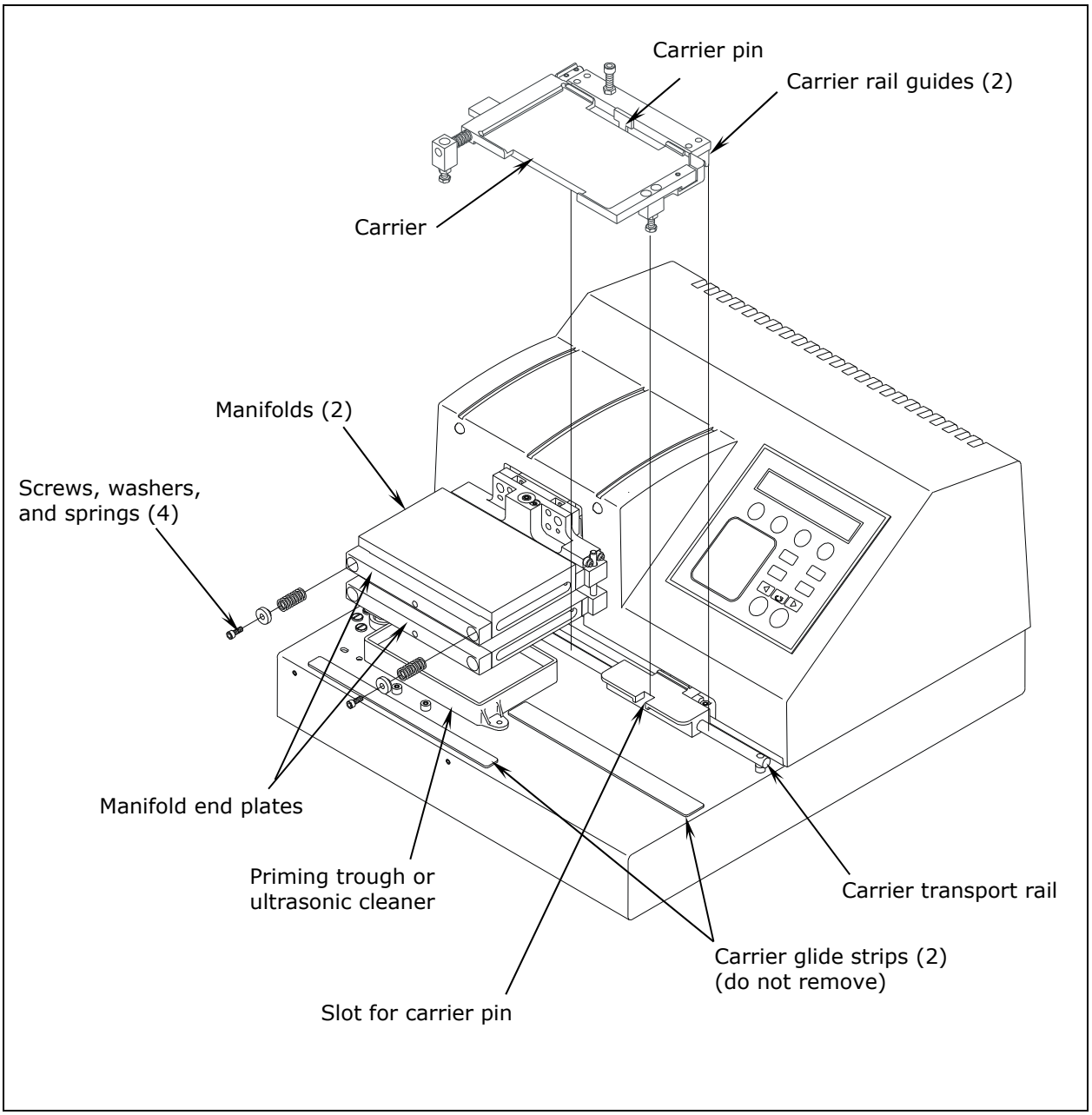


Figure 27: Carrier and Manifold Placement in the Select, Select CW, and HT Models

❖ The ultrasonic cleaner is available in Ultrasonic Advantage™ models only. Do not try to remove the ultrasonic cleaner! Only BioTek authorized service personnel should remove the cleaner for maintenance or repair.

AUTOCLEAN (for Ultrasonic Advantage "S" models only)

WARNING **Ultrasonic energy.** "S" models. Ultrasonic energy is present in the cleaning reservoir when the AutoClean program is running. Do not put your fingers in the reservoir. Ultrasonic energy can harm human tissue.

Ultrasonic Advantage "S" models feature a built-in **ultrasonic cleaner** that provides enhanced periodic maintenance capabilities by using ultrasonic pulses in a water bath to clean residuals from 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 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 on the washer in the same position as the priming trough in other models.

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

The onboard **AUTOCLEAN** (**AUTCL**) function in the Utility menu enables you to define and run an ultrasonic cleaning program that includes one or more cleaning "loops." Use multiple loops if you want to clean with more than one type of fluid.

AUTOCLEAN Parameter	Selectable Range
Number of Loops	1-10 loops
Duration of each loop	1-60 minutes
Supply bottles	A-D for buffer switching

❖ **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 protinaceous residue such as bovine serum albumin (BSA).

Run one or more 30 minute loops in the cleaning program. Follow with a rinse loop using deionized water to remove the detergent from the system, or with a wash buffer to leave the instrument primed and ready for use.

Prepare the waste and supply bottles

Empty the waste bottle. Ensure that there is a **sufficient volume** of deionized water and detergent in the supply bottle(s): An AUTOCLEAN program initially primes the system with **200 mL** of fluid from the supply bottle specified for Loop 1; each cleaning loop fills the reservoir with approximately **93 mL** of fluid.

❖ Priming with 200 mL is done for **each successive loop** in models without Buffer Switching, and in models with Buffer Switching, when valve selection changes between loops.

Define the AUTOCLEAN program parameters:

From the washer's main menu, follow the path below:

- Washers not equipped with Buffer Switching:

  UTIL → AUTCL → DEFINE →
  AUTOCLEAN NUM LOOPS: Enter **01** to **10** loops →
  LOOP <*loop number*> DURATION: Enter **01** to **60** minutes →
  OK TO SAVE PROGRAM? **YES**

- Washers equipped with **Buffer Switching**:

  UTIL → AUTCL → DEFINE →
  AUTOCLEAN NUM LOOPS: Enter **01** to **10** loops →
  LOOP <*loop number*> DURATION: Enter **01** to **60** minutes →
  LOOP <*loop number*> VALVE: Select **A**, **B**, **C**, or **D** →
  OK TO SAVE PROGRAM? **YES**

Run the AUTOCLEAN program:

From the washer's main menu, select **UTIL → AUTCL → RUN.**

The program begins with a priming sequence. When priming is complete, the manifold lowers into the reservoir, the washer dispenses approximately 93 mL of fluid, and cleaning LOOP 01 begins. When the loop is complete, the washer aspirates the fluid from the reservoir.

If another loop is specified in the program, the washer is primed (only if valve selection changes or if operating without the valve module), fluid is dispensed, and the next loop begins. This process is repeated until all loops are complete.

- **Models without Buffer Switching:** If more than one cleaning loop is defined, the washer will pause between loops and display "CONNECT SUPPLY <next loop number>" to allow you to switch supply bottles. Press the ENTER key to resume cleaning.

While the program is running, the ultrasonic cleaner will pulse on and off approximately every ten seconds (a 50% duty cycle), and you will hear a periodic "hissing" sound that indicates the ultrasonic energy is present.

When **PROGRAM COMPLETE** appears, select **REPEAT** to run the program again, or select **STOP** and press the **Main Menu** key.

Cleaning the Fluid Inlet Filter

Periodically clean the fluid inlet filter on the rear panel of the instrument. To clean the filter:

1. Unscrew the fluid inlet fitting from the back of the washer (see ***Figure 28***).
2. Note the orientation of the filter in the fitting (the cone-shaped end of the filter points "in" toward the instrument) and then remove the filter from the fitting.
3. Wash the filter with hot water and a soft-bristled brush.
4. Rinse the filter, then replace it in the fitting and reinstall onto the rear of the instrument.

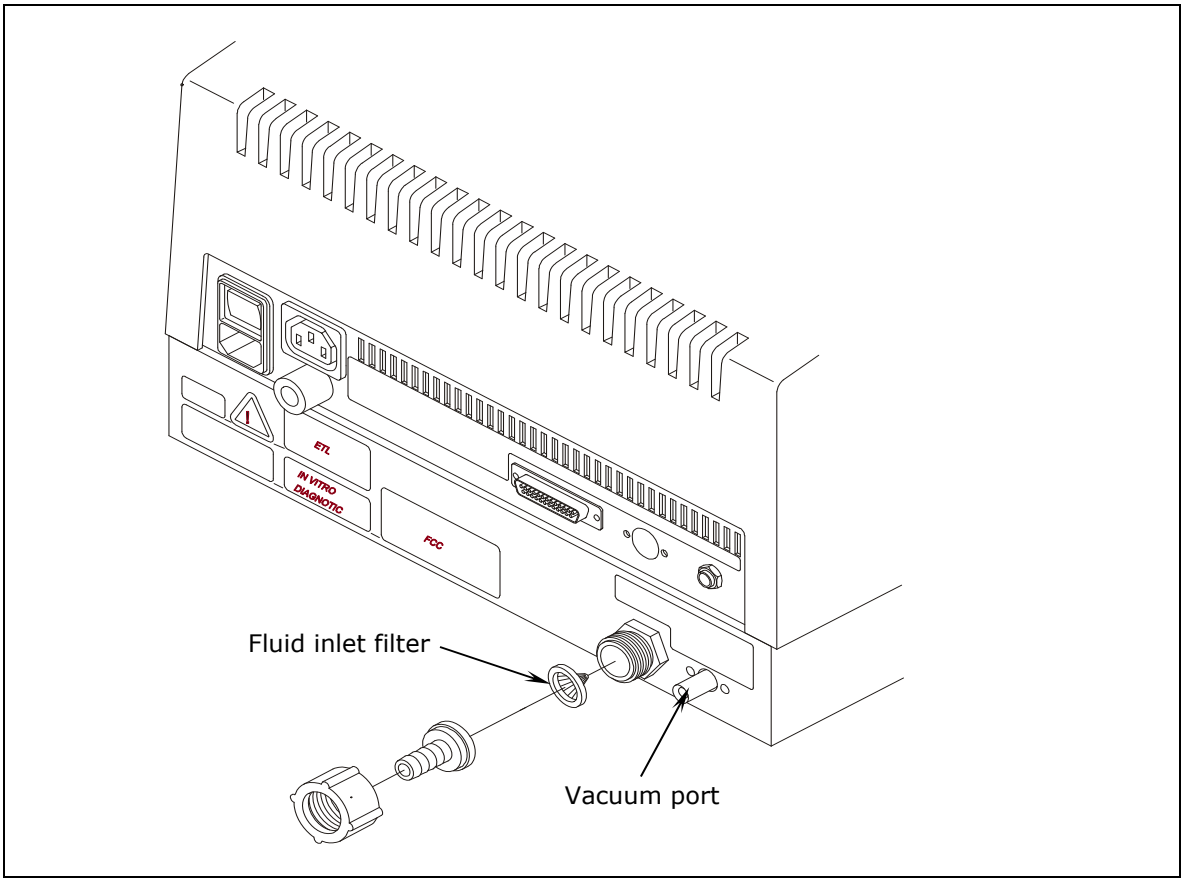


Figure 28: Cleaning the Fluid Inlet Filter

Decontaminate the Washer

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

CAUTION **Liquids.** Do not immerse the instrument, spray it with liquid, or use a dripping-wet cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact Technical Support. Do not soak the keypad.

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

- The washer requires decontamination prior to shipping, storage, and disposal.
- Decontamination is required by the U.S. Department of Transportation regulations.
- Persons performing the decontamination process must be familiar with the basic setup and operation of the instrument.
- BioTek recommends the use of the following decontamination solutions and methods based on our knowledge of the instrument and recommendations of the Centers for Disease Control and Prevention (CDC). Neither BioTek nor the CDC assumes any liability for the adequacy of these solutions and methods. Each laboratory must ensure that decontamination procedures are adequate for the biohazard(s) they handle.

Decon Procedure for External Surfaces of the Instrument

1. Turn the washer off and disconnect the power cord. Empty the waste bottle.
2. Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach). As an alternative, 70% isopropyl alcohol (or 70% ethanol) may be used if the effects of bleach are a concern.

   ❖ **Isopropyl alcohol** is not recommended for removing **proteins** (such as bovine serum albumin).

3. Moisten a cloth with the bleach solution or alcohol. **Do not soak the cloth**.

   ➢ Wipe the keypad (do not soak). Wipe again with a clean cloth moistened with deionized or distilled water. Dry immediately with a clean, dry cloth.

- Remove the washer's mist shield if it is attached. Wipe the inside and outside surfaces of the mist shield. Wipe the plate carrier, top surface of the instrument's base, supply bottles and tubing, and all exposed surfaces of the instrument.

4. Wait 20 minutes. Moisten a cloth with DI or distilled water.
   - Wipe the inside and outside surfaces of the mist shield. Wipe the plate carrier, top surface of the instrument's base, supply bottles, tubing, bottle covers and all exposed surfaces of the instrument that have been cleaned with the bleach solution or alcohol.
5. Use a clean, dry cloth to dry all wet surfaces.
6. Reassemble the instrument as necessary.
7. Discard the used gloves and cloths using a Biohazard trash bag and an approved Biohazard container.

Decon Procedure for Tubing and Manifold

The recommended onboard Maintenance program is DECONTAMINATION. This program flushes and soaks the supply tubing and manifold with disinfectant, then flushes the system with rinse, and finally purges the system of fluid.

The LONG_SHUTDOWN program primes and soaks the washer with the Prime Volumes and Soak Durations specified in the P_DECON1 and P_DECON2 prime programs. The Prime Volume and Prime Flow Rate parameters for these Prime programs can be edited for optimum cleaning. The Soak Duration cannot be edited. Refer to the charts in the ***Prime Programs*** section of this chapter for a list of default parameters and to ***Chapter 3***, ***Operation***, for instructions on editing these parameters.

❖ Two supply bottles are required for this procedure: one for disinfectant, and one for rinse.

1. Perform the decontamination procedure described on the previous page.
2. Turn the washer off and disconnect the power cord.
3. Empty the waste bottle.
4. Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach).
5. Fill one supply bottle with at least 400 mL of bleach solution (disinfectant).
6. Fill another supply bottle with at least 800 mL of deionized water (rinse).
7. If the washer is equipped with **Buffer Switching**, connect the supply bottles this way:
   - Valve A: Disinfectant bottle

- Valve B: Rinse solution bottle

8. Reconnect the power cord and turn on the washer.
9. To run the DECONTAMINATION program, follow this sequence:

❖ While this program is running, you will need to periodically check the display panel and follow the instructions.

Washer **not** equipped with Buffer Switching:

MAINT → SELECT MAINT PROGRAM: → **DECONTAMINATION** →
CONNECT DISINFECTANT AND PRESS <**START**> KEY
RUNNING: DECONTAMINATION/ DISINFECTING →
CONNECT RINSE BOTTLE AND PRESS <**START**> KEY

Washer equipped with **Buffer Switching:**

MAINT → SELECT MAINT PROGRAM: → **DECONTAMINATION** →
DISINFECTANT VALVE? **A B C** or **D** → RINSE VALVE?
A B C or **D** → START MAINTENANCE? **YES**

Alternate Decontamination Procedure

If you are unable to run the DECONTAMINATION program due to a system failure, perform the following alternate decontamination procedure to disinfect the internal tubing and manifold.

1. Turn the washer off and disconnect the power cord.
2. Remove the mist shield, if it is attached:
   - Using your fingers, loosen the two thumbscrews on the shield (**use no tools**).
   - Lift the shield off the two posts.
   - Refer to the instructions on page 128 for decontaminating the mist shield.

   ❖ Use extra care when removing the **Select**, **HT**, and **Select CW** dual manifolds. Hold the two manifolds (and end plates) together as a single unit when removing or replacing.

3. Using the 9/64" (3.57 mm) hex wrench, remove the screws, washers, and springs that hold the manifold(s) in place. Remove the manifold(s) and end plates. See **Figure 26** or **Figure 27** beginning on page 120.

4. Prepare an aqueous solution of 0.5% sodium hypochlorite (bleach). As an alternative, 70% isopropyl alcohol (or ethanol) may be used if the effects of bleach are a concern.

   ❖ **Isopropyl alcohol** is not recommended for removing **proteins** (such as bovine serum albumin).

5. Soak the tubing and manifold in the bleach or alcohol solution.
6. Wait 20 minutes. Rinse the tubing and manifold with DI or distilled water.
7. Use a clean, dry cloth to dry all wet surfaces of the tubes and manifold.

Important. When reinstalling the manifold, only tighten the screw-washer-spring assembly that holds it in place until you feel the mechanical stop. You will damage the instrument if you continue tightening past this point, and will **void your warranty.**

8. Reassemble the manifold and end plates, making sure that the two o-rings are in place prior to reassembly. **Do not overtighten the manifold screws.**
9. Re-attach the mist shield.
10. Prime the system by running DAY_RINSE or a similar Maintenance or Prime program. Watch for leaks. If fluid leaks out of the back of the instrument, firmly seat the tubing. If fluid leaks from the manifold, try disassembling and carefully reassembling.
11. Discard the used gloves and cloths using a Biohazard trash bag and an approved Biohazard container.

Prepare for Storage or Shipment

Before the washer is shipped or stored, the entire system should be rinsed and soaked with disinfectant and then purged of all fluid. Perform these steps when leaving the washer unused for a long period of time.

Long_Shutdown

The recommended onboard Maintenance program is LONG_SHUTDOWN**.** This program flushes and soaks the supply tubing and manifold with disinfectant, then flushes the system with rinse, and finally purges the system of fluid.

- **HT2 models:** Before switching from one manifold to another (e.g., before removing the 192-tube manifold and installing the 96-tube manifold), BioTek recommends that you perform this procedure to thoroughly clean whichever manifold will be removed and stored.

The LONG_SHUTDOWN Maintenance program primes and soaks the washer with the Prime Volumes and Soak Durations specified in the P_DECON1 and P_DECON2 Prime programs. The Prime Volume and Prime Flow Rate parameters for these Prime programs can be edited for optimum cleaning. The Soak Duration cannot be edited. Refer to the charts in the ***Prime Programs*** section of this chapter for a list of default Prime program parameters and to ***Chapter 3***, ***Operation***, for instructions on editing these parameters.

- Three supply bottles are required for this procedure: one for disinfectant, one for rinse, and one for air.

Be sure to check the percent NaClO of the bleach you are using; this information is printed on the side of the bottle. Commercial bleach is typically 10% NaClO; if this is the case, prepare a 1:20 dilution. Household bleach is typically 5% NaClO; if this is the case, prepare a 1:10 dilution.

1. Turn off the instrument. Empty the waste bottle.
2. Prepare an aqueous solution of 0.5% sodium hypochlorite (NaClO, or bleach).
3. Fill one supply bottle with at least 400 mL of bleach solution (disinfectant).
4. Fill another supply bottle with at least 800 mL of deionized water (rinse).
5. Keep the third supply bottle empty (air).

6. If the washer is equipped with the **Buffer Switching valve module**, connect the supply bottles this way:

   Valve A: Disinfectant bottle

   Valve B: Rinse solution bottle

   Valve C: Empty bottle

7. Turn on the washer.
8. To run the LONG_SHUTDOWN program, follow this sequence:

❖ While this program is running, you will need to periodically check the display panel and follow the instructions.

Washers not equipped with the Buffer Switching valve module:

MAINT → SELECT MAINT PROGRAM: → **LONG_SHUTDOWN** → CONNECT DISINFECTANT AND PRESS **<START>** KEY

Washers equipped with the **Buffer Switching valve module:**

MAINT → SELECT MAINT PROGRAM: → **LONG_SHUTDOWN** → DISINFECTANT VALVE? **A** → RINSE VALVE? **B** → AIR VALVE? **C** → START MAINTENANCE? **YES**

Storing the Washer

After performing the **Long_Shutdown** procedure:

1. Turn off the washer and disconnect the power cord.
2. Store the washer on a flat surface that is relatively free of vibration, in a dust-free and particle-free environment.
3. Protect the washer from temperature extremes that can cause condensation within the unit and from corrosive fumes and vapors.
4. Store the washer under the following environmental conditions:

   Temperature: –20°C to 50°C (-4°F to 122°F)

   Relative humidity: 10% to 80% (non-condensing)

❖ **Note:** Allow the washer to reach room temperature before use after storage.

Replace Components

Replacing the O-Rings and Channel-End Seals

Replace the manifold o-rings and replace the 12 (or 24) rubber plugs (seals) on the channel ends if they show signs of cracking or drying out or other damage. Order the replacement o-rings and seals from BioTek (see page 104).

You must remove the manifold to change the seals, so these tasks work best in conjunction with the ***Cleaning the Manifold, Mist Shield, and Tubing*** procedure on page 117.

Replacing the O-Rings

After completing Step 9 of the procedure on page 118:

1. Using your fingers or an appropriate tool, such as a very small, flat screwdriver, remove the two o-rings that are exposed when the manifold is removed.
2. Replace the used o-rings with new ones by fitting them into the grooved slots.
3. If you are not replacing the channel end-seals at this time, reinstall the manifold. **Do not overtighten the manifold screws.**

Important: When reinstalling the manifold, only tighten the screw-washer-spring assembly that holds it in place until you feel the mechanical stop. You will damage the instrument if you continue tightening past this point.

Replacing/Cleaning the Channel-End Seals

Cleaning or replacing the channel-end seals is most easily and efficiently accomplished in conjunction with ***Cleaning the Manifold, Mist Shield, and Tubing*** procedure on page 117. If the channel-end seals do not need to be replaced, they should be washed with mild detergent or alcohol.

1. If you haven't already done so, remove the manifold end plate to access the channel-end seals as described in Step 7 on page 118, when removing the manifold(s). See ***Figure 29*** on the following page.

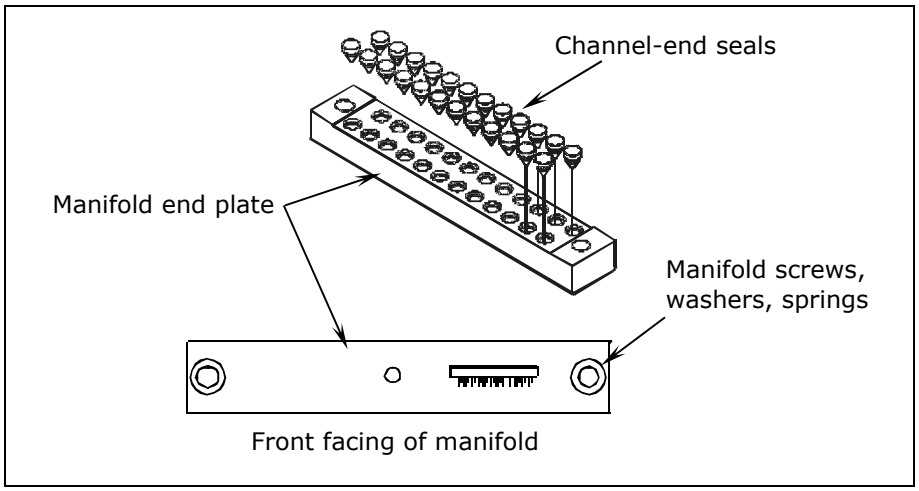


Figure 29: Replacing the Channel-End Seals

The manifold end plate sits in front of the manifold and holds the screws, washers, and springs that hold the manifold in place. The channel-end seals sit in bored holes in the backside of the plate, facing the manifold's channels. The manifold end plate has markings to indicate its position relative to the manifold, e.g., Top or Bottom.

2. Using an appropriate tool, such as a very small, flat screwdriver or a paper clip, remove the seals from the manifold end plate.

> **Important:** Do not grease any parts of this mechanism. Lubricate the seals and the bored holes with alcohol to assist with reinsertion.

3. Clean the seals if you are not replacing them with new ones.
4. Lubricate both the seals and the bored holes with 70% isopropyl alcohol to facilitate insertion of the seals. Make sure the seals sit firmly in the bored holes in the manifold end plate.

> ❖ The 9/64" (3.57 mm) hex wrench shipped with the washer is useful for reinserting the seals into the bored holes.

5. When all of the seals are in place, reinstall the manifold end plates and the manifold. **Do not overtighten the manifold screws**.

> **Important:** When reinstalling the manifold, only tighten the screw-washer-spring assembly that holds it in place until you feel the mechanical stop. You will damage the instrument if you continue tightening past this point.

Chapter 5

Qualification

This chapter describes how to verify the performance of the ELx405 Microplate Washer.

Overview

❖ This chapter provides instructions for qualifying ELx405 models that are currently available for purchase (see ***Instrument Models*** in chapter 1). This includes references to Deep Well "D" and Select models. This chapter also provides instructions for qualifying older ELx405 models that are no longer available for purchase.

Instrument verification for the ELx405 involves three activities: qualification of installation and setup, qualification of routine capability, and qualification of long-term stability. This chapter refers to these activities as Installation Qualification **(IQ)**, Operational Qualification **(OQ)**, and Performance Qualification **(PQ)**, respectively.

Verification testing of the washer includes the **System Self Test** and **Checksum Test**, and liquid testing for **Evacuation Efficiency** and **Dispense Precision**. For washers equipped with the optional valve module, instrument verification includes Dispense Precision tests for the valve module.

- The **System Self Test** verifies system components, such as the vacuum, manifold, and carrier positioning. The **Checksum Test** verifies the basecode software against internal checksum values to ensure that no corruption has occurred. If the Checksum Test is run manually, part number and version information is displayed for the software on the instrument.
- **Evacuation Efficiency.** This test measures the residual volume per well after the aspiration aspect of plate washing. The lower the residuals per well, the better the evacuation efficiency of the washer.
- **Dispense Precision.** This test measures the variability of volumes dispensed from tube to tube across the manifold.
- **Annual Buffer Switching Module Test.** The Dispense Precision Test for the external Buffer Switching valve module measures the variability of volumes dispensed from tube to tube across the manifold, when the washer is used with the valve module.

❖ **Note:** The Ultrasonic Advantage (ultrasonic cleaner) does not require qualification testing.

Verification Schedule

The following schedule defines the factory-recommended intervals for verification tests for a washer used two to five days a week. The schedule assumes that the washer is properly maintained as outlined in ***Chapter 4**, **Maintenance.***

❖ **Note:** An **instrument qualification package** (PN 7100567) for the washer is available for purchase. The package contains thorough procedures for performing Installation Qualification, Operational Qualification and Performance Qualification (IQ-OQ-PQ) and preventative maintenance (PM). Extensive Checklists and Logbooks are included for recording results. Contact your local dealer for more information.

Recommended Instrument Verification Schedule

Tests	IQ	OQ		PQ
	Initially	Initially	Annually	Monthly
System Self Test and Checksum Test	✓	✓	✓	✓
Evacuation Efficiency Test		✓	✓	✓
Dispense Precision Test		✓	✓	✓
Annual Buffer Switching Module Test			✓	
Vacuum Filtration Evacuation Test		✓	✓	✓
Deep Well Evacuation Test		✓	✓	
Note: Refer to page 143 to determine which liquid tests to perform.				

Important! The risk factors associated with your assays may require that the Operational and Performance Qualification procedures be performed more or less frequently than shown above.

IQ/OQ/PQ

Installation Qualification (IQ) confirms that the washer and its components have been supplied as ordered and ensures that they are assembled and configured properly for your lab environment.

- The recommended IQ procedure consists of setting up the instrument as described in ***Chapter 2***, ***Installation*** and then performing the System Self-Test and the Checksum test.
- The IQ procedure should be performed *initially* (before the washer is used for the first time).
- The successful completion of the IQ procedure verifies that the instrument is installed correctly. The Operational Qualification procedure (see below) should be performed immediately following the successful IQ.

Operational Qualification (OQ) confirms that the washer operates according to specification initially and over time.

- The recommended OQ procedure consists of performing the System Self-Test and the Checksum, Evacuation Efficiency, and Dispense Precision tests.
- Your facility's operating policies may also require that you perform an actual assay prior to accepting the washer for routine use. You should not use the data obtained from the first assay that utilizes the washer until you have confirmed that the package insert criteria have been met.
- The OQ procedure should be performed *initially* (before first use) and then routinely; the recommended interval is *annually*. It should also be performed after any major repair or upgrade to the hardware or software.
- Although out-of-tolerance failures will be detected by the OQ tests, results should be compared with those from the monthly Performance Qualification tests and previous OQ tests to monitor for trends.
- The successful completion of the OQ procedure, in combination with results that are comparable to previous PQ and OQ tests, confirms that the washer is performing consistently over time.

Performance Qualification (PQ) confirms that the washer consistently meets the requirements of the tests performed at your laboratory.

- The recommended PQ procedure consists of performing the System Self-Test and the Checksum, Evacuation Efficiency, and Dispense Precision tests.

- Your facility's operating policies may also require that you routinely perform an actual assay, to confirm that the washer will consistently give adequate results for the assays to be run with it.
- These tests should be performed routinely; the recommended interval is *monthly*. This frequency may be adjusted depending on the trends observed over time.
- The successful completion of the PQ procedure confirms that the washer is performing consistently under normal operating conditions.

System and Checksum Tests

The **System Self Test** and **Checksum Test** are performed automatically whenever the washer is powered on. They can also be run manually via the washer's keypad.

System Self Test

The System Self Test checks the vacuum (when run manually), manifold, and manifold-to-carrier positioning.

To run the System Self Test:

At the Main Menu, select UTIL → TESTS → **SELFCHK**.

The following screen will appear while the test is running:

```
SYSTEM TEST RUNNING. . .

PLEASE WAIT. . . .
```

If the test passes, the Main Menu will be displayed.

If the test fails, the washer will beep repeatedly and the display will show an error code. If this happens, write down the error code and then press the **Stop** key on the keypad to stop the beeping. Look up the error code in ***Appendix B, Error Codes***, to determine its cause. If the problem is something you can fix, turn off the washer, fix the problem, and then turn the washer back on. If the cause is not something you can fix, contact Technical Support.

Checksum Test

The Checksum Test compares the on-board software with an internally recorded checksum value to ensure the program has not become corrupted.

To run the Checksum Test:

At the Main Menu, select UTIL → TESTS → **CHKSUM**.

The first screen will display the **onboard (basecode) software** part number, version number, and checksum:

```
7100xxx Version x.xx

CODE CHECKSUM: (xxxx)
```

After a few seconds, a second screen will display the **assay software** part number and version number:

```
7100xxx Version x.xx
```

The Main Menu will be displayed after the test is finished.

- **If you need to provide the Checksum information to Technical Support**: Since the above screens are displayed only briefly, you may have to run the Checksum Test a few times to record all of the required information.

Liquid Tests

Evacuation Efficiency Test

The Evacuation Efficiency test measures the **residual volume** (mean residual weight) per well after aspiration. The lower the residual per well, the better the evacuation efficiency of the washer. A known solution is dispensed into all wells of a previously weighed microplate. The aspiration program is run and the plate is reweighed in order to calculate the total residual fluid based on the weight difference. The total residual fluid weight is divided by 96 or 384 as appropriate to obtain the **mean residual weight**.

If further testing is necessary (to identify "problem" wells), the supplemental test is performed. A concentrated dye solution is dispensed to/evacuated from the wells, and the plate is weighed. Buffer is then pipetted to all wells to bring the volume of fluid to a consistent measurement level. The optical density of each well is measured at 630 nm and the background at 450 nm is subtracted to account for scratches on the plate or particulates in a well. Each well's residual volume is calculated using its optical density and a calibration factor derived from the mean residual weight and the mean optical density of all wells on the plate. It is assumed that 1 mg = 1 µL of fluid for this calculation.

Dispense Precision Test

The Dispense Precision Test measures the **variability of the volumes dispensed** from tube to tube across the manifold. In this test, a blue dye solution is dispensed into a microplate. The optical density of each well is measured at 630 nm and the background at 450 nm is subtracted to account for scratches on the plate or particulates in the well. The average error percentage is calculated and the amount dispensed to each well is calculated. Acceptance is based on the **%CV** (%Coefficient of Variation), or the ratio of the standard deviation of the distribution of fluid volumes in the wells to the mean value of volume per well. The lower the %CV, the better the uniformity across the manifold.

Annual Buffer Switching Test: The Dispense Precision test is conducted for the external Buffer Switching valve module to ensure that each valve (A, B, C, D) is calibrated to deliver the same volume of fluid.

HT models with the accessory 96-tube manifold: Ensure that the washer is configured for operation with the correct manifold (**96** or **192**) (refer to ***Manifold Selection*** in ***Chapter 3, Operation***). Failure to set the correct manifold type in the software before operating the washer may damage the manifold and void your warranty.

We recommend that you perform these routine tests before first use (after the IQ) and then monthly:

- **Dispense Precision Test.** Measures the variability of volumes dispensed from tube to tube across the manifold.
- **Evacuation Efficiency Test.** Measures the residual volume per well after the aspiration aspect of plate washing. The lower the residuals per well, the better the evacuation efficiency of the washer.

If your washer is equipped with Buffer Switching, we recommend performing this additional test annually (starting one year after installation):

- **Annual Buffer Switching Module Test.** Measures the variability of volumes dispensed from tube to tube across the manifold, for each valve, when the washer is used with this external valve-switching module.

Which Tests to Perform?

Which tests you will perform depend on the **washer model**, in some cases which **manifold type** is installed on it, and whether or not the washer is equipped with **Buffer Switching**. Refer to the chart below to determine which tests to perform.

Washer Model	Manifold Type	Liquid Tests to Perform	See Page
405 **Select** **Select CW** **Deep Well**	Single/96 or Dual/96 (incl. deep tube models)	Dispense Precision Test Annual Buffer Switching Test* (if applicable) Evacuation Efficiency Test	146 147 148
HT	Dual/192	Dispense Precision Test (192) Annual Buffer Switching Test (192)* (if applicable) Evacuation Efficiency Test (192)	150 151 152
HT2	Dual/96	Dispense Precision Test Annual Buffer Switching Test* (if applicable) Evacuation Efficiency Test	146 147 148
Vacuum Filtration	All	Vacuum Filtration Evacuation Efficiency Test	154
Deep Well	Dual 96 Deep	Deep Well Evacuation Efficiency Test	155

** Test is performed after the instrument has been in use for one year, and then annually.*

Materials

- One **new** microplate per test to be performed:

Microplate Type	Liquid Tests
Flat-bottom 96-well plates, Corning® Costar #3590 (or equivalent)	Dispense Precision Test
	Evacuation Efficiency Test
	Annual Buffer Switching Test (if applicable), one plate per valve tested
96-well filter plate, Millipore® MSHVN4550 96 (or equivalent)	Vacuum Filtration Evacuation Efficiency Test
Flat-bottom 384-well plates, Corning Costar (or equivalent)	Dispense Precision Test (192)
	Evacuation Efficiency Test (192)
	Annual Buffer Switching Test (192) (if applicable), one plate per valve tested
384-well filter plate, Millipore® MZFCN0W10 (or equivalent)	Vacuum Filtration Evacuation Efficiency Test
Corning 96 Polypropylene Storage Block, PN 3960 or 3961	Deep Well Evacuation Efficiency

- Precision balance with minimum capacity of 100 g and readability of 0.001 g resolution
- Pipettes and graduated beakers
- Microplate absorbance reader capable of dual wavelength reading at 630/450 nm
- Liquid Test Worksheets at the end of this chapter for recording data and results
- Deionized water
- **Test solutions:**

If this manifold is installed:	Prepare these solutions, as described on the next page:			
	Sol. #1	**Sol. #2**	**Sol. #3**	**Sol. #4**
Single/96 or Dual/96	1 batch (1000 mL)	1 batch (100 mL)	1 batch (1200 mL)	n/a
Dual/192	2 batches (2000 mL)	1 batch (100 mL)	n/a	1 batch (1440 mL)

❖ Volumes are sufficient for performing the standard and supplemental Evacuation Efficiency tests, plus the Dispense Precision test. In most cases, enough fluid will be left over to re-run a test, if necessary.

- If you will be performing the **annual OQ** with the **Buffer Switching module**, you will need several additional liters of deionized water.
- If you are testing a Magnetic Bead washer model, do not perform these tests with the magnet in the microplate carrier.

Test Solution Recipes

- Using **pure deionized water** in place of Solution #1 is not recommended and will likely result in the failure of the washer to meet specifications.
- We *recommend* that you prepare the solutions a few hours before you plan to run the tests. This will allow any foam caused by the agitation of solutions containing Tween® 20 to settle.
- You may use **your own buffer solution** in place of Solution #1. If any tests fail using your own buffer, however, retry the tests using the suggested solutions.
- **Important:** BioTek has determined the pass/fail specifications for the following tests using the test solutions described here.

SOLUTION #1: Buffer Solution		
Pipette 1 mL Tween® 20 into 1 liter (1000 mL) of deionized water and mix well.	**or**	Pipette 10 mL of BioTek Wetting Agent* into 1 liter of deionized water and mix well.

** BioTek Solution #1 100X Concentrate Wetting Agent 125 mL (PN 7773002) contains 10% Tween 20 in deionized water and 0.01% Sodium Azide as a preservative.*

SOLUTION #2: Residual Test Solution		
Mix 100 mL of **Solution #1** with 0.050 grams of FD&C #1 blue dye.	**or**	Mix 90 mL of **Solution #1** with 10 mL of BioTek Blue Test Dye***.**

** BioTek Solution #2 10X Concentrate Blue Test Dye 125 mL (PN 7773001) contains 5 g per liter FD&C Blue #1, 0.1% Tween 20 in DI water and 0.01% Sodium Azide preservative.*

SOLUTION #3: Dispense Precision Solution for Single/Dual/96 manifolds
Mix 1180 mL of deionized water with 20 mL of **Solution #2**.

SOLUTION #4: Dispense Precision Solution for the Dual/192 manifold
Mix 1420 mL of **Solution #1** with 20 mL of **Solution #2**.

Dispense Precision Test

*This test is designed for **Single/96** and **Dual/96** manifolds and can be used to test Vacuum Filtration models. See page 150 if you're looking for the Dispense Precision Test for the Dual/192 manifold.*

- If the washer is equipped with **Buffer Switching**, use Valve A or whichever valve is used most frequently.
- When this test is complete, the dispensed plate can be used to perform the Evacuation Efficiency Test (see page 148).

1. Fill a supply bottle with two liters of **deionized water**. Run Maintenance program **DAY_RINSE** three times to prime the fluid lines and manifold.
2. Fill a supply bottle with 1200 mL of **Solution #3**. Run **DAY_RINSE** again, to prime the washer with the solution.
3. If you will be using the same plate for the Evacuation Efficiency Test: place a new 96-well plate on the balance and tare the balance.
4. Place the microplate on the washer and run Dispense program **accuracy_qc_test** to dispense 300 µL of solution to each well of the plate.
5. When the program is finished, carefully remove the plate.
6. Read the plate in an optical reader (blank on air), using the dual-wavelength method (630 nm – 450 nm) and then print or export the results.
7. Using the "Dispense Precision Test" worksheet at the end of this section, perform data reduction:
    - Calculate the **Standard Deviation** for the 96 delta OD values.
    - Calculate the sum of the delta OD values and then divide by **96** to determine the **Mean OD** for the plate.
    - Calculate the **%CV:** (Standard Deviation/Mean OD) ***** 100.
    - The %CV should be **<= 3.0** (washer serial numbers > 204271) **or** **<= 4.0** (washer serial numbers ≤ 204271)

    If the test fails, one or more dispense tubes may need to be cleaned. Run AUTOCLEAN (Ultrasonic Advantage™ models only), and/or remove the manifold and use the stylus to clean the dispense tube(s) giving lower-than-average readings (see ***Chapter 4, Maintenance*** for complete instructions). When finished, prime the washer and retry the test.

Annual Buffer Switching Module Test

- ❖ Applies to models with the external Buffer Switching module only.
- ❖ Perform this test during the **annual OQ**.
- ❖ The Dispense Precision Test described on page 146 must pass for one valve before the annual test for all valves can be performed.

1. Empty the waste bottle now, and then as needed throughout this procedure.
2. Fill each of the supply bottles connected to **Valves A, B, C,** and **D** with three liters (3000 mL) of deionized water.

Repeat the following steps <u>for each valve</u>:

3. Run the Maintenance program **DAY_RINSE** three times to prime the fluid lines, manifold, and the valve being tested.
4. Edit the Dispense program **accuracy_qc_test** to use the Valve currently being tested (**DEFINE > EDIT > DISP > accuracy_qc_test**).

- ❖ For some washer models, accuracy_qc_test is locked for editing (it can only be used to test Valve A). If this is the case, create a copy of this program (DEFINE > COPY > DISP) and then edit the copy when performing step 4. Run this program when performing step 6.

5. Place a new 96-well microplate on the balance and zero the balance.
6. Place the microplate on the carrier and run Dispense program **accuracy_qc_test**. The program dispenses 300 µL of water to each well of the plate. It does not evacuate the wells.
7. When the program is finished, carefully remove the plate and weigh it. This is the **Total Dispense Weight** in grams.
    - The Total Dispense Weight should be **28.8 grams, ±10%** (between 25.92 g and 31.68 g).
    - If the weight falls above this range, the valve may be defective. Contact Technical Support.
    - If the weight falls below this range, the valve may be contaminated with fungi or proteins and should be cleaned using an appropriate enzyme, alcohol, or a diluted bleach solution, depending on the contaminant.

    See ***Removing Protein Residuals & Fungi Growth***, as well as the Decontamination procedure in ***Chapter 4, Maintenance***, for suggestions. After cleaning the valve and tubing, retry the test. If the test continues to fail, contact Technical Support.
8. Record results in the "Annual Buffer Switching Module Test" worksheet at the end of this section.

Evacuation Efficiency Test

*This test is designed for **Single/96** and **Dual/96** manifolds. See page 154 for this test for Vacuum Filtration models. See page 150 for the Evacuation Efficiency Test for the Dual/192 manifold.*

> ❖ If you tared the balance at the start of the Dispense Precision Test (page 146) to use the same plate in this test: **skip steps 1-3**.

1. Fill a supply bottle with two liters of **deionized water**. Run Maintenance program **DAY_RINSE** three times to prime the fluid lines and manifold.
2. Place a new 96-well microplate on the balance and tare the balance.
3. Pipette or dispense 300 µL of **Solution #1, 2, or 3** (your choice) into each well of the microplate.
4. Place the plate on the washer and run the Aspirate program **residual_qc_test**. This program evacuates all of the wells, leaving a small amount of residual fluid.
5. When the program is finished, remove the plate and weigh it immediately, because evaporation will affect the results. This is the **Total Residual Weight**, in grams.
6. Visually inspect the plate and note if any wells appear to have considerably more liquid in them than others.
7. Using the "Evacuation Efficiency Test" worksheet at the end of this section, calculate results:
   - Divide the Total Residual Weight by **96** to find the **Mean Residual Weight.**
   - The Mean Residual Weight should be:
     <= 0.002 g (washer serial numbers > 204271) **or**
     <= 0.005 g (washer serial numbers ≤ 204271)

If the Mean Residual Weight is greater than the appropriate limit above, or if one or more wells appear to have much more liquid than the others, the washer failed the test. If the test fails once, troubleshoot as follows:

- If the problem appears to be related to particular wells, clean those aspiration tubes: run AUTOCLEAN (Ultrasonic Advantage™ models), and/or remove the manifold and thoroughly clean the tubes with the stylus (see ***Chapter 4, Maintenance*** for instructions.) When finished, retry the test.
- Failure is commonly caused by improper aspiration tube placement within the wells, usually because a microplate other than the recommended Corning® Costar 96 was used. If you prefer to use a different plate, modifying the ASPIRATE HEIGHT or HORIZONTAL ASPIRATE POSITION parameters in a copy of **residual_qc_test** should correct this error. After making this change, retry the test using a new microplate.

If the test fails a second time: Perform the diagnostic procedure on the next page.

Evacuation Diagnostic Procedure

Perform these steps if the Evacuation Efficiency Test fails twice. This procedure will confirm which aspirate tube(s) may be clogged, or if the plate's alignment or position is the problem.

1. If you have not already done so, repeat steps 2 through 7 of the previous test, using **Solution #2** for the dispense fluid. Be sure to recalculate the **Mean Residual Weight**.
2. Pipette or dispense 300 µL of **Solution #1** into each well, on top of the residual solution.
3. Shake the plate for uniform distribution of the remaining dye in each well.
4. Read the plate in an optical reader (blank on air), using the dual-wavelength method (630 nm – 450 nm), then print or export the results.
5. Using the "Evacuation Diagnostics" worksheet at the end of this section, perform data reduction:
    - Calculate the sum of the delta OD values for all 96 wells, then divide by **96** to determine the **Mean OD** for the plate.
    - Divide the Mean OD by the Mean Residual Weight (from step 1) to find the **Residual Factor**.
    - For each well, divide its delta OD value by the Residual Factor to find its **Residual Weight**.
    - Each well's Residual Weight should be:

      <= 0.002 g (washer serial numbers > 204271) **or**
      <= 0.005 g (washer serial numbers ≤ 204271)

If one or more wells has a Residual Weight greater than the specification, review the data to determine which well, or wells, is causing the problem.

- If the problem appears to be related to particular wells, clean those aspiration tubes: run AUTOCLEAN (Ultrasonic Advantage™ models), and/or remove the manifold and thoroughly clean the tubes with the stylus (see ***Chapter 4, Maintenance*** for instructions). When finished, retry the Evacuation Efficiency Test.
- If the problem appears to be related to a particular region, edge, or corner of the plate, review the alignment and flatness of the plate on the carrier.
- For additional suggestions, see the ***Troubleshooting Charts*** in ***Appendix A***.
- If the test continues to fail, contact Technical Support.

Dispense Precision Test (192)

*This test is designed for the **Dual/192 manifold**. See page 146 if you're looking for the Dispense Precision Test for Single/96 and Dual/96 manifolds. See page 144 for a list of required materials.*

- If the washer is equipped with **Buffer Switching**, use Valve A or whichever valve is used most frequently.
- When this test is complete, the dispensed plate can be used to perform the Evacuation Efficiency Test (see page 152).

1. Fill a supply bottle with two liters of **deionized water**. Run Maintenance program **DAY_RINSE** two or three times to prime the fluid lines and manifold.
2. Fill a supply bottle with 1440 mL of **Solution #4**. Run **DAY_RINSE** again to prime the washer with the solution.
3. If you will be using the same plate for the Evacuation Efficiency Test: place a new 384-well plate on the balance and tare the balance.
4. Place a new 384-well microplate on the washer and run Dispense program **192accuracy_qc** to dispense 80 µL of solution to each well of the plate.
5. When the program is finished, carefully remove the plate.
6. Read the plate in an optical reader (blank on air), using the dual-wavelength method (630 nm – 450 nm) and then print or export the results.
7. Using the "Dispense Precision Test (192)" spreadsheet on the product CD **OR** worksheet at the end of this section, perform data reduction:
    - Calculate the **Standard Deviation** for the 384 delta OD values.
    - Calculate the sum of the delta OD values and then divide by **384** to determine the **Mean OD** for the plate.
    - Calculate the **%CV:** (Standard Deviation/Mean OD) ***** 100.
    - The %CV should be **<= 4.0**

    If the %CV is greater than 4.0, one or more dispense tubes may need to be cleaned. Run AUTOCLEAN (Ultrasonic Advantage™ models only), and/or remove the manifold and use the stylus to clean the dispense tube(s) giving lower-than-average readings (see ***Chapter 4, Maintenance*** for complete instructions). When finished, prime the washer and retry the test.

Annual Buffer Switching Module Test (192)

- ❖ Applies to models with Buffer Switching only.
- ❖ The Dispense Precision Test described on page 150 must pass for one valve before the annual test for all valves can be performed.

1. Empty the waste bottle now, and then as needed throughout this procedure.
2. Fill each of the supply bottles connected to **Valves A, B, C,** and **D** with three liters (3000 mL) of deionized water.

Repeat the following steps <u>for each valve</u>:

3. Run the Maintenance program **DAY_RINSE** three times to prime the fluid lines, manifold, and the valve being tested.
4. Edit the Dispense program **192accuracy_qc** to use the Valve currently being tested (**DEFINE > EDIT > DISP > 192accuracy_qc**).
5. Place a new 384-well microplate on the balance and zero the balance.
6. Place the microplate on the carrier and run Dispense program **192accuracy_qc**. The program dispenses 80 µL of water to each well of the plate. It does not evacuate the wells.
7. When the program is finished, carefully remove the plate and weigh it. This is the **Total Dispense Weight** in grams.
    - The Total Dispense Weight should be **30.72 grams, ±10%** (between 27.65 g and 33.79 g).
    - If the weight falls above this range, the valve may be defective. Contact Technical Support.
    - If the weight falls below this range, the valve may be contaminated with fungi or proteins and should be cleaned using an appropriate enzyme, alcohol, or a diluted bleach solution, depending on the contaminant.

    See ***Removing Protein Residuals & Fungi Growth***, as well as the Decontamination procedure in ***Chapter 4, Maintenance***, for suggestions. After cleaning the valve and tubing, retry the test. If the test continues to fail, contact Technical Support.
8. Record results in the "Annual Buffer Switching Module Test (192)" worksheet at the end of this section.

Evacuation Efficiency Test (192)

*This test is designed for the **Dual/192** manifold. See page 146 if you're looking for the Evacuation Efficiency Test for the Single/96 and Dual/96 manifolds. See page 144 for a list of required materials.*

> ❖ If you tared the balance at the start of the Dispense Precision Test (page 150) to use the same plate in this test: **skip steps 1-3**.

1. Fill a supply bottle with two liters of **deionized water**. Run Maintenance program **DAY_RINSE** three times to prime the fluid lines and manifold.
2. Place a new 384-well microplate on the balance and zero the balance.
3. Pipette or dispense 80 µL of **Solution #1, 2, or 4** (your choice) into each well of the microplate.
4. Place the plate on the washer and run the Aspirate program **192resid_qc_test**. This program evacuates all of the wells, leaving a small amount of residual fluid.
5. When the program is finished, remove the plate and weigh it immediately, because evaporation will affect the results. This is the **Total Residual Weight**, in grams.
6. Visually inspect the plate and note if any wells appear to have considerably more liquid in them than others.
7. Using the "Evacuation Efficiency Test (192)" worksheet at the end of this section, calculate results:
   - Divide the Total Residual Weight by **384** to find the **Mean Residual Weight**.
   - The Mean Residual Weight should be **<= 0.002 g**

If the Mean Residual Weight is greater than 0.002 g, or if one or more wells appear to have much more liquid than the others, the washer failed the test.

If the test fails once, troubleshoot as follows:

- If the problem appears to be related to particular wells, clean those aspiration tubes: run AUTOCLEAN (Ultrasonic Advantage™ models), and/or remove the manifold and thoroughly clean the tubes with the stylus (see ***Chapter 4, Maintenance*** for instructions.) When finished, retry the test.
- Failure is commonly caused by improper aspiration tube placement within the wells, usually because a microplate other than the recommended Corning® Costar 384 was used. If you prefer to use a different plate, modifying the ASPIRATE HEIGHT or HORIZONTAL ASPIRATE POSITION parameters in a copy of **192resid_qc_test** should correct this error. After making this change, retry the test using a new microplate.

If the test fails a second time: Perform the diagnostic procedure on the next page.

Evacuation Diagnostic Procedure (192)

Perform these steps if the Evacuation Efficiency Test fails twice. This procedure will confirm which aspirate tube(s) may be clogged, or if the plate's alignment or position is the problem.

1. If you have not already done so, repeat steps 2 through 7 of the previous test, using **Solution #2** for the dispense fluid. Be sure to recalculate the **Mean Residual Weight**.
2. Pipette or dispense 80 µL of **Solution #1** into each well, on top of the residual solution.
3. Shake the plate for uniform distribution of the remaining dye in each well.
4. Read the plate in an optical reader (blank on air), using the dual-wavelength method (630 nm – 450 nm), then print or export the results.
5. Using the "Evacuation Diagnostics (192)" spreadsheet on the product CD **OR** worksheet at the end of this section, perform data reduction:
    - Calculate the sum of the delta OD values for all 384 wells, then divide by **384** to determine the **Mean OD** for the plate.
    - Divide the Mean OD by the Mean Residual Weight (from step 1) to find the **Residual Factor**.
    - For each well, divide its delta OD value by the Residual Factor to find its **Residual Weight**.
    - Each well's Residual Weight should be **<= 0.002 g**

If one or more wells has a Residual Weight greater than 0.002 g, review the data to determine which well, or wells, is causing the problem.

- If the problem appears to be related to particular wells, clean those aspiration tubes: run AUTOCLEAN (Ultrasonic Advantage™ models), and/or remove the manifold and thoroughly clean the tubes with the stylus (see ***Chapter 4, Maintenance*** for instructions). When finished, retry the Evacuation Efficiency Test.
- If the problem appears to be related to a particular region, edge, or corner of the plate, review the alignment and flatness of the plate on the carrier.
- For additional suggestions, see the ***Troubleshooting Charts*** in Appendix A.
- If the test continues to fail, contact Technical Support.

Vacuum Filtration Evacuation Efficiency Test

This test is designed for Vacuum Filtration models. The vacuum filtration plate carrier must be installed and the instrument setting for **CARRIER** *set correctly. Perform the 96-well filter plate test on all models except the ELx405HTMF; run the 384-well test for these models.*

1. Fill a supply bottle with two liters of **deionized water**. Run Maintenance program **DAY_RINSE** three times to prime the fluid lines and manifold.
2. Place a new microplate on the balance and zero the balance:
   - 96-well 0.45µm filter plate: Millipore MSHVN4550 96 is recommended,
   - 384-well 1.2µm filter plate: Millipore MZFCN0W10 is recommended.
3. Run the **Link** protocol to first dispense DI water into each well of the microplate and then evacuates the wells:

Plate Type	Link Protocol	Volume	Vacuum Time
96-well plate	**VAC30_TEST**	300 µL/well	30 seconds
384-well plate	**VAC10_TEST**	80 µL/well	10 seconds

4. When the program is fi nished, remove the plate, and blot the bottom of the plate on a paper towel to remove any droplets.
5. Weigh the plate immediately. This is the **Total Residual Weight,** in grams.
6. Visually inspect the plate and note if any wells appear to have considerably more liquid in them than others.
7. Use the "Vacuum Filtration Evacuation Efficiency Test" worksheet at the end of this chapter to record the results:
   - For **96-well plates** the **Residual Weight** should be **<= 01.2 g**.
   - For **384-well plates** the **Residual Weight** should be **<= 04.0 g**.

If the test fails:

If the Residual Weight is greater than specified, the washer failed the test. Make sure a tight seal was maintained between the filter plate and plate carrier:

- A new, defect-free 96-well filter plate, BioTek PN 98258, or 384-well filter plate, BioTek PN 98287 was used. Carefully exam the edges of the plate for the potential cause of a vacuum leak;
- The vacuum filtration plate carrier's gasket is clean and has not been damaged by previous use or mishandling;
- The intermediate waste bottle's cap is well sealed.

Correct any of these conditions and rerun the test or contact Technical Support.

Deep Well Model Evacuation Efficiency Test

This test for Deep Well models verifies specified aspiration performance from a deep well plate/storage block. It is an optional test. Successful completion of the Dispense Precision and Evacuation Efficiency tests for 96-well plates (beginning on page 146) qualifies the instrument.

> ❖ Test results can be recorded using the **worksheets** at the end of the chapter.

1. Fill a supply bottle with one liter of test **Solution 1**. Run Maintenance program **DAY_RINSE** to prime the fluid lines and manifold.
2. Place a new Corning 96 Polypropylene Storage Block, part number 3960 or 3961 on the balance and zero the balance. (If you are using a different but equivalent vessel, you may need to modify the recommended protocol parameters to achieve expected performance.)
3. Create a wash protocol with these parameters:
   - Plate type: 96D or 96 Deep Well
   - 1 cycle (under Method on the keypad)
   - Dispense volume: 2000 µL
   - Dispense rate: 5
   - Dispense height: 354 steps
   - Aspirate height: 12
   - Aspirate rate: 2
   - Final Aspirate: NO
   - Retain all other default settings.

   Save the protocol for future use, e.g. name it "Deep Well Evac Test," so you can skip this step when performing qualification procedures in the future.
4. Run the protocol to dispense solution and when the program is finished, weigh the plate immediately. Record this as **Total Residual Weight,** in grams.
5. Visually inspect the plate and note if any wells appear to have considerably more liquid in them than others or if fluid drops have collected on top of the vessel.
6. Use the "Deep Well Evacuation Efficiency Test" worksheet at the end of this chapter to record the results. The **Residual Weight** should be **<= 0.192 g**.

If the test fails:

Generally, this test only fails when a plate other than the specified round-bottom Corning storage block is used. In this case, modify the protocol to enhance performance and rerun the test. For example, if drops are observed on top of the vessel, lower the dispense height. Contact Technical Support for assistance.

Default Parameters for the Liquid Test Programs

Evacuation Efficiency Tests				
	residual_qc_test		**192resid_qc_test**	
Aspirate Height	28 steps	3.556 mm	16 steps	2.032 mm
Horiz Aspirate Position	-28	-1.280 mm	00	0 mm
Horiz Y Aspir Position	N/A		00	0 mm
Aspirate Rate	2	3.4 mm/sec	3	4.0 mm/sec
Aspirate Delay	0000		0000	
Crosswise Aspirate	No		No	
For Vacuum Filtration models				
	96-well plates		**384-well plates**	
LINK Protocols	**VAC30_TEST**		**VAC10_TEST**	
Aspiration Type	VAC		VAC	
Vacuum Filtration Time	30 seconds		10 seconds	

Dispense Precision Tests		
	accuracy_qc_test	**192accuracy_qc**
Reagent Bottle	A	A
Dispense Volume	300 µL/well	80 µL/well
Dispense Flow Rate	4	5
Dispense Height	120	120
Horiz Disp Position	00	00
Horiz Y Disp Position	N/A	00
Prime Before Start	No	No

Dispense Precision Test

for Single/96 and Dual/96 Manifolds

Washer Model:	☐ ELx405™ ☐ Select CW ☐ Select ☐ HT2 (with Dual/96 manifold)
Valve Used:	or ☐ N/A
Serial Number:	

Calculations	
Standard Deviation: (calculate using spreadsheet program)	
Mean OD: (sum of all wells ÷ 96)	
% Coefficient of Variation: ((Standard Deviation ÷ Mean OD) x 100)	
%CV <= 3.0 (SN > 204271) or <= 4.0 (SN ≤ 204271)	☐ Pass ☐ Fail

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Annual Buffer Switching Module Test

for Single/96 and Dual/96 Manifolds

with Buffer Switching (Annual OQ only)

Washer Model:	☐ ELx405™ ☐ Select CW ☐ Select ☐ HT2 (with Dual/96 manifold)
Serial Number:	

Calculations for Valves A-D		
	Total Dispense Weight	**28.8 g ±10%**
Valve A	grams	☐ Pass ☐ Fail ☐ N/A
Valve B	grams	☐ Pass ☐ Fail ☐ N/A
Valve C	grams	☐ Pass ☐ Fail ☐ N/A
Valve D	grams	☐ Pass ☐ Fail ☐ N/A

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Evacuation Efficiency Test

for Single/96 and Dual/96 Manifolds

Washer Model:	☐ ELx405™	☐ Select CW
	☐ Select	☐ HT2 (with Dual/96 manifold)
Serial Number:		

Test Results	
Total Residual Weight:	grams
Verification that wells are consistent in appearance:	☐ Pass ☐ Fail
Mean Residual Weight (Total Residual Weight ÷ 96):	grams
Mean Residual Weight: <= 0.002 g (SN > 204271) or <= 0.005 g (SN ≤ 204271)	☐ Pass ☐ Fail

Additional Diagnostic Procedure (check here ☐ if not performed)	
Mean OD for the plate (Sum of all wells ÷ 96):	
Residual Factor (Mean OD ÷ Mean Residual Weight):	
Calculate the Residual Weight for each well: well OD ÷ Residual Factor	
Each Residual Weight per well: <= 0.002 g (SN > 204271) or <= 0.005 g (SN ≤ 204271)	☐ Yes ☐ No

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Vacuum Filtration Evacuation Efficiency Test

for 96-Well Filter Plates

Washer Model:	☐ ELx405™ ☐ Select CW ☐ Select ☐ HT2 (with Dual/96 manifold)
Serial Number:	

Test Results	
Verification that wells are consistent in appearance:	☐ Pass ☐ Fail
Residual Weight:	grams
Residual Weight: <= 1.2 g	☐ Pass ☐ Fail

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Deep Well Evacuation Efficiency Test

for 96-Deep-Well Storage Block/Plates

Washer Model:	☐ Select ☐ Select CW
Serial Number:	

Test Results	
Verification that wells are consistent in appearance:	☐ Pass ☐ Fail
Residual Weight:	grams
Residual Weight: <= .192 g	☐ Pass ☐ Fail

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Dispense Precision Test

for the Dual/192 Manifold

Washer Model:	☐ HT ☐ HT2 (with Dual/192 manifold)
Valve Used:	or ☐ N/A
Serial Number:	

Calculations	
Standard Deviation: (calculate using spreadsheet program)	
Mean OD: (sum of all wells ÷ 384)	
% Coefficient of Variation: ((Standard Deviation ÷ Mean OD) x 100)	
%CV <= 4.0	☐ Pass ☐ Fail

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Annual Buffer Switching Module Test

for the Dual/192 Manifold

with Buffer Switching (Annual OQ only)

Washer Model:	☐ HT ☐ HT2 (with Dual/192 manifold)
Serial Number:	

Calculations for Valves A-D		
	Total Dispense Weight	**30.72 g ±10%**
Valve A	grams	☐ Pass ☐ Fail ☐ N/A
Valve B	grams	☐ Pass ☐ Fail ☐ N/A
Valve C	grams	☐ Pass ☐ Fail ☐ N/A
Valve D	grams	☐ Pass ☐ Fail ☐ N/A

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Evacuation Efficiency Test

for the Dual/192 Manifold

Washer Model:	☐ HT ☐ HT2 (with Dual/192 manifold)
Serial Number:	

Test Results	
Total Residual Weight:	grams
Verification that wells are consistent in appearance:	☐ Pass ☐ Fail
Mean Residual Weight (Total Resid. Weight ÷ 384):	grams
Mean Residual Weight <= 0.002 g	☐ Pass ☐ Fail

Additional Diagnostic Procedure (check here ❑ if not performed)	
Mean OD for the plate (sum of all wells ÷ 384):	
Residual Factor (Mean OD ÷ Mean Residual Weight):	
Calculate the Residual Weight for each well: well OD ÷ Residual Factor	
Each Residual Weight per well <= 0.002 g	☐ Yes ☐ No

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Vacuum Filtration Evacuation Efficiency Test

for 384-Well Filter Plates

Washer Model:	☐ HT ☐ HT2 (with Dual/192 manifold)
Serial Number:	

Test Results	
Verification that wells are consistent in appearance:	☐ Pass ☐ Fail
Residual Weight:	grams
Residual Weight: <= 04.0 g	☐ Pass ☐ Fail

Date:	
Performed By:	
If required, Reviewed/Approved By:	

Appendix A

Troubleshooting

This appendix lists problems that you may experience with the washer, and suggests possible solutions for these problems.

Overview

Every effort has been made to ensure that the ELx405 Microplate Washer is extremely reliable and easy to use. Nevertheless, you could experience problems with the washer hardware, software, and/or accessories. This appendix offers information to help resolve these problems.

The ***Troubleshooting Checklist*** below is a concise summary of possible causes for many of the problems that may occur during operation of the washer.

The ***Troubleshooting Charts*** on the following pages provide detailed lists of problems, their possible causes, and possible solutions.

❖ **Note:** If you are operating the washer with the **BioStack** and encounter problems during plate transfers between the Stacker and the washer, or during communication between the two instruments, refer to the ***Troubleshooting and Error Codes*** section of the BioStack User Manual.

Troubleshooting Checklist

Periodic inspection of the washer, tubing, and bottles for the possible causes listed below may help to eliminate many of the problems listed on the following pages.

Check for the following:	
✓	**Loose or disconnected** power cord, vacuum pump accessory cable, waste/supply tubing and fittings.
✓	**Incomplete or incorrect installation** of manifold, carrier, High Flow vacuum pump, Buffer Switching module, Direct Drain Waste System, Vacuum Filtration module, incorrect attachment of mist shield or placement of microplates/strips in carrier.
✓	**Loose covers** on waste or supply bottles.
✓	**Accumulation of residue** on microplate carrier, carrier transport rails and carrier glide strips, or inside aspirate/dispense tubes, waste/supply bottles and tubing, manifold, inlet/outlet fittings, or fluid inlet filter.
✓	**Worn or defective** tubing, o-rings, inlet/outlet fittings, manifold or vacuum seals.
✓	**Kinked or bent** aspirate/dispense tubes or waste/supply tubing.
✓	**Protocol parameters not optimized or incorrect:** aspiration/dispense height too high/low, dispense flow rate too fast/slow for volume selected, horizontal aspirate position programmed too wide for a movement, system not primed or not adequately primed, insufficient vacuum dissipation delay, incorrect manifold selected (models with both the 96-tube and 192-tube manifolds).

Troubleshooting Charts

See ***Chapter 2***, ***Installation*** and ***Chapter 4***, ***Maintenance*** for illustrations of the components referenced in the Troubleshooting Charts.

WASHER START-UP		
Problem	**Probable Cause**	**Possible Solution**
Display (LCD) not on.	Power cord not plugged in.	Check power connection.
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.	The vacuum pump accessory cable should be plugged into the back of the washer.
	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.	(High flow vacuum pumps shipped prior to December 2005 only) Replace fuse (PN 46055). Increase vacuum dissipation delay (refer to the section on *Vacuum Dissipation Delay* in *Ch. 3*). Ensure that the vacuum pump accessory cable is plugged into the vacuum pump accessory outlet on the back of the washer, and not into a wall outlet. See *Ch. 2*.
Repeated blown fuses.	Vacuum Dissipate Delay is set too low for the volume of the waste bottle.	See Solution above. If not enough time is allowed for the vacuum to dissipate, then the pump with try to start while it is under a vacuum. This makes the pump draw more current to start 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.
Carrier/manifold position error.	Manifold or carrier is being obstructed.	Remove obstruction.
	Motor, sensor, or electrical problem.	Turn washer off, wait at least 15 seconds, then turn back on. If washer does not pass its self-test, contact BioTek TAC.
	Misaligned carrier or manifold.	Contact BioTek TAC.

WASHER START-UP		
Problem	**Probable Cause**	**Possible Solution**
Carrier/manifold position error, *cont'd*.	Incorrect manifold selected.	**HT models with the accessory 96-tube dual manifold** (including Select models upgraded to HT models): Ensure that the washer is configured for the installed manifold (96-tube or 192-tube). See *Manifold Selection* in *Ch. 3*.

❖ **Fluid Aspriation Note:** Monthly performance of the Evacuation Efficiency test is recommended to verify that the residual volume per well after evacuation (aspiration) meets the specified criteria. See ***Evacuation Efficiency Test Procedure*** in **Ch. 5**.

FLUID ASPIRATION		
Problem	**Probable Cause**	**Possible Solution**
Poor or uneven aspiration.	Insufficient or no vacuum.	Firmly seat the waste bottle covers. Ensure tubing is connected properly. Check all external tubing for kinks or clogs. If you are using an in-line vacuum filter, the filter may need to be replaced. If the vacuum pump is on, remove the vacuum pump tubing from the back of the washer while the pump is on. 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 manifold (see *Cleaning the Manifold* in *Ch. 4, Preventive Maintenance*).
	Microplate aspiration height adjustment too high or too low.	Change the Aspiration Height in the program (see *Define Wash ASPIRATION Program Options* in *Ch. 3*).
	Vacuum pump failure.	Contact BioTek TAC.
Uneven aspiration of wash buffer. Some wells left full.	No surfactant in the buffer such as Tween® 20.	Add surfactant to the buffer such as Tween 20. If this is not possible, continue below.
	Insufficient vacuum.	BioTek offers a high flow pump for those 96- and 384-well assays using only water for the wash fluid. Contact BioTek for more information.

FLUID ASPIRATION		
Problem	**Probable Cause**	**Possible Solution**
Uneven aspiration of wash buffer. Some wells left full, *cont'd.*	Check fluid aspiration problem section.	Check aspiration height, waste system for leaks, waste bottle caps, tubing for kinks, and in-line filter for clogs. Check to see if the microplate is not level or if the waste valve of the Buffer Switching module is touching the bench. Clean the aspiration tubes with a stylus.
	Program settings not optimized.	Try these changes in this order and in combination if necessary: 1. Enable crosswise aspiration. 2. Increase aspiration time to 800 ms. 3. Slow aspiration speed to 1 or 2.
	Aspiration tubes not properly positioned horizontally in wells.	If none of the tubes are bent, try adjusting the Horizontal Aspirate Position in the program (see *Define Wash ASPIRATION Program Parameters* in *Ch. 3*).
	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 (see *Cleaning the Plate Carrier System* in *Ch. 4*). 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, the filter may need to be 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.
	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 (see *Cleaning the Plate Carrier System* in *Ch. 4*). Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.

FLUID ASPIRATION		
Problem	**Probable Cause**	**Possible Solution**
Too much residual left in wells after aspiration, *cont'd*.	Washer program requires optimization.	To minimize the residuals, add a second or crosswise aspiration to the wash cycle (see *Define Wash ASPIRATION Program Options* in *Ch. 3*). Other options include decreasing the aspiration rate or adding a delay on the final aspiration.
	Aspirate tubes are bent.	Contact BioTek TAC.
Vacuum Filtration leaving too much fluid in wells	Vacuum leak	Use a new, defect-free filter plate. Exam the edges of the plate for the potential cause of a vacuum leak, like a chip or crack in the plate; Make sure the vacuum filtration plate carrier's gasket is clean and undamaged by previous use or mishandling; Tighten the intermediate waste bottle's cap.

❖ **Fluid Delivery Note:** Monthly performance of the Dispense Precision test is recommended to measure the variability of volumes dispensed from tube to tube across the manifold. See ***Dispense Precision Test Procedure*** in ***Ch. 5***.

FLUID DELIVERY		
Problem	**Probable Cause**	**Possible Solution**
Unable to dispense fluid—models without Buffer Switching.	Clogged fluid inlet filter.	Clean the fluid inlet filter. See *Cleaning the Fluid Inlet Filter*, in *Ch. 4*; note orientation of filter in the Figure.
	Supply tube inside the supply bottle is kinked or disconnected.	Straighten or connect supply tube. Make sure the end is cut; see *General Usage Guidelines*, *Ch. 3*.
	Inlet tube not connected.	Check all tubing (see *Connecting the Tubes and Bottles* in *Ch. 2*).
	Clogged dispense tubes on the washer manifold.	Remove and clean the manifold (see *Cleaning the Manifold* in *Ch. 4*).
	No wash or rinse fluid.	Fill bottles with appropriate fluid. Ensure bottles are clean and do not contain particles or organic material.

FLUID DELIVERY		
Problem	**Probable Cause**	**Possible Solution**
Unable to dispense fluid—models without Buffer Switching, *cont'd*.	System not primed. Large air pockets in tubing.	Run a Prime program using the following volumes; do not use the AutoPrime program for the initial prime: **All models except Select CW:** 200 mL Prime Volume when all the lines are empty or when changing fluids. **Select CW models:** 200 mL Prime Volume and 150 mL Low Flow Prime Volume when all the lines are empty; 300 mL Prime Volume and 200 mL Low Flow Prime Volume when changing fluids.
	Insufficient suction force, clogged tubing, or faulty valve.	Perform Maintenance as described in *Ch. 4*. If the problem persists, contact BioTek TAC.
Unable to dispense fluid—models with Buffer Switching.	System not primed. Large air pockets in tubing.	Run a Prime program using the following volumes: **All models except Select CW:** 400 mL Prime Volume when all the lines are empty or when changing fluids. **Select CW models:** 400 mL Prime Volume and 300 mL Low Flow Prime Volume when all the lines are empty; 600 mL Prime Volume and 400 mL Low Flow Prime Volume when changing fluids.
	Buffer Switching module not connected to washer or supply tubing set up incorrectly.	Check Buffer Switching module cable and tubing.
	Solenoid valve not opening.	Ensure Buffer Switching module cable is plugged into the valve control port on the back of the washer. If plugged in, contact BioTek TAC.
Plate overfills (floods).	Dispense height too high. The aspirate tubes are too many steps above the microwells to prevent overflow.	Change the Dispense Height (see *Define Wash DISPENSE Program Options* in *Ch. 3*).
	Dispense flow rate too low. Select CW model low flow rate 10 or 11 is used with 384-well plates.	Select a higher flow rate (see *Define Wash DISPENSE Program Options* in *Ch. 3*).
	Aspiration tubes hit bottom of trough during Prime or Maintenance.	Manifold may not be properly seated or mounted. Contact BioTek TAC.

FLUID DELIVERY		
Problem	**Probable Cause**	**Possible Solution**
Plate overfills (floods), *cont'd*.	In-line vacuum filter plugged.	Replace or remove vacuum line filter.
	Loose covers on waste bottles.	Firmly tighten waste bottle covers.
	Dispense rate too fast for volume selected.	Use slower dispense rate or lower volume (see *Define Wash DISPENSE Program Options*, in *Ch. 3*).
	Faulty vacuum pump.	Contact BioTek TAC.
	Insufficient or no vacuum.	Firmly seat the waste bottle covers; ensure tubing is connected properly. Check all external tubing for kinks or clogs. An in-line vacuum filter may need to be replaced. 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 washer while the pump is on and put your finger over the port. If there is no vacuum, contact BioTek TAC.
Uneven dispensing of fluid; wells not filled.	Clogged dispense tubes on the washer manifold.	Remove and clean the manifold (see *Cleaning the Manifold* in *Ch. 4*).
	Manifold or tubing not adequately primed.	Run a prime program using the following minimum Prime Volumes: **All models except Select CW:** Without Buffer Switching, 200 mL Prime Volume when all the lines are empty or when changing fluids. With Buffer Switching, 400 mL Prime Volume when all the lines are empty or when changing fluids. **Select CW:** Without Buffer Switching, 200 mL Prime Volume/150 mL Low Flow Prime Volume when all the lines are empty; 300 mL Prime Volume/200 mL Low Flow Volume when changing fluids. With Buffer Switching - 400 mL Prime Volume/300 mL Low Flow Prime Volume when all the lines are empty; 600 mL Prime Volume/400 mL Low Flow Volume when changing fluids.

FLUID DELIVERY		
Problem	**Probable Cause**	**Possible Solution**
Uneven dispensing of fluid; wells not filled, *cont'd*.	Dispense flow rate too low. Select CW model low flow rate 10 or 11 is used with 384-well plates.	Select a higher flow rate (see *Define Wash DISPENSE Program Options* in *Ch. 3*).
	Microplate aspiration height too high or too low.	Change the Aspiration Height (see *Define Wash ASPIRATE Program Options*, *Ch. 3*).

FLUID LEAKAGE		
Problem	**Probable Cause**	**Possible Solution**
Fluid leaking from manifold.	Defective seals.	Replace individual seals at the front of the manifold, or o-rings at the rear of the manifold (see *Cleaning the Manifold* in *Ch. 4*). Replace o-rings on washer manifold inlet fittings. Contact BioTek TAC.
	Aspiration tubes only: vacuum too low.	Check waste connector tubes; make sure they are properly connected to the manifold. 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. The instrument may not be level. Check to ensure that the manifold is level or slightly tilted to the rear. Use a slower Aspiration Rate in the program (see *Define Wash ASPIRATION Program Options* in *Ch. 3*).
Fluid leaking from underneath the washer.	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 (see *Connecting the Tubes and Bottles* in *Ch. 2*).

MICROPLATE CARRIER MOVEMENT		
Problem	***Probable Cause***	***Possible Solution***
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.
	Horizontal Aspirate Position is too wide for a movement.	Change the Horizontal Aspir Pos (see *Define Wash ASPIRATION Program*).
	Aspirate tubes bent.	Contact BioTek TAC.

WASHER MANIFOLD MOVEMENT		
Problem	***Probable Cause***	***Possible Solution***
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 front of the instrument. Check for and remove any obstructions. Ensure that the manifold is installed properly (see *Setting Up the Washer* in *Ch. 2*).
	Incorrect manifold selected.	**HT models with the accessory 96-tube manifold** (including Select models upgraded to HT models): Ensure that the washer is configured for the installed manifold (96-tube or 192-tube).

MICROPLATE SCRATCHES		
Problem	***Probable Cause***	***Possible Solution***
Scratches on microplate bottom.	Microplate dispense or aspiration height adjustment too low.	Change the Dispense or Aspiration Height in the program (see *Define Wash DISPENSE or ASPIRATION Program Options* in C*h. 3*).
	Microplate not properly seated or strips not level.	Reseat microplate in carrier or strips in holder. Make sure the carrier is clean (see *Cleaning the Plate Carrier System* in *Ch. 4*). Try a different microplate or strip holder. If the problem is unresolved, the carrier may have to be realigned. Contact BioTek TAC.

Appendix B

Error Codes

This appendix lists error codes that may appear on the ELx405. If an error is displayed, find it in the tables in this section and then refer to ***Appendix A, Troubleshooting***. Contact Technical Support if further instructions are necessary.

Error Codes

An error code is displayed on the ELx405 as a four-digit identifier. The first digit will be **0**, **1**, **2**, **3**, or **A**.

- **0**, **1**, **2**, **3**, or **4** denote a noncritical (**General**) error, which means that the instrument will still respond to keypad input. See ***General Errors***, page 179.
- **A** denotes a more serious (**Fatal**) error, which requires that the ELx405 be turned off and then powered up. Upon restarting the washer, you should be able to enter commands into the keypad. See ***Fatal Errors***, page 190.

If an error is displayed, refer to ***Appendix A***, ***Troubleshooting***. Contact BioTek's Technical Assistance Center if further instructions are necessary.

BioStack Errors

Error codes displayed on the washer during operation with the **BioStack Microplate Stacker**, that are prefixed with a **B-**, indicate either errors generated by the BioStack or problems with communication between the two instruments.

Pages 192 to 199 contain a partial listing of errors that may appear on the display of the ELx405 during operation with the BioStack. Refer to the ***Troubleshooting and Error Codes*** section of your BioStack User Manual for a more complete listing of these types of error codes and their descriptions.

General Errors (0100 – 4500)

For the codes that represent **motor** errors, the **fourth** digit of the code represents the affected motor:

0 = manifold motor

1 = carrier motor (x-direction)

2 = magnet motor (discontinued Magna models only)

3 = carrier motor (y-direction) (dual-manifold models)

For example, error code 020**1** means that the microplate carrier motor (x-axis) could not find its optical sensor.

General Errors are described in the tables on the next several pages.

- **Note: Calibration errors** (AUTOCAL_JIG_ERR; MANIFOLD_AUTOCAL_ERR; etc.) will normally be displayed only during calibration or repair of the instrument by BioTek TAC.
- **Motor errors:** n = motor; **Program errors:** n = program #.

Code	Cause
0100 ABORT_ERR	Washer function was aborted due to operator-initiated abort, or following some other error.
0200 NO_SENSOR_ERR	Manifold motor couldn't find the optical sensor – occurs in a homing sequence during self-test, prior to running a program, or following a program. If auto-calibration jigs are out of calibration or incorrectly installed, the error may occur during a Dispense, Wash, or Aspirate Protocol, if plate clearance is less than priming trough clearance. **Probable Causes:** • Linear way is dirty, loosing steps due to lack of grease, or an object is blocking its path. • Motor is defective. • Optical sensor is defective. • Shipping block is still installed. • Lead screw has become unglued from the motor shaft.

Code	Cause
0201 NO_SENSOR_ERR	Carrier x-axis motor couldn't find optical sensor – occurs in a homing sequence during self-test, prior to running a program, or following a program. **Probable Causes:** • Carrier x-axis motor is unable to move due to contamination of the carrier transport rail. • Carrier x-axis motor failed, belt is slipping, or drive or idler pulley is defective. • Optical sensor is defective.
0203 NO_SENSOR_ERR	**Dual-manifold models only**: Carrier y-axis motor couldn't find optical sensor – occurs in a homing sequence during self-test, prior to running a program, or following a program. **Probable Causes:** • Carrier y-axis motor is unable to move due to contamination. • Optical sensor is defective. • Carrier y-axis motor is defective. • Incorrect jumper was set during basecode download, and the unit thinks it is a Magna washer when it is actually a 96- or 384-well model.
0300 AUTOCAL_JIG_ERR	Manifold motor couldn't find edge of autocal jig during autocal routine. **Probable Causes:** • Distance from optical sensor to autocal jig is too short. • Autocal jig contacts are contaminated. • Autocal jig is not installed properly or a connection is not made.
0301 AUTOCAL_JIG_ERR	Carrier x-axis motor couldn't find edge of autocal jig. **Probable Causes:** • Autocal jig contacts are contaminated. • Autocal jig is not properly installed or a connection is not made.
0303 AUTOCAL_JIG_ERR	**Dual-manifold models only**: Carrier y-axis motor couldn't find edge of autocal jig. **Probable Causes:** • Autocal jig contacts are contaminated. • Autocal jig is not properly installed or a connection is not made.

Code	Cause
0400 MOTOR_VERIFY_ERR	Manifold motor failed positional verify – occurs when verifying the current motor position during self-test, prior to running a program, or following a program. **Probable Causes:** • Linear way is dirty, losing steps due to lack of grease, or an object is blocking its path. • Motor is defective. • Optical sensor is defective. • Shipping block is still installed. • Lead screw has become unglued from the motor shaft. • Incorrect manifold selected (HT2 models).
0401 MOTOR_VERIFY_ERR	Carrier x-axis motor failed positional verify – occurs when verifying the current motor position during self-test, prior to running a program, or following a program. **Probable Causes:** • Carrier x-axis motor is unable to move due to contamination of the carrier transport rail. • Carrier x-axis motor failed, belt is slipping, or drive or idler pulley is defective. • Optical sensor is defective. • Incorrect manifold selected (HT2 models).
0403 MOTOR_VERIFY_ERR	**Dual-manifold models only**: Carrier y-axis cam motor failed positional verify – occurs when verifying the current motor position during self-test, prior to running a program, or following a program. This error can occur during one of the following scenarios: During a Dispense, Shake/Soak, Linked Method, or Wash End Protocol, when the Y-axis is verified. **Probable Causes:** • Contamination on the y-axis rail of the carrier. • Y-axis motor is not able to move due to contamination. • Optical sensor is defective. • Y-axis motor is defective. • Incorrect manifold selected (HT2 models).
0500 UNDEF_PROG_TYPE_ERR	Undefined program type - occurs when trying to define or run a program type that is invalid (usually initiated from washer keypad operations). **Probable Causes:** • BioStack control is enabled and an unidentified program is requested and not able to control the BioStack (corrupt memory). • Memory is corrupt.

Code	Cause
06nn PROGRAM_NUM_ERR	Invalid program number (n = program number) - occurs when trying to return information for a program that is not found in the list of programs in the flash memory. **Probable Causes:** • Corrupt memory. • Program not loaded when requested by the controlling software.
0700 PROGRAM_SET_ERR	Invalid write attempt - occurs when trying to store a program in flash memory (e.g., when saving a program via the washer keypad, or when downloading programs from a controlling PC), and there are no empty locations. **Probable Causes:** • Processor failure.
08nn PROGRAM_DEL_ERR	Invalid delete attempt (n = program number) - occurs when trying to delete a program from flash memory via the washer keypad or a controlling PC, and it is not found in the memory. **Probable Causes:** • Program is not available or listed. • Memory corruption.
0Ann PROGRAM_CHECKSUM_ERR	Program checksum failure (n = program number) - occurs when trying to return information for a program. At that time, a checksum test is run when validating a program name, or when loading a program from flash memory to RAM. If it fails, then the software assumes the program is corrupt in flash memory. **Probable Causes:** • Memory corruption.
0Bnn MANIFOLD_AUTOCAL_ERR	Hardware type is invalid for selected model – occurs when the value stored in flash memory for the hardware type is invalid. This is checked at power-up, during self-test, and during and after autocal is run. Serial communication only (ELx405 Interface Software/ActiveX): valid values for **nn** are: 4F = 384, 50 = 96 well only **Probable Causes:** • Memory corruption.
0C00 INVALID_BUFFER_ERR	An invalid buffer is selected – occurs when a program first starts, when fluid is going to be dispensed, and when a linked program is going to the next link, and the buffer selected for any of these activities is invalid. Example: If valve E was set due to memory corruption. **Probable Causes:** • Memory corruption.

Code	Cause
0E00 DISPENSE_RATE_ERR	Dispense rate is invalid for manifold type – occurs when verifying validity of a program, e.g., during run-time, or when saving a program and an invalid dispense rate was entered. Serial communication only (ELx405 Interface Software/ ActiveX): This error can occur during a Prime or Dispense Protocol when the software verifies the rate for the defined manifold type. **Probable Causes:** • Incorrect rate/volume entered for manifold selected.
0F00 DISPENSE_VOLUME_ERR	Dispense/prime volume invalid for manifold type (96 or 192). Error is detected at runtime. Also occurs when attempting to dispense fluid and the transition volume for that rate is larger than the volume to be dispensed. (Transition volume = the non-linear volume dispensed when the dispense motor is turned on and off.) Serial communication only (ELx405 Interface Software/ ActiveX): This error can occur (1) during a Prime or Dispense Protocol when software verifies the volume for the defined manifold type; or (2) during a Dispense Protocol if the transition volume is not >= to the specified volume display error. **Probable Causes:** • Incorrect volume requested for the installed manifold.
1000 CNFG_DATA_ERR	Necessary configuration data is missing because flash memory configuration data has not been properly initialized, or flash memory is corrupted. **Probable Causes:** • New basecode overwrites configuration values. • Unit has not been calibrated or has lost calibration values. • Main PCB has been replaced. • Memory corruption.
1100 CNFG_CHECKSUM_ERR	Failed configuration checksum test because flash memory configuration data is corrupt. Occurs during powerup, or after running a program. **Probable Causes:** • New basecode overwrites configuration values. • Main PCB has been replaced. • Memory corruption.
1300 MOTOR_NOT_HOMED_ERR	Manifold motor not homed successfully – occurs anytime a motor is requested to be moved before it has been homed. **Probable Causes:** • Errors 0200 or 0400 initially occurred and were not resolved; see the Probable Causes for 0200.

<table>
<tr><th>Code</th><th>Cause</th></tr>
<tr><td>1301
MOTOR_NOT_HOMED_ERR</td><td>Carrier x-axis motor not homed successfully – occurs anytime a motor is requested to be moved before it has been homed.
Probable Causes:
Errors 0201 or 0401 initially occurred and were not resolved; see the Probable Causes for 0201.</td></tr>
<tr><td>1303
MOTOR_NOT_HOMED_ERR</td><td>Dual-manifold models only: Carrier y-axis motor not homed successfully – occurs anytime a motor is requested to be moved before it has been homed.
Probable Causes:
Errors 0203 or 0403 initially occurred and were not resolved; see the Probable Causes for 0203.</td></tr>
<tr><td>1400
AUTOCAL _ABORT_ERR</td><td>Autocal of washer is aborted – occurs whenever the operator requests an abort of the autocal procedure.</td></tr>
<tr><td>1900
MALLOC_ERR</td><td>Memory allocation failure - occurs when trying to store a large block of configuration data in flash memory, such as downloaded configuration data, or autocal configuration data.
Probable Causes:
The memory is corrupt. Contact BioTek TAC.
If the error persists, the processor PCB needs to be replaced.</td></tr>
<tr><td>1A00
ASPIRATE_POS_ERR</td><td>Horizontal aspirate position is out of range – occurs when verifying the validity of a program prior to running the program, or prior to saving the program to flash memory.
Probable Causes:
The horizontal aspirate position requested is out of range. See Wash ASPIRATE Defaults and Ranges in Chapter 3, Operation for a list of acceptable ranges.
Serial communication only (ELx405 Interface Software/ ActiveX): The list below shows the range in quarter steps.
<table>
<tr><th>Manifold Type</th><th>Plate Type</th><th>Axis</th><th>Aspirate Range</th></tr>
<tr><td>Multiplate</td><td>384</td><td>X</td><td>-25 to +25</td></tr>
<tr><td>Multiplate</td><td>384</td><td>Y</td><td>-10 to +20</td></tr>
<tr><td>Multiplate</td><td>96</td><td>X</td><td>-55 to +55</td></tr>
<tr><td>Multiplate</td><td>96</td><td>Y</td><td>-55 to +55</td></tr>
<tr><td>Standard 96</td><td>96</td><td>X</td><td>-30 to +30</td></tr>
<tr><td>HT 192</td><td>384</td><td>X</td><td>-25 to +25</td></tr>
<tr><td>HT 192</td><td>384</td><td>Y</td><td>-10 to +20</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code</th><th>Cause</th></tr>
<tr><td>1B00
DISPENSE_POS_ERR</td><td>Horizontal dispense position is out of range – occurs when verifying the validity of a program prior to running the program, or prior to saving the program to flash memory.
Probable Causes:
The horizontal dispense position requested is out of range. See Wash DISPENSE Defaults and Ranges in Chapter 3, Operation for a list of acceptable ranges.
Serial communication only (ELx405 Interface Software/ActiveX): The list below shows the range in quarter steps.<table><tr><th>Manifold Type</th><th>Plate Type</th><th>Axis</th><th>Dispense Range</th></tr><tr><td>Multiplate</td><td>384</td><td>X</td><td>-25 to +25</td></tr><tr><td>Multiplate</td><td>384</td><td>Y</td><td>-10 to +20</td></tr><tr><td>Multiplate</td><td>96</td><td>X</td><td>-45 to +45</td></tr><tr><td>Multiplate</td><td>96</td><td>Y</td><td>-20 to +20</td></tr><tr><td>Standard 96</td><td>96</td><td>X</td><td>-30 to +30</td></tr><tr><td>HT 192</td><td>384</td><td>X</td><td>-25 to +25</td></tr><tr><td>HT 192</td><td>384</td><td>Y</td><td>-10 to +20</td></tr></table></td></tr>
<tr><td>1D00
MANIFOLD_POS_ERR</td><td>Manifold Position Error. For the specified height, the manifold will need to travel above the home sensor, which is not allowed.
Modify the protocol parameter for dispense or aspirate height that exceeds the instrument’s limit and retry.</td></tr>
<tr><td>1E00
AUTOCAL_CHECKSUM_ERR</td><td>Failed autocal checksum during the powerup sequence; autocal data is missing.
Probable Causes:
Basecode is loaded, but autocalibration has not been performed.
Memory corruptions.
Autocalibration has not been performed.
Main PCB was replaced.</td></tr>
<tr><td>1E01
VF_AUTOCAL_CHECKSUM_ERR</td><td>Failed autocal checksum of vacuum filtration.
Probable Causes:
Memory corruptions.
Autocalibration has not been performed.</td></tr>
<tr><td>1E02
VALVE_96_CAL_CHECKSUM_ERR</td><td>Failed autocal checksum for 96-tube manifold.
Probable Causes:
Memory corruptions.
Autocalibration has not been performed.</td></tr>
</table>

Code	Cause
1E03 VALVE_192_CAL_CHECKSUM_ERR	Failed autocal checksum for 192-tube manifold. **Probable Causes:** • Memory corruptions. • Autocalibration has not been performed.
1F00 VACUUM_ON_ERR	Vacuum switch failed to close in time—occurs whenever the vacuum pump fails to turn on properly, usually at the start of a program, but also during a full self-test sequence. The switch is normally open. When the switch senses the vacuum, it will close. Whenever the software turns on the vacuum pump, the software will monitor the vacuum switch until it closes, or until the vacuum startup delay expires. The above is also true when using a house vacuum. **Probable Causes:** • Pump has been flooded. Remove the head from the pump and inspect it for corrosion, crystalline buildup or liquid. If this is the case, contact BioTek TAC. • Q-cups are defective or not properly connected. • No vacuum source, external pump fuse has blown, or external pump is defective and unable to reach minimum vacuum requirements of 1.6” Hg. • Vacuum source has not reached 1.6” Hg. • Waste bottle cap or caps are loose. • Tubing between the washer and first waste bottle is not properly connected. • Vacuum switch has failed in the open state. • Running a dry filter plate when using vacuum filtration.
2000 WASTE_FULL_ERR	Waste switch detects a full waste bottle – occurs at the start of a program (including AUTOCLEAN programs in Ultrasonic Advantage™ models). The switch is normally closed and when the waste bottle is full, the switch will open. **Probable Causes:** • Overflow sensor cable not connected to rear of ELx405 • Waste switch is stuck or always in the open state. • Waste bottle is full. • Foam in the overflow bottle has pushed the switch open. • Waste tubing is not properly connected, and the overflow bottle is the primary bottle, i.e., the first bottle that waste flows into.

Code	Cause
2100 FLUID_ERR	No fluid detected during a dispense, prime, or maintenance cycle in a program. **Probable Causes:** • Ball used to block the sensor is missing or stuck below the infrared detector. • Infrared detector or fluid sensor is no longer functioning. • Dispense valve has not closed and fluid is still flowing. • Air bubble present in the detection path. • Valve module insufficiently primed.
2200 FLOW_ERR	No flow detected – occurs at the end of a dispense, if no fluid flow was detected during the prime or dispense operation in a Prime, Dispense, or Maintenance protocol. **Probable Causes:** • Fluid or sensor housing is opaque, not allowing the infrared detector to toggle. • Infrared detector or fluid sensor failed. • Main PCB failed to detect the fluid sensor. • Valve module insufficiently primed.
2300 INVALID_PLATE_TYPE	Plate type not valid for hardware – occurs at the start of a program. Serial communication only (ELx405™ Interface Software/ ActiveX). **Probable Causes:** • Invalid plate type entered. • Protocol is corrupt.
2400 INVALID_LINK_ERR	Failure to get a program to view/run – occurs at program start time, at program validation time (i.e., when programs are saved and/or downloaded), or when one of the programs within a linked program is not found or is invalid. Serial communication only (ELx405 Interface Software/ActiveX). **Probable Causes:** • Memory corruption. • Requested program is corrupt or not available.
2700 YAXIS_POSITION_ERR	**Dual manifold models only:** Cannot move to requested position/offset – occurs when trying to move the carrier along the y-axis to a position greater than allowed. **Probable Causes:** • Memory corruption.

Code	Cause
2800 NO_FLUID_START_ERR	No fluid detected at the start of a wash or dispense program, or at the start of a loop for an AUTOCLEAN program (Ultrasonic Advantage™ models only). **Probable Causes:** • Insufficient prime volumes (air bubble). • The floating ball that blocks the infrared detector is missing. • The floating ball is stuck to the tubing and not able to float. • Infrared detector or fluid sensor has failed. • Main PCB failed to detect the fluid sensor. • Air bubble in the detection path. • No fluid in unit (unit has not been primed). • Stuck or defective dispense valve.
2900 NO_FLUID_END_ERR	No fluid detected at the end of a wash or dispense program. **Probable Causes:** • Insufficient prime volumes (air bubbles). • Floating ball that blocks the infrared detector is missing. • Floating ball is stuck to the tubing and not able to float. • Infrared detector or fluid sensor has failed. • Main PCB failed to detect fluid sensor. • Air bubble moving ball out of sensor intermittently. • Dispense valve did not close properly, allowing some fluid to flow, causing manifold to drip.
2A00 INCOMPATIBLE_HW_ERR	Incompatible settings detected, most likely caused by the BioStack and plate carrier settings. The BioStack cannot interface with the vacuum filtration plate carrier.
3200 SERIAL_PORT_ERR	Error running serial port test on test station. (EPROM test station error only.)
3300 KEYBOARD_ERR	Error running keyboard test on test station. (EPROM test station error only.)
3400 IO_TEST_ERR	I/O test error – occurs when one part of the I/O test on the test station has failed. (EPROM test station error only.)
3500 DC_PUMP_ERR	DC pump test error on the test station. (EPROM test station error only.)
3600 STACKER_NOT_READY	Stacker uninitialized error – Indicates that the BioStack is not ready or is in a state that cannot perform the requested abort command from the washer (Stop button was pressed).

Code	Cause
3700 AUTCLN_NUM_LOOPS_INVALID_ERR	Invalid number of loops selected for the AUTOCLEAN program. This usually occurs when trying to start the AUTOCLEAN feature from a PC, and the parameters downloaded include an out-of-range loop count.
3800 AUTCLN_DURATION_INVALID_ERR	Invalid duration selected for one of the loops of the AUTOCLEAN program. This usually occurs when trying to start the AUTOCLEAN feature from a PC, and the parameters downloaded include an out-of-range loop duration.
3900 AUTCLN_VALVE_INVALID_ERR	Invalid valve index selected for one of the loops of the AUTOCLEAN program (if external valve module is used). This usually occurs when trying to start the AUTOCLEAN feature from a PC, and the parameters downloaded include an out-of-range loop valve index.
3A00 AUTCLN_VOLUME_INVALID_ERR	Invalid fill volume value entered. This occurs when trying to start the AUTOCLEAN feature, and the value stored in the flash memory for the fill volume is out of range.
3B00 AUTCLN_LOOP_IN_PROGRESS_ERR	Error running one of the AUTOCLEAN loops. This usually occurs when trying to start the AUTOCLEAN feature from a PC, and the PC tries to run an AUTOCLEAN loop while the previous loop is already in progress.
4000 INVALID_VAC_FILTR_ERR	A Vacuum Filtration protocol specifies 384-well plate processing by "Sector," rather than "Plate" mode. This is incompatible with vacuum filtration. Change the Wash Format to Plate.
4500 INVALID_FEATURE_ERR	During PC control of the washer, the PC is trying to set or run an undefined feature.
4600 VAC_FILTRATION_SENSOR	Unable to correctly read vacuum filtration sensor. Contact BioTek TAC.
4610 FILTRATION_VAC_START_OR_END	Vacuum for vacuum filtration assays detected when it is unexpected, before starting or after a run. Contact BioTek TAC for further guidance.
4620 FILTER_VACUUM_ON_ERR	Vacuum for vacuum filtration assays is required but fails to be provided. Contact BioTek TAC for further guidance.
4800 AUTOPRIME_IN_PROGRESS_ERR	AutoPrime is in progress, but will be stopped.
4810 AUTOPRIME_ABORTING_ERR	Unable to abort AutoPrime; abort is already in progress.

AUTCLN errors appear only in Ultrasonic Advantage™ models. These errors may also appear during **keypad control** of the washer, with the exception of error code **3A00**.

Fatal Errors (A100 – A900)

Fatal errors indicate conditions that require immediate attention. If a fatal error is displayed, contact BioTek's Technical Assistance Center for further instructions.

For the codes that represent **device** errors, the fourth digit of the code represents the affected device:

0 = manifold motor

1 = carrier motor (x-direction)

2 = magnet motor (discontinued Magna models only)

3 = carrier motor (y-direction) (dual-manifold models)

4 = software timer

5 = display

6 = quick flash memory

7 = memory manager (memory allocation heap)

Code	Cause
A100 TCB_NOT_AVAIL_ERR	Task control block not available – occurs when trying to create a new software task to run "simultaneously" with other tasks, such as when first trying to run a wash program, or when trying to start an AUTOCLEAN program in an Ultrasonic Advantage™ model.
A300 NOT_AVAIL_ERR	Manifold motor not available – occurs when trying to get access to a system resource, such as the manifold motor or a timer. If the requested device is the manifold motor, usually that motor is still running, or the software "thinks" the motor is still running, even if it isn't.
A301 NOT_AVAIL_ERR	Carrier x-axis motor not available – occurs when trying to get access to a system resource, such as the carrier x-axis motor or a timer. If the requested device is the x-axis motor, usually that motor is still running, or the software "thinks" the motor is still running, even if it isn't.
A303 NOT_AVAIL_ERR	**Dual manifold models only:** Carrier y-axis motor not available – occurs when trying to get access to a system resource, such as the carrier y-axis motor or a timer. If the requested device is the y-axis motor, usually that motor is still running, or the software "thinks" the motor is still running, even if it isn't.
A304 NOT_AVAIL_ERR	Software timer not available.
A305 NOT_AVAIL_ERR	Display not available.

Code	Cause
A306 NOT_AVAIL_ERR	Quick flash memory not available.
A307 NOT_AVAIL_ERR	Memory manager (memory allocation heap) not available.
A400 CHECKSUM_ERR	Failed code checksum test on powerup – returned by EPROM software when downloading code unsuccessfully, or when it is trying to initialize after a successful download.
A500 POWER_ERR	Power dropped below safe level – occurs at powerup and when trying to perform a write to flash memory, if there is insufficient power to perform the desired operation.
A600 QFLASH_TIMEOUT_ERR	Quick flash memory configuration timed out. Occurs in the interrupt handler routine, which is triggered every 1 msec, if there is a quick flash memory error.
A700 QFLASH_ERR	Quick flash memory read did not match write. Occurs when verifying that configuration data written to flash memory actually matches that intended to be written, in size or content. This could follow configuration downloads, saving of autocal data or program files, etc.
A800 RAM_ERR	RAM error - occurs during failure of the RAM test on the test station. (EPROM test station error only.)
A900 HEAP_CORRUPTED_ERR	Memory manager (memory allocation heap) corruption detected – occurs when writing data to flash memory. This can also be detected during that portion of the software, which runs in the background, while other tasks are simultaneously running.

BioStack Errors (B-xxxx)

The following error codes may be displayed on the ELx405™ during operation with the BioStack™ Microplate Stacker. Refer to the ***Troubleshooting and Error Codes*** section of the BioStack Operator's Manual for more information.

Code	Cause
B-xxxx BIOSTACK _ERR	These are errors generated by the BioStack during an operation (plate transfer, re-stacking, etc.) with the ELx405. See your BioStack Operator's Manual. The following errors are generated by the ELx405 during communication with the BioStack.
B-8303	The ELx405 is unable to communicate with the BioStack because the BioStack is in an invalid mode for receiving a message and cannot process requests from the washer. **Probable Causes:** • The ELx405 was turned on before the BioStack finished its startup routine. • The ELx405 was turned on first, then the BioStack was turned on. • The BioStack has an error or is in a bad state and needs to be turned off and then turned back on. • The cable connection is lost, not allowing communications to transfer properly.
B-8304 NAK_RECEIVED_ERR	The ELx405 is unable to communicate with the BioStack because the BioStack didn't properly acknowledge a message sent to it. This occurs when a NAK is received from the BioStack. This can happen during any message sent to the BioStack, including those associated with retrieving information, as well as those used for moving motors. **Probable Causes:** • The ELx405 was turned on before the BioStack finished its startup routine. • The ELx405 was turned on first, then the BioStack was turned on. • The BioStack has an error or is in a bad state and needs to be turned off and then turned back on. • The cable connection is lost, not allowing communications to transfer properly.

Code	Cause
B-8305 INVALID_RESPONSE_ERR	The ELx405™ has received an invalid message response from the BioStack™. Occurs when neither a NAK nor an ACK is received from the BioStack. This can happen during any message sent to the BioStack, including those associated with retrieving information, as well as those used for moving motors. **Probable Causes:** • The ELx405 was turned on before the BioStack finished its startup routine. • The ELx405 was turned on first, then the BioStack was turned on. • The BioStack has an error or is in a bad state and needs to be turned off and then turned back on. • The cable connection is lost, not allowing communications to transfer properly.
B-8306 TIMEOUT_ERR	The ELx405 failed to communicate with the BioStack because the serial communications timed out. This can happen during any message sent to the BioStack, including those associated with retrieving information, as well as those used for moving motors. **Probable Causes:** • The ELx405 was turned on before the BioStack finished its startup routine. • The ELx405 was turned on first, then the BioStack was turned on. • The BioStack has an error or is in a bad state and needs to be turned off and then turned back on. • The cable connection is lost, not allowing communications to transfer properly.

ELx405 Chemical Compatibility Tables

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	D	C	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
Hydrocholoric 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	D	C	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.

Appendix D

Predefined and Onboard Protocols

This appendix lists pre-loaded and predefined wash, prime, dispense, aspirate, and maintenance programs available on the washer and shipped with the ELx405 Interface Software and installed on your computer for use with the LHC software.

Onboard Protocols

	ELx405	Select	Select CW	V models	HT
Wash					
COSTAR_FLAT	X	X	X		X*
COSTAR_ROUND	X	X	X		X*
NUNC_FLAT	X	X	X		X*
NUNC_ROUND	X	X	X		X*
NUNC_384		X	X		X*
192NUNC_384					X
Prime					
Autoprime	X	X	X		X
Prime_200	X	X	X		X
Prime_CW			X		
P_DAY_RINSE	X	X	X		X
P_RINSE_LOOP	X	X	X		X
P_RINSE_AND_SOAK	X	X	X		X
P_DECON1	X	X	X		X
P_DECON2	X	X	X		X
Qualification tests					
accuracy_qc_test	X	X	X		X*
192accuracy_qc					X
residual_qc_test	X	X	X		X*
192resid_qc_test					X
VAC30_TEST				X	
VAC10_TEST				X	
Maintenance					
DAY_RINSE	X	X	X	X	X
OVERNIGHT_LOOP	X	X	X	X	X
RINSE_AND_SOAK	X	X	X	X	X
LONG_SHUTDOWN	X	X	X	X	X
DECONTAMINATION	X	X	X	X	X
AUTOCLEAN**	X	X	X		X

*These programs are available in **HT models** when the accessory **96-tube** manifold is installed.

** AUTOCLEAN appears only in "U" models with the **Ultrasonic Advantage** (ultrasonic cleaner).

Predefined Protocols

> ❖ The predefined protocols and their settings are subject to change. Contact Technical Support with any questions related to the protocols on your washer.

The following pages illustrate the parameters of several predefined protocols that are downloaded to the washer at BioTek. You can upload and run these protocols using the LHC software. The ".LHC" filename extension indicates they were uploaded to a computer using BioTek's Liquid Handling Control (LHC) Software, and then saved as LHC files. Use this section as a reference only; **the onboard protocols vary slightly depending on the model.**

The predefined protocols serve two purposes:

- As sample protocols
- To assist in maintenance and instrument qualification procedures.

LHC users can upload these protocols with the **Transfer Protocol** feature and save the files on their computer for future use. They can then be edited, executed, and printed with the LHC software, but making changes to the files is not recommended. Instead, BioTek recommends making a copy of the protocol and editing the copy.

The only predefined protocols onboard the ELx405 that cannot be uploaded to the computer are the maintenance routines. Instead, copies of these protocols are shipped with and installed on the computer by the ELx405 Interface Software (IS) during LHC installation:

- **DAY_RINSE**
- **OVERNIGHT_LOOP**
- **RINSE_AND_SOAK**
- **LONG_SHUTDOWN**
- **DECONTAMINATION**
- **AUTOCLEAN:** appears only in models with the Ultrasonic Advantage™ (ultrasonic cleaner).

PC Control: Refer to the LHC Help system for information on uploading/downloading, editing, running, or printing protocols via the LHC software.

Keypad Control: Refer to ***Chapter 3***, ***Operation***, for information on editing, running, or printing ELx405 protocols via the washer's keypad.

accuracy_qc_test

File Name: accuracy_qc_test.LHC
File Location: C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling Control\Protocols
Last Saved: 9/11/2008 11:16:31 AM

Instrument: ELx405
Port: COM2
Settings: Model: Select
Manifold: 96 Well

Protocol Name: accuracy_qc_test
Protocol Version: <no data>
Plate Type: 96 Well
Comments: <uploaded from on-board>
(L) - Dispense program; 96 Well; 96 Well manifold
Step Details: Dispense
Volume: 300 uls
Buffer valve: A
At start prime: No
Dispense flow rate: 4
Height: 120
Horizontal position: 0
Horizontal Y position: 0
<end>

COSTAR_FLAT

```
File Name:          COSTAR_FLAT.LHC
File Location:      C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling
                    Control\Protocols
Last Saved:         9/11/2008 11:16:40 AM

Instrument:         ELx405
Port:               COM2
Settings:           Model: Select
                    Manifold: 96 Well

Protocol Name:      COSTAR_FLAT
Protocol Version:   <no data>
Plate Type:         96 Well
Comments:           <uploaded from on-board>
                    (L) - Wash program; 96 Well; 96 Well manifold
Step Details:       Wash
                      Number of cycles: 3
                      Volume: 300 uls
                      Buffer valve: A
                      At start prime: No
                      Dispense parameters:
                        Dispense flow rate: 7
                        Height: 120
                        Horizontal position: 0
                        Horizontal Y position: 0
                        Bottom wash: No
                      Aspirate parameters:
                        Height: 32
                        Horizontal position: -50
                        Horizontal Y position: 8
                        Rate: 4
                        Delay: 0 msecs
                        Crosswise aspirate: None
                        Final aspirate: Yes
                          Final aspirate delay: 0 msecs
                        Soak after dispense: No
<end>
```

Autoprime

```
File Name:          Autoprime.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:38 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Well
Protocol Name:      Autoprime
Protocol Version:   <no data>
Archive Revision:   0
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 60 mls
                      Flow rate: 7
                      Buffer valve: A
                      Low-flow prime volume: 0 mls
                      Soak after prime: Yes
                        Soak time: 03:50
<end>
```

COSTAR_ROUND

```
File Name:          COSTAR_ROUND.LHC
File Location:      C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling
                    Control\Protocols
Last Saved:         9/11/2008 11:16:41 AM

Instrument:         ELx405
Port:               COM2
Settings:           Model: Select
                    Manifold: 96 Well

Protocol Name:      COSTAR_ROUND
Protocol Version:   <no data>
Plate Type:         96 Well
Comments:           <uploaded from on-board>
                    (L) - Wash program; 96 Well; 96 Well manifold
Step Details:       Wash
                      Number of cycles: 3
                      Volume: 250 uls
                      Buffer valve: A
                      At start prime: No
                      Dispense parameters:
                        Dispense flow rate: 5
                        Height: 120
                        Horizontal position: 0
                        Horizontal Y position: 0
                        Bottom wash: No
                      Aspirate parameters:
                        Height: 34
                        Horizontal position: 0
                        Horizontal Y position: 8
                        Rate: 4
                        Delay: 0 msecs
                        Crosswise aspirate: None
                        Final aspirate: Yes
                          Final aspirate delay: 0 msecs
                        Soak after dispense: No
<end>
```

NUNC_384

```
File Name:          NUNC_384.LHC
File Location:      C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling
                    Control\Protocols
Last Saved:         9/11/2008 11:16:31 AM

Instrument:         ELx405
Port:               COM2
Settings:           Model: Select
                    Manifold: 96 Well

Protocol Name:      NUNC_384
Protocol Version:   <no data>
Plate Type:         384 Well
Comments:           <uploaded from on-board>
                    (L) - Wash program; 384 Well; 96 Well manifold
Step Details:       Wash
                      Number of cycles: 3
                      Volume: 100 uls
                      Buffer valve: A
                      At start prime: No
                      Dispense parameters:
                        Dispense flow rate: 5
                        Height: 115
                        Horizontal position: 0
                        Horizontal Y position: 0
                        Bottom wash: No
                      Aspirate parameters:
                        Height: 26
                        Horizontal position: 0
                        Horizontal Y position: 2
                        Rate: 3
                        Delay: 0 msecs
                        Crosswise aspirate: None
                        Final aspirate: Yes
                          Final aspirate delay: 0 msecs
                        Soak after dispense: No
<end>
```

NUNC_FLAT

```
File Name:          NUNC_FLAT.LHC
File Location:      C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling
                    Control\Protocols
Last Saved:         9/11/2008 11:16:33 AM

Instrument:         ELx405
Port:               COM2
Settings:           Model: Select
                    Manifold: 96 Well

Protocol Name:      NUNC_FLAT
Protocol Version:   <no data>
Plate Type:         96 Well
Comments:           <uploaded from on-board>
                    (L) - Wash program; 96 Well; 96 Well manifold
Step Details:       Wash
                      Number of cycles: 3
                      Volume: 300 uls
                      Buffer valve: A
                      At start prime: No
                      Dispense parameters:
                        Dispense flow rate: 7
                        Height: 120
                        Horizontal position: 0
                        Horizontal Y position: 0
                        Bottom wash: No
                      Aspirate parameters:
                        Height: 29
                        Horizontal position: -48
                        Horizontal Y position: 5
                        Rate: 4
                        Delay: 0 msecs
                        Crosswise aspirate: None
                        Final aspirate: Yes
                          Final aspirate delay: 0 msecs
                        Soak after dispense: No
<end>
```

NUNC_ROUND

```
File Name:          NUNC_ROUND.LHC
File Location:      C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling
                    Control\Protocols
Last Saved:         9/11/2008 11:16:32 AM

Instrument:         ELx405
Port:               COM2
Settings:           Model: Select
                    Manifold: 96 Well

Protocol Name:      NUNC_ROUND
Protocol Version:   <no data>
Plate Type:         96 Well
Comments:           <uploaded from on-board>
                    (L) - Wash program; 96 Well; 96 Well manifold
Step Details:       Wash
                      Number of cycles: 3
                      Volume: 250 uls
                      Buffer valve: A
                      At start prime: No
                      Dispense parameters:
                        Dispense flow rate: 5
                        Height: 120
                        Horizontal position: 0
                        Horizontal Y position: 0
                        Bottom wash: No
                      Aspirate parameters:
                        Height: 37
                        Horizontal position: 0
                        Horizontal Y position: 5
                        Rate: 4
                        Delay: 0 msecs
                        Crosswise aspirate: None
                        Final aspirate: Yes
                          Final aspirate delay: 0 msecs
                        Soak after dispense: No
<end>
```

Prime_200

File Name:	Prime_200.LHC
File Location:	C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:	2/4/2013 7:11:41 AM
LHC Version:	2.10.7
Instrument:	ELx405
Port:	USB ELx405 sn:234539
Settings:	Model: Select
	Manifold: 96-tube Deep
Plate Type:	96 Well
Protocol Name:	Prime_200
Protocol Version:	<no data>
Archive Revision:	0
Comments:	<uploaded from on-board>
	(L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:	Prime
	Volume: 200 mls
	Flow rate: 7
	Buffer valve: A
	Low-flow prime volume: 0 mls
	Soak after prime: No
<end>	

Prime_CW

```
File Name:          Prime_CW.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:35 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Deep Well
Protocol Name:      Prime_CW
Protocol Version:   <no data>
Archive Revision:   0
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Deep Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 150 mls
                      Flow rate: 7
                      Buffer valve: A
                      Low-flow prime volume: 150 mls
                      Soak after prime: No
<end>
```

P_DAY_RINSE

File Name:	P_DAY_RINSE.LHC
File Location:	C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:	2/4/2013 7:11:44 AM
LHC Version:	2.10.7
Instrument:	ELx405
Port:	USB ELx405 sn:234539
Settings:	Model: Select Manifold: 96-tube Deep
Plate Type:	96 Well
Protocol Name:	P_DAY_RINSE
Protocol Version:	<no data>
Archive Revision:	0
Comments:	<uploaded from on-board> (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:	Prime Volume: 300 mls Flow rate: 7 Buffer valve: D Low-flow prime volume: 200 mls Soak after prime: No
<end>	

P_DECON1

```
File Name:          P_DECON1.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:47 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Well
Protocol Name:      P_DECON1
Protocol Version:   <no data>
Archive Revision:   0
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 300 mls
                      Flow rate: 7
                      Buffer valve: D
                      Low-flow prime volume: 200 mls
                      Soak after prime: Yes
                        Soak time: 00:20
<end>
```

P_DECON2.LHC

```
File Name:          P_DECON2.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:50 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Well
Protocol Name:      P_DECON2
Protocol Version:   <no data>
Archive Revision:   0
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 600 mls
                      Flow rate: 7
                      Buffer valve: D
                      Low-flow prime volume: 200 mls
                      Soak after prime: Yes
                        Soak time: 00:02
<end>
```

P_RINSE_AND_SOAK

```
File Name:          P_RINSE_AND_SOAK.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:53 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Well
Protocol Name:      P_RINSE_AND_SOAK
Protocol Version:   <no data>
Archive Revision:
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 300 mls
                      Flow rate: 7
                      Buffer valve: D
                      Low-flow prime volume: 200 mls
                      Soak after prime: Yes
                        Soak time: 00:05
<end>
```

P_RINSE_LOOP

```
File Name:          P_RINSE_LOOP.LHC
File Location:      C:\ProgramData\BioTek\Liquid Handling Control 2.10\Protocols
Last Saved:         2/4/2013 7:11:56 AM

LHC Version:        2.10.7

Instrument:         ELx405
Port:               USB ELx405 sn:234539
Settings:           Model: Select
                    Manifold: 96-tube Deep

Plate Type:         96 Well
Protocol Name:      P_RINSE_LOOP
Protocol Version:   <no data>
Archive Revision:   0
Comments:           <uploaded from on-board>
                    (L) - Prime program; 96 Well; 96-tube Deep manifold
Step Details:       Prime
                      Volume: 60 mls
                      Flow rate: 7
                      Buffer valve: D
                      Low-flow prime volume: 0 mls
                      Soak after prime: Yes
                        Soak time: 04:00
<end>
```

residual_qc_test

File Name: residual_qc_test.LHC
File Location: C:\Documents and Settings\All Users\Application Data\BioTek\Liquid Handling Control\Protocols
Last Saved: 9/11/2008 11:16:30 AM

Instrument: ELx405
Port: COM2
Settings: Model: Select
Manifold: 96 Well

Protocol Name: residual_qc_test
Protocol Version: <no data>
Plate Type: 96 Well
Comments: <uploaded from on-board>
(L) - Aspirate program; 96 Well; 96 Well manifold
Step Details: Aspirate
Height: 28
Horizontal position: -50
Horizontal Y position: 3
Rate: 2
Delay: 0 msecs
Crosswise aspirate: No
<end>

Appendix E

Changing the Manifolds

This appendix contains instructions for changing manifolds in ELx405 HT models with the accessory 96-tube manifold.

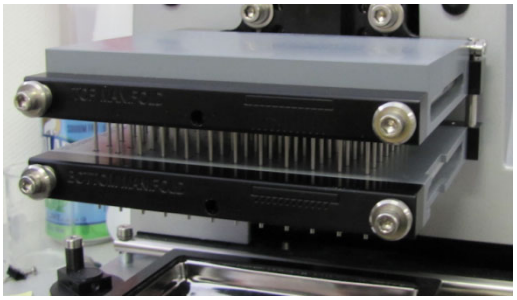
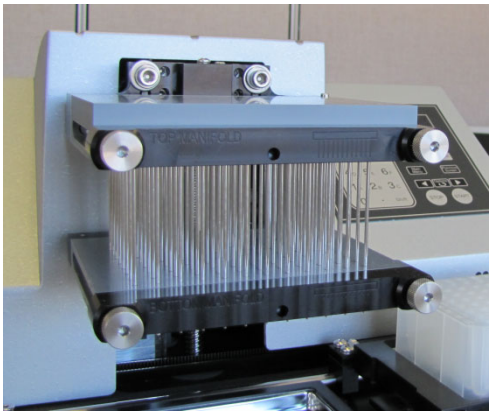
Changing Manifolds

HT2 models ship the accessory 96-tube dual manifold in a special case (PN 7102136). Use this shipping case to store whichever manifold is not being used (see page 218).

Important: if the washer has been in operation, run a Maintenance program (such as DAY_RINSE) to flush any residue from the manifold tubes before removing the manifold.

❖ **Tip:** It is easier to clean the manifold now, before removing and storing it, rather than after residuals in the manifold have been allowed to dry or crystallize during storage.

1. Run DAY_RINSE once or twice using deionized water in the supply bottle. **Models with the Ultrasonic Advantage™ (ultrasonic cleaner):** Run an AUTOCLEAN program instead of DAY_RINSE.
2. Run the system "dry": Connect an empty supply bottle and run DAY_RINSE.
3. Turn off the washer and disconnect the power cord.
4. Remove the mist shield (if it is attached).
5. Depending on the type of manifold:

Standard dual manifold	Quick release dual manifold
	
Using the 9/64" (3.57 mm) hex wrench supplied with the instrument, remove the screws, washers, and springs that hold the manifold in place, and set them aside.	Release the thumbscrews that secure the manifolds in place.

6. Carefully remove the manifold and end plates, holding the upper and lower manifolds together as a single unit, and place the manifold into the shipping case for safe storage. If you ran DAY_RINSE or an AUTOCLEAN program as instructed in step 1 above, ensure that the manifold is thoroughly dry before storing it.

7. Install the alternate manifold and end plates, carefully holding the upper and lower manifolds together as a single unit, and making sure that the two o-rings do not fall out of their grooves during installation.
8. Tighten the screws that hold the manifold in place:
   - Quick-release manifolds: finger tightening is normally sufficient;
   - Standard manifolds: do not over tighten.

Important! When reinstalling the standard manifold, only tighten the screw-washer-spring assembly until you feel the mechanical stop. You will damage the instrument if you continue tightening past this point.

Very Important!

9. Reinstall the mist shield.
10. Configure the washer for the correct manifold. Follow the menu path shown below, and select **96** or **192**, as appropriate.

Keypad	**UTIL** → **SETUP** → MORE → MORE → MORE → **MANIFOLD** → MANIFOLD SELECTION: **96** or **192** or **96DEEP**
LHC	**Tools>Instrument Utilities>Configuration Data**

11. Re-prime the washer. Observe the process carefully to make sure you have correctly reinstalled the manifold. Consider running the qualification tests for your washer to verify performance.

The correct manifold (**96** or **192**) must be specified under **Manifold Selection** before operating the washer.

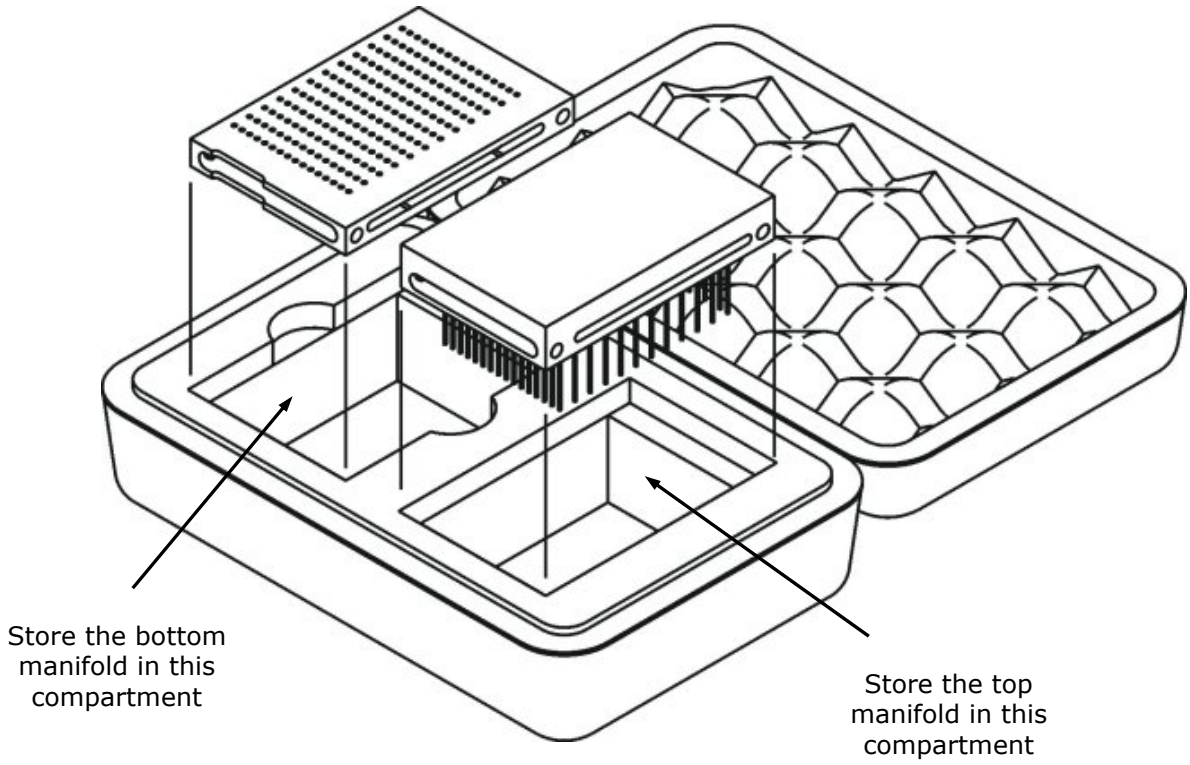


Figure 31: Storing the 96- or 192-Tube Dual Manifold in the Shipping Case

Appendix F

Safety Information

This appendix contains safety information translated into Dutch, French, German, Italian, and Spanish.

Safety Notices

Veiligheidsmededelingen

Avis de sécurité

Sicherheitshinweise

Avvisi di sicurezza

Avisos de seguridad

Pay special attention to the following safety notices in all product documentation.

Let vooral op de volgende veiligheidsmededelingen in alle productdocumentatie.

Portez une attention particulière aux avis de sécurité suivants dans l'ensemble de la documentation du produit.

Achten Sie besonders auf die folgenden Sicherheitshinweise in allen Produktdokumentationen.

Prestare particolare attenzione agli avvisi di sicurezza presenti in tutta la documentazione del prodotto.

Preste especial atención a los siguientes avisos de seguridad en toda la documentación del producto.

WARNING

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

De aanduiding WAARSCHUWING duidt op een gevaar. Deze vestigt de aandacht op een bedieningsprocedure, praktijk of iets dergelijks die, indien niet correct uitgevoerd of nageleefd, persoonlijk letsel of de dood tot gevolg kan hebben. Ga niet verder bij een aanduiding WAARSCHUWING voordat de aangegeven voorwaarden volledig begrepen zijn en eraan voldaan is.

Un AVERTISSEMENT signale un danger. Il attire l'attention sur une procédure d'utilisation, une pratique ou autre qui, si elle n'est pas correctement exécutée ou respectée, peut entraîner des dommages corporels, voire un décès. Ne passez pas outre l'AVERTISSEMENT uniquement si les conditions indiquées sont entièrement comprises et remplies.

Ein WARNHINWEIS weist auf eine Gefahr hin. Er weist auf ein

Betriebsverfahren, eine Vorgehensweise oder ähnliches hin, deren falsche Ausführung oder Nichtbeachtung zu Verletzungen oder zum Tod führen können. Fahren Sie bei einem WARNHINWEIS erst dann mit Ihrer Arbeit fort, wenn die angegebenen Bedingungen vollständig verstanden und erfüllt sind.

Un avviso di AVVERTENZA indica un pericolo. Richiama l'attenzione su procedure operative, pratiche o azioni simili che, se non rispettate o eseguite correttamente, potrebbero causare lesioni personali o decesso. Non procedere ignorando un avviso di AVVERTENZA fino a quando le condizioni indicate non sono state completamente comprese e soddisfatte.

Un aviso de ADVERTENCIA indica un peligro. Destaca la importancia de un procedimiento operativo, una práctica o un proceso similar que, si no se realiza o se sigue correctamente, podría provocar lesiones o la muerte. No siga adelante sin antes comprender y cumplir plenamente los requisitos indicados en el aviso de ADVERTENCIA.

CAUTION

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

De aanduiding VOORZICHTIG duidt op een gevaar. Deze vestigt de aandacht op een bedieningsprocedure, praktijk of iets dergelijks die, indien niet correct uitgevoerd of nageleefd, schade aan het product of verlies van belangrijke gegevens tot gevolg kan hebben. Ga niet verder bij een aanduiding VOORZICHTIG voordat de aangegeven voorwaarden volledig begrepen zijn en eraan voldaan is.

Une MISE EN GARDE signale un danger. Elle attire l'attention sur une procédure d'utilisation, une pratique ou autre qui, si elle n'est pas correctement exécutée ou respectée, peut endommager le produit ou entraîner la perte de données importantes. Ne passez pas outre la MISE EN GARDE uniquement si les conditions indiquées sont entièrement comprises et remplies.

Ein VORSICHTSHINWEIS weist auf eine Gefahr hin. Er weist auf ein Betriebsverfahren, eine Vorgehensweise oder ähnliches hin, deren falsche Ausführung oder Nichtbeachtung zu einer Beschädigung des Produkts oder zum Verlust wichtiger Daten führen kann. Fahren Sie bei einem VORSICHTSHINWEIS erst dann mit Ihrer Arbeit fort, wenn die angegebenen Bedingungen vollständig verstanden und erfüllt sind.

Un avviso di ATTENZIONE indica un pericolo. Richiama l'attenzione su

procedure operative, pratiche o azioni simili che, se non rispettate o eseguite correttamente, potrebbero causare danni al prodotto o perdita di dati importanti. Non procedere ignorando un avviso di ATTENZIONE fino a quando le condizioni indicate non sono state completamente comprese e soddisfatte.

Un aviso de PRECAUCIÓN indica un peligro. Destaca la importancia de un procedimiento operativo, una práctica o un proceso similar que, si no se realiza o no se sigue correctamente, podrían provocar daños en el producto o la pérdida de datos importantes. No siga adelante sin antes comprender y cumplir plenamente los requisitos indicados en el aviso de PRECAUCIÓN.

Warnings and Precautions

Waarschuwingen en voorzorgsmaatregelen

Avertissements et précautions

Warnhinweise und Sicherheitsvorkehrungen

Avvertenze e precauzioni

Advertencias y precauciones

Electrical Hazards

Elektrische gevaren

Risques électriques

Elektrische Gefahren

Rischi elettrici

Peligros eléctricos

WARNING

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

Interne spanning. Zet altijd de stroomschakelaar uit en haal de stekker uit het stopcontact voordat de buitenkant van het instrument wordt gereinigd.

Tension interne. Désactivez toujours l'interrupteur d'alimentation électrique et débranchez l'alimentation avant de nettoyer la surface extérieure de l'instrument.

Spannung im Geräteinneren. Vor dem Reinigen der Außenfläche des

Geräts grundsätzlich den Stromschalter ausschalten und das Stromkabel aus der Steckdose ziehen.

Tensione interna. Spegnere sempre l'interruttore dell'alimentazione e scollegare l'alimentazione prima di pulire le superfici esterne dello strumento.

Tensión interna. Siempre apague el interruptor y desconecte la fuente de alimentación antes de limpiar la superficie exterior del instrumento.

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.

Vermogensklasse. De voeding of het netsnoer van het instrument moet worden aangesloten op een stopcontact dat spanning en stroom levert binnen de gespecificeerde nominale waarden voor het systeem. Gebruik van een niet-compatibel stopcontact kan leiden tot elektrische schokken en brandgevaar.

Puissance électrique nominale. L'alimentation ou le cordon d'alimentation de l'instrument doit être raccordé(e) à une prise de courant qui fournit la tension et le courant correspondants à la puissance spécifiée du système. L'emploi d'une prise de courant incompatible peut entraîner un choc électrique et un risque d'incendie.

Leistungsbemessung. Die Stromversorgung des Geräts bzw. das Anschlusskabel muss mit einer Steckdose verbunden werden, deren Spannungs- und Stromwerte innerhalb der für das System vorgeschriebenen Nennwerte liegen. Die Verwendung einer nicht kompatiblen Steckdose kann zu einem elektrischen Schlag und Brandgefahr führen.

Potenza nominale. L'alimentazione o il cavo di alimentazione dello strumento devono essere collegati a una presa di corrente che fornisca tensione e corrente comprese entro il valore nominale previsto per il sistema. L'uso di una presa di alimentazione non compatibile può causare scosse elettriche e rischi di incendio.

Potencia nominal. La fuente de alimentación o el cable de alimentación del instrumento tienen que conectarse a un receptáculo que suministre tensión y corriente dentro de la potencia especificada para el sistema. El uso de un receptáculo incompatible puede producir descargas eléctricas y riesgo de incendio.

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.

Elektrische aarding. Gebruik nooit een stekkeradapter om de primaire stroom aan te sluiten op de externe voeding. Het gebruik van een adapter verbreekt de verbinding met de aarding van het elektriciteitsnet, waardoor een ernstige schok kan ontstaan. Sluit het netsnoer altijd rechtstreeks aan op een geschikt stopcontact met werkende aarding.

Mise à la terre électrique. N'utilisez jamais d'adaptateur de prise pour raccorder l'alimentation principale à l'alimentation électrique extérieure. L'utilisation d'un adaptateur déconnecte la terre du secteur, créant un risque important de choc. Raccordez toujours le cordon d'alimentation directement à une prise appropriée dotée d'une mise à la terre fonctionnelle.

Elektrische Erdung. Verwenden Sie niemals einen Steckeradapter zum Anschließen der Primärstromversorgung an die externe Stromversorgung. Bei Verwendung eines Adapters wird die Verbindung zur Gebäudeerde unterbrochen, sodass ein erhebliches Stromschlagrisiko besteht. Das Stromkabel ist immer direkt an eine geeignete Steckdose mit Funktionserdung anzuschließen.

Messa a terra elettrica. Non usare mai un adattatore per collegare l'alimentazione principale all'alimentazione esterna. Se si usa un adattatore, si scollega la messa a terra della rete elettrica creando un grave pericolo di scosse elettriche. Collegare sempre il cavo di alimentazione direttamente a una presa idonea dotata di messa a terra funzionale.

Conexión a tierra. Nunca use un adaptador de enchufe para conectar la corriente principal a la fuente de alimentación externa. El uso de un adaptador desconecta la tierra del servicio y crea un riesgo de descarga grave. Conecte siempre el cable de alimentación directamente a un receptáculo adecuado con una toma de tierra funcional.

WARNING

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

Service. Alleen gekwalificeerd technisch personeel mag serviceprocedures aan interne onderdelen uitvoeren.

Entretien. L'exécution des procédures d'entretien des composants internes doit être réservée au personnel technique qualifié.

Wartung. Wartungsarbeiten an Komponenten im Geräteinneren sollten nur von qualifizierten Servicetechnikern durchgeführt werden.

Manutenzione. Le procedure di manutenzione sui componenti interni devono essere eseguite esclusivamente da personale tecnico qualificato.

Revisión. Solo puede realizar procedimientos de revisión de los componentes internos el personal técnico cualificado.

Chemical/Environmental

Chemisch/Milieu

Substances chimiques/Environnement

Chemie/Umwelt

Rischi chimici/ambientali

Riesgos químicos y medioambientales

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. Always wear safety glasses and appropriate protective equipment, such as chemical-resistant rubber gloves and apron.

Potentiële biologische gevaren. Sommige tests of specimens kunnen een biologisch gevaar inhouden. Er moeten adequate veiligheidsmaatregelen worden getroffen zoals aangegeven in de bijsluiter van de test. Draag altijd een veiligheidsbril en geschikte beschermingsmiddelen, zoals chemicaliënbestendige rubberen handschoenen en een schort.

Risques biologiques potentiels. Certains tests ou échantillons peuvent présenter un risque biologique. Des précautions de sécurité adéquates doivent être prises, comme indiqué dans la notice de l'emballage du test. Portez toujours des lunettes de sécurité et un équipement de protection approprié, comme des gants en caoutchouc résistant aux substances chimiques et un tablier.

Potenzielle Biogefahren. Manche Assays oder Proben stellen eine Biogefahr dar. Es sollten angemessene Sicherheitsvorkehrungen entsprechend der Packungsbeilage des Assays ergriffen werden. Tragen Sie immer eine Schutzbrille und eine geeignete Schutzausrüstung, wie chemikalienbeständige Gummihandschuhe und Schürze.

Potenziali rischi biologici. Alcuni test o campioni potrebbero comportare un rischio biologico. Implementare misure di sicurezza adeguate secondo quanto delineato nel foglietto della confezione del test. Indossare sempre occhiali di sicurezza e dispositivi di protezione appropriati, ad esempio guanti e grembiule in gomma resistenti alle sostanze chimiche.

Riesgos biológicos potenciales. Algunos ensayos y especímenes pueden constituir un riesgo biológico. Se han de tomar precauciones de seguridad suficientes tal como se indica en el folleto del paquete del ensayo. Use siempre gafas de seguridad y equipos protectores adecuados, como guantes de caucho resistentes a productos químicos y un delantal.

Potential Biohazards. 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.

Potentiële biologische gevaren. Indien geïnstalleerd, pompt het afvoersysteem met directe afvoer de afvalvloeistoffen van de wasmachine rechtstreeks in een gootsteen of tank en mogelijk in het openbare afvalwatersysteem. Omdat het afval een biologisch gevaar kan zijn, moet u ervoor zorgen dat u voldoet aan de wetten van uw lokale of nationale overheid inzake de veilige verwijdering van het afval.

Risques biologiques potentiels. Lorsqu'il est installé, le système de vidange directe des déchets pompe les fluides usés du laveur directement dans un évier ou un réservoir et, potentiellement, dans les circuits d'eaux usées publics. Les déchets pouvant constituer un risque biologique, vous devez veiller à être en conformité avec les lois gouvernementales locales ou nationales concernant l'élimination sûre des déchets.

Potenzielle Biogefahren. Ein etwaiges installiertes System zur Direktabfallentleerung pumpt Abfallflüssigkeiten direkt aus dem Washer in ein Abflussbecken oder einen Behälter und potenziell in ein öffentliches Abwassersystem. Da der Abfall biologisch gefährdend sein kann, müssen Sie sicherstellen, dass Sie Ihre kommunalen und Landesvorschriften für die sichere Abfallentsorgung einhalten.

Potenziali rischi biologici. Se è installato, il sistema di scarico diretto dei rifiuti pompa i fluidi di scarto dalla rondella direttamente in un contenitore o un serbatoio e, potenzialmente, nella rete pubblica delle acque reflue. Poiché i rifiuti potrebbero costituire un rischio biologico, occorre garantire la conformità con la legislazione governativa locale o nazionale in materia di smaltimento in sicurezza dei rifiuti.

Riesgos biológicos potenciales. Si está instalado, el sistema de residuos de drenaje directo bombea los fluidos residuales del limpiador directamente a una pileta o depósito y, posiblemente, a los sistemas públicos de aguas residuales. Los residuos pueden constituir un riesgo biológico, por lo tanto, debe asegurarse de cumplir con las leyes del

gobierno local o nacional sobre la eliminación segura de los residuos.

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, stop the program and turn off the instrument. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

Vloeistoffen. Voorkom dat vloeistoffen op het instrument worden gemorst; het doorsijpelen van vloeistoffen in interne onderdelen kan leiden tot schokgevaar of beschadiging van het instrument. Als een lekkage optreedt terwijl een programma loopt, stopt u het programma en schakelt u het instrument uit. Veeg alle gemorste vloeistof onmiddellijk op. Gebruik het instrument niet als interne onderdelen aan vloeistof zijn blootgesteld.

Liquides. Évitez de renverser des liquides sur l'instrument ; les infiltrations de liquide dans les composants internes créent un risque potentiel de choc ou de détérioration de l'instrument. En cas de déversement de liquide alors qu'un programme est en cours d'exécution, arrêtez le programme et mettez l'instrument hors tension. Essuyez immédiatement tout liquide renversé. N'utilisez pas l'instrument si les composants internes ont été exposés à du liquide.

Flüssigkeiten. Keine Flüssigkeiten auf dem Gerät verschütten! In die Bauteile im Geräteinneren bilden einsickernde Flüssigkeiten ein Potenzial für die Gefahr von Stromschlägen oder Schäden am Gerät. Bei Verschütten von Flüssigkeiten während ein Programm läuft, ist dieses zu stoppen und das Gerät auszuschalten. Verschüttete Flüssigkeiten sind unverzüglich abzuwischen. Das Gerät darf nicht betrieben werden, wenn Komponenten im Geräteinneren Flüssigkeiten ausgesetzt waren.

Liquidi. Evitare di versare liquidi sullo strumento; l'infiltrazione di fluidi nei componenti interni crea rischi di scosse elettriche o danni allo strumento. Se si verifica un versamento durante l'esecuzione di un programma, arrestare il programma e spegnere lo strumento. Ripulire immediatamente tutti i versamenti. Non utilizzare lo strumento se i componenti interni sono stati esposti a fluidi.

Líquidos. Procure no derramar líquidos sobre el instrumento, ya que si se filtran fluidos en los componentes internos se puede producir un riesgo de descarga o de deterioro del instrumento. Si se produce un derramamiento mientras se está ejecutando un programa, detenga el programa y apague el instrumento. Limpie el derrame inmediatamente. No utilice el instrumento si los componentes internos han estado

expuestos a fluidos.

CAUTION

Liquids. Do not immerse the instrument, spray it with liquid, or use a dripping-wet cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact Technical Support. Do not soak the keypad.

Vloeistoffen. Dompel het instrument niet onder, bespuit het niet met vloeistof en gebruik er geen druipnatte doek op. Zorg ervoor dat er geen water of andere schoonmaakmiddelen in het inwendige van het instrument terechtkomen. Als dit gebeurt, neem dan contact op met de afdeling Technische Ondersteuning. Maak het toetsenbord niet nat.

Liquides. N'immergez pas l'instrument, ne le vaporisez pas de liquide et n'utilisez pas de chiffon non essoré dessus. Ne laissez pas d'eau ou autre solution de nettoyage pénétrer à l'intérieur de l'instrument. Le cas échéant, contactez l'assistance technique. N'immergez pas le clavier.

Flüssigkeiten. Das Gerät nicht in Flüssigkeit eintauchen oder damit einsprühen und keine tropfnassen Tücher verwenden. Kein Wasser oder andere Reinigungslösung in das Geräteinnere eindringen lassen. Sollte dies vorkommen, setzen Sie sich mit dem technischen Kundendienst in Verbindung. Die Tastatur nicht einweichen.

Liquidi. Non immergere lo strumento, nebulizzarlo con liquidi né usare un panno che non sia stato strizzato bene. Evitare che acqua o soluzioni detergenti penetrino all'interno dello strumento. Se si verifica un'infiltrazione, contattare il supporto tecnico. Non mettere in ammollo la tastiera.

Líquidos. No sumerja el instrumento, no lo pulverice con líquidos y no use un paño mojado que gotee sobre él. No permita que entre agua ni otra solución de limpieza en el interior del instrumento. Si esto sucediera, póngase en contacto con el servicio de soporte técnico. No remoje el teclado.

CAUTION

Environmental Conditions. Do not expose the instrument to temperature extremes. For proper operation, temperature near the instrument should remain within the range in the ***Specifications*** section of this document. Performance may be adversely affected if temperatures fluctuate above or below this range.

Omgevingsvoorwaarden. Stel het instrument niet bloot aan extreme temperaturen. Voor een goede werking moet de temperatuur in de buurt van het instrument binnen het bereik blijven zoals aangegeven in het gedeelte ***Specificaties*** van dit document. De prestaties kunnen nadelig worden beïnvloed als de temperatuur boven of onder dit bereik schommelt.

Conditions environnementales. N'exposez pas l'instrument à des températures extrêmes. Pour assurer un bon fonctionnement, la

température à proximité de l'instrument doit demeurer dans la plage indiquée sous la rubrique ***Spécifications*** du présent document. La performance peut être affectée négativement si les températures fluctuent au-dessus ou au-dessous de cette plage.

Umgebungsbedingungen. Das Gerät darf keinen Extremtemperaturen ausgesetzt werden. Für den ordnungsgemäßen Betrieb müssen die Temperaturen in Gerätenähe in den im Abschnitt ***Spezifikationen*** dieses Dokuments angegebenen Grenzen bleiben. Temperaturschwankungen über diese Grenzwerte hinaus können die Geräteleistung beeinträchtigen.

Condizioni ambientali. Non esporre lo strumento a temperature estreme. Per il corretto funzionamento, la temperatura nei pressi dello strumento deve restare nell'intervallo indicato nella sezione ***Specifiche*** di questo documento. Fluttuazioni delle temperature al di sopra o al di sotto di questo intervallo possono compromettere le prestazioni dello strumento.

Condiciones ambientales. No exponga el instrumento a temperaturas extremas. Para su correcto funcionamiento, la temperatura que rodee al instrumento deberá estar dentro del rango indicado en la sección ***Especificaciones*** de este documento. Si las temperaturas fluctúan por encima o por debajo de este rango, el rendimiento puede verse afectado negativamente.

CAUTION

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

Natriumhypochloriet. Stel geen enkel deel van het instrument langer dan 20 minuten bloot aan de aanbevolen verdunde natriumhypochlorietoplossing. Langdurig contact kan de oppervlakken van het instrument beschadigen. Zorg ervoor dat alle oppervlakken goed worden afgespoeld en schoongeveegd.

Hypochlorite de sodium. N'exposez aucune pièce de l'instrument à la solution d'hypochlorite de sodium diluée comme recommandé pendant plus de 20 minutes. Un contact prolongé peut endommager les surfaces de l'instrument. Veillez à rincer et essuyer soigneusement toutes les surfaces.

Natriumhypochlorit. Kein Teil des Geräts darf der empfohlenen verdünnten Natriumhypochloritlösung länger als 20 Minuten lang ausgesetzt werden. Bei längerem Kontakt drohen Beschädigungen an den Geräteoberflächen. Alle Oberflächen unbedingt abspülen und

gründlich abwischen.

Ipoclorito di sodio. Non esporre nessun componente dello strumento alla soluzione di ipoclorito di sodio diluita raccomandata per più di 20 minuti. Un contatto prolungato potrebbe danneggiare le superfici dello strumento. Accertarsi di sciacquare e ripulire accuratamente tutte le superfici.

Hipoclorito sódico. No exponga ninguna parte del instrumento a la solución de hipoclorito sódico diluido recomendada durante más de 20 minutos. Un contacto demasiado prolongado puede dañar las superficies del instrumento. Asegúrese de aclarar y secar concienzudamente todas las superficies.

CAUTION

Lubricants. Do not apply lubricants to moving parts. Lubricant on components in the carrier compartment will attract dust and other particles, which may cause the instrument to produce an error. Do not apply lubricants to manifold o-rings, channel-end seals, bottle cover seals, any tubing connection, or any surface that is a part of the fluid path.

Smeermiddelen. Breng geen smeermiddelen aan op bewegende delen. Smeermiddel op onderdelen in het draagcompartiment zal stof en andere deeltjes aantrekken, waardoor het instrument een fout kan produceren. Breng geen smeermiddelen aan op o-ringen van het spruitstuk, afdichtingen van kanaaleinden, afdichtingen van flesdeksels, slangaansluitingen of oppervlakken die deel uitmaken van het vloeistoftraject.

Lubrifiants. N'appliquez pas de lubrifiants sur les pièces mobiles. La présence de lubrifiant sur les composants dans le compartiment du portoir attire la poussière et autres particules, ce qui peut provoquer une erreur de l'instrument. Ne pas appliquer de lubrifiant sur les joints toriques, les joints d’extrémité de canal, les joints des couvercles de bouteille, les raccords de tuyauterie ou les surfaces faisant partie du circuit de fluide.

Schmierstoffe. Keine Schmierstoffe auf bewegliche Teile auftragen. Schmierstoffe auf Komponenten im Trägerfach ziehen Staub und andere Teilchen an, die zu einem Gerätefehler führen können. Keine Schmierstoffe auf die O-Ringe der Verteiler, die Dichtungen am Kanalende, die Flaschendeckeldichtungen, Schlauchverbindungen oder Oberflächen auftragen, die Teil des Flüssigkeitspfades sind.

Lubrificanti. Non applicare lubrificanti alle parti in movimento. La presenza di lubrificante sui componenti del vano portapiastra attira polvere e altre particelle che potrebbero causare errori dello strumento.

Non applicare lubrificanti agli o-ring del collettore, alle guarnizioni delle estremità dei canali, alle guarnizioni dei coperchi dei flaconi, ai collegamenti dei tubi o alle superfici che fanno parte del percorso del fluido.

Lubricantes. No aplique lubricantes en las piezas móviles. El lubricante en los componentes del compartimento del portador atraerá polvo y otras partículas que pueden hacer que el instrumento muestre un error. No aplique lubricante en las juntas tóricas del distribuidor, los sellos del extremo del canal, los sellos de la cubierta de la botella, la conexión de cualquier tubería o cualquier superficie que forme parte del recorrido del fluido.

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, and 20% sodium hydroxide. Never use acetic acid, DMSO, or other organic solvents. These chemicals may cause severe damage to the instrument.

Chemische compatibiliteit. Sommige chemicaliën kunnen onherstelbare schade aan het instrument toebrengen. De volgende chemicaliën zijn veilig bevonden voor gebruik in het instrument: bufferoplossingen (zoals PBS), zoutoplossing, oppervlakteactieve stoffen, gedeïoniseerd water, 70% ethyl-, isopropyl- of methylalcohol en 20% natriumhydroxide. Gebruik nooit azijnzuur, DMSO of andere organische oplosmiddelen. Deze chemicaliën kunnen ernstige schade aan het instrument veroorzaken.

Compatibilité chimique. Certaines substances chimiques peuvent endommager irrémédiablement l'instrument. Les substances chimiques suivantes sont considérées comme sûres pour utilisation dans l'instrument : solutions tampon (PBS par exemple), saline, surfactants, eau déionisée, alcool éthylique, isopropylique ou méthylique à 70 % et hydroxyde de sodium à 20 %. N'utilisez jamais d'acide acétique, de DMSO ou autres solvants organiques. Ces substances chimiques peuvent gravement endommager l'instrument.

Chemische Kompatibilität. Einige Chemikalien können irreparable Schäden am Gerät verursachen. Die folgenden Chemikalien wurden als für die Verwendung im Gerät sicher eingestuft: Pufferlösungen (wie PBS), Salzwasser, Tenside, entionisiertes Wasser, 70%-iger Ethyl-, Isopropyl- oder Methylalkohol und 20%-iges Natriumhydroxid. Verwenden Sie niemals Essigsäure, DMSO oder andere organische Lösungsmittel. Diese Chemikalien können schwere Schäden am Gerät verursachen.

Compatibilità chimica. Alcune sostanze chimiche possono causare danni irreparabili allo strumento. Le seguenti sostanze chimiche sono state considerate sicure per l'uso nello strumento: soluzioni tampone (ad esempio, PBS), soluzione salina, surfactanti, acqua deionizzata, alcol etilico, isopropilico o metilico al 70% e idrossido di sodio al 20%. Non usare mai acido acetico, DMSO o altri solventi organici. Queste sostanze chimiche possono causare gravi danni allo strumento.

Compatibilidad química. Algunos productos químicos pueden causar daños irreparables al instrumento. Se ha determinado que los siguientes productos químicos son seguros para su uso con el instrumento: soluciones búfer (como PBS), salinas, surfactantes, agua desionizada, alcohol metílico, isopropílico o etílico al 70 % e hidróxido de sodio al 20 %. Nunca use ácido acético, DMSO ni otros disolventes orgánicos. Estos productos químicos pueden causar daños graves al instrumento.

CAUTION

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

Runderalbumine. Oplossingen die eiwitten bevatten, zoals runderalbumine (BSA, bovine serum albumin), zullen de prestaties van het instrument na verloop van tijd aantasten, tenzij een strikt onderhoudsprotocol wordt nageleefd.

Albumine de sérum bovin. Les solutions contenant des protéines, comme l'albumine de sérum bovin (ASB), compromettent la performance dans le temps de l'instrument si un protocole strict d'entretien n'est pas respecté.

Bovines Serumalbumin. Lösungen, die Proteine enthalten, wie bovines Serumalbumin (BSA), beeinträchtigen auf Dauer die Geräteleistung, sofern nicht ein strenges Wartungsprotokoll eingehalten wird.

Albumina di siero bovino. Soluzioni contenenti proteine, ad esempio albumina di siero bovino (BSA), compromettono nel tempo le prestazioni dello strumento, a meno che non venga utilizzato un rigido protocollo di manutenzione.

Albúmina de suero bovino. Las soluciones que contienen proteínas, como la albúmina de suero bovino (ASB), comprometerán el rendimiento del instrumento con el tiempo, a menos que se siga un protocolo de mantenimiento estricto.

Components

Onderdelen

Composants

Komponenten

Componenti

Componentes

WARNING

Pinch Hazard. Some areas of the instrument can present pinch hazards when the instrument is operating. These areas are marked with the symbol shown here. Keep hands/fingers clear of these areas when the instrument is operating.

Beknellingsgevaar. Sommige delen van het instrument kunnen beknellingsgevaar opleveren wanneer het instrument in bedrijf is. Deze gebieden zijn gemarkeerd met het hier afgebeelde symbool. Houd handen/vingers uit de buurt van deze gebieden wanneer het instrument in bedrijf is.

Risque de pincement. Certaines zones de l'instrument peuvent présenter des risques de pincement lors du fonctionnement de l'instrument. Ces zones sont signalées par le symbole illustré ci-contre. Gardez vos mains/doigts à l'écart de ces zones lors du fonctionnement de l'instrument.

Quetschgefahr. In einigen Bereichen des Geräts können beim Betrieb des Geräts Quetschgefahren auftreten. Diese Bereiche sind mit dem hier abgebildeten Symbol gekennzeichnet. Hände/Finger von diesen Bereichen fernhalten, wenn das Gerät in Betrieb ist.

Rischio di pizzicamento. Alcune aree dello strumento possono presentare rischi di pizzicamento quando lo strumento è in funzione. Queste aree sono contrassegnate dal simbolo mostrato qui. Tenere le mani e le dita lontane da queste aree quando lo strumento è in funzione.

Peligro de atrapamiento. Algunas áreas del instrumento pueden presentar riesgos de atrapamiento cuando el instrumento está en funcionamiento. Estas áreas están marcadas con el símbolo que se muestra aquí. Mantenga las manos y los dedos alejados de estas áreas cuando el instrumento esté en funcionamiento.

WARNING

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

Ultrasone energie. In het reinigingsreservoir is ultrasone energie aanwezig wanneer het AutoClean-programma loopt. Steek uw vingers niet in het reservoir. Ultrasone energie kan menselijk weefsel beschadigen.

Énergie ultrasonique. Présence d'énergie ultrasonique dans le réservoir de nettoyage lorsque le programme AutoClean est en cours. Ne mettez pas vos doigts dans le réservoir. L'énergie ultrasonique peut endommager les tissus humains.

Ultraschallenergie. Im Reinigungsreservoir ist Ultraschallenergie vorhanden, wenn das Programm AutoClean (Automatische Reinigung) ausgeführt wird. Stecken Sie Ihre Finger nicht in das Reservoir. Ultraschallenergie kann menschliches Gewebe schädigen.

Energia a ultrasuoni. L'energia a ultrasuoni è presente nel serbatoio di pulizia quando il programma di pulizia automatica è in esecuzione. Non mettere le dita nel serbatoio. L'energia a ultrasuoni può danneggiare i tessuti umani.

Energía ultrasónica. La energía ultrasónica está presente en el depósito de limpieza cuando se está ejecutando el programa AutoClean (Limpieza automática). No meta los dedos en el depósito. La energía ultrasónica puede dañar tejidos humanos.

WARNING

Accessories. Only accessories that meet the manufacturer's specifications shall be used with the instrument.

Accessoires. Bij het instrument mogen alleen accessoires worden gebruikt die voldoen aan de specificaties van de fabrikant.

Accessoires. L'instrument doit être utilisé exclusivement avec des accessoires correspondant aux spécifications du fabricant.

Zubehör. In Verbindung mit dem Gerät dürfen nur Zubehörkomponenten verwendet werden, die den Spezifikationen des Herstellers entsprechen.

Accessori. Utilizzare esclusivamente accessori dello strumento che rispettano le specifiche del fabbricante.

Accesorios. Solamente aquellos accesorios que cumplan las especificaciones del fabricante deberán usarse con el instrumento.

CAUTION

Vacuum Pump Installation. Do not plug the 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.

Vacuümpomp installatie. Steek de kabel van de vacuümpomp niet in

een stopcontact. Gebruik de adapter die bij de pomp is geleverd om de pomp aan te sluiten op de accessoire-uitgang aan de achterkant van de wasmachine.

Installation de la pompe à vide. Ne branchez pas le câble de la pompe à vide dans une prise murale. Utilisez l'adaptateur fourni avec la pompe pour connecter la pompe à la prise d'accessoires à l'arrière de la laveuse.

Installation der Vakuumpumpe. Stecken Sie das Vakuumpumpenkabel nicht in eine Wandsteckdose. Verwenden Sie den mit der Pumpe gelieferten Adapter, um die Pumpe an den Zubehörausgang auf der Rückseite der Waschmaschine anzuschließen.

Installazione della pompa del vuoto. Non collegare il cavo della pompa per vuoto a una presa a muro. Utilizzare l'adattatore fornito con la pompa per collegare la pompa all'uscita accessori sul retro della lavatrice.

Instalación de la bomba de vacío. No conecte el cable de la bomba de vacío a una toma de corriente. Use el adaptador provisto con la bomba para conectar la bomba a la salida de accesorios en la parte posterior de la lavadora.

CAUTION

Waste Sensor Port. For installations with the BioStack Microplate Stacker: Do not plug the BioStack's external power supply into the waste sensor port on the back of the washer. Doing so will permanently damage the washer's internal components.

Afvalsensorpoort. Voor installaties met de BioStack Microplate Stacker: Sluit de externe voeding van de BioStack niet aan op de afvalsensorpoort aan de achterkant van de wasmachine. Als u dit wel doet, worden de interne onderdelen van de wasmachine permanent beschadigd.

Port du capteur de déchets. Pour les installations avec l'empileur de microplaques BioStack : Ne branchez pas l'alimentation externe du BioStack dans le port du capteur de déchets à l'arrière de la laveuse. Cela endommagerait de façon permanente les composants internes de la laveuse.

Abfallsensoranschluss. Für Installationen mit dem BioStack Microplate Stacker: Stecken Sie das externe Netzteil des BioStack nicht in den Abfallsensoranschluss auf der Rückseite der Waschmaschine. Dadurch werden die internen Komponenten der Waschmaschine dauerhaft beschädigt.

Porta sensore rifiuti. Per le installazioni con l'impilatore di micropiastre BioStack: non collegare l'alimentatore esterno di BioStack alla porta del sensore di scarto sul retro della lavatrice. Ciò danneggerà

permanentemente i componenti interni della lavatrice.

Puerto del sensor de residuos. Para instalaciones con el apilador de microplacas BioStack: No conecte la fuente de alimentación externa de BioStack en el puerto del sensor de desechos en la parte posterior de la lavadora. Hacerlo dañará permanentemente los componentes internos de la lavadora.

CAUTION

Shipping Hardware. All shipping hardware must be removed before operating the instrument and reinstalled before repackaging the instrument for shipment.

Verzendingshardware. Alle verzendingshardware moet worden verwijderd voordat het instrument wordt gebruikt en opnieuw worden geïnstalleerd voordat het instrument opnieuw wordt verpakt voor verzending.

Matériel d'expédition. Tout le matériel d'expédition doit être retiré avant d'utiliser l'instrument et réinstallé avant de remballer l'équipement pour expédition.

Festes Versandmaterial. Alle festen Versandmaterialien müssen vor der Inbetriebnahme des Geräts entfernt und vor der Wiederverpackung des Geräts zum Versand neu angebracht werden.

Minuteria di spedizione. Prima di utilizzare lo strumento, rimuovere tutta la minuteria di spedizione, che dovrà essere reinstallata prima di reimballare lo strumento per la spedizione.

Equipo de envío. Antes de utilizar el instrumento es necesario retirar todo el equipo de envío y, del mismo modo, habrá que volver a colocárselo cuando el instrumento se vaya a enviar.

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.

Reserveonderdelen. Voor onderhoud mogen alleen goedgekeurde reserveonderdelen worden gebruikt. Het gebruik van niet-goedgekeurde onderdelen en accessoires kan tot gevolg hebben dat de garantie vervalt en mogelijk de prestaties van het instrument nadelig beïnvloeden of het instrument beschadigen.

Pièces de rechange. Utilisez exclusivement des pièces de rechange approuvées pour l'entretien. L'utilisation de pièces de rechange et accessoires non approuvés peut entraîner l'annulation de la garantie et potentiellement nuire à la performance de l'instrument ou

l'endommager.

Ersatzteile. Für die Wartung sollten nur genehmigte Ersatzteile verwendet werden. Die Verwendung nicht genehmigter Ersatzteile und Zubehörkomponenten kann zum Verlust der Garantie führen und möglicherweise die Geräteleistung beeinträchtigen oder Schäden am Gerät verursachen.

Parti di ricambio. Per la manutenzione, usare esclusivamente parti di ricambio approvate. L'uso di parti di ricambio e accessori non approvati potrebbe dare luogo all'annullamento della garanzia e ripercuotersi negativamente sulle prestazioni o causare danni allo strumento.

Repuestos. Durante el mantenimiento, solo deben emplearse repuestos originales. El uso de repuestos y accesorios no autorizados puede producir la pérdida de la garantía y reducir el funcionamiento del instrumento o provocar daños en él.

CAUTION

Use BioTek-Provided Bottles Only. Do not substitute the fluid supply and waste bottles provided by BioTek with other commercially available bottles. BioTek provides bottles that perform well with our liquid handling systems, including the vacuum pressure of the waste system.

Gebruik alleen door BioTek geleverde flessen. De door BioTek geleverde vloeistoftoevoer- en afvalflessen mogen niet worden vervangen door andere in de handel verkrijgbare flessen. BioTek levert flessen die goed presteren met onze vloeistofbehandelingssystemen, inclusief de vacuümdruk van het afvalsysteem.

Utilisez uniquement des bouteilles fournies par BioTek. Ne substituez pas les bouteilles d'alimentation liquide et de déchets fournies par BioTek par d'autres bouteilles disponibles dans le commerce. BioTek fournit des bouteilles qui fonctionnent bien avec nos systèmes de gestion des liquides, notamment la dépression du système de déchets.

Verwenden Sie nur von BioTek zur Verfügung gestellte Flaschen. Ersetzen Sie die von BioTek zur Verfügung gestellten Flüssigkeitsversorgungs- und Abfallflaschen nicht durch andere im Handel erhältliche Flaschen. BioTek liefert Flaschen, deren Einsatz sich in Verbindung mit unseren Systemen zur Behandlung von Flüssigkeiten bewährt hat, auch was den Vakuumdruck des Abfallsystems angeht.

Usare esclusivamente flaconi forniti da BioTek. Non sostituire l'alimentazione di fluido e i flaconi per i rifiuti forniti da BioTek con altri flaconi disponibili in commercio. BioTek fornisce flaconi dalle prestazioni idonee con i nostri sistemi di movimentazione di liquidi, inclusa la pressione del vuoto di sistema dei rifiuti.

Uso de botellas proporcionadas por BioTek únicamente. No sustituya las botellas de residuos o suministro de fluido proporcionadas por BioTek por otras botellas disponibles en el mercado. BioTek proporciona botellas que tienen un buen rendimiento con nuestros sistemas de gestión de líquidos, incluida la presión de vacío del sistema de residuos.

CAUTION

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

Service. Alleen gekwalificeerd technisch personeel mag serviceprocedures aan interne onderdelen uitvoeren.

Entretien. L'exécution des procédures d'entretien des composants internes doit être réservée au personnel technique qualifié.

Wartung. Wartungsarbeiten an Komponenten im Geräteinneren sollten nur von qualifizierten Servicetechnikern durchgeführt werden.

Manutenzione. Le procedure di manutenzione sui componenti interni devono essere eseguite esclusivamente da personale tecnico qualificato.

Revisión. Solo puede realizar procedimientos de revisión de los componentes internos el personal técnico cualificado.

Intended Product Use

Beoogd productgebruik

Utilisation prévue du produit

Vorgesehene Produktverwendung

Uso previsto del prodotto

Uso previsto del producto

WARNING

Software Quality Control. The operator must follow the manufacturer's assay package insert when modifying software parameters and establishing washing methods. 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.

Softwarekwaliteitscontrole. Bij het wijzigen van de softwareparameters en het vaststellen van afleesmethoden moet de operator de bijsluiter van de test van de fabrikant volgen. Het wordt beschouwd als een goede laboratoriumpraktijk om laboratoriummonsters te onderzoeken volgens

de instructies en specifieke aanbevelingen die zijn opgenomen in de bijsluiter van de verpakking van de uit te voeren test. Het niet uitvoeren van kwaliteitscontroles kan leiden tot foutieve testgegevens.

Contrôle de qualité du logiciel. L'opérateur doit respecter la notice présente dans l'emballage du test lorsqu'il modifie les paramètres du logiciel et établit les méthodes de lecture. L'exécution d'échantillons de laboratoire conformément aux instructions et aux recommandations spécifiques présentées dans la notice de l'emballage du test à réaliser est considérée comme une bonne pratique de laboratoire. Ne pas exécuter les vérifications de contrôle de qualité peut produire des données de test erronées.

Qualitätskontrolle der Software. Beim Ändern von Softwareparametern und Festlegen der Leseverfahren muss der Bediener die Vorschriften des Herstellers auf der Packungsbeilage des Assays beachten. Es gilt als bewährte Laborpraxis, Messungen an Laborproben gemäß den Anweisungen und speziellen Empfehlungen der Packungsbeilage des Assay-Pakets für den beabsichtigten Test durchzuführen. Das Versäumnis, Qualitätskontrollprüfungen vorzunehmen, kann zu falschen Messergebnissen führen.

Controllo qualità del software. L'operatore deve attenersi alle istruzioni del fabbricante contenute nel foglietto della confezione del test quando modifica i parametri software e stabilisce i metodi di lettura. È considerata una buona pratica di laboratorio eseguire campioni di laboratorio in base alle istruzioni e alle raccomandazioni specifiche incluse nel foglietto della confezione del test relativo al test da condurre. La mancata esecuzione delle verifiche di controllo qualità potrebbe dare luogo a dati di test errati.

Control de calidad del software. El operador tiene que seguir las instrucciones del folleto del paquete del ensayo cuando modifique parámetros del software y establezca métodos de lectura. Se considera una buena práctica de laboratorio efectuar las muestras de laboratorio siguiendo las instrucciones y las recomendaciones específicas incluidas en el folleto del paquete del ensayo para cada prueba que se va a realizar. Si no se realizan las comprobaciones de control de calidad, la prueba puede arrojar datos erróneos.

WARNING

User Evaluation. The performance characteristics of the software have not been established with any laboratory diagnostic assay. Users must evaluate this instrument and software in conjunction with their specific assay(s). This evaluation must include the confirmation that performance characteristics for the specific assay(s) are met.

Gebruikersevaluatie. De prestatiekenmerken van de software zijn voor

geen enkele diagnostische laboratoriumtest vastgesteld. Gebruikers moeten dit instrument en de software evalueren in samenhang met hun specifieke test(s). Deze evaluatie moet de bevestiging omvatten dat aan de prestatiekenmerken voor de specifieke test(s) is voldaan.

Évaluation des utilisateurs. Les caractéristiques de performance du logiciel n'ont pas été établies par un test de diagnostic en laboratoire. Les utilisateurs doivent évaluer l'instrument et le logiciel conjointement à leur(s) test(s) spécifique(s). Cette évaluation doit comprendre la confirmation que les caractéristiques de performance pour le ou les tests spécifiques sont remplies.

Benutzerbewertung. Die Leistungsmerkmale der Software wurden bei keinem Labordiagnostik-Assay bestimmt. Die Evaluierung dieses Geräts und der Software durch den Anwender muss in Verbindung mit dessen speziellem/speziellen Assay(s) erfolgen. Diese Evaluierung muss die Bestätigung einschließen, dass die Leistungsmerkmale für den/die speziellen Assay(s) erfüllt sind.

Valutazione dell'utente. Le caratteristiche di prestazione del software non sono state stabilite con nessun test di diagnostica di laboratorio. Gli utenti devono valutare questo strumento e il software congiuntamente ai loro test specifici. Tale valutazione deve comprendere la conferma che siano rispettate le caratteristiche di prestazione per i test specifici.

Evaluación del usuario. Las características de rendimiento del software no se han establecido con ningún ensayo de diagnóstico de laboratorio. Los usuarios deberán evaluar este instrumento y el software junto con sus ensayos específicos. Esta evaluación deberá incluir la confirmación de que se cumplen las características de rendimiento de los ensayos específicos.

WARNING

Unspecified Use. Failure to operate equipment according to the guidelines and safeguards specified in the product user documentation could result in a hazardous condition.

Ongespecificeerd gebruik. Als de apparatuur niet wordt gebruikt volgens de richtlijnen en voorzorgsmaatregelen die in de gebruikersdocumentatie van het product staan vermeld, kan dat leiden tot een gevaarlijke situatie.

Utilisation non spécifiée. Ne pas utiliser l'équipement conformément aux recommandations spécifiées dans la documentation utilisateur relative au produit peut entraîner des situations dangereuses.

Von den Vorschriften abweichende Verwendung. Die Verwendung des Geräts und der zugehörigen Komponenten in Abweichung von den Vorschriften und Sicherheitshinweisen in diesem Dokument für

Produktanwender kann gefährliche Situationen verursachen.

Uso non specificato. Il mancato utilizzo delle apparecchiature in base alle linee guida e le misure di protezione specificate nella documentazione per l'utente del prodotto potrebbe causare pericoli.

Uso no especificado. Si no se utiliza el equipo de conformidad con las directrices y salvaguardias especificadas en la documentación del producto para el usuario, se puede producir una situación de peligro.

CAUTION Use of labware other than described in this document can result in positioning errors during program execution.

Gebruik van labware anders dan beschreven in dit document kan leiden tot positioneringsfouten tijdens de uitvoering van het programma.

L'utilisation de matériel de laboratoire autre que celui décrit dans ce document peut entraîner des erreurs de positionnement lors de l'exécution du programme.

Die Verwendung anderer als in diesem Dokument beschriebener Laborgeräte kann zu Positionierungsfehlern bei der Programmausführung führen.

L'uso di vetreria diversa da quella descritta in questo documento può causare errori di posizionamento durante l'esecuzione del programma.

El uso de material de laboratorio diferente al descrito en este documento puede dar lugar a errores de posicionamiento durante la ejecución del programa.

In This Book

This document contains installation, operation, maintenance, and qualification information for all models of the ELx405.

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