BioStack™

Operator's Manual

BioTek®

BioStack™ Microplate Stacker

Operator's Manual

For All Models

Notices

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998

Winooski, Vermont 05404-0998 USA

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Contacting BioTek Instruments, Inc.

BioTek® Instruments, Inc.

Highland Park, P.O. Box 998

Winooski, Vermont 05404-0998 USA

Customer Service and Sales

Internet: www.biotek.com

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

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

Fax: 802-655-7941

E-Mail: customercare@biotek.com

Service/TAC

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

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

Fax: 802-654-0638

E-Mail: tac@biotek.com

European Coordination Center/Authorized European Representative

BioTek® Instruments GmbH

Kocherwaldstrasse 34

D-74177 Bad Friedrichshall

Germany

Internet: www.biotek.de

Phone: +49 (0) 7136 9680

Fax: +49 (0) 7136 968 111

E-Mail: info@biotek.de

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.
DEFINE	Text in COURIER font represents menu options as they appear on the display of the MicroFill or MicroFlo Select Microplate Dispensers, ELx405 Microplate Washer, or EL406 Washer Dispenser during operation with the BioStack.
ⓘ	This icon calls attention to important information.

About This Manual

The intent of this Operator's Manual is to instruct the new user how to set up and operate BioTek's BioStack. To help you read and understand this manual, certain document conventions have been used.

Major topic headings start a new page (such as **Document Conventions**, above) to give you a visual and style clue that a new major subject is being introduced. One or more subheadings may appear below each major heading.

Revision History

Revision	Date	Changes
A	11/02	First Release.
B	05/03	• Added a Caution concerning the Waste Monitor Sensor Connector on the ELx405™, in the Cautions section of the Preface.
		• Updated TAC information in the Preface and Chapter 1, and Customer Service and European contact information, Safety Symbols, and Warranty in the Preface.
		• Updated Package Contents, Chapter 1, and Repackaging the Instrument, Chapter 2.
		• Clarified the compatibility of the ELx405 with the Bio-Stack™ by specifying the Washer's Auto Plate and Select models only in the Preface, Chapters 1 through 5, and Appendices C, D, and E.
		• Removed steps 10 and 11 regarding the aerosol cover in "ELx405 Aligning Plate Instructions," Appendix C.
		• Updated Appendix E with additional error code probable causes and new tables E-3, E-4, and E-5 for Bio-Stack motor numbers, sensor numbers, and interfacing instrument numbers referenced in Table E-2.
C	10/03	• Updated the Intended Use statement to distinguish between the European Union and all other jurisdictions.
D	06/04	• Re-formatted the manual in the new template and according to the format designated in TP01, Structure for Operator Manuals/User Guides.
		• Added references throughout manual about compatibility of the Bio-Stack™ with the ELx405™ HT and ELx405™ Select CW Microplate Washers.
		• Added new sections throughout manual about compatibility, installation, operation, alignment, etc., of the Precision™ XS Microplate Sample Processor and Precision™ Microplate Pipetting System with the Bio-Stack, controlled by Precision Power™ Software.
		• Revised the Technical Support section and added new sections on Depot Service Contracts and Applications Support. Enhanced Introduction, Installation, Operation, and Maintenance chapters of the manual.

Revision History, *Cont'd*

Revision	Date	Changes
E	06/05	• Added text to all sections of the manual about the Bio-Stack™ enhancements: new barcode scanner and USB port. Added new Appendix B, Barcode Scanner. • Restructured manual: moved instructions from previous Appendix B, Serial Cable Connections and Appendix C, Mounting the Aligning Plates and Posts into Chapter 3, Installation. • Applied current product name configuration for ELx405™ standard model: changed "Auto" to "ELx405." • Simplified/clarified IQ and OQ sections in Chapter 5, Qualification Tests. • Enhanced Chapter 7, Troubleshooting and Error Codes with KC4™ error codes for Bio-Stack operation with readers, and Bio-Stack barcode scanner error codes.
F	05/06	• Added Gen5™ references and instructions wherever KC4 references or instructions were present. • Updated safety information and removed Warranty, Registration Card, and Registration Online sections in Preface. • Added laser beam warning to the Preface and to Appendix B, Bio-Stack Barcode Scanner.
G	07/06	• Added references to the Synergy™ 2 throughout the manual, and artwork and instructions for installation/alignment of the reader with the Bio-Stack™.
H	12/06	• Added references to the NanoQuot™ Microplate Dispenser throughout the manual, instructions/ artwork for installation, operation, and qualification of the NanoQuot (Chapters 3, 4, & 5), and troubleshooting/error codes information for the NanoQuot (Chapter 7). • Added the Bio-Stack Barcode Scanner Test as an optional IQ and OQ test (for the readers and Precision instruments) in Chapter 5, and added instructions for performing the Scanner Test in Appendix B.

Revision History, *Cont'd*

Revision	Date	Changes
I	06/07	• Added references to the Synergy™ 4 throughout the manual. • Updated Chapter 7, Troubleshooting and Error Codes, with several new error codes. • Incorporated manual update revision H1 as Appendix C, Reconfiguration of the Bio-Stack. • Added Appendix D, Required Software Versions.
J	08/07	• Added references to the Liquid Handling Control™ (LHC) Software throughout the manual, and instructions for installation/operation of the software for PC control of the Bio-Stack and ELx405.
K	10/07	• Added references to BioTek's new MicroFlo™ Select Microplate Dispenser throughout the manual. Added instructions for installation/operation of the MicroFlo with the Bio-Stack, via instrument control (using the MicroFlo keypad) and PC control (using the LHC Software).
L	03/08	• Added references to BioTek's new PowerWave™ XS2 Reader throughout the manual. Added instructions for installation/operation of the PowerWave XS2 with the Bio-Stack. • Updated the product name of the "µFill" Dispenser to "MicroFill" Dispenser.
M	06/08	• Changed "Bio-Stack" to "BioStack." • Added references to BioTek's new fixed wrist model (PN BIOSTACK2) and rotational wrist model (PN BIOSTACK2WR). Added instructions for installation/ operation of the new models with interfacing instruments.
N	10/08	• Added references to/information about BioTek's new EL406 Microplate Washer Dispenser. Added instructions for installation and operation of the BioStack with the EL406, in Chapters 3 and 4. Changed "Alignment Kit" to "Integration Kit" throughout the manual. Added more information about installation of two BioStacks with two interfacing instruments (ELx405, MicroFlo Select, EL406).
O	12/08	• Added references to the new Synergy Mx Reader and installation/operation instructions for the BioStack with the new Reader. Removed references to obsolete BioStack PN BIOSTACK.

Revision History, *Cont'd*

Revision	Date	Changes
P	04/09	• Added information regarding instrument control of the EL406 and installation/operation instructions for controlling the BioStack and EL406 using the Washer Dispenser's keypad. Also added more information about how the BioStack barcode scanner works in Appendix B. Added instructions or notes throughout the manual instructing the user to turn the BioStack on before the interfacing instrument, and to manually raise the BioStack's claw/gripper above the interfacing instrument's plate carrier or supply station (Precision) before turning the BioStack on.

Intended Use Statement

- The BioStack Microplate Stacker is an automated microplate stacking system that is designed to systematically transfer a stack of microplates to and from BioTek laboratory instruments wherever washing, dispensing, pipetting, or reading of multiple microplates is performed.

- The BioStack is available in the fixed wrist model (PN BIOSTACK2) and rotational wrist model (PN BIOSTACK2WR).

- The BioStack can be **computer-controlled**

  ➢ via BioTek's BioStack PC Control Software, when used with BioTek's PowerWave/PowerWave XS/PowerWave XS2 Microplate Spectrophotometers or Synergy HT/Synergy 2/Synergy 4/ Synergy Mx Multi-Detection Microplate Readers,

  ➢ via BioTek's Precision Power Software when used with BioTek's Precision XS Microplate Sample Processor or Precision Microplate Pipetting System, or

  ➢ via BioTek's Liquid Handling Control (LHC) Software, when used with BioTek's ELx405 Microplate Washer, MicroFlo Select Microplate Dispenser, or EL406 Microplate Washer Dispenser.

- The BioStack can be **instrument-controlled** by BioTek's MicroFill, NanoQuot, and MicroFlo Select Microplate Dispensers, ELx405 Washer, and EL406 Washer Dispenser.

- The intended use of this instrument is dependent on the instrument's labeling. If there is an **IVD label**, then the instrument may be used for clinical, research and development, or other nonclinical purposes. If there is no such label, then the instrument may **only** be used for research and development, or for other nonclinical purposes.

  ❖ **ELx405 Washer:** The BioStack with the ELx405 may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the ELx405.

    All ELx405 models *except* the Magna support the BioStack.

  ❖ **MicroFlo Select Dispenser:** The BioStack with the MicroFlo Select may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the MicroFlo Select.

  ❖ **EL406 Washer Dispenser:** The BioStack with the EL406 may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the EL406.

Quality Control

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

Warranty & Product Registration

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

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

Repackaging and Shipping

> **Important!** If you need to ship the instrument to BioTek for service or repair, contact BioTek 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 BioTek for replacement packing.

Warnings

Operate the BioStack 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 instrument. However, the operator should be aware of certain situations that could result in serious injury; these vary depending on the instrument type. See **Hazards** and **Precautions**.

Hazards and Precautions

Hazards

The following hazards are provided to help avoid injury:

Warning! Power Rating. The BioStack's power supply 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 external power supply. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the system power cord directly to an appropriate receptacle with a functional ground.

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

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

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

Warning! Laser Beam (Barcode Scanner). Serious eye injury may occur if you stare directly into the laser beam of the BioStack's barcode scanner during operation of the scanner. This hazard is noted by the warning label attached to the scanner's cover and shown in the *Safety Symbols* section of this *Preface*. Do not look directly into the laser beam during operation of the scanner.

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

Warning! Pinch Hazard. The following areas on the BioStack are marked with the symbol shown below: the **claw mechanism** on the fixed wrist model (PN BIOSTACK2), and the **wrist** on the rotational wrist model (PN BIOSTACK2WR).

Warning! Pinch Hazard. Keep hands/fingers clear of these areas when the instrument is operating. **Do not** pick up the instrument or touch the stacks or the plates within the stacks during operation of the BioStack!
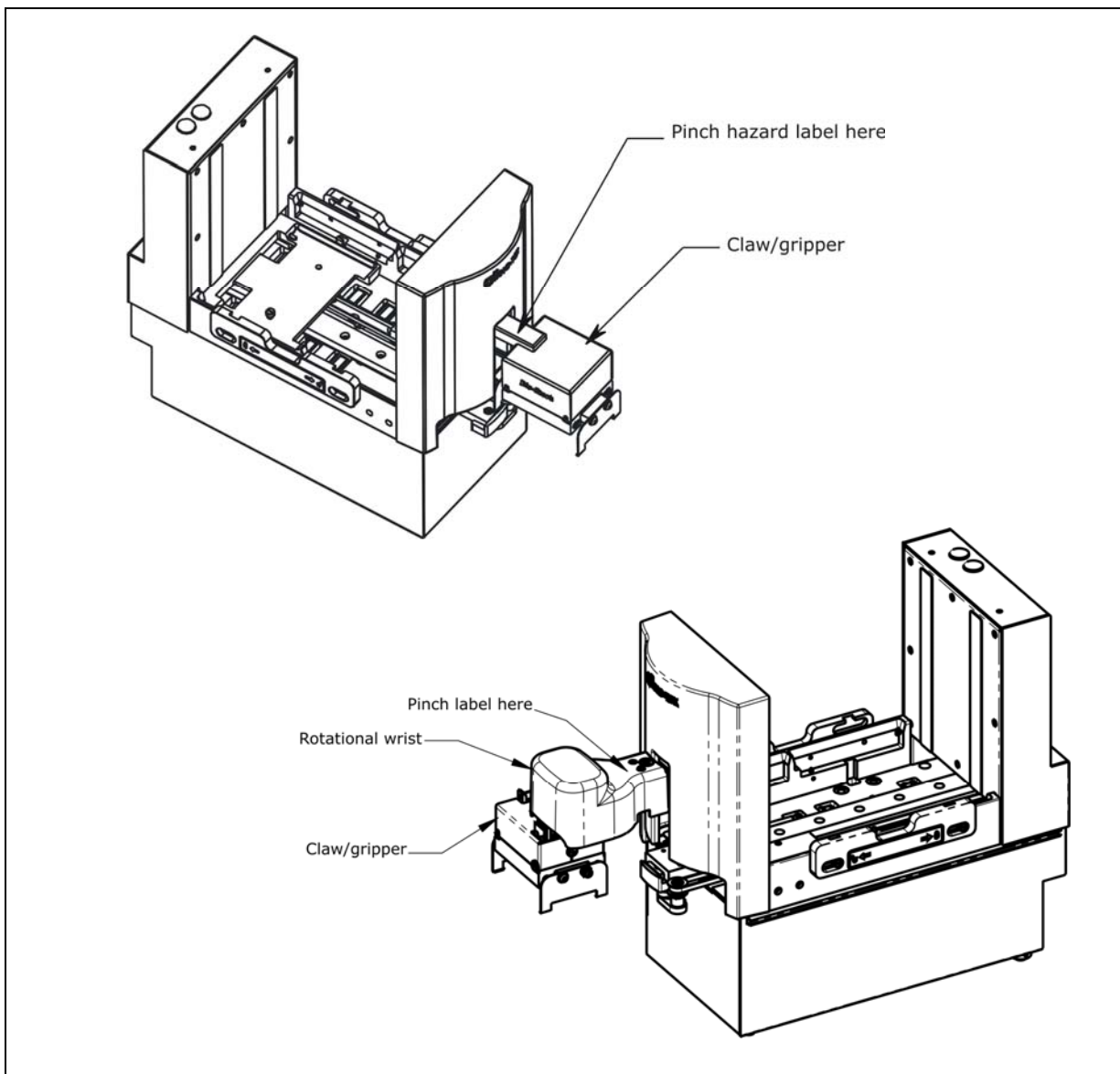
Precautions

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

Caution: Service. The BioStack should be serviced by BioTek authorized service personnel. 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 within the range listed in the *Specifications* section in *Chapter 1*. Performance may be adversely affected if temperatures fluctuate above or below this range. Storage temperature limits are broader.

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

Caution: Shipping Hardware. **All BioStack models:** The BioStack's shipping panel, shipping block, and carrier shipping screw must be removed prior to operating the Stacker, and reinstalled before repackaging the instrument for shipment. **BioStack rotational wrist model (PN BIOSTACK2WR):** In addition to the shipping hardware listed above, the BioStack rotational wrist model is also shipped with a claw assembly shipping screw and wrist shipping bracket that must be removed before operation of the Stacker, and reinstalled before shipment. See *Chapter 3*, *Installation*, for instructions for removing and reinstalling the shipping hardware.

Caution: Aligning Posts. When installing the BioStack's four aligning posts, use caution not to cross thread these parts. **Finger-tighten only!** See *Chapter 3*, *Installation*.

Caution: BioStack Barcode Scanner Mirror. Be very careful not to scratch or damage the mirror when unpacking or installing the barcode scanner!

Caution: Warranty. Failure to follow preventive maintenance protocols may **void the warranty**. See *Chapter 6*, *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)" or local ordinances.

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

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

Caution: Waste Sensor Port on ELx405. (For all customers who have purchased the BioStack Microplate Stacker for use with the ELx405 Microplate Washer.) Although the port on the back of all ELx405 Washers for the waste sensor is the same type as the 24-VDC power connector on the back of the BioStack, if an external 24-VDC power supply is plugged into this waste sensor port, **it will permanently damage components** on the PCB inside the ELx405.

> **(i)** **Important! DO NOT** plug the external 24-VDC power supply that came with your BioStack into the waste sensor port on the ELx405!
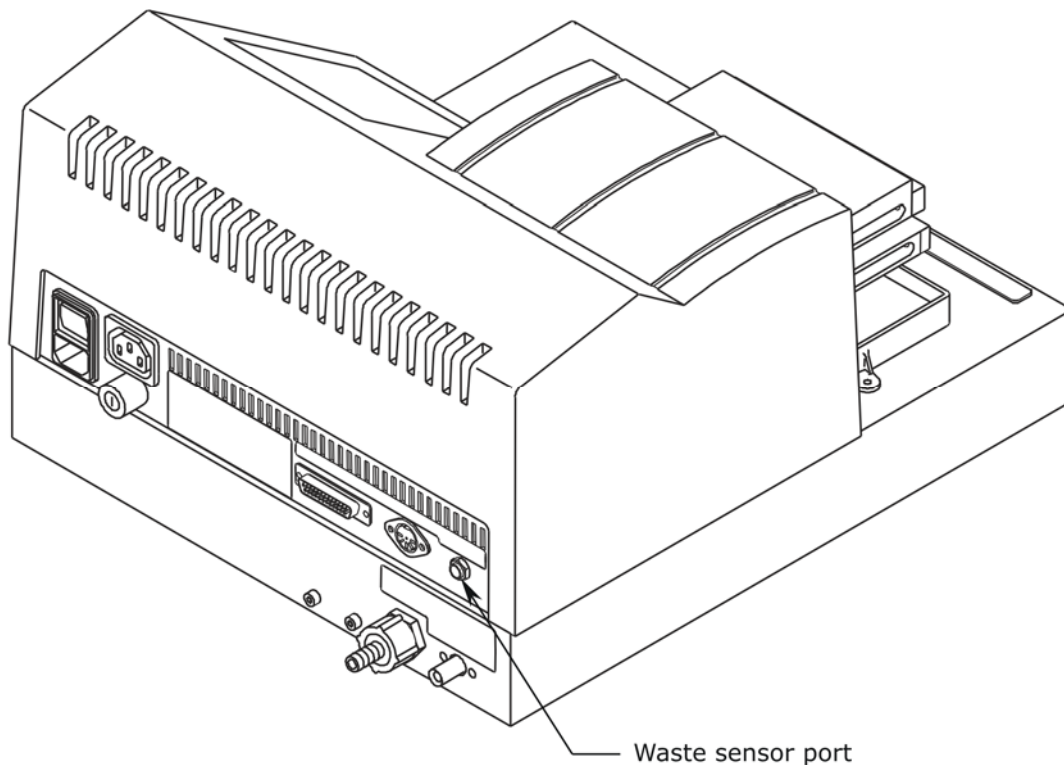
Waste sensor port

Caution: Waste Sensor Port on EL406. (For all customers who have purchased the BioStack Microplate Stacker for use with the EL406 Microplate Washer Dispenser.) Although the port on the back of all EL406 Washer Dispensers for the waste sensor is the same type as the 24-VDC power connector on the back of the BioStack, if an external 24-VDC power supply is plugged into this waste sensor port, **it will permanently damage components** on the PCB inside the EL406.

Important! DO NOT plug the external 24-VDC power supply that came with your BioStack into the waste sensor port on the EL406!

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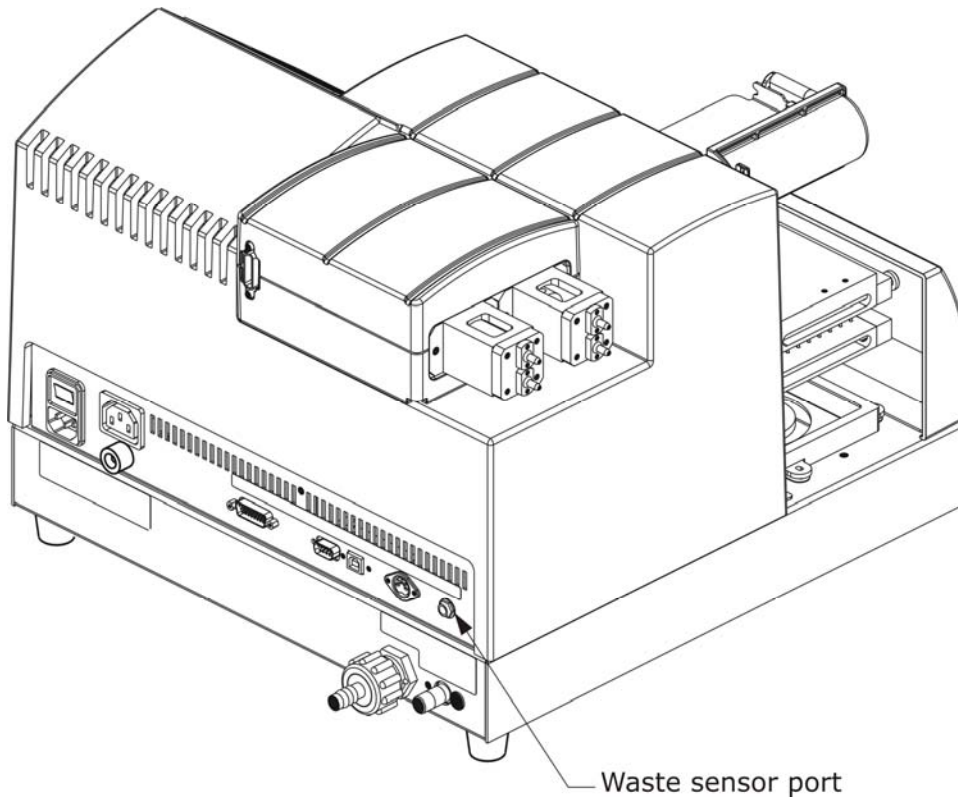
CE **Based on the testing described below and information contained herein, this instrument bears the CE mark.**

❖ **Note:** Refer to the Declaration of Conformity for specific details.

Directive 2004/108/EC: Electromagnetic Compatibility

Emissions - CLASS A

The system has been type tested by an independent, accredited testing laboratory and found to meet the requirements of EN 61326-1 and EN 61326-2-6: Class A for Radiated Emissions and Line Conducted Emissions.

Verification of compliance was conducted to the limits and methods of EN 55011 – (CISPR11) Class A. In a domestic environment it may cause radio interference, in which case you may need to mitigate the interference.

Immunity

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

EN 61000-4-2 Electrostatic Discharge

EN 61000-4-3 Radiated EM Fields

EN 61000-4-4 Electrical Fast Transient/Burst

EN 61000-4-5 Surge Immunity

EN 61000-4-6 Conducted Disturbances from RFI

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

Directive 73/23/EEC Low Voltage (Safety)

The system has been type tested by an independent, accredited testing laboratory and was found to meet the requirements of EC Directive 73/23/EEC for Low Voltage. Verification of compliance was conducted to the limits and methods of the following:

EN 61010-1 (2001) 2nd Edition. "Safety requirement for electrical equipment for measurement, control and laboratory use. Part 1, General requirements."

EN 61010-2-81 (2003). "Requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes."

EN 61010-101 (2002). "Particular requirements for in vitro diagnostic (IVD) medical equipment."

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)" or local ordinances.

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

- Product registration with competent authorities.

- Traceability to the U.S. National Institute of Standards and Technology (NIST):

Specific data for a particular serial number is available on request from BioTek Instruments. See page xvi for contact information.

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:

North America

- **Underwriters Laboratories UL 61010-1:2005**

  "Electrical Equipment for Laboratory Use; Part 1: General Requirements."

- **Canadian Standards Association CAN/CSA C22.2 No. 61010-1:2004**

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

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)

Warning, risk of electric shock
Attention, risque de choc électrique
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

Laser radiation: Do not stare into beam
Rayonnement laser: Ne pas regarder dans le faisceau
Laserstrahlung: Nicht in den strahl blicken
Radiación de láser: No mire fijamente al rayo
Radiazione di laser: Non stare nel fascio

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

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

IVD

***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

Chapter 1

Introduction

This chapter introduces the BioStack™ and describes its models, hardware and software features, and technical specifications. Instructions on how to contact BioTek for *Product Support & Service* are included on page 21.

Introducing the BioStack

Compact, fast, and easy to use, the BioStack Microplate Stacker can efficiently and repeatedly transfer a stack of microplates to a wide variety of BioTek instruments. The BioStack's seamless operation and rugged construction guarantee walk-away automation wherever washing, dispensing, pipetting, and/or reading of multiple microplates is performed.

Features include:

- Two easily removable, interchangeable stacks (one input and one output)
- Optional automatic re-stacking of plates in original order
- Delivery or retrieval of a microplate in less than 8 seconds
- Flexibility to be PC-controlled or instrument-controlled
- Universal design for operation with BioTek's
  - ➢ PowerWave/PowerWave XS/PowerWave XS2 Microplate Spectrophotometers
  - ➢ Synergy HT/Synergy 2/Synergy 4/Synergy Mx Multi-Detection Microplate Readers
  - ➢ Precision Microplate Pipetting System
  - ➢ Precision XS Microplate Sample Processor
  - ➢ MicroFill , NanoQuot , and MicroFlo Select Microplate Dispensers
  - ➢ ELx405 Microplate Washer
  - ➢ EL406 Microplate Washer Dispenser
- Cams actuated by stepper motors for quiet and reliable operation
- Onboard diagnostics
- Durable precision-ground aluminum base
- Sensors to ensure completion of each plate movement
- Gripper spring pre-loaded to maintain grip on plate in event of power loss
- Rack and pinion drive for synchronous movement
- Microplate addressed from below for reliable transport
- Linear mechanisms built around proven BioTek technology
- Extremely small footprint that saves bench space
- Accommodation of SBS compliant standard-height microplates as well as low-profile microplates
- Optional barcode scanner
- A rotational wrist (in model PN BIOSTACK2WR) that allows access to microplate instrument carriers with both landscape and portrait orientations.

  ❖ **SBS** = Society for Biomolecular Screening.
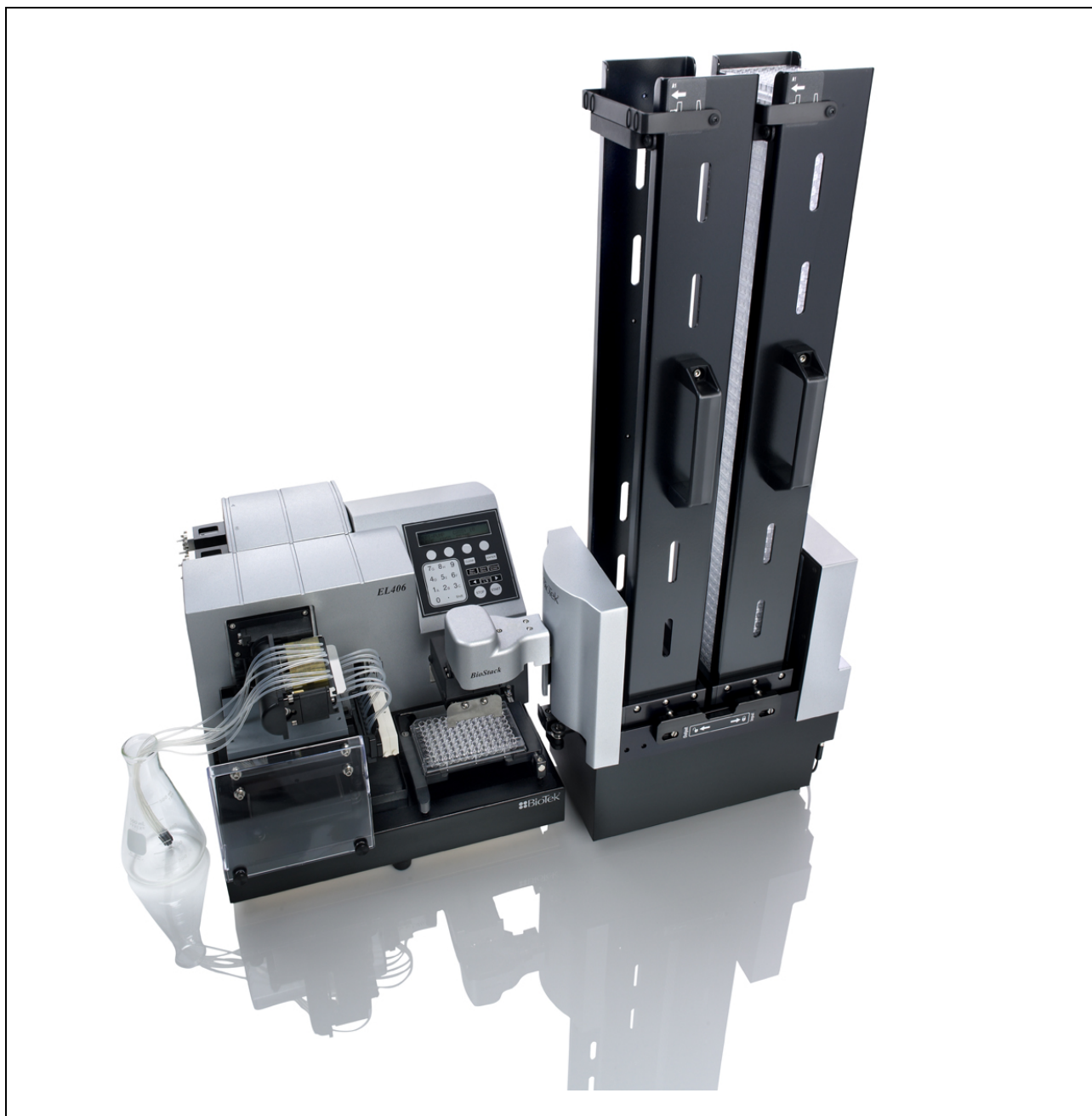
Figure 1: BioTek's EL406 and BioStack

❖ The BioStack rotational wrist model (PN BIOSTACK2WR) with the 50-plate stacks is shown.

BioStack Models

The BioStack Microplate Stacker is available in the following models:

Model	Features
Fixed Wrist: PN BIOSTACK2	 • Standard model. • Compatible with 30-plate and 50-plate microplate stacks. • Basecode PN 7310209 onboard.
Rotational wrist: PN BIOSTACK2WR	• Equivalent of standard model, but with an additional rotational wrist that allows access to microplate instrument carriers with both landscape and portrait orientations. • Includes a user-accessible selection switch for controlling the azimuth of the grip mechanism from 0° to 90°. • Compatible with 30-plate and 50-plate stacks. • Basecode PN 7310209 onboard.

PC Control of the BioStack

BioStack with the PowerWave or Synergy Readers

In this configuration, BioTek's **BioStack PC Control Software** and **Gen5** or **KC4 Software** are installed on a host computer equipped with at least two communication ports.

The BioStack PC Control Software uses

- one serial port to control the PowerWave/PowerWave XS, or one serial or USB port to control the PowerWave XS2 or Synergy HT/Synergy 2/ Synergy 4/Synergy Mx (with the help of Gen5 or KC4 running in the background), and

- another communication port (serial or USB) to control the BioStack.

❖ In the configuration described above, the BioStack PC Control Software uses **Gen5 only** to control the **PowerWave XS2**, **Synergy 2**, **Synergy 4**, and **Synergy Mx** readers. KC4 software does not support these four readers.

❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with all readers in the software configurations described above, however, the rotational wrist angle must be set at the **0°** interface position for operation with the readers. Refer to the section **Configure the Rotational Wrist Model for the Interfacing Instrument** in **Chapter 3** for more information.

❖ Some Synergy HT readers may need to be upgraded with a BioStack compatible carrier. See **Upgrade Information** on page 16 for more information.

❖ Refer to **Appendix D**, **Required Software Versions**, for information on required software versions for the BioStack and readers, or contact BioTek Instruments.

BioStack™ with the Precision/XS

In this configuration, BioTek's **BioStack PC Control Software** and **Precision Power Software** are installed on a host computer equipped with at least two communication ports.

Precision Power software uses

- one serial port to control all functions of the Precision Microplate Pipetting System/Precision XS, and

- another communication port (serial or USB) and a component of the BioStack PC Control Software to control all functionality of the BioStack.

❖ Precision Power also allows you to operate **two BioStacks** with **one Precision instrument** that is BioStack compatible. In this configuration, you will need a computer equipped with three communication ports. You will also need one Precision Integration Kit, PN 7110004 (listed on page 15), and a second set of the BioStack aligning posts (PN 7110542) and BioStack aligning plate (PN 7112140). You will need to perform the installation steps in the appropriate section of *Chapter 3* for each BioStack/Precision configuration.

❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with the Precision/XS in the software configurations described above, however, the rotational wrist angle must be set at the **0°** interface position for operation with the Precision/XS. Refer to the section *Configure the Rotational Wrist Model for the Interfacing Instrument* in *Chapter 3* for more information.

❖ Precision XS instruments do not need to be upgraded for operation with the BioStack, however, some Precision Microplate Pipetting Systems may need an upgrade. Refer to *Upgrade Information* on page 16 for more information.

❖ Refer to *Appendix D*, *Required Software Versions*, for information on required software versions for the BioStack and Precision instruments, or contact BioTek Instruments.

BioStack with the ELx405

> ❖ The BioStack with the ELx405 may be either computer controlled using the Liquid Handling Control (LHC) Software, or instrument controlled using the keypad on the ELx405. (See *Instrument Control of the BioStack* on page 10.)

In this configuration, BioTek's **Liquid Handling Control (LHC) Software**, **ELx405 Interface Software**, and **BioStack PC Control Software** are installed on a host computer equipped with at least two communication ports (one serial port and a second serial or USB port).

LHC Software uses

- one serial port and the **ELx405 Interface Software** to control all functions of the ELx405, and

- another communication port (serial or USB) and a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

> ❖ The LHC Software also allows you to operate **two BioStacks** simultaneously with **two ELx405 washers**. In this configuration, you will need a computer equipped with at least four communication ports and two washers that are BioStack and LHC compatible. You will also need one ELx405 Integration Kit, PN 7310010 (listed on page 15), for each BioStack. You will need to perform the installation steps in the appropriate section of *Chapter 3* for each BioStack/ELx405 configuration.
>
> ❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with the MicroFill and ELx405 in the software configurations described above, however the rotational wrist angle must be set at the **0°** interface position for operation with the MicroFill.
>
> The wrist angle may be set at the default **90°** interface position or at the **0°** interface position for operation with the ELx405. Refer to the section *Configure the Rotational Wrist Model for the Interfacing Instrument* in *Chapter 3* for more information.
>
> ❖ The ELx405 does not support the **BioStack barcode scanner**, and the **Magna** model of the ELx405 washer is not compatible with the BioStack.
>
> ❖ Some ELx405 washers may need to be upgraded to support the BioStack. For example, if the ELx405 is not equipped with the robot compatible microplate carrier, you will need to upgrade the washer. Refer to *Upgrade Information* on page 16, or contact BioTek for more information.
>
> ❖ Refer to *Appendix D*, *Required Software Versions*, for information on required software versions for the BioStack and ELx405 using LHC, or contact BioTek Instruments.

BioStack with the MicroFlo Select

❖ The BioStack with the MicroFlo Select Microplate Dispenser may be either computer controlled using the Liquid Handling Control (LHC) Software, or instrument controlled using the keypad on the MicroFlo Select. (See *Instrument Control of the BioStack* on page 10.)

In this configuration, BioTek's **Liquid Handling Control (LHC) Software**, **MicroFlo Select Interface Software**, and **BioStack PC Control Software** are installed on a host computer equipped with at least two communication ports (one USB port and a second USB or serial port)**.**

LHC Software uses

- one communication port (serial or USB) and the **MicroFlo Select Interface Software** to control all functions of the MicroFlo Select, and

- another communication port (serial or USB) and a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

❖ The LHC Software also allows you to operate **two BioStacks** simultaneously with **two MicroFlo Select Dispensers**. In this configuration, you will need a computer equipped with at least four communication ports (serial and/or USB). You will also need one MicroFlo Select Integration Kit, PN 7310020 (listed on page 15), for each BioStack. You will need to perform the installation steps in the appropriate section of *Chapter 3* for each BioStack/MicroFlo configuration.

❖ The MicroFlo Select does not support the **BioStack barcode scanner**.

❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with the MicroFlo Select in the software configurations described above. The rotational wrist angle may be set at the default **90°** interface position or at the **0°** interface position for operation with the MicroFlo. Refer to the section *Configure the Rotational Wrist Model for the Interfacing Instrument* in *Chapter 3* for more information.

❖ The MicroFlo Select basecode software may need to be upgraded for operation of the Dispenser with the fixed wrist or rotational wrist models. Refer to *Upgrade Information* on page 16, or contact BioTek for more information.

❖ Refer to *Appendix D*, *Required Software Versions*, for information on required software versions for the BioStack and MicroFlo Select using LHC, or contact BioTek Instruments.

BioStack with the EL406

❖ The BioStack with the EL406 Washer Dispenser may be either computer controlled using the Liquid Handling Control (LHC) Software, or instrument controlled using the keypad on the EL406. (See *Instrument Control of the BioStack* on page 10.)

In this configuration, BioTek's **Liquid Handling Control™ (LHC) Software**, **EL406 Interface Software**, and **BioStack™ PC Control Software** are installed on a host computer equipped with at least two communication ports (one USB or serial port and a second USB or serial port)**.**

LHC Software uses

- one communication port (serial or USB) and the **EL406 Interface Software** to control all functions of the EL406, and

- another communication port (serial or USB) and a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

❖ The LHC Software also allows you to operate **two BioStacks** simultaneously with **two EL406 washer dispensers**. In this configuration, you will need a computer equipped with at least four communication ports (serial and/or USB) and one EL406 Integration Kit PN 7310027, (listed on page 15), for each BioStack. You will need to perform the installation steps in the appropriate section of *Chapter 3* for each BioStack/EL406 configuration.

❖ The EL406 does not support the **BioStack barcode scanner**.

❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with the EL406 in the software configurations described above. The rotational wrist angle may be set at the default **90°** interface position or at the **0°** interface position for operation with the EL406. Refer to the section *Configure the Rotational Wrist Model for the Interfacing Instrument* in *Chapter 3* for more information.

❖ Refer to *Appendix D*, *Required Software Versions*, for information on required software versions for the BioStack and EL406 using LHC, or contact BioTek Instruments.

Instrument Control of the BioStack

BioStack with the MicroFill, NanoQuot, ELx405, MicroFlo Select, or EL406

In this configuration, the BioStack is controlled serially by the MicroFill, NanoQuot, MicroFlo Select, ELx405, or EL406. A serial cable must be used with the MicroFill, NanoQuot, and ELx405, which do not currently support the USB cable. A serial cable must also be used for instrument control of the BioStack by the MicroFlo and EL406. The MicroFLo and EL406 USB cable connections are only intended for use with PC control.

❖ Some MicroFill and ELx405 instruments may need to be upgraded to be BioStack compatible. The MicroFlo Select basecode software may need to be upgraded for compatibility with the BioStack fixed wrist (PN BIOSTACK2) or rotational wrist (BIOSTACK2WR) models. Refer to ***Upgrade Information*** on page 16 or contact BioTek for more information.

❖ The **fixed wrist model** (PN BIOSTACK2) and **rotational wrist model** (PN BIOSTACK2WR) are compatible with the MicroFill, NanoQuot, ELx405, MicroFlo Select, and EL406 configurations described above, however, the rotational wrist angle must be set at the **0°** interface position, for operation with the MicroFill and NanoQuot.

The rotational wrist angle may be set at the default **90°** interface position or at the **0°** interface position for operation with the ELx405, MicroFlo, or EL406. Refer to the section ***Configure the Rotational Wrist Model for the Interfacing Instrument*** in ***Chapter 3*** for more information.

❖ The Magna model of the ELx405 washer is not compatible with the BioStack.

❖ The MicroFill, NanoQuot, ELx405, MicroFlo Select, and EL406 do not support the **BioStack barcode scanner**.

❖ During installation of the BioStack with the NanoQuot, the BioStack must be *temporarily* connected to a host computer that has version 2.00.4 or greater of the BioStack™ PC Control Software installed. The PC Software is used to align the BioStack's claw/gripper with the Dispenser's plate carrier, and to obtain software versions for the BioStack.

❖ Refer to ***Appendix D***, ***Required Software Versions***, for information on required software versions for the BioStack and MicroFill, NanoQuot, ELx405, MicroFlo Select, and EL406, or contact BioTek Instruments.

Hardware Features

- Microprocessor-driven device with adequate memory for performing all functions

- Two removable, interchangeable upright microplate stacks (one input and one output) that can accommodate a variety of microplate types, including 96-, 384-, and 1536-well plates:

  ➢ 30-plate stacks

  ➢ 50-plate stacks

- A carrier to transfer plates one at a time from the input stack (holds incoming plates) and to the output stack (holds processed plates)

- A claw/gripper mechanism for securely lowering plates to, and lifting them from, the plate carrier and the interfacing instrument

- A rotational wrist (model PN BIOSTACK2WR) for access to microplate instrument carriers with both landscape and portrait orientations

- Two stack lifters to lift and lower the stack of plates within the input and output stacks

- Two stack locks to secure the stacks during operation of the instrument

- Two dogs in each stack to hold a set of plates within the stack and to lower a single plate down to the carrier

- Compatible with 100 to 240 V~ ± 10% @ 50-60 Hz; an external 24-VDC power supply is supplied

- (Optional) barcode scanner

Software Features

Functionality of the BioStack is controlled by the **BioStack's basecode software**, as well as by **serial messages** transmitted either from the

> ➢ BioStack PC Control Software, Precision Power Software, or LHC Software during PC control of the BioStack, or from the

> ➢ basecode software of the MicroFill, NanoQuot, MicroFlo Select, the ELx405, or EL406 during instrument control of the BioStack.

- **The BioStack PC Control Software** is an efficient design that works with BioTek's **Gen5** or **KC4 Software** to send serial commands for the transfer of plates to and from the BioStack and the PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4/Synergy Mx Readers.

  > ➢ The operator may initially run Gen5 or KC4 as a stand-alone application to create Gen5 protocols and experiments or KC4 protocols, and later to review plate results or manually export the results. During actual processing of the plates, the BioStack PC Control Software automatically runs Gen5 or KC4 in the "background" to send serial commands to the reader, while sending its own set of serial commands to the BioStack to control plate transfers.

  > ❖ Gen5 experiments may also be created from within the BioStack PC Control Software. **Note:** Gen5 software must be used with the PowerWave XS2, Synergy 2, Synergy 4, and Synergy Mx readers (KC4 does not support these three readers).

- **The BioStack PC Control Software** is also used with the NanoQuot, for aligning the BioStack-to-instrument interface height, verifying the alignment, and obtaining software versions for the BioStack PC Control Software and for the BioStack basecode software.

- **Precision Power Software** controls all functions of the Precision/XS, and uses a component of the BioStack PC Control Software to control all functionality of the BioStack.

  > ➢ For high-throughput fluid-transfer programs, up to **two BioStacks** may be used with the Precision instruments.

- **Liquid Handling Control (LHC) Software** uses

  > ➢ the **ELx405 Interface Software** to control all functions of the ELx405, and a component of the **BioStack PC Control Software** to control all functionality of the BioStack; or

  > ➢ the **MicroFlo Select Interface Software** to control all functions of the MicroFlo Select, and a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

  > ➢ The **EL406 Interface Software** to control all functions of the EL406, and a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

- The **basecode software** on the **MicroFill**, **ELx405** (ELx405, Select, HT, and Select CW models), and EL406 has been modified so their normal operating displays now accommodate instructing the operator to place plates on the BioStack, and identifying how many plates have been processed. The **basecode software** on the **NanoQuot** and **MicroFlo Select** includes a **BioStack** mode for running, re-stacking plates, and homing the BioStack.

- The **NanoQuot PC Control Software** must be installed on a host computer to obtain software versions for the NanoQuot PC Control Software and for the NanoQuot basecode software.

- **Additional software features** include:
  - ➢ A utility for aligning the BioStack-to-instrument interface height (MicroFill, MicroFlo Select, ELx405, and EL406)
  - ➢ The ability to home both instruments
  - ➢ The ability to continue processing a stack of plates, following the aborting/failure of one plate (MicroFill and ELx405)

    > ➢ **Note:** The EL406 returns to the Main Menu after an abort. Restarting the program will run the remainder of the plates.

  - ➢ The ability to pause processing to add more plates to the input stack or to remove some from the output stack (MicroFill, ELx405, and EL406)

Package Contents

- BioStack Microplate Stacker (PNs BIOSTACK2 or BIOSTACK2WR)
- 24 VDC power supply, 48 watts minimum (PN 61062)
- Plate Stacking Pedestal (PN 7312083)
- Grease kit (PN 7110017)
- Unpacking (PN 7311003) and packing (PN 7311002) instructions
- Operator's Manual (PN 7311000) on CD (PN 7311033)
- Set of shipping materials (PN 7313002 for BioStack; PN 7313001 for stacks)
- Shipping document (PN 94075) that includes a Warranty Statement and Certificate of Compliance and Calibration
- Declaration of Conformity (PN 7311001)

> ❖ Microplate stacks are optional accessories (see the next page).
> ❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.

Optional Accessories

- Set of two microplate stacks:
    - ➢ 30-plate stacks, PN 7310008S
    - ➢ 50-plate stacks, PN 7310539
- Instrument Qualification package (PN 7310530)
- BioStack Service Manual (PN 7311018)
- Barcode scanner and installation kit (PN 7310017) for scanner-compatible BioStack units

    > ❖ The BioStack barcode scanner is compatible only with BioStack instruments that include the necessary hardware and basecode software version. Contact BioTek to determine if your BioStack supports the barcode scanner. **Note:** The BioStack rotational wrist model does not support the barcode scanner with the wrist angle set at the 90° interface position.

- Instrument Integration Kits (PN's listed in the chart on the following page) for the interfacing instruments, that may consist of the following:
    - ➢ **2 aligning plates** (1 for the BioStack (PN 7312052), and 1 for the interfacing instrument), to prevent the instrument from sliding around and becoming misaligned with the BioStack
    - ➢ **2 aligning caps** for elevating the interfacing instrument to the correct height and for positioning in the alignment plate (not necessary for the MicroFill or NanoQuot)
    - ➢ **4 aligning posts** ("feet") for elevating the BioStack to the correct height and for positioning in the alignment plate
    - ➢ **Other hardware:** Left and right roller extensions (PN's 7110544 and 7110556) to extend the supply platform on the Precision instruments
    - ➢ **BioStack PC Control Software** (PN 7310204) (not included for the MicroFill)
    - ➢ **2 RS-232 serial cables:** 9-pin to 9-pin (PN 75034 or 75110), 9-pin to 25-pin (PN 75053 or 75111), and/or 25-pin to 25-pin (PN 75106)
    - ➢ **1 USB cable** (PN 75108) and **driver software** (PN 7090204) (not included for the MicroFill or NanoQuot)

    > ❖ Some instruments may need to be **upgraded** before their Integration Kit hardware and software can be installed. Refer to the ***Upgrade Information*** section on page 16 or contact BioTek.

Instrument Integration Kits

This Integration Kit	Contains the following:						
	2 Plates	**2 Caps**	**4 Posts*** **("feet")**	**Other Hardware**	**PC Control Software**	**2 Serial Cables**	**USB Cable/ Software**
7310011 PowerWave, PowerWave XS, PowerWave XS2	7312047; 7312052	7312075	7310523 (66 mm)	N/A	7310204	75034 75053	75108/ 7090204
7310009 Synergy HT	7312048; 7312052	7312073	7310523 (66 mm)	N/A	7310204	75034 75053	75108/ 7090204
7310019 Synergy 2, Synergy 4, Synergy Mx	7132153 7312052	7312073	7130559 (73 mm)	N/A	7310204	75034 75053	75108/ 7090204
7110004 Precision XS, Precision Microplate Pipetting System	7112139; 7112140	7312074	7110542 (33 mm)	7110544; 7110556	7310204	75034 75053	75108/ 7090204
7310012 MicroFill	7312049; 7312052	N/A	7310524 (14 mm)	N/A	N/A	75106 75111	N/A
7310010 ELx405 (Excludes Magna)	7312050; 7312052	7312074	7310524 (14 mm)	N/A	7310204	75106 75111	75108/ 7090204
7150001 NanoQuot	7152000; 7312052	N/A	7310524 (14 mm)	N/A	7310204	75110 75111	N/A
7310020 MicroFlo Select	7172125 7312052	7170527 (4 caps instead of 2)	7310524 (14 mm)	N/A	7310204	75110 75111	75108/ 7090204
7310027 EL406	7182076 7312052	7312074	7180530 (12 mm)	N/A	7310204	75034 75110	75108
* The lengths listed for the posts include the rubber bits, but do not include the threaded portions.							

❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.

Upgrade Information

❖ **MicroFlo Select:** The MicroFlo basecode software may need to be upgraded for operation with the fixed wrist (PN BIOSTACK2) and rotational wrist (PN BIOSTACK2WR) models. MicroFlo basecode version **1.06** is required for these BioStack models. Contact BioTek for more information.

Upgrade Kits

Upgrade kits are available for customers with existing BioTek instruments that may be interfaced with the BioStack™. Please refer to the chart in *Figure 2* on the next page or contact BioTek's Technical Assistance Center (tac@biotek.com) to determine whether your instrument must be upgraded to be compatible with the BioStack.

The following upgrade kits are available:

- **Synergy HT Multi-Detection Microplate Reader (PN 7310007)**
  ➢ BioStack-compatible microplate carrier

  ❖ The Synergy HT BioStack-compatible microplate carrier must be installed by a qualified BioTek Technician.

- **MicroFill Microplate Dispenser (PN 7310015)**
  ➢ Disk with latest MicroFill basecode software (PN 7140200)
  ➢ CD with BioTek's Download Utility (PN 8300200) and disk with MicroFill ActiveX (PN 7140202); both used for downloading the latest MicroFill basecode software

- **ELx405 Microplate Washer (PN 7310006)**
  ➢ BioStack-compatible microplate carrier
  ➢ Disk with latest ELx405 basecode software (PN 7100227)
  ➢ CD with BioTek's Download Utility (PN 8300200) for downloading the basecode software

  ❖ The ELx405 BioStack-compatible carrier must be installed by a qualified BioTek Technician.

- **ELx405 Microplate Washer Software Upgrade Only (PN 7310013)**
  ➢ Disk with latest ELx405 basecode software (PN 7100227)
  ➢ CD with BioTek's Download Utility (PN 8300200) for downloading the basecode software

  ❖ The Magna model of the ELx405 is not BioStack compatible.
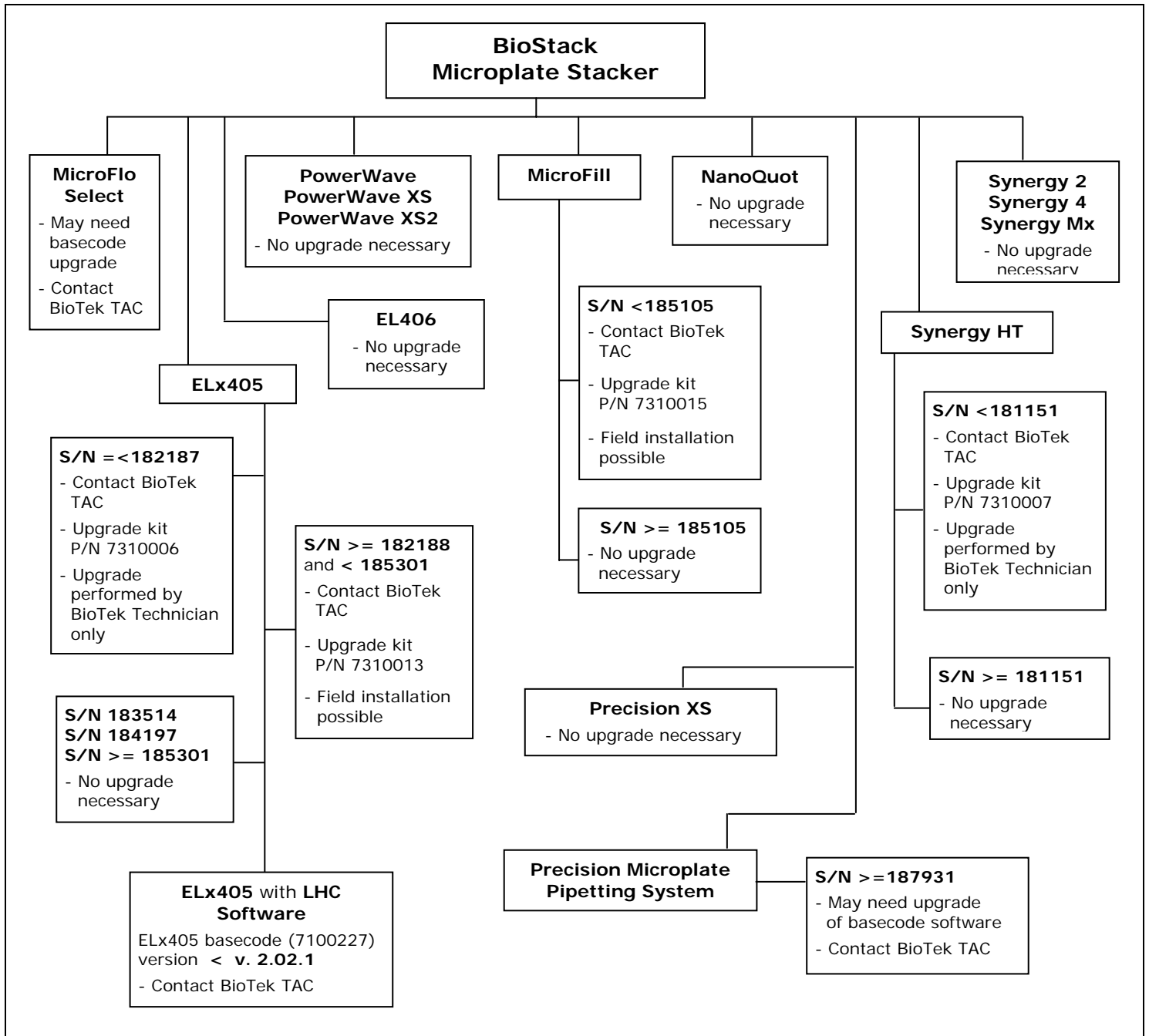
Figure 2: Criteria Chart for Upgrading BioStack Interfacing Instruments

❖ The following Precision Microplate Pipetting Systems **are not BioStack compatible** or **cannot be upgraded**:

- Instruments with serial numbers < 187931
- All 12-Channel models
- Universal 8-/12-Channel models in 12-channel mode

Specifications

BioStack (All Models)

Electrical	
External Power Supply:	Compatible with 100 to 240 V~ ± 10% @ 50-60 Hz
Power Consumption:	40 watts maximum
Physical	
Display:	None
Dimensions:	Length: 18.5" (46.9 cm) Width: 7" (17.8 cm)
	Height when aligned with the following instruments: **PowerWave**, **PowerWave XS**, **PowerWave XS2**, **Synergy HT**, **Synergy 2***, **Synergy 4***, **Synergy Mx***
	25" (63.5 cm) with 30-plate stacks and long aligning posts 35" (88.5 cm) with 50-plate stacks and long aligning posts 16" (40.6 cm) without stacks
	* The BioStack is taller with the Synergy 2/Synergy 4/ Synergy Mx than with the other readers: .28" (.71 cm) higher with/without the stacks.
	Precision XS, **Precision Microplate Pipetting System**
	24" (61.1 cm) with 30-plate stacks and medium aligning posts 34" (86.1 cm) with 50-plate stacks and medium aligning posts 15" (37.0 cm) without stacks
	MicroFill, **ELx405**, **NanoQuot**, **MicroFlo Select, EL406**
	23" (58.4 cm) with 30-plate stacks and short aligning posts 33" (83.4 cm) with 50-plate stacks and short aligning posts 14" (35.6 cm) without stacks
Weight:	24 lbs (10.9 kg)
Environmental	
Operating Temperature:	15°C to 35°C (59°F to 95°F)
Humidity:	Maximum relative humidity of 80% at temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F)

Microplates

Dimensions:	Society for Biomolecular Screening (SBS) compliant standard-height 96- and 384-well microplates Other laboratory microplates, which conform to the following standardized dimensions: Width: 3.365″ (85.48 mm) ± 0.015″ (0.381 mm) at the corners Length: 5.030″ (127.76 mm) ± 0.015″ (0.381 mm) at the corners Height: 0.400″ (10.16 mm) to 0.575″ (14.605 mm) **Shorter profile plates:** 1536-well and low volume 384-well microplates are shorter than standard-height plates, and **can** be processed in the BioStack™. These plates have a minimum height of 0.400″ (10.16 mm). The maximum rim height for plates with an overall height that is less than 0.450″ (11.43 mm) is 0.100″ (2.54 mm). To run plates shorter than 0.565″ (14.35 mm), you will need version 2.00.x of BioStack basecode software PN 7310209 installed in the fixed wrist or rotational wrist models. Some half-height plates may require reconfiguration of the BioStack. See ***Appendix C***, ***Reconfiguration of the BioStack***. **Note:** The BioStack is not compatible with removable strip type microplates.
Standards:	With the exception of 1536-well and low volume 384-well microplates, BioTek recommends that you use microplates that comply with the following American National Standards Institute (ANSI)/Society for Biomolecular Screening (SBS) dimensional standards: ANSI/SBS 1-2004 "for Microplates – Footprint Dimensions" ANSI/SBS 2-2004 "for Microplates – Height Dimensions" ANSI/SBS 3-2004 "for Microplates – Bottom Outside Flange Dimensions" ANSI/SBS 4-2004 "for Microplates – Well Positions" **Note:** Microplates that do not meet these requirements may cause functional problems. Plastic "flash" (burrs and extra plastic) on the edges of plates, and strip plates that are not as rigid or flat, may also cause problems. **Note:** Less rigid polystyrene plates may cause problems, especially after thermocycling.

PC Software

For PC control of the BioStack, you will need a computer equipped with **at least two communication ports**. If you are operating *two* BioStack's with one Precision instrument, you will need a PC with **three com ports**. If you are using the Liquid Handling Control (LHC) Software to operate *two* BioStack's with *two* ELx405 washers, *two* MicroFlo Select dispensers, or *two* EL406 washer dispensers, you will need a PC with **four com ports**.

You will also need the following *minimum* software versions.

BioStack PC Control Software (v. 1.02.8 with KC4) (v. 2.00.x with Gen5) (v. 2.00.4 with the NanoQuot; you do not need to install KC4 or Gen5 for the NanoQuot) (v. 2.01.6 with the EL406) (v. 2.00.7 with the Synergy 4) (v. 2.00.10 with LHC Software) (v. 2.01.3 with the PowerWave XS2) (v. 2.01.6 with the EL406) (v. 2.02.x with the BioStack fixed wrist model (PN BIOSTACK2) and rotational wrist model PN BIOSTACK2WR), and with the Synergy Mx	▪ Intel Pentium processor / 266 MHz (or compatible) ▪ Microsoft® Windows 2000, XP, or Vista operating system ▪ 256 MB of RAM (minimum), 512 MB recommended ▪ 60 MB of available hard drive space ▪ CD ROM drive ▪ Color monitor, 800x600 resolution with 256 colors minimum (1024x768 resolution with 32-bit color recommended) ▪ Keyboard, mouse, and serial or USB ports
Gen5 Software (v.2.00.x with the PowerWave/XS or Synergy HT) (v. 1.05.x with the PowerWave XS2) (v. 1.01.x with the Synergy 2) (v. 1.04.x with the Synergy 4) (v. 1.07.x with the Synergy Mx)	Refer to the *Gen5 Getting Started Guide* or Gen5 Help for system requirements.
KC4 Data Analysis Software (v. 3.3, Rev. 9)	Refer to the *KC4 User's Guide* or KC4 Help for system requirements.
Precision Power Software (v. 2)	Refer to the *Precision Power User's Guide* or Precision Power Help for system requirements.
Liquid Handling Control (LHC) Software (Any version of the LHC with v. 2.00.4 of the ELx405 Interface Software, for the ELx405, and v.1.01.0 of the MicroFlo Select Interface Software for the MicroFlo. Version 1.00.6 of the LHC Software with version 1.00.3 of the EL406 Interface Software, for the EL406.)	Refer to the *Liquid Handling Control Software Installation Guide* or LHC Help for system requirements.
Refer to *Appendix D* for more information on required software versions.	

Product Support & Service

All of BioTek's products are backed by a superior support staff. If your instrument ever fails to function perfectly, if you have questions about how to use or maintain it, or if you need to send the instrument to BioTek for service or repair, please contact our Technical Assistance Center (TAC).

Contacting the Technical Assistance Center

Our Technical Assistance Center is open from 8:30 AM to 5:30 PM (EST), Monday through Friday, excluding standard U.S. holidays. You can send a fax or an e-mail any time.

Phone: 800-242-4685 (in the U.S.) or 802-655-4740 (outside the U.S.)

Fax: 802-654-0638

E-Mail: tac@biotek.com

Please be prepared to provide the following information:

- Your name and company information

- A daytime phone or fax number, and/or an e-mail address

- The product name, model, and serial number

- The software part number and basecode versions for the BioStack and interfacing instrument, and, if applicable, the software versions for the BioStack PC Control Software or other computer software (Gen5, KC4 , Precision Power, Liquid Handling Control, etc).

- For troubleshooting assistance or instruments needing repair: the specific steps that produce your problem, and any error codes displayed (see also *Chapter 7*, *Troubleshooting and Error Codes*).

Returning Instruments for Service/Repair

If you need to return an instrument to BioTek for service or repair, please contact the TAC for a Return Materials Authorization (RMA) number *before* shipping the instrument. Repackage the instrument properly (see *Chapter 3*, *Installation*), write the RMA number on the shipping box, and ship to this address:

BioTek Instruments, Inc.
ATTN: RMA# xxxxx
100 Tigan Street
Highland Park
Winooski, Vermont 05404 USA

Chapter 2

Instrument Description

This chapter describes the important external components of the BioStack.

Review the Major Components of the BioStack

Before you install the BioStack according to the instructions in *Chapter 3*, please take a few minutes to become familiar with the BioStack components described in this chapter.

> ❖ Refer to *Figure 3* on the next page for an illustration of the BioStack components. Refer to *Figure 4* on page 27 for an illustration of the rotational wrist model.

The BioStack's major external components consist of the **microplate stacks** ("input stack" and "output stack"), **carrier**, **claw/gripper**, **rotational wrist** (model PN BIOSTACK2WR), **stack lifters**, **stack locks**, **stack dogs**, and **LED**.

There is no onboard display or keypad, because the BioStack is either

- **computer-controlled**
    - ➢ via the BioStack PC Control Software (when used with the PowerWave/PowerWave XS/PowerWave XS2 or Synergy HT/Synergy 2/Synergy 4/Synergy Mx Readers), or
    - ➢ via Precision Power Software, (when used with the Precision Microplate Pipetting System/Precision XS instruments), or
    - ➢ via Liquid Handling Control (LHC) Software (when used with the ELx405 Washer, MicroFlo Select Dispenser, or EL406 Microplate Washer Dispenser).
- **instrument-controlled** by the MicroFill, NanoQuot, or MicroFlo Select Dispenser, ELx405 Washer, or EL406 Washer Dispenser.

> ❖ **ELx405 Washer:** The BioStack with the ELx405 may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the ELx405. **Note:** The Magna model of the ELx405 does not support the BioStack.
>
> ❖ **MicroFlo Select Dispenser:** The BioStack with the MicroFlo Select may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the dispenser.
>
> ❖ **EL406 Washer Dispenser:** The BioStack with the EL406 may be either computer controlled using the LHC Software, or instrument controlled using the keypad on the EL406.
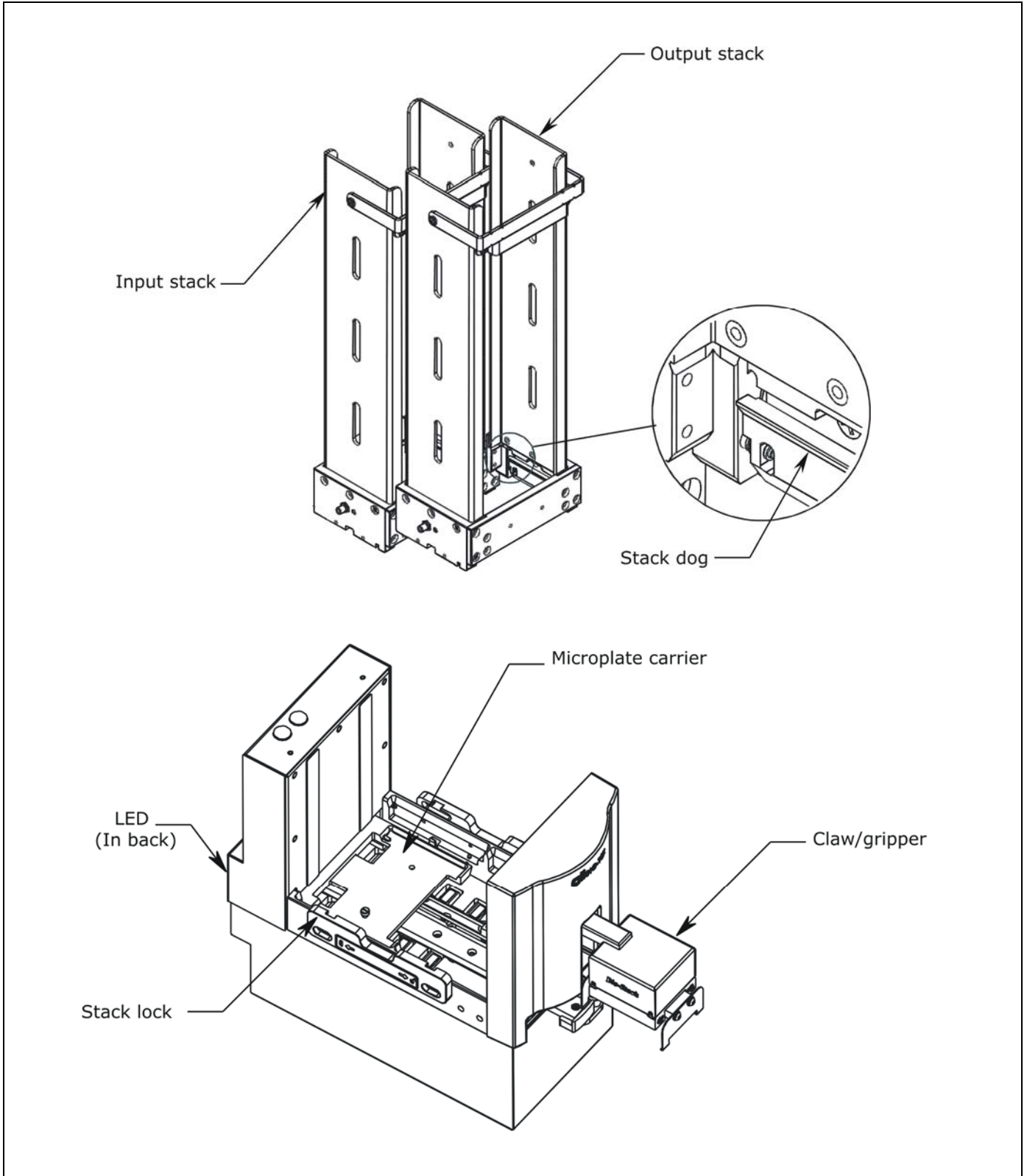
Figure 3: External Components of the BioStack

❖ The fixed wrist model and 30-plate microplate stacks are shown.

Stacks

The two microplate stacks are for storing plates to be processed (input stack) and for storing plates after they have been processed (output stack). The input and output stacks are mechanically identical and interchangeable, and are available in 30-plate or 50-plate capacity.

Carrier

The carrier transfers one plate at a time from the input stack to the extended carrier position, and then back to the output stack. The carrier can also transfer a plate from the output stack to the input stack, if the **optional re-stacking feature** is requested.

Claw/Gripper

The claw/gripper

- lifts the plate off the carrier at the extended carrier position and places it on the instrument, and
- lifts the plate off the instrument and places it back on the carrier.

The gripper has a sensor that indicates when the grip arms are at their closest position. The sensor is triggered when there is no plate within the gripper arms.

The two sides of the gripper are spring-loaded so that if the power goes off, the gripper still holds the plate.

Rotational Wrist (Model PN BIOSTACK2WR)

The rotational wrist model (see *Figure 4* on the following page) has an additional, rotational wrist that allows access to microplate instrument carriers with both landscape and portrait orientations. The rotational wrist model has a user-accessible selection switch for setting the angle of the wrist at the 0° or 90° interface position. The Stacker is shipped from BioTek with the angle set at the default 90° interface.

Stack Lifters

The two stack lifters lift and lower the stack of plates contained within the input and output stacks.

Stack Locks

The two stack locks (one on the left side, one on the right side of the BioStack) prevent the stacks from accidentally getting knocked over during operation of the instrument. A **magnetic latch** holds the locks in place.
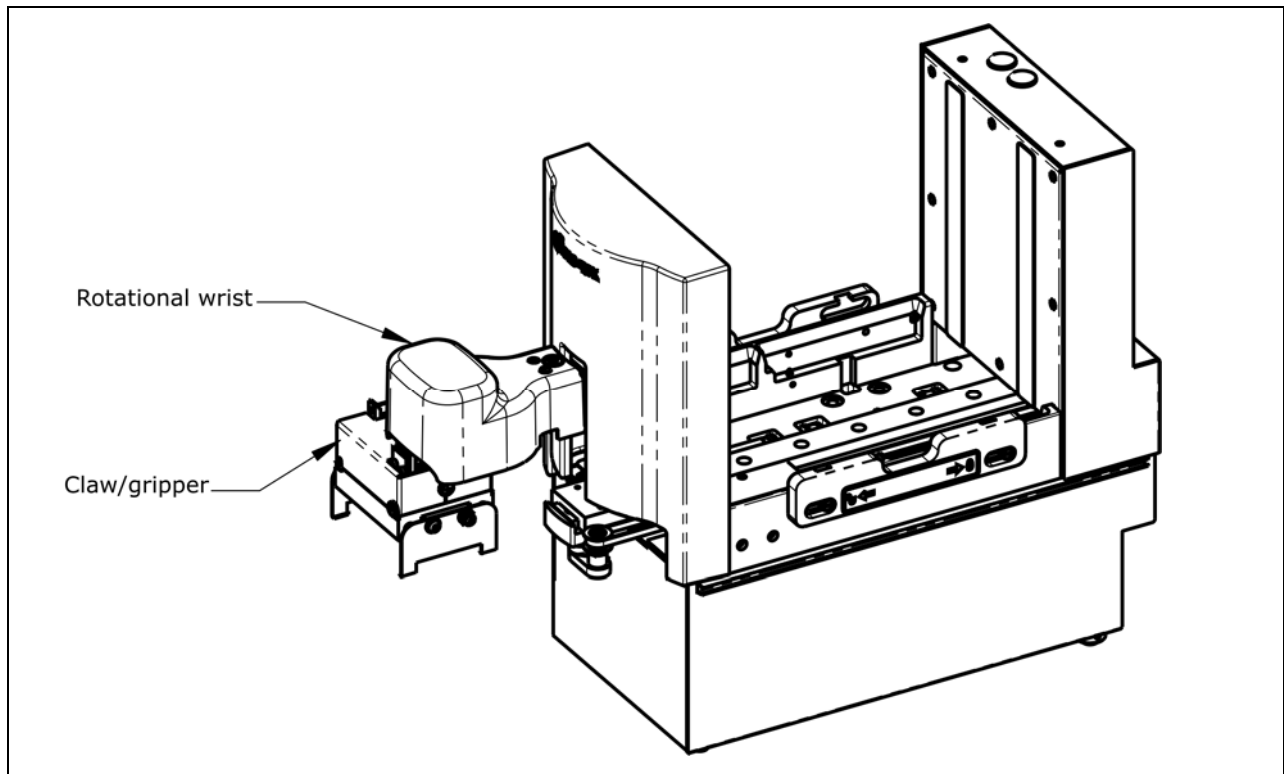
Figure 4: Rotational Wrist Model (PN BIOSTACK2WR)

Stack Dogs

There are two dogs per stack to hold a set of plates within the stack, and to aid the stack lifters in the process of lowering a plate down to the carrier.

LED

A green LED on the back of the BioStack indicates the current state of the instrument.

- During the system self-test, the light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- A flashing light indicates an error that requires user intervention. (Refer to **Chapter 7**, **Troubleshooting and Error Codes**.)

Optional Barcode Scanner

The BioStack barcode scanner may be installed by the operator on the BioStack as shown in the following barcode scanner location configurations:

Model	Synergy HT/2/4/Mx	PowerWave/ XS/XS2	Precision/XS
Fixed wrist model (PN BIOSTACK2)	Left or right	Left only	Left or right
Rotational wrist model (PN BIOSTACK2WR)	Left or right (wrist angle at 0° only)	Left (wrist angle at 0° only)	Left or right (wrist angle at 0° only)

❖ The **rotational wrist model** does not support Synergy HT/2/4/Mx, PowerWave/XS/XS2, and Precision/XS integrations, or the barcode scanner, with the wrist angle set at the **90°** interface position.

The scanner automatically scans barcode labels on plates at the BioStack's extended carrier position during plate transfers between the BioStack and interfacing instrument.

Barcode values returned from the scanner may be displayed in the BioStack PC Control Software if the operator selects the option to display barcode information. The barcode value is then passed into Gen5 or KC4 Software for storage in the Gen5 experiment or KC4 output file, and optionally, as part of the output filename (KC4 only).

Barcode scanner options are also available in Precision Power Software through the Supply Command and To-Do List features.

❖ The **MicroFill**, **NanoQuot**, **ELx405**, **MicroFlo Select**, and **EL406** do not support the BioStack barcode scanner.

Chapter 3

Installation

This chapter includes instructions for unpacking and setting up the BioStack Microplate Stacker, installing the BioStack with the interfacing instrument, and repackaging the BioStack for shipment.

Product Registration

If you have not already done so, please register your product(s) with BioTek to ensure that you receive important information and updates about the product(s) you have purchased.

Register online through BioTek's *Customer Resource Center* at **www.biotek.com** or by contacting BioTek Customer Care.

Once registered, you can log into the Customer Resource Center and:

- Check the status and track your order
- Register your product warranty
- Manage your equipment inventory
- Access documentation on your products
- Download user manuals and software
- Check the status of your instrument's service

Before You Begin the Installation

> ❖ For your convenience, an **Installation Checklist** is provided in *Chapter 5*, *Instrument Qualification*. The Checklist is a one-page form that you can use to check off each of the installation tasks you will be performing in this chapter.
>
> ❖ If you have purchased the BioStack's optional **barcode scanner**, install the BioStack™ with the interfacing instrument first, *before* you install the scanner.
>
> ❖ You will need a **flat-blade screwdriver**, **7/64" hex wrench**, and **9/64" hex wrench** to perform some of the Installation tasks.

Tips for Easier Installation

It may be easier to install the BioStack with the instruments listed below, if you remove the following components from these instruments *before* installation. After you have completed installation and alignment of the BioStack with the instrument, re-install the components that you removed.

- **Synergy HT/Synergy 2/Synergy 4/Synergy Mx with injectors:** If equipped with injectors, and the dispense module is in use, disconnect the cable and tubing from the back of the reader and set the module aside.

- **Precision/Precision XS:** Remove any supplies from the platform. If installed, remove the optional aerosol cabinet; the cabinet is not designed to be used in a robotic environment. Disconnect the tubing and remove the manifold and manifold priming trough.

- **ELx405 and EL406**: Remove the microplate carrier. Disconnect the tubing, vacuum pump cable, and waste sensor cable from the back of the ELx405 and EL406.

Unpack and Inspect the BioStack

> (i) **Save all packaging materials!** If you need to ship the instrument to BioTek for repair or replacement, you must use the original packaging. Using other forms of commercially available packaging is not recommended and can **void the warranty**.
>
> If the shipping box has been damaged, inspect the instrument for visible dents and scratches as you unpack it. If the instrument is damaged, notify the carrier and your BioTek sales representative. Keep the shipping cartons and the packing material for the carrier's inspection. BioTek will arrange for the repair or replacement of your instrument immediately.
>
> See *Repackaging and Shipping* at the end of this chapter for complete shipping instructions.

Perform these steps to unpack and inspect the instrument:

1. Open the outer shipping container and remove the top foam shipping blocks from the inner box (see *Figure 5* on the following page).

2. Lift the inner box out of the bottom foam shipping blocks and outer shipping container, and place the box on a level surface.

3. Remove all accessories from the inner sleeve, and then remove the inner sleeve (see *Figure 6* on the following page).

4. Carefully pull the BioStack out of the inner box by lifting on the handles of the shipping panel. Place the instrument on a level surface.

5. Place all packing materials back into the shipping container for reuse if the instrument needs to be shipped again.

6. Unpack the two microplate stacks, which are shipped in a smaller, separate container. See *Figure 7* on page 34 for 30-plate stacks, and *Figure 8* on page 35 for 50-plate stacks. Save this container with the other packaging materials for the BioStack and its accessories.
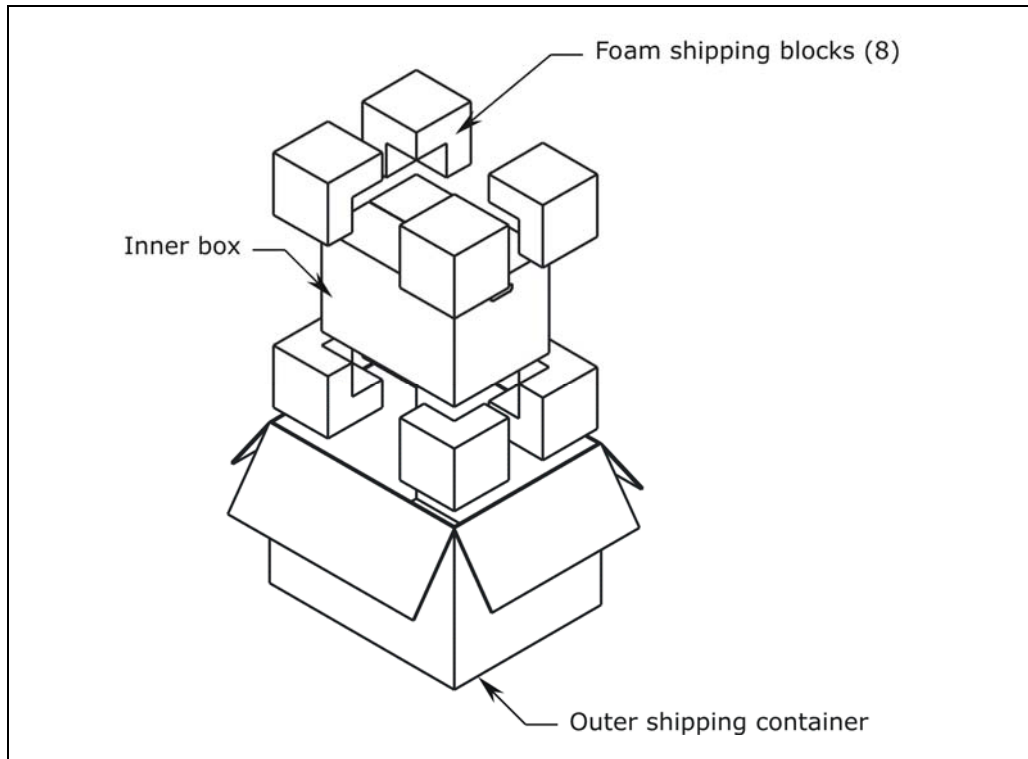
Figure 5: Opening the Outer Shipping Container
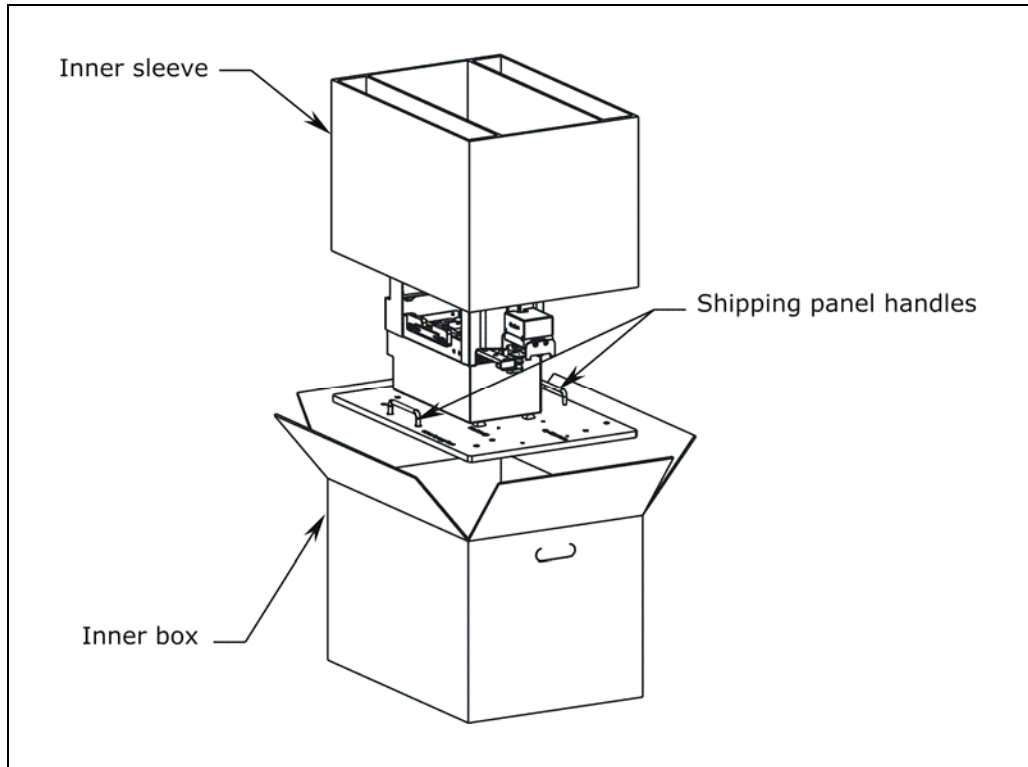
Figure 6: Removing the BioStack from the Inner Box
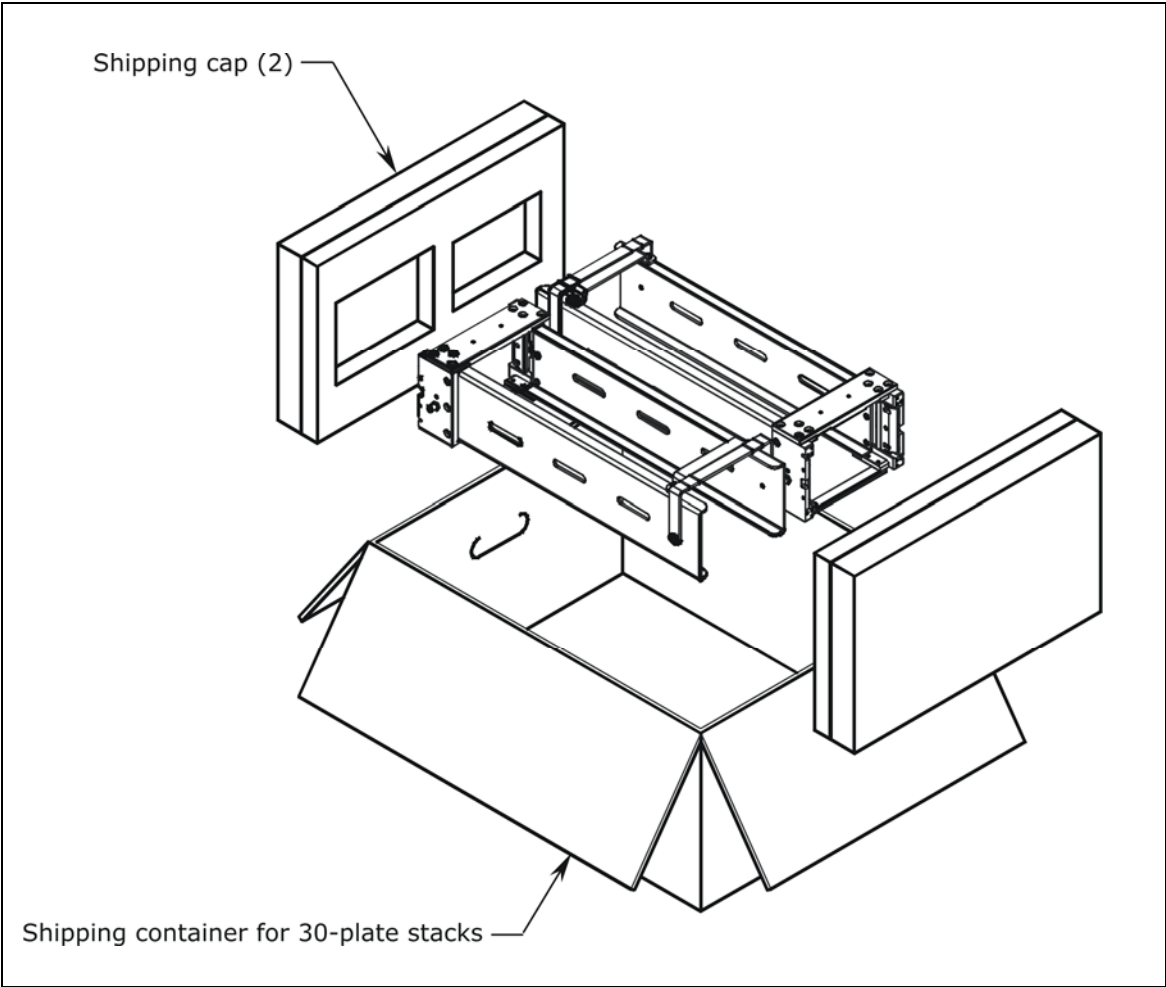
Figure 7: Unpacking the 30-Plate Microplate Stacks
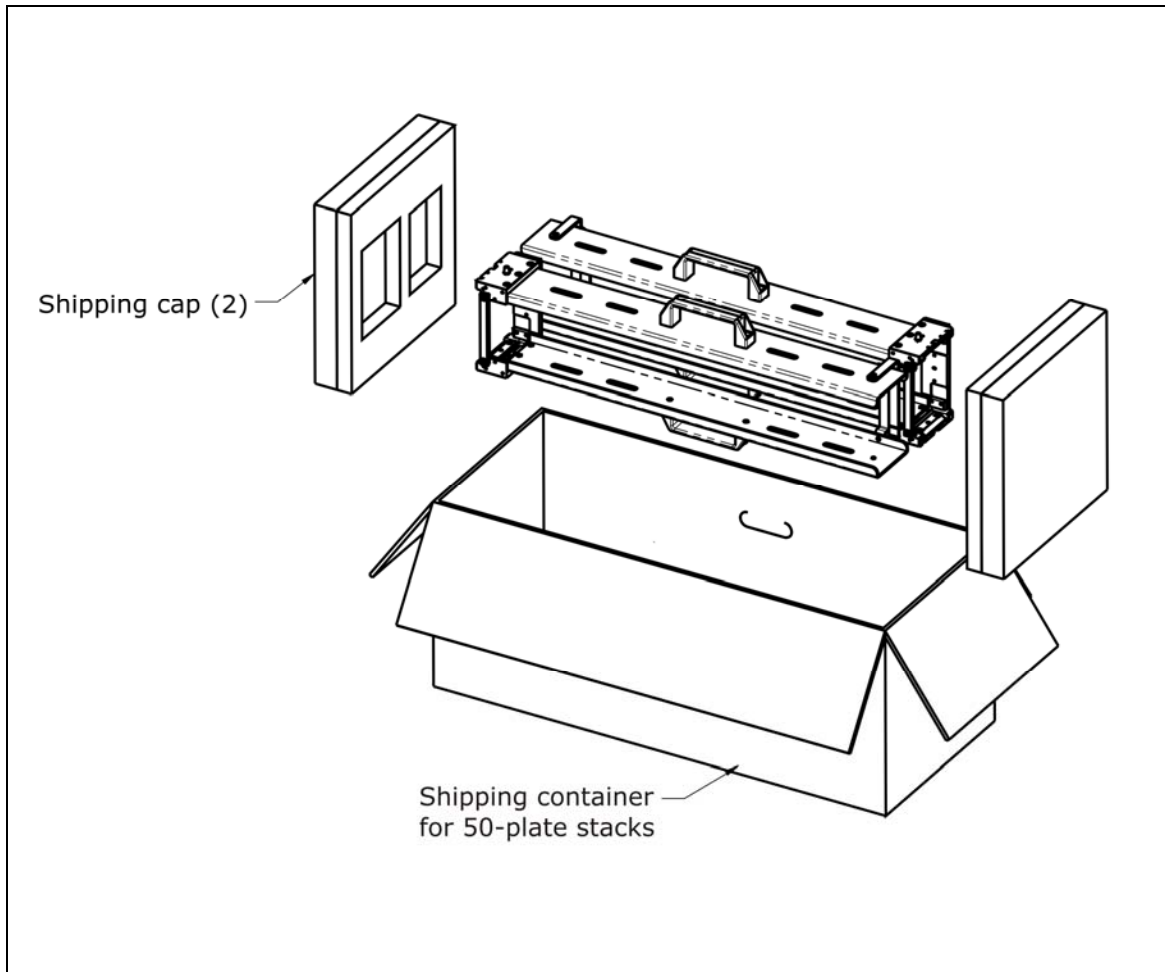
Figure 8: Unpacking the 50-Plate Microplate Stacks

Check the Components

Required Components

Confirm that all required components are included. If any are missing or damaged, contact your BioTek sales representative.

> ❖ *Chapter 1*, *Introduction*, contains BioTek part numbers for the components listed below.
>
> ❖ Microplate stacks (30-plate or 50-plate) are optional accessories.

- BioStack Microplate Stacker
- Power supply
- Plate stacking pedestal
- Grease kit
- Unpacking and packing instructions
- BioStack Operator's Manual (on CD)
- Declaration of Conformity, Warranty Statement, and Certificate of Compliance and Calibration
- BioStack Integration Kit for one of the following instruments:
  - ➢ PowerWave/PowerWave XS/PowerWave XS2 Reader
  - ➢ Synergy HT Reader
  - ➢ Synergy 2/Synergy 4/Synergy Mx Reader
  - ➢ Precision Microplate Pipetting System/Precision XS
  - ➢ MicroFill Dispenser
  - ➢ ELx405 Washer
  - ➢ NanoQuot Dispenser
  - ➢ MicroFlo Select Dispenser
  - ➢ EL406 Washer Dispenser

> ❖ Refer to *Appendix B*, *BioStack Barcode Scanner*, for a complete list of the components contained in the BioStack's **optional barcode scanner** installation kit.

Optional Components

Confirm that all purchased optional components are included (they should be documented on the packing list). If any are missing or damaged, contact your BioTek sales representative.

Set Up the BioStack

Select an Appropriate Location

For optimal operation, install the BioStack on a clean, level surface in an area where ambient temperatures between 15ºC (59°F) and 35ºC (95°F) can be maintained.

Conditions to avoid are:

- **Excessive humidity:** Condensation directly on the sensitive electronic circuits can cause the instrument to fail internal self-checks. The BioStack requires a maximum relative humidity of 80% at temperatures up to 31°C (87.8°F), decreasing linearly to 50% relative humidity at 40°C (104°F).

- **Dust:** Efficient microplate transporting may be affected by extraneous particles (such as dust) on the carrier's linear ways. A clean work area is necessary to ensure smooth plate transporting.

Remove the Shipping Hardware

> ⓘ All BioStack models are shipped with a **shipping panel**, **shipping block**, and **carrier shipping screw** that must be removed before the instrument can be used. In addition to the shipping hardware listed above, the **rotational wrist model** also is shipped with a **claw assembly shipping screw** and **wrist shipping bracket**. **Do not throw any of the shipping hardware away!** Save them in case the instrument needs to be repackaged for shipment.

Perform these steps to remove the shipping hardware:

1. Carefully set the instrument on its side with the bottom of the shipping panel facing you and hanging over the edge of a flat surface (see *Figure 9* on the following page).

2. Using a screwdriver, remove the four shipping panel mounting screws. Remove the shipping panel and set it aside.

3. Carefully lift the BioStack and set it upright.

4. Locate the shipping block and carrier shipping screw inside the BioStack (see *Figure 10* on the following page).

5. Remove the four shipping block mounting screws and the shipping block.

6. Remove the carrier shipping screw.

7. **Rotational wrist model** (see *Figure 11* on page 39): Remove the claw assembly shipping screw. To remove the rotational wrist shipping bracket, remove the three screws for the rotational wrist cover, then the wrist cover. Remove the shipping bracket, then replace the cover and cover screws.

8. Keep all screws together, and store them with the shipping panel, shipping block, claw assembly shipping screw and wrist shipping bracket (rotational wrist model), and all other packaging materials in the shipping container.
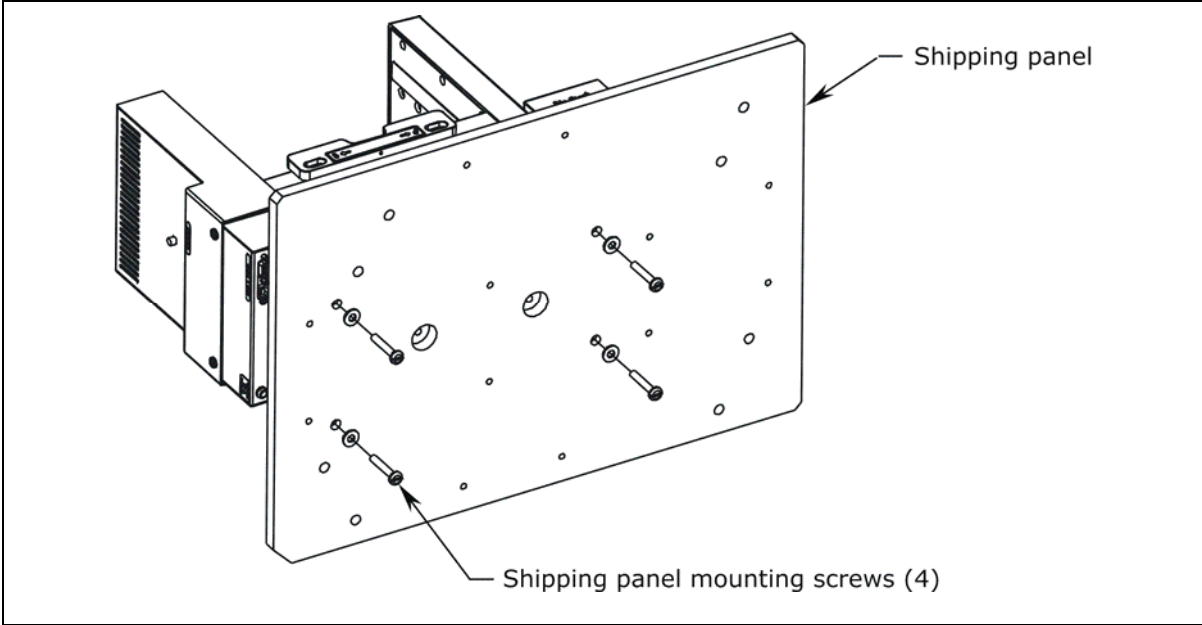
Figure 9: Removing the Shipping Panel
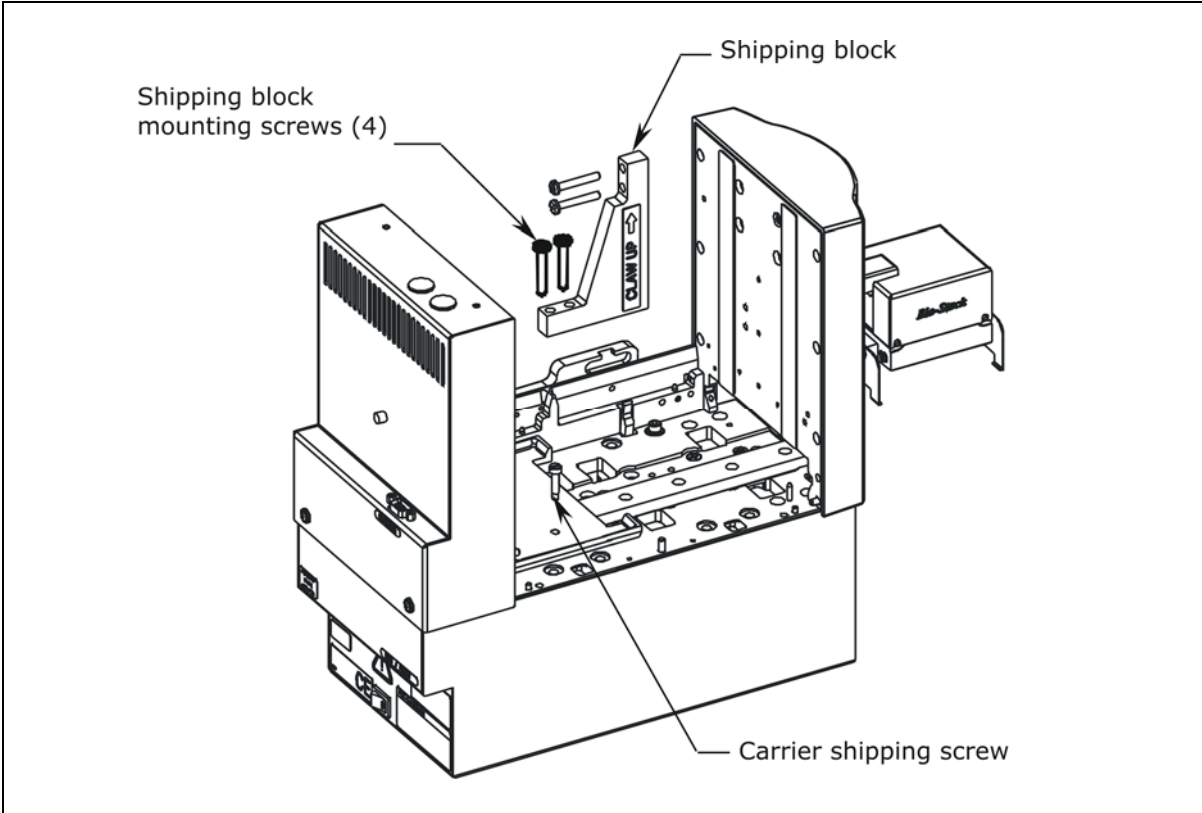
Figure 10: Removing the Shipping Block and Carrier Shipping Screw
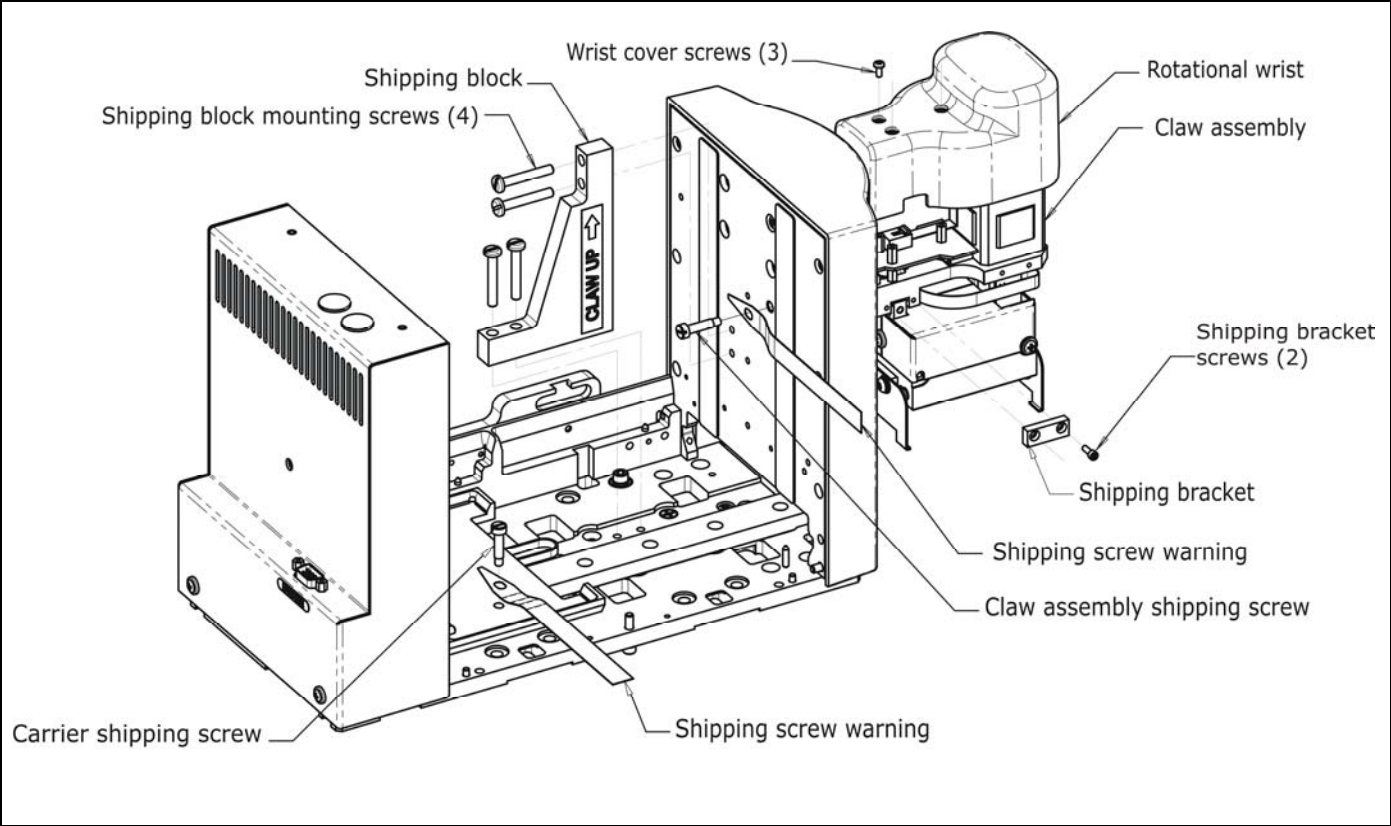
Figure 11: Removing the Claw Shipping Screw and Wrist Shipping Bracket
on the Rotational Wrist Model (PN BIOSTACK2WR)

Connect the Power Supply and Cord

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

Perform these steps to connect the power supply to the BioStack (refer to *Figure 12* on the next page):

1. Connect the power cord to the external 24-volt power supply.

2. Locate the power inlet on the rear of the BioStack, above the power on/off switch (see *Figure 12*). Plug the rounded end of the power supply's line cord into the power inlet. Be sure to tighten the knurled nut.

3. Plug the 3-prong end of the power cord into an appropriate power receptacle.

❖ Do **not** turn on the BioStack! Aligning posts ("feet") need to be attached to the BioStack before power-up. You will perform this step during installation of the BioStack with the interfacing instrument.
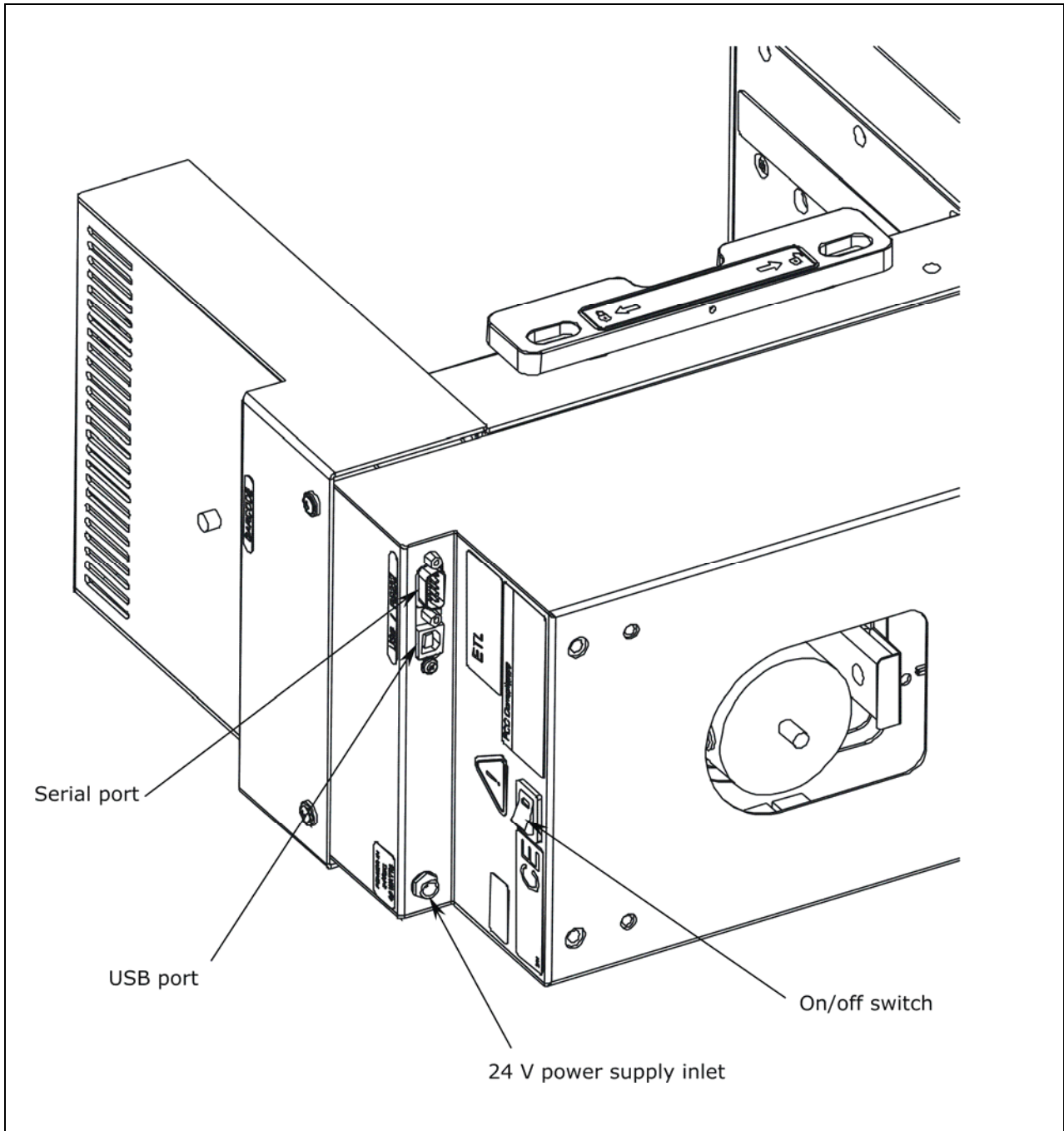
Figure 12: Location of the Power Supply Inlet and Serial/USB Ports on the BioStack

Configure the Rotational Wrist Model for the Interfacing Instrument

The wrist on the BioStack rotational wrist model controls the azimuth of the grip mechanism from **0°** to **90°**. The wrist model is shipped with the wrist angle set at the default 90° interface position. The ELx405, MicroFlo Select, and EL406 may be used with the wrist angle set at the 90° or 0° interface position.

- **At the 0° interface**, the claw on the wrist model is aligned with the Stacker's carrier.

- **At the 90° interface**, the claw is visually perpendicular to the Stacker and aligned with the ELx405, MicroFlo, or EL406 carrier.

The following interfacing instruments may only be used if the wrist is set at the **0°** interface position:

- PowerWave/XS/XS2

- Synergy HT/Synergy 2/Synergy 4/Synergy Mx

- Precision/XS

- MicroFill

- NanoQuot

Dipswitch **SW2-3** on the Stacker controls the wrist angle. The interface position is set to 90° by opening the dipswitch, and set to 0° by closing the dipswitch.

To change the interface position on the wrist model:

1. If the Stacker is on, turn it off.

2. The left and right hole plugs on the back of the Stacker cover the two sets of dipswitches. Refer to *Figure 13a* and *Figure 13b* on the following page.

   - The **left hole plug** covers the four dipswitches **SW1-1** through **SW1-4**.

   - The **right hole plug** covers the four dipswitches **SW2-1** through **SW2-4**.

3. To change the wrist angle to the **default 90° interface**, remove the hole plug and set dipswitch SW2-3 to the "OPEN" position as shown in *Figure 13b*. Replace the hole plug.

4. To change the wrist angle to the **0° interface**, remove the hole plug and set dipswitch SW2-3 to the closed position. Replace the hole plug.

❖ When the wrist's default interface position has been changed from 90° to 0°, the gripper mechanism will remain fixed in the same position as the grippers on the fixed wrist model (PN BIOSTACK2). During the homing sequence, or when processing plates, the gripper will remain at the 0° position.
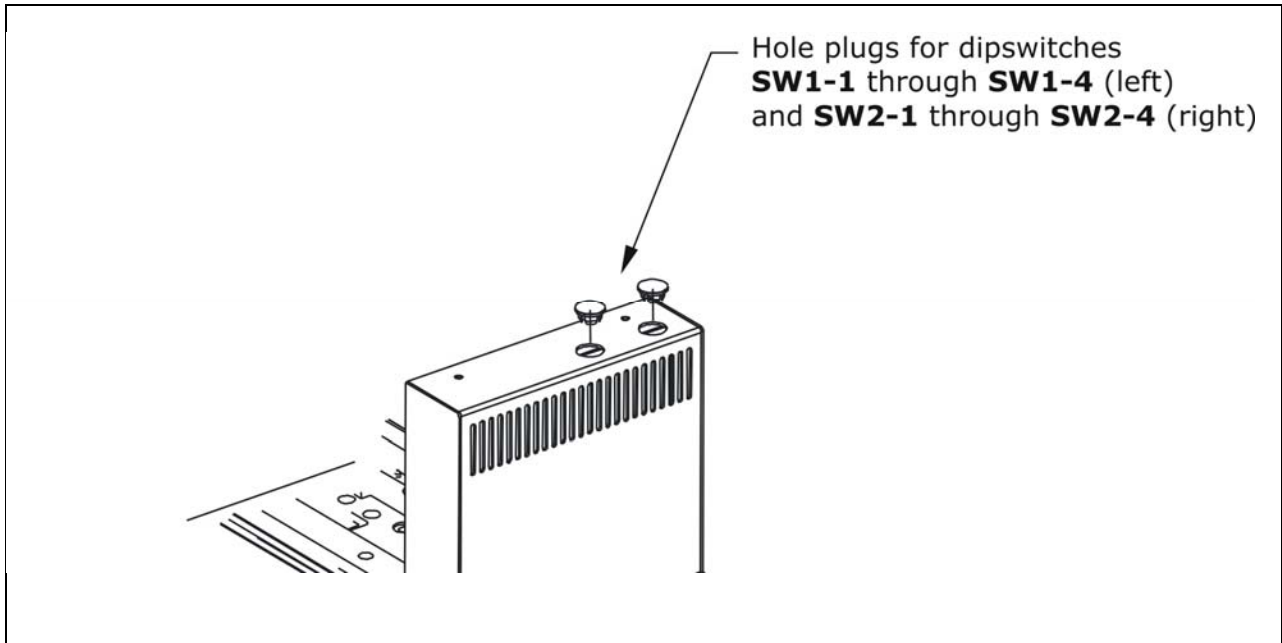
Figure 13a: Location of Hole Plugs for Dipswitch Sets SW1 and SW2
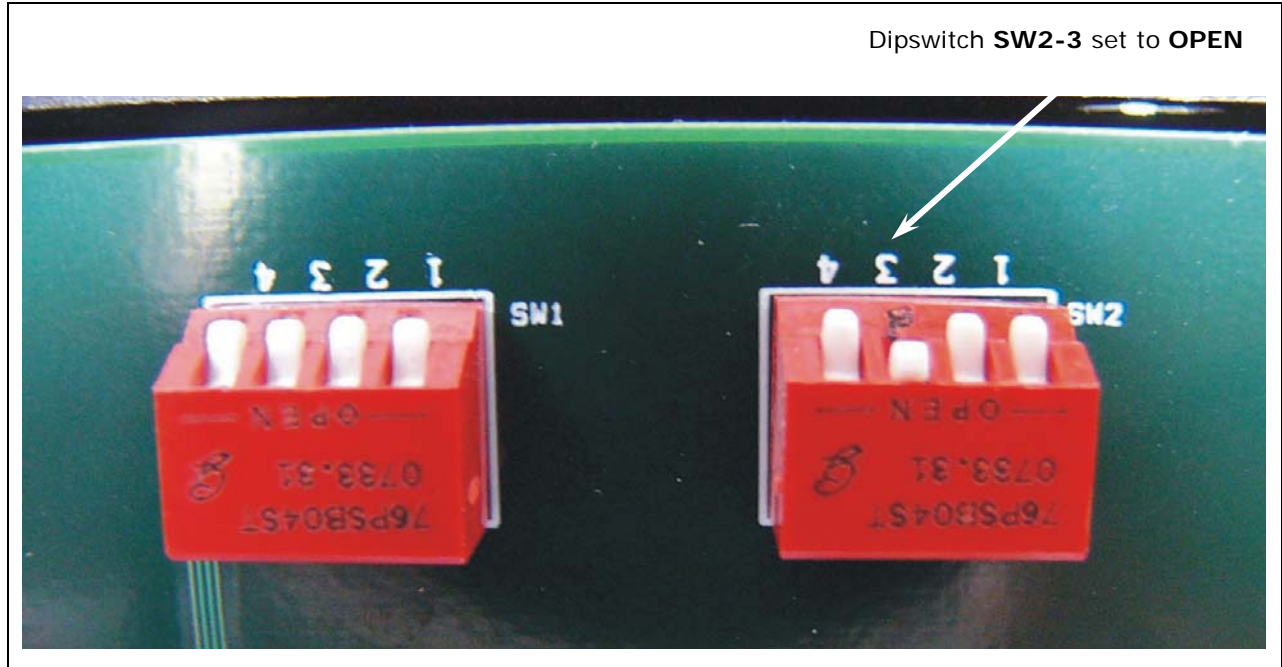
Figure 13b: Close-up of Dipswitch SW2-3 Set to "OPEN" for Rotational Wrist

Where To Go From Here

Installation of the BioStack with the Interfacing Instrument

Before the BioStack can operate with the interfacing instrument, the two instruments must be **mechanically aligned** with each other, **serial or USB cables** need to be attached, and instruments that are computer-controlled require **installation of software** on the PC.

Refer to the following sections in this chapter for instructions:

- *Install the BioStack with the PowerWave or Synergy Readers*, page 45

- *Install the BioStack with the Precision/XS*, page 69

- *Install the BioStack with the MicroFill or ELx405*, page 89

- *Install the BioStack with the NanoQuot*, page 121

- *Install the BioStack with the MicroFlo Select*, page 139

- *Install the BioStack with the EL406*, page 169

Installation of the BioStack Barcode Scanner

Install the BioStack with the interfacing instrument *first*, then refer to *Appendix B*, *BioStack Barcode Scanner* for instructions on installing the barcode scanner. It will be easier to install the BioStack if the barcode scanner is not attached.

Install the BioStack with the PowerWave or Synergy Readers

❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with a **PowerWave or Synergy** reader, you will need to change the wrist angle from the default interface position of 90° to 0°. Refer to ***Configure the Rotational Wrist Model for the Interfacing Instrument*** on page 42, for instructions.

❖ Except where noted, the installation steps apply to all BioStack models.

Lay Out the Alignment Hardware

You will need the alignment hardware from the PowerWave/PowerWave XS/PowerWave XS2 Integration Kit (**PN 7310011**), illustrated below, or the Synergy HT Integration Kit (**PN 7310009**) or Synergy 2/Synergy 4/Synergy Mx Integration Kit (**PN 7310019**), illustrated on the following pages.

PowerWave/XS/XS2 Integration Kit 7310011

Four aligning posts (PN 7310523) for elevating the BioStack to the correct height and for seating in the aligning plate.

Two aligning caps (PN 7312075) for elevating the PowerWave/XS/XS2 to the correct height and for seating in the aligning plate.
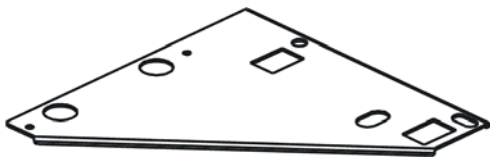
PowerWave/XS/XS2 aligning plate (PN 7312047) for preventing the instrument from sliding around and being misaligned with the BioStack.
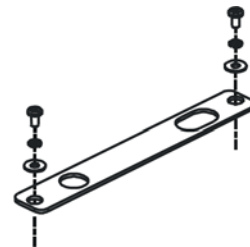
BioStack aligning plate (PN 7312052) for attachment to the PowerWave/XS/XS2 aligning plate.

Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Synergy HT Integration Kit 7310009

Four aligning posts (PN 7310523) for elevating the BioStack to the correct height and for seating in the aligning plate.

Two aligning caps (PN 7312073) for elevating the Synergy HT to the correct height and for seating in the aligning plate.
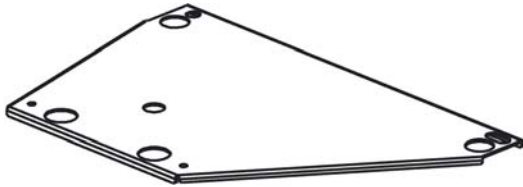
Synergy HT aligning plate (PN 7312048) for preventing the instrument from sliding around and being misaligned with the BioStack.
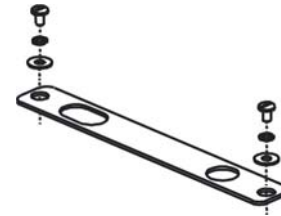
BioStack aligning plate (PN 7312052) for attachment to the Synergy HT aligning plate.

Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Synergy 2/Synergy 4/Synergy Mx Integration Kit 7310019

Four aligning posts (PN 7130559) for elevating the BioStack to the correct height and for seating in the aligning plate.

Two aligning caps (PN 7312073) for elevating the Synergy 2/Synergy 4/ Synergy Mx to the correct height and for seating in the aligning plate.
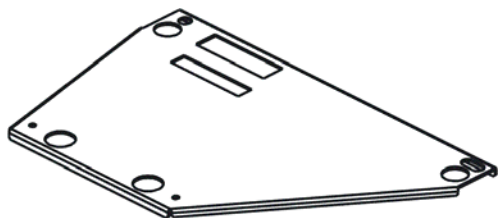
Synergy 2/Synergy 4/ Synergy Mx aligning plate (PN 7132153) for preventing the instrument from sliding around and being misaligned with the BioStack.
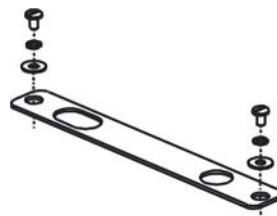
BioStack aligning plate (PN 7312052) for attachment to the Synergy 2/ Synergy 4/Synergy Mx aligning plate.

Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Attach the Aligning Posts and Caps

> (i) **Important!** When attaching the four aligning posts ("feet") to the BioStack, do not over-tighten the posts!
> **Finger-tighten only!**
>
> To avoid scratches to the BioStack or to the reader, place a towel down before laying the instrument on its side or back.

> (i) **Important!** The Synergy 2/Synergy 4/Synergy Mx are very heavy instruments; use extra care when laying one of these readers on its side or when returning it to the upright position.

Perform these steps to attach the aligning posts to the BioStack and the aligning caps to the reader:

1. Carefully lay the BioStack on its side so the bottom is facing you (see *Figure 14* on the following page).

2. Screw in all four aligning posts as shown.

3. Return the BioStack to the upright position.

4. If the reader is on, turn it off and disconnect the power supply.

5. Attach the aligning caps:

   PowerWave/XS/XS2:

   - Carefully lay the reader on its side so the bottom is facing you.

   - Using a 9/64" hex wrench, remove the mounting hardware on the reader and replace the flat washers with the aligning caps as shown in *Figure 15* on the following page.

   - Reinstall the hardware that was removed (except the flat washers).

   Synergy HT/Synergy 2/Synergy 4/Synergy Mx:

   - Carefully lay the reader on its back (Synergy HT) or on its side (Synergy 2/Synergy 4/Synergy Mx) so the bottom is facing you.

   - Screw in the two aligning caps as shown in *Figure 16* (Synergy HT) or *Figure 17* (Synergy 2/Synergy 4/Synergy Mx) on page 50.

6. Return the reader to the upright position.

BioStack aligning post (4)
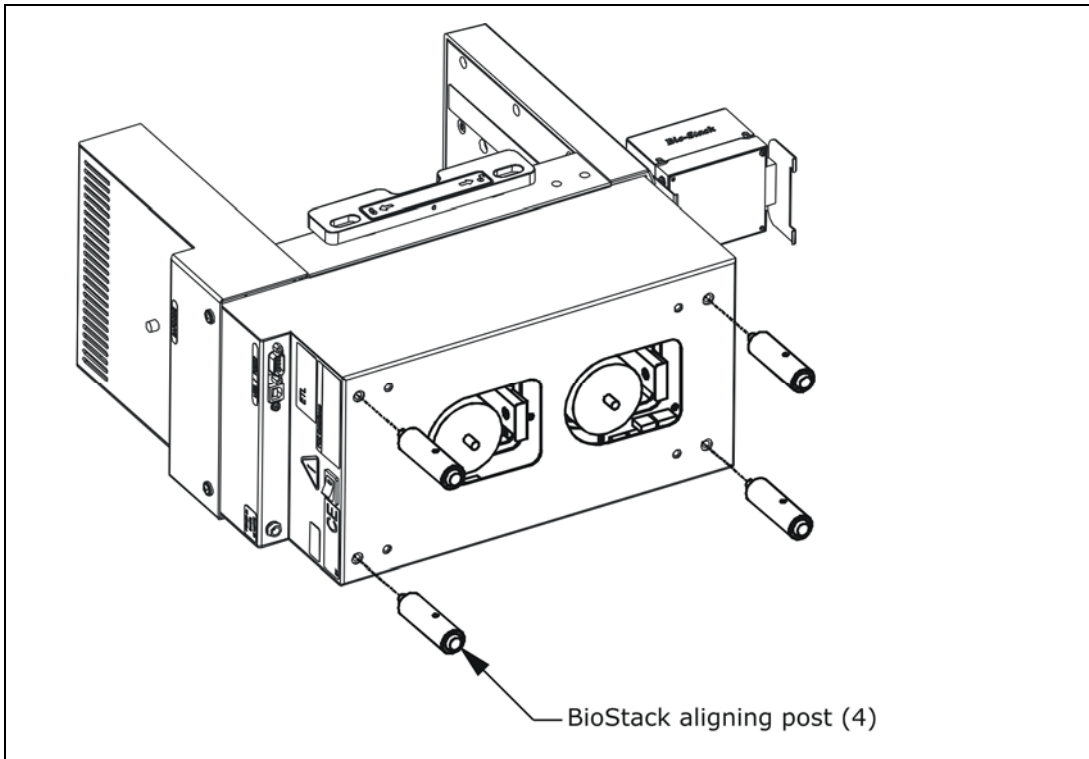
Figure 14: Attaching the Aligning Posts to the BioStack

PowerWave aligning cap (2)
(smaller cap)
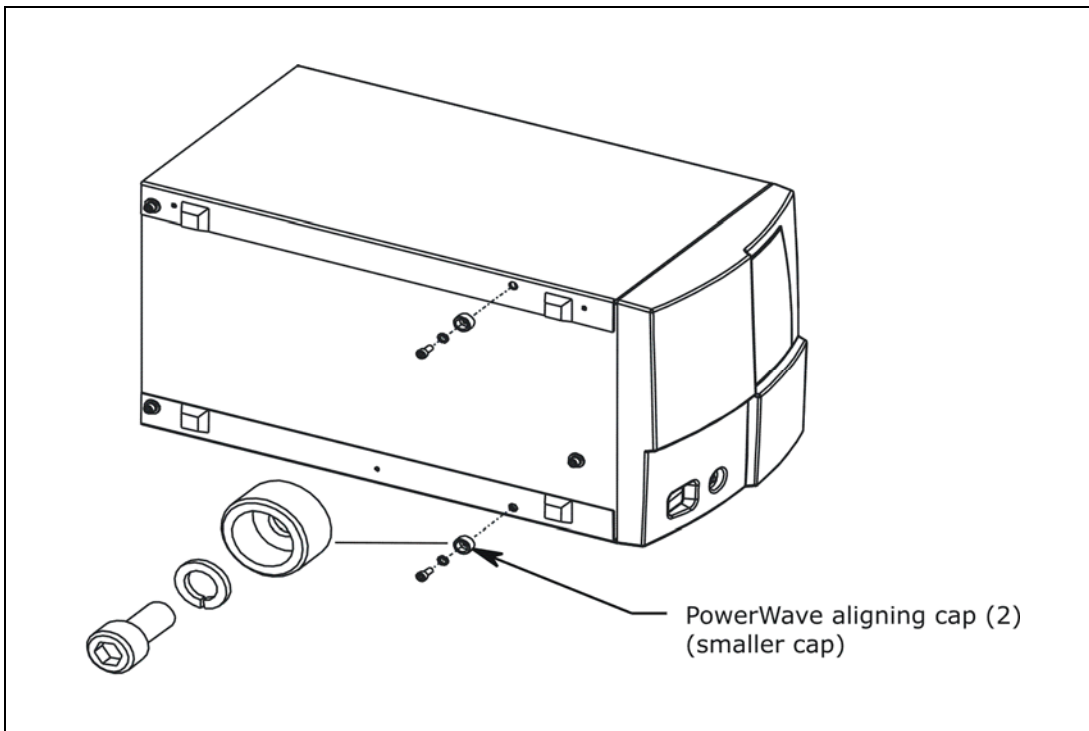
Figure 15: Attaching the Aligning Caps to the PowerWave/XS/XS2 Reader
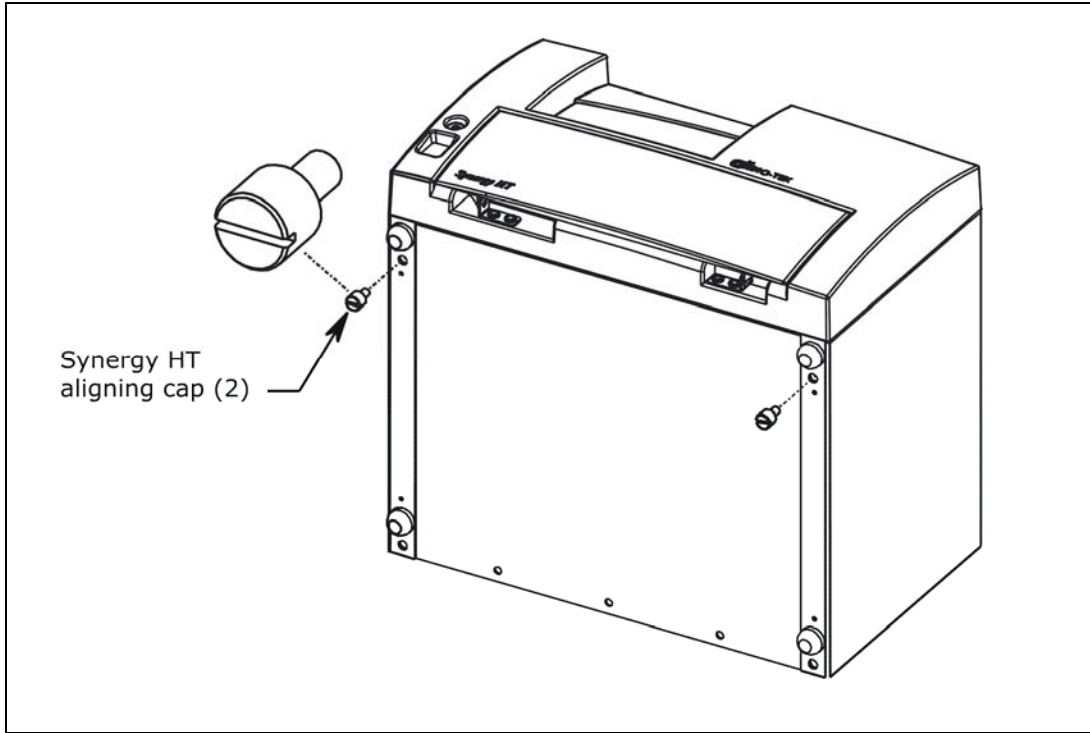
Figure 16: Attaching the Aligning Caps to the Synergy HT Reader
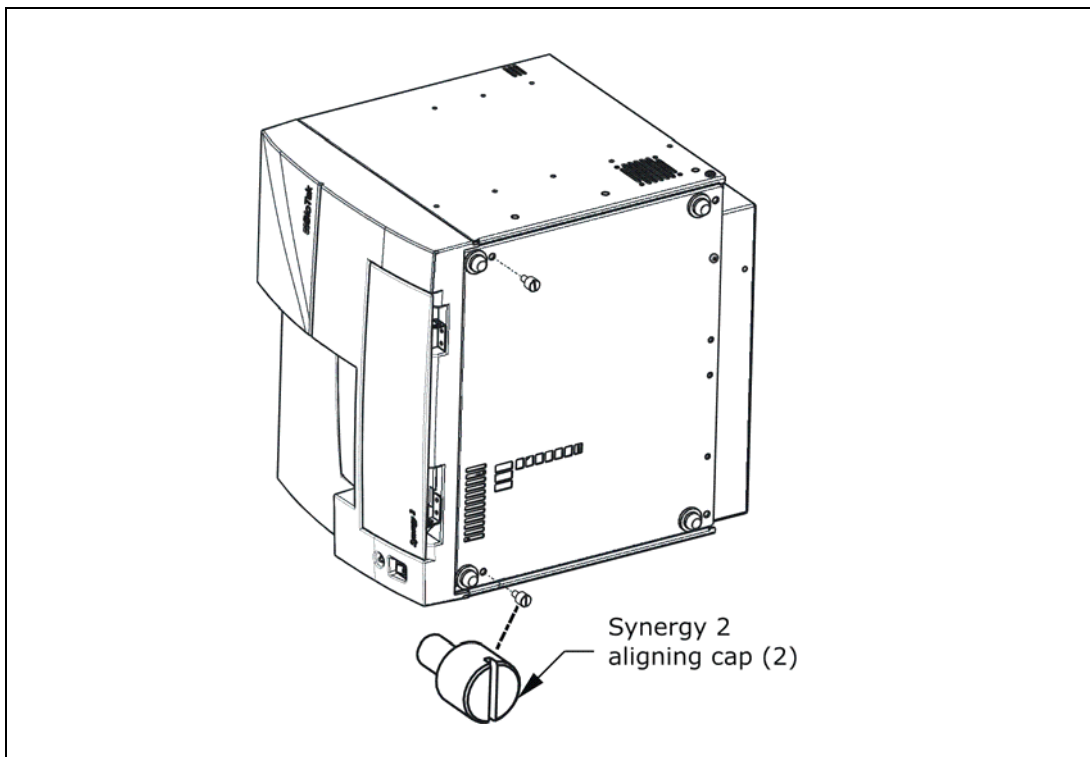
Figure 17: Attaching the Aligning Caps to the Synergy 2/Synergy 4/Synergy Mx Reader

❖ The Synergy 2 is shown.

Seat the Instruments in the Aligning Plates

(i) **Important!** The Synergy 2/Synergy 4/Synergy Mx are very heavy instruments; use extra care when lifting or moving one of these readers. The following instructions require *two people* when seating the Synergy 2/Synergy 4/ Synergy Mx in the aligning plate, to ensure that the reader's aligning caps/legs are properly positioned in the slots provided on the plate.

Perform these steps to seat the BioStack and reader in the aligning plates:

1. Place the reader's aligning plate on a level surface.

2. Loosely attach the BioStack aligning plate to the reader's aligning plate by screwing in the pan head screw, lock washer, and flat washer only halfway. See **Figures 18** through **20** on the following pages.

3. Seat the reader in its aligning plate:

    PowerWave/XS/XS2 and Synergy HT:

    • Slide the reader's two front aligning caps and two front legs into the slots provided on the reader's plate (**Figure 18** and **Figure 19**).

    Synergy 2/Synergy 4/Synergy Mx (two people are required):

    • Lift the front of the reader slightly while another person slides the reader's aligning plate in place under the reader, so the slots on the plate are lined up with the reader's aligning caps and legs.

    • Carefully lower the reader's aligning caps/legs into the slots (**Figure 20**).

4. Slide the BioStack's two front aligning posts into the slots provided on the BioStack's plate.

5. Move both instruments back and forth in their slots until you are satisfied that they are positioned correctly next to each other (approximately). Ensure that all posts and caps are properly seated (not resting on top of the plates), and that the instruments are level.
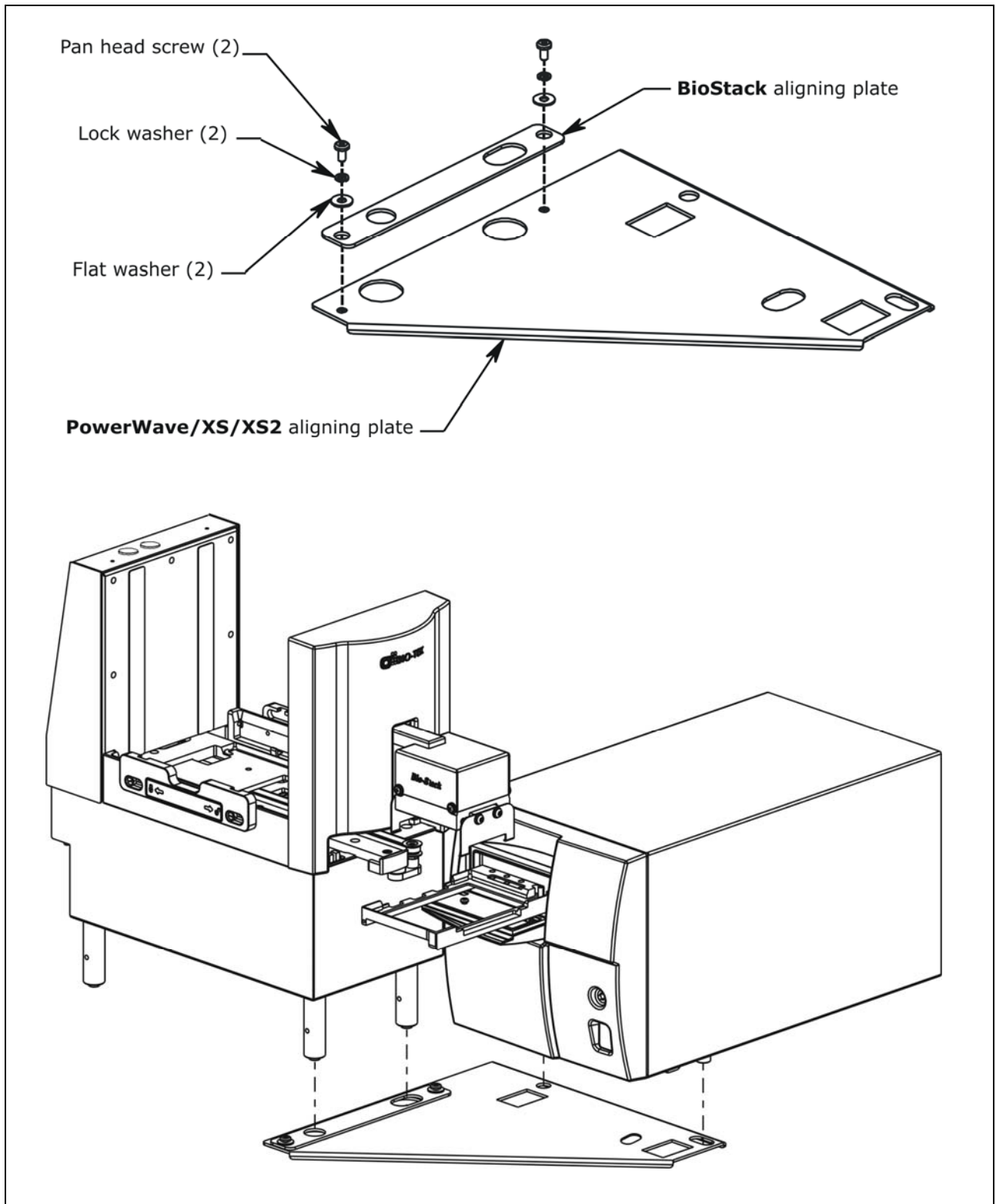
Figure 18: Seating the BioStack and PowerWave/XS/XS2 in the Aligning Plates
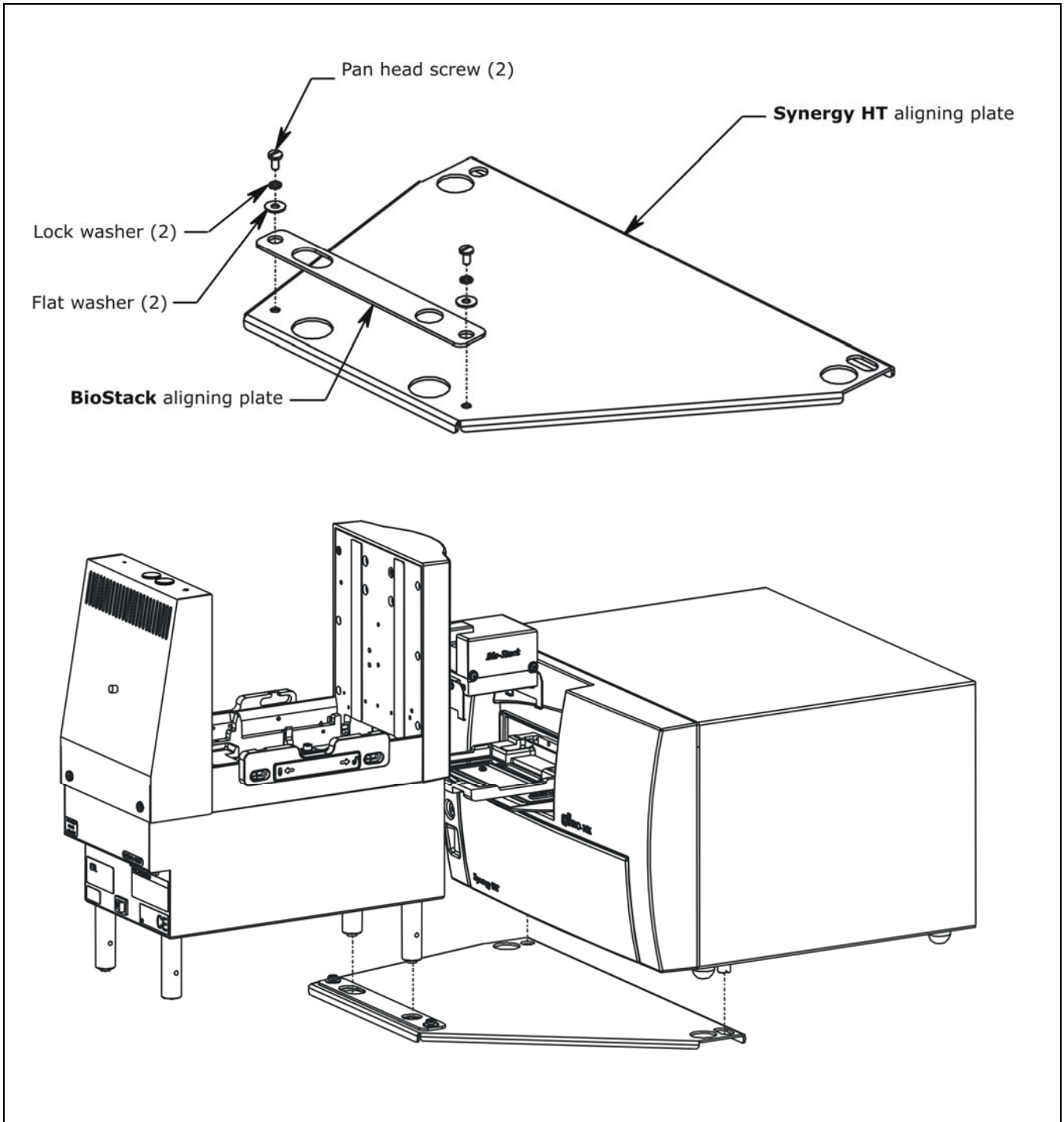
Figure 19: Seating the BioStack and Synergy HT in the Aligning Plates
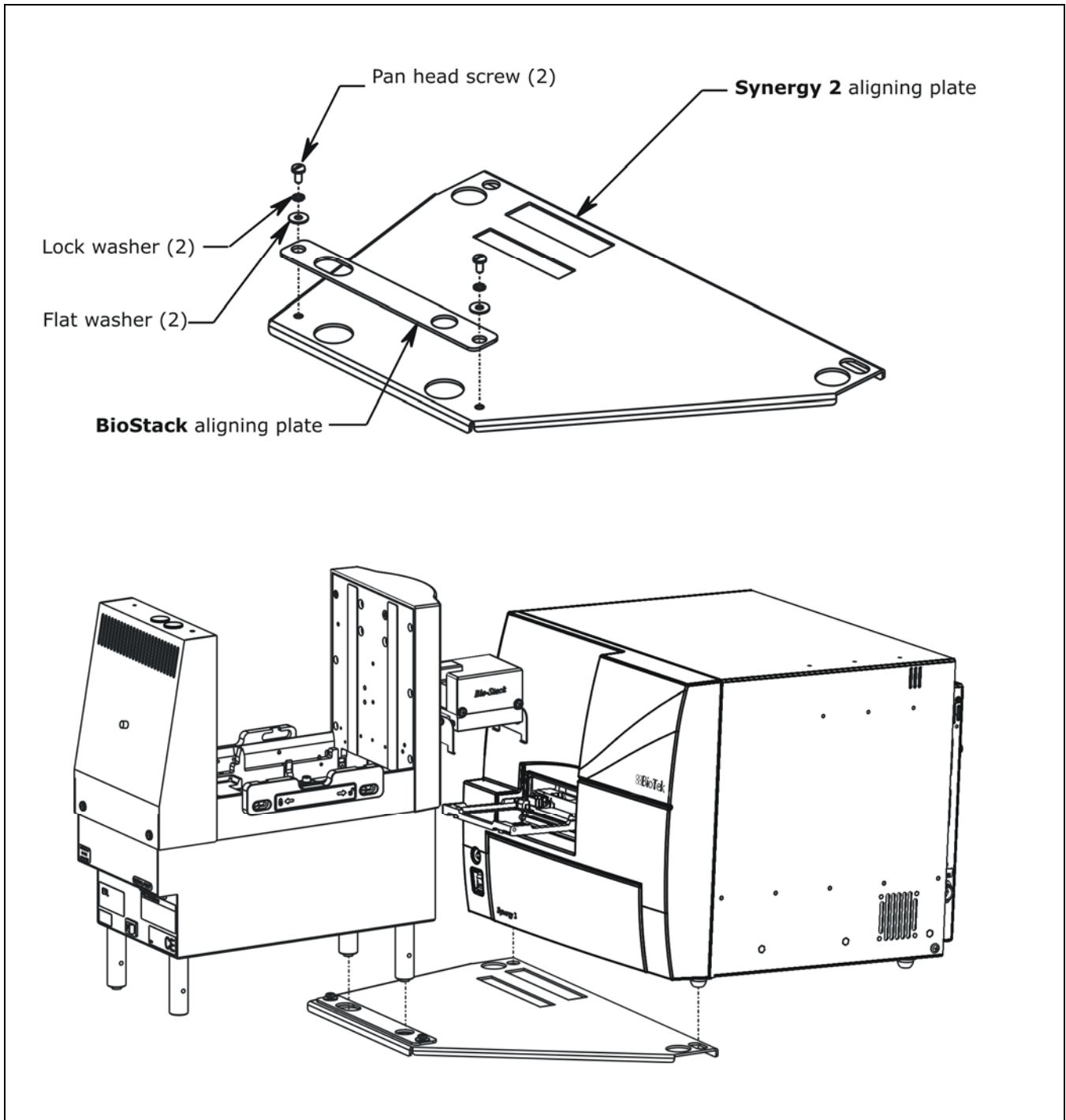
Figure 20: Seating the BioStack and Synergy 2/Synergy 4/Synergy Mx in the Aligning Plates

❖ The Synergy 2 is shown.

Turn on the BioStack and Run a Self-Test

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	The BioStack **must** pass the self-test for installation with the PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4/ Synergy Mx.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the reader, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the reader's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the reader.

❖ The BioStack does not need to be connected to a host computer for this test.

❖ **Rotational wrist model:** If you changed the wrist angle from the default interface of 90° to 0° (mandatory for operation with the readers), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see ***Figure 12*** on page 41 for the location of the switch). The BioStack will home all axes (claw/gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier, and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Leave the BioStack powered up for the next section, ***Align the BioStack with the Reader***.

Align the BioStack with the Reader

Perform these steps to align the BioStack with the PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4/Synergy Mx reader:

1. Ensure that the BioStack has been homed according to the instructions in the previous section.

2. **PowerWave/XS/XS2:** Reconnect the power supply to the reader.

   Synergy HT/Synergy 2/Synergy 4/Synergy Mx: Reconnect the power supply and serial or USB cable to the reader.

3. Turn on the reader. The carrier should be in the "out" position. Leave the reader powered up.

4. Turn the BioStack off.

5. Manually pull the BioStack carrier all the way out and position it below the claw assembly. Refer to *Figure 21* or *Figure 22* on pages 57 and 58.

   > ❖ **PowerWave/XS/XS2:** The BioStack's carrier should not touch the front of the reader.

6. Place a dry microplate on the BioStack carrier.

7. Manually lower the claw assembly down to the microplate and pick up the microplate (manually open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

8. Push the BioStack carrier out of the way.

9. Lower the claw assembly until the microplate is just above the carrier of the reader.

10. Manually adjust the BioStack on the tabletop so the microplate can be lowered onto the carrier of the reader. The microplate carrier should be positioned as if it was just homed by the reader. If the reader's carrier or microplate has been moved, home the instruments (the BioStack first, then the reader) remove the microplate from the BioStack claw, then repeat steps 4 through 10.

11. When you are satisfied with the microplate positioning relative to the carrier of the reader (look carefully at the top-down drawing in *Figure 21* for the PowerWave/XS/XS2 or *Figure 22* for the Synergy HT/Synergy 2/ Synergy 4/Synergy Mx, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

12. Repeat all of the steps a couple times to ensure that the microplate does not change position and that it rides smoothly in and out of the carriers.
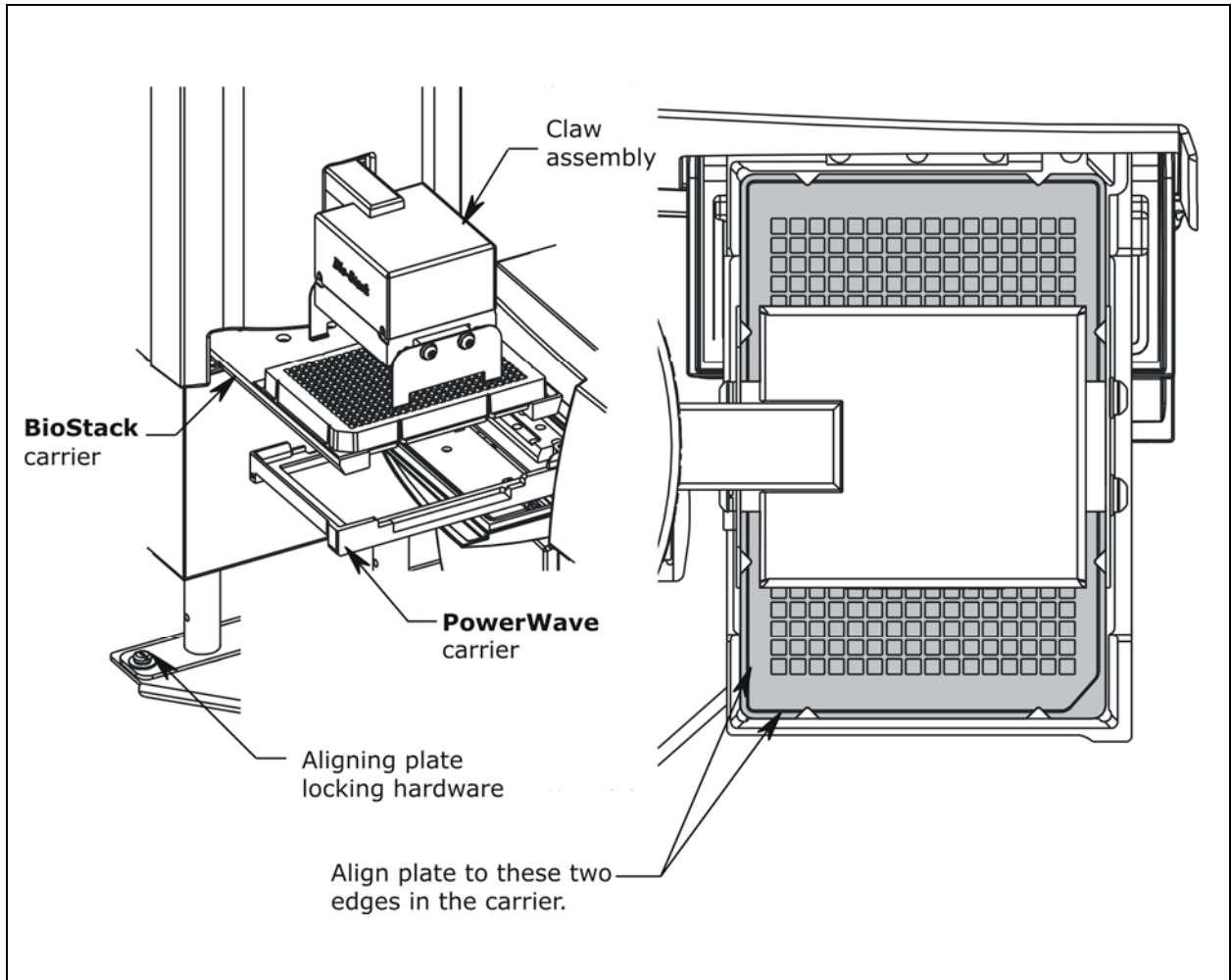
Figure 21: Aligning the BioStack with the PowerWave/XS/XS2 Reader
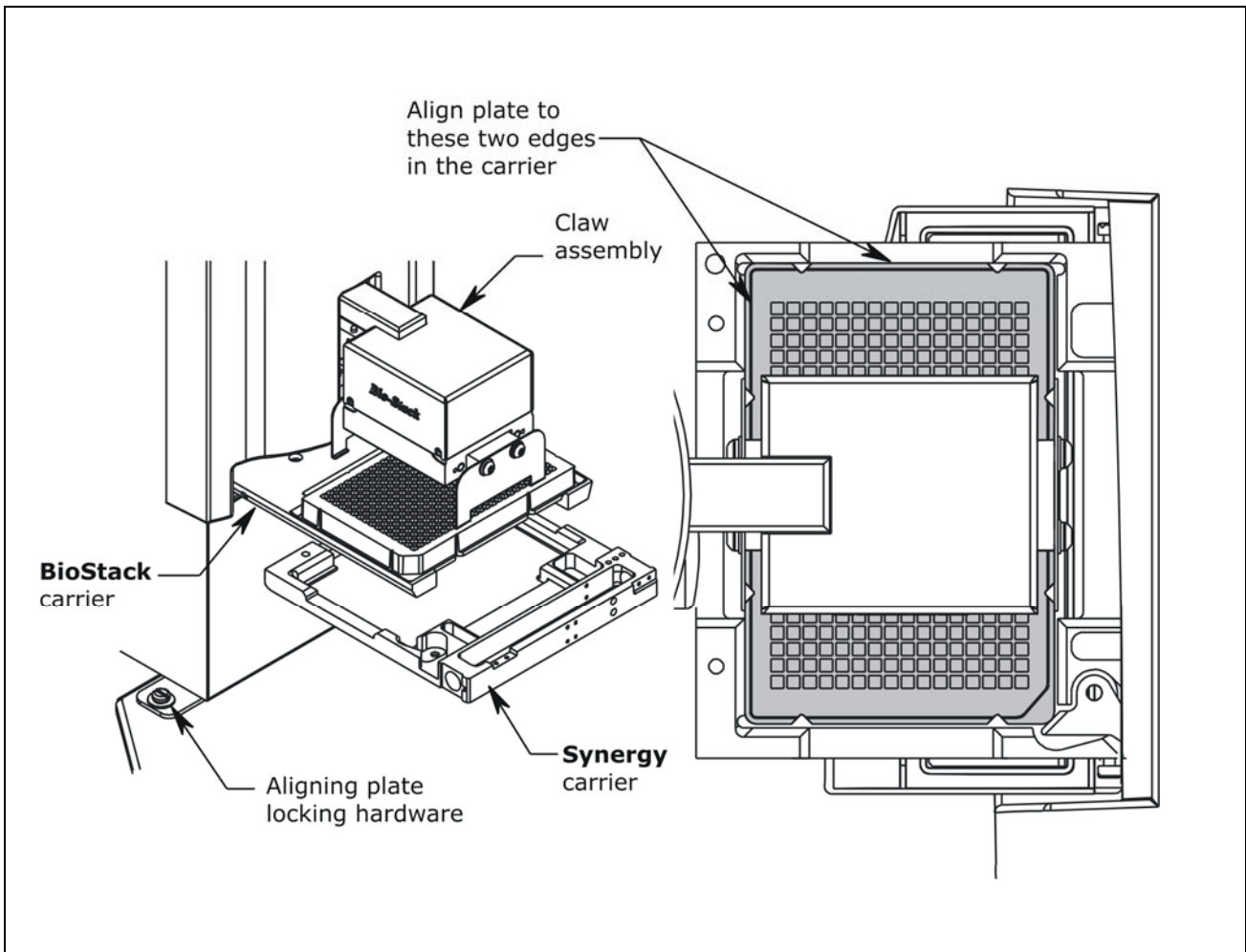
Figure 22: Aligning the BioStack with the Synergy HT/Synergy 2/Synergy 4/
Synergy Mx Reader

Install the Microplate Stacks

Locate the stack locks on the sides of the BioStack. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 23* below and then close the stack locks.
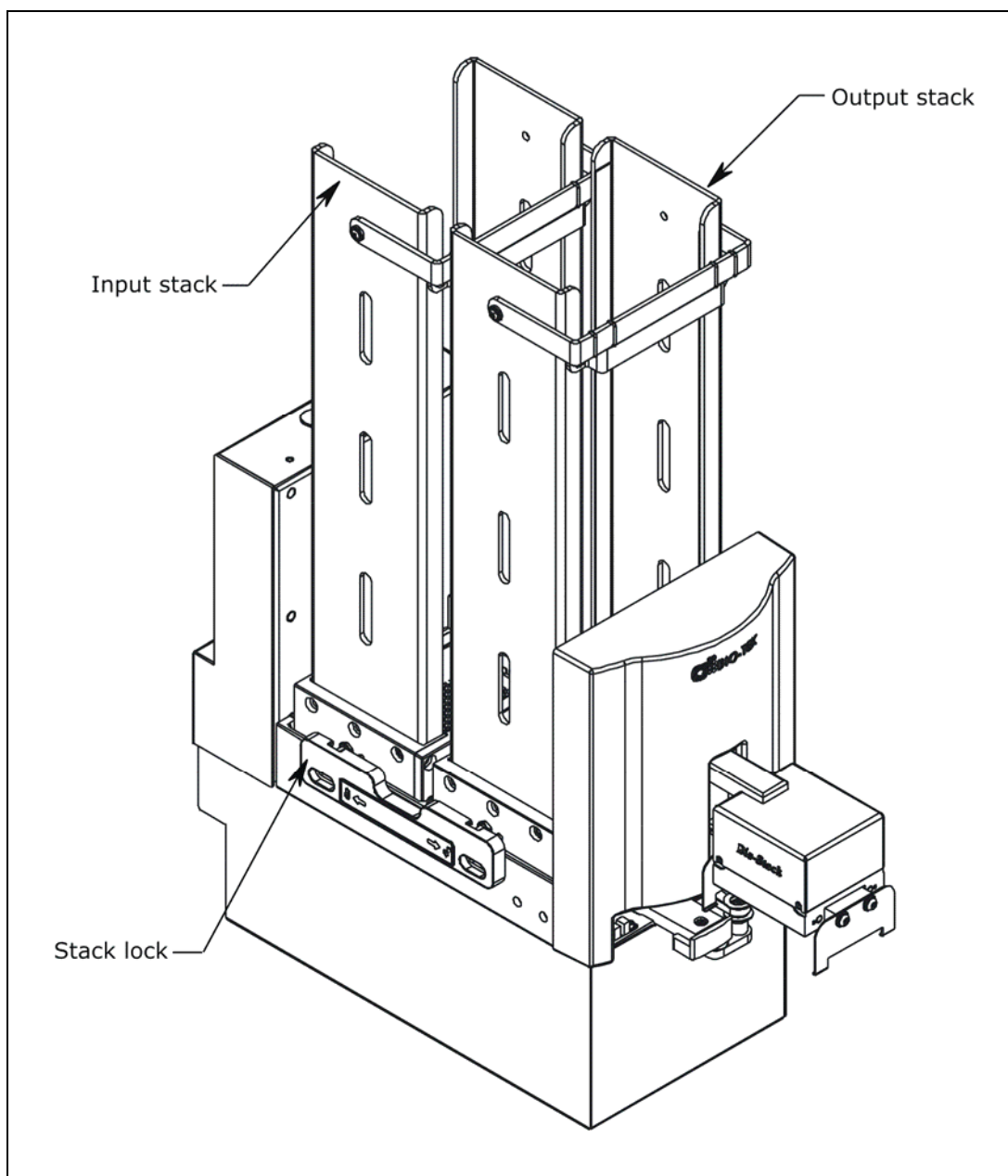
Figure 23: Installing the Microplate Stacks

❖ The 30-plate stacks are shown.

Connect the Host Computer to the BioStack and Reader

> (i) The host computer must be equipped with at least **two serial ports** or **one serial port and one USB port**.

❖ The **Integration Kits** for the PowerWave/XS/XS2, Synergy HT, and Synergy 2/Synergy 4/Synergy Mx include two serial cables (a 9-pin to 9-pin male/female cable and 9-pin to 25-pin female/female cable), a USB cable, and Virtual USB Com Port driver software CD. **Note:** The USB cable may only be used with the PowerWave XS2, Synergy HT/ Synergy 2/Synergy 4/Synergy Mx.

The **shipping accessories** for the PowerWave/XS include a 9-pin to 25-pin female/female serial cable.

The **shipping accessories** for the PowerWave XS2, Synergy HT/ Synergy 2/Synergy 4/Synergy Mx include a 9-pin to 9-pin male/female serial cable, USB cable, and Virtual USB Com Port driver software CD.

Perform these steps to connect the host computer to both the BioStack and the interfacing reader (refer to *Figure 12* on page 41 for an illustration of the serial and USB ports):

1. If the BioStack is on, turn it off. If the reader or computer are on, turn them off.
2. Place the computer in a location adjacent to the BioStack and the reader.
3. Connect the computer to the BioStack and reader, using the supplied serial cables **or** USB cables:

   If using the serial cable: Plug one end into the **RS232** serial port on the instrument and the other end into an available port on the computer.

   If using the USB cable: Plug one end into the **USB** port on the instrument and the other end into an available port on the computer.

   • Refer to the instructions that shipped with the "USB Virtual COM Driver Software" CD to install the necessary drivers and identify the **Com Port number**.

Install Gen5 Software and Test Communication with the Reader

> (i) All Gen5 software versions support the BioStack, however, you will need versions of the BioStack PC Control Software and the BioStack basecode software that are appropriate for the Gen5 version you are using with your reader. For example, if you have **v.2.00.10** or greater of the BioStack PC Control Software, you will need Gen5 **v.1.02.8** or greater. See *Appendix D*, *Required Software Versions*.

Perform these steps to install the **Gen5** software, and then test communication with the interfacing reader:

1. Turn on the computer and follow the instructions provided in the *Gen5 Getting Started Guide* for installing and registering Gen5.

   - If you purchased the Gen5 Diagnostic Utility and Test Plate Package (PN 7770042), install the Diagnostic Utility.

2. Turn on the reader and allow the system self-test to complete.

3. Launch Gen5. Log in if prompted to do so (Gen5 Secure); the default password is **admin**.

4. At the Welcome screen, select **System Menu**.

5. At Gen5's main screen, select **System > Reader Configuration** to open the 'Reader Configuration' dialog.

6. Click the **Add** button to open the 'Reader Settings' dialog.

   - Gen5 and Gen5 Secure: Up to two readers may be added in Gen5.

7. Use the drop-down list in **Reader Type** to select the correct reader.

8. Enter the reader's **Com Port**.

9. Select a **Baud Rate** (**9600** is recommended for most BioTek readers).

10. Click **Test Comm.** to establish communication. If any informational messages appear, read them carefully and follow the instructions provided by Gen5.

    - If you receive "The Reader is communicating!" message, click **OK** and then **OK** again to save the settings.

    - If you receive an error message, check the serial cable connections or refer to the Troubleshooting section of the Help system for assistance.

11. Click **Close** at the Reader Configuration dialog to return to the main menu.

> ❖ Gen5 Secure: An 'Audit Trail' dialog will appear after closing Reader Configuration. Enter any comments, if desired, and then click **Close**. Note also that when Gen5 Secure is used in the BioStack operating environment, Audit Trail events are identified by the user "OLE User."

Install KC4 Software and Test Communication with the Reader

> (i) You will need KC4 software **v. 3.3**, **Rev. 9 or greater** for operation of the reader with the BioStack. If you do not have this software, please contact your BioTek sales representative for more information.
>
> For operation of the BioStack's optional barcode scanner, you will need KC4 **v. 3.4**, **Rev. 16 or greater.** (You will need **v. 3.4**, **Rev. 22** if you wish to have BioStack scanned barcodes appear in KC4 plate description dialogs.)
>
> See *Appendix D*, *Required Software Versions*.

Perform these steps to install the **KC4** software, and then test communication with the interfacing reader:

1. Follow the instructions provided in the KC4 User's Guide for installing and registering the software.

2. Turn on the reader and allow the system self-test to complete.

3. Launch KC4. Log in if prompted to do so.

4. From KC4's main menu, select **System > Readers** to open the 'Reader Selection' dialog.

5. Carefully review the list of **Available Readers**. Click once to highlight the correct reader model.

> ❖ BioTek's PowerWave XS2, Synergy 2,Synergy 4, and Synergy Mx readers are not included in the list of Available Readers; KC4 does not support these four readers.

6. Click **Port** and select the reader's **COM port#**.

7. Click **Setup** and set the **Transmission Speed** (Baud Rate), **Data Bits**, **Parity**, and **Stop Bits** to **9600**, **8**, **No**, and **2**.

8. Click **OK**, **OK** to return to the Reader Selection dialog.

9. Click **Current Reader** to establish communication. If any informational messages appear, read them carefully and follow the instructions provided by KC4.

   - If asked, "Do you want to update the software wavelength table?" click **Yes**.

   - If a "No reader response" message appears, you may have selected the wrong Com port in step 6.

10. Click **Close** to return to KC4's main screen.

Run the Checksum Test for the Reader

Perform these steps to run the Checksum Test and record the software versions for Gen5 or KC4 Software and for the reader:

> ❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the software versions for Gen5 or KC4 and for the PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4/Synergy Mx.

Gen5:

1. At Gen5's main screen, select **Help > About Gen5**.

2. Record Gen5's Installation Version, Build Version, Reader Control Version, and Diagnostics Version (if the Gen5 Diagnostic Utility was installed). Record the serial number listed on the Gen5 software package.

3. Return to the main menu and select **System > Reader Control**, then click the appropriate reader to open the 'Reader Control' dialog.

4. At the Reader Control dialog, select the **Information** tab to display the reader's basecode software information. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

5. Record the reader's basecode part number, version number, and checksum. Record the serial number listed on the reader.

KC4:

1. At KC4's main screen, select **About > About KC4**.

2. Record KC4's version and revision numbers. Record the serial number listed on the KC4 software package.

3. Click **OK** to return to the main screen, then select **System > Reader Control**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

4. Record the reader's basecode part number, version number, and checksum. Record the serial number listed on the reader.

Install the BioStack PC Control Software and Test Communication with the BioStack

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

❖ A CD containing the **BioStack PC Control Software** and an installation guide are included in the Integration Kits for the readers.

❖ **Gen5 users:** If you are installing **v2.00.10 or greater** of the BioStack PC Control Software, you will need Gen5 **v1.02.8 or greater** installed on the PC. Contact BioTek for more information.

Perform these steps to install the BioStack PC Control Software on the computer, and then test communication with the BioStack:

1. Turn the computer on. Manually raise the BioStack's claw/gripper above the reader's plate carrier, then turn the BioStack on and allow its self-test to complete. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Follow the instructions provided in the *BioStack PC Control Software Installation Guide* to install the software on the computer.

3. Launch the BioStack PC Control Software.

4. From the software main screen, select **Gen5** or **KC4**, as appropriate, for the **Reader Control Software**.

5. Click the **Configure Instruments** button.

6. When the 'Instrument Configuration' dialog appears, select the appropriate **COM Port** for the **BioStack Configuration** and then click **Test Communications**.

   - If the test is **not** successful, ensure that the cable is properly connected and you have correctly identified the Com port number.

   - (Optional) If you installed Gen5, you may also test communication with the reader in the Instrument Configuration dialog. Select the appropriate **Instrument**, **COM Port**, and **BAUD Rate** (**9600** is recommended) for the **Instrument Configuration**, then click **Test Communications**.

7. If the test is successful, return to the main screen.

Run the Checksum Test for the BioStack

Perform these steps to run the Checksum Test for the BioStack and record the software versions for the BioStack PC Control Software and for the BioStack:

> ❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the BioStack software versions.

1. From the top menu bar in the BioStack PC Control Software, select **Help > About BioStack**.

2. The 'About BioStack Software' dialog will open. Record the BioStack PC Software Versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX. Record the serial number listed on the BioStack PC Control Software package.

3. Click **Get On-board values now**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

4. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum. Record the serial number listed on the BioStack.

> ❖ When you have Gen5 or KC4 software installed on your PC, the BioStack PC Control Software also retrieves and displays the Gen5 or KC4 software versions in the 'About BioStack Software' dialog.

Align the Claw/Gripper with the Reader's Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the reader's plate carrier. The BioStack PC Control Software has an **Instrument Alignment Utility** for this task.

Perform these steps to run the Instrument Alignment Utility:

1. Launch the BioStack PC Control Software.

2. From the main screen, click the **Configure Instruments** button.

3. When the 'Instrument Configuration' dialog appears, select the appropriate **Instrument** (reader).

> ❖ **KC4:** Select "PowerWave" for any PowerWave™ model, and "Synergy" for any Synergy™ model (excludes the PowerWave XS2, Synergy 2, Synergy 4, and Synergy Mx readers).

4. Click the **Instrument Alignment Utility** button.

5. Use the **Re-Alignment Control** buttons to position the BioStack's claw/gripper mechanism to the desired height relative to the reader's plate carrier. To aid in this activity, place a dry microplate on the reader's carrier. Lower the claw/gripper so that the gripper's "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface (see *Figure 24* on the following page).

> ❖ If the BioStack and reader are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

- Begin with the **Down** radio button selected. To avoid collision of the gripper with the reader's carrier, click the **20 Step** button first, to see how far that goes, before clicking the **400 Step** button. Use the **400/20/1 Step** buttons to *gradually* lower the claw/gripper mechanism to the desired height.

  If you go down too far, click the **Up** radio button and step up a bit.

> ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button (in the **Instrument Alignment Utility** dialog) to home all axes on the BioStack, then repeat step 5 above.

6. When you are satisfied with the position, click the **Save Position** button.

7. Remove the plate from the carrier.

Figure 24: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the Reader's Plate Carrier

Verify the Alignment

Perform the following test to verify alignment of the BioStack with the reader:

1. Place a dry microplate in the BioStack's input stack.

2. If you have not already done so, launch the BioStack PC Control Software.

3. Click **Configure Instruments** to open the 'Instrument Configuration' dialog, then select the appropriate **Instrument** (reader).

4. Click **Instrument Alignment Utility**, then click the **Verify** button.

5. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   - The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.

   - The claw/gripper will pick up the plate, lower it toward the reader's plate carrier, and then *smoothly* place the plate on the carrier.

   ❖ If the plate drops onto the carrier, the claw interface position has been set too high. Repeat the steps in the previous section: ***Align the Claw/Gripper with the Reader's Plate Carrier***.

   - The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

   ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will appear in the software. Repeat the steps in ***Align the Claw/Gripper with the Reader's Plate Carrier***.

   - If the gripper fingers did not catch on the plate, the "Verify plate placement" message will appear. Click **OK** to continue.

   - The claw/gripper will lower, pick up the plate, place the plate on the BioStack's carrier, and then place the plate in the output stack.

   - The plate will then be transferred by the carrier from the output stack to the input stack.

6. If the alignment verification completed successfully and you have determined that the gripper fingers are positioned correctly, the BioStack is now ready for operation with the reader.

   - If the gripper fingers are not positioned correctly, perform the steps in ***Align the Claw/Gripper with the Reader's Plate Carrier*** again, and then re-run the Verify Test.

   ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

Install the BioStack with the Precision/XS

❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with a **Precision** instrument, you will need to change the wrist angle from the default interface position of 90° to 0°. Refer to *Configure the Rotational Wrist Model for the Interfacing Instrument* on page 42, for instructions.

❖ Except where noted, the installation steps apply to all BioStack models.

❖ If you will be operating **two BioStacks** with **one Precision instrument**, you will need a computer equipped with three communication ports, one Precision Integration Kit (PN 7110004), and a second set of the BioStack aligning posts (PN 7110542), BioStack aligning plate (PN 7112140), and mounting hardware. You will need to perform the installation steps for both BioStack/Precision configurations.

Lay Out the Alignment Hardware

You will need the alignment hardware from the Precision/XS Integration Kit (**PN 7110004**) illustrated below:
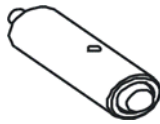
Four aligning posts (PN 7110542) for elevating the BioStack to the correct height and for seating in the aligning plate.

Two aligning caps (PN 7312074) for elevating the Precision/XS to the correct height and for seating in the aligning plate.
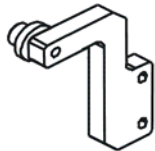
Left roller
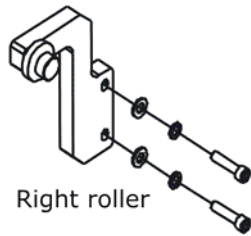
Right roller

Left and right roller extensions (PN's 7110544 and 7110556) for extending the Precision supply platform forward for alignment with the BioStack.

Four each of mounting hardware: lock washer (PN 16003), screw (PN 19055), and flat washer (PN 17003).

Precision plate
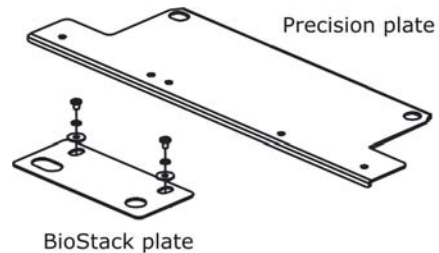
BioStack plate

Precision aligning plate (PN 7112139) for preventing the instrument from sliding around and being misaligned with the BioStack.

BioStack aligning plate (PN 7112140) for attachment to the Precision aligning plate. Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Attach the Aligning Posts and Caps

> ⓘ **Important!** When attaching the four aligning posts ("feet") to the BioStack, do not over-tighten the posts! **Finger-tighten only!**
>
> To avoid scratches to the BioStack or to the Precision, place a towel down before laying the instrument on its side or back.

Refer to *Figure 25* on the next page for the following instructions. Perform these steps to attach the aligning posts to the BioStack and the aligning caps to the Precision.

1. Carefully lay the BioStack on its side, so the bottom of the instrument is facing you.

2. Screw in all four aligning posts as shown. Return the BioStack to the upright position.

3. If you are using two BioStacks with a Precision instrument, repeat steps 1 through 2 for the second BioStack.

4. Turn off the Precision instrument and disconnect it from the power supply cord and serial or USB cable.

5. Carefully lay the Precision on its back so that the bottom surfaces of the left and right supports are facing you.

6. Using a 9/64" hex wrench, remove the stop from the bottom of one support first. Install the aligning cap, using a flat blade screwdriver.

7. Repeat Step 6 for the other support on the Precision. Return the Precision to the upright position.

Attach the Roller Extensions to the Supply Platform

Refer to *Figure 26* on page 72 for the following instructions. Perform these steps to attach the left and right roller extensions to the Precision supply platform:

1. If you haven't already done so, install the supply platform (refer to the *Installation* chapter in the Precision Operator's Manual).

2. Using a 7/64" hex wrench, loosely attach the left roller extension to the left support by screwing in the screw, lock washer and flat washer only halfway.

3. Slide the extension up until it touches the bottom of the supply platform without raising the platform.

4. Tighten the mounting hardware of the extension.

5. Repeat steps 2 through 4, using the right roller extension, mounting hardware, and the right support.
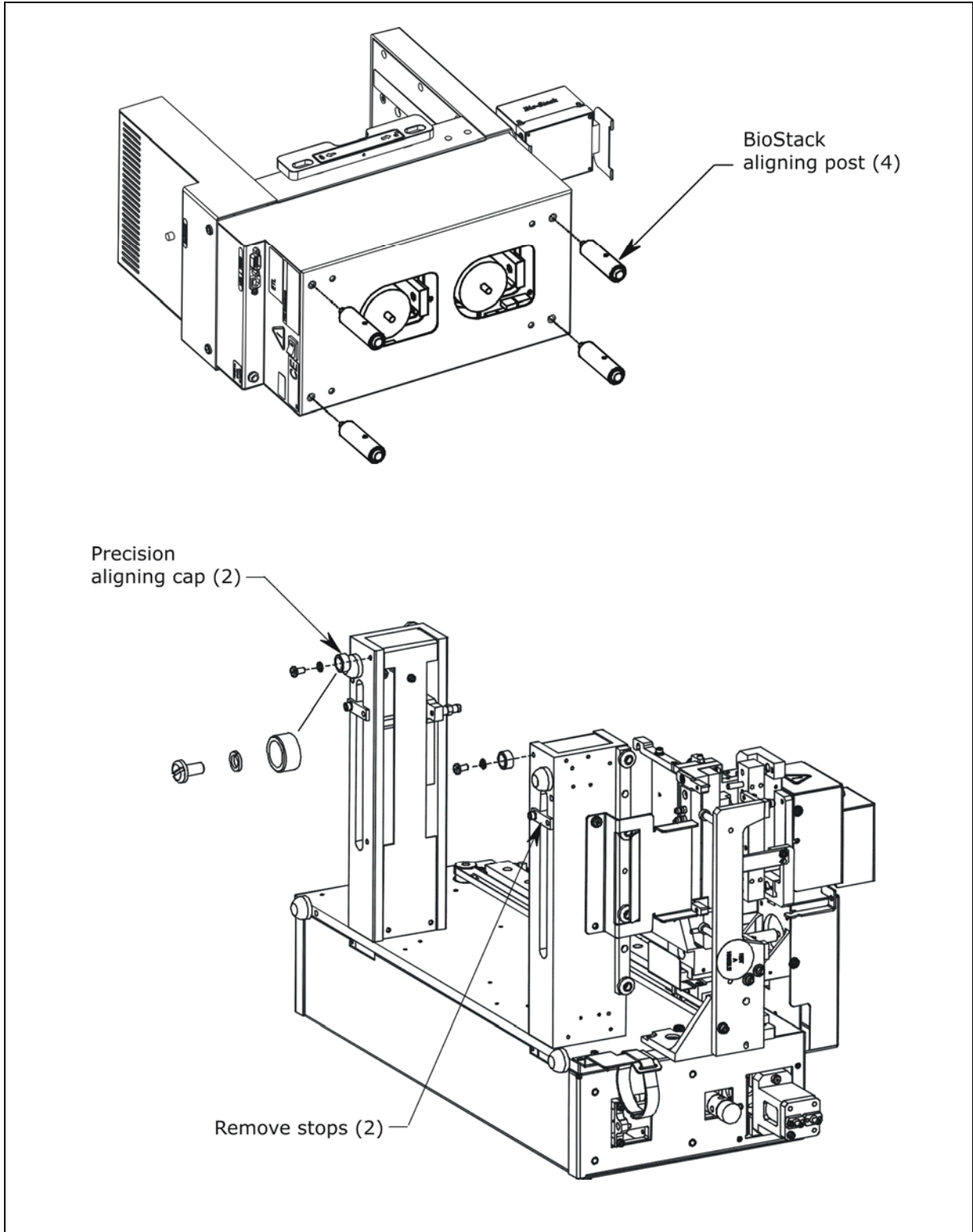
Figure 25: Removing the Stops and Attaching the Aligning Posts (BioStack)
and Caps (Precision/XS)

❖   The Precision XS is illustrated in *Figure 25*.
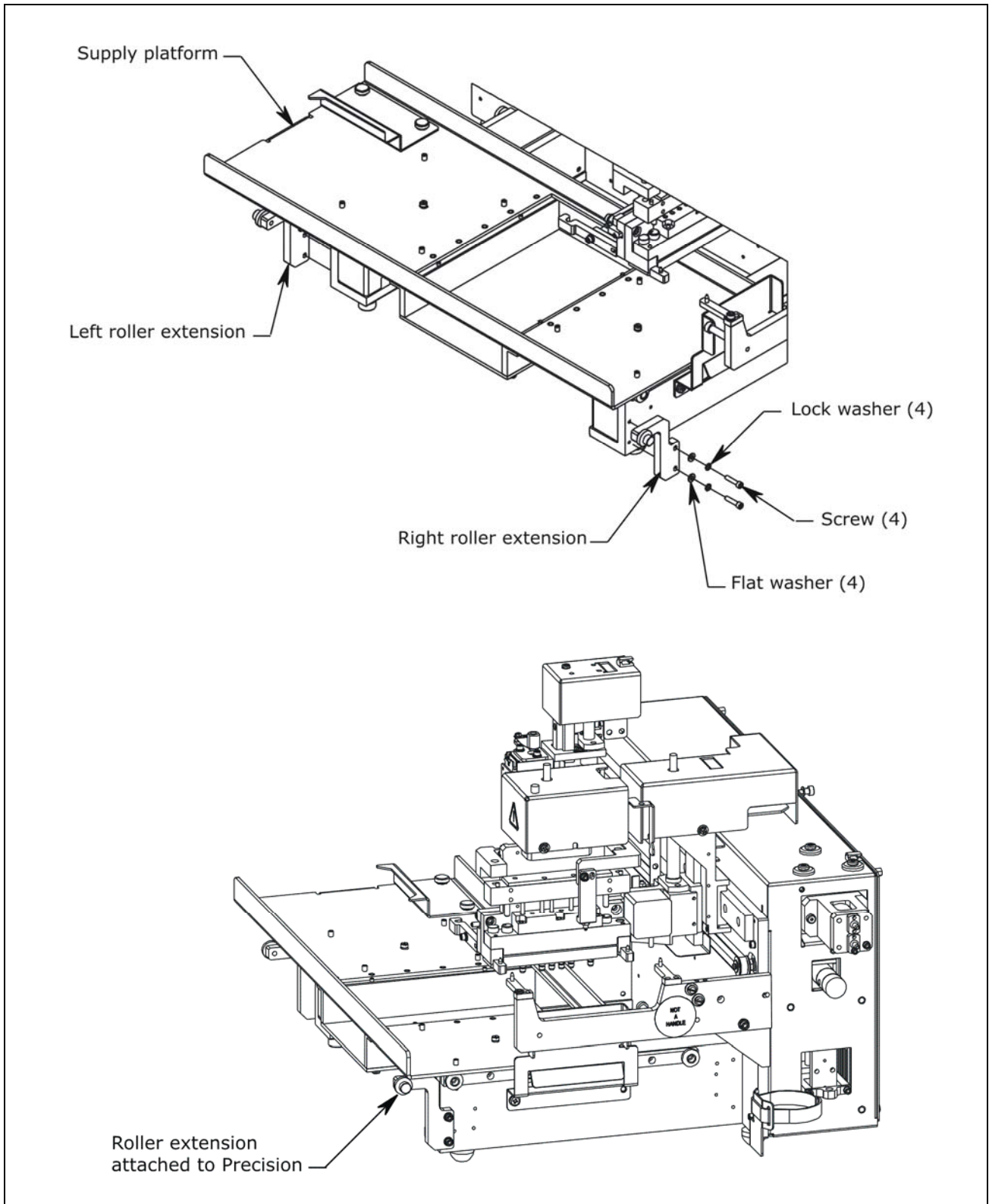
Figure 26: Attaching the Roller Extensions to the Precision/XS

❖ The Precision XS is illustrated in *Figure 26*.

Seat the Instruments in the Aligning Plates

❖ The Precision's aligning plate contains slots for aligning the BioStack with any one of the supply stations A, B, or C, located on the front row of the supply platform. *Figure 28* on page 75 illustrates the BioStack aligned with station C.

❖ If you are installing two BioStacks with a Precision instrument, align one BioStack with **supply station A**, and the other BioStack with **supply station C**, in order to allow adequate spacing between the two BioStacks.

Refer to *Figure 27* and *Figure 28* on pages 74 and 75 for the following instructions. Perform these steps to seat the Precision and BioStack in the aligning plates:

1. With the Precision still in the upright position, slide the Precision's two front aligning caps into the slots provided on the Precision aligning plate (*Figure 27*).

2. Loosely attach the BioStack aligning plate to the Precision aligning plate in front of the supply station (A, B, or C) that the BioStack will be aligned with, by screwing in the pan head screw, lock washer, and flat washer only half-way.

3. Slide the BioStack's two front aligning posts into the slots provided on the BioStack aligning plate (*Figure 28*).

4. Move both instruments back and forth in their slots until you are satisfied that they are positioned correctly next to each other (approximately). Ensure that all posts and caps are properly seated (not resting on top of the plates), and that the instruments are level.
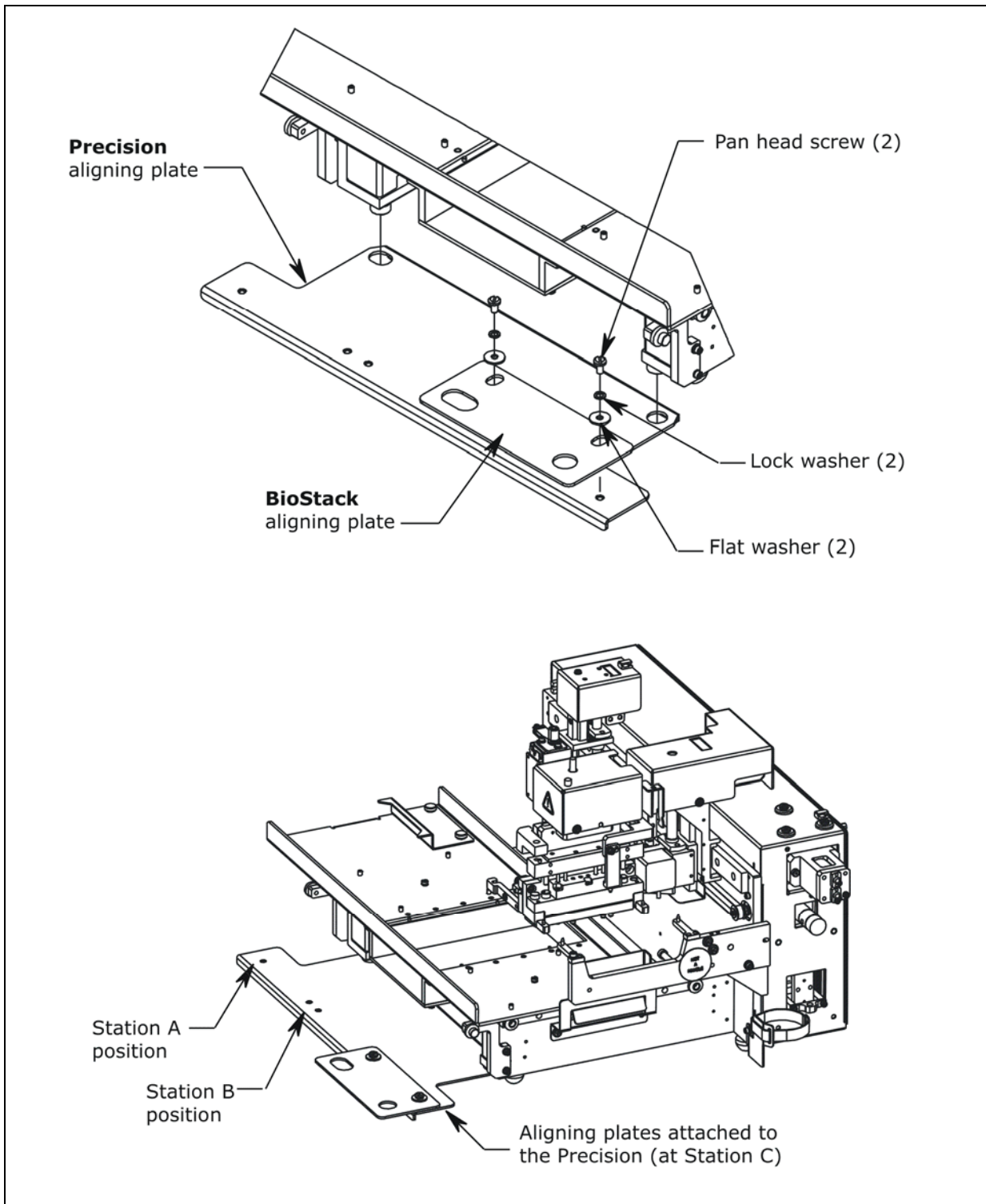
Figure 27: Attaching the Aligning Plates (Precision™/XS)

❖   The Precision XS is illustrated in *Figure 27*.
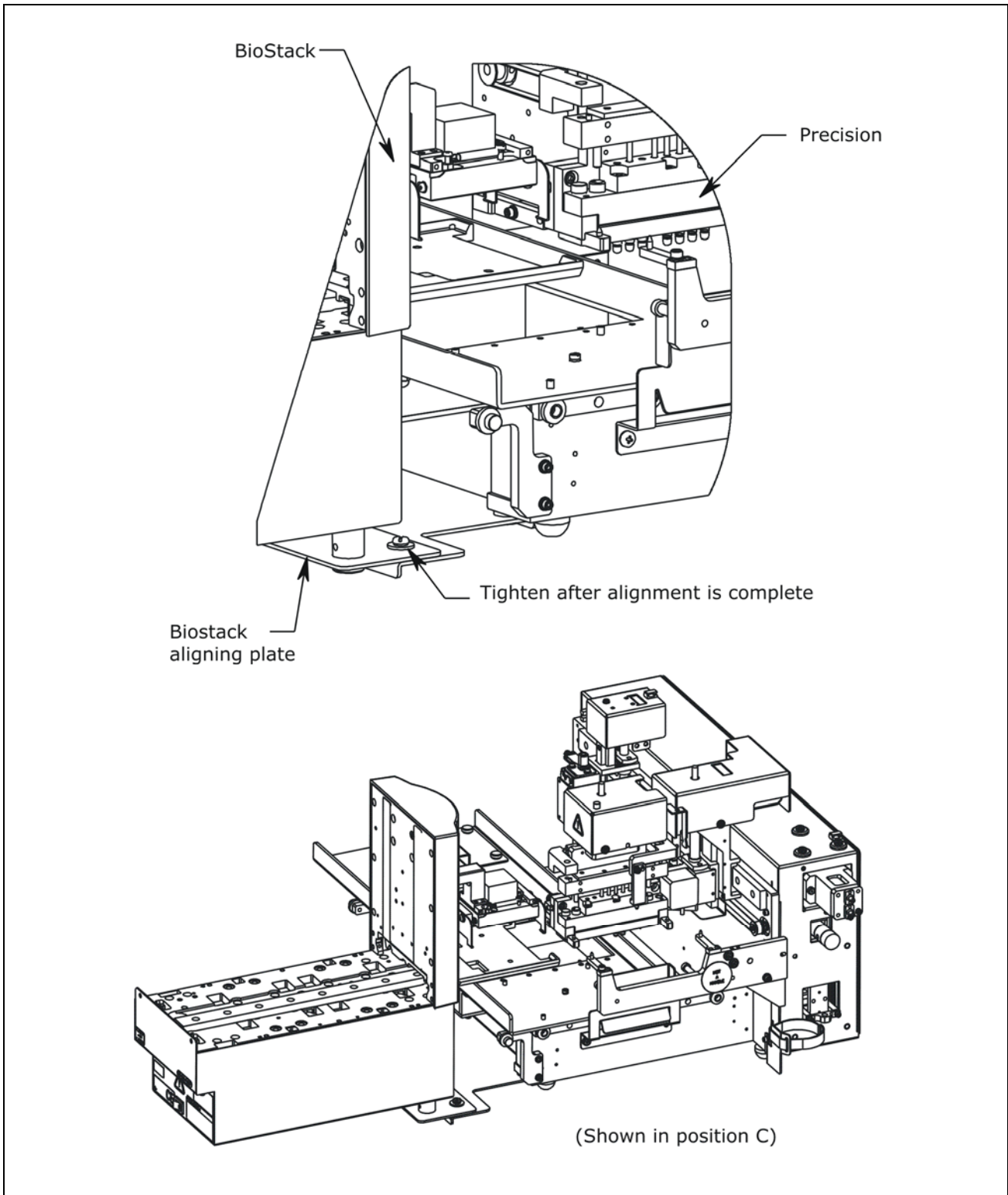
Figure 28: Seating the BioStack and Precision/XS in the Aligning Plates

❖ The Precision XS is illustrated in *Figure 28*.

Turn on the BioStack and Run a Self-Test

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	The BioStack **must** pass the self-test for installation with the Precision/XS.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the Precision, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the Precision's supply station before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the Precision.

❖ The BioStack does not need to be connected to a host computer for this test.

❖ **Rotational wrist model (PN BIOSTACK2WR):** If you changed the wrist angle from the default interface of 90° to 0° (mandatory for operation with the Precision), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see *Figure 12* on page 41 for the location of the switch). The BioStack will home all axes (claw/gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier, and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Connect the Host Computer to the BioStack and Precision/XS

(i) **For operation of one BioStack with the Precision:** The host computer must be equipped with at least two communication ports (two serial ports or one serial port and one USB port).

For operation of two BioStacks with the Precision: The host computer must be equipped with at least three communication ports.

❖ The **Precision/XS Integration Kit** includes two serial cables (9-pin to 9-pin female/male cable and 9-pin to 25-pin female/female cable), a USB cable, and USB driver software CD. **Note:** The serial cable must be used to connect the Precision/XS to the computer.

❖ The **Precision/XS shipping accessories** include a 9-pin to 25-pin female/female serial cable.

Perform the steps on the following page to connect the host computer to both the BioStack and the interfacing Precision instrument (refer to *Figure 12* on page 41 for an illustration of the serial and USB ports).

1. If the BioStack is on, turn it off. Turn off the computer or Precision if they are on.

2. Place the computer in a location adjacent to the BioStack and the Precision.

3. Connect the computer to the BioStack and Precision, using a serial cable **or** USB cable (BioStack only):

   If using the serial cable: Plug one end into the **RS232** serial port on the instrument and the other end into an available port on the computer.

   If using the USB cable: Plug one end into the **USB** port on the instrument and the other end into an available port on the computer.

   • Refer to the instructions that shipped with the "USB Virtual COM Driver Software" CD to install the necessary drivers and identify the **Com Port number**.

Install the BioStack PC Control Software

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

❖ A CD containing the **BioStack PC Control Software** and an installation guide are included in the **Precision/XS Integration Kit** (PN 7110004).

❖ Since Precision Power Software controls the BioStack via a component of the BioStack PC Control Software, it is not necessary to test communication between the BioStack and the BioStack PC Control Software. There is a step to test communication between the BioStack and Precision Power in *Configure Precision Power for BioStack Operation and Test Communication* on page 80.

Perform these steps to install the BioStack PC Control Software on the computer:

1. Turn the computer on. Manually raise the BioStack's claw/gripper above the Precision's supply station, then turn the BioStack on and allow its self-test to complete. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Follow the instructions in the *BioStack PC Control Software Installation Guide* for installation of the software.

3. Launch the BioStack PC Control Software.

Run the Checksum Test for the BioStack

Perform these steps to run the Checksum Test and record the software versions for the BioStack PC Control Software and for the BioStack:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the BioStack software versions.

❖ **Two BioStacks with the Precision:** If you are installing two BioStacks with the Precision, make a copy of the Software Data Sheet to record software information for the second BioStack.

1. From the top menu bar in the BioStack PC Control Software, select **Help > About BioStack**.

2. The 'About BioStack Software' dialog will open. Record the BioStack PC Software Versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX. Record the serial number listed on the BioStack PC Control Software package.

3. Click **Get On-board values now**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

4. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum. Record the BioStack's serial number.

Install Precision Power Software and Test Communication

> ⓘ A CD containing **Precision Power Software**, **v. 2 or greater** is included in the package contents with the Precision XS. If you are operating with the Precision Microplate Pipetting System, please contact BioTek for more information.

Perform these steps to install **Precision Power** software on the computer, and then test communication with the Precision instrument:

1. Follow the instructions provided in the Precision Power User's Guide to install and register the software.

2. Turn on the Precision instrument.

   > ❖ The Precision Microplate Pipetting System will perform a system self-test upon startup, however, this feature has been disabled in the Precision XS as a precaution to avoid shattering any breakable supplies that may be present on the platform during power-up.

3. Launch Precision Power.

   • If you **haven't** registered the software, the first time you launch Precision Power and each time you run it before it is registered (i.e., running in Demo mode), the **Program Registration** screen opens. Click **Demo** to run Precision Power in trial mode.

   • If you **have** already registered the software, an introductory screen will appear. After a few moments (or if you press any key or click the mouse on the image), Precision Power's main screen will appear.

4. At the main screen, select **Instrument** > **Precision Series Configuration** to open the 'Precision Series Instrument Configuration dialog'.

5. If the Com port that is highlighted is not the correct port, click the **Modify** button. At the 'Modify Instrument' dialog, select the correct **Com Port**, then click **OK**.

6. At the Precision Series Instrument Configuration dialog, click **Test Comm**.

   • If the test fails, ensure that the cable is properly connected and you have correctly identified the Com port number.

7. If the test is successful, return to Precision Power's main screen.

   You must now configure Precision Power for operation with the BioStack before you can test communication with the BioStack. (See the next topic.)

Configure Precision Power for BioStack Operation and Test Communication

Perform these steps to configure Precision Power for BioStack operation, and then test communication with the BioStack:

1. <u>For the Precision Microplate Pipetting System only</u>:

   Prepare the Precision for operation with the BioStack:

   - Select **Instrument** > **Precision Series Configuration** > **Settings**. Precision Power will attempt to communicate with the instrument. (If an error is displayed, click **OK** to get to the dialog.)

   - Under **For Non-Precision XS Models**, select **Operating adjacent to BioStack** to prepare the instrument to function with the BioStack. This prevents the Precision from performing its normal homing routine (self-test) at startup – avoiding any hardware collisions with the BioStack.

   - Click **Exit** and then **OK** to return to Precision Power's main screen.

2. <u>For the Precision Microplate Pipetting System and Precision XS</u>:

   Add a BioStack to Precision Power's Instrument Configuration:

   - Select **Instrument** > **BioStack Configuration** > **Add**. Enter a unique **Name** for the BioStack, using up to 16 alphanumeric characters.

   - Use the up/down arrow keys to select a **Com Port**, or enter the desired number directly in the field.

   - Select the supply **Station** where the BioStack will interface with the Precision instrument.

   - Click **OK** to save the settings and return to the Configuration dialog.

   - At the Configuration dialog, click **Test Comm**. If the test is a success, Precision Power and the BioStack are communicating properly. If the test fails, an error code will be provided for troubleshooting.

   - Return to Precision Power's main screen.

Run the Checksum Test for the Precision/XS

Perform these steps to run the Checksum Test and record the software versions for Precision Power Software and for the Precision/XS:

> ❖ Use the **Software Data Sheet** from the section *Run the Checksum Test for the BioStack* to record software versions for Precision Power and the Precision instruments.

1. At Precision Power's main screen, select **Help > About Precision Power**.

2. Record the Precision Power software versions for the Installation CD, PrecisionPower#.exe, and BTIAutoDispenserActiveX. Click **OK** to return to the main screen. Record the serial number listed on the Precision Power Software package.

3. Select **Instrument > Precision Series Configuration > Test Comm**, then select **ActiveX/Instrument Versions > Instrument Version**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

4. Record the Precision instrument's basecode part number, Function Version, and Structure Version. Record the serial number listed on the Precision instrument.

Align the BioStack with the Precision/XS

Refer to *Figure 29* on the next page for the following instructions (the Precision XS is illustrated). Perform these steps to align the BioStack with the desired supply station on the Precision:

1. To home all components on the Precision, select **Instrument > Precision Series Configuration > Utilities > Home All Axis.**

2. After all axes have been homed, keep the 'Utilities' dialog open and prepare the supply platform for alignment with the BioStack by clicking **Position Platform for BioStack.** The platform will move forward. Click **Exit**, then **OK** to return to the main screen.

3. Leave the Precision powered up, however, turn the BioStack off.

4. Manually pull the BioStack carrier all the way out and position it below the claw assembly.

5. Place a dry microplate on the BioStack carrier, and a microplate holder on the supply station that the BioStack is aligned with.

6. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

7. Push the BioStack carrier out of the way.

8. Lower the claw assembly until the microplate is just above the microplate holder on the supply station of the Precision.

9. Manually adjust the BioStack on the tabletop so the microplate can be lowered onto the microplate holder on the supply station. If the supply platform has been repositioned or the microplate has been moved, home the instruments (the BioStack first, then the Precision), remove the microplate from the BioStack claw, then repeat steps 3 through 10.

10. When you are satisfied with the microplate positioning relative to the supply station (refer to the top-down drawing in *Figure 29* to see how the plate should fit into the holder on the supply station), finger-tighten the aligning plate locking hardware in both places.

11. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the holder on the supply station.

12. If you are using two BioStacks with a Precision instrument, power down the first BioStack, then turn off the Precision. Manually raise the claw/gripper on the second BioStack above the Precision's supply station and turn the BioStack on to home the instrument. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Power up the Precision, and repeat steps 2 through 12 for the second BioStack.

Align plate to these two edges in the holder on the supply station.

Claw assembly

BioStack carrier

Holder on **Precision** supply station

Aligning plate locking hardware (2)
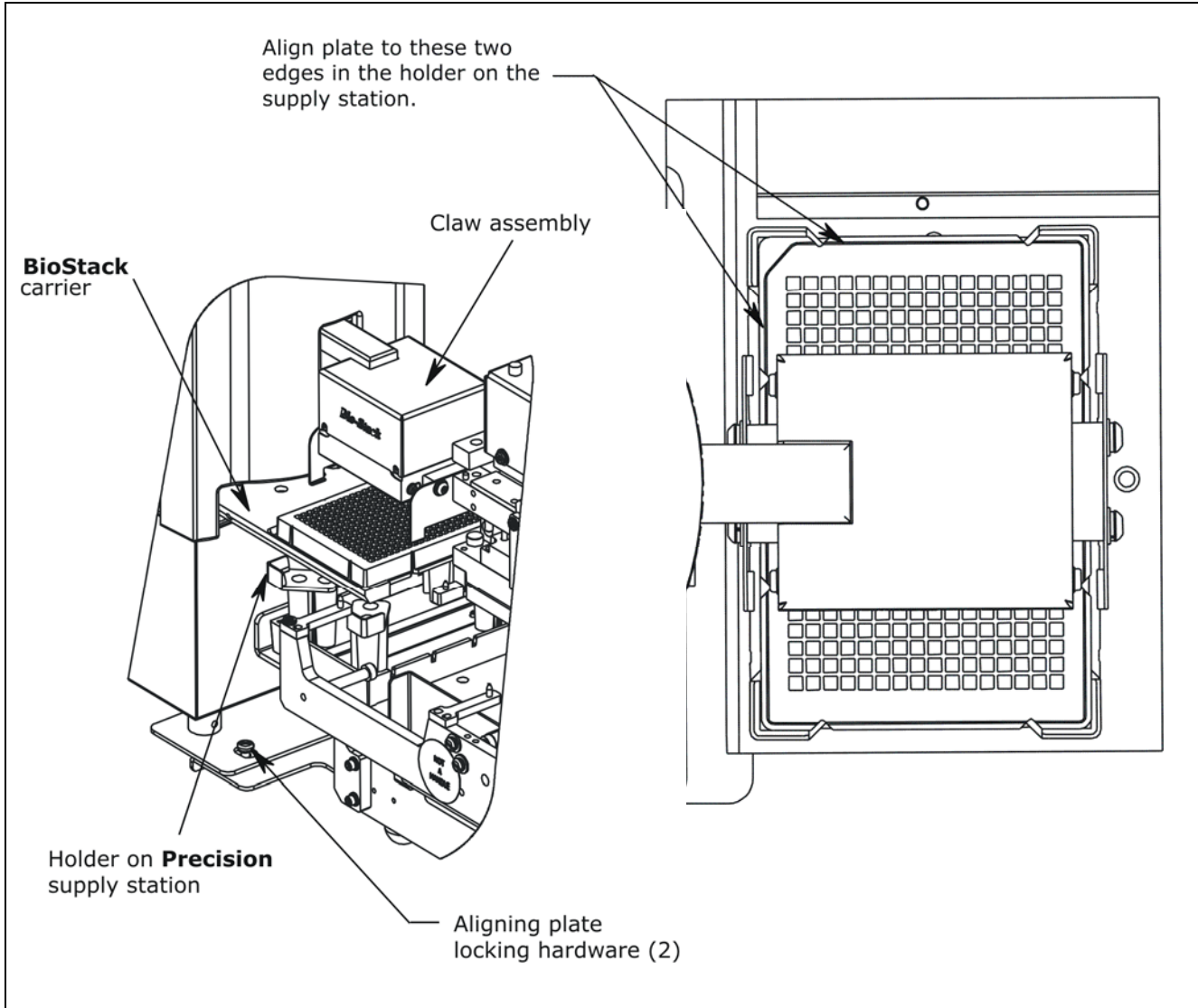
Figure 29: Aligning the BioStack with the Precision Instruments

Install the Microplate Stacks

Locate the stack locks on the side of the BioStack. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 30* below and then close the stack locks.
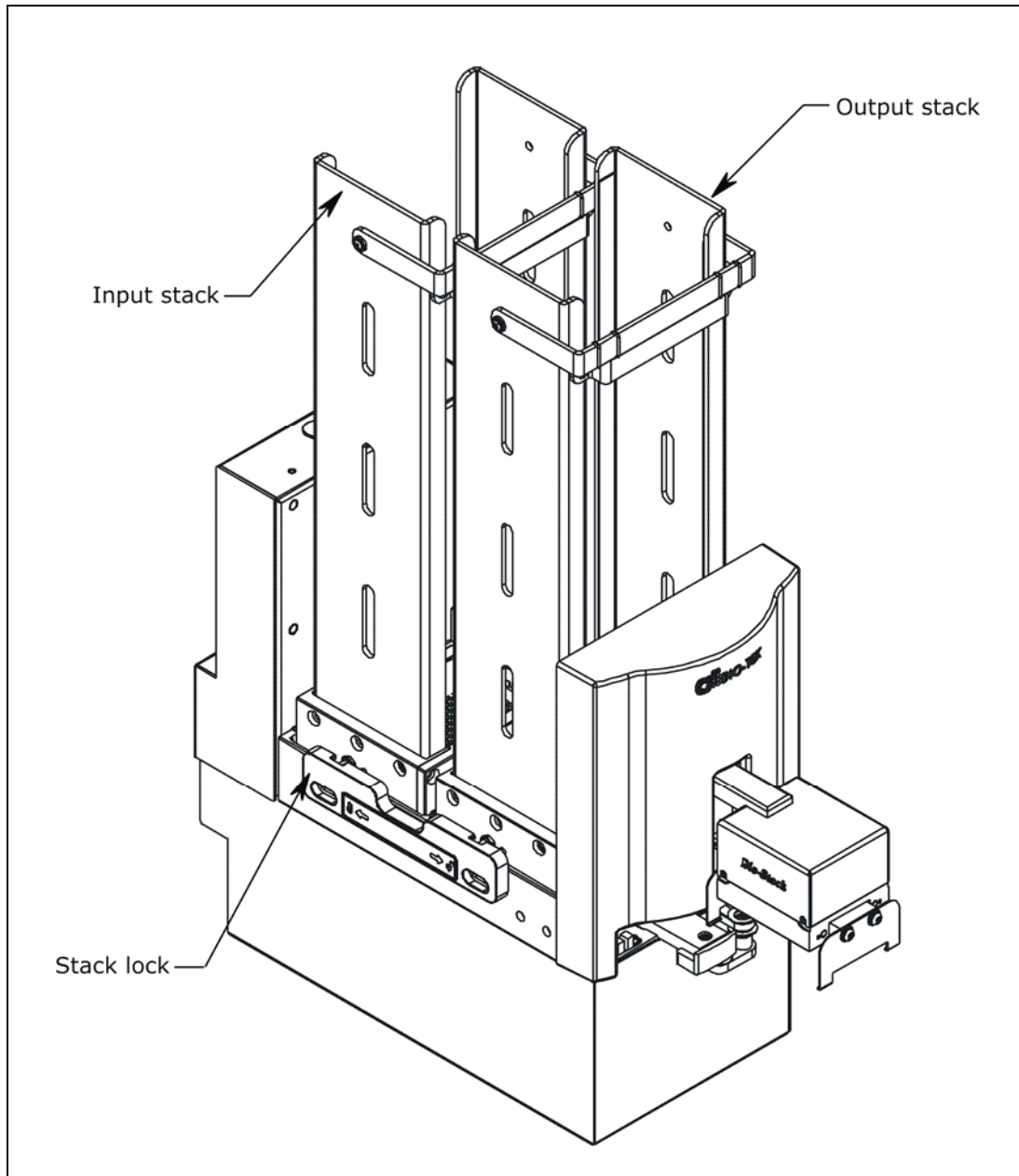
Figure 30: Installing the Microplate Stacks

❖   The 30-plate stacks are shown.

Align the Claw/Gripper with the Precision's Supply Station

The BioStack's claw/gripper mechanism must now be aligned vertically with the Precision supply station. Precision Power Software has an **Instrument Alignment Utility** for this task.

Perform these steps to run the Instrument Alignment Utility:

1. Turn off the Precision.

2. Power up the BioStack and allow it to complete its self-test: manually raise the claw/gripper above the Precision's supply station before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

3. Turn on the Precision and allow it to complete its self-test.

4. At Precision Power's main screen, select **Instrument > BioStack Configuration**.

5. Click **Utilities**.

6. Click **Alignment Utility**.

7. To configure the alignment of the BioStack to the Precision, begin with the **Home the BioStack** function.

8. After all axes have been homed on the BioStack, place a dry microplate in the microplate holder on the Precision's supply station. Then use the **Re-alignment Control** buttons to position the BioStack's claw/gripper so that the gripper "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom: click **Begin**. The gripper's jaws open. (See *Figure 31* on page 87.)

    > ❖ If the BioStack and Precision instrument are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

    -   Begin with the **Down** radio button selected. To avoid collision of the gripper with the Precision supply station, click the **20 Step** button first, to see how far that goes, before clicking the **400 Step** button. Use the **400/20/1 Step** buttons to *gradually* lower the claw/gripper to the desired height.

        If you have moved the gripper too far below the plate bottom, click the **Up** radio button and step up a bit.

> ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button (in the **Instrument Alignment Utility**) to home all axes on the BioStack, then repeat step 5 above.

9. When you're satisfied with the positioning of the gripper, click **Save Position**.

10. Remove the microplate from the station.
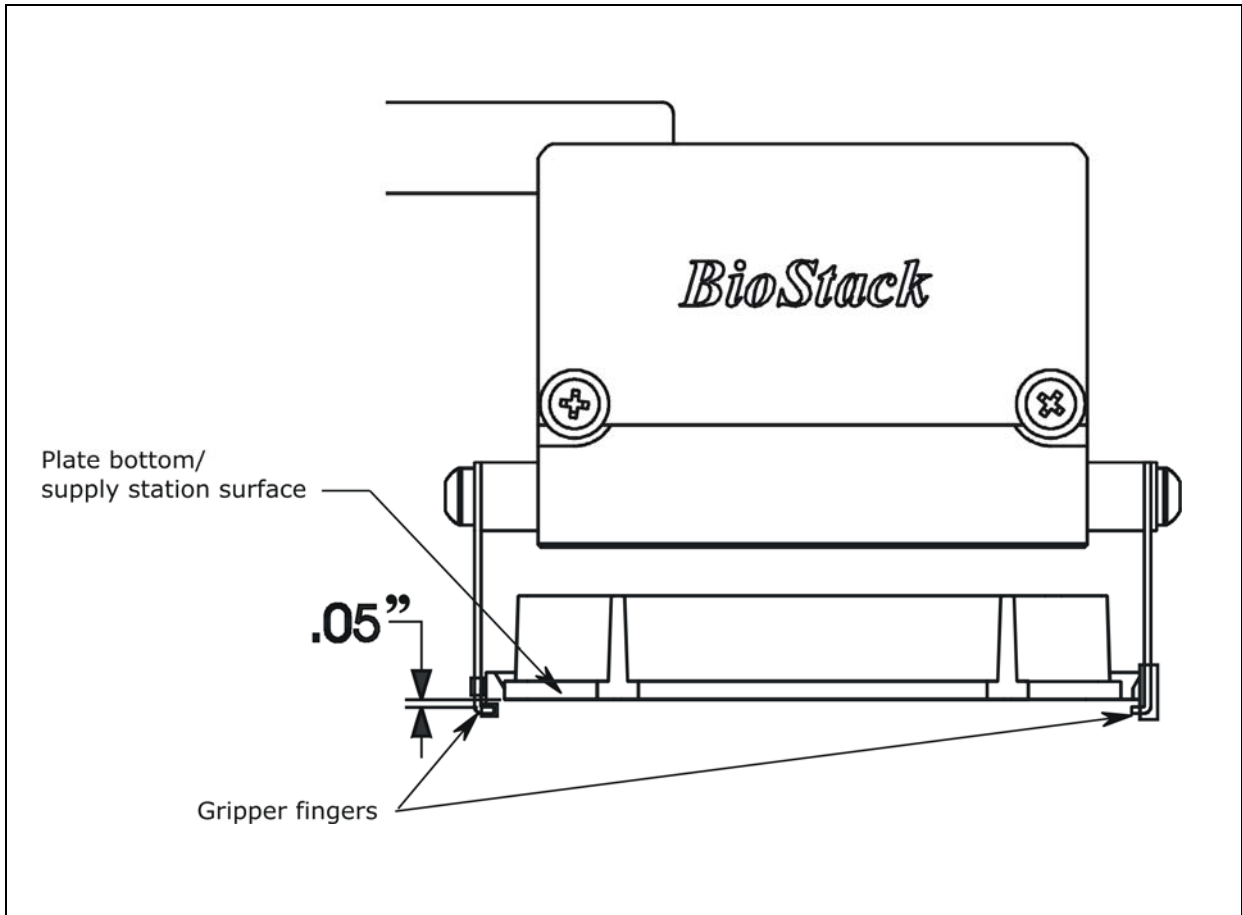
Figure 31: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the Precision Supply Station

Verify the Alignment

Perform the following test to verify alignment of the BioStack with the Precision:

1. Place a dry microplate in the BioStack's input stack.

2. In Precision Power, select **Instrument > BioStack Configuration**.

3. Click **Utilities > Alignment Utility**.

4. At the 'BioStack Instrument Alignment Utility' dialog, click the **Verify** button.

5. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   - The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then eject the plate carrier.

   - The claw/gripper will pick up the plate, lower it toward the supply station, and then *smoothly* place the plate on the station.

     > ❖ If the plate drops onto the station, the claw interface position has been set too high. Repeat the steps in the previous section *Align the Claw/Gripper with the Precision's Supply Station*.

   - The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

     > ❖ If the gripper fingers catch on the top of the microplate, the claw interface position has been set too low. An error code will appear in the software. Repeat the steps in the previous section *Align the Claw/Gripper with the Precision's Supply Station*.

   - If the gripper fingers did not catch the plate, Precision Power issues a "Verify the placement" message and delays the BioStack's movement to give you time to observe the action. Click **OK** to continue.

   - The claw/gripper will lower, pick up the plate, place the plate on the BioStack carrier, and then place the plate in the output stack.

   - The plate will then be transferred from the output stack to the input stack

   - If the gripper fingers are not positioned correctly, repeat the steps in *Align the Claw/Gripper with the Precision's Supply Station* and then re-run the Verify Test.

6. Click **OK**, **Exit**, then **OK**. Close Precision Power Software.

   > ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

Install the BioStack with the MicroFill or ELx405

❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with the **MicroFill**, you will need to change the wrist angle from the default interface position of 90° to 0°. Refer to *Configure the Rotational Wrist Model for the Interfacing Instrument* on page 42, for instructions.

❖ If you will be using the **rotational wrist model** with the **ELx405**, you may use the Stacker with the wrist angle set at the default 90° or you may change it to 0°. Refer to *Configure the Rotational Wrist Model for the Interfacing Instrument*.

❖ Except where noted, the installation steps apply to all BioStack models.

❖ If you will be operating **two BioStacks** with **two ELx405 washers** via computer control (using the Liquid Handling Control Software), you will need a PC equipped with four communication ports, and two ELx405 Integration Kits (PN 7310010). You will need to perform the installation steps for both BioStack/ELx405 configurations.

Lay Out the Alignment Hardware

You will need the alignment hardware from the MicroFill Integration Kit (**PN 7310012**), illustrated below, or for the ELx405 Integration Kit (**PN 7310010**), illustrated on the following page.

MicroFill Integration Kit 7310012

Four aligning posts (PN 7310524) for elevating the BioStack to the correct height and for seating in the aligning plate.
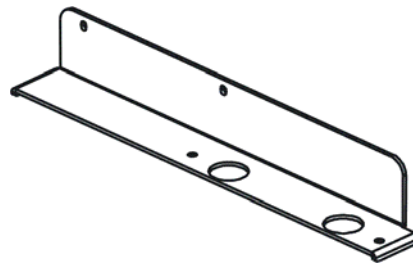
MicroFill aligning plate (PN 7312049) for preventing the instrument from sliding around and being misaligned with the BioStack.
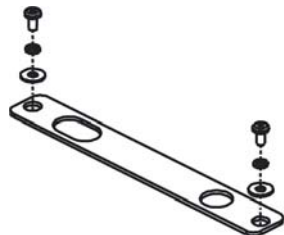
BioStack aligning plate (PN 7312052) for attachment to the MicroFill aligning plate. Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

ELx405 Integration Kit 7310010

Four aligning posts
(PN 7310524) for elevating the
BioStack to the correct height and
for seating in the aligning plate.

Two aligning caps (PN 7312074) for
elevating the ELx405 to the correct
height and for seating in the aligning
plate.
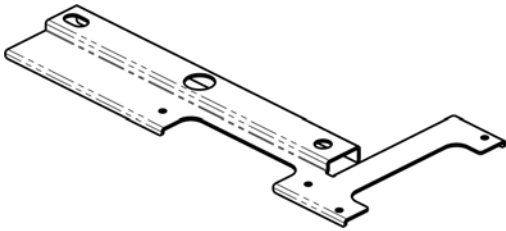
ELx405 aligning plate
(PN 7312050) for preventing the
instrument from sliding around and
being misaligned with the BioStack.
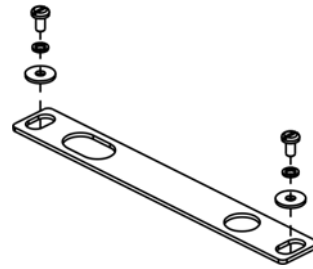
BioStack aligning plate (PN 7312052)
for attachment to the ELx405 aligning
plate.
Includes two each of mounting
hardware: pan head screws (PN 12028),
lock washers (PN 16017), and flat
washers (PN 16068).

Attach the Aligning Posts and Caps

> **(i)** **Important!** When attaching the four aligning posts ("feet") to the BioStack, do not over-tighten the posts!
> **Finger-tighten only!**
>
> To avoid scratches to the BioStack or to the ELx405, place a towel down before laying the instrument on its side.

Perform these steps to attach the aligning posts to the BioStack and the aligning caps to the ELx405 (refer to *Figure 32* on the following page):

❖ The **MicroFill** is already at the correct height for operation with the BioStack, and does not need aligning caps attached to it.

1. Carefully lay the BioStack on its side so the bottom is facing you.

2. Screw in all four aligning posts as shown.

3. Return the BioStack to the upright position.

4. Turn off the MicroFill or ELx405. Disconnect the power supply cord from the MicroFill and the power cord from the ELx405.

ELx405 only:

- Carefully lay the washer on its side so the bottom is facing you.

- Remove the mounting hardware. Replace the flat washers with the aligning caps.

- Reinstall the hardware that was removed (except the flat washers).

- Return the washer to the upright position.

BioStack
aligning post (4)

ELx405 aligning cap (2)
(larger cap)
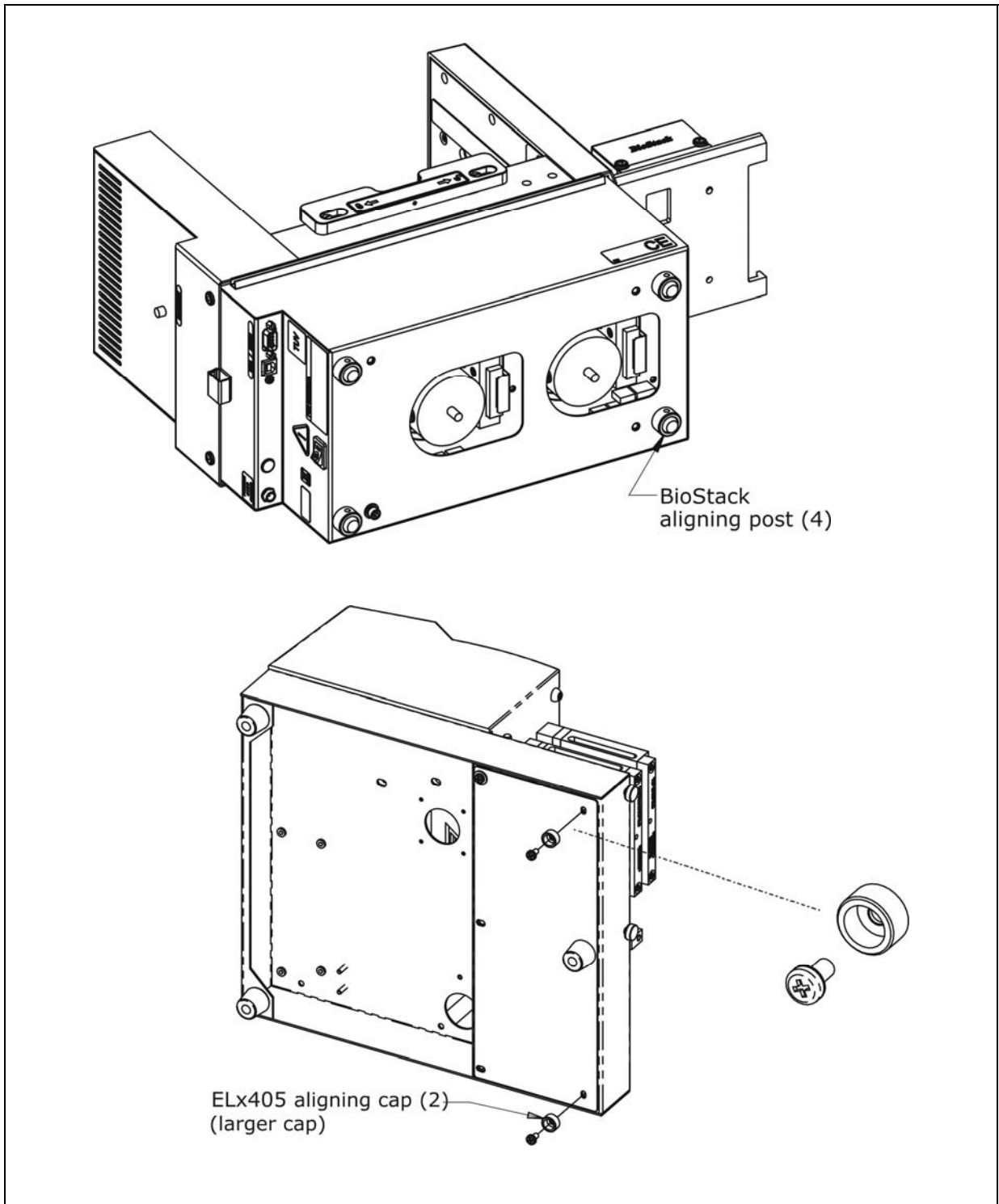
Figure 32: Attaching the Aligning Posts to the BioStack and the Caps to the ELx405

Seat the Instruments in the Aligning Plates

Perform these steps to seat the BioStack and the MicroFill or ELx405 in the aligning plates:

1. Place the MicroFill or ELx405 aligning plate on a level surface.

2. Attach the BioStack aligning plate as follows:

   MicroFill (see *Figure 33* on the next page for the MicroFill with the BioStack fixed wrist model, **PN BIOSTACK2**):

   ❖ The mist shield is not illustrated in *Figure 33*.

   ❖ *Figure 33* also represents the position of the BioStack rotational wrist model in the aligning plate with the MicroFill, if the Stacker's default interface angle has been changed from 90° to 0°.

   - Loosely attach the BioStack aligning plate to the MicroFill aligning plate by screwing in the pan head screw, lock washer, and flat washer only halfway.
   - Unscrew the two thumbscrews that attach the mist shield to the MicroFill.
   - Holding the MicroFill's aligning plate against the mist shield, loosely screw in the two thumbscrews.

   ELx405 (see *Figure 34* on page 95 for the ELx405 with the BioStack fixed wrist model, or *Figure 35* on page 96 for the ELx405 with the BioStack rotational wrist model, with the wrist angle set at the default 90° interface):

   ❖ *Figure 34* also represents the position of the rotational wrist model in the aligning plates with the ELx405, if the Stacker's default interface angle has been changed from 90° to 0°.

   - Loosely attach the BioStack aligning plate to the ELx405 aligning plate by screwing in the pan head screw, lock washer, and flat washer only halfway.
   - Slide the ELx405's two front aligning caps into the slots provided on the ELx405 aligning plate.

3. Slide the BioStack's two front aligning posts into the slots provided on the BioStack's plate.

4. Move both instruments back and forth in their slots until you are satisfied that they are positioned correctly next to each other (approximately). Ensure that the posts and caps (ELx405 only) are properly seated (not resting on top of the plates), and that the instruments are level.

5. **ELx405:** Place the ELx405 microplate carrier on the washer.
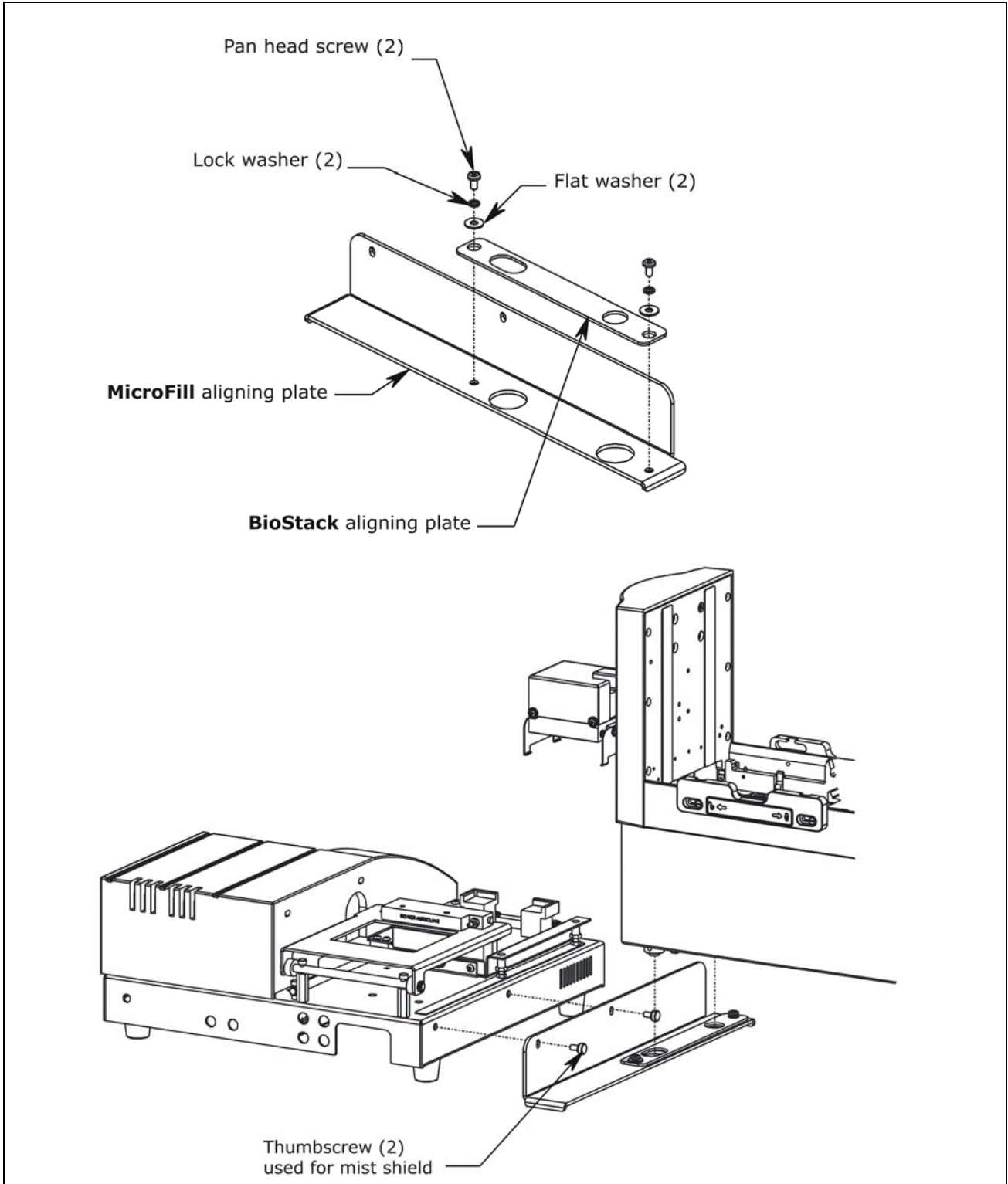
Figure 33: Seating the BioStack and MicroFill in the Aligning Plates

❖ The fixed wrist model (PN BIOSTACK2) is shown.
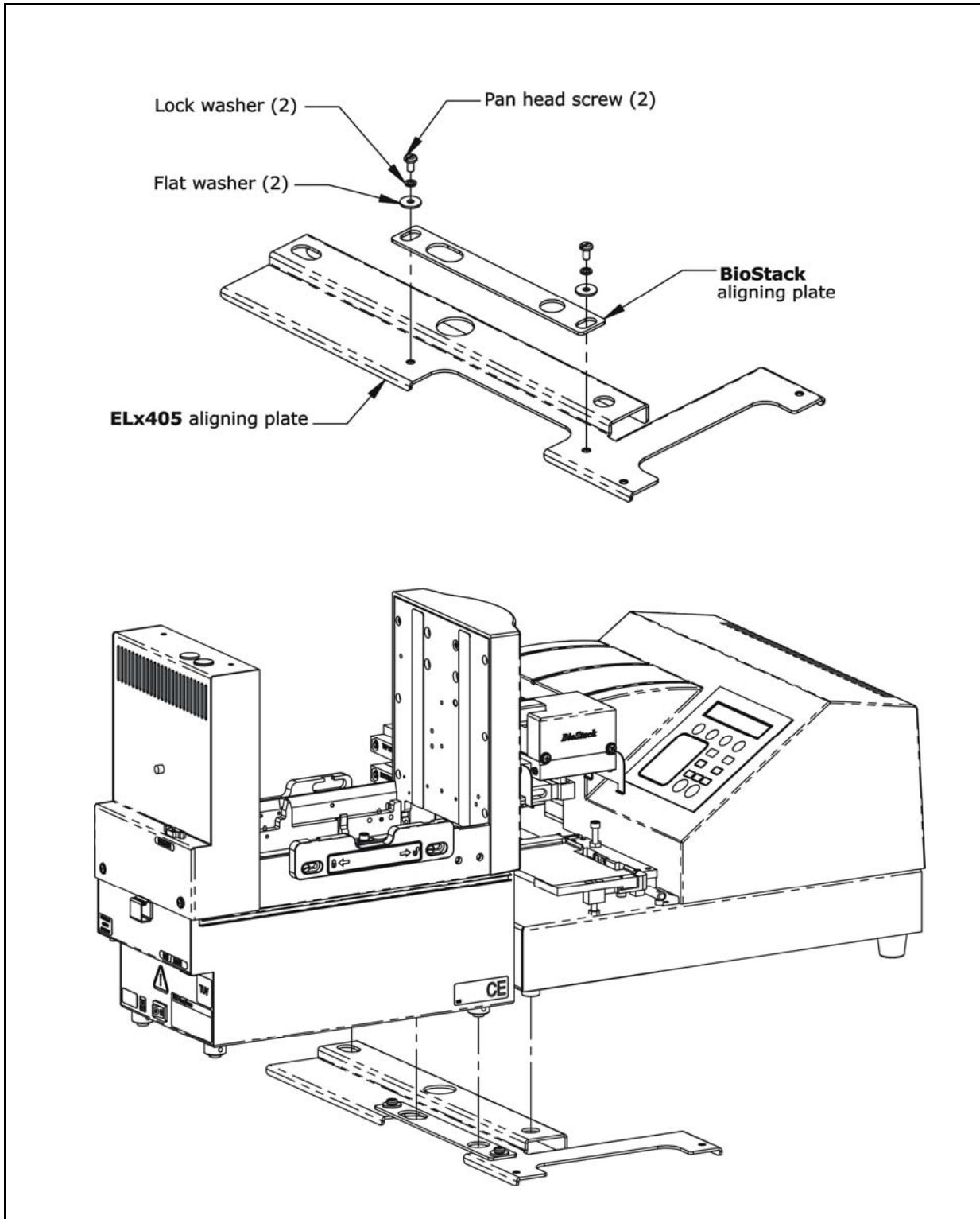
Figure 34: Seating the BioStack and the ELx405 in the Aligning Plates

❖   The fixed wrist model (PN BIOSTACK2) is shown.
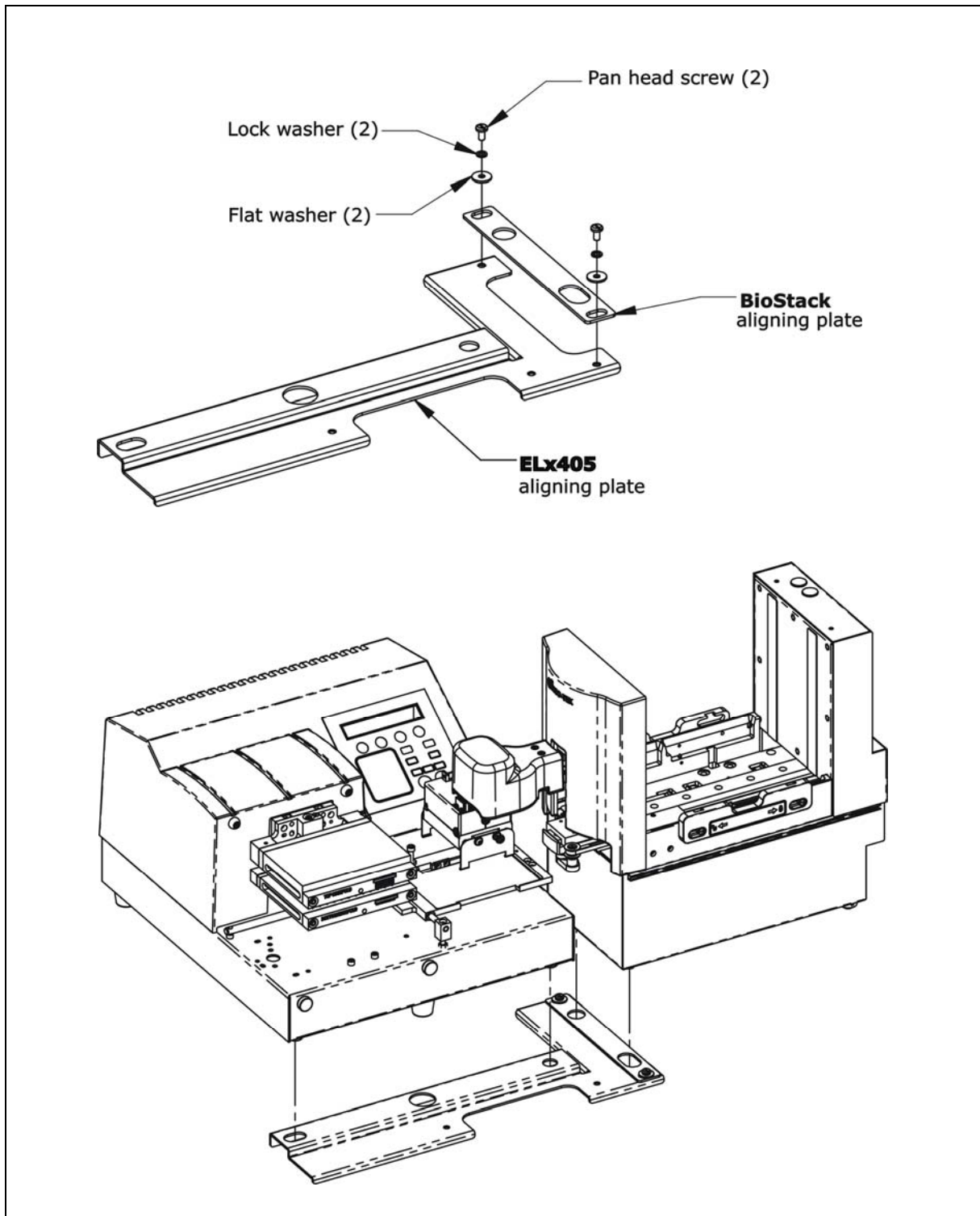
Figure 35: Seating the Rotational Wrist Model and the ELx405 in the Aligning Plates

❖ The Stacker is shown with the wrist angle set at the 90° interface.

Turn on the BioStack and Run a Self-Test

⚠️	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	The BioStack **must** pass the self-test for installation with the MicroFill or ELx405.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the dispenser or washer, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the MicroFill or ELx405 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the dispenser/ washer.

❖ The BioStack does not need to be connected to the MicroFill or ELx405 or to a host computer for this test.

❖ **Rotational wrist model (PN BIOSTACK2WR):** If you changed the wrist angle from the default interface of 90° to 0° (mandatory for operation with the MicroFill, and optional for operation with the ELx405), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see *Figure 12* on page 41 for the location of the switch). The BioStack will home all axes (claw/gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Align the BioStack with the MicroFill or ELx405

> ❖ Follow the instructions below if installing the BioStack **fixed wrist model** or the **rotational wrist model** (at the **0°** interface) with the MicroFill or ELx405.
>
> ❖ Follow the instructions on page 101 if installing the **rotational wrist model** at the **90°** interface with the ELx405.

Perform the steps below to align the BioStack with the MicroFill or ELx405.

1. Ensure that the BioStack is powered up and homed. If the BioStack is off, turn it on to home all axes: manually raise the claw/gripper above the MicroFill or ELx405 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply cord to the MicroFill or the power cord to the ELx405 and turn the instrument on. The carrier should be in the "out" position. Leave the MicroFill or ELx405 powered up.

3. Turn the BioStack off.

4. Manually slide the BioStack carrier all the way out and position it below the claw assembly. Refer to *Figure 36* on the next page for the MicroFill or to *Figure 37* on page 100 for the ELx405.

5. Place a dry microplate on the BioStack carrier.

6. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

7. Slide the BioStack carrier out of the way.

8. Lower the claw assembly until the microplate is just above the carrier of the MicroFill or ELx405.

9. Manually adjust the BioStack on the tabletop so the microplate can be lowered into the carrier of the MicroFill or ELx405. The microplate carrier should be positioned as if it was just homed by the MicroFill or ELx405. If the MicroFill or ELx405's carrier or the microplate has been moved, home the instruments (the BioStack first, then the MicroFill or ELx405), remove the microplate from the BioStack claw, then repeat steps 3 through 9.

10. When you are satisfied with the microplate positioning relative to the carrier of the MicroFill or ELx405 (look carefully at the top-down drawing in *Figure 36* on the next page for the MicroFill or *Figure 37* on page 100 for the ELx405, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

11. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
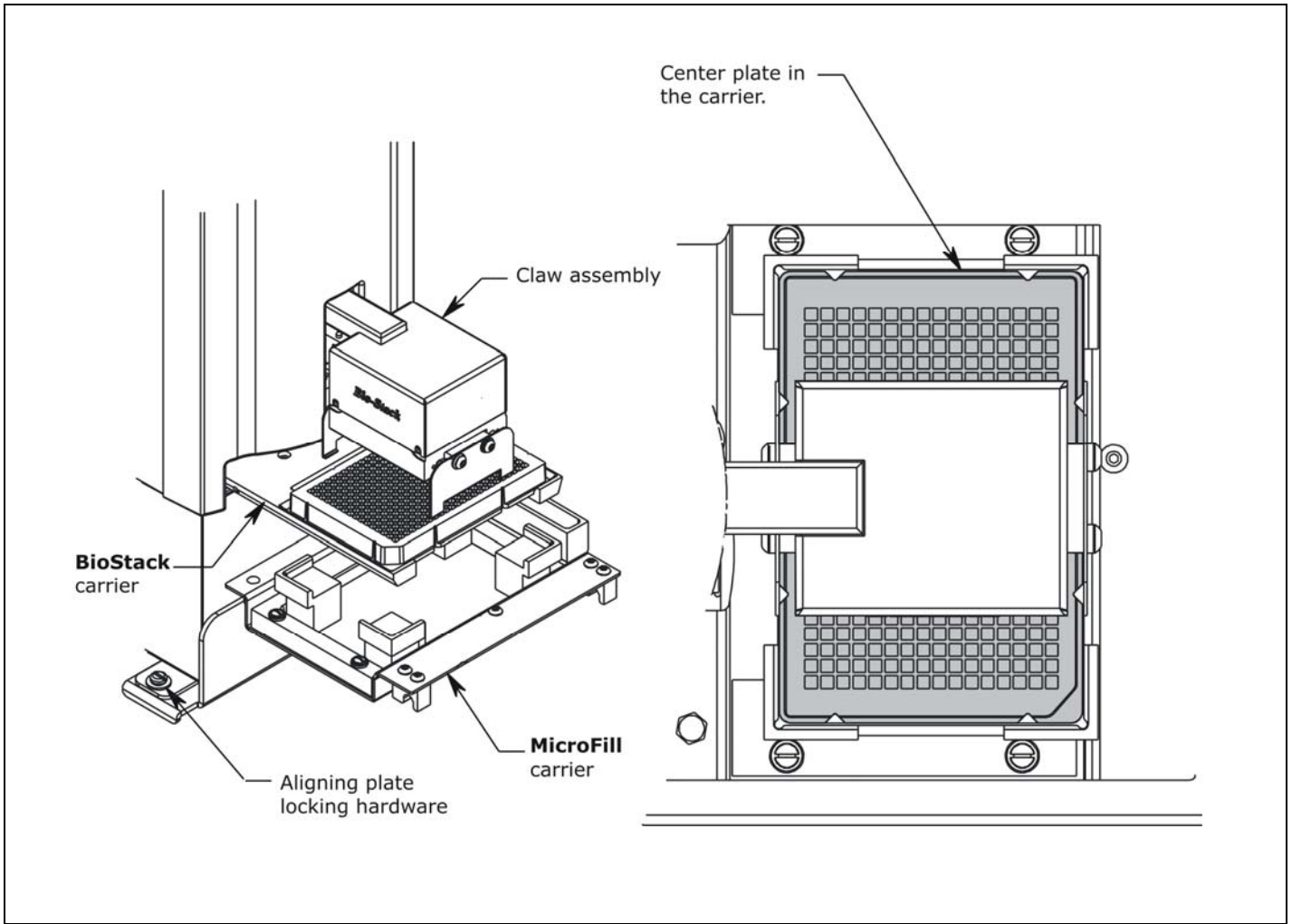
Figure 36: Aligning the BioStack with the MicroFill

❖ The fixed wrist model (PN BIOSTACK2) is shown.
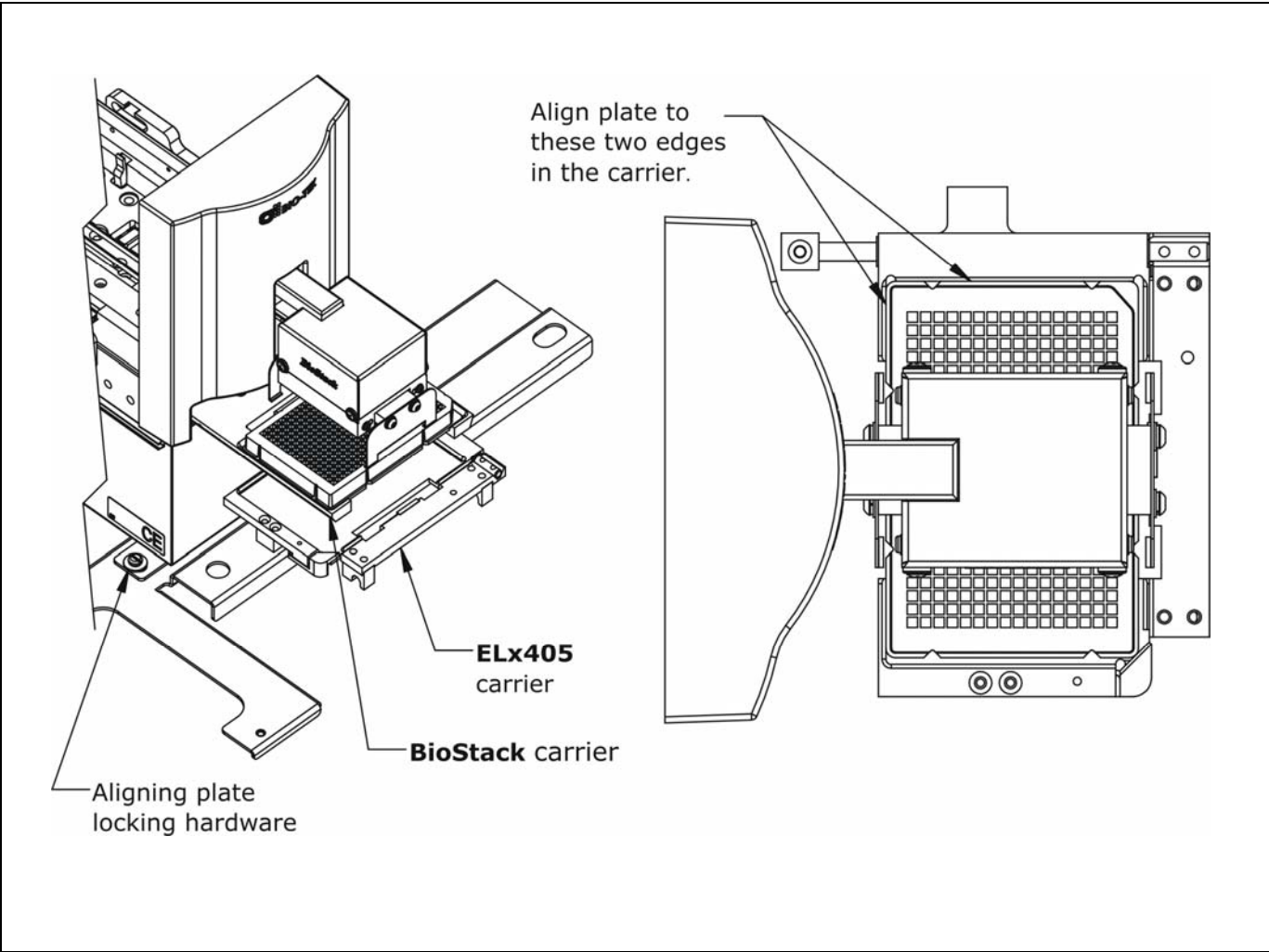
Figure 37: Aligning the BioStack with the ELx405

❖   The fixed wrist model (BIOSTACK2) is shown.

❖ Follow the instructions below if installing the **rotational wrist model** (PN BIOSTACK2WR) at the **90°** interface with the ELx405.

Perform the steps below to align the rotational wrist model with the ELx405.

1. Ensure that the Stacker is powered up and homed. If the Stacker is off, turn it on to home all axes: manually raise the claw/gripper above the ELx405 plate carrier before turning on the BioStack. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power cord to the ELx405 and turn the instrument on. The carrier should be in the "out" position. Leave the ELx405 powered up.

3. Turn the Stacker off.

4. Manually rotate the claw assembly to where the claw will be aligned with a microplate on the Stacker's carrier (**0° angle**).

5. Manually slide the Stacker carrier all the way out and position it below the claw assembly. Refer to *Figure 38* on the following page.

6. Place a dry microplate on the Stacker's carrier.

7. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate).

8. Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

9. Push the Stacker's carrier out of the way.

10. Lower the claw to the carrier's opening.

11. Manually rotate the claw assembly to where the claw is visually perpendicular to the Stacker and aligned with the ELx405 carrier (**90° angle**), making sure that the microplate does not change position in the claw.

12. Lower the claw assembly until the microplate is just above the carrier of the ELx405. Make sure the plate is centered in the claw.

13. Manually adjust the Stacker on the tabletop so the microplate can be lowered into the carrier of the ELx405. The microplate carrier should be positioned as if it was just homed by the ELx405. If the ELx405's carrier or the microplate has been moved, home the instruments (the BioStack first, then the ELx405), remove the microplate from the Stacker's claw, then repeat steps 3 through 12.

14. When you are satisfied with the microplate positioning relative to the carrier of the ELx405 (look carefully at the top-down drawing in *Figure 38* on the following page, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

15. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
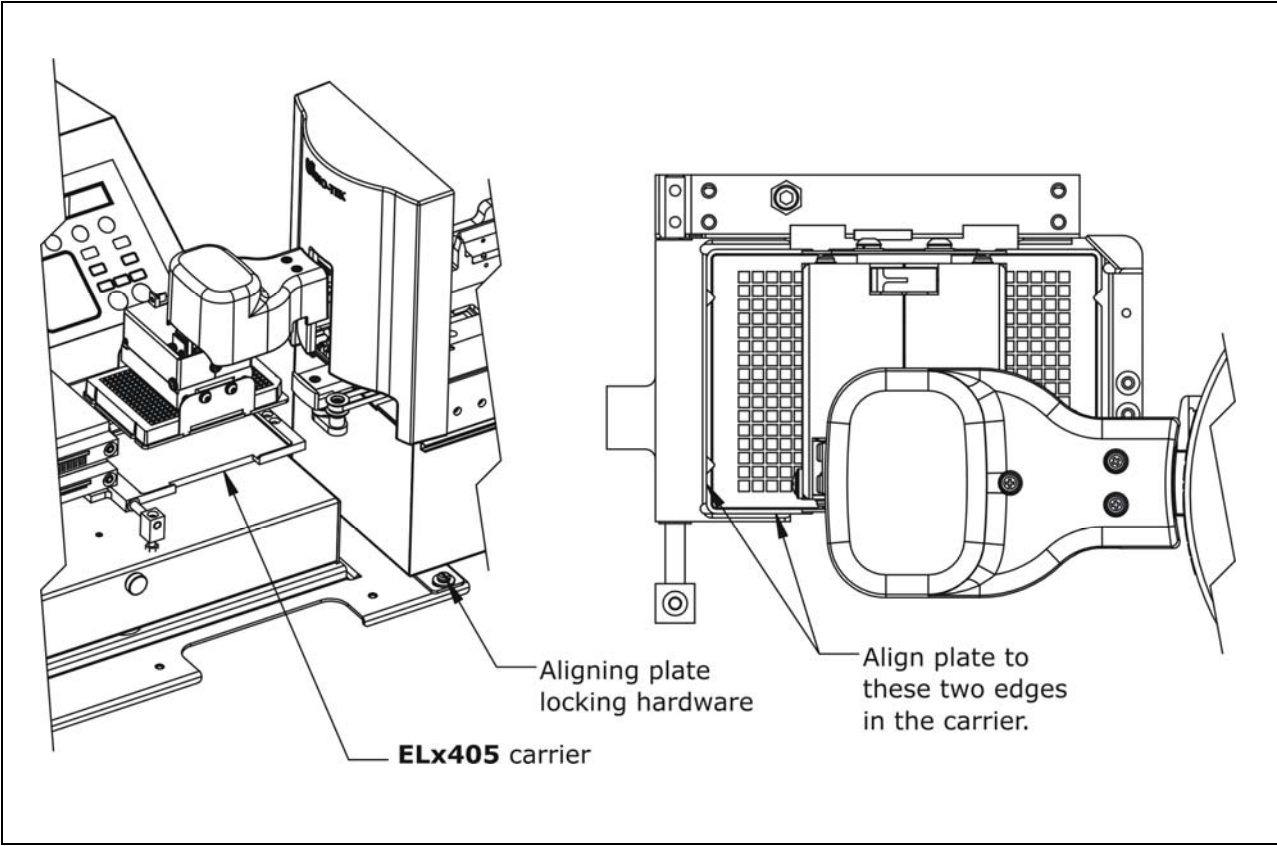
Figure 38: Aligning the BioStack Rotational Wrist Model with the ELx405

❖   The Stacker is shown with the wrist angle set at the 90° interface.

Install the Microplate Stacks

Locate the stack locks on the side of the BioStack. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 39* below and then close the stack locks.
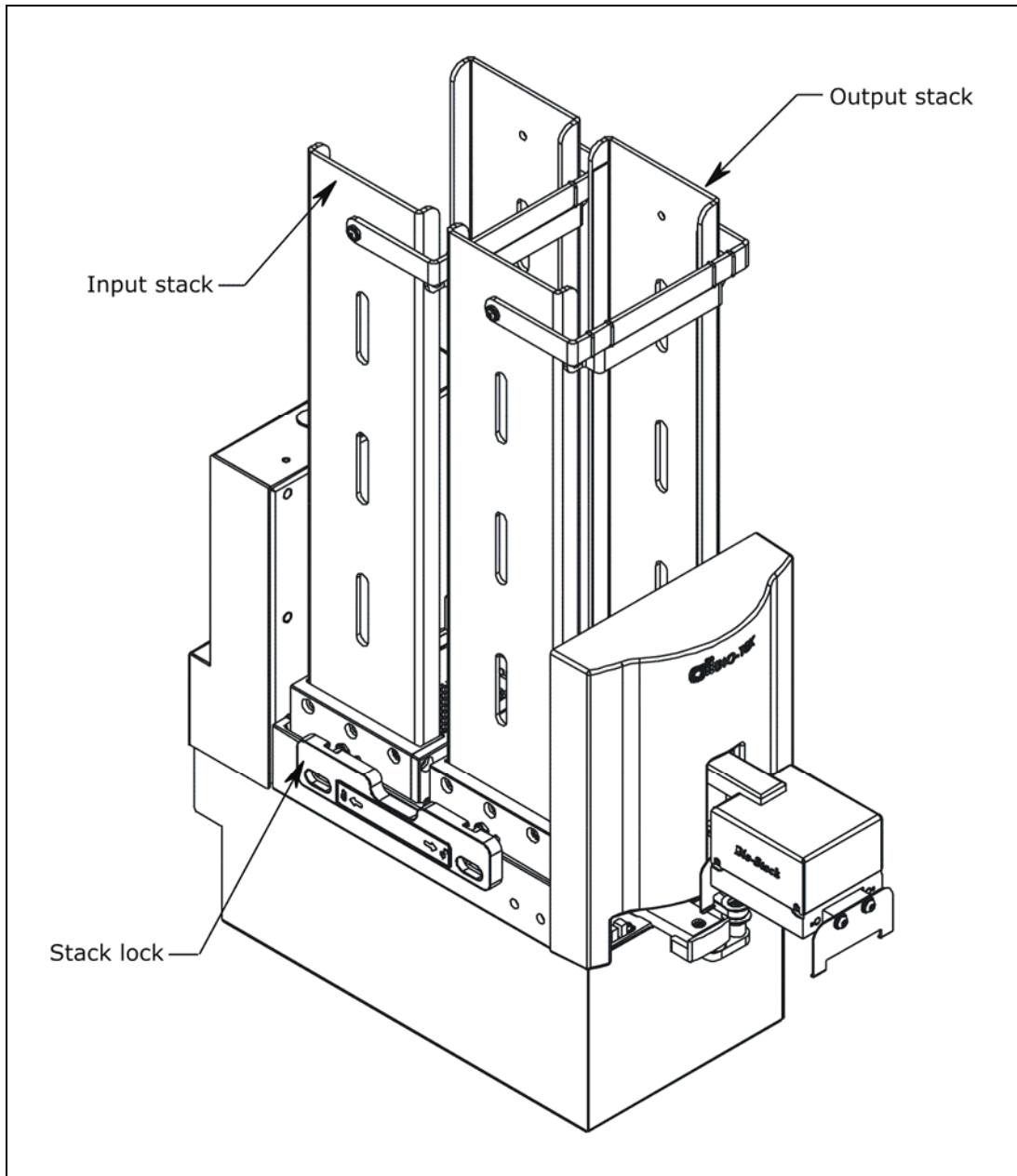
Figure 39: Installing the Microplate Stacks

❖ The 30-plate stacks are shown.

Instrument Control of the BioStack and MicroFill or ELx405 Using the Dispenser or Washer Keypad (Pages 104 through 110)

> (i) For **instrument control** of the BioStack and MicroFill or ELx405 using the MicroFill/ELx405 keypad:
>
> - Perform the steps in the sections below and on pages 105 through 110.
>
> For **PC control** of the BioStack and ELx405 using the Liquid Handling Control™ (LHC) Software:
>
> - Perform the steps in the sections on pages 111 through 119.

Connect the BioStack to the MicroFill or ELx405

> ❖ The **MicroFill** and **ELx405 Integration Kits** include two serial cables: a 25-pin to 25-pin female/female cable and a 9-pin to 25-pin male/female cable. ELx405 Kits also include a USB cable and USB driver software CD. The USB cable may be used instead of a serial cable for connection of the BioStack to a host computer.

Perform these steps to connect the serial cable between the BioStack and the MicroFill or ELx405:

1. Make sure that the BioStack and MicroFill or ELx405 are turned off.

2. Attach one end of the *appropriate* serial cable to the serial port on the rear of the BioStack (refer to **Figure 12** on page 41 for an illustration of the serial port on the BioStack).

3. Attach the other end of the cable to the serial port on the rear of the MicroFill or ELx405.

4. Tighten the securing screws on both ends of the cable.

Run the Checksum Test for the MicroFill or ELx405

Perform these steps to run the Checksum Test and record the basecode software versions for the MicroFill or ELx405, and the assay configuration software information for the ELx405:

> ❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the software versions for the MicroFill or ELx405.

1. Turn on the MicroFill or ELx405 and allow the self-test to complete.

2. From the instrument's keypad, select **UTIL** > **TESTS** > **CHKSUM**.

3. The first screen will display the MicroFill or ELx405 basecode software part number, version number, and checksum. Record this information.

> ❖ If the MicroFill or ELx405 displays an error code preceded by the letter "**B**", this means that the instrument is already configured to recognize the BioStack™ (see *Configure the MicroFill or ELx405 for the BioStack* below) and it is trying unsuccessfully to communicate with the BioStack. This is not a problem. Press the **Stop** key and continue with the procedure.

4. **ELx405 only:** After a few seconds, a second screen will display the assay configuration information. Record the ELx405 configuration software part number and version number.

5. **MicroFill only:** After a few seconds, a second screen will display "Default Config Data." This information does not need to be recorded.

6. Record the serial number listed on the MicroFill or ELx405.

7. Return to the MicroFill or ELx405 main menu.

Configure the MicroFill or ELx405 for the BioStack

Perform these steps to configure the MicroFill or ELx405 to recognize the BioStack:

1. **MicroFill:** From the main menu, select:
   UTIL > SETUP > BIOSTACK > CONF > BIOSTACK

   ELx405: From the main menu, select:
   UTIL > SETUP > MORE > BIOSTACK > CONF > BIOSTACK

2. When the selection sequence is complete, the **RE-STACK?** screen will appear. Select **YES** or **NO**.

3. Press the **Main Menu** key.

Test Communication with the BioStack

⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

Perform these steps to test communication between the BioStack and the MicroFill or ELx405 and (optionally) to record the software versions for the BioStack:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the software versions for the BioStack.

1. **Important:** Turn off the MicroFill or ELx405.

2. Turn on the BioStack and allow its self-test to complete: manually raise the claw/gripper above the MicroFill or ELx405 plate carrier before turning on the BioStack. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

3. Turn on the MicroFill or ELx405 and allow its self-test to complete.

4. From the MicroFill or ELx405 main menu, select **UTIL > TESTS > CHKSUM**.

5. Examine the screens as they are displayed. The first two screens contain the basecode software information for the MicroFill or ELx405 (first screen) and "Default Config Data" for the MicroFill or assay configuration software information for the ELx405 (second screen). These screens appear regardless of configuration.

   Two additional screens will appear, if the instrument is able to communicate with the BioStack:

   ```
   P L E A S E    W A I T . . .
   ```

   ```
   B I O - S T A C K :    X . X X ,    X . X X
   C O D E    C H E C K S U M :    ( X X X X )
   ```

6. If communication is successful, record the BioStack basecode software version (the first X.XX), the interface definition version (the second X.XX), and the checksum. Record the serial number listed on the BioStack.

7. If the MicroFill or ELx405 cannot communicate with the BioStack, an error code will be displayed. Consult *Chapter 7*, *Troubleshooting and Error Codes* for guidance.

Align the Claw/Gripper with the MicroFill or ELx405 Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the MicroFill or ELx405. The MicroFill and ELx405 have an on-board **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack claw/gripper with the MicroFill or ELx405 microplate carrier:

1. **MicroFill:** From the main menu, select:
   UTIL > SETUP > BIOSTACK > ALIGN > C-POS.

   ELx405: From the main menu, select:
   UTIL > SETUP > MORE > BIOSTACK > ALIGN > C-POS.

2. The **FIND CLAW INTERFACE POS** menu will appear on the display with the following four selections:

   -/+   +1   +20   +400

3. Use the four softkeys on the MicroFill or ELx405 keypad to position the BioStack's claw/gripper mechanism to the desired height relative to the plate carrier on the MicroFill or ELx405. To help in this activity, place a microplate on the carrier of the MicroFill or ELx405 (optional). Lower the mechanism so that the gripper's "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface (see *Figure 40* on the next page).

   ❖ If the BioStack and MicroFill or ELx405 are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

   - To avoid collision of the gripper with the carrier on the MicroFill or ELx405, press the **+20** key first, to see how far that goes, before pressing the **+400** key. Use the **1/20/400** softkeys to *gradually* lower the claw/gripper mechanism to the desired height.

   - If you go too far, press the **-/+** softkey to step up a bit.

   ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. To home the BioStack, select **UTIL > SETUP > BIOSTACK > ALIGN > HOME > BIOSTACK**, then repeat steps 1 through 3 above.

4. When you are satisfied with the position, press the **PREVIOUS SCREEN** key to return to the Alignment screen and select **SAVE**.

5. At the **OK TO SAVE LOCATION?** screen, press **YES**, and then **ENTER**.

6. Remove the plate from the carrier on the MicroFill or ELx405.
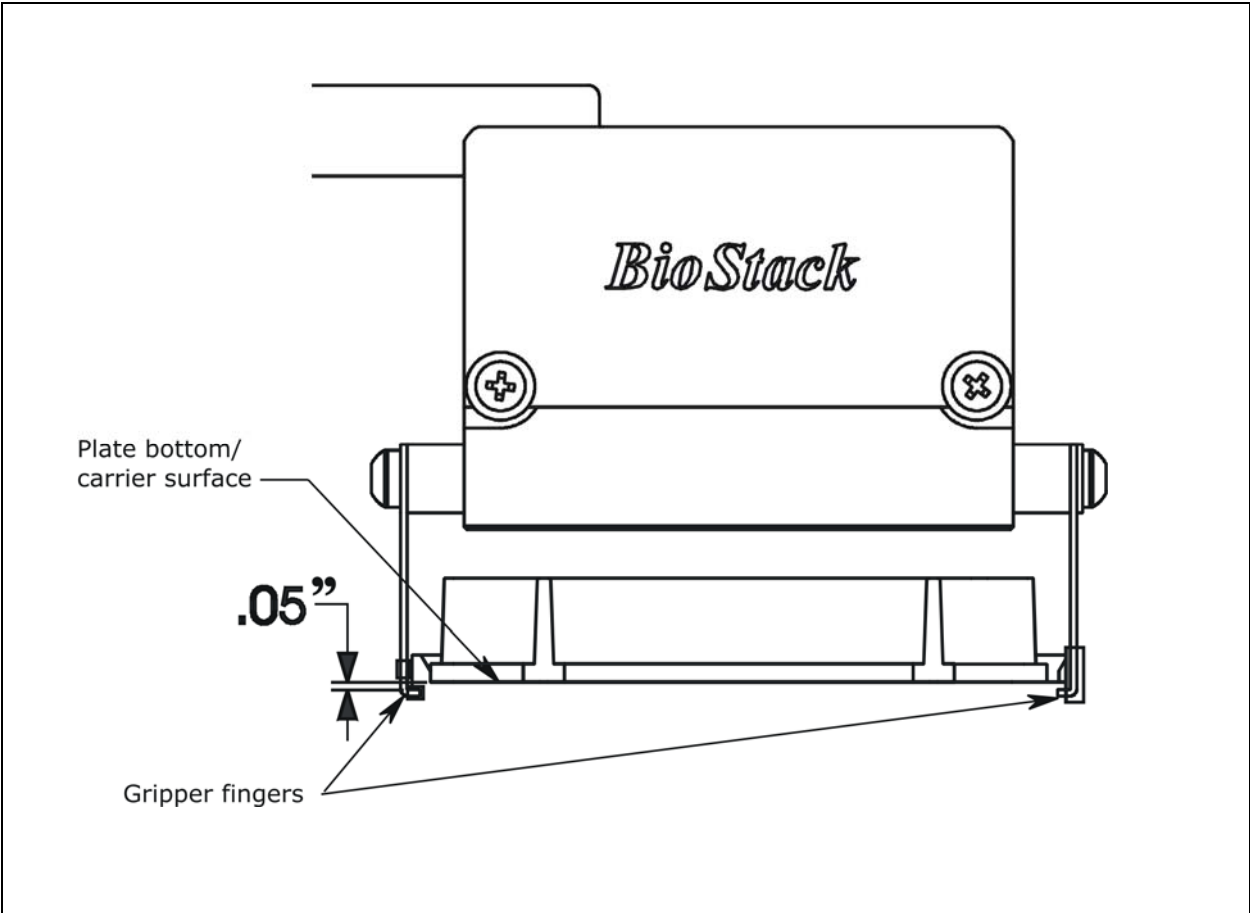
Figure 40: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the MicroFill or ELx405 Plate Carrier

Verify the Alignment

❖ The BioStack **rotational wrist model** instructions in the following section apply only when the wrist angle is set at the **90°** interface with the ELx405.

Perform the following test to verify alignment of the BioStack with the MicroFill or ELx405:

1. Ensure that both instruments are turned on.

2. Place a dry microplate in the BioStack's input stack.

3. From the MicroFill or ELx405 main menu, select **UTIL > SETUP > MORE** (ELx405 only) **> BIOSTACK > VERIFY**. Press the **Enter** key.

4. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   • The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.

   • The claw/gripper will pick up the plate, lower it toward the MicroFill's or ELx405's plate carrier, and then *smoothly* place the plate on the carrier. **BioStack rotational wrist model with ELx405:** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the ELx405's plate carrier, and then *smoothly* place the plate on the carrier.

   ❖ If the plate drops onto the carrier, the claw interface position is set too high. Repeat the instructions in *Align the Claw/Gripper with the MicroFill or ELx405 Plate Carrier* on page 107.

   • The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

   ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will display on the MicroFill or ELx405. Repeat the instructions in *Align the Claw/Gripper with the MicroFill or ELx405 Plate Carrier* on page 107.

   • If the gripper fingers did not catch on the plate, the MicroFill or ELx405 will display **VERIFY PLATE PLACEMENT**. Press **Enter** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model with ELx405:** The claw/gripper will lower and pick up the plate from the ELx405 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- The MicroFill or ELx405 will display **BIOSTACK UTILITIES**. From here you can select **VERIFY** to run the program again, or press **Main Menu**.

5. If the alignment verification completed successfully and you have determined that the gripper fingers are positioned correctly, return to the instrument's main menu.

   - If the gripper fingers are not positioned correctly, repeat the instructions in *Align the Claw/Gripper with the MicroFill or ELx405 Plate Carrier*, and then re-run the Verify Test.

6. **Rotational wrist model:** Home the Stacker. The wrist will rotate the claw/gripper to the default 90° interface position.

   ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

PC Control of the BioStack and ELx405 Using the LHC Software (Pages 111 through 119)

ⓘ For computer control of the BioStack and ELx405 using the **Liquid Handling Control (LHC) Software**, you will need appropriate versions of the ELx405 Interface Software, washer basecode software, BioStack PC Control Software, and BioStack basecode software. **Note:** Any version of the LHC Software may be used to control the BioStack and ELx405.

Refer to *Appendix D*, *Required Software Versions*, or contact BioTek for more information on required software versions.

During PC control of the BioStack and ELx405, both instruments are controlled by BioTek's Liquid Handling Control (LHC) Software running on a host computer. The LHC Software uses the ELx405 Interface Software to control all functions of the ELx405, and uses a component of the BioStack PC Control Software to control all functionality of the BioStack.

❖ The **LHC Help system** contains a detailed description of the LHC Software, and how it interacts with the ELx405 Interface Software and BioStack PC Control Software to control the instruments.

Perform the instructions below and on the following pages, for computer control of the BioStack and ELx405 using the LHC Software.

Prerequisites

- Verify that the host PC meets the minimum system requirements specified in the *Liquid Handling Control Software Installation Guide* and *BioStack PC Control Software Installation Guide*.

- Verify Administrator privileges. BioTek software requires the user who is installing the software application to have Administrator privileges for the Windows® 2000/XP/Vista systems. If a user with restricted access attempts to install the application, errors may occur. Contact your organization's system administrator if you are uncertain about your privileges.

Connect the Host Computer to the BioStack and ELx405

> ⓘ **For operation of one BioStack with one ELx405 washer:** The host computer must be equipped with at least two communication (COM) ports.
>
> **For operation of two BioStacks with two ELx405 washers:** The host computer must be equipped with at least four COM ports.

❖ The **ELx405 Integration Kit** includes two RS-232 serial cables (25-pin to 25-pin female/female cable and 9-pin to 25-pin male/female cable). The kit also includes a USB cable, and USB driver software CD. The USB cable may be used instead of a serial cable for connection of the BioStack to the host computer.

❖ The **ELx405 shipping accessories** include a 9-pin to 25-pin female/ female serial cable.

Perform these steps to connect the host computer to both the BioStack and the ELx405 washer (refer to *Figure 12* on page 41 for an illustration of the serial and USB ports):

1. If the BioStack is on, turn it off.

2. Place the computer in a location adjacent to the BioStack and the ELx405.

3. Connect the computer to the BioStack™ and ELx405, using a serial cable **or** USB cable (BioStack only).

   If using the serial cable: Plug one end into the RS232 serial port on the instrument and the other end into an available port on the computer.

   If using the USB cable: Plug one end into the USB port on the instrument and the other end into an available port on the computer.

   • Refer to the instructions that shipped with the "USB Virtual COM Driver Software" CD to install the necessary drivers and identify the **Com Port number**.

Install the Liquid Handling Control (LHC) Software

❖ A CD containing the **Liquid Handling Control Software** and an installation guide are included in the LHC Software package (part number LHC405) for the ELx405. The package also includes a CD containing version 2.00.4 or greater of the **ELx405 Interface Software** and instructions for installing the software.

❖ ELx405 basecode software PN 7100227, version 2.02.1 or greater, is required for use of the LHC Software.

There is a certain sequence of events that *must* be followed to ensure that the Liquid Handling Control Software is properly installed and configured on the host PC. You will also need to install the ELx405 Interface Software on the PC, and, depending upon when you purchased your ELx405, you may need to download upgraded basecode software to the washer.

Please follow the instructions provided in the *Liquid Handling Control Software Installation Guide* to install and configure the Liquid Handling Control Software and any other necessary software components.

Install the BioStack PC Control Software

❖ A CD containing version 2.00.10 or greater of the **BioStack PC Control Software** and an installation guide are included in the **ELx405 Integration Kit** (PN 7310010). Version 2.00.10 (or greater) is required for compatibility with the Liquid Handling Control Software.

❖ **Two BioStacks with two ELx405 Washers**: Both ELx405 Integration Kits contain a package of the BioStack PC Control Software, however, you need to install only **one** package of the software on the PC. For simultaneous operation of two BioStacks with two washers, you will open the Liquid Handling Control™ Software twice. Each instance of the LHC will open an instance of the BioStack PC Control Software.

There is a certain sequence of events that *must* be followed to ensure that the BioStack PC Control Software is properly installed and configured on the host PC. Please follow the instructions provided in the *BioStack PC Control Software Installation Guide* to install the software.

Test Communication

Perform these steps to test communication between the LHC Software and the instruments:

1. Turn the BioStack on and allow its self-test to complete: manually raise the claw/gripper above the ELx405 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Turn the ELx405 on and allow its self-test to complete.

3. Launch the LHC Software.

4. **Test communication between the LHC Software and the ELx405:**

   - When the LHC main screen opens, click **Name** in the **Instrument** field. The 'ELx405 Communications' dialog will appear.

     > ❖ If more than one instrument's interface software is found on your PC by the LHC Software, clicking **Name** will open the 'Installed Instruments' dialog. Select **ELx405** and click **OK**. The 'ELx405 Communications' dialog will then appear.

   - Select the correct **COM Port** for the serial cable connection to the ELx405, and then click **Test Communications**.

     If the test passes, click **OK**. The 'Instrument Settings Dialog' will then open.

     > ❖ If the test fails, check the serial cable connections or try a different serial port.

   - At the 'Instrument Settings Dialog,' select the correct washer **Model** (**Auto**, **Magna**, or **Select**) and **Manifold Type** (**96 well** or **192 well**) and then click **OK**.

5. **Test communication between the LHC Software and the BioStack:**

   - Click the **BioStack** box.

   - Click **Port** to open the 'BioStack Communications' dialog. Select the correct **COM Port** for the serial or USB connection to the BioStack, and then click **Test Communications**.

     If the test passes, click **OK**. If the test fails, check the serial/USB cable connections or try a different Com port.

6. Leave the LHC open for the next section, ***Run the Checksum Test for the ELx405***.

Run the Checksum Test for the ELx405

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the ELx405 software versions.

❖ **Two BioStacks with two ELx405 Washers:** Make a copy of the Software Data Sheet to record software information for the second ELx405.

Perform these steps to run the Checksum Test and record the software versions for the Liquid Handling Control Software and for the ELx405:

1. Make sure that the washer is powered on, and the cable connected from the PC to the washer.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version. Record the serial number listed on the LHC Software package.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities**. The 'ELx405 Washer Utilities' screen will open.

6. Click **Test Communications**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

7. Record the ELx405 Interface Software Version, Interface Functional Version, Basecode SW Version, and Basecode SW Checksum. Record the washer's serial number (listed on the ELx405).

8. Close the LHC Software.

Configure the ELx405 for the BioStack

Perform these steps to configure the ELx405 to recognize the BioStack:

1. From the washer's main menu, select **UTIL > SETUP > MORE > BIOSTACK > CONF > MANUAL**.

2. When the selection sequence is complete, the **RE-STACK?** screen will appear. Select **YES** or **NO**.

3. Press the **Main Menu** key, then turn off the Dispenser for the next section.

Run the Checksum Test for the BioStack

> ❖ Use the **Software Data Sheet(s)** from the previous section to record software information for the BioStack(s).

Perform these steps to run the Checksum Test and record the software versions for the BioStack PC Control Software and for the BioStack:

1. Make sure that the BioStack is powered on, and the cable connected from the PC to the BioStack.

2. Launch the BioStack PC Control Software.

3. Click the **Configure Instruments** button.

4. Set the **COM Port** and click **Test Communications**. If the test fails, check the cable and/or try another Com port. Return to the main screen.

5. From the top menu bar in the BioStack PC Control Software, select **Help** > **About BioStack**. The 'About BioStack Software' dialog will open.

6. Record the BioStack PC Software Versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX. Record the serial number listed on the BioStack PC Control Software package.

7. Click **Get On-board values now**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

8. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum. Record the BioStack's serial number listed on the BioStack.

9. Close the BioStack PC Control Software.

Align the Claw/Gripper with the ELx405 Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the ELx405. The Liquid Handling Control Software has an **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack claw/gripper with the ELx405 microplate carrier:

1. Start the LHC Software and select **Tools > BioStack Utilities**.

2. Click **Alignment Utility**.

3. From the 'BioStack Instrument Alignment Utility,' use the drop-down arrow in the **Selected Instrument** field to select the **ELx405 Washer**.

4. To configure the alignment of the BioStack to the ELx405, begin with the **Home the BioStack** function.

5. After all axes have been homed on the BioStack, place a dry microplate on the ELx405's plate carrier. Then use the **Re-alignment Control** buttons to position the BioStack's claw/gripper so that the gripper "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface: click **Begin**.

   The gripper's fingers open. (See *Figure 40* on page 108.)

   ❖ If the BioStack and ELx405 washer are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

   • Begin with the **Down** radio button selected. To avoid collision of the gripper with the carrier on the ELx405, click the **20 Steps** button first, to see how far that goes, before clicking the **400 Steps** button. Use the **400 Steps**, **20 Steps**, and **1 Step** buttons to gradually lower the claw/gripper to the desired height.

   • If you have moved the gripper too far below the plate bottom, click the **Up** radio button and step up a bit.

   ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button to home all axes on the BioStack, then repeat step 5 above.

6. When you're satisfied with the positioning of the gripper, click **Save Position**. The BioStack will home.

7. Remove the microplate from the washer's carrier.

Verify the Alignment

> ❖ The BioStack **rotational wrist model** instructions in the following section apply only when the wrist angle is set at the **90°** interface with the ELx405.

Perform the following test to verify alignment of the BioStack with the ELx405:

1. Place a dry microplate in the BioStack's input stack.

2. At the Liquid Handling Control Software's main screen, select **Tools > BioStack Utilities**.

3. Click **Alignment Utility**.

4. From the 'BioStack Instrument Alignment Utility,' click the **Verify** button.

5. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   • The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.

   • The claw/gripper will pick up the plate, lower it toward the ELx405's plate carrier, and then *smoothly* place the plate on the carrier. **Rotational wrist model:** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the Stacker's plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the ELx405's plate carrier, and then *smoothly* place the plate on the carrier.

> ❖ If the plate drops onto the carrier, the claw interface position is set too high. Repeat the steps in the preceding section, *Align the Claw/Gripper with the ELx405 Plate Carrier.*

   • The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

> ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will be displayed in the LHC Software. Repeat the steps in the preceding section*.*

   • If the gripper fingers did not catch on the plate, the LHC Software issues a "Verify plate placement" message and delays the BioStack's movement to give you time to observe the action. Click **OK** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model:** The claw/gripper will lower and pick up the plate from the ELx405 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the Stacker's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- If the gripper fingers are not positioned correctly, repeat the steps in the preceding section and then re-run the Verify Test.

6. Click **OK**, then **Exit** to return to the main screen.

7. **Rotational wrist model:** Home the Stacker. The wrist will rotate the claw/gripper to the default 90° interface position.

> ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

Install the BioStack with the NanoQuot

> ❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with the NanoQuot, you will need to change the wrist angle from the default interface position of 90° to 0°. Refer to ***Configure the Rotational Wrist Model for the Interfacing Instrument*** on page 42, for instructions.
>
> ❖ Except where noted, the installation steps apply to all BioStack models.

Lay Out the Alignment Hardware

You will need the alignment hardware from the NanoQuot Integration Kit (**PN 7150001**), illustrated below.

NanoQuot Integration Kit 7150001

Four aligning posts
(PN 7310524) for elevating the BioStack to the correct height and for seating in the aligning plate.
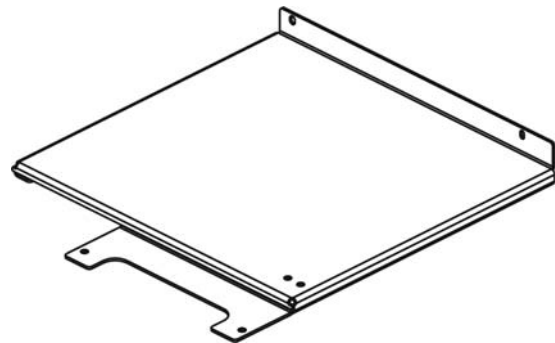
NanoQuot aligning plate
(PN 7152000) for preventing the instrument from sliding around and being misaligned with the BioStack.
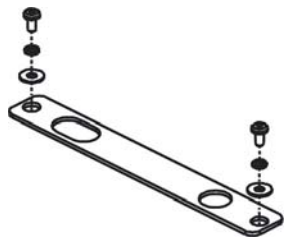
BioStack aligning plate (PN 7312052) for attachment to the NanoQuot aligning plate.

Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Attach the Aligning Posts to the BioStack

> (i) **Important!** When attaching the four aligning posts ("feet")
> to the BioStack, do not over-tighten the posts!
> **Finger-tighten only!**
>
> To avoid scratches to the BioStack, place a towel down
> before laying the instrument on its side.

Perform these steps to attach the aligning posts to the BioStack (refer to *Figure 41*
on the following page):

❖ The NanoQuot is already at the correct height for operation with the
   BioStack, and does not need aligning caps attached to it.

1. Carefully lay the BioStack on its side so the bottom is facing you.

2. Screw in all four aligning posts, as shown.

3. Return the BioStack to the upright position.

4. If the NanoQuot is on, turn it off and disconnect the power supply.

Seat the Instruments in the Aligning Plates

Perform these steps to seat the BioStack and the NanoQuot in the aligning plates
(refer to *Figure 42* on page 124):

1. Place the NanoQuot's aligning plate on a level surface.

2. Loosely attach the BioStack aligning plate to the NanoQuot aligning plate
   by screwing in the pan head screw, lock washer, and flat washer only
   halfway.

3. Slide the NanoQuot into its aligning plate until the two thumbscrew holes
   in the rear panel of the NanoQuot are aligned with the two holes in the back
   of the aligning plate. Screw in the thumbscrews halfway.

4. Slide the BioStack's two front aligning posts into the slots provided on the
   BioStack's plate.

5. Move both instruments back and forth until you are satisfied that they are
   positioned correctly next to each other (approximately). Ensure that the
   BioStack's posts are properly seated (not resting on top of the plates), and
   that the instruments are level.
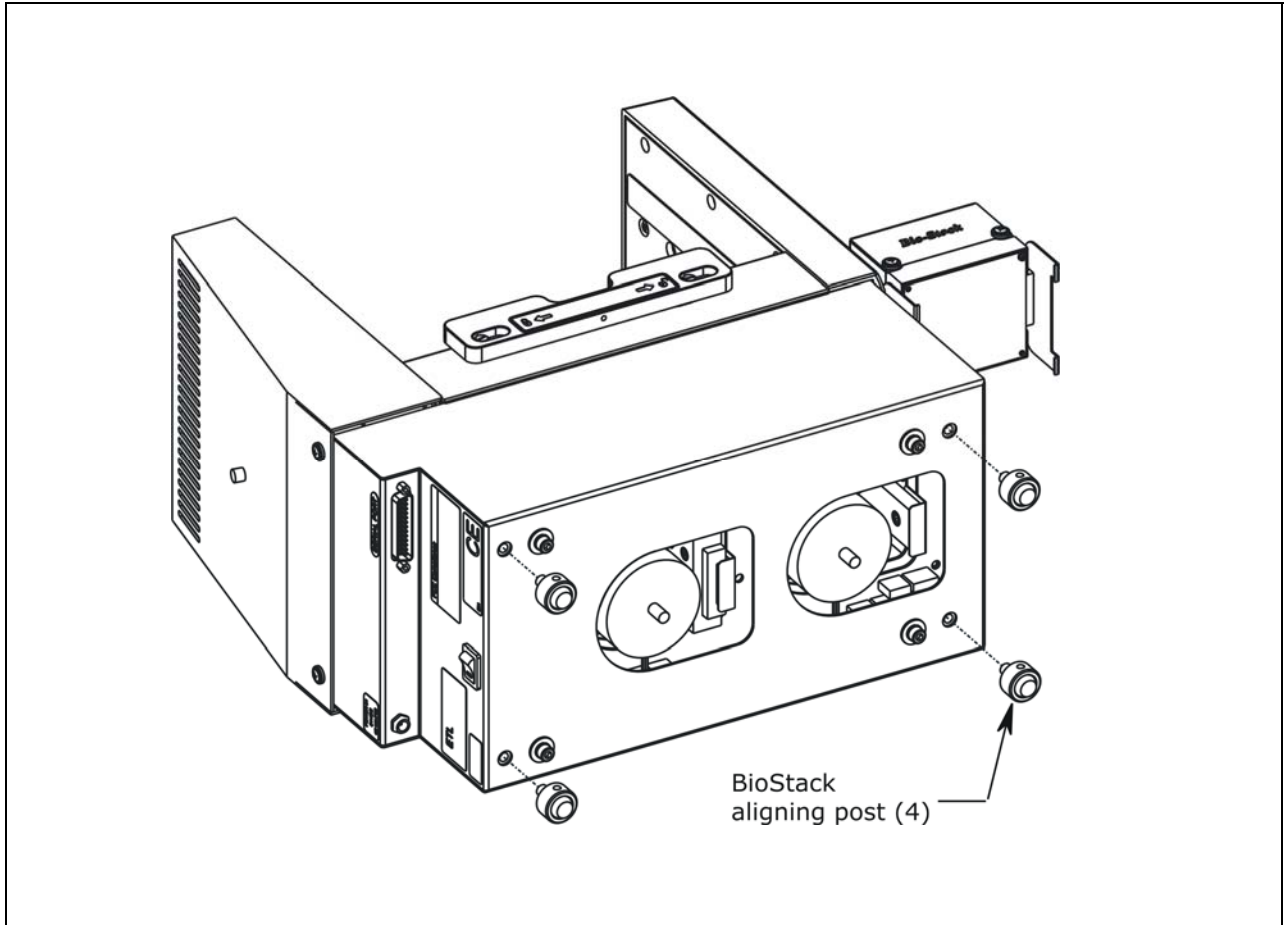
Figure 41: Attaching the Aligning Posts to the BioStack
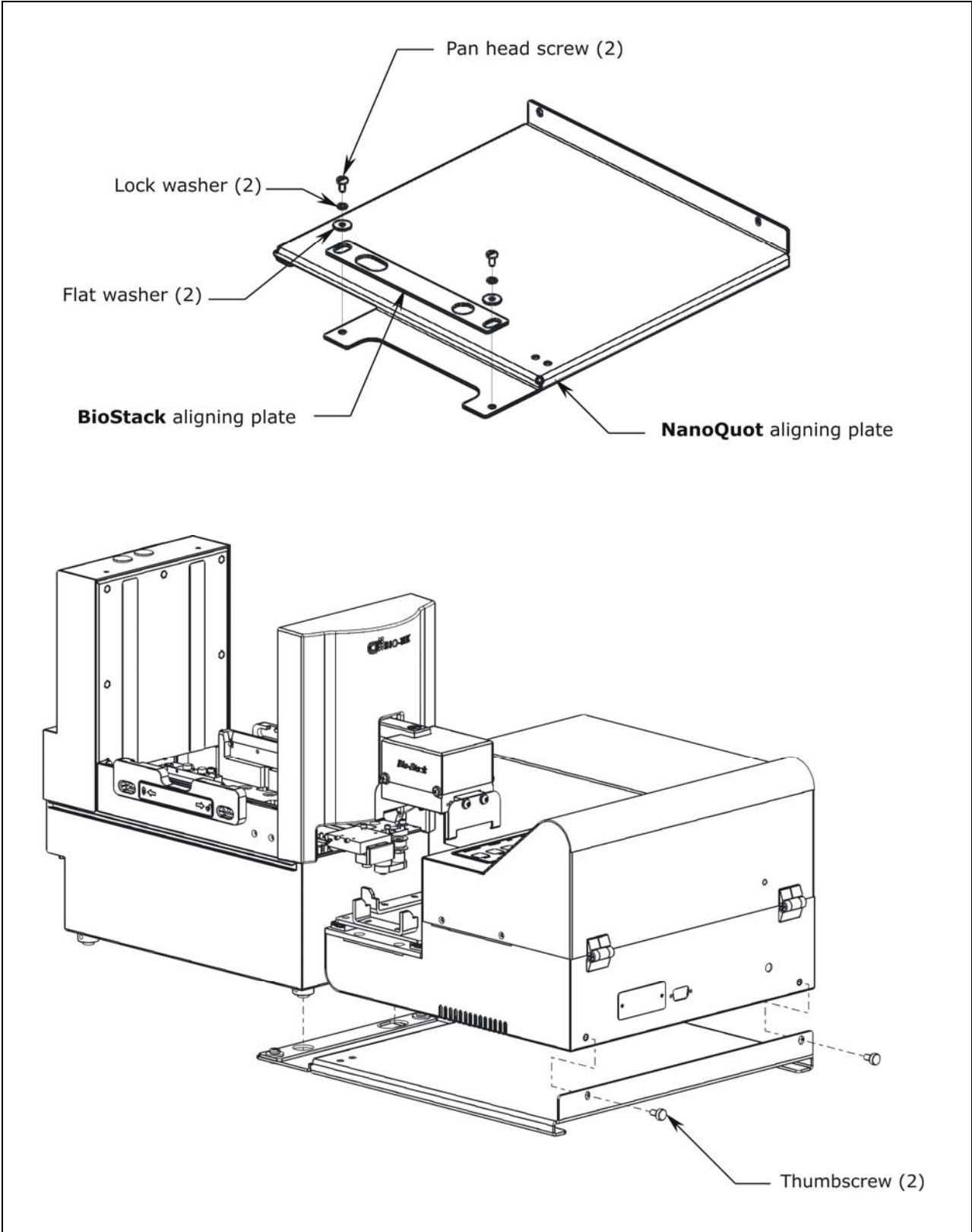
Figure 42: Seating the BioStack and the NanoQuot in the Aligning Plates

Set Dipswitch in Fixed Wrist Model or Rotational Wrist Model for NanoQuot

For installation and operation of the fixed wrist model and rotational wrist model with the NanoQuot, the Stacker must first be configured for the NanoQuot by setting a user-selectable switch. Refer to *Figure 13a* and *Figure 13b* on page 43 for the locations of the two arrays of dipswitches: SW1-1 through SW1-4, and SW2-1 through SW2-4.

Perform these steps to set the dipswitch on the Stacker for the NanoQuot:

1. Remove the hole plug for the SW2 array of switches.
2. Set dipswitch **SW2-2** to the "OPEN" position.
3. Replace the hole plug.

Turn on the BioStack and Run a Self-Test

⚠️	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/ gripper move quickly during the homing sequence.
🛈	The BioStack **must** pass the self-test for installation with the NanoQuot.
🛈	**Important!** Always power up the BioStack **first** before turning on the NanoQuot, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the dispenser's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the NanoQuot.

❖ The BioStack does not need to be connected to a host computer for this test.
❖ **Rotational wrist model:** If you changed the rotational wrist angle from the default interface of 90° to 0° (mandatory for operation with the NanoQuot), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see *Figure 12* on page 41 for the location of the switch). The BioStack will home all axes (claw/ gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Align the BioStack with the NanoQuot

Perform these steps to align the BioStack with the NanoQuot:

1. Ensure that the BioStack has been homed according to the instructions in the previous section. If the BioStack is off, turn it on to home all axes: manually raise the claw/gripper above the NanoQuot's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply to the NanoQuot.

3. Turn on the Dispenser. The carrier should be in the home position. Leave the NanoQuot powered up.

4. Turn the BioStack off.

5. Manually pull the BioStack carrier all the way out and position it below the claw assembly. Refer to *Figure 43* on the following page.

6. Place a dry microplate on the BioStack carrier.

7. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

8. Push the BioStack carrier out of the way.

9. Lower the claw assembly until the microplate is just above the carrier of the NanoQuot.

10. Manually adjust the BioStack on the tabletop so the microplate can be lowered into the carrier of the NanoQuot. The microplate carrier should be positioned as if it was just homed by the Dispenser. If the NanoQuot's carrier or the microplate has been moved, home the instruments (the BioStack first, then the NanoQuot), remove the microplate from the BioStack claw, then repeat steps 4 through 10.

11. When you are satisfied with the microplate positioning relative to the carrier of the NanoQuot (look carefully at the top-down drawing in *Figure 43* on the next page, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

12. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
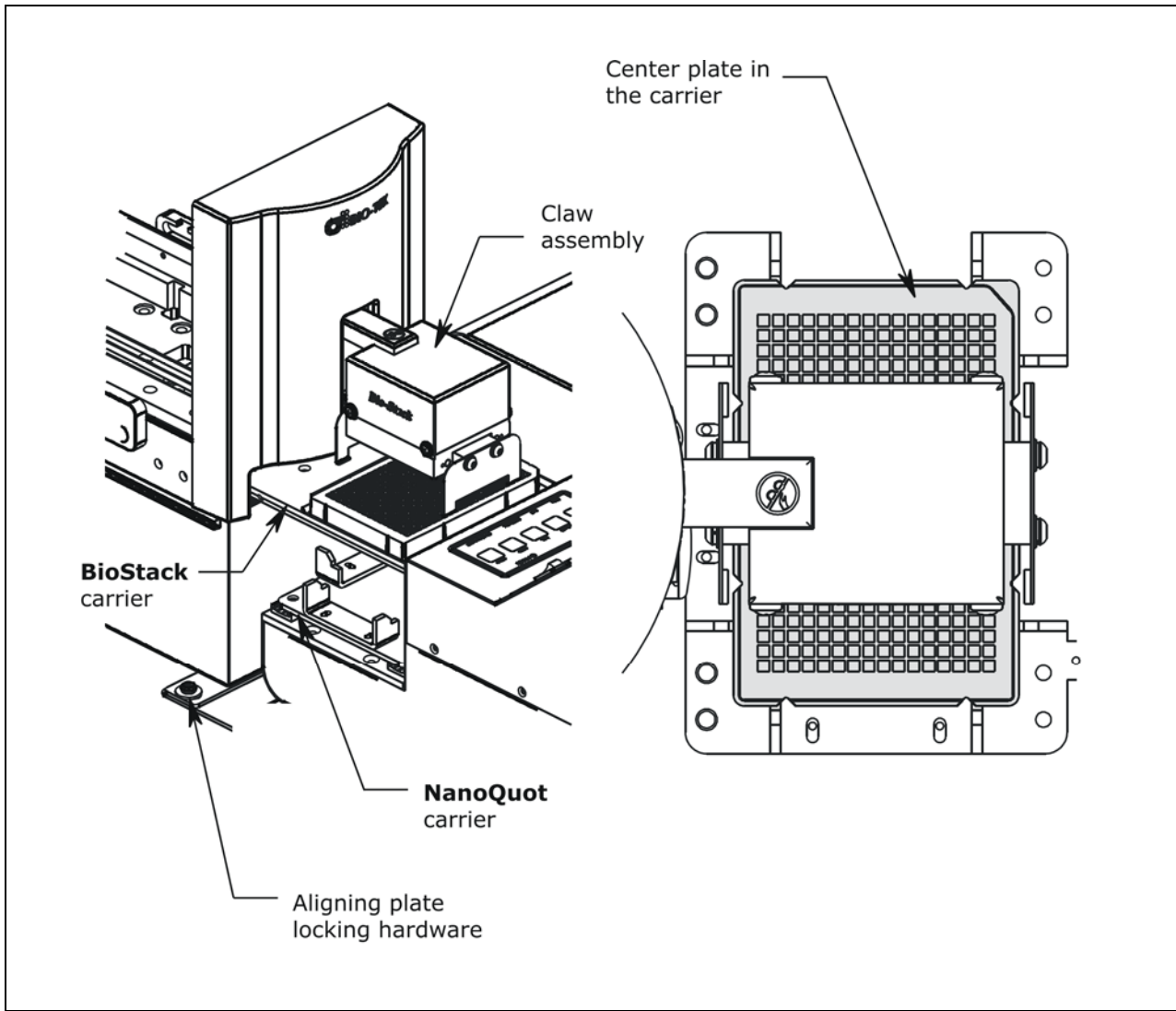
Figure 43: Aligning the BioStack with the NanoQuot

Install the Microplate Stacks

Locate the stack locks on the side of the BioStack. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 44* below and then close the stack locks.
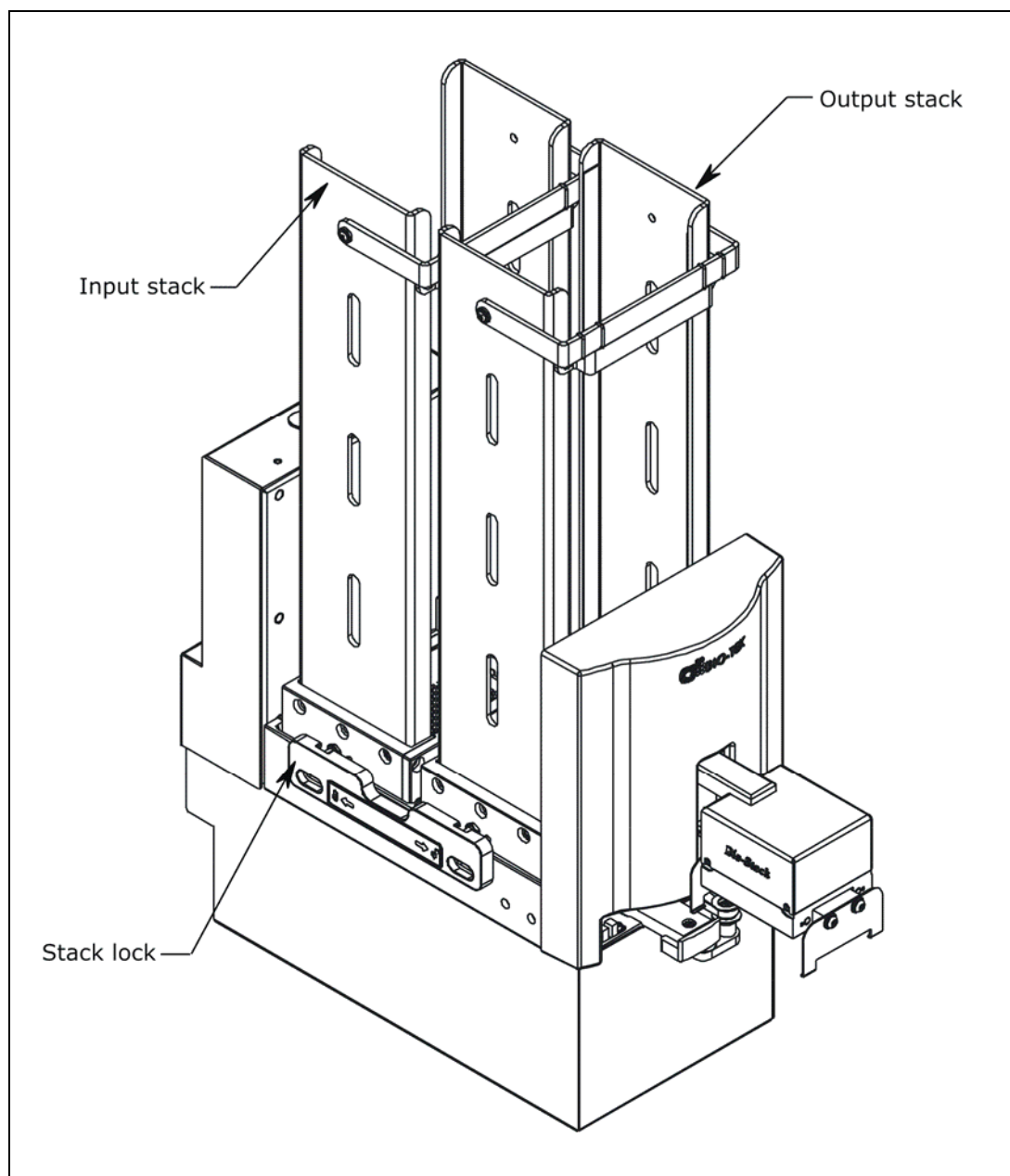
Figure 44: Installing the Microplate Stacks

❖ The 30-plate stacks are shown.

Connect the Host Computer to the BioStack

❖ To obtain software versions for the BioStack (Checksum Test) and to vertically align the BioStack's claw/gripper with the NanoQuot's microplate carrier, you must *temporarily* connect the BioStack to a host computer that has the BioStack™ PC Control Software installed.

❖ The **NanoQuot Integration Kit** includes two serial cables: a 9-pin to 9-pin male/male cable and 9-pin to 25-pin male/female cable. The **DB9M** end of either cable must be connected to the serial port on the BioStack.

Perform these steps to connect the host computer to the BioStack:

1. If the BioStack is on, turn it off.

2. Turn off the host computer. Place the computer in a location that is adjacent to both the BioStack and the NanoQuot.

3. Using the *appropriate* serial cable, attach the DB9M end of the cable to the serial port on the rear of the BioStack (refer to *Figure 12* on page 41 for an illustration of the serial port on the BioStack).

4. Attach the other end of the cable to a serial port on the computer.

5. Tighten the securing screws on both ends of the cable.

Install the BioStack PC Control Software and Test Communication

 Warning! Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

❖ A CD containing the **BioStack PC Control Software** and an installation guide are included in the **NanoQuot Integration Kit**.

Perform these steps to install the BioStack PC Control Software on the computer, and then test communication with the BioStack:

1. Turn the computer and the BioStack on: first, manually raise the BioStack's claw/gripper above the NanoQuot's plate carrier, then turn the BioStack on. Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. Allow the BioStack to complete its self-test.

2. Follow the instructions provided in the *BioStack PC Control Software Installation Guide* to install the software on the computer.

3. Launch the BioStack PC Control Software.

4. From the software's main screen, click the **Configure Instruments** button.

5. When the 'Instrument Configuration' dialog appears, select the appropriate **COM Port** for the **BioStack Configuration** and then click **Test Communications**.

   • If the test is **not** successful, ensure that the cable is properly connected and you have correctly identified the Com port number.

❖ The BioStack and the BioStack PC Control Software **must** be communicating before you can continue with the Installation Qualification.

6. If the test is successful, return to the main screen.

Run the Checksum Test for the BioStack

Perform these steps to run the Checksum Test for the BioStack and to record the software versions for the BioStack PC Control Software and for the BioStack:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the BioStack software versions.

1. From the top menu bar in the BioStack PC Control Software, select **Help > About BioStack**.

2. The 'About BioStack Software' dialog will open. Record the BioStack PC Software Versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX. Record the serial number listed on the BioStack PC Control Software package.

3. Click **Get On-board values now.** If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

4. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum. Record the serial number listed on the BioStack.

Align the Claw/Gripper with the NanoQuot's Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the NanoQuot's plate carrier. The BioStack PC Control Software has an **Instrument Alignment Utility** for this task.

Perform these steps to run the Instrument Alignment Utility:

1. Launch the BioStack PC Control Software.

2. At the software's main screen, click the **Configure Instruments** button.

3. When the 'Instrument Configuration' dialog appears, select **PowerWave**.

> ❖ For the purpose of alignment only, the user must select 'PowerWave' for the NanoQuot, since the NanoQuot uses the same BioStack alignment scheme as the PowerWave.

4. Click the **Instrument Alignment Utility** button.

5. Use the **Re-Alignment Control** buttons to position the BioStack's claw/gripper mechanism to the desired height relative to the NanoQuot's plate carrier. To aid in this activity, place a dry microplate on the Dispenser's carrier. Lower the claw/gripper so that the gripper's "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface (see *Figure 45* on the following page).

> ❖ If the BioStack and NanoQuot are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

• Begin with the **Down** radio button selected. To avoid collision of the gripper with the Dispenser's carrier, click the **20 Step** button first, to see how far that goes, before clicking the **400 Step** button. Use the **400/20/1 Step** buttons to *gradually* lower the claw/gripper mechanism to the desired height.

If you go down too far, click the **Up** radio button and step up a bit.

> ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button (in the **Instrument Alignment Utility** dialog) to home all axes on the BioStack, then repeat step 5 above.

6. When you are satisfied with the position, click the **Save Position** button.

7. Remove the plate from the carrier.

Figure 45: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the NanoQuot's Plate Carrier

Verify the Alignment

Perform the following test to verify alignment of the BioStack with the NanoQuot:

1. Place a dry microplate in the BioStack's input stack.
2. Launch the BioStack™ PC Control Software.
3. Click **Configure Instruments** to open the 'Instrument Configuration' dialog, then select **PowerWave** for the NanoQuot.
4. Click **Instrument Alignment Utility**, then click the **Verify** button.
5. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

    *   The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.
    *   The claw/gripper will pick up the plate, lower it toward the Dispenser's plate carrier, and then *smoothly* place the plate on the carrier.

    > ❖ If the plate drops onto the carrier, the claw interface position has been set too high. Repeat the steps in the previous section: ***Align the Claw/Gripper with the NanoQuot's Plate Carrier***.
    >
    > ❖ It may also be necessary to adjust the NanoQuot's microplate carrier so the plate can move freely in the carrier. Using your fingers, loosen the screws that attach the two adjustable brackets to the carrier, then adjust the brackets to allow clearance for the microplate. Finger-tighten the screws in the brackets.

    *   The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

    > ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will appear in the software. Repeat the steps in ***Align the Claw/Gripper with the NanoQuot's Plate Carrier***.

    *   If the gripper fingers did not catch on the plate, the "Verify plate placement" message will appear. Click **OK** to continue.
    *   The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's carrier.
    *   The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

6. If the alignment verification completed successfully and you have determined that the gripper fingers are positioned correctly, the BioStack is now ready for operation with the NanoQuot.
7. If the gripper fingers are not positioned correctly, perform the steps in ***Align the Claw/Gripper with the NanoQuot's Plate Carrier*** again, and then re-run the Verify Test. The Verify Test must pass before the BioStack can be used to transfer microplates.

Connect the Host Computer to the NanoQuot

❖ To obtain software versions for the NanoQuot you must *temporarily* connect the NanoQuot to a host computer that has the NanoQuot PC Control Software installed.

❖ The NanoQuot is shipped with a 9-pin to 9-pin male/female serial cable, for connection to a host computer. The **DB9M** end of the cable must be connected to the serial port on the NanoQuot.

Perform these steps to connect the host computer to the NanoQuot:

1. Turn off the BioStack and computer.

2. Disconnect the serial cable between the BioStack and computer.

3. Turn off the NanoQuot.

4. Using the supplied DB9F to DB9M serial cable, attach the DB9F end of the cable to a serial port on the computer.

5. Attach the DB9M end of the cable to the serial port on the rear of the NanoQuot. Refer to the *Installation* chapter in the *NanoQuot Operator's Manual* (on CD part number 7151008) for a photo of the serial port on the Dispenser.

6. Tighten the securing screws on both ends of the cable.

Install the NanoQuot PC Control Software and Test Communication

❖ The NanoQuot is shipped with a CD containing the **NanoQuot PC Control Software** (PN 7150202).

Perform these steps to install the NanoQuot PC Control Software, and then test communication with the NanoQuot:

1. Turn on the computer and NanoQuot. Allow the NanoQuot to complete its self-test.

2. Follow the instructions provided in the *Installation* chapter of the *NanoQuot Operator's Manual* on CD for installation of the software on the computer.

3. Launch the NanoQuot PC Control Software. When the software's main screen appears, verify that the Dispenser's **Serial No.** and **Instrument Software** information (basecode part number and version) are displayed and that the correct **COM Port** is selected.

4. Click **Test Communications**.

   - If the software does not display the serial number and instrument software version, verify that the instrument is turned on and the serial cable is connected properly. Click 'Test Communications' again.

   - If you receive the 'Communication test was successful' dialog, click **OK**.

   - If the test is not successful, try a different Com port or check the serial cable connections. Refer also to the Troubleshooting section of the PC Software's Help system for assistance.

Record Software Information for the NanoQuot

Perform these steps to record the software versions for the NanoQuot PC Control Software and for the NanoQuot:

> ❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the NanoQuot software versions.
>
> ❖ The NanoQuot basecode software does not include a Checksum.

1. From the top menu bar in the NanoQuot PC Control Software, select **Help > About NanoQuot PC Software**.

2. The 'About NanoQuot PC Control' dialog will open. Record the NanoQuot PC Control version as well as the three **Component Software** versions, then click **OK** to close the dialog. Record the serial number listed on the NanoQuot PC Control Software package.

3. At the software's main screen, record the NanoQuot's **Instrument Software** (basecode part number and version) and **Serial No**.

    > ❖ The serial number displayed in the PC Software should match the serial number listed on the Dispenser.

Connect the BioStack to the NanoQuot

> ❖ The **NanoQuot Integration Kit** includes two serial cables: a 9-pin to 9-pin male/male cable and 9-pin to 25-pin male/female cable. The DB9M to DB9M cable must be used to connect the BioStack to the NanoQuot.

Perform these steps to connect the BioStack to the NanoQuot:

1. Turn off the computer and the NanoQuot.

2. Disconnect the serial cable between the computer and the NanoQuot.

3. Connect the DB9M to DB9M serial cable between the BioStack and NanoQuot.

4. Turn on the BioStack: manually raise the claw/gripper above the NanoQuot's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Allow the BioStack's self-test to complete.

    > ❖ It is recommended that the BioStack be powered up *before* the NanoQuot.

5. Turn on the NanoQuot and allow the self-test to complete.

Test Communication with the BioStack

Perform these steps to test communication between the BioStack and the NanoQuot™, by using the NanoQuot's Initialization (**Init**) feature to home all axes on the BioStack:

1. Set the **Mode** rocker switch on the NanoQuot to **BioStack**.

2. Press the **Init** key.

   - If the communication test passes, the BioStack will home all axes. The carrier will home and the claw assembly will move up.

   - If the communication test fails, the BioStack will fail to home all axes, and the green light on the BioStack may flash. If this happens, turn off the BioStack and check the serial cable connection between the BioStack and NanoQuot. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Install the BioStack with the MicroFlo Select

> ❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with the MicroFlo, you may use the Stacker with the wrist angle set at the default 90° or you may change it to 0°. Refer to ***Configure the Rotational Wrist Model for the Interfacing Instrument*** on page 42.
>
> ❖ Except where noted, the installation steps apply to all BioStack models.
>
> ❖ If you will be operating **two BioStacks** with **two MicroFlo Select Dispensers** via computer control (using the Liquid Handling Control Software), you will need a PC equipped with four communication ports, and two MicroFlo Select Integration Kits (PN 7310020). You will need to perform the installation steps for both BioStack/MicroFlo configurations.

Lay Out the Alignment Hardware

You will need the alignment hardware from the MicroFlo Select Integration Kit (**PN 7310020**), illustrated below.

MicroFlo Select Integration Kit 7310020

Four aligning posts (PN 7310524) for elevating the BioStack to the correct height and for seating in the aligning plate.	**Four aligning caps** (PN 7170527) for elevating the MicroFlo Select to the correct height and for seating in the aligning plate.
MicroFlo Select aligning plate (PN 7172125) for preventing the instrument from sliding around and being misaligned with the BioStack.	**BioStack aligning plate** (PN 7312052) for attachment to the MicroFlo Select aligning plate. Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).
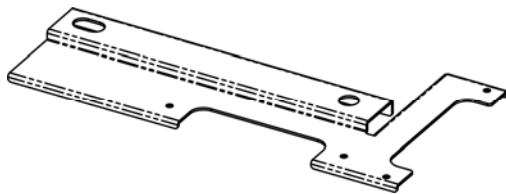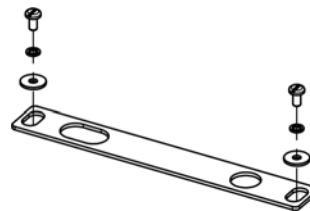
Attach the Aligning Posts and Caps

> (i) **Important!** When attaching the four aligning posts ("feet") to the BioStack, do not over-tighten the posts! **Finger-tighten only!**
>
> To avoid scratches to the BioStack or to the MicroFlo Select, place a towel down before laying the instrument on its side or back.

> ❖ **BioStack barcode scanner:** If you have installed the barcode scanner on the BioStack (for operation with a PowerWave or Synergy reader or Precision instrument), lay the BioStack on the opposite side of the scanner. Note that the scanner must be installed on the *left side* of the BioStack for proper alignment with the MicroFlo. See *Appendix B*, *BioStack Barcode Scanner* for more information.

Perform these steps to attach the aligning posts to the BioStack and the aligning caps to the MicroFlo Select (refer to *Figure 46* on the following page):

1. Turn off the BioStack.

2. Carefully lay the BioStack on its side so the bottom is facing you.

3. Screw in all four aligning posts as shown. Return the BioStack to the upright position.

4. Turn off the MicroFlo and disconnect the power supply cord from the dispenser.

5. Carefully lay the MicroFlo on its back so the bottom is facing you.

6. Remove the four rubber feet on the Dispenser.

7. Screw in all four aligning caps as shown. Return the MicroFlo to the upright position.
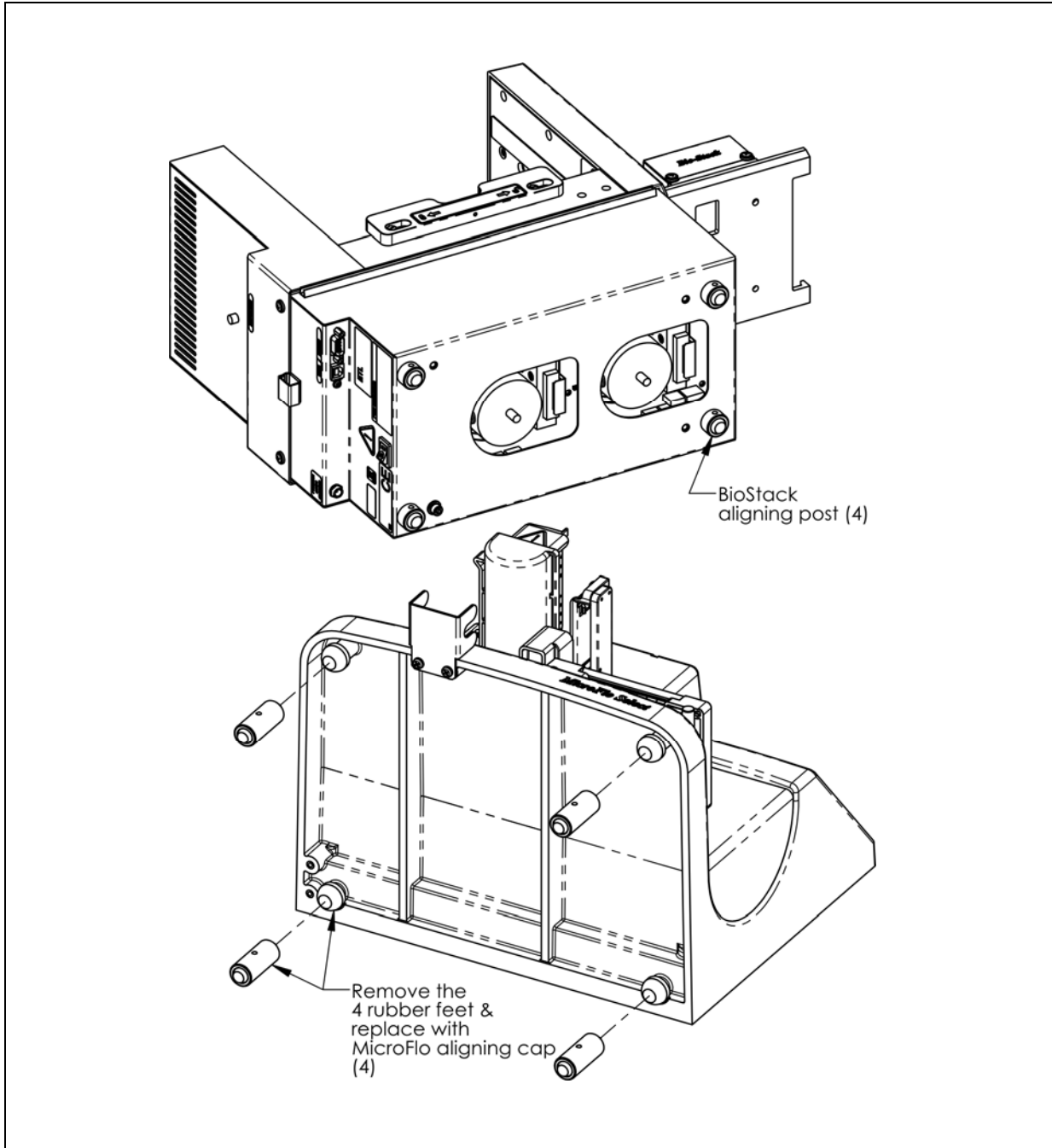
Figure 46: Attaching the Aligning Posts to the BioStack and the Aligning Caps
to the MicroFlo Select

Seat the Instruments in the Aligning Plates

Perform these steps to seat the BioStack and the MicroFlo Select in the aligning plates:

1. Place the MicroFlo aligning plate on a level surface.

2. Attach the BioStack aligning plate as follows. See *Figure 47* on the following page for the MicroFlo with the fixed wrist model, (**PN BIOSTACK2**), or *Figure 48* on page 144 for the MicroFlo with the rotational wrist model (**PN BIOSTACK2WR**), with the wrist angle set at the default 90° interface:

   ❖ *Figure 47* also represents the position of the rotational wrist model in the aligning plates with the MicroFlo, if the Stacker's default interface angle has been changed from 90° to 0°.

   • Loosely attach the BioStack aligning plate to the MicroFlo aligning plate by screwing in the pan head screw, lock washer, and flat washer only halfway.
   • Slide the MicroFlo's two front aligning caps into the slots provided on the MicroFlo aligning plate.

3. Slide the BioStack's two front aligning posts into the slots provided on the BioStack's plate.

4. Move both instruments back and forth in their slots until you are satisfied that they are positioned correctly next to each other (approximately). Ensure that all posts and caps are properly seated (not resting on top of the plates), and that the instruments are level.
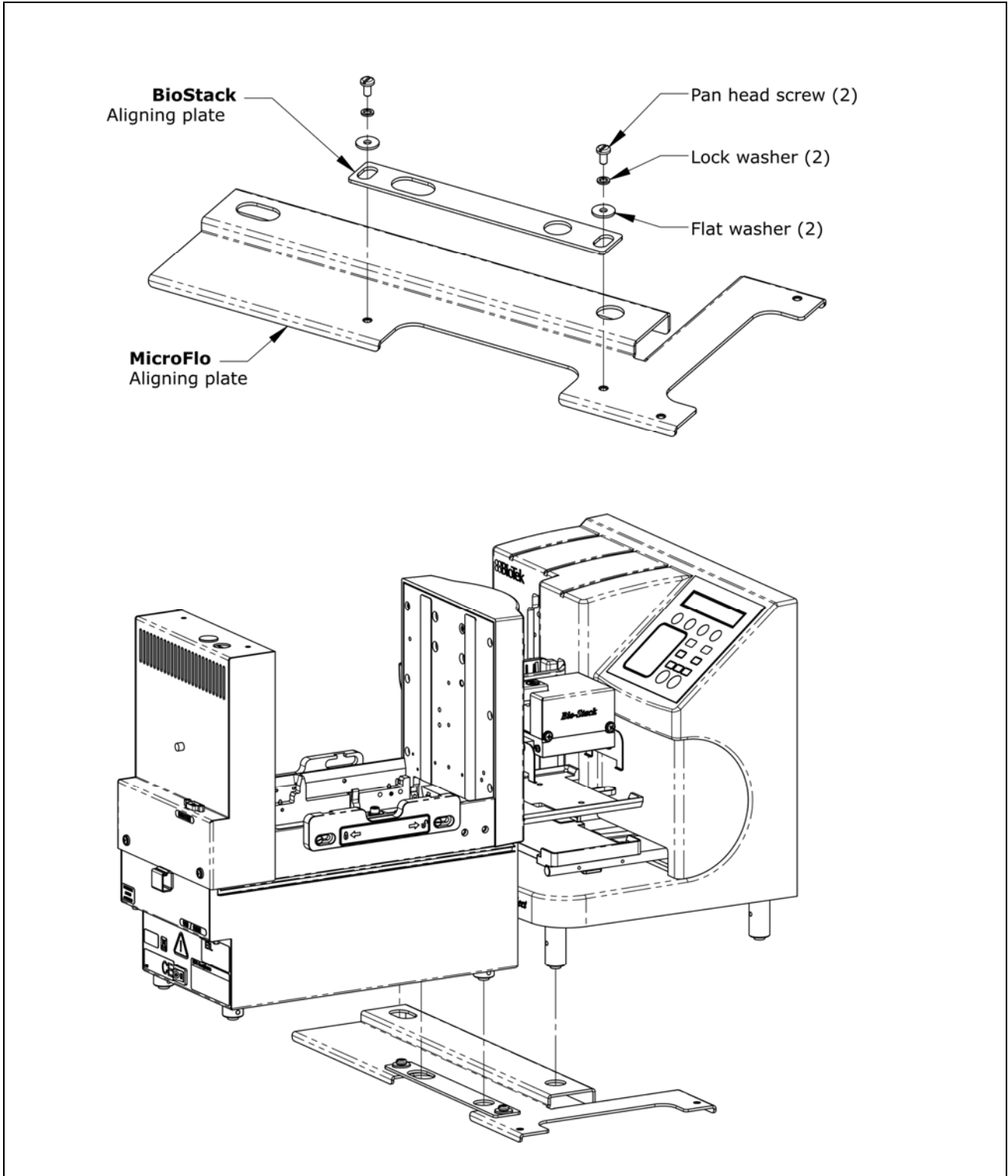
Figure 47: Seating the BioStack and MicroFlo Select in the Aligning Plates

❖ The fixed wrist model (PN BIOSTACK2) is shown.
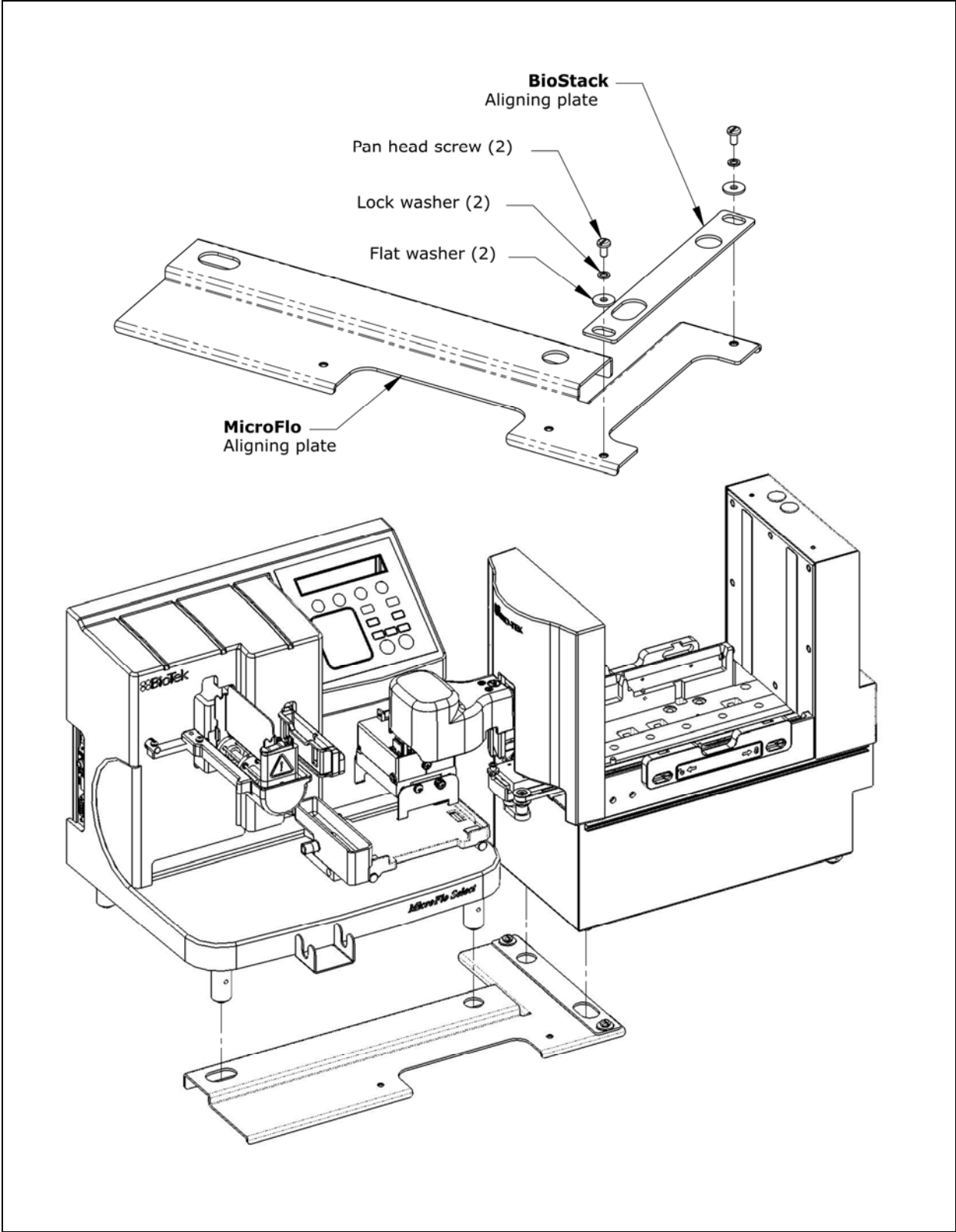
Figure 48: Seating the Rotational Wrist Model and MicroFlo Select in the Aligning Plates

❖ The wrist is shown at the 90° interface.

Turn on the BioStack and Run a Self-Test

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	The BioStack **must** pass the self-test for installation with the MicroFlo Select.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the MicroFlo, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the dispenser's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the MicroFlo.

❖ The BioStack does not need to be connected to the MicroFlo Select or to a host computer for this test.

❖ **Rotational wrist model (PN BIOSTACK2WR):** If you changed the wrist angle from the default interface of 90° to 0° (optional for operation with the MicroFlo), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see *Figure 12* on page 41 for the location of the switch). The BioStack will home all axes (claw/gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Align the BioStack with the MicroFlo Select

> ❖ Follow the instructions below if installing the BioStack **fixed wrist model** or the **rotational wrist model** (**0°** interface) with the MicroFlo.
>
> ❖ Follow the instructions on page 148 if installing the BioStack **rotational wrist model** at the **90°** interface with the MicroFlo.

Perform these steps to align the BioStack with the MicroFlo Select:

1. Ensure that the BioStack is powered up and homed. If the BioStack is off, turn it on to home all axes: manually raise the claw/gripper above the dispenser's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply cord to the MicroFlo and turn the instrument on. The carrier should be in the "out" (far right) position. Leave the MicroFlo powered up.

3. Turn the BioStack off.

4. Manually slide the BioStack carrier all the way out and position it below the claw assembly. Refer to *Figure 49* on the following page for the MicroFlo with the BioStack fixed wrist model.

5. Place a dry microplate on the BioStack carrier.

6. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

7. Slide the BioStack carrier out of the way.

8. Lower the claw assembly until the microplate is just above the carrier of the MicroFlo.

9. Manually adjust the BioStack on the tabletop so the microplate can be lowered into the carrier of the MicroFlo. The microplate carrier should be positioned as if it was just homed by the MicroFlo. If the MicroFlo's carrier or the microplate has been moved, home the instruments (the BioStack first, then the MicroFlo), remove the microplate from the BioStack claw, then repeat steps 3 through 9.

10. When you are satisfied with the microplate positioning relative to the carrier of the MicroFlo (look carefully at the top-down drawings in *Figure 49* to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

11. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
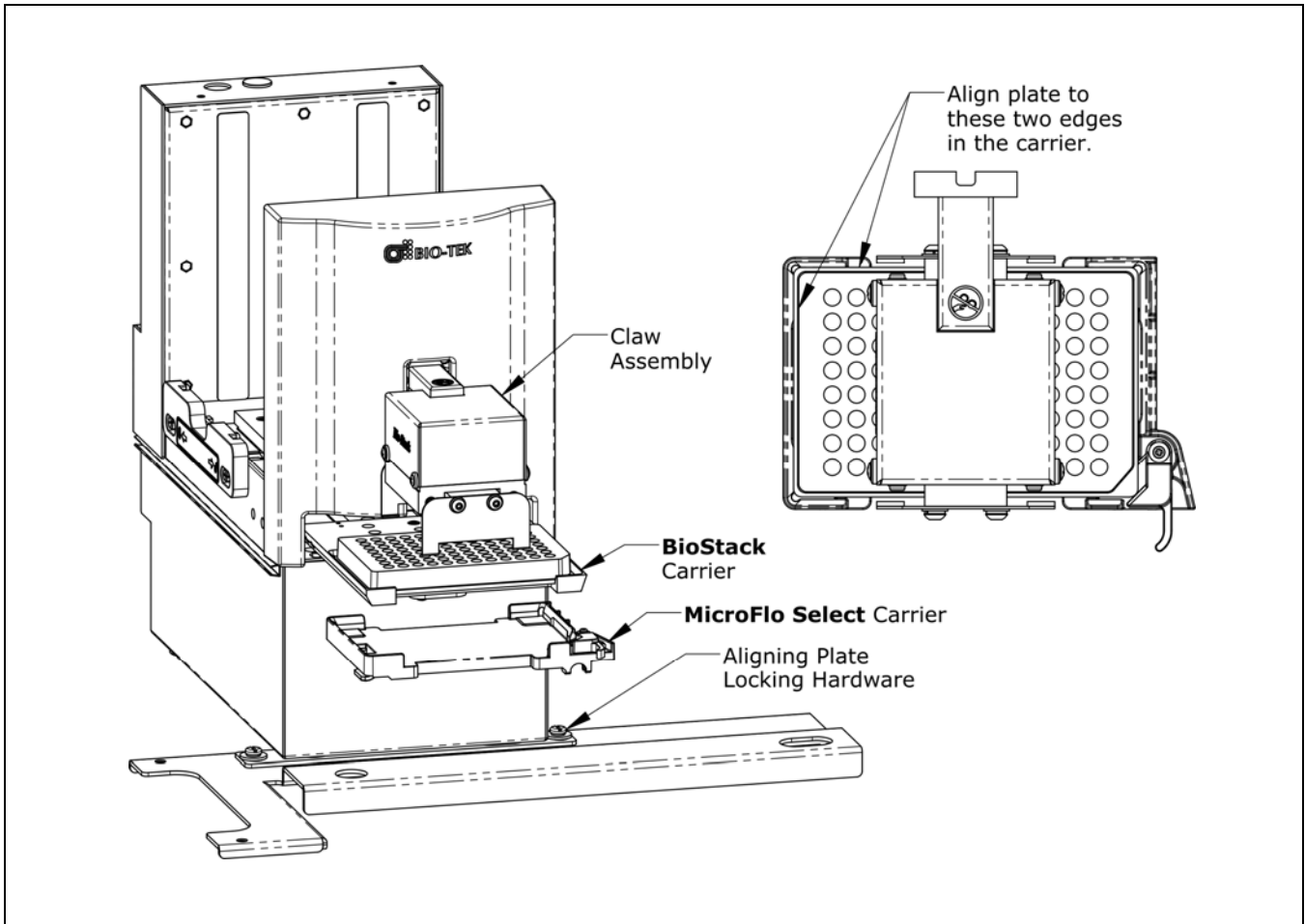
Figure 49: Aligning the BioStack with the MicroFlo Select

❖   The fixed wrist model (PN BIOSTACK2) is shown.

❖ Follow the instructions below if installing the BioStack **rotational wrist model** at the **90°** interface with the MicroFlo.

Perform the steps below to align the BioStack rotational wrist model with the MicroFlo.

1. If the Stacker is off, turn it on to home all axes: manually raise the claw/gripper above the dispenser's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply cord to the MicroFlo and turn the instrument on. The carrier should be in the "out" (far right) position. Leave the MicroFlo powered up.

3. Turn the Stacker off.

4. Manually rotate the claw assembly to where the claw will be aligned with a microplate on the Stacker's carrier (**0° angle**).

5. Manually slide the Stacker carrier all the way out and position it below the claw assembly. Refer to *Figure 50* on the next page.

6. Place a dry microplate on the BioStack carrier.

7. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate).

8. Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

9. Slide the Stacker's carrier out of the way.

10. Lower the claw to the carrier's opening.

11. Manually rotate the claw assembly to where the claw is visually perpendicular to the Stacker and aligned with the MicroFlo's plate carrier (**90° angle**), making sure that the microplate does not change position in the claw.

12. Lower the claw assembly until the microplate is just above the carrier of the MicroFlo. Make sure the plate is centered in the claw.

13. Manually adjust the Stacker on the tabletop so the microplate can be lowered into the carrier of the MicroFlo. The microplate carrier should be positioned as if it was just homed by the MicroFlo. If the MicroFlo's carrier or the microplate has been moved, home the instruments (the BioStack first, then the MicroFlo), remove the microplate from the Stacker's claw, then repeat steps 3 through 12.

14. When you are satisfied with the microplate positioning relative to the carrier of the MicroFlo (look carefully at the top-down drawing in *Figure 50* on the following page, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

15. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
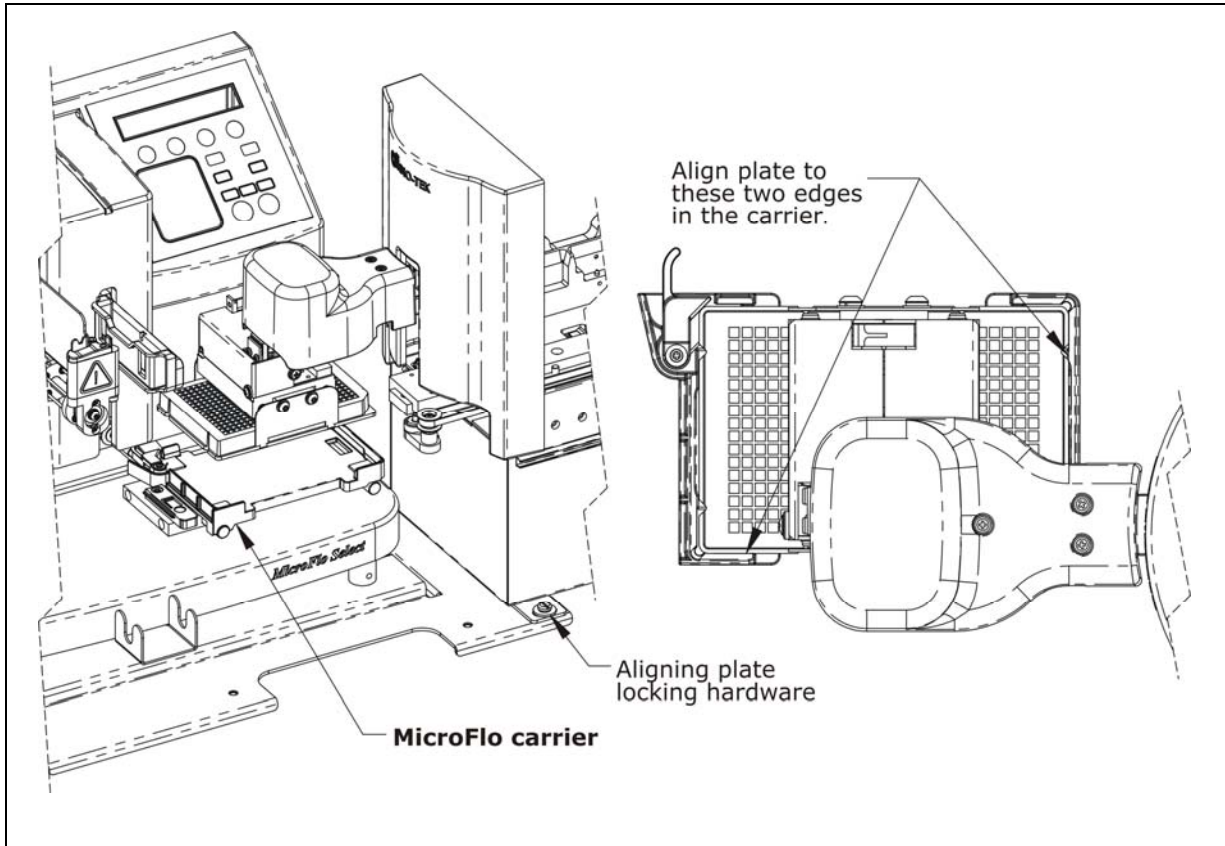
Figure 50: Aligning the Rotational Wrist Model with the MicroFlo Select

❖ The wrist is shown at the 90° interface.

Install the Microplate Stacks

Locate the stack locks on the side of the BioStack™. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 51* below and then close the stack locks.
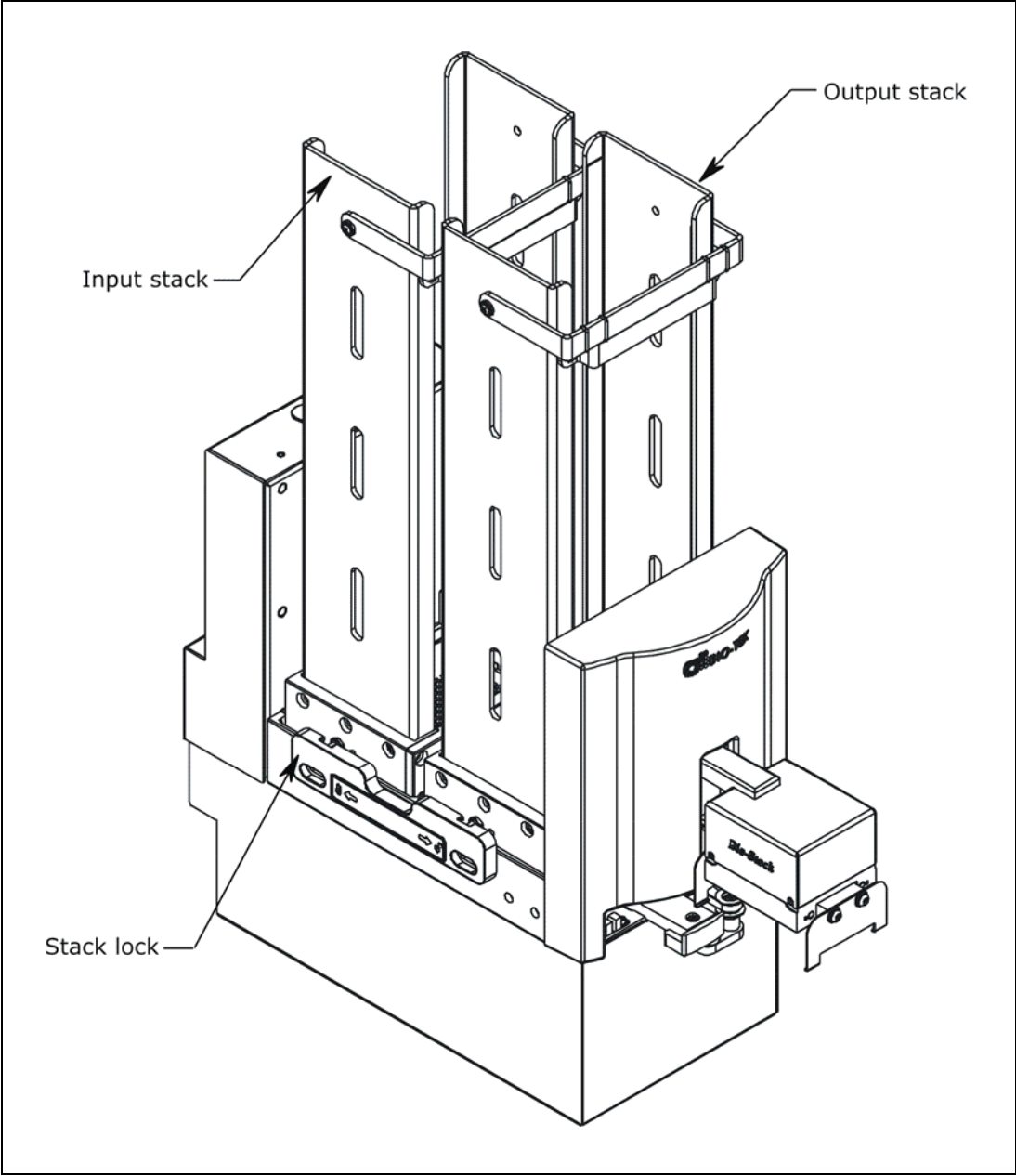
Figure 51: Installing the Microplate Stacks

❖ The 30-plate stacks are shown.

Instrument Control of the BioStack and MicroFlo Select Using the Dispenser's Keypad (Pages 151 through 158)

> ⓘ If using **instrument control** of the BioStack and MicroFlo Select via the MicroFlo keypad:
>
> - Perform the steps in the sections below and on pages 152 through 158.
>
> If using **PC control** of the BioStack and MicroFlo Select via the Liquid Handling Control (LHC) Software:
>
> - Perform the steps in the sections on pages 159 through 167.
>
> For instrument control or PC control of the **fixed wrist model** (PN BIOSTACK2) or **rotational wrist model** (PN BIOSTACK2WR) with the MicroFlo Select:
>
> - You will need MicroFlo basecode software version **1.06** installed on the Dispenser. Contact BioTek for more information.

Connect the BioStack™ to the MicroFlo™ Select

> ❖ The **MicroFlo Integration Kit** includes two serial cables (a 9-pin to 9-pin male/male cable and 9-pin to 25-pin male/female cable), a USB cable, and USB driver software CD. The BioStack must be connected to the Microflo Select with the appropriate serial cable.
>
> ❖ The USB cable may be used instead of a serial cable for connection of the BioStack to a host computer (for instance, if you will be using the LHC Software to control the BioStack and MicroFlo). See the PC Control section on pages 159 through 167.

Perform these steps to connect the serial cable between the BioStack and the MicroFlo Select:

1. Make sure that the BioStack and MicroFlo are turned off.

2. Attach one end of the *appropriate* serial cable to the serial port on the rear of the BioStack (refer to **Figure 12** on page 41 for an illustration of the serial port on the BioStack).

3. Attach the other end of the cable to the serial port on the side of the MicroFlo.

4. Tighten the securing screws on both ends of the cable.

Run the Checksum Test for the MicroFlo Select

Perform these steps to run the Checksum Test and record the basecode software versions for the MicroFlo Select:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the software versions for the MicroFlo.

1. Turn on the MicroFlo and allow its self-test to complete. After the initial powerup screen is displayed, the main menu screen will appear if the self-test passes:

```
( 9 6 )    C A S S ( 5 )    V O L : 0 0 1 0 u l

P R I M E    P U R G E    u P L A T E      - - >
```

2. From the main menu select **- - >** twice. The Dispenser Action Menu screen will appear:

```
D I S P E N S E R    A C T I O N    M E N U

D E F I N E    U T I L    S E T U P
```

3. Select **UTIL > CHKSUM**. The Version Checksum Info screen will appear with the three options as shown below:

```
V E R S I O N    C H E C K S U M    I N F O :

  U I        M C        S T K R
```

- **UI** displays basecode software and checksum information for the User Interface processor. The UI processor communicates with the computer (during PC control of the MicroFlo), keyboard, display, and BioStack.

- **MC** displays basecode software and checksum information for the Motor Controller processor. The MC processor is responsible for driving the motors on the instruments and working directly with the hardware.

- **STKR** displays basecode and checksum information for the BioStack, if the BioStack is connected to the MicroFlo <u>and</u> the dispenser's operating mode has been set to **BIOSTACK** (as instructed in the following section *Configure the MicroFlo Select for the BioStack*.)

  ❖ If the dispenser's operating mode is set at **MANUAL**, an error will be displayed when the **STKR** option is selected from the Version Checksum Info screen.

4. Select **UI**. Record the basecode software version (X.XX) and checksum (XXXX) information:

```
7 1 7 0 2 0 0      V E R S I O N    X . X X

C O D E    C H E C K S U M :        ( X X X X )
```

Press the **ENTER** or **Previous Screen** key to return to the Version Checksum Info screen.

5. Select **MC**. Record the basecode software version (X.XX) and checksum (XXXX) information:

```
7 1 7 0 2 0 0      V E R S I O N    X . X X

C O D E    C H E C K S U M :        ( X X X X )
```

> ❖ **Note:** You will run the Checksum Test for the BioStack in the section *Test Communication with the BioStack* on the following page.

6. Press the **Previous Screen** key until you return to the Dispenser Action Menu.

7. Record the MicroFlo serial number (listed on the instrument).

Configure the MicroFlo Select for the BioStack

> ❖ By default, the MicroFlo is configured for operation as a stand-alone instrument. The dispenser must be configured for BioStack operation by using the BioStack's **Configuration** (**CONF**) utility.

Perform these steps to configure the MicroFlo Select to recognize the BioStack:

1. From the Dispenser Action Menu, select **SETUP > BIOSTACK > CONF > BIOSTACK.**

2. When the selection sequence is complete, the **RE-STACK?** screen will appear. Select **YES** or **NO**.

3. Press the **Main Menu** key.

Test Communication with the BioStack

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

Perform these steps to test communication between the BioStack and the MicroFlo Select and (optionally) to record the software versions for the BioStack:

❖ Use the **Software Data Sheet** from the section *Run the Checksum Test for the MicroFlo Select*, to record software versions for the BioStack.

1. **Important:** Turn off the MicroFlo.

2. Turn on the BioStack and allow its self-test to complete: manually raise the claw/gripper above the dispenser's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

3. Turn on the MicroFlo and allow its self-test to complete.

4. From the MicroFlo main menu, select **- - >** twice to get to the Dispenser Action Menu**.**

5. Select **UTIL > CHKSUM > STKR**.

   The following screen should appear if the instrument is able to communicate with the BioStack:

   ```
   BIO-STACK:    X.XX,    X.XX
   CODE  CHECKSUM:        (XXXX)
   ```

6. If communication is successful, record the BioStack basecode software version (the first X.XX), the interface definition version (the second X.XX), and the checksum. Record the serial number listed on the BioStack.

7. If the MicroFlo cannot communicate with the BioStack, an error code will be displayed, with "Stacker Error" shown in the first line of the display. Consult *Chapter 7*, *Troubleshooting and Error Codes* for guidance.

Align the Claw/Gripper with the MicroFlo Select Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the MicroFlo Select. The MicroFlo has an on-board **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack claw/gripper with the MicroFlo microplate carrier:

1. From the MicroFlo main menu, select **- - >** twice to get to the Dispenser Action Menu**.**

2. Select **SETUP** > **BIOSTACK** > **ALIGN** > **C-POS**.

3. The **FIND CLAW INTERFACE POS** menu will appear on the display with the following four selections:

   -/+   **+1**   **+20**   **+400**

4. Use the four softkeys on the MicroFlo keypad to position the BioStack's claw/gripper mechanism to the desired height relative to the plate carrier on the MicroFlo. To help in this activity, place a dry microplate on the carrier of the MicroFlo (optional). Lower the mechanism so that the gripper's "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface (see *Figure 52* on the next page).

   > ❖ If the BioStack and MicroFlo are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

   - To avoid collision of the gripper with the carrier on the MicroFlo, press the **+20** key first, to see how far that goes, before pressing the **+400** key. Use the **1/20/400** softkeys to *gradually* lower the claw/gripper mechanism to the desired height.

   - If you go too far, press the **-/+** softkey to step up a bit.

   > ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. To home the BioStack, press the **Previous Screen** key until you return to the Alignment Utility screen. Select **HOME > BIOSTACK**, then repeat steps 1 through 4 above.

5. When you are satisfied with the position, press the **Previous Screen** key until you return to the Alignment Utility screen and select **SAVE**.

6. At the **OK TO SAVE LOCATION?** screen, press **YES**, and then **ENTER**.

7. Remove the plate from the carrier on the MicroFlo.
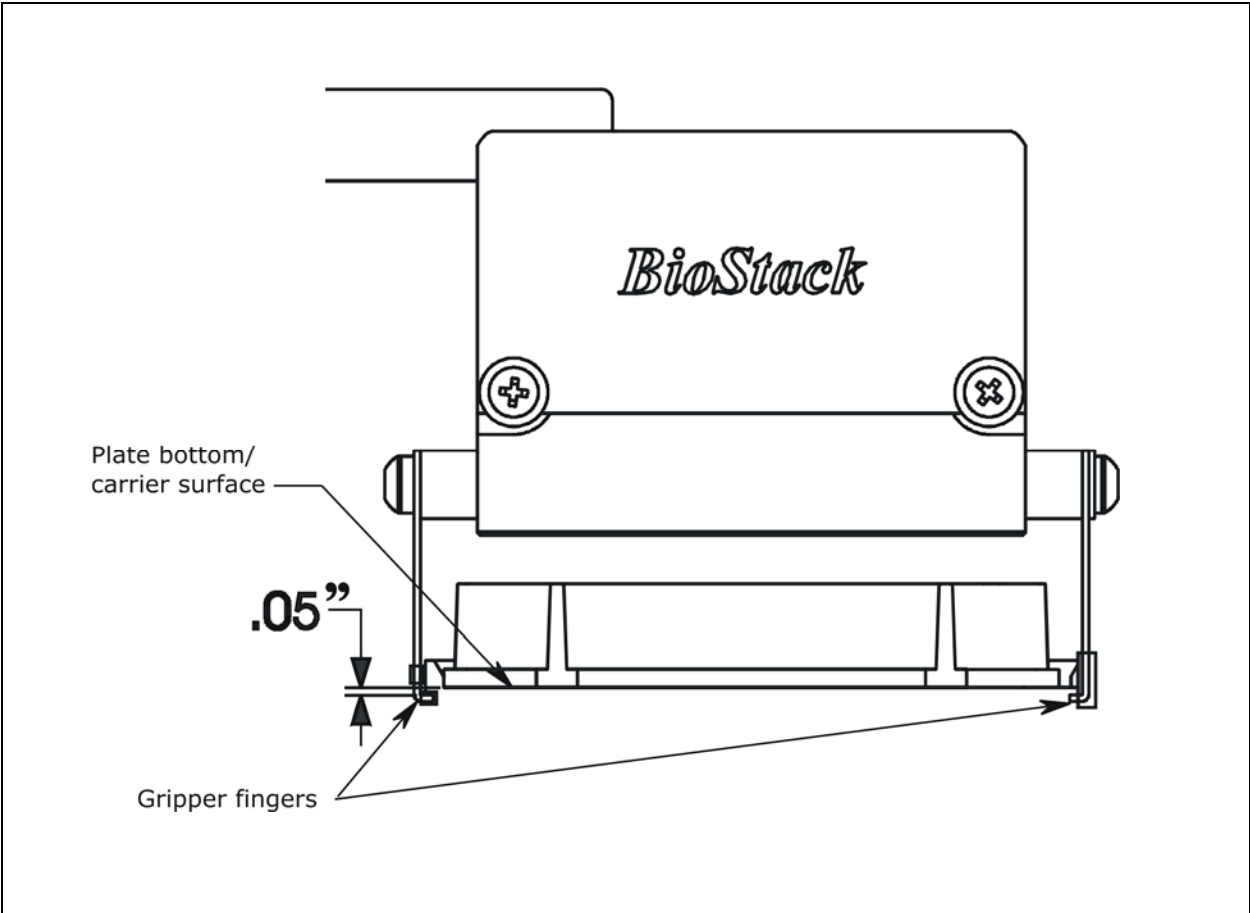
Figure 52: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the MicroFlo Select Plate Carrier

Verify the Alignment

> ❖ The BioStack **rotational wrist model** instructions below apply only when the wrist angle is set at the **90°** interface with the MicroFlo.

Perform the following test to verify alignment of the BioStack with the MicroFlo Select:

1. Ensure that both instruments are turned on.

2. Place a dry microplate in the BioStack's input stack.

3. From the Dispenser Action Menu, select **SETUP > BIOSTACK > VERIFY**. Press the **ENTER** key.

4. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   - The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.

   - The claw/gripper will pick up the plate, lower it toward the MicroFlo's plate carrier, and then *smoothly* place the plate on the carrier.
     Rotational wrist model: The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the MicroFlo's plate carrier, and then *smoothly* place the plate on the carrier.

   > ❖ If the plate drops onto the carrier, the claw interface position is set too high. Repeat the instructions in *Align the Claw/Gripper with the MicroFlo Select Plate Carrier* on page 155.

   - The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

   > ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will display on the MicroFlo. Repeat the instructions in *Align the Claw/Gripper with the MicroFlo Select Plate Carrier* on page 155.

   - If the gripper fingers did not catch on the plate, the MicroFlo will display **VERIFY PLATE PLACEMENT**. Press **ENTER** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model with MicroFlo:** The claw/gripper will lower and pick up the plate from the MicroFlo plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- The MicroFlo will display **BIOSTACK UTILITIES**. From here you can select **VERIFY** to run the program again, or press **Main Menu**.

5. If the alignment verification completed successfully and you have determined that the gripper fingers are positioned correctly, return to the instrument's main menu.

   - If the gripper fingers are not positioned correctly, repeat the instructions in *Align the Claw/Gripper with the MicroFlo Select Plate Carrier*, and then re-run the Verify Test.

6. **Rotational wrist model:** Home the Stacker. The wrist will rotate the claw/gripper to the default 90° interface position.

❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

PC Control of the BioStack and MicroFlo Select Using the LHC Software (Pages 159 through 167)

> (i) For computer control of the BioStack and MicroFlo Select using the **Liquid Handling Control™ (LHC) Software**, you will need appropriate versions of the MicroFlo Select Interface Software, dispenser basecode software, BioStack PC Control Software, and BioStack basecode software. **Note:** Any version of the LHC Software may be used to control the BioStack and MicroFlo.
>
> Refer to *Appendix D*, *Required Software Versions*, or contact BioTek for more information on required software versions.

During PC control of the BioStack and MicroFlo Select, both instruments are controlled by BioTek's Liquid Handling Control (LHC) Software running on a host computer. The LHC Software uses the MicroFlo Select Interface Software to control all functions of the MicroFlo, and uses a component of the BioStack PC Control Software to control all functionality of the BioStack.

> ❖ The **LHC Help system** contains a detailed description of the LHC Software, and how it interacts with the MicroFlo Select Interface Software and BioStack PC Control Software to control the MicroFlo and BioStack.

Perform the instructions below and on the following pages, for computer control of the BioStack and MicroFlo using the LHC Software.

Prerequisites

- Verify that the host PC meets the minimum system requirements specified in the *Liquid Handling Control Software Installation Guide* and *BioStack PC Control Software Installation Guide*.

- Verify Administrator privileges. BioTek software requires the user who is installing the software application to have Administrator privileges for the Windows® 2000/XP/Vista systems. If a user with restricted access attempts to install the application, errors may occur. Contact your organization's system administrator if you are uncertain about your privileges.

Connect the Host Computer to the BioStack and MicroFlo Select

> (i) **For operation of one BioStack with one MicroFlo Select Dispenser:** The host computer must be equipped with at least two communication (COM) ports: one USB or serial port and a second USB or serial port.
>
> **For operation of two BioStacks with two MicroFlo Select Dispensers:** The host computer must be equipped with at least four COM ports.

❖ The **MicroFlo Integration Kit** includes two RS-232 serial cables (a 9-pin to 9-pin male/male cable and 9-pin to 25-pin male/female cable), a USB cable, and USB driver software CD. The USB cable may be used instead of a serial cable for connection of the BioStack to the host computer.

❖ The **shipping accessories** for the MicroFlo include a USB cable and USB driver software CD. You may use the USB cable instead of a serial cable for connection of the MicroFlo to the host computer.

Perform these steps to connect the host computer to both the BioStack and the MicroFlo Select (refer to *Figure 12* on page 41 for an illustration of the serial and USB ports):

1. If the BioStack is on, turn it off.

2. Place the computer in a location adjacent to the BioStack and the MicroFlo.

3. Connect the computer to the BioStack™ and MicroFlo, using the serial or USB cables.

    If using the serial cable: Plug one end into the RS232 serial port on the instrument and the other end into an available port on the computer.

    If using the USB cable: Plug one end into the USB port on the instrument and the other end into an available port on the computer.

    •   Refer to the instructions that shipped with the "USB Virtual COM Driver Software" CD to install the necessary drivers and identify the **Com Port number**.

Install the Liquid Handling Control (LHC) Software

❖ A CD containing the **Liquid Handling Control Software** and an installation guide are included in the LHC Software package (part number LHCMFS) for the MicroFlo. The package also includes a CD containing version 1.01.0 or greater of the **MicroFlo Select Interface Software** and instructions for installing the software.

❖ MicroFlo basecode software PN 7170200, version **1.06** or greater is required for use of the LHC Software, if installing the **fixed wrist model** (PN BIOSTACK2) or **rotational wrist model** (PN BIOSTACK2WR) with the MicroFlo.

There is a certain sequence of events that *must* be followed to ensure that the Liquid Handling Control Software is properly installed and configured on the host PC. You will also need to install the MicroFlo Select Interface Software on the PC.

Please follow the instructions provided in the ***Liquid Handling Control Software Installation Guide*** to install and configure the Liquid Handling Control Software and any other necessary software components.

Install the BioStack PC Control Software

❖ A CD containing version 2.00.10 or greater of the **BioStack PC Control Software** and an installation guide are included in the **MicroFlo Select Integration Kit** (PN 7310020). Version 2.00.10 (or greater) is required for compatibility with the Liquid Handling Control Software.

❖ **Two BioStacks with two MicroFlo Select Dispensers**: Both MicroFlo Select Integration Kits contain a package of the BioStack PC Control Software, however, you need to install only **one** package of the software on the PC. For simultaneous operation of two BioStacks with two dispensers, you will open the Liquid Handling Control Software twice. Each instance of the LHC will open an instance of the BioStack PC Control Software.

There is a certain sequence of events that *must* be followed to ensure that the BioStack PC Control Software is properly installed and configured on the host PC. Please follow the instructions provided in the ***BioStack PC Control Software Installation Guide*** to install the software.

Test Communication

Perform these steps to test communication between the LHC Software and the instruments:

1. Turn the BioStack on and allow its self-test to complete: manually raise the claw/gripper above the dispenser's plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Turn the MicroFlo on and allow its self-test to complete.

3. Launch the LHC Software.

4. **Test communication between the LHC Software and the MicroFlo:**

   - When the LHC main screen opens, click **Name** in the **Instrument** field. The 'MicroFlo Select Communications' dialog will appear.

     > ❖ If more than one instrument's interface software is found on your PC by the LHC Software, clicking **Name** will open the 'Installed Instruments' dialog. Select **MicroFlo Select** and click **OK**. The 'MicroFlo Select Communications' dialog will then appear.

   - Select the correct **COM Port** for the serial or USB cable connection to the MicroFlo, and then click **Test Communications**.

     If the test passes, click **OK**. The 'MicroFlo Select Settings' dialog will appear. If the test fails, check the serial/USB cable connections or try a different Com port.

   - At the 'MicroFlo Select Settings' dialog, select the correct **Instrument** model: **MFS** or **MFS1536**, and then click **OK**.

5. **Test communication between the LHC Software and the BioStack:**

   - Click the **BioStack** box.

   - Click **Port** to open the 'BioStack Communications' dialog. Select the correct **COM Port** for the serial or USB connection to the BioStack, and then click **Test Communications**.

     If the test passes, click **OK**. If the test fails, check the serial/USB cable connections or try a different Com port.

Run the Checksum Test for the MicroFlo Select

❖ The Checksum Test for the MicroFlo allows you to obtain checksum values for the User Interface (**UI**) Processor and Motor Controller (**MC**) Processor.

The **UI** processor communicates with the computer (during PC control of the MicroFlo), keyboard, display, and BioStack.

The **MC** processor is responsible for driving the motors on the instruments and working directly with the hardware.

Perform these steps to run the Checksum Test and record the software versions for the Liquid Handling Control™ Software and for the MicroFlo:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the MicroFlo software versions.

❖ **Two BioStacks with two MicroFlo Dispensers:** Make a copy of the Software Data Sheet to record software information for the second MicroFlo Select.

1. Make sure that the dispenser is powered on, the dispenser UI (User Interface) is at the main menu, and the serial or USB cable connected from the PC to the dispenser.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version. Record the serial number listed on the LHC Software package.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities.** The 'MicroFlo Select Utilities' screen will open.

6. Click **Test Communications**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

7. Record the MicroFlo Select Interface Software Version and Data Version, and the MicroFlo Select Basecode Software Version and Data Version, and the Checksums for the UI Processor and the MC Processor. Record the dispenser's serial number (listed on the MicroFlo).

8. Click **Exit** to close the MicroFlo Select Utilities screen.

9. Close the LHC Software.

Configure the MicroFlo Select for the BioStack

> ❖ By default, the MicroFlo is configured for operation as a stand-alone instrument. The dispenser must be configured for BioStack operation by using the BioStack's **Configuration** (**CONF**) utility.

Perform these steps to configure the MicroFlo Select to recognize the BioStack:

1. From the Dispenser Action Menu, select **SETUP > BIOSTACK > CONF > MANUAL.**

2. When the selection sequence is complete, the **RE-STACK?** screen will appear. Select **YES** or **NO**.

3. Press the **Main Menu** key, then turn the Dispenser off for the next section.

Run the Checksum Test for the BioStack

> ❖ Use the **Software Data Sheet(s)** from the section *Run the Checksum Test for the MicroFlo Select* to record software information for the BioStack(s).

Perform these steps to test communication between the BioStack PC Control Software and the BioStack, run the Checksum Test, and record the software versions for the BioStackPC Control Software and for the BioStack:

1. Make sure that the BioStack is powered on, and the serial or USB cable connected from the PC to the BioStack.

2. Launch the BioStack PC Control Software.

3. Click the **Configure Instruments** button.

4. Set the **COM Port** and click **Test Communications**. If the test fails, check the cable and/or try another COM port. Return to the main screen.

5. From the top menu bar in the BioStack PC Control Software, select **Help** > **About BioStack**. The 'About BioStack Software' dialog will open.

6. Record the BioStack PC Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX. Record the serial number listed on the BioStack PC Control Software package.

7. Click **Get On-board values now**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

8. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum. Record the BioStack's serial number listed on the BioStack.

9. Close the BioStack PC Control Software.

Align the Claw/Gripper with the MicroFlo Select Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the MicroFlo Select. The Liquid Handling Control Software has an **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack claw/gripper with the MicroFlo microplate carrier:

1. Start the LHC Software and select **Tools > BioStack Utilities**.

2. Click **Alignment Utility**.

3. From the 'BioStack Instrument Alignment Utility,' use the drop-down arrow in the **Selected Instrument** field to select the **MicroFlo Select Dispenser**.

4. To configure the alignment of the BioStack to the MicroFlo, begin with the **Home the BioStack** function.

5. After all axes have been homed on the BioStack, place a dry microplate on the MicroFlo's plate carrier. Then use the **Re-alignment Control** buttons to position the BioStack's claw/gripper so that the gripper "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface: click **Begin**.

   The gripper's fingers open. (See *Figure 52* on page 156.)

   > ❖ If the BioStack and MicroFlo dispenser are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

   • Begin with the **Down** radio button selected. To avoid collision of the gripper with the carrier on the MicroFlo, click the **20 Steps** button first, to see how far that goes, before clicking the **400 Steps** button. Use the **400 Steps**, **20 Steps**, and **1 Step** buttons to gradually lower the claw/gripper to the desired height.

   • If you have moved the gripper too far below the plate bottom, click the **Up** radio button and step up a bit.

   > ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button to home all axes on the BioStack, then repeat step 5 above.

6. When you're satisfied with the positioning of the gripper, click **Save Position**.

7. Remove the microplate from the dispenser's carrier.

Verify the Alignment

❖ The BioStack **rotational wrist model** instructions in the following section apply only when the wrist angle is set at the **90°** interface with the MicroFlo.

Perform the following test to verify alignment of the BioStack with the MicroFlo Select:

1. Place a dry microplate in the BioStack's input stack.

2. At the Liquid Handling Control Software's main screen, select **Tools > BioStack Utilities**.

3. Click **Alignment Utility**.

4. From the 'BioStack Instrument Alignment Utility,' click the **Verify** button.

5. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   - The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then eject the plate carrier.

   - The claw/gripper will pick up the plate, lower it toward the MicroFlo's plate carrier, and then *smoothly* place the plate on the carrier. **Rotational wrist model:** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the MicroFlo's plate carrier, and then *smoothly* place the plate on the carrier.

   ❖ If the plate drops onto the carrier, the claw interface position is set too high. Repeat the steps in the preceding section, ***Align the Claw/Gripper with the MicroFlo Select Plate Carrier.***

   - The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

   ❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will be displayed in the LHC Software. Repeat the steps in the preceding section*.*

   - If the gripper fingers did not catch on the plate, the LHC Software issues a "Verify plate placement" message and delays the BioStack's movement to give you time to observe the action. Click **OK** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model:** The claw/gripper will lower and pick up the plate from the MicroFlo plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- If the gripper fingers are not positioned correctly, repeat the steps in the preceding section and then re-run the Verify Test.

6. Click **OK**, then **Exit** to return to the main screen.

7. **Rotational wrist model:** Home the Stacker to return the claw/gripper to the default 90° interface position.

❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

Install the BioStack with the EL406

❖ If you will be using the BioStack **rotational wrist model** (PN BIOSTACK2WR) with the EL406, you may use the Stacker with the wrist angle set at the default 90° or you may change it to 0°. Refer to *Configure the Rotational Wrist Model for the Interfacing Instrument* on page 42.

❖ Except where noted, the installation steps apply to all BioStack models.

❖ If you will be operating **two BioStacks** with **two EL406 Washer Dispensers** via computer control (using the Liquid Handling Control Software), you will need a PC equipped with four communication ports, and two EL406 Integration Kits (PN 7310027). You will need to perform the installation steps for both BioStack/EL406 configurations.

Lay Out the Alignment Hardware

You will need the alignment hardware from the EL406 Integration Kit (**PN 7310027**), illustrated below.

EL406 Integration Kit 7310027

Four aligning posts (PN 7180530) for elevating the BioStack to the correct height and for seating in the aligning plate.

Two aligning caps (PN 7312074) for elevating the EL406 to the correct height and for seating in the aligning plate.

EL406 aligning plate (PN 7182076) for preventing the instrument from sliding around and being misaligned with the BioStack.
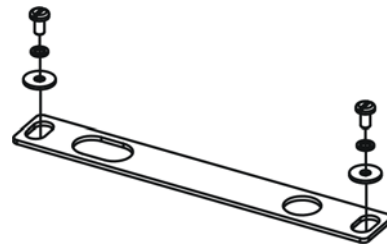
BioStack aligning plate (PN 7312052) for attachment to the EL406 aligning plate.

Includes two each of mounting hardware: pan head screws (PN 12028), lock washers (PN 16017), and flat washers (PN 16068).

Attach the Aligning Posts and Caps

> (i) **Important!** When attaching the four aligning posts ("feet")
> to the BioStack, do not over-tighten the posts!
> **Finger-tighten only!**
>
> To avoid scratches to the BioStack or to the EL406, place a
> towel down before laying the instrument on its side.

Perform these steps to attach the aligning posts to the BioStack and the aligning caps to the EL406 (refer to **_Figure 53_** on the following page):

1. Turn off the BioStack.

2. Carefully lay the BioStack on its side so the bottom is facing you.

3. Screw in all four aligning posts as shown. Return the BioStack to the upright position.

4. Turn off the EL406 and disconnect the power supply cord from the Washer Dispenser.

5. Carefully lay the EL406 on its side so the bottom is facing you.

6. Remove the two rubber feet on the Washer Dispenser.

7. Screw in the two aligning caps as shown. Return the EL406 to the upright position.
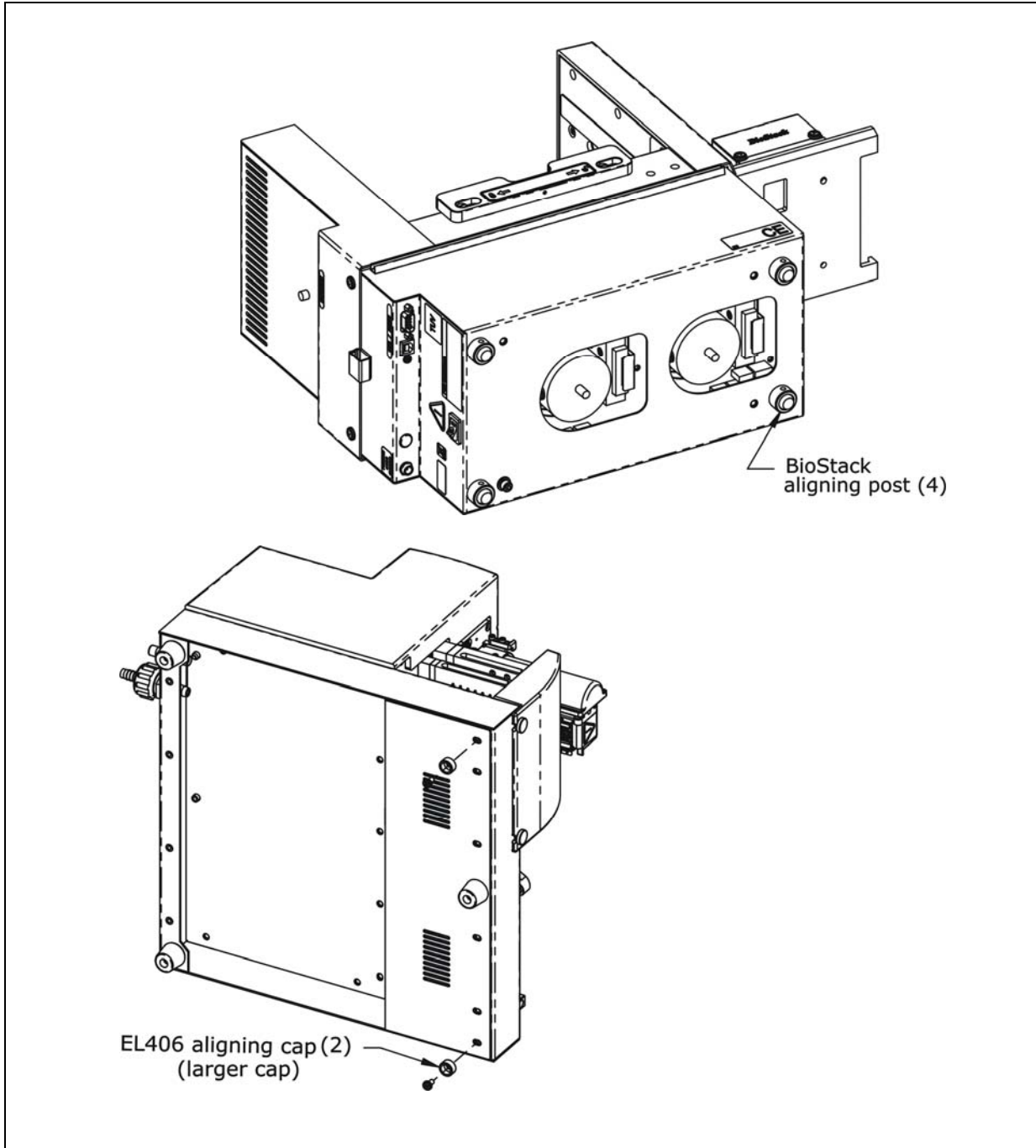
Figure 53: Attaching the Aligning Posts to the BioStack
and the Aligning Caps to the EL406

Seat the Instruments in the Aligning Plates

Perform these steps to seat the BioStack and the EL406 in the aligning plates:

1. Place the EL406 aligning plate on a level surface.

2. Attach the BioStack aligning plate as follows. See *Figure 54* on the following page for the EL406 with the fixed wrist model (**PN BIOSTACK2**). See *Figure 55* on page 174 for the EL406 with the rotational wrist model (**PN BIOSTACK2WR**), with the wrist angle set at the default 90° interface:

    > ❖ *Figure 54* also represents the position of the rotational wrist model in the aligning plates with the EL406, if the Stacker's default interface angle has been changed from 90° to 0°.

    -   Loosely attach the BioStack aligning plate to the EL406 aligning plate by screwing in the pan head screw, lock washer, and flat washer only halfway.
    -   Slide the EL406's two front aligning caps into the slots provided on the EL406 aligning plate.

3. Slide the BioStack's two front aligning posts into the slots provided on the BioStack's plate.

4. Move both instruments back and forth in their slots until you are satisfied that they are positioned correctly next to each other (approximately). Ensure that all posts and caps are properly seated (not resting on top of the plates), and that the instruments are level.
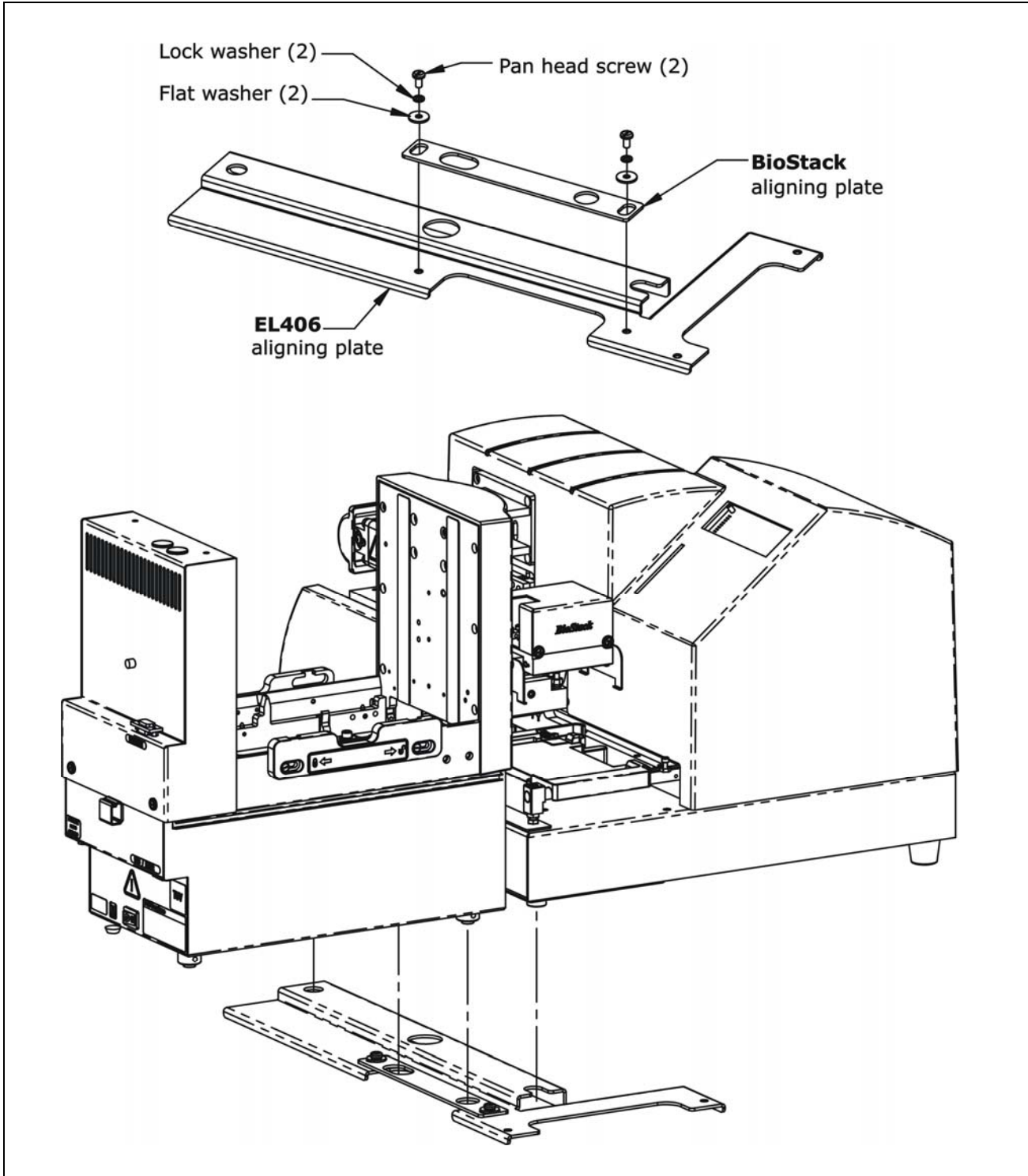
Figure 54: Seating the BioStack and EL406 in the Aligning Plates

❖ The fixed wrist model is shown.
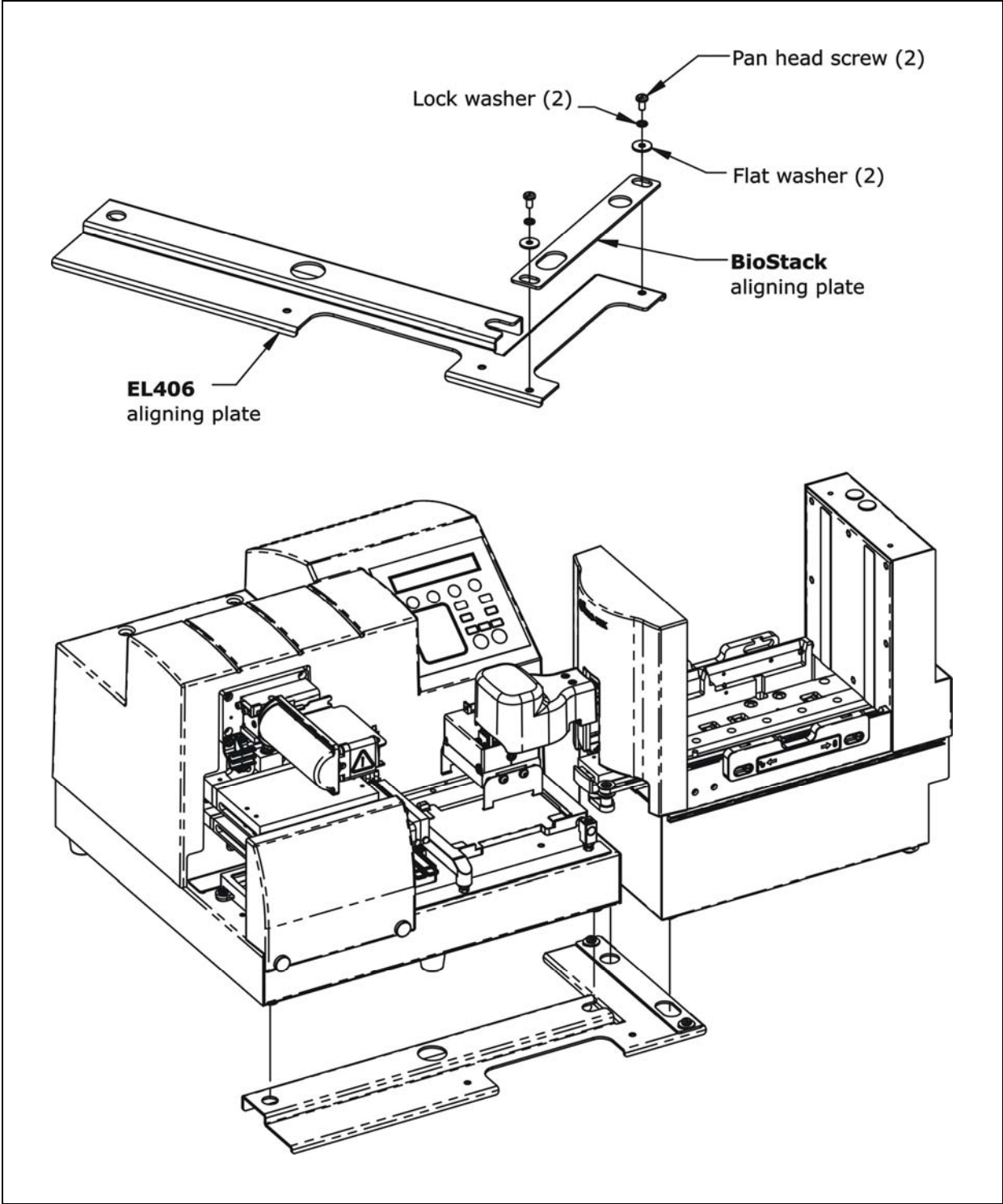
Figure 55: Seating the Rotational Wrist Model and EL406 in the Aligning Plates

❖ The wrist is shown at the 90° interface.

Turn on the BioStack and Run a Self-Test

⚠️	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	The BioStack **must** pass the self-test for installation with the EL406.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the EL406, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the EL406 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the EL406.

❖ The BioStack does not need to be connected to the EL406 or to a host computer for this test.

❖ **Rotational wrist model (PN BIOSTACK2WR):** If you changed the wrist angle from the default interface of 90° to 0° (optional for operation with the EL406), the first time the BioStack is turned on, the wrist will home and park at the 0° interface.

Locate the BioStack's power switch and turn on the instrument (see *Figure 12* on page 41 for the location of the switch). The BioStack will home all axes (claw/gripper, carrier, input and output stack lifts) and then perform a system self-test.

- **If the Self-Test passes**, the green light will turn on and blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

- **If the Self-Test fails**, the green light will flash repeatedly. If this happens, turn off the BioStack. Make sure there is no plate on the carrier and check for any obstructions. Ensure that all of the shipping hardware has been removed. If you cannot resolve the problem, contact BioTek's Technical Assistance Center for guidance.

Align the BioStack with the EL406

❖ Follow the instructions below if installing the BioStack **fixed wrist model** or the **rotational wrist model** (**0°** interface) with the EL406.

❖ Follow the instructions on page 178 if installing the BioStack **rotational wrist model** with the EL406, with the Stacker's wrist angle set at the **90°** interface.

Perform these steps to align the BioStack with the EL406:

1. Ensure that the BioStack is powered up and homed. If the BioStack is off, turn it on to home all axes: manually raise the claw/gripper above the EL406 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply cord to the EL406 and turn the instrument on. The carrier should be in the "out" (far right) position. Leave the EL406 powered up.

3. Turn the BioStack off.

4. Manually slide the BioStack carrier all the way out and position it below the claw assembly. Refer to *Figure 56* on the following page for the EL406 with the BioStack fixed wrist model.

5. Place a dry microplate on the BioStack carrier.

6. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate). Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

7. Push the BioStack carrier out of the way.

8. Lower the claw assembly until the microplate is just above the carrier of the EL406.

9. Manually adjust the BioStack on the tabletop so the microplate can be lowered into the carrier of the EL406. The microplate carrier should be positioned as if it was just homed by the EL406. If the EL406's carrier or the microplate has been moved, home the instruments (the BioStack first, then the EL406), remove the microplate from the BioStack claw, then repeat steps 3 through 9.

10. When you are satisfied with the microplate positioning relative to the carrier of the EL406 (look carefully at the top-down drawing in *Figure 56* to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

11. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
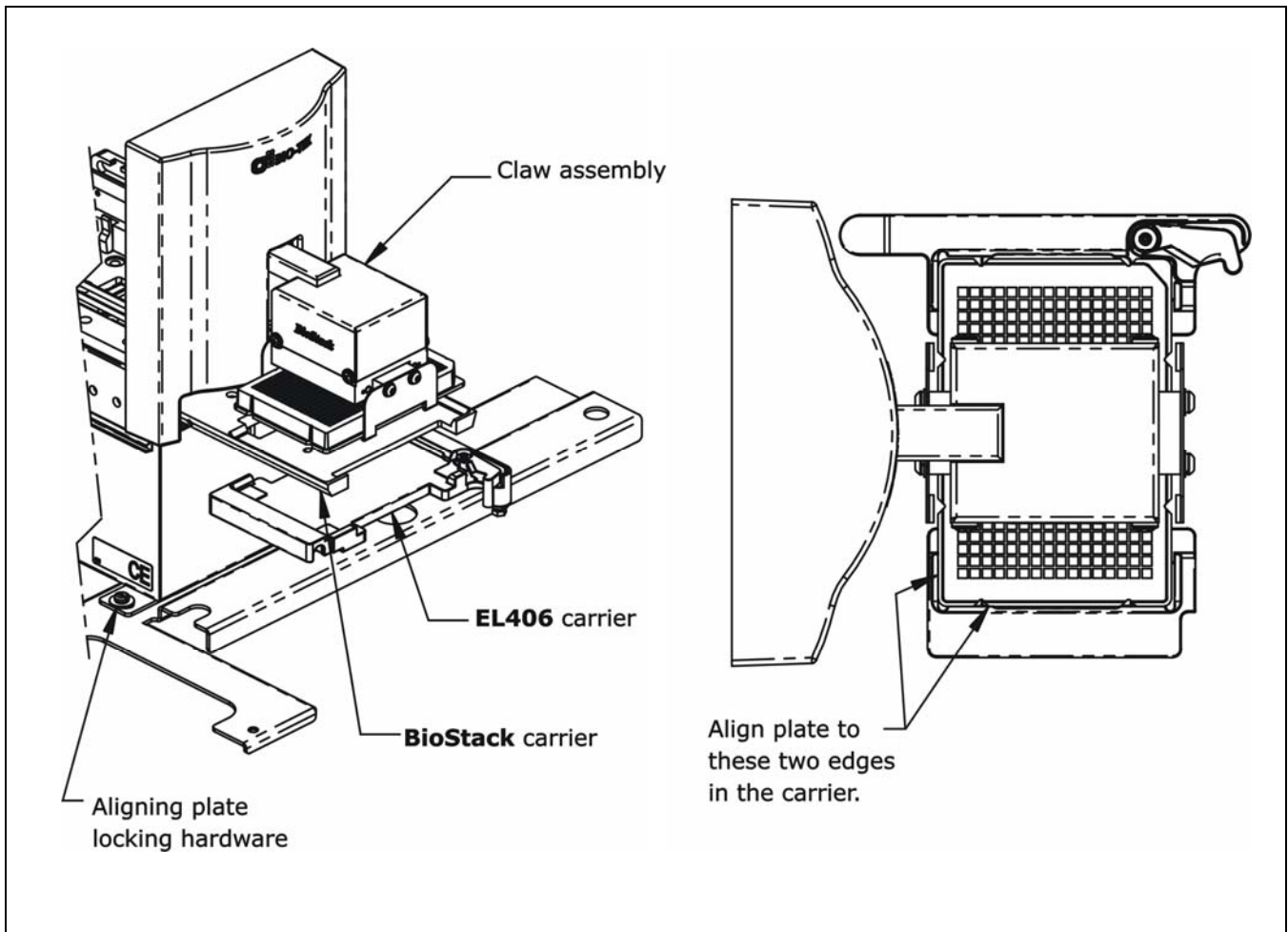
Figure 56: Aligning the BioStack with the EL406

❖   The fixed wrist model (PN BIOSTACK2) is shown.

❖ Follow the instructions below if installing the BioStack **rotational wrist model** at the **90°** interface with the EL406.

Perform the steps below to align the BioStack rotational wrist model with the EL406.

1. Ensure that the Stacker is powered up and homed. If the Stacker is off, turn it on to home all axes: manually raise the claw/gripper above the EL406 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Reconnect the power supply cord to the EL406 and turn the instrument on. The carrier should be in the "out" (far right) position. Leave the EL406 powered up.

3. Turn the Stacker off.

4. Manually rotate the claw assembly to where the claw will be aligned with a microplate on the Stacker's carrier (**0° angle**).

5. Manually slide the Stacker carrier all the way out and position it below the claw assembly. Refer to *Figure 57* on the next page.

6. Place a dry microplate on the BioStack carrier.

7. Manually lower the claw assembly down to the microplate and pick up the microplate (open the gripper to get around the plate and close it to pick up the plate).

8. Raise the claw assembly carefully to ensure that the microplate does not change positions in the claw.

9. Slide the Stacker's carrier out of the way.

10. Lower the claw to the carrier's opening.

11. Manually rotate the claw assembly to where the claw is visually perpendicular to the Stacker and aligned with the EL406's plate carrier (**90° angle**), making sure that the microplate does not change position in the claw.

12. Lower the claw assembly until the microplate is just above the carrier of the EL406. Make sure the plate is centered in the claw.

13. Manually adjust the Stacker on the tabletop so the microplate can be lowered into the carrier of the EL406. The microplate carrier should be positioned as if it was just homed by the EL406. If the EL406's carrier or the microplate has been moved, home the instruments (the BioStack first, then the EL406), remove the microplate from the Stacker's claw, then repeat steps 3 through 12.

14. When you are satisfied with the microplate positioning relative to the carrier of the EL406 (look carefully at the top-down drawing in *Figure 57* on the following page, to see how the plate should fit in the carrier), finger-tighten the aligning plate locking hardware in both places.

15. Repeat all of the steps a couple of times to ensure that the microplate does not change positions and that it rides smoothly in and out of the carriers.
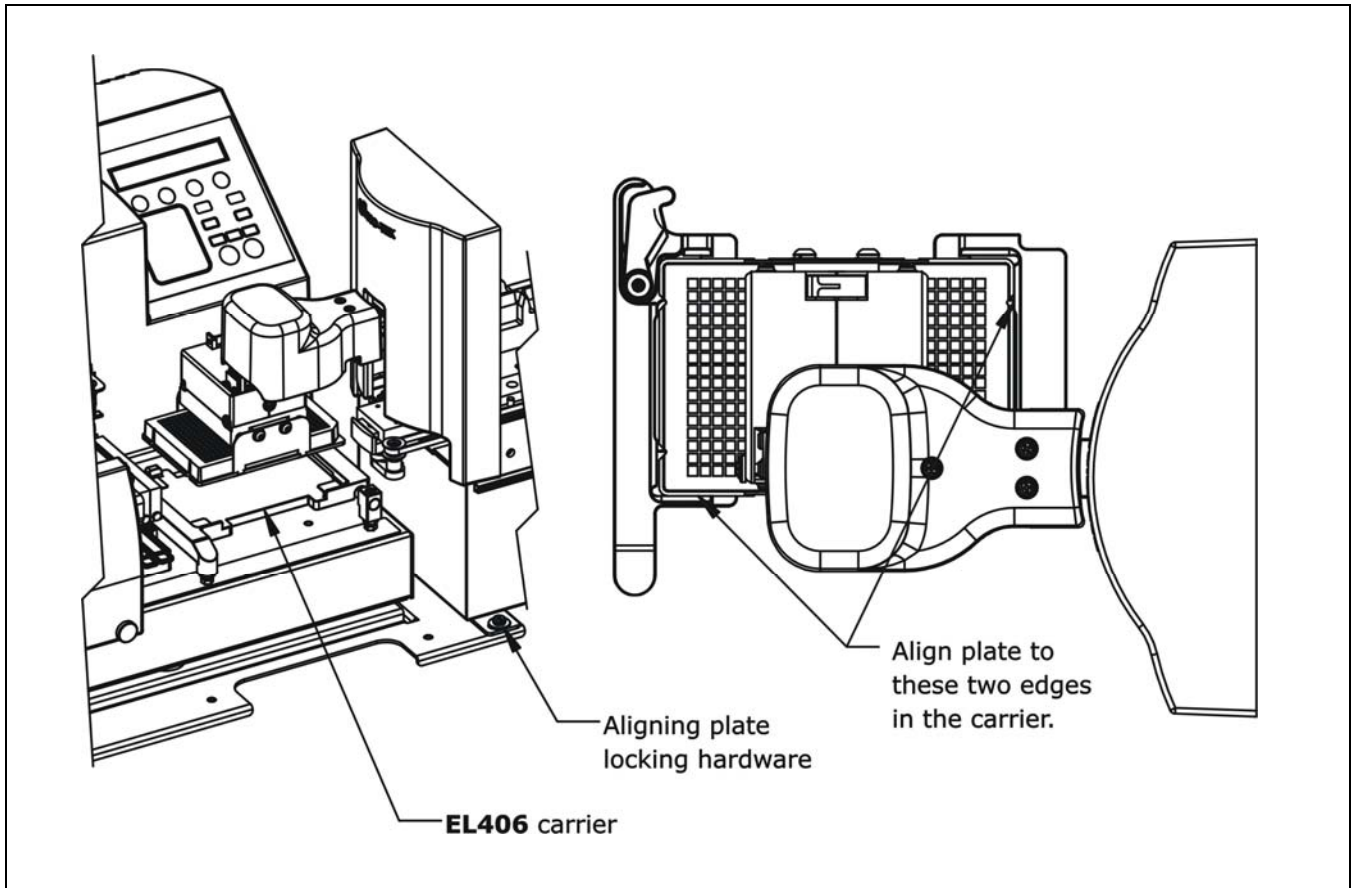
Figure 57: Aligning the Rotational Wrist Model with the EL406

❖ The wrist is shown at the 90° interface.

Install the Microplate Stacks

Locate the stack locks on the side of the BioStack. Make sure the locks are both in the "unlocked" position. Install the stacks as shown in *Figure 58* below and then close the stack locks.
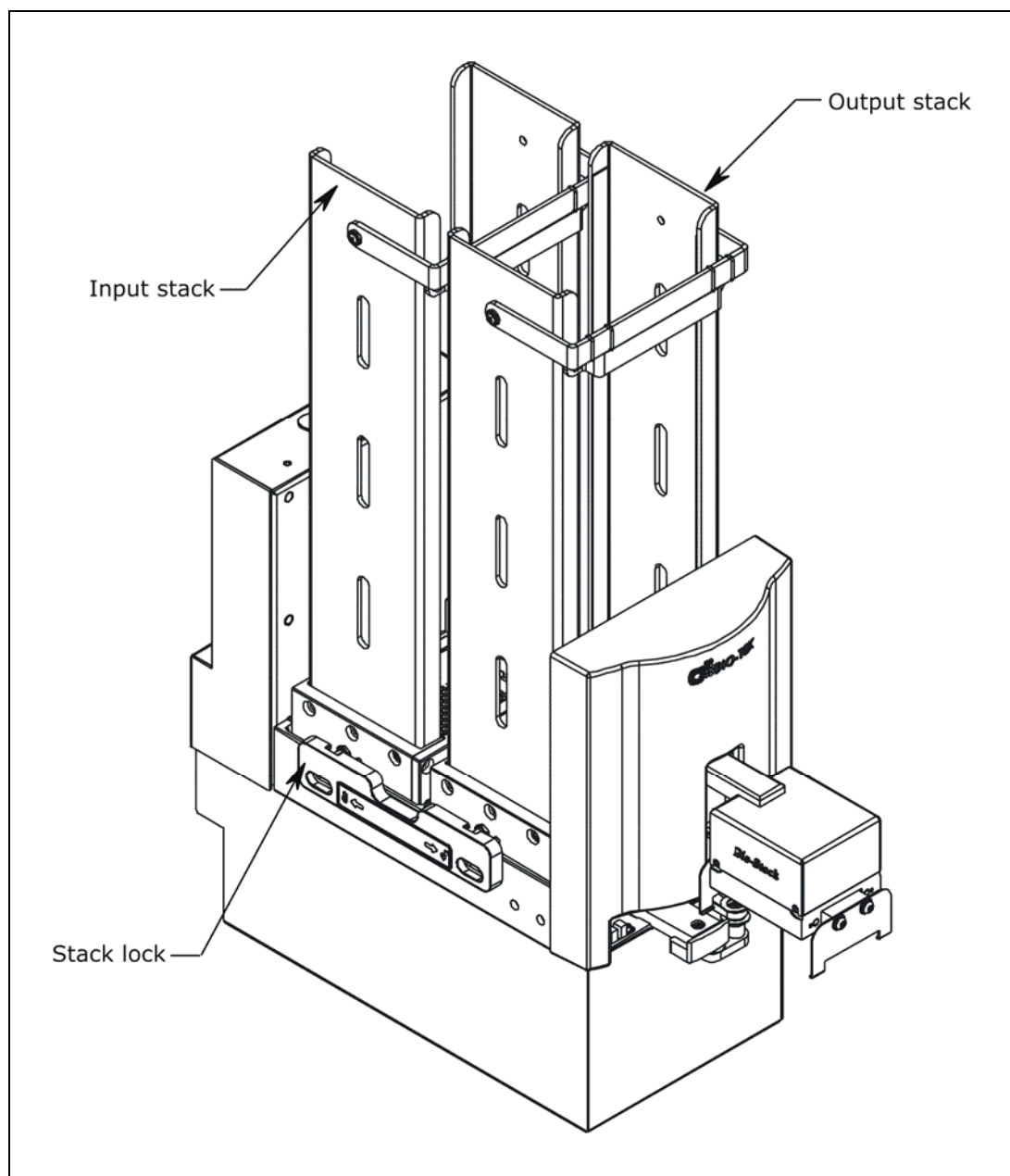
Figure 58: Installing the Microplate Stacks

❖ The 30-plate stacks are shown.

Instrument Control of the BioStack and EL406 Using the EL406 Keypad (Pages 181 through 188)

> (i) If using **instrument control** of the BioStack and EL406 via the EL406 keypad:
>
> • Perform the steps in the sections below and on pages 182 through 188.
>
> If using **PC control** of the BioStack and EL406 via the Liquid Handling Control (LHC) Software:
>
> • Perform the steps in the sections on pages 189 through 197.

Connect the BioStack to the EL406

> ❖ The **EL406 Integration Kit** includes two serial cables (a 9-pin to 9-pin male/male cable and 9-pin to 25-pin male/female cable), a USB cable, and USB driver software CD. The BioStack must be connected to the EL406 with the appropriate serial cable.
>
> ❖ The USB cable may be used instead of a serial cable for connection of the BioStack to a host computer (for instance, if you will be using the LHC Software to control the BioStack and EL406). See the PC Control section on pages 189 through 197.

Perform these steps to connect the serial cable between the BioStack and the EL406:

1. Make sure that the BioStack and EL406 are turned off.

2. Attach one end of the *appropriate* serial cable to the serial port on the rear of the BioStack (refer to *Figure 12* on page 41 for an illustration of the serial port on the BioStack).

3. Attach the other end of the cable to the serial port on the rear of the EL406.

4. Tighten the securing screws on both ends of the cable.

Run the Checksum Test for the EL406

Perform these steps to run the Checksum Test and record the basecode software versions for the EL406:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the software versions for the EL406.

1. Turn on the EL406 and allow its self-test to complete. After the initial powerup screen is displayed, the main menu screen will appear if the self-test passes:

```
E L 4 0 6                      C A S S ( # )

  R U N        W A S H       D I S P     - - >
```

2. From the instrument's keypad, press the **Setup Menu** button. The Setup Menu screen will appear:

```
S E T U P    M E N U    -    P A G E 1

W A S H       P E R I    S Y R         - - >
```

3. Select the arrow - - > once. The second Setup Menu screen will appear:

```
S E T U P    M E N U    -    P A G E 2

T E S T S    A D J S T    B I O S T K      - - >
```

4. Select **TESTS** > **CHKSUM**. The Version Checksum Info screen will appear with the three options shown below:

```
V E R S I O N    C H E C K S U M    I N F O :

  U I         M C       B I O S T K
```

- **UI** displays basecode software and checksum information for the User Interface processor. The UI processor communicates with the computer (during PC control of the EL406), keyboard, display, and BioStack.

- **MC** displays basecode software and checksum information for the Motor Controller processor. The MC processor is responsible for driving the motors on the instruments and working directly with the hardware.

- **BIOSTK** displays basecode and checksum information for the BioStack, if the BioStack is connected to the EL406 <u>and</u> the EL406's operating mode has been set to **BIOSTACK** (as instructed in the following section *Configure the EL406 for the BioStack*).

❖ If the dispenser's operating mode is set at **MANUAL**, an error will be displayed when the **BIOSTK** option is selected from the Version Checksum Info screen.

5. Select **UI**. Record the basecode software version (X.XX) and checksum (XXXX) information:

```
7 1 8 0 2 0 1     V E R S I O N   X . X X
C O D E   C H E C K S U M :     ( X X X X )
```

6. Press the **ENTER** or **Previous Screen** key to return to the Version Checksum Info screen.

7. Select **MC**. Record the basecode software version (X.XX) and checksum (XXXX) information:

```
7 1 8 0 2 0 1     V E R S I O N   X . X X
C O D E   C H E C K S U M :     ( X X X X )
```

❖ **Note:** You will run the Checksum Test for the BioStack in the section *Test Communication with the BioStack* on the following page.

8. Record the EL406 serial number (listed on the instrument).

Configure the EL406 for the BioStack

❖ By default, the EL406 is configured for operation as a stand-alone instrument. The dispenser must be configured for BioStack operation by using the BioStack's **Configuration** (**CONF**) utility.

Perform these steps to configure the EL406 to recognize the BioStack:

1. From the instrument's keypad, press **Setup Menu**.

2. At the Setup menu, select the arrow **- - >** once.

3. Select **BIOSTK** > **CONF** > **BIOSTACK.**

4. When the selection sequence is complete, the **RE-STACK?** screen will appear. Select **YES** or **NO**.

Test Communication with the BioStack

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

Perform these steps to test communication between the BioStack and the EL406 and (optionally) to record the software versions for the BioStack:

> ❖ Use the **Software Data Sheet** from the section *Run the Checksum Test for the EL406*, to record software versions for the BioStack.

1. **Important:** Turn off the EL406.

2. Turn on the BioStack and allow its self-test to complete: manually raise the claw/gripper above the EL406 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

3. Turn on the EL406 and allow its self-test to complete.

4. From the instrument's keypad, press **Setup Menu**.

5. At the Setup menu, select the arrow - - > once.

6. Select **TESTS > CHKSUM > BIOSTACK**.

   The following screen should appear if the instrument is able to communicate with the BioStack:

```
BIOSTACK:     X.XX,   X.XX
CODE  CHECKSUM:       (XXXX)
```

7. If communication is successful, record the BioStack basecode software version (the first X.XX), the interface definition version (the second X.XX), and the checksum. Record the serial number listed on the BioStack.

8. If the EL406 cannot communicate with the BioStack, an error code will be displayed, with "BIOSTACK ERROR" shown in the first line of the display. Consult *Chapter 7*, *Troubleshooting and Error Codes* for guidance.

Align the Claw/Gripper with the EL406 Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the EL406. The EL406 has an on-board **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack™ claw/gripper with the EL406 microplate carrier:

1. From the instrument's keypad, press **Setup Menu**.

2. At the Setup Menu, select the arrow **- - >** once.

3. Select **BIOSTK** > **ALIGN** > **C-POS**.

4. The **FIND CLAW INTERFACE POS** menu will appear on the display with the following four selections:

    -/+　　　　**+1**　　　　**+20**　　　　**+400**

5. Use the four softkeys on the EL406 keypad to position the BioStack's claw/gripper mechanism to the desired height relative to the plate carrier on the EL406. To help in this activity, place a dry microplate on the carrier of the EL406 (optional). Lower the mechanism so that the gripper's "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface (see *Figure 59* on the next page).

> ❖ If the BioStack and EL406 are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

-   To avoid collision of the gripper with the carrier on the EL406, press the **+20** key first, to see how far that goes, before pressing the **+400** key. Use the **1/20/400** softkeys to *gradually* lower the claw/gripper mechanism to the desired height.

-   If you go too far, press the **-/+** softkey to step up a bit.

> ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. To home the BioStack, press the **Previous Screen** key until you return to the Alignment Utility screen. Select **HOME > BIOSTACK**, then repeat steps 1 through 4 above.

6. When you are satisfied with the position, press the **Previous Screen** key until you return to the Alignment Utility screen and select **SAVE**.

7. At the **OK TO SAVE LOCATION?** screen, press **YES**.

8. Remove the plate from the carrier on the EL406.
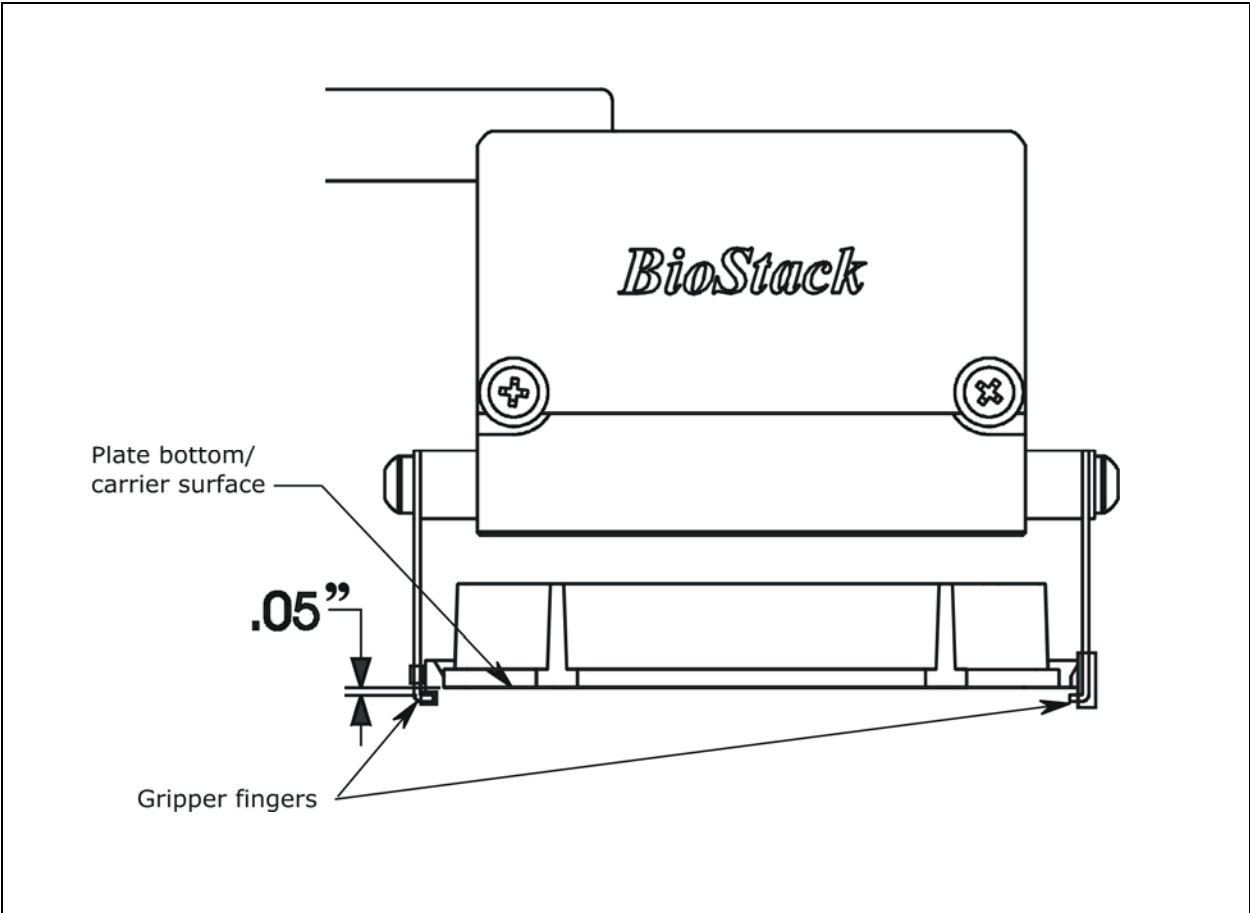
Figure 59: Position of the BioStack's Gripper Fingers Below the Plate Bottom
on the EL406 Plate Carrier

Verify the Alignment

❖ The BioStack **rotational wrist model** instructions below apply only when the wrist angle is set at the **90°** interface with the EL406.

Perform the following test to verify alignment of the BioStack with the EL406:

1. Ensure that both instruments are turned on.

2. Place a dry microplate in the BioStack's input stack.

3. From the instrument's keypad, press **Setup Menu**.

4. At the Setup Menu, select the arrow **- - >** once.

5. Select **BIOSTK > VERIFY**. Press the **ENTER** key.

6. Watch closely to confirm the following behavior (the claw/gripper will pause periodically; this is the expected behavior):

   • The BioStack will transfer the plate from the input stack to the BioStack plate carrier, and then extend the plate carrier.

   • The claw/gripper will pick up the plate, lower it toward the EL406's plate carrier, and then *smoothly* place the plate on the carrier.
   Rotational wrist model: The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the EL406's plate carrier, and then *smoothly* place the plate on the carrier.

❖ If the plate drops onto the carrier, the claw interface position is set too high. Repeat the instructions in *Align the Claw/Gripper with the EL406 Plate Carrier* on page 185.

   • The claw/gripper will come up a short distance. The gripper will then power-down, allowing its spring mechanism to tighten the gripper "fingers."

❖ If the gripper fingers catch on the top of the microplate, the claw interface position is set too low. An error code will display on the EL406. Repeat the instructions in *Align the Claw/Gripper with the EL406 Plate Carrier* on page 185.

   • If the gripper fingers did not catch on the plate, the EL406 will display **VERIFY PLATE PLACEMENT.** Press **ENTER** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model with EL406:** The claw/gripper will lower and pick up the plate from the EL406 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- The EL406 will display **BIOSTACK SETUP MENU**. From here you can select **VERIFY** to run the program again, or press **Main Menu**.

7. If the alignment verification completed successfully and you have determined that the gripper fingers are positioned correctly, return to the instrument's main menu.

   - If the gripper fingers are not positioned correctly, repeat the instructions in *Align the Claw/Gripper with the EL406 Plate Carrier*, and then re-run the Verify Test.

8. **Rotational wrist model:** Home the Stacker. The wrist will rotate the claw/gripper to the default 90° interface position.

> ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

PC Control of the BioStack and EL406 Using the LHC Software (Pages 189 through 197)

> (i) For computer control of the BioStack and EL406 using the **Liquid Handling Control (LHC) Software**, you will need appropriate versions of the LHC Software, EL406 Interface Software, Washer Dispenser basecode software, BioStack PC Control Software, and BioStack basecode software.
>
> Refer to **Appendix D**, **Required Software Versions**, or contact BioTek for more information on required software versions.

During PC control of the BioStack and EL406, both instruments are controlled by BioTek's Liquid Handling Control (LHC) Software running on a host computer. The LHC Software uses the EL406 Interface Software to control all functions of the EL406, and uses a component of the BioStack PC Control Software to control all functionality of the BioStack.

> ❖ The **LHC Help system** contains a detailed description of the LHC Software, and how it interacts with the EL406 Interface Software and BioStack PC Control Software to control the instruments.

Perform the instructions below and on the following pages, for computer control of the BioStack and EL406 using the LHC Software.

Prerequisites

- Verify that the host PC meets the minimum system requirements specified in the *Liquid Handling Control Software Installation Guide* and *BioStack PC Control Software Installation Guide*.

- Verify Administrator privileges. BioTek software requires the user who is installing the software application to have Administrator privileges for the Windows® 2000/XP/Vista systems. If a user with restricted access attempts to install the application, errors may occur. Contact your organization's system administrator if you are uncertain about your privileges.

Connect the Host Computer to the BioStack and EL406

> (i) **For operation of one BioStack with one EL406 Washer Dispenser:** The host computer must be equipped with at least two communication (COM) ports: one USB or serial port and a second USB or serial port.
>
> **For operation of two BioStacks with two EL406 Washer Dispensers:** The host computer must be equipped with at least four COM ports.

❖ The **EL406 Integration Kit** includes two RS-232 serial cables (a 9-pin to 9-pin male/female cable and 9-pin to 9-pin male/male cable), and a USB cable. If desired, the USB cable may be used instead of a serial cable for connection of the BioStack to the host computer.

❖ The **EL406 shipping accessories** include one RS-232 serial cable (a 9-pin to 9-pin male/female cable), a USB cable, and USB driver software CD. If desired, the USB cable may be used instead of a serial cable for connection of the EL406 to the host computer.

Perform these steps to connect the host computer to both the BioStack and the EL406 (refer to *Figure 12* on page 41 for an illustration of the serial and USB ports):

1. If the BioStack is on, turn it off.

2. Place the computer in a location adjacent to the BioStack and the EL406.

3. Connect the computer to the BioStack and EL406, using the serial or USB cables.

    If using the serial cable: Plug one end into the RS232 serial port on the instrument and the other end into an available port on the computer.

    If using the USB cable: Plug one end into the USB port on the instrument and the other end into an available port on the computer.

    - Refer to the instructions that shipped with the "USB Virtual COM Driver Software" CD to install the necessary drivers and identify the **Com Port number**.

Install the Liquid Handling Control (LHC) Software

> ❖ A CD containing the **Liquid Handling Control Software** and an
> installation guide are included in the LHC Software package
> (PN LHC) for the EL406. A CD containing version 1.00.3 or greater of the
> **EL406 Interface Software** and instructions for installing the software
> are included in the EL406 Interface Software package
> (PN 7180202).

There is a certain sequence of events that *must* be followed to ensure that the
Liquid Handling Control Software is properly installed and configured on the host
PC. You will also need to install the EL406 Interface Software on the PC.

Please follow the instructions provided in the ***Liquid Handling Control
Software Installation Guide*** to install and configure the Liquid Handling
Control Software. Refer to the EL406 Interface Software installation instructions for
installing the software.

Install the BioStack PC Control Software

> ❖ A CD containing version 2.01.6 or greater of the **BioStack PC Control
> Software** and an installation guide are included in the EL406 Integration Kit
> (PN 7310027).
>
> ❖ **Two BioStacks with two EL406 Washer Dispensers**: Both EL406
> Integration Kits contain a package of the BioStack PC Control Software,
> however, you need to install only **one** package of the software on the PC. For
> simultaneous operation of two BioStacks with two EL406 instruments, you will
> open the Liquid Handling Control Software twice. Each instance of the LHC will
> open an instance of the BioStack PC Control Software.

There is a certain sequence of events that *must* be followed to ensure that the
BioStack PC Control Software is properly installed and configured on the host PC.
Please follow the instructions provided in the ***BioStack PC Control Software
Installation Guide*** to install the software.

Test Communication

Perform these steps to test communication between the LHC Software and the instruments:

1. Turn the BioStack on and allow its self-test to complete: manually raise the claw/gripper above the EL406 plate carrier before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.

2. Turn the EL406 on and allow its self-test to complete.

3. Launch the LHC Software.

4. **Test communication between the LHC Software and the EL406:**

    *   When the LHC main screen opens, click **Name** in the **Instrument** field. The 'EL406 Communications' dialog will appear.

        > ❖ If more than one instrument's interface software is found on your PC by the LHC Software, clicking **Name** will open the 'Installed Instruments' dialog. Select **EL406** and click **OK**. The 'EL406 Communications' dialog will then appear.

    *   Select the correct **COM Port** for the serial or USB cable connection to the EL406, and then click **Test Communications**.

        If the test passes, click **OK**. The 'EL406 Settings' dialog will appear. If the test fails, check the serial/USB cable connections or try a different Com port.

    *   At the 'EL406 Settings' dialog, select the correct instrument configurations, and then click **OK**.

5. **Test communication between the LHC Software and the BioStack:**

    *   Click the **BioStack** box.

    *   Click **Port** to open the 'BioStack Communications' dialog. Select the correct **COM Port** for the serial or USB connection to the BioStack, and then click **Test Communications**.

        If the test passes, click **OK**. If the test fails, check the serial/USB cable connections or try a different Com port.

Run the Checksum Test for the EL406™

Perform these steps to run the Checksum Test and record the software versions for the Liquid Handling Control™ Software and for the EL406:

❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5*, *Instrument Qualification*, for recording the EL406 software versions.

❖ **Two BioStacks with two EL406 Washer Dispensers:** Make a copy of the Software Data Sheet to record software information for the second EL406.

1. Make sure that the EL406 is turned on and the serial or USB cable is connected from the PC to the EL406.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version. Record the serial number listed on the software package.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities**. The 'EL406 Utilities' screen will open.

6. Click **Retrieve All**. If software version information is displayed and no errors occurred, the Checksum Test completed successfully.

7. Record the EL406 Interface Software information and the serial number listed on the software package. Record the EL406 Basecode Software information, and the Washer Dispenser's serial number (listed on the EL406).

8. Click **Exit** to close the EL406 Utilities screen.

9. Close the LHC Software.

Run the Checksum Test for the BioStack

Perform these steps to test communication between the BioStack PC Control
Software and the BioStack, run the Checksum Test, and record the software
versions for the BioStack PC Control Software and for the BioStack:

> ❖ Use the **Software Data Sheet(s)** from the previous section to record
> software information for the BioStack(s).

1. Make sure that the BioStack is powered on, and the serial or USB cable
   connected from the PC to the BioStack.

2. Launch the BioStack PC Control Software.

3. Click the **Configure Instruments** button.

4. Set the **COM Port** and click **Test Communications**. If the test fails, check
   the cable and/or try another Com port. Return to the main screen.

5. From the top menu bar in the BioStack PC Control Software, select
   Help > **About BioStack**. The 'About BioStack Software' dialog will open.

6. Record the BioStack PC Software versions and the serial number listed on
   the BioStack PC Control Software package.

7. Click **Get On-board values now**. If software version information is
   displayed and no errors occurred, the Checksum Test completed
   successfully.

8. Record the BioStack onboard software versions. Record the BioStack's serial
   number listed on the BioStack.

9. Close the BioStack PC Control Software.

Align the Claw/Gripper with the EL406 Plate Carrier

The BioStack's claw/gripper mechanism must now be aligned vertically with the microplate carrier on the EL406. The Liquid Handling Control Software has an **Instrument Alignment Utility** for this task.

Perform these steps to align the BioStack claw/gripper with the EL406 microplate carrier:

1. Start the LHC Software and select **Tools > BioStack Utilities**.

2. At the 'BioStack Utilities' dialog, click **Alignment Utility**.

3. From the 'BioStack Instrument Alignment Utility,' use the drop-down arrow in the **Selected Instrument** field to select the **EL406**.

4. To configure the alignment of the BioStack to the EL406, begin with the **Home the BioStack** function.

5. After all axes have been homed on the BioStack, place a dry microplate on the EL406's plate carrier. Then use the **Re-alignment Control** buttons to position the BioStack's claw/gripper so that the gripper "fingers" rest approximately 50-60 thousandths of an inch (1.3-1.5 mm) below the plate bottom or carrier surface: click **Begin**.

    The gripper's fingers open. (See *Figure 59* on page 186.)

    > ❖ If the BioStack and EL406 Washer Dispenser are located on an uneven surface, the gripper's fingers should rest below the lowest point of the plate bottom, to ensure proper plate delivery.

    - Begin with the **Down** radio button selected. To avoid collision of the gripper with the carrier on the EL406, click the **20 Steps** button first, to see how far that goes, before clicking the **400 Steps** button. Use the **400 Steps**, **20 Steps**, and **1 Step** buttons to gradually lower the claw/gripper to the desired height.

    - If you have moved the gripper too far below the plate bottom, click the **Up** radio button and step up a bit.

    > ❖ If the alignment is interrupted, and you receive an error code such as **2500**, the BioStack will have to be homed to resolve the error. Click the **Home the BioStack** button to home all axes on the BioStack, then repeat step 5 above.

6. When you're satisfied with the positioning of the gripper, click **Save Position**.

7. Remove the microplate from the EL406's carrier.

Verify the Alignment

> ❖ The BioStack **rotational wrist model** instructions below apply only
> when the wrist angle is set at the **90°** interface with the EL406.

Perform the following test to verify alignment of the BioStack with the EL406:

1. Place a dry microplate in the BioStack's input stack.

2. At the Liquid Handling Control Software's main screen, select **Tools >
    BioStack Utilities**.

3. Click **Alignment Utility**.

4. From the 'BioStack Instrument Alignment Utility,' click the **Verify** button.

5. Watch closely to confirm the following behavior (the claw/gripper will
    pause periodically; this is the expected behavior):

    •   The BioStack will transfer the plate from the input stack to the
        BioStack plate carrier, and then eject the plate carrier.

    •   The claw/gripper will pick up the plate, lower it toward the EL406's
        plate carrier, and then *smoothly* place the plate on the carrier.
        Rotational wrist model: The wrist will rotate the claw/gripper from
        the 90° interface to the 0° interface, and the gripper will pick up the
        plate from the BioStack plate carrier. The wrist will then rotate the
        claw/gripper from the 0° interface to the 90° interface. The gripper will
        lower the plate toward the EL406's plate carrier, and then *smoothly* place
        the plate on the carrier.

    > ❖ If the plate drops onto the carrier, the claw interface position is set
    > too high. Repeat the steps in the preceding section, ***Align the
    > Claw/Gripper with the EL406 Plate Carrier.***

    •   The claw/gripper will come up a short distance. The gripper will then
        power-down, allowing its spring mechanism to tighten the gripper
        "fingers."

    > ❖ If the gripper fingers catch on the top of the microplate, the claw
    > interface position is set too low. An error code will be displayed in the
    > LHC Software. Repeat the steps in the preceding section*.*

    •   If the gripper fingers did not catch on the plate, the LHC Software issues
        a "Verify plate placement" message and delays the BioStack's
        movement to give you time to observe the action. Click **OK** to continue.

- The claw/gripper will lower, pick up the plate, and place the plate on the BioStack's plate carrier. **Rotational wrist model:** The claw/gripper will lower and pick up the plate from the EL406 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier.

- The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

- If the gripper fingers are not positioned correctly, repeat the steps in the preceding section and then re-run the Verify Test.

6. Click **OK**, then **Exit** to return to the main screen.

7. **Rotational wrist model:** Home the Stacker to return the claw/gripper to the default 90° interface position.

> ❖ The Verify Test must pass before the BioStack can be used to transfer microplates.

Repackaging and Shipping

If you need to ship the BioStack to BioTek for service or repair, be sure to use the original packaging materials. Other forms of commercially available packaging are not recommended and can void the warranty.

If the original packaging materials have been damaged or lost, contact BioTek to order **PN 7313002** for the packaging materials, **PN 7313001** for the 30-plate microplate stacks shipping materials, **PN 7313006** for the 50-plate microplate stacks shipping material, and **PN 7310014** for the shipping hardware. See *Product Support & Service* in *Chapter 1* for contact information.

The following tables list the materials that are included in the part numbers referenced above.

Packaging materials included in PN 7313002	PN's
Outer shipping container	7112063
Inner shipping container	7112064
Foam shipping blocks (8)	7112197
Inner sleeve	7312082
Plywood shipping panel	7112067
30-plate stacks shipping materials included in PN 7313001	**PN's**
Shipping container	6022002
Shipping end caps (2)	7312081
50-plate stacks shipping materials included in PN 7313006	**PN's**
Shipping container	7312119
Shipping end caps	7312120
Shipping hardware included in PN 7310014	**PN's**
Shipping panel mounting screws, flat washers (4)	12185, 17057
Shipping panel handles (2)	44285
Rubber feet for shipping panel (4)	49064
Screws, lock washers, and flat washers for handles (4)	12121, 16016, 17054
Shipping block	7312080
Shipping block mounting screws (4)	12189
Carrier shipping screw	19513

> ❖ Part numbers are subject to change over time. Please contact BioTek Customer Care if you have any questions.
> ❖ The instrument's packaging design is subject to change over time. If the instructions in this section do not appear to apply to the packaging materials you are using, please contact BioTek's Technical Assistance Center for guidance.

Before Repackaging the Instrument

> ⚠ **Warning!** If the BioStack has been exposed to potentially hazardous material, decontaminate it to minimize the risk to all who come in contact with the instrument during shipping, handling, and servicing. 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 instrument for shipment.

> ⓘ **Important!** The shipping panel and block, mounting screws, and carrier shipping screw must be re-attached to the BioStack before the instrument can be shipped.

1. Turn the BioStack off and disconnect the power supply cord.

2. Remove all alignment hardware and the microplate stacks.

    ❖ The microplate stacks do not have to be returned with the BioStack unless a problem has occurred with plates in the stacks.

3. **Decontaminate** the BioStack as necessary. Refer to the *Decontamination* section in *Chapter 6*, *Preventive Maintenance*, for complete instructions.

4. (Optional) If the BioStack barcode scanner is installed, remove the scanner according to the instructions in *Appendix B*, *BioStack Barcode Scanner.*

    ❖ The optional barcode scanner does not have to be returned with the BioStack unless there is a problem with the scanner.

5. Replace all shipping hardware and repackage the instrument as described on the following pages. Failure to comply with these packaging instructions can **void the instrument's warranty**.

6. Obtain a **Return Materials Authorization (RMA)** number from BioTek's Technical Assistance Center through BioTek's website, fax, or e-mail address listed in *Chapter 1*.

    When obtaining the RMA, explain whether the BioStack requires calibration, cleaning, periodic maintenance, warranty work, and/or repair. Make a note of any error messages that were displayed on the controlling PC or on the controlling instrument, and their frequency.

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

Attach the Shipping Hardware

1. Place the BioStack upright on a flat surface (see *Figure 60*), connect the power supply, and power up the instrument to home all axes. The claw assembly must be at its full height in order to mount the shipping block.

   ❖ If power cannot be applied, **manually raise the claw** to full height and hold it in that position while installing the top shipping block mounting screw in step 2 below.

2. **Power down the instrument and disconnect the power supply.** Loosely install the shipping block so the top shipping block mounting screw is protruding out below the claw assembly screw block.

3. Tighten the two bottom shipping block mounting screws, then loosen them by one-quarter turn.

4. Tighten the two top mounting screws and then the two bottom screws.

5. Slide the carrier back to the position shown; install the carrier shipping screw.
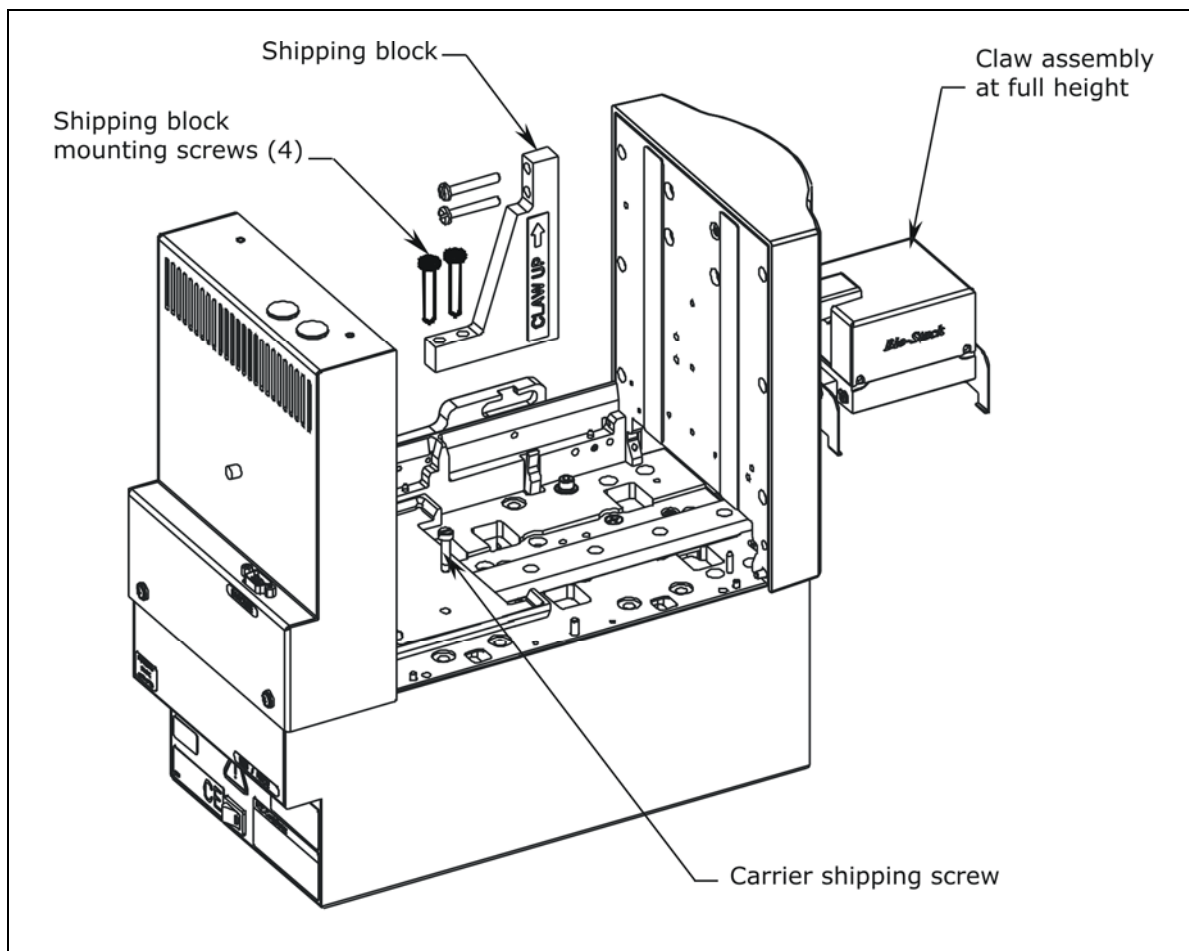
Figure 60: Attaching the Shipping Block and Mounting Screws

6.   **Rotational wrist model** (refer to *Figure 61a* and *Figure 61b*): Install the claw assembly shipping screw. Install the rotational wrist shipping bracket:

   ➢   Remove the three screws from the wrist cover, then remove and set aside the cover.

   ➢   Install the wrist shipping bracket: line up the dowel pin on the back of the bracket with the dowel pin hole on the wrist. Install the two bracket screws.

   ➢   Reinstall the wrist cover.
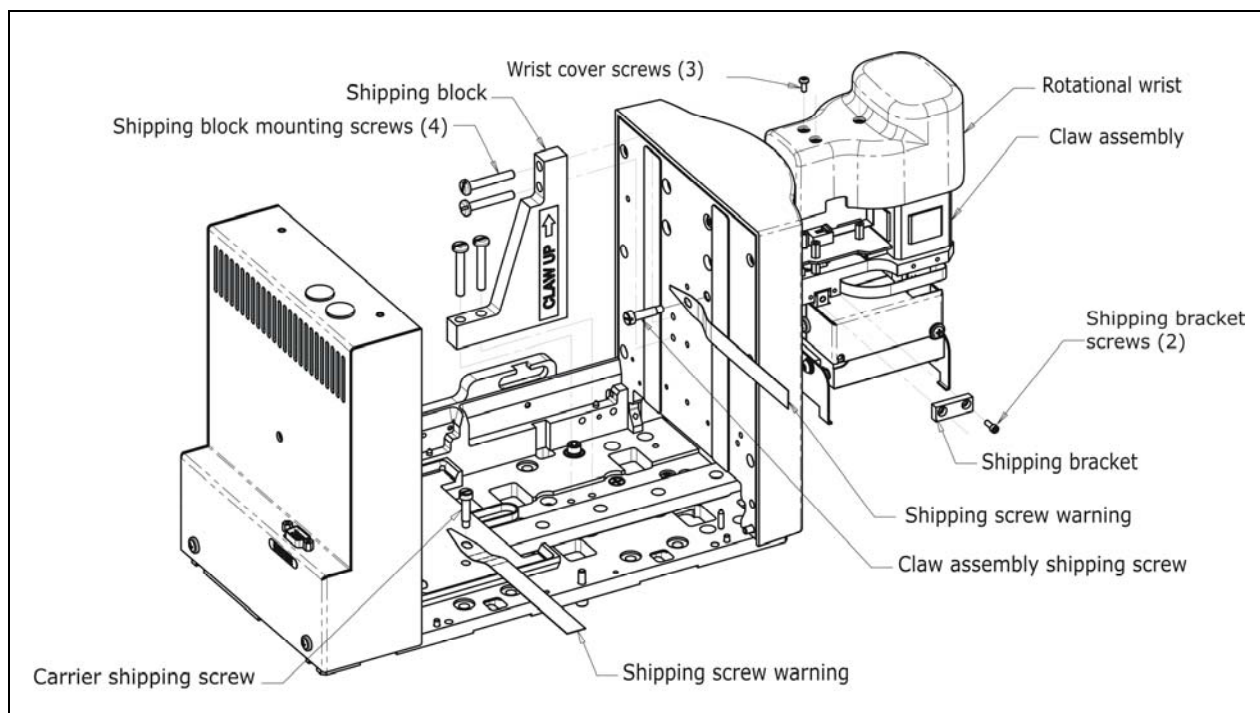
Figure 61a: Installing the Claw Shipping Screw and Rotational Wrist Shipping Bracket
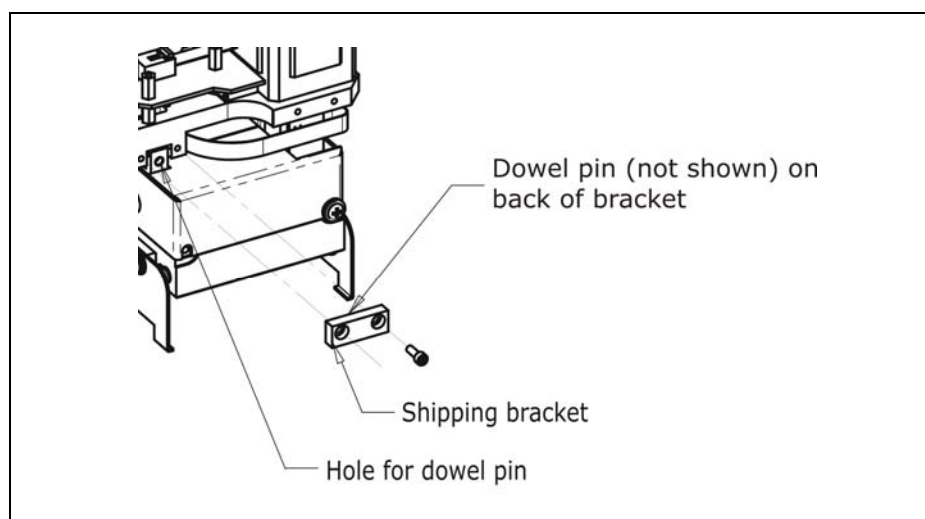
Figure 61b: Close-Up of Hole for Shipping Bracket Dowel Pin

7. Carefully lay the BioStack on its side, with the bottom of the instrument facing you and flush against the edge of the work surface (see *Figure 62*).

8. Remove the four aligning posts/legs. Keep the posts with the accessories package.

9. Install the shipping panel with the accompanying mounting screws and washers. (Note the orientation of the panel to the unit.)

10. Lift the instrument until it is resting upright on the work surface.
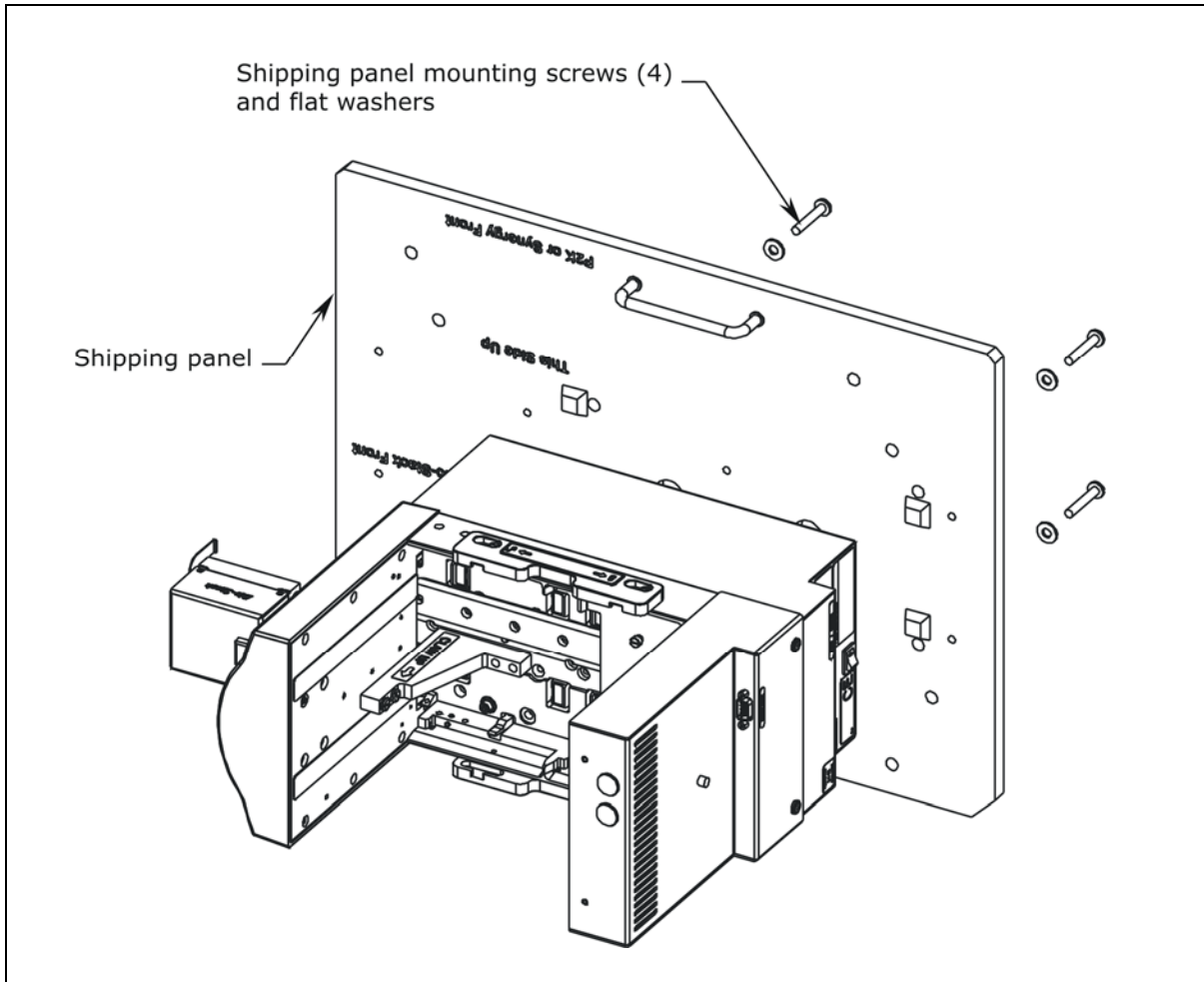
Figure 62: Attaching the Shipping Panel

Repackage the BioStack

1. Grasp the shipping handles and carefully lower the BioStack into the inner shipping box (see *Figure 63* below).

2. Lower the inner sleeve into the inner shipping box as shown.

3. **Optional barcode scanner:** If you are returning the BioStack's barcode scanner, repackage the scanner and installation kit components using the original shipping materials (plastic bag and small shipping box). Place the box in the inner sleeve.
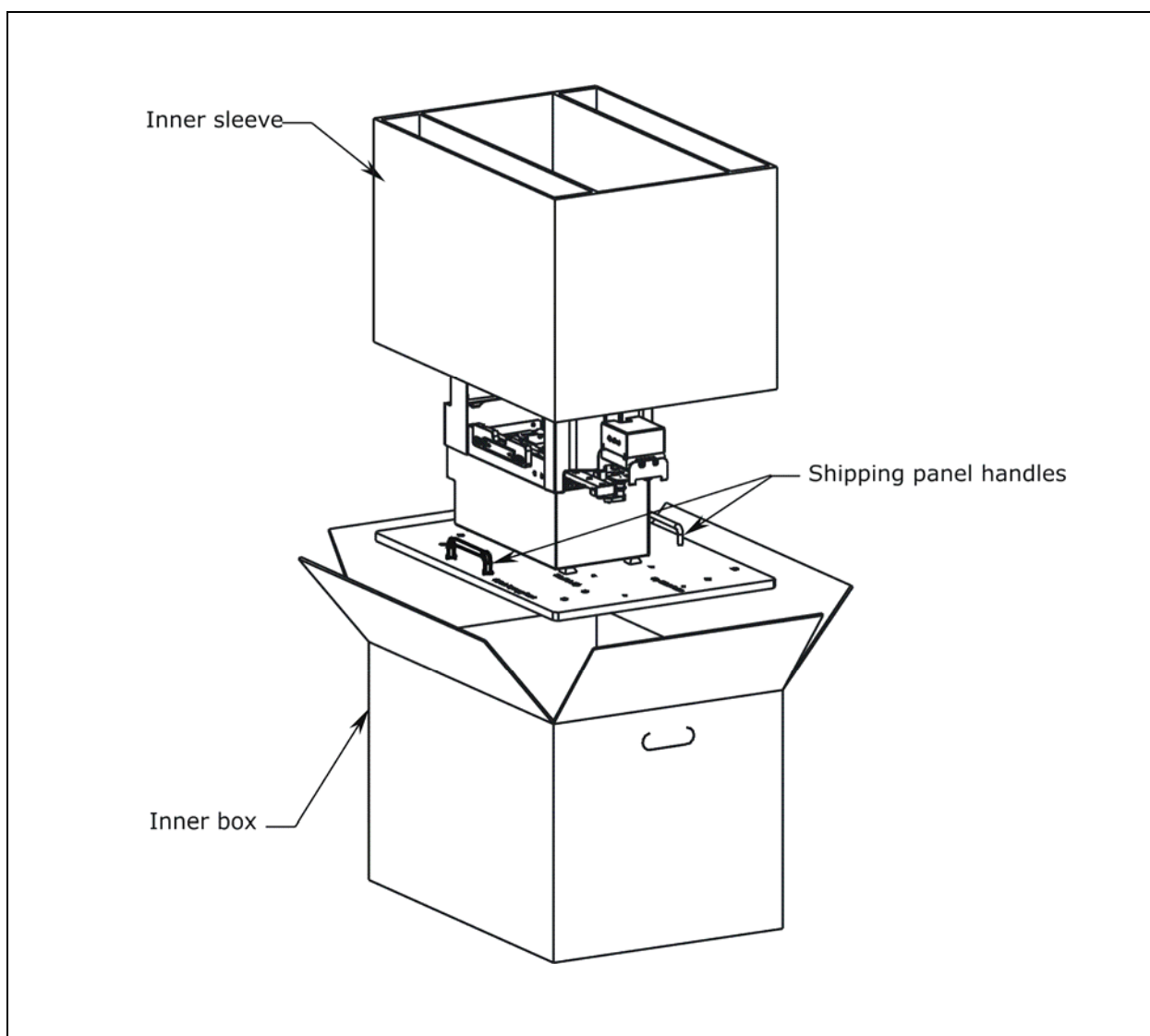
Figure 63: Repackaging the BioStack

4. Ensure that all the foam shipping blocks are attached to the inner shipping container; reattach if necessary.

5. Close the top of the inner shipping container and tape it shut.

6. Lower the inner shipping container into the outer shipping container (see **Figure 64** below).

7. Close the top of the outer shipping container and tape it shut.

8. Write "RMA" and the RMA number in large, clear letters on the outside of the shipping container.

9. Insure the BioStack for full value and ship the instrument to the BioTek address provided in the **Product Support & Service** section of **Chapter 1**.
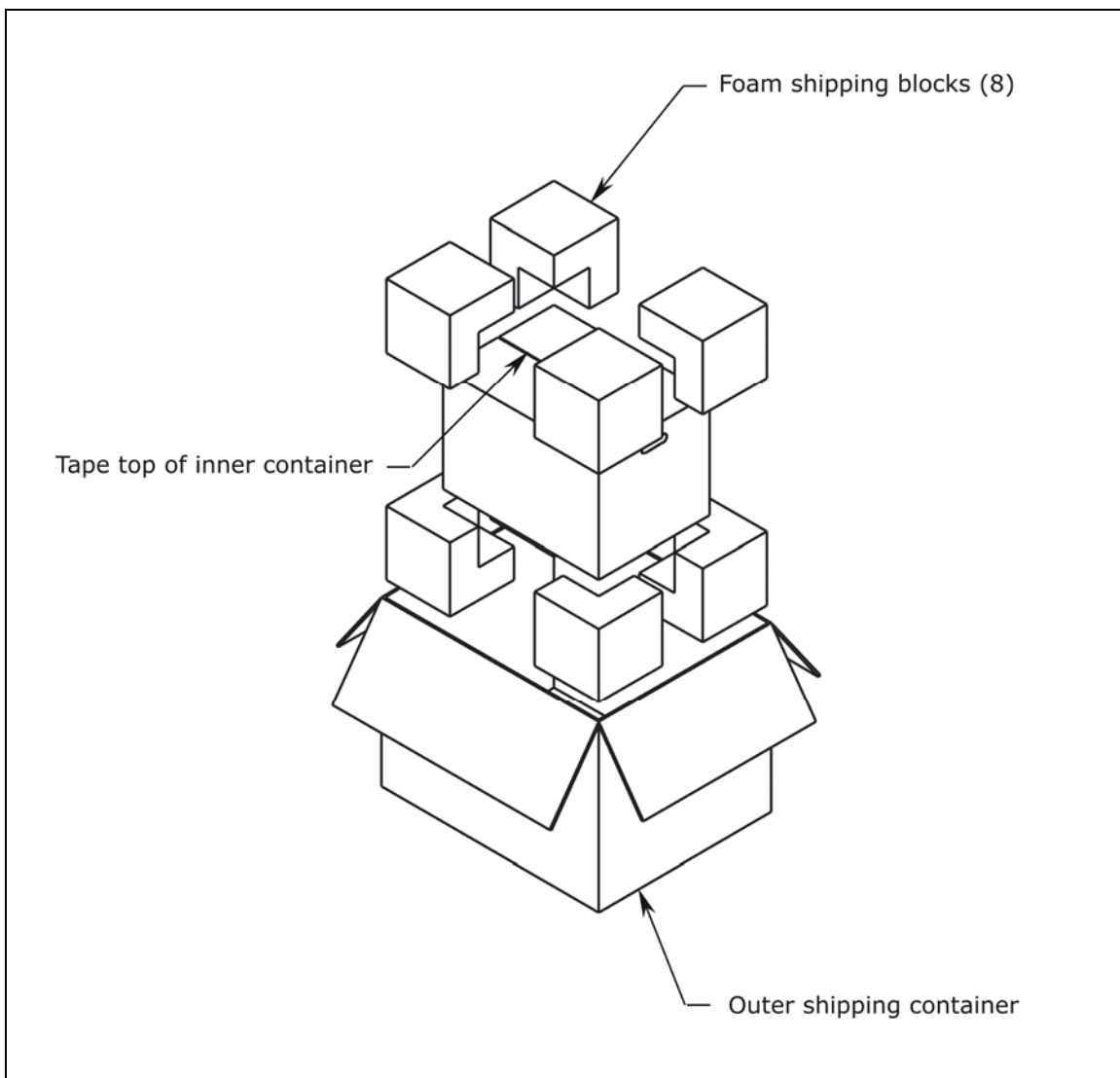
Figure 64: Preparing the Outer Shipping Container

Repackage the Microplate Stacks

1.   Place the microplate stacks into their shipping end caps as shown in *Figure 65* below for the 30-plate stacks and in *Figure 66* on the following page for the 50-plate stacks.

2.   Lower the stacks into their shipping container.

3.   Close the top of the shipping container and tape it shut.

4.   On the outside of the container, write "RMA" and the same RMA number that you wrote on the shipping container for the BioStack.

5.   Ship the stacks with the BioStack to BioTek.
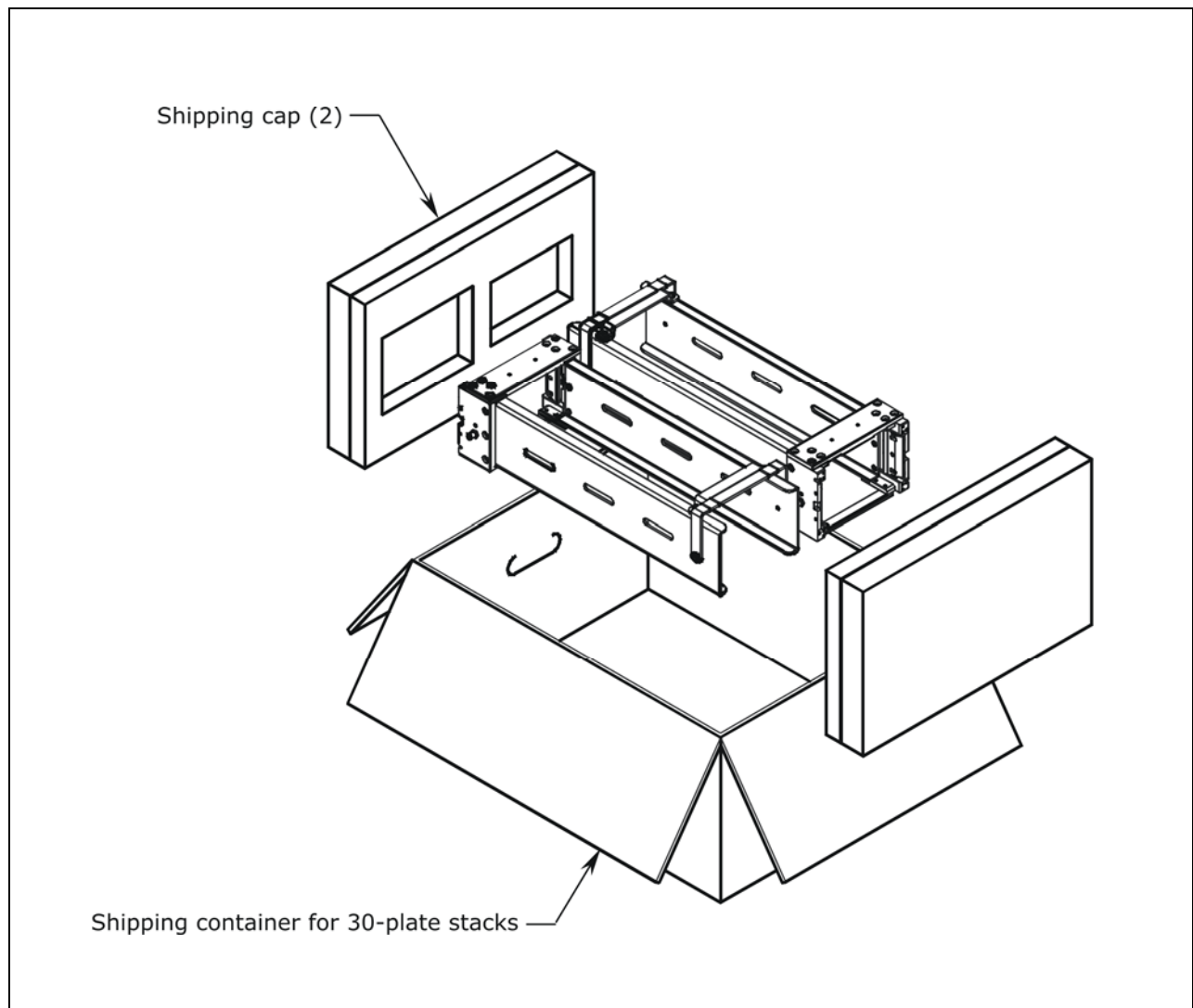
Figure 65: Repackaging the 30-Plate Microplate Stacks
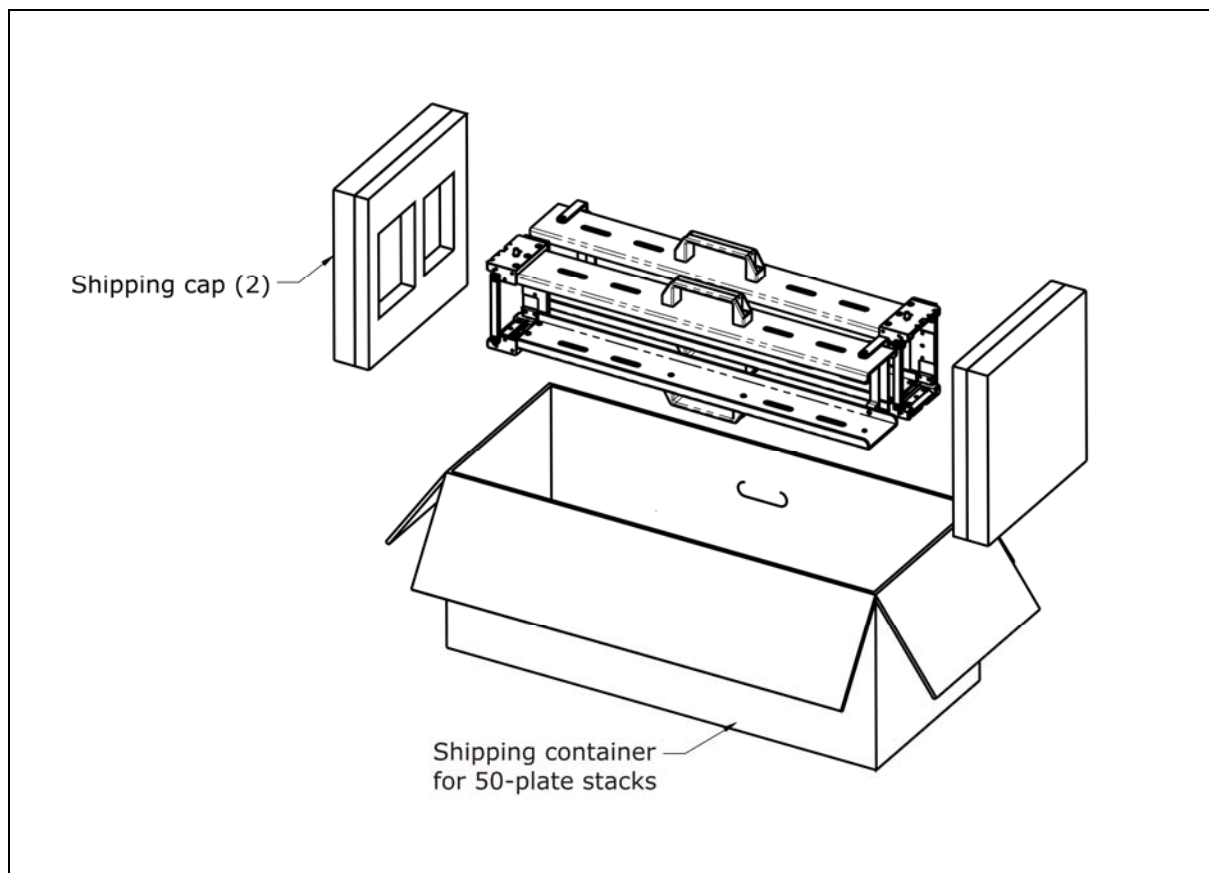
Figure 66: Repackaging the 50-Plate Microplate Stacks

Chapter 4

Operation

This chapter includes instructions for operating the BioStack with compatible BioStack Instruments.

Before You Start

(i) **Important!** The BioStack must be installed with the interfacing instrument as instructed in *Chapter 3*, *Installation*, before you can operate the instruments! Review the Installation Qualification (IQ) checklist (provided in *Chapter 5*, *Instrument Qualification*), to ensure that every installation task/test has been successfully performed.

If the instruments have been moved since installation, perform the Verify Test to verify alignment. Check all serial/USB cable and power cord/power supply connections to ensure that they have not become loose.

Ensure that **all components** of the interfacing instruments have been installed according to the installation sections of their operator's manuals.

❖ Except where noted, the operational steps in this chapter apply to all BioStack models (fixed wrist model and rotational wrist model).

Review Principles of Operation

Please take a few minutes to review the following principles of operation of the BioStack:

1. The **input stack lifter** picks up a plate from the **input stack** and places it on the **carrier**.

2. The carrier transfers the plate to the **claw/gripper**, which picks up the plate and places it on the interfacing instrument for processing.

   ❖ **BioStack rotational wrist model** with **ELx405**, **MicroFlo Select**, **or EL406**: The wrist rotates the claw/gripper from the 90° interface to the 0° interface to pick up the plate from the BioStack carrier. The wrist then rotates the claw/gripper from the 0° interface to the 90° interface to place the plate on the ELx405, MicroFlo, or EL406 microplate carrier for processing.

   ❖ If the **optional barcode scanner** is installed on the BioStack, the scanner automatically scans the barcode label on a microplate at the BioStack's extended carrier position during plate transfers between the BioStack and reader or Precision instrument.

3. Once the plate has been processed, the claw/gripper picks up the plate and places it back on the carrier, which moves it to the **output stack**.

> ❖ **BioStack rotational wrist model** with **ELx405**, **MicroFlo Select**, **or EL406**: Once the plate has been processed, the claw/gripper picks up the plate, and the wrist rotates the claw/gripper from the 90° interface to the 0° interface to place the plate back on the BioStack carrier. The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

Because there is **no on-board keypad** or user interface to allow an operator to control the BioStack directly, the BioStack is either **computer-controlled** (via the BioStack PC Control Software, Precision Power Software, or Liquid Handling Control Software) or **instrument-controlled** by the MicroFill, NanoQuot, ELx405, MicroFlo Select, or EL406.

> ❖ **ELx405, MicroFlo Select, or EL406:** The BioStack with the ELx405, MicroFlo Select, or EL406 may be either computer controlled using the Liquid Handling Control (LHC) Software, or instrument controlled using the keypads on these instruments.

Instructions for operating the BioStack with the interfacing instruments are located in this chapter as follows:

Review Microplate Requirements

> (i) **Important!** The BioStack is not compatible with removable strip type microplates.

Please review the following microplate requirements to ensure that the plates you will be using meet specifications (refer also to the **Specifications** section in **Chapter 1**, **Installation**).

- The microplates must be robot-compatible, stackable plates of single-piece construction.

- Use Society for Biomolecular Screening (SBS) standard-height 96- and 384-well microplates or other laboratory microplates that conform to the following standardized dimensions:

  ➢ **Width:** 3.365″ (85.48 mm) ± 0.015″ (0.381 mm) at the corners

  ➢ **Length:** 5.030″ (127.76 mm) ± 0.015″ (0.381 mm) at the corners

  ➢ **Height:** 0.400″ (10.16 mm) to 0.575″ (14.605 mm)

> ❖ **Shorter profile plates:** 1536-well and low volume 384-well microplates are shorter than standard-height plates, and **can** be processed in the BioStack. These plates have a minimum height of 0.400″ (10.16 mm). The maximum rim height for plates with an overall height that is less than 0.450″ (11.43 mm) is 0.100″ (2.54 mm).
>
> ❖ **To run plates shorter than 0.565″ (14.35 mm)**, you will need version 2.00.x of the BioStack basecode software PN 7310209 installed in the fixed wrist model (PN BIOSTACK2) or rotational wrist model (PN BIOSTACK2WR).
>
> ❖ **Half-height plates:** Some half-height plates may require reconfiguration of the BioStack. One microplate known to require this reconfiguration is MJ Research's *Hard-Shell* 384-well PCR plate. See **Appendix C**, **Reconfiguration of the BioStack** for more information.
>
> ❖ The BioStack is not compatible with **removable strip type** microplates.

- The microplates must "nest" or stack easily with each other. Some brands or models of plates that have ribs or other small, sharp edges on their base may not stack easily, and may "catch" when moving down the stack.

> ❖ Plastic "flash" (burrs and extra plastic) on the edges of plates, and strip plates that are not as rigid or flat, may also cause problems.
>
> ❖ Less rigid polystyrene plates may cause problems, especially after thermocycling.

Perform the following simple test to determine whether a particular brand of plates will nest easily:

➢ Stack one plate on top of another, then check to see if the top plate is slightly (1 mm or 1/16") off to the side or front-to-back. If this is the case, the plates may "catch" when moving down the stack.

• If you will be attaching barcode labels to microplates for use with the BioStack's **optional barcode scanner**, use plates with flat, vertical sidewalls so that the labels will lie flat upon the surface (see *Appendix B, BioStack Barcode Scanner*).

Load the Microplates into the Input Stack

> ⓘ **Important!** Ensure that when the microplates are stacked, the wells are not overfilled with fluid. If the wells are overfilled, the plates may stick together due to suction, and they will not separate for processing.

Before starting a program with the BioStack, load all of the microplates you plan to process into the **input stack**.

❖ **30-plate stacks:** You can load up to 30 of the standard-height 96- and 384-well plates or at least 40 shorter profile plates.

❖ **50-plate stacks:** You can load up to 50 standard-height plates.

You can designate either one of the stacks as the input stack, since, mechanically, they are identical. However, whichever one you choose should be placed onto the BioStack in the **input stack position** (rear), as indicated on the labels attached to both stack locks (see *Figure 67* on the next page).

A **plate-stacking pedestal** (PN 7312083) is included in your BioStack package contents for ease in loading and unloading the plates, however, you may also stack the plates without using the pedestal. The pedestal may be used with 30-plate and 50-plate stacks.
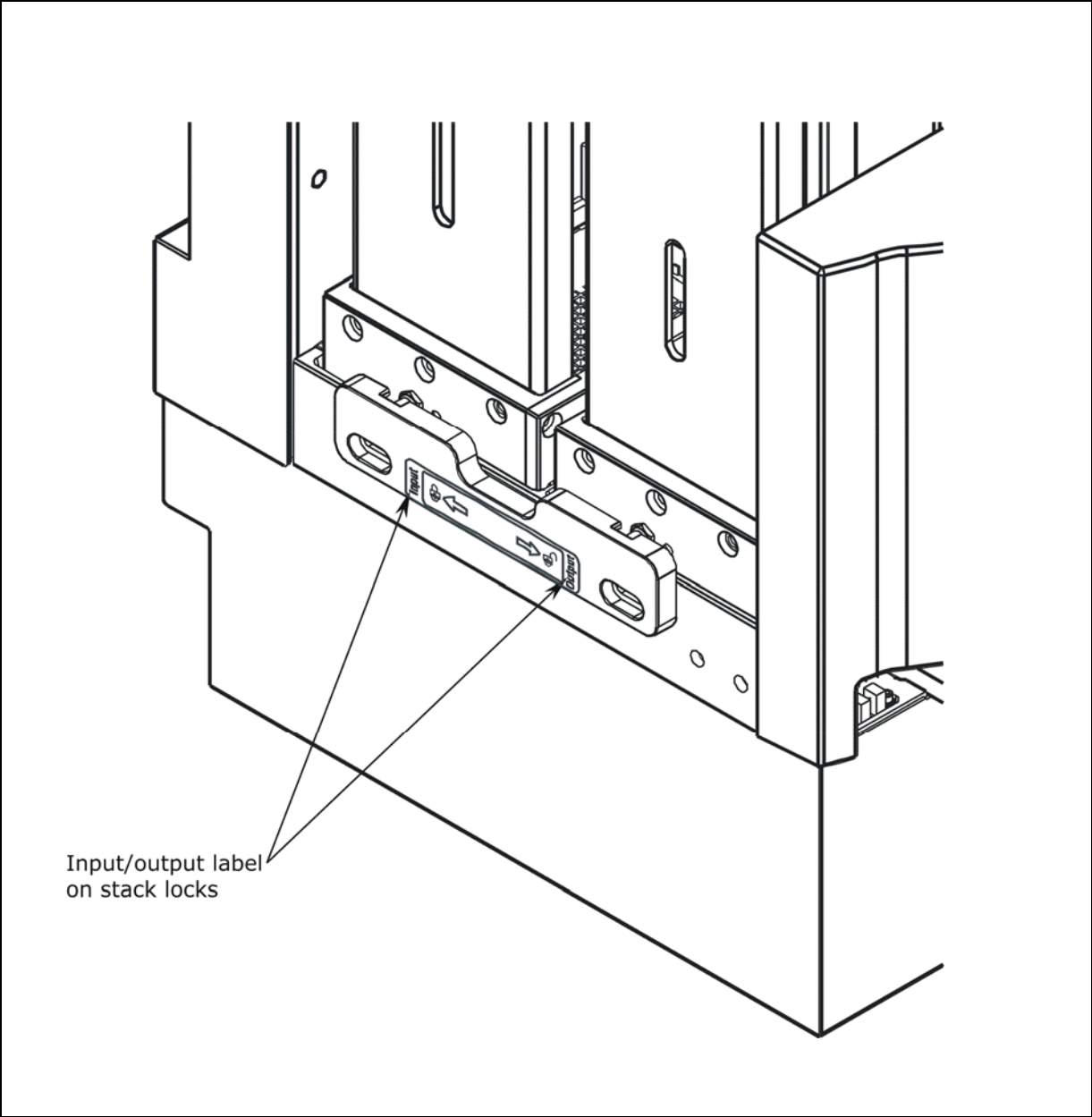
Figure 67: Close-Up View of the Input/Output Label on the Stack Lock

Load the Plates Using the Plate-Stacking Pedestal

> ❖ If you are loading plates up to the full capacity of the 30-plate or 50-plate input stack while using the pedestal, the last couple of plates will be resting above the top of the input stack. This should not be a problem, since 1) the plates should be stackable, and 2) when you lift the input stack off the pedestal, the complete stack is lowered down onto the dogs.

1. Place the pedestal upright (legs up) on a flat surface.

2. Unlock the stack locks on the sides of the BioStack and lift out the input stack (see *Figure 67* on the previous page).

3. Place the input stack over the top of the pedestal, and lower it until the stack completely covers the pedestal and is resting on the surface (see *Figure 68* on the next page).

4. Taking one or more microplates, lower them from the top of the stack down to the bottom, resting the bottom plate on the pedestal legs.

    As you are lowering the plates, it is recommended that your hand/arm be on the opposite side of the stabilizing bracket located at the top of the stack.

5. After you have loaded all of the plates that you plan to process, gently lift the input stack off the pedestal. The stack of plates should lower smoothly onto the stack dogs.

6. Lower the input stack back into position on the BioStack and close the stack locks.

Load the Plates without the Plate-Stacking Pedestal

BioTek recommends that you perform the following instructions using empty microplates first, until you are comfortable with the process of loading and unloading the plates into the stacks.

1. Unlock the stack locks on the sides of the BioStack (see *Figure 67* on the previous page). Lift out the input stack and place the stack on a flat surface.

2. Taking one or more plates, lower them from the top of the stack down to the bottom, resting the bottom plate on the two dogs at the side of the stack.

3. As you are lowering the plates, it is recommended that your hand/arm be on the opposite side of the stabilizing bracket located at the top of the stack. It is also recommended that you not touch the bottoms of the plates.

4. When you have finished loading all of the plates that you plan to process, lower the input stack back into position on the BioStack and close the stack locks.
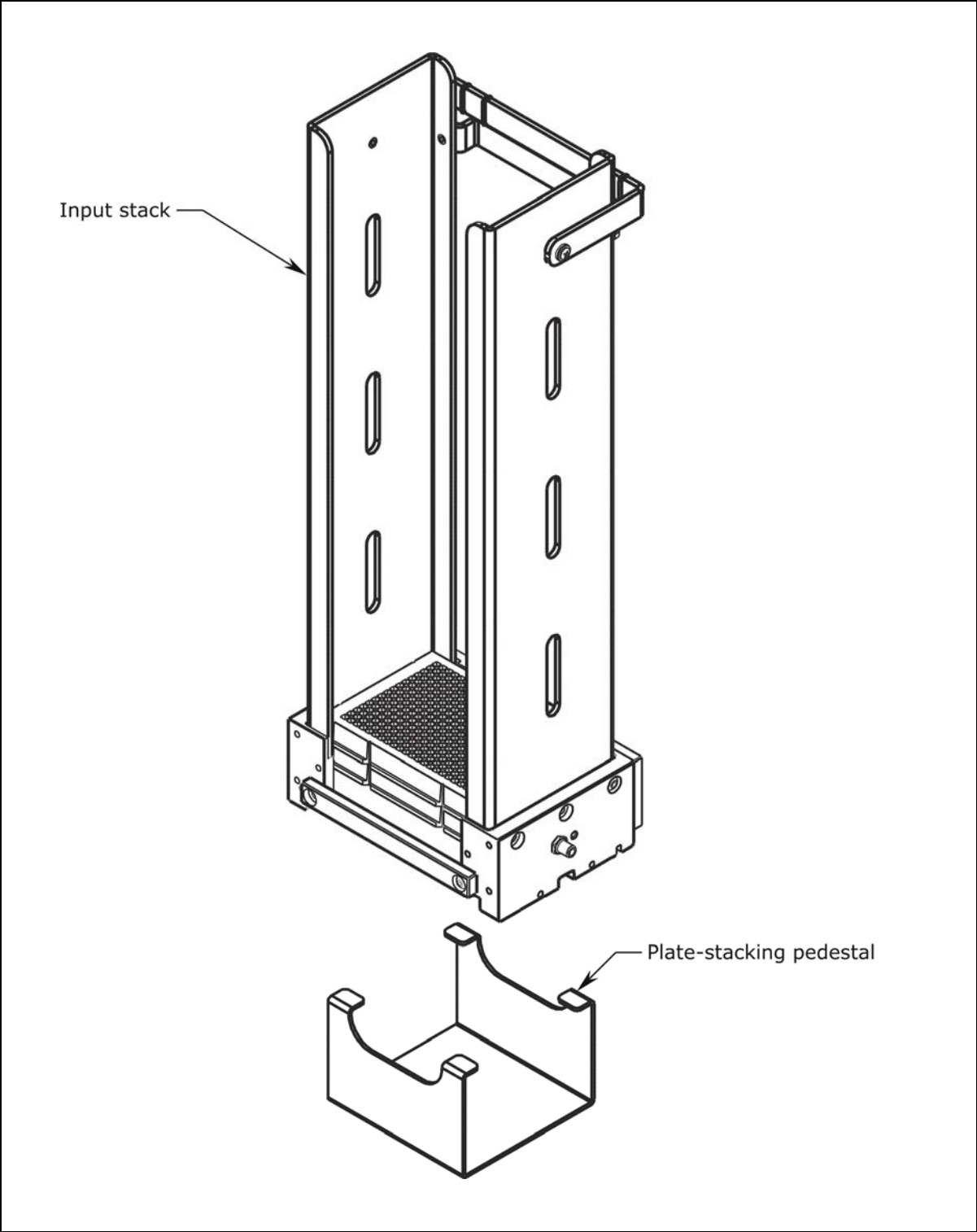
Figure 68: Pedestal for Loading/Unloading Plates in the Stacks

❖ The 30-plate stack is shown.

Operate the BioStack with the PowerWave or Synergy Readers

> ⚠ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

> ⓘ **Important!** If you are using half-height plates and the BioStack is passing multiple plates at once from the input stack to the BioStack carrier, the instrument may need to be reconfigured to accommodate your microplates. Refer to *Appendix C*, *Reconfiguration of the BioStack*, for more information.

> ⓘ **Important!** Always power up the BioStack **first** before turning on the reader, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the reader's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the reader.

> ❖ **BioStack rotational wrist model:** The wrist must be set at the **0°** interface position for operation with the readers.

During operation of the BioStack with the PowerWave/XS/XS2 or Synergy HT/ Synergy 2/Synergy 4/Synergy Mx readers, the **BioStack PC Control Software** controls all functionality of the BioStack and runs **Gen5** or **KC4** software in the background to control the PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4 /Synergy Mx.

> ❖ Gen5 is required for the PowerWave XS2, Synergy 2, Synergy 4, and Synergy Mx readers (KC4 does not support these three readers).

When operating the BioStack with the reader, you will run Gen5 or KC4 as a stand-alone application

- *initially*, when creating KC4 protocols or Gen5 protocols and possibly Gen5 experiments, and

- *later*, when reviewing plate results, or manually exporting results.

However, during the actual processing of plates, the BioStack PC Control Software is your primary operating software and it automatically runs Gen5 or KC4 in OLE mode to send serial commands to the reader, while sending its own set of serial commands to the BioStack to control plate transfers.

> ❖ You may also create Gen5 *experiments* in the BioStack PC Control Software, however, *protocols* must be predefined in Gen5.
>
> ❖ When the BioStack PC Control Software is running Gen5 experiments, it is *not* recommended that you also run Gen5 in standalone mode in order to modify or delete the experiments.

> ❖ When the BioStack PC Control Software first initiates the KC4 software as an automatic background task, you will be able to see the KC4 application running, but it will be as if KC4 is running in "read-only" mode, since you will not be able to modify anything during that sequence of the program. Also, you should not modify any reader protocol while that protocol may be in-process under the BioStack operation.

Figure 69 below shows the relationship between the PC and its software (i.e., BioStack PC Control Software and Gen5 or KC4) and the BioStack and the microplate readers. The BioStack PC Control Software sends the necessary RS-232 serial commands to control the physical plate transfers. To control the reader, the PC software "calls" various Gen5 or KC4 functions running in the background.

For a complete description of the BioStack PC Control Software and its operation, please refer to its online Help system by selecting **Help > Help Topics** from the main menu. Refer also to the Help system for complete instructions for using the **BioStack barcode scanner**.

> ❖ The BioStack PC Control Software is primarily in control of the user interface, except in the case of processing errors that Gen5 or KC4 catch.
>
> ❖ If you have *both* Gen5 and KC4 applications *and* two readers connected to a PC, you may run Gen5 in stand-alone mode to control one reader, at the same time that the BioStack PC Control Software uses KC4 to control another reader.
>
> ❖ When referring to the software configuration illustrated in *Figure 69* below, remember that KC4 does not support the PowerWave XS2, Synergy 2, Synergy 4, and Synergy Mx readers.
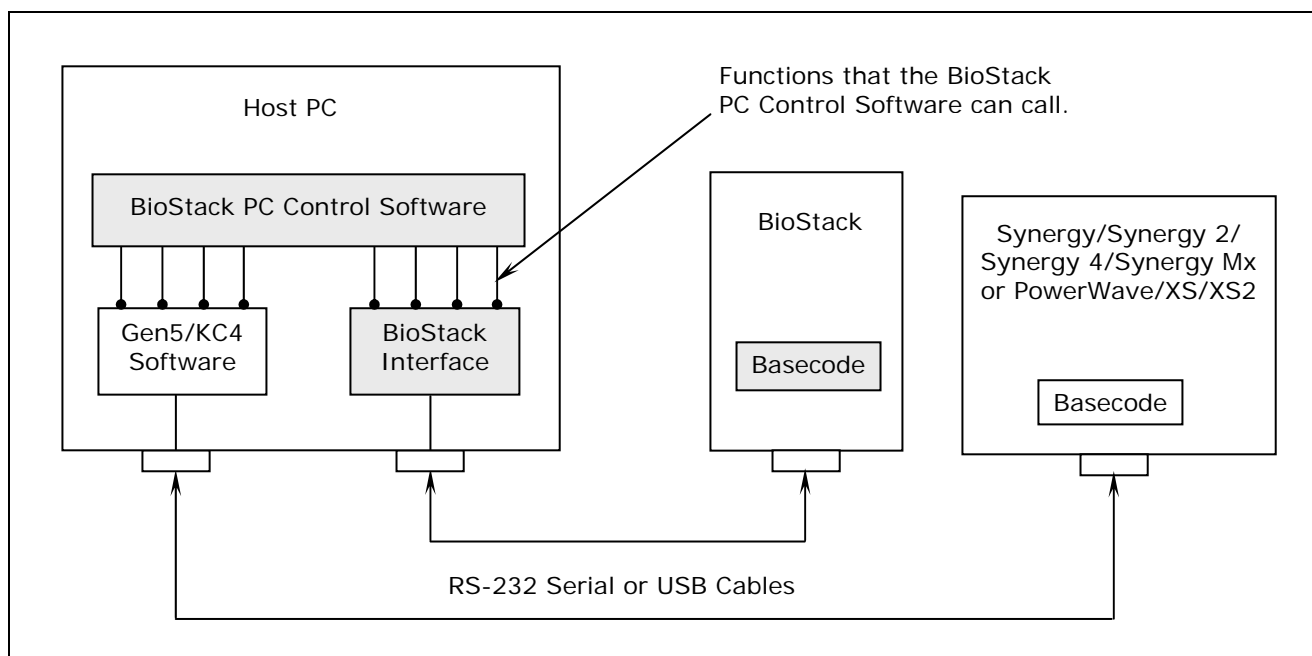
Figure 69: BioStack PC Control Software Architecture

Operate the BioStack with the Precision/XS

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	**Important!** If you are using half-height plates and the BioStack is passing multiple plates at once from the input stack to the BioStack carrier, the instrument may need to be reconfigured to accommodate your microplates. Refer to *Appendix C*, *Reconfiguration of the BioStack*, for more information.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the Precision, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the Precision's supply station before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the Precision.

❖ **BioStack rotational wrist model:** The wrist must be set at the **0°** interface position for operation with the Precision/XS.

❖ **Two BioStacks** with **one Precision** instrument: If you are operating two BioStacks with one Precision instrument, you will need to open Precision Power twice (one instance per BioStack/Precision configuration).

BioTek's **Precision Power Software** controls all functions of the Precision XS Microplate Sample Processor and Precision Microplate Pipetting System, and uses a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

Using Precision Power, the operator may configure the BioStack to interface with the desired supply platform stations on the Precision, and up to two BioStacks may be simultaneously used with a Precision for high throughput plate processing.

Figure 70 on the next page shows the relationship between the PC and its software (i.e., Precision Power) and the BioStack and a Precision.

Figure 71 on page 221 illustrates the same relationship with two BioStacks and a Precision.

For a complete description of the Precision Power software and its operation, please refer to the Precision Power User's Guide or the online Help system by selecting **Help > Help Topics** from the main menu. Refer also to the Help system for complete instructions for using the **BioStack barcode scanner**.

In *Figure 70* below, the Precision Power software uses

- one serial or USB port to control the BioStack instrument plate transfers (via a component of the BioStack PC Control Software); and

- one serial port to control all functionality of the interfacing instrument.
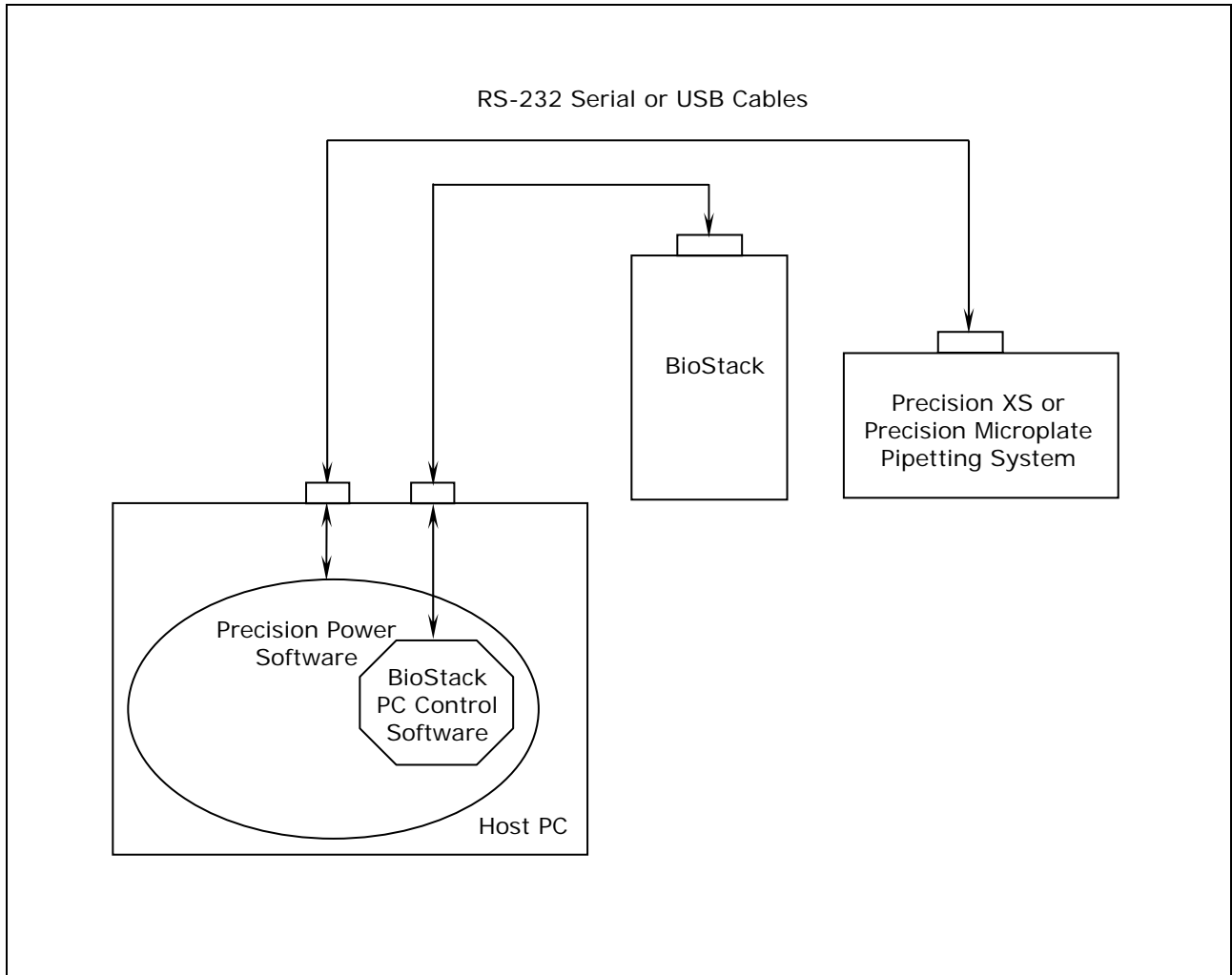
Figure 70: BioStack/Precision Power Software Architecture (with One BioStack)

In *Figure 71* below, the Precision Power software uses

- two serial or USB ports to control instrument plate transfers on two BioStack instruments (via a component of the BioStack PC Control Software); and

- one serial port to control all functions of the interfacing instrument.
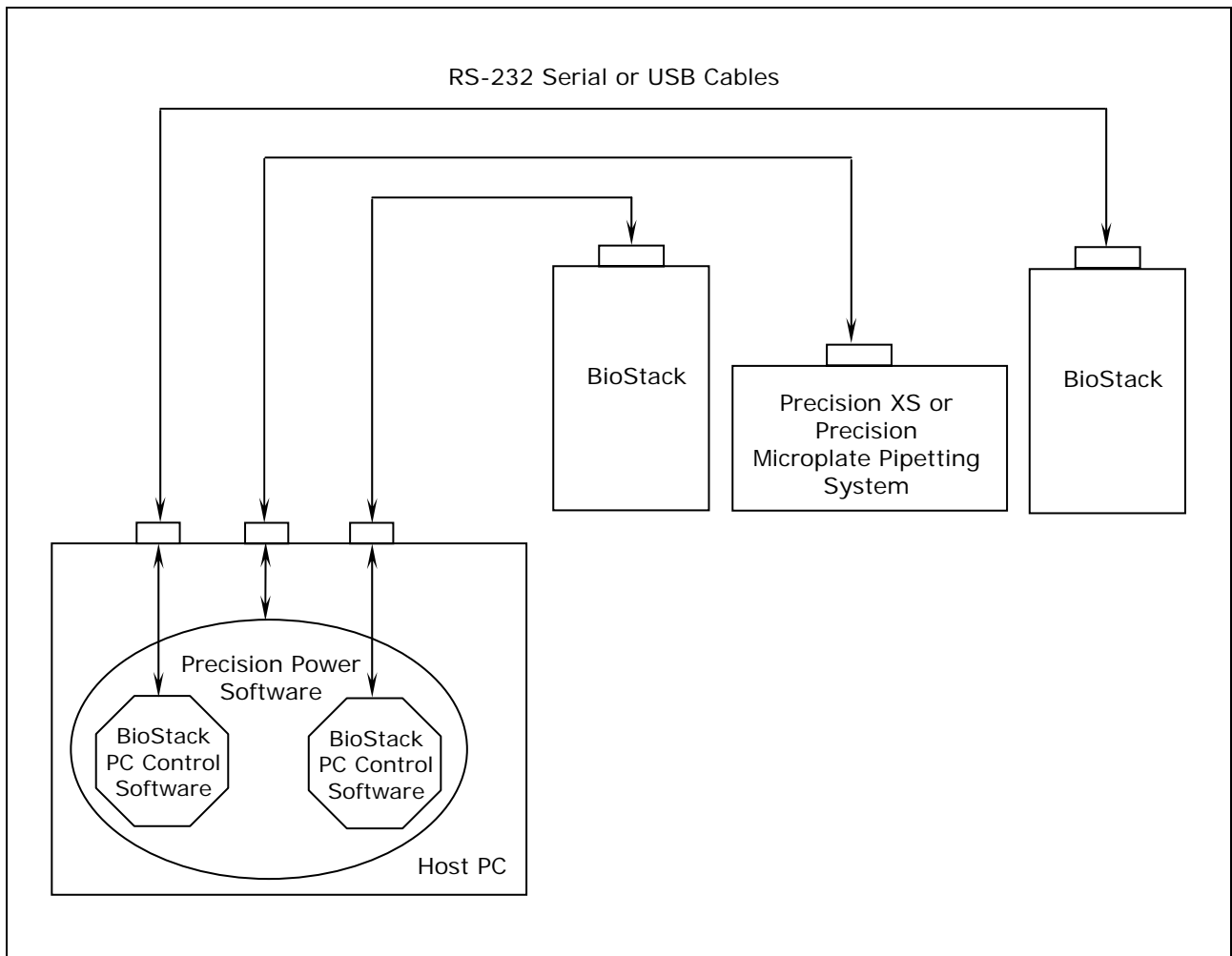
Figure 71: BioStack/Precision Power Software Architecture (with Two BioStacks)

Operate the BioStack with the MicroFill

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	**Important!** If you are using half-height plates and the BioStack is passing multiple plates at once from the input stack to the BioStack carrier, the instrument may need to be reconfigured to accommodate your microplates. Refer to *Appendix C*, *Reconfiguration of the BioStack*, for more information.
ⓘ	**Important!** Always power up the BioStack first before turning on the dispenser, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the MicroFill plate carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the dispenser.

> ❖ **BioStack rotational wrist model:** The wrist must be set at the **0°** interface position for operation with the MicroFill.

The **MicroFill Microplate Dispenser** uses RS-232 serial commands to control the BioStack and displays all BioStack-related information, including error codes.

> ❖ The one exception to this is when the BioStack is first powered up, and is not yet under the control of the MicroFill. At this point, it will run a series of self-test homing operations. The LED on the BioStack will flash if there is a failure during this sequence. If a failure occurs, you may turn the MicroFill on, and it will determine the status of the BioStack and display any errors (ensure that the serial cable is connected).

Perform the following steps to power up the MicroFill and BioStack:

1. Ensure that the BioStack is correctly positioned next to the MicroFill and that the alignment hardware and serial cable are attached. See *Install the BioStack with the MicroFill or ELx405*, in *Chapter 3*, *Installation*.

2. Power up the BioStack **first** before turning on the MicroFill: raise the claw/gripper manually before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. If the claw/gripper is not homed before the BioStack is powered up, the BioStack self-test will home the mechanism. Ensure that the claw/gripper has risen to its full height.

3. Power up the MicroFill. Before performing the self-test, the MicroFill will attempt to establish communication with the BioStack. If communication is successful, and the BioStack has passed its own self-test, the MicroFill will proceed with its self-test. If the BioStack has failed the self-test, or communication could not be established, then the dispenser's self-test will fail, and the instrument will beep and display an error code (e.g., **B-8306**). Refer to *Chapter 7*, *Troubleshooting and Error Codes* for a listing of all error codes associated with the BioStack that may be displayed on the MicroFill.

4. Once the BioStack has been turned on, its LED will blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

   If the LED is off or flashing, an error has occurred. If the MicroFill is on, running, and properly connected, an error code may be displayed.

❖ By default, the MicroFill is configured as a stand-alone instrument. The MicroFill must be configured for BioStack operation by using the BioStack's **Configuration** utility. See *BioStack Utilities Screen* on page 225.

Startup Screens

❖ The screens listed below and on the following pages appear as menu selections in the bottom (second line) of the keypad LCD of the MicroFill. To make a selection, press the SoftKey below the menu function. To move to a previous menu, press the **Previous Screen** key. Refer to your MicroFill Operator's Manual for a detailed illustration of the keypad and description of its functions. The MicroFill Manual currently contains instructions for running the MicroFill as a stand-alone instrument, whereas this manual describes the BioStack specific operation.

When the MicroFill is powered up, the following two screens are displayed, and the microplate carrier is homed:

```
P O W E R U P   S E Q U E N C E   V X . X X

I N I T I A L I Z I N G . . .
```

```
U F I L L   R E A G E N T   D I S P E N S E R

S Y S T E M   S E L F - T E S T . . .
```

The above screen is displayed while communication with the BioStack is being established and the self-test has begun. If no communication occurs after 30 seconds, a timeout results and error **B-8306** is displayed. Press **ENTER** to display the Main Menu. If the self-test and homing sequence is successful, the MicroFill main menu screen appears:

```
U  F  I  L  L     R  E  A  G  E  N  T     D  I  S  P  E  N  S  E  R

R  U  N     D  E  F  I  N  E     M  A  I  N  T     U  T  I  L
```

❖ If the communication fails, the MicroFill software will display its Main Menu, but will not perform its homing sequence. This is to prevent collision of the MicroFill carrier with the claw/gripper. Hence, once the serial communication problems are corrected, it is recommended that the MicroFill be repowered so it can run its own homing sequence.

BioStack Utilities Screen

To access the BioStack Utilities screen and configure the MicroFill for proper BioStack operation, follow the screens below:

- Select **UTIL** from the main menu screen. The Select Utility screen will appear:

```
S  E  L  E  C  T     U  T  I  L  I  T  Y  :

T  E  S  T  S     S  E  T  U  P     A  U  T  O  P  R  M
```

- Select **SETUP**. The Edit Setup screen will appear:

```
E  D  I  T     S  E  T  U  P  :

L  A  N  G     M  A  N     B  I  O  S  T  A  C  K
```

- Select **BIOSTACK**. The BioStack Utilities screen will appear with the three utilities as described below:

```
B  I  O  S  T  A  C  K     U  T  I  L  I  T  I  E  S  :

C  O  N  F     A  L  I  G  N     V  E  R  I  F  Y
```

1. **CONF:** The Configuration utility is used to describe the BioStack operating mode.

2. **ALIGN:** The instrument Alignment utility is used to align the claw/gripper of the BioStack to the carrier of the MicroFill (i.e., the z-height alignment).

3. **VERIFY:** The Verify utility is used to verify the z-height alignment.

Configuration Utility

- Select **CONF** first. The Configuration screen gives you the options of running the MicroFill either as a stand-alone instrument or with the BioStack. The default mode is to run the MicroFill by itself (i.e., in Manual mode).

```
O P E R A T I N G    M O D E :            M A N

M A N U A L     B I O S T A C K
```

MAN in the upper right corner indicates the instrument is set for manual operation. If **MANUAL** is selected, the BioStack Utilities screen will be re-displayed.

- Select **BIOSTACK** to indicate that the MicroFill will be operated with the BioStack. (The next time this screen is displayed, **BIO** will appear in the upper right corner.) The Re-Stack screen will then appear:

```
R E - S T A C K ?                    Y E S

  Y E S          N O
```

Use this screen to indicate whether plates residing in the output stack at the end of a run shall be automatically re-stacked into the input stack.

- Select **YES** or **NO**. After a brief pause, the BioStack Utilities screen will appear.

Instrument Alignment Utility

> ❖ Ensure that the instrument alignment plate has already been mounted (per the instructions in *Chapter 3*, *Installation*) and the x and y positioning of the BioStack to the MicroFill has been performed before proceeding with the z-height (vertical) alignment.

To align the z-height of the claw/gripper on the BioStack with the carrier of the MicroFill, select **ALIGN** on the BioStack Utilities screen. The Alignment screen will appear:

```
A L I G N M E N T    U T I L I T Y :

H O M E    C – P O S    S A V E
```

The instrument's Alignment Utility has three selections:

1. **HOME:** This allows you to home all axes for either the BioStack or the MicroFill.

2. **C-POS:** This allows you to "step" the claw/gripper down to the MicroFill's carrier to find the proper interface position (the z-height).

3. **SAVE:** When the interface position has been found, the Save function is used to tell the BioStack to save the z-height for proper plate seating.

Home Selection

◆ Select **HOME**. The following screen will appear with the two options of homing all axes for either the MicroFill or for the BioStack. Select **BIOSTACK** to home all its axes, then press the **PREVIOUS SCREEN** key on the keypad to return to the Alignment Utility Screen.

```
H O M E    A L L :

u F i l l    B I O S T A C K
```

C-POS Selection

◆ Select **C-POS**. At this point, if the claw is not fully homed, it will rise to its full height (its home position) and the gripper will spread out to its full width. The Find Claw Interface Pos screen will then appear:

```
FIND  CLAW   INTERFACE   POS:

  - / +      + 1       + 2 0      + 4 0 0
```

◆ The goal of this utility is to align the claw so that the gripper fingers are resting approximately 50-60 thousandths of an inch below the plate bottom or carrier surface. See *Figure 40* in *Chapter 3*, *Installation*, for an illustration of proper alignment of the claw/gripper with the plate.

To help in this activity, place a dry microplate on the carrier of the MicroFill (optional). To avoid collision of the gripper with the plate or carrier on the MicroFill, press the **+20** key first to see how far that goes, before pressing the **+400** key. Use the **+1/+20/+400** softkeys to *gradually* lower the claw/gripper to the precise location (i.e., .05" or .06" below the plate bottom or carrier surface).

❖ The C-POS measurement-to-inch ratios are: 1 = 0.001875", 20 = 0.0375", and 400 = 0.75".

◆ If you have moved the gripper too far below the carrier, press the **-/+** key to change direction.

Save Selection

◆ If you are satisfied with the alignment, press the **PREVIOUS SCREEN** key to return to the Alignment screen and select **SAVE**. At the following screen, select **YES**, and then press the **ENTER** key.

```
OK  TO  SAVE  LOCATION?  YES

  YES        NO
```

At this point, the claw will home, the grippers will close, and the setting will be saved in the flash memory of the BioStack. After a brief wait, the BioStack Utilities screen will appear.

Verify Utility

> ❖ Remove the microplate (if one was used) from the MicroFill carrier before proceeding with the Verify sequence below, otherwise the plate that the claw gripper retrieves from the input stack to place on the carrier will collide with the plate in the carrier! Also, ensure that there is at least one plate in the input stack.

- At the Utilities screen, select **VERIFY**. The following screen will appear:

```
P L A C E     P L A T E     I N     I N - S T A C K

< E N T E R >     K E Y     T O     C O N T I N U E
```

- Place a dry plate in the input stack.
- Press **ENTER**. The claw will pick up a plate drawn from the input stack and place it onto the MicroFill carrier, with several delays during the place sequence. Watch to ensure that the gripper picks up the plate and gently sets it down in the carrier.

Two possible problems can occur at this point:

1. **The gripper fingers are too low**, so that after the gripper has released the plate, it will rise an inadequate distance before closing the gripper, thus catching the top of the plate. An error code will be displayed in this instance.

2. **The gripper fingers are too high**, in which case the gripper will drop the plate a little further than it should, possibly causing fluid in the microwells to spill.

If no error codes were displayed, the following screen will appear:

```
V E R I F Y     P L A T E     P L A C E M E N T

< E N T E R >     K E Y     T O     C O N T I N U E
```

- Press **ENTER**. The claw will pick up the plate and place it on the BioStack carrier for transfer to the output stack. Ensure that the claw performs this correctly. After a brief pause, the Utilities screen will appear. Press the Main Menu key to return to the MicroFill main menu screen.

> ❖ Moving the BioStack, inserting a new MicroFill Dispenser, etc. can potentially change the alignment. If this is the case, you may have to repeat the x, y, and z alignment steps in *Chapter 3*, *Installation*.

Running Programs

To run Dispense and Link programs, refer to your MicroFill Operator's Manual for instructions.

The following sections contain examples of screens that will appear on the MicroFill display during sample Dispense and Link programs when the MicroFill is operated with the BioStack, in contrast to screens that appear on the MicroFill when it is used as a stand-alone.

> ❖ The Prime and Maintenance programs can only be run on the MicroFill when used <u>without</u> the BioStack. You can run Dispense and Link programs whether the MicroFill is operated with or without the BioStack.

Starting Dispense/Link Programs

After indicating that you want to run a program and have selected the program type, one of the following screens is displayed. Pressing the **START** or the **ENTER** key will initiate the program.

With the BioStack:

```
PLACE    PLATES    ON    BIOSTACK

PRESS   < START >   KEY
```

Without the BioStack:

```
INSERT   MICROPLATE

PRESS   < START >   KEY
```

In-Process Programs

While a program is being processed, you will see one of the following screens. When the Dispense/Link Program Running screen is displayed, you may press the **STOP** key, if necessary, to stop the execution of the program.

With the BioStack:

```
P L A T E    # #   R U N N I N G . . .

P R E S S    < S T O P >   K E Y    T O    Q U I T
```

Without the BioStack:

```
D I S P E N S E    P R O G R A M    R U N N I N G

P R E S S    < S T O P >    K E Y    T O    Q U I T
```

```
L I N K    P R O G R A M    R U N N I N G

P R E S S    < S T O P >    K E Y    T O    Q U I T
```

In either instance, if you press the **STOP** key while a plate is being processed on the MicroFill, the MicroFill will abort the program and the Home All Axes screen will appear, as described in the *Abort Actions* section on the following page. Although the plate currently being processed will be aborted, the sequence described in the *Abort Actions* section not only provides a way to home all axes, but, if the BioStack is being used, allows the remainder of the plates in the BioStack to be run.

If you are using the BioStack and you press the **STOP** key while the plate is being transferred to or from the BioStack, the BioStack will complete the transfer and the system will pause. The Abort/Proceed screen will appear:

```


A B O R T    P R O C E E D
```

This pause gives you the chance to add more plates to, or remove some plates from the BioStack, without aborting the currently processing plate. Select **PROCEED** to resume program operation, or **ABORT** to abort the whole run.

Completing the Program

At the completion of the selected program, if you are running the MicroFill with the BioStack and have selected the Re-Stack option (see page 226), you will see the following display after the program has been run for all plates:

```
R E - S T A C K I N G

P L E A S E    W A I T
```

After 1) re-stacking is done, or, 2) if no re-stack was requested, or, 3) if you are running without the BioStack, one of the following screens will be displayed, once the program is complete:

With the BioStack:

```
# #    P L A T E S    C O M P L E T E

  N E W     R E P E A T
```

Without the BioStack:

```
D I S P    P R O G R A M    C O M P L E T E .

  N E W     R E P E A T
```

```
L I N K    P R O G R A M    C O M P L E T E .

  N E W     R E P E A T
```

Abort Actions

When the **STOP** key is pressed during execution of the Dispense or Link programs, the program immediately halts and the following screen is displayed:

With the BioStack:

```
H O M E    A L L    A X I S ?                Y E S

   Y E S       N O
```

Without the BioStack:

```
P R E S S    < E N T E R >    K E Y

T O    H O M E    A L L    A X I S
```

When you select **YES** or press **ENTER**, all motor axes will home while displaying the following message:

With the BioStack™:

```
R U N N I N G    S T O P    P R O T O C O L


```

Without the BioStack:

```
R U N N I N G    S T O P    P R O T O C O L

P L E A S E    W A I T . . .
```

At this point, if operating with the BioStack, you have the option of homing the BioStack and running the remainder of the plates:

```
H O M E    T H E    B I O - S T A C K ?    Y E S

   Y E S       N O
```

```
R U N    R E S T    O F    P L A T E S ?      Y E S

   Y E S         N O
```

Ensure that you remove the aborted plate from the MicroFill before selecting
YES. The program will then continue to run and will display the count of the
plate in process (-1 for the aborted plate).

Operate the BioStack with the ELx405 (Instrument Control)

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

> ❖ For operation with the ELx405, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

> ⓘ **Important!** Always power up the BioStack **first** before turning on the washer, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the ELx405 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the washer.

The **ELx405 Microplate Washer** (all models except the Magna) uses RS-232 serial commands to control the BioStack and it displays all BioStack related information, including error codes.

> ❖ The one exception to this is when the BioStack is first powered up, and is not yet under the control of the washer. At this point, it will run a series of self-test homing operations. The LED on the BioStack will flash if there is a failure during this sequence. If a failure occurs, you may turn the ELx405 on, and the washer will determine the status of the BioStack and display any errors (ensure that the serial cable is connected).

Perform the following steps to power up the ELx405 and BioStack:

1. Ensure that the BioStack is correctly positioned next to the washer and that the alignment hardware and serial cable are attached. See *Install the BioStack with the MicroFill or ELx405* in *Chapter 3, Installation*.

2. Power up the BioStack **first** before turning on the ELx405: raise the claw/gripper manually before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. If the claw/gripper is not homed before the BioStack is powered up, the BioStack self-test will home the mechanism. Ensure that the claw/gripper has risen to its full height.

3. Power up the ELx405. Before performing the self-test, the washer will attempt to establish communication with the BioStack. If communication is successful, and the BioStack has passed its own self-test, the washer will proceed with its self-test. If the BioStack has failed the self-test, or communication could not be established, then the ELx405 self-test will fail, and the washer will beep and display an error code.

Refer to *Chapter 7*, *Troubleshooting and Error Codes*, for a listing of all error codes associated with the BioStack that are displayed on the ELx405.

4. Once the BioStack has been turned on, its LED will blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

If the LED is off or flashing, an error has occurred. If the ELx405 is on, running, and properly connected, an error code may be displayed.

> ❖ By default, the ELx405 is configured for operation as a stand-alone instrument. The washer must be configured for BioStack operation by using the BioStack's **Configuration (CONF)** utility. See *BioStack Utilities Screen* on page 237.

Startup Screens

> ❖ The screens listed below and on the following pages appear as menu selections in the bottom (second line) of the keypad LCD on the ELx405. To make a selection, press the SoftKey below the menu function. To move to a previous menu, press the **Previous Screen** key. Refer to your ELx405 Operator's Manual for a detailed illustration of the keypad and description of its functions. The ELx405 Manual contains instructions for running the washer as a stand-alone instrument, whereas this manual describes the BioStack specific operation.

When the ELx405 is powered up, the following two screens are displayed, and the carrier is homed:

```
POWERUP  SEQUENCE  VX.XX

INITIALIZING...
```

```
BIO-TEK  ELx405

SELF-TEST.....
```

The above screen is displayed while communication with the BioStack is being established and the self-test has begun. If no communication occurs after 30 seconds, a timeout will result and error **B-8306** is displayed. Press **ENTER** to display the main menu. If the self-test and homing sequence is successful, the ELx405 main menu screen will appear:

```
BIO-TEK  ELx405

RUN    DEFINE    MAINT    UTIL
```

❖ If the communication fails, the ELx405 software will display its Main Menu, but will not perform its homing sequence. This is to prevent the ELx405 carrier from colliding with the claw/gripper. Therefore, it is recommended that once the serial communication problems are corrected, that the ELx405 be turned off/on so it can run its own homing sequence.

BioStack Utilities Screen

To access the BioStack Utilities screen and configure the ELx405 for proper BioStack operation, follow the screens below:

- Select **UTIL** from the main menu screen. The Select Utility screen will appear:

```
S E L E C T    U T I L I T Y :

T E S T S    S E T U P          A U T O P R M
```

- Select **SETUP.**

```
E D I T    S E T U P :

R S 2 3 2    S E N S O R    A D J S T    * M O R E
```

- Select ***MORE**:

```
E D I T    S E T U P :

P A R K      B I O S T A C K          * M O R E
```

- Select **BIOSTACK**.

```
B I O S T A C K    U T I L I T I E S :

C O N F      A L I G N     V E R I F Y
```

The BioStack Utilities screen will appear with the three utilities as described below:

1. **CONF:** The Configuration utility is used to describe the BioStack operating mode.
2. **ALIGN:** The instrument Alignment utility is used to align the claw/gripper of the BioStack to the carrier of the ELx405 (i.e., the z-height alignment).
3. **VERIFY:** The Verify utility is used to verify the z-height alignment.

Configuration Utility

- Select **CONF** first. The Configuration screen provides the options of running the ELx405 either as a stand-alone instrument or with the BioStack. The default mode is to run the ELx405 by itself (i.e., in Manual mode).

```
O P E R A T I N G   M O D E :           M A N

M A N U A L     B I O S T A C K
```

MAN in the upper right corner indicates the instrument is set for manual operation. If **MANUAL** is selected, the BioStack Utilities screen will be re-displayed.

- Select **BIOSTACK** to indicate that the ELx405 will be operated with the BioStack (the next time this screen is displayed, **BIO** will appear in the upper right corner). The Re-Stack screen will then appear:

```
R E – S T A C K ?                   Y E S

 Y E S         N O
```

The Re-Stack screen indicates whether plates residing in the output stack at the end of a run shall be automatically re-stacked into the input stack.

- Select **YES** or **NO**. After a brief pause, the BioStack Utilities screen will reappear.

Instrument Alignment Utility

> ❖ Ensure that the instrument alignment plate has already been mounted (per the instructions in *Chapter 3*, *Installation*) and the x and y positioning of the BioStack to the ELx405 has been performed before proceeding with the z-height (vertical) alignment.

To align the z-height of the claw/gripper on the BioStack with the carrier of the ELx405, select **ALIGN** on the BioStack Utilities screen. The Alignment Utility screen will appear:

```
A L I G N M E N T    U T I L I T Y :

H O M E      C - P O S      S A V E
```

The instrument Alignment Utility has three selections:

1. **HOME**: This allows the operator to home all axes for either the BioStack or the ELx405.

2. **C-POS**: This allows the operator to "step" the claw/gripper down to the ELx405's carrier to find the proper interface position (the z-height).

3. **SAVE**: When the interface position has been found, the Save function is used to tell the BioStack to save the z-height for proper plate transferring.

Home Selection

◆ Select **HOME**. The following screen will appear with the two options of homing all axes for either the ELx405 or for the BioStack. Select **BIOSTACK** to home all its axes, then press the **PREVIOUS SCREEN** key on the keypad to return to the Alignment Utility screen.

```
H O M E    A L L :

E L x 4 0 5      B I O S T A C K
```

C-POS Selection

◆ Select **C-POS**. At this point, if the claw is not fully homed, it will rise to its full height (its home position) and the gripper will spread out to its full width. The Find Claw Interface Pos screen will then appear:

```
F I N D     C L A W     I N T E R F A C E     P O S :

  - / +          + 1          + 2 0          + 4 0 0
```

◆ The goal of this utility is to align the claw so that the gripper fingers are resting approximately 50-60 thousandths of an inch below the plate bottom or carrier surface. See *Figure 40* in *Chapter 3*, *Installation*, for an illustration of proper alignment of the claw/gripper with the plate.

◆ To help in this activity, place a dry microplate on the carrier of the ELx405. To avoid collision of the gripper with the plate or carrier on the washer, press the **+20** key first to see how far that goes, before pressing the **+400** key. Use the **+1/+20/+400** softkeys to *gradually* lower the claw/gripper to the precise location (i.e., .05″ or .06″ below the plate bottom or carrier surface).

> ❖ The C-POS measurement-to-inch ratios are: 1 = 0.001875", 20 = 0.0375", and 400 = 0.75".

◆ If you have moved the gripper too far below the carrier, press the **-/+** key to change direction.

Save Selection

◆ If you are satisfied with the alignment, press the **PREVIOUS SCREEN** key to return to the Alignment screen and select **SAVE**. At the following screen, press **YES**, and then the **ENTER** key.

```
O K     T O     S A V E     L O C A T I O N ?     Y E S

  Y E S            N O
```

◆ At this point, the claw will home, the grippers will close, and the setting is saved in the flash memory of the BioStack. After a brief wait, the BioStack Utilities screen will appear.

Verify Utility

❖ Remove the microplate (if one was used) from the ELx405 carrier before proceeding with the Verify sequence below, otherwise the plate that the claw gripper retrieves from the input stack to place on the carrier will collide with the plate in the carrier! Also, ensure that there is at least one plate in the input stack.

- At the BioStack Utilities screen, select **VERIFY**. The following screen will appear:

```
P L A C E    P L A T E    I N    I N - S T A C K

< E N T E R >    K E Y    T O    C O N T I N U E
```

- Place a dry plate in the input stack.

- Press **ENTER**. The claw will pick up a plate drawn from the input stack and place it onto the ELx405 carrier, with several delays during the place sequence. Watch to ensure that the gripper picks up the plate and gently sets it down in the carrier.

  ➢ **BioStack rotational wrist model (with the wrist angle set at the 90° interface position):** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the Stacker's plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the ELx405's plate carrier, and then gently set it down in the carrier.

Two possible problems can occur at this point:

1. **The gripper fingers are too low**, so that after the gripper has released the plate, it will rise an inadequate distance before closing the gripper, thus catching the top of the plate. An error will be displayed in this instance.

2. **The gripper fingers are too high**, in which case the gripper will drop the plate a little further than it should, possibly causing fluid in the microwells to spill.

If no errors are displayed, the following screen will appear:

```
V E R I F Y    P L A T E    P L A C E M E N T

< E N T E R >    K E Y    T O    C O N T I N U E
```

- Press **ENTER**. The claw will pick up the plate and place it on the BioStack carrier for transfer to the output stack. Ensure that the claw performs this correctly.

> ➢ **BioStack rotational wrist model (with the wrist angle set at the 90° interface position):** The claw/gripper will lower and pick up the plate from the ELx405 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the Stacker's plate carrier. The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

After a brief pause, the BioStack Utilities screen will appear. Press the Main Menu key to return to the ELx405 main menu screen and the Run, Define, Maint or Util options.

❖ Moving the BioStack, inserting a new ELx405 washer, etc. can potentially change the alignment. If this is the case, you may have to repeat the x, y, and z alignment steps in *Chapter 3*, *Installation*.

Running Programs

To run Wash, Dispense, Aspirate, and Link programs, refer to your ELx405 Operator's Manual for instructions.

The following sections contain sample screens that will appear on the ELx405 display during Wash, Dispense, Aspirate and Link programs when the washer is operated with the BioStack, in contrast to screens that appear on the ELx405 when it is used as a stand-alone.

❖ The Prime, Soak, and Maintenance programs can only be run on the ELx405 <u>without</u> the BioStack. You can run ELx405 Wash, Dispense, Aspirate, and Link programs whether the washer is operated with or without the BioStack.

Starting Programs

After indicating that you want to run a program and have selected the program type, one of the following screens is displayed. Pressing the **START** or the **ENTER** key will initiate the program.

With the BioStack:

```
PLACE    PLATES    ON    BIOSTACK
AND    PRESS    < START >    KEY
```

Without the BioStack:

```
P L A C E     P L A T E     I N     C A R R I E R

A N D     P R E S S     < S T A R T >     K E Y
```

In-Process Programs

While a program is being processed, you will see one of the following screens. When the Wash, Dispense, Aspirate or Link Program Running screen is displayed, you may press the **STOP** key, if necessary, to stop the execution of the program.

With the BioStack:

```
P L A T E     # #     R U N N I N G . . .

P R E S S     < S T O P >     K E Y     T O     Q U I T
```

Without the BioStack:

```
W A S H     P R O G R A M     R U N N I N G . . .

P R E S S     < S T O P >     K E Y     T O     Q U I T
```

```
D I S P E N S E     P R O G R A M     R U N N I N G

P R E S S     < S T O P >     K E Y     T O     Q U I T
```

```
A S P I R     P R O G R A M     R U N N I N G

P R E S S     < S T O P >     K E Y     T O     Q U I T
```

```
L I N K     P R O G R A M     R U N N I N G

P R E S S     < S T O P >     K E Y     T O     Q U I T
```

In either instance, if you press the **STOP** key while a plate is being processed on the ELx405, the washer will abort the program and the Home All Axes screen will appear, as described in the *Abort Actions* section on page 245. Although the plate currently being processed will be aborted, the sequence described in the *Abort Actions* section not only provides a way to home all axes, but, if the BioStack is being used, allows the remainder of the plates in the BioStack to be run.

If you are using the BioStack and you press the **STOP** key while the plate is being transferred to or from the BioStack, the BioStack will complete the transfer and the system will pause. The Abort Continue screen will appear:

```
A B O R T    C O N T I N U E
```

This pause gives you the chance to add more plates to, and remove some plates from, the BioStack without aborting the currently processing plate. Select **CONTINUE** to resume program operation, or **ABORT** to abort the whole run.

Completing the Program

At the completion of the selected program, if you are running the ELx405 with the BioStack and have selected the Re-Stack option (see page 238), you will see the following display after the program has been run for all plates:

```
R E - S T A C K I N G

P L E A S E    W A I T
```

After 1) re-stacking is done, or, 2) if no re-stack was requested, or, 3) if you are running without the BioStack, one of the following screens will be displayed, once the program is complete:

With the BioStack:

```
# #    P L A T E S    C O M P L E T E

P R E S S    < E N T E R >    K E Y
```

Without the BioStack:

```
W A S H   P R O G R A M   C O M P L E T E

P R E S S   < E N T E R >   K E Y
```

```
D I S P   P R O G R A M   C O M P L E T E

P R E S S   < E N T E R >   K E Y
```

```
A S P I R   P R O G R A M   C O M P L E T E

P R E S S   < E N T E R >   K E Y
```

```
L I N K   P R O G R A M   C O M P L E T E

P R E S S   < E N T E R >   K E Y
```

Abort Actions

When the **STOP** key is pressed during execution of the Wash, Aspirate, Dispense or Link programs, the program immediately halts and the following screen is displayed:

With the BioStack:

```
H O M E   A L L   A X I S ?           Y E S

  Y E S       N O
```

Without the BioStack:

```
P R E S S   < E N T E R >   K E Y

T O   H O M E   A L L   A X I S
```

When you select **YES** or press **ENTER**, all motor axes will home while displaying one of the following messages:

With the BioStack:

```
RUNNING    STOP   PROTOCOL

```

Without the BioStack:

```
RUNNING    STOP   PROTOCOL
PLEASE   WAIT...
```

At this point, if operating with the BioStack, you have the option of homing the BioStack and running the remainder of the plates:

```
HOME   THE   BIO-STACK?    YES
  YES      NO
```

```
RUN   REST   OF   PLATES?     YES
  YES      NO
```

Ensure that you remove the aborted plate from the ELx405 before selecting **YES**. The program will then continue to run and will display the count of the plate in process (-1 for the aborted plate).

Operate the BioStack with the ELx405 (PC Control)

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the washer, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the ELx405 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the washer.

❖ For operation with the ELx405, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

❖ **Two BioStacks** with **two ELx405** washers: If you are operating two BioStacks with two ELx405 washers, you will need to open the Liquid Handling Control™ (LHC) Software twice (one instance per BioStack/ELx405 configuration).

BioTek's **Liquid Handling Control (LHC) Software** uses the **ELx405 Interface Software** to control all functions of the ELx405, and uses a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

Using LHC, the operator may configure the BioStack to interface with the microplate carrier on the ELx405, and up to two BioStacks may be simultaneously used with two ELx405 washers for high throughput plate processing.

Figure 72 on the next page shows the relationship between the PC and its software (i.e., LHC) and the BioStack and an ELx405.

Figure 73 on page 249 illustrates the same relationship with two BioStacks and two ELx405 washers.

For a complete description of the LHC Software and its operation, please refer to the *Liquid Handling Control Software Installation Guide* or the online Help system by selecting **Help > About Liquid Handling Control** from the software's main menu.

In *Figure 72* below, the LHC software uses

- one serial or USB port to control the BioStack instrument plate transfers (via a component of the BioStack PC Control Software); and

- one serial port to control all functionality of the ELx405 washer (via the ELx405 Interface Software).
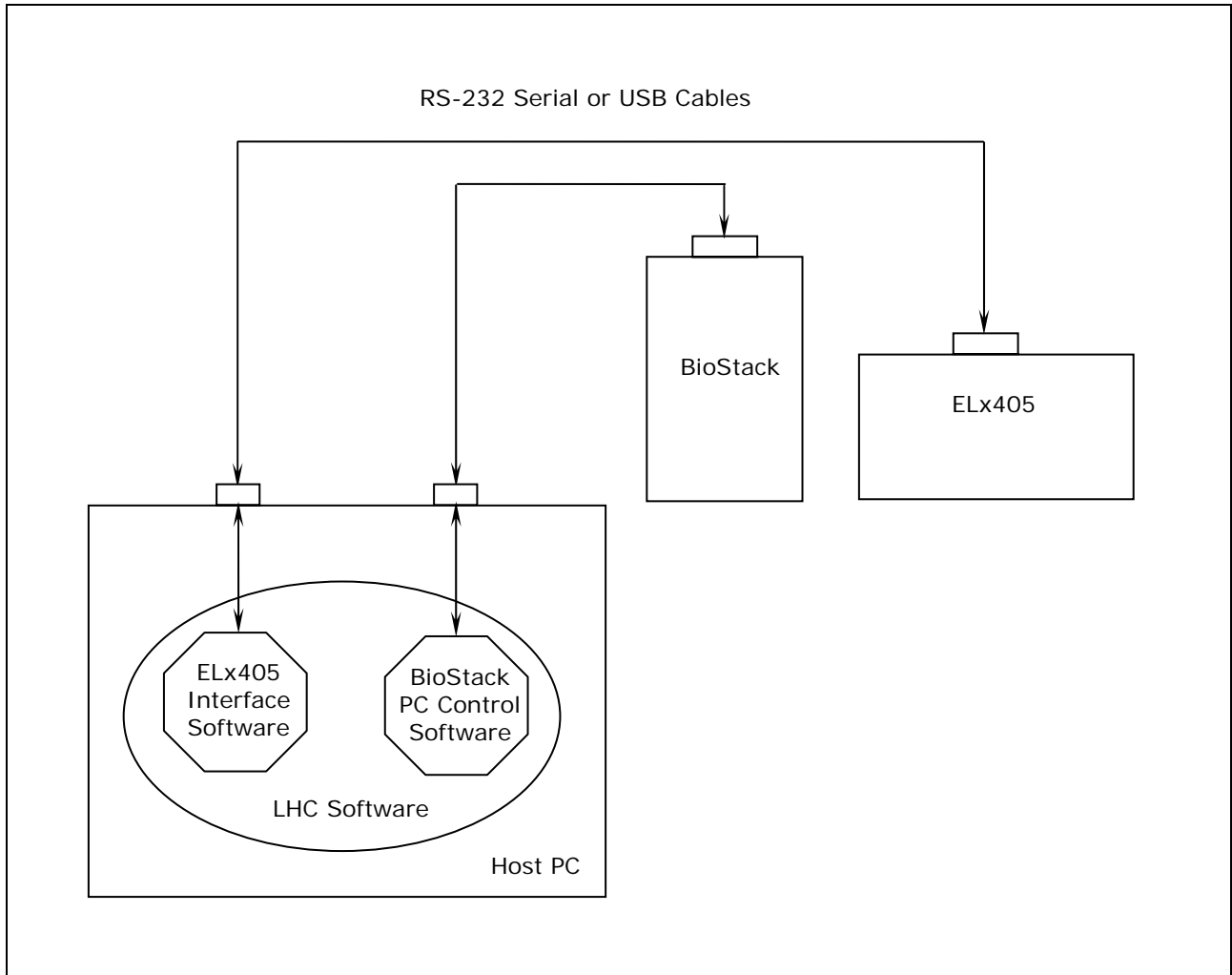
Figure 72: BioStack/LHC Architecture (with One BioStack and One Washer)

In *Figure 73* below, the LHC software uses

- two serial or USB ports to control instrument plate transfers on two BioStack instruments (via a component of the BioStack PC Control Software); and

- two serial ports to control all functions of the two ELx405 washers (via the ELx405 Interface Software).
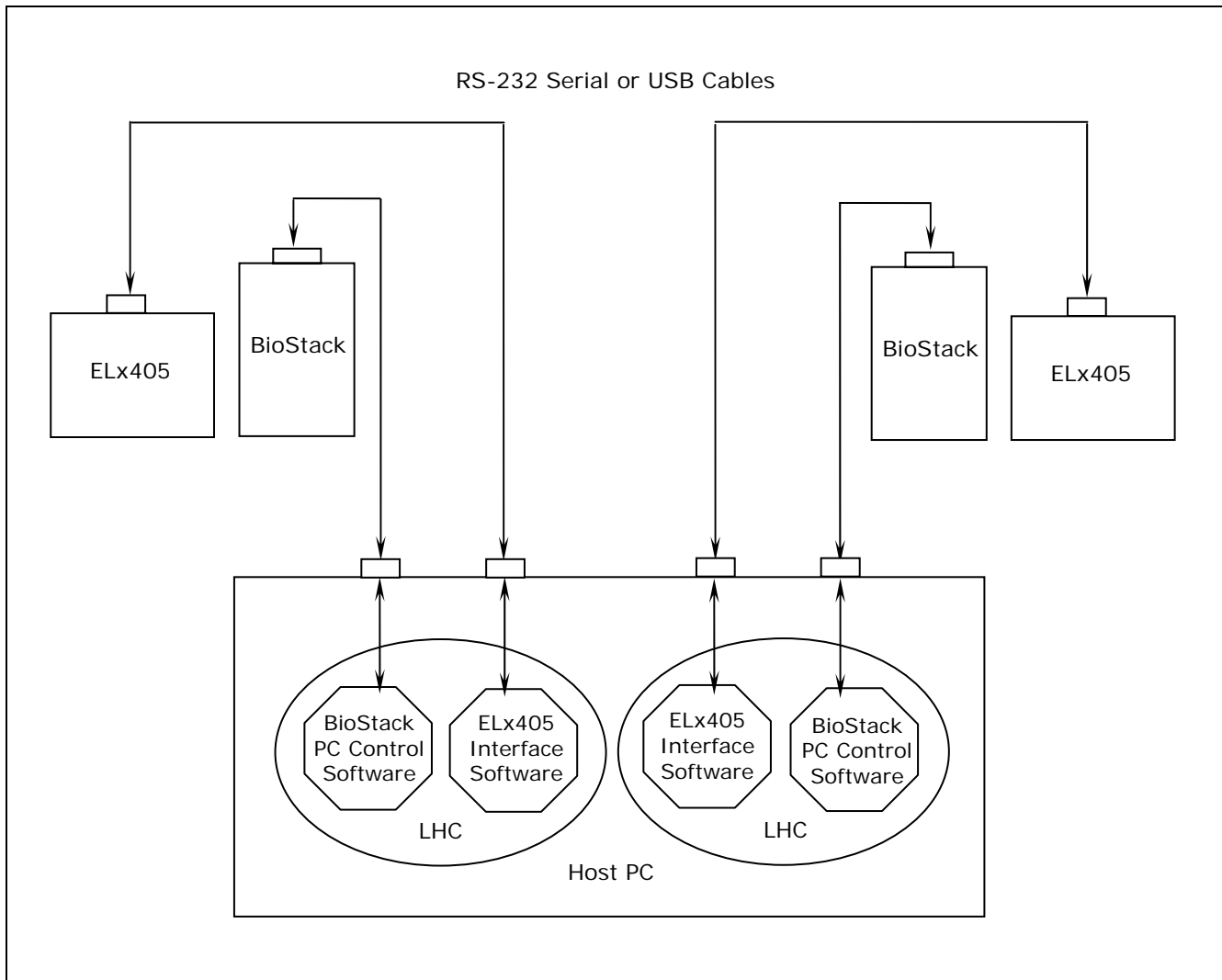
Figure 73: BioStack/LHC Architecture (with Two BioStacks and Two Washers)

Operate the BioStack with the NanoQuot

⚠	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
⚠	**Warning! Pressure Hazard!** Before operating the BioStack with the NanoQuot, ensure that the inlet pressure on the Dispenser's compressor does not exceed 30 psi and the pressure to the NanoQuot's supply bottle does not exceed 15 psi! Pressures outside the specified limit may cause the bottle to burst and result in possible injury.
ⓘ	**Important!** If you are using half-height plates and the BioStack is passing multiple plates at once from the input stack to the BioStack carrier, the instrument may need to be reconfigured to accommodate your microplates. Refer to *Appendix C*, *Reconfiguration of the BioStack*, for more information.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the NanoQuot, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the dispenser's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the NanoQuot.

> ❖ **BioStack rotational wrist model:** The wrist must be set at the **0°** interface position for operation with the NanoQuot.

The **NanoQuot Microplate Dispenser** uses RS-232 serial commands to control the BioStack, when the Dispenser is in **BioStack** mode (selected via the **Mode** rocker switch on the Dispenser).

Perform the following steps to power up the BioStack and NanoQuot:

1. Ensure that the BioStack is correctly positioned next to the NanoQuot and that the alignment hardware and serial cable are attached between the two instruments. See *Install the BioStack with the NanoQuot*, in *Chapter 3*, *Installation*.

2. Power up the BioStack **first** before turning on the NanoQuot: raise the claw/gripper manually before turning the BioStack on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. If the claw/gripper is not homed before the BioStack is powered up, the BioStack self-test will home the mechanism. Ensure that the claw/gripper has risen to its full height.

3. Power up the NanoQuot and allow the self-test to complete.

4. Once the BioStack has been turned on, its LED will blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

If the LED is off or flashing, an error has occurred. To display error codes, you will need to temporarily disconnect the BioStack from the NanoQuot, then connect the Dispenser to a host computer that has the NanoQuot™ PC Control Software installed. Refer to *Chapter 7*, *Troubleshooting and Error Codes* in this manual, for instructions for retrieving error codes that occur during operation of the BioStack with the NanoQuot.

Run Plates

1. Prime the NanoQuot™, if necessary, before running plates with the BioStack™. (Refer to the *Operation* chapter in the *NanoQuot Operator's Manual* for instructions for running a **Prime** program.)
2. Place the number of plates you wish to run into the BioStack's input stack.
3. Set the **Mode** rocker switch on the Dispenser to **BioStack**.
4. Set the program parameters using the NanoQuot's rocker switches, thumbwheels and keypad:
   - Select a Liquid Profile (only necessary when *changing* liquids):
     ➢ Use the Plate/Liquid Profile rocker switch to select the desired Liquid Profile (**LP1**, **LP2**, or **LP3**).
     ➢ Press and hold the **Cal** key until the **Alert** light repeatedly flashes. The **Alert** light will then verify the Liquid Profile selected by blinking once for **LP1**, twice for **LP2**, and three times for **LP3**. The carrier will then home.
   - Set a desired volume with the **Volume** thumbwheels.
   - Set the ending column number with the **Cols** thumbwheels.

     ❖ The starting column is pre-defined as column 1. Starting columns cannot be changed when operating the NanoQuot via the Dispenser's keypad.

   - Select the plate type with the plate type (**96**, **384**, **1536**) rocker switch.
5. Ensure that the pressure setting is not above 15 psi for the Dispenser's supply bottle. The generally recommended pressure setting is 12.5 psi; however, the actual pressure should correspond with that set when the liquid profile was defined.
6. Press the **Start/Run** key on the NanoQuot to begin processing. All plates in the input stack will be processed then stacked in the output stack.

Restack Plates

To restack plates that have been processed, press the **Cal/Restack** key on the Dispenser. The BioStack will move all of the plates that are stacked in the output stack back into the input stack.

Home the BioStack

To home the BioStack, press the **Home** key on the NanoQuot. The BioStack will home all axes.

Operate the BioStack with the MicroFlo Select (Instrument Control)

⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

ⓘ **Important!** Always power up the BioStack **first** before turning on the MicroFlo, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the dispenser's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the MicroFlo.

❖ For operation with the MicroFlo Select, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

The **MicroFlo Select Dispenser** uses RS-232 serial commands to control the BioStack and it displays all BioStack related information, including error codes.

❖ The one exception to this is when the BioStack is first powered up, and is not yet under the control of the dispenser. At this point, it will run a series of self-test homing operations. The LED on the BioStack will flash if there is a failure during this sequence. If a failure occurs, you may turn the MicroFlo on, and the dispenser will determine the status of the BioStack and display any errors (ensure that the serial cable is connected).

Perform the following steps to power up the MicroFlo and BioStack:

5. Ensure that the BioStack is correctly positioned next to the dispenser and that the alignment hardware and serial cable are attached. See *Install the BioStack with the MicroFlo Select* in *Chapter 3, Installation*.

6. Power up the BioStack **first** and allow its self-test to complete before turning on the MicroFlo: raise the claw/gripper manually before turning on the BioStack. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. If the claw/gripper is not homed before the BioStack is powered up, the BioStack self-test will home the mechanism. Ensure that the claw/gripper has risen to its full height.

7. Power up the MicroFlo. Before performing the self-test, the dispenser will attempt to establish communication with the BioStack. If communication is successful, and the BioStack has passed its own self-test, the dispenser will proceed with its self-test. If the BioStack has failed the self-test, or communication could not be established, then the MicroFlo self-test will fail, and the dispenser will "chirp" and display an error code. Refer to *Chapter 7, Troubleshooting and Error Codes*, for a listing of all error codes associated with the BioStack that are displayed on the MicroFlo.

8. Once the BioStack has been turned on, its LED will blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

If the LED is off or flashing, an error has occurred. If the MicroFlo is on, running, and properly connected, an error code may be displayed.

> ❖ By default, the MicroFlo is configured for operation as a stand-alone instrument. The dispenser must be configured for BioStack operation by using the BioStack's **Configuration (CONF)** utility. See *BioStack Utilities Screen* on the next page.

Startup Screens

> ❖ The screens listed below and on the following pages appear as menu selections in the bottom (second line) of the keypad LCD on the MicroFlo Select. To make a selection, press the SoftKey below the menu function. To move to a previous menu, press the **Previous Screen** key. Refer to your MicroFlo Select Operator's Manual for a detailed illustration of the keypad and description of its functions. The MicroFlo Operator's Manual contains instructions for running the dispenser as a stand-alone instrument, whereas this manual describes the BioStack specific operation.

When the MicroFlo is powered up, the following screen is displayed, and the carrier is homed:

```
        M i c r o F l o    S e l e c t

7 1 7 0 2 0 0    V e r s i o n    X . X X
```

The above screen is displayed while communication with the BioStack is being established and the self-test has begun. If no communication occurs after 30 seconds, a timeout will result and error **B-8306** is displayed. Press **ENTER** to display the Main Menu. If the self-test and homing sequence is successful, the MicroFlo Main Menu screen will appear:

```
( 9 6 )    C A S S ( 5 )    V O L : 0 0 1 0 u l

P R I M E    P U R G E    u P L A T E      - - >
```

> ❖ If the communication fails, the MicroFlo software will display its Main Menu, but will not perform its homing sequence. This is to prevent the MicroFlo carrier from colliding with the claw/gripper. Therefore, it is recommended that once the serial communication problems are corrected, that the MicroFlo be turned off/on so it can run its own homing sequence.

BioStack Utilities Screen

To access the BioStack Utilities screen and configure the MicroFlo Select for proper BioStack operation, follow the screens below:

- At the MicroFlo main menu screen, select **- - >** twice. The Dispenser Action Menu screen will appear:

```
D I S P E N S E R    A C T I O N    M E N U

D E F I N E    U T I L    S E T U P
```

- Select **SETUP**.

```
S E T U P    O P T I O N S :

C A L    C A S S    B I O S T A C K    - - >
```

- Select **BIOSTACK**.

```
B I O S T A C K    U T I L I T I E S :

C O N F    A L I G N    V E R I F Y
```

The BioStack Utilities screen will appear with the three utilities as described below:

1. **CONF:** The Configuration utility is used to describe the BioStack operating mode.

2. **ALIGN:** The instrument Alignment utility is used to align the claw/gripper of the BioStack to the carrier of the MicroFlo (i.e., the z-height alignment).

3. **VERIFY:** The Verify utility is used to verify the z-height alignment.

Configuration Utility

- Select **CONF** first. The Configuration screen provides the options of running the MicroFlo Select either as a stand-alone instrument or with the BioStack. The default mode is to run the MicroFlo by itself (i.e., in Manual mode).

```
O P E R A T I N G    M O D E :              M A N

M A N U A L      B I O S T A C K
```

MAN in the upper right corner indicates the instrument is set for manual operation. If **MANUAL** is selected, the BioStack Utilities screen will be re-displayed.

- Select **BIOSTACK** to indicate that the MicroFlo will be operated with the BioStack (the next time this screen is displayed, **BIO** will appear in the upper right corner). The Re-Stack screen will then appear:

```
R E – S T A C K ?                            Y E S

  Y E S            N O
```

The Re-Stack screen indicates whether plates residing in the output stack at the end of a run shall be automatically re-stacked into the input stack.

- Select **YES** or **NO**. After a brief pause, the BioStack Utilities screen will reappear.

Instrument Alignment Utility

> ❖ Ensure that the instrument alignment plate has already been mounted (per the instructions in *Chapter 3*, *Installation*) and the x and y positioning of the BioStack to the MicroFlo Select has been performed before proceeding with the z-height (vertical) alignment.

To align the z-height of the claw/gripper on the BioStack with the carrier of the MicroFlo, select **ALIGN** on the BioStack Utilities screen. The Alignment Utility screen will appear:

```
A L I G N M E N T    U T I L I T Y :

H O M E      C - P O S      S A V E
```

The instrument Alignment Utility has three selections:

1. **HOME:** This allows the operator to home all axes for either the BioStack or the MicroFlo.

2. **C-POS:** This allows the operator to "step" the claw/gripper down to the MicroFlo's carrier to find the proper interface position (the z-height).

3. **SAVE:** When the interface position has been found, the Save function is used to tell the BioStack to save the z-height for proper plate transferring.

Home Selection

◆ Select **HOME**. The following screen will appear with the two options of homing all axes for either the dispenser or for the BioStack. Select **BIOSTACK** to home all its axes, then press the **Previous Screen** key on the keypad to return to the Alignment Utility screen.

```
H O M E    A L L :

D I S P    B I O S T A C K
```

C-POS Selection

◆ Select **C-POS**. At this point, if the claw is not fully homed, it will rise to its full height (its home position) and the gripper will spread out to its full width. The Find Claw Interface Pos screen will then appear:

```
F I N D    C L A W    I N T E R F A C E    P O S :

  - / +         + 1           + 2 0          + 4 0 0
```

◆ The goal of this utility is to align the claw so that the gripper fingers are resting approximately 50-60 thousandths of an inch below the plate bottom or carrier surface. See *Figure 52* in *Chapter 3*, *Installation*, for an illustration of proper alignment of the claw/gripper with the plate.

◆ To help in this activity, place a dry microplate on the carrier of the MicroFlo. To avoid collision of the gripper with the plate or carrier on the dispenser, press the **+20** key first to see how far that goes, before pressing the **+400** key. Use the **+1/+20/+400** softkeys to *gradually* lower the claw/gripper to the precise location (i.e., .05″ or .06″ below the plate bottom or carrier surface).

❖ The C-POS measurement-to-inch ratios are: 1 = 0.001875″, 20 = 0.0375″, and 400 = 0.75″.

◆ If you have moved the gripper too far below the carrier, press the **-/+** key to change direction.

Save Selection

◆ If you are satisfied with the alignment, press the **Previous Screen** key to return to the Alignment Utility screen and select **SAVE**. At the following screen, press **YES**, and then the **ENTER** key.

```
O K    T O    S A V E    L O C A T I O N ?

  Y E S          N O
```

◆ At this point, the claw will home, the grippers will close, and the setting is saved in the flash memory of the BioStack. After a brief wait, the BioStack Utilities screen will appear.

Verify Utility

> ❖ Remove the microplate (if one was used) from the MicroFlo Select carrier before proceeding with the Verify sequence below, otherwise the plate that the claw gripper retrieves from the input stack to place on the carrier will collide with the plate in the carrier! Also, ensure that there is at least one plate in the input stack.

- At the BioStack Utilities screen, select **VERIFY**. The following screen will appear:

```
P L A C E     P L A T E     I N     I N - S T A C K

< E N T E R >     T O     C O N T I N U E
```

- Place a dry plate in the input stack.

- Press **ENTER**. The claw will pick up a plate drawn from the input stack and place it onto the MicroFlo carrier, with several delays during the place sequence. Watch to ensure that the gripper picks up the plate and gently sets it down in the carrier.

  ➢ **BioStack rotational wrist (with the wrist angle set at the 90° interface position):** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the MicroFlo's plate carrier, and then gently set it down in the carrier.

Two possible problems can occur at this point:

4. **The gripper fingers are too low**, so that after the gripper has released the plate, it will rise an inadequate distance before closing the gripper, thus catching the top of the plate. An error will be displayed in this instance.

5. **The gripper fingers are too high**, in which case the gripper will drop the plate a little further than it should, possibly causing fluid in the microwells to spill.

If no errors are displayed, the following screen will appear:

```
V E R I F Y     P L A T E     P L A C E M E N T

< E N T E R >     T O     C O N T I N U E
```

- Press **ENTER**. The claw will pick up the plate and place it on the BioStack carrier for transfer to the output stack. Ensure that the claw performs this correctly.

Rotational wrist model (with the wrist angle set at the 90° interface position): The claw/gripper will lower and pick up the plate from the MicroFlo plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier. The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

After a brief pause, the BioStack Utilities screen will appear. Press the **Main Menu** key twice to return to the MicroFlo main menu screen.

❖ Moving the BioStack, inserting a new MicroFlo Select, etc., can potentially change the alignment. If this is the case, you may have to repeat the x, y, and z alignment steps in *Chapter 3*, *Installation*.

Running Dispense Programs

The MicroFlo Select allows you the flexibility of running either a "Quick Dispense" or a Dispense protocol. To run Dispense programs, refer to your MicroFlo Select Operator's Manual for instructions.

The following section contains sample screens that will appear on the MicroFlo display during a Dispense program when the MicroFlo is operated with the BioStack.

Starting Dispense Programs

After you have selected (and, if applicable, created/edited) the Dispense program you wish to run, one of the following screens is displayed. Pressing the **START** or the **ENTER** key will initiate the program.

With the BioStack:

```
PLACE   PLATES   ON   BIOSTACK
PRESS   <START>   KEY
```

Without the BioStack:

```
INSERT   MICROPLATE
PRESS   <START>   KEY
```

In-Process Dispense Programs

While a Dispense program is being processed, you will see the following screen. You may press the **STOP** key, if necessary, to stop the execution of the program.

With or without the BioStack:

```
D I S P E N S I N G . .   C A S S :   X u L

P R E S S   < S T O P >   K E Y   T O   Q U I T
```

If you press the **STOP** key while a plate is being processed on the MicroFlo Select, the dispenser will pause the dispense operation and you will have the option to Cancel or Resume:

```


C A N C E L   R E S U M E
```

Cancel will discontinue the dispense operation and the dispenser will be homed. Resume will continue execution where the instrument left off and complete the dispense operation.

If you press the **STOP** key while the plate is being transferred to or from the BioStack, the Please Wait screen will be displayed until the BioStack has completed its action. At that point, the Cancel or Resume screen will be displayed:

```


P L E A S E   W A I T . . .
```

```


C A N C E L   R E S U M E
```

Cancel will discontinue the dispense operation, and the dispenser will be homed. Resume will continue execution where the instrument left off and complete the dispense operation.

Completing the Dispense Program

The following screen will be displayed, once the Dispense program is complete:

```
DISPENSE   PROG   COMPLETE
 NEW    REPEAT
```

Operate the BioStack with the MicroFlo Select (PC Control)

⚠️	**Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.
ⓘ	**Important!** Always power up the BioStack **first** before turning on the MicroFlo, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the dispenser's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the MicroFlo.

❖ For operation with the MicroFlo Select, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

❖ **Two BioStacks** with **two MicroFlo Select** dispensers: If you are operating two BioStacks with two Microflo dispensers, you will need to open the Liquid Handling Control™ (LHC) Software twice (one instance per BioStack/MicroFlo configuration).

BioTek's **Liquid Handling Control™ (LHC) Software** uses the **MicroFlo Select Interface Software** to control all functions of the MicroFlo Select, and uses a component of the **BioStack™ PC Control Software** to control all functionality of the BioStack.

Using LHC, the operator may configure the BioStack to interface with the microplate carrier on the MicroFlo.

Figure 74 on the next page shows the relationship between the PC and its software (i.e., LHC) and the BioStack and one MicroFlo.

Figure 75 on page 265 illustrates the same relationship with two BioStacks and two MicroFlo Select Dispensers.

For a complete description of the LHC Software and its operation, please refer to the *Liquid Handling Control Software Installation Guide* or the online Help system by selecting **Help > About Liquid Handling Control** from the software's main menu.

In *Figure 74* below, the LHC software uses

- one serial or USB port to control the BioStack instrument plate transfers (via a component of the BioStack PC Control Software); and

- one USB port to control all functionality of the MicroFlo Select dispenser (via the MicroFlo Select Interface Software).
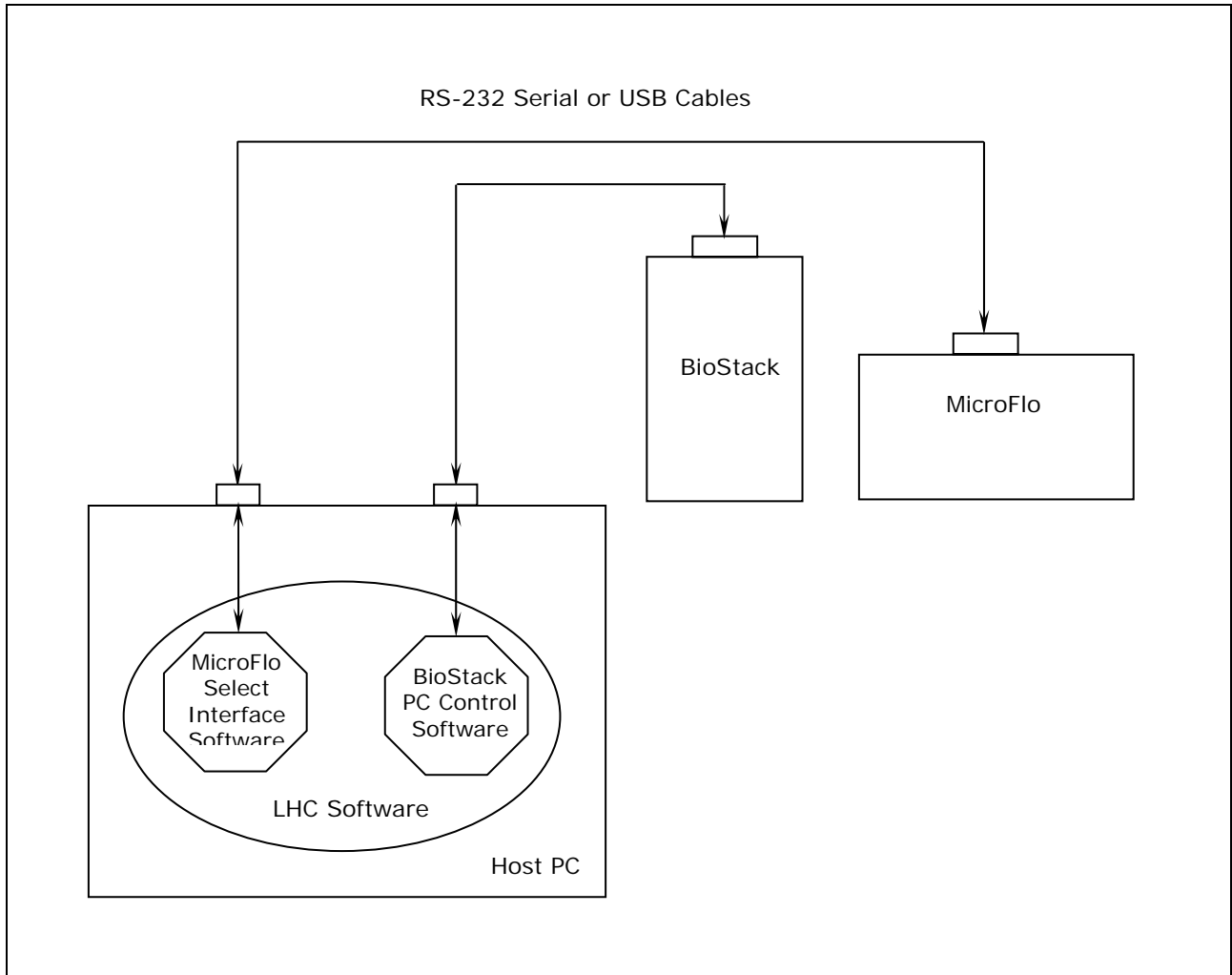
Figure 74: BioStack/LHC Architecture (with One BioStack and One MicroFlo Dispenser)

In *Figure 75* below, the LHC software uses

- two communication ports (serial or USB) to control instrument plate transfers on two BioStack instruments (via a component of the BioStack PC Control Software); and

- two communication ports (serial or USB) to control all functions of the two MicroFlo Select Dispensers (via the MicroFlo Select Interface Software).
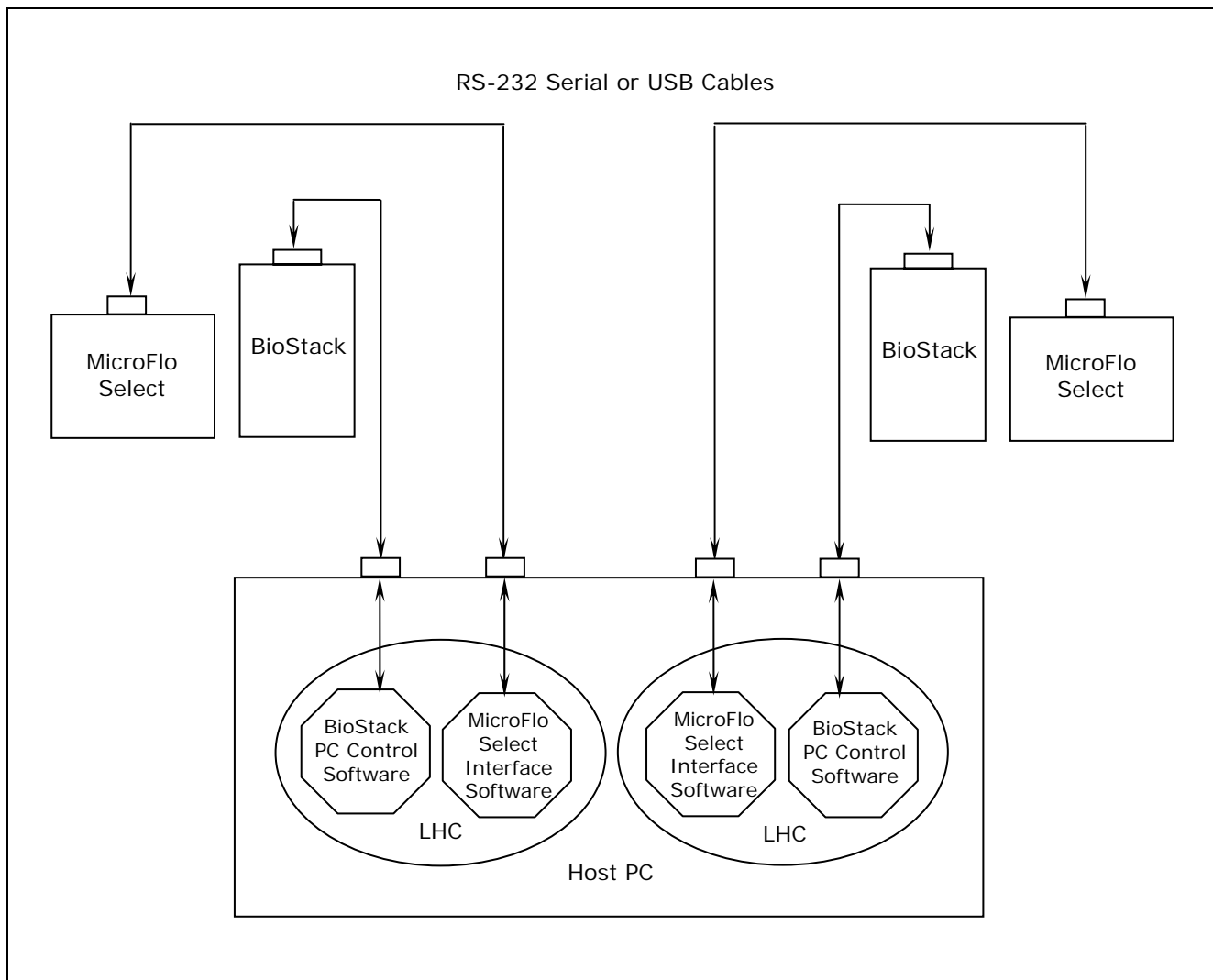
Figure 75: BioStack/LHC Architecture (with Two BioStacks and Two MicroFlo Select Dispensers)

Operate the BioStack with the EL406 (Instrument Control)

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

> ⓘ **Important!** Always power up the BioStack **first** before turning on the EL406, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the EL406 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the EL406.

> ❖ For operation with the EL406, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

The **EL406 Washer Dispenser** uses RS-232 serial commands to control the BioStack and it displays all BioStack related information, including error codes.

> ❖ The one exception to this is when the BioStack is first powered up, and is not yet under the control of the EL406. At this point, it will run a series of self-test homing operations. The LED on the BioStack will flash if there is a failure during this sequence. If a failure occurs, you may turn the EL406 on, and the instrument will determine the status of the BioStack and display any errors (ensure that the serial cable is connected).

Perform the following steps to power up the EL406 and BioStack:

1. Ensure that the BioStack is correctly positioned next to the EL406 and that the alignment hardware and serial cable are attached. See *Install the BioStack with the EL406* in *Chapter 3, Installation*.

2. Power up the BioStack **first** and allow its self-test to complete before turning on the EL406: raise the claw/gripper manually before turning on the BioStack. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up.If the claw/gripper is not homed before the BioStack is powered up, the BioStack self-test will home the mechanism. Ensure that the claw/gripper has risen to its full height.

3. Power up the EL406. Before performing the self-test, the washer dispenser will attempt to establish communication with the BioStack. If communication is successful, and the BioStack has passed its own self-test, the EL406 will proceed with its self-test. If the BioStack has failed the self-test, or communication could not be established, then the EL406 self-test will fail, and the washer dispenser will "chirp" and display an error code. Refer to *Chapter 7, Troubleshooting and Error Codes*, for a listing of all error codes associated with the BioStack that are displayed on the EL406.

4. Once the BioStack has been turned on, its LED will blink until the power-up and homing sequence is complete (approximately 20 seconds), then it will remain on.

If the LED is off or flashing, an error has occurred. If the EL406 is on, running, and properly connected, an error code may be displayed.

❖ By default, the EL406 is configured for operation as a stand-alone instrument. The dispenser must be configured for BioStack operation by using the BioStack's **Configuration (CONF)** utility. See *BioStack Utilities Screen* on the next page.

Startup Screens

❖ The screens listed below and on the following pages appear as menu selections in the bottom (second line) of the keypad LCD on the EL406. To make a selection, press the SoftKey below the menu function. To move to a previous menu, press the **Previous Screen** key. Refer to your EL406 Operator's Manual for a detailed illustration of the keypad and description of its functions. The EL406 Operator's Manual contains instructions for running the washer dispenser as a stand-alone instrument, whereas this manual describes the BioStack specific operation.

When the EL406 is powered up, the following screen is displayed, and the carrier is homed:

```
EL406   WASHER   DISPENSER
7180201     VERSION   X.XX
```

If the self-test and homing sequence is successful, the EL406 Main Menu screen will appear:

```
EL406                    CASS(#)
  RUN      WASH      DISP    -->
```

BioStack Setup Menu Screen

To access the BioStack Setup Menu screen and configure the EL406 for proper BioStack operation, follow the screens below:

- From the instrument's keypad, press the **Setup Menu** button. The Setup Menu screen will appear:

```
S E T U P    M E N U    -    P A G E 1

W A S H        P E R I    S Y R        - - >
```

- Select the arrow **- - >** once. The second Setup Menu screen will appear:

```
S E T U P    M E N U    -    P A G E 2

T E S T S    A D J S T    B I O S T K    - - >
```

- Select **BIOSTK**.

```
B I O S T A C K    S E T U P    M E N U

C O N F      A L I G N      V E R I F Y
```

The BioStack Setup Menu screen will appear with the three utilities as described below:

1. **CONF:** The Configuration utility is used to describe the BioStack operating mode.

2. **ALIGN:** The instrument Alignment utility is used to align the claw/gripper of the BioStack to the carrier of the EL406 (i.e., the z-height alignment).

3. **VERIFY:** The Verify utility is used to verify the z-height alignment.

Configuration Utility

- Select **CONF** first. The Configuration screen provides the options of running the EL406 either as a stand-alone instrument or with the BioStack. The default mode is to run the EL406 by itself (i.e., in Manual mode).

```
O P E R A T I N G    M O D E :        M A N

M A N U A L    B I O S T A C K
```

MAN in the upper right corner indicates the instrument is set for manual operation. If **MANUAL** is selected, the BioStack Setup Menu screen will be re-displayed.

- Select **BIOSTACK** to indicate that the EL406 will be operated with the BioStack (the next time this screen is displayed, **BIO** will appear in the upper right corner). The Re-Stack screen will then appear:

```
R E - S T A C K ?                              Y E S

  Y E S            N O
```

The Re-Stack screen indicates whether plates residing in the output stack at the end of a run shall be automatically re-stacked into the input stack.

- Select **YES** or **NO**. The BioStack Setup Menu screen will reappear.

Instrument Alignment Utility

> ❖ Ensure that the instrument alignment plate has already been mounted (per the instructions in *Chapter 3, Installation*) and the x and y positioning of the BioStack to the EL406 has been performed before proceeding with the z-height (vertical) alignment.

To align the z-height of the claw/gripper on the BioStack with the carrier of the EL406, select **ALIGN** on the BioStack Setup Menu screen. The Alignment Utility screen will appear:

```
A L I G N M E N T   U T I L I T Y :

H O M E      C - P O S     S A V E
```

The instrument Alignment Utility has three selections:

1. **HOME:** This allows the operator to home all axes for either the BioStack or the EL406.

2. **C-POS:** This allows the operator to "step" the claw/gripper down to the EL406's carrier to find the proper interface position (the z-height).

3. **SAVE:** When the interface position has been found, the Save function is used to tell the BioStack to save the z-height for proper plate transferring.

Home Selection

◆ Select **HOME**. The following screen will appear with the two options of homing all axes for either the dispenser or for the BioStack. Select **BIOSTACK** to home all its axes, then press the **Previous Screen** key on the keypad to return to the Alignment Utility screen.

```
H O M E     A L L :

D I S P      B I O S T A C K
```

C-POS Selection

◆ Select **C-POS**. At this point, if the claw is not fully homed, it will rise to its full height (its home position) and the gripper will spread out to its full width. The Find Claw Interface Pos screen will then appear:

```
F I N D    C L A W    I N T E R F A C E    P O S :

  - / +        + 1         + 2 0        + 4 0 0
```

◆ The goal of this utility is to align the claw so that the gripper fingers are resting approximately 50-60 thousandths of an inch below the plate bottom or carrier surface. See *Figure 59* in *Chapter 3*, *Installation*, for an illustration of proper alignment of the claw/gripper with the plate.

◆ To help in this activity, place a dry microplate on the carrier of the EL406. To avoid collision of the gripper with the plate or carrier on the EL406, press the **+20** key first to see how far that goes, before pressing the **+400** key. Use the **+1**/**+20**/**+400** softkeys to *gradually* lower the claw/gripper to the precise location (i.e., .05″ or .06″ below the plate bottom or carrier surface).

❖ The C-POS measurement-to-inch ratios are: 1 = 0.001875″, 20 = 0.0375″, and 400 = 0.75″.

◆ If you have moved the gripper too far below the carrier, press the **-/+** key to change direction.

Save Selection

◆ If you are satisfied with the alignment, press the **Previous Screen** key to return to the Alignment Utility screen and select **SAVE**. At the following screen, press **YES**.

```
O K    T O    S A V E    L O C A T I O N ?

  Y E S          N O
```

◆ At this point, the claw will home, the grippers will close, and the setting is saved in the flash memory of the BioStack. After a brief wait, the BioStack Setup Menu screen will appear.

Verify Utility

❖ Remove the microplate (if one was used) from the EL406 carrier before proceeding with the Verify sequence below, otherwise the plate that the claw gripper retrieves from the input stack to place on the carrier will collide with the plate in the carrier! Also, ensure that there is at least one plate in the input stack.

• At the BioStack Setup Menu screen, select **VERIFY**. The following screen will appear:

```
P L A C E    P L A T E    I N    I N - S T A C K

< E N T E R >    T O    C O N T I N U E
```

• Place a dry plate in the input stack.

• Press **ENTER**. The claw will pick up a plate drawn from the input stack and place it onto the EL406 carrier, with several delays during the place sequence. Watch to ensure that the gripper picks up the plate and gently sets it down in the carrier.

  ➢ **BioStack rotational wrist (with the wrist angle set at the 90° interface position):** The wrist will rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will pick up the plate from the BioStack plate carrier. The wrist will then rotate the claw/gripper from the 0° interface to the 90° interface. The gripper will lower the plate toward the EL406's plate carrier, and then gently set it down in the carrier.

Two possible problems can occur at this point:

1. **The gripper fingers are too low**, so that after the gripper has released the plate, it will rise an inadequate distance before closing the gripper, thus catching the top of the plate. An error will be displayed in this instance.

2. **The gripper fingers are too high**, in which case the gripper will drop the plate a little further than it should, possibly causing fluid in the microwells to spill.

If no errors are displayed, the following screen will appear:

```
V E R I F Y    P L A T E    P L A C E M E N T

< E N T E R >    T O    C O N T I N U E
```

- Press **ENTER**. The claw will pick up the plate and place it on the BioStack carrier for transfer to the output stack. Ensure that the claw performs this correctly.

  Rotational wrist model (with the wrist angle set at the 90° interface position): The claw/gripper will lower and pick up the plate from the EL406 plate carrier. The wrist will then rotate the claw/gripper from the 90° interface to the 0° interface, and the gripper will place the plate on the BioStack's plate carrier. The carrier will transfer the plate to the output stack. The plate will then be transferred by the carrier from the output stack to the input stack.

  After a brief pause, the BioStack Setup Menu screen will appear. Press the **Main Menu** key to return to the EL406 main menu screen.

❖ Moving the BioStack, inserting a new EL406, etc., can potentially change the alignment. If this is the case, you may have to repeat the x, y, and z alignment steps in *Chapter 3*, *Installation*.

Running Programs

> (i) **Important!** If you wish to run EL406 **pre-defined maintenance protocols**, you must change the BioStack mode on the EL406 keypad to "Manual." At the **Setup Menu**, select:
> - →
> - **BIOSTK**
> - **CONF**
> - **MANUAL**
>
> Refer to the *Maintenance* chapter in the *EL406 Operator's Manual* for more information about running EL406 maintenance programs.

The following section contains sample screens that will appear on the EL406 display during a program when the EL406 is operated with the BioStack. To run programs, refer to your EL406 Operator's Manual for instructions.

Starting Programs

After you have selected (and, if applicable, created/edited) the program you wish to run, one of the following screens is displayed. Pressing the **START** or the **ENTER** key will initiate the program.

With the BioStack:

```
PLACE    PLATES    ON    BIOSTACK
PRESS    <START>    KEY
```

Without the BioStack:

```
INSERT    MICROPLATE
PRESS    <START>    KEY
```

Operate the BioStack with the EL406 (PC Control)

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

> ⓘ **Important!** Always power up the BioStack first before turning on the EL406, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper assembly manually above the EL406 carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the EL406.

❖ For operation with the EL406, the **BioStack rotational wrist model** may be used with the wrist set at the default **90°** interface position or it may be changed to the **0°** interface position.

❖ **Two BioStacks** with **two EL406** Washer Dispensers: If you are operating two BioStacks with two EL406 Washer Dispensers, you will need to open the Liquid Handling Control™ (LHC) Software twice (one instance per BioStack/ EL406 configuration).

BioTek's **Liquid Handling Control (LHC) Software** uses the **EL406 Interface Software** to control all functions of the EL406, and uses a component of the **BioStack PC Control Software** to control all functionality of the BioStack.

Using LHC, the operator may configure the BioStack to interface with the microplate carrier on the EL406.

Figure 76 on the next page shows the relationship between the PC and its software (i.e., LHC) and the BioStack and an EL406.

Figure 77 on page 277 illustrates the same relationship with two BioStacks and two EL406 Washer Dispensers.

For a complete description of the LHC Software and its operation, please refer to the *Liquid Handling Control Software Installation Guide* or the online Help system by selecting **Help > About Liquid Handling Control** from the software's main menu.

In *Figure 76* below, the LHC software uses

- one communication port (serial or USB) to control the BioStack instrument plate transfers (via a component of the BioStack PC Control Software); and

- one communication port (serial or USB) to control all functionality of the EL406 Washer Dispenser (via the EL406 Interface Software).
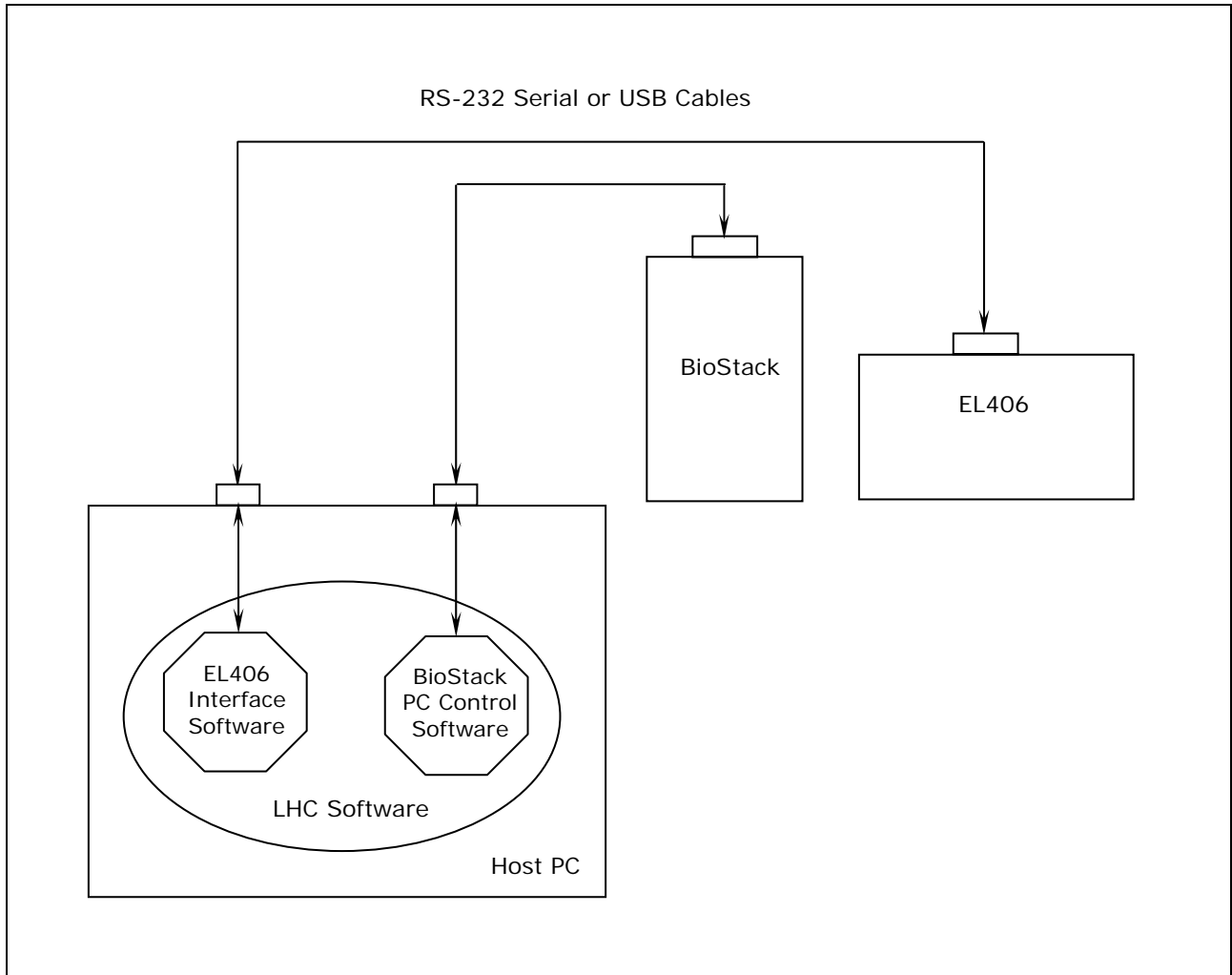
Figure 76: BioStack/LHC Architecture (with One BioStack and One Washer Dispenser)

In *Figure 77* below, the LHC software uses

- two communication ports (serial or USB) to control instrument plate transfers on two BioStack instruments (via a component of the BioStack PC Control Software); and

- two communication ports (serial or USB) to control all functions of the two EL406 Washer Dispensers (via the EL406 Interface Software).
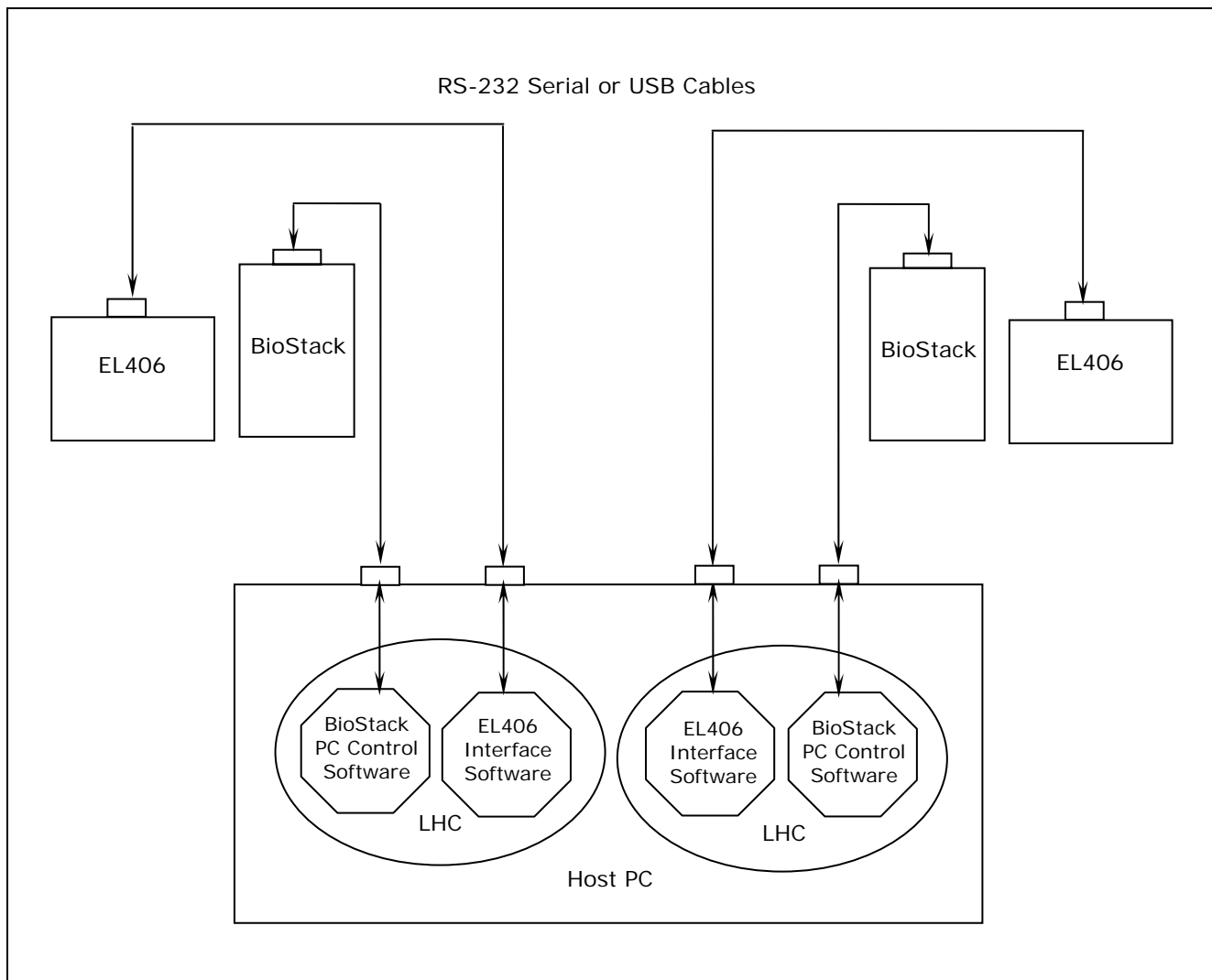
Figure 77: BioStack/LHC Architecture (with Two BioStacks and Two Washer Dispensers)

Chapter 5

Instrument Qualification

This chapter discusses the tasks and tests necessary for qualification of the instrument on an ongoing basis.

Overview

Equipment qualification of the BioStack involves two activities:

- Qualification of installation and setup
- Qualification of routine capability

This chapter refers to these activities as **Installation Qualification (IQ)** and **Operational Qualification (OQ)**.

> ❖ An **instrument qualification package (PN 7310530)** for the BioStack is available for purchase. The package contains thorough procedures for performing Installation/Operational Qualification (IQ/OQ) and Preventive Maintenance (PM). Extensive Checklists and Logbooks are included for recording results. Contact your local dealer for more information.

Qualification tasks and tests for the BioStack include installing the BioStack with the interfacing instrument, and running the **System Self-Test**, **Checksum Test**, **Instrument Alignment Utility**, and **Verify Test**. If the optional barcode scanner has been installed, a test is performed to verify proper installation.

- The **System Self-Test** verifies the BioStack's system components, such as the input and output stack lifters, carrier, claw/gripper, rotational wrist (BioStack model PN BIOSTACK2WR).

- The **Checksum Test** verifies the basecode software of the BioStack or interfacing instrument against internal checksum values to ensure that no corruption has occurred.

  If the Checksum Test is run manually, the version numbers and checksum for the basecode are displayed

  - ➢ **on the computer** during operation of the BioStack with the PowerWave/XS/XS2, Synergy HT/Synergy 2/Synergy 4, Synergy Mx, Precision/XS, NanoQuot, ELx405, MicroFlo Select, or EL406; or

  - ➢ **on the display** of the MicroFill, ELx405, MicroFlo Select, or EL406. (The assay configuration software information will also be displayed on the ELx405.)

> ❖ **BioStack with NanoQuot:** To obtain basecode software information for the BioStack and NanoQuot, you will need a host computer that has the BioStack PC Control Software and NanoQuot PC Control Software installed, respectively. **Note:** The NanoQuot basecode software information includes a part number and version only; there is no Checksum.

> ❖ **BioStack with ELx405, MicroFlo Select, or EL406:** The BioStack and ELx405, MicroFlo, or EL406 may be instrument controlled via the keypads on these instruments, or PC controlled via the Liquid Handling Control™ (LHC) Software.

- An **Instrument Alignment Utility** is provided in the

  - ➤ **BioStack PC Control Software** for aligning the claw/gripper with the height of the carrier on the PowerWave/XS/XS2 and Synergy HT/Synergy 2/Synergy 4/Synergy Mx readers and NanoQuot Dispenser

  - ➤ **Precision Power Software** for aligning the claw/gripper with the height of the selected supply station on the Precision/XS

  - ➤ **Liquid Handling Control (LHC) Software** for aligning the claw/gripper with the height of the carrier on the ELx405, MicroFlo Select, or EL406 during PC control of the BioStack and these instruments

  - ➤ **basecode software** of the MicroFill, ELx405, MicroFlo, or EL406 for aligning the claw/gripper with the height of the carrier on these instruments

- The **Verify Test** confirms whether or not the BioStack's claw/gripper has been properly aligned with the interfacing instrument's carrier or supply station (Precision/XS).

Qualification Schedule

The following schedule defines BioTek's recommended intervals for qualification task and tests. The risk factors associated with your tests may require that the Operational procedures be performed more or less frequently than shown below.

	IQ	OQ
TASKS/TESTS	**Initially**	**Every 3 months**
Install/set up BioStack and its components	✓	
Rotational wrist: Change wrist angle from 90° to 0° (mandatory for operation with the readers, Precision instruments, MicroFill or NanoQuot; optional for operation with the ELx405, MicroFlo, or EL406)	✓	
Attach alignment hardware	✓	
Run Self-Test	✓	✓
Align BioStack with interfacing instrument	✓	
Install microplate stacks	✓	
Instrument Control: Connect BioStack to interfacing instrument	✓	
PC Control: Connect host computer to BioStack and interfacing instrument, install software, and test communication	✓	
Run Checksum Tests	✓	✓
Run Instrument Alignment Utility	✓	If Verify Test fails
Run Verify Test	✓	✓
Readers and Precision instruments only:		
(Optional) Install BioStack barcode scanner and run Scanner Test	✓	✓

❖ The Instrument Alignment Utility and Verify Test should also be performed whenever the instruments are **moved** from one location to another within the laboratory.

Installation Qualification (IQ)

Installation Qualification confirms that the BioStack 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 BioStack, and performing the Self-Test, Checksum Test, Instrument Alignment Utility, and Verify Test as described in *Chapter 3*, *Installation*. If applicable, the IQ procedure also consists of setting up the BioStack's optional barcode scanner (Readers and Precision instruments only), and performing the Scanner Test as described in *Appendix B*, *BioStack Barcode Scanner*.

- When performing the Checksum Test, record the software versions in the Software Data Sheets at the end of this chapter.

- The IQ procedure should be performed *initially* (before the BioStack is used for the first time). Some of the IQ steps should be performed if the instruments are moved from one location to another within the laboratory.

- The successful completion of the IQ procedure verifies that the instruments and their components are installed correctly.

Operational Qualification (OQ)

Operational Qualification confirms that the BioStack's onboard software is operating properly and verifies the claw/gripper-to-instrument carrier alignment (even if the instruments have not been moved).

- The recommended OQ procedure consists of performing the Self-Test, Checksum Test, and Verify Test, as described in *Chapter 3*, *Installation*. The Instrument Alignment Utility should be run if the Verify Test fails. If applicable, the OQ procedure also consists of performing the Scanner Test as described in *Appendix B*, *BioStack Barcode Scanner*.

- The OQ procedure should be performed *every three months*. It should also be performed after any major repair or upgrade to the hardware or software.

- The successful completion of the OQ procedure confirms that the BioStack is operating correctly.

IQ Procedure/Checklist

Date: _____ BioStack Model/Serial number: _____

All instruments:

☐ Unpack and inspect the BioStack

☐ Check required and optional components

☐ Select an appropriate location

☐ Remove the shipping hardware

☐ Connect the power supply

☐ **Rotational wrist model:** Change wrist angle to 90° or 0° interface (as appropriate)

PowerWave/XS/XS2 or Synergy HT/Synergy 2/Synergy 4/Synergy Mx

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the reader

☐ Install the microplate stacks

☐ Connect the host PC to the BioStack and reader

☐ Install software on the host PC/test communication (run Checksum Tests)

☐ Align the claw/gripper with the reader's carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

☐ (Optional) Install the BioStack barcode scanner and perform the Scanner Test

Precision™/XS:

❖ If you are operating **two BioStacks** with **one Precision instrument**, use two checklists.

☐ Attach the aligning posts, aligning caps, and roller extensions for the supply platform

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Connect the host PC to the BioStack and Precision/XS

☐ Install software on the host PC/test communication (run Checksum Tests)/configure Precision Power

☐ Align the BioStack with the Precision/XS

☐ Install the microplate stacks

☐ Align the claw/gripper with Precision supply station (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

☐ (Optional) Install the BioStack barcode scanner and perform the Scanner Test

IQ Procedure/Checklist, *Cont'd*

MicroFill or ELx405 - *Instrument Control Using the Dispenser/Washer Keypad*:

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the MicroFill or ELx405

☐ Install the microplate stacks

☐ Connect the BioStack to the MicroFill or ELx405

☐ Run the Checksum Test for the MicroFill or ELx405

☐ Configure the MicroFill or ELx405 for the BioStack

☐ Test communication (run the Checksum Test for the BioStack)

☐ Align the claw/gripper with the MicroFill or ELx405 plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

ELx405 - *PC Control Using the Liquid Handling Control (LHC) Software*:

❖ If you are operating **two BioStacks** with **two ELx405 washers** via PC control, use two checklists.

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the ELx405

☐ Install the microplate stacks

☐ Connect the host PC to the BioStack and ELx405

☐ Install software on the host PC and, if necessary, upgrade basecode software on the ELx405

☐ Test Communication

☐ Run the Checksum Test for the ELx405

☐ Configure the ELx405 for the BioStack

☐ Run the Checksum Test for the BioStack

☐ Align the claw/gripper with the ELx405 plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

IQ Procedure/Checklist, *Cont'd*

NanoQuot:

☐ Attach the aligning posts

☐ Seat the instruments in the aligning plates

☐ Fixed wrist and rotational wrist models: Set dipswitch in Stacker for NanoQuot

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the NanoQuot

☐ Install the microplate stacks

☐ Connect the host PC to the BioStack

☐ Install the BioStack PC Control Software

☐ Run the Checksum Test for the BioStack

☐ Align the claw/gripper with the NanoQuot plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

☐ Connect the host PC to the NanoQuot

☐ Install the NanoQuot PC Control Software

☐ Obtain software information for the NanoQuot

☐ Connect the BioStack to the NanoQuot

☐ Test communication

IQ Procedure/Checklist, *Cont'd*

MicroFlo Select *- Instrument Control Using the Dispenser Keypad*:

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the MicroFlo

☐ Install the microplate stacks

☐ Connect the BioStack to the MicroFlo

☐ Run the Checksum Test for the MicroFlo

☐ Configure the MicroFlo for the BioStack

☐ Test communication (run the Checksum Test for the BioStack)

☐ Align the claw/gripper with the MicroFlo plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

MicroFlo Select *- PC Control Using the Liquid Handling Control (LHC) Software*:

❖ If you are operating **two BioStacks** with **two MicroFlo Select dispensers** via PC control, use two checklists.

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the MicroFlo

☐ Install the microplate stacks

☐ Connect the host PC to the BioStack and MicroFlo

☐ Install software on the host PC

☐ Test Communication

☐ Run the Checksum Test for the MicroFlo

☐ Configure the MicroFlo for the BioStack

☐ Run the Checksum Test for the BioStack

☐ Align the claw/gripper with the MicroFlo plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

IQ Procedure/Checklist, *Cont'd*

EL406 - *Instrument Control Using the Washer Dispenser Keypad*:

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the EL406

☐ Install the microplate stacks

☐ Connect the BioStack to the EL406

☐ Run the Checksum Test for the EL406

☐ Configure the EL406 for the BioStack

☐ Test communication (run the Checksum Test for the BioStack)

☐ Align the claw/gripper with the EL406 plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

EL406 - *PC Control Using the Liquid Handling Control (LHC) Software*:

❖ If you are operating **two BioStacks** with **two EL406 washer dispensers**, use two checklists.

☐ Attach the aligning posts and aligning caps

☐ Seat the instruments in the aligning plates

☐ Turn on the BioStack and run a Self-Test

☐ Align the BioStack with the EL406

☐ Install the microplate stacks

☐ Connect the host PC to the BioStack and EL406

☐ Install software on the host PC

☐ Test Communication

☐ Run the Checksum Test for the EL406

☐ Run the Checksum Test for the BioStack

☐ Align the claw/gripper with the EL406 plate carrier (run Instrument Alignment Utility)

☐ Verify the alignment by running a Verify Test

OQ Procedure/Checklist

Date: _____   BioStack Model/Serial number: _____

☐ Perform the Self-Test
☐ Perform the Checksum Test
☐ Perform the Verify Test

If the Verify Test fails:

☐ Run the Instrument Alignment Utility
☐ Repeat the Verify Test

Readers and Precision instruments only:

☐ (Optional) Perform the Scanner Test

Software Data Sheets

Record BioStack and interfacing instrument software/serial number information in the appropriate data sheet:

- PowerWave/XS/XS2, page 290

- Synergy HT/2/4/Mx, page 291

- Precision/XS, page 292

- MicroFill, page 293

- ELx405, pages 294 and 295

- NanoQuot, page 296

- MicroFlo Select, pages 297 and 298

- EL406, pages 299 and 300

> ❖ KC4 Software does not support the PowerWave XS2, Synergy 2, Synergy 4, or Synergy Mx readers.
>
> ❖ If you are operating two BioStacks with one Precision instrument, two ELx405 washers, two MicroFlo Select dispensers, or two EL406 washer dispensers, use one data sheet per BioStack/interfacing instrument configuration.

PowerWave/XS/XS2 Software Data Sheet

PowerWave model: _____ **BioStack model:**_____	
Gen5 Software **Serial #:** _____	
Installation Version:	
Build Version:	
Reader Control Version:	
(Optional) Diagnostics Version:	
KC4 Software **Serial #:** _____	
Version:	Revision:
PowerWave/XS/XS2 **Serial #:** _____	
Basecode Software Part Number:	
Version:	
Checksum:	
BioStack PC Control Software **Serial #:** _____	
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack **Serial #:** _____	
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

Synergy HT/2/4/Mx Software Data Sheet

Synergy model: _____	
BioStack model:_____	

Gen5 Software	**Serial #: _____**
Installation Version:	
Build Version:	
Reader Control Version:	
(Optional) Diagnostics Version:	

KC4 Software	**Serial #: _____**
Version:	Revision:

Synergy HT/2/4/Mx	**Serial #: _____**
Basecode Software Part Number:	
Version:	
Checksum:	

BioStack PC Control Software	**Serial #: _____**
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	

BioStack	**Serial #: _____**
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

Precision/XS Software Data Sheet

Precision model: _____ **BioStack model:**_____	
BioStack PC Control Software	**Serial #:** _____
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack	**Serial #:** _____
Basecode Software Version:	
Interface Definition Version:	
Checksum:	
Precision Power Software	**Serial #:** _____
Installation CD Version:	
PrecisionPower#.exe Version:	
BTIAutoDispenserActiveX Version:	
Precision/Precision XS	**Serial #:** _____
Basecode Software Part Number:	
Function Version:	
Structure Version:	

MicroFill Software Data Sheet

BioStack model:_____	
MicroFill	**Serial #: _____**
Basecode Software Part Number:	
Version:	
Checksum:	
BioStack	**Serial #: _____**
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

ELx405 Software Data Sheet

(Instrument Control)

ELx405 model: _____	
BioStack model: _____	
ELx405	**Serial #:** _____
Basecode Software Part Number:	
Version:	
Checksum:	
Assay Configuration Part Number:	
Version:	
BioStack	**Serial #:** _____
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

ELx405 Software Data Sheet

(PC Control)

ELx405 model: _____	
BioStack model: _____	
LHC Software	**Serial #:** _____
Build Version:	
Installation Version:	
ELx405 Interface Software	
Interface Software Version:	
Interface Functional Version:	
ELx405	**Serial #:** _____
Basecode SW Version:	
Basecode SW Checksum:	
BioStack PC Control Software	**Serial #:** _____
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack	**Serial #:** _____
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

NanoQuot Software Data Sheet

BioStack model:_____	
BioStack PC Control Software	**Serial #: _____**
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack	**Serial #: _____**
Basecode Software Version:	
Interface Definition Version:	
Checksum:	
NanoQuot PC Control Software	**Serial #: _____**
Version:	
BTINanoQuotClassLibrary Version:	
BTICommonMessagesClassLibrary Version:	
BTICommunicationsClassLibrary Version:	
NanoQuot	**Serial #: _____**
Basecode Software Part Number:	
Version:	

MicroFlo Select Software Data Sheet
(Instrument Control)

BioStack model:_____	
MicroFlo Select **Serial #:**_____	
Basecode Software Part Number:	
Version:	
Checksums:	UI:
	MC:
BioStack **Serial #: _____**	
Basecode Software Version:	
Interface Definition Version:	
STKR Checksum:	

MicroFlo Select Software Data Sheet
(PC Control)

BioStack model:_____	
LHC Software **Serial #:** _____	
Build Version:	
Installation Version:	
MicroFlo Select Interface Software	
Interface Software Version:	
Data Version:	
MicroFlo Select **Serial #:** _____	
Basecode Software Version:	
Data Version	
Checksums:	UI:
	MC:
BioStack PC Control Software **Serial #:** _____	
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack **Serial #:** _____	
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

EL406 Software Data Sheet
(Instrument Control)

BioStack model:_____	
EL406	**Serial #:_____**
Basecode Software Part Number:	
Version:	
Checksums:	UI:
	MC:
BioStack	**Serial #: _____**
Basecode Software Version:	
Interface Definition Version:	
BIOSTK Checksum:	

EL406 Software Data Sheet
(PC Control)

BioStack model:_____	
LHC Software	**Serial #: _____**
Build Version:	
Installation Version:	
EL406 Interface Software	**Serial #:_____**
Installation Version:	
Build Version:	
Data Version:	
EL406	**Serial #: _____**
Basecode Software Version:	
Data Version	
Checksums:	UI:
	MC:
BioStack PC Control Software	**Serial #: _____**
Installation CD Version:	
StackerContainer.exe Version:	
BTIAutoStacker ActiveX Version:	
BioStack	**Serial #: _____**
Basecode Software Version:	
Interface Definition Version:	
Checksum:	

Chapter 6

Preventive Maintenance

This chapter describes how to clean, decontaminate, and maintain the BioStack.

Overview

Preventive Maintenance (PM) represents a set of procedures that should be performed regularly to maintain equipment in top condition. For example, during normal operation, debris and dust from plate wear can accumulate on the microplate stacks, carrier surface and other plate transport components.

Preventive maintenance of the BioStack is the responsibility of the user and is required for continuous problem-free operation. Adherence to the *Recommended Maintenance Schedule* below reduces problems caused by dust and debris, maximizes running time, and extends the life of the BioStack.

This chapter includes instructions for the following:

- Routine Cleaning Procedure
- Decontamination
- Cleaning and Lubrication of the Linear Ways

Recommended Maintenance Schedule

❖ If you are operating two BioStacks with one Precision instrument, two ELx405 washers, two MicroFlo Select dispensers, or two EL406 washer dispensers, perform the maintenance tasks below for each BioStack.

The following chart recommends preventative maintenance tasks, the frequency with which each task should be performed, and where to find more information.

MAINTENANCE				
TASK	**Daily/ as needed**	**Monthly**	**Every 6 months**	**Before Storage or Shipment**
Clean plate carrier, stacks, and all exposed surfaces, page 305	✓			✓
Decontaminate the instrument, and, if applicable, the barcode scanner, page 306		✓		✓
Clean and lubricate linear ways, page 308			✓	✓

Required Materials

- Mild detergent

- Deionized or distilled water

- Clean, lint-free cotton cloths or towels

- 70% isopropyl alcohol (or ethanol)

- Safety glasses

- Surgical mask

- Protective gloves

- Lab coat

- Biohazard trash bags

- 125 mL beakers

- Cotton swabs or paper towels

- Toothbrush

- BioTek grease kit (PN 7110017)

Optional barcode scanner:

- Lens cleaning agent

- Tissue or soft cloth

Warnings & Precautions

Please read the following before performing any maintenance procedures.

ⓘ	**Important!** Do not immerse the instrument, spray it with liquid, or use a "wet" cloth. Do not allow water or other cleaning solution to run into the interior of the instrument. If this happens, contact BioTek's Technical Assistance Center.
⚠	**Warning! Internal Voltage.** Turn off and disconnect the BioStack from its power supply for all cleaning and decontamination operations.
⚠	**Warning!** 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.
⚠	**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.
⚠	**Caution: BioStack Barcode scanner.** The BioStack's optional barcode scanner is housed in a protective cover. Do not allow cleaning solution to seep into the narrow opening in the cover, where it may come into contact with the scanner. Be very careful not to scratch or damage the mirror during cleaning!

Routine Cleaning Procedure

> (i) **Important!** Turn off the BioStack and disconnect it from the power supply for the cleaning procedure.

Purpose

A daily cleaning regimen is recommended to keep the instrument free of debris and dust from plate wear. Exposed surfaces may be cleaned (not decontaminated) with a cloth moistened (not soaked) with water or water and a mild detergent.

Procedure

Perform these steps *daily* and *before storage or shipment* to clean the carrier surface and microplate stacks, all other exposed surfaces, and, if applicable, the barcode scanner:

1. Turn off and disconnect the BioStack.

2. Remove the microplate stacks for cleaning: locate the stack locks on the side of the BioStack, open the locks, and lift the stacks out.

3. Moisten a clean cotton cloth with water, or with water and mild detergent. Do **not** soak the cloth.

4. Wipe the inside and outside of the stacks and the plate-stacking pedestal (if used).

5. Wipe the carrier surface, lifts, claw/gripper, rotational wrist (rotational wrist model only), all other exposed surfaces of the BioStack, and the aligning hardware (aligning plates, posts, etc.).

6. **If the optional barcode scanner is installed:**

    > ❖ **Do not allow solution to come into contact with the scanner:** Ensure that cleaning solution does not seep into the narrow opening in the cover that protects the scanner.
    >
    > ❖ Lens cleaning solution and lens tissue may also be used to clean the mirror. **Be very careful not to scratch or damage the mirror!**

    - Gently wipe the external surface of the scanner assembly, including the scanner's protective cover, mounting bracket, cable, and mirror.

7. If detergent (or lens cleaning solution on the scanner) was used, wipe all surfaces with a cloth moistened with water.

8. Use a clean, dry cloth to dry all wet surfaces.

9. Reinstall the stacks and then close the stack locks.

Decontamination

Purpose

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.

> (i) **Important!** BioTek 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 BioTek nor the CDC assumes any liability for the adequacy of these solutions and methods. Each laboratory must ensure that decontamination procedures are adequate for the Biohazard(s) they handle.

> (i) **Important!** Turn off the BioStack and disconnect it from the power supply for the decontamination procedure.

Procedure

Perform these steps *monthly* and *before storage or shipment*:

1. Turn off the BioStack and disconnect it from the power supply.

2. Remove the microplate stacks: locate the stack locks on the side of the BioStack, open the locks, and then lift the stacks out.

3. Moisten a clean cotton cloth with 70% alcohol. Do **not** soak the cloth.

4. Wipe the inside and outside of the stacks and plate-stacking pedestal (if used).

5. Wipe the carrier surface, lifts, claw/gripper, rotational wrist (rotational wrist model only), all other exposed surfaces of the BioStack, and the aligning hardware (aligning plates, posts, etc.).

6. **If the optional barcode scanner is installed:**

❖ **Do not allow solution to come into contact with the scanner:** Ensure that decontamination solution does not seep into the narrow opening in the cover that protects the scanner.

❖ Lens cleaning solution and lens tissue may also be used to clean the mirror. **Be very careful not to scratch or damage the mirror!**

- Gently wipe the external surface of the scanner assembly, including the scanner's protective cover, mounting bracket, cable, and mirror.

7. Wait 20 minutes. Moisten a cloth with deionized or distilled water and wipe all surfaces of the instrument and barcode scanner that have been cleaned with the alcohol.

8. Use a clean, dry cloth to dry all wet surfaces.

9. Discard the used gloves and cloths using a Biohazard trash bag and an approved Biohazard container.

10. Reinstall the stacks and then close the stack locks.

Cleaning and Lubrication of the Linear Ways

Purpose

Periodic cleaning and lubrication of the linear ways and screws on the two stack lifters and the plate carrier is necessary to ensure optimum performance of these components during all plate transfer operations.

A **grease kit** (PN 7110017) has been included in your BioStack package contents. Use a clean towel, rubber gloves, a toothbrush and cotton swabs or paper towels (moistened with alcohol to assist the process), and the lubricant contained in the kit when performing the following procedure. Refer to *Figure 78* on the next page for an illustration of the BioStack's linear ways.

Procedure

Perform these steps *every six months* and *before storage or shipment*:

1. Turn off the BioStack and disconnect it from the power supply.

2. Gently turn the instrument onto its side so that the bottom of the BioStack is facing you. If the **optional barcode scanner** is installed, turn the BioStack on the side without the scanner.

3. Using cotton swabs or paper towels, remove old, possibly contaminated grease from the three linear ways (see *Figure 78*).

4. Allow these parts to dry completely.

5. Apply a small amount of new lubricant to all surfaces of the linear ways and screws, spreading thin layers and working the grease into the surfaces with a toothbrush.

   ❖ Ensure that you lubricate the sides of the linear ways, since ball bearings travel on these surfaces.

6. Return the BioStack to its upright position and connect it to the power supply.

7. Turn on the BioStack and run a **Verify Test** to confirm that moving the BioStack did not compromise its alignment with the interfacing instrument. Perform the appropriate set of instructions in *Chapter 3*, *Installation*.

   • If the Verify Test passes, the BioStack is ready to resume normal operation.

   • If the Verify Test fails, you may need to re-align the claw/gripper with the plate carrier. Perform the appropriate set of instructions in *Chapter 3* and run the Verify Test again. If the test still fails, contact BioTek's Technical Assistance Center.

Linear ways – stack lifters

Linear way - carrier
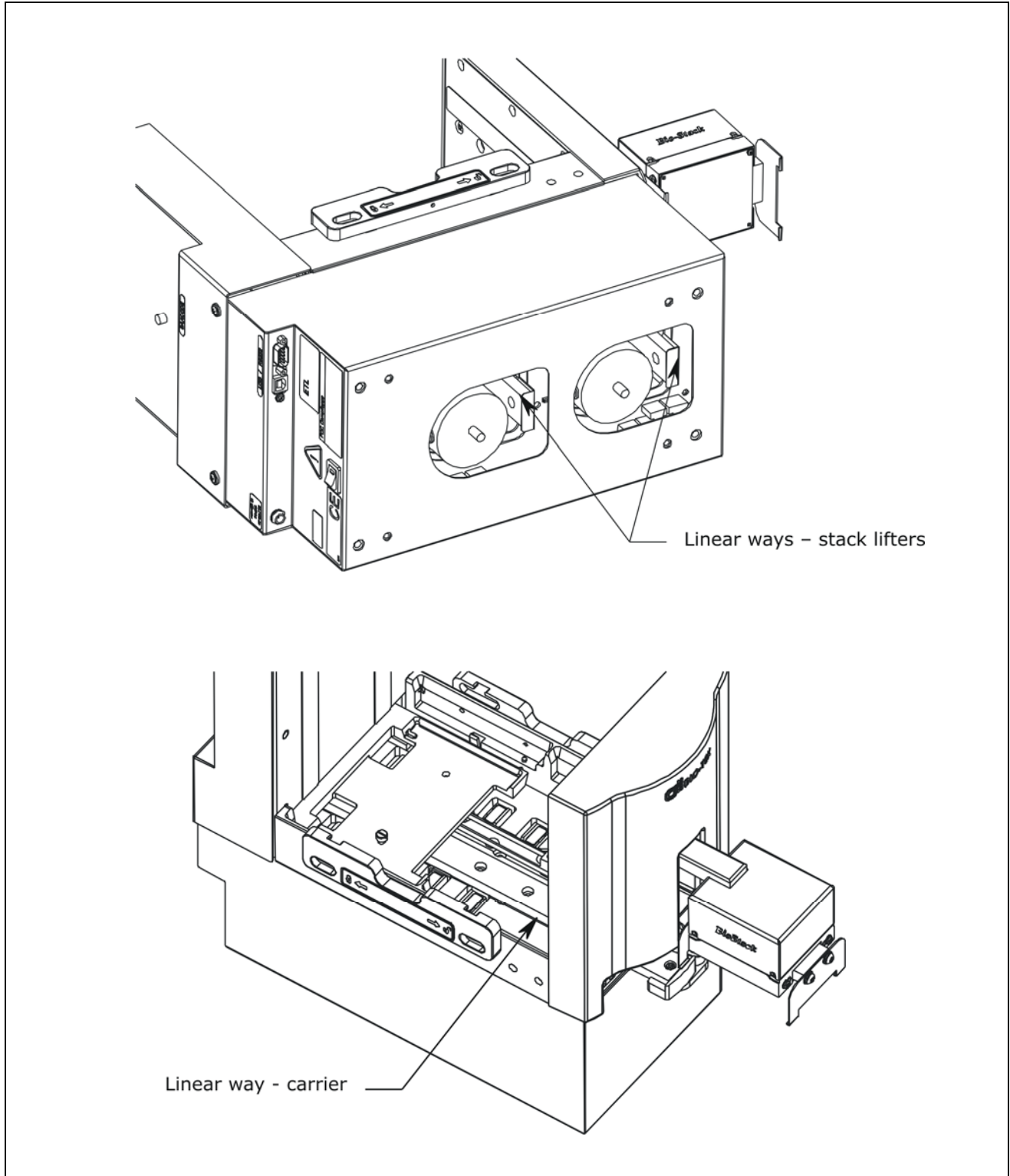
Figure 78: Locations of the Linear Ways on the BioStack

❖ The fixed wrist model (PN BIOSTACK2) is shown.

Chapter 7

Troubleshooting and Error Codes

This chapter contains instructions for obtaining software versions and describes the error codes that may appear in the BioStack PC Control Software, Precision Power Software, NanoQuot PC Control Software, Liquid Handling Control Software, or on the MicroFill, ELx405, or MicroFlo Select instrument display, during operation with the BioStack.

Overview

> **Warning! Crush/Pinch Hazard.** Moving parts during operation of the instrument can present crushing or pinching hazards. Always **turn off and disconnect the instrument** from the power supply for all hands-on troubleshooting procedures.

Every effort has been made to ensure that the BioStack Microplate Stacker is extremely reliable and easy to use. If you encounter problems during operation of the BioStack, however, you will need to **obtain software versions** for the BioStack and interfacing instrument, and **note any error codes** that may be displayed.

> ❖ For your convenience, **Software Data Sheets** are provided in *Chapter 5* for recording software versions for the BioStack and interfacing instruments.

This information will be needed by BioTek's **Technical Assistance Center** (**TAC**) for troubleshooting any problems.

- **For instructions on obtaining software versions**, refer to the following sections:
  - ➢ PowerWave or Synergy readers: page 313
  - ➢ Precision/XS: page 314
  - ➢ MicroFill: page 315
  - ➢ ELx405 (Instrument Control): page 316
  - ➢ ELx405 (PC Control): page 317
  - ➢ NanoQuot: page 318
  - ➢ MicroFlo (Instrument Control): page 319
  - ➢ MicroFlo (PC Control): page 320
  - ➢ EL406 (Instrument Control): page 321
  - ➢ EL406 (PC Control): page 322

- **For descriptions of the different error code types** that may be displayed during BioStack operation, refer to the following sections:
  - ➢ PowerWave or Synergy readers: page 323
  - ➢ Precision/XS: page 325
  - ➢ MicroFill or ELx405 (Instrument Control): page 327
  - ➢ ELx405 (PC Control): page 328
  - ➢ NanoQuot: page 330
  - ➢ MicroFlo (Instrument Control): page 332
  - ➢ MicroFlo (PC Control): page 333
  - ➢ EL406 (Instrument Control): page 335
  - ➢ EL406 (PC Control): page 336
- **For lists of the error codes,** refer to *Error Code Tables* on page 338 and to the error code tables that follow.

Obtain Software Versions for PowerWave or Synergy Readers

BioStack Software

Perform the following steps to obtain software versions for the BioStack PC Control Software and for the BioStack onboard software:

1. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**.

2. Record the BioStack PC Control Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX (the Gen5 or KC4 Software version and revision number are also available on this screen).

3. Click **Get On-board values now**.

4. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum.

Gen5 Software and Reader Software

Perform the following steps to obtain software versions for Gen5 Software and for the reader's basecode version and checksum:

1. At Gen5's main screen, select **Help > Gen5**.

2. Record Gen5's Installation Version, Build Version, Reader Control Version, and Diagnostics Version (if the Gen5 Diagnostic Utility was installed).

3. Return to the main menu and select **System > Reader Control**, then click the appropriate reader to open the 'Reader Control' dialog.

4. At the Reader Control dialog, select the **Information** tab to display the reader's basecode software information.

5. Record the reader's basecode part number, version number, and checksum.

KC4 Software and Reader Software

Perform the following steps to obtain software versions for KC4 Software and for the reader's basecode version and checksum:

1. At KC4's main screen, select **About > KC4**.

2. Record KC4's version and revision numbers.

3. Return to the main menu and select **System > Reader Control**.

4. Record the reader's basecode part number, version number, and checksum.

> ❖ KC4 does not support the PowerWave XS2 or Synergy 2/ Synergy 4/Synergy Mx readers.

Obtain Software Versions for Precision/XS

BioStack Software

Perform the following steps to obtain software versions for the BioStack PC Control Software and for the BioStack onboard software:

1. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**.

2. Record the BioStack PC Control Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX.

3. Click **Get On-board values now**.

4. Record the BioStack onboard software versions for the basecode software, interface definition, and checksum.

Precision Power Software and Precision/XS Software

Perform the following steps to obtain software versions for Precision Power Software and for the Precision/XS:

1. At Precision Power's main screen, select **Help > About Precision Power**.

2. Record the Precision Power software versions for the Installation CD, Precision Power#.exe and BTIAutoDispenserActiveX. Click **OK** to return to the main screen.

3. Select **Instrument > Precision Series Configuration > Test Comm**, then select **ActiveX/Instrument Versions > Instrument Version**.

4. Record the Precision instrument's basecode software part number, Function Version, and Structure Version.

Obtain Software Versions for MicroFill

Perform the following steps to obtain software versions for the MicroFill and BioStack.

1. At the MicroFill's Main Menu select **UTIL > TESTS > CHKSUM**.

2. Record the MicroFill basecode software part number, version number, and checksum, as shown in the **first screen**:

    ```
    X X X X X X   V E R S I O N   X . X X
    C O D E   C H E C K S U M :   ( X X X X )
    ```

3. The **second screen** will display the following information, which does not need to be recorded:

    ```
     D E F A U L T   C O N F I G   D A T A
    ```

4. If the MicroFill is not running with the BioStack, the **SELECT UTILITY** screen will then appear. If the MicroFill **is** running with the BioStack, wait while the **third screen** is displayed:

    ```
    P L E A S E   W A I T . . .
    ```

    ❖ If the MicroFill cannot communicate with the BioStack, an error message will be displayed.

5. Record the BioStack basecode software version, interface definition version, and checksum, as shown in the **fourth screen**:

    ```
    B I O - S T A C K :   X . X X ,   X . X X
    C O D E   C H E C K S U M :   ( X X X X )
    ```

Obtain Software Versions for ELx405 (Instrument Control)

Perform the following steps to obtain software versions for the ELx405 and BioStack.

1. At the ELx405's Main Menu, select **UTIL > TESTS > CHKSUM**.

2. Record the ELx405 basecode software part number, version number, and checksum, as shown in the **first screen**:

```
X X X X X X   V E R S I O N   X . X X
C O D E   C H E C K S U M :   ( X X X X )
```

3. Record the assay configuration software part number and version number, as shown in the **second screen**:

```
 X X X X X X   V E R S I O N   X . X X
```

4. If the ELx405 is not running with the BioStack, the **SELECT UTILITY** screen will then appear. If the ELx405 **is** running with the BioStack, wait while the **third screen** is displayed:

```
P L E A S E   W A I T . . .
```

> ❖ If the instrument cannot communicate with the BioStack™, an
> error message will be displayed.

5. Record the BioStack basecode software version, interface definition version, and checksum, as shown in the **fourth screen**:

```
B I O - S T A C K :   X . X X ,   X . X X
C O D E   C H E C K S U M :   ( X X X X )
```

Obtain Software Versions for ELx405 (PC Control)

BioStack Software

Perform the following steps to obtain software versions for the BioStack™ PC Control Software and for the BioStack™ onboard software:

1. Make sure that the BioStack is powered on, and the cable is connected between the PC and the BioStack.

2. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**.

3. Record the BioStack PC Control Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX.

4. Click **Get On-board values now**.

5. Record the BioStack basecode software version, interface definition version, and checksum.

Liquid Handling Control (LHC) Software and ELx405 Software

Perform the following steps to obtain software versions for the LHC Software and for the ELx405:

1. Make sure that the washer is powered on, and the cable is connected between the PC and the washer.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities**. The 'ELx405 Washer Utilities' screen will open.

6. Record the ELx405 Interface Software Version, Interface Functional Version, Basecode SW Version, and Basecode SW Checksum.

Obtain Software Versions for NanoQuot

> (i) In order to obtain software information for the BioStack and NanoQuot, you will need the **BioStack PC Control Software** and **NanoQuot PC Control Software** installed on a host computer.

BioStack Software

> ❖ For the following instructions, ensure that the BioStack has been disconnected from the NanoQuot, and is connected to the host computer via one of the two serial cables that are included with the BioStack: a 9-pin to 9-pin male/male cable or 9-pin to 25-pin male/female cable.

Perform the following steps to obtain software versions for the BioStack PC Control Software and for the BioStack onboard software:

1. Open the BioStack PC Control Software. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**.

2. Record the BioStack PC Control Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX.

3. Click **Get On-board values now**.

4. Record the BioStack basecode software version, interface definition version, and checksum.

NanoQuot Software

> ❖ For the following instructions, ensure that the NanoQuot has been disconnected from the BioStack, and is connected to the host computer via the 9-pin to 9-pin female/male serial cable that is included with the NanoQuot.

Perform the following steps to obtain software versions for the NanoQuot PC Control Software and for the NanoQuot onboard software:

1. Open the NanoQuot PC Control Software. From the software's main screen, select **Help > About NanoQuot PC Software**.

2. Record the NanoQuot PC Control version as well as the three **Component Software** versions, then click **OK** to close the dialog.

3. Record the NanoQuot's **Instrument Software** (basecode part number and version) and **Serial No**. **Note:** The NanoQuot basecode software does not include a checksum.

Obtain Software Versions for MicroFlo Select (Instrument Control)

Perform the following steps to obtain software versions for the MicroFlo Select Dispenser and BioStack.

1. At the dispenser's Main Menu, select **- - >** twice to get to the Dispenser Action Menu.

2. Select **UTIL > CHKSUM**. The Version Checksum Info screen will appear:

```
VERSION  CHECKSUM   INFO:

 UI        MC        STKR
```

3. Select **UI** to display basecode and checksum information for the User Interface processor:

```
7170200    VERSION   X.XX

CODE  CHECKSUM:       ( XXXX )
```

Record the basecode software version (X.XX) and checksum (XXXX) information. Press the **ENTER** or **Previous Screen** key to return to the Version Checksum Info screen.

4. Select **MC** to display basecode and checksum information for the Motor Controller processor:

```
7170200    VERSION   X.XX

CODE  CHECKSUM:       ( XXXX )
```

Record the basecode software version (X.XX) and checksum (XXXX) information. Press the **ENTER** or **Previous Screen** key to return to the Version Checksum Info screen.

5. Select **STKR** to display basecode and checksum information for the BioStack:

❖ If the instrument cannot communicate with the BioStack™, an error message will be displayed.

```
BIO-STACK:   X.XX,   X.XX

CODE  CHECKSUM:       ( XXXX )
```

Record the BioStack basecode software version (first X.XX), interface definition version (second X.XX), and checksum (XXXX).

Obtain Software Versions for MicroFlo Select (PC Control)

BioStack Software

Perform the following steps to obtain software versions for the BioStack PC Control Software and for the BioStack onboard software:

1. Make sure that the BioStack is powered on, and the cable is connected between the PC and the BioStack.

2. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**.

3. Record the BioStack PC Control Software versions for the Installation CD, StackerContainer.exe, and BTIAutoStackerActiveX.

4. Click **Get On-board values now**.

5. Record the BioStack basecode software version, interface definition version, and checksum.

Liquid Handling Control (LHC) Software and MicroFlo Select Software

Perform the following steps to obtain software versions for the LHC Software and for the MicroFlo:

1. Make sure that the dispenser is powered on, the dispenser UI is at the main menu, and the cable is connected between the PC and the dispenser.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities**. The 'MicroFlo Select Utilities' screen will open.

6. Record the MicroFlo Select Interface Software Version and Data Version, and the MicroFlo Select Basecode Software Version, Data Version, and Checksum.

Obtain Software Versions for EL406 (Instrument Control)

Perform the following steps to obtain software versions for the EL406 Washer Dispenser and BioStack.

1.   From the instrument's keypad, press the **Setup Menu** button.

2.   At the Setup Menu, select the arrow - - > once.

3.   Select **TESTS** > **CHKSUM**.

4.   The Version Checksum Info screen will appear:

```
VERSION  CHECKSUM  INFO:

  UI      MC      BIOSTK
```

5.   Select **UI** to display basecode and checksum information for the User Interface processor:

```
7180201    VERSION  X.XX

CODE  CHECKSUM:      (XXXX)
```

Record the basecode software version (X.XX) and checksum (XXXX) information.

6.   Select **MC** to display basecode and checksum information for the Motor Controller processor:

```
7180201    VERSION  X.XX

CODE  CHECKSUM:      (XXXX)
```

Record the basecode software version (X.XX) and checksum (XXXX) information.

7.   Select **BIOSTK** to display basecode and checksum information for the BioStack:

❖   If the instrument cannot communicate with the BioStack, an error message will be displayed.

```
BIOSTACK:    X.XX,   X.XX

CODE  CHECKSUM:      (XXXX)
```

Record the BioStack basecode software version (first X.XX), interface definition version (second X.XX), and checksum (XXXX).

Obtain Software Versions for EL406 (PC Control)

BioStack Software

Perform the following steps to obtain software versions for the BioStack PC Control Software and for the BioStack onboard software:

1. Make sure that the BioStack is powered on, and the cable is connected between the PC and the BioStack.

2. From the top menu in the BioStack PC Control Software, select **Help > About BioStack**. The 'About BioStack Software' dialog will open.

3. Record the BioStack PC Control Software versions.

4. Click **Get On-board values now**.

5. Record the BioStack basecode software versions.

Liquid Handling Control (LHC) Software and EL406 Software

Perform the following steps to obtain software versions for the LHC Software and for the EL406:

1. Make sure that the EL406 is powered on and the serial or USB cable is connected from the PC to the EL406.

2. At the LHC Software's main screen, select **Help > About Liquid Handling Control**.

3. The 'Help About' dialog will open. Record the Liquid Handling Control Build Version and Installation Version.

4. Click **Close** to return to the main screen.

5. Select **Tools > Instrument Utilities**. The 'EL406 Utilities' screen will open.

6. Click **Retrieve All**.

7. Record the EL406 Interface Software Version and Data Version, the EL406 Basecode Software Version and Data Version, and the Checksums for the UI Processor and the MC Processor.

> ❖ **UI and MC Processors Checksums:** The **UI** (User Interface) Processor communicates with the computer (during PC control of the EL406), keyboard, display, and BioStack. The **MC** (Motor Controller) processor is responsible for driving the motors on the instruments and working directly with the hardware.

Errors During Operation of BioStack with PowerWave or Synergy Readers

The **BioStack PC Control Software** controls all functionality of the BioStack and uses Gen5 or KC4 Software in OLE mode to control the readers. All errors are displayed in the BioStack PC Control Software on the controlling PC.

- Errors generated when the BioStack PC Control Software is driving the BioStack include **serial communication errors** and **BioStack instrument errors**.

- Errors generated when the BioStack PC Control Software is driving the reader via Gen5 include **Gen5 function call errors** and **reader instrument errors**.

- Errors generated when the BioStack PC Control Software is driving the reader via KC4 include **KC4 function call errors** and **reader instrument errors**.

The following sections contain brief descriptions of each error code type.

Serial Communication Errors

Errors detected by the portion of the BioStack PC Control Software responsible for performing the serial communications with the BioStack are displayed as negative value error codes, for example: **-1**, **-401**. Serial communication errors include errors found when sending messages to the instrument, and receiving messages back from the instrument, as well as timer-based errors when waiting for a response.

- Refer to *Table 1* on page 338 for a list of serial communication errors.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during the self-test or plate transfers are displayed as 4-digit hexadecimal codes, along with some textual description.

> ❖ These error codes are prefixed with a **B-** to distinguish them from similar hexadecimal reader instrument error codes. For example, **B-0200** indicates a **0x0200** error generated by the BioStack, rather than by a reader.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 for lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

Gen5 Function Call Errors

Errors detected by Gen5 Software following calls to Gen5 functions by the BioStack PC Control Software are displayed in a negative value format, for example: **-8, -100**, **-2010.** These errors can occur when Gen5 is requested to open an invalid Gen5 experiment file, during serial communication between Gen5 and the reader, or during post-reading activities performed by Gen5, including data reduction and results exporting.

- Refer to *Table 6* on page 351 for a list of Gen5 function call errors.

KC4 Function Call Errors

Errors detected by KC4 Software following calls to KC4 functions by the BioStack PC Control Software are displayed as negative value 4-digit codes. These errors can occur when KC4 is requested to open an invalid KC4 protocol file, during serial communication between KC4 and the reader, or during post-reading activities performed by KC4, including data reduction and results exporting.

- Refer to *Table 7* on page 367 for a list of KC4 function call errors.

❖ KC4 does not support the PowerWave XS2 or Synergy 2/ Synergy 4/Synergy™ Mx readers.

Reader Instrument Errors

Errors detected by the reader's basecode software and transmitted back to Gen5/KC4 (and, ultimately, to the BioStack PC Control Software), which are related to operation of the reader's hardware are displayed as 4-digit hexadecimal error codes, along with some textual description. These errors can occur during self-test, plate reading, drawer opening/closing, barcode scanning, etc.

❖ As noted in the previous section on *BioStack Instrument Errors*, in order to distinguish reader error instrument error codes from BioStack instrument error codes, the BioStack™ codes are prefixed with a **B-**.

- Refer to the *PowerWave™/XS/XS2* or *Synergy™ HT/Synergy™ 2/ Synergy™ 4/Synergy™ Mx Operator's Manuals* for lists of reader error codes.

Errors During Operation of BioStack with Precision/XS

Precision Power Software controls all functionality of the Precision/XS instruments, and uses a component of the BioStack PC Control Software to control the BioStack. All errors are displayed in Precision Power on the controlling PC.

- Errors generated when Precision Power is driving the BioStack, via a component of the BioStack PC Control Software, include **serial communication errors** and **BioStack instrument errors**.

- Errors generated when Precision Power Software is driving the Precision instrument include **program validation errors** and **Precision/XS instrument errors**.

Serial Communication Errors

Errors detected by the BioStack PC Control Software during serial communication between the host PC and the BioStack are displayed as text messages (in English). Serial communication errors include errors found when sending messages to the instrument, and receiving messages back from the instrument, as well as timer-based errors when waiting for a response.

> ❖ Occasionally an error code may appear without the text; these codes are always in a negative value format, for example: **-3**, -**401**.

- Refer to *Table 1* on page 338 for a list of serial communication errors (refer also to the *Precision/XS Operator's Manuals*).

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as text messages (in English).

> ❖ Occasionally an error code may appear without the text; these codes are displayed in four-digit format, for example: **1000**, and are sometimes preceded by **0x**, as in **0x1000**.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors (refer also to the *Precision/XS Operator's Manuals*).

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 contain lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

Program Validation Errors

Program validation errors detected by the Precision/XS basecode software and transmitted back to Precision Power Software, occur when a fluid-transfer program fails to meet internally programmed validation criteria. These errors are displayed as four-digit codes beginning with the number **4**, and may include additional information, such as program name and command, loop and run numbers.

- Refer to the ***Precision Power User's Guide*** or help system for lists of program validation errors.

Precision/XS Instrument Errors

Errors detected by the Precision/XS basecode software and transmitted back to Precision Power Software, which are related to operation of the Precision instrument's hardware are displayed as 4-digit hexadecimal error codes. These errors can occur during self-test, dispense or aspiration, pick-up of tips, etc.

- Refer to the ***Precision/XS Operator's Manuals*** for lists of Precision instrument run time errors.

Errors During Operation of BioStack with MicroFill or ELx405 (Instrument Control)

Error codes that appear on the displays of the MicroFill Dispenser and ELx405 Washer during instrument control of the BioStack can include

- Communication errors between the BioStack and the MicroFill or ELx405
- BioStack instrument errors
- MicroFill or ELx405 instrument errors

Communication Errors

Communication errors during instrument control of the BioStack by the MicroFill or ELx405 are displayed as 4-digit error codes, and may be generated by the BioStack itself, or by the interfacing instrument.

❖ Error codes generated by the BioStack are prefixed by a **B-** to distinguish them from codes generated by the MicroFill or ELx405.

- Refer to *Table 8* on page 374 for a list of communication error codes.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as 4-digit hexadecimal codes.

❖ BioStack instrument error codes are prefixed with a **B**- to distinguish them from similar hexadecimal error codes generated by the MicroFill or ELx405. For example, **B-0200** indicates a **0x0200** error generated by the BioStack, rather than by the MicroFill or ELx405.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.
- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 for lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

MicroFill or ELx405 Instrument Errors

Errors detected by the MicroFill or ELx405 basecode software that are related to operation of the MicroFill or ELx405 hardware are displayed as 4-digit hexadecimal error codes. These errors can occur during self-test, dispense, aspiration, etc.

- Refer to the *MicroFill Operator's Manual* or *ELx405 Operator's Guide* for a list of these codes.

Errors During Operation of BioStack with ELx405 (PC Control)

Liquid Handling Control (LHC) Software uses a component of the BioStack PC Control Software to control the BioStack, and the ELx405 Interface Software to control all functionality of the ELx405. All errors are displayed in LHC on the controlling PC.

- Errors generated when LHC Software is driving the BioStack, via a component of the BioStack PC Control Software include **serial communication errors** and **BioStack instrument errors**.

- Errors generated when LHC Software is driving the ELx405 washer, via the ELx405 Interface Software include **serial communication errors** and **ELx405 instrument errors**.

Serial Communication Errors

Errors detected by the BioStack PC Control Software during serial communication between the host PC and the BioStack, or as detected by the ELx405 Interface Software during serial communication between the host PC and the ELx405 washer, are displayed as text messages (in English). Serial communication errors include errors found when sending messages to the instrument, and receiving messages back from the instrument, as well as timer-based errors when waiting for a response.

❖ Occasionally an error code may appear without the text; these codes are always in a negative value format, for example: **-3**, -**401**.

- Refer to *Table 1* on page 338 for a list of serial communication errors.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as text messages (in English).

❖ Occasionally an error code may appear without the text; these codes are displayed in four-digit format, for example: **1000**, and are sometimes preceded by **0x**, as in **0x1000**.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 contain lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

ELx405 Instrument Errors

Errors detected by the ELx405 basecode software and transmitted back to the LHC Software, which are related to operation of the ELx405 washer's hardware are displayed as 4-digit hexadecimal error codes, along with a textual message.

- Refer to the *ELx405 Operator's Manual* for examples of ELx405 instrument errors.

Errors During Operation of BioStack with NanoQuot

Errors that occur during instrument control of the BioStack by the NanoQuot may be

- Communication errors between the BioStack and the NanoQuot

- BioStack instrument errors

- NanoQuot instrument errors

Error codes may be displayed by connecting the NanoQuot to a host computer that has the NanoQuot PC Control Software installed (see *Display Error Codes* on the next page). The NanoQuot PC Control Software will identify whether the errors are NanoQuot errors (which includes communication errors detected by the NanoQuot when trying to communicate with the BioStack), or if they are BioStack errors.

Communication Errors

Communication errors during instrument control of the BioStack by the NanoQuot are displayed in the NanoQuot PC Control Software as NanoQuot 4-digit hexadecimal codes. There will also be a textual description of the error.

Serial communication errors that are detected by the BioStack™ PC Control Software during computer control of the BioStack (e.g., when running the Instrument Alignment Utility), are displayed in the BioStack PC Control Software as negative value error codes, for example: **-504**, **-506**.

- Refer to *Table 1* on page 338 for a list of serial communication errors.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed in the NanoQuot PC Control Software as 4-digit hexadecimal codes. There will also be a textual description of the error.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 for lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

NanoQuot Instrument Errors

Errors detected by the NanoQuot basecode software, that are related to operation of the NanoQuot hardware are displayed in the NanoQuot PC Control Software as 4-digit hexadecimal error codes, along with a textual description. These errors can occur during self-test, dispense, etc.

- Refer to the **NanoQuot Operator's Manual** for a list of these codes.

Display Error Codes

> (i) **Important!** You will need a host computer that has the NanoQuot PC Control Software installed for the following instructions.

❖ Two serial cables are supplied with the BioStack: a 9-pin to 9-pin male/male serial cable and a 9-pin to 25-pin male/female serial cable. The DB9M to DB9M serial cable must be used to connect the BioStack to the NanoQuot.

❖ A 9-pin to 9-pin female/male serial cable is shipped with the NanoQuot, for connecting the Dispenser to a computer. The **DB9M** end of the cable must be connected to the NanoQuot.

To display errors that occur during operation of the BioStack with the NanoQuot:

1. Turn off the BioStack and NanoQuot, then disconnect the DB9M to DB9M serial cable between the two instruments.

2. Turn off the computer. Connect the DB9F end of the DB9F to DB9M serial cable to a serial port on the computer.

3. Connect the DB9M end of the serial cable to a serial port on the rear of the NanoQuot. Refer to **Chapter 2**, **Installation**, in the NanoQuot Operator's Manual (on CD part number 7151008) for a photo of the serial port on the Dispenser.

4. Open the PC Software, and at the main screen, click the **Get System Status** button to retrieve any current error codes. The dialog displayed will show both NanoQuot instrument errors as well as BioStack instrument errors.

5. Click **OK** to clear the error stored on the NanoQuot. Also, refer to **Table 2**, **BioStack Instrument Errors**, in this chapter to identify the cause and remedy for any BioStack error. (For NanoQuot instrument errors, refer to the tables in **Appendix A**, **Error Codes**, of the **NanoQuot Operator's Manual**.)

6. Disconnect the serial cable between the NanoQuot and computer, then reconnect the DB9M to DB9M cable between the BioStack and Dispenser.

Errors During Operation of BioStack with MicroFlo Select (Instrument Control)

Error codes that appear on the display of the MicroFlo Select during instrument control of the BioStack can include

- Communication errors between the BioStack and the MicroFlo
- BioStack instrument errors
- MicroFlo instrument errors

Communication Errors

Communication errors during instrument control of the BioStack by the MicroFlo are displayed as 4-digit error codes, with "**Stacker Error**" in the first line of the display. These errors may be generated by the BioStack itself, or by the MicroFlo.

> ❖ Error codes generated by the BioStack are prefixed by a **B-** to distinguish them from codes generated by the MicroFlo.

- Refer to *Table 8* on page 374 for a list of communication error codes.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as 4-digit hexadecimal codes, with "**Stacker Error**" in the first line of the display.

> ❖ BioStack instrument error codes are prefixed with a **B-** to distinguish them from similar hexadecimal error codes generated by the MicroFlo. For example, **B-0200** indicates a **0x0200** error generated by the BioStack, rather than by the MicroFlo.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.
- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 for lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

MicroFlo Select Instrument Errors

Errors detected by the MicroFlo Select basecode software that are related to operation of the MicroFlo hardware are displayed as 4-digit hexadecimal error codes. These errors can occur during self-test, dispense, etc.

- Refer to the *MicroFlo Select Operator's Manual* for a list of these codes.

Errors During Operation of BioStack with MicroFlo Select (PC Control)

Liquid Handling Control (LHC) Software uses a component of the BioStack PC Control Software to control the BioStack, and the MicroFlo Select Interface Software to control all functionality of the MicroFlo Select. All errors are displayed in LHC on the controlling PC.

- Errors generated when LHC Software is driving the BioStack, via a component of the BioStack PC Control Software include **serial communication errors** and **BioStack instrument errors**.

- Errors generated when LHC Software is driving the MicroFlo dispenser, via the MicroFlo Select Interface Software include **serial communication errors**, **MicroFlo instrument errors**, and **MicroFlo Select Interface Software errors**.

Serial Communication Errors

Errors detected by the BioStack PC Control Software during serial communication between the host PC and the BioStack, or as detected by the MicroFlo Select Interface Software during serial communication between the host PC and the MicroFlo dispenser, are displayed as text messages (in English). Serial communication errors include errors found when sending messages to the instrument, and receiving messages back from the instrument, as well as timer-based errors when waiting for a response.

> ❖ Occasionally an error code may appear without the text; these codes are always in a negative value format, for example: **-505**, -**506**.

- Refer to *Table 1* on page 338 for a list of serial communication errors.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as text messages (in English).

> ❖ Occasionally an error code may appear without the text; these codes are displayed in four-digit format, for example: **1000**, and are sometimes preceded by **0x**, as in **0x1000**.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 contain lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

MicroFlo Select Instrument Errors

Errors detected by the MicroFlo Select basecode software and transmitted back to the LHC Software, which are related to operation of the MicroFlo dispenser's hardware are displayed as 4-digit hexadecimal error codes, along with a textual message.

- Refer to the ***MicroFlo Select Dispenser's Operator's Manual*** for examples of MicroFlo instrument errors.

MicroFlo Select Interface Software Errors

Errors generated by the MicroFlo Select Interface Software are displayed in the LHC Software as 4-digit hexadecimal error codes, along with a textual message. These errors include program validation errors (when a dispense program/protocol fails to meet programmed validation criteria) and serial communication errors.

- Refer to the ***Table 9*** on page 375 for examples of errors generated by the MicroFlo Select Interface Software.

Errors During Operation of BioStack with EL406 (Instrument Control)

Error codes that appear on the display of the EL406 during instrument control of the BioStack can include

- Communication errors between the BioStack and the EL406
- BioStack instrument errors
- EL406 instrument errors

Communication Errors

Communication errors during instrument control of the BioStack by the EL406 are displayed as 4-digit error codes, with "**BIOSTACK ERROR**" in the first line of the display. These errors may be generated by the BioStack itself, or by the EL406.

- Refer to *Table 8* on page 374 for a list of communication error codes.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as 4-digit hexadecimal codes, with "**BIOSTACK ERROR**" in the first line of the display.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.
- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 for lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

EL406 Instrument Errors

Errors detected by the EL406 basecode software that are related to operation of the EL406 hardware are displayed as 4-digit hexadecimal error codes. These errors can occur during self-test, dispense, etc.

- Refer to the *EL406 Operator's Manual* for a list of these codes.

Errors During Operation of BioStack with EL406 (PC Control)

Liquid Handling Control (LHC) Software uses a component of the BioStack PC Control Software to control the BioStack, and the EL406 Interface Software to control all functionality of the EL406. All errors are displayed in LHC on the controlling PC.

- Errors generated when LHC Software is driving the BioStack, via a component of the BioStack PC Control Software include **serial communication errors** and **BioStack instrument errors**.

- Errors generated when LHC Software is driving the EL406 Washer Dispenser, via the EL406 Interface Software include **serial communication errors**, **EL406 instrument errors**, and **EL406 Interface Software errors**.

Serial Communication Errors

Errors detected by the BioStack PC Control Software during serial communication between the host PC and the BioStack, or as detected by the EL406 Interface Software during serial communication between the host PC and the EL406, are displayed as text messages (in English). Serial communication errors include errors found when sending messages to the instrument, and receiving messages back from the instrument, as well as timer-based errors when waiting for a response.

❖ Occasionally an error code may appear without the text; these codes are always in a negative value format, for example: **-505**, -**506**.

- Refer to *Table 1* on page 338 for a list of serial communication errors.

BioStack Instrument Errors

Errors detected by the BioStack basecode software that are related to operation of the BioStack hardware during self-test or plate transfers are displayed as text messages (in English).

❖ Occasionally an error code may appear without the text; these codes are displayed in four-digit format, for example: **1000**, and are sometimes preceded by **0x**, as in **0x1000**.

- Refer to *Table 2* on page 341 for a list of BioStack instrument errors.

- Refer to *Table 3*, *Table 4*, and *Table 5* on pages 348 to 350 contain lists of the sensors, motors, and interfacing instruments referenced in *Table 2*.

EL406 Instrument Errors

Errors detected by the EL406 basecode software and transmitted back to the LHC Software, which are related to operation of the EL406 Washer Dispenser's hardware are displayed as 4-digit hexadecimal error codes, along with a textual message.

- Refer to the *EL406 Microplate Washer Dispenser Operator's Manual* for examples of EL406 instrument errors.

EL406 Interface Software Errors

Errors generated by the EL406 Interface Software are displayed in the LHC Software as 4-digit hexadecimal error codes, along with a textual message. These errors include program validation errors (when a wash or dispense program/protocol fails to meet programmed validation criteria) and serial communication errors.

- Refer to *Table 10* on page 377 for examples of errors generated by the EL406 Interface Software.

Error Code Tables

Table 1
Serial Communication Errors

Serial communication errors are displayed in the BioStack PC Control Software during BioStack operation with the PowerWave or Synergy Readers, in Precision Power Software during operation with the Precision/XS, and in Liquid Handling Control (LHC) Software during operation with the ELx405, MicroFlo Select, or EL406. Serial communication errors may also be displayed in the BioStack PC Control Software during installation of the BioStack with the NanoQuot, when the PC Software's Instrument Alignment Utility is used to align the BioStack's claw/gripper with the NanoQuot's plate carrier.

> ❖ Precision errors usually are displayed as text messages (in English), and occasionally as an error code without the text.

Code	Probable Causes
-1	**General failure in talking to instrument driver software.** This error indicates that something is not correct with the driver software, or with the communications. • Try closing the application and restarting. If this has no effect, try re-booting the PC.
-3	**Operation cancelled by user.** There is a problem with the driver software or with the communications. • Try closing the application and restarting. If this has no effect, try re-booting the PC.
-4	**Unable to start delay timer associated with waiting for message response from instrument.** This error indicates that there may be too many applications using timers on the PC (there are only 8 timers available), or the delay timer is already set. • Close the application and try again. • Close one or more other applications that may be using timers.
-5	**Invalid request.** The BioStack is not in the correct mode for handling this request. • Re-start the BioStack.

Table 1 (Cont'd)

Code	Probable Causes
-6	**Unable to process request.** The BioStack™ is not in the correct mode for handling this request. Re-start the BioStack.
-401	**Object doesn't exist.** This error indicates that the driver software has somehow lost information on the instrument it is trying to communicate with. • Re-start the application.
-504	**Unable to open a serial port.** This error indicates that either another application is using the serial port, or the port was opened either by another application or by the BioStack PC Control Software, but was not closed properly. • Close the other application. • If that doesn't work, close the BioStack PC Control software and re-start it. • Lastly, re-boot the PC.
-505	**Unable to write all of the serial data.** • Try re-starting the application.
-506	**Timeout while reading in serial data, or incorrect number of serial characters were read in.** • Check the serial cable connection to ensure it is not loose. • Check to see if any other application is very CPU intensive. • Try re-starting the application.
-507	**Checksum error with the serial data read in.** • Attempt the operation again. • Try re-starting the application.

Table 1 (Cont'd)

Code	Probable Causes
-508	**When attempting to talk to the instrument, the instrument basecode software returned a NAK, indicating it did not recognize the request.** • Attempt the operation again. • Try re-starting the instrument. • Try re-starting the application.
-509	**PC software received back more data than it was expecting.** • Unlikely to be seen. It is expected that a −506 would be sent instead. • Try re-starting the application.
-510	**Invalid message object.** This error indicates that either the instrument basecode software or the PC software doesn't recognize the message sent. This is unlikely to be seen, but could possibly happen if the software fell out-of-sync with the characters sent back and forth. • Try re-starting the application and the instrument.
-511	**Invalid message body size.** This error indicates that either the instrument basecode software or the PC software received an invalid count of expected characters for a specific message. This is unlikely to be seen, but could possibly happen if the software fell out-of-sync with the characters sent back and forth. • Try re-starting the application and the instrument.
-512	**Serial message timeout waiting for response from the instrument.** • Check the instrument to ensure it has been powered-up correctly and is in a good operational state (i.e., the light is on, but NOT flashing). • Check the cable connections and the cable itself. • Try re-starting the application.

Table 2
BioStack Instrument Errors

BioStack instrument errors are displayed in the BioStack PC Control Software, Precision Power Software, NanoQuot PC Control Software, Liquid Handling Control (LHC) Software, and on the displays of the MicroFill , ELx405, MicroFlo Select, or EL406.

> ❖ In Precision Power, these errors usually are displayed as text messages (in English), and occasionally as an error code without the text (e.g., **1000** or **0x1000**). Refer also to the ***Precision/XS Operator's Manuals*** for a list of BioStack™ instrument errors ("operational errors").
>
> ❖ Calibration errors ("Jig contact not made in required steps") will normally be displayed only during calibration or repair of the instrument by BioTek TAC.
>
> ❖ The error codes are hexadecimal numbers.
>
> ❖ **EL406:** BioStack instrument errors are displayed as 4-digit hexadecimal codes, with "**BIOSTACK ERROR**" in the first line of the display.

Code	Probable Causes
020# **(#=sensor)** Refer to *Table 3* on page 348 for a list of sensor numbers.	**Couldn't find opto sensor.** This error indicates that a sensor was not tripped. • Plates sticking because wells are overfilled, causing a jam. • Plate not seated properly, causing a jam. • Plate stack not installed properly. • Shipping block still installed. • Plate dimensions are incompatible with BioStack.
035# **(#=motor)** Refer to *Table 4* on page 349 for a list of motor numbers.	**Motor interlock open – not used.** • This error is not used in the BioStack. Contact BioTek TAC.

Table 2 (Cont'd)

Code	Probable Causes
040# **(#=motor)** Refer to *Table 4* on page 349 for a list of motor numbers.	**Failed positional verify.** This error indicates that an axis failed its positional verify test. After moving a predefined number of steps from a home position, the motor should return to the home position in the proper amount of time and steps. If the axis moves back to its home position in the wrong amount of time, or uses too few or too many steps, the test fails. • A belt may be slipping due to incorrect tension, a loose motor pulley, or a loose belt clamp. This can also be caused by a defective motor drive circuit. • Gripper motor error (0407): If the BioStack is not on, its gripper falls to the fully down position. When the interfacing instrument is powered on and goes through its normal homing sequence, the BioStack gripper gets in the way and causes the attached instrument to error. The solution is to power up the BioStack first and keep the BioStack powered on. If the BioStack is powered off, raise the claw/gripper assembly manually above the interfacing instrument's carrier before powering on. Once its initialization is complete, then power on the interfacing instrument.
055# **(#=motor)** Refer to *Table 4* on page 349 for a list of motor numbers.	**Motor in use error.** • An internal programming error. A command was issued to move a motor that was already in motion. Turn the instrument off/on. If the error persists, contact BioTek TAC.
0600	**Calibration data missing.** Nonvolatile calibration data may be missing or corrupt. • One or more components of the instrument may need to be recalibrated. Turn the instrument off/on, and if the error persists, contact BioTek TAC.
0700	**Failed interface configuration checksum test.** Nonvolatile configuration data associated with the external instrument interface may be missing or corrupt. • Turn the instrument off/on. If the error persists, contact BioTek TAC.

❖ Calibration errors ("Calibration data missing") will normally be displayed only during calibration or repair of the instrument by BioTek TAC.

Table 2 (Cont'd)

Code	Probable Causes
080# **(#=motor)** Refer to *Table 4* for motor numbers.	**Motor was not homed successfully.** This error is usually only seen during the autocalibration sequence. See the probable causes for 020# on the preceding page.
1000	**Autocalibration data checksum failed at power-up.** Nonvolatile calibration data may be missing or corrupted. One or more components on the instrument may need to be recalibrated. • Turn the instrument off/on. If the error persists, contact BioTek TAC.
1200	**Internal RAM test error.** • A failure of the internal random access memory was detected during the powerup test. Turn the instrument off/on, and if the error persists, contact BioTek TAC.
1300	**Timeout sending or receiving serial data.** • Cable not connected, or loose. • Incorrect cable. • ELx405, MicroFill, NanoQuot, MicroFlo Select, or EL406 not set up properly. • Gen5, KC4, BioStack PC Control Software, Precision Power, NanoQuot PC Control Software, or Liquid Handling Control (LHC) Software not set up properly.
1303	**Serial receive buffer overflow.** • A communication error – see error **1300**.
1304	**Serial message checksum.** • A communication error – see error **1300**.
1307	**Received request object not supported.** • A communication error – see error **1300**.

❖ Calibration errors ("Autocalibration data checksum failed at power-up") will normally be displayed only during calibration or repair of the instrument by BioTek TAC.

Table 2 (Cont'd)

Code	Probable Causes
1308	**Message body size exceeds max limit.** • A communication error – see error **1300**.
1309	**Max requests currently running.** • A communication error – see error **1300**.
1501	**Internal 5V power supply test error.** • Check connections to the external power supply. Turn the instrument off/on, and if the error persists, contact BioTek TAC.
1502	**External 24V power supply test error.** • Check connections to the external power supply. Check AC line voltage. Turn the instrument off/on, and if the error persists, contact BioTek TAC.
1600	**Failed attempted plate transfer from output stack to input stack.** This error indicates that no plate was found on the BioStack™ carrier after attempted plate retrieval from the output stack. • Plate stack not installed properly. • Plate dimensions are incompatible with BioStack.
1601	**Failed attempted plate transfer from carrier to input or output stack; started with no plate on carrier.** • Plate dimensions are incompatible with BioStack. • Plates are sticking because wells are overfilled. • Plate stack not installed properly.
1602	**Failed attempted plate transfer from input stack to BioStack carrier.** This error indicates that no plate was found on the carrier after attempted plate retrieval from the input stack. • Plate dimensions are incompatible with BioStack. • Plates are sticking because wells are overfilled. • Plate stack not installed properly.

Table 2 (Cont'd)

Code	Probable Causes
1700	**Failed attempted plate transfer from BioStack carrier to instrument.** This error indicates that no plate was found in the gripper after attempted plate retrieval from the carrier. • Plates are sticking because wells are overfilled. • Plate dimensions are incompatible with the BioStack™. • Instrument needs calibration.
1701	**Failed attempted plate transfer from instrument to output stack.** This error indicates that no plate was found in the gripper after an attempted plate retrieval from the instrument. • Plates are sticking because wells are overfilled. • Need realignment between BioStack and interfacing instrument. Run the Instrument Alignment Utility. • Plate dimensions are incompatible with the BioStack.
180# **(#=motor)** Refer to ***Table 4*** on page 349 for a list of motor numbers.	**The given motor number was not present.** • If the motor number in the error code is not in Table 4, the problem is in whatever is sending commands to the BioStack, otherwise, turn the instrument off/on. If the error persists, contact BioTek TAC.
1900	**Plate found in gripper during power-up.** • Power down the BioStack and remove the plate.
1901	**Failed attempted plate transfer from carrier to instrument.** This error indicates that a plate was still in the gripper after move. • Plates are sticking because wells are overfilled. • Plate dimensions are incompatible with the BioStack.
1902	**Plate found in gripper during factory burnin test.** • This error indicates that a plate was in the gripper when it shouldn't be, while running the factory burnin test.

Table 2 (Cont'd)

Code	Probable Causes
2000	**Plate found on carrier during power-up.** • Power down the BioStack and remove the plate.
2001	**Plate found on carrier when it should not be there.** • Power down the BioStack and remove the plate. This error code is not used in the BioStack. Contact BioTek TAC.
2002	**Plate found on carrier when it should not be there.** • Power down the BioStack and remove the plate. This error code is not used in the BioStack. Contact BioTek TAC.
2003	**Failed attempted plate transfer from carrier to input or output stack; plate left on carrier when done.** • Power down the BioStack and remove the plate. • Plate dimensions are incompatible with the BioStack.
210# **(#=motor)** Refer to *Table 4* on page 349 for a list of motor numbers.	**Requested motor axis is unknown to the BioStack.** • Turn the instrument off/on. If the error persists, contact BioTek TAC.
220# **(#=instrument)** Refer to *Table 5* on page 350 for a list of instrument numbers.	**Instrument set to interface with is unknown to the BioStack.** The instrument is not a PowerWave/PowerWave XS/PowerWave XS2, Synergy HT/Synergy 2/Synergy 4/Synergy Mx, Precision XS Microplate Sample Processor, Precision Microplate Pipetting System, MicroFill, ELx405, MicroFlo Select, or EL406.
2300	**Gripper width saved is outside allowed range.** • Incorrect measurement entered. • Incorrect units.
2400	**Hardware not present.** • Indicates a "Presenter Model" was selected. Not possible with the BioStack. An internal code error is likely. Contact BioTek TAC.

Table 2 (Cont'd)

Code	Probable Causes
2500	**Invalid alignment.** • Z-alignment (vertical alignment) is incomplete or incorrect. Rerun the Instrument Alignment Utility to clear the error. • Incorrect instrument type is selected.
2600	**Claw/instrument interface error.** • Rerun the Instrument Alignment Utility to clear the error.
2700	**Error attempting to run the barcode scanner SET command.** • A response returned from the scanner is invalid.
2701	**Error attempting to run the barcode scanner SET command.** • The command message is calling out an invalid barcode location. Valid numbers are 1-4.
2702	**Error attempting to get barcode scanner information regarding one of the barcode types.** • The barcode type returned by the scanner is not one of those expected. See *Appendix B*, *BioStack Barcode Scanner* for required barcode types.
2703	**Barcode type is not supported.** • One of the four default barcode types is not supported by the scanner. See *Appendix B*, *BioStack Barcode Scanner* for required barcode types.
2704	**Error disabling start/stop character transmission.** • While attempting to tell the scanner to disable the transmission of start and stop characters along with the barcode value for the Codeabar barcode type, an error occurred.
2800	**Out of range error.** • An attempt was made to set a configuration parameter, using an out-of-range value.
A100	**Task has been deleted because of an error — fatal.** • Internal code malfunction. Contact BioTek TAC.
A300	**Device not available — fatal.** • Internal code malfunction. Contact BioTek TAC.

Table 3

BioStack Sensor Numbers Referenced in Table 2

Sensor	Number
Claw Home	0
Output Stack Cam1 Home	1
Output Stack Lift Home	2
Input Stack Cam1 Home	3
Input Stack Lift Home	4
Input Stack Cam2 Home	5
Output Stack Cam2 Home	6
Gripper Home	7
Carrier Home	8
Autocalibration	9
Plate Present	A
Carrier Out	B
Input Stack Lift Up	C
Output Stack Lift Up	D
Wrist Home	E

Table 4

BioStack Motor Numbers Referenced in Table 2

Motor	Number
Claw	0
Output Stack Cam1	1
Output Stack Lift	2
Input Stack Cam1	3
Input Stack Lift	4
Input Stack Cam2	5
Output Stack Cam2	6
Gripper	7
Carrier	8
Wrist	9

Table 5

Interfacing Instrument Numbers Referenced in Table 2

Instrument	Number
PowerWave/XS/XS2	0
Synergy HT/Synergy 2/ Synergy 4/Synergy Mx	1
ELx405	2
MicroFill	3
Precision/XS	4
Reserved for specific customer	5
Custom instrument	6
Custom instrument	7
Custom instrument	8

❖ If you are operating the BioStack with the **NanoQuot**, the interfacing instrument number will be **0**, since the NanoQuot uses the same BioStack alignment scheme as the **PowerWave**.

❖ If you are operating the BioStack with the **MicroFlo Select**, the interfacing instrument number will be **3**, since the MicroFlo uses the same BioStack alignment scheme as the **MicroFill**. This is true when operating the BioStack from the dispenser's keypad or from the Liquid Handling Control Software.

❖ If you are operating the BioStack with the **EL406**, the interfacing instrument number will be **2**, since the EL406 uses the same BioStack alignment scheme as the **ELx405**.

Table 6

Gen5 Function Call Errors

Gen5 function call error codes are displayed in the BioStack PC Control Software during BioStack operation with the PowerWave/XS/XS2 or Synergy HT/Synergy 2/ Synergy 4/Synergy Mx.

❖ **Gen5 Function Call Errors** are usually only seen by software developers when using BioTek's ActiveX component or serial programming to control the BioStack. If the information provided in this table does not help you resolve the problem, contact BioTek TAC for assistance.

❖ The **Label** column is for use by robotic application developers, and corresponds to the labels found in the **BTI StatusCodes.h** file that is included with the Gen5 installation (if "Custom Installation" was selected to install Gen5's OLE Automation tool). These labels may also be beneficial to the developers of the BioStack PC software, to troubleshoot problems associated with BioStack PC software/Gen5 operations.

Code	Label	Probable Cause
-8	BTI_UNKNOWN_CHARACTERISTIC_ID	There are no values associated with the characteristic ID used.
-100	BTI_FILE_DOES_NOT_EXIST	The system cannot find the file specified.
-101	BTI_UNABLE_TO_OPEN_FILE	Unable to open the file.
-102	BTI_FILE_ALREADY_EXISTS	File already exists.
-103	BTI_FILE_READ_ONLY	Read file only.
-104	BTI_INVALID_PATHNAME	The path name is invalid.
-105	BTI_FILE_LOCKED	Unable to access the file because another process has locked the file.
-106	BTI_FILE_SHARING_VIOLATION	Unable to access the file because it is being used by another process.
-107	BTI_FILE_WRITE_ERROR	Error writing a file.
-108	BTI_FILE_READ_ERROR	A system error occurred while reading from the file.
-109	BTI_READ_FROM_FILE_EOF_ERROR	The end of the file was reached before all needed data was read.
-110	BTI_READ_FROM_FILE_TIME_STAMP_ NOT_FOUND	The import file does not contain a valid timestamp.
-200	BTI_INVALID_RECORD_FORMAT	Invalid record format.

Table 6 (Cont'd)

Code	Label	Probable Cause
-201	BTI_INVALID_PARAMETER_LIST	Invalid parameter list.
-202	BTI_UNKNOWN_RECORD_TYPE	Unknown record type.
-300	BTI_INVALID_FIELD_OPTION	Invalid field option.
-301	BTI_FIELD_BELOW_MIN_RANGE	Field below minimum range.
-302	BTI_FIELD_ABOVE_MAX_RANGE	Field above maximum range.
-303	BTI_FIELD_TOO_LONG	Field too long.
-304	BTI_FIELD_TOO_SHORT	Field too short.
-400	BTI_OBJECT_CREATION_ERROR	Object creation error.
-401	BTI_OBJECT_DOES_NOT_EXIST	Object does not exist.
-402	BTI_INSUFFICIENT_FIELDS	Insufficient fields.
-403	BTI_NAME_REQUIRED	Name required.
-450	BTI_DEVICE_PROXY_CREATION_ ERROR	Device proxy creation error.
-451	BTI_DEVICE_MGR_NO_AVAIL_ READERS	Device manager: no available reader.
-500	BTI_BAUD_RATE_INVALID	Invalid baud rate.
-501	BTI_DATA_BITS_INVALID	Invalid number of data bits.
-502	BTI_STOP_BITS_INVALID	Invalid number of stop bits.
-503	BTI_PARITY_INVALID	Invalid parity setting.
-504	BTI_SERIAL_PORT_ERROR	Serial port error.
-505	BTI_SERIAL_WRITE_ERROR	Serial write error.
-506	BTI_SERIAL_READ_ERROR	Serial read error.
-507	BTI_CHECKSUM_ERROR	Checksum error.
-508	BTI_SERIAL_NAK_ERROR	Serial NAK error. Message not acknowledged.
-509	BTI_EXCESS_DATA_RECEIVED	Excess serial data received.
-510	BTI_INVALID_MSG_OBJECT	Invalid serial message object.

Table 6 (Cont'd)

Code	Label	Probable Cause
-511	BTI_INVALID_MSG_BODY_SIZE	Invalid serial message body size.
-512	BTI_PURGE_COMM_FAILURE	Failure purging the COM port.
-513	BTI_PORT_NOT_OPEN	COM port not open failure.
-514	BTI_PORT_HANDLE_ERROR	COM port handle error.
-515	BTI_SERIAL_STREAM_ERROR	The reader output was not in the correct format.
-516	BTI_SEND_CMD_HEADER_ERROR	Communication output failure. Reader may not be attached or turned on.
-517	BTI_SEND_CMD_BODY_ERROR	Command body error with the sent message.
-518	BTI_RECEIVE_CMD_BODY_ERROR	Command body error with the received message.
-519	BTI_RECEIVE_CMD_STATUS_ERROR	Request sent to reader, but no response received.
-520	BTI_RECEIVE_BODY_SIZE_ MISMATCH	Received serial message body size mismatch.
-521	BTI_RECEIVE_STATUS_SIZE_ MISMATCH	Received serial message status size mismatch.
-522	BTI_COM_PORT_ALREADY_IN_USE	COM port already in use. Please select another.
-523	BTI_SET_TIMEOUT_ERROR	Error setting timeout.
-524	BTI_SET_DCB_BLOCK_FAILURE	DCB block failure with serial communication.
-525	BTI_CREATE_FILE_HANDLE_ERROR	Error creating file handle.
-526	BTI_CREATE_FILE_NO_PORT_ERROR	The specified COM port does not exist.
-527	BTI_CREATE_FILE_PORT_IN_USE	The specified COM port is in use by another application.
-528	BTI_COULD_NOT_MATCH_BAUD_ RATE	Attempted, but could communicate with reader. Please cycle power to the reader and try again.
-529	BTI_READER_NOT_CONNECTED	Communication output failure. Reader may not be attached or turned on.

Table 6 (Cont'd)

Code	Label	Probable Cause
-600	BTI_UNKNOWN_READER	Unknown reader type.
-601	BTI_READER_STATUS_ERROR	Reader status error.
-602	BTI_READER_NO_ACKNOWLEDGE	Reader failed to acknowledge request
-603	BTI_TEMP_RANGE_NOT_FOUND	Temperature range not found.
-605	BTI_GEOMETRY_INVALID	Invalid plate geometry.
-606	BTI_READ_TIMEOUT_ERROR	The current process timed out before receiving a reader response.
-607	BTI_ABS_READER_DATA_NEW_ ERROR	New error on reader absorbance data.
-608	BTI_READER_INV_WAVELENGTH	Invalid reader wavelength.
-609	BTI_READER_INV_NUM_FILTER_SETS	Invalid number of reader filter sets.
-610	BTI_FLUOR_READER_DATA_NEW_ ERROR	New error on reader fluorescence data.
-611	BTI_READER_COMMANDS_NULL	Reader commands are empty (NULL).
-612	BTI_SPECTRAL_SCAN_DATA_NEW_ ERROR	New error on reader spectrum scan data.
-613	BTI_EVENT_MISMATCH_IN_DATA_ RESPONSE	Plate and well synch modes expected event did not match event of data from reader.
-614	BTI_SPECTRAL_SCAN_DATA_STATE_ ERROR	State error on reader spectrum data.
-615	BTI_AREA_SCAN_DATA_NEW_ERROR	New error on reader area scan data.
-616	BTI_LINEAR_SCAN_DATA_NEW_ ERROR	New error on reader linear scan data.
-617	BTI_AREA_LINEAR_SCAN_DATA_NEW _ERROR	New error on reader area scan or linear scan data.
-618	BTI_READER_VERSION_NOT_ SUPPORTED	Gen5 does not support the version of the firmware installed on this reader. Please contact BioTek Service for assistance.
-619	BTI_READ_TYPE_NOT_VALID	Invalid read type for Absorbance detection method.

Table 6 (Cont'd)

Code	Label	Probable Cause
-620	BTI_GET_SENSITIVITY_INVALID_FILTER_SET	Invalid filter set for get sensitivity command.
-621	BTI_SET_PROBE_HEIGHT_INVALID_HEIGHT	Invalid set probe height value.
-622	BTI_SET_PROBE_HEIGHT_INVALID_SELECTION	Invalid selection for set probe height.
-623	BTI_INCUBATION_TEMP_INVALID	The temperature specified in the procedure is outside the range of the instrument.
-624	BTI_INCUBATION_NOT_SUPPORTED	Temperature control is not supported by this reader
-625	BTI_FLUOR_LUMIN_S_CMD_RSP_DATA_ERR	Error with response data associated with luminescence or fluorescence 'S' command.
-626	BTI_CFLUORESCENCEREADERDATA_ERROR	'C' command fluorescence reader data error.
-627	BTI_FLUOR_LUMIN_DATA_CHECKSUM_ERROR	Fluorescence or luminescence data checksum error.
-628	BTI_SYSTEM_TEST_NOT_SUPPORTED	System test not supported.
-629	BTI_SYSTEM_TEST_TIMER_READ_DATA_FAIL	System test timer read data failure.
-630	BTI_MSG_DIALOG_START_TIMER_FAILED	Message dialog start timer failed.
-631	BTI_TIMEOUT_ERROR	Timeout error.
-632	BTI_ABORT_ERROR	Abort error.
-633	BTI_NO_ENDPOINT_DATA_PRESENT	No endpoint data is available.
-634	BTI_ABSORBANCE_DATA_CHECKSUM_ERROR	Absorbance data checksum error.
-635	BTI_NO_SPECTRAL_SCAN_DATA_PRESENT	No spectrum scan data present.
-636	BTI_UNDEFINED_SPECTRAL_VALUE	Undefined spectral value.
-637	BTI_SPECTRAL_DATA_CHECKSUM_ERROR	Spectral data checksum error.

Table 6 (Cont'd)

Code	Label	Probable Cause
-638	BTI_SPECTRAL_DATA_COMMAND_ ERROR	Spectral data command error.
-639	BTI_NO_AREA_SCAN_DATA_PRESENT	No area scan data present.
-640	BTI_READER_IN_USE	The reader is in use and the operation selected is not available.
-641	BTI_EXECUTE_READ_PARAM_TRY_ CATCH	Software exception on an execute read command.
-642	BTI_NO_MONITOR_WELL_DATA_ PRESENT	No monitor well data present.
-643	BTI_AUXILIARY_DATA_PRESENT	Auxiliary data found (BioCell, Pathlength Correction, etc) and should be empty.
-644	BTI_AUXILIARY_DATA_TRY_CATCH	Software exception on auxiliary data read.
-645	BTI_NO_AUXILIARY_DATA_PRESENT	No auxiliary data present.
-646	BTI_NO_WELL_DATA_PRESENT	No well data present.
-647	BTI_READER_DATA_PRESENT	Data found when list should be empty.
-648	BTI_NO_SENSITIVITY_VALUE_MATCH	Could not find match for auto sensitivity value.
-649	BTI_EDIT_READ_PARAM_TRY_CATCH	Software exception on edit read parameters attempt.
-650	BTI_RDR_NO_ABSORBANCE_ SUPPORT	Absorbance detection not supported by reader
-651	BTI_RDR_NO_FLUORESCENCE_ SUPPORT	Fluorescence detection not supported by reader
-652	BTI_RDR_NO_LUMINESCENCE_ SUPPORT	Luminescence detection not supported by reader
-653	BTI_RDR_MIN_WAVELENGTH_ EXCEEDED	Wavelength must be between value 1 and value 2
-654	BTI_RDR_MAX_WAVELENGTH_ EXCEEDED	Wavelength must be between value 1 and value 2
-655	BTI_RDR_NO_INCUBATION_SUPPORT	Incubation not supported by this reader.
-656	BTI_RDR_MIN_TEMP_EXCEEDED	Temperature must be between value 1 and value 2

Table 6 (Cont'd)

Code	Label	Probable Cause
-657	BTI_RDR_MAX_TEMP_EXCEEDED	Temperature must be between value 1 and value 2
-658	BTI_RDR_NO_SHAKE_SUPPORT	Shaking is not supported by this reader
-659	BTI_FEATURE_NOT_IMPLEMENTED	The feature has not been implemented at this time.
-660	BTI_PROBE_HEIGHT_OUT_OF_RANGE	The probe height is out of range for the current plate type.
-661	BTI_RDR_REQUIRES_SPECIFIC_ PROTOCOL	The reader requires a specific protocol.
-662	BTI_PROTOCOL_REQUIRES_SPECIFIC _RDR	The protocol requires a specific reader.
-663	BTI_RDR_NO_SPECTRUM_SCAN_ SUPPORT	The reader does not support spectrum scanning.
-664	BTI_RDR_NO_AREA_SCAN_SUPPORT	The reader does not support area scanning.
-665	BTI_RDR_NO_LINEAR_SCAN_ SUPPORT	The reader does not support linear scanning.
-666	BTI_RDR_NO_DISPENSER_SUPPORT	The reader does not support dispensing.
-667	BTI_RDR_MAX_DISPENSERS_ EXCEEDED	The maximum dispensers supported for the reader has been exceeded.
-668	BTI_RDR_NO_WELL_MODE_SUPPORT	The reader does not support well mode.
-669	BTI_RDR_WELL_MODE_READS_ EXCEEDED	The maximum well mode reads has been exceeded.
-670	BTI_RDR_WELL_MODE_SHAKES_ EXCEEDED	The maximum well mode shake cycles have been exceeded.
-671	BTI_RDR_WELL_MODE_DISPENSES_ EXCEEDED	The maximum well mode dispenses have been exceeded.
-672	BTI_RDR_NO_SYNC_PLATE_MODE_ SUPPORT	The reader does not support plate mode.
-673	BTI_RDR_SYNC_PLATE_MODE_ READS_EXCEEDED	The maximum synchronized plate mode reads have been exceeded.
-674	BTI_RDR_SYNC_PLATE_MODE_ SHAKES_EXCEEDED	The maximum synchronized plate mode shake cycles have been exceeded.

Table 6 (Cont'd)

Code	Label	Probable Cause
-675	BTI_RDR_SYNC_PLATE_MODE_ DISPNS_EXCEEDED	The maximum synchronized plate mode dispenses have been exceeded.
-676	BTI_RDR_SYNC_PLATE_MODE_ STEPS_EXCEEDED	The maximum synchronized plate mode steps have been exceeded.
-677	BTI_RDR_NO_PATHLEN_ CORRECTION_SUPPORT	The reader does not support pathlength correction.
-678	BTI_DATA_FORMAT_ERROR	The expected data has not been received. Possible reasons are: Your computer is not able to retrieve the data in a timely fashion. Your reader cable is loose or damaged. (Press Help for more information)
-679	BTI_KINETIC_DURATION_LESS_THAN _INTERVAL	The kinetic read time must exceed the kinetic interval.
-697	BTI_RDR_MIRROR_NOT_DEFINED	The required mirrors are not defined on the reader.
-700	BTI_NO_PLATE_TYPE_DEFINED	The Plate Type specified is invalid or the definition no longer exists.
-701	BTI_UNSUPPORTED_READ_PARAM_ STEP	The read parameter step is invalid or not currently supported.
-702	BTI_INVALID_ORDER_PAUSE_STEP	Invalid order for a pause step.
-703	BTI_INVALID_ORDER_INCUBATE_ STEP	Invalid order for an incubate step.
-704	BTI_INVALID_ORDER_CARRIER_IN_ OUT_STEP	Invalid order for a carrier in/out step.
-705	BTI_INVALID_ORDER_READ_STEP	Invalid order for a read step.
-706	BTI_INVALID_ORDER_KINETIC_END_ STEP	The Kinetic End step is missing or is in an invalid order.
-707	BTI_NO_READ_PARAMETERS	No read parameters.
-708	BTI_INVALID_RESUME_INDEX	The Resume index is invalid for the current read parameters.
-709	BTI_INSUFFICIENT_KINETIC_READ_ PARAMS	Illegal kinetic read structure defined.
-710	BTI_NO_KINETIC_SCANS_ALLOWED	Kinetic reads of Spectrum, Linear and Area scanning are not supported.

Table 6 (Cont'd)

Code	Label	Probable Cause
-711	BTI_AUTOSENSITIVITY_ERROR	Error during determination of Auto Sensitivity value.
-712	BTI_STOP_RESUME_LAST_STEP_ ERROR	A Stop/Resume step cannot be the last step in the sequence.
-713	BTI_STOP_RESUME_NEXT_STEP_ ERROR	Error obtaining Resume step number.
-714	BTI_ILLEGAL_PRODUCT_ DELINEATION_SETTING	An illegal product delineation setting was sent to the ActiveX.
-715	BTI_READER_CONFIG_NOT_ SUPPORTED_PD	Reader configuration not supported.
-716	BTI_DISPENSE_MEASURE_NOT_ SUPPORTED	Dispense measure not supported.
-717	BTI_INVALID_MESSAGE_RESP_SIZE	Invalid message response size.
-718	BTI_E_COMMAND_CHECKSUM_ FAILURE	'E' command checksum failure.
-719	BTI_E_COMMAND_RATES_ SUPPORTED_ERROR	'E' command rates supported error.
-720	BTI_INVALID_ORDER_MODE_END_ STEP	Invalid order for a mode End step.
-721	BTI_MAX_G_COMMAND_TOTAL_ EVENTS_EXCEEDED	The maximum number of events in a mode block has been exceeded.
-722	BTI_MAX_G_COMMAND_SHAKE_ EVENTS_EXCEEDED	The maximum number of shake events in a block has been exceeded.
-723	BTI_MAX_G_COMMAND_READ_ EVENTS_EXCEEDED	The maximum number of read events in a mode block has been exceeded.
-724	BTI_MAX_G_COMMAND_DISPENSE_ EVENTS_EXCEEDED	The maximum number of dispense events in a mode block has been exceeded.
-725	BTI_ILLEGAL_STEP_TYPE_FOUND_ IN_BLOCK	An illegal step type was found within the current block.
-726	BTI_G_COMMAND_MISMATCH_ RESPONSE_SIZE	The length of the response from the 'G' command did not match the expected length.
-727	BTI_G_COMMAND_CHECKSUM_ FAILURE	'G' command checksum failure.

Table 6 (Cont'd)

Code	Label	Probable Cause
-728	BTI_INVALID_ORDER_MONITOR_WELL_END_STEP	Invalid order for a monitor well step.
-729	BTI_DISPENSER1_NOT_PRIMED	Dispenser 1 is not primed. Please prime before running protocol.
-730	BTI_DISPENSER2_NOT_PRIMED	Dispenser 2 is not primed. Please prime before running protocol.
-731	BTI_INVALID_WELL_MODE_EVENT_TYPE	An invalid event type for well mode was detected when creating the 'G' command request body.
-732	BTI_INVALID_PLATE_MODE_EVENT_TYPE	Invalid plate mode event type.
-733	BTI_WELL_MODE_DATA_ERROR	Well mode data error.
-734	BTI_WELL_MODE_EVENT_MISMATCH_ERROR	The event number in the data stream did not match the expected event number.
-735	BTI_WELL_MODE_END_OF_WELL_ERROR	Error with the end of well data stream from the reader.
-736	BTI_WELL_MODE_HEADER_ERROR	Error in header of well mode response.
-737	BTI_WELL_MODE_DELAY_FROM_START_ERROR	Delay step is not long enough. Increase the Delay step prior to action step number # within the Well Mode Block. Action steps are Read, Shake and Dispense.
-738	BTI_AREA_SCAN_PROBE_SIZE_CHANGED	The Probe size used in the area scanning calculations has changed since the Read Step was last modified. To correct this situation, have the desired reader connected and in a ready state, then edit the Read Step that has Area Scanning specified. The Area Scanning matrix will be re-evaluated based on the reader's limitations, current probe size, and plate type.
-739	BTI_AREA_SCAN_SPACING_SIZE_CHANGED	The Spacing size used in the area scanning calculations has changed since the Read Step was last modified. To correct this situation, have the desired reader connected and in a ready state, then edit the Read Step that has Area Scanning specified. The Area Scanning matrix will be re-evaluated based on the reader's limitations, current probe size, and plate type.

Table 6 (Cont'd)

Code	Label	Probable Cause
-740	BTI_AREA_SCAN_MATRIX_SIZE_ CHANGED	The Matrix size used in the area scanning calculations has changed since the Read Step was last modified. To correct this situation, have the desired reader connected and in a ready state, then edit the Read Step that has Area Scanning specified. The Area Scanning matrix will be re-evaluated based on the reader's limitations, current probe size, and plate type.
-741	BTI_BIOCELL_READ_FROM_FILE_ ERROR	Error reading the BioCell=x.xxxx value from the data file.
-742	BTI_Y_COMMAND_CHECKSUM_ FAILURE	'Y' command checksum error.
-743	BTI_UNKNOWN_DETECTION_ METHOD	Unknown detection error.
-744	BTI_BLOCK_MODE_DELAY_ERROR	Delay step error. Delay steps are not allowed inside a kinetic loop or in sequence back to back.
-746	BTI_ABS_KINETIC_INTERVAL_ERROR	The kinetic interval is too short for the defined parameters.
-747	BTI_FLUORLUMIN_KINETIC_ INTERVAL_ERROR	The kinetic interval is too short for the defined parameters.
-748	BTI_WELL_MODE_KINETIC_INTERVAL _ERROR	The kinetic interval is too short for the defined parameters.
-754	BTI_DISPENSERS_NOT_PRIMED	Neither dispenser 1 or 2 is primed. Please prime both before running protocol.
-755	BTI_WELL_MODE_DELAY_TOO_ SHORT	Well mode Delay step is too short.
-756	BTI_USER_OVERRIDE_SET_ TEMPERATURE	The temperature had not reached the setpoint when the user chose to override.
-757	BTI_INVALID_READER_TYPE	The assigned reader type is unknown and cannot be configured.
-758	BTI_LUMINESCENCE_DATA_FORMAT_ ERROR	Luminescence data format error.
-759	BTI_NO_WELL_MODE_SIMULATION	Well mode simulation is not supported.

Table 6 (Cont'd)

Code	Label	Probable Cause
-760	BTI_NO_PLATE_SYNCH_MODE_ SIMULATION	Plate synchronous mode simulation is not supported.
-761	BTI_EVENT_START_TIME_EXCEEDS_ LIMIT	The start time of one of the steps inside the 'Mode' block exceeds the limit of 16:39.99 mm:ss.msec in well mode or 27:46:39 hh:mm:ss in plate mode.
-762	BTI_WELL_MODE_KINETIC_INTERVAL _EXCEEDED	The well mode kinetic interval cannot exceed 1:39.99 m:ss.msec.
-763	BTI_PLATE_MODE_KINETIC_ INTERVAL_EXCEEDED	The plate mode kinetic interval cannot exceed 02:46:39 hh:mm:ss.
-764	BTI_STAND_ALONE_SHAKE_NOT_ SUPPORTED	The current order of the shake step is illegal. The reader does not support stand-alone shake steps.
-765	BTI_MONITOR_WELL_ILLEGAL_ DEFINITION	A Monitor well sequence must contain one read step. An optional shake step before the Monitor Well loop or before the read step inside the Monitor Well loop is allowed for absorbance and luminescence reads.
-766	BTI_NO_APPEND_IN_MULTIMODE_ BLOCK	When two or three read steps are in a Kinetic loop, appending kinetic data is not supported.
-767	BTI_FLUORESCENCE_DATA_ TERMINATOR_INVALID	Invalid fluorescence data stream termination character found.
-768	BTI_MULTI_MODE_KINETIC_ INTERVAL_EXCEEDED	The kinetic interval is too small for the read steps defined.
-769	BTI_OLD_STATUS_FORMAT	The reader attached only supports an old style status format. Any error produced should have been displayed by the reader.
-772	BTI_SYNERGY_WELL_SYNCH_NUM_ KINETIC_READS	The Synergy in plate or well synch mode is limited to 999 reads in a kinetic read step.
-773	BTI_SYNERGY_PLATE_SYNCH_NUM_ KINETIC_READS	The Synergy in plate or well synch mode is limited to 999 reads in a kinetic read step.
-774	BTI_MULTI_MODE_NUM_KINETIC_ READS_ERROR	Luminescence and Multi-Mode kinetics are limited to 999 reads.
-775	BTI_FLUORESCENCE_KINETIC_ READS_ERROR	Fluorescence kinetic reads area limited to 300 reads.

Table 6 (Cont'd)

Code	Label	Probable Cause
-776	BTI_ABSORBANCE_KINETIC_READS_ ERROR	Absorbance kinetic reads error.
-777	BTI_KINETIC_DURATION_VS_ INTERVAL_ERROR	The kinetic read time must exceed the kinetic interval.
-778	BTI_ERROR_DETECTED_DURING_ BULB_WARMUP	Error detected during bulb warm-up. Excitation filter cartridge removal is the most likely cause.
-780	BTI_FINAL_STATUS_ERROR	Status was not received after completion of read step. This could be due to an error that should be displayed on the reader.
-781	BTI_CONTINUOUS_SHAKE_ MULTIMODE_ERROR	Continuous shake option is not allowed in a kinetic block with multiple read steps.
-782	BTI_PLATE_MODE_DELAY_FROM_ START_ERROR	Delay step is not long enough. Increase the Delay step prior to action step number # within the Plate Mode Block. Action steps are Read, Shake and Dispense.
-2010	BTI_AUTM_DOCUMENT_ALREADY_IN_ MEMORY	Automation error: Experiment already in memory.
-2011	BTI_AUTM_INVALID_INDEX	Automation error: Invalid index.
-2012	BTI_AUTM_DATABASE_GENERIC_ ERROR	Automation error: Generic database error.
-2013	BTI_AUTM_FILE_GENERIC_ERROR	Automation error: Generic file error.
-2014	BTI_AUTM_FILE_FILE_NOT_FOUND	Automation error: File not found.
-2015	BTI_AUTM_FILE_BAD_PATH	Automation error: Bad file pathname.
-2100	BTI_AUTM_APP_NEW_EXP_GENERIC_ ERROR	Automation error: Application object, Generic error creating new experiment.
-2101	BTI_AUTM_APP_OPEN_EXP_GENERIC _ERROR	Automation error: Application object, Generic error opening experiment.
-2120	BTI_AUTM_APP_SET_CLIENT_ WINDOW_GENERIC_ERROR	Automation error: Application object, Error setting client window.
-2130	BTI_AUTM_APP_BROWSE_FOR_FILE_ GENERIC_ERROR	Automation error: Application object, Generic error browsing for a file.
-2140	BTI_AUTM_APP_BROWSE_FOR_ FOLDER_GENERIC_ERROR	Automation error: Application object, Browse for folder generic error.

Table 6 (Cont'd)

Code	Label	Probable Cause
-2145	BTI_AUTM_APP_READER_OPERATION _READER_NOT_CONFIGURED	Automation error: Application object, Reader not configured.
-2150	BTI_AUTM_APP_CONFIGURE_OLE_ READER_GENERIC_ERROR	Automation error: Application object, OLE reader configuration failed.
-2160	BTI_AUTM_APP_CONFIGURE_COM_ READER_GENERIC_ERROR	Automation error: Application object, COM reader configuration failed.
-2161	BTI_AUTM_APP_CONFIGURE_COM_ READER_INVALID_READER_TYPE	Automation error: Application object, Invalid COM reader type.
-2162	BTI_AUTM_APP_CONFIGURE_COM_ READER_INVALID_COM_PORT	Automation error: Application object, Invalid COM port.
-2163	BTI_AUTM_APP_CONFIGURE_COM_ READER_INVALID_BAUD_RATE	Automation error: Application object, Invalid baud rate.
-2170	BTI_AUTM_APP_CARRIER_IN_ GENERIC_ERROR	Automation error: Application object, Carrier in generic error.
-2175	BTI_AUTM_APP_CARRIER_OUT_ GENERIC_ERROR	Automation error: Application object, Carrier out generic error.
-2180	BTI_AUTM_APP_GET_LAST_READER_ ERROR_GENERIC_ERROR	Automation error: Application object, Get last reader error generic error.
-2300	BTI_AUTM_EXP_PLATES_GENERIC_ ERROR	Automation error: Experiment object, plates generic error.
-2310	BTI_AUTM_EXP_SAVE_GENERIC_ ERROR	Automation error: Experiment object, save generic error.
-2320	BTI_AUTM_EXP_SAVE_AS_GENERIC_ ERROR	Automation error: Experiment object, save as generic error.
-2330	BTI_AUTM_EXP_CLOSE_GENERIC_ ERROR	Automation error: Experiment object, close generic error.
-2331	BTI_AUTM_EXP_EXPERIMENT_IS_ CLOSED	Automation error: Experiment object, experiment is closed error.
-2400	BTI_AUTM_PLATES_GET_PLATE_ GENERIC_ERROR	Automation error: Plates object get plate error.
-2410	BTI_AUTM_PLATES_ADD_MULTI_ PLATE_ASSAY_PROTOCOL	Automation error: Plates object, the addition of plates is not supported in a multi-plate assay protocol.

Table 6 (Cont'd)

Code	Label	Probable Cause
-2420	BTI_AUTM_PLATES_ADD_GENERIC_ ERROR	Automation error: Plates object, add generic error.
-2500	BTI_AUTM_PLATE_START_READ_ GENERIC_ERROR	Automation error: Plate object start read error.
-2501	BTI_AUTM_PLATE_RESUME_READ_ READ_NOT_PAUSED	Automation error: Plate object, resume read error.
-2502	BTI_AUTM_PLATE_READ_FROM_FILE_ INVALID_SEPARATOR	Automation error: Plate object, read from file error – invalid separator.
-2503	BTI_AUTM_PLATE_BARCODE_ GENERIC_ERROR	Automation error: Plate object, barcode generic error.
-2504	BTI_AUTM_PLATE_ID_GENERIC_ ERROR	Automation error: Plate object, plate ID generic error.
-2505	BTI_AUTM_PLATE_NAME_GENERIC_ ERROR	Automation error: Plate object, plate name generic error.
-2506	BTI_AUTM_PLATE_PLATE_TYPE_ GENERIC_ERROR	Automation error: Plate object, plate type generic error.
-2507	BTI_AUTM_PLATE_READ_STATUS_ GENERIC_ERROR	Automation error: Plate object, read status generic error.
-2510	BTI_AUTM_PLATE_ABORT_READ_ GENERIC_ERROR	Automation error: Plate object, abort read error.
-2511	BTI_AUTM_PLATE_ABORT_READ_ READ_NOT_IN_PROGRESS	Automation error: Plate object, abort called while plate was not being read.
-2520	BTI_AUTM_PLATE_DELETE_GENERIC_ ERROR	Automation error: Plate object, delete generic error.
-2521	BTI_AUTM_PLATE_DELETE_MULTI_ PLATE_ASSAY_PROTOCOL	Automation error: Plate object, the deletion of plates is not supported in a multi-plate assay protocol.
-2522	BTI_AUTM_PLATE_DELETE_PLATE_IS _CALIBRATE	Automation error: Plate object, the deletion of calibration plates is not supported.
-2523	BTI_AUTM_PLATE_DELETE_LAST_ PLATE	Automation error: Plate object, the last plate of the experiment cannot be deleted.
-2524	BTI_AUTM_PLATE_PLATE_IS_ DELETED	Automation error: Plate object, plate has been deleted.

Table 6 (Cont'd)

Code	Label	Probable Cause
-2525	BTI_AUTM_PLATE_READ_IN_ PROGRESS	Automation error: Plate object, read in progress.
-2530	BTI_AUTM_PLATE_POWER_EXPORT_ GENERIC_ERROR	Automation error: Plate object, Power Export generic error.
-2531	BTI_AUTM_PLATE_POWER_EXPORT_ NOT_DEFINED	Automation error: Plate object, Power Export not defined.
-2540	BTI_AUTM_PLATE_FILE_EXPORT_ GENERIC_ERROR	Automation error: Plate object, file export generic error.
-2541	BTI_AUTM_PLATE_FILE_EXPORT_NOT _DEFINED	Automation error: Plate object, file export not defined.
-2550	BTI_AUTM_PLATE_PRINT_REPORT_ GENERIC_ERROR	Automation error: Plate object, print report generic error.
-2551	BTI_AUTM_PLATE_PRINT_REPORT_ NOT_DEFINED	Automation error: Plate object, print report not defined.
-2560	BTI_AUTM_PLATE_IMPORT_SAMPLE_ IDS_GENERIC_ERROR	Automation error: Plate object, import sample IDs generic error.
-2561	BTI_AUTM_PLATE_IMPORT_SAMPLE_ IDS_FILE_CONTAINS_EXTRA_IDS	Automation error: Plate object, import file contained more sample IDs than the plate.
-2562	BTI_AUTM_PLATE_DISCONTINUOUS_ KINETIC_GENERIC_ERROR	Automation error: Plate object, discontinuous kinetic generic error.
-2563	BTI_AUTM_PLATE_DISCONTINUOUS_ KINETIC_ INTERVAL_ GENERIC_ ERROR	Automation error: Plate object, discontinuous kinetic interval generic error.
-2564	BTI_AUTM_PLATE_DISCONTINUOUS_ KINETIC_RUNTIME_GENERIC_ERROR	Automation error: Plate object, discontinuous kinetic runtime generic error.

Table 7

KC4 Function Call Errors

KC4 function call error codes are displayed in the BioStack PC Control Software during BioStack operation with the PowerWave/XS or Synergy HT.

❖ If there are problems with a protocol, launch KC4 in standalone mode, open the protocol, and try to read a plate. Refer to the KC4 User's Guide or Help System for more information. If you cannot resolve the problem, contact BioTek TAC for assistance.

❖ KC4 does not support the PowerWave XS2 or Synergy 2/Synergy 4/ Synergy Mx readers.

Code	Probable Cause
-1000	**Generic error when opening the KC4 protocol file.** • Close the application and try to open the protocol in KC4 under manual mode, then retry.
-1001	**Either a plate or a protocol was already open in the KC4 memory, when a new plate or protocol was to be opened.** • Close the plate or protocol and retry.
-1002	**Incompatible reader type defined in the KC4 protocol.** • Correct the reader type in the protocol, or create a new protocol for the correct reader type.
-1003	**Incorrect protocol or plate file extension.** • Correct the file extension.
-1004	**Plate or protocol file not found.** • Select a different plate or protocol.
-1050	**Generic error when opening new KC4 plate file** • Close the application and try to open the protocol in KC4 under manual mode, then retry.
-1086	**Expected response never received** • Check the cable connection to the reader; re-boot the reader if necessary.
-1087	**Out of range parameter during read** • Correct the parameter in the protocol. Launch KC4 and review the protocol parameters. Initiate a plate read via KC4 to test the protocol.

Table 7 (Cont'd)

Code	Probable Cause
-1088	**Defective reader connected** • Replace or repair the reader.
-1089	**Checksum error during read operation** • Check the protocol and reader to make sure they are compatible, and retry.
-1090	**Unexpected response during read operation** • Close the application and retry.
-1091	**Software error message during read operation** • Close the application and retry.
-1092	**Reader error during read operation** • Check the reader. Re-boot if necessary.
-1093	**Negative acknowledgement during read operation** • Check the connection to the reader; re-boot the reader if necessary.
-1095	**Abnormal error during read operation** • Check the reader. Re-boot if necessary.
-1096	**Reading pending** • Check the reader. Re-boot if necessary.
-1097	**Communication port busy** • Make sure no other application has the port open. Close the application and retry.
-1098	**Communication port error** • Close the application and retry.
-1099	**Reading stopped** • Check the reader. Re-boot if necessary.
-1100	**No response from reader** • Check the connection to the reader; re-boot the reader if necessary.
-1150	**No plate in memory during read operation** • Close the application and retry.

Table 7 (Cont'd)

Code	Probable Cause
-1151	**No protocol in memory during read operation** • Close the application and retry. Make sure a valid KC4 protocol is selected.
-1152	**Plate already read** • Select a different plate.
-1153	**Can't read reader's filter table** • Close the application and see if a plate with the same protocol can be read via KC4 manually, then retry.
-1154	**Filter table mismatch** • Correct the protocol to match the reader's filter table.
-1155	**Filter not found in filter read table** • Correct the protocol to match the reader's filter table.
-1156	**Incorrect filter selection** • Correct the protocol to match the reader's filter table.
-1157	**Kinetic read interrupted** • Check the reader. Re-boot if necessary.
-1158	**Abnormal end to kinetic read** • Check the reader. Re-boot if necessary.
-1159	**Reading parameters not supported** • Correct the protocol.
-1160	**Monitor well not supported** • Correct the protocol (disable well monitoring in protocol).
-1161	**Probe size error** • Correct the protocol.
-1163	**Auto save failed** • Launch KC4 manually, then open the protocol and try to read a plate. If there are problems with the protocol or with the reader, KC4 will display prompts to fix the problems.

Table 7 (Cont'd)

Code	Probable Cause
-1199	**Generic error during read operation** • Check the reader. Re-boot if necessary.
-1200	**Generic error during plate closing** • Check the reader. Re-boot if necessary.
-1201	**Invalid plate file name during plate closing** • Correct the plate file name. If the file name is to be created using a barcode value, make sure the barcode does not have illegal file name characters.
-1250	**Generic error during file export operation** • Correct the export file name in the KC4 protocol.
-1251	**No plate in memory during file export operation** • Check the protocol to see if it is set up correctly for exporting.
-1252	**No protocol in memory during export operation** • Check the protocol to see if it is set up correctly for exporting.
-1253	**Nothing to export** • Close the application and attempt to run a plate with the same protocol via KC4 manually, then retry.
-1254	**File creation error during export operation** • Check the protocol to see if it is set up correctly for exporting, and that there is a valid export filename.
-1300	**Generic error during protocol closing** • Check the protocol.
-1350	**Unable to start KC4 via BioStack software** • Make sure that KC4 has been installed, and that there is not another instance of KC4 already running.
-1400	**Generic error during file importing** • Correct the import filename.
-1401	**No plate in memory during file importing** • Check the protocol to see if it is correct for importing.

Table 7 (Cont'd)

Code	Probable Cause
-1402	**Invalid filename for file importing** • Correct the filename.
-1403	**File not found for file importing** • Check the protocol to see if it is correct for importing.
-1404	**Invalid parameter format during file importing** • Check the protocol to see if it is correct for importing.
-1450	**Generic error during plate opening** • Correct the plate file name.
-1451	**Plate already in memory during plate opening** • Close the application and retry.
-1452	**No protocol in memory during plate opening** • Close the application and retry.
-1453	**Protocol already in memory during plate opening** • Close the application and retry.
-1454	**Incorrect file extension for plate opening** • Correct the file extension.
-1455	**File not found during plate opening** • Correct the filename or file path.
-1456	**Incompatible reader during plate opening** • Correct the reader type called out in the protocol or select a different protocol.
-1457	**Incompatible reading parameter during plate opening** • Correct the protocol.
-1500	**Error getting the plate barcode value – either because the scanning failed, or because there is no scanner** • If there is a scanner, make sure that there is a valid, readable barcode on the plate, in the correct location and orientation. See **Appendix B**, **BioStack Barcode Scanner**, for required barcode types and proper position on the microplates.

Table 7 (Cont'd)

> ❖ For data reduction errors (−1600 to −1613), launch KC4 in standalone mode, open the plate and protocol, and initiate a plate read to determine why the error occurred. Refer to the KC4 User's Guide and Help System for more information.

Code	Probable Cause
-1600	**Calculation error** • Correct the protocol.
-1601	**Log axis incompatibility** • Correct the protocol's curve-fitting parameters.
-1602	**Curve could not be not calculated** • Correct the protocol.
-1603	**Curve is ambiguous** • Correct the protocol.
-1604	**Not enough valid standards on the plate** • Re-try the test, or modify the protocol's plate layout in the location specified in the protocol. See note above.
-1605	**Archived curve not loaded** • Make sure the archived curve is available.
-1606	**Data to interpolate not available** • Correct the protocol; make sure the read was properly performed.
-1607	**Cut-off values not calculated** • Correct the protocol; make sure the read was properly performed.
-1608	**Cut-off values not in increasing order** • Correct the protocol; make sure the read was properly performed.
-1609	**Single plate transfer data is not available** • Correct the protocol; make sure the read was properly performed.
-1610	**Kinetic calculation data to process is not available** • Correct the protocol; make sure the read was properly performed.

Table 7 (Cont'd)

Code	Probable Cause
-1611	**Validation condition failure** • This is probably a valid failure.
-1612	**4-parameter curve-fit not converging** • Correct the protocol; make sure the read was properly performed.
-1613	**Multi-plate transfer data is not available** • Correct the protocol; make sure the read was properly performed.
-4000	**Generic database error** • Close the application and attempt to run the plate and protocol in KC4 manually. Refer to the KC4 User's Guide for database troubleshooting information.

> ❖ Warning codes indicate that the data might be questionable because something went wrong, but KC4 didn't have enough information to accept or reject the results.

Warning Code	Warning Code Description
1000	**Expected incubation temperature not reached** • Make sure expected incubation temperature has been reached on the reader before starting the processing of plates.
1001	**Barcode read failure** • Make sure that the barcode reader is working properly, and that the plate has a valid barcode label, which is properly positioned on the microplate. See *Appendix B*, *BioStack Barcode Scanner*, for required barcode types and proper position on the microplates.

Table 8

Communication Errors Displayed on the MicroFill, ELx405, MicroFlo Select, or EL406

Communication errors appear on the displays of the MicroFill, ELx405, MicroFlo Select, or EL406 during operation with the BioStack, and indicate that the software may be corrupted. Contact BioTek TAC if you receive these errors.

> ❖ When communication errors are generated by the BioStack, the error code appears on the display of the MicroFill, ELx405, or MicroFlo Select prefixed with a **B-**. "Stacker Error" also appears in the first line of the display of the MicroFlo.
>
> ❖ Communication error codes generated by the BioStack **do not** appear on the EL406 display prefixed with **B-**. "BIOSTACK ERROR" appears in the first line of the display of the EL406.

Code	Probable Cause
8300	An invalid password was sent to the BioStack during a protected operation. This error can only occur when the BioStack is under serial control, using a software program other than the BioStack™ PC Control Software.
8301	The BioStack was requested to send some configuration data to the controlling software, and the BioStack did not know about the requested data.
8302	A checksum was generated following a code download, which did not match what was expected. Turn the MicroFill, ELx405, or MicroFlo off then on, and re-try the operation.
8303	The BioStack is in an invalid mode for receiving a message. Turn the MicroFill, ELx405, or MicroFlo off then on again, and re-try the operation.
8304	The BioStack didn't properly acknowledge a message sent to it. Turn the MicroFill, ELx405, or MicroFlo off then on again, and re-try the operation.
8305	An invalid message response was received from the BioStack. Turn the MicroFill, ELx405, or MicroFlo off then on again, and re-try the operation.
8306	The serial communications timed out. Turn the MicroFill, ELx405, or MicroFlo off then on again, and re-try the operation.

Table 9

**MicroFlo Select Interface Software Errors Displayed
in the LHC Software**

MicroFlo Select Interface Software errors are displayed in the Liquid Handling Control Software during BioStack operation with the MicroFlo Select Dispenser.

Code	Probable Cause
6000	General communication error during download.
6001	COM port created by USB converter no longer active.
6010	The data is invalid or out-of-range.
6012	This step type can not be downloaded.
6014	Illegal characters in protocol name; valid characters are letters, numbers, spaces, or symbols (_ - % &).
6016	The protocol name length must be 16 characters or less.
6018	A 1536 well plate is not supported by this instrument.
6020	The specified volume exceeds the cassette maximum limit.
6022	The volume is out-of-range.
6024	Invalid flow rate.
6026	Invalid number of pre-dispenses.
6028	Invalid horizontal dispense position.
6030	Invalid dispense height.
6032	Invalid plate clear height.
6034	Invalid column selection value (must be 0 or 1).
6036	Invalid protocol step type.
6038	The Definition String contains invalid data.
6040	Invalid baud rate.
6041	Invalid data bits selection.
6042	Invalid stop bits selection.
6043	Invalid parity selection.

Table 9 (Cont'd)

Code	Probable Cause
6044	Serial port error.
6045	Serial write error.
6046	Serial read error.
6047	Checksum error.
6048	Serial NAK error.
6049	Excess data or not enough data received.
6050	Invalid message header.
6051	Invalid message object.
6052	Invalid message body size.
6053	Serial message timeout.
6054	Port handle error.
6055	Read timeout value is invalid.
6056	Unauthorized to open the COM port.
6057	Out-of-range parameter for the open port function.
6058	Unable to open the COM port.
6059	Unable to clear the transmission buffer.
6060	Unable to close the port.
6061	Port is no longer available.

Table 10

**EL406 Interface Software Errors Displayed
in the LHC Software**

EL406 Interface Software errors are displayed in the Liquid Handling Control Software during BioStack operation with the EL406 Washer Dispenser.

Code	Probable Cause
6000	General communication error during download.
6001	COM port created by USB converter no longer active.
6002	Invalid basecode part number; instrument is not an EL406.
6010	The data is invalid or out-of-range.
6011	This step type cannot be downloaded.
6012	Illegal characters in protocol name; valid characters are letters, numbers, spaces, or symbols (_ - % &).
6013	The protocol name length must be 16 characters or less.
6014	A 1536-well plate is not supported by this instrument.
6015	The specified volume exceeds the cassette maximum limit.
6016	The volume is out-of-range.
6017	Invalid flow rate.
6018	Invalid number of pre-dispenses.
6019	Invalid horizontal dispense position.
6020	Invalid dispense height.
6021	Invalid plate clear height.
6022	Invalid column selection value (must be 0 or 1).
6023	Invalid protocol step type.
6024	The Definition String contains invalid data.
6025	Manifold conflict between protocol requirements and instrument configuration.

Table 10 (Cont'd)

Code	Probable Cause
6026	Valve module conflict between protocol requirements and instrument configuration.
6027	Syringe module conflict between protocol requirements and instrument configuration.
6028	Filter washer conflict between protocol requirements and instrument configuration.
6029	Required cassette does not match installed cassette.
6030	Invalid cassette type was specified.
6031	Cannot use a 96-well plate with a 192-tube manifold.
6032	Downloading protocols is not supported in this version.
6034	Invalid column selection value (must be 0 or 1).
6040	Invalid baud rate.
6041	Invalid data bits selection.
6042	Invalid stop bits selection.
6043	Invalid parity selection.
6044	Serial port error.
6045	Serial write error.
6046	Serial read error.
6047	Checksum error.
6048	Serial NAK error.
6049	Excess data or not enough data received.
6050	Invalid message header.
6051	Invalid message object.
6052	Invalid message body size.
6053	Serial message timeout.

Table 10 (Cont'd)

Code	Probable Cause
6054	Port handle error.
6055	Read timeout value is invalid.
6056	Unauthorized to open the COM port.
6057	Out of range parameter for the open port function.
6058	Unable to open the COM port.
6059	Unable to clear the transmission buffer.
6060	Unable to close the port.
6061	Port is no longer available.
6070	Invalid syringe specified.
6071	Invalid number of syringe prime cycles.
6072	Invalid syringe aspirate delay value.
6073	Invalid x-axis offset value.
6074	Invalid y-axis offset value.
6075	Invalid z-axis offset value.
6080	Invalid Peri-pump prime duration.
6085	Invalid minutes:seconds value.
6086	Invalid hours:minutes value.
6088	Invalid shake/soak options selected.
6089	Invalid shake intensity selected.
6090	Invalid washer buffer selected.
6091	Invalid washer aspirate delay value.
6092	Invalid washer aspirate travel rate value.
6093	Invalid wash cycles value.
6094	Invalid wash format selected.
6095	Invalid wash sectors selected.

Table 10 (Cont'd)

Code	Probable Cause
6096	Wash aspirate delay value is required.
6100	This functionality requires the software to be registered.

Appendix A

Computer Control

This appendix describes how to obtain the information necessary to serially control the BioStack without using the BioStack PC Control Software, Precision Power Software, or Liquid Handling Control (LHC) Software.

Computer Control

If you wish to serially control a BioStack instrument without using the BioStack PC Control Software, Precision Power Software, or Liquid Handling Control Software, you will need to write your own application to control the BioStack. BioTek recommends using one of the following two methods:

- **Write a container application to interface with the BioStack ActiveX component** (recommended for a **Microsoft® Windows** operating system). The BioStack ActiveX, which is included with the BioStack PC Control Software installation, handles all of the low-level serial communication, providing higher-level methods and properties for a container application to access.

  Refer to the **ActiveX Programmer's Reference Guide** for details, by selecting **Start > Programs > BioTek > BioStack > Developer**.

- **Write an application to directly control serial communication, without using the BioStack ActiveX** (recommended for a **non-Windows** operating system). To do this, you will need to learn about the serial message protocol recognized by the instrument software.

  Refer to the **User Guide to Serial Programming** for details, by selecting **Start > Programs > BioTek > BioStack > Developer**.

Appendix B

BioStack Barcode Scanner

This appendix contains instructions for installing the BioStack's optional barcode scanner, and the specifications for barcode label format and position on the microplate.

Overview

The barcode scanner is enabled via a dipswitch setting on the BioStack. The scanner automatically scans a barcode label as a plate goes from the carrier home position to the BioStack's extended carrier position. If a valid barcode label is found on the plate after it is processed, then it is displayed (e.g., *05726692775*) in the BioStack PC Control Software main screen (if the operator has selected the option to display barcode information).

The barcode value is then automatically passed into Gen5 or KC4 Software for storage in the Gen5 experiment or KC4 output file, and optionally, as part of the output filename (KC4 only).

Barcode scanner options are also available in Precision Power Software through the Supply Command and To-Do List features.

The following barcode scanner options are provided in the BioStack PC Control Software:

Display Options Setting

The **Display Options** feature in the BioStack PC Control Software Settings for Gen5 and KC4 allows you to select the option to display barcode labels (IDs) to the left of the Input Stack or to the right of the Output Stack in the BioStack PC Control Software main screen:
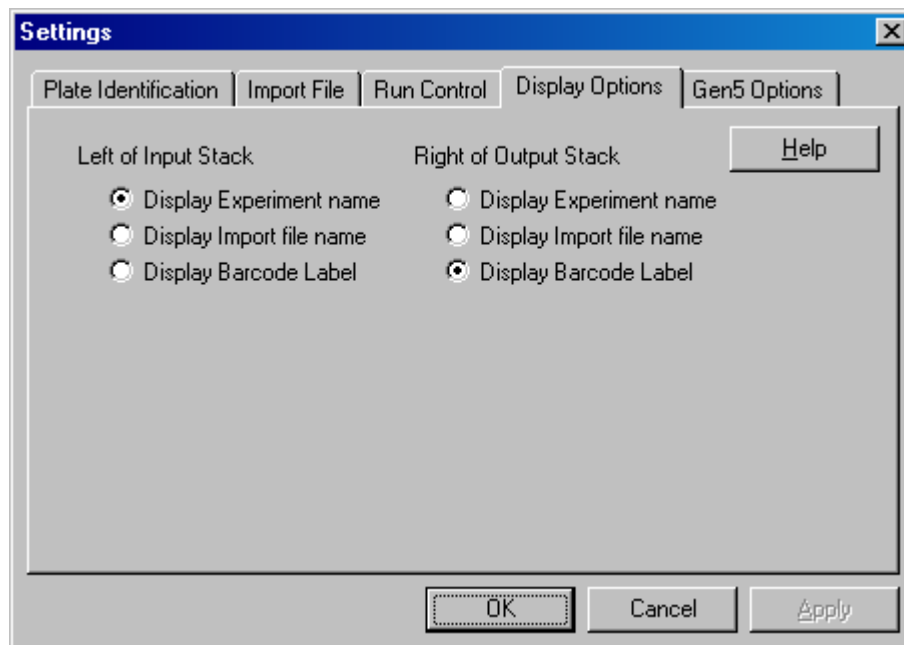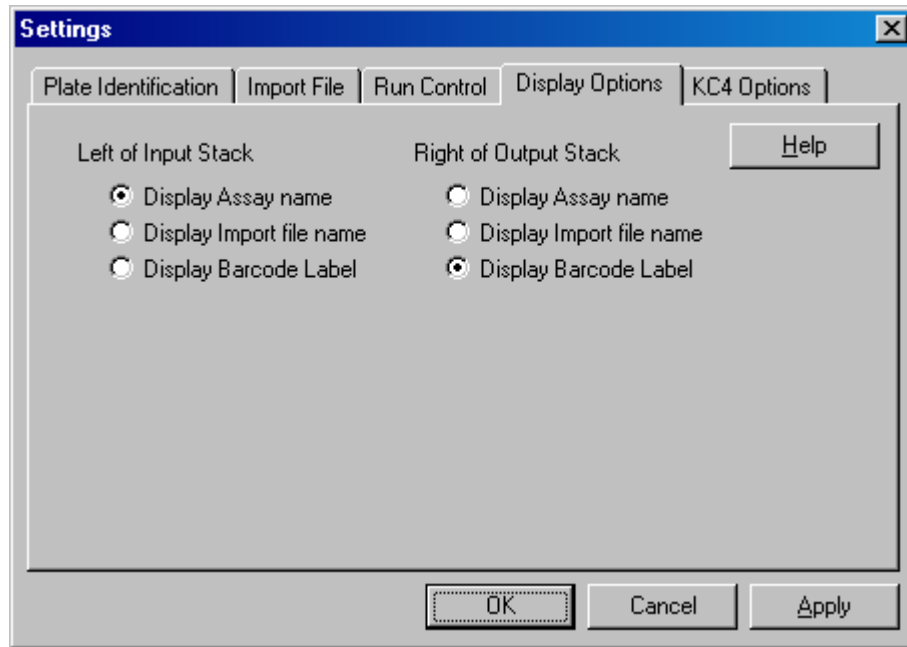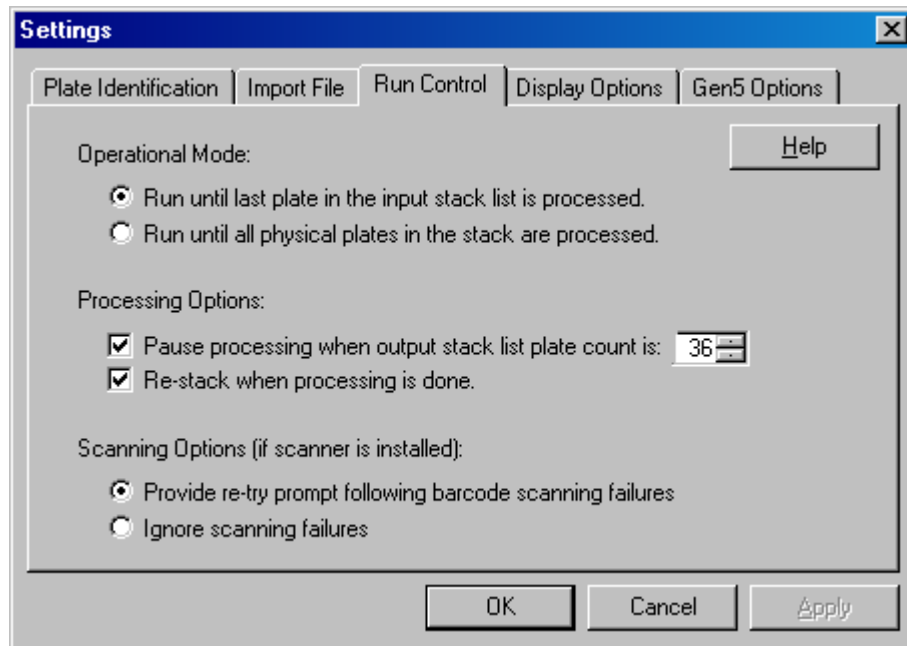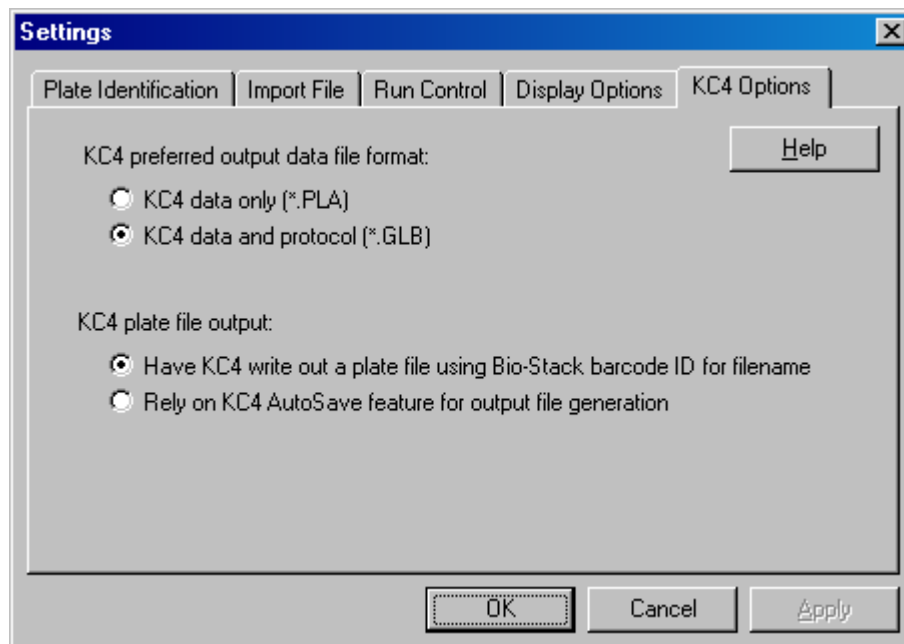
Run Control Setting

The **Run Control** feature in the BioStack PC Control Software Settings for Gen5 allows you to specify how scanning failures will be handled: either provide a retry prompt or ignore the failure:

KC4 Options Setting

The **KC4 Options** feature, "KC4 plate file output," in the BioStack PC Control Software Settings for KC4 allows you to specify that the BioStack barcode ID will be used for the plate file output name:

Step 1: Install the BioStack Barcode Scanner

⚠	**Warning! Laser Radiation.** Do not look directly into the laser beam during operation of the scanner. Serious eye injury may occur if you stare directly into the beam. Please note the warning label on the outside of the scanner's protective cover.
ⓘ	Be very careful not to scratch or damage the mirror when unpacking or installing the barcode scanner!
ⓘ	Ensure that you have performed all of the instructions for installation of the BioStack with the interfacing instrument **before** you install the BioStack barcode scanner (see *Chapter 3*, *Installation*). The BioStack must be equipped with the scanner's cable connection (on the rear panel of the BioStack) and the appropriate basecode software version. You will also need appropriate versions of the BioStack PC Control Software and Gen5, KC4, or Precision Power Software. Refer to *Appendix D* for information on required software versions.

The BioStack barcode scanner may be installed by the operator on the BioStack as shown in the following barcode scanner location configurations:

Model	Synergy HT/2/4/Mx	PowerWave/XS/ XS2	Precision/XS
Fixed wrist model (PN BIOSTACK2)	Left or right	Left only	Left or right
Rotational wrist model (PN BIOSTACK2WR)	Left or right (wrist angle at 0° only)	Left (wrist angle at 0° only)	Left or right (wrist angle at 0° only)

❖ The **rotational wrist model** does not support Synergy HT/2/4/Mx, PowerWave/ XS/XS2, and Precision/XS integrations, or the barcode scanner, with the wrist angle set at the **90°** interface position.

❖ The **MicroFlo Select Dispenser** does not support the BioStack barcode scanner. However, if you wish to alternate use of the BioStack with the MicroFlo and with another BioTek instrument that *does* support the barcode scanner, you will need to install the scanner on the **left side** of the BioStack, before you can align the MicroFlo with the BioStack.

The following sections describe how to install the barcode scanner, which label format to use, and how to verify the installation by performing the Scanner Test.

Unpack the Barcode Scanner Installation Kit

> ⓘ Be very careful not to scratch or smudge the mirror when unpacking the barcode scanner!

> ❖ If you are installing *two* barcode readers for operation of two BioStacks with a Precision instrument, you can install the scanners on either the left or right sides of the BioStacks.
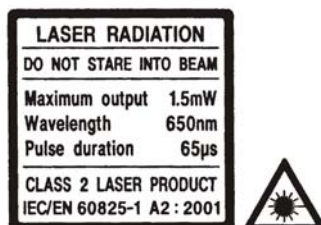
1. Turn off and unplug the BioStack.

2. Open the shipping container for the barcode scanner kit, and carefully remove the kit (enclosed in a plastic bag). The kit should contain the following components:

   - Barcode scanner assembly: scanner (housed in a protective cover), scanner cable, and mirror attached to a removable mounting bracket

   - 2 shoulder screws and washers for attaching the mounting bracket to the BioStack

   - Cable duct and cable clip for fastening the cable to the BioStack

   - Combination Phillips head/flat head screwdriver

   - Installation instructions

Install the Scanner on the BioStack

The barcode scanner is shipped already attached to the mounting bracket for installation on the right side of the BioStack, as you are facing the claw/gripper. If necessary, the scanner may be removed from the bracket and reassembled for installation on the left side of the BioStack.

   - **Synergy readers and Precision instruments:** Refer to the instructions on pages 389 to 390 for right-side installation of the scanner.

   - **PowerWave/XS/XS2 and Synergy readers, and Precision instruments:** Refer to the instructions on pages 391 to 392 for left-side installation of the scanner.

After you have installed the scanner, take a minute to read the "Laser Radiation" label (shown below) that is attached to the scanner's protective cover. This warning is to remind you to avoid looking directly at the laser beam during operation of the scanner.

LASER RADIATION
DO NOT STARE INTO BEAM
Maximum output   1.5mW
Wavelength   650nm
Pulse duration   65µs
CLASS 2 LASER PRODUCT
IEC/EN 60825-1 A2 : 2001

Mount the Scanner on the Right Side of the BioStack

Refer to *Figure 79* for the following instructions.

1. Align the two holes in the mounting bracket with the two holes on the **right** side of the BioStack, as shown.

2. Using the screwdriver and the two shoulder screws, attach the scanner to the BioStack.

3. Using lens tissue or a soft cloth moistened with lens cleaner, carefully wipe the mirror to remove any dust or particles.
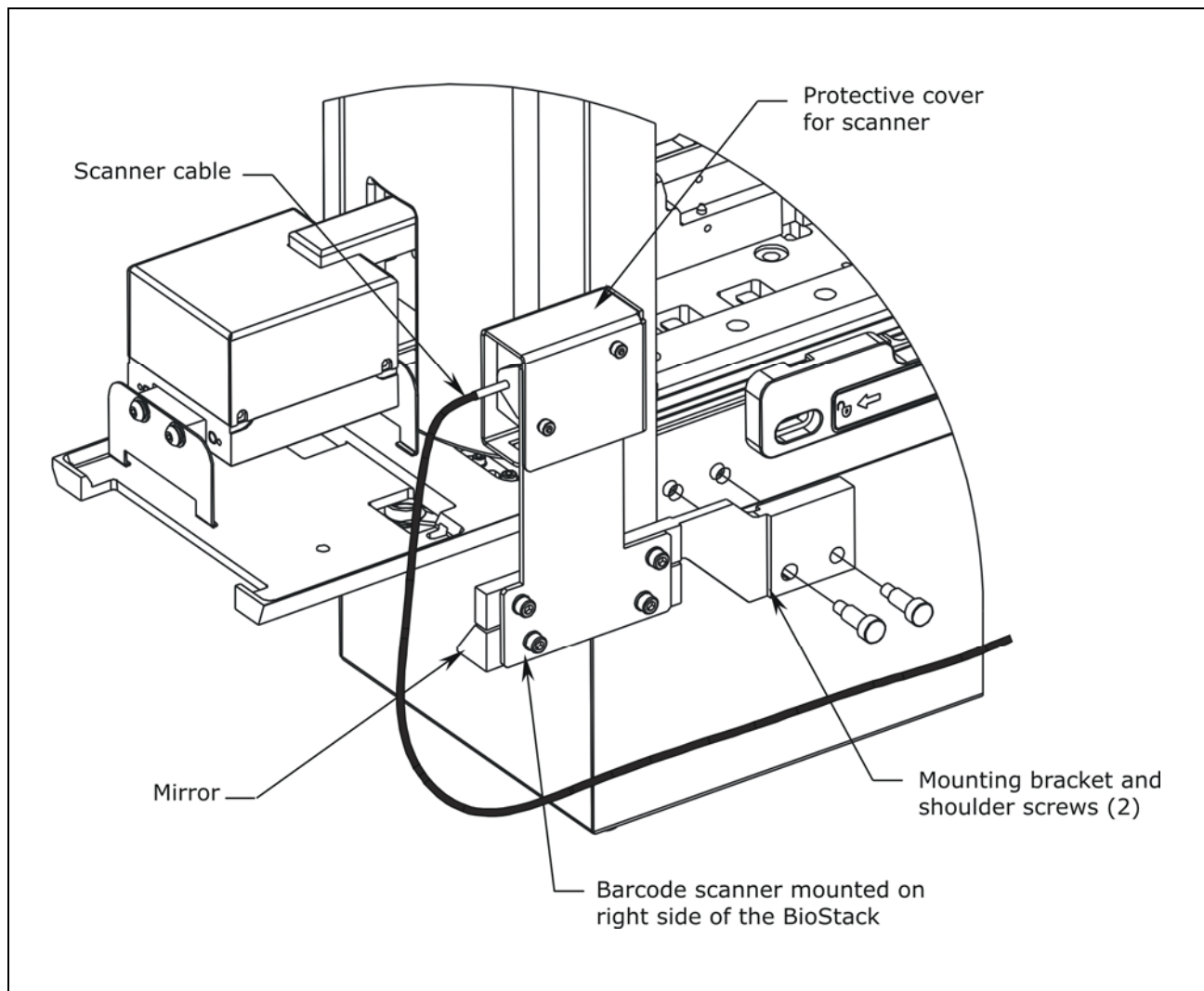
**Figure 79:** Installing the Barcode Scanner on the Right Side of the BioStack

❖ The fixed wrist model (BIOSTACK2) is shown.

Set the Dipswitch and Attach the Scanner Cable Hardware

> ❖ Both the fixed wrist model (PN BIOSTACK2) and rotational wrist model (PN BIOSTACK2WR) have two sets of dipswitches: SW1-1 through SW1-4, and SW2-1 through SW2-4 (see *Figure 13b* in *Chapter 3*).

In order for the BioStack to "recognize" the scanner, you must set dipswitch **SW1-3** to "OPEN." Refer to *Figure 80* for the following instructions.

1. With the BioStack still turned off, remove the hole plug for the SW1 dipswitches, and set dipswitch **SW1-3** to "OPEN." Replace the hole plug.

2. Using a clean, cotton cloth moistened with alcohol, clean the scanner cable duct, then remove the adhesive backing from the duct.

3. Attach the duct to the **same side** of the BioStack as the scanner's mounting bracket, and center the duct front to back.

4. Push the scanner cable into the duct.

5. Remove the adhesive backing on the cable clip and attach the clip to the back panel of the BioStack.

6. Loop the excess cable into the clip, and plug the scanner cable into the cable connection on the back panel of the BioStack.
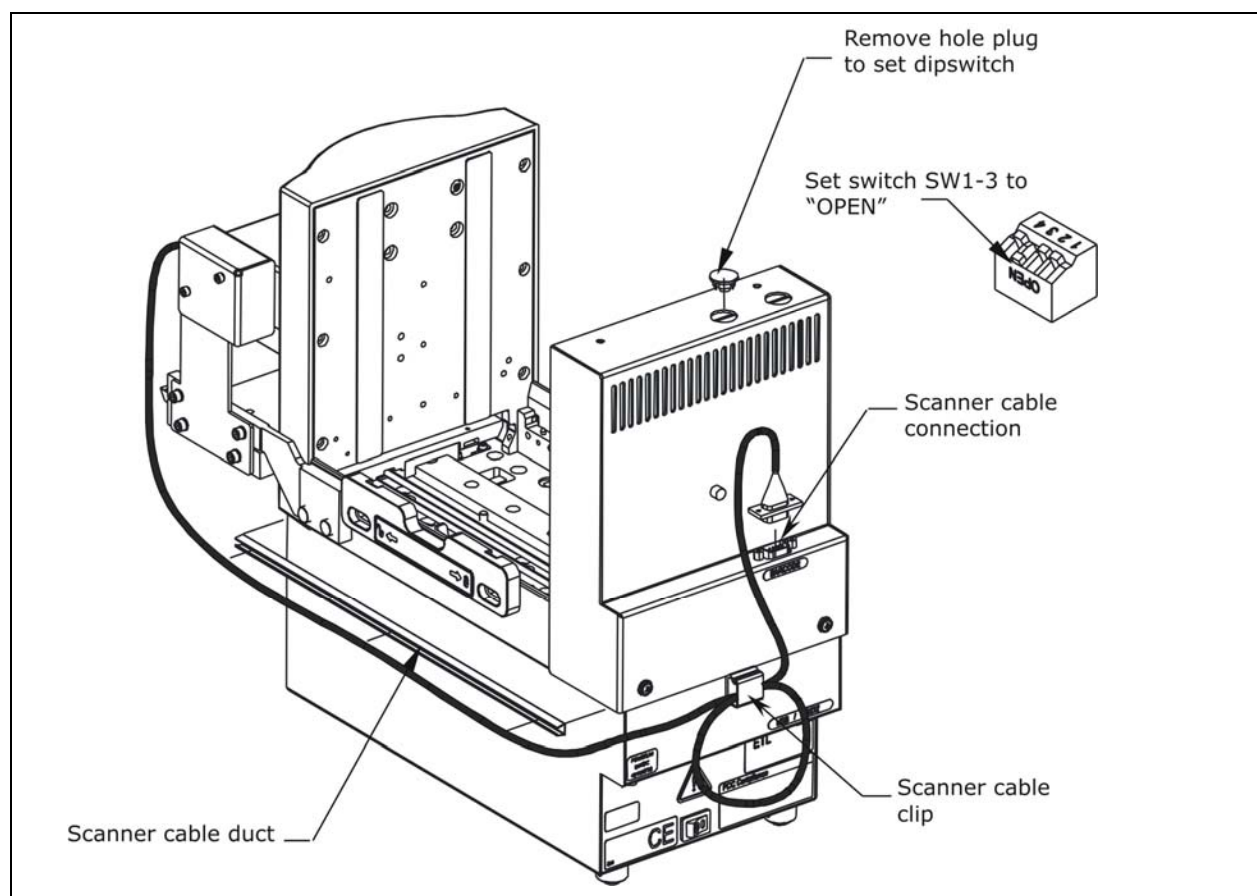

Figure 80: Setting the Dipswitch and Attaching the Cable Hardware (fixed wrist model)

Reassemble the Scanner Bracket for Mounting on the Left Side

1. Using the supplied screwdriver, remove the two screws and washers that attach the scanner assembly to the mounting bracket, as shown in *Figure 81* and set them aside.

2. Using a 9/64" hex wrench, remove the scanner from the bracket. **Be very careful not to scratch or damage the mirror!**

3. Position the scanner on the opposite side of the bracket, as shown in *Figure 82* and align the mounting holes.

4. Reassemble, using the two screws and washers and a 9/64" hex wrench.
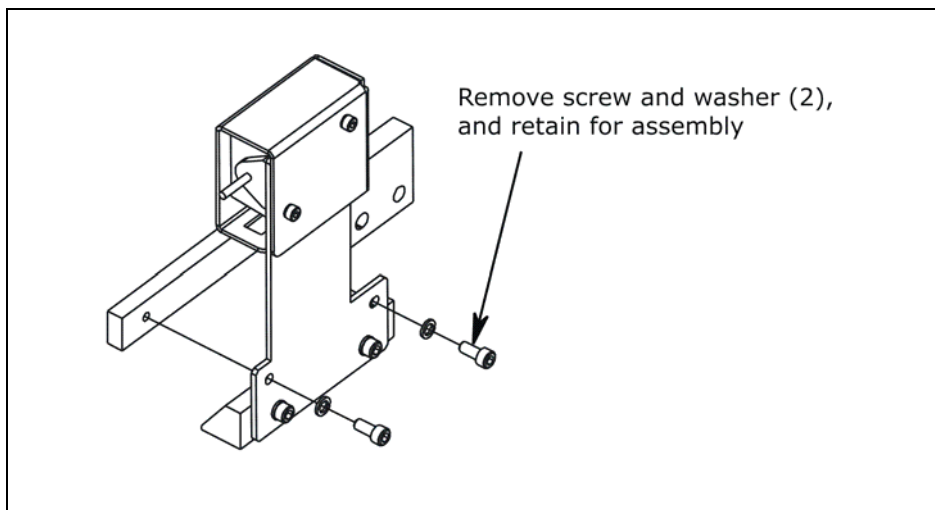
**Figure 81:** Removing the Scanner from the Mounting Bracket
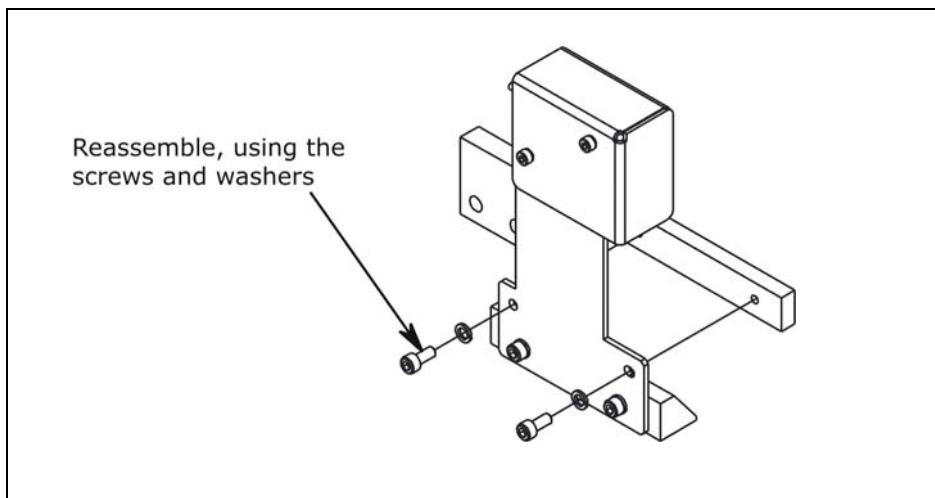
Figure 82: Reattaching the Scanner to the Mounting Bracket for Left Side Installation

Mount the Scanner on the Left Side of the BioStack

Refer to *Figure 83* for the following instructions.

1. Align the two holes in the scanner mounting bracket with the two holes on the **left** side of the BioStack, as shown.

2. Using the screwdriver and two shoulder screws, attach the scanner to the BioStack.

3. Using lens tissue or a soft cloth moistened with lens cleaner, carefully wipe the mirror to remove any dust or particles.

4. To complete the installation, follow the instructions in **Set the Dipswitch and Attach the Scanner Cable Hardware** on page 390 for setting the dipswitch, and for mounting the cable duct and cable clip. Ensure that you mount the cable duct on the *left* side of the BioStack!

Scanner cable

Mounting bracket and shoulder screws (2)

Barcode scanner mounted on left side of the BioStack

Mirror
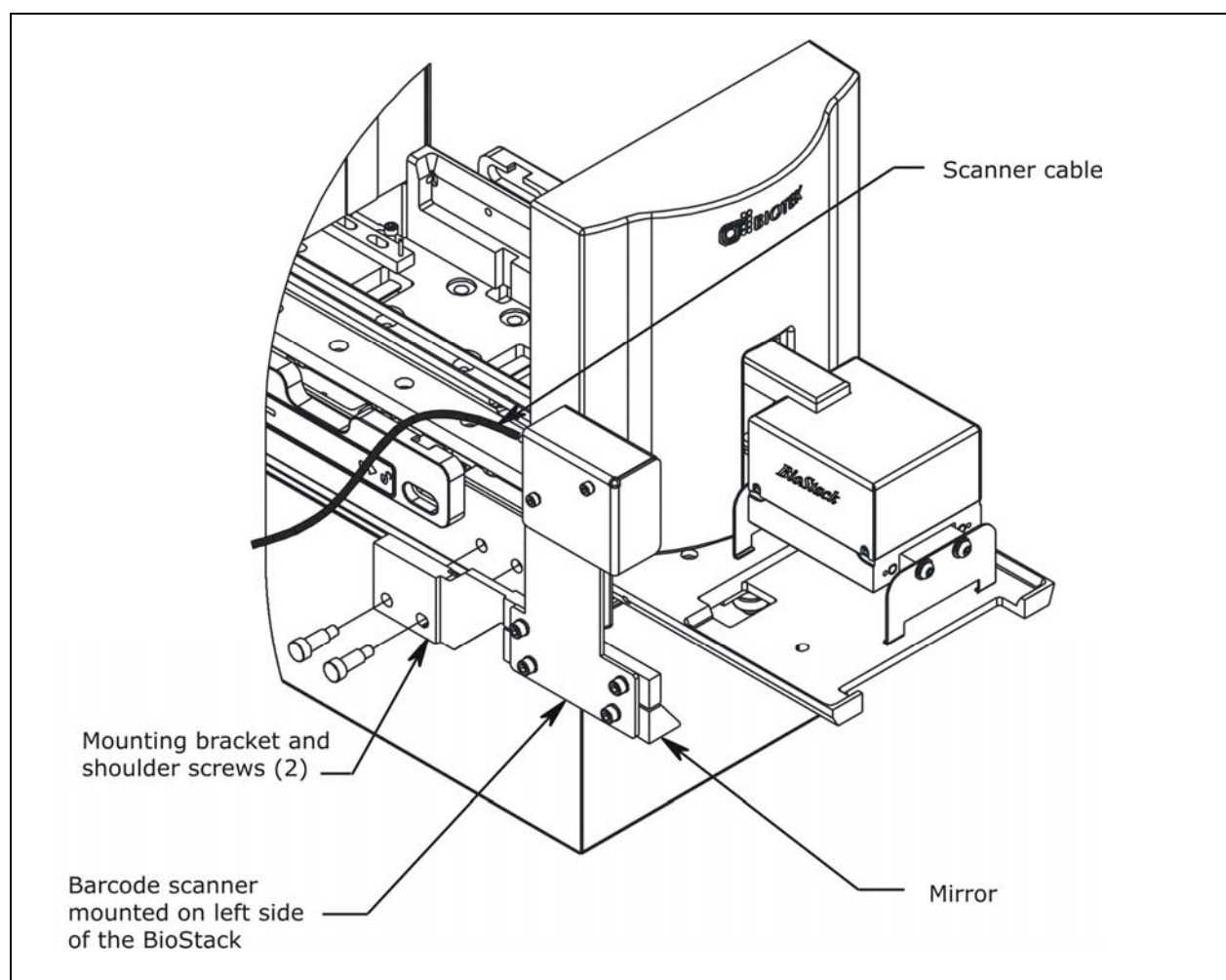
Figure 83: Installing the Barcode Scanner on the Left Side of the BioStack

❖ The fixed wrist model (BIOSTACK2) is shown.

Step 2: Prepare Barcode Labels

Purchase or Create Labels to Specifications

Barcode labels are available for purchase from BioTek, or they may be created using barcode software and label products that meet the following specifications:

- **Label format ("symbology"):** Required formats are:

  - ➢ Code 39

  - ➢ Codeabar

  - ➢ UPC/EAN

  - ➢ Code 128

- **Industry Standards:** The labels should be made in accordance with Automation Identification Manufactures (AIM) uniform symbol specification for all codes supported. Label decodability should meet ANSI Specification X2, 182-199 "Bar-Code Print Quality Guideline" for a rating of A/05/880.

- **Label quality:** The labels should be printed on good-quality copier machines or laserjet printers.

- **Label position on plate:** The labels should be attached to the "short" sides of the microplates.

BioTek offers pre-printed, self-adhesive barcode labels (PN 7121094), in rolls containing 500 labels, which meet the above specifications for format, industry standards, and quality. Each label features a perforated section that may be easily attached to the side of a 96-, 384- or 1536-well microplate. *Figure 84* and *Figure 85* on the following page are actual-size reproductions of one of the BioTek labels and its perforated section.
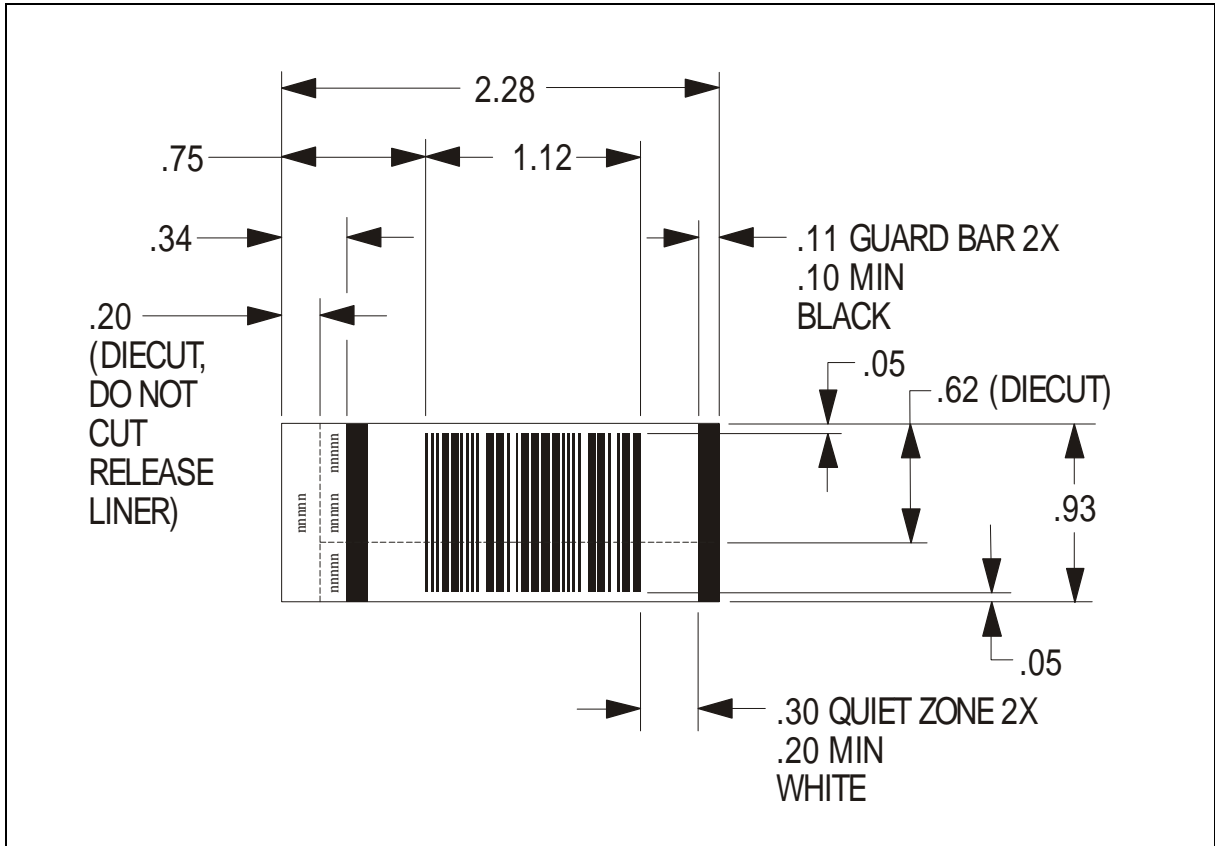
Figure 86 on page 395 contains barcode label artwork that may be submitted to a print vendor for creation of labels that meet the code symbology and industry standards.
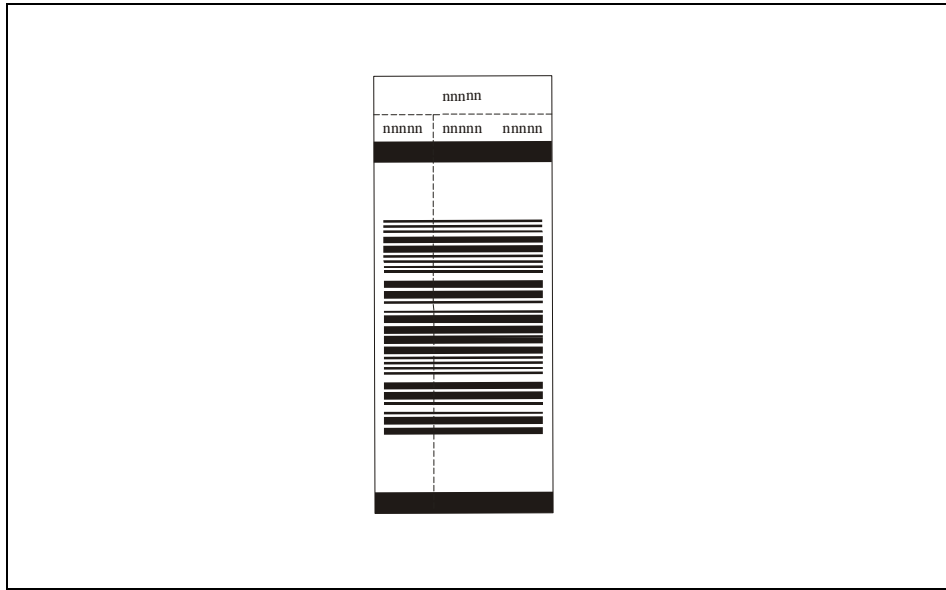
Figure 84: Sample of One BioTek Barcode Label from Roll (PN 7121094)
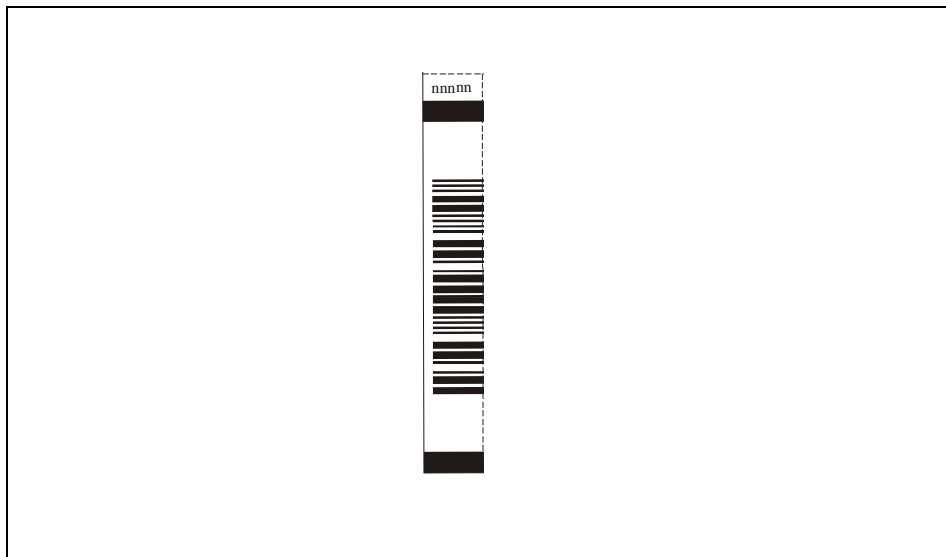
Figure 85: Section of Label for Attachment to Microplate

Figure 86: Barcode Label Artwork with Recommended Dimensions

Step 3: Verify Installation – Perform Scanner Test

Before using the BioStack barcode scanner for the first time, verify the installation by performing the Scanner Test, as instructed in the following sections:

- *Scanner Test for BioStack with Readers*, page 397.

- *Scanner Test for BioStack with Precision Instruments*, page 405.

❖ **Readers:** The BioStack PC Control Software Help system contains complete instructions for using the BioStack barcode scanner, that include

- displaying barcodes that have been scanned next to the input and output stacks in the BioStack PC Control Software main screen,

- using the barcodes as plate data file names (KC4 only), and

- specifying how barcode scanning failures should be processed.

❖ **Precision instruments:** The Precision Power Software Help system contains complete instructions for using the BioStack barcode scanner, that include

- using the BioStack in a Supply Command, and

- using the BioStack to build the To-Do List.

Refer also to the Precision Power User's Guide.

Scanner Test for BioStack with Readers

> ⓘ **Important!** Always power up the BioStack **first** before turning on the reader, and leave the BioStack on as much as possible (power consumption will be nominal). If you turn the BioStack off, raise the claw/gripper assembly manually above the reader's carrier before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the reader.

If you are operating the BioStack and barcode scanner with the PowerWave, PowerWave XS, PowerWave XS2, Synergy HT, Synergy 2, Synergy 4, or Synergy Mx readers, perform the instructions in this section for verifying installation of the scanner.

Prepare Microplates for the Scanner Test

Refer to *Figure 87* on page 398 for the following instructions:

1. Assemble the required materials:

   ◆ Purchased or custom-made barcode labels that meet label requirements and dimensions described in *Purchase or Create Labels to Specifications* on page 393.

   ◆ Three "dry" (empty) 96-, 384-, or 1536-well microplates that meet plate specifications described on page 19 in *Chapter 1*, and that have **flat**, vertical sidewalls so the labels will lie flat upon the surface.

2. Place the labels on whichever "short" sides of the microplates that will be scanned. See *Figure 87*; a 384-well plate is shown. The labels should not extend above or below the edges of the plate, or the plates may stick to one another when they are stacked.

3. Load the barcode labeled plates into whichever stack you have designated as the **input** stack.
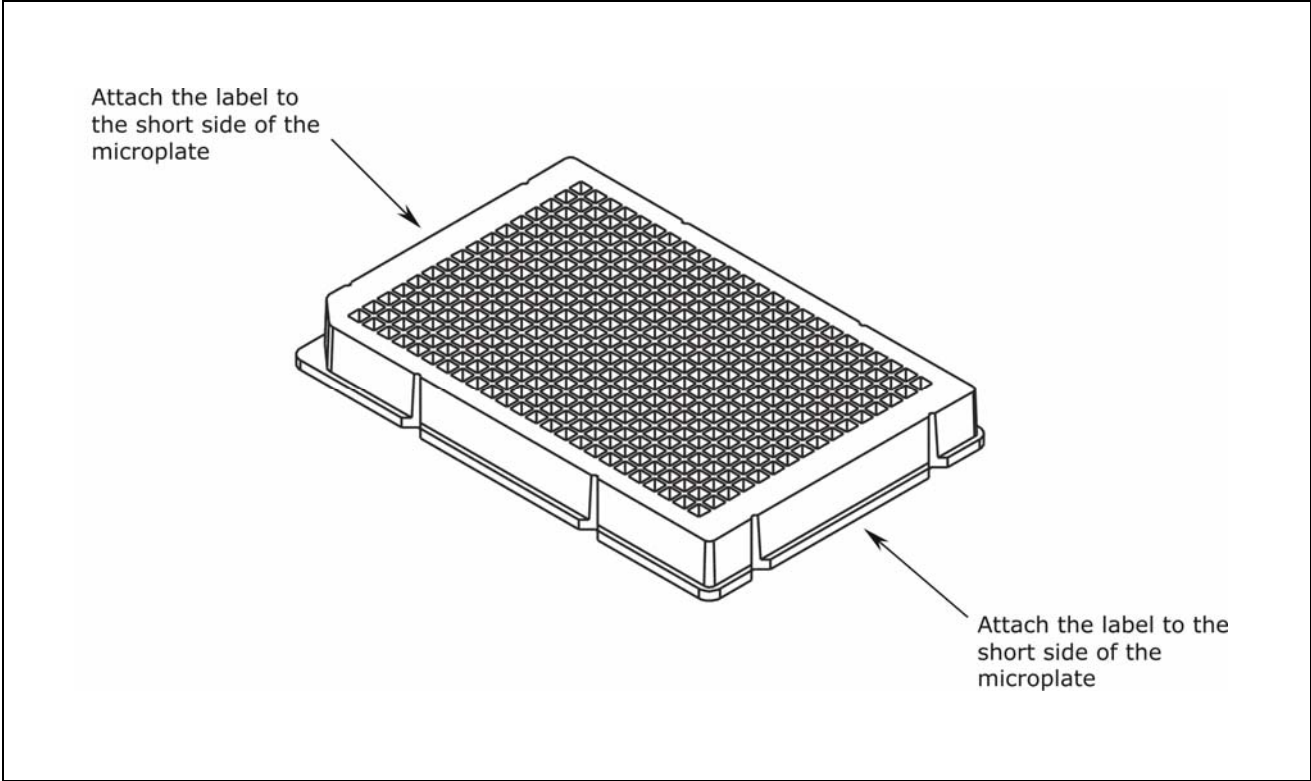
Figure 87: Positioning the Barcode Label on the Microplate

Create a Gen5 Experiment for the Scanner Test

❖ Gen5 *must* be used for the PowerWave XS2, Synergy 2/Synergy 4/ Synergy Mx readers. KC4 does not support these readers.

❖ Gen5 Software does not need to be configured before creating the following experiment for the Scanner Test. However, prior to running the BioStack™ PC Control Software with Gen5 on a regular basis, there are several Gen5 items that must be configured properly while running Gen5 as a stand-alone application. These include choosing a file storage mode, setting user preferences, etc. Refer to the ***Gen5 Getting Started Guide*** or Help system for more information on configuration of Gen5.

The BioStack PC Control Software links each plate in the input stack to a previously created and stored Gen5 experiment. Perform the following steps to create a simple Gen5 experiment for the Scanner Test:

1. Launch Gen5. Log in if prompted to do so (Gen5 Secure).

2. From Gen5's main menu, select **File > New Experiment**.

3. Select the **Default Protocol** then click **OK**. Gen5 will open the experiment workspace, which includes the New Experiment menu tree and the plate screen.

4. Double-click **Protocol** in the menu tree to open the Protocol menu. Double-click **Procedure** to open the Procedure dialog.

   ◆ Gen5 and Gen5 Secure: If the 'Instrument Selection' dialog appears, highlight the appropriate reader, then click **OK**.

5. Select the appropriate **Plate Type** for the three microplates that you loaded into the input stack in ***Prepare Microplates for the Scanner Test***, on page 397. If your particular plate is not in the list, select **96 WELL PLATE**.

6. Click **Read**. Keep the default settings for all parameters in the 'Read Step' dialog.

7. Click **OK > OK** to save all settings and return to the main menu.

8. Select **File > Save As**, and save the experiment, using a unique name (e.g., Scanner Test.xpt). Make a note of the file name and storage location.

   ❖ The default storage location is **C:\Program Files\BioTek\ Gen5\Experiments** (if you selected a conventional installation of Gen5).

   You will select this file in the BioStack PC Control Software when you run the Scanner Test on page 403.

9. **Important!** Close Gen5 software.

Configure KC4™ Software for the Scanner Test

> ❖ KC4 does not support the PowerWave XS2, Synergy 2/Synergy 4 /Synergy Mx readers.

Perform the following steps to configure KC4 for the Scanner Test:

KC4 v3.x (non-Signature) Users:

1. Launch KC4 v3.x.

2. Select **System > Setup** and click the 'Start-up' tab.

3. Check **Minimize KC4 when running in OLE mode** and then click **OK**.

4. Select **System > Administrator Login**, enter the **Administrator Password**, and then click **OK**. (The default password is **admin**.)

5. Select **System > Security** and click the 'Files' tab.

6. Select a **Preferred data file format** of .PLA or .GLB, according to your site's assay requirements. (Click the **Help** button for assistance.) Make a note of this selection for use with the BioStack™ PC Control Software configuration in *Configure BioStack PC Control Software for the Scanner Test* on page 402.

7. Click **OK** to return to KC4's main application window.

KC4 Signature Users:

1. Launch KC4 *Signature*.

2. When the 'Login' dialog appears, enter the **Administrator Password** and click **OK**. (The default password is **admin**.)

3. Select **System > Setup** and click the 'Start-up' tab.

4. Check **Minimize KC4 when running in OLE mode** and then click **OK**.

5. Select **System > Security** and click the 'Files' tab.

6. Select a **Preferred data file format** of .PLA or .GLB, according to your site's assay requirements. (Click the **Help** button for assistance.) Make a note of this selection for use with the BioStack PC Control Software configuration in *Configure BioStack PC Control Software for the Scanner Test* on page 402.

7. Click **OK** to return to KC4's main application window.

Create a KC4 Protocol for the Scanner Test

The BioStack PC Control Software links each plate in the input stack to a previously created and stored KC4 protocol. Perform the following steps to create a simple protocol for the Scanner Test:

1. Select **Data > New Plate**. If prompted to select a protocol, select **Empty Protocol** and click **OK**. If *not* prompted, select **Protocol > New**.

2. Select **Protocol > Reading**. Define the following parameters in the 'Reading' dialog:

   ◆ (Synergy™ HT only) Select **Absorbance** for the **Detection method**.

   ◆ Select **End Point** for the **Reading Type**.

   ◆ Keep the default **Wavelength(s)**.

   ◆ Select the appropriate **Plate Type** for the three microplates that you loaded into the input stack in *Prepare Microplates for the Scanner Test* on page 397. If your particular plate is not in the list, select **96 WELL PLATE**.

   ◆ Keep the default settings for all other parameters in the Reading dialog.

   > ❖ **PowerWave™ HT customers**: *Do not* select the **Read Barcode** parameter. The Read Barcode parameter is designed specifically for use with the *reader's* scanner.

   ◆ Click **OK** to verify the parameters and return to the main screen.

3. Select **Protocol > Save As** and save the protocol. Make a note of the file name and storage location. You will select this file in the BioStack PC Control Software when you run the Scanner Test.

4. (Optional) If you wish to specify the storage location for the plate data files, select **Protocol > Options**, and in the **Save Directory** box, enter the path of the folder in which to store the files.

   > ❖ If the Save Directory box is left empty, the plate data files will be stored in the default KC4 folder, or in the secure database, depending on the KC4 license/configuration.

5. **Important**! Close KC4 software.

   ◆ If **Save changes to New Plate** appears, click **No**.

Configure BioStack PC Control Software for the Scanner Test

> ⚠️ **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

Perform the following steps to configure the BioStack PC Control Software for the Scanner Test:

1. Plug in and turn on the BioStack.

2. Launch the BioStack PC Control Software.

3. Click on **Change Current Settings** to open the 'Settings' dialog.

4. At the 'Plate Identification' tab, select **Auto-generated Plate ID**. Keep the default **Plate_** for the **optional prefix**, and enter **1** for the **starting plate #**.

> ❖ The **Plate ID** labels are *only* used for the BioStack PC Control Software stack *displays*, to make it easier to track a plate within the stacks. There is no automatic association between the Plate ID defined for a plate in the BioStack software and the usage of plate barcode IDs in Gen5/KC4, or plate output file names in KC4.

5. At the 'Run Control' tab, select **Re-stack when processing is done** and **Provide re-try prompt following barcode scanning failures**.

6. At the 'Display Options' tab, select **Display Barcode Label** for both **Left of Input Stack** and **Right of Output Stack**.

7. KC4 only: At the 'KC4 Options' tab, select **KC4 data only (*.PLA**) or **KC4 data and protocol (*.GLB)**, as appropriate, for the **KC4 preferred output data file format**.

   ◆ If you wish to use barcode IDs scanned by the BioStack's barcode scanner as KC4 plate data file names: click **Have KC4 write out a plate file using BioStack barcode ID for filename**. The files will be stored in the location you specified in *Create a KC4 Protocol for the Scanner Test* on the previous page, or (if you did not specify a location) in the default KC4 folder or secure database.

8. Click **OK** to save and close the Settings dialog.

Run the Scanner Test

> ⚠️ **Warning! Laser Radiation.** Do not look directly into the laser beam during operation of the scanner. Serious eye injury may occur if you stare directly into the beam. Please note the warning label on the outside of the scanner's protective cover.

> ℹ️ Ensure that you are not also running Gen5 or KC4 software in stand-alone mode when performing the Scanner Test.

Perform the following steps to run the BioStack Barcode Scanner test:

1. At the BioStack PC Control Software's main screen, **Add New Plate** area, open the scanner test file that you created:

   Gen5

   ◆ Click **Existing Exper.** then click the three-dot button next to **Exper.** to open the 'Browse for Experiment' dialog.

   ◆ Search through the folders until you locate the Gen5 experiment file you created.

   ◆ Click **Open**, and the file path will now appear in the **Exper.** Field.

   KC4

   ◆ Click the three-dot button next to **Assay** to open the 'Browse for Protocol' dialog.

   ◆ Search through the folders until you locate the KC4 protocol file you created.

   ◆ Click **Open**, and the file path will now appear in the **Assay** field.

2. Click **Top of Input Stack**, then click **Add plate to Input Stack** three times to "add" the three plates that will be scanned. An image of each plate will be added to the **Input Stack** in the BioStack PC Control Software.

3. Under **Run Control**, click **Start**. The BioStack PC Control Software will run Gen5 or KC4 "in the background," to process each plate in accordance with the Gen5 experiment or KC4 protocol.

As the plates are transferred between the BioStack and the reader, note whether the following activities occur:

◆ The red LED on the barcode scanner should flash as the scanner reads a barcode on a plate

   ➢ during transfer from the input stack to the BioStack's extended carrier position (before the plate is picked up by the claw/gripper for transfer to the reader's carrier), and

   ➢ during transfer from the BioStack's extended carrier position to the output stack (after the plate has been processed and transferred from the reader's carrier to the BioStack carrier).

◆ A barcode ID should appear

   ➢ to the right of the **Output Stack** in the BioStack PC Control Software as the claw/gripper is transferring a processed plate from the reader's carrier to the BioStack carrier (for transfer to the Output Stack), and

   ➢ to the left of the **Input Stack** in the BioStack PC Control Software as a processed plate in the Output Stack is being lowered onto the carrier for transfer to the Input Stack.

4. If a scanning failure occurs, the BioStack will pause while the 'Barcode Scan Failure' dialog appears with the options to retry the scan, manually enter the barcode, ignore the error, or abort the run.

> ❖ If you choose to manually enter the barcode and need to remove the plate from the BioStack's carrier in order to read the barcode, ensure that you place the plate back onto the carrier.
>
> ❖ If you choose to ignore the error, the BioStack PC Control Software will display a code (e.g., **###NoBarcode##**) to the right of the Output Stack and to the left of the Input Stack.

◆ Check for missing labels, invalid or illegible barcodes, or plates loaded into the input stack with the barcode label on the wrong side of the plate.

◆ Correct the problem, then select **Retry Scan**.

◆ If the test still doesn't pass, contact BioTek TAC.

5. Click **OK** when the "All plates have been completed" dialog appears.

> ❖ Check to ensure that **Done** appears above **Number of Runs** in the BioStack PC Control Software.

## Scanner Test for BioStack with Precision Instruments

> (i) **Important!** Always power up the BioStack **first** before turning on the Precision, and leave the BioStack on. If you turn the BioStack off, raise the claw/gripper manually above the dispenser's supply station before turning it back on. Keep your hands away from the claw/gripper and carrier <u>while</u> the BioStack is being powered up. Once the BioStack's self-test and homing sequence is complete, turn on the Precision.

If you are operating the BioStack and barcode scanner with the Precision Microplate Pipetting System or Precision XS, perform the instructions in this section for verifying installation of the scanner.

Prepare Microplates for the Scanner Test

Refer to *Figure 88* on page 406 for the following instructions:

1. Assemble the required materials:

   ◆ Purchased or custom-made barcode labels that meet label requirements and dimensions described in *Purchase or Create Labels to Specifications* on page 393.

   ◆ Three "dry" (empty) 96- or 384-well microplates that meet plate specifications described on page 19 in *Chapter 1*, and that have **flat**, vertical sidewalls so that the labels will lie flat upon the surface. The plates should also be compatible with Precision Power's Vessel Specification files for 96- and 384-well plates.

2. Place the labels on whichever "short" sides of the microplate that will be scanned. See *Figure 88* on the next page (a 384-well plate is illustrated). The labels should not extend above or below the edges of the plate, or the plates may stick to one another when they are stacked.

3. Write down the barcode IDs for each plate. You will need to enter these numbers when you create the plate maps in the section *Create Plate Maps for the Scanner Test* on page 407.

4. Load the barcode-labeled plates into whichever stack you have designated as the **output stack**.
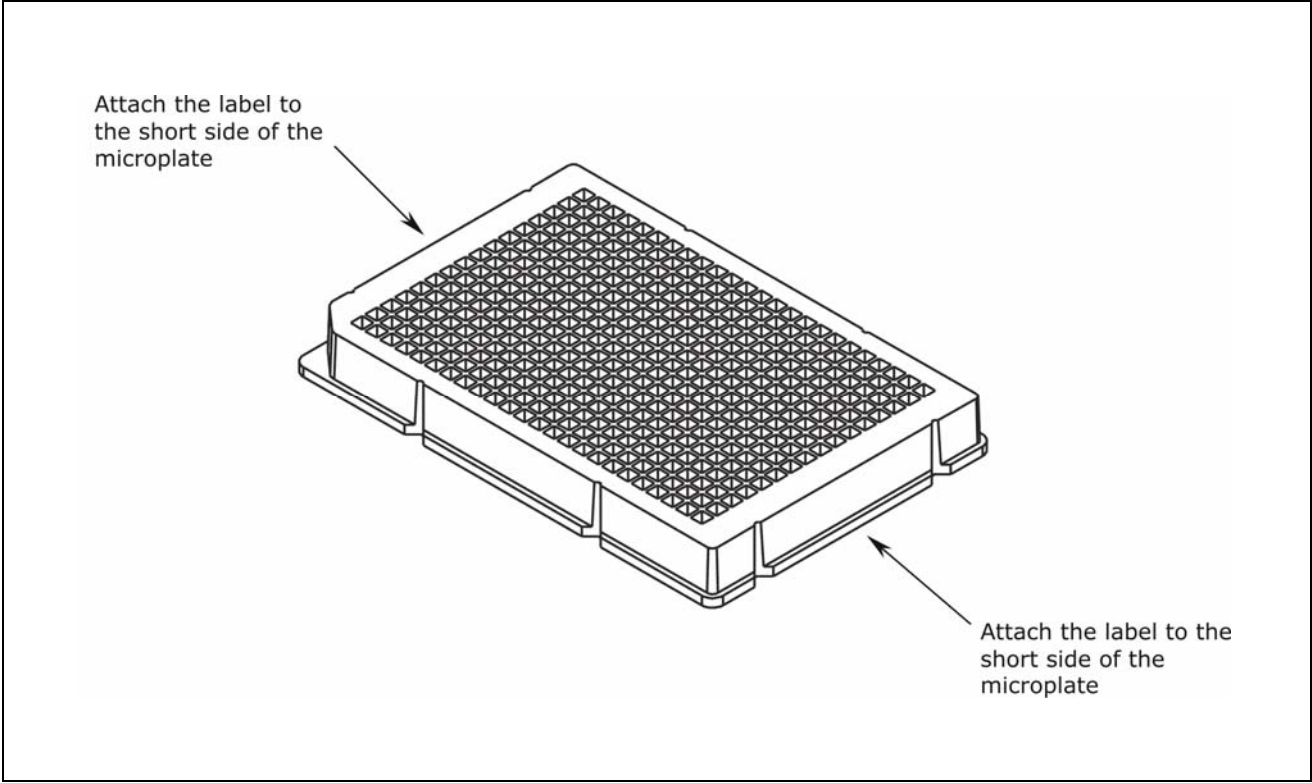
Figure 88: Positioning the Barcode Label on the Microplate

Create Plate Maps for the Scanner Test

Perform the following steps in Precision Power to create simple plate maps that you will use in the Scanner Test:

1. Launch Precision Power Software.

2. Click the **Unprocessed Maps** icon on the toolbar.

3. At the 'Unprocessed Maps' dialog, click the **Add** button.

4. In the 'Add Plate/Rack Map' dialog:

   ◆ At the **Plate/Rack ID** field, type the barcode number of the first plate that you loaded into the output stack.

   ◆ Select a **Vessel Specification File** (from the pull-down menu) that is compatible with the plates you are using.

   ◆ Click **Create** to continue setting up a new plate map.

5. In the 'Add Map' dialog:

   ◆ At the **When processing is done** field, click **Leave in Unprocessed Folder**.

   ◆ Keep the default settings for all other parameters in the Add Map dialog, and click **Save**.

6. At the Unprocessed Maps dialog:

   ◆ Repeat the instructions in steps 3 through 5 for the other two plates, entering the barcode numbers for the plates in the Plate/Rack ID fields.

   ◆ Click **Exit**.

Run Scanner Test: Use BioStack™ to Build To-Do List

> ⚠️ **Warning! Laser Radiation.** Do not look directly into the laser beam during operation of the scanner. Serious eye injury may occur if you stare directly into the beam. Please note the warning label on the outside of the scanner's protective cover.

Perform the following steps to test the scanner, using the BioStack to build the To-Do List:

1. At the Precision Power main screen, click on the **To-Do List** icon on the toolbar.

   The 'Modifying the To-Do List' dialog will open, and the three barcode plate maps that you created and saved in the **Unprocessed** folder will appear in the **Available Plate Maps** list.

2. Select the option to **Add to To-Do List via BioStack**.

3. Configure the **Options** as follows:

   ◆ Use the drop-down list in the **BioStack Selection** field to identify the BioStack and supply station.

   ◆ De-select **Limit by location count**.

   ◆ Select **Ignore failures**.

   > ❖ When the Ignore Failures is not selected and errors occur scanning the barcode or locating a matching plate map, Precision Power offers multiple options for resolving the error or continuing the process.

4. Click the **Generate List** button to start the BioStack scanning process. The BioStack scanner will scan each barcoded plate as it is moved from the output stack to the input stack.

   Note whether the following activities occur:

   ◆ The red LED on the barcode scanner should flash as the scanner reads the barcode on the plate at the extended carrier position.

   ◆ Precision Power will look for an **Available Plate Map** with the same Plate ID as the scanned plate. As it finds a match, it moves the plate map to the **Assigned Plate Maps**, i.e., the **To-Do List**. All three barcode plate maps should now appear in the Assigned Plate Maps list.

If a failure occurs during the process, Precision Power puts a placeholder in the Assigned list marked with a red error icon. A barcode scanning error results in a placeholder name **No barcode #**.

◆ Remove the plate from the carrier, and check for a missing label, invalid or illegible barcode, or a barcode label on the wrong side of the plate in reference to the position of the scanner. Ensure that the barcode ID you entered in *Create Plate Maps for the Scanner Test* on page 407 matches the barcode ID on the plate.

◆ Correct the problem, place the plate back into the output stack, and home the BioStack. Repeat steps 1 through 4.

◆ If the test doesn't pass, contact BioTek TAC.

Appendix C

Reconfiguration of the BioStack

This appendix contains instructions for reconfiguring the BioStack to accommodate half-height plates.

Reconfigure the BioStack for Half-Height Plates

> ⓘ **Important!** These instructions configure the BioStack and the input/output stacks for use with a specific half-height plate. After performing these instructions, if you wish to use a plate type with distinctly different dimensions (e.g., a "standard height" plate) you must reconfigure the instrument and stacks for the new plate. Alternatively, consider purchasing an additional set of input/output stacks (30-plate stacks: PN 7310008S; 50-plate stacks: PN 7310539) and configuring them for the new plate type.

Overview

If you are using **half-height plates** and the BioStack is **passing multiple plates at once** from the input stack to the BioStack carrier, the instrument may need to be reconfigured to accommodate your microplates. One microplate known to require this reconfiguration is MJ Research's *Hard-Shell* 384-well PCR plate. To configure the BioStack to prevent multiple half-height plates from passing to the carrier at once, you will perform three steps:

1. "Open" an internal dipswitch.
2. Make minor adjustments to the 30-plate or 50-plate input and output stacks.
3. Run the BioStack in a special test mode with dry plates, to test the adjusted stacks.

Instructions are provided on the following pages. Please contact BioTek's Technical Assistance Center with any questions or concerns (see *Chapter 1* for contact information).

Required Materials

- 5/64" (2.0 mm) allen wrench
- 7 of the half-height microplates you are working with
- Small piece of paper approximately 0.02" (0.5 mm) thick

Step 1: "Open" Dipswitch #SW1-1

❖ Both the fixed wrist and rotational wrist models have two sets of dipswitches: SW1-1 through SW1-4, and SW2-1 through SW2-4 (see *Figure 13b* in *Chapter 3*).

❖ Perform Step 1 only if dipswitch #SW1-1 is not already open. If it is already open, skip this step and go to Step 2.

1. If the BioStack is on, turn it off. Locate and remove the round dipswitch access cover on top of the BioStack, as shown in *Figure 89* on the following page. Inside the hole you'll see a small panel with four numbered dipswitches.

2. Switch *#SW1-1* must be in its OPEN position, as shown in *Figure 90* on the following page. If the switch is "closed," use the end of a paper clip to move it to the OPEN position.

> ⓘ **Important!** Switch #SW1-1 must be moved back to its CLOSED position to process standard-height plates.
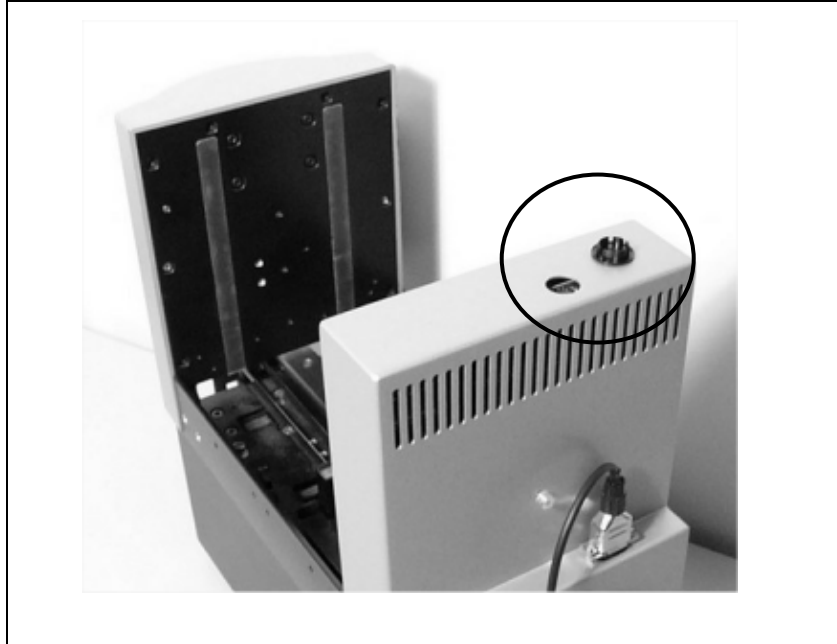
Figure 89: Dipswitch Access Cover

❖ The fixed wrist model (PN BIOSTACK2) is shown.

Figure 90: Switch #SW1-1 in OPEN Position

Step 2: Adjust the Input and Output Stacks

Turn an empty stack upside down and identify its two movable brackets, one on each of the short sides of the stack. These are plate-grippers, called "dogs." In *Figure 91* below, each arrow points to a stack dog.

When multiple half-height plates are passing to the carrier at once, the factory-set dogs are gripping the plates in the wrong place. The cause is likely the length of the plate (slightly longer than standard) combined with the way the plates "nest" inside one another in the stack.

You will adjust the dogs slightly to increase the distance between them, to allow the plates to be gripped properly.

You'll need a **5/64" (2.0 mm) allen wrench**, the **microplate** you are working with, and a small piece of **paper** that is approximately 0.02" (0.5 mm) thick.

> **Important!** The adjustment process may take a few tries. You'll make a slight adjustment to the input and output stacks, and then run the BioStack™ in a special test mode with seven empty plates to ensure that only one plate at a time passes from the stack to the carrier. You may find that the dogs were moved too far apart, or not quite far enough, and you'll have to repeat the adjustment/test process. Once the dogs are set properly, you should not have to repeat this procedure for this plate type.
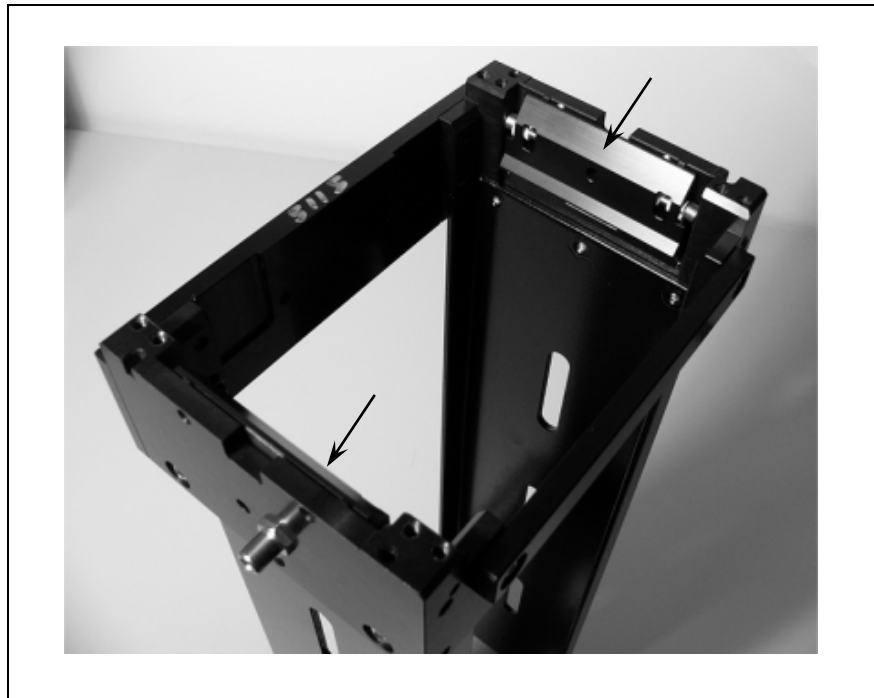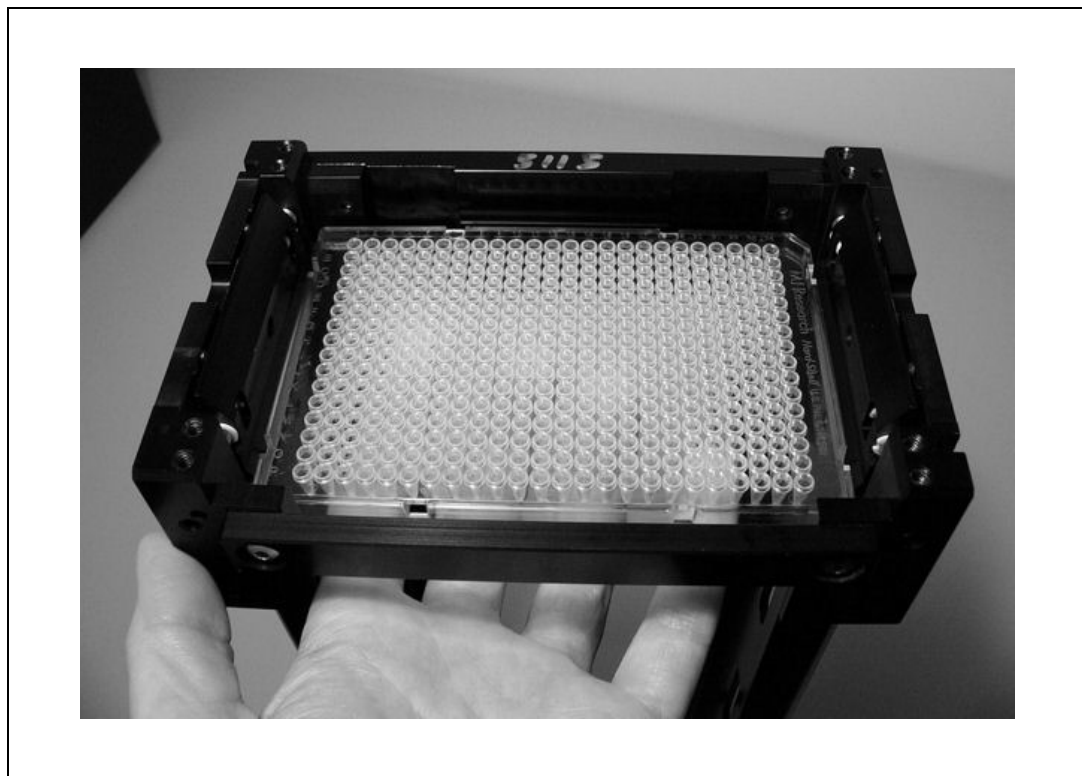

Figure 91: Stack "Dogs"

❖ The 30-plate stack is shown.

To make the adjustments (perform these steps for both the input and output stacks):

1. Turn the empty stack upside down and set it on a flat surface.

2. Hold the plate right-side up and slide it into the middle of the stack. Move it up until the plate's flange is flush against the bottoms of both dogs, as shown in *Figure 92*:
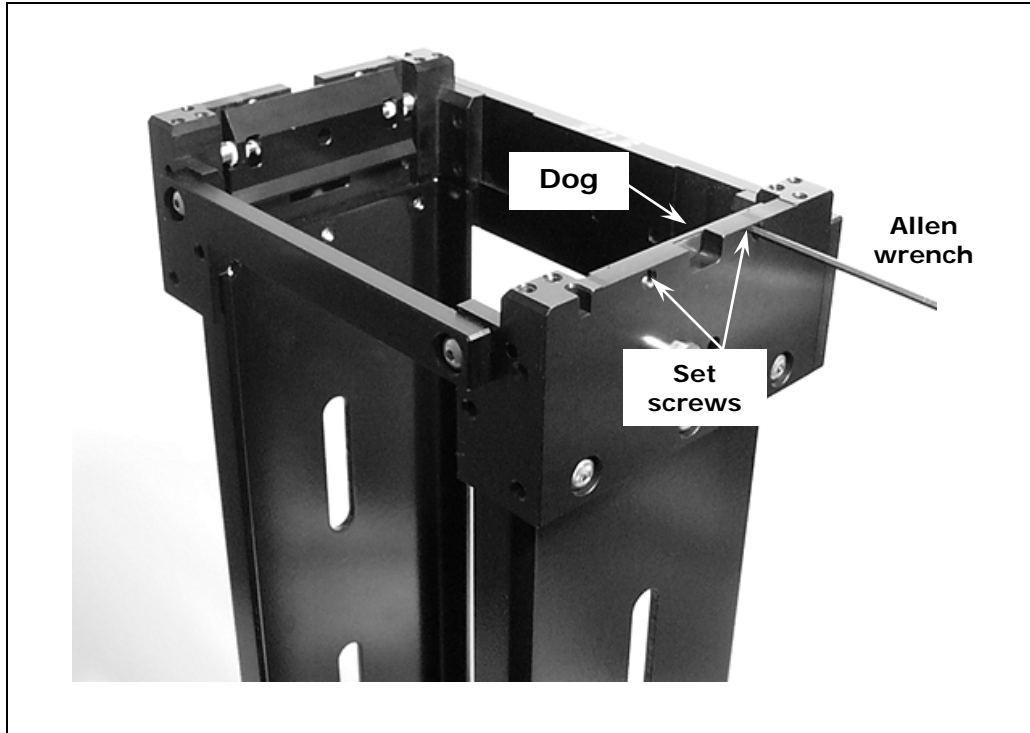

Figure 92: Positioning the Plate in the Stack

3. Attempt to slide the paper between the plate and the dog on one side; notice that the dog is too tight against the side of the plate to allow the paper to slide freely. Set the paper aside for now.

> ❖ Use the photos on the next page to help with the adjustments. Each dog is held in position by two set screws, as shown in *Figure 93*. *Figure 94* and *Figure 95* demonstrate incorrect and correct positioning of the dogs in relation to the plate when the plate is held in place as in *Figure 92.*

4. Using the allen wrench, turn one dog's set screws **clockwise** to increase the distance between the dog and the side of the plate to approximately 0.02″ (0.5 mm). Repeat for the other dog. When the plate is held as shown in *Figure 92*, each dog should rest on the plate's flange and you should be able to insert and remove the test paper without friction between the dog and the side of the plate.
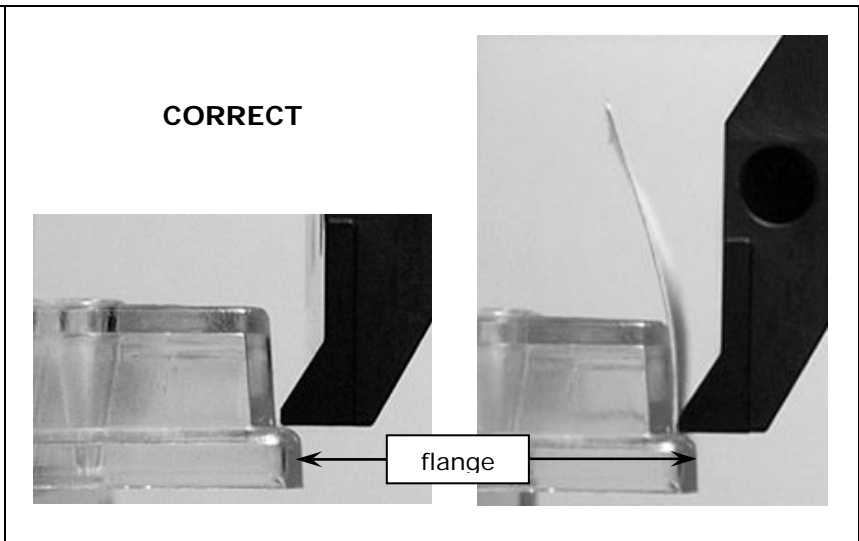
Figure 93: Turning the Dog's Set Screws

> ❖ *Figure 93:* The 30-plate stack is shown.
> ❖ *Figure 94* and *Figure 95* demonstrate incorrect and correct positioning of the dogs in relation to the plate when the plate is held in place as in *Figure 92*.

Figure 94: Incorrect Positioning of the Dogs	**Figure 95a** and **95b:** Correct Positioning of the Dogs
The dog is too high and it touches the side of the plate.	The dog rests on the flange and does not touch the side of the plate. A piece of 0.02″ (0.5 mm) thick paper easily slides between the dog and the plate.

Step 3: Test the Adjusted Stacks

> **Warning!** Keep your hands away from the claw/gripper and carrier while the BioStack is being powered up. The carrier and claw/gripper move quickly during the homing sequence.

As mentioned in *Step 2: Adjust the Input and Output Stacks* on page 415 (in the **Important!** note), you'll need to test the adjusted stacks with seven dry plates, to see if the stacks are set properly or require further adjustment.

1. If the BioStack is on, turn it off.

2. Remove the dipswitch access cover and move switch **#SW1-4** to the OPEN position.

3. Load the input stack with **seven** clean, dry microplates.

4. Install the input and output stacks.

5. Turn on the BioStack.

   Plates will begin to transfer from the input stack to the carrier and then to the output stack. When all plates have been transferred to the output stack, they will be transferred back to the input stack. This process will repeat until you turn off the BioStack.

6. Observe the plate transfer process. Plates should pass one-at-a-time to the plate carrier.

   If, after several transfers, you are satisfied with the performance, turn off the BioStack and <u>restore dipswitch # **SW1-4** to its closed position</u>.

   If multiple plates continue to pass to the plate carrier, turn off the BioStack and attempt to adjust the stacks again. Repeat the adjustment/test process until the plates are transferring to your satisfaction.

> **Important!** When finished, be sure to attach **labels** to the stacks and the BioStack to indicate that they are "Configured for <your plate type>."

"Configured for MJR Hard-Shell 384/PCR on 5/01/2007"

Appendix D

Required Software Versions

This appendix lists all software versions required for operation of the BioStack with the PowerWave/XS, Synergy HT/Synergy 2/Synergy 4/Synergy Mx readers, Precision/XS instruments, MicroFill, NanoQuot, and MicroFlo dispensers, ELx405 washer, and EL406 washer dispenser.

Overview

For operation of the BioStack with an interfacing instrument, you will need the correct software versions installed on both instruments, and, if applicable, on the controlling computer.

Refer to the tables on the following pages to determine if you have all of the correct software versions. (See *Chapter 7*, *Troubleshooting and Error Codes* for instructions for obtaining software versions for the BioStack and interfacing instruments.)

BioStack models referred to in this Appendix are:

- **Fixed wrist** (model PN BIOSTACK2)

- **Rotational wrist** (model PN BIOSTACK2WR)

> ❖ **Note:** Software versions are subject to change over time. Contact BioTek for more information.

Required Software Versions for the BioStack with the PowerWave or Synergy Readers

BioStack with PowerWave/XS or Synergy HT

To operate the BioStack with the **PowerWave, PowerWave XS, or Synergy HT**	**using Gen5**, you will need these *minimum* software versions:	**using KC4**, you will need these *minimum* software versions:
	Gen5 Software ✓ **1.00.14** with/without barcode scanner ✓ **1.02.8** or greater if using version **2.00.10** or greater of the BioStack PC Control Software	**KC4 Software** ✓ **3.3**, **Rev. 9** without barcode scanner ✓ **3.4**, **Rev. 16** with barcode scanner ✓ **3.4**, **Rev. 22** to have BioStack scanned barcodes appear in KC4 plate description dialogs
	Reader basecode ✓ **1.21.1** for PowerWave ✓ **1.06** for PowerWave XS ✓ **2.24** for Synergy HT	**Reader basecode** ✓ Any version for PowerWave, PowerWave XS, or Synergy HT
	BioStack™ PC Control Software ✓ **2.01.6** with/ without barcode scanner (all plate types)	**BioStack PC Control Software** ✓ **2.01.6** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)	**BioStack basecode** **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner

BioStack with PowerWave XS2

> ❖ Gen5 Software must be used with the PowerWave XS2. KC4 Software does not support the PowerWave XS2.

To operate the BioStack with the **PowerWave XS2**	**using Gen5** you will need these *minimum* software versions:
	Gen5 Software ✓ **1.05.x** with/without barcode scanner
	Reader basecode ✓ Any version
	BioStack PC Control Software ✓ **2.01.6** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)

BioStack with Synergy 2 or Synergy 4

> ❖ Gen5 Software must be used with the Synergy 2 or Synergy 4 Readers. KC4 Software does not support these readers.

To operate the BioStack with the **Synergy 2**	**using Gen5** you will need these *minimum* software versions:
	Gen5 Software ✓ **1.01.x** with/without barcode scanner
	Reader basecode ✓ Any version
	BioStack™ PC Control Software ✓ **2.01.6** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)
To operate the BioStack with the **Synergy 4**	**using Gen5** you will need these *minimum* software versions:
	Gen5 Software ✓ **1.04.x** with/without barcode scanner for the Synergy 4
	Reader basecode ✓ Any version
	BioStack PC Control Software ✓ **2.01.6** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)

BioStack with Synergy Mx

> ❖ Gen5 Software must be used with the Synergy Mx Reader. KC4
> Software does not support this reader.

To operate the BioStack with the **Synergy Mx**	**using Gen5** you will need these *minimum* software versions:
	Gen5 Software ✓ **1.07.x** with/without barcode scanner
	Reader basecode ✓ Any version
	BioStack PC Control Software ✓ **2.02.x** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)

Required Software Versions for the BioStack with the Precision Instruments

To operate the BioStack with the **Precision or Precision XS**	you will need these *minimum* software versions:
	BioStack PC Control Software ✓ **2.01.6** with/without barcode scanner (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** with/without barcode scanner (all plate types)
	Precision Power Software ✓ **2** without barcode scanner ✓ **2.xx** with barcode scanner
	Precision instrument basecode ✓ **2.14** for Precision Microplate Pipetting System ✓ Any version for Precision XS

Required Software Versions for the BioStack with the MicroFill Dispenser

❖ The MicroFill does not support the BioStack barcode scanner.

To operate the BioStack with the **MicroFill**	you will need these *minimum* software versions:
	MicroFill basecode ✓ **1.21.x**
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

Required Software Versions for the BioStack with the ELx405 Washer

❖ The Magna model of the ELx405 does not support the BioStack.

❖ The ELx405 does not support the BioStack barcode scanner.

Instrument Control of the BioStack

To operate the BioStack with the **ELx405**	you will need these *minimum* software versions:
	ELx405 basecode ✓ **1.88.x**
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

PC Control of the BioStack

To operate the BioStack with the **ELx405** using the **LHC Software**	you will need these *minimum* software versions:
	Liquid Handling Control (LHC) Software ✓ Any version
	ELx405 Interface Software ✓ **2.00.4**
	ELx405 basecode (PN 7100227) ✓ **2.02.1**
	BioStack™ PC Control Software ✓ **2.01.6** (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

Required Software Versions for the BioStack with the NanoQuot Dispenser

❖ The NanoQuot does not support the BioStack barcode scanner.

❖ During operation of the BioStack with the NanoQuot, the BioStack is directly controlled by the basecode software onboard the NanoQuot. The BioStack PC Control Software is used only to obtain BioStack software versions or to align the two instruments. The NanoQuot™ PC Control Software is used only to obtain NanoQuot software versions or to operate the NanoQuot in PC mode, without the BioStack.

To operate the BioStack with the **NanoQuot**	you will need these *minimum* software versions:
	BioStack™ PC Control Software ✓ **2.01.6** (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)
	NanoQuot PC Control Software ✓ **1.00.4**
	NanoQuot basecode ✓ Any version

Required Software Versions for the BioStack with the MicroFlo Select Dispenser

> ❖ The MicroFlo Select does not support the BioStack barcode scanner.

Instrument Control of the BioStack

To operate the BioStack with the **MicroFlo**	you will need these *minimum* software versions:
	MicroFlo basecode ✓ **1.06** for fixed wrist and rotational wrist models
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

PC Control of the BioStack

To operate the BioStack with the **MicroFlo** using the **LHC Software**	you will need these *minimum* software versions:
	Liquid Handling Control (LHC) Software ✓ Any version
	MicroFlo Select Interface Software ✓ **1.01**
	MicroFlo basecode ✓ **1.06** for fixed wrist and rotational wrist models
	BioStack PC Control Software ✓ **2.01.6** (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

Required Software Versions for the BioStack with the EL406 Washer Dispenser

❖ The EL406 does not support the BioStack barcode scanner.

Instrument Control of the BioStack

To operate the BioStack with the **EL406**	you will need these *minimum* software versions:
	EL406 basecode ✓ **1.05**
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)

PC Control of the BioStack

To operate the BioStack with the **EL406** using the **LHC Software**	you will need these *minimum* software versions:
	Liquid Handling Control (LHC) Software ✓ **1.00.6**
	EL406 Interface Software ✓ **1.00.3**
	EL406 basecode ✓ **1.05**
	BioStack PC Control Software ✓ **2.01.6** (all plate types)
	BioStack basecode **PN 7310209** for fixed wrist and rotational wrist models ✓ **2.00.x** (all plate types)