ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Bio-Tek ELx405 Select* at our website: ***Click HERE***

ELx405™

Microplate Washer

Operator's Guide



For all models:

ELx405
ELx405 Select
ELx405 Magna
ELx405 HT
ELx405 Select CW

BIO-TEK®

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

.

ELx405™ Microplate Washer Operator's Guide

January 2005
© 2005
7101000
Revision I
Bio-Tek® Instruments, Inc.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Notices

Bio-Tek® Instruments, Inc.

P.O. Box 998, Highland Park

Winooski, Vermont 05404-0998 USA

All Rights Reserved

© 2005, Bio-Tek® Instruments, Incorporated. No part of this publication may be reproduced, transcribed, or transmitted in any form, or by any means electronic or mechanical, including photocopying and recording, for any purpose other than the purchaser's use without written permission of Bio-Tek Instruments, Inc.

Trademarks

Bio-Tek® is a registered trademark, and ELx405™, Bio-Stack™, and Ultrasonic Advantage™ are trademarks of Bio-Tek Instruments, Inc. Microsoft®, Windows®, and the Windows logo are registered trademarks of Microsoft Corporation in the United States and other countries. All other trademarks are the property of their respective holders.

Restrictions and Liabilities

Information in this document is subject to change and does not represent a commitment by Bio-Tek Instruments, Inc. Changes made to the information in this document will be incorporated in new editions of the publication. Bio-Tek assumes no responsibility for the use or reliability of software or equipment that is not supplied by Bio-Tek or its affiliated dealers.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table of Contents

Notices ..... **iii**

Table of Contents ..... **v**

List of Figures ..... **xii**

Contact Information ..... **xiii**

Customer Service and Sales xiii

Service/TAC xiii

European Coordination Center xiii

Document Conventions ..... **xiv**

Revision History ..... **xv**

Intended Use Statement ..... **xviii**

Quality Control ..... **xviii**

Repackaging and Shipping ..... **xviii**

Warnings ..... **xix**

Hazards and Precautions ..... **xix**

Hazards xix

Precautions xx

Directive 89/336/EEC: Electromagnetic Compatibility xxii

Directive 73/23/EEC: Low Voltage (Safety) xxii

Directive 2002/96/EC: Waste Electrical and Electronic Equipment xxii

Directive 98/79/EC: *In Vitro* Diagnostics (some models) xxiii

Electromagnetic Interference and Susceptibility ..... **xxiv**

USA FCC CLASS A xxiv

Canadian Department of Communications Class A xxiv

User Safety ..... **xxiv**

Safety Symbols ..... **xxv**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Warranty xxvii

Bio-Tek Instruments Warranty Policy xxvii

Hardware Warranty xxvii

Registration Card xxviii

Registration Online xxviii

Chapter 1: Introduction 1

Introducing the ELx405 2

ELx405 Washer Variations 3

Compatibility With the Bio-Stack System 4

Hardware Features 6

Software Features 7

Package Contents 8

Optional Accessories 9

Specifications 10

Performance Specifications 11

Technical Support 12

Phone Support 13

Electronic Communication 13

Facsimile Support 13

Written Communication 13

Shipping Address 13

Applications Support 14

Phone Support 14

Electronic Communication 14

Chapter 2: Installation 15

Unpacking and Inspecting the Instrument 16

To unpack the washer and its accessories 16

Unpacking the Valve Module 19

Removing the Manifold Shipping Bracket 21

Setting Up the Washer 22

Operating Environment 22

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Installing the Microplate Carrier 22
Connecting the Tubes and Bottles 26
Attaching the Mist Shield 33
Connecting the Power Cord 34
Serial Port for Communication With Other Devices 34
Verifying Performance 35
Installation of the Washer for Operation With the Bio-Stack 36
Repackaging and Shipping 37
Before Repackaging the Instrument 38
Repackaging the ELx405 and Its Accessories 39
Repackaging the External Valve Module (if equipped) 39

Chapter 3: Operation 41

ELx405 Front Panel 42
Keypad Description 43
Entering Program Names 44
System Startup 45
Main Menu 46
Programs 47
Operation With the Bio-Stack 48
General Usage Guidelines 49
Before Running Any Program 49
Maintenance 50
Programming Considerations 51
Wash 52
Run Wash Program 52
Define Wash Program 53
Edit Wash Program 71
Copy Wash Program 71
Delete Wash Program 72
Prime 73
Run Prime Program 73
Define Prime Program 74

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Recommended Prime and Low Flow Prime Volumes 76
Edit Prime Program 76
Copy Prime Program 77
Delete Prime Program 77
Default Prime Program: Prime_200 78
Default Prime Program: Prime_CW 78
Dispense 79
Run Dispense Program 79
Define Dispense Program 80
Edit Dispense Program 81
Copy Dispense Program 81
Delete Dispense Program 82
Aspiration 83
Run Aspiration Program 83
Define Aspiration Program 84
Edit Aspiration Program 84
Copy Aspiration Program 85
Delete Aspiration Program 85
Soak 86
Define Soak Program 86
Edit Soak Program 86
Copy Soak Program 87
Delete Soak Program 87
Linking Programs 88
Run Link Program 88
Define Link Program 89
Delete Link Program 90
Setup Utilities 91
RS-232 Settings (RS232) 91
Sensor System (SENSOR) 91
Adjust Utility (ADJUST) 92
Park Utility (PARK) 93
Bio-Stack Utilities (BIOSTACK) 93

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Delay After Dispense (DISP) 94
Plate Clearance Height (PLATE) 94
Vacuum Dissipation Delay (VACUUM) 94
Manifold Selection (MANIFOLD) 95
ELx405 Washer Menu Maps 96
Main Menu (DEFINE function path for Create and Edit) 97
Main Menu (DEFINE function path for Copy and Delete) 98
Main Menu (RUN function path) 99
Main Menu (MAINT, UTIL function path) 100

Chapter 4: Preventive Maintenance 101

Overview 102
Schedule 102
Recommended Maintenance Schedule 103
Required Materials 104
Warnings & Precautions 105
Maintenance Programs 106
Prime Programs 107
Rinse/Soak the Fluid Path 109
Daily Maintenance 109
Overnight/Multi-Day Maintenance 111
Clean Components 114
Periodic Maintenance 114
Decontaminate the Washer 128
Decon Procedure for External Surfaces of the Instrument 129
Decon Procedure for Tubing and Manifold 130
Alternate Decontamination Procedure for Tubing and Manifold 132
Prepare for Storage or Shipment 134
Long_Shutdown 134
Storing the Washer 135
Replace Components 136
Replacing the O-Rings and Channel-End Seals 136

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 5: Performance Verification/Qualification Tests 139

Overview 140
Verification Schedule 141
Installation Qualification (IQ) 142
Operational Qualification (OQ) 142
Performance Qualification (PQ) 143
System and Checksum Tests 144
System Self Test 144
Checksum Test 145
Liquid Tests 146
Evacuation Efficiency Test (Overview) 146
Dispense Precision Test (Overview) 146
Valve Module Test (Overview) 147
Which Tests to Perform? 147
Materials 148
Evacuation Efficiency Test (96) 150
Dispense Precision Test (96) 153
Evacuation Efficiency Test (192) 157
Dispense Precision Test (192) 160
Worksheets 164

Appendix A: Troubleshooting 171

Overview 172
Troubleshooting Checklist 172
Troubleshooting Charts 173
Washer Start-Up 173
Fluid Aspiration 175
Fluid Delivery 178
Fluid Leakage 181
Microplate Carrier Movement 182
Washer Manifold Movement 182
Microplate Scratches 183

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Appendix B: Error Codes.....185

Error Codes.....186

Bio-Stack Errors (Overview).....186

General Errors.....187

Fatal Errors.....200

Bio-Stack Errors.....203

Appendix C: Chemical Compatibility.....205

Components and Materials Composition.....206

Appendix D: Default Programs.....207

Default Programs.....208

Appendix E: Changing the Manifolds.....209

Changing Manifolds in HT Models With the 96-Tube Manifold.....210

Index.....213

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

List of Figures

Figure 1: The ELx405™ Microplate Washer With the Bio-Stack 5
Figure 2: Removing the Inner Shipping Box 17
Figure 3: Removing the Carrier and Other Accessories 17
Figure 4: Removing the End Caps 18
Figure 5: Manifold Shipping Bracket 18
Figure 6: Removing the Valve Module From the Shipping Container 20
Figure 7: Removing the Wire Holders, Supply Bottles, and Other Accessories 20
Figure 8: Removing and Storing the Manifold Shipping Bracket 21
Figure 9: Installing the Microplate Carrier for the ELx405 Model 23
Figure 10: Installing the Microplate Carrier for the Select, Select CW, and all HT Models 24
Figure 11: Installing the Microplate and Magnet Plate Carriers for the Magna Model 25
Figure 12: Rear Panel 27
Figure 13: Washer With Vacuum Pump and Waste Tubing Connections 29
Figure 14: Washer With Supply Tubing Connections (Without External Valve Module) 31
Figure 15: Washer With External Valve Module 32
Figure 16: Attaching the Mist Shield 33
Figure 17: ELx405 Front Panel With LCD and Keypad 42
Figure 18: Dispense and Aspirate Heights for the ELx405 and Magna Models 68
Figure 19: Dispense and Aspirate Heights for the Select, Select CW, and HT2/HTV2 Models With Dual/96 Manifold 69
Figure 20: Dispense and Aspirate Heights for the HT Model 70
Figure 21: Using the Adjust Utility 93
Figure 22: Position of the Transport Arm on the Plate Carrier 116
Figure 23: Removing the Screws and Washers From the Transport Arm 117
Figure 24: The Transport Arm Removed From the Carrier 117
Figure 25: Carrier and Manifold Placement in the ELx405 Model 120
Figure 26: Carrier and Manifold Placement in the Select, Select CW, and HT Models 121
Figure 27: Carrier and Manifold Placement in the Magna Model 122
Figure 28: Cleaning the Fluid Inlet Filter 127
Figure 29: Replacing the Channel-End Seals 137
Figure 30: Storing the 96- or 192-Tube Dual Manifold in the Shipping Case 212

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Contact Information

Bio-Tek® Instruments, Inc.

P.O. Box 998, Highland Park

Winooski, Vermont 05404-0998 USA

Customer Service and Sales

Internet: www.biotek.com

Phone: 888-451-5171 (toll free in the U.S.)

802-655-4740 (outside the U.S.)

Fax: 802-655-7941

E-Mail: customercare@biotek.com

Service/TAC

Phone: 800-242-4685 (toll free in the U.S.)

802-655-4740 (outside the U.S.)

Fax: 802-655-3399

E-Mail: tac@biotek.com

European Coordination Center

Bio-Tek® Instruments GmbH

Kocherwaldstrasse 34

D-74177 Bad Friedrichshall

Germany

Internet: www.biotek.de

Phone: +49 (0) 7136 9680

Fax: +49 (0) 7136 968 111

E-Mail: info@biotek.de

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Document Conventions

This manual uses the following typographic conventions:

Example	Description
	This icon calls attention to important safety notes.
Warning!	A **Warning** indicates the potential for bodily harm and tells you how to avoid the problem.
Caution	A **Caution** indicates potential damage to the instrument and tells you how to avoid the problem.
Note:	Bold text is primarily used for emphasis.
	This icon calls attention to important information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Revision History

Rev	Date	Changes
A	12/98	• Release to Production.
B	3/99	• Replaced graphic of the Magna carrier placement to clarify position. Added defaults and ranges for Method, Dispense, Aspirate, Prime and Soak parameters.
C	02/00	• Updated contact information under Notices. Added "patented" to all references to the "dual-manifold design." Enhanced the Maintenance and Instrument Verification chapters.
D	6/00	• Corrected default prime dispense volume. Added new error code A900. Added info on pump for testing 384-well plates.
E	3/03	• Updated contact information, standards, and safety symbols in Preface. Added Cautions to Precautions section: Chemical Compatibility, Bovine Serum Albumin, Shipping Bracket, Waste Monitor Sensor Connector. • Revised hardware/software features, package contents, optional accessories, and specifications in Ch. 1. Moved Technical Support section from App. A to Ch. 1, and updated TAC addresses, phone numbers, etc. Included information about compatibility of ELx405™ Auto Plate and Select models with Bio-Stack™ Microplate Stacking System in Ch. 1. • Added brief paragraphs in Ch. 2 & 3, App. A & B regarding installation, operation, troubleshooting, error codes when operating with Bio-Stack; referenced Bio-Stack Operator's Manual. • Updated Ch. 3 screens, descriptions of program options, and menu maps to reflect New/Repeat options at program completion and additional 4 aspirate rates (for Aspiration and Wash programs); added new sections to Setup Utilities about the Bio-Stack, delay after dispense, plate clearance height, and vacuum dissipation delay options. • Updated maintenance and IQ-PQ-OQ chapters.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Revision History, Cont'd

Rev	Date	Changes
F	10/03	• Added information about new ELx405™ HT model throughout manual. • Updated TAC information in Preface and Ch. 1, and Customer Service contact information, Hazards, Safety Symbols, Intended Use Statement, and Warranty in Preface. • Updated Introduction, Variations, Hardware and Software Features, Package Contents, Optional Accessories, and Specifications in Ch. 1. • Enhanced Unpacking/Repackaging and Installation sections in Ch. 2; added new sections on unpacking/repackaging the optional valve module, and new Fig. 2-2A, Removing the valve module from the shipping container, and Figure 2-2B, Removing the wire holders, buffer bottles and other accessories from the shipping container. • Corrected menu screens, program options, and menu maps in Operation, Ch. 3. Included new ELx405 HT version and additional Bio-Stack information; added new Fig. 3-2C: Dispense and aspirate heights for the ELx405 HT (384-well) washer. • Updated Ch. 4 and Ch. 5. Added information from revised ELx405 IQ-OQ-PQ Manual (PN 7100567) to liquid testing section of Ch. 5, including new section on liquid testing for ELx405 HT model. • Updated App. A, Troubleshooting, and App. B, Error Codes; added several Bio-Stack error codes that appear on the ELx405. • Added new Appendix C, Chemical Compatibility. • Replaced previous artwork of microplate carriers with revised artwork of the latest, robotic compatible and Bio-Stack compatible carriers in figures throughout manual.
G	5/04	• Re-formatted manual in new template and according to format designated in latest Revision D of TP01, Structure for Operator Manuals/User Guides. • Added information on new cell washer model ELx405™ Select CW throughout manual, including the Low Flow Prime Volume, Dispense Flow Rates 10 and 11, Vacuum on Volume, prime program Prime_CW, and cell washer defaults in Maintenance and AutoPrime prime programs. • Revised Technical Support section and added new sections on Depot Service Contracts and Applications Support in Ch. 1. • Enhanced installation instructions in Ch. 2, and General Usage Guidelines in Ch. 3. • Updated Liquid Testing sections and added Valve Module Dispense Precision Test in Ch. 4. • Enhanced cleaning, decon, and long-term storage sections of Ch. 5. • Revised Troubleshooting and Error Codes sections. • Added new Appendix D, Default Programs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Revision History, Cont'd

Rev	Date	Changes
H	7/04	• Edited Chemical Compatibility caution in Preface and Components and Materials Composition table in Appendix C concerning use of acetic acid. • Replaced section in Chapter 1 on Depot Service Contracts with reference to the Bio-Tek website, where this information may be found. • Revised Maintenance chapter with updated cleaning procedure for removal of Bovine Serum Albumin (BSA) residue from washer. • Updated ELx405 product name to reflect latest product name configuration.
I	1/05	• Added text throughout manual about new models: – HT2/HTV2 (HT models with the accessory 96-tube dual manifold) – Ultrasonic Advantage™ (ELx405, Select, Select CW, or HT models equipped with the ultrasonic cleaner) • Updated accessories and specs in Chapter 1, Introduction. • Revised artwork in Chapter 2, Installation, Chapter 3, Operation, and Chapter 4, Preventive Maintenance. • Revised instructions in Chapter 3 for the following: – Clarified use of the Select CW Dispense Flow Rates 10 and 11 (not recommended for 384-well plates). – Revised description of rapid Aspirate Rates 7 to 10. – Added more information about Magna soak/shake options. – Recommended a range of 12-175 (current range is 12-180) in Dispense Height, Bottom Dispense Height, Aspirate Height, Crosswise Aspirate Height, Plate Clearance Height sections. – Revised sections on recommended Prime and Low Flow Prime Volumes for the Select CW models. • Updated Chapter 4, and Chapter 5, Performance Verification/Qualification Tests with revisions from latest ELx405 IQ-OQ-PQ procedures. • Enhanced Appendix B, Error Codes with descriptions of the codes and new AUTOCLEAN codes. • Added new Appendix E, Changing the Manifolds (for HT2/HTV2 models).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Intended Use Statement

- The ELx405™ Microplate Washer provides microplate priming, washing, dispensing, and aspiration for ELISA™, fluorescence and chemiluminescence immunoassays, cellular and agglutination assays.
- The washer can operate as a stand-alone instrument or with standard robotic systems, such as Bio-Tek's Bio-Stack Microplate Stacker.
- The intended use of this instrument is dependent on the instrument's rear panel label. If there is an IVD label, then the instrument may be used for clinical, research and development, or other non-clinical purposes. If there is no such label, then the instrument may **only** be used for research and development, or for other non-clinical purposes.

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.

Repackaging and Shipping



Important! If you need to ship the instrument to Bio-Tek for service or repair, contact Bio-Tek for a **Return Materials Authorization** (**RMA**) number, and be sure to use the original packing. Other forms of commercially available packing are not recommended and can **void the warranty**. If the original packing materials have been damaged or lost, contact Bio-Tek for replacement packing.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Warnings



Operate the instrument on a flat surface and away from excessive humidity.

When operated in a safe environment according to the instructions in this document, there are no known hazards associated with the ELx405™. However, the operator should be aware of certain situations that could result in serious injury; these may vary depending on the instrument model.

Hazards and Precautions

Hazards



Warning! Power Rating. The ELx405's 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 two-prong plug adapter to connect primary power to the ELx405. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the power cord directly to a three-prong receptacle with a functional ground.

Warning! Internal Voltage. Always turn off the power switch and unplug the power cord 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 chemically resistant rubber gloves and apron.

Warning! Ultrasonic Energy. Ultrasonic energy is present in the ultrasonic cleaner reservoir when AUTOCLEAN programs are running (Ultrasonic Advantage™ models only). Avoid putting your fingers in the bath. Ultrasonic energy can be destructive to human tissue.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Hazards, Cont'd

Warning! Liquids. Avoid spilling liquids on the washer; fluid seepage into internal components creates a potential for shock hazard. Wipe up all spills immediately. Do not operate the instrument if internal components have been exposed to fluid.

Warning! Software Quality Control. The operator must follow the manufacturer's assay package insert when modifying software parameters and establishing wash methods, using the washer's onboard software.

Precautions

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



Caution: Service. Only Bio-Tek authorized service personnel should service the instrument. Only qualified technical personnel should perform troubleshooting and service procedures on internal components.

Caution: Environmental Conditions. Do not expose the instrument to temperature extremes. For proper operation, ambient temperatures should remain between 15°-30°C. Performance may be adversely affected if temperatures fluctuate above or below this range. Storage temperature limits are broader (see ***Chapter 4***, ***Preventive Maintenance***).

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

Caution: Chemical Compatibility - Washers. Some chemicals may cause irreparable damage to washers. The following chemicals have been deemed safe for use in washers: buffer solutions (such as PBS), saline, surfactants, deionized water, 70% ethyl, isopropyl, or methyl alcohol, 40% formaldehyde, and 20% sodium hydroxide. Never use DMSO or other organic solvents. These chemicals may cause severe damage to the instrument. Refer to ***Appendix C***, ***Chemical Compatibility***. Use of wash buffers containing acetic acid is limited to washers upgraded with PN 68098 Teflon® valves. Contact Bio-Tek for upgrade information and prior to using other questionable chemicals.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Precautions, Cont'd

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

Caution: Bovine Serum Albumin. Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the washer's performance over time unless a strict maintenance protocol is adhered to. See ***Chapter 4***, ***Preventive Maintenance*** for cleaning instructions regarding BSA.

Caution: Shipping Bracket. The manifold shipping bracket must be removed prior to operating the ELx405™, and reinstalled before repackaging the washer for shipment. See ***Chapter 2***, ***Installation***, for instructions.

Caution: Waste Sensor Port. The port on the back of all ELx405 Washers for the waste sensor is the same type as the 24-VDC power connector on some other Bio-Tek products (like the Bio-Stack Microplate Stacker). If an external 24-VDC power supply is plugged into this waste sensor port, it will permanently damage components on the PCB inside the ELx405.

Caution: High Flow Pump Installation. DO NOT plug the High Flow vacuum pump cable into a wall outlet! Use the adapter provided with the pump to connect the pump to the accessory outlet on the back of the washer. See ***Chapter 2***, ***Installation***, for instructions.

Caution: Warranty. Failure to follow preventive maintenance protocols may **void the warranty.** See ***Chapter 4***, ***Preventive Maintenance***.

Caution: Disposal. This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)."



Important! Do **not** plug an external 24-VDC power supply into the waste sensor port on the ELx405!

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

Directive 89/336/EEC:Electromagnetic Compatibility

Emissions - CLASS A

EN 61326-1:1998

CISPR 16-1:1997 and CISPR-2:1999

Immunity

EN 61326-1:1998

EN 61000-4-2:1998 Electrostatic Discharge

EN 61000-4-3:1998 Radiated EM Fields

EN 61000-4-4:1995 Electrical Fast Transient/Burst

EN 61000-4-5:1995 Surge Immunity

EN 61000-4-6:1996 Conducted Disturbances

EN 61000-4-11:1994 Voltage Dips, Short Interruptions and Variations

Directive 73/23/EEC: Low Voltage (Safety)

EN 61010-1:2001

"Safety requirement for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General requirements."

Directive 2002/96/EC: Waste Electrical and Electronic Equipment

Disposal Notice

This instrument contains printed circuit boards and wiring with lead solder. Dispose of the instrument according to Directive 2002/96/EC, "on waste electrical and electronic equipment (WEEE)."

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Directive 98/79/EC: *In Vitro* Diagnostics (some models)

- Product registration with competent authorities
- Traceability to the U.S. National Institute of Standards and Technology (NIST):
  - **Microplate Washers:** Dispense precision and average residual volume is traceable to NIST.

Specific data for a particular serial number is available on request from Bio-Tek Instruments. See page xiii for contact information.

EN 61010-2-101:2002

Particular requirements for *in vitro* diagnostic (IVD) medical equipment.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Electromagnetic Interference and Susceptibility

USA FCC CLASS A

Warning: Changes or modifications to this unit not expressly approved by the manufacturer could **void the user's authority** to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Like all similar equipment, this equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications Class A

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

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

User Safety

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

- **Canadian Standards Association CAN/CSA C22.2 No. 61010-1-04**

  "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements."

- **Underwriters Laboratories UL 61010-1:2004**

  "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements."

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Safety Symbols

Some of these symbols may appear on the instruments:



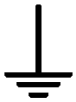
Alternating current
Courant alternatif
Wechselstrom
Corriente alterna
Corrente alternata



Direct current
Courant continu
Gleichstrom
Corriente continua
Corrente continua



Both direct and alternating current
Courant continu et courant alternatif
Gleich - und Wechselstrom
Corriente continua y corriente alterna
Corrente continua e corrente alternata



Earth ground terminal
Borne de terre
Erde (Betriebserde)
Borne de tierra
Terra (di funzionamento)



Protective conductor terminal
Borne de terre de protection
Schutzleiteranschluss
Borne de tierra de protección
Terra di protezione

On (Supply)
Marche (alimentation)
Ein (Verbindung mit dem Netz)
Conectado
Chiuso



Off (Supply)
Arrêt (alimentation)
Aus (Trennung vom Netz)
Desconectado
Aperto (sconnessione dalla rete di alimentazione)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Caution (refer to accompanying documents)
Attention (voir documents d'accompanement)
Achtung siehe Begleitpapiere
Atención (vease los documentos incluidos)
Attenzione, consultare la doc annessa



Warning, risk of electric shock
Attention, risque de choc electrique
Gefährliche elektrische Schlag
Precaución, riesgo de sacudida eléctrica
Attenzione, rischio di scossa elettrica



Warning, risk of crushing or pinching
Attention, risque d'écrasement et pincement
Warnen, Gefahr des Zerquetschens und Klemmen
Precaución, riesgo del machacamiento y sejeción
Attenzione, rischio di schiacciare ed intrappolarsi



Warning, hot surface
Attention, surface chaude
Warnen, heiße Oberfläche
Precaución, superficie caliente
Attenzione, superficie calda



Consult instructions for use
Consulter la notice d'emploi
Gebrauchsanweisung beachten
Consultar las instrucciones de uso
Consultare le istruzioni per uso



***In vitro* diagnostic medical device**
Dispositif médical de diagnostic *in vitro*
Medizinisches *In-Vitro*-Diagnostikum
Dispositivo médico de diagnóstico *in vitro*
Dispositivo medico diagnostico *in vitro*



Separate collection for electrical and electronic equipment
Les équipements électriques et électroniques font l'objet d'une collecte sélective
Getrennte Sammlung von Elektro- und Elektronikgeräten
Recogida selectiva de aparatos eléctricos y electrónicos
Raccolta separata delle apparecchiature elettriche ed elettroniche

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Warranty

Bio-Tek Instruments Warranty Policy

Bio-Tek grants Limited Warranties that are applied to hardware and software products manufactured by Bio-Tek Instruments, Inc. (“Bio-Tek”).

This Limited Warranty contains the entire obligation of Bio-Tek Instruments, Inc., and no other warranties, expressed, implied, or statutory, are given. Purchaser agrees to assume all liability for any damage and/or bodily injury or death that may result from the use or misuse of any instrument/software by the purchaser, his employees, agents or customers, other than the express warranty contained herein. Under no circumstances shall Bio-Tek be liable to the purchaser or any other person for any direct, incidental or consequential damages, whether rising out of breach of Warranty or otherwise. The implied warranties of merchantability and of fitness for any particular purpose are expressly excluded and do not apply to the instrument/software. This warranty shall not be changed or modified in any way without the express written permission of an officer of Bio-Tek Instruments.

Hardware Warranty

Bio-Tek warrants the hardware instrument for a period of one (1) year from the date of the product shipment from Bio-Tek against defective materials and workmanship. This warranty is limited to the original purchaser and cannot be assigned or transferred. All claims under this limited warranty must be made in writing to Bio-Tek, Attention: Service Department, or to Bio-Tek’s authorized representative. Purchaser must ship the product to Bio-Tek, postage pre-paid. Bio-Tek shall either repair or replace with new, like new, or equipment of similar condition at its option and without cost to the purchaser, any product that in Bio-Tek’s sole judgment is defective by reason of defects in the material or workmanship.

This warranty is void if the instrument has been damaged by accident or misuse, or has been damaged by abuse or negligence in the operation or maintenance of the product, including without limitation, unsafe operation, operation by untrained personnel, and failure to perform routine maintenance. This warranty is void if the instrument has been repaired or altered by persons not authorized by Bio-Tek, or if the product has had the serial number altered, effaced, or removed. This warranty is void if the instrument has not been connected, installed, or adjusted strictly in accordance with written directions furnished by Bio-Tek. Batteries, fuses, lamps, and other ‘consumable’ items used in any of the instruments are not covered by this warranty.

Bio-Tek will continue to stock parts for a minimum of five (5) years after the manufacture of any equipment has been discontinued. Parts shall include all materials, charts, instructions, diagrams, and accessories that were furnished with the standard instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Registration Card

Once the instrument has been set up and is running successfully, please take a moment to fill out and mail the postage-paid Warranty Registration card. By sending in the registration card, you will be assured of receiving prompt information on product enhancements.

Registration Online

If you prefer, you may register your instrument online at Bio-Tek's Web site: www.biotek.com.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 1

Introduction

This chapter introduces the ELx405™ Microplate Washer, and describes variations of the washer, hardware and software features, and technical specifications. Instructions on how to contact Bio-Tek for Technical Assistance are included on page 12.

Introducing the ELx405 2
ELx405 Washer Variations.....3
Compatibility With the Bio-Stack System.....4
Hardware Features.....6
Software Features.....7
Package Contents 8
Optional Accessories 9
Specifications.....10
Performance Specifications.....11
Technical Support 12
Applications Support 14

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introducing the ELx405

Precise, fast, and easy to use, the ELx405™ is a user-programmable, fully automated microplate washer. Variations of the washer include the ELx405, Select, HT, Magna, and Select CW. Its key features include the following:

- Programmable dispense volumes, flow, and aspiration rates provide for a wide range of washing capabilities, from gentle washing for cellular assays to vigorous washing for ELISA™.
- The bottom washing routine can be applied to lower the background absorbance. The crosswise aspiration routine can be utilized to reduce residual volumes.
- The ELx405 can be used to wash all microplate-based assays, including ELISA, fluorescence, chemiluminescence, RIA, DNA probes, and cellular assays.
- The intuitive menu-driven software allows you to create and store up to 75 washer programs. When you are ready to run a program, simply select the program name and follow the screen prompts. The ELx405 will then process the plate according to the program parameters.
- All ELx405 models support Wash, Prime, Dispense, and Aspirate programs. In addition, these programs can be "linked" together to run automatically.
- An optional external valve-switching module with four different supply bottles can be used with models that have been retrofitted to support the module.
- Built-in fluid flow, fluid detection, and vacuum sensing provide complete protection for unattended operation.
- Several pre-defined programs are provided to simplify preventative maintenance, which should be performed regularly to ensure optimum washer performance.
- In addition to operating on a stand-alone basis, the ELx405, Select, HT, and Select CW models are compatible with the Bio-Stack™ Microplate Stacker. See page 4, ***Compatibility With the Bio-Stack System***. (The Magna model is not compatible.)
- All ELx405 models include a robot accessible carrier and can be interfaced into some standard robotic systems.
- All ELx405 models may be serially controlled using Bio-Tek's Autowasher ActiveX® component, typically for integration into automated systems.
- Models equipped with the Ultrasonic Advantage™ (ultrasonic cleaner) provide extra cleaning power by using ultrasonic pulses in a water bath to remove residue on the manifold tubes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ELx405 Washer Variations

The ELx405™ is available in the models listed below. See ***Figures 18-20*** in ***Chapter 3***, ***Operation***, for illustrations of these models.

- The **ELx405** is the "standard" model, used to wash 96-well microplates. It has one manifold with 96 sets of dispense and aspirate tubes.
- The **ELx405 Select** can be used to wash standard 96-well plates and 384-well plates. Its patented Dual-Action™ manifold features 96 sets of dispense and aspirate tubes that are arranged in a fixed horizontal position relative to each other but located in two separate manifolds. The two manifolds move independently of each other on the vertical axis.
- The **ELx405 HT** is a fast 384-well microplate washer and is ideal for high throughput washing. The washer includes the Bio-Tek patented Dual-Action manifold that has been fitted with 192 aspirate and dispense tubes, and allows overflow wash/overfill protection in 384 plates for the most demanding assays. The ELx405 HT is also available in two models that include the 96-tube Dual Action manifold as an accessory: the ELx405HT2 and ELx405HTV2 (valve module).
- The **ELx405 Magna** allows the use of magnets for assays that use plastic-coated metal beads as a substrate. The beads are placed in a standard 96-well microplate. A second carrier that travels beneath the microplate carrier can be fitted with a magnetic plate. When the second carrier is below the microplate, the magnet will pull the beads into the bottom of the microwells and hold them there during aspiration of the supernatant and during soaking cycles. The Magna can also be used as a standard 96-well washer.
- The **ELx405 Select CW** or "cell washer" incorporates all the functionality of the ELx405 Select washer with additional low flow tubing for sensitive, cell-based assays. The ELx405 Select CW software includes the standard flow rates of the ELx405 Select as well as two ultra low flow rates for a gentler washing of non-adherent cells or cell lines that are more loosely adhered to the microplate.

All models can be configured to work with the optional valve module, for users who have complex assay requirements. With the valve module attached, the user can create linked programs to automatically draw reagent from up to four separate reservoirs.

Models equipped with the Ultrasonic Advantage™ feature a built-in ultrasonic cleaner for enhanced maintenance of the manifold tubes. A stainless steel cleaning reservoir with an ultrasonic transducer bonded to the bottom of the reservoir is mounted on the washer. An **AUTOCLEAN** function in the onboard Utility menu enables the user to create and run ultrasonic cleaning routines using programmable parameters such as number and duration of loops, and supply sources.

- ❖ Not all Select CW models support the external valve module. If you have questions about your Select CW's compatibility with this valve module, contact Bio-Tek.
- ❖ Magna models do not support the Ultrasonic Advantage™.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Compatibility With the Bio-Stack System

The ELx405, Select, HT, and Select CW models are compatible with Bio-Tek's Bio-Stack™ Microplate Stacker (see ***Figure 1*** on the following page). The basecode software of these washers has been modified so that their normal operating displays now include the Bio-Stack options. Upgrade kits are also available for customers who purchased their ELx405 and Select models before modifications to the basecode. (*All* HT and Select CW models support the Bio-Stack.)

Controlled serially by the ELx405™, the Bio-Stack can rapidly and systematically transfer microplates one at a time to and from the washer, and includes:

- Removable stacks (one input and one output) that can hold up to 30 microplates each.
- Optional restacking of plates to maintain correct sequencing.
- The ability to continue processing a stack of plates following the aborting/failure of one plate.
- The ability to pause processing to allow the user to add more plates to the input stack or to remove some from the output stack.

If you have purchased the Bio-Stack to operate with the ELx405, Select, HT, and Select CW, refer to the Bio-Stack Operator's Manual for instructions on configuring the washer to run with the Bio-Stack. If you are interested in purchasing the Bio-Stack, contact your local Bio-Tek dealer for more information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Figure 1: The ELx405™ Microplate Washer With the Bio-Stack

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Hardware Features

- 2-line x 24-character LCD display
- Membrane keypad with 25 alphanumeric keys
- Washes standard microwell strips and microplates with a maximum height of 22.86 mm, including:
  - 96-well microplates with 0.355"/9-mm well centers (ELx405™, Select, Magna, Select CW, and HT models with the 96-tube manifold)
  - 384-well microplates with 0.177"/4.5-mm centers (Select, Select CW, and HT models)
- Crosswise aspiration for optimizing washing performance
- Internal switching power supply
- One serial RS-232 COM port (25-pin male connector)
- Positive displacement pump that provides controllable flow rates and volumes to make washing cellular assays and immunoassays equally convenient
  - The settings are adjustable through the on-board software, for low to high velocity dispensing
- 5-amp accessory outlet for automatic vacuum pump control
- Stepper motors for accurate and repeatable carrier and manifold positioning
- Plate carrier that is easily removed for cleaning
- Priming/soaking trough
- Mist shield that protects the user from contaminants
- Waste, fluid, flow, and vacuum detection sensors
- Robot accessible carrier for all models
- Bio-Stack accessible carrier for the ELx405, Select, HT, and Select CW models
- Typical processing speeds for the following models:
  - **Single/Dual 96-tube manifolds:** < 30 seconds (3 cycles, 300 µl/well 96 wells, no soak); < 80 seconds (3 cycles, 100 µl/well 384 wells, no soak)
  - **Dual 192-tube manifold:** < 20 seconds (1 cycle, 400 µl/well overflow washing, 384 wells, with final aspirate

- **Single/Dual 96-tube manifolds** = the ELx405, Select, Select CW, HT2/HTV2, and Magna models.
- **Dual 192-tube manifold =** All HT models.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 Bio-Tek 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.

❖ **Note:** Contact Bio-Tek for information on changing to a different language.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Package Contents

Description		PN
Power cord (part numbers vary according to country of use)		Varies
RS-232 serial cable		75053
Microplate carrier (part numbers vary according to model)		Varies
Magnet plate (packaged with magnet plate carrier - Magna model only)		7100558
Mist shield		7102012
Thumbscrews for mist shield (2)		19965
Dust cover		7342066
Stylus – aspirate tubes (all 96-tube and 192-tube manifold models)		7102108
Stylus – dispense tubes	96-tube single or dual manifolds (ELx405, Select, Select CW, Magna, HT2/HTV2	2872304
	192-tube manifolds (all HT models)	7102139
Accessory 96-tube dual manifold (for HT models only that are sold with this accessory)		7102064 7102068
Storage case for accessory 96-tube manifold		7102136
Manifold shipping bracket	Models without Ultrasonic Advantage™	7102033
	Models with Ultrasonic Advantage	7102152
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 manifold shipping bracket, manifold		48434
Instructions for removal of manifold shipping bracket		7101009
ELx405™ Operator’s Guide		7101000
Packing instructions		7101022
Shipping document kit (Warranty Registration Card, Certificate of Compliance and Calibration, FDA Certification)		94075
Declaration of Conformity	For clinical use (IVD label)	7101010
	For non-clinical use (no IVD label)	7101044

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the HT model)	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
External valve module with 4 separate supply bottles		7100540
10-liter dispense bottle		7100559
Waste bottles	10-liter waste bottle	7100557
	20-liter waste bottle	7100556
High Flow vacuum pump 1/3 HP 115 V~ used for applications with a 384-well microplate or where strong aspiration is required		7103003
Liquid testing solutions for Evacuation Efficiency or Dispense Precision tests	Bio-Tek Wetting Agent Solution	7773002
	Bio-Tek Blue Test Dye Solution	7773001
Installation-Operational-Performance Qualification (IQ-OQ-PQ) package		7100567
Bio-Stack™ Microplate Stacker		BIOSTACK
ELx405™ ActiveX Programmer's Package		7100560
ELx405 Service Manual		7101001

❖ **Note:** For accessories not listed here, contact Bio-Tek for more information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Specifications

Microplates	
96-well plates/strips:	ELx405™, Select, Magna, Select CW, HT2/HTV2 (with the dual/96-tube manifold installed)
384-well plates:	Select, Select CW, all HT models

Electrical	
Voltage range:	100 to 240 V~ at 50 to 60 Hz, ≤ 8.0 A
Accessory Outlet:	≤ 5.0 A, used for vacuum pump

Physical	
Dimensions:	17″ D x 14″ W x 10″ H (43.2 cm x 35.6 cm x 25.4 cm)
Weight:	≤ 30 lb (13.5 kg)

Environmental	
Operating conditions:	15 to 30°C (59 to 86°F)
Relative Humidity:	10% to 85% (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.	ELx405 (standard), and Magna
Two manifolds, one with 96 aspirate tubes and the other with 96 dispense tubes, for processing 96- and 384-well plates.	Select, Select CW, and HT2/HTV2
Two manifolds, one with 192 aspirate tubes and the other with 192 dispense tubes, for processing 384-well plates.	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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Performance Specifications

Average Residual Volume (Evacuation Efficiency)		
Single/Dual 96-Tube Manifolds	ELx405 Select, Magna Select CW HT2/HTV2	Average residual volume in the microwells is ≤ **5 µl per well** after a 3-cycle wash, when 300 µl of deionized water with 0.1% Tween 20, or buffer equivalent, is dispensed per well into a Costar 96-well flat-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.

Dispense Precision		
Single/Dual 96-Tube Manifolds	ELx405 Select Magna Select CW HT2/HTV2	≤ **4.0% CV**, 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 (3.0% CV is typical) 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Technical Support

Bio-Tek's ELx405™ Microplate Washer is backed by a superior support staff. The TAC engineers provide assistance with use and maintenance, troubleshooting support, and frequently asked questions.

The Bio-Tek Service Center provides periodic certification of laboratory instruments and calibration plates, performing both calibration and verification to ensure that your instrumentation meets the manufacturer's specifications.

Our Service Center also provides repair and refurbishment services, thoroughly testing each repaired instrument to ensure it meets current factory performance specifications.

If the washer ever fails to work perfectly and you need troubleshooting assistance, or if you require certification, refurbishment, or repair of the instrument, please contact Bio-Tek's Technical Assistance Center.

Whichever method of contact you choose, please be prepared to provide the following information:

- Product name and serial number
- The software configuration information. To see this information, start at the washer Main Menu and follow the path below:

  UTIL → TESTS → **CHKSUM**

- For troubleshooting assistance or instruments needing repair:
  - the specific steps that produce your problem
  - any error codes displayed on the screen (descriptions of error codes are available in ***Appendix B, Error Codes***)
- A daytime phone number
- Your name and company information
- A fax number and/or e-mail address, if available.

If you need to return the washer to Bio-Tek for service, contact Bio-Tek for a **Return Materials Authorization (RMA)** number. When obtaining the RMA, explain whether the washer requires calibration, cleaning, periodic maintenance, warranty work, and/or repair.

Repackage the washer properly (see ***Repackaging and Shipping*** in ***Chapter 2, Installation***), and ship the instrument to Bio-Tek at the shipping address listed on the following page.

❖ **Note:** Bio-Tek offers a **Depot Service Contract** for instruments after the initial warranty has expired, and field service contracts for several locations. Please refer to the Bio-Tek website for more information: www.biotek.com.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Phone Support

You can telephone the **Technical Assistance Center** between 8:30 AM and 5:30 PM Eastern Standard Time (EST), Monday through Friday, excluding holidays.

- **Bio-Tek Instruments Main Number:** 802-655-4040
- **Technical Assistance Center:** 800-242-4685

Electronic Communication

Electronic communication is available via the following:

- **E-Mail:** tac@biotek.com
- **Internet Site:** www.biotek.com

Facsimile Support

You may send a fax with your questions or requests for help 24 hours a day to the following number:

- **Technical Assistance Center:** 802-655-3399

Written Communication

If you prefer, you may write a letter with your comments and send it to:

Bio-Tek Instruments, Inc.
Technical Assistance Center
P.O. Box 998, Highland Park
Winooski, Vermont 05404-0998 USA

Shipping Address

Ship instruments that need repair or service to Bio-Tek at the following address:

Bio-Tek Instruments, Inc.
Technical Assistance Center
100 Tigan Street
Highland Park
Winooski, Vermont 05404 USA

❖ Please call or e-mail TAC for an RMA number **before** shipping the instrument.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Applications Support

Bio-Tek's fully equipped Application Laboratory provides our on-staff scientists with the means to assist you with your most difficult applications. The primary focus of our scientists is to help you with the integration of our instrumentation and software with your unique scientific applications.

If you are having difficulty with washing cell-based assays, integrating a unique data reduction transformation, or just looking for a recommendation on an appropriate fluorophore, contact Bio-Tek at the phone numbers or e-mail address listed below.

Phone Support

You can telephone the **Applications Support** staff between 8:30 AM and 5:30 PM Eastern Standard Time (EST), Monday through Friday, excluding holidays.

- **In the U.S. call:** 888-451-5171
- **Outside the U.S. call:** 802-655-4740

Electronic Communication

Electronic communication is available via the following:

- **E-Mail:** applications@biotek.com
- **Internet Site:** www.biotek.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 2

Installation

This chapter includes instructions for unpacking and setting up the ELx405™ Microplate Washer, installing its components, and repackaging the instrument for shipment.

Unpacking and Inspecting the Instrument 16
Removing the Manifold Shipping Bracket 21
Setting Up the Washer.....22
Verifying Performance 35
Installation of the Washer for Operation with the Bio-Stack.....36
Repackaging and Shipping 37

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Unpacking and Inspecting the Instrument

Important! Save **all packaging materials**. If the ELx405™ is shipped to the factory for repair or replacement, it must be carefully repackaged, according to the instructions in this chapter, using the original packing materials (PN 7103000). Using other forms of commercially available packing materials, or failing to follow the repackaging instructions may **void your warranty**. If the original packing materials have been damaged, replacements are available from Bio-Tek.

For customers who purchased the **optional Valve Module** (PN 7100540): The valve module should be returned with the ELx405 in order to ensure that the washer will meet published performance specifications when used with the valve module. Refer to the instructions in this chapter for unpacking the module and repackaging the unit for shipment. Use the original packaging materials for the valve module.

See ***Repackaging and Shipping*** at the end of this chapter for complete shipping instructions.

The ELx405 washer and its accessories are securely packaged inside custom-designed shipping materials. This packaging should protect the instrument from damage during shipping. Inspect the shipping box, packaging, instrument, and accessories for signs of damage.

If the washer is damaged: Notify the carrier and your manufacturer's representative. Keep the shipping cartons and packing material for the carrier's inspection. The manufacturer will arrange for repair or replacement of your instrument immediately, before the shipping-related claim is settled.

Refer to the unpacking instructions and ***Figures 2*** through ***7*** on the following pages when removing the instrument, its accessories, and the external valve module from the shipping containers, and ***Figure 8*** for removing the manifold shipping bracket.

See ***Repackaging and Shipping*** at the end of this chapter for complete shipping instructions.

To unpack the washer and its accessories:

1. Carefully open the top of the outer shipping box.
2. Lift out the inner shipping box that contains the washer and accessories (***Figure 2***) and place it on a level surface.
3. Open the top of the inner shipping box.
4. Remove the mist shield, model-specific carrier, shipping document kit, and other accessories (***Figure 3***) listed in ***Package Contents***, ***Chapter 1***.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

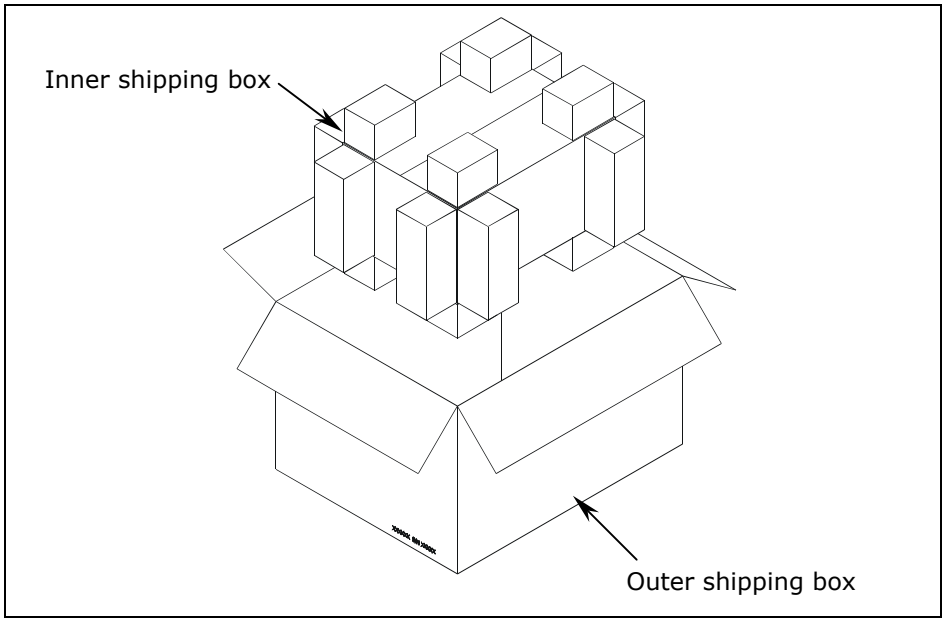


Figure 2: Removing the Inner Shipping Box

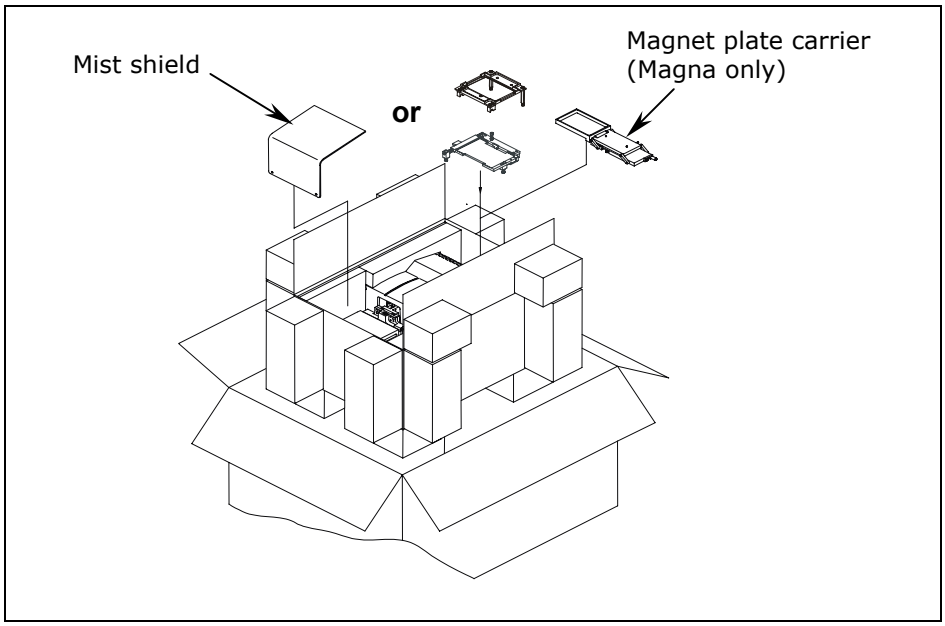


Figure 3: Removing the Carrier and Other Accessories

- **HT2/HTV2 models with the 96-tube manifold:** The washer is shipped with the 192-tube manifold installed; the 96-tube manifold is packaged in a special case and included in the accessories.
- **Magna models:** The magnet plate carrier is packaged with the magnetic plate in a small container, and is included in the shipping accessories, with the Magna's microplate carrier.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5. Carefully lift the washer out of the inner shipping box and place it on a level surface.
6. Remove the left and right end caps and the plastic bag (***Figure 4***).
7. Save the end caps, bag, and shipping containers for repackaging.
8. Note the manifold shipping bracket in ***Figure 5*** (the Select model is shown). Follow the instructions on page 21 for removing the bracket.

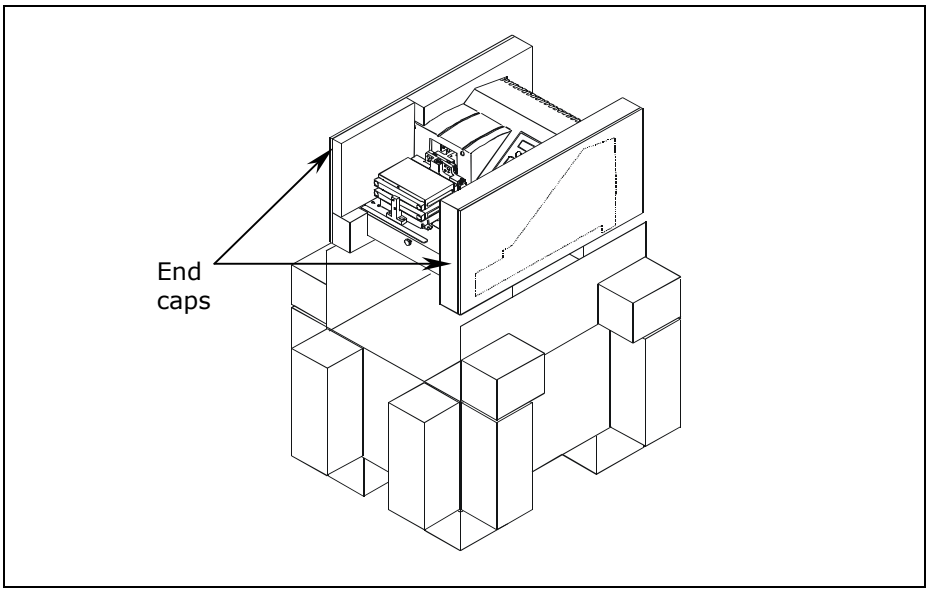


Figure 4**:** Removing the End Caps

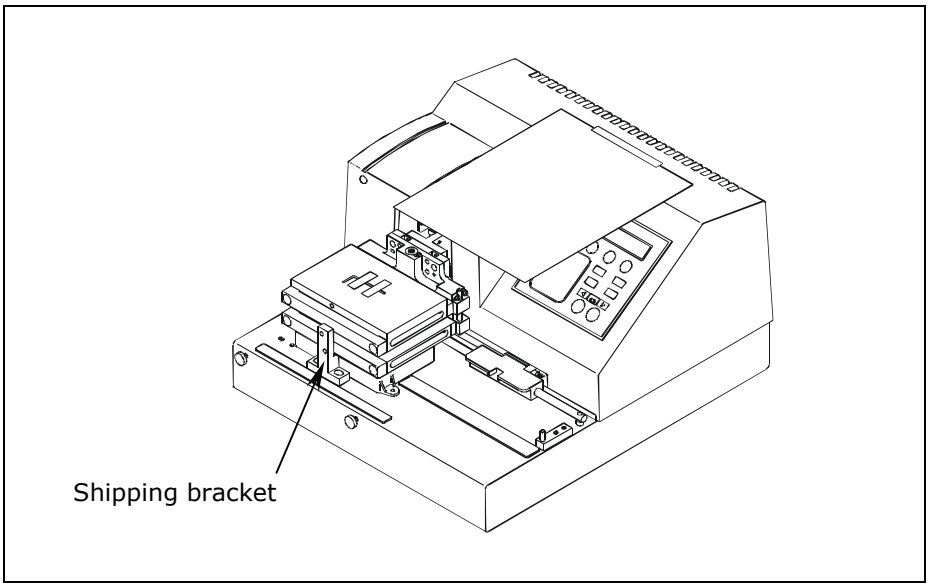


Figure 5: Manifold Shipping Bracket

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Unpacking the Valve Module

To unpack the optional valve module and its accessories:

1. Carefully open the top of the shipping container.
2. Lift out the valve module as shown in ***Figure 6*** and place it on a level surface.
3. Remove any bubble wrap enclosing it.
4. Lift out the two wire holders containing the four supply bottles, the tubing and other accessories (***Figure 7***).
5. Remove the bubble wrap between the two bottle holders and place it in the shipping container with any other shipping materials that came with the valve module.
6. Store these shipping materials with the packaging containers for the washer and accessories.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

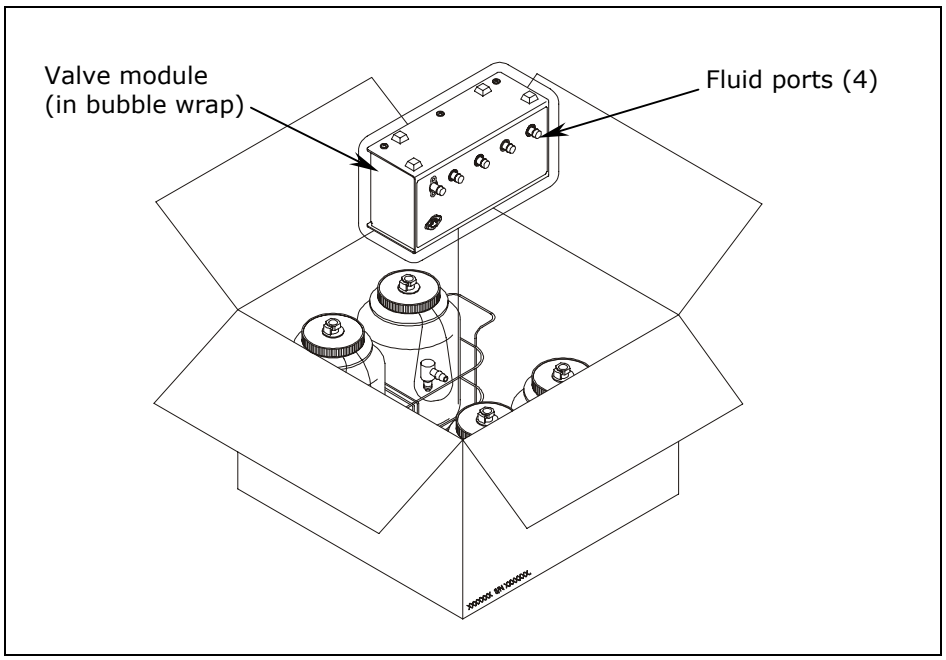


Figure 6: Removing the Valve Module From the Shipping Container

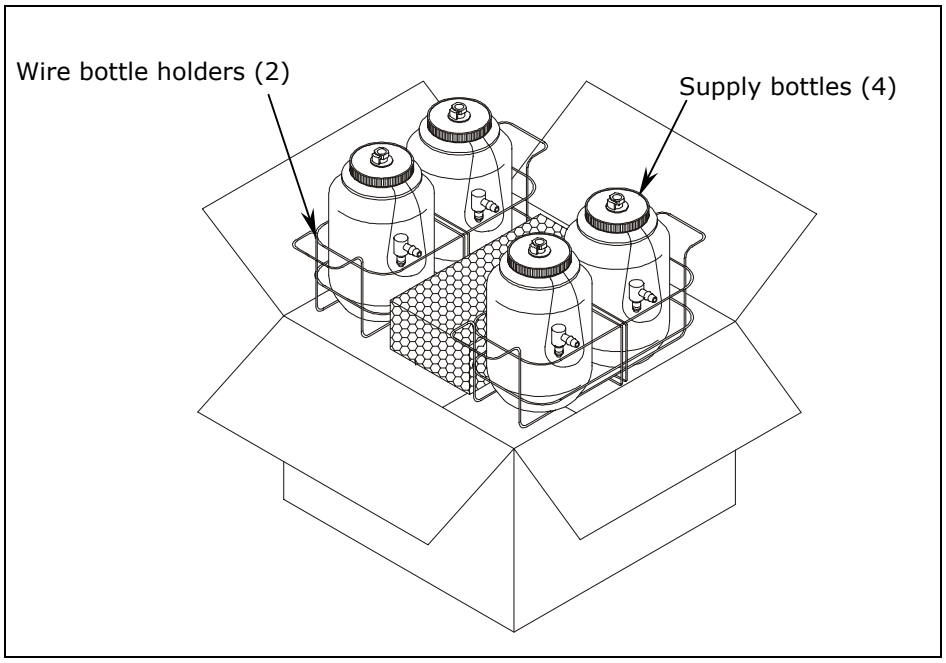


Figure 7: Removing the Wire Holders, Supply Bottles, and Other Accessories From the Shipping Container

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Removing the Manifold Shipping Bracket

Important! The ELx405™ washer is shipped with a protective **manifold shipping bracket**. This bracket must be *removed* before the washer is used, and must be *reinstalled* prior to shipping to avoid irreparable damage to the manifold. Failure to properly remove and reinstall the shipping bracket may **void your warranty**. Do not discard the shipping bracket!

Refer to ***Figure 8*** for the following (the Select model is shown):

1. Using the 9/64" (3.57 mm) hex wrench supplied, unscrew the socket head cap screws located at the base of the shipping bracket.
2. To store the bracket, mount it on the back of the instrument using the hardware that was removed from the front, as illustrated.

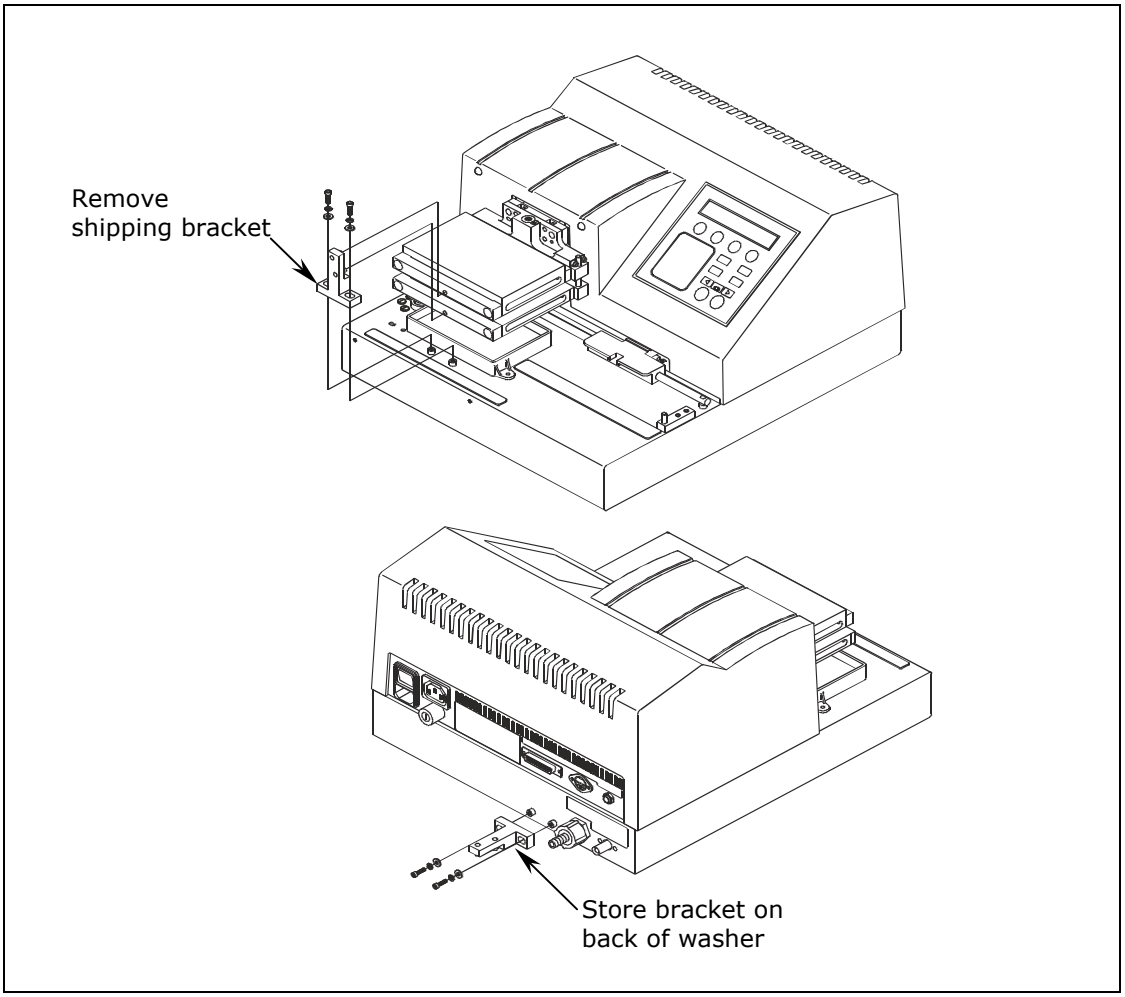


Figure 8**:** Removing and Storing the Manifold Shipping Bracket

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setting Up the Washer

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

Operating Environment

The washer is sensitive to extreme environmental conditions. For optimal operation, install the ELx405™ Washer under the following conditions:

- On a level surface.
- In an area where ambient temperatures between 15°C and 30°C can be maintained.
- Away from excess humidity: 10% to 85% (non-condensing).

Installing the Microplate Carrier

Important! The microplate carrier has a **serial number** etched on the bottom side. This serial number should match the washer's serial number. If the numbers do not match, call Bio-Tek immediately.

Refer to ***Figure 9*** for the ELx405 model, ***Figure 10*** for the Select, Select CW, and all HT models, and ***Figure 11*** for the Magna model.

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

❖ The **Magna** model comes with a magnet plate carrier that travels beneath the microplate carrier. Install the magnet plate carrier first: Line up the pin on the side of the carrier with the slot on the magnet plate carrier transport (lower) rail. Press down gently on the carrier to ensure that it is level with the washer's base plate.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

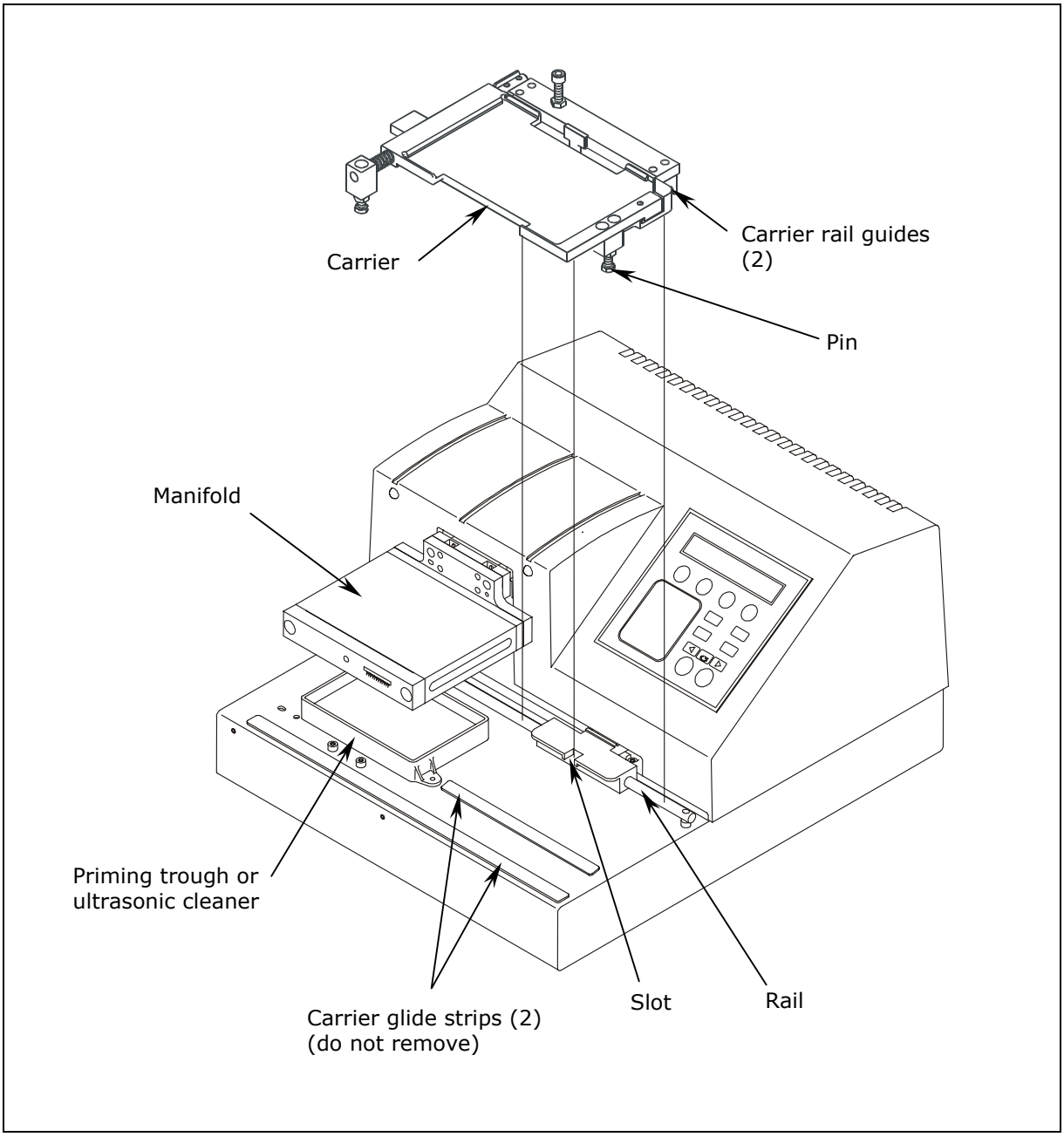


Figure 9: Installing the Microplate Carrier for the ELx405™ Model

❖ The ultrasonic cleaner is available in Ultrasonic Advantage™ models only.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

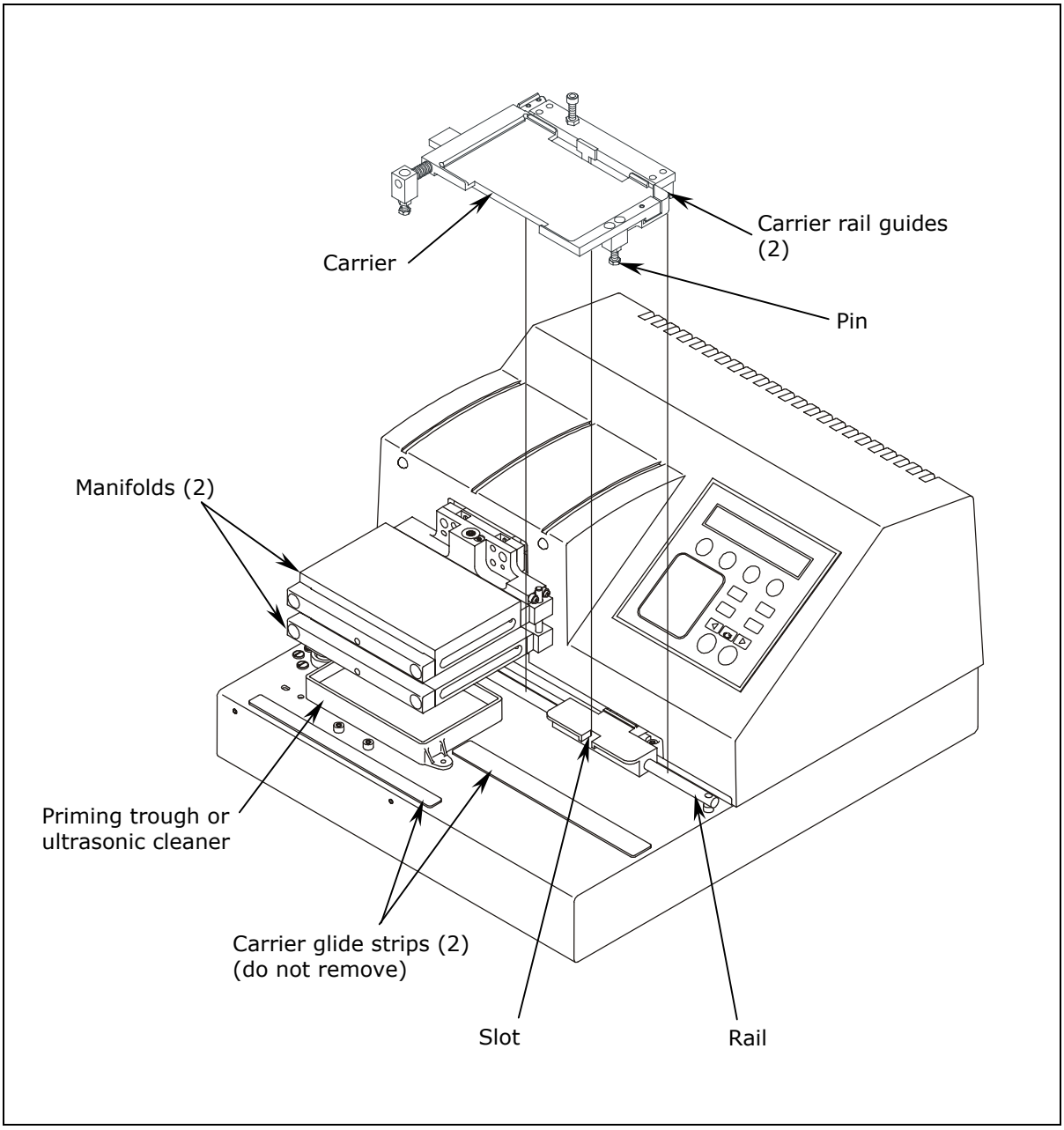


Figure 10: Installing the Microplate Carrier for the Select, Select CW, and all HT Models

❖ The ultrasonic cleaner is available in Ultrasonic Advantage™ models only.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

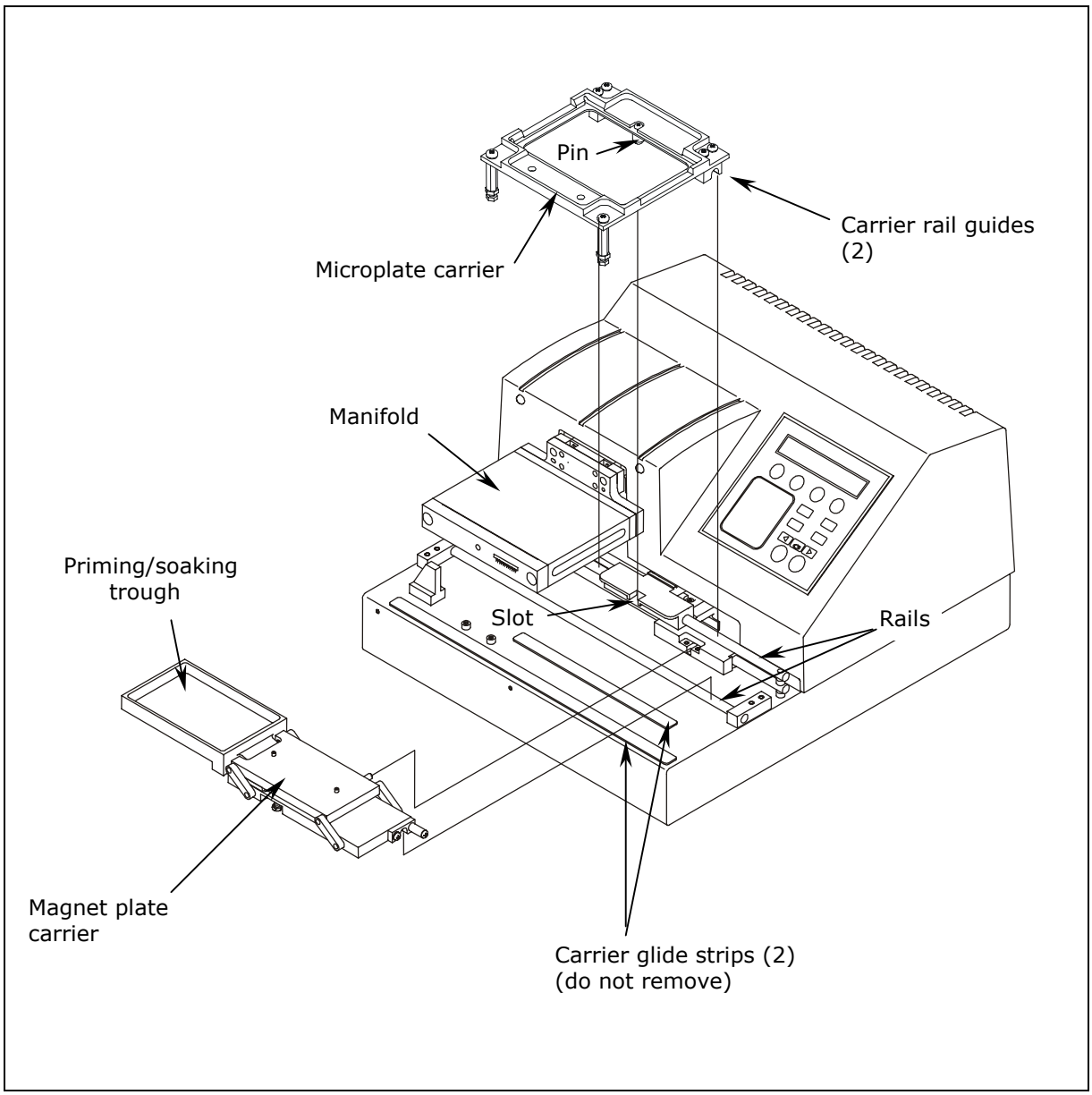


Figure 11: Installing the Microplate and Magnet Plate Carriers for the Magna Model

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connecting the Tubes and Bottles

Important! If you are using the **Bio-Stack Microplate Stacker** with the ELx405™, do not plug the external 24-VDC power supply that came with the Bio-Stack into the waste sensor port! See ***Figure 12*** for the location of this port.

For optimal operation of the ELx405 washer, all tubing, cables, and fittings for the waste and supply systems must be properly connected.

Figure 12 on the following page illustrates the rear panel of instrument and the locations of the ports and connections for the waste and supply systems.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

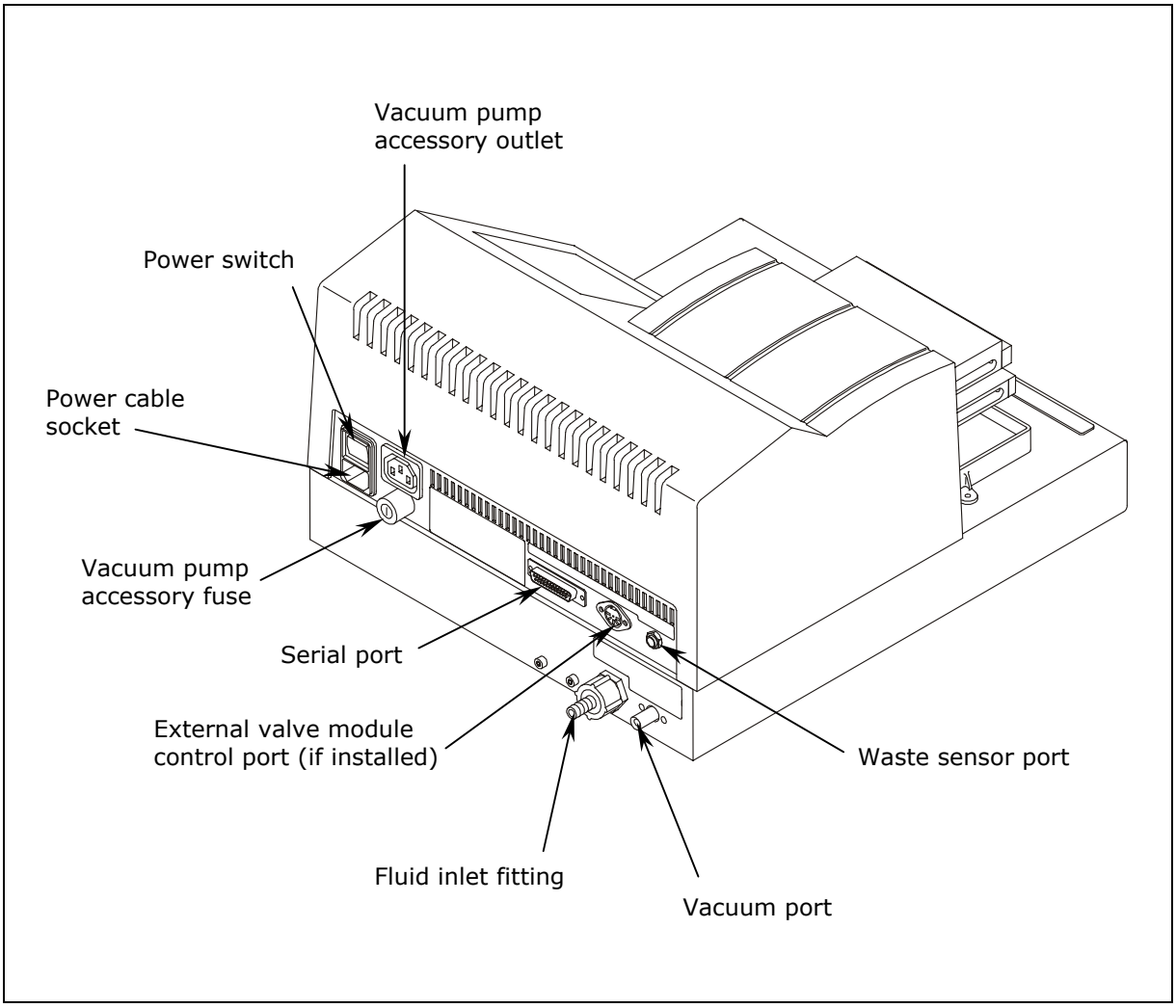


Figure 12: Rear Panel

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Waste System



Caution: High Flow Pump Installation. DO NOT plug the High Flow vacuum pump cable into a wall outlet! Use the adapter provided with the pump to connect the pump to the accessory outlet on the back of the washer. See ***Figure 12*** for an illustration of the vacuum pump accessory outlet and ***Figure 13*** for an illustration of the connection of the cable to the outlet. (See also the High Flow Pump Installation instructions, PN 7101049, included in the package contents of your ELx405™ washer.)

There is no regulator on the pump; therefore, if the pump is plugged directly into a wall outlet, the pump will run continuously, resulting in vacuum levels outside the specified range. This requires the pump to draw a much higher current at setup in order to operate, and may blow the auxiliary 5-amp fuse (PN 46055) and/or produce arcing in the pump's On/Off switch.

A **Vacuum Dissipation Delay** feature is available in the **Setup** utility that allows you to increase the delay, thereby preventing the pump from drawing excess current and blowing the 5-amp fuse. The delay should be set at 10 seconds or greater if using 10-liter bottles, and 20 seconds if using 20-liter bottles. Refer to ***Setup Utilities***, ***Vacuum Dissipation Delay*** in ***Chapter 3***, ***Operation***.

Refer to ***Figures 12*** and ***13*** for the following instructions.

1. Attach the single vacuum tube to the vacuum port on the back of the instrument and to the inlet port of the waste bottle.
2. Attach the waste sensor cable to the waste sensor port.
3. **Important**! Connect the vacuum pump to the vacuum pump accessory outlet on the back of the washer (see **Caution** above). Use the accessory outlet adapter provided.
4. Place the waste bottles and vacuum on the same surface as the washer to ensure optimum performance.

❖ **Note:** To facilitate correct connection of the tubing to the waste bottles, the waste tubes have green or yellow labels that correspond to the green or yellow dots next to the inlet/outlet ports on the waste bottles.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

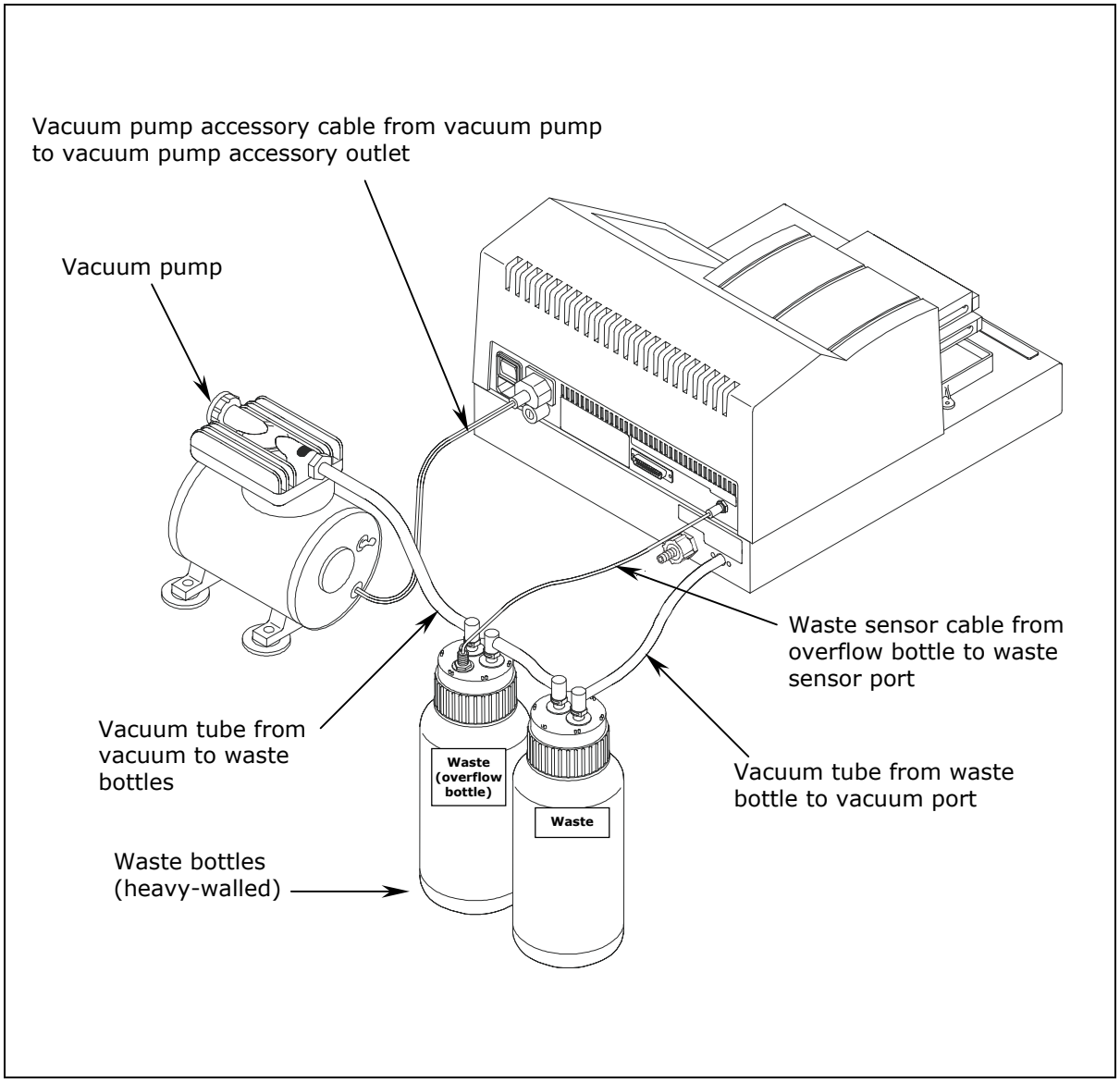


Figure 13: Washer With Vacuum Pump and Waste Tubing Connections

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Supply System

Refer to ***Figure 14*** for the following instructions.

1. There is one supply tube. Connect one end to the fluid inlet port and the other end to the supply bottle.
2. To optimize dispense accuracy, the supply bottle should be on the same surface as the washer.

External Valve Module (if Equipped)

Refer to ***Figure 15*** for the following instructions.

1. To install the optional valve module, connect the valve cable from the module to the valve control port on the back panel of the washer.
2. Attach the tubing from one of the supply bottles to Valve A in the valve module.
3. Repeat step 2 with the other three supply bottles for Valves B, C, and D.
4. Place the four supply bottles and valve module on the same surface as the washer to optimize performance.

Final Check

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

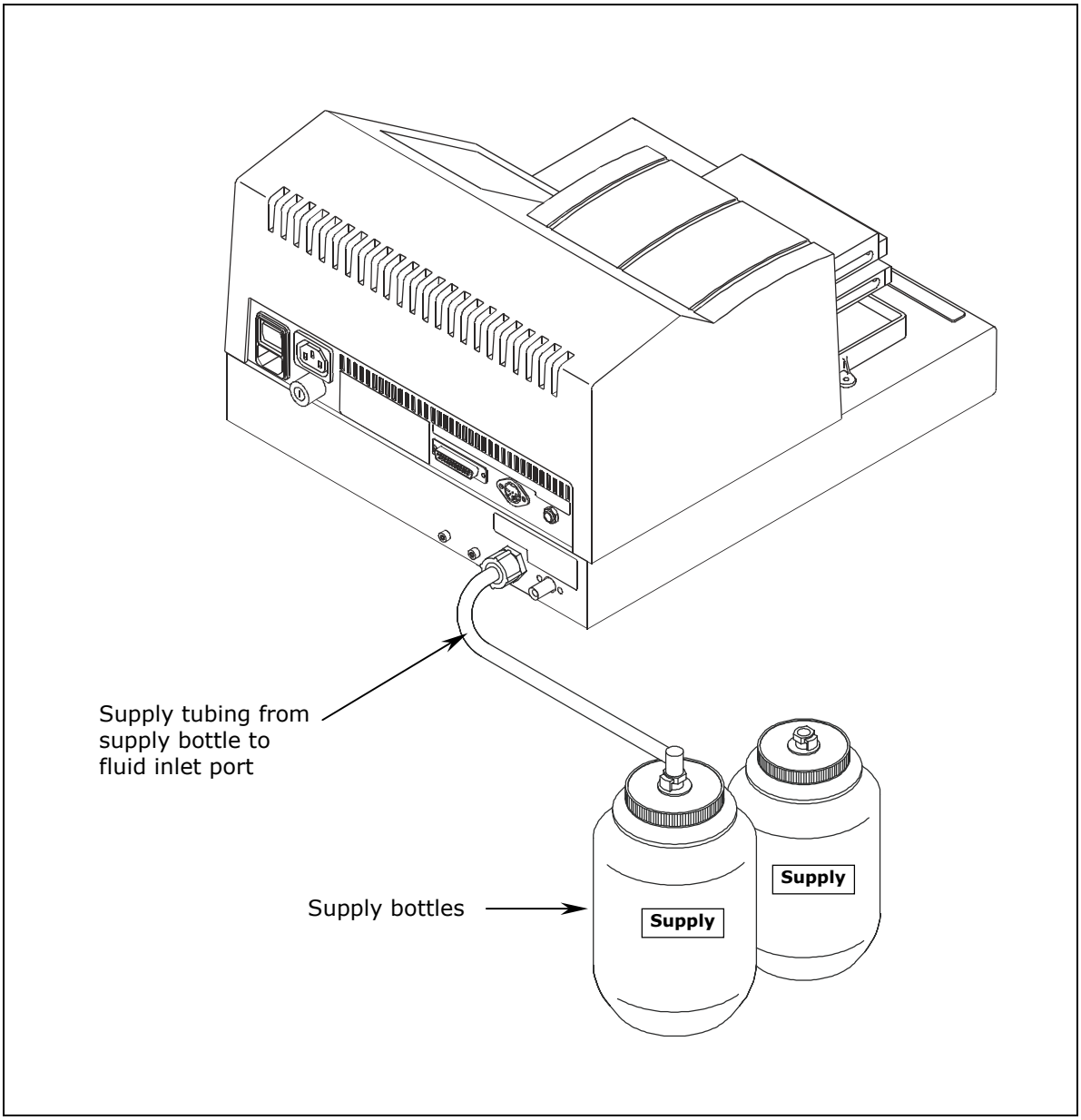


Figure 14: Washer With Supply Tubing Connections (Without Optional External Valve Module)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

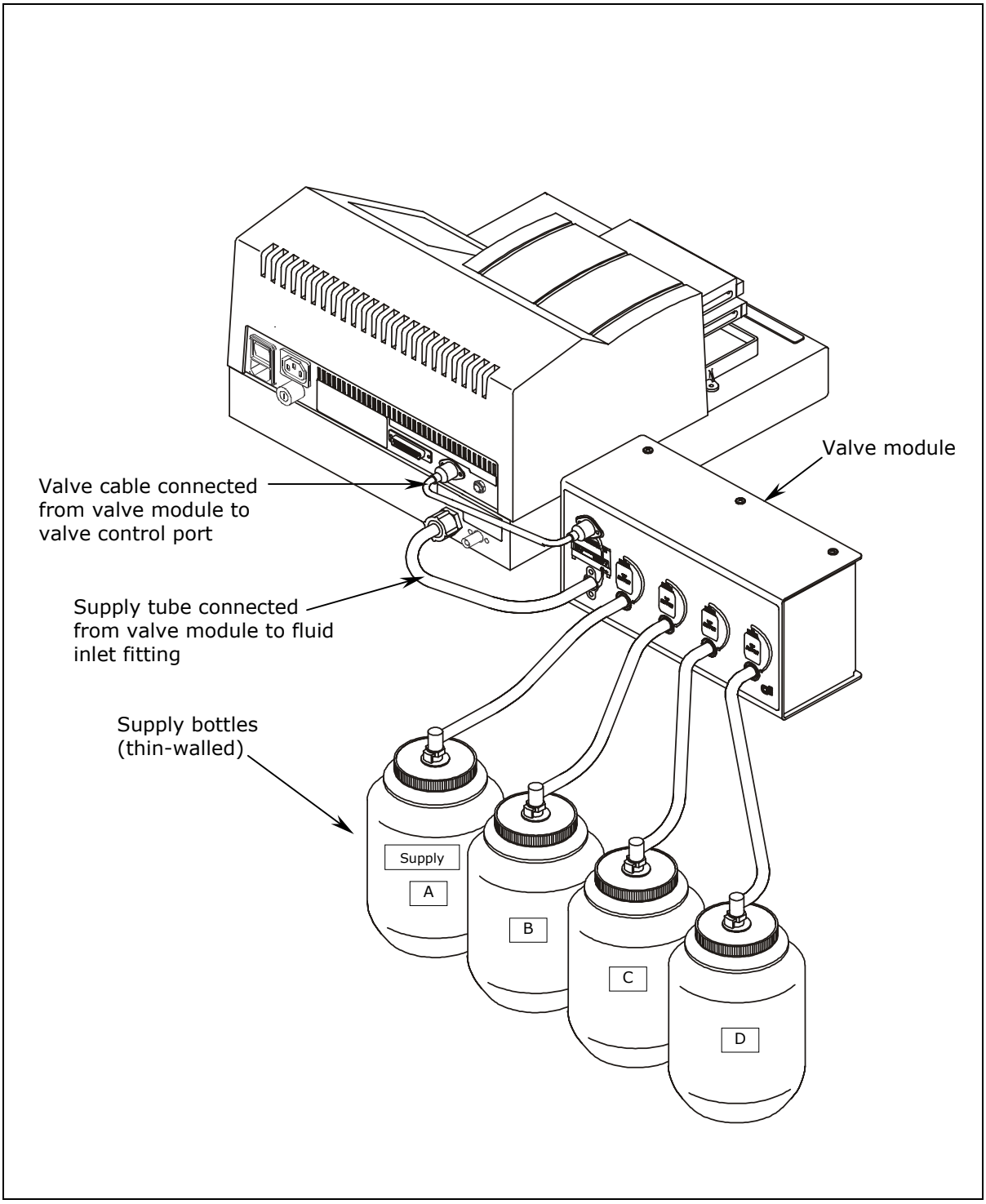


Figure 15: Washer With Optional External Valve Module

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Attaching the Mist Shield

1. Align the mist shield with the washer so it rests on top of the two posts (shown in ***Figure 16*** below) and the two thumbscrew holes in the shield are lined up with the two holes in the front base of the washer.
2. Insert the two thumbscrews and finger-tighten only.

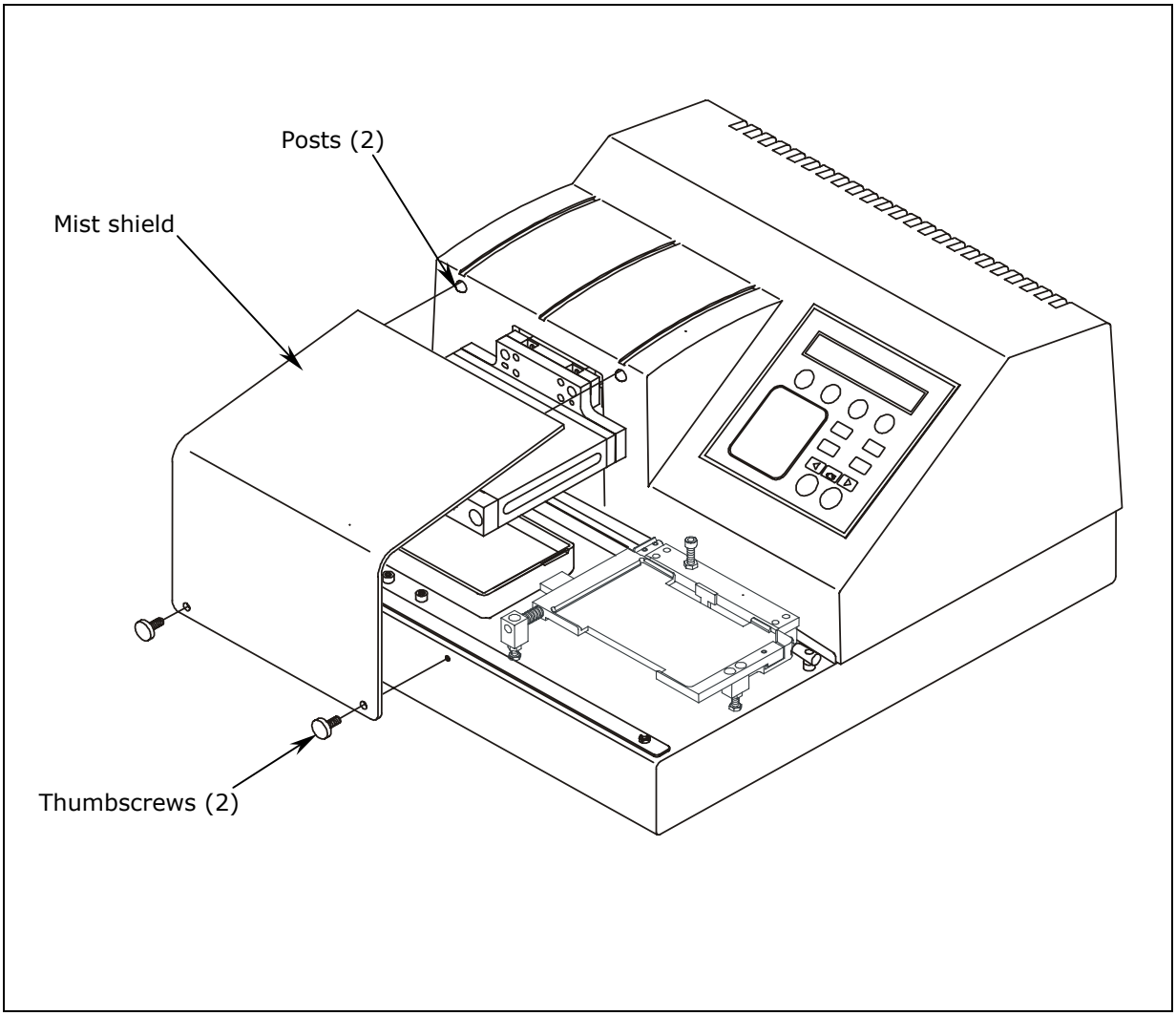


Figure 16: Attaching the Mist Shield

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Connecting the Power Cord



Warning! Power Rating. The ELx405™ must be connected to a power receptacle that provides voltage and current within the specified rating for the system. Use of an incompatible power receptacle may produce electrical shock and fire hazards.



Warning! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the ELx405. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the system power cord directly to a three-prong receptacle with a functional ground.

The ELx405 has a built-in switching power supply that automatically adjusts for input voltage in the range of 100-240 V~ at 50-60 Hz.

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.

Serial Port for Communication With Other Devices

The ELx405 has a 25-pin serial (RS-232) port located on the rear panel of the instrument (see ***Figure 12***). The serial port allows the washer to receive data from a computer for purposes of factory or dealer service.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Verifying Performance

Before using the ELx405™ Washer for the first time, verify that it is operating properly by turning the washer on. The washer will automatically perform a System Self Test to check the manifold, and manifold-to-carrier positioning. It also performs a magnetic carrier load test on the Magna models.

You can also choose to run this test from the washer's front panel. To run the washer's System Self Test, follow the washer menu path shown below.

UTIL → TESTS → **SLFCHK**

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, note the error code and then press the **Stop** key on the keypad to stop the beeping. Refer to ***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 Bio-Tek's Technical Assistance Center.

Chapter 5, ***Performance Verification/Qualification Tests*** 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.

The successful completion of the Installation Qualification 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 successful completion of the Operational Qualification confirms that the washer is operating according to specification.

❖ **Note:** An **instrument qualification package** (PN 7100567) for the ELx405 is available for purchase from Bio-Tek. The package contains thorough procedures for performing Installation Qualification, Operational Qualification and Performance Qualification (IQ-OQ-PQ) and preventive maintenance (PM). Extensive Checklists and Logbooks are included for recording results. Contact your local dealer for more information.

Important! Before operating this washer, review the ***General Usage Guidelines*** in ***Chapter 3***, ***Operation***. These guidelines include necessary steps to perform before running any program, information on performing periodic maintenance, and points to consider when creating or editing washer programs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Installation of the Washer for Operation with the Bio-Stack

Installation of the ELx405™ for operation with the Bio-Stack™ Microplate Stacker includes the following:

- Installation of special alignment hardware on both instruments.
- Serial cable connection between the Bio-Stack and the PC controlling the Stacker.

An accessory package (**PN 7310010**) that contains the alignment hardware for both instruments and a serial cable is included with the Bio-Stack.

Please refer to your Bio-Stack Operator's Manual for complete installation instructions.

❖ Some ELx405 instruments may need to be upgraded for Bio-Stack compatibility. Refer to ***Upgrade Information*** in ***Chapter 1*** of the Bio-Stack Operator's Manual, or contact Bio-Tek for more information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Repackaging and Shipping

If you need to ship the ELx405™ Washer to Bio-Tek for service or repair, be sure to use the original packaging. Other forms of commercially available packaging are not recommended and can void the warranty.

If the original packing materials have been damaged or lost, contact Bio-Tek to order **PN 7103000**. See ***Technical Assistance*** in ***Chapter 1*** for contact information.

The following table lists all materials included in the ELx405™ shipping package as well as the optional valve module.

Packing materials included in PN 7103000	**PN**
Outer shipping box	7102099
Inner shipping box	7102097
Left end cap	7102096
Right end cap	7102095
Valve module shipping materials	**PN**
Shipping box	3740008
Wire holder for buffer bottles	4032066

Important! HT models with the accessory 96-tube dual manifold: HT2/HTV2 models are shipped with the 192-tube manifold installed and the 96-tube manifold packaged in a special case. If you must return the washer to Bio-Tek for service or repair, please ensure that the 192-tube manifold **and protective shipping bracket** have been reinstalled, and that the 96-tube manifold has been repackaged according to the instructions in the following sections.

For instructions on changing the manifolds, refer to ***Appendix E***, ***Changing the Manifolds.***

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Before Repackaging the Instrument

⚠	**Warning!** If the washer has been exposed to potentially hazardous material, **decontaminate it** to minimize the risk to all who come in contact with the washer during shipping, handling and servicing. Decontamination prior to shipping is required by the U.S. Department of Transportation regulations.
ⓘ	**Important!** Perform the following steps in the order presented before repackaging the washer for shipment.
ⓘ	**Important!** Failure to fasten the manifold in place with the shipping bracket before shipment could result in irreparable manifold damage.

1. **Decontaminate** the washer and its accessories as necessary. Refer to the ***Decontamination*** procedure in ***Chapter 4, Preventive Maintenance*** for complete instructions.
2. **HT2/HTV2 models:** If the 192-tube manifold is not installed, install it now. Store the 96-tube manifold in its special case.
3. Run the **PARK** utility. **PARK** prepares the manifold for installing the manifold shipping bracket.

   UTIL → SETUP → MORE → **PARK**

4. Turn the washer off and disconnect the power cord and all tubing.
5. Remove the mist shield and carrier, and set aside for packing. Screw the mist shield mounting screws back into the base.
6. Reinstall the **manifold shipping bracket** (see ***Figure 5*** on page 18 and ***Figure 8*** on page 21).
7. Obtain a **Return Materials Authorization** (RMA) number from Bio-Tek's Technical Assistance Center through Bio-Tek's website, fax, or e-mail address listed in ***Chapter 1***.

   When obtaining the RMA, explain whether the washer requires calibration, cleaning, periodic maintenance, warranty work, and/or repair. Make a note of any error messages displayed and their frequency.

   Provide Bio-Tek with the name and contact information of a person who may be contacted if questions arise.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Repackaging the ELx405™ and Its Accessories

After the above steps are completed, pack the washer in its original shipping box, using original packing materials, following the steps below.

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 as shown in ***Figure 4*** on page 18.
3. Wrap the mist shield and the carrier in bubble wrap and place them into the box (see ***Figure 3***, page 17).
4. **HT models with the accessory 96-tube manifold (HT2/HTV2):** Repackage the 96-tube manifold in its shipping container and place it into the inner shipping box with the other accessories.
5. Close the inner box and place it into the outer box (***Figure 2***). Close and tape shut the outer box.
6. Write the RMA number on the outside of the shipping box.
7. Insure the instrument for full value before shipping to Bio-Tek.

Repackaging the External Valve Module (if equipped)

Refer to ***Figures 6*** and ***7*** (on page 20) for the instructions below:

1. Place the four supply bottles into the two wire bottle holders as shown in ***Figure 7***, 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 6***.

> ❖ 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 tape the box securely.
7. Write the RMA number on the outside of the box.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 3

Operation

This chapter includes instructions for operating the ELx405™ Microplate Washer and its software.

ELx405 Front Panel 42
Keypad Description 43
Entering Program Names 44
System Startup 45
Main Menu 46
Programs 47
Operation With the Bio-Stack 48
General Usage Guidelines 49
Wash 52
Prime 73
Dispense 79
Aspiration 83
Soak 86
Linking Programs 88
Setup Utilities 91
ELx405 Washer Menu Maps 96

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ELx405 Front Panel

The front panel on the ELx405™ Microplate Washer features a 25-key keypad and a 2-line x 24-character LCD display as shown below.

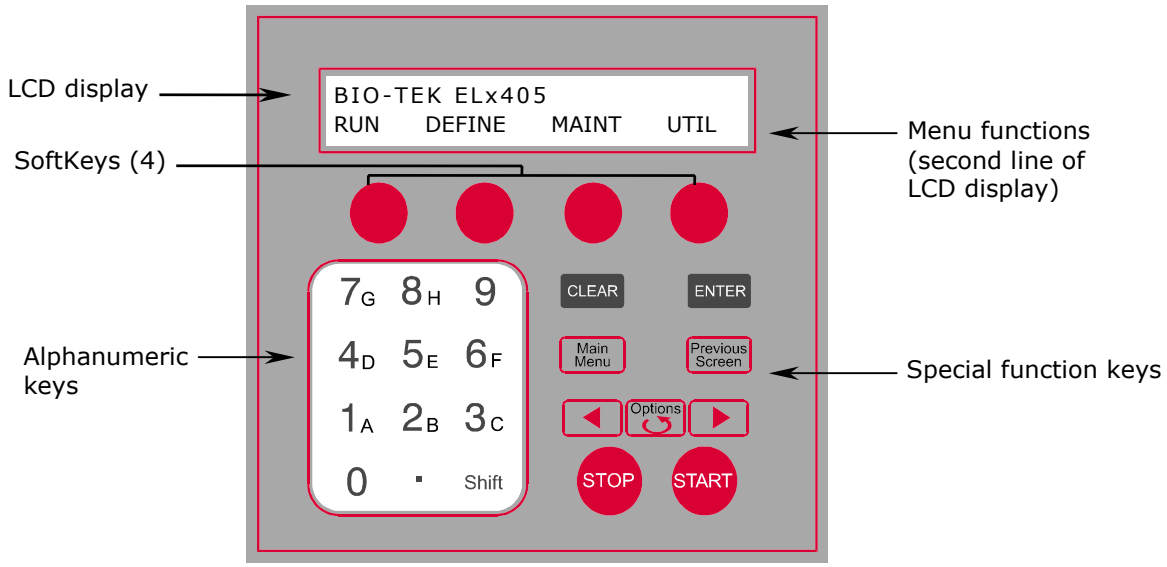
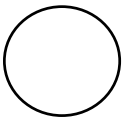


Figure 17: ELx405 Front Panel With LCD and Keypad

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Keypad Description



The keypad has four **SoftKeys**, one below each selectable menu option. Press a SoftKey to choose a menu selection. For example, from the **Main Menu**, press the leftmost SoftKey to select **RUN**, the rightmost 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 washer program, press the **Main Menu** key, and then press 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 or the **Shift** + **Options** key combination. Press the **ENTER** key to select the current option.

STOP

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

START

To start running a washer program, press the **START** key.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Entering Program Names

Each ELx405™ washer program requires the entry of a unique name, using up to 16 alphanumeric characters. To enter a program name via the washer keypad:

- Press **Shift** + key **A**-**H**, or scroll through the alphabet with the **Options** key for **A**-**Z**.
- Press **Shift** + **Options** to reverse direction.
- Use the ► (forward) or ◄ (reverse) arrows to move the cursor within the display.
- Press the **ENTER** key to store the completed program name and continue.

❖ If the program name already exists, the washer software will require you to enter a unique name. This protects washer programs from inadvertently being overwritten.

The **NAME** display offers four symbols that can be used in a program name: dash (hyphen), forward slash, colon, and underscore (see below). These symbols appear in the LCD as SoftKey choices. To include a symbol within a program name, press its corresponding SoftKey.

```
NAME:  COSTAR_FLAT
 -    /    :    _
```


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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...
```

```
BIO-TEK 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 Bio-Tek's Technical Assistance Center (see ***Chapter 1***), for further assistance with troubleshooting.

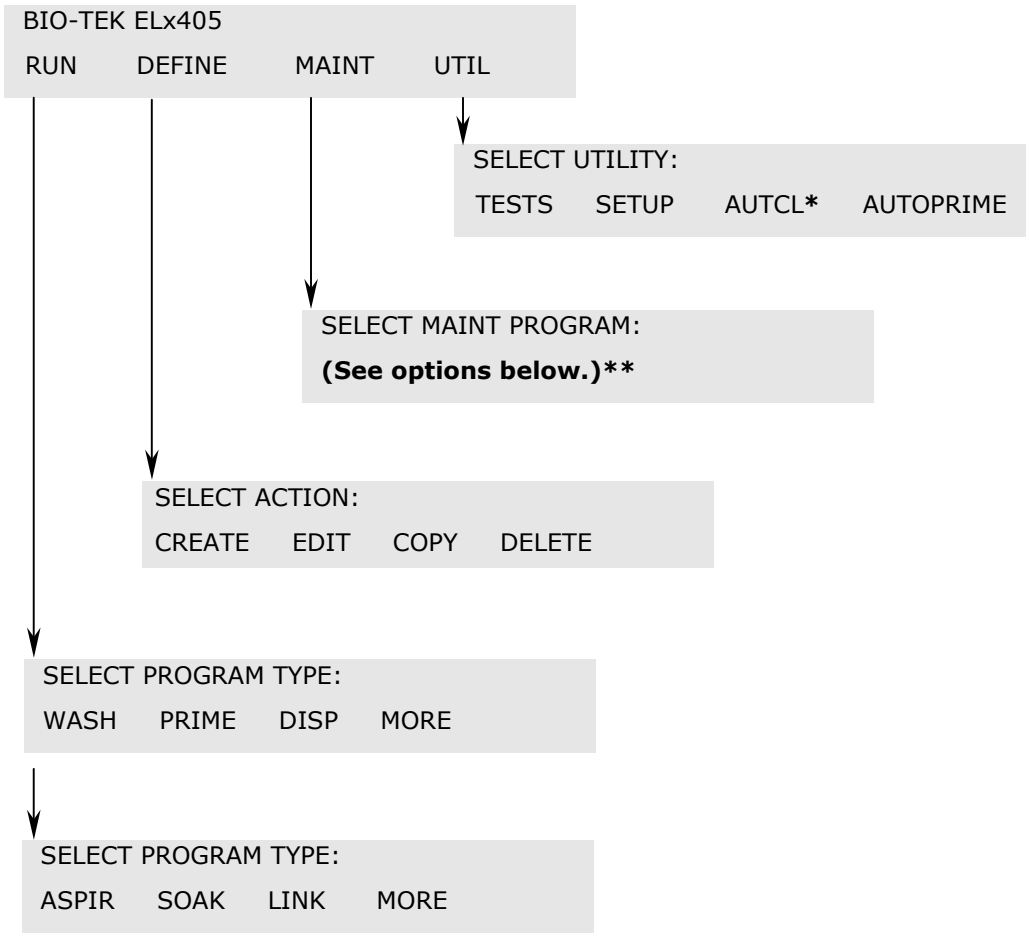
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Main Menu

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

```
BIO-TEK ELx405
RUN      DEFINE      MAINT      UTIL
```

The following options are available through the Main Menu. (See the ***Washer Menu Maps*** on pages 96 through 100 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Programs

The following table lists the program types that can be created through the keypad of the ELx405 Microplate Washer:

Program	Description	Page
WASH	Create a typical wash program with fully customizable dispense and aspirate sequences.	52
PRIME	Set up routines for priming the instrument before washing begins.	73
DISPENSE	Create a dispense-only program, to dispense a user-specified volume into all wells in a microplate.	79
ASPIRATE	Create an aspirate-only program, to evacuate all wells in a microplate.	83
SOAK	Specify the soaking parameters to be included in a Link program.	86
LINK	Link up to 10 Wash, Prime, Dispense, Aspirate, and Soak programs to run sequentially and automatically.	88

❖ See ***Appendix D***, ***Default Programs***, for a listing of onboard Wash, Prime, Dispense, Aspirate, and Maintenance programs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Operation With the Bio-Stack

If you have purchased the **Bio-Stack™ Microplate Stacker** to operate with the washer, refer to the instructions in your Bio-Stack Operator's Manual for setting up and configuring the washer to operate with the Bio-Stack.

You can run Wash, Dispense, Aspirate and Link programs whether the washer is operated with or without the Bio-Stack. The Prime, Soak, and Maintenance programs are run on the washer without the Bio-Stack.

❖ The Magna model does not support the Bio-Stack.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Usage Guidelines

When operating the washer, follow these guidelines to ensure optimal performance in the washer and to prevent the problems described in the troubleshooting charts in ***Appendix A***, ***Troubleshooting***.

Important! HT models with the **96-tube** manifold: The washer software must be configured for operation with the manifold installed (96 or 192). Refer to ***Manifold Selection (MANIFOLD)***, on page 95, 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 Any Program

- Fill the wash/rinse bottles with sufficient fluid. Make sure the supply tube is in the liquid.
- The supply tube should extend to the bottom of the bottle and be cut at the end (see drawing to the right) to ensure free flow of liquid at the bottom of the supply bottle.



- Empty the waste bottles and firmly seat the waste bottles' stoppers. 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 91). 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 program *before* running another program. Use the volumes specified for the following models (see ***Recommended Prime and Low Flow Prime Volumes***, page 76):
  - **ELx405, Magna, Select, and HT models.** Without the external valve module: 200 ml Prime Volume, when all the lines are empty or when changing fluids. With the valve module: 400 ml Prime Volume, when all the lines are empty or when changing fluids.
  - **Select CW model.** Without the valve module: 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. With the valve module: 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- 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.

Maintenance

Rinse and soak the fluid path, clean and replace components, and decontaminate the washer as described in ***Chapter 4***, ***Preventive Maintenance***. The following components should be periodically cleaned:

- Bottles
- Plate carrier system
- Manifold
- Aspirate/dispense tubes
- Mist shield
- Inlet filter

❖ Models with the **Ultrasonic Advantage™** (ultrasonic cleaner): An AUTOCLEAN program should be run on a periodic basis.

The following components should be periodically replaced:

- O-rings and channel-end seals

Frequent inspection of the washer, tubing, and bottles for possible causes listed below may help to eliminate many of the problems listed in ***Appendix A, Troubleshooting***.

- **Loose or incorrect connections** of power cord, vacuum pump accessory cable, external valve module cable, supply/waste tubing, or fittings
- **Incomplete or incorrect installation** of manifold or carrier, attachment of mist shield, or **placement** of microplate/microstrips in carrier
- **Accumulation of residue** on carrier or inside aspirate/dispense tubes, waste/supply bottles or tubing, manifold, inlet/outlet fittings
- **Worn** tubing, o-rings or channel-end seals
- **Kinked or bent** aspirate/dispense tubes or waste/supply tubing

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Programming Considerations

- **Dispense Height:** The dispense (overflow) height in the wash protocol should be low enough to ensure that excess fluid is removed by the aspirate tubes when the manifold is dispensing.
- **Plate Clearance:** Ensure that a sufficient plate clearance height is programmed for plates that are slightly taller than standard plates. See ***Plate Clearance Height (PLATE)***, p. 94.
- **Vacuum Dissipation Delay:** Increase the vacuum dissipation delay when using vacuum systems such as the high flow pump. See ***Vacuum Dissipation Delay (VACUUM)***, p. 94.
- **Sensor Systems:** Do not deactivate the vacuum, waste, or fluid detection systems, unless priming with air instead of fluid. See ***Sensor System (SENSOR)***, p. 91.
- **Manifold Type** (HT models with the dual 96-tube manifold (HT2/HTV2) and Select models upgraded to the HT): The correct manifold (96 or 192) must be chosen in the Manifold Selection feature of the Setup utilities before operating the washer. Refer to ***Manifold Selection (MANIFOLD)***, p. 95.
- **Plate Type** (Select, Select CW, and Magna models, and HT2/HTV2 models with the 96-tube manifold installed): Be sure to specify the correct plate type (96 or 384 for the dual manifold models; 96 or 96Bead for the Magna) when defining or editing wash, aspiration, dispense, or link programs.
- **Operation with the Bio-Stack Microplate Stacker**: The washer should be configured to operate with the Bio-Stack (refer to the Bio-Stack Operator's Manual for instructions on configuring the washer for Bio-Stack operation).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wash

This section discusses how to run, define, edit, copy and delete **Wash** programs. (See ***Appendix D***, ***Default Programs*** for a list of default Wash programs.)

Run Wash Program



Important! Before running a Wash program, ensure that you have reviewed the **General Usage Guidelines** on the previous pages and that the microplate is properly seated in the plate carrier.

To run 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.

RUN → SELECT PROGRAM TYPE → WASH → **SELECT WASH PROGRAM** →
SELECT REAGENT BOTTLE → **PRIME THE WASHER?** →
PLACE PLATE IN CARRIER AND PRESS <START> KEY →
WASH PROGRAM RUNNING. PRESS <STOP> KEY TO QUIT →
WASH PROGRAM COMPLETE. **NEW/REPEAT**

Run Wash Program Options

Option & Description	Models	Action/Comments
Select Wash Program Select a Wash program to run.	All	Press the **Options** key to cycle through the available Wash programs.
Select Reagent Bottle Select the supply source for this program.	All	Select bottle **A**, **B**, **C**, or **D**. This only appears if the washer is equipped with the external valve module.
Prime the Washer? Choose to run a prime program before starting the wash program.	All	This only appears after power-up and before a Prime, Dispense, or Wash program has been run.
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** to return to the Main Menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash Program

> ❖ **Note:** To quickly define a new wash program with some or all of the same parameters as an existing program, copy the existing program and then edit parameters as necessary. See ***Copy Wash Program*** on page 71.

To define 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 → CREATE → SELECT PROGRAM TYPE →
WASH → **NAME** → **SELECT REAGENT BOTTLE** → **PLATE TYPE** →
DEFINE WASH COMPONENT → **MAIN MENU** KEY →
OK TO SAVE PROGRAM?

Define Wash Program Options

Option & Description	Models	Action/Comments
Name Enter a unique name for the Wash program.	All	Use up to 16 alphanumeric characters. See ***Entering Program Names*** on page 44 for instructions.
Select Reagent Bottle Select the supply source for this program.	All	Select bottle **A**, **B**, **C** or **D**. This only appears if the washer is equipped with the external valve module.
Plate Type Specify the microplate type.	Select, Select CW, HT/96-tube	The options are 96 or 384. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	Magna	The options are 96 or 96Bead.
Define Wash Component Specify program parameters.	All	Select **METHOD**, **DISP** (Dispense), or **ASPIR** (Aspirate). See METHOD, DISP, and ASPIR Program Options tables on the following pages.
Press **Main Menu** to Save.	All	After all wash components have been selected, press **Main Menu** then select **YES** to save the program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash METHOD Program Options

Option & Description	Models	Action/Comments
Number of Cycles Specify 1 to 10 complete wash cycles.	All	A complete wash cycle represents an aspirate and dispense sequence, which may or may not end with a final aspiration of the liquid from the wells. **Note:** If Bottom Wash is enabled, an additional aspirate and dispense is performed using unique bottom-washing dispense parameters.
Wash Format Specify how the wells should be processed (384-well plate).	Select, Select CW, HT/96-tube	Only appears if **Plate Type** is 384. Plate format applies each cycle to the entire plate before it starts the next cycle. Sector format applies each cycle to one quarter of the plate before it moves to the next quarter (sector). **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
Soak/Shake? Specify 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 allow the wash buffer to remain 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 chemistries it enhances washing by allowing unbound material to diffuse into the wash buffer. When washing wells in a plate format, use a soak that lasts as long as it takes to process one wash cycle of all wells.
Shake Before Soak? Specify whether to agitate the microwells back and forth linearly along the carrier track to aid in dispersal.	All	Select **YES** or **NO**. Before the microwells begin shaking, the manifold raises so that the dispense and aspirate tubes clear the microwells, and the carrier returns to its home position.
Shake Duration Specify the length of time for microwell agitation.	All	The duration range is from 1 to 600 seconds.
Shake Intensity Specify the intensity of microwell shaking.	All	The options range from 1 to 5, where 1 = Least Intense, and 5 = Most Intense. The washer display shows the corresponding cycles/sec value for each option.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash METHOD Program Options, Cont'd

Option & Description	Models	Action/Comments
Re-Move Magnet? Move the magnet carrier out from under the carrier for shake cycle?	Magna	Select **YES** or **NO**. This is an option in the Magna model if either 96 or 96bead was selected for Plate Type.
Prime After Soak? Prime the dispense tubes after a soak cycle?	All	Select **YES** or **NO**.
		Note: A prime after soak is an option for Magna models only if **96** was selected for **Plate Type**; it is **not** an option in the Magna if **96bead** was selected.
Prime Volume The volume, in milliliters, of the solution used to prime the dispense tubes.	All	The volume range is 1 to 999 ml.
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 (1 = Slowest, and 9 = Fastest).
Press **Main Menu** to save.	All	After all wash components have been selected, 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	
Re-Move Magnet?		No	No/Yes	Magna
Prime After Soak?		No	No/Yes	All (Magna models must have 96 Plate Type selected)
Prime Volume	milliliters	40	1-999	
Prime Flow Rate		7	1-9	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash DISPENSE (DISP) Program Options

Option & Description	Models	Action/Comments
Dispense Volume The volume (in microliters) of wash solution to dispense per microwell, per wash cycle.	ELx405, Magna, 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 the fluid is dispensed from the tubes.	All	The flow rate options range from 1 to 9, where 1 = Slowest, and 9 = Fastest.
	Select CW	Two additional flow rates, 10 and 11, are provided for gentle washing. Rates 1 to 9 range from lowest to highest flow. Rate 10 is lower than rate 1. Rate 11 is higher than 10. **Note:** Rates 10 and 11 are **not** recommended for 384-well plates. Performance of rates 10 and 11 may vary, depending upon the plate and buffer used.
Vacuum on Volume The vacuum pump turns on when the defined volume is reached.	Select CW	Appears only if flow rates 10 or 11 have been selected for the Dispense Flow Rate (see above). The volume range is 50 to 3000 µl/well. Bio-Tek recommends that you set the vacuum on volume equal to your dispense volume for small volumes. Refer also to application notes on the Bio-Tek website for more information (www.biotek.com).
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. See ***Figures 18*** to ***20***.	All	The options range from 12 to 180. 12 is the closest to the carrier surface; 180 is the furthest. The washer display shows the corresponding measurement in millimeters for each option. **Note:** Due to hardware variations, the 180 value may be out of range for some washers; it is recommended, therefore, that the highest value be closer to **175**.
	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** (see page 92).	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash DISPENSE (DISP) Program Options, Cont'd

Option & Description	Models	Action/Comments
Horizontal Disp Pos Horizontal Dispense Position represents the left and right position of the dispense tubes when the carrier is beneath the manifold.	ELx405, Magna	The range is –30 to 30.
	Select, Select CW, HT/96-tube	The range is –45 to 45 with 96-well plates.
	Select, Select CW, HT/96-tube, HT/192-tube	The range is –25 to 25 with 384-well plates. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	The washer display shows the corresponding measurement in millimeters for each option. A **negative** offset positions the dispense tubes toward the left side of the well. A **positive** offset positions the dispense tubes toward the right side of the well. The default setting of 0 indicates no offset (0.000 mm). **Note:** A more negative offset combined with a low flow rate, are the recommended settings for "gentle washing," such as required by cell-based assays. To visually determine the best offset parameters for a microplate or assay, use the **Adjust Utility** (see page 92).	
Horiz Y Disp Pos Horizontal Y Dispense Position represents the carrier Y axis position (front/back movement) which aligns the microplate wells with the manifold tubes during a dispense.	Select, Select CW, HT/96-tube	The range is –20 to 20 with 96-well plates.
	Select, Select CW, HT/96-tube, HT/192-tube	The range is –10 to 20 with 384-well plates. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	The washer display shows the corresponding measurement in millimeters for each option. 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 (0.000 mm). To visually determine the best offset parameters for a microplate assay, use the **Adjust Utility** (see page 92).	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash DISPENSE (DISP) Program Options, Cont'd

Option & Description	Models	Action/Comments
Bottom Wash First? Bottom washing consists of an initial dispense/ aspirate sequence, which adds another wash cycle to the specified number of cycles.	All	The manifold is positioned at the specified Bottom Disp Height. The reagent is simultaneously dispensed and aspirated at this height to create cleaning turbulence. The manifold descends to aspirate again and ends with a final dispensing of fluid to fill the well.
Bottom Disp Volume The volume of wash solution to dispense per microwell during the bottom wash.	All	The volume range is 50 to 3000 µl/well.
Bottom Flow Rate The rate at which the fluid is dispensed from the tube during the bottom wash.	All	The flow rate options range from 1 to 9, where 1 = Slowest, 9 = Fastest.
Bottom Disp Height Bottom Dispense Height represents the height between the bottom of the aspirate tubes and the carrier surface on which the plate rests during the wash. See ***Figures 18*** to ***20***.	All	The Bottom Disp Height options range from 12 to 180. The washer display shows the corresponding measurement in millimeters for each option. 12 is the closest to the carrier surface; 180 is the furthest from this surface. The dispense tubes are shorter than the aspirate tubes. **Note:** Due to hardware variations, the 180 value may be out of range for some washers; it is recommended, therefore, that the highest value be closer to **175**.
Bottom Horiz Pos See the description for Horizontal Disp Pos on the preceding page.	All	The only difference is that Bottom Horiz Pos specifically refers to Bottom Washing.
Bottom Horiz Y Pos See the description for Horiz Y Disp Pos on the preceding page.	All	The only difference is that Bottom Horiz Y Pos specifically refers to Bottom Washing.
Prime Before Start? Prime the dispense tubes before starting the wash program.	All	Select **YES** or **NO**.

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash DISPENSE (DISP) Program Options, Cont'd

Option & Description	Models	Action/Comments
Prime Volume The volume of the buffer or rinse used to prime the dispense tubes.	All	The volume range is 1 to 999 ml.
Prime Flow Rate The rate at which the priming fluid is dispensed from the tubes during the prime.	All	The flow rate options range from 1 to 9, where 1 = Slowest, 9 = Fastest.
Press **Main Menu** to save	All	Select **YES** to save the program.

Wash DISPENSE (DISP) Defaults and Ranges

Parameter	Units	Default	Range	Models
Dispense Volume (In a Dispense-only program, the default volume is 250.)	µl/well	300	50-3000	ELx405, Magna, Select, Select CW, HT/96-tube
			25-3000	HT/192-tube
Dispense Flow Rate		5	1-9	All
			Additional flow rates 10 and 11	Select CW
Vacuum on Volume (Appears only in the Select CW if Flow Rates 10 or 11 were selected.)	µl/well	10	50-3000	Select CW
Dispense Height	See note below.	120	12-180	All

Notes:

- **Dispense Flow Rate - Select CW**: Flow rates 10 and 11 **are not** recommended for 384-well plates.
- **Dispense Height**: The display shows the corresponding measurement in mm. Although the range is 12-180, the recommended highest value is **175**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wash DISPENSE (DISP) Defaults and Ranges, cont'd

Parameter	Units	Default	Range	Models
Horizontal Dispense Position	quarter steps	0	-30 to 30	ELx405 or Magna
			-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	12-180	

Notes:

- The shaded options above are **not** available for Dispense-only programs.
- **Horizontal Dispense Position** and **Horizontal Y Dispense Position**: For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
- **Bottom Dispense Height**: Although the range is 12-180, the recommended highest value is **175**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wash DISPENSE (DISP) Defaults and Ranges, cont'd

Parameter	Units	Default	Range	Models
Bottom Horizontal Dispense Position	quarter steps	0	-30 to 30	ELx405, Magna
			-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
Bottom 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
Prime Before Start?		No	No/Yes	All
Prime Volume	milliliters	40	1-999	
Prime Flow Rate		7	1-9	

Notes:

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash ASPIRATE (ASPIR) Program Options

Option & Description	Models	Action/Comments
Aspirate Height Represents the height between the bottom of the *aspirate* tubes and the carrier surface on which the plate rests when *aspirating* the microwells. The aspirate tubes are longer than the dispense tubes. See ***Figures 18*** to ***20***.	All	The Aspirate Height range is 12 to 180. The washer display shows the corresponding measurement in millimeters for each option. 12 is the closest to the carrier surface; 180 is the furthest from this surface. It is not recommended that the aspirate tubes touch the well bottoms. Use the **Adjust Utility** (see page 92) to determine at what setting the aspirate tubes hit the bottom of the well, and choose a setting 2 to 4 steps higher in your wash program. **Note:** Due to hardware variations, the 180 value may be out of range for some washers; it is recommended, therefore, that the highest value be closer to **175**.
Horizontal Aspr Pos Horizontal Aspirate Position represents the left and right position of the aspirate tubes when the carrier is beneath the manifold.	ELx405, Magna	The range is -30 to 30.
	Select, Select CW, HT/96-tube	The range is -55 to 55 with 96-well plates.
	Select, Select CW, HT/96-tube HT/192-tube	The range –25 to 25 with 384-well plates. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	The washer display shows the corresponding measurement in millimeters for each option. A **negative offset** positions the aspirate tubes toward the left side of the well. A **positive offset** positions the aspirate tubes toward the right side of the well. A setting of **0** indicates no offset (0.000 mm). It is recommended that aspirate tubes be positioned close to the sides of a flat-bottom well, and in the center of a round-bottom well. Use *UTIL* to experiment with settings.	
Magnet Aspirate Height The height of the magnet carrier during aspiration.	Magna	Appears only on the Magna model, if **96bead** (instead of **96**) was selected for **Plate Type**. A range of –20 to 20 may be selected; the default is 0.
	Use the **Adjust Utility** (see page 92) to determine the height of the magnet carrier in relation to the microplate carrier.	

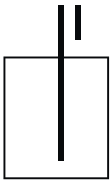
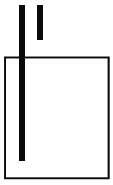
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash ASPIRATE (ASPIR) Program Options, Cont'd

Option & Description	Models	Action/Comments
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, HT/96-tube	The range is –55 to 55 with 96-well plates.
	Select, Select CW, HT/96-tube HT/192-tube	The range is –10 to 20 with 384-well plates. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	The washer display 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 (0.000 mm).	
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.
	For most assays (non cell-based), a rate from 1 to 5, where 1 = slowest, and 5 = fastest, is sufficient. With any of these rates, the tubes slow their descent as they approach the programmed 'Aspirate Height'. For delicate, cell-based assays, rates 7 to 10, where 7 = slowest and 10 = fastest, are designed to minimize turbulence (disturbance) in the wells. With any of these "rapid" rates (indicated by an "R"), the tubes descend at a constant rate to the programmed 'Aspirate Height'. Rate 6 provides the least disturbance to delicate, cell-based assays. Like rates 7 to 10, the tubes descend at a constant rate to the programmed 'Aspirate Height', however, rate 6 is *faster* than rate 10. **Note:** 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 if Crosswise Aspirate is not enabled. If Crosswise Aspirate is enabled, the delay applies to the crosswise, not the normal initial, aspiration.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash ASPIRATE (ASPIR) Program Options, Cont'd

Option & Description	Models	Action/Comments
Crosswise Aspir? Specify whether to perform a Crosswise Aspiration.	All	A crosswise aspiration is a two-step aspiration. The wells are *first* aspirated at the Horizontal Aspirate Position. The aspirating tubes raise a fixed number of steps and then do a *second* (crosswise) aspiration at the Crosswise Horizontal Position.
	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 removing higher than expected residual. Crosswise aspiration is used only with flat-bottom plates. Lower residuals can often be achieved without crosswise aspiration if the horizontal aspiration position is programmed correctly. Select **YES** to designate a second aspiration. Example of initial and then crosswise aspiration in a microwell:  **Horizontal Aspirate Position 10**  **Crosswise Horizontal Position -40**	
Crosswise On Specify how the Crosswise Aspiration shall be performed.	All	Select **ALL** to perform a crosswise aspiration on all aspirations within the wash program, or **FINAL** to perform the crosswise aspiration on just the final aspiration.
Crosswise Height See the description for Aspirate Height on the preceding page.	All	The only difference is that Crosswise Height specifically refers to Crosswise Aspiration.
Crosswise Horiz Pos See the description for Horizontal Aspr Pos on the preceding page.	All	The only difference is that Crosswise Horizontal Position specifically refers to Crosswise Aspiration. The recommended range is +10 to +35.

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Wash ASPIRATE (ASPIR) Program Options, Cont'd

Option & Description	Models	Action/Comments
Crosswise Horiz Y Pos See the description for Horizontal Y Aspr Pos on the preceding page.	Select, Select CW, HT	The only difference is that Crosswise Horiz Y Pos specifically refers to Crosswise Aspiration.
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.
Press **Main Menu** to save.	All	Select **YES** to save the program.
Note: The shaded options above are **not** available for Aspirate-only programs.		

Wash ASPIRATE Defaults and Ranges

Parameter	Units	Default	Range	Models
Aspirate Height		24	12 to 180	ELx405, Magna, Select, Select CW
		16	12 to 180	HT/96-tube or 192-tube
Horizontal Aspirate Position	quarter steps	0	-30 to 30	ELx405, Magna
			-55 to 55 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

Notes:

- **Aspirate Height**: Although the range is 12-180, the recommended highest value is **175**.
- **Horizontal Aspirate Position**: For higher throughput of the HT with 384-well plates, use the 192-tube manifold.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wash ASPIRATE Defaults and Ranges, Cont'd

Parameter	Units	Default	Range	Models
Magnet Aspirate Height Magna only		0	-20 to 20	Magna (if 96bead Plate Type was selected)
Horizontal Y Aspirate Position Select, Select CW, HT only	quarter steps	0	-55 to 55 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
Aspirate Rate		3	1 to 10	All
Aspirate Delay	milliseconds	0	0-5000	
Crosswise Aspirate?		No	No/Yes	
Crosswise On		Final	Final, All	All
Crosswise Height		24	12-180	All
Crosswise Horizontal Position	quarter steps	0	-30 to 30	ELx405, Magna
			-55 to 55 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

Notes:

- The shaded options are **not** available for Aspirate-only programs.
- **Horizontal Y Aspirate Position** and **Crosswise Horizontal Position**: For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
- **Crosswise Height**: Although the range is 12-180, the recommended highest value is **175**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wash ASPIRATE Defaults and Ranges, Cont'd

Parameter	Units	Default	Range	Models
Crosswise Horizontal Y Position Select, Select CW, HT	quarter steps	0	-55 to 55 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
Final Aspirate?		Yes	Yes/No	All
Final Aspirate Delay	milliseconds	0	0 to 5000	

Notes:

- The shaded options are **not** available for Aspirate-only programs.
- **Crosswise Horizontal Y Position**: For higher throughput of the HT with 384-well plates, use the 192-tube manifold.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

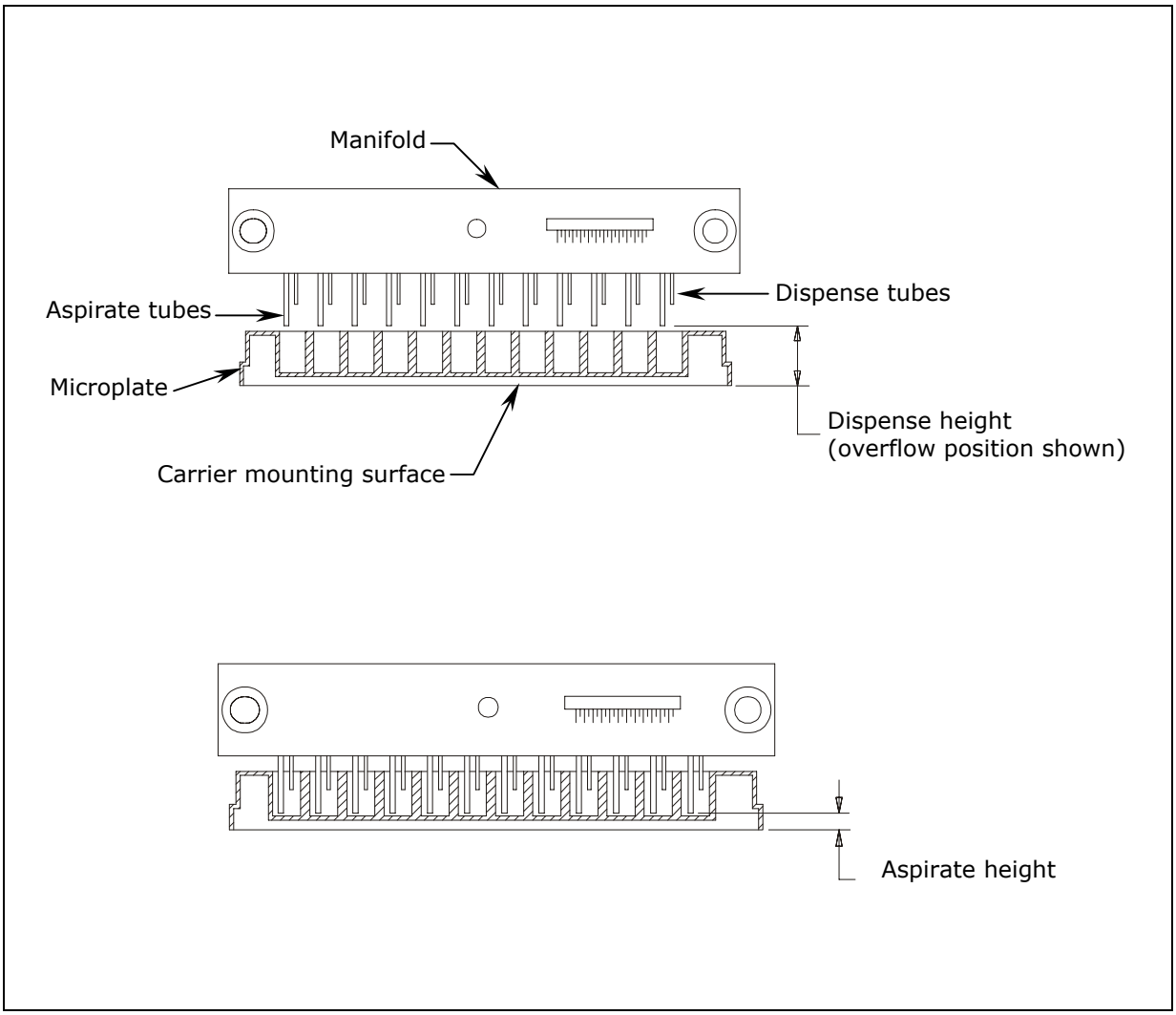


Figure 18: Dispense and Aspirate Heights for the ELx405 and Magna Models

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

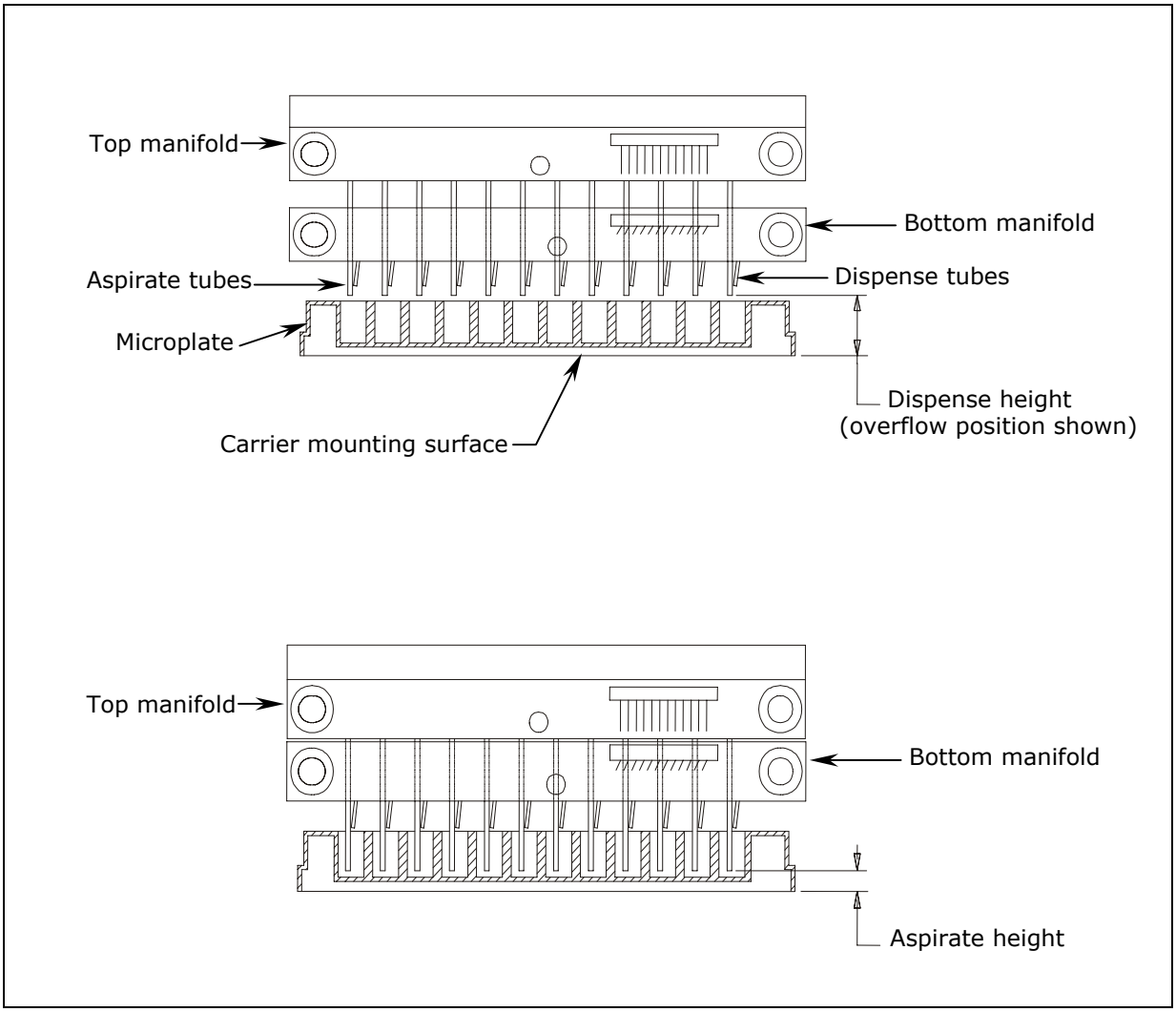


Figure 19: Dispense and Aspirate Heights for the Select, Select CW, and HT2/HTV2 Models With Dual/96 Manifold

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

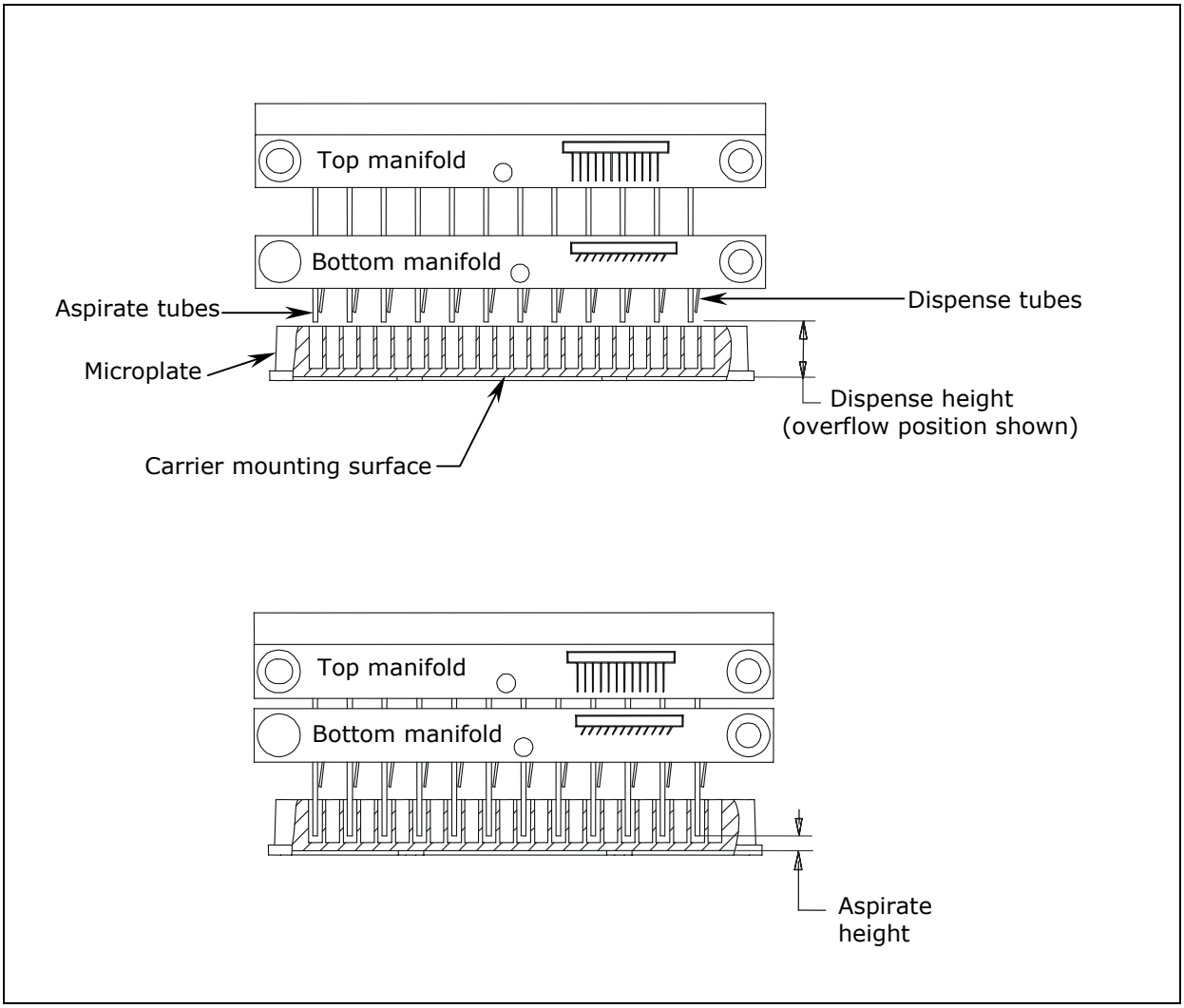


Figure 20: Dispense and Aspirate Heights for the HT Model

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Edit Wash Program

To modify a Wash 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 → WASH → SELECT WASH PROGRAM →
SELECT REAGENT BOTTLE → NAME → **PLATE TYPE** →
DEFINE WASH COMPONENT → MAIN MENU KEY → OK TO SAVE PROGRAM?

The following options appear only on the specified models:

- **SELECT REAGENT BOTTLE:** washers equipped with the external valve module (excludes earlier models of the Select CW).
- **PLATE TYPE:** Select, Magna, Select CW, and HT models with the accessory 96-tube manifold installed.

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. See ***Entering Program Names*** on page 44 for instructions.
OK To Copy?	All	Select **YES** to copy the program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Prime

This section discusses how to run, define, edit, copy and delete **Prime** programs. (See ***Appendix D***, ***Default Programs*** for a list of default Prime programs.)

Run Prime Program



Important! Before running a Prime program, ensure that you have reviewed the ***General Usage Guidelines*** on page 49 and that the microplate is properly seated in the plate carrier.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the external valve module (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 the external valve module.
Name Enter a unique name for the Prime program.	All	Use up to 16 alphanumeric characters. See ***Entering Program Names*** on page 44 for instructions.
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 76.)
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).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Define Prime Program Options, Cont'd

Option & Description	Models	Action/Comments
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.
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 manifold raises to its home position over the priming trough. The soak solution is then dispensed to the 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	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

❖ See ***Default Prime Program: Prime_200*** (which contains a default Prime Volume of 200 ml) and ***Default Prime Program: Prime_CW*** (which contains parameters that may be edited), on page 78.

Models	Recommended Minimum Prime Volumes	
ELx405, Magna, Select, HT	**Washers <u>without</u> the valve module**	
	200 ml Prime Volume	When all the lines are empty or when changing fluids.
	Washers with the valve module	
	400 ml Prime Volume	When all the lines are empty or when changing fluids.
Select CW	**Washers <u>without</u> the valve module**	
	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.
	Washers with the valve module	
	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.

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 the external valve module.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. See ***Entering Program Names*** on page 44 for instructions.
OK To Copy?	All	Select **YES** to copy the program.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Default Prime Program: Prime_200

The default 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 76). The table below lists the program's default parameters.

- ❖ 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	

Default Prime Program: Prime_CW

The default 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	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense

This section discusses how to run, define, edit, copy and delete **Dispense** programs. (See ***Appendix D***, ***Default Programs*** for a list of default Dispense programs.)

Run Dispense Program



Important! Before running a Dispense program, ensure that you have reviewed the ***General Usage Guidelines*** on page 49 and that the microplate is properly seated in the plate carrier.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the specified models:

- **SELECT REAGENT BOTTLE:** Washers equipped with the external valve module (excludes earlier models of the Select CW).
- **PLATE TYPE:** Select, Magna, 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 ***Define Wash DISPENSE (DISP) Program Options*** (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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the external valve module (excludes earlier models of the Select CW).
- **PLATE TYPE** only appears on the Select, Magna, 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. See ***Entering Program Names*** on page 44 for instructions.
OK to Copy?	All	Select **YES** to copy the program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Aspiration

This section discusses how to run, define, edit, copy and delete Aspiration programs. (See ***Appendix D***, ***Default Programs*** for a list of default Aspiration programs.)

Run Aspiration Program



Important! Before running an Aspiration program, ensure that you have reviewed the ***General Usage Guidelines*** on page 49 and that the microplate is properly seated in the plate carrier.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 → **MAGNET ASPIR HEIGHT** → **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, Magna, Select CW models, and HT models with the accessory 96-tube manifold installed.
- **MAGNET ASPIR HEIGHT:** Magna.
- **HORIZ Y ASPR POS** and **CROSS HORIZ Y POS:** Select, HT, and Select CW.

Define Aspiration Program Options

See ***Define Wash ASPIRATE (ASPIR) Program Options*** (page 62) 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, Magna, Select CW, and HT models with the accessory 96-tube manifold installed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. See ***Entering Program Names*** on page 44 for instructions.
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 be run on its own; it must be selected as part of a **Link** program (see page 88).
- Soak *parameters* can also be defined within a Wash program (see page 54).

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?

Define Soak Program Options

See ***Define Wash METHOD Program Options*** (page 54) for a complete listing of Soak Program Options.

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?

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. See ***Entering Program Names*** on page 44 for instructions.
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Linking Programs

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

- Pre-defined 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, 96Bead, or 384).
- The linked program will not ask for a buffer if the external valve hardware is present. Each pre-defined 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 specified within the Link program, however, can be edited.

Run Link Program



Important! Before running a Link program, ensure that you have reviewed the ***General Usage Guidelines*** on page 49 and that the microplate is properly seated in the plate carrier.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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, Magna, 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. See ***Entering Program Names*** on page 44 for instructions.
Plate Type Specify the microplate type.	Select, Select CW, Magna, HT/96-tube	Choose 96 or 384. **Note:** For higher throughput of the HT with 384-well plates, use the 192-tube manifold.
	Magna	Choose 96 or 96Bead.
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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?**

Delete Link Program Options

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Setup Utilities

To access the **SETUP** utilities, start at the Main Menu and select **UTIL → SETUP**. The **EDIT SETUP** screen will appear with the following options: **RS232**, **SENSOR**, **ADJUST**, **PARK**, **BIOSTACK**, **DISP**, **PLATE**, **VACUUM**, **MANIFOLD**. These options are described below and on the following pages.

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 the user to activate or deactivate the detection systems on the washer, however, Bio-Tek recommends that the sensor detection systems **remain activated**.

Once exception would be, for instance, 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 washer menu below.

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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, and **96** or **96Bead** for the Magna. (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), **DISP** (dispense), or **MAGNET** (magnetic plate – Magna model only). 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
MAGNET	Magnet plate carrier (up/down movement)	Magna

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 21*** on the following page.
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 quit the Adjust utility, press **Main Menu**. When the selection is made, the software automatically repositions the carrier and manifold to their *default* positions.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

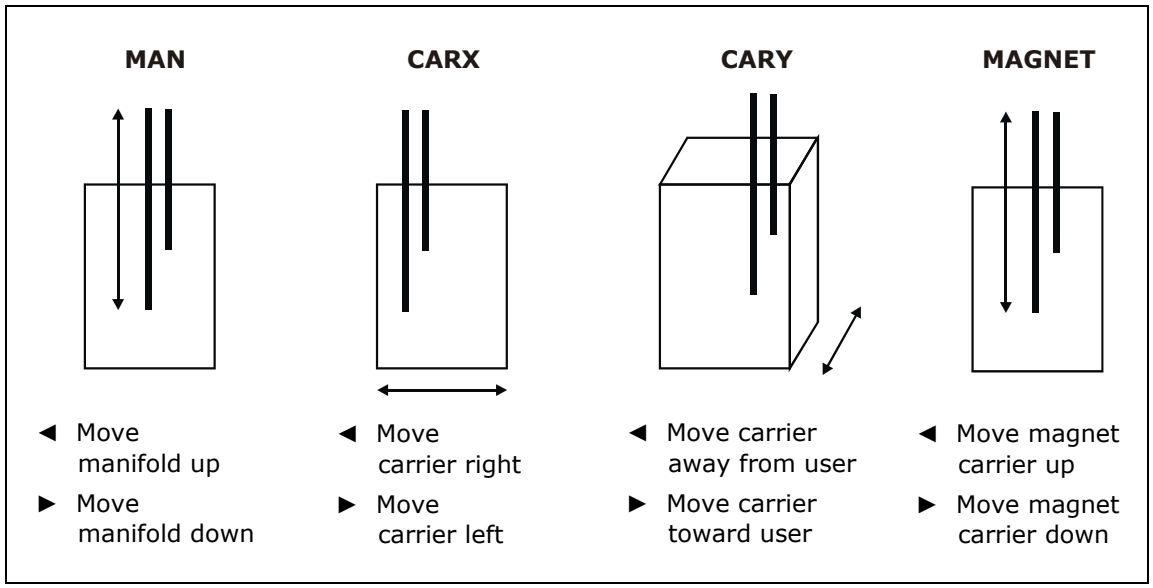


Figure 21: Using the Adjust Utility

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:

UTIL → SETUP → MORE → **PARK**

The manifold will immediately move to the Park or "pre-defined" position.

Bio-Stack Utilities (BIOSTACK)

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

UTIL → SETUP → MORE → **BIOSTACK** → BIOSTACK UTILITIES →
CONF ALIGN VERIFY

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 Clearance Height (PLATE)

A **Plate Clearance Height** option has been added to accommodate plates that are slightly taller than standard plates to ensure that the manifold tubes are raised high enough above the plate to prevent crashes when the plate carrier moves. The clearance height range is 12 (3.048 mm) to 180 (22.86 mm), with a default value of 130 (16.510 mm). Due to hardware variations, however, the 180 value may be out of range for some washers; it is recommended, therefore, that the highest value be closer to **175**.

To change the plate clearance height, select the following:

UTIL → SETUP → MORE → MORE → **PLATE** → PLATE CLEAR HEIGHT

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 sec.

Increasing the delay prevents some vacuum systems, such as the High Flow Pump, from drawing excess current and blowing the auxiliary 5-amp fuse (PN 46055). A delay of 10 seconds or greater is recommended when using the High Flow pump with 10-liter bottles; a delay of at least 20 seconds is recommended when using the High Flow Pump with 20-liter bottles.

To change the vacuum dissipation delay, select the following:

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

❖ **Note**: 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 Bio-Stack™ or other automated system. For standalone use, Bio-Tek 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Manifold Selection (MANIFOLD)

Some washer models can support two types of manifolds:

- The HT2/HTV2 supports the dual 192-tube manifold and the dual 96-tube manifold.
- The Select can be upgraded to an HT, in which case it can support the dual 192-tube manifold and the dual 96-tube manifold.

When a manifold is installed at the factory, a parameter is set on the washer to indicate which manifold type is installed. This parameter is called "Manifold Selection" and it can be set to **96** or **192**.

For the models described above, this parameter must be changed each time the manifold is changed. For example, the HT2/HTV2 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

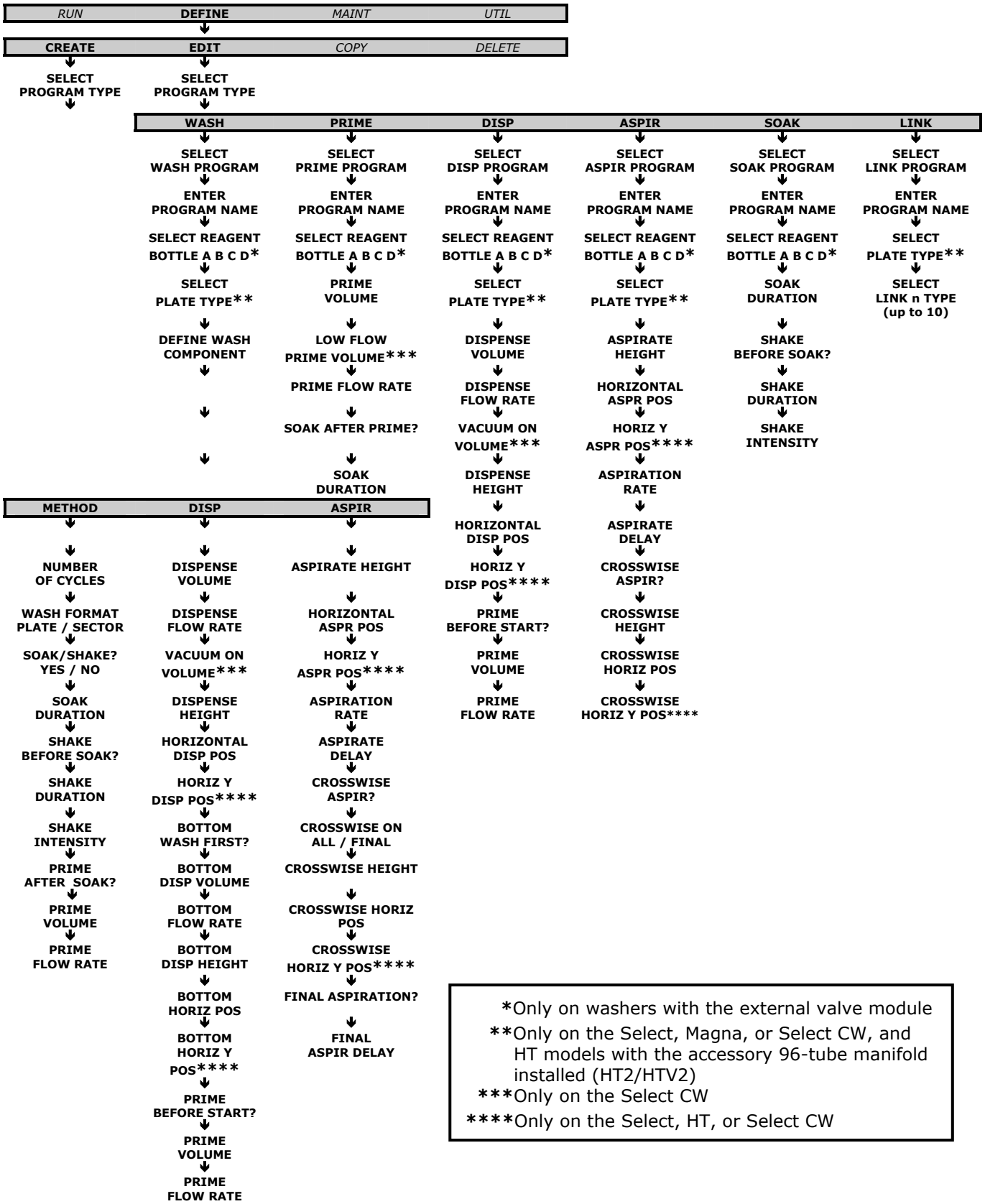
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ELx405 Washer Menu Maps

Refer to the ***Washer Menu Maps*** on pages 97 through 100 for a complete listing of options available through the Main Menu.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Main Menu (DEFINE function path for Create and Edit)



*Only on washers with the external valve module

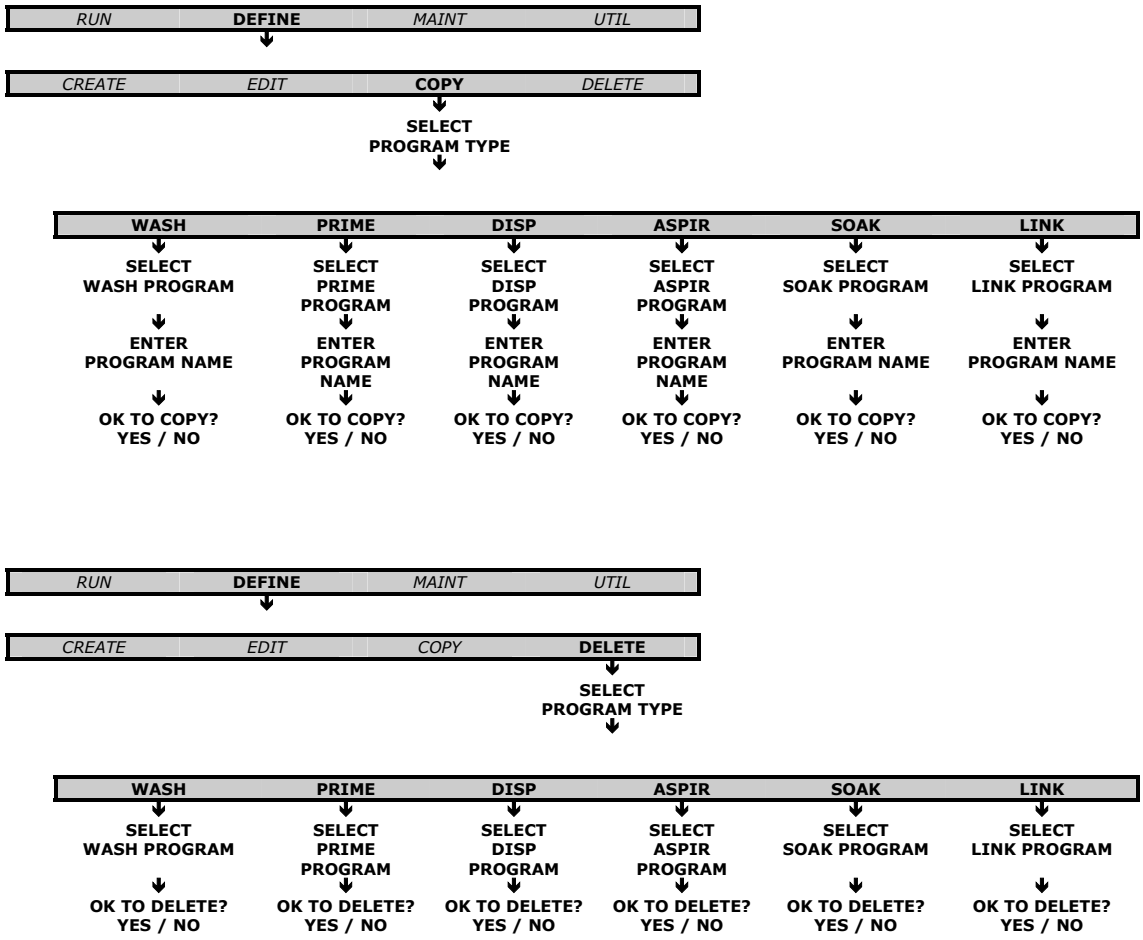
**Only on the Select, Magna, or Select CW, and HT models with the accessory 96-tube manifold installed (HT2/HTV2)

***Only on the Select CW

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

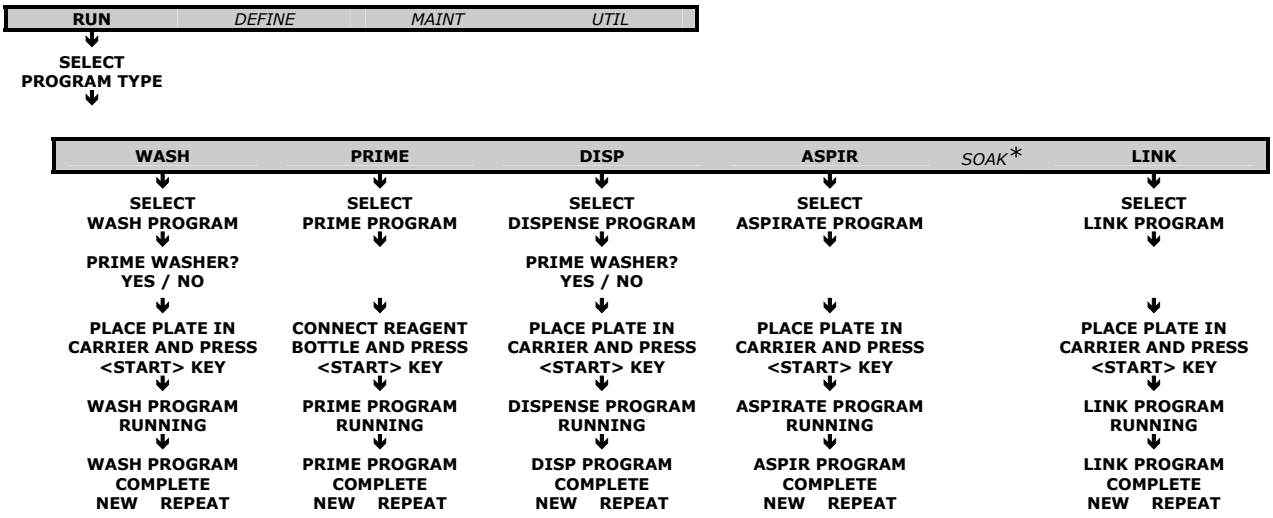
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Main Menu (DEFINE function path for Copy and Delete)



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Main Menu (RUN function path)

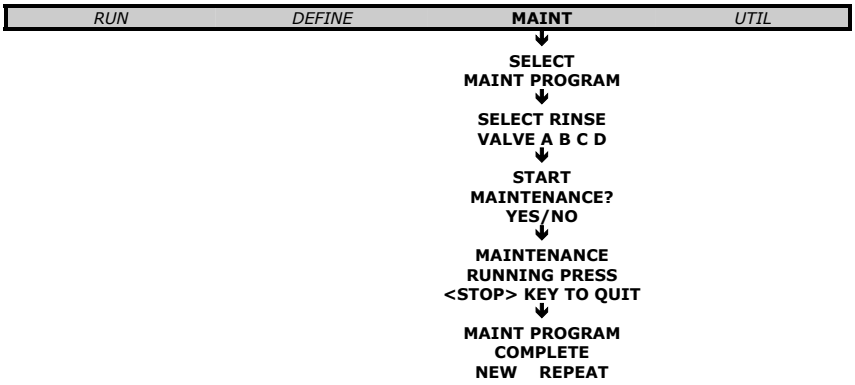


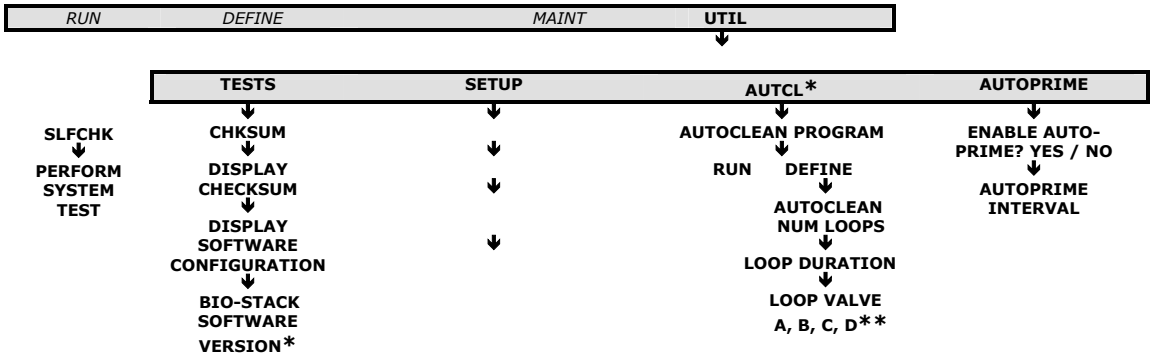
- If the NEW option is selected at the Wash, Prime, Dispense, Aspirate, or Link Program Complete screen, control is returned to the corresponding Select Program screen. For example, if REPEAT is selected after a Wash program completes, the program returns to the Select Wash Program Screen.
- If the REPEAT option is selected at the Wash, Prime, Dispense, Aspirate, or Link Program Complete screen, the program will run through another complete cycle.

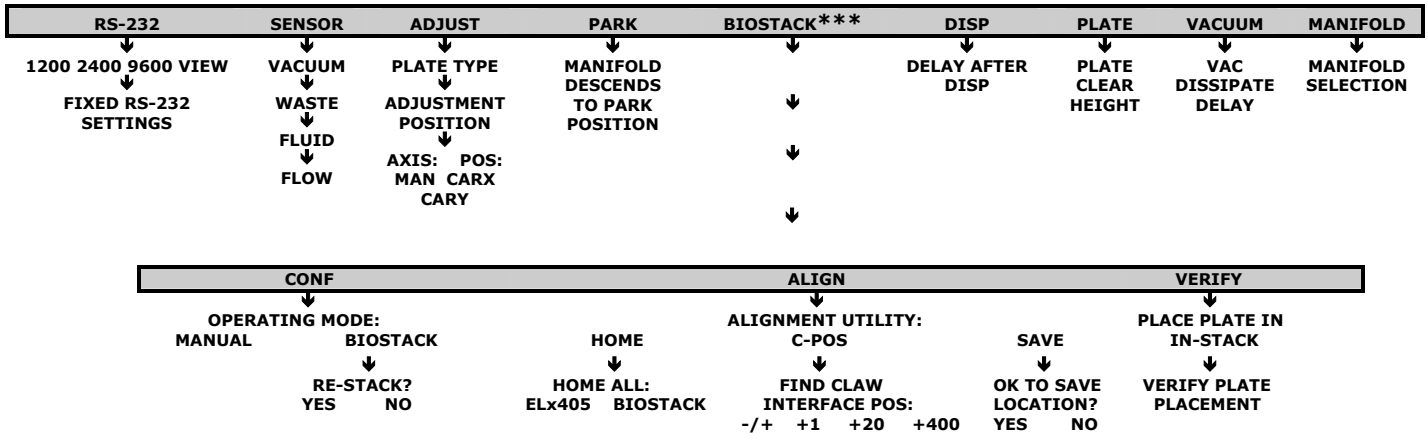
A Soak program cannot be run independently; it must be selected within a Link program. Soak parameters ***can be defined within a Wash program (see "Main Menu, DEFINE function path for Create and Edit").

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Main Menu (MAINT, UTIL function path)







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

**Only on washers with the external valve module

***Bio-Stack options available on all ELx405™ models, except the Magna

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 4

Preventive Maintenance

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

Overview 102
Recommended Maintenance Schedule 103
Required Materials 104
Warnings & Precautions 105
Maintenance Programs 106
Prime Programs 107
Rinse/Soak the Fluid Path 109
Clean Components 114
Decontaminate the Washer 128
Prepare for Storage or Shipment 134
Replace Components 136

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Overview

A **Preventive Maintenance (PM)** 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 Bio-Tek's recommended maintenance tasks, and indicates approximately how often each task should be performed. Daily and periodic routines and minimal guidelines for frequency are listed. Beyond that, it is difficult for Bio-Tek 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, Bio-Tek 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 it sit 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 in use will affect the rinsing frequency. If the solution does not contain surfactant, consider rinsing (or running AUTOPRIME) at least once an hour.

Schedule

The following chart recommends preventive maintenance tasks, the frequency with which each task should be performed, and the pre-defined 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 the **Ultrasonic Advantage™**: The ultrasonic cleaner does not require maintenance.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. 112		✓			
Remove protein residuals and fungi growth, (if necessary), p. 112	✓		✓	✓	
Clean Components					
Check/empty waste bottle, p. 115	✓				✓
Clean bottles, p. 115				✓	✓
Clean plate carrier system, p. 115			✓		✓
Clean carrier transport arm, p. 116			✓		✓
Clean manifold and mist shield, p. 118				✓	✓
Clean aspirate and dispense tubes, p. 118				✓	✓
Run AUTO CLEAN (Ultrasonic Advantage™), p. 123				✓	✓
Clean fluid inlet filter, p. 126				✓	✓
Decontaminate the Washer					
Decontaminate external surfaces, p. 129				✓	✓
Run DECONTAMINATION, p. 130				✓	✓
Prepare the Washer for Storage or Shipment					
Run LONG_SHUTDOWN, p. 134					✓
Replace Components					
Replace o-rings, and channel-end seals, p. 136	*Annually*				

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Warnings & Precautions

Please read the following before performing any Maintenance procedures:

	**Warning! Internal Voltage.** Turn off and unplug the instrument for all maintenance and repair operations.
	**Caution! Chemical Compatibility with Washers.** Some chemicals may cause irreparable damage to washers. The following chemicals have been deemed safe for use in washers: buffer solutions (such as PBS), saline, surfactants, deionized water, 70% ethyl, isopropyl, or methyl alcohol, 40% formaldehyde, and 20% sodium hydroxide. Never use DMSO or other organic solvents. These chemicals may cause severe damage to the instrument. See ***Appendix C***, ***Chemical Compatibility***, for more information. Use of wash buffers containing acetic acid is limited to washers upgraded with Bio-Tek part number 68098 Teflon® valves. Contact Bio-Tek for upgrade information and prior to using other questionable chemicals.
	**Warning!** Wear protective gloves when handling contaminated instruments. Gloved hands should be considered contaminated at all times; keep gloved hands away from eyes, mouth, nose, and ears.
	**Warning!** Mucous membranes are considered prime entry routes for infectious agents. Wear eye protection and a surgical mask when there is a possibility of aerosol contamination. Intact skin is generally considered an effective barrier against infectious organisms; however, small abrasions and cuts may not always be visible. Wear protective gloves when handling contaminated instruments.
	**Important!** Do not immerse the instrument, spray it with liquid, or use a "wet" cloth on it. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact Bio-Tek's Technical Assistance Center.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Maintenance Programs

The ELx405™ onboard software contains the following pre-defined **Maintenance programs** for most of the recommended tasks:

- DAY_RINSE
- OVERNIGHT_LOOP
- RINSE_AND_SOAK
- LONG_SHUTDOWN
- DECONTAMINATION

To **run** a Maintenance program:

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 external valve module), make the appropriate selections.
4. When **START MAINTENANCE?** appears, select **YES** or press the **START** key to begin.

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

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Prime Programs

Each pre-defined Maintenance program runs a pre-defined **Prime program**. The charts below and on the following page show the default prime program parameters. 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:** In addition to the tubing that every ELx405™ Washer model is equipped with, the Select CW model contains 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 Select CW's 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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. To view or edit the parameters in this Prime program, see ***Prime Programs*** on page 107.

To run the DAY_RINSE program, follow this sequence:

Washers not equipped with the **external valve module:**

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

Washers equipped with the **external valve module:**

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AUTOPRIME

The AutoPrime feature can be enabled to automatically prime the washer after it has been idle for a user-specified amount of time. The volume, flow rate, and soaking parameters specified in the AUTOPRIME Prime program are used. AUTOPRIME is particularly useful if the washer is used intermittently throughout the day, to keep the fluid lines and manifold in a wetted condition.

- **Washers with the external valve module:** AUTOPRIME uses the last-used valve (A, B, C, or D) for priming and soaking.
- **"AUTPRM"** appears only in models with the Ultrasonic Advantage™ (ultrasonic cleaner).

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 Prime program to run.
3. Press **ENTER** and then return to the Main Menu.

AutoPrime is now 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** the AUTOPRIME program, press the **STOP** key.
- To **view** or **edit** the AUTOPRIME program parameters, select **DEFINE → EDIT → PRIME → AUTOPRIME →** and press the **Options** key to scroll through the parameters you wish to view or edit. The table below shows the AUTOPRIME program parameters and ranges.

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

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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), the tubes should be left to soak 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.

- The OVERNIGHT_LOOP program requires the washer to remain turned on.
- As an alternative, run RINSE_AND_SOAK and turn off the washer after the soak begins. This leaves the tubes soaking in the priming trough until the instrument is turned on again.

❖ If the washer will be left idle for two or more days, run DAY_RINSE and OVERNIGHT_LOOP **or** run RINSE_AND_SOAK.



Important! Keep the manifold in a wetted condition to ensure proper evacuation of fluid. Bio-Tek 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 Prime program. To view or edit the parameters in this Prime program, see ***Prime Programs*** on page 107.

To run the OVERNIGHT_LOOP program, follow this sequence:

Washers not equipped with the **external valve module:**

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

Washers equipped with the **external valve module:**

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 Prime program. To view or edit the parameters in this Prime program, see ***Prime Programs*** on page 107.

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

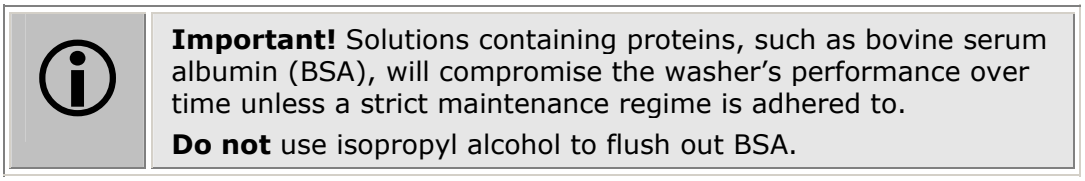
Washers not equipped with the **external valve module:**

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

Washers equipped with the **external 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



Important! Solutions containing proteins, such as bovine serum albumin (BSA), will compromise the washer's performance over time unless a strict maintenance regime is adhered to.

Do not use isopropyl alcohol to flush out BSA.

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

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

Daily

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 (Valve "A" if the valve module is connected).
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3 Connect a bottle containing four liters of deionized water and run the **P_DAY_RINSE** Prime program three times to flush the system.

Using Ethanol:

At the end of the day:

1 Prepare a four-liter solution of 10% ethanol and deionized water. (**Do not** use isopropyl alcohol.) Connect the bottle to the washer (Valve "A" if the valve module is connected).

2 Run the **DECONTAMINATION** Maintenance program.

3 Connect a bottle containing four liters of deionized water and flush the system by running either the **P_DAY_RINSE** Prime program (three times), or the **OVERNIGHT_LOOP** Maintenance program.

Using Deionized Water:

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 deionized water. Connect the bottle to the washer (Valve "A" if the valve module is connected).

2 Run the **P_DAY_RINSE** Prime program.

3 Enable **AUTOPRIME** for 60-minute intervals.

At the end of the day:

1 Fill a supply bottle with deionized water. Connect the bottle to the washer (Valve "A" if the valve module is connected).

2 Run the **P_DAY_RINSE** Prime program three times.

3 Run the **OVERNIGHT_LOOP** Maintenance program.

Weekly/Monthly

1 Flush the system with 0.1-0.5 N NaOH, followed by neutralization with an equivalent normality (0.1-0.5 N) of HCl.

2 Rinse well with deionized water to remove the HCl.

3 Run the **OVERNIGHT_LOOP** Maintenance program with deionized water, or run the **P_DAY_RINSE** Prime program three times with deionized water if you plan to use the washer immediately.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Clean Components

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.



Warning! Internal Voltage. Turn off and unplug the washer for all cleaning operations.



Important! 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. *The use of any lubricant on the fluid handling components will interfere with the aspirate and dispense performance, and may cause irreparable damage to these components.*



Important! When cleaning components:

- Do not immerse the instrument, spray it with liquid, or use a "wet" cloth on it.
- Do not allow the cleaning solution to run into the interior of the instrument. (If this happens, contact the Bio-Tek Service Department.)
- Do not expose any part of the instrument to the recommended diluted sodium hypochlorite solution (bleach) for more than 20 minutes. Prolonged contact may damage the instrument surfaces. Be certain to rinse and thoroughly wipe all surfaces.
- Do not soak the keypad. Instead, moisten a clean cloth with deionized or distilled water and wipe the keypad. Dry it immediately with a clean, dry cloth.



Important! HT models with the accessory 96-tube manifold (HT2/HTV2): Perform Periodic Maintenance on the manifold (96-tube or 192-tube) most frequently in use.

Ensure that the washer is configured for operation with the installed manifold (refer to ***Manifold Selection*** in ***Chapter 3***, ***Operation***.) Failure to set the manifold type before operating the washer may damage the manifold and **void your warranty**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 stopper.
- Rinse the covers every time the wash or rinse bottles are filled.
- Accumulated algae, fungi, or mold may require decontamination. Decontamination is described on page 128.

❖ 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 (the sensor is enabled by default; see ***Setup Utilities*** in ***Chapter 3***, ***Operation***). If fluid collects in the **overflow bottle**, thoroughly rinse the level-switch assembly and bottle.

- Check the white hex nuts securing the Quick-Disconnects to the bottle cap to ensure they are not loose or corroded.

Cleaning the Plate Carrier System

If liquid has overflowed onto the plate carrier, transport rail, 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 straight up and off the horizontal transport rail. See ***Figures 25***, ***26***, and ***27***.
3. Clean the carrier, rail, and glide strips, using mild detergent and hot water, 70% isopropyl alcohol, or 70% ethanol.

❖ **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 (Select, Select CW, and HT Models)*** on page 116 for thorough cleaning instructions.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 rail. Snap the two carrier rail guides onto the rail. The pin should sit in the slot.

Cleaning the Carrier Transport Arm (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.

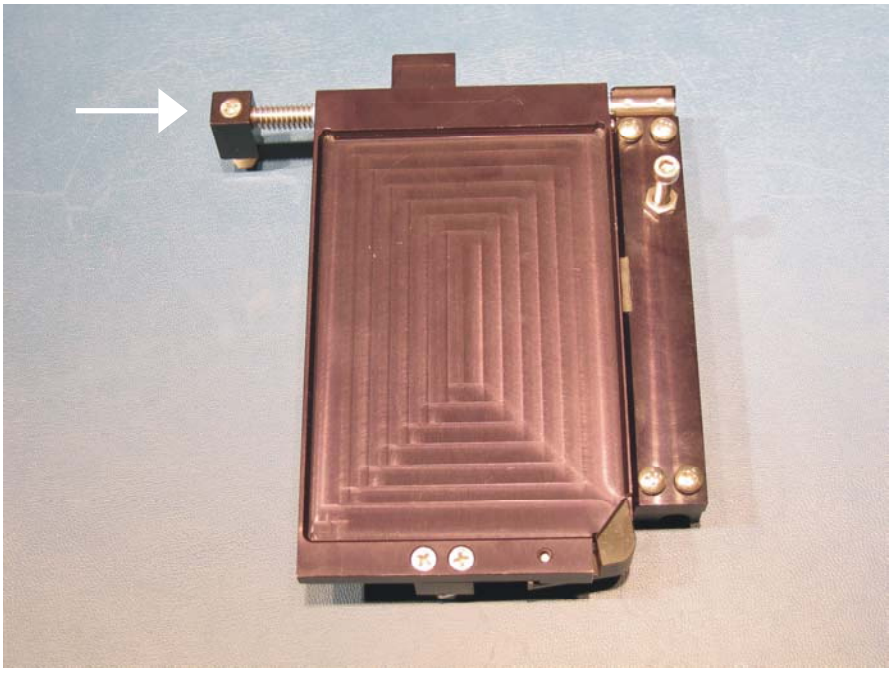


Figure 22: Position of the Transport Arm on the Plate Carrier

The transport arm is noted with an arrow in the photo above. As shown in the photo, the arm fits into the left side of the plate carrier.

Follow the instructions on the next two pages for removing, cleaning, and reassembling the transport arm.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the photo below).

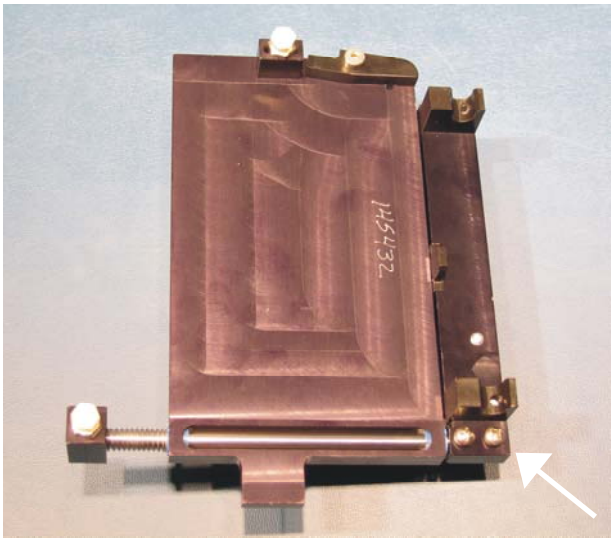


Figure 23: Removing the Screws and Washers From the Transport Arm

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

❖ Take note of the orientation of the arm to the plate carrier as it is turned upside down. Be sure to reassemble the components properly.

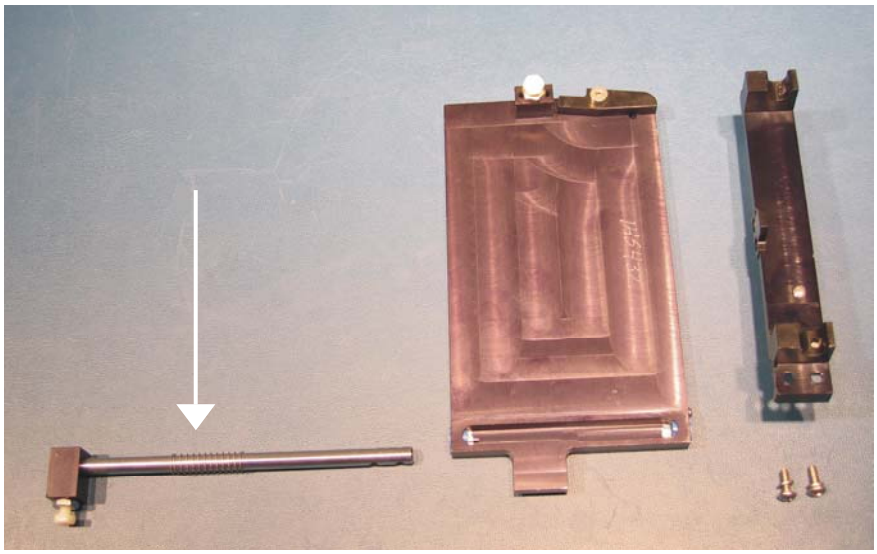


Figure 24: The Transport Arm Removed From the Carrier

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 it increases 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 130 to disinfect the manifold and tubing.

To clean the manifold, mist shield, and tubing:

1. Run the system "dry":
   - From the main menu, 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**.
4. Remove the mist shield if it is attached (see ***Figure 16*** in ***Chapter 2, Installation***). Wipe the inside and outside surfaces of the mist shield with the towel. 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

❖ 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 (see ***Figures 25***, ***26***, and ***27***). Carefully remove the manifold(s) and end plates.
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.



Caution. 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 (**use no tools**). Refer to ***Attaching the Mist Shield***, ***Chapter 2***, ***Installation***.
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***, ***Performance Verification/Qualification Tests***.

❖ Replace the o-rings on an annual basis. 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 136.

❖ 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 123).

DO NOT AUTOCLAVE the manifold!

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

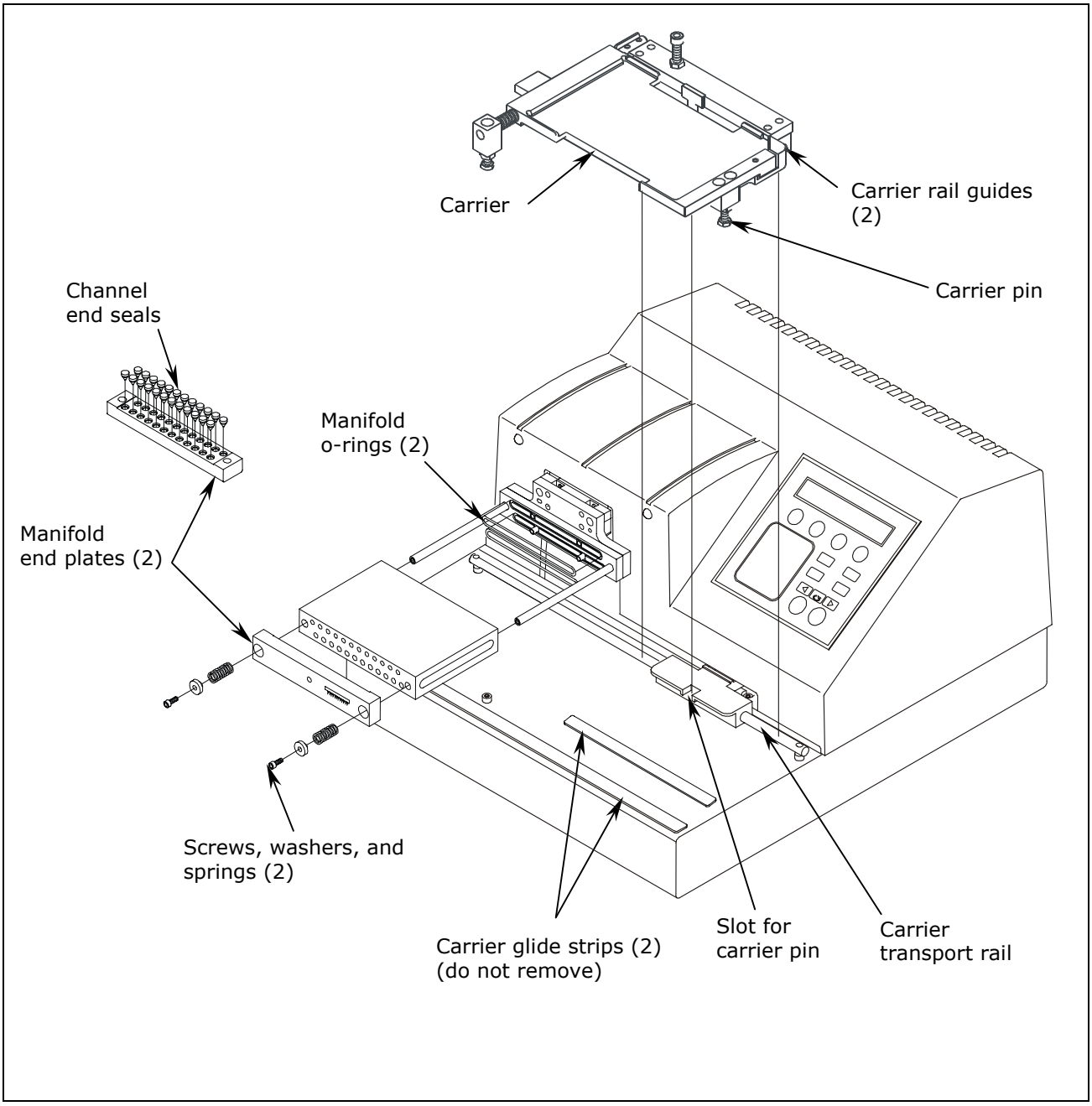


Figure 25: Carrier and Manifold Placement in the ELx405 Model

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

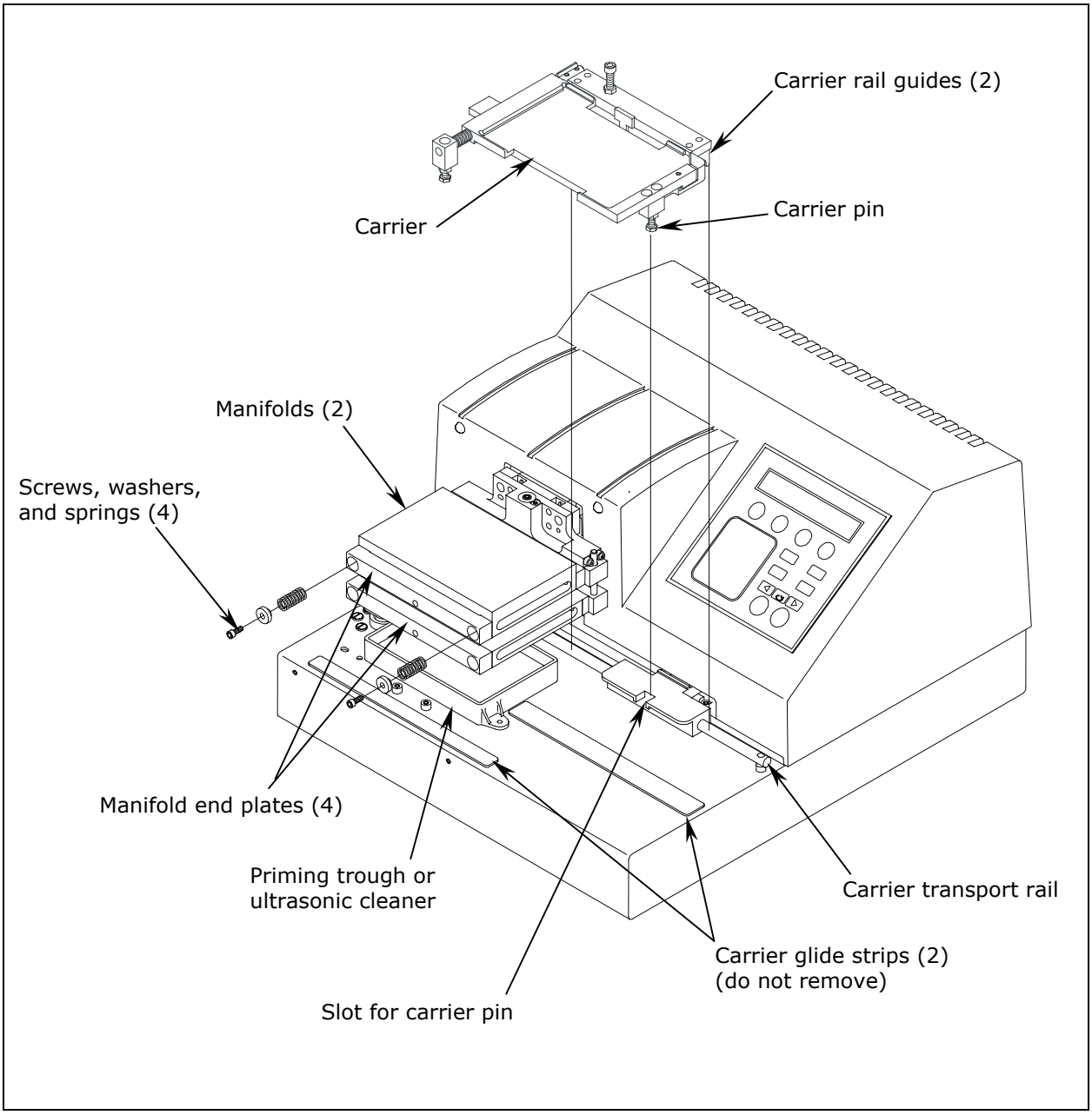


Figure 26: Carrier and Manifold Placement in the Select, Select CW, and HT Models

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

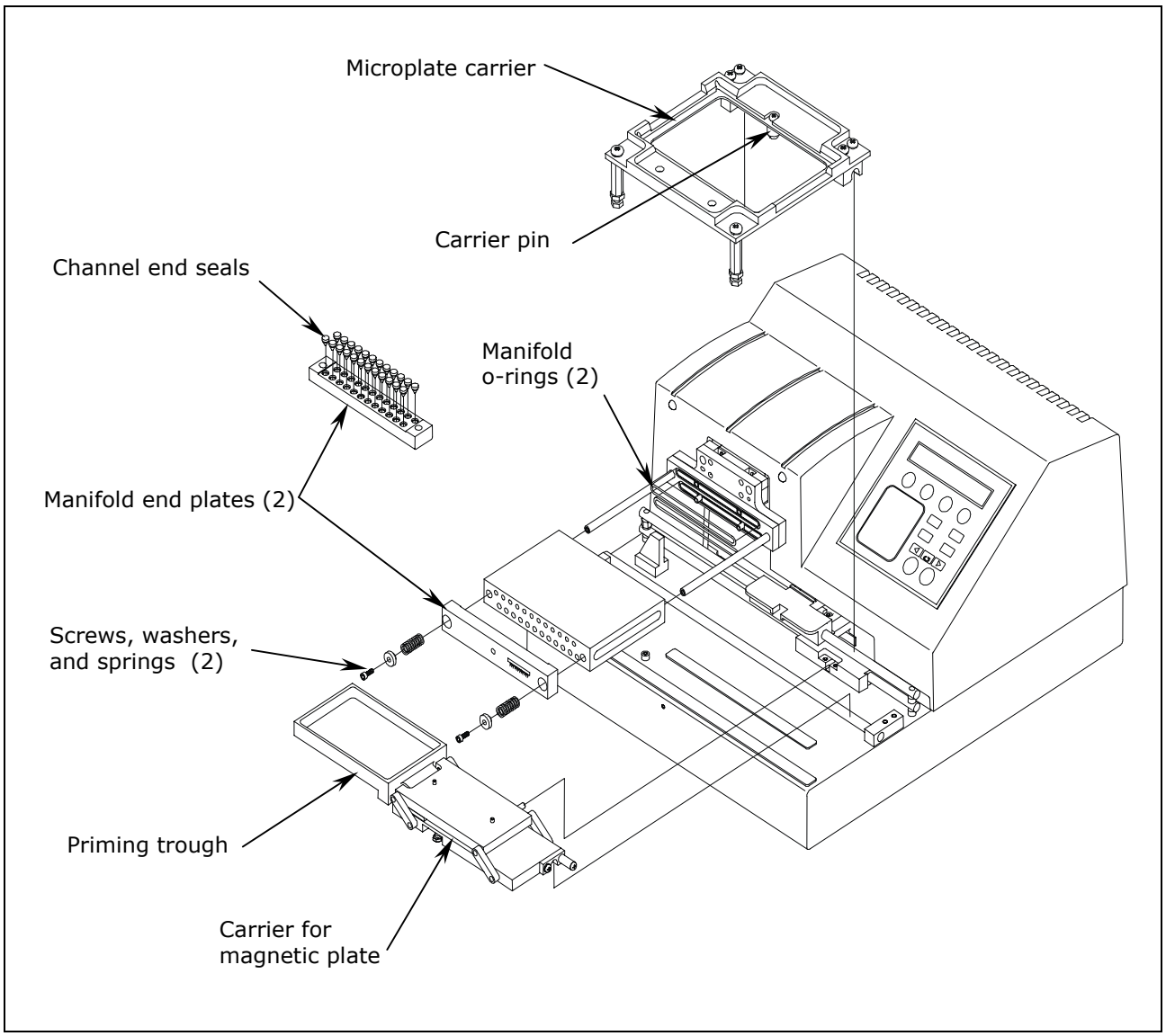


Figure 27: Carrier and Manifold Placement in the Magna Model

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AUTOCLEAN (for Ultrasonic Advantage™ models only)



Warning! Ultrasonic energy is present in the cleaning reservoir when an AUTOCLEAN program is running. **Do not put your fingers in the bath!** Ultrasonic energy can be destructive to human tissue.



Important! Ensure that adequate room exists in the vacuum bottle and adequate volume is available in the supply bottle **before** running an AUTOCLEAN program!

Ultrasonic Advantage™ 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 Bio-Tek 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 valve modules

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

> ❖ **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 loops in the cleaning program for 30 minutes in each loop. 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 always done for **each successive loop** in models without the valve module, and in models with the valve module, if the valve selection changes between loops.

Define the AUTOCLEAN program parameters:

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

➢ Washers not equipped with the **external valve module**:

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 the **external valve module**:

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**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 the valve module:** 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Cleaning the Fluid Inlet Filter



Warning! Internal Voltage. Turn off and unplug the washer for all cleaning operations.

Periodically clean the fluid inlet filter (PN 49943) that is located next to the vacuum port 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 housing.
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

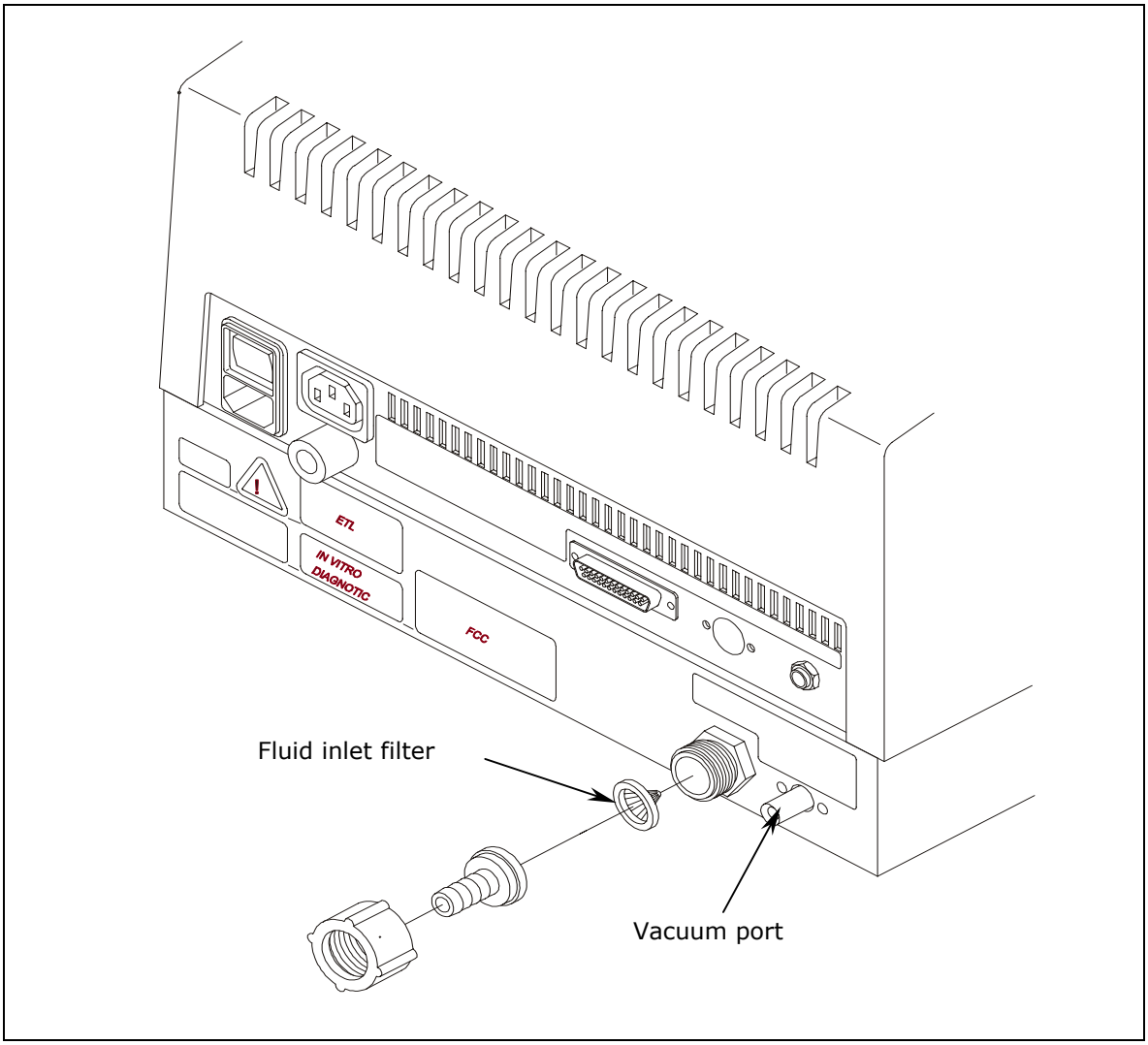


Figure 28: Cleaning the Fluid Inlet Filter

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Decontaminate the Washer

Any laboratory instrument that has been used for research or clinical analysis is considered a biohazard and requires decontamination prior to handling.

Decontamination minimizes the risk to all who come into contact with the instrument during shipping, handling, and servicing. 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.

The recommended **frequency for decontamination** is at least monthly, and before shipment of the instrument to Bio-Tek for calibration or repair.

	**Important!** Bio-Tek Instruments, Inc. 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 Bio-Tek 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.
	**Warning! Internal Voltage.** Turn off and unplug the instrument for all decontamination operations.
	Do not immerse the instrument, spray it with liquid, or use a "wet" cloth. Do not allow the cleaning solution to run into the interior of the instrument. If this happens, contact the Bio-Tek Service Department. Do not soak the keypad.
	Wear prophylactic gloves when handling contaminated instruments. Gloved hands should be considered contaminated at all times; keep gloved hands away from eyes, mouth, nose, and ears. Eating and drinking while decontaminating instruments is not advised.
	Mucous membranes are considered prime entry routes for infectious agents. Wear eye protection and a surgical mask when there is a possibility of aerosol contamination. Intact skin is generally considered an effective barrier against infectious organisms; however, small abrasions and cuts may not always be visible. Wear protective gloves when performing the decontamination procedure.
	**HT models with the 96-tube manifold (HT2/HTV2):** For routine maintenance, decontaminate the manifold (96- or 192-tube) most frequently in use. For shipment of the instrument to Bio-Tek for calibration or repair, decontaminate both manifolds.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Decon Procedure for External Surfaces of the Instrument

	The bleach solution is caustic; wear gloves and eye protection when handling this solution.
	**Caution!** 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 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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. These Prime programs can be edited for optimum cleaning. 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.



Caution! 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. 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 the **external valve module**, 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Washer not equipped with the **external valve module:**

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

Washer equipped with the **external valve module:**

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Alternate Decontamination Procedure for Tubing and Manifold

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.



Caution! 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 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 ***Decon Procedure for External Surfaces of the Instrument*** on page 129 for decontamination of 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 (see ***Figures 25***, ***26***, and ***27***). Remove the manifold(s) and end plates.
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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Caution. 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:
   - Align the mist shield with the washer so it is resting on top of the two posts, and the two thumbscrew holes in the shield are lined up with the two holes in the front base of the washer. (Refer to ***Figure 16*** in the section ***Attaching the Mist Shield***, ***Chapter 2***.)
   - Insert the two thumbscrews and finger-tighten only (**use no tools**).
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.
12. Verify dispenser performance visually or by performing the ***Dispense Precision Test*** in ***Chapter 5***, ***Performance Verification/Qualification Tests***.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Prepare for Storage or Shipment

Before the washer is shipped or stored, it 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.

- **For the ELx405™ HT2/HTV2:** Before switching from one manifold to another (e.g., before removing the 192-tube manifold and installing the 96-tube manifold), Bio-Tek 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. These prime programs can be edited for optimum cleaning. 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.



Caution! 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).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

6. If the washer is equipped with the **external 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 **external valve module:**

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

Washers equipped with the **external 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° to 50°C (-4° to 122°F)

   Relative humidity: 10% to 85% (non-condensing)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Replace Components

Replacing the O-Rings and Channel-End Seals

For optimal performance and to extend the life of the washer, replace the manifold o-rings once a year and replace the 12 (or 24) rubber plugs (seals) on the channel ends if they show signs of cracking or drying out. Order the replacement o-rings and seals from Bio-Tek (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 118.

Replacing the O-Rings

After completing Step 9 of the procedure on page 119:

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.**



Caution: 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 118. 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 119, when removing the manifold(s). See ***Figure 29*** on the following page.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

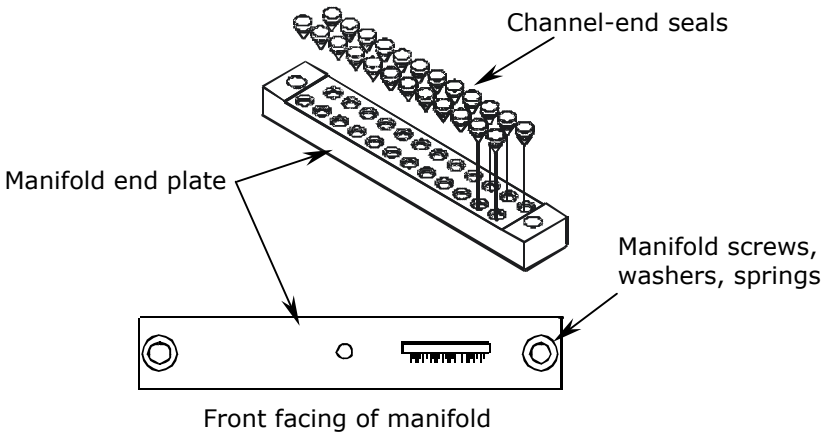


Figure 29: Replacing the Channel-End Seals

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.

Caution: 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**.

Caution: 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Chapter 5

Performance Verification/ Qualification Tests

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

Overview 140
Verification Schedule 141
Installation Qualification (IQ) 142
Operational Qualification (OQ) 142
Performance Qualification (PQ) 143
System and Checksum Tests 144
Liquid Tests 146

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Overview

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.
- **Dispense Precision, Valve Module.** The Dispense Precision Test for the external valve module measures the variability of volumes dispensed from tube to tube across the manifold, when the washer is used with the valve module.

❖ The Ultrasonic Advantage™ (ultrasonic cleaner) does not require qualification testing.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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**, **Preventative Maintenance.***

Recommended Instrument Verification Schedule

Tests	IQ	OQ		PQ
	Initially	Initially	Annually	Monthly
System Self Test and **Checksum Test**	✓	✓	✓	✓
Evacuation Efficiency		✓	✓	✓
Dispense Precision (*without* valve module)		✓	✓	✓
Dispense Precision (*with* valve module)			✓	
Note: Refer to page 147 to determine which 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.

❖ **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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Installation Qualification (IQ)

Installation Qualification 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 should be performed immediately following the successful IQ (see below).

Operational Qualification (OQ)

Operational Qualification 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Performance Qualification (PQ)

Performance Qualification 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

System and Checksum Tests



The information from the System and Checksum Tests is important if you need to contact Bio-Tek.

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.

For the **Magna**, a magnetic carrier test is also performed. This test moves the magnet holder to the extreme left and most vertical position and then back to home where a "position verify" command is executed. If the magnet holder loses steps when making these moves, the "position verify" will generate an error code, failing the test.

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 Bio-Tek's Technical Assistance Center.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 TAC**: 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Liquid Tests

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**.

Evacuation Efficiency Test

The Evacuation Efficiency test measures the **residual volume** (mean residual weight) per well after the aspiration aspect of plate washing. 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Valve Module Test

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

Which Tests to Perform?

Which tests you will perform depend on the **washer model**, which **manifold type** is installed on it, and whether or not the washer is equipped with the external **valve module**. Please refer to the chart below to determine which tests to perform.

Washer Model	Manifold Type	Valve Module?	Liquid Tests to Perform	Page
405, Magna	Single/96	No	Evacuation Efficiency Test Dispense Precision Test, without Valve Module	150 153
		Yes	Evacuation Efficiency Test Dispense Precision Test, with Valve Module	150 154
Select, Select CW	Dual/96	No	Evacuation Efficiency Test Dispense Precision Test, without Valve Module	150 153
		Yes	Evacuation Efficiency Test Dispense Precision Test, with Valve Module	150 154
HT	Dual/192	No	Evacuation Efficiency Test (192) Dispense Precision Test (192), without Valve Module	157 160
		Yes	Evacuation Efficiency Test (192) Dispense Precision Test (192), with Valve Module	157 161
	Dual/96 (HT2/HTV2 only)	No	Evacuation Efficiency Test Dispense Precision Test, without Valve Module	150 153
		Yes	Evacuation Efficiency Test Dispense Precision Test, with Valve Module	150 154

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Materials

- One clean, dry microplate per test to be performed:

Microplate Type	Liquid Tests
Corning® Costar #3590 96-well plates	Evacuation Efficiency Test
	Dispense Precision Test
	Dispense Precision Test, with Valve Module
Corning Costar flat-bottom 384-well plates	Evacuation Efficiency Test (192)
	Dispense Precision Test (192)
	Dispense Precision Test (192), with Valve Module

- Precision balance with minimum capacity of 100 g and readability of 0.01 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, using the recipes 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	1 batch (1000 ml)	1 batch (100 ml)	n/a	1 batch (1440 ml)

❖ These 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 **external valve module**, you will need several additional liters of deionized water.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Test Solutions

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 Bio-Tek Wetting Agent (PN 7773002) into 1 liter of deionized water and mix well.

SOLUTION #2: Evacuation Efficiency (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 Bio-Tek Blue Test Dye (PN 7773001)**.**

SOLUTION #3: Dispense Precision Test Solution (Single/Dual 96 manifolds)

Mix 1180 ml of deionized water with 20 ml of **Solution #2**.

SOLUTION #4: Dispense Precision Test Solution (Dual 192 manifold)

Mix 1420 ml of deionized water with 20 ml of **Solution #2**.

- 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. Using pure DI water in place of Solution #1 is *not* recommended and will likely result in the failure of the unit to meet specifications.
- **Important:** The factory determined the pass/fail specifications for the following tests using the test solutions described above.
- **Bio-Tek PN 7773002** (Solution #1 100X Concentrate Wetting Agent 125 ml) contains 10% Tween 20 in deionized water and 0.01% Sodium Azide as a preservative.

  Bio-Tek PN 7773001 (Solution #2 10X Concentrate Blue Test Dye 125 ml) contains 5 g per liter FD&C Blue #1, 0.1% Tween 20 in deionized water, and 0.01% Sodium Azide as a preservative.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Evacuation Efficiency Test (96)

- This test is designed for **Single/96** or **Dual/96** manifolds. See page 157 if you're looking for the Evacuation Efficiency Test for the Dual/192 manifold.
- See page 148 for a list of required materials.

1. Fill a supply bottle with two liters of deionized water. Run the Maintenance program **DAY_RINSE** two or three times to prime the fluid lines and manifold.
2. Place a clean, dry 96-well microplate on the balance and zero the balance.
3. Pipette or dispense 150 µl of **Solution #1** 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*** on page 164, perform initial data reduction:
   a. Divide the Total Residual Weight by **96** to find the **Mean Residual Weight**.
   b. The Mean Residual Weight should be **<= 0.005 g**.

If the Mean Residual Weight is *greater than* 0.005 g, or if one or more wells appear to have much more liquid than the others, the washer failed the test.

Troubleshoot as follows:

- If the test fails once: Failure of this test is commonly caused by improper aspiration tube placement within the wells, usually because a microplate other than the recommended Corning Costar® 96 was used.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- If you prefer to use a plate *other than* the Corning Costar 96, modifying the ASPIRATE HEIGHT or HORIZONTAL ASPIRATE POSITION parameters in a copy of the **residual_qc_test** program should correct this error (residual_qc_test is locked for editing, but you can copy the program and edit its parameters in the newly created copy). See ***Chapter 3***, ***Operation***, for instructions on copying and editing programs and modifying the abovementioned parameters. After making this change, retry the test using a clean, dry microplate.
- If you *are* using the Corning Costar 96 microplate, run **AUTOCLEAN** (Ultrasonic Advantage™ models only), and/or remove the manifold and clean the aspiration tubes with the stylus (all models). See ***Chapter 4***, ***Preventive Maintenance*** for complete instructions. When finished, retry the test using a clean, dry microplate.

- If the test fails a second time: Perform the ***Supplemental Test*** below.

Supplemental Test

Conduct this test if the Standard Evacuation Efficiency Test fails twice. This test will confirm which aspirate tube(s) may be clogged, or if the plate's alignment or position is the problem.

1. 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 300 µl of **Solution #1** into each well, on top of the residual solution.
3. Shake the plate to get uniform distribution of the remaining dye in each well.

> ❖ If you are using one of Bio-Tek's keypad-based readers, such as the ELx800™ or ELx808™, ensure that the reader is **not** running in **Rapid mode**. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

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 Efficiency Test Worksheet*** on page 164, perform data reduction:
   a. Calculate the sum of the OD values for all 96 wells, then divide by **96** to determine the **Mean OD** for the plate.
   b. Divide the Mean OD by the **Mean Residual Weight** (from step 1), to find the **Residual Factor.**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

c. For each well, divide its OD value by the Residual Factor to find its **Residual Weight**.

   Each well's Residual Weight should be **<= 0.005 g**.

If one or more wells has a Residual Weight *greater than* 0.005 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 the associated aspiration tubes: run **AUTOCLEAN** (Ultrasonic Advantage™ models only), and/or remove the manifold and thoroughly clean the tubes with the stylus (all models). See ***Chapter 4***, ***Preventive Maintenance*** for complete instructions. When finished, retry the 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.

  ❖ **Please do not adjust** the carrier adjustment screws! Contact your Bio-Tek dealer if you suspect an alignment problem.

- For additional suggestions, see ***Appendix A***, ***Troubleshooting***.

- If the test continues to fail, contact Bio-Tek Instruments.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test (96)

- This test is designed for **Single/96** and **Dual/96** manifolds. See page 160 if you're looking for the Dispense Precision Test for the Dual/192 manifold.
- See page 148 for a list of required materials.

Without the Valve Module

1. Fill a supply bottle with two liters of deionized water. Run the Prime program **P_DAY_RINSE** two or three times to prime the fluid lines and manifold.
2. Fill a supply bottle with 1200 ml of **Solution #3**.
3. Run **P_DAY_RINSE** to prime the washer with the solution.
4. Place a clean, dry 96-well microplate on the washer and run the Dispense program **accuracy_qc_test**. This program dispenses 300 µl of solution to each well of the plate. It does not evacuate the solution.
5. When the program is finished, carefully remove the plate.

- If you are using one of Bio-Tek's keypad-based readers, such as the ELx800™ or ELx808™, ensure that the reader is **not** running in Rapid mode. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

6. 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.
7. Using the ***Dispense Precision Test Worksheet*** on page 165, perform data reduction:
   a. Calculate the **Standard Deviation**.

      Tip: If you have a spreadsheet software program, enter/export all 96 values into a spreadsheet and apply your program's Standard Deviation function (e.g., Microsoft Excel's STDEV).

   b. Calculate the sum of the OD values for all 96 wells, then divide by **96** to determine the **Mean OD** for the plate.
   c. Calculate the **%CV**: (Standard Deviation / Mean OD) * 100.

      The %CV should be **<= 4.0**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 absorbance readings (all models). When finished, re-prime the washer and retry the test.

8. When finished, prime with deionized water to flush out the dye solution.

With the Valve Module

Routine Procedure for Valve A

❖ Perform this test during the **initial/annual OQ**, and the **monthly PQ**.

1. Fill the supply bottle for **Valve A** with two liters of deionized water. Run the Maintenance program **DAY_RINSE** two or three times to prime the fluid lines and the manifold.
2. Fill the supply bottle for Valve A with 1200 ml of **Solution #3**.
3. Run **DAY_RINSE** to prime **Valve A** with the solution.
4. Place a clean, dry 96-well microplate on the washer and run the Dispense program **accuracy_qc_test**. This program dispenses 300 µl of solution to each well of the plate. It does not evacuate the solution.
5. When the program is finished, carefully remove the plate.

❖ If you are using one of Bio-Tek's keypad-based readers, such as the ELx800™ or ELx808™, ensure that the reader is **not** running in Rapid mode. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

6. 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.
7. Using the ***Dispense Precision Test Worksheet*** on page 166, perform data reduction:
   a. Calculate the **Standard Deviation**.

      Tip: If you have a spreadsheet program, enter/export all 96 values into a spreadsheet and apply your program's Standard Deviation function (e.g., Microsoft Excel's STDEV).

   b. Calculate the sum of the OD values for all 96 wells, then divide by **96** to determine the **Mean OD** for the plate.
   c. Calculate the **%CV**: (Standard Deviation / Mean OD) * 100.

      The %CV should be **<=4.0**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

8. When finished, prime with deionized water to flush out the dye solution.

Annual Procedure for All Valves

- Perform this test during the **annual OQ** only.
- The **routine** test for Valve A (see previous page) must pass before the **annual** test for Valves A-D 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. Place the bottles on a surface level with the washer, i.e., the adjacent (lab bench) area.

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

3. Run the Maintenance program **DAY_RINSE** two or three times to prime the fluid lines, manifold, and the valve being tested.

- ELx405 **standard** models (Single/96 manifold): See the note on the next page before performing step #4.

4. Edit the Dispense program **accuracy_qc_test** to use the Valve currently being tested (**DEFINE → EDIT → DISP → accuracy_qc_test**).
5. Place a clean, dry 96-well microplate on the balance and zero the balance.
6. Place the microplate on the carrier and run the Dispense program **accuracy_qc_test**. This 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 weight should be **28.8 grams, ± 10%** (between 25.92 g and 31.68 g).
   - If the weight falls outside this range, contact Bio-Tek.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- If the weight falls below this range, the fluid inlet filter could be clogged, or the valve may be contaminated with fungi or proteins. See ***Cleaning the Fluid Inlet Filter*** in ***Chapter 4***, ***Preventive Maintenance***, for recommendations on cleaning the filter. The valve should be cleaned using an appropriate enzyme, alcohol, or a diluted bleach solution, depending on the contaminant. See ***Removing Protein Residuals and Fungi Growth*** and ***Decontamination*** in ***Chapter 4*** for suggestions.

  After cleaning the fluid inlet filter or valve and tubing, retry the test. If the test continues to fail, contact Bio-Tek.

8. Record the results in the ***Dispense Precision Test Worksheet*** on page 166.

❖ For the ELx405™ standard model only, the accuracy_qc_test program is locked for editing; it can only be used to test Valve A. In order to test all four valves, you'll need to create a copy of this program. You will then edit the copy when performing step #4.

To copy the test program:

- Select **DEFINE → COPY → DISP**.
- When **accuracy_qc_test** appears, press the **Enter** key.
- When **NAME:** appears, use the keypad to enter an identifying name, such as ACC_QC_TEST.

  Tip: Press **Shift** + a **number key** to type a letter. When the cursor is positioned under a letter, via the ► (forward) or ◄ (reverse) arrows, press the **Options** key to advance through the alphabet.
- When finished entering the name, press the **Enter** key.
- When **OK TO COPY?** appears, select **YES**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Evacuation Efficiency Test (192)

- This test is designed for the **Dual/192** manifold. See page 150 if you're looking for the Evacuation Efficiency Test for Single/96 and Dual/96 manifolds.
- See page 148 for a list of required materials.

1. Fill a supply bottle with two liters of deionized water. Run the Maintenance program DAY_RINSE two or three times to prime the fluid lines and manifold.
2. Place a clean, dry 384-well microplate on the balance and zero the balance.
3. Pipette or dispense 80 µl of **Solution #1** 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 Worksheet*** on page 167, perform initial data reduction:
   a. Divide the Total Residual Weight by **384** to find the **Mean Residual Weight**.
   b. 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.

Troubleshoot as follows:

- If the test fails once: Failure of this test is most commonly caused by improper aspiration tube placement within the well, usually because a microplate other than the recommended Corning Costar® 384 was used.
  - If you prefer to use a plate *other than* the Corning Costar 384, modifying the ASPIRATE HEIGHT or HORIZONTAL ASPIRATE POSITION parameters in a copy of the **192resid_qc_test** program should correct this error. (192resid_qc_test is locked for editing, but you can copy the program and edit its parameters in the newly created copy.) See ***Chapter 3***, ***Operation***, for instructions on copying and editing programs and modifying the abovementioned parameters. After making this change, retry the test using a clean, dry microplate.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- If you *are* using the Corning Costar 384 microplate, run **AUTOCLEAN** (Ultrasonic Advantage™ models only), and/or remove the manifold and clean the aspiration tubes with the stylus (all models). See ***Chapter 4***, ***Preventive Maintenance*** for complete instructions. When finished, retry the test using a clean, dry microplate.

- If the test fails a second time: Perform the ***Supplemental Test*** below.

Supplemental Test

Conduct this test if the Standard Evacuation Efficiency Test (192) fails twice. This test will confirm which aspirate tube(s) may be clogged, or if the plate's alignment or position is the problem.

1. 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 80 µl of **Solution #1** into each well, on top of the residual solution.
3. Shake the plate to get uniform distribution of the remaining dye in each well.

> ❖ **Note:** If you are using one of Bio-Tek's keypad-based readers, such as the ELx800NB™, ensure that the reader is **not** running in **Rapid Mode**. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

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 Efficiency Test Worksheet*** on page 167, perform data reduction:
   a. Calculate the sum of the OD values for all 384 wells, then divide by **384** to determine the **Mean OD** for the plate.
   b. Divide the Mean OD by the **Mean Residual Weight** (from step 1) to find the **Residual Factor.**
   c. For each well, divide its 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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- If the problem appears to be related to particular wells, clean the associated aspiration tubes: run **AUTOCLEAN** (Ultrasonic Advantage™ models only), and/or remove the manifold and thoroughly clean the tubes with the stylus (all models). See ***Chapter 4***, ***Preventive Maintenance*** for complete instructions. When finished, retry the 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.

> ❖ **Please do not adjust** the carrier adjustment screws! Contact your Bio-Tek dealer if you suspect an alignment problem.

- For additional suggestions, refer to ***Appendix A***, ***Troubleshooting***.
- If the test continues to fail, contact Bio-Tek Instruments.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test (192)

- This test is designed for the **Dual/192** manifold. See page 153 if you're looking for the Dispense Precision Test for Single/96 and Dual/96 manifolds.
- See page 148 for a list of required materials.

Without Valve Module

1. Fill a supply bottle with two liters of deionized water. Run the Prime program **P_DAY_RINSE** two or three times to prime the fluid lines and manifold.
2. Fill a supply bottle with 1440 ml of **Solution #4**.
3. Run **P_DAY_RINSE** to prime the washer with the solution.
4. Place a clean, dry 384-well microplate on the washer and run the Dispense program **192accuracy_qc**. This program dispenses 80 µl of solution to each well of the plate. It does not evacuate the solution.
5. When the program is finished, carefully remove the plate.

- **Note:** If you are using one of Bio-Tek's keypad-based readers, such as the ELx800NB™, ensure that the reader is **not** running in **Rapid Mode**. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

6. 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.
7. Using the appropriate ***Dispense Precision Test Worksheet*** on page 168, perform data reduction:
   a. Calculate the **Standard Deviation**.

      Tip: If you have a spreadsheet software program, enter/export all 384 values into a spreadsheet and apply your program's Standard Deviation function (e.g., Microsoft Excel's STDEV).

   b. Calculate the sum of the OD values for all 384 wells, then divide by 384 to determine the **Mean OD** for the plate.
   c. Calculate the **%CV**: (Standard Deviation / Mean OD) * 100.

      The %CV should be **<= 4.0**.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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 absorbance readings (all models). When finished, re-prime the washer and retry the test.

8. When finished, prime with deionized water to flush out the dye solution.

With the Valve Module

Routine Procedure for Valve A

❖ Perform this test during the **initial/annual OQ**, and the **monthly PQ**.

1. Fill the supply bottle for **Valve A** with two liters of deionized water. Run the Maintenance program **DAY_RINSE** two or three times to prime the fluid lines and the manifold.
2. Fill the supply bottle for Valve A with 1440 ml of **Solution #4**.
3. Run **DAY_RINSE** to prime **Valve A** with the solution.
4. Place a clean, dry 384-well microplate on the washer and run the Dispense program **192accuracy_qc**. This program dispenses 80 µl of solution to each well of the plate. It does not evacuate the solution.
5. When the program is finished, carefully remove the plate.

❖ **Note:** If you are using one of Bio-Tek's keypad-based readers, such as the ELx800NB™, ensure that the reader is **not** running in **Rapid Mode**. To check the setting, select UTIL → READ and cycle through the options until READ IN RAPID MODE? appears. Set it to **NO**.

6. 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.
7. Using the ***Dispense Precision Test Worksheet*** on page 169, perform data reduction:
   a. Calculate the **Standard Deviation**.

      Tip: If you have a spreadsheet software program, enter/export all 384 values into a spreadsheet and apply your program's Standard Deviation function (e.g., Microsoft Excel's STDEV).

   b. Calculate the sum of the OD values for all 384 wells, then divide by **384** to determine the **Mean OD** for the plate.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

c. Calculate the **%CV:** (Standard Deviation / Mean OD) * 100.

The %CV should be **<= 4.0**.

8. 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 absorbance readings (all models). When finished, re-prime the washer and retry the test.
9. When finished, prime with deionized water to flush out the dye solution.

Annual Procedure for All Valves

- Perform this test during the **annual OQ** only.
- The **routine** test for Valve A must pass before the **annual** test for Valves A-D 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 for each valve:

3. Run the Maintenance program **DAY_RINSE** two or 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 clean, dry 384-well microplate on the balance and zero the balance.
6. Place the microplate on the washer and run the Dispense program **192accuracy_qc**. This 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 weight should be **30.72 grams, ± 10%** (between 27.65 g and 33.79 g).
   - If the weight falls outside this range, contact Bio-Tek.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- If the weight falls below this range, the fluid inlet filter could be clogged, or the valve may be contaminated with fungi or proteins. See ***Cleaning the Fluid Inlet Filter*** in ***Chapter 4***, ***Preventive Maintenance***, for recommendations on cleaning the filter. The valve should be cleaned using an appropriate enzyme, alcohol, or a diluted bleach solution, depending on the contaminant. See ***Removing Protein Residuals and Fungi Growth*** and ***Decontamination*** in ***Chapter 4*** for suggestions.

  After cleaning the fluid inlet filter or valve and tubing, retry the test. If the test continues to fail, contact Bio-Tek.

8. Record results in the ***Dispense Precision Test Worksheet*** on page 169.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Evacuation Efficiency Test Worksheet

for Single/96 and Dual/96 Manifolds

Washer Model:	❑ ELx405™	❑ Select CW
	❑ Magna	❑ HT2 (with Dual/96 manifold)
	❑ Select	❑ HTV2 (with Dual/96 manifold)
Serial Number:		

Standard Test	
Total Residual Weight:	g
Verification that wells are consistent in appearance:	❑ Pass ❑ Fail
Mean Residual Weight (Total Residual Weight ÷ 96):	g
Mean Residual Weight <= 0.005 g?	❑ Pass ❑ Fail

Supplemental Test (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	
Every Residual Weight per well <= 0.005 g?	❑ Pass ❑ Fail

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test Worksheet

for Single/96 and Dual/96 Manifolds

without the External Valve Module

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

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

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test Worksheet

for Single/96 and Dual/96 Manifolds
with the External Valve Module

Washer Model:	❑ ELx405™ ❑ Select CW ❑ Magna ❑ HTV2 (with Dual/96 manifold) ❑ Select
Serial Number:	

Calculations for Valve A	
Standard Deviation:	
Mean OD (Sum of all wells ÷ Number of wells):	
% CV (Standard Deviation ÷ Mean OD x 100):	
% CV <= 4.0?	❑ Pass ❑ Fail

Calculations for Valves A-D (Annual OQ only, check here ❑ if not performed)		
	Total Dispense Weight	**28.8 g ±10%? (25.92 g - 31.68 g)**
Valve A	grams	❑ Pass ❑ Fail
Valve B	grams	❑ Pass ❑ Fail
Valve C	grams	❑ Pass ❑ Fail
Valve D	grams	❑ Pass ❑ Fail

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Evacuation Efficiency Test Worksheet

for the Dual/192-Tube Manifold

Washer Model:	❑ HT ❑ HT2/HTV2 (with Dual/192 manifold)
Serial Number:	

Standard Test	
Total Residual Weight:	g
Verification that wells are consistent in appearance:	❑ Pass ❑ Fail
Mean Residual Weight (Total Residual Weight ÷ 384):	g
Mean Residual Weight <= 0.002 g?	❑ Pass ❑ Fail

Supplemental Test (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	
Every Residual Weight per well <= 0.002 g?	❑ Pass ❑ Fail

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test Worksheet

for the Dual/192 Manifold

without the External Valve Module

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

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

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Dispense Precision Test Worksheet

for the Dual/192 Manifold
with the External Valve Module

Washer Model:	❑ HT ❑ HTV2 (with Dual/192 manifold)
Serial Number:	

Calculations for Valve A	
Standard Deviation:	
Mean OD (Sum of all wells ÷ Number of wells):	
% CV (Standard Deviation ÷ Mean OD x 100):	
% CV <= 4.0?	❑ Pass ❑ Fail

Calculations for Valves A-D (Annual OQ only, check here ❑ if not performed)		
	Total Dispense Weight	**30.72 g ±10%? (27.65 g – 33.79 g)**
Valve A	grams	❑ Pass ❑ Fail
Valve B	grams	❑ Pass ❑ Fail
Valve C	grams	❑ Pass ❑ Fail
Valve D	grams	❑ Pass ❑ Fail

Date:	
Test Performed By:	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Errors, *Cont'd*

Code	Cause
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.
4500 INVALID_FEATURE_ERR	During PC control of the washer, the PC is trying to set or run an undefined feature.
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**.	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP